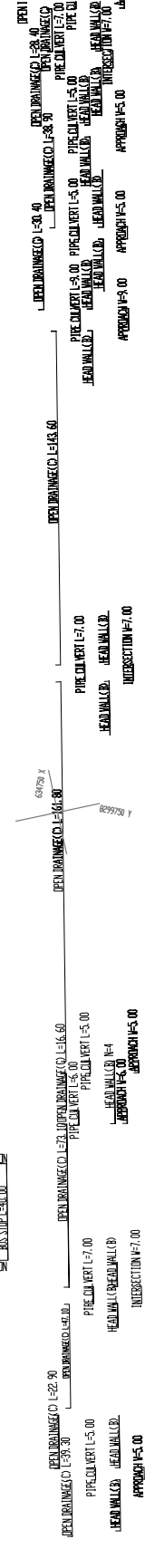
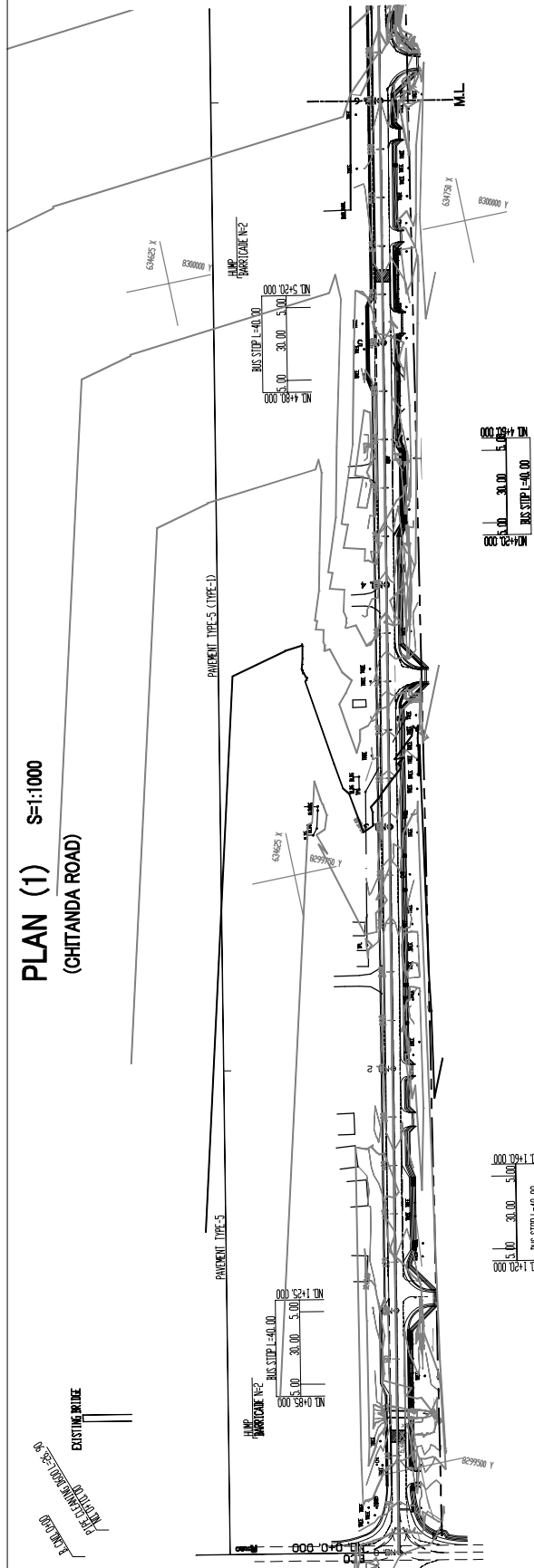


**PLAN (1) S=1:1000**  
**(CHITANDA ROAD)**



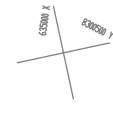
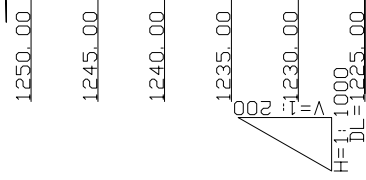
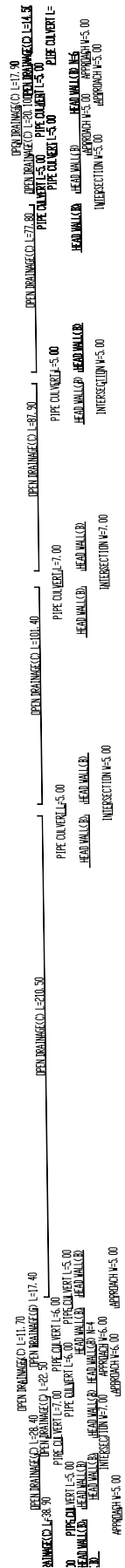
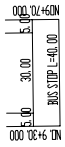
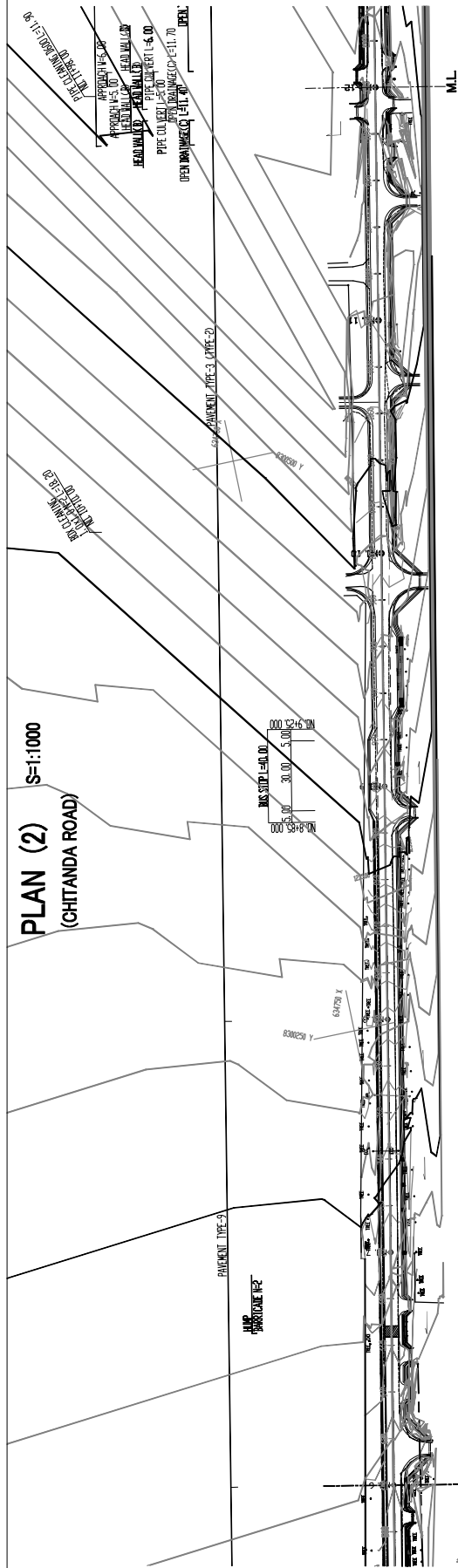
1260.00	
1255.00	
1250.00	
1245.00	
H=1:1000	
DL=1240.00	
Gradient	1247.35
CL Reg Levels	1245.00
Distance	1245.81
Station NO.	1245.92

1247.35	0	+20	20.00	1246.92	1245.81	40.00	1245.81	1245.00	1245.00	60.00	1245.00	1245.37	80.00	1245.37	1245.40	100.00	1245.40	1245.88	120.00	1245.88	1246.22	140.00	1246.22	140.00	1246.22	160.00	1246.18	180.00	1246.60	200.00	1246.83	220.00	1246.98	240.00	1246.71	260.00	1246.48	280.00	1246.06	300.00	1245.94	320.00	1244.93	340.00	1244.47	360.00	1243.63	380.00	1243.00	400.00	1242.66	420.00	1242.21	440.00	1241.46	460.00	1241.33	480.00	1241.52	500.00	1241.90	520.00	1242.40	540.00	1242.72	560.00	1243.00	580.00	1242.63	600.00	1242.60
1247.35	0	+20	20.00	1246.92	1245.81	40.00	1245.81	1245.00	1245.00	60.00	1245.00	1245.37	80.00	1245.37	1245.40	100.00	1245.40	1245.88	120.00	1245.88	1246.22	140.00	1246.22	140.00	1246.22	160.00	1246.18	180.00	1246.60	200.00	1246.83	220.00	1246.98	240.00	1246.71	260.00	1246.48	280.00	1246.06	300.00	1245.94	320.00	1244.93	340.00	1244.47	360.00	1243.63	380.00	1243.00	400.00	1242.66	420.00	1242.21	440.00	1241.46	460.00	1241.33	480.00	1241.52	500.00	1241.90	520.00	1242.40	540.00	1242.72	560.00	1243.00	580.00	1242.63	600.00	1242.60

MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE II) THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.LTD	CHITANDA ROAD PLAN (1/6)	SCALE S=1:1000	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED	JAPAN ENGINEERING CONSULTANTS CO.LTD	PREPARED CHECKED	DATE	SHEET NO
									MAR,2005	16/42

**PLAN (2)**  
**(CHITANDA ROAD)**

S=1:1000



Station No.	Distance	DL	Gradient
6+0	0.00	1242.60	1242.55
8+0	200.00	1241.00	1239.55
10+0	400.00	1238.76	1233.55
12+0	600.00	1239.26	1233.55
14+0	800.00	1238.19	1236.66
16+0	1000.00	1235.45	1235.45
18+0	1200.00	1234.15	1234.15
20+0	1400.00	1232.41	1232.41
22+0	1600.00	1229.90	1229.90
24+0	1800.00	1228.41	1228.41
26+0	2000.00	1229.97	1231.40
28+0	2200.00	1231.21	1231.21
30+0	2400.00	1230.00	1230.00
32+0	2600.00	1229.89	1229.89
34+0	2800.00	1229.00	1229.00
36+0	3000.00	1228.00	1228.00
38+0	3200.00	1228.27	1228.27
40+0	3400.00	1228.31	1228.31
42+0	3600.00	1228.36	1228.36

**THE PROJECT**  
**FOR IMPROVEMENT AND MAINTENANCE**  
**OF LUSAKA CITY ROADS (PHASE II)**  
**THE REPUBLIC OF ZAMBIA**

**JAPAN ENGINEERING CONSULTANTS CO.LTD**

**CHITANDA ROAD**  
**PLAN (2/6)**

**SCALE**  
**S=1:1000**

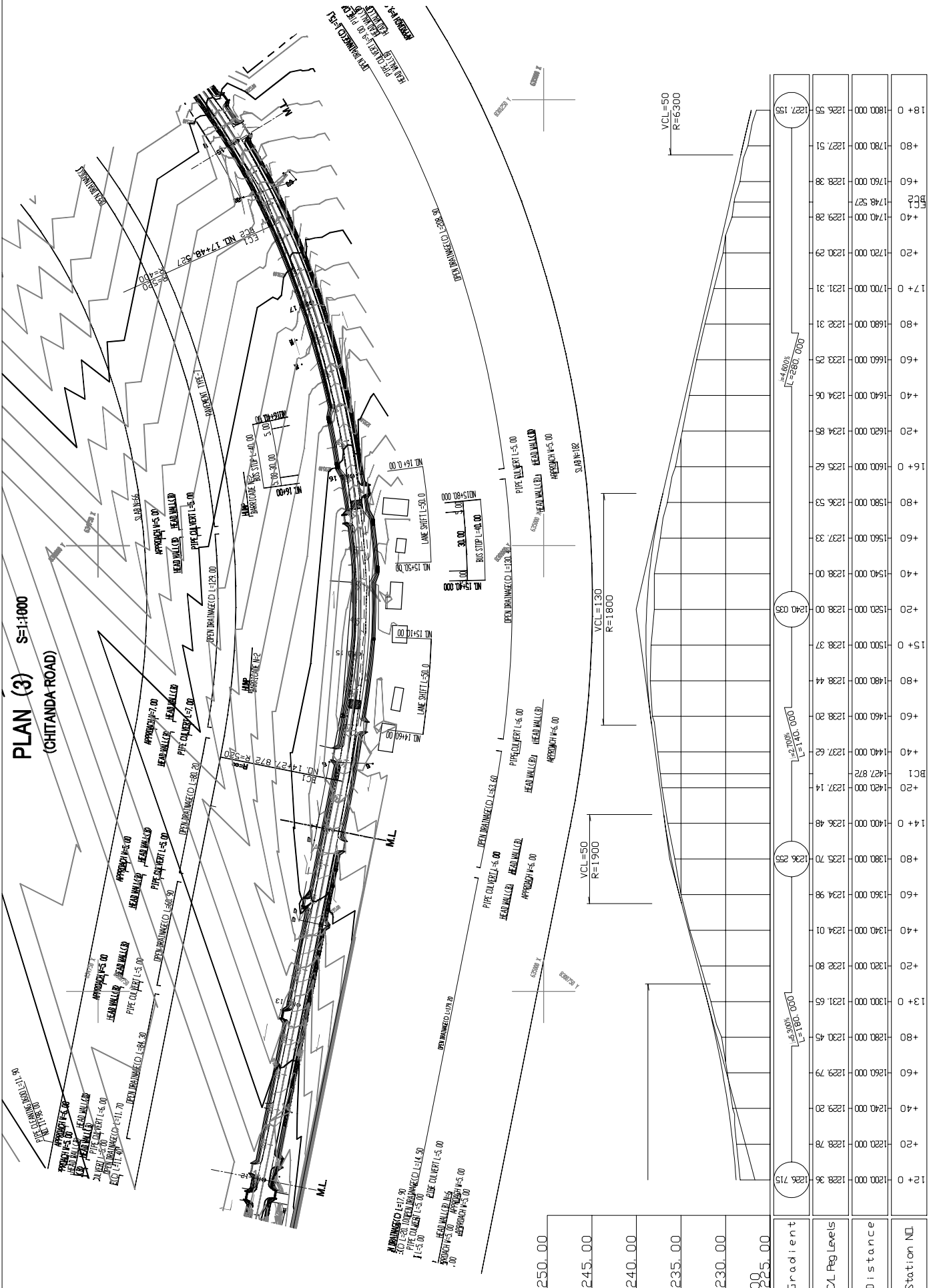
**APPROVED**  
MINISTRY OF LOCAL GOVERNMENT AND HOUSING OF THE REPUBLIC OF ZAMBIA  
DATE

**PREPARED CHECKED**  
JAPAN ENGINEERING CONSULTANTS CO.LTD  
SUBMITTED

**DATE**  
MAR, 2005

**SHEET NO**  
17 / 42

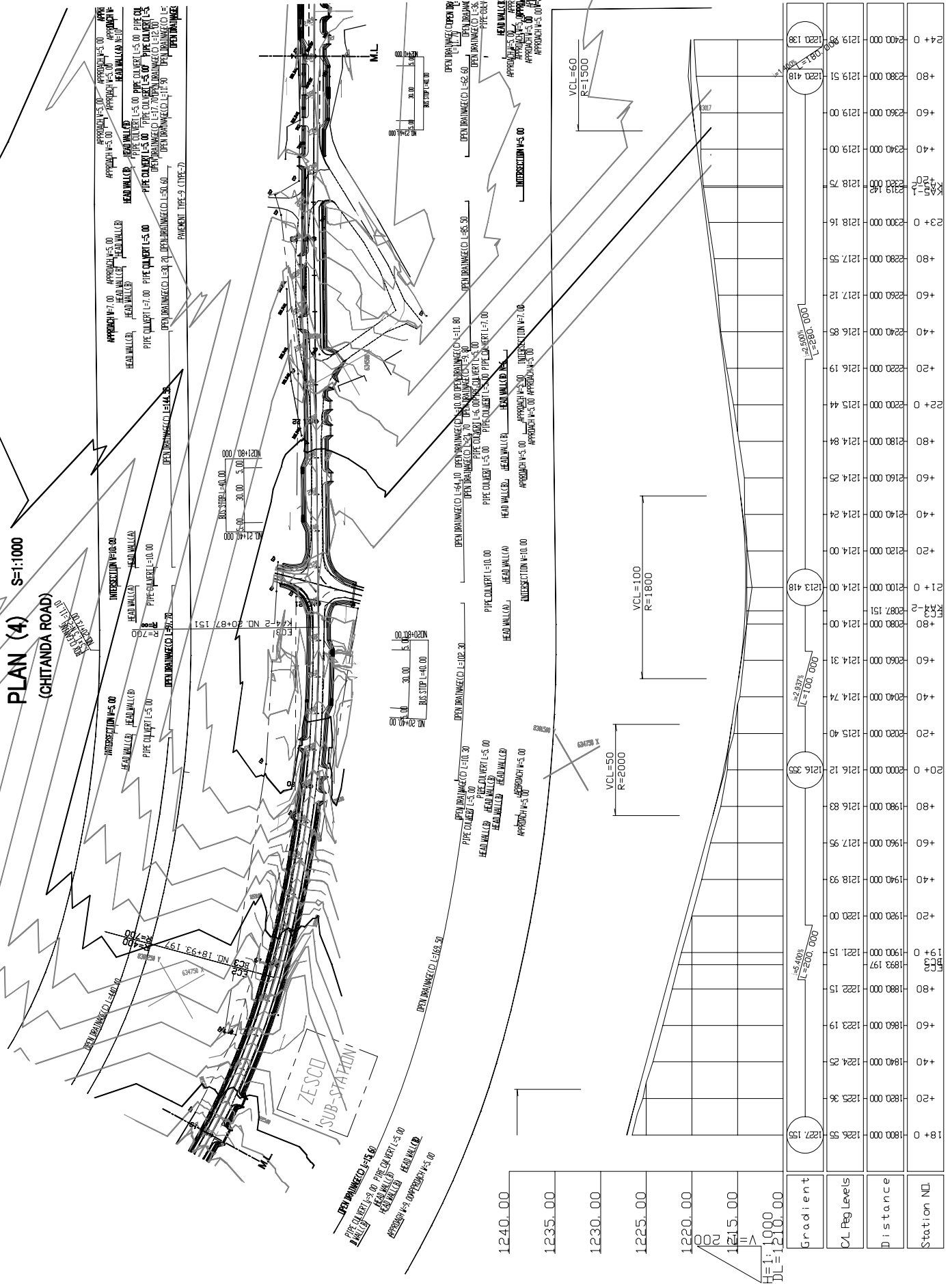
**PLAN (3) S=1:1000**  
**(CHITANDA ROAD)**



MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE II) THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.LTD	CHITANDA ROAD PLAN (3/6)	SCALE S=1:1000	APPROVED	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED	JAPAN ENGINEERING CONSULTANTS CO.LTD	PREPARED CHECKED	DATE	SHEET NO
										MAR,2005	18/42

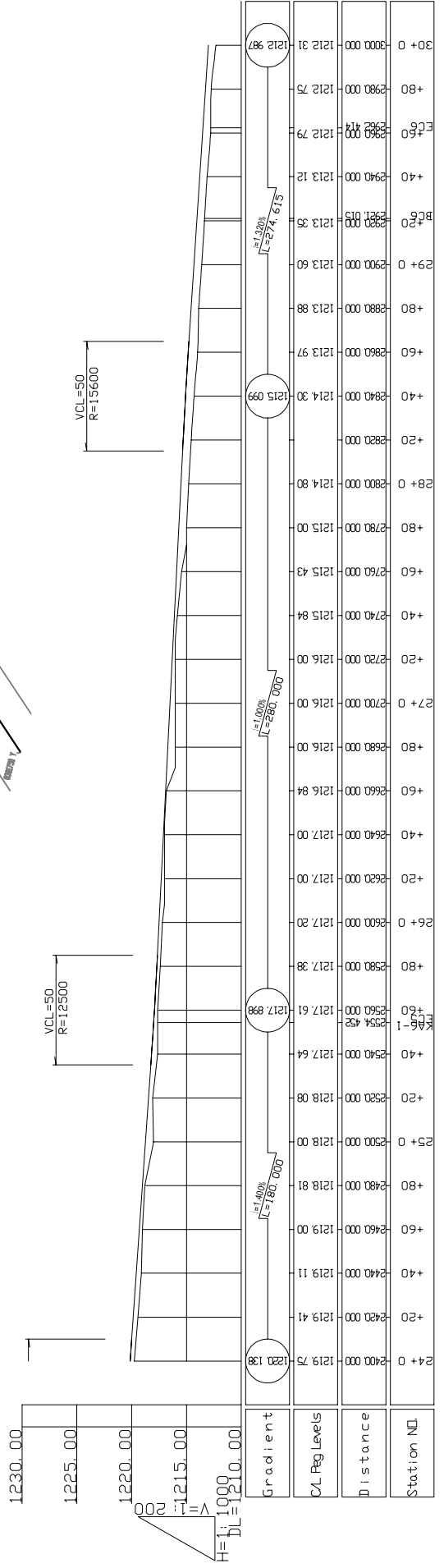
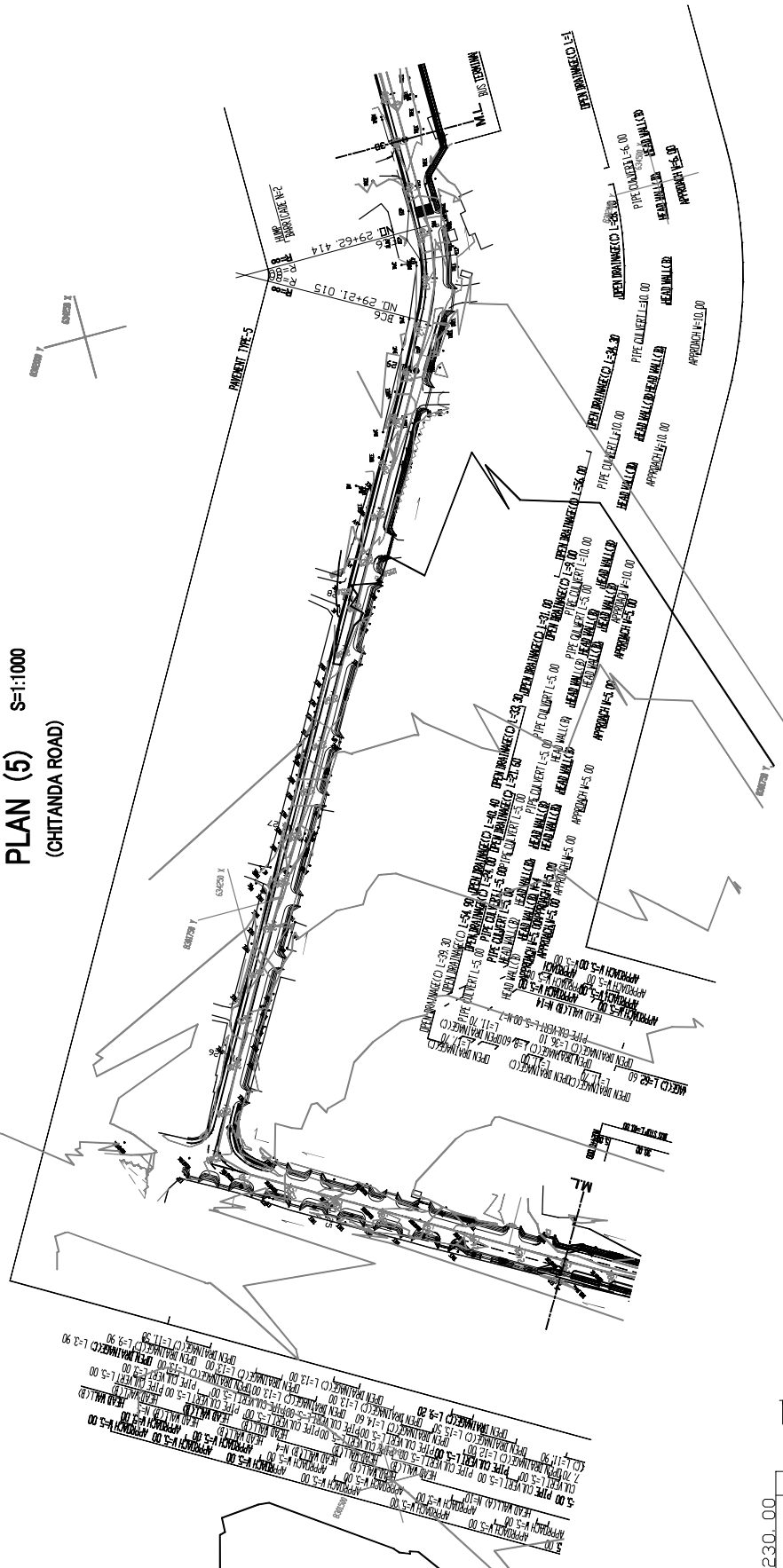
Station No.	Distance	DL Reg Levels	Gradient
12+00	1228.36	1228.36	1226.715
+20	1228.78	1228.78	1226.715
+40	1229.20	1229.20	1226.715
+60	1229.79	1229.79	1226.715
+80	1230.45	1230.45	1226.715
+100	1231.65	1231.65	1226.715
+120	1233.00	1233.00	1226.715
+140	1234.48	1234.48	1226.715
+160	1236.00	1236.00	1226.715
+180	1237.62	1237.62	1226.715
+200	1239.33	1239.33	1226.715
+220	1241.14	1241.14	1226.715
+240	1243.00	1243.00	1226.715
+260	1244.92	1244.92	1226.715
+280	1246.90	1246.90	1226.715
+300	1248.94	1248.94	1226.715
+320	1251.04	1251.04	1226.715
+340	1253.20	1253.20	1226.715
+360	1255.42	1255.42	1226.715
+380	1257.70	1257.70	1226.715
+400	1260.00	1260.00	1226.715
+420	1262.33	1262.33	1226.715
+440	1264.70	1264.70	1226.715
+460	1267.12	1267.12	1226.715
+480	1269.58	1269.58	1226.715
+500	1272.08	1272.08	1226.715
+520	1274.62	1274.62	1226.715
+540	1277.20	1277.20	1226.715
+560	1279.82	1279.82	1226.715
+580	1282.48	1282.48	1226.715
+600	1285.18	1285.18	1226.715
+620	1287.92	1287.92	1226.715
+640	1290.70	1290.70	1226.715
+660	1293.52	1293.52	1226.715
+680	1296.38	1296.38	1226.715
+700	1299.28	1299.28	1226.715
+720	1302.22	1302.22	1226.715
+740	1305.20	1305.20	1226.715
+760	1308.22	1308.22	1226.715
+780	1311.28	1311.28	1226.715
+800	1314.38	1314.38	1226.715
+820	1317.52	1317.52	1226.715
+840	1320.70	1320.70	1226.715
+860	1323.92	1323.92	1226.715
+880	1327.18	1327.18	1226.715
+900	1330.48	1330.48	1226.715
+920	1333.82	1333.82	1226.715
+940	1337.20	1337.20	1226.715
+960	1340.62	1340.62	1226.715
+980	1344.08	1344.08	1226.715
+1000	1347.58	1347.58	1226.715
+1020	1351.12	1351.12	1226.715
+1040	1354.70	1354.70	1226.715
+1060	1358.32	1358.32	1226.715
+1080	1361.98	1361.98	1226.715
+1100	1365.68	1365.68	1226.715
+1120	1369.42	1369.42	1226.715
+1140	1373.20	1373.20	1226.715
+1160	1377.02	1377.02	1226.715
+1180	1380.88	1380.88	1226.715
+1200	1384.78	1384.78	1226.715
+1220	1388.72	1388.72	1226.715
+1240	1392.70	1392.70	1226.715
+1260	1396.72	1396.72	1226.715
+1280	1400.78	1400.78	1226.715
+1300	1404.88	1404.88	1226.715
+1320	1409.02	1409.02	1226.715
+1340	1413.20	1413.20	1226.715
+1360	1417.42	1417.42	1226.715
+1380	1421.68	1421.68	1226.715
+1400	1425.98	1425.98	1226.715
+1420	1430.32	1430.32	1226.715
+1440	1434.70	1434.70	1226.715
+1460	1439.12	1439.12	1226.715
+1480	1443.58	1443.58	1226.715
+1500	1448.08	1448.08	1226.715
+1520	1452.62	1452.62	1226.715
+1540	1457.20	1457.20	1226.715
+1560	1461.82	1461.82	1226.715
+1580	1466.48	1466.48	1226.715
+1600	1471.18	1471.18	1226.715
+1620	1475.92	1475.92	1226.715
+1640	1480.70	1480.70	1226.715
+1660	1485.52	1485.52	1226.715
+1680	1490.38	1490.38	1226.715
+1700	1495.28	1495.28	1226.715
+1720	1500.22	1500.22	1226.715
+1740	1505.20	1505.20	1226.715
+1760	1510.22	1510.22	1226.715
+1780	1515.28	1515.28	1226.715
+1800	1520.38	1520.38	1226.715

**PLAN (4)**  
S=1:1000  
(CHITANDA ROAD)



Station No.	Distance	DL	CL	Reg Levels	Gradient
18+0	1800.000	1226.55	1227.15	1800.000	1227.15
+20	1820.000	1223.36	1224.55	1820.000	1224.55
+40	1840.000	1224.55	1224.55	1840.000	1224.55
+60	1860.000	1223.19	1224.55	1860.000	1223.19
+80	1880.000	1222.15	1222.15	1880.000	1222.15
+100	1900.000	1221.15	1221.15	1900.000	1221.15
+120	1920.000	1220.00	1220.00	1920.000	1220.00
+140	1940.000	1218.93	1218.93	1940.000	1218.93
+160	1960.000	1217.95	1217.95	1960.000	1217.95
+180	1980.000	1216.83	1216.83	1980.000	1216.83
+200	2000.000	1216.12	1216.12	2000.000	1216.12
+220	2020.000	1215.40	1215.40	2020.000	1215.40
+240	2040.000	1214.74	1214.74	2040.000	1214.74
+260	2060.000	1214.31	1214.31	2060.000	1214.31
+280	2080.000	1214.00	1214.00	2080.000	1214.00
+300	2100.000	1214.00	1214.00	2100.000	1214.00
+320	2120.000	1214.24	1214.24	2120.000	1214.24
+340	2140.000	1214.24	1214.24	2140.000	1214.24
+360	2160.000	1214.25	1214.25	2160.000	1214.25
+380	2180.000	1214.84	1214.84	2180.000	1214.84
+400	2200.000	1215.44	1215.44	2200.000	1215.44
+420	2220.000	1216.19	1216.19	2220.000	1216.19
+440	2240.000	1216.85	1216.85	2240.000	1216.85
+460	2260.000	1217.12	1217.12	2260.000	1217.12
+480	2280.000	1217.55	1217.55	2280.000	1217.55
+500	2300.000	1218.16	1218.16	2300.000	1218.16
+520	2320.000	1218.75	1218.75	2320.000	1218.75
+540	2340.000	1219.00	1219.00	2340.000	1219.00
+560	2360.000	1219.00	1219.00	2360.000	1219.00
+580	2380.000	1219.51	1219.51	2380.000	1219.51
+600	2400.000	1219.96	1219.96	2400.000	1219.96

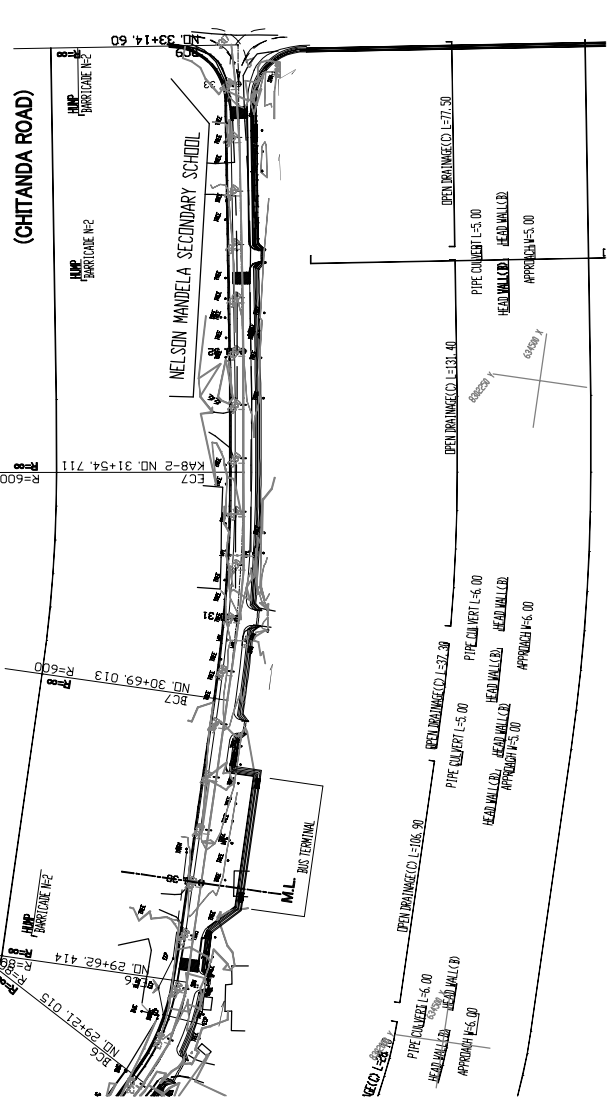
**PLAN (5) S=1:1000**  
**(CHITANDA ROAD)**



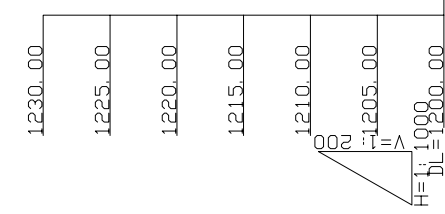
Station No.	Distance	CL Reg Levels	Gradient
24+0	0	2400.00	1219.75
24+20	20	2420.00	1219.41
24+40	40	2440.00	1219.11
24+60	60	2460.00	1219.00
24+80	80	2480.00	1218.81
25+0	0	2500.00	1218.08
25+20	20	2520.00	1217.64
25+40	40	2540.00	1217.61
25+60	60	2560.00	1217.38
25+80	80	2580.00	1217.20
26+0	0	2600.00	1217.00
26+20	20	2620.00	1217.00
26+40	40	2640.00	1216.84
26+60	60	2660.00	1216.80
26+80	80	2680.00	1216.00
27+0	0	2700.00	1216.00
27+20	20	2720.00	1216.00
27+40	40	2740.00	1215.84
27+60	60	2760.00	1215.43
27+80	80	2780.00	1215.00
28+0	0	2800.00	1214.80
28+20	20	2820.00	1214.30
28+40	40	2840.00	1213.97
28+60	60	2860.00	1213.88
28+80	80	2880.00	1213.53
29+0	0	2900.00	1213.60
29+20	20	2920.00	1213.09
29+40	40	2940.00	1213.12
29+60	60	2960.00	1212.79
29+80	80	2980.00	1212.75
30+0	0	3000.00	1212.31

MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE II) THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.LTD	CHITANDA ROAD		SCALE S=1:1000	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED	DATE	DATE	SHEET NO
			PLAN (5/6)							

**PLAN (6)** S=1:1000  
(CHITANDA ROAD)

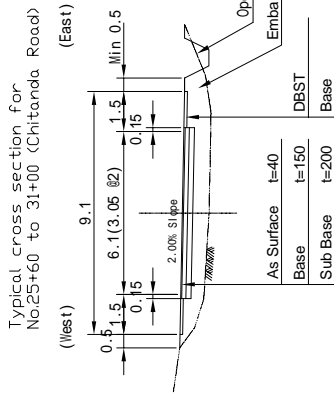
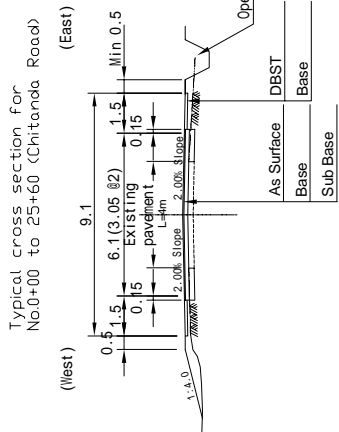


E.C. NO. 33+14.60

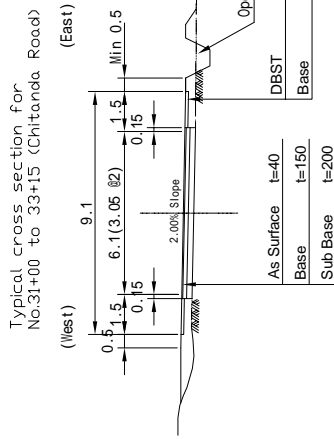
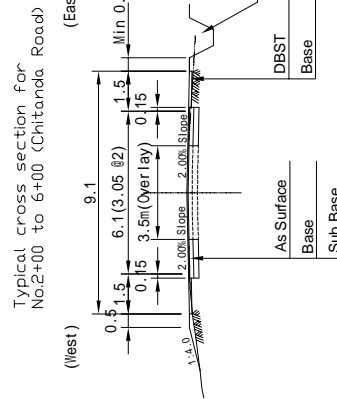


Gradient	1212.987	1211.474	1210.791	1210.447
CL Reg Levels	30+0 3000.000	31+0 3100.000	32+0 3200.000	33+0 3300.000
Distance	30+0 3000.000	30+60 3060.013	31+20 3120.000	31+80 3180.000
Station NO.	30+0	31+0	32+0	33+0

# Typical-Cross-Section(1) S=1:100 (CHITANDA ROAD)



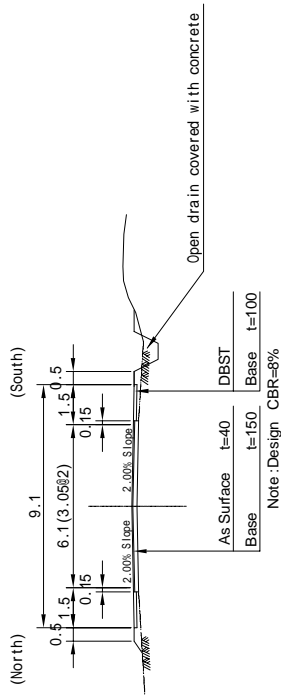
	As Surface	Base	Sub base	Existing road	Design	CBR
0+00 to 2+00	40	150	200	—	10%	10%
2+00 to 6+00	40	Existing (150)	Existing (200)	3.5m	10%	10%
6+00 to 8+00	40	200	300	—	4%	4%
8+00 to 14+00	40	150	Existing (200)	4.0m	15%	15%
14+00 to 20+00	40	200	200	—	5%	5%
20+00 to 25+60	40	200	200+ Existing (100)	5.0m	4%	4%



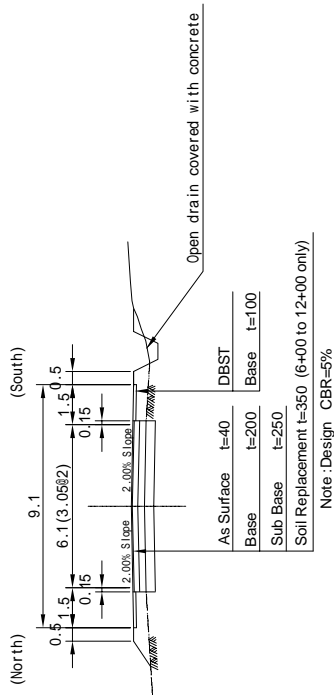
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE III) THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD	CHITANDA ROAD Typical-Cross-Section (1/4)	SCALE S=1:100	APPROVED MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA DATE: _____	JAPAN ENGINEERING CONSULTANTS CO.,LTD	PREPARED CHECKED SUBMITTED _____	DATE MAR,2005	SHEET NO 22/42
							PREPARED CHECKED SUBMITTED _____	DATE MAR,2005	SHEET NO 22/42

# Typical-Cross-Section(2)S=1:100 (KASANGULA ROAD)

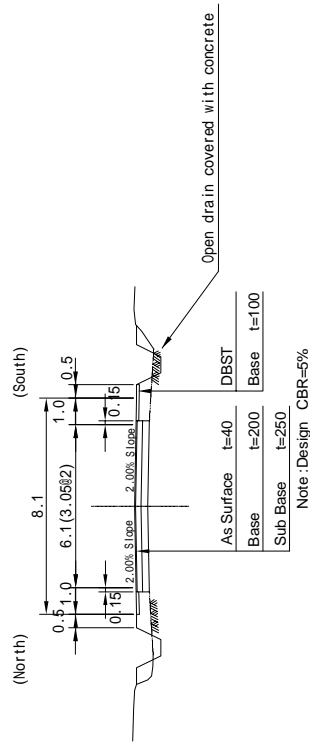
Typical cross section for No.0 to No.4+00 (Kasangula Road)



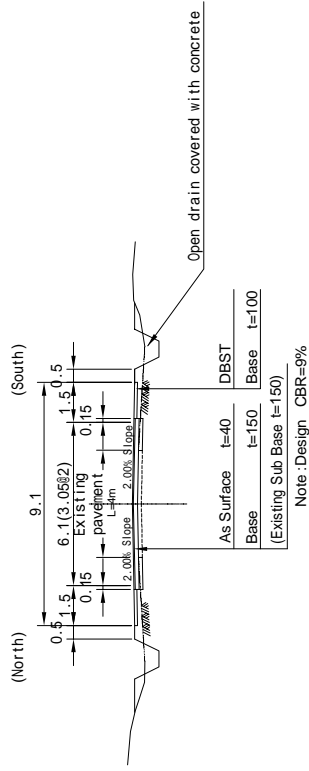
Typical cross section for No.4+00 to No.16+50 (Kasangula Road)



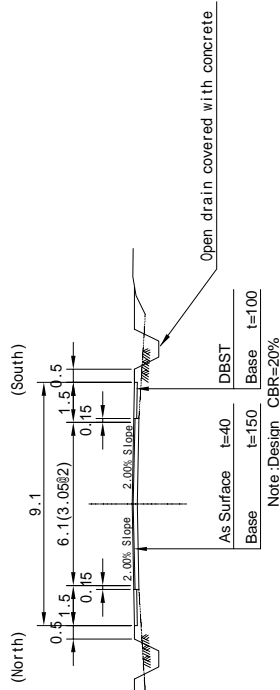
Typical cross section for No.16+50 to No.22+20 (Kasangula Road)



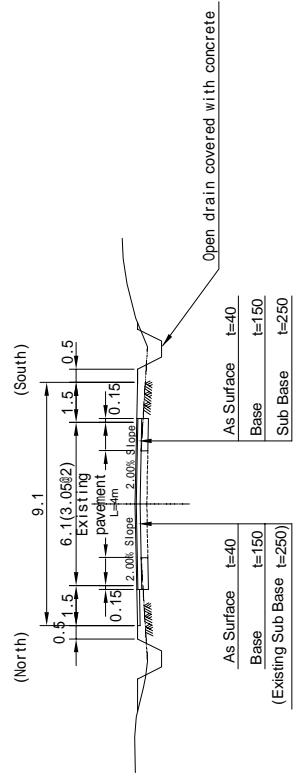
Typical cross section for No.22+20 to No.28+00 (Kasangula Road)



Typical cross section for No.28+00 to No.40+00 (Kasangula Road)



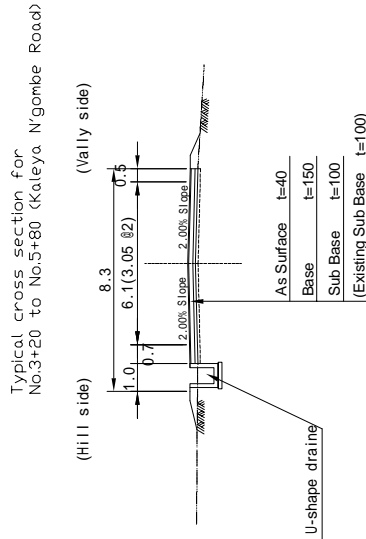
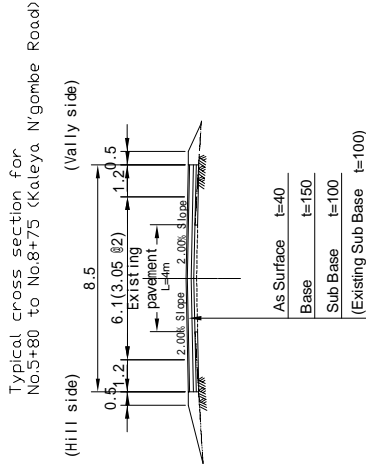
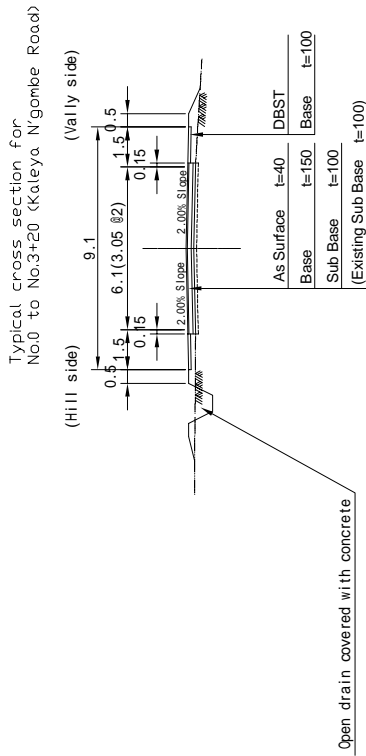
Typical cross section for No.40+00 to No.51+58 (Kasangula Road)



MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE III) THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD	KASANGULA ROAD Typical-Cross-Section (2/4)	SCALE S=1:100	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED	JAPAN ENGINEERING CONSULTANTS CO.,LTD	PREPARED CHECKED	DATE	SHEET NO
								SUBMITTED		23/42
									MAR,2005	

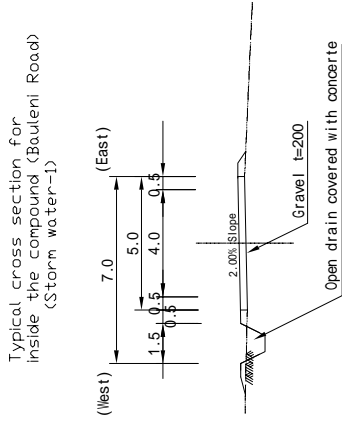
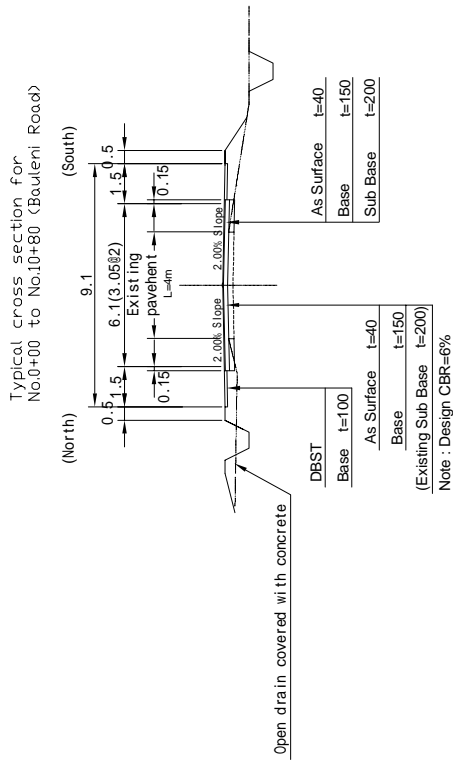


# Typical-Cross-Section(3)S=1:100 (KALEYA-N'GOMBE ROAD)



MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE III) THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD	KALEYA-N'GOMBE ROAD Typical-Cross-Section (3/4)	SCALE S=1:100	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED	DATE	
						JAPAN ENGINEERING CONSULTANTS CO.,LTD	PREPARED CHECKED	DATE
						SUBMITTED	MAR,2005	24/42

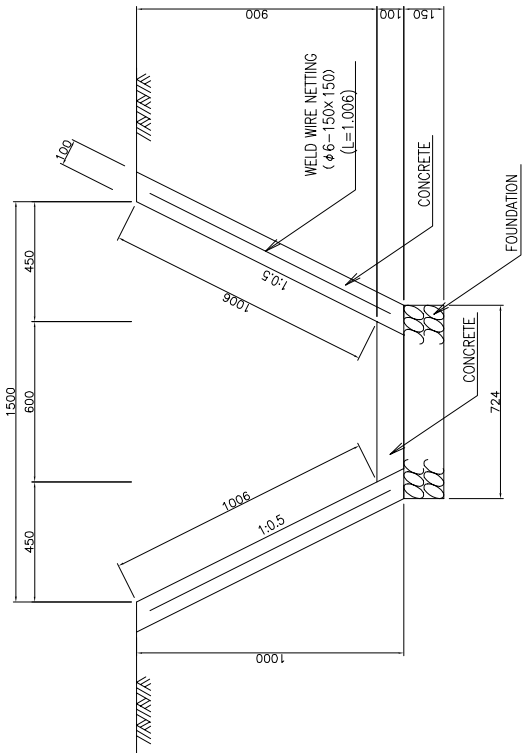
# Typical-Cross-Section(4)S=1:100 (BAULENI ROAD)



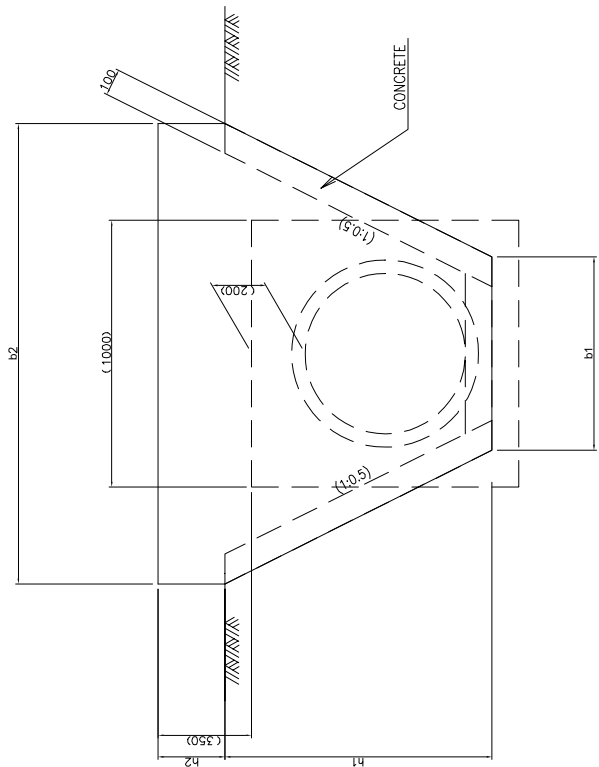
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE III) THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD	BAULENI ROAD Typical-Cross-Section (4/4)	SCALE S=1:100	APPROVED MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA DATE:	PREPARED CHECKED	DATE	SHEET NO
						SUBMITTED	MAR,2005	25/42

# DRAINAGE STRUCTURE ( 1 )

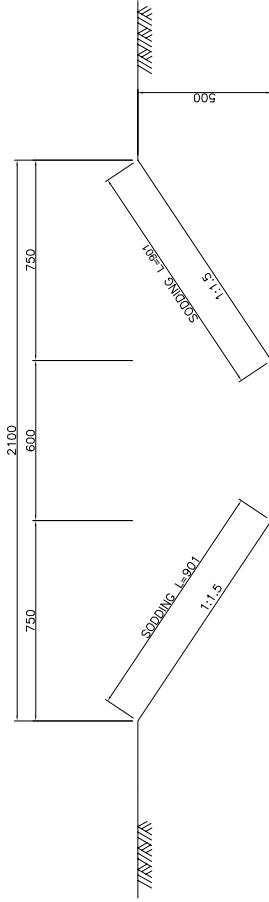
OPEN DRAINAGE ( C ) S=1:10



HEAD WALL S=1:10



OPEN DRAINAGE S=1:10

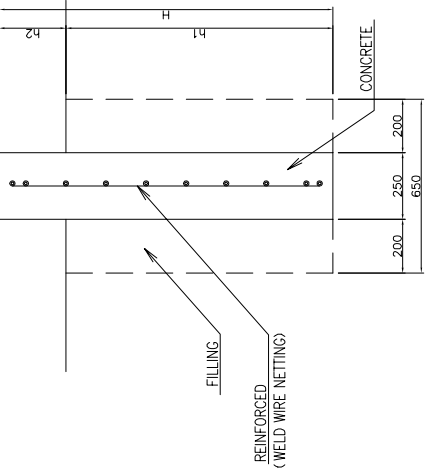


MATERIALS LIST PER m

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cu.m	1.333	
SURPLUS SOILS		cu.m	1.333	
PREPARATION FOR SLOPE		sq.m	2.236	
CONCRETE	ρck=18N/mm <sup>2</sup>	cu.m	0.279	
FORM		sq.m	2.236	
FOUNDATION		cu.m	0.109	
REINFORCED	φ6-150x150 WELD WIRE NETTING	kg	6.157	

MATERIALS LIST PER m

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cu.m	0.675	
SURPLUS SOILS		cu.m	0.675	
SODDING		sq.m	1.802	



DIMENSION TABLE

TYPE	H	h1	h2	b1	b2	REMARK
TYPE-A	1250	1000	250	724	1724	CA
TYPE-B	1250	1000	250	1050	2500	CB
TYPE-C	1450	1450	0	1174	2574	CC

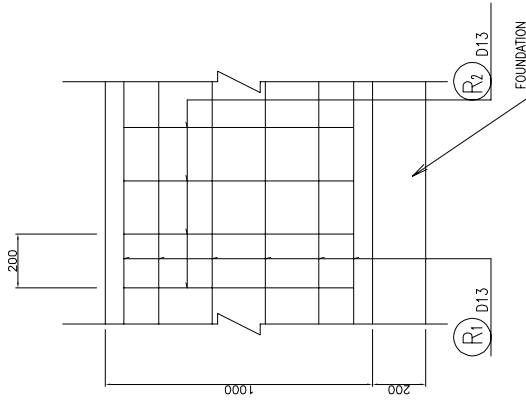
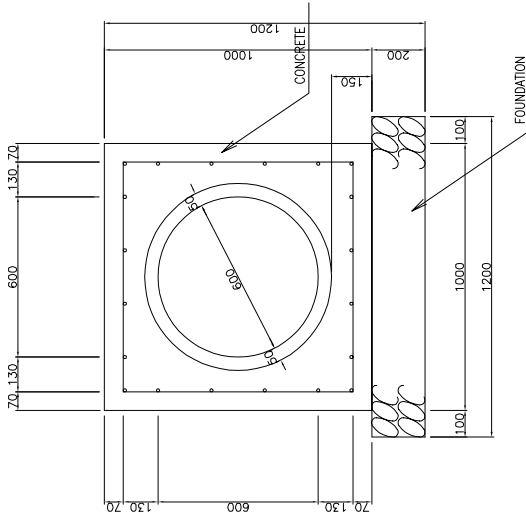
MATERIALS LIST PER EACH

CLASSIFICATION	STANDARD	UNIT	QUANTITY			REMARK
			TYPE-A	TYPE-B	TYPE-C	
EXCAVATION		cu.m	0.796	1.154	1.743	
FILLING		cu.m	0.490	0.710	1.072	
SURPLUS SOILS		cu.m	0.306	0.444	0.671	
CONCRETE	ρck=18N/mm <sup>2</sup>	cu.m	0.343	0.529	0.430	
FORM		sq.m	3.429	4.977	4.944	
REINFORCED	φ6-150x150 WELD WIRE NETTING	kg	2.723	4.800	3.676	

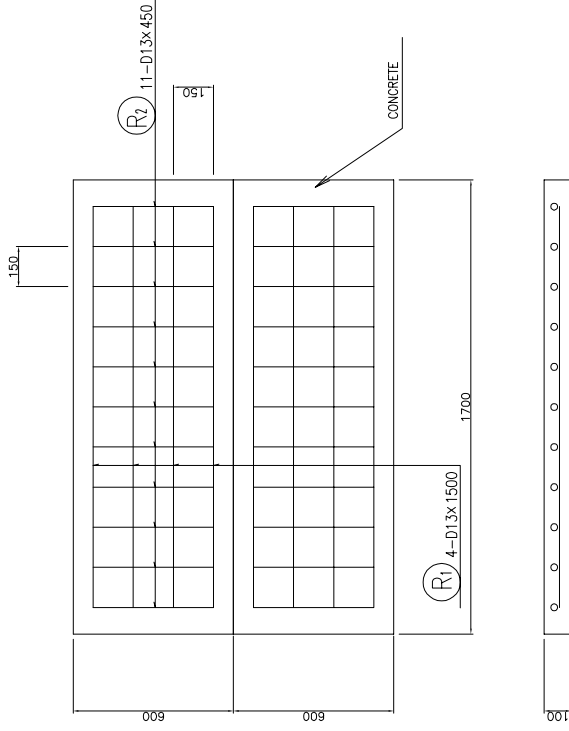


# DRAINAGE STRUCTURE ( 3 )

PIPE CULVERT D600 s=1:10



SLAB s=1:10



MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cu.m	29.250	
FILLING		cu.m	16.850	
SURPLUS SOILS		cu.m	12.400	
CONCRETE	cc=18N/mm <sup>2</sup>	cu.m	6.152	
FORM		sq.m	20.000	
FOUNDATION REINFORCED	D13	cu.m	2.400	
		kg	416.905	

PER 10m

MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
CONCRETE	cc=24N/mm <sup>2</sup>	cu.m	0.102	
FORM		sq.m	1.480	
REINFORCED	D13	kg	10.895	

PER EACH

MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA

THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE II) THE REPUBLIC OF ZAMBIA

JAPAN ENGINEERING CONSULTANTS CO.,LTD

DRAINAGE STRUCTURE ( 3 )  
STRUCTURE ( 3 / 17 )

SCALE

SHOWN

MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA

APPROVED

DATE

JAPAN ENGINEERING CONSULTANTS CO.,LTD

PREPARED CHECKED

SUBMITTED

DATE

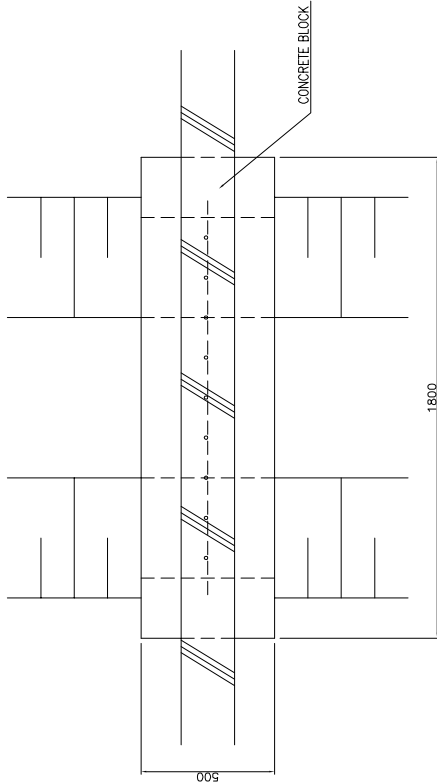
MAR, 2005

SHEET NO

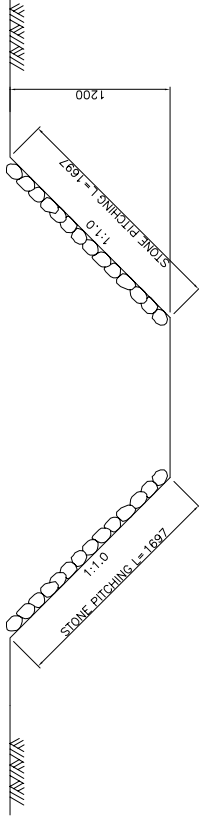
28 / 42

# DRAINAGE STRUCTURE ( 4 )

SECURITY PROTECTION WITH REINFORCEMENT BAR S=1:10

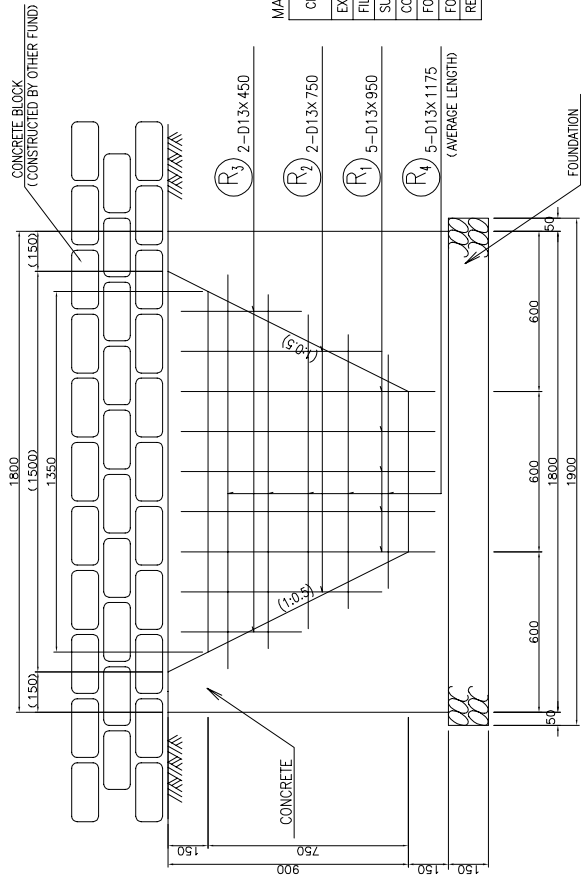


RIVER PROTECTION S=1:20

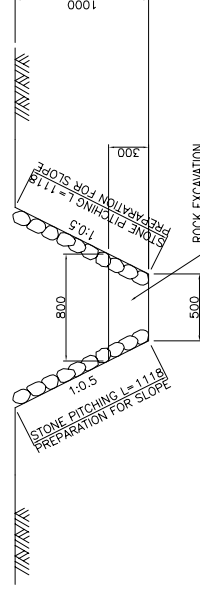


MATERIALS LIST PER 10m

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
STONE PITCHING		sq.m	33.940	



DRAINAGE REPAIR S=1:20



MATERIALS LIST PER EACH

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cu.m	1.800	
FILLING		cu.m	0.713	
SURPLUS SOILS		cu.m	1.087	
CONCRETE		cu.m	0.579	
FORM		sq.m	5.049	
FOUNDATION		cu.m	0.143	
REINFORCED	DT3	kg	12.960	

MATERIALS LIST PER 10m

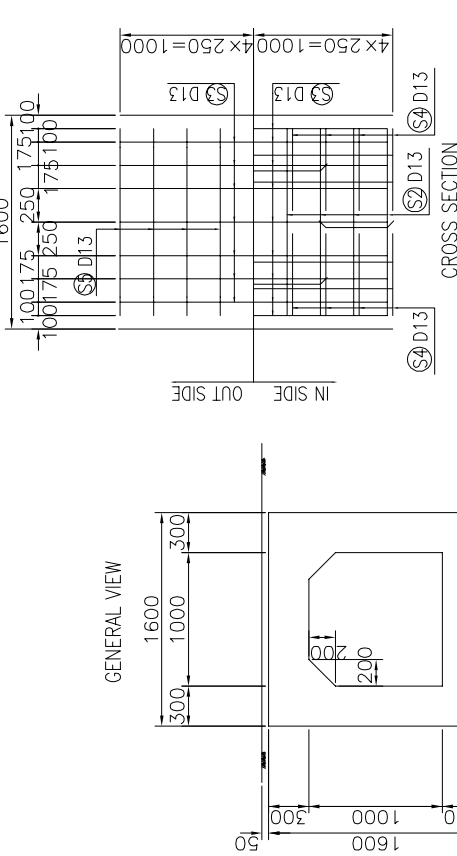
CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
ROCK EXCAVATION		cu.m	1.950	
PREPARATION FOR SLOPE		sq.m	22.360	
STONE PITCHING		sq.m	22.360	

MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE II) THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD		DRAINAGE STRUCTURE ( 4 ) STRUCTURE ( 4 / 17 )	SCALE SHOWN	APPROVED DATE	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD	PREPARED CHECKED	DATE	SHEET NO
		SUBMITTED	MAR.2005						29 / 42		

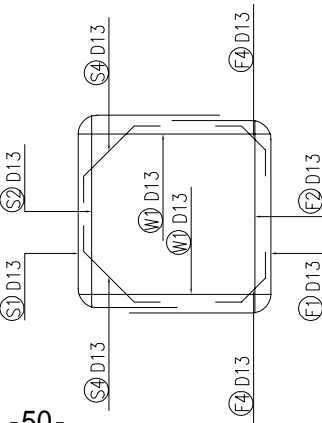
# DRAINAGE STRUCTURE (5)

BOX CULVERT

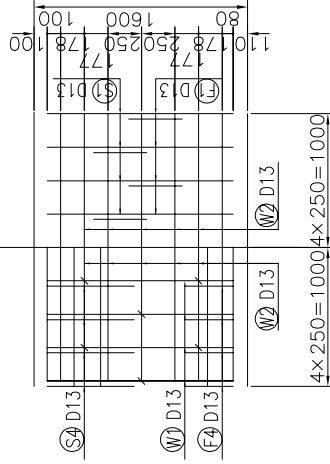
S=1:20  
SLAB



ARRANGEMENT OF REINFORCEMENT BAR



WALL



PER 10m

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cum	57.813	
FILLING		cum	28.613	
SURPLUS SOILS		cum	29.200	
CONCRETE	cc=24N/mm <sup>2</sup>	cum	16.000	
FORM		sqm	59.656	
FOUNDATION		cum	3.600	
REINFORCED	D13	kg	1,219.5	

DIMENSION TABLE

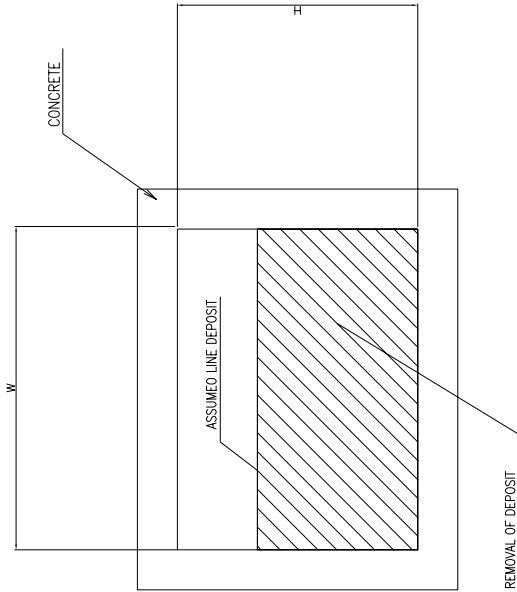
SYMBOL	TYPE	DIAMETER	LENGTH (mm)	L 1 (mm)	L 2 (mm)	L 3 (mm)	L 4 (mm)	H (mm)	R (mm)
S1	4	D13	3080	600	220	1120	920		140
S2	1	D13	4	1400					
S3	1	D13	16	1000					
S4	5	D13	8	1040	195	649		459	
S5	3	D13	3	980		126			
W1	1	D13	8	1390	1390				
W2	1	D13	20	1000	1000				
W3	2	D13	12	360		152			
F1	4	D13	4	3080	600	220	1120	920	140
F2	1	D13	4	1400					
F3	1	D13	16	1000					
F4	5	D13	8	650	195	255		180	
F5	3	D13	3	940		106			

REINFORCEMENT BAR LIST

SYMBOL	DIAMETER	LENGTH (mm)	No.	UNIT_W (kg)	W_SEGMENT (kg)	WEIGHT (kg)	REMARK
S1	D13	3080	4	0.955	3.065	12.260	
S2	D13	1400	4	0.955	1.393	5.572	
S3	D13	1000	16	0.955	0.955	15.920	
S4	D13	1040	8	0.955	1.035	8.280	
S5	D13	980	3	0.955	0.975	2.925	
W1	D13	1390	8	0.955	1.383	11.064	
W2	D13	1000	20	0.955	0.955	19.900	
W3	D13	360	12	0.955	0.358	4.296	
F1	D13	3080	4	0.955	3.065	12.260	
F2	D13	1400	4	0.955	1.393	5.572	
F3	D13	1000	16	0.955	0.955	15.920	
F4	D13	650	8	0.955	0.647	5.176	
F5	D13	940	3	0.955	0.935	2.805	

# CLEANING OF DRAINAGE

CLEANING OF EXISTING BOX CULVERT S=1:10



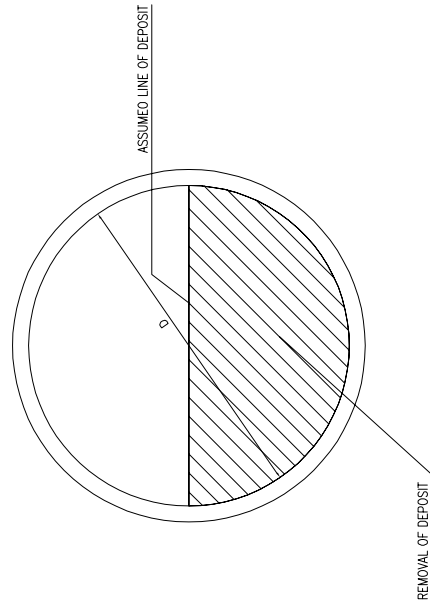
DIMENSION TABLE

SYMBOL	H	h	W	REMARKS
BOX	1000	667	1000	1000x1000
CULVERT	1500	1000	1500	1500x1500

MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARKS
REMOVAL OF DEPOSIT	1000x1000	cu.m	6.670	
	1500x1500	cu.m	15.000	

CLEANING OF EXISTING PIPE CULVERT S=1:10



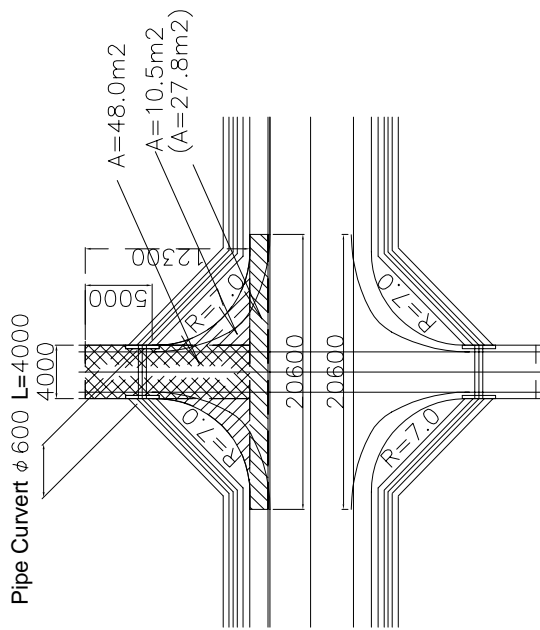
MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARKS
REMOVAL OF DEPOSIT	D 600	cu.m	1.414	

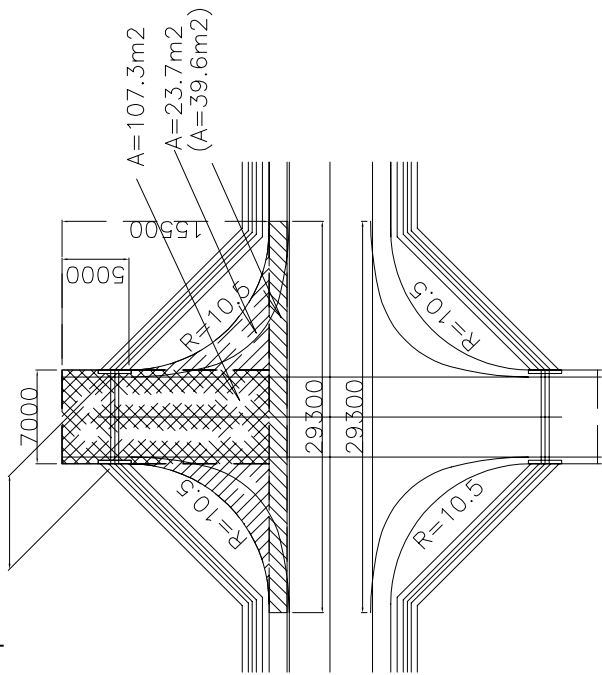
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE II) THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD		APPROVED	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	DATE	SHEET NO
		CLEANING OF DRAINAGE STRUCTURE (6/17)					
		JAPAN ENGINEERING CONSULTANTS CO.,LTD		APPROVED	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	DATE	SHEET NO
		SCALE		APPROVED	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	DATE	SHEET NO
		STRUCTURE (6/17)		APPROVED	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	DATE	SHEET NO
		SHOWIN		APPROVED	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	DATE	SHEET NO
		DATE		APPROVED	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	DATE	SHEET NO
		SUBMITTED		APPROVED	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	DATE	SHEET NO
		DATE		APPROVED	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	DATE	SHEET NO
		DATE		APPROVED	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	DATE	SHEET NO



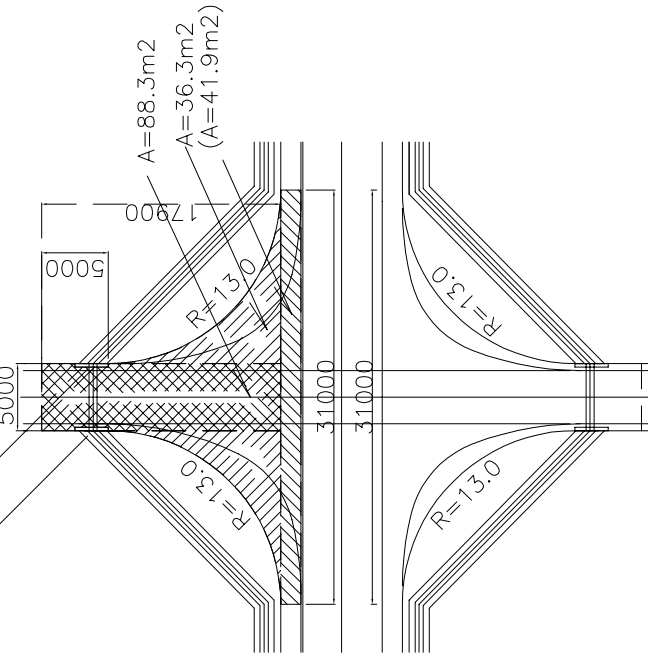
Intersection Type  
Type-1 (W=4.0)



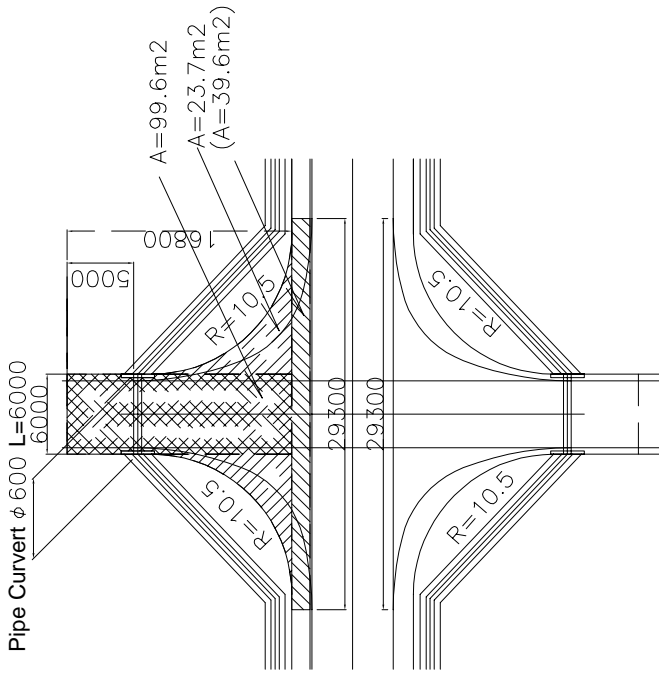
Type-4 (W=7.0)



Type-2 (W=5.0)



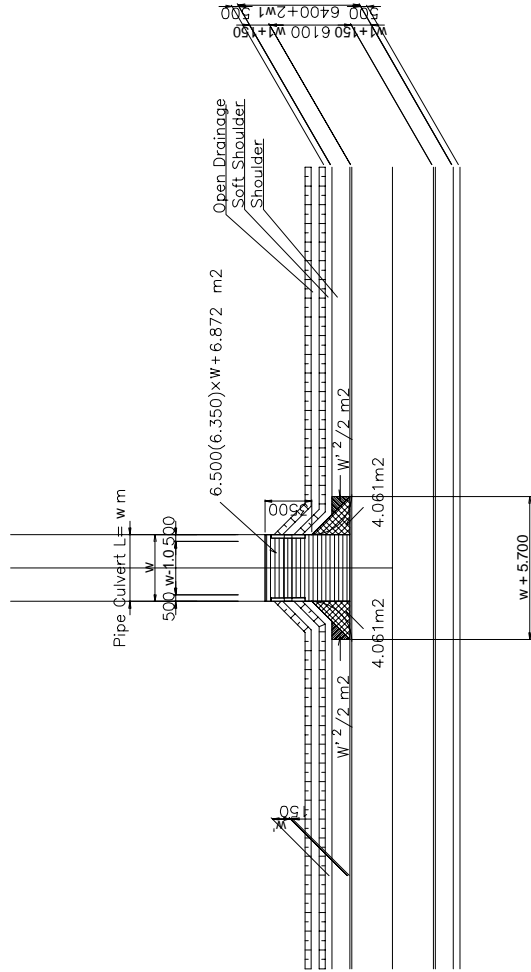
Type-3 (W=6.0)



MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	TYPE		REMARKS
			T	W	
Pavement	Shoulder W=1.5 Sq.m	96.8	4.0m	5.0m	6.0m
			3.0m	3.0m	3.0m
			7.0m	7.0m	7.0m
DBST	Shoulder Other Sq.m	69.0	4.0m	5.0m	6.0m
			3.0m	3.0m	3.0m
			7.0m	7.0m	7.0m
					PER EACH
					W=1.35

# Approach Road



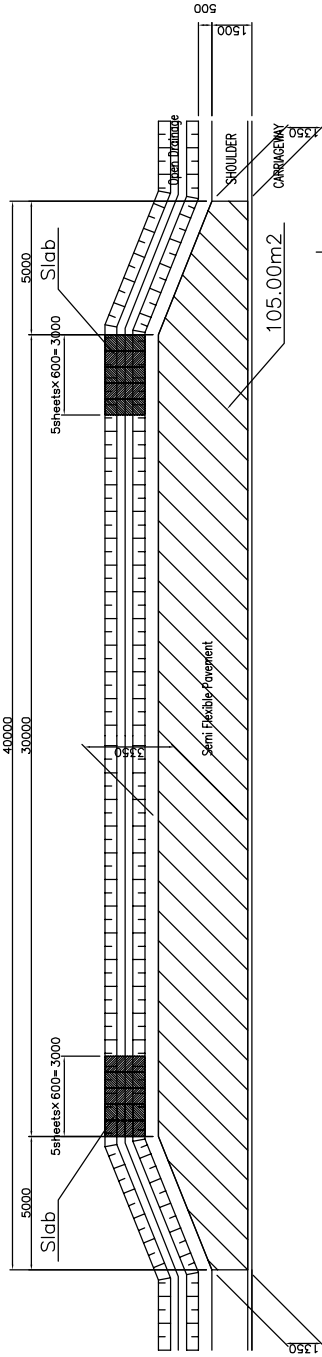
PER EACH

CLASSIFICATION	STANDARD	UNIT	QUANTITY			REMARKS
			W=5.0m	W=6.0m	W=7.0m	
Pavement	Shoulder W=1.5 Sq.m	38.6	45.0	51.3	64.0	W=1.35
	Shoulder W=1.2 Sq.m	28.5	33.8	39.1	49.7	
	Shoulder W=1.0 Sq.m	30.3	35.8	41.3	52.3	
	Shoulder W=0.7 Sq.m	33.0	38.8	44.6	56.2	
DBST	Shoulder W=0.5 Sq.m	35.0	41.0	47.0	59.0	
	Shoulder W=1.5 Sq.m	-12.6	-14.0	-15.3	-18.0	W=1.35

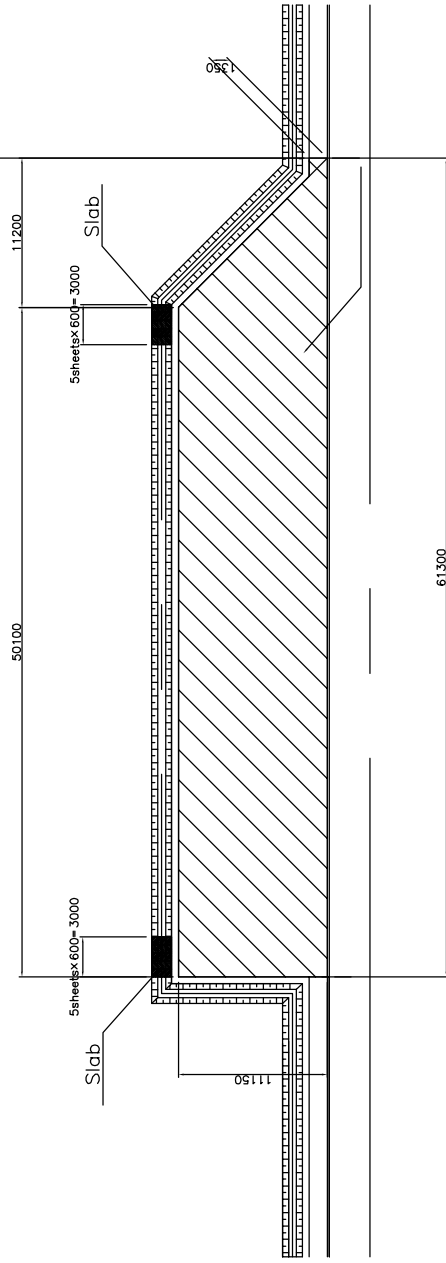
$\text{Pavement}(W=1.5\text{m}) = 6.350 \times W + 6.872 \text{ m}^2$   
 $\text{Pavement}(\text{Others}) = (6.5 - W) \times W + (3.0 - W)^2 - 1.25 \text{ m}^2$   
 $\text{DBST}(W=1.5\text{m}) = W^2 - (W + 5.70) \times W$

MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE III) THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD	APPROACH ROAD STRUCTURE ( 8/17)	SCALE SHOWN	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED DATE	JAPAN ENGINEERING CONSULTANTS CO.,LTD	PREPARED CHECKED SUBMITTED	DATE MAR, 2005	SHEET NO 33 / 42
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DETAIL OF BUS STOP S=1:100



DETAIL OF BUS TERMINAL S=1:200



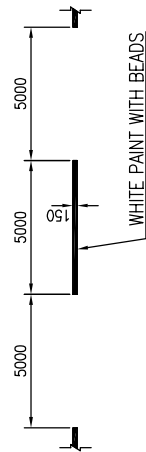
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE II) IN THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD	DETAIL OF BUS STOP STRUCTURE (9/17)	SCALE SHOWN	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED	PREPARED CHECKED	DATE	SHEET NO
						DATE			
								MAR, 2005	34 / 42

# ROAD MARKING

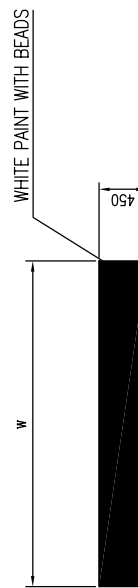
OUTER-BOUNDARY LINE S=1:200



LANE LINE S=1:200

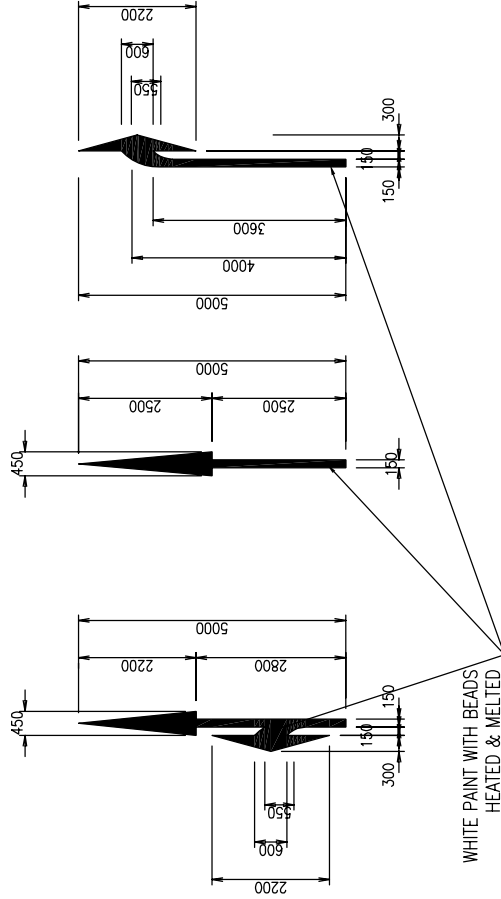


STOP LINE S=1:50



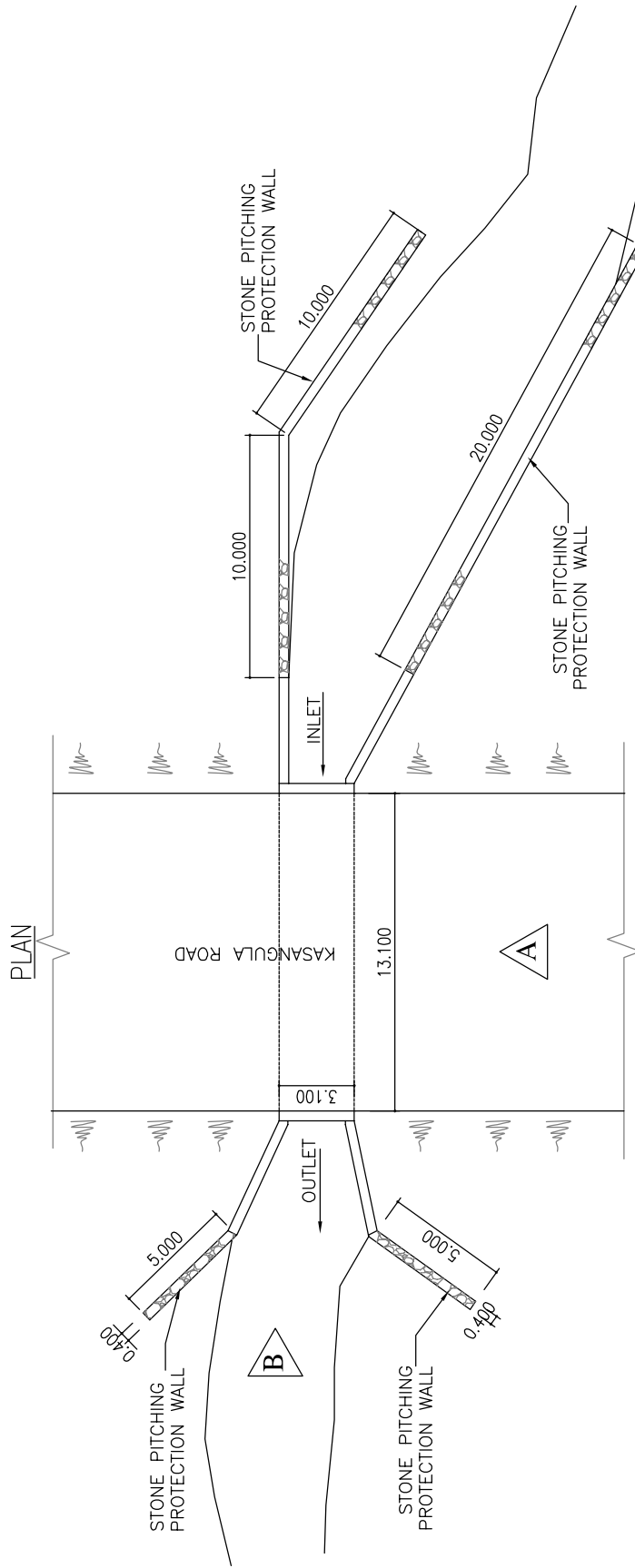
ARROW MARK S=1:100

STRAIGHT RIGHT-TURN



MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE II) THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD	ROAD MARKING STRUCTURE (10/17)	SCALE SHOWN	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED	DATE	JAPAN ENGINEERING CONSULTANTS CO.,LTD	PREPARED CHECKED	DATE	SHEET NO
											35/42
									SUBMITTED		

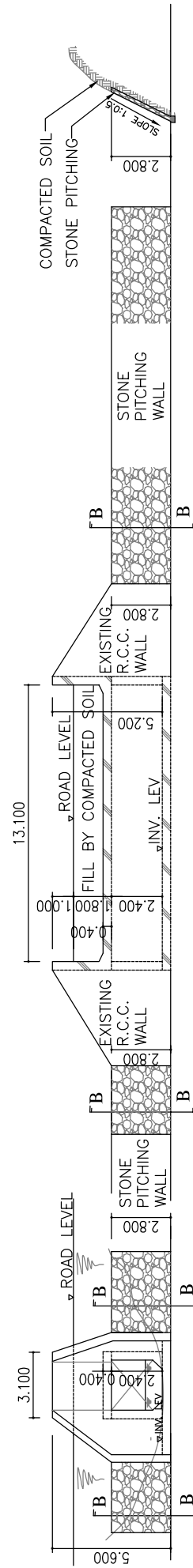
OUTLET-4 S=1/1.00



TYP. SEC- B-B

ELEVATION-A

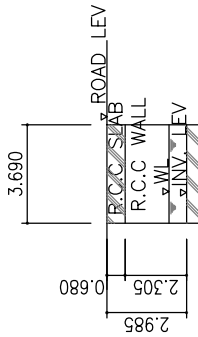
ELEVATION-B



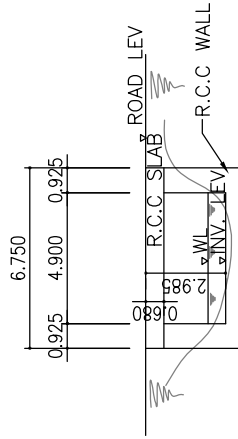
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD	OUTLET -4- STRUCTURE (11/17)	SCALE S=1:20	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED	JAPAN ENGINEERING CONSULTANTS CO.,LTD	PREPARED CHECKED	DATE	SHEET NO
							SUBMITTED	MAR,2005	36/42

OUTLET-5 S=1/100

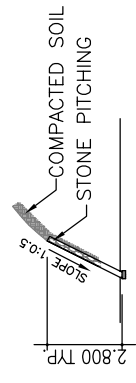
SECA-A  
OLD BRIDGE



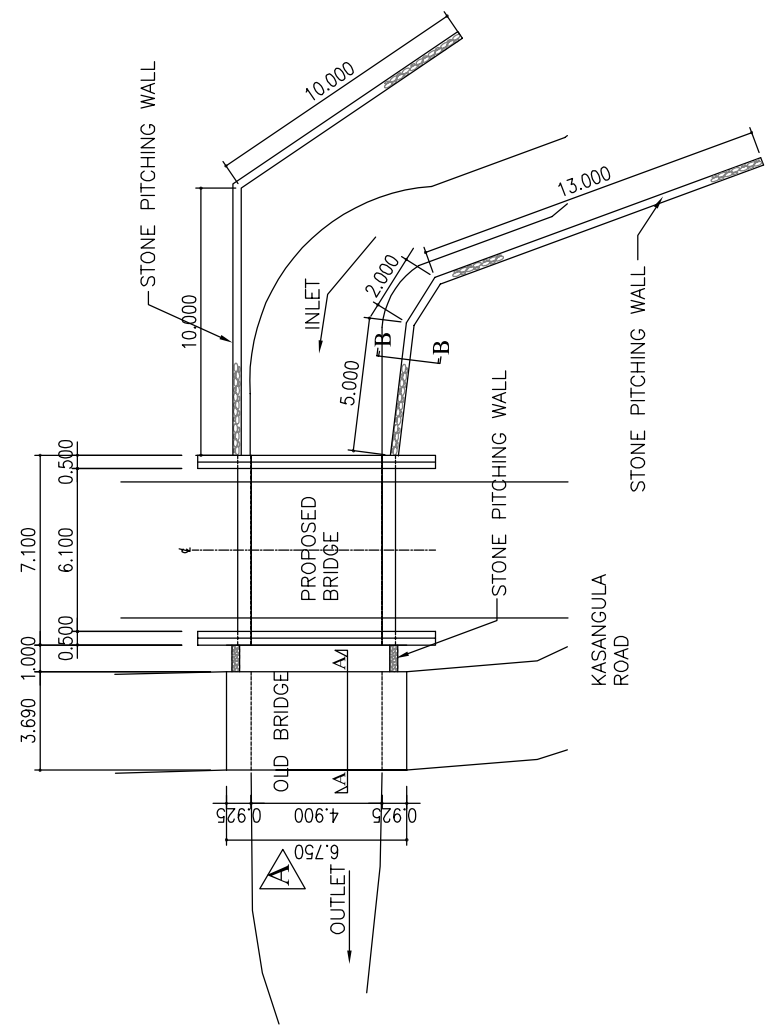
ELEVATION-A  
OLD BRIDGE



TYP. SEC- B-B



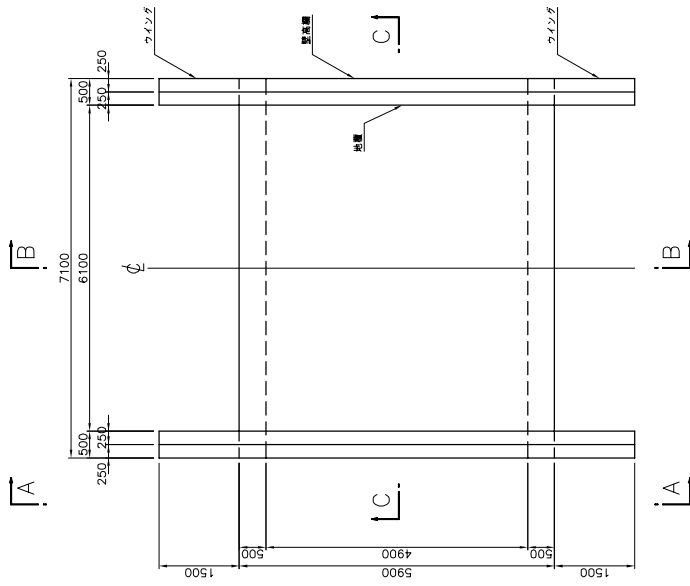
PLAN



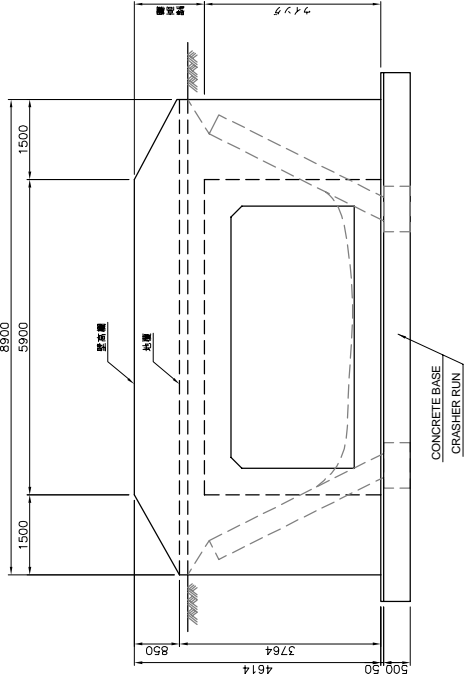
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LOSAKA CITY ROADS (PHASE III) E.T.C THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD	OUTLET -5-(1) STRUCTURE (12/17)	SCALE S=1:20	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED	JAPAN ENGINEERING CONSULTANTS CO.,LTD	PREPARED CHECKED	DATE	SHEET NO
						(DATE)		SUBMITTED	MAR,2005	37/42

# OUTLET-5 GENERAL VIEW OF BOX CULVERT

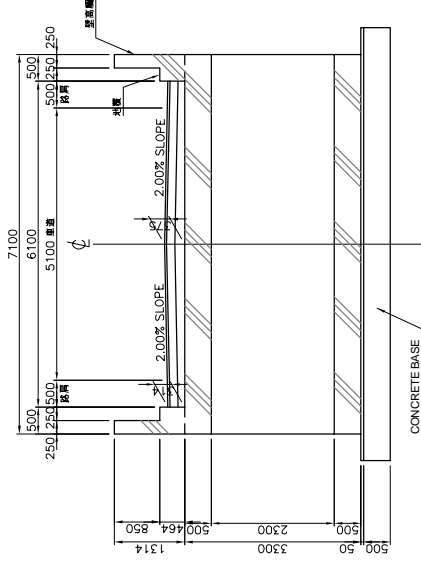
PLAN S=1:50



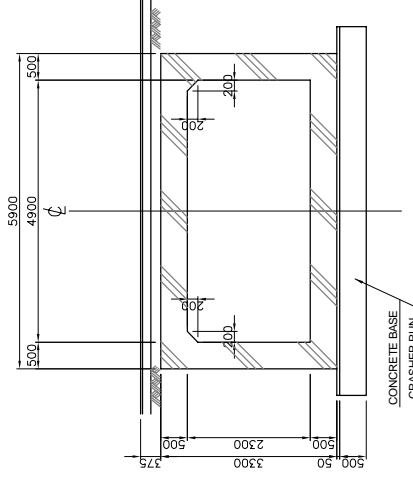
A - A S=1:50



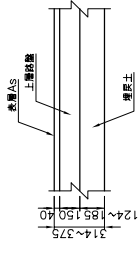
C - C S=1:50



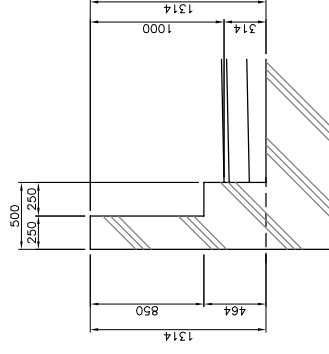
B - B S=1:50



TYPICAL SECTION OF PAVEMENT S=



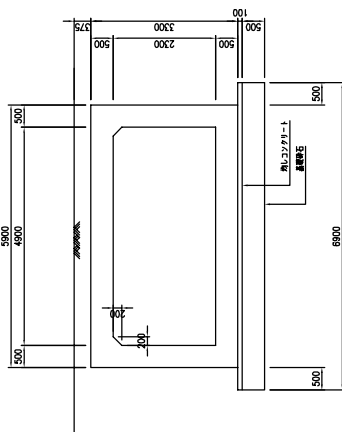
GENERAL CROSSING VIEW OF W/



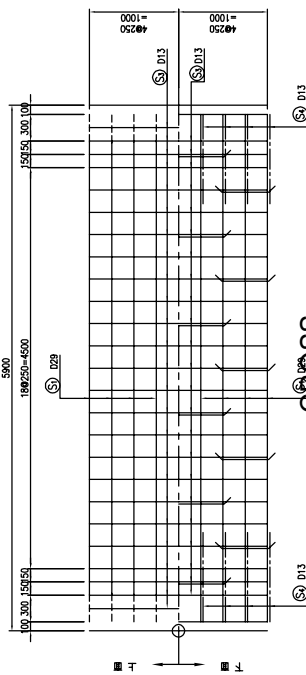
MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE II) THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD	OUTLET -5-(2) STRUCTURE (13/17)	SCALE S=1:20	APPROVED MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA DATE	PREPARED CHECKED JAPAN ENGINEERING CONSULTANTS CO.,LTD SUBMITTED	DATE MAR, 2005	SHEET NO 38/42
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# OUTLET-5 BAR ARRANGEMENT OF BOX CULVERT

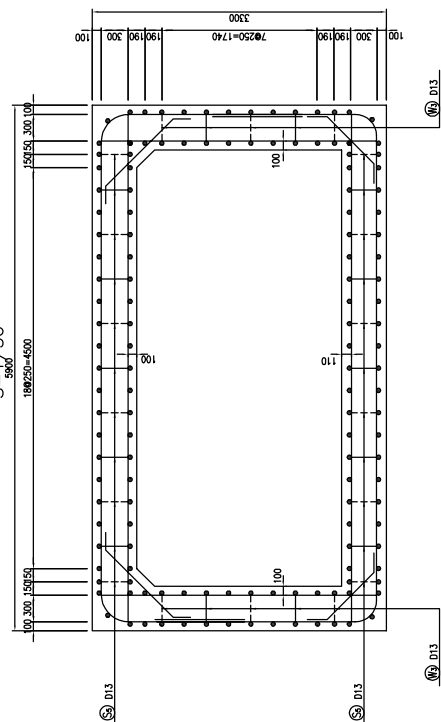
GENERAL  
S=1/60



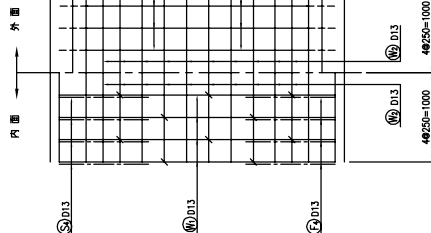
SLAB



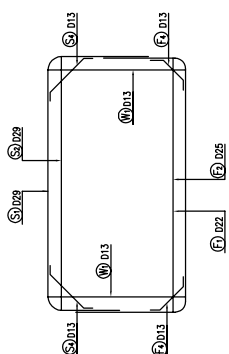
CROSS  
SECTION  
S=1/30



SIDEWALL



主鉄筋組立



DIMENSION TABLE

TYPE	DIA (mm)	a (mm)	b (mm)	c (mm)	R (mm)	L (mm)	TOTAL (mm)
S1	D29	1300	4	5.04	48.872	187.488	—
S2	D29	1700	4	5.04	28.728	114.912	—
S3	D13	1000	50	0.995	0.995	49.75	—
S4	D13	1130	8	0.995	1.74	12.984	—
S5	D13	3030	8	0.995	3.075	24.6	—
W1	D13	1000	52	0.995	0.995	51.74	—
W2	D13	800	28	0.995	0.995	33.986	—
W3	D13	800	28	0.995	0.995	33.986	—
F1	D25	1700	4	3.381	22.886	90.744	—
F2	D13	1000	50	0.995	0.995	49.75	—
F3	D13	1710	8	0.995	1.204	8.632	—
F4	D13	1710	8	0.995	1.204	8.632	—
F5	D13	1380	11	0.995	3.231	13.103	—

WEIGHT OF THE BAR

TYPE	DIA (mm)	LENGTH (mm)	WEIGHT (kg)	TOTAL (kg)			
S1	D29	1300	4	5.04	48.872	187.488	—
S2	D29	1700	4	5.04	28.728	114.912	—
S3	D13	1000	50	0.995	0.995	49.75	—
S4	D13	1130	8	0.995	1.74	12.984	—
S5	D13	3030	8	0.995	3.075	24.6	—
W1	D13	1000	52	0.995	0.995	51.74	—
W2	D13	800	28	0.995	0.995	33.986	—
W3	D13	800	28	0.995	0.995	33.986	—
F1	D25	1700	4	3.381	22.886	90.744	—
F2	D13	1000	50	0.995	0.995	49.75	—
F3	D13	1710	8	0.995	1.204	8.632	—
F4	D13	1710	8	0.995	1.204	8.632	—
F5	D13	1380	11	0.995	3.231	13.103	—

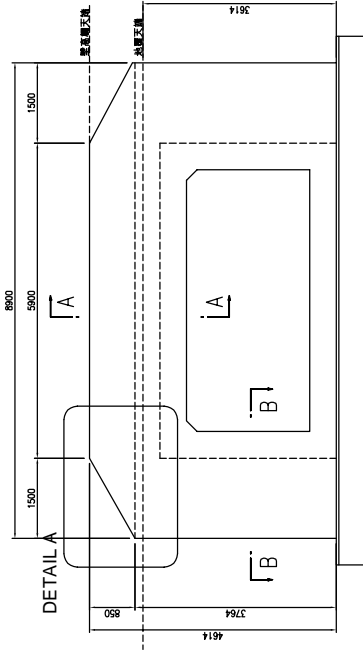
DIMENSION TABLE

CLASSIFICATION	UNIT	QUANTITY
CONCRETE	FOOT	2.340
FORM	SQ. FT	2.950
FORM	TOTAL	15.862
FORM	D13	240.239
FORM	D22	118.165
FORM	D25	302.481
FORM	TOTAL	752.951
BASE	CO. MM.	0.680
BASE	SQ. FT	3.450



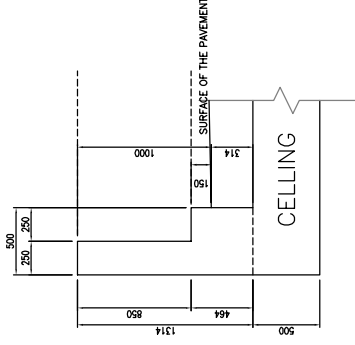
# OUTLET-5 Wall/Wing

BOX CULVERT CROSS SECTION S=1/50

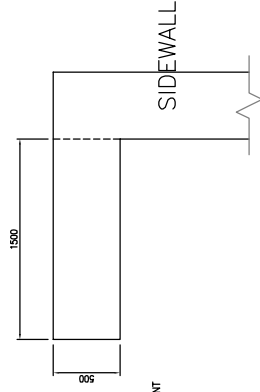


ARRANGEMENT OF RAINFORCEMENT BAR S=1/20

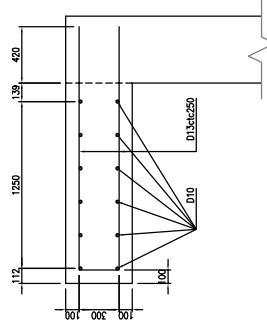
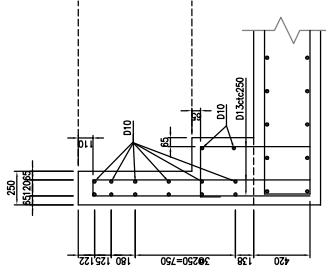
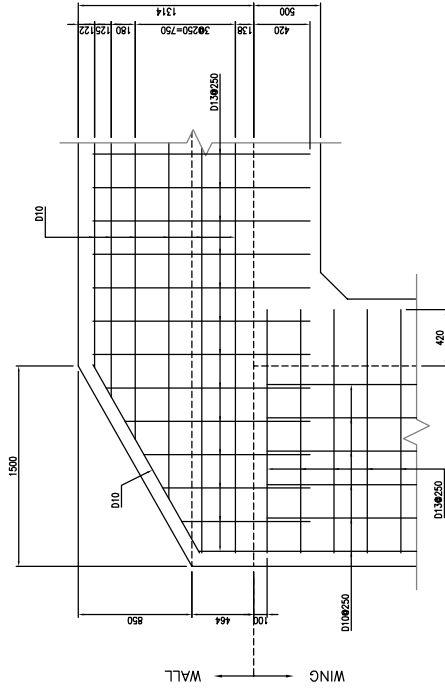
(A - A)



S=1/20  
(B - B)



DETAIL DRAWING OF A S=1/20

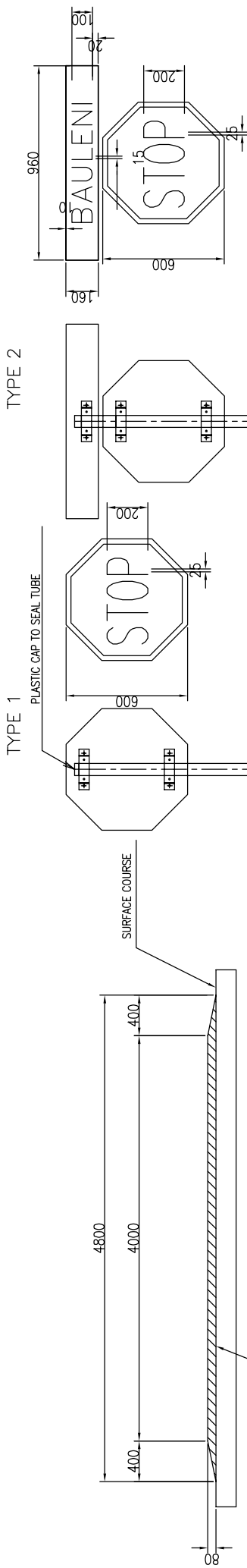


MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LOSAKA CITY ROADS (PHASE III) P.L.C. THE REPUBLIC OF ZAMBIA	JAPAN ENGINEERING CONSULTANTS CO.,LTD	OUTLET -5-(4) STRUCTURE (15/17)	SCALE S=1:20	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED _____ DATE _____	JAPAN ENGINEERING CONSULTANTS CO.LTD	PREPARED CHECKED _____ SUBMITTED _____	DATE MAR,2005	SHEET NO 40/42
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# PAVEMENT WORK

HUMP S=1:20

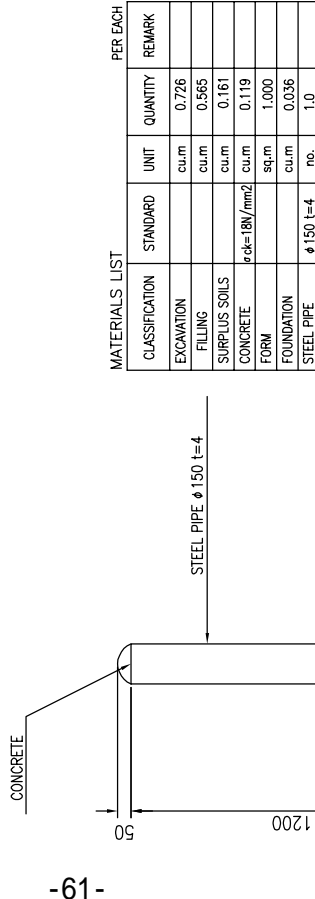
SIGN POST S=1:20



MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	QUANTITY	PER EACH	REMARK
ASPHALT		t	5.045		

BARRICADE S=1:10

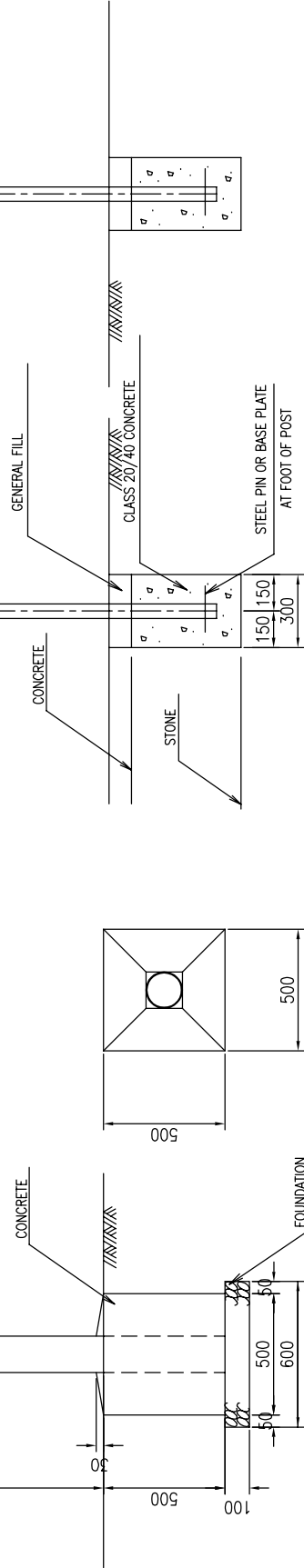


MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	QUANTITY	PER EACH	REMARK
EXCAVATION		cu.m	0.726		
FILLING		cu.m	0.566		
SURPLUS SOILS		cu.m	0.161		
CONCRETE		cu.m	0.119		
FORM		sq.m	1.000		
FOUNDATION		cu.m	0.036		
STEEL PIPE		no.	1.0		

MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	QUANTITY		REMARK
			TYPE 1	TYPE 2	
EXCAVATION		cu.m	0.486	0.486	
FILLING		cu.m	0.446	0.446	
SURPLUS SOILS		cu.m	0.040	0.040	
SIGN	ALUMINIUM PLATE	no.	1.0	2.0	
SEAL TUBE	PLASTIC CAP	no.	1.0	1.0	
STEEL PIPE	48X3X305mm GALVANIZED	no.	1.0	1.0	
STEEL PIN	GALVANIZED	no.	1.0	1.0	
CONCRETE	σ <sub>ck</sub> =18N/mm <sup>2</sup>	cu.m	0.041	0.041	
FORM		sq.m	0.054	0.054	
FIXING BRACKET		no.	2.0	3.0	
STIFFENING MATERIAL	ANGLE AND PREFORM FLANGE	no.	1.0	1.0	

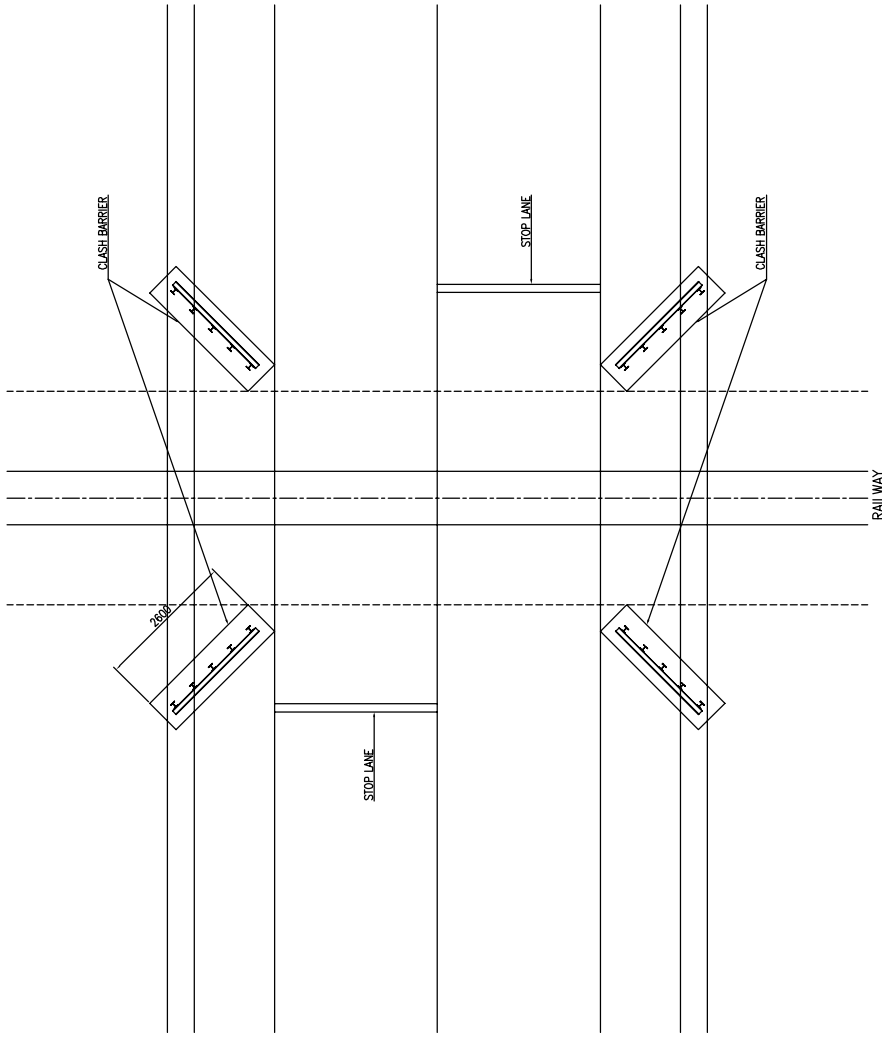


MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE II)	JAPAN ENGINEERING CONSULTANTS CO.,LTD	PAVEMENT WORK	SCALE SHOWN	STRUCTURE ( 16/17)	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED	JAPAN ENGINEERING CONSULTANTS CO.,LTD	PREPARED CHECKED	DATE	SHEET NO
							DATE		SUBMITTED	MAR, 2005	41 / 42

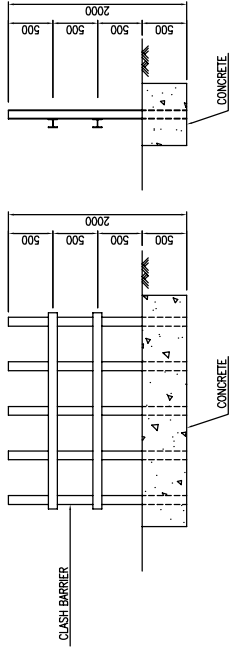
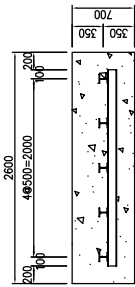
# CLASH BARRIER

## RAILWAY LEVEL CROSSING LAYOUT (REFERENCE DRAWING)

PLAN S=1:50



CLASH BARRIER S=1:30

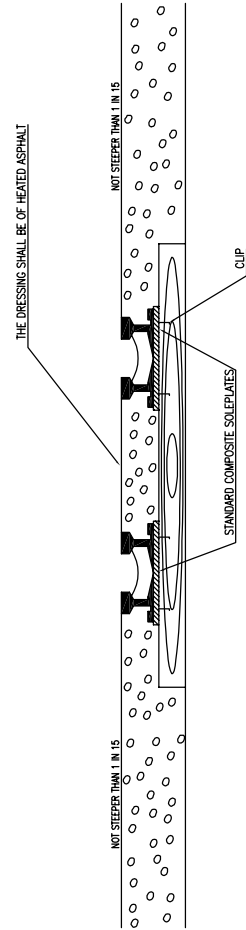


MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cu.m	2.080	
FILLING		cu.m	1.170	
SURPLUS SOILS		cu.m	0.910	
CONCRETE	std=18N/mm <sup>2</sup>	cu.m	0.910	
FORM	H=1,500 L=2,000	sq.m	3.300	
CLASH BARRIER		set	1	

PER EACH

CROSS SECTION S=1:5



MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	THE PROJECT FOR IMPROVEMENT AND MAINTENANCE OF LUSAKA CITY ROADS (PHASE II)	JAPAN ENGINEERING CONSULTANTS CO.,LTD	CLASH BARRIER STRUCTURE (17/17)	SCALE SHOWN	MINISTRY OF LOCAL GOVERNMENT AND HOUSING THE REPUBLIC OF ZAMBIA	APPROVED	JAPAN ENGINEERING CONSULTANTS CO.,LTD	PREPARED CHECKED	DATE	SHEET NO
						DATE		SUBMITTED		

## **Chapter 3 Implementation Plan**

### **3-1 Implementation Plan**

The Ministry of Local Government and Housing of Zambia will be responsible for the administrative control of the Project while the Engineering Department of the Lusaka City Council will be responsible for technical matters. Accordingly, the Ministry of Local Government and Housing will conduct the administrative work, coordination and preparation for grant aid and technical cooperation agreed upon between the two governments. Meanwhile, the Engineering Department of the Lusaka City Council will conduct the technical control and supervision of the Project. The Lusaka City Council will also be responsible for road maintenance in the post-project period.

In connection with the implementation of the Project, the Ministry of Local Government and Housing will participate in the implementation review study work conducted by the JICA and will conclude a service agreement with the Japanese Consultant who is fully aware of the required work under the Project. The Consultant will conduct the following work based on the full knowledge of the role of a consultant in a grant aid project.

- Preparation of tender documents
- Supportive work regarding pre-qualification, tender and signing of contract
- Work supervision

The actual construction work will be conducted by a Japanese construction company (the Contractor) selected in accordance with the grant aid scheme of the Government of Japan. The Contractor will procure the necessary equipment and materials in an efficient and appropriate manner and will conduct the construction work in accordance with the work schedule.

#### **3-1-1 Implementation Concept**

##### **(1) Project Implementation Concept**

Assuming the Project's implementation within the framework of the Japan's grant aid scheme, the construction work must take the following principles into proper consideration.

- The maximum utilisation of local labour, equipment and materials will be considered for the purpose of contributing to the creation of employment opportunities, facilitation of technology transfer and vitalisation of the local economy.
- A close liaison system incorporating the Ministry of Local Government and Housing of Zambia, the Lusaka City Council, the Consultant and the Contractor will be established to ensure the smooth implementation of the Project.

- A realistic work plan will be formulated, taking the pattern of rain at the Project Site, required period for the procurement of equipment and materials and the employment of an appropriate construction method, etc. into consideration.
- A work supervision system which ensures close liaisoning with the Lusaka City Council will be formulated.
- The Japanese Contractor will be responsible for the construction of facilities and the procurement of equipment, etc. in accordance with the relevant contract.
- The Contractor should establish a camp yard at a site provided by the Lusaka City Council free of charge to proceed with the construction work.
- The relocation or removal of utility facilities which disrupt the work, other than the lighting and traffic signal facilities to be relocated by the Contractor, must be completed by the Lusaka City Council prior to the commencement of the construction work.
- The Lusaka City Council will also be responsible for coordinating the work with local people and those responsible for the management of the facilities affected by the Project with the assistance of the Consultant and the Contractor.
- When the Contractor completes the improvement work of a subject road, the road will be handed over to the Lusaka City Council for its use by traffic. Following this handing over, the Lusaka City Council will be responsible for the maintenance of the road in question.
- The Project Site has distinctive dry and rainy seasons. The possibility of becoming useless is high that earth work during rainy season. The work schedule will be planned based on the assumption that earth work can be conducted during dry season as much as possible.
- Safety and environmental protection measures shall be executed to the resident living along the roads from lesson of the Project of Lusaka City Roads (phase ).

## **(2) Dispatch of Japanese Engineers**

Zambia has few highly skilled workers because of its relatively small population (10.2 million as of 2002) and low school enrollment rate. The management and specialist positions in local companies are mainly occupied by people of either Indian or Sri Lankan origin or by white people from South Africa or Europe. The same situation prevails in regard to construction work with a dual structure of Zambians conducting general labour and people of Indian or Sri Lankan origin and white people of South African or European origin mainly occupying such professional positions as supervisors and operators.

Consequently, for the ordinary earth work and paving work planned under the Project, it will, in principle, be unnecessary to dispatch skilled workers from Japan. However, Japanese engineers will be dispatched to operate and maintain the asphalt plant, the performance of which will have significant implications for the successful completion of the work, to supervise the earth work and paving work and to control the quality of the work results.

### **3-1-2 Implementation Conditions**

The following points must be carefully noted in regard to the construction work under the Project in view of the labors, social, site and equipment procurement conditions in Zambia.

#### **(1) Respect for Labor Standards**

The Contractor will employ local workers pursuant to the Labour Standards Law in Zambia. This law stipulates the following obligations, etc. The planned enforcement of any supplementary rule will be announced in the official gazette.

- Basic working hours : 45 hours/week
- Over-time pay : hourly wage  $\times$  1.5 for over-time beyond 45hours/week  
hourly wage  $\times$  2 for work on Sundays and national holidays
- Transport expenses and housing allowance : payment of appropriate transport expenses and housing allowance
- Paid holidays : two days/month, i.e. 24 days/year; unused paid holidays are purchased by the employed
- Retirement allowance : equivalent to the wage for 45 working hours  $\times$  full working month
- Maternity leave : up to 90 days every three years but may be extended to 3 months with a doctor's note
- Tax payment : local workers are liable to income tax
- Pension scheme : equal contributions by worker and employer

#### **(2) Environmental Protection during Construction Period**

The construction work will be conducted pursuant to the laws and regulations relating to pollution control in Zambia or Japan and such pollution factors as dust and muddy water, etc. caused by soil pit development, surplus soil disposal, banking, paving and other activities under the Project will be properly dealt with on the presumption that the pre-work environment will be conserved.

### **(3) Necessity for Strict On-Site Security**

As the work under the Project will be conducted in the city centre, the Lusaka City Council will be requested to provide security guards to ensure the safety of on-site staff and to prevent the theft of equipment and materials at night.

### **(4) Respect for Local Customs**

In determining the work schedule and the total working days, etc., religious and traditional customs in Lusaka must be taken into proper consideration so that the work under the Project does not infringe such customs. The national holidays in Zambia in the year 2000 are listed below.

**Table-3.1 National holidays in Zambia**

<b>Date</b>	<b>National Holiday</b>
1st January	New Year's Day
12th March	Youth Day
13th March	(Day following Youth Day which falls on a Sunday)
21st April	Good Friday
22nd April	Holy Saturday
24th April	Easter Monday
1st May	Labour Day
25th May	Africa Freedom Day
3rd July	Heroes Day
4th July	Unity Day
7th August	Farmers Day
24th October	Independence Day
25th December	Christmas Day

### **(5) Utilization of Tax Exemption System**

This relates to the taxation system (VAT) which was introduced in July, 1995. In the case of a project to be implemented with foreign aid, imported goods may be exempt from tax provided that they are accompanied by the necessary documents, such as a letter of request from the Embassy of Japan or the JICA, etc. Goods procured locally should be exempt from VAT if the Contractor applies to the Inland Revenue for such exemption for goods it has directly procured.

## **(6) Safe Work without Halting Traffic**

The most difficult work situation anticipated for the Project is the implementation of work without halting daytime traffic. Traffic safety and the safety of workers and pedestrians is of paramount importance. The cooperation of the traffic police and the Lusaka City Council during the work period will be essential and the work plan should feature the presence of full-time policemen for traffic control at the work sites. In addition to policemen for traffic control, the Contractor should deploy full-time guards for traffic safety at the work sites.

### **3-1-3 Scope of Work**

The Government of Japan and the Government of Zambia will be responsible for the work described below for the implementation of the Project.

#### **(1) Scope of Work for Japanese Side**

##### 1) Construction of Facilities

- Construction of those facilities indicated in 2.1 - Basic Concept of the Project and 2.2 -Basic Design Regarding Optimal Alternative for the Project (hereinafter referred to as the Basic Plan)
- Improvement of drainage facilities related to the above item up to the connection point with the existing drainage system
- Construction of traffic safety facilities related to the first item
- Construction of temporary facilities (camp yard and office building, etc.)

##### 2) Procurement of Equipment and Materials

- Procurement of road construction equipment and materials and also construction machinery indicated in the Basic Plan
- Transportation of construction equipment, etc. from Japan and third countries

##### 3) Safety Measures

- Safety control and safety measures required for the work

##### 4) Consultancy Work

- Preparation of tender and contract documents and supervision of the work indicated in the Basic Plan



## **(2) Scope of Work for Zambian Side**

### **1) Construction of Facilities**

- Relocation of water supply and sewerage pipes, electric poles, transmission/distribution lines, street lights and telephone, etc. which hamper the planned work under the Project
- Provision of temporary sites (for camp yard and office building, etc.) free of charge
- Provision of a soil pit(s) and quarry for aggregate and stone which are required for the construction of facilities indicated in the Basic Plan
- Deployment of local supervisors, provision of an office and means of transport for local supervisors and payment of their expenses

### **2) Safety Measures**

- Arrangement of security for temporary facilities and work sites

### **3) Miscellaneous**

- Provision of all conveniences for the entry to and stay in Zambia of third country nationals (other than Zambian nationals)
- Exemption from or payment of customs duty, domestic taxes and levies imposed by the Government of Zambia

## **3-1-4 Construction Supervision**

### **(1) Consultancy Services**

#### **1) Scope of Consultancy Services**

The Project will commence after the Exchange of Notes (E/N) regarding grant aid for the Project has been signed between the both Governments of Japan and Zambia. Following the signing of the E/N, being supported with a recommendation letter issued by JICA, the Consultant will conclude a consultancy agreement regarding assistance for tender process and supervision for the construction work of the Project with the MLGH which is project implementation body on the Zambian side and the LCC in accordance with the scope and procedure of the grant aid scheme of the Government of Japan. The main types of work involved in this consultancy agreement are shown below.

#### **a) Preparation of Tender Documents Stage**

Based on the results of the Implementation Review Study, the Consultant will

conduct review of the Implementation Review Study and will prepare such tender documents as Design Drawings, Technical Specification, Draft Contract of the Construction, etc, and then will receive upon those documents an approval from the Ministry of Local Government and Housing and the Lusaka City Council.

- Design drawings
- Bill of quantities and cost estimation
- Work implementation plan
- Tender documents

#### **b) Tender Stage**

The Ministry of Local Government and Housing and the Lusaka City Council will select the Contractor of Japanese nationality in Japan by means of open tender under assistance of the Consultant. The Consultant will assist the Ministry of Local Government and Housing and the Lusaka City Council in the following work items.

- Public announcement of tender
- Pre-qualification
- Briefing on tender procedure and construction sites
- Evaluation of bids
- Contract negotiations

#### **c) Construction Supervision Stage**

Receiving the approval of the construction contract from the Government of Japan, the Consultant will issue the Contractor an order for commencement of the construction work and will begin his own supervisory work. In the construction supervision stage, the Consultant will directly report the work progress situation to the Ministry of Local Government and Housing, the Lusaka City Council and the Embassy of Japan in Zambia, etc. while conducting the administrative work in regard to work progress, quality, safety and payment vis-à-vis the Contractor and providing technical advices, proposals for improvement of his work activities. And the Consultant will discuss with JICA or/and the Embassy of Japan in Zambia and the Government of Zambia and will coordinate with them to solve the pending matters, if necessary.

## 2) Implementation Regime

### a) Implementation Regime for Tender Document Preparation and Assistance for Tender

The assistance by the Consultant for the tender process will include the preparation of tender documents. The Consultant will pay particular attention to the following matters in full knowledge of the fact that the Project will be implemented under the grant aid scheme of the Government of Japan.

- The rules in the agreement should conform to the relevant international standards.
- The work specifications used by the Government of Zambia should be taken into full consideration.
- The engineers responsible for the detailed design and tender should be selected from among those involved in the Basic Design Study.

The personnel plan for the preparation of the tender documents and assistance for the tender should feature those people who are familiar with the contents of the design of the Project because of their involvement in the Basic Design Study.

- Chief engineer : Manages and coordinates all of the engineering works, tender, construction supervision to ensure smooth progress of those works
- Tender document work : Preparation of technical specification and tender documents, including preparation of the construction contract and assistance for the tender.
- Tender preparation : Assistance for the tender, etc..

### b) Implementation Regime for Construction Supervision

A road engineer with experience of grant aid projects will be dispatched as a full-time supervisor on-site. This chief supervisor will be dispatched at critical stages of the construction work for work coordination and other purposes. The roles of those engineers whose services are deemed to be required at different stages of the construction work are described below.

- Chief supervisor (C/S): coordinates of the engineering works to ensure smooth progress of the construction work and manages on technical matters.
- Full-time on-site supervisor  
/(Resident engineer: R/E ): conducts daily supervisory work, such as work progress and technical advices as well as quality control
- Road & Material engineer: assists the R/E on site dealing with quality control on such materials as soil for filling, aggregates for cement

- concrete and asphalt mixtures, etc. and also with technical advices and other supervisory work
- Structure engineer: assists the R/E on site dealing with discrepancies regarding structures and other auxiliary facilities of roads which may occur during construction work vis-a-vis the technical specification.

## **(2) Construction supervision**

### **1) Temporary Facilities Construction Work**

#### **a) Temporary Yard**

On receiving the order for work commencement, the Contractor will immediately start to arrange the required construction machinery, construction materials and manpower. The camp yard will be established at a site in the Garden District along Manchichi Road which will be provided by the Lusaka Municipal Authority free of charge and such temporary facilities as an office building and stock yard, etc. will be constructed.

#### **b) Temporary Power and Water Supply and Drainage**

The power for the construction work will mainly rely on the public power supply. However, a generator will be provided to cope with emergencies or to compensate for a power shortage. City water will be used for drinking water while a well will be dug to obtain water for the construction work.

### **2) Principal Work**

The Project aims at improving urban roads in Lusaka and the target roads function as important roads for the lives of the public. The main component of the Project is the improvement of the following roads which are currently in use.

- The Chitanda road (total length of 3.3 km)
- The Kasangula road (total length of 5.3 km)
- The Kaleya Ng'ombe road (total length of 0.9 km)
- The Bauleni road (total length of 1.1 km)

All of these target roads are urban roads and there are restrictions on the width of their right of way except for some routes to minimize the subjects for compensation, such as houses, shops and other facilities.

Accordingly, the utmost priority should be given to maintaining a safe traffic flow and total road closure to traffic during the work period must be avoided. In other words, the work must proceed while ensuring the sufficient functioning of these roads while accepting the resulting decline of the work efficiency. In principle, the work will be

conducted in the daytime and night work will be conducted when such work is absolutely necessary.

The work on the target roads will be conducted taking the requirements described below into full consideration.

**a) Single Carriageway (Two Lanes) Improvement Work**

- The work will be conducted for one lane at a time so that the other lane can be used for current traffic.
- If the improvement work involves banking of some 1m, a temporary road will be introduced provided that there is sufficient space for a temporary road.
- If the introduction of a temporary road is impossible because of the lack of sufficient space, a road section between neighboring intersections will make up a unit work section so that a nearby road can be used as a detour.

**b) Intersection Improvement Work**

- One side (either one lane or two lanes) of the trunk roads will firstly be improved together with improvement of the intersection on the same side while allowing traffic flow on the other side. The work at intersections with side roads will then be conducted.
- In order to prevent traffic congestion, a detour using an existing road will be introduced to guide traffic to nearby intersections. Any perceived obstruction to the traffic flow because of the work will be minimized as much as is practically possible.

Lusaka has a tropical savannah climate and the dry season and rainy season last from April to October and from November to March respectively. There are no downpours or strong winds which cause damage throughout the year, indicating a gentle climate. It was confirmed that the rain in the rainy season does not continue for a whole day.

### **3) Work Control**

Because of the use of local subcontractors, it will be necessary for the Japanese Contractor to conduct sufficient quality control as well as schedule control. The project implementation plan therefore provides for frequent interim inspections and schedule control for the work to be conducted by local subcontractors to ensure a high work quality. A Japanese engineer especially responsible for such inspection and quality control will be posted on-site.

### **4) Traffic Control during Construction Work**

The Project intends the improvement of the existing important roads for the compound people which are either single carriageways (two lanes) and one problem is to secure the traffic flow on these roads while the work is in progress. It will, therefore, be necessary to conduct the work on one side at a time, if possible, while accepting a reduction of the work efficiency.

Therefore, the implementation of the planned work while allowing traffic flow will require the close cooperation of the Lusaka City Council and the traffic police. In addition to the deployment of traffic policemen at key points, the work implementation plan must include the posting of full-time traffic guards to ensure traffic safety at those sections where the work is in progress.

### **3-1-5 Procurement Plan**

As Zambia is a landlocked country, the land transportation of goods for export and for imported goods must be linked to Port Durban in South Africa, Port Dar es Salaam in Tanzania or Port Beira in Mozambique. There is, therefore, concern in regard to the disruption of such transportation if political tension develops between Zambia and its neighbors. Most of materials for road construction can be procured in Zambia. Therefore the procurement of the construction materials shall be in Zambia.

In principle the construction machinery required for the project will be procured in Zambia. There are several companies of construction machinery in Lusaka and also almost those machines are reliable in recent years. Therefore the procurement of the construction machinery shall be in Zambia.

**Table 3.2 Procurement Sources of Materials**

Item	Zambia	South Africa	Japan
Cement	O		
Cement Additives	O		
Structural Steel	O		
Straight Asphalt	O		
Asphalt Emulsion	O		
Coarse Aggregate	O		
Fine Aggregate	O		
Wood for Forms	O		
Timbers	O		
Secondary Concrete Products	O		
Petrol	O		
Disel and Heavy Oil, etc.	O		
Paints for Road-marking	O		

**Table 3.3 Procurement Sources of Construction Machinery**

Item	Zambia	South Africa	Japan
Bulldozer (12 tons - 21 tons)	O		
Back-hoe (0.35 m <sup>3</sup> - 1.0 m <sup>3</sup> )	O		
Tractor Shovel (1.0 m <sup>3</sup> - 3.2 m <sup>3</sup> )	O		
Wheel Loader (1.0 m <sup>3</sup> - 2.1 m <sup>3</sup> )	O		
Dump Truck (2 tons - 10 tons)	O		
Truck Crane (4 tons - 20 tons)	O		
Trailer Trucks (20 tons)	O		
Motor-grader (3.1 m)	O		
Macadam Roller (10 tons - 20 tons)	O		
Tire Roller (8 tons - 20 tons)	O		
Vibration Roller (0.5 tons - 4 tons)	O		
Asphalt Finisher (2.4 m - 5.0 m)	O		
Emulsion Sprayer (200 litres)	O		
Road Sprinkler (5.5 kl - 6.5 kl)	O		
Tank Lorry (6 m <sup>3</sup> )	O		
Concrete Mixer (0.4 m <sup>3</sup> - 6.0 m <sup>3</sup> )	O		
Rammer/Tamper (60 kg - 100 kg)	O		
Line Marker (10 cm - 15 cm)	O		
Asphalt Plant (40 tons/hr)	O		
Compressor (1.7 m <sup>3</sup> /min - 35 m <sup>3</sup> /min)	O		
Generator (15 kVA - 200 kVA)	O		

### 3-1-6 Quality Control Plan

Quality Control becomes important in each stage of works due to safety and durability influence of pavement and structures. A manual is maintained for design criteria of road referring to the AASHO standard in Zambia as well as the Quality Control to be applied to the project shall be referred the Zambian standard.

**Table 3.4 Quality Control Plan**

Control Item		Test Item	Pitch /Frequency
<b>Earth Work</b>	Materials	Soil test of embankment materials · specific gravity/moisture content/grading/liquid-plastic limit /Compaction/dry density/CBR test	Before starting work
	Routine	Execution control test · field density test	Every work/layer done in every day
<b>Pavement Work</b>	Materials	· Marshall test · asphalt emulsion test · physical test	Before starting work
	Routine	· sieving test · moisture content test · Marshall test · wheel tracking test · compaction test · in-situ permeability test	Every work/layer done in every day
<b>Concrete</b>	Batcher plant	measurement instrument · mixer performance test	Before starting works
	Materials	· amount of water/specific gravity unit weight · alkali aggressive reaction	Before starting work and the time of material change
	Test for compressive strength	trial mix · slump/air content/temperature/compressive strength /process capability chart	Before starting work
	Routine	· slump/air content/temperature/	first five productions & after each 50m <sup>3</sup>
		concrete placement · construction joint/curing/laitance	Joint inspection at the time of placement
	concrete test piece · compressive strength test	one time per day 7day & 28day	
<b>Reinforcement Work</b>	Material	for mill certification reports · tensile test/bending test	Before starting work
	Routine	assembled · size/splice/clear/tying	Before concrete work



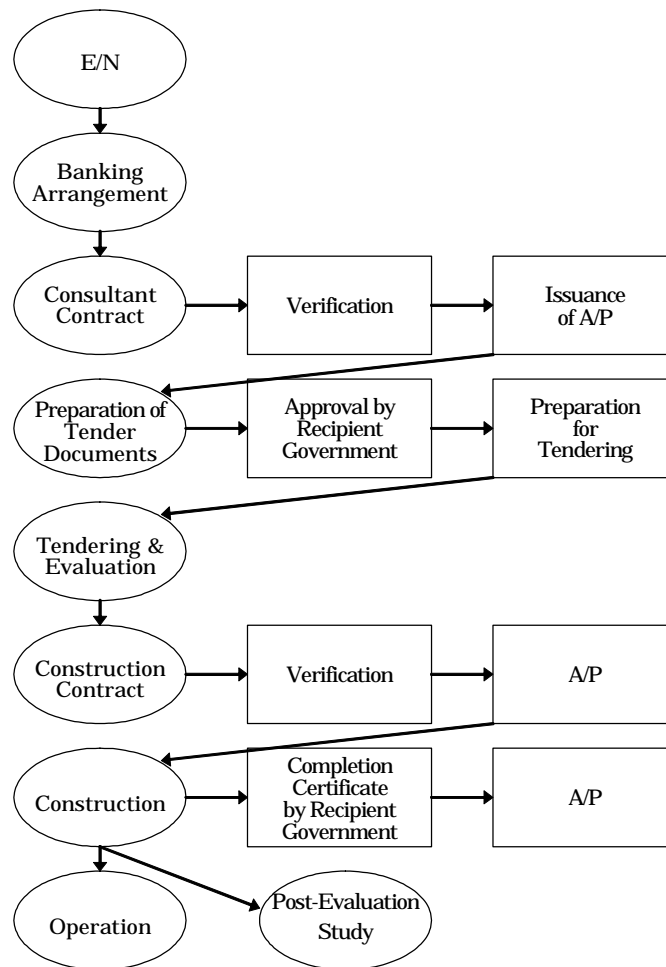
**Table 3.5 Measurement of the Control Plan**

Control Item		Measurement	Tolerance	Remark
<b>Earth Work</b>	Subgrade	Elevation	+2cm ~ -5cm	each 20m
		Width	over design width	
	subbase	Elevation	±3cm	
		Aberration at any two points within 20m length	<2cm	
<b>Pavement</b>	Surface	Thickness	>90% of design thickness	
		Width	over design width	
		Aberration	±4mm	
		Aberration at any two points	<4mm	
		Surface roughness	< 1.3mm	
		Skid resistance	>BPN60	each 200m
<b>Foundation</b>	Sprend foundation	Elevation	Lower than design hight	4m mesh
<b>Concrete structure</b>	Slab · Wall	Elevation	±5cm	
		Thickness	±75cm or ±3%	
		Location	±30mm	
		Dimension	-30mm ~ +10mm	

### 3-1-7 Implementation Schedule

Following the signing of the E/N in regard to the consultancy work (assistance for the tender and supervision of the construction work) and the main work, the Consultant will immediately conclude a consultancy contract with the Ministry of Local Government and Housing and will officially commence the Project as a grant aid project of the Government of Japan. To assist the tender to be held by the Government of Zambia, the Consultant will provide assistance for a series of tender-related work, i.e. pre-qualification, tender, selection of the Contractor and signing of the agreement for the construction work, etc. The contractor will then conclude the construction contract. Following approval of the contents of the construction work by the Government of Japan, the Contractor will commence the work on receiving the relevant order issued by the Consultant.

Assuming the implementation of the Project under the grant aid scheme of the Government of Japan, the Project will be implemented in accordance with the processes described in Fig. 3-1.



Note (1)E/N : Exchange of Note  
 (2)A/P : Authorization to pay

Fig3.1 Project Implantation Process

The Project is divided into the following two stages for its actual implementation in line with the principles described in 2.1 - Basic Concept of the Project and in consideration of the urgency, size, contents and cost of the Project and the anticipated grant aid for the Project.

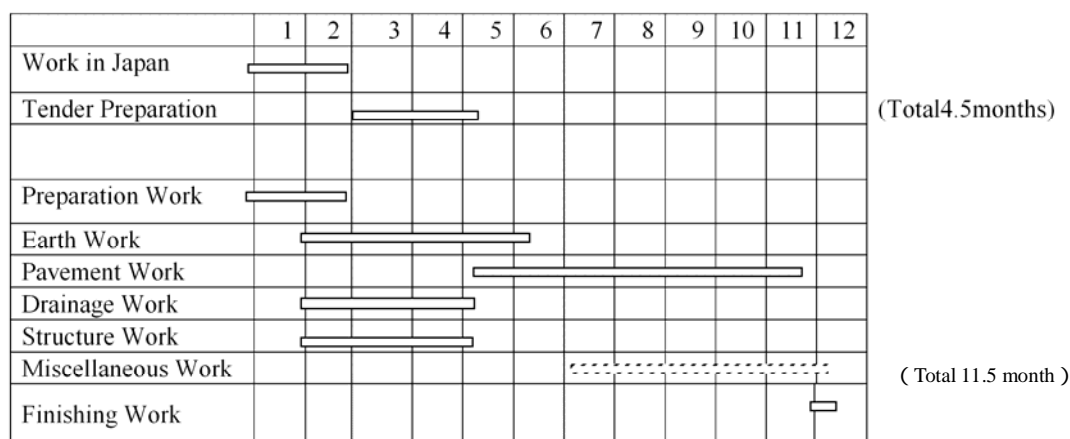
Scope of Work

- Rehabilitation and improvement of the Chitanda road (total length of 3.32 km)
- Rehabilitation and improvement of the Kasangula road (total length of 5.26 km)
- Rehabilitation and improvement of the Kaleya Ng’ombe road (total length of 0.88 km)
- Rehabilitation and improvement of the Bauleni road (total length of 1.08 km)

Construction Preiod 11.5 months

The resulting implementation schedule for the Project is shown in Table 3.6. The Construction stage period of the Project is estimated to be approximately 11.5 months.

**Table 3.6 Implementation Schedule for the Project for Improvement and Maintenance of Lusaka City Roads**



### 3-2 Obligations of Recipient Country

It will be necessary for the Government of Zambia to undertake the following work..

- To provide data and information required for the implementation of the Project
- To secure the necessary road sites
- To relocate or remove utility facilities which hamper the road work
- To ensure the speedy customs clearance of the equipment procured in Japan and the third country.
- To exempt the equipment, etc. procured in accordance with certified contracts and Japanese nationals working for the Project from customs duty, inland taxes and levies
- To provide all conveniences for persons providing services in accordance with certified contracts for their entry to and stay in Zambia to perform their assigned duties
- To open a project account at a foreign exchange bank in Japan
- To issue the authorization to pay
- To bear the costs of that work which is not included in the scope of work for the Japanese side
- To ensure that the Lusaka Police appoint full-time traffic policemen for traffic safety control during the construction work
- To provide a site for the temporary facilities (camp yard and office building, etc.)

Utility	Quantity	Cost ( Unit : 1000ZMK )
Electric Pole	2 ps	2,000
Power Line ( Overhead ) 11kv	100 m	200

### 3-3 Project Operation Plan

#### 3-3-1 Project Operation Plan

Operation and maintenance required after completion of the Project is Road and Drainage Cleaning. The average annual maintenance cost is estimated at 68,000,000 ZMK and accounts for approximately 0.75% of the total budget of the Lusaka City Council.

#### 3-3-2 Project Costs Estimation

##### (1) Project Cost

##### 1) Cost Borne by Japanese Grant Aid

The total cost of Project by the Japanese Grant Aid is summarized in Table 3.7. This cost estimate is provisional and will be further examined by the Government of Japan for the approval of the Grant. In addition , this approximate project costs will not be quoted as the Maximum Amount of Japanese Grant Aid in the Exchange of Note immediately just as they are.

#### Approximate Project Costs: Japanese Yen 706 million

**Table 3.7 Approximate Project Costs**

Item			Approximate Amount (million Japanese Yen)	
Facilities	Earth Work	Excavation Embankment Slope protection	61	637
	Pavement Work	Subbase Pavement	360	
	Drainage Work	Side ditch Catch basin	189	
	Structure Work	Box culvert	6	
	Miscellaneous Work	Lane marking • Traffic sign • Hump	21	
Tender and Construction supervision			69	

## 2) Cost Borne by Zambian Government Side

Approximate costs required for the undertaking of Zambian Government side are shown in Table-3.8. This cost estimate is provisional.

**Table-3.8 Approximate Costs to be borne by Zambian Government Side**

Items	Cost (ZMK)
Relocation cost of electric poles and power lines	220,000

## 3) Condition of Estimation

-Time of estimate	September 2004
-Exchange rate	1US\$=JPY110.76 1ZMK=JPY0.02
-Implementation period	11.5 months excluding tender stage
-Others	On condition that the Project is implemented under The Japan's Grant Aid Scheme.

## (2) Operation and Maintenance Cost

Operation and Maintenance costs after the start of operation are shown in Table 3.9.

**Table-3.9 Operation and Maintenance for Project Road**

Item	Quantity	Cost(ZMK)/year
Road Cleaning	109,600m <sup>2</sup>	23,200,000
Drainage Cleaning	20.4km	44,800,000
	Total	68,000,000

## **CHAPTER-4 PROJECT EVALUATION AND RECOMMENDATIONS**

### **4.1 Project Effect**

#### **1) Direct Effect**

The following major effect can be expected through the implementation of the Project and implementation of the post maintenance by the Government of Zambia.

##### **•Improvement of Commuting to Schools and Workplace by Upgrading Roads for Public Welfare**

Although the target routes are collector roads providing access to trunk roads in the city and high-density residential districts without city planning (compounds), it is difficult for buses commuting to schools and workplaces to pass due to pavement damage or inadequate drainage and it is impossible to pass due to muddy surface during the rainy season. Through the implementation of the Project, two-lane paved roads, bus stops and terminals, shoulders for pedestrians, and bus routes will be improved and the travel speed for residents in the compounds commuting to schools and workplaces by bus will be sharply increased from the current 20km/h to over 40km/h. In addition, reliable commuting will be ensured even during the rainy season. Although there is no bus service on Kasungula Road where remarkably damage can be seen, a significant improvement in public transportation is expected after the introduction of buses after the completion of road construction.

#### **2) Indirect Effects**

##### **• Improvement of Basic Human Needs(BHN)**

It is difficult for emergency vehicles to provide services in the target roadside areas due to road damage or traffic difficulties during the rainy season. By improving paved 2-lane roads through the Project, it will become feasible for emergency vehicles at fire stations at 2 locations or the police stations in each area to provide services. In addition, if residents in high-density unplanned residential districts (compounds) utilize busses, accessibility to 33 hospitals and clinics within the city will be possible. Moreover, social services facilities such as schools, and in turn, the improvement of BHN can be expected. Furthermore, since district drainage channels will be improved through the implementation of the Project, this will contribute to controlling outbreaks of contagious diseases, i.e. malaria, associated with environmental improvement.

- **Improvement in Traffic Safety Awareness in Lusaka**

Since the proposed roads contain narrow carriageways which are experiencing conspicuous pavement damage, there are many bottlenecks in local traffic. In addition, to avoid potholes vehicles often pass suddenly, so vehicle safety cannot be guaranteed. To make matters worse, since road crossing points for pedestrians have not been established, there is a high risk of traffic accidents and the pedestrian safety at crossings cannot be secured. If target roads are designed as 2-lane roads and shoulders for pedestrians are secured, intersections are improved, and pedestrian crossings, bumps or indicators to control speed near schools and churches or signs are improved, improvements in traffic safety awareness for pedestrians and vehicles can be expected.

#### **4.2 Recommendations**

The most important issue to be taken by the Zambian side in order for the effects of the Project to be displayed and continued is to substantiate the road maintenance project to be implemented after facility services commence. In particular, it is important to carry out periodic routine maintenance such as cleaning of side gutters or patching of potholes. Since the Lusaka City Council has carried out maintenance through the privatization of roads completed in the Projects of Phase I and Phase II, steadily implementation of similar maintenance is also recommended after the completion of this Project.

In addition, for the steady implementation of road maintenance through private consignment, budgetary measures for periodical maintenance should be continued as well as removing existing gavages within the road width and requesting neighboring people cooperation during construction is also necessary.