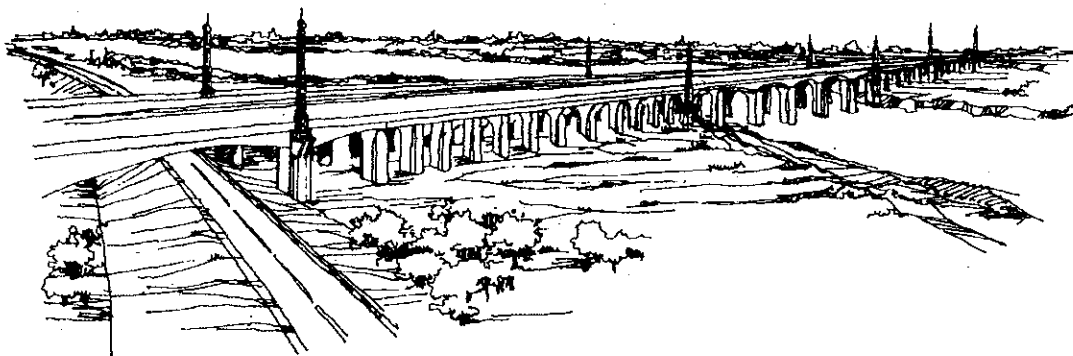


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
PROJECT MANAGEMENT UNIT THANG LONG
MINISTRY OF TRANSPORT
THE SOCIALIST REPUBLIC OF VIET NAM

**THE DETAILED DESIGN
OF
THE RED RIVER BRIDGE (THANH TRI BRIDGE)
CONSTRUCTION PROJECT
IN
THE SOCIALIST REPUBLIC OF VIET NAM**

FINAL REPORT

VOLUME III : APPENDIX



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June 2000

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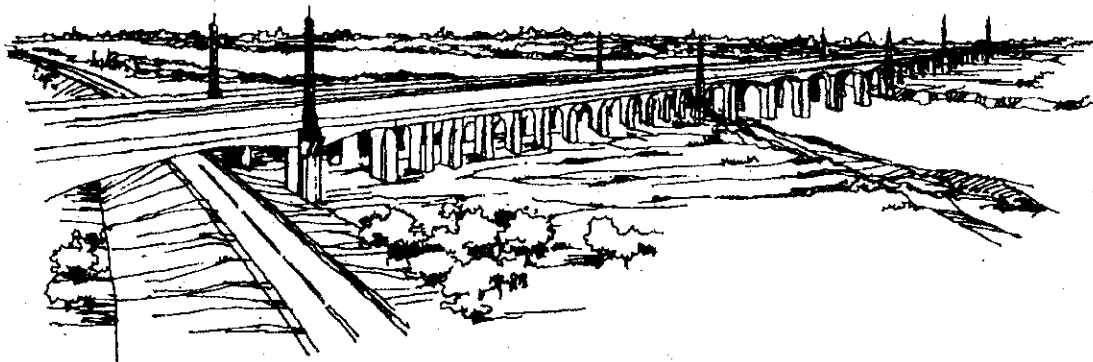
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APPENDIX 1 Chapter 3 Physical Conditions Survey

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Appendix 3.3.1 Quantities of borehole drilling

Name of section	Number of borehole	Name of borehole	Station	Elevation (m)	Drilling depth		SPT	
					Estimated	Actual	Estimated	Actual
Road section Thanh Tri side	1	BH-R1	0-184.5	4.83	50	50	50	50
	2	BH-R2	0+020	5.60	50	50	50	50
	3	BH-R3	0+116.15	6.40	50	50	50	47
	4	BH-R4	0+371	6.31	50	50	50	50
	5	BH-R5	0+540	3.67	50	50	50	47
	6	BH-R4b	0+600	3.52	50	50	50	50
	7	BH-R6	0+930	3.21	50	50	50	50
	8	BH-R7	0+720	3.16	50	50	50	47
	9	BH-R8	1+100	4.99	50	50	50	50
	10	BH-R9	1+660	4.00	50	50	50	47
	11	BH-R10	1+720	5.46	50	50	50	50
	12	BH-R11	5+608.63	5.53	50	50	50	50
	13	BH-R12	5+676.1	6.20	50	50	50	50
Bridge section	14	BH-B1	6+340	5.69	50	50	50	50
	15	BH-B2	6+240	5.53	50	50	50	47
	16	BH-B4	6+810	6.68	50	50	50	50
	17	BH-B5	6+960	6.02	50	50	50	50
	18	BH-B6	7+160	9.37	50	50	50	50
	19	BH-B7	7+340	6.49	50	50	50	50
	20	BH-B8	7+470	0.02	50	50	50	48
	21	BH-B9	7+730	-3.42	50	50	50	48
	22	BH-B10	7+860	-1.81	50	50	50	50
	23	BH-B11	8+040	9.24	50	50	50	50
	24	BH-B12	8+380	4.21	50	50	50	50
	25	BH-B13	8+540	8.78	50	50	50	50
	26	BH-B14	8+720	5.05	50	50	50	48
	27	BH-B15	8+880	6.85	50	50	50	50
	28	BH-B16	9+070	4.03	50	50	50	49
Road section Gia Lam side	29	BH-R13	11+400	3.91	50	50	50	50
	30	BH-R14	11+590	3.75	50	50	50	50
	31	BH-R15	11+930	2.90	50	50	50	47
	32	BH-R16	12+210	3.80	50	50	50	50
	33	BH-R17	12+380	3.77	50	50	50	50
		Total			1,650	1,650	1,650	1,625

Appendix 3.3.2 Quantities of Static Cone Penetration Test

Name of section	No.	Name of SCPT	Station	Elevation (m)	Depth (m)	
					Estimated	Actual
Road section Thanh Tri side	1	SCPT 1	0+313.2	5.38	20	20
	2	SCPT 2	0+420	5.70	20	20
	3	SCPT 3	0+558.1	5.38	20	20
	4	SCPT 4	0+796.5	5.05	20	20
	5	SCPT 5	1+240	4.91	20	20
	6	SCPT 6	1+348	5.79	20	20
	7	SCPT 7	1+500	4.76	20	20
	8	SCPT 8	1+910	5.54	20	20
	9	SCPT 9	2+053.7	5.90	20	20
	10	SCPT 10	2+192	5.19	20	20
	11	SCPT 11	2+331.4	5.40	20	20
	12	SCPT 12	2+470	5.18	20	20
	13	SCPT 13	2+610	5.33	20	20
	14	SCPT 14	2+771.8	6.28	20	20
	15	SCPT 15	2+886.9	5.47	20	20
	16	SCPT 16	3+040	5.55	20	20
	17	SCPT 17	3+167.4	5.25	20	20
	18	SCPT 18	3+315.5	5.49	20	20
	19	SCPT 19	3+454.1	5.63	20	20
	20	SCPT 20	3+649.25	5.58	20	20
	21	SCPT 21	3+730	5.77	20	20
	22	SCPT 22	3+827.45	5.45	20	20
	23	SCPT 23	4+005.7	5.68	20	20
	24	SCPT 24	4+149	5.60	20	20
	25	SCPT 25	4+289.52	5.75	20	20
	26	SCPT 26	4+418.6	5.53	20	20
	27	SCPT 27	4+584.99	5.45	20	20
	28	SCPT 28	4+713.97	5.52	20	20
	29	SCPT 29	4+849.82	5.40	20	20
	30	SCPT 30	4+992.98	6.68	20	20
	31	SCPT 31	5+138.56	5.68	20	20
	32	SCPT 32	5+251.90	5.32	20	20
	33	SCPT 33	5+410.09	5.30	20	20
	34	SCPT 34	5+864.73	5.24	20	20
	35	SCPT 35	6+044	5.44	20	20
Road section Gia Lam side	36	SCPT 36	9+360	4.10	20	20
	37	SCPT 37	9+528	4.45	20	20
	38	SCPT 38	9+797	3.98	20	20
	39	SCPT 39	9+970	4.00	20	20
	40	SCPT 40	10+148	4.07	20	20
	41	SCPT 41	10+351	4.44	20	20
	42	SCPT 42	10+587	4.34	20	20
	43	SCPT 43	10+726	4.06	20	20
	44	SCPT 44	10+917	4.15	20	20
	45	SCPT 45	11+184	4.01	20	20
	46	SCPT 46	11+740	3.44	20	20
	47	SCPT 47	11+817	3.78	20	20
		Total			940	940

Appendix 3.3.3 Locations of borehole drilling

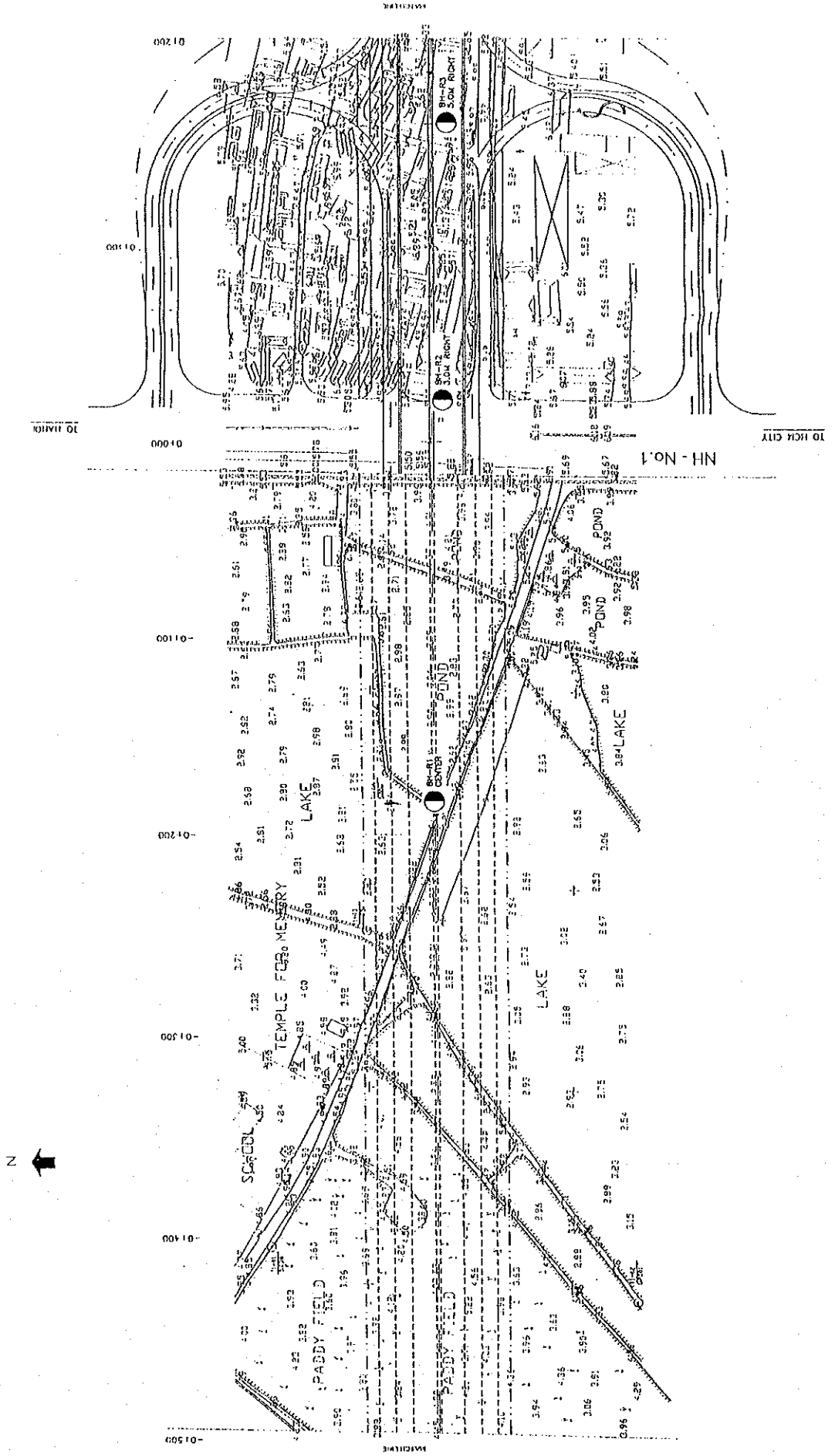
Name of section	No.	Name of borehole	Station (km)	Elevation (m)	National co-ordinate		Remarks
					X	Y	
Road section Thanh Tri side	1	BH-R1	0-184.5	4.83	2319569.268	587339.542	On the land, center
	2	BH-R2	0+020	5.60	2319568.268	587544.950	On the land, 3.0 m right
	3	BH-R3	0+161.5	6.40	2319567.974	587686.452	On the land, 5.0 m right
	4	BH-R4	0+371	6.31	2319575.630	587895.941	On the land, center
	5	BH-R5	0+540	3.67	2319577.316	588064.975	Over water, center
	6	BH-R4b	0+600	3.52	2319698.739	588125.006	Over water, 120 m left
	7	BH-R6	0+930	3.21	2319573.951	588454.701	Over water, center
	8	BH-R7	0+720	3.16	2319579.708	588244.911	Over water, center
	9	BH-R8	1+100	4.99	2319549.024	588622.804	On the land, center
	10	BH-R9	1+660	4.00	2319452.177	589174.366	On the land, center
	11	BH-R10	1+720	5.46	2319441.801	589233.461	On the land, 3.88 right
	12	BH-R11	5+608.63	5.53	2321101.378	592411.833	On the land, 8.09 m left
	13	BH-R12	5+676.1	6.20	2321157.636	592449.560	On the land, center
Bridge section	14	BH-B1	6+340	5.69	2321666.224	592876.344	On the land, center
	15	BH-B2	6+240	5.53	2321589.159	592812.619	On the land, center
	16	BH-B4	6+810	6.68	2322028.415	593175.869	On the land, center
	17	BH-B5	6+960	6.02	2322144.009	593271.463	On the land, center
	18	BH-B6	7+160	9.37	2322298.134	593398.920	On the land, center
	19	BH-B7	7+340	6.49	2322436.847	593513.632	Over water, center
	20	BH-B8	7+470	0.02	2322537.028	593596.480	Over water, center
	21	BH-B9	7+730	-3.42	2322737.391	593762.175	Over water, center
	22	BH-B10	7+860	-1.81	2322837.572	593845.022	Over water, center
	23	BH-B11	8+040	9.24	2322976.285	593959.734	On the land, center
	24	BH-B12	8+380	4.21	2323238.297	594176.412	On the land, center
	25	BH-B13	8+540	8.78	2323361.597	594278.378	On the land, center
	26	BH-B14	8+720	5.05	2323500.310	594393.090	On the land, center
	27	BH-B15	8+880	6.85	2323623.610	594495.056	On the land, center
	28	BH-B16	9+070	4.03	2323772.259	594613.444	On the land, left 3.5 m
Road section Gia Lam side	29	BH-R13	11+400	3.91	2325568.270	596083.519	On the land, center
	30	BH-R14	11+590	3.75	2325688.491	596230.617	On the land, center
	31	BH-R15	11+930	2.90	2325948.975	596446.659	On the land, center
	32	BH-R16	12+210	3.80	2326203.300	596563.205	On the land, center
	33	BH-R17	12+380	3.77	2326360.751	596627.309	On the land, center

Appendix 3.3.4 Locations of Static Corn Penetration Test

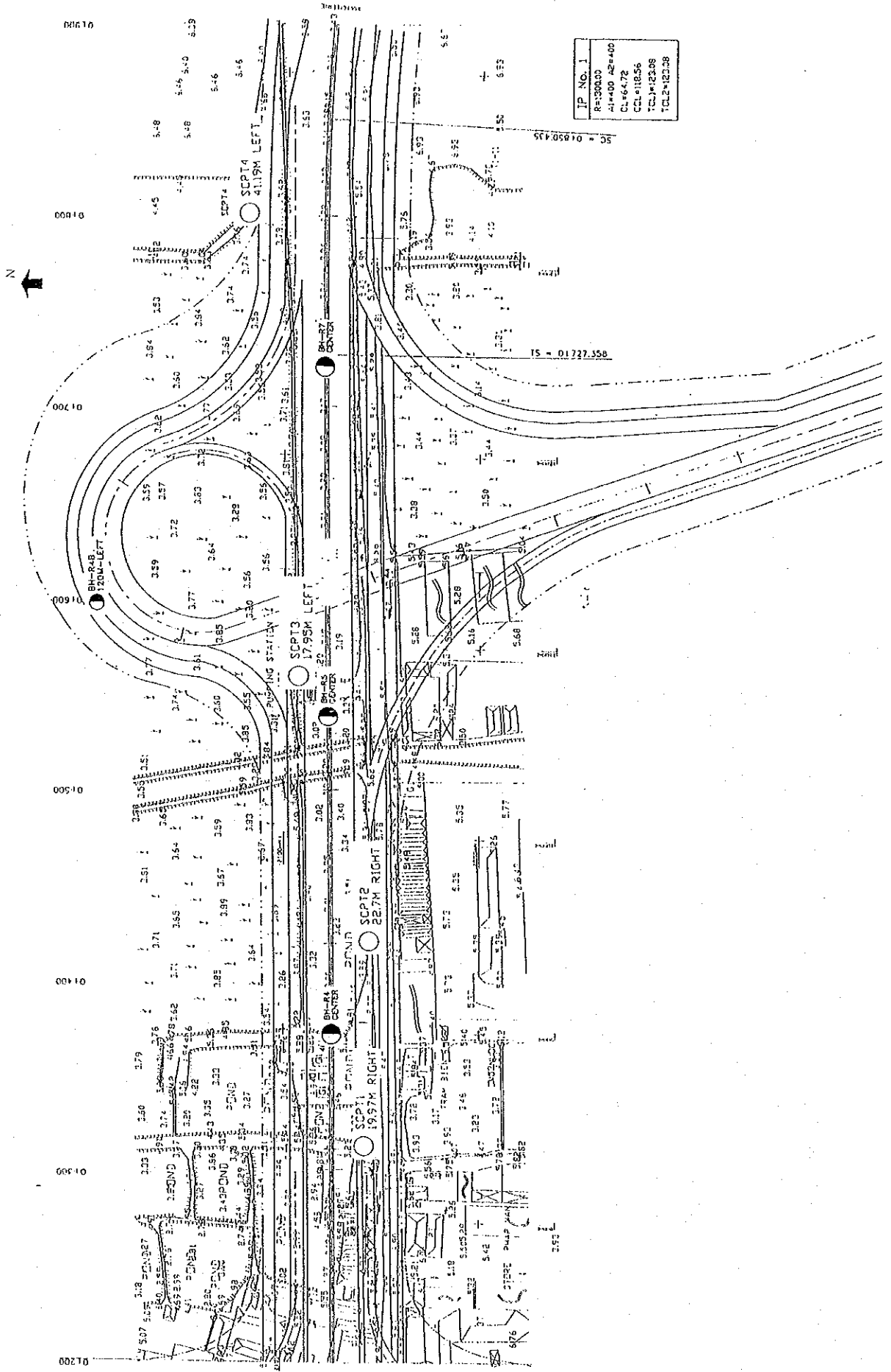
Name of section	No.	Name of SCPT	Station (km)	Elevation (m)	National co-ordinate		Remarks
					X	Y	
Road section Thanh Tri side	1	SCPT 1	0+313.2	5.38	2319554.861	587837.680	On the land, 19.97 m right
	2	SCPT 2	0+420	5.70	2319553.411	587944.891	On the land, 22.7 m right
	3	SCPT 3	0+558.1	5.38	2319595.706	588082.605	On the land, 17.95 m left
	4	SCPT 4	0+796.5	5.05	2319621.388	588323.377	On the land, 41.19 m left
	5	SCPT 5	1+240	4.91	2319535.231	588762.412	On the land, 10.55 m left
	6	SCPT 6	1+348	5.79	2319499.910	588902.519	On the land, center
	7	SCPT 7	1+500	4.76	2319481.817	589017.123	On the land, 2.0 m left
	8	SCPT 8	1+910	5.54	2319412.898	589419.106	On the land, 2.0 m left
	9	SCPT 9	2+053.7	5.90	2319422.925	589964.385	On the land, 22.72 m left
	10	SCPT 10	2+192	5.19	2319412.424	589699.743	On the land, 8.84 m left
	11	SCPT 11	2+331.4	5.40	2319393.660	589843.884	On the land, 17.76 m right
	12	SCPT 12	2+470	5.18	2319423.802	589979.733	On the land, 8.22 m left
	13	SCPT 13	2+610	5.33	2319441.562	590119.100	On the land, 20.00 m left
	14	SCPT 14	2+771.8	6.28	2319440.878	590281.066	On the land, 12.38 m left
	15	SCPT 15	2+886.9	5.47	2319438.365	590395.453	On the land, 4.88 m left
	16	SCPT 16	3+040	5.55	2319450.489	590549.422	On the land, 6.78 m left
	17	SCPT 17	3+167.4	5.25	2319750.501	590673.424	On the land, 14.3 m left
	18	SCPT 18	3+315.5	5.49	2319496.571	590819.384	On the land, 3.4 m right
	19	SCPT 19	3+454.1	5.63	2319514.914	590951.906	On the land, 16.66 m right
	20	SCPT 20	3+649.25	5.58	2319681.331	591092.886	On the land, 17.67 m left
	21	SCPT 21	3+730	5.77	2319923.789	591162.914	On the land, center
	22	SCPT 22	3+827.45	5.45	2319823.509	591266.325	On the land, 14.71m right
	23	SCPT 23	4+005.7	5.68	2319921.476	591358.085	On the land, 32.0 m right
	24	SCPT 24	4+149	5.60	2320060.465	591411.243	On the land, center
	25	SCPT 25	4+289.52	5.75	2320193.492	591464.799	On the land, 28.51 m left
	26	SCPT 26	4+418.6	5.53	2320285.445	591559.184	On the land, center
	27	SCPT 27	4+584.99	5.45	2320408.137	591671.333	On the land, 20.43 m right
	28	SCPT 28	4+713.97	5.52	2320513.074	591746.232	On the land, 2.6 m right
	29	SCPT 29	4+849.82	5.40	2320620.132	591836.375	On the land, 25.1 m left
	30	SCPT 30	4+992.98	6.68	2320668.758	591975.832	On the land, 11.14 m right
	31	SCPT 31	5+138.56	5.68	2320378.053	592106.938	On the land, 27.53 m right
	32	SCPT 32	5+251.90	5.32	2320863.156	592148.344	On the land, 41.23 m left
	33	SCPT 33	5+410.09	5.30	2320959.291	592272.221	On the land, 14.69 m left
	34	SCPT 34	5+864.73	5.24	2321296.514	592574.365	On the land, 2.907 m right
	35	SCPT 35	6+044	5.44	2321436.767	592686.623	On the land, center
Road section Gia Lam	36	SCPT 36	9+360	4.10	2323993.51	594800.950	On the land, centert
	37	SCPT 37	9+528	4.45	2324119.720	594912.860	On the land, 6.0 m right
	38	SCPT 38	9+797	3.98	2324233.080	595075.850	On the land, 4.0 m left
	39	SCPT 39	9+970	4.00	2324479.350	595172.550	On the land, 16.0 m left
	40	SCPT 40	10+148	4.07	2324622.460	595277.290	On the land, 15.0 m left
	41	SCPT 41	10+351	4.44	2324788.650	595388.000	On the land, 15.0 m left
	42	SCPT 42	10+587	4.34	2324977.040	595534.300	On the land, 3.0 m right
	43	SCPT 43	10+726	4.06	232588.520	595614.850	On the land, 6.0 m right
	44	SCPT 44	10+917	4.15	2325242.460	595727.600	On the land, centert
	45	SCPT 45	11+184	4.01	2324696.560	595931.180	On the land, 20.0 m right
	46	SCPT 46	11+740	3.44	2325775.820	596360.590	On the land, 30.0 m right
	47	SCPT 47	11+817	3.78	2325854.490	596384.700	On the land, center

Appendix 3.3.5 Location maps of borehole drilling and SCPT

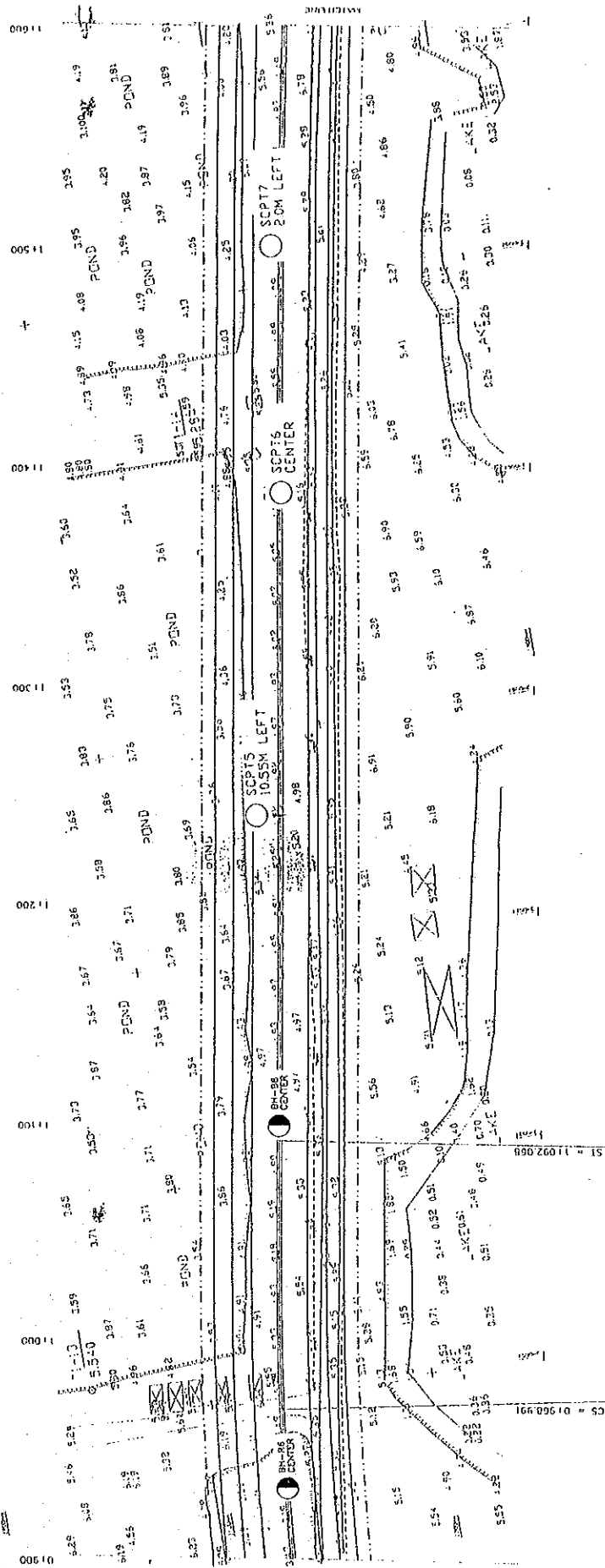
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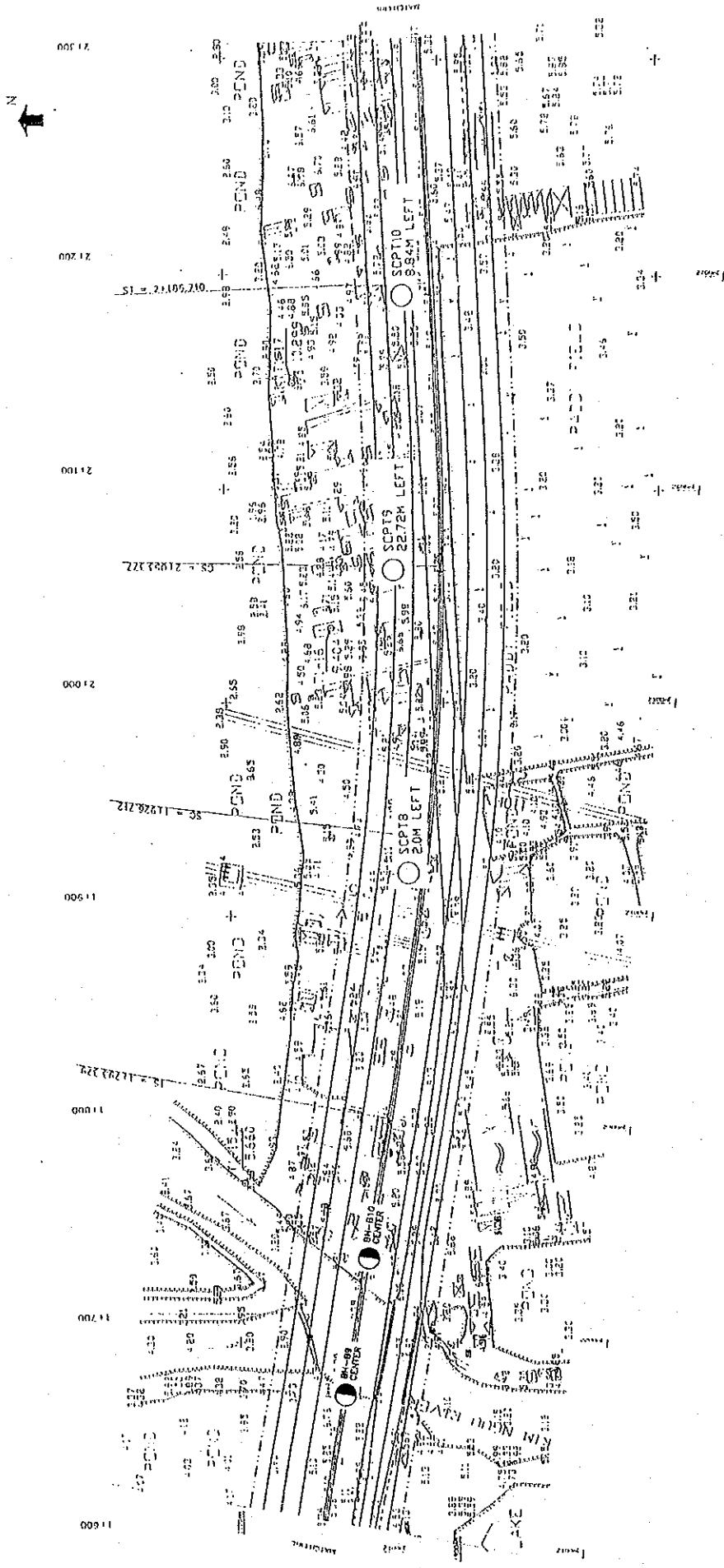
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PLAN OF BOREHOLE AND SCPT LOCATIONS
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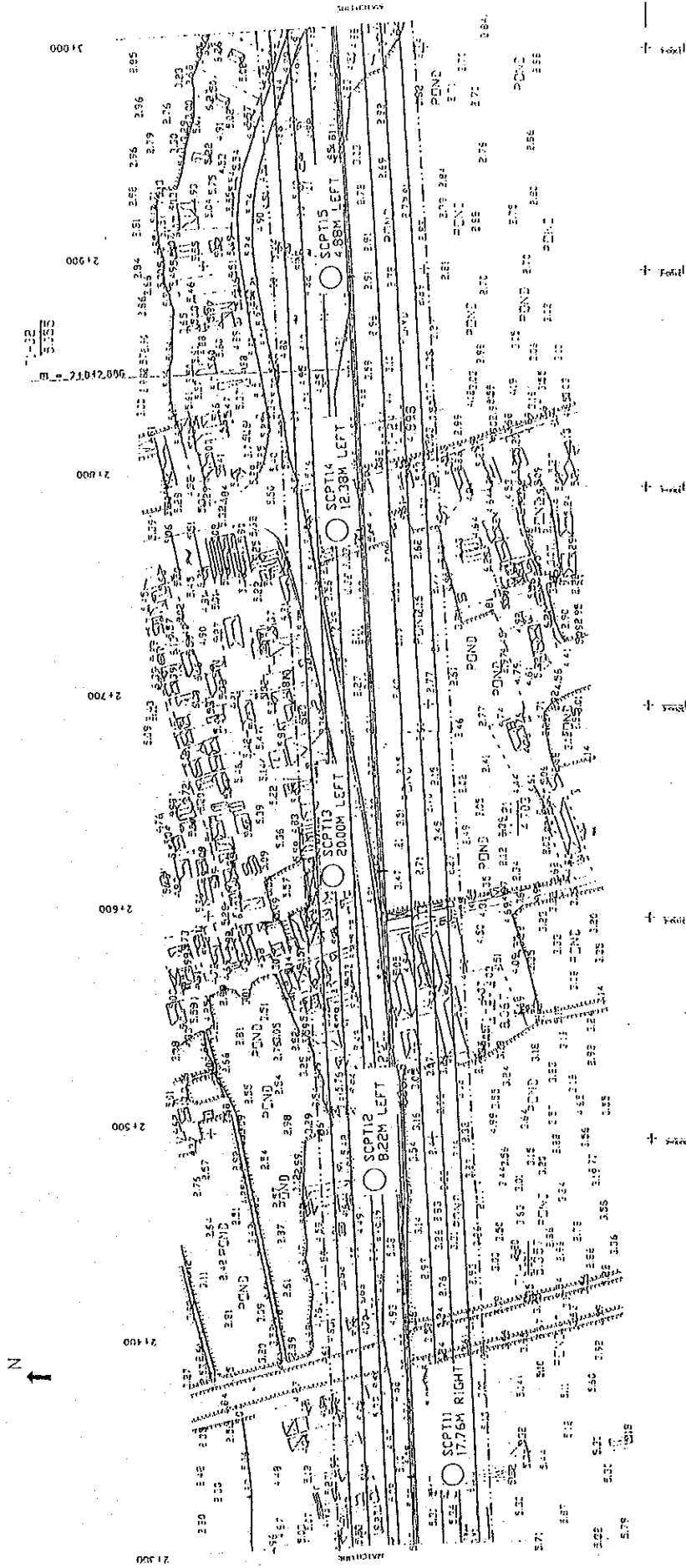


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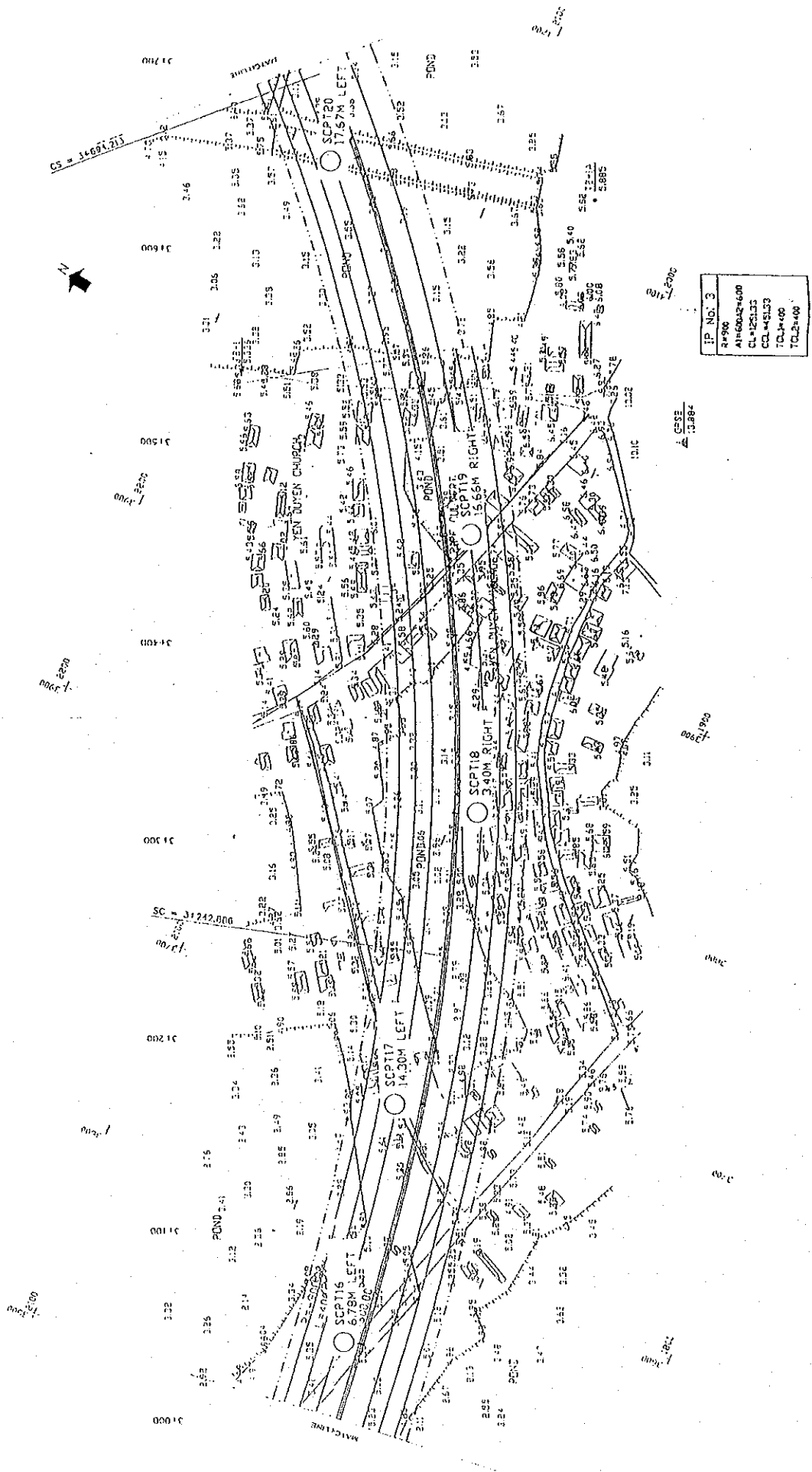


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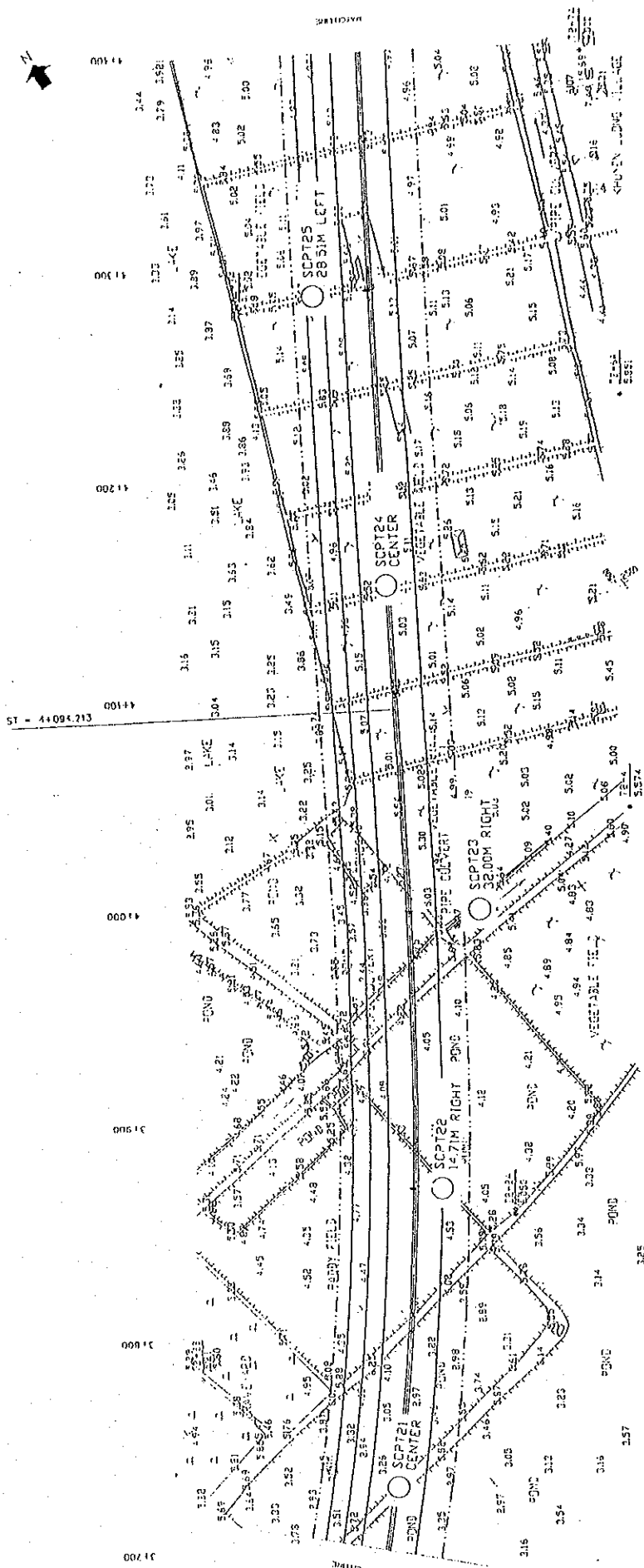
PLAN OF BOREHOLE AND SCPT LOCATIONS
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 SCALE: 1/2000



PLAN OF BOREHOLE AND SCPT LOCATIONS
 KM 3+000 - KM 3+700
 SCALE: 1/2000

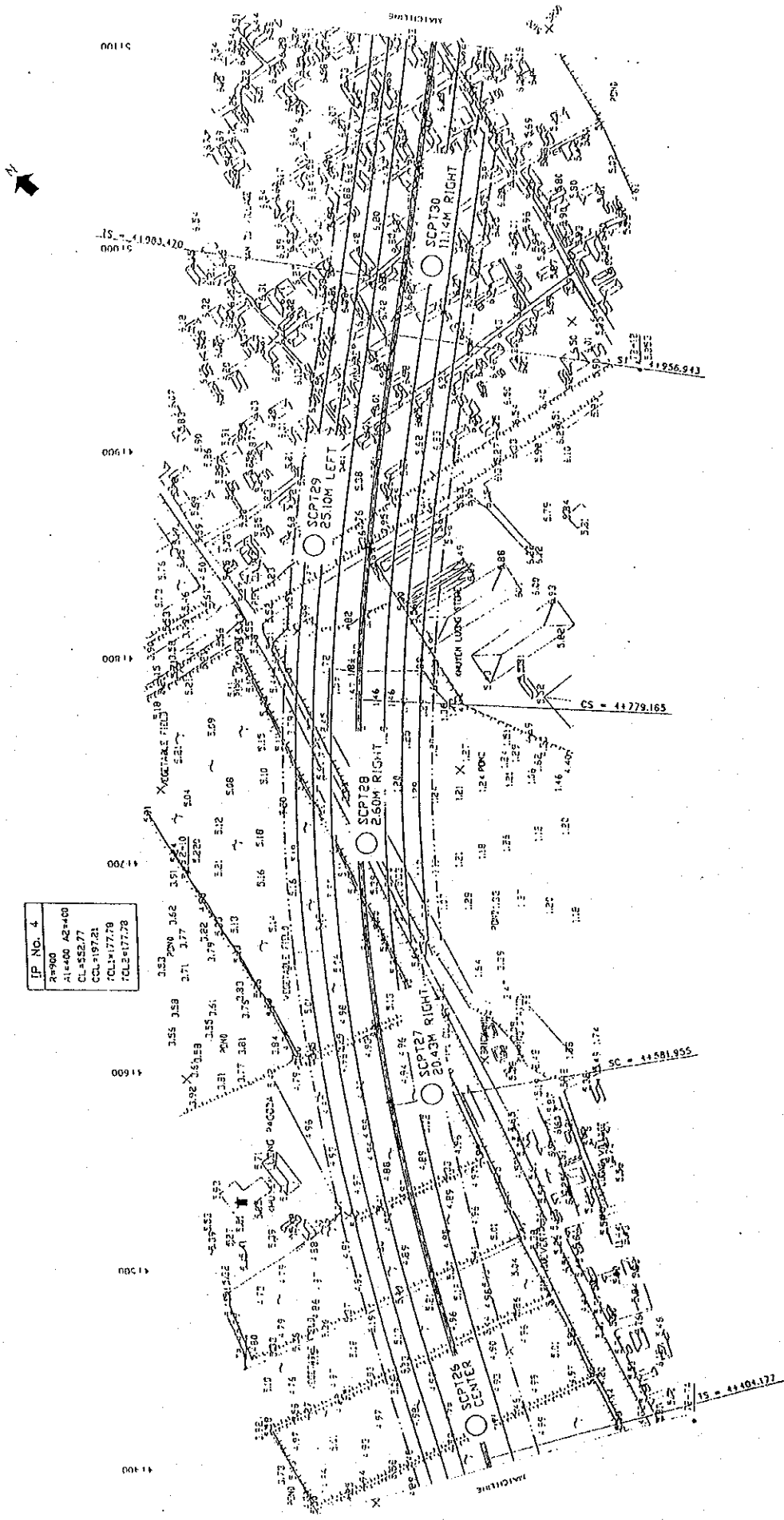


PLAN OF BOREHOLE AND SCPT LOCATIONS
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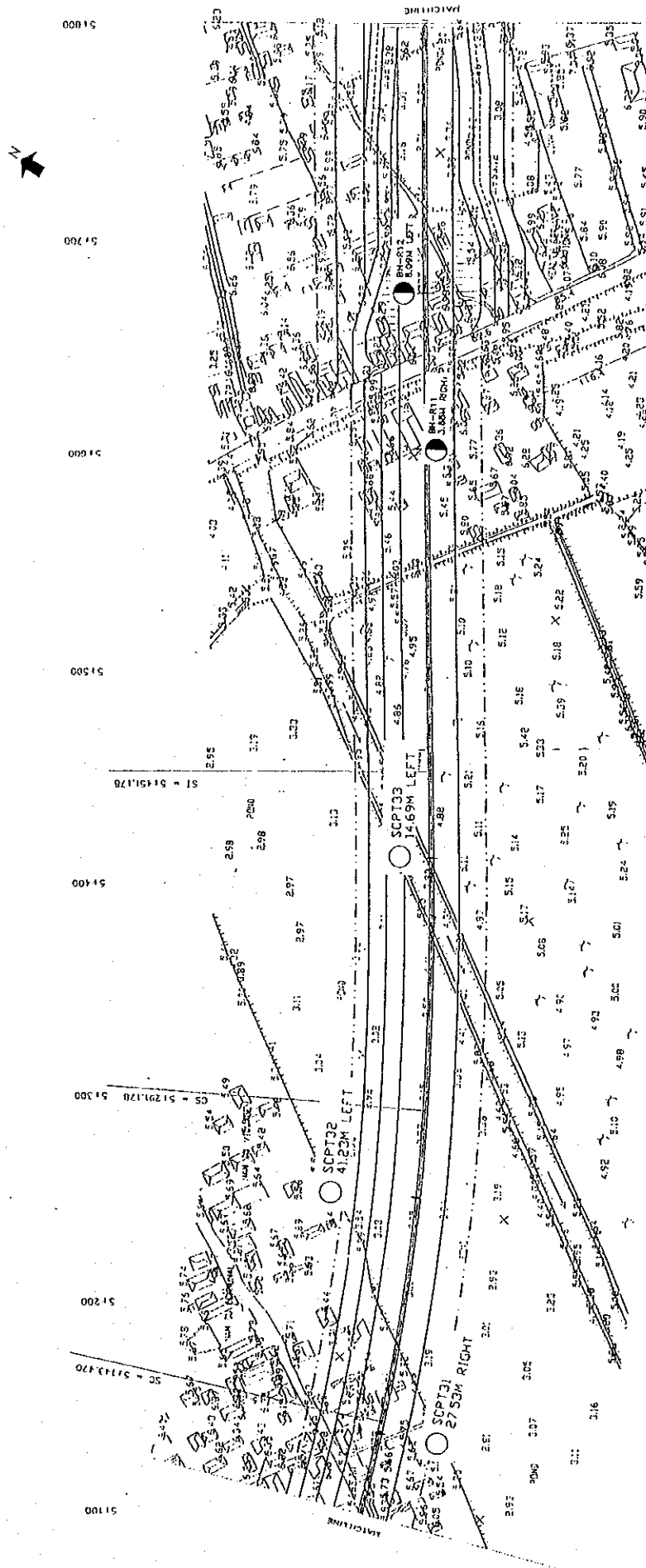


PLAN OF BOREHOLE AND SCPT LOCATIONS
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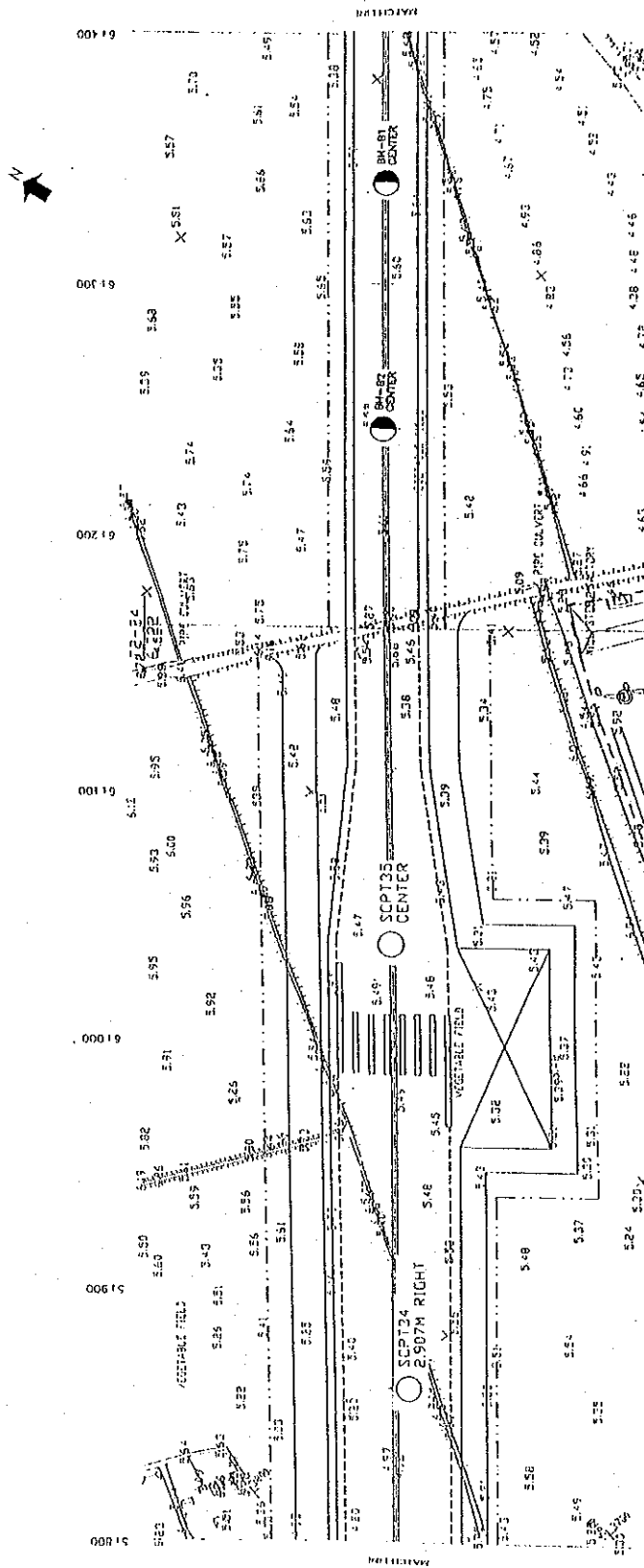


PLAN OF BOREHOLE AND SCPT LOCATIONS
 KM 5+100 - KM 5+800
 SCALE: 1/2000

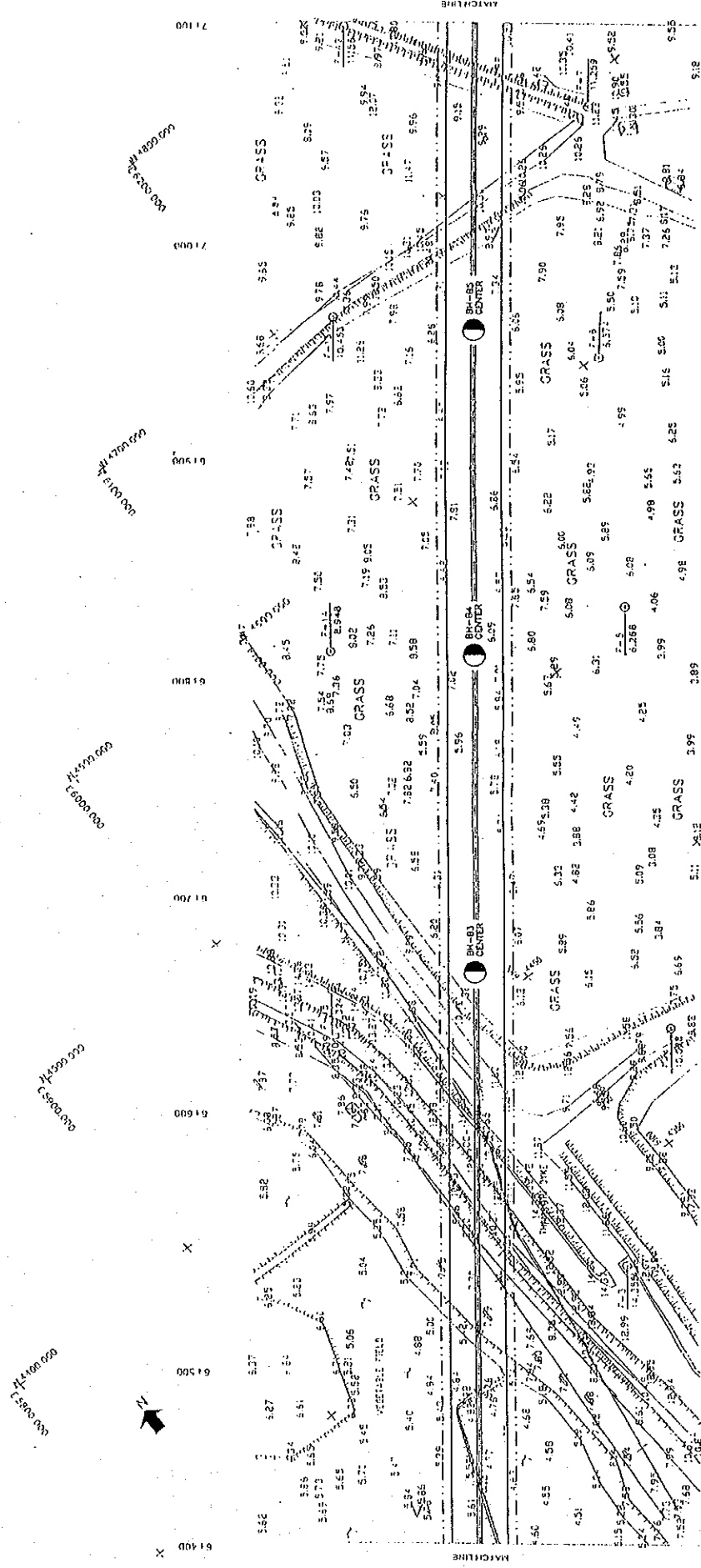


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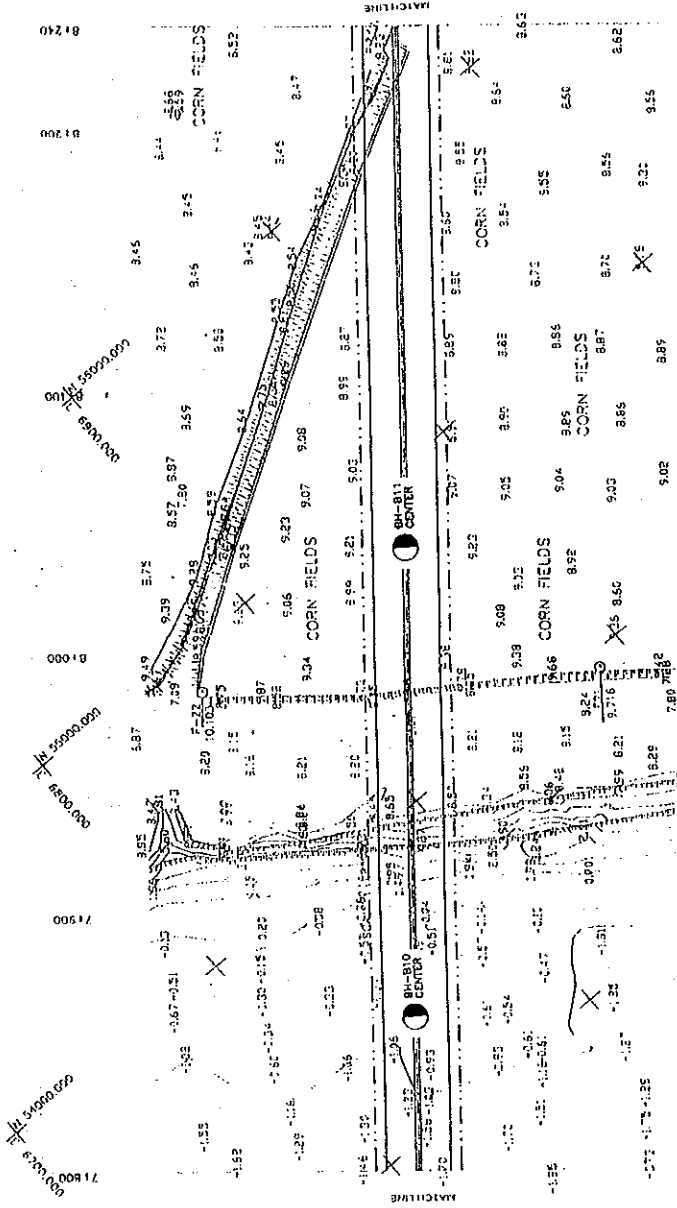
PLAN OF BOREHOLE AND SCPT LOCATIONS
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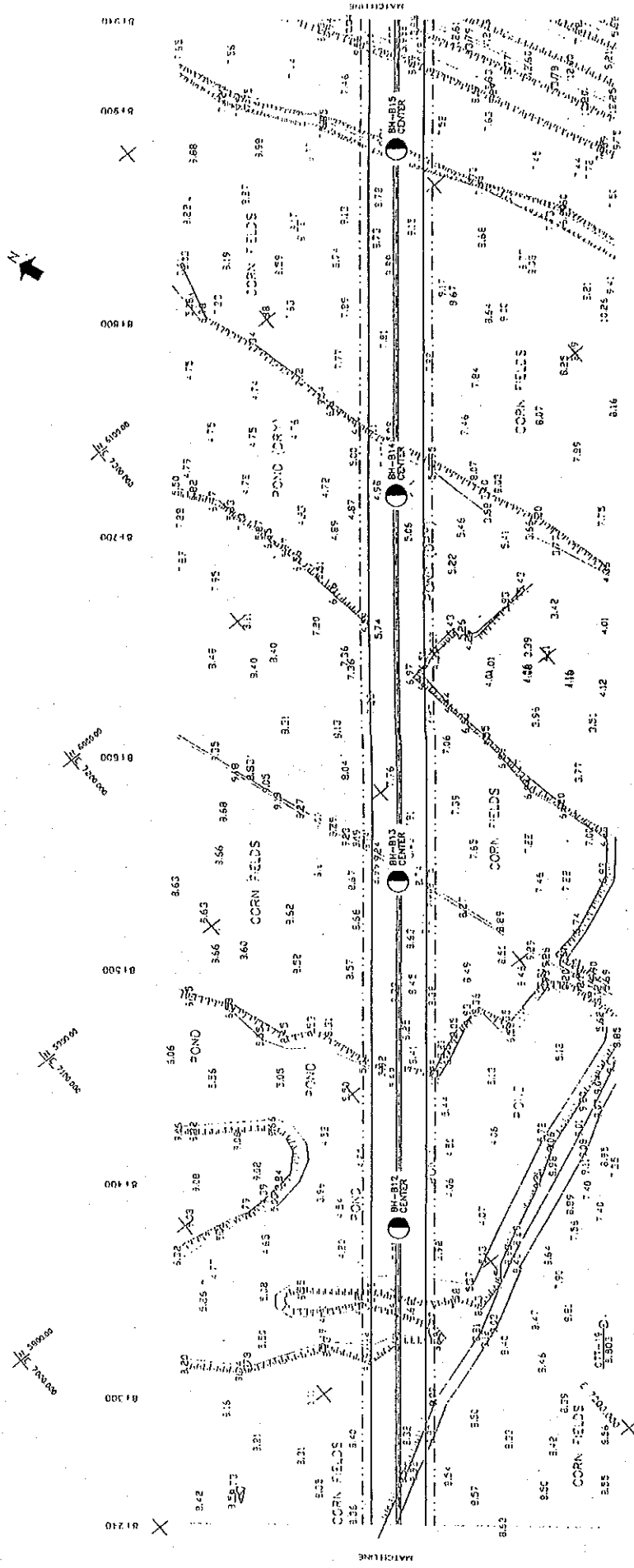
PLAN OF BOREHOLE AND SCPT LOCATIONS
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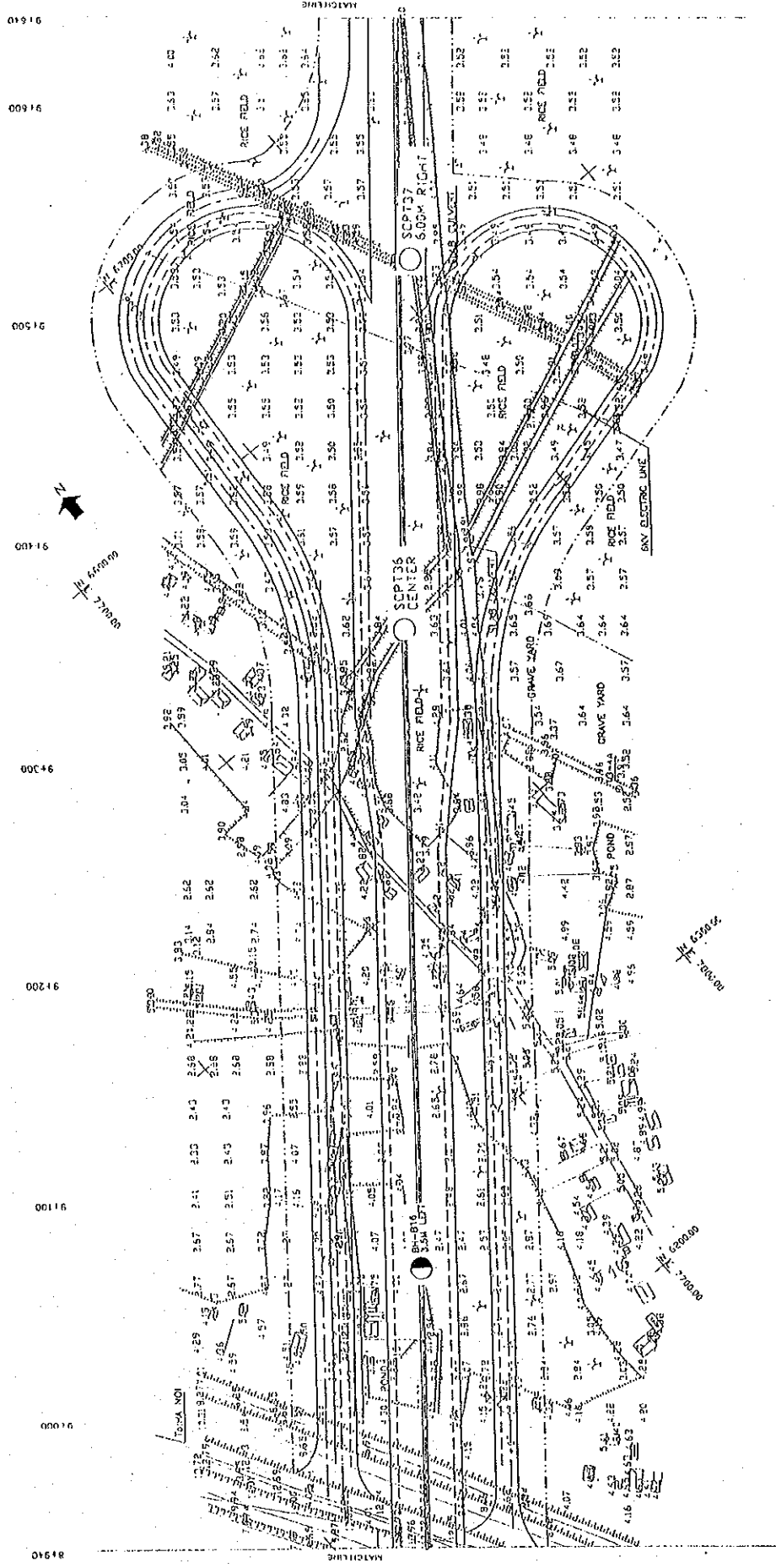
PLAN OF BOREHOLE AND SCPT LOCATIONS
 KM 7+800 - KM 8+240
 SCALE: 1/2000



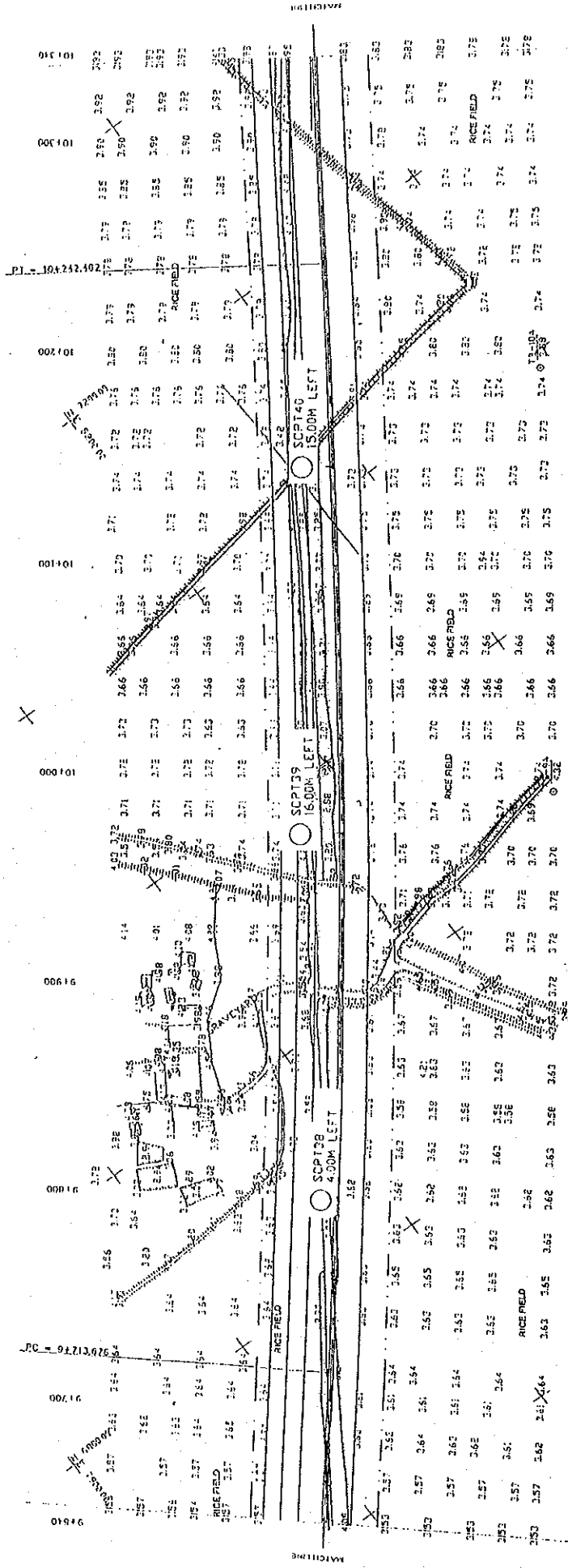
PLAN OF BOREHOLE AND SCPT LOCATIONS
 KM8+240 - KM 8+940
 SCALE: 1/2000



PLAN OF BOREHOLE AND SCPT LOCATIONS
 KM 8+940 - KM 9+640
 SCALE: 1/2000



PLAN OF BOREHOLE AND SCPT LOCATIONS
 KM 9+640 - KM 10+340
 SCALE: 1/2000

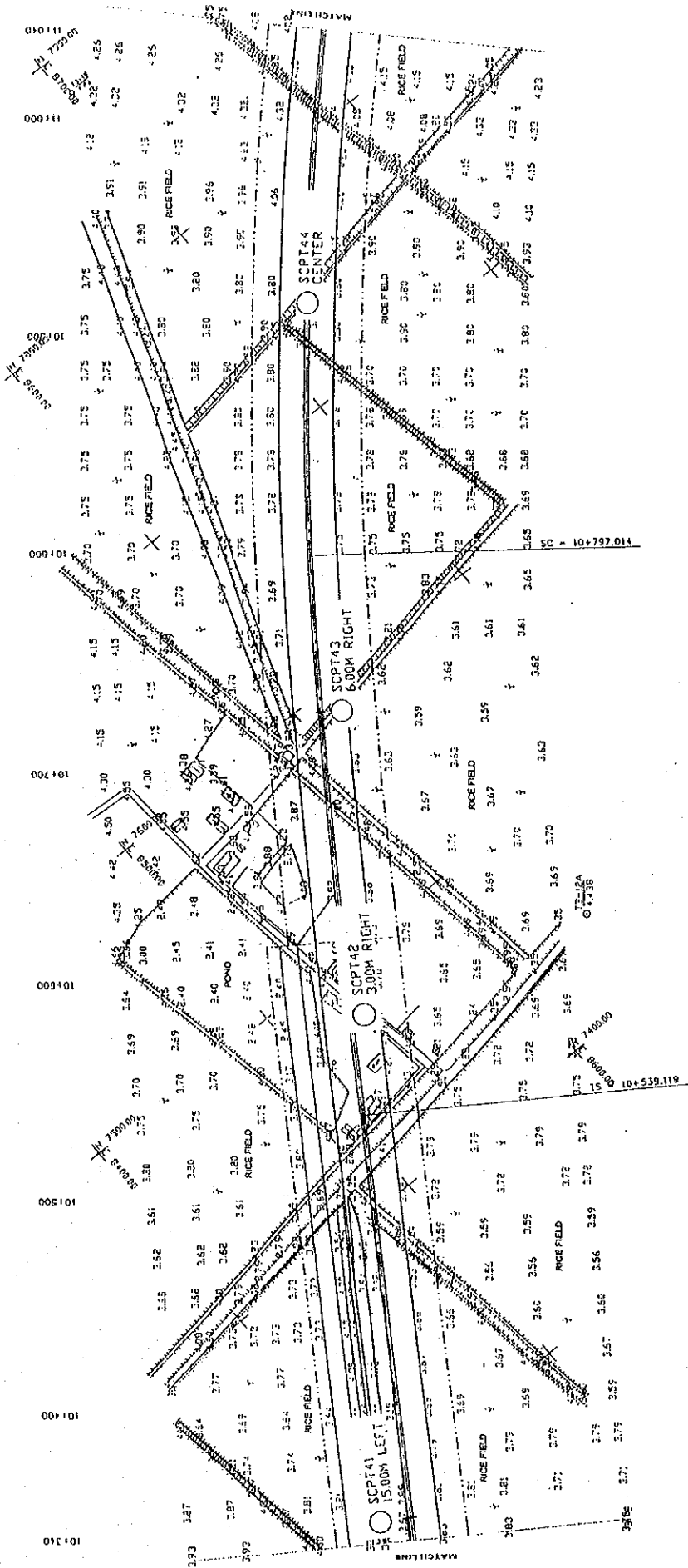


IP No. 6
 R=5000
 CCL#528.79

1:5000.00
 1:2500.00

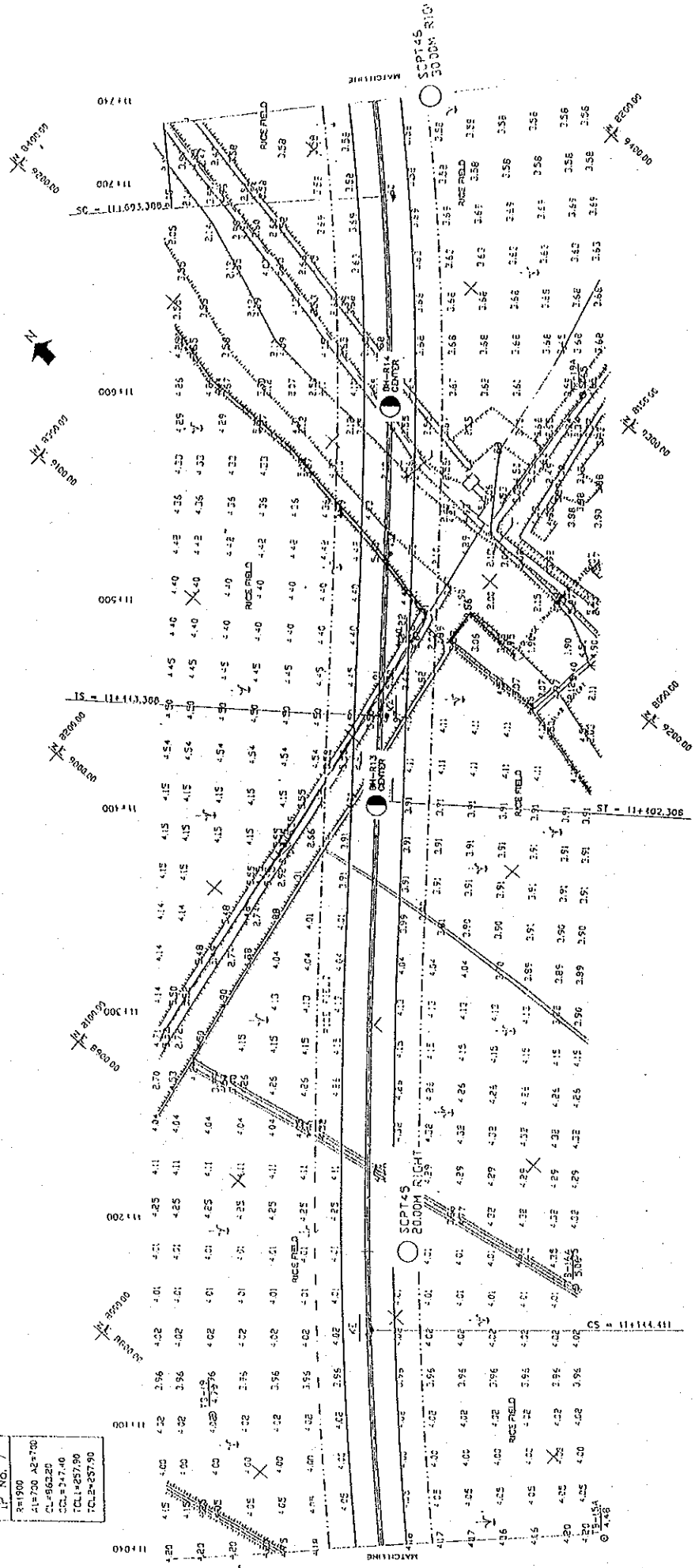
1:5000.00
 1:2500.00

PLAN OF BOREHOLE AND SCPT LOCATIONS
 KM 10+340 - KM 11+040
 SCALE: 1/2000

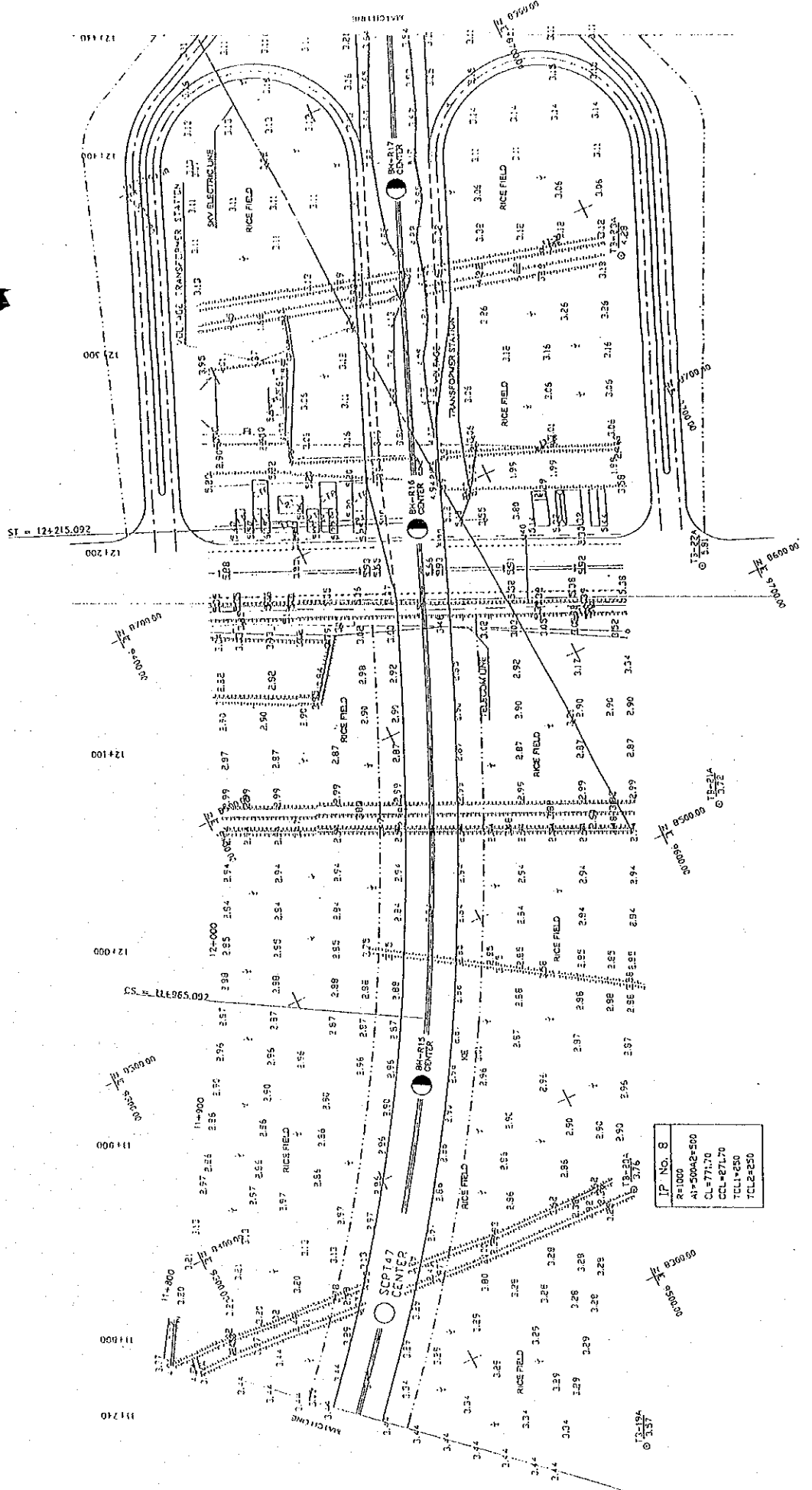


PLAN OF BOREHOLE AND SCPT LOCATIONS
 KM 11+040 - KM 11+740
 SCALE: 1/2000

IP No. 7
 241900
 A1=700 A2=700
 CL=86320
 COL=24740
 TOL=25790
 TOLB=25790

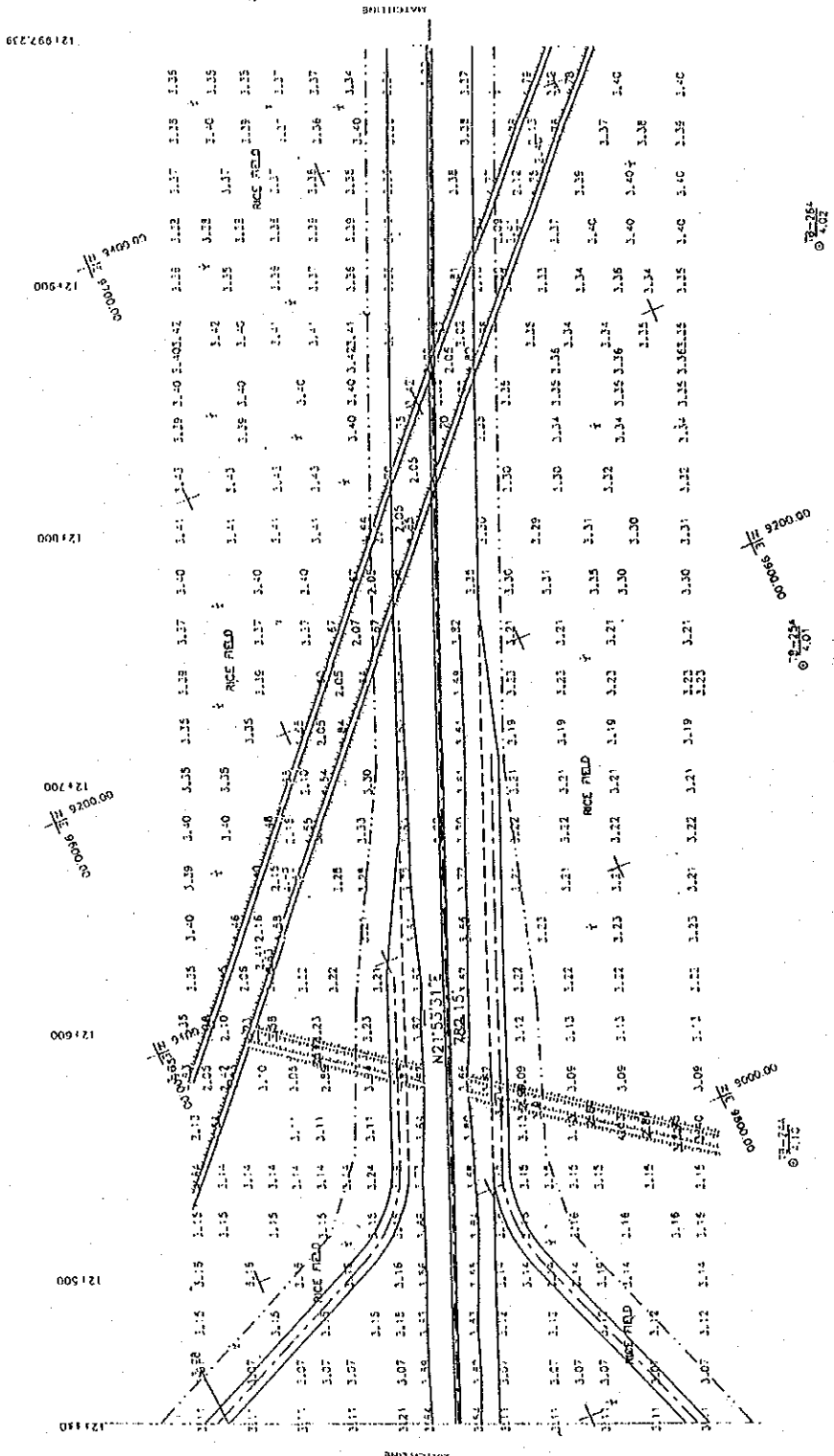


PLAN OF BOREHOLE AND SCPT LOCATIONS
 KM 11+740 - KM 12+440
 SCALE: 1/2000



IP NO. 8
 R=1000
 A1=500A2=500
 CL=771.70
 CCL=671.70
 TLL1=650
 TLL2=650

PLAN OF BOREHOLE AND SCPT LOCATIONS
 KM 12+440 - KM 12+997.239
 SCALE: 1/2000



Appendix 3.3.6 Locations of pressuremeter tests

Name of section	No.	Name of borehole	Station	Elevation of the borehole	Depth of the test	Elevation of the test
Bridge section	1	BH-B2	6+240	5.53	-5.5	0.03
	2			5.53	-15.5	-9.97
	3	BH-B8	7+470	0.02	-5.5	-5.48
	4			0.02	-15.5	-15.48
	5	BH-B9	7+730	-3.42	-5.5	-8.92
	6			-3.42	-15.5	-18.92
	7	BH-B14	8+720	5.05	-5.5	-0.45
	8			5.05	-15.5	-10.45

Appendix 3.3.7 Location of undisturbed samples and laboratory testing of physical and mechanical properties

Name of section	No.	Name of borehole	No. of sample	Depth of sample (m)	Natural water content	Specific gravity test	Wet density test	Grain size analysis	Liquid and plastic limit test	Triaxial compression test	Permeability test	Consolidation test
Road section Thanh Tri side	1	BH-R3	UD1	6.0 - 7.0	0	0	0	0	0	0	0	0
	2		UD2	26.0 - 27.0	0	0	0	0	0	0	0	0
	3		UD3	34.0 - 35.0	0	0	0	0	0	0	0	0
	4	BH-R5	UD1	9.0 - 10.0	0	0	0	0	0	0	0	0
	5		UD2	21.0 - 22.0	0	0	0	0	0	0	0	0
	6		UD3	34.0 - 35.0	0	0	0	0	0	0	0	0
	7	BH-R7	UD1	6.0 - 7.0	0	0	0	0	0	0	0	0
	8		UD2	17.0 - 18.0	0	0	0	0	0	0	0	0
	9		UD3	31.0 - 32.0	0	0	0	0	0	0	0	0
	10	BH-R9	UD1	6.0 - 7.0	0	0	0	0	0	0	0	0
	11		UD2	24.0 - 24.6	0	0	0	0	0	0	0	0
	12		UD3	33.0 - 34.0	0	0	0	0	0	0	0	0
Bridge section	13	BH-B1	UD1	2.0 - 2.5	0	0	0	0	0	0	0	0
	14		UD2	26.6 - 27.1	0	0	0	0	0	0	0	0
	15	BH-B2	UD1	1.0 - 1.6	0	0	0	0	0	0	0	0
	16	BH-B14	UD1	0.85 - 1.45	0	0	0	0	0	0	0	0
	17	BH-B16	UD1	3.9 - 4.5	0	0	0	0	0	0	0	0
	18		UD2	8.3 - 8.9	0	0	0	0	0	0	0	0
Road section Gia Lam side	19	BH-R13	UD1	5.5 - 5.9	0	0	0	0	0	0	0	0
	20		UD2	8.5 - 8.9	0	0	0	0	0	0	0	0
	21		UD3	12.6 - 13.0	0	0	0	0	0	0	0	0
	22	BH-R15	UD1	3.0 - 3.4	0	0	0	0	0	0	0	0
	23		UD2	6.0 - 6.4	0	0	0	0	0	0	0	0
	24		UD3	9.0 - 9.4	0	0	0	0	0	0	0	0

Appendix 3.3.8 Samples on soil materials

Name of section	Number of sample	Name of source	Location
Road section Thanh Tri side	9	Water way repair enterprise sand pit	1.5 km from main bridge
	10		
Bridge section	1	Linh Nam sand pit	near alignment of bridge section
	2		
	3		
	4		
Road section Gia Lam side	5	Duong Ha sand pit	12..0 km from Gia Lam side
	6		
	7		
	8	Anh Dinh sand pit	10.0 km from Gia Lam side

Appendix 3.3.9 Samples on quarry materials

Area	Number of sample	Name of source	Location
Tan Vinh - Loung Son - Hoa Binh	1	Mieu Mon quarry	45 km from project site along the NH6
	2		
	3		
	4		
	5		
Chau Son - Kim Bang - Phu Ly - Ha Nam	6	Kien Khe quarry	67 km from project site along the NH1
	7		
	8		
	9		
	10		

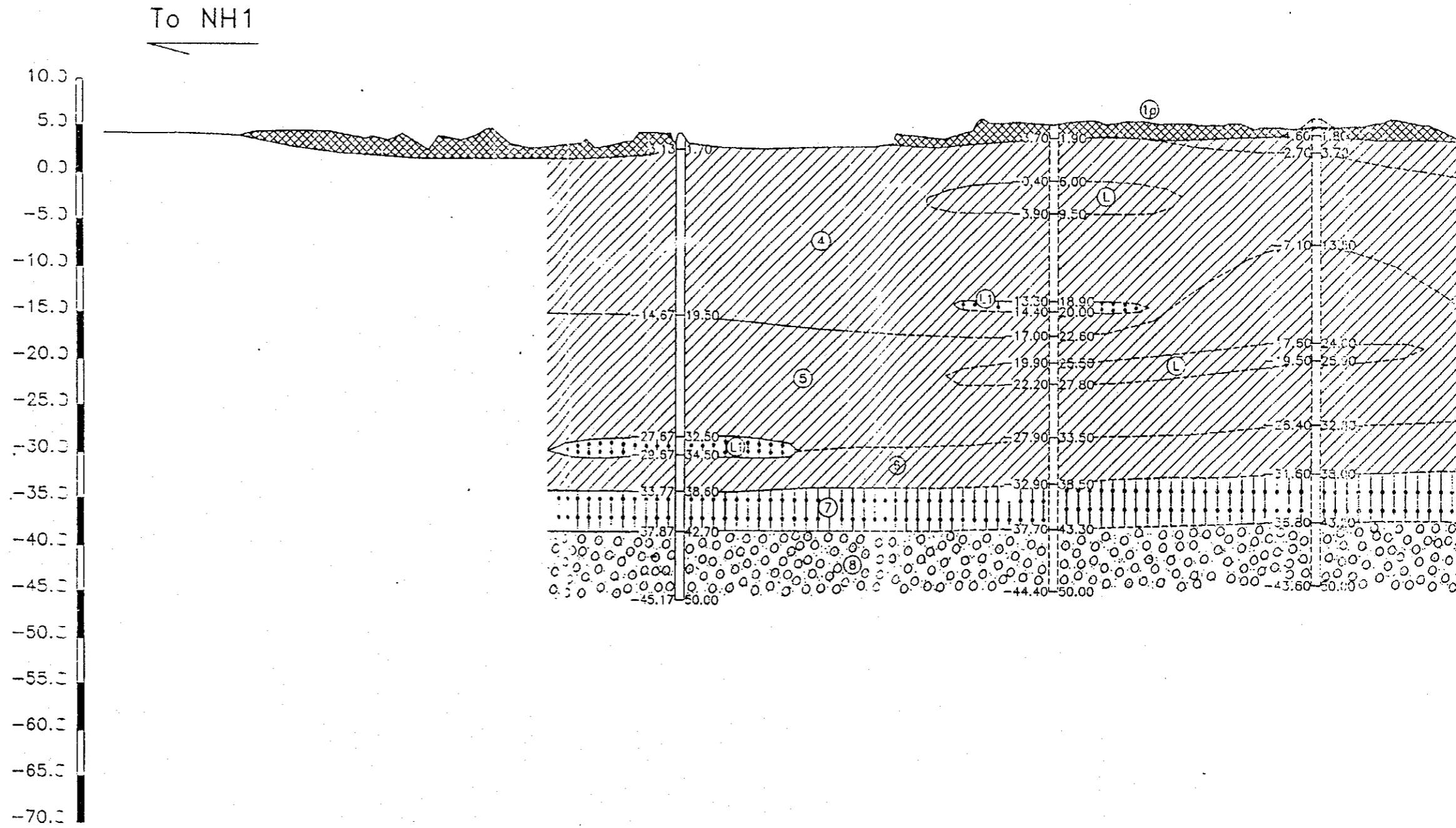
Appendix 3.3.10 Samples on water for making concrete

Name of section	Number of sample	Name of source or location
Road section Thanh Tri side	1	km 0+700
	2	Phap Van Lake (km 1+100)
	3	ditto
	4	Thanh Tri new dike (km 5+600,right>100)
	5	ditto
Bridge section	6	Red River
	7	ditto
Road section Gia Lam side	8	Thach Ban road (left)
	9	ditto
	10	Thach Ban road (right)

Appendix 3.3.11 Samples on ready mixed concrete

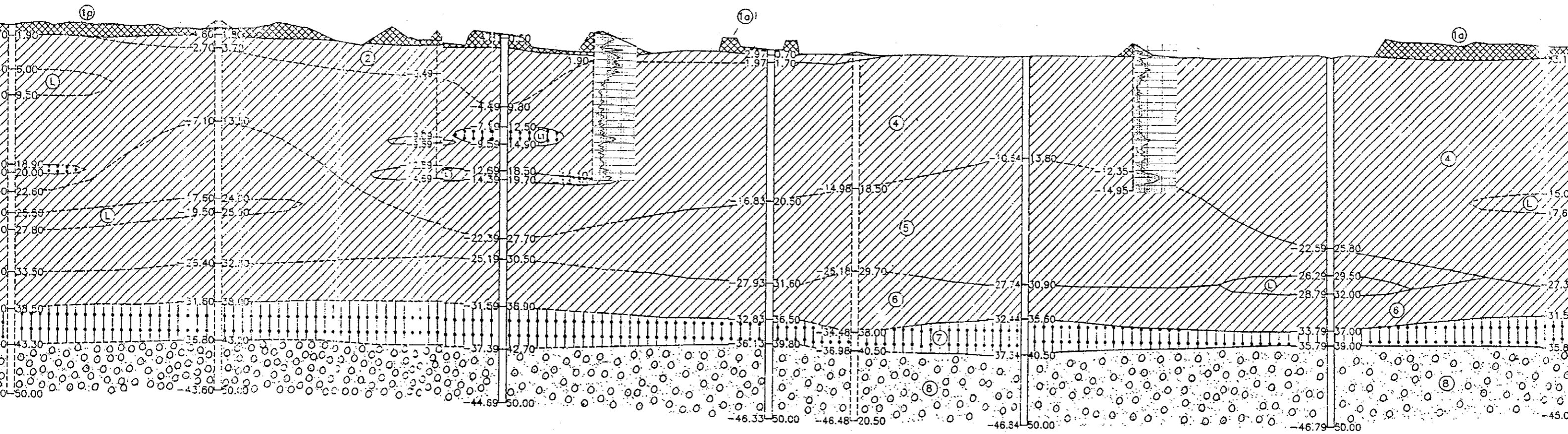
Classification	Number of sample	Type of used cement	Used admixture
210 kg/cm ²	1	Portland, PC30	Sika NN
	2	Portland, PC30	Sika NN
290 kg/cm ²	3	Portland, PC30	Sika NN
	4	Portland, PC30	Sika NN
400 kg/cm ²	5	Early-strength, PC40	Sika NN
	6	Early-strength, PC40	Sika NN
	7	Early-strength, PC40	Sika NN
	8	Portland, PC30	RHEOBUILD R716-MBT
	9	Portland, PC30	RHEOBUILD R716-MBT
	10	Portland, PC30	RHEOBUILD R716-MBT

Appendix 3.3.12 Soil profile along the planned center line

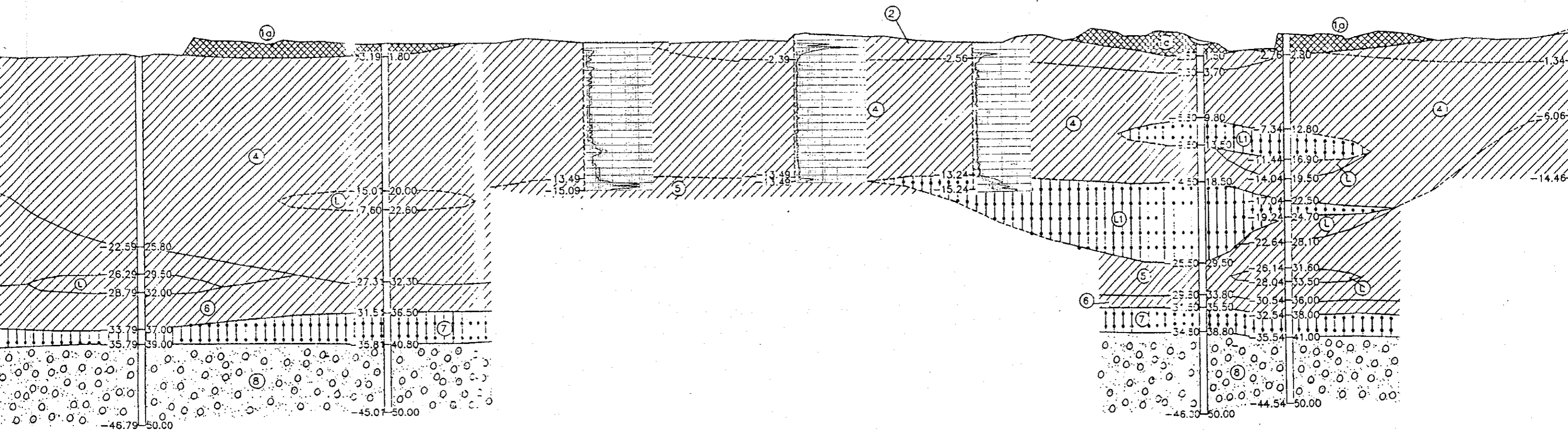


1

BOREHOLES & SCPT NAME	● BH-R1 (Center)										● BH-R2 (Right 3.0m)					● BH-R3 (Right 5.0m)																							
GROUND LEVEL	4.300	4.300	4.330	4.191	4.520	4.610	4.595	4.084	4.339	4.116	4.132	3.288	2.920	1.474	3.212	4.568	4.870	3.885	3.002	2.901	3.028	3.088	3.122	4.385	4.012	6.023	5.868	5.600	6.094	6.065	5.822	5.700	5.839	5.300	5.403	5.421	6.287	5.654	4.001
STATION	-500	-480	-460	-440	-420	-400	-380	-360	-340	-320	-300	-280	-260	-240	-220	-200	-180	-160	-140	-120	-100	-80	60	-40	-20	0000	20	40	60	80	100	120	140	161.5	180	200	220	240	



BH-R2 (Right 3.0m)				BH-R3 (Right 5.0m)				SCPT1 (Right 15.5m)				BH-R4 (Center)				SCPT2 (Right 22.70m)				BH-R5 (Center)				BH-R4B (Left 120m)				BH-R7 (Center)				SCPT4 (Left 41.19m)				BH-R6 (Center)																						
0	20	40	60	80	100	120	140	161.5	180	200	220	240	260	280	300	313.2	320	340	361.5	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	796.5	800	820	840	860	880	900	920	930	940	960	980	1000	1020	1040	1060	1080	
3.800		6.094	6.065	5.822	5.700	5.839	5.300	5.403	5.421	6.287	5.654	4.001	3.230	5.818	4.016	3.314	5.653	5.310	3.552	3.171	5.700	3.022	2.954	3.340	3.401	4.043	3.670	4.993	3.173	3.520	3.119	3.221	3.210	3.021	4.071	3.160	3.258	3.280	3.338	5.050	3.360	3.132	3.188	2.991	3.153	3.292	3.564	3.655	3.210	3.647	3.531	5.865	5.464	5.333	4.215	5.230	5.202	4.205



● BH-R6
(Center)

● BH-R8
(Center)

○ SCPT5
(Left 10.55m)

○ SCPT6
(Center)

○ SCPT7
(Left 2.0m)

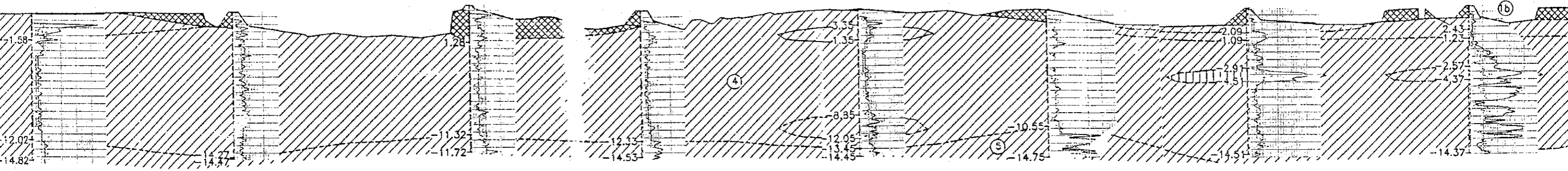
● BH-R9
(Center)

● BH-R10
(Center)

840	3.188
860	2.991
880	3.153
900	3.292
920	3.564
930	3.655
940	3.210
960	3.647
980	3.531
1000	5.865
1020	5.464
1040	5.333
1060	4.915
1080	5.230
1100	5.202
1120	4.905
1140	4.920
1160	4.947
1180	4.930
1200	4.970
1220	4.940
1240	5.529
1260	5.250
1280	4.910
1300	4.930
1320	4.930
1340	5.020
1360	5.050
1384	5.040
1400	5.720
1420	5.540
1440	5.527
1460	5.579
1480	5.001
1500	4.790
1520	4.760
1540	4.651
1560	5.681
1580	4.920
1600	6.472
1620	5.858
1640	5.419
1660	5.832
1680	4.000
1700	3.176
1720	3.425
1740	5.460
1760	5.400
1780	4.567
1800	5.675
1820	5.270
1840	4.322
1860	4.687
1880	4.375
1900	4.421
1920	5.027

GEOLOGICAL PROFILE ALONG THE CENTERLINE - ROAD SECTION THANH TRI SIDE
 PROJECT : THANH TRI BRIDGE

Scale : Horizontal : 1/2500
 Vertical : 1/500



○ SCPT12
 (Left 8.22m)

○ SCPT13
 (Left 20.0m)

○ SCPT14
 (Left 12.38m)

○ SCPT15
 (Left 4.38m)

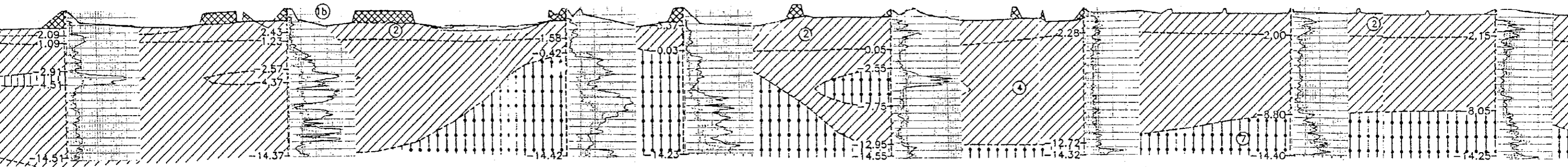
○ SCPT16
 (Left 6.78m)

○ SCPT17
 (Left 14.20m)

○ SCPT18
 (Right 3.40m)

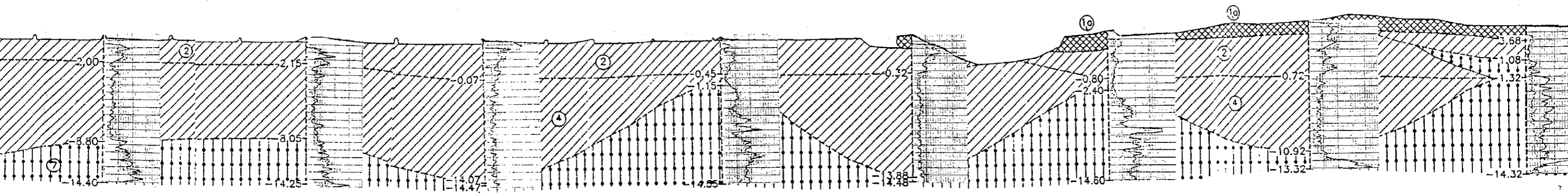
○ SCPT19
 (Right 5.56m)

2460	4.73
2470	5.180
2480	5.170
2500	5.189
2520	5.260
2540	5.320
2560	5.248
2580	5.228
2600	3.470
2610	5.330
2620	3.168
2640	2.986
2660	2.091
2680	2.610
2700	2.103
2720	2.300
2740	1.991
2760	2.597
2771	6.280
2780	5.477
2800	4.450
2820	4.748
2840	3.901
2860	3.070
2880	3.665
2886.9	5.470
2900	3.164
2920	3.034
2940	3.749
2960	4.472
2980	5.191
3000	5.352
3020.00	5.60
3040.00	5.55
3060.00	5.20
3080.00	5.02
3100.00	5.33
3120.00	4.55
3140.00	5.24
3160.00	5.34
3167.00	5.25
3180.00	4.97
3200.00	4.47
3220.00	3.21
3242.00	3.07
3250.00	3.08
3280.00	3.11
3300.00	3.35
3320.00	3.25
3340.00	3.18
3360.00	3.15
3380.00	3.14
3400.00	5.08
3420.00	3.89
3440.00	3.25
3454.00	5.63
3460.00	4.67
3480.00	3.36
3500.00	3.83
3520.00	5.41



○ SCPT18 (Right 3.40m) ○ SCPT19 (Right 5.56m) ○ SCPT20 (Left 17.67m) ○ SCPT21 (Center) ○ SCPT22 (Right 4.71m) ○ SCPT23 (Right 2.55m) ○ SCPT24 (Center) ○ SCPT25 (Left 28.51m)

3250.00	3.08	3280.00	3.11	3310.00	3.25	3340.00	3.18	3370.00	3.15	3400.00	3.14	3430.00	5.08	3460.00	3.89	3490.00	3.25	3520.00	5.63	3550.00	4.67	3580.00	3.36	3610.00	3.83	3640.00	5.41	3670.00	5.34	3700.00	3.21	3730.00	3.23	3760.00	3.10	3790.00	3.00	3820.00	5.32	3850.00	5.58	3880.00	5.87	3910.00	3.12	3940.00	3.34	3970.00	4.01	4000.00	5.77	4030.00	3.33	4060.00	3.02	4090.00	3.45	4120.00	4.12	4150.00	4.51	4180.00	4.45	4210.00	5.45	4240.00	4.63	4270.00	4.12	4300.00	4.07	4330.00	4.07	4360.00	5.85	4390.00	3.85	4420.00	4.05	4450.00	5.03	4480.00	5.00	4510.00	4.98	4540.00	5.01	4570.00	5.01	4600.00	5.01	4630.00	5.01	4660.00	5.03	4690.00	5.60	4720.00	5.02	4750.00	5.03	4780.00	5.09	4810.00	11	4840.00	5.08	4870.00	5.07	4900.00	5.12	4930.00	5.75	4960.00	5.82	4990.00	5.36	5020.00	5.00
---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	----	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------	---------	------



○ SCPT24
(Center)

○ SCPT25
(Left 28.5m)

○ SCPT26
(Center)

○ SCPT27
(Right 20.45m)

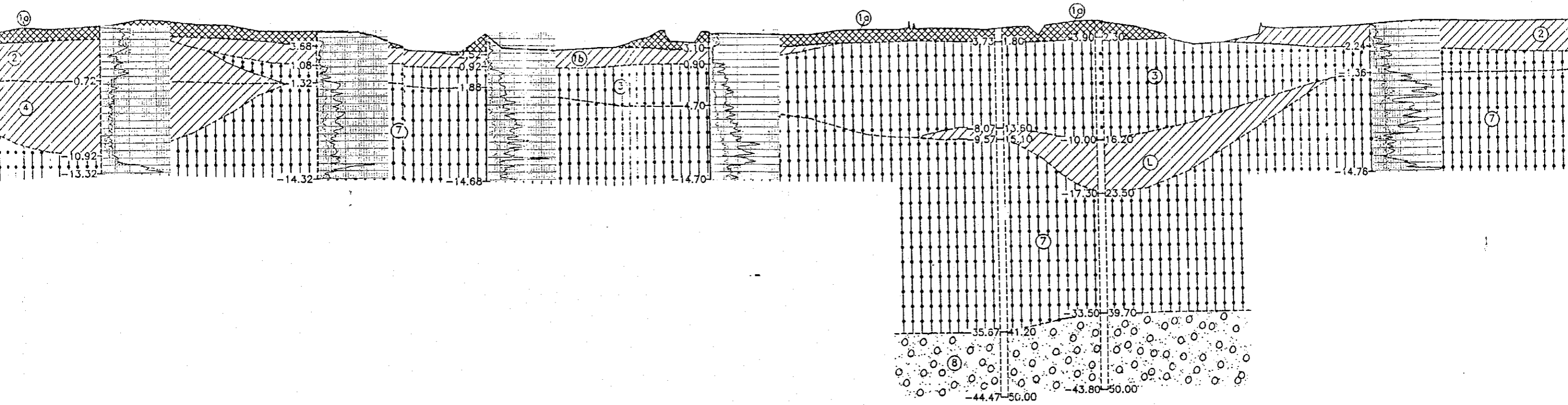
○ SCPT28
(Right 25.0m)

○ SCPT29
(Right 25.10m)

○ SCPT30
(Right 11.14m)

○ SCPT31
(Right 27.1m)

4100.00	5.01
4120.00	5.01
4140.00	5.03
4149.00	5.60
4160.00	5.02
4180.00	5.03
4200.00	5.09
4220.00	11
4240.00	5.08
4260.00	5.07
4280.00	5.12
4289.52	5.75
4300.00	5.82
4320.00	5.36
4340.00	5.00
4360.00	5.02
4380.00	1.94
4400.00	4.92
4418.60	5.53
4430.00	4.92
4460.00	4.96
4480.00	4.94
4500.00	4.83
4520.00	4.84
4540.00	5.36
4560.00	4.95
4580.00	5.44
4582.99	5.44
4600.00	4.90
4620.00	5.53
4640.00	5.03
4660.00	5.09
4680.00	5.14
4700.00	4.10
4700.00	3.78
4713.97	5.52
4720.00	5.43
4740.00	2.82
4760.00	1.47
4760.00	1.63
4800.00	2.24
4820.00	5.00
4840.00	5.1
4849.82	5.0
4860.00	3.57
4880.00	5.25
4900.00	5.36
4920.00	5.96
4940.00	6.61
4960.00	6.31
4980.00	6.63
4992.98	6.63
5000.00	6.84
5020.00	7.59
5040.00	7.34
5060.00	6.85
5080.00	6
5100.00	5.87
5120.00	5.76
5138.56	5.68
5160.00	5.73



○ SCPT30
(Right 11.14m)

○ SCPT31
(Right 27.55m)

○ SCPT32
(Left 41.55m)

○ SCPT33
(Left 14.69m)

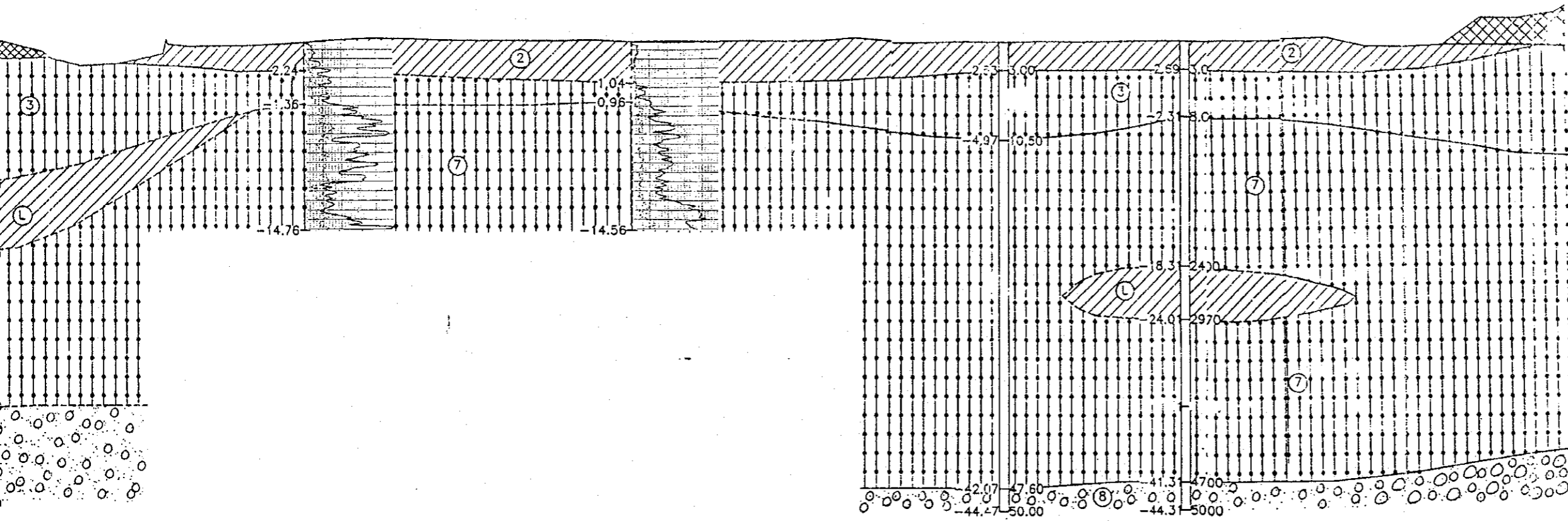
● BH-R11
(Right 3.28m)

● BH-R12
(Left 8.09m)

○ SCPT34
(Right 2.97m)

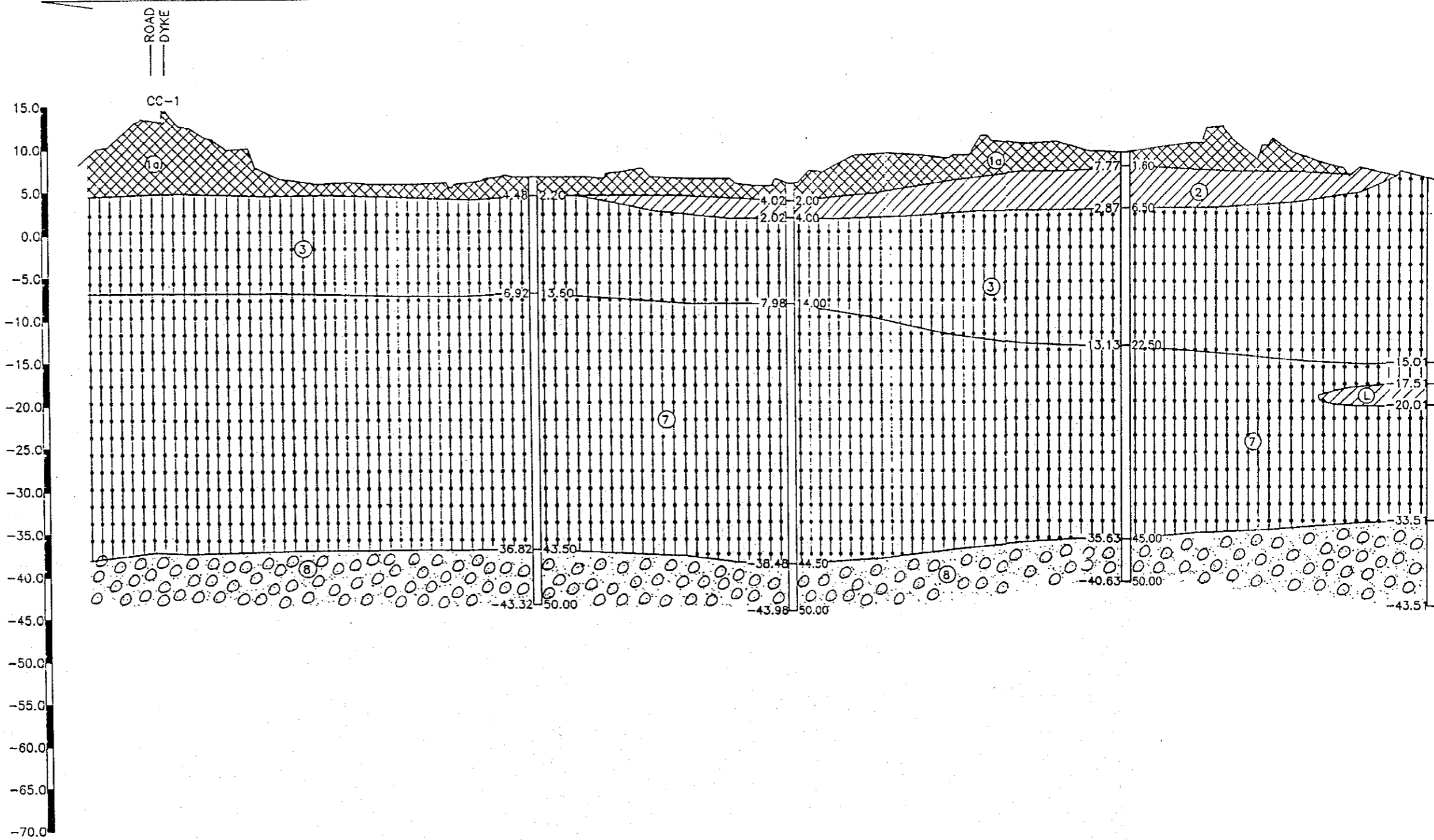
4920.00	5.96
4940.00	6.61
4960.00	6.31
4980.00	6.63
4992.98	6.63
5000.00	6.84
5020.00	7.59
5040.00	7.34
5060.00	6.85
5080.00	6
5100.00	5.87
5120.00	5.76
5138.56	5.68
5160.00	5.73
5180.00	5.23
5200.00	3.25
5220.00	3.07
5240.00	3.05
5251.90	5.32
5260.00	2.97
5280.00	2.92
5300.00	3.15
5320.00	3.31
5340.00	3.50
5360.00	4.41
5380.00	4.87
5400.00	3.93
5410.09	5.30
5420.00	4.91
5440.00	4.90
5460.00	4.90
5480.00	4.83
5500.00	5.36
5520.00	5.38
5540.00	5.34
5560.00	5.46
5580.00	5.41
5600.00	5.17
5608.63	5.53
5620.00	5.57
5640.00	5.71
5660.00	6.23
5676.16	6.20
5680.00	6.74
5700.00	5.45
5720.00	4.37
5740.00	2.89
5760.00	3.10
5780.00	3.92
5800.00	4.84
5820.00	4.92
5840.00	5.02
5860.00	5.24
5864.73	5.24
5880.00	5.55
5900.00	5.75
5920.00	5.64
5940.00	5.51
5960.00	5.48
5980.00	5.46

To Main Bridge



R12 (8.09m)		SCPT34 (BPH 2.507m)		SCPT35 (Center)		BH-B2 (Center)		BH-B1 (Center)	
5720.00	4.17	5860.00	3.24	6044.00	5.44	6240.00	5.53	6380.00	5.66
5740.00	2.89	5880.00	5.55	6060.00	5.50	6260.00	5.61	6400.00	5.83
5760.00	3.10	5900.00	5.75	6080.00	5.40	6280.00	5.54	6420.00	4.85
5780.00	3.92	5920.00	5.64	6100.00	5.37	6300.00	5.58	6440.00	4.77
5800.00	4.84	5940.00	5.51	6120.00	5.37	6320.00	5.67	6460.00	4.93
5820.00	4.92	5960.00	5.48	6140.00	5.31	6340.00	5.59	6480.00	7.76
5840.00	5.02	5980.00	5.46	6160.00	5.71	6360.00	5.68	6500.00	7.75
5860.00	5.24	6000.00	5.45	6180.00	5.35	6380.00	5.66	6520.00	8.22
5880.00	5.55	6020.00	5.51	6200.00	5.42	6400.00	5.67		
5900.00	5.75	6040.00	5.44	6220.00	5.50	6420.00	5.59		
5920.00	5.64	6060.00	5.50	6240.00	5.53	6440.00	5.68		
5940.00	5.51	6080.00	5.40	6260.00	5.61	6460.00	5.66		
5960.00	5.48	6100.00	5.37	6280.00	5.54	6480.00	5.74		
5980.00	5.46	6120.00	5.37	6300.00	5.58	6500.00	5.83		
6000.00	5.45	6140.00	5.31	6320.00	5.67				
6020.00	5.51	6160.00	5.71	6340.00	5.59				
6044.00	5.44	6180.00	5.35	6360.00	5.68				
6060.00	5.50	6200.00	5.42	6380.00	5.66				
6080.00	5.40	6220.00	5.50	6400.00	5.67				
6100.00	5.37	6240.00	5.53	6420.00	5.59				
6120.00	5.37	6260.00	5.61	6440.00	5.68				
6140.00	5.31	6280.00	5.54	6460.00	5.66				
6160.00	5.71	6300.00	5.58	6480.00	5.74				
6180.00	5.35	6320.00	5.67	6500.00	5.83				
6200.00	5.42	6340.00	5.59						
6220.00	5.50	6360.00	5.68						
6240.00	5.53	6380.00	5.66						
6260.00	5.61	6400.00	5.74						
6280.00	5.54	6420.00	5.83						
6300.00	5.58	6440.00	4.85						
6320.00	5.67	6460.00	4.77						
6340.00	5.59	6480.00	4.93						
6360.00	5.68	6500.00	7.75						
6380.00	5.66		7.76						
6400.00	5.74		8.22						

To Thanh Tri side

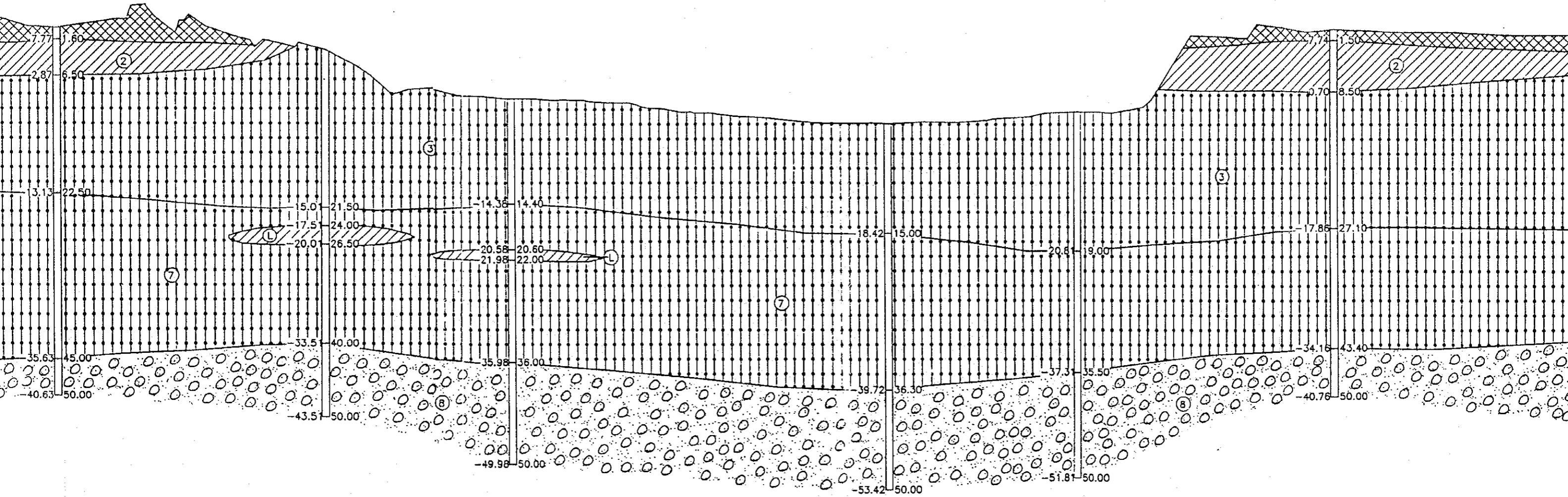


BOREHOLES & SCPT NAME	BH-B4										BH-B5										BH-B6																																																														
GROUND LEVEL	8.22	9.76	10.39	12.21	13.26	13.27	14.75	15.88	16.03	11.13	10.10	10.23	7.38	6.48	6.27	6.06	6.15	6.23	6.09	5.95	5.98	6.00	6.08	5.53	6.12	6.46	6.70	6.59	6.68	6.68	6.73	6.79	6.73	6.67	7.30	7.70	6.79	6.73	6.67	6.59	6.50	5.95	5.86	6.16	6.02	7.07	7.38	8.35	9.31	9.47	9.63	9.45	9.28	9.11	9.31	9.72	11.60	10.78	10.54	10.62	10.72	10.19	9.66	9.52	9.37	9.66	9.95	10.30	10.65	12.21	12.55	10.29	8.84	11.18	9.62	8.94	8.26	7.72	7.77	7.30	6.83	7.03	6.49
STATION	6+540	6+560	6+580	6+591.8	6+800	6+620	6+640	6+660	6+680	6+700	6+720	6+740	6+760	6+780	6+800	6+820	6+840	6+860	6+880	6+900	6+920	6+940	6+960	6+980	7+000	7+020	7+040	7+060	7+080	7+100	7+120	7+140	7+160	7+180	7+200	7+220	7+240	7+260	7+280	7+300	7+320	7+340																																									

GEOLOGICAL PROFILE ALONG THE CENTERLINE - MAIN BRIDGE SECTION

PROJECT : THANH TRI BRIDGE

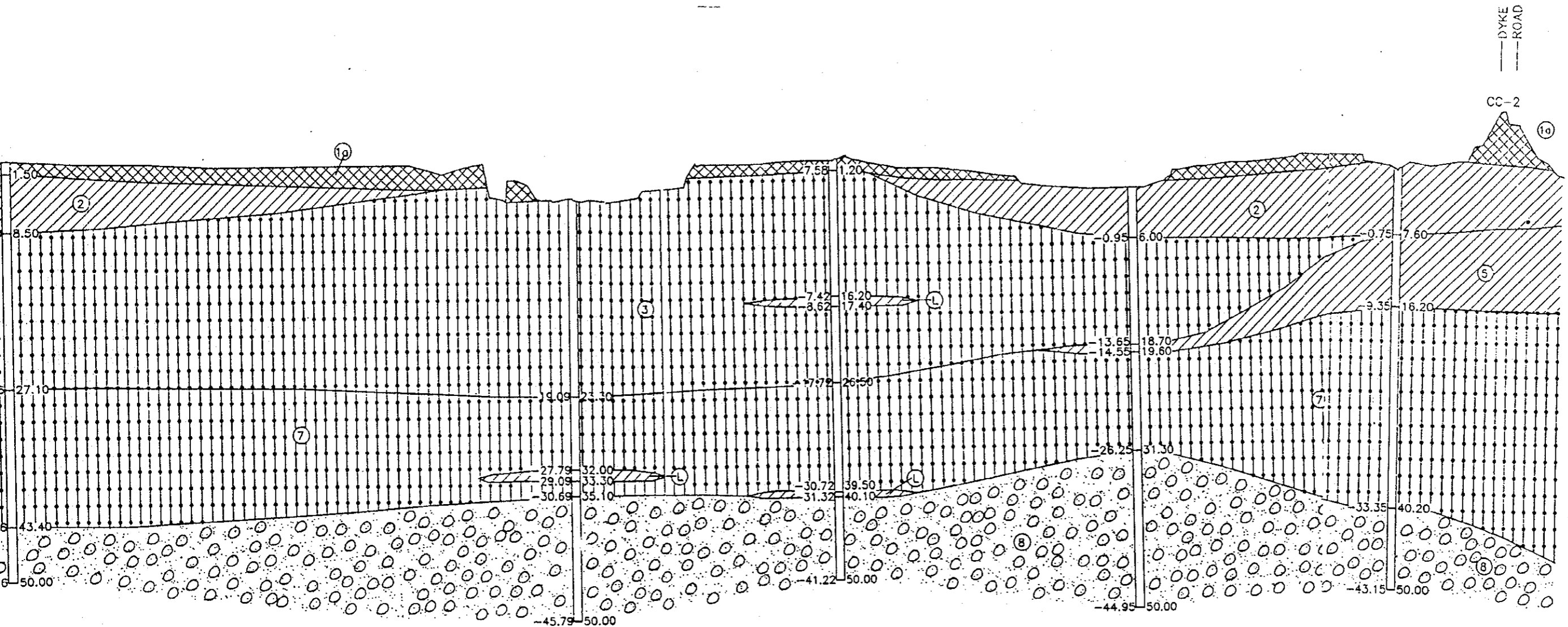
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Horizontal : 1/2500



● BH-B6 ● BH-B7 ● BH-B8 ● BH-B9 ● BH-B10 ● BH-B11

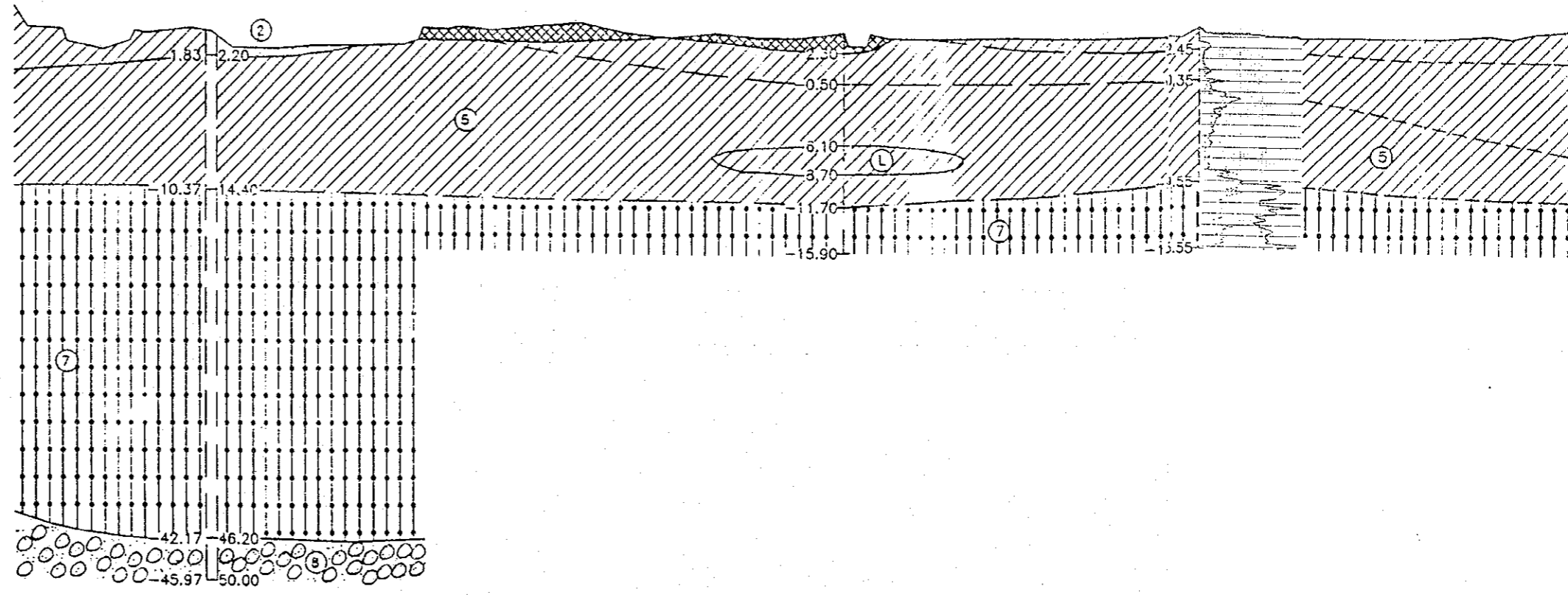
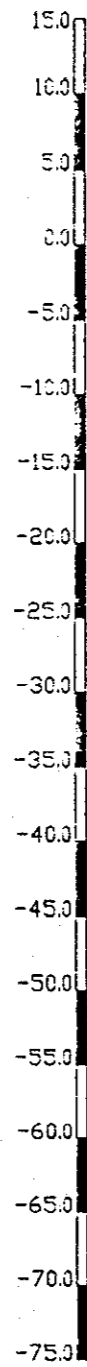
10.19	9.66	9.52	9.37	9.66	9.95	10.30	10.65	12.21	12.55	10.29	8.84	11.18	9.62	8.94	8.26	7.72	7.77	7.30	6.83	7.03	6.49	5.46	4.25	2.95	1.20	0.79	1.17	1.27	0.95	0.48	0.39	0.37	0.16	0.02	-0.02	-0.12	-0.25	-0.23	-0.22	-0.49	-0.59	-0.59	-1.11	-1.37	-1.63	-1.88	-1.98	-2.08	-2.31	-2.47	-2.56	-2.74	-2.96	-3.15	-3.33	-3.37	-3.37	-3.38	-3.35	-3.42	-3.35	-3.22	-3.20	-3.22	-3.21	-3.07	-2.82	-2.65	-2.52	-2.27	-1.96	-1.87	-1.81	-1.80	-1.92	-1.75	-1.41	-0.48	2.41	5.90	8.60	8.43	8.25	8.14	8.14	9.75	9.56	9.23	8.90	9.07	9.24	9.15	9.05	8.98	8.92	8.91	8.90	8.89	8.89	8.89	8.82	8.75	8.67	8.59	8.60	8.60	8.59	8.57
7+140	7+160	7+180	7+200	7+220	7+240	7+260	7+280	7+300	7+320	7+340	7+360	7+380	7+400	7+420	7+440	7+460	7+480	7+500	7+520	7+540	7+560	7+580	7+600	7+620	7+640	7+660	7+680	7+700	7+720	7+740	7+760	7+780	7+800	7+820	7+840	7+860	7+880	7+900	7+920	7+940	7+960	7+980	8+000	8+020	8+040	8+060	8+080	8+100	8+120	8+140	8+160	8+180	8+200																																																							

To Gia Lam side



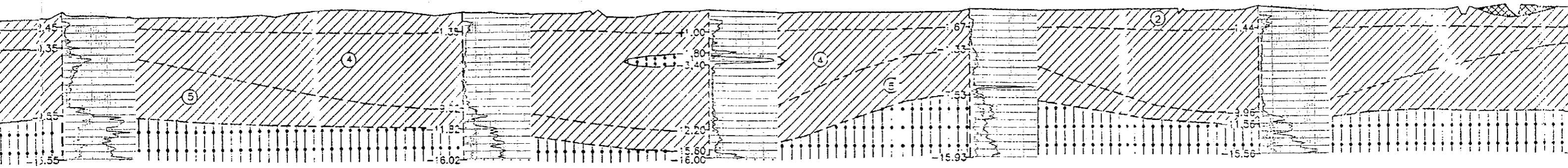
BH-B11	BH-B12	BH-B13	BH-B14	BH-B15
9.24				
9.15				
9.05				
8.98				
8.92				
8.91				
8.90				
8.89				
8.89				
8.82				
8.75				
8.67				
8.59				
8.60				
8.60				
8.59				
8.57				
8.55				
8.54				
8.54				
8.55				
8.57				
8.52				
8.46				
7.88				
7.32				
7.84				
8.36				
4.44				
3.91				
6.12				
4.17				
4.04				
4.21				
4.05				
3.99				
4.24				
4.49				
5.40				
5.46				
5.94				
8.37				
8.36				
8.34				
8.42				
8.56				
8.62				
8.67				
8.73				
8.78				
9.05				
8.45				
8.12				
7.78				
7.69				
7.68				
7.51				
7.34				
7.05				
6.75				
6.63				
5.54				
5.37				
5.21				
5.12				
5.03				
5.04				
5.05				
5.28				
5.87				
7.11				
7.45				
7.57				
7.76				
7.84				
7.98				
8.21				
8.46				
8.73				
8.71				
7.89				
7.54				
6.85				
7.75				
7.41				
7.77				
8.13				
10.06				
13.62				
13.95				
12.55				
9.99				
8.11				
6.37				

To main Bridge



3

BOREHOLES & SCPT NAME	● BH-316 (Left 3.5m)															○ SCPT 36 (Center)			○ SCPT 37 (Right 6.0m)																																																														
GROUND LEVEL	6.20	4.25	2.20	3.08	4.32	4.03	2.57	2.51	2.76	2.72	2.82	4.25	4.15	4.54	4.85	3.90	3.54	3.93	3.57	3.62	4.10	2.88	3.64	3.63	3.61	3.65	3.50	3.53	3.60	3.58	4.45	3.55	3.57	3.56	2.63	3.63	3.61	3.60	3.80	3.53	3.99	4.30																																							
STATION	900.0	910.0	920.0	930.0	940.0	950.0	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0	1040.0	1050.0	1060.0	1070.0	1080.0	1090.0	1100.0	1110.0	1120.0	1130.0	1140.0	1150.0	1160.0	1170.0	1180.0	1190.0	1200.0	1210.0	1220.0	1230.0	1240.0	1250.0	1260.0	1270.0	1280.0	1290.0	1300.0	1310.0	1320.0	1330.0	1340.0	1350.0	1360.0	1370.0	1380.0	1390.0	1400.0	1410.0	1420.0	1430.0	1440.0	1450.0	1460.0	1470.0	1480.0	1490.0	1500.0	1510.0	1520.0	1530.0	1540.0	1550.0	1560.0	1570.0	1580.0	1590.0	1600.0	1610.0	1620.0	1630.0	1640.0	1650.0	1660.0	1670.0	1680.0	1690.0	1700.0



○ SCPT 37
(Right 6.0m)

○ SCPT 38
(Left 4.0m)

○ SCPT 39
(Left 16.0m)

○ SCPT 40
(Left 15.0m)

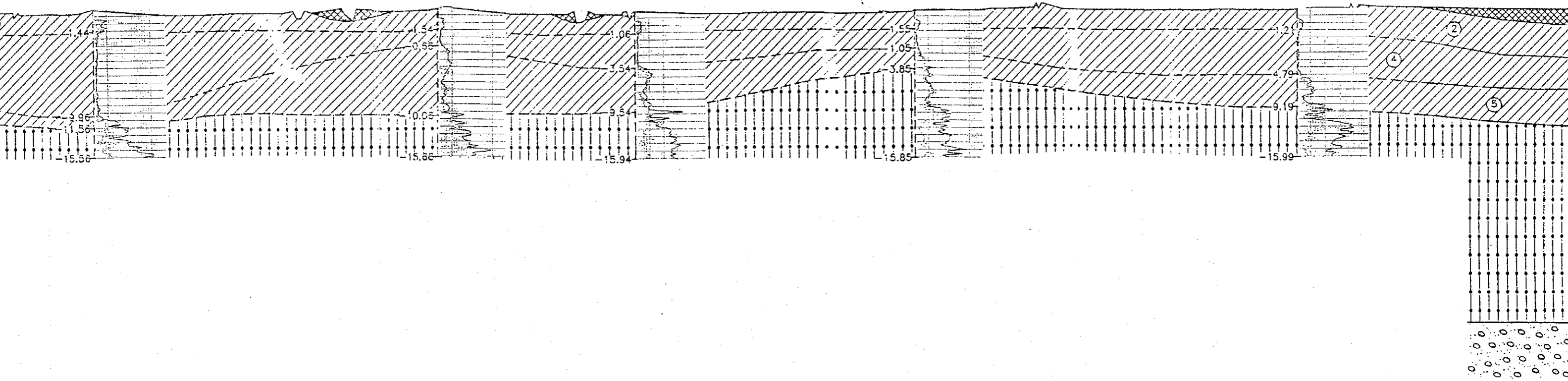
○ SCPT 41
(Left 15.0m)

4800	3.11	7600	3.89	9400	3.79	11000	3.73	12000	3.70	13000	3.73	14000	3.70	15000	3.73	16000	3.70	17000	3.76	18000	3.88	19000	4.44	20000	3.84	21000	3.69	22000	3.67	23000	3.71	24000	3.73	25000	3.73	26000	3.77	27000	4.35	28000	4.17	29000	3.96
5000	3.60	7800	3.50	9600	3.79	11200	3.73	12200	3.70	13200	3.73	14200	3.70	15200	3.73	16200	3.70	17200	3.76	18200	3.88	19200	4.44	20200	3.84	21200	3.69	22200	3.67	23200	3.71	24200	3.73	25200	3.77	26200	4.35	27200	4.17	28200	3.96		
5200	3.80	8000	3.53	9800	3.79	11400	3.73	12400	3.70	13400	3.73	14400	3.70	15400	3.73	16400	3.70	17400	3.76	18400	3.88	19400	4.44	20400	3.84	21400	3.69	22400	3.67	23400	3.71	24400	3.73	25400	3.77	26400	4.35	27400	4.17	28400	3.96		
5400	3.55	8200	3.53	10000	3.71	11600	3.74	12600	3.70	13600	3.73	14600	3.70	15600	3.73	16600	3.70	17600	3.76	18600	3.88	19600	4.44	20600	3.84	21600	3.69	22600	3.67	23600	3.71	24600	3.73	25600	3.77	26600	4.35	27600	4.17	28600	3.96		
5600	3.57	8400	3.63	10200	3.74	11800	3.74	12800	3.70	13800	3.73	14800	3.70	15800	3.73	16800	3.70	17800	3.76	18800	3.88	19800	4.44	20800	3.84	21800	3.69	22800	3.67	23800	3.71	24800	3.73	25800	3.77	26800	4.35	27800	4.17	28800	3.96		
5800	4.45	8600	3.63	10400	3.74	12000	3.70	13000	3.70	14000	3.73	15000	3.70	16000	3.73	17000	3.70	18000	3.76	19000	3.88	20000	4.44	21000	3.84	22000	3.69	23000	3.67	24000	3.71	25000	3.73	26000	3.77	27000	4.35	28000	4.17	29000	3.96		
6000	3.63	8800	3.67	10600	3.64	12200	3.70	13200	3.70	14200	3.73	15200	3.70	16200	3.73	17200	3.70	18200	3.76	19200	3.88	20200	4.44	21200	3.84	22200	3.69	23200	3.67	24200	3.71	25200	3.73	26200	3.77	27200	4.35	28200	4.17	29200	3.96		
6200	3.63	9000	3.17	10800	3.64	12400	3.70	13400	3.70	14400	3.73	15400	3.70	16400	3.73	17400	3.70	18400	3.76	19400	3.88	20400	4.44	21400	3.84	22400	3.69	23400	3.67	24400	3.71	25400	3.73	26400	3.77	27400	4.35	28400	4.17	29400	3.96		
6400	3.61	9200	3.14	11000	3.77	12600	3.70	13600	3.70	14600	3.73	15600	3.70	16600	3.73	17600	3.70	18600	3.76	19600	3.88	20600	4.44	21600	3.84	22600	3.69	23600	3.67	24600	3.71	25600	3.73	26600	3.77	27600	4.35	28600	4.17	29600	3.96		
6600	3.80	9400	3.50	11200	3.79	12800	3.70	13800	3.70	14800	3.73	15800	3.70	16800	3.73	17800	3.70	18800	3.76	19800	3.88	20800	4.44	21800	3.84	22800	3.69	23800	3.67	24800	3.71	25800	3.73	26800	3.77	27800	4.35	28800	4.17	29800	3.96		
6800	3.53	9600	3.50	11400	3.79	13000	3.70	14000	3.70	15000	3.73	16000	3.70	17000	3.73	18000	3.70	19000	3.76	20000	3.88	21000	4.44	22000	3.84	23000	3.69	24000	3.67	25000	3.71	26000	3.73	27000	4.35	28000	4.17	29000	3.96				
7000	4.70	9800	3.63	11600	3.74	13200	3.70	14200	3.70	15200	3.73	16200	3.70	17200	3.73	18200	3.70	19200	3.76	20200	3.88	21200	4.44	22200	3.84	23200	3.69	24200	3.67	25200	3.71	26200	3.73	27200	4.35	28200	4.17	29200	3.96				
7200	4.35	10000	3.67	11800	3.74	13400	3.70	14400	3.70	15400	3.73	16400	3.70	17400	3.73	18400	3.70	19400	3.76	20400	3.88	21400	4.44	22400	3.84	23400	3.69	24400	3.67	25400	3.71	26400	3.73	27400	4.35	28400	4.17	29400	3.96				
7400	4.21	10200	3.67	12000	3.77	13600	3.70	14600	3.70	15600	3.73	16600	3.70	17600	3.73	18600	3.70	19600	3.76	20600	3.88	21600	4.44	22600	3.84	23600	3.69	24600	3.67	25600	3.71	26600	3.73	27600	4.35	28600	4.17	29600	3.96				

GEOLOGICAL PROFILE ALONG THE CENTERLINE - ROAD SECTION GIA LAM SIDE

PROJECT : THANH TRI BRIDGE

Scale: Vertical: 1/500
Horizontal: 1/2500



○ SCPT 41
(Left 15.0m)

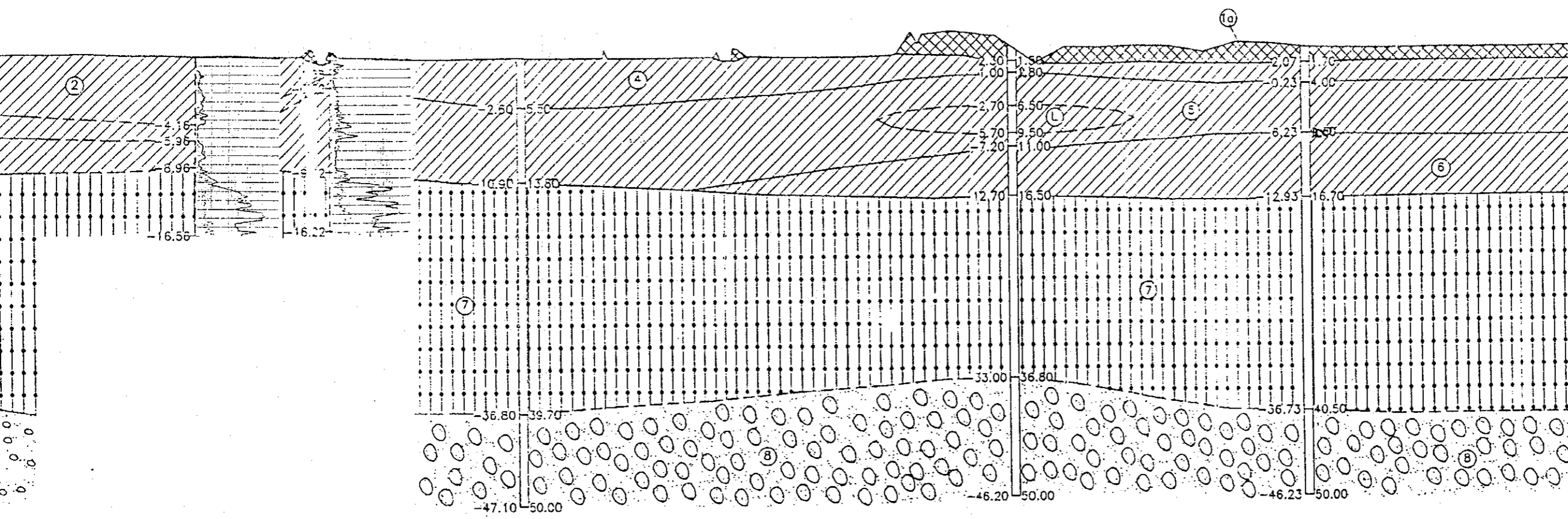
○ SCPT 42
(Right 11.5m)

○ SCPT 43
(Right 6.0m)

○ SCPT 44
(Center)

○ SCPT 45
(Right 20.0m)

300.0	375	330.0	376	340.0	388	350.0	444	360.0	386	380.0	383	400.0	369	420.0	367	440.0	371	460.0	373	480.0	373	500.0	377	520.0	435	540.0	417	560.0	396	580.0	412	590.0	433	600.0	427	620.0	380	640.0	371	660.0	366	680.0	367	700.0	363	720.0	486	740.0	373	760.0	373	780.0	373	800.0	379	820.0	380	840.0	380	860.0	379	880.0	382	900.0	380	910.0	415	920.0	360	940.0	396	960.0	400	980.0	423	1000.0	433	980.0	415	960.0	400	940.0	405	920.0	400	900.0	402	880.0	396	860.0	402	840.0	401	820.0	401	800.0	401	780.0	425	760.0	411	740.0	432	720.0	426	700.0	415	680.0	413	660.0	404	640.0	400	620.0	390
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○ SCPT 46
(Right 30.0m)

○ SCPT 47
(Center)

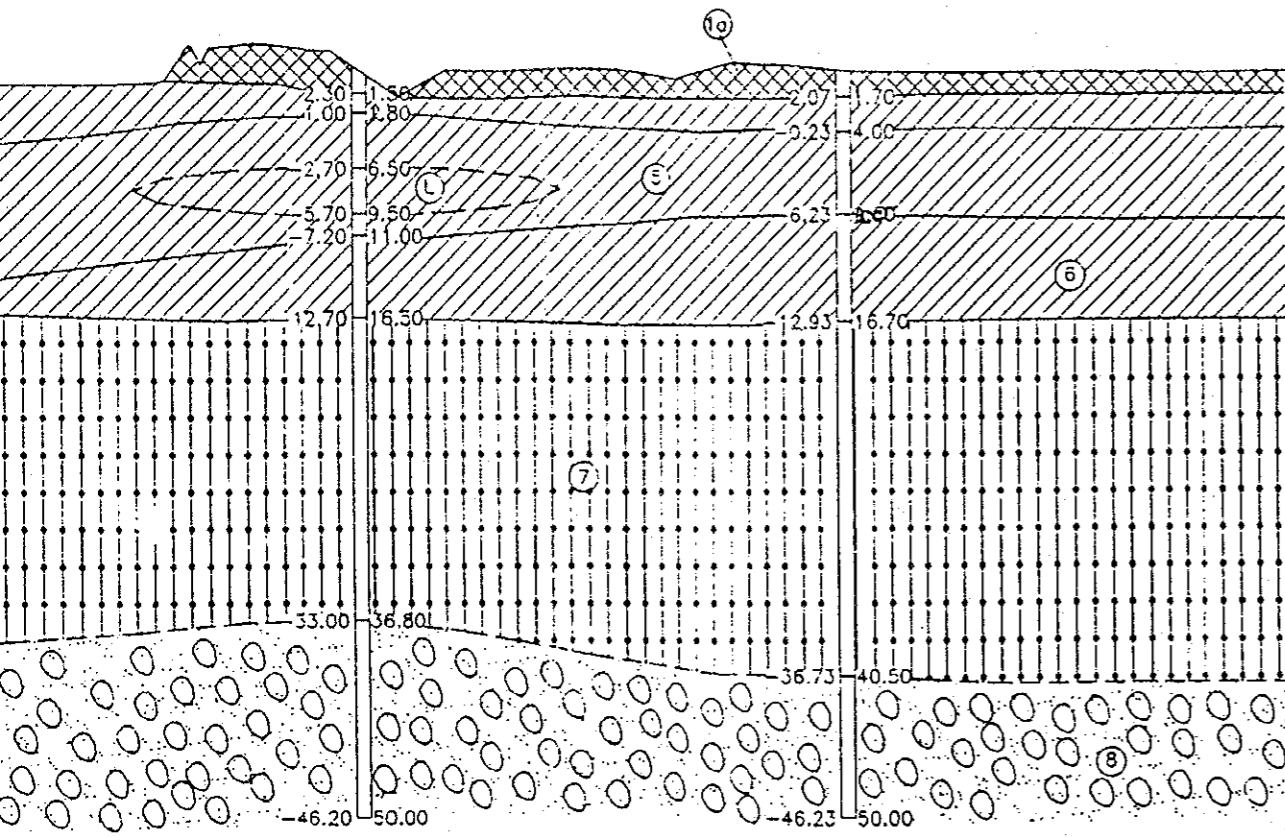
● BH-R15
(Center)

● BH-R16
(Center)

● BH-R17
(Center)

64000	3.69	66000	3.63	68000	3.69	70000	3.58	72000	3.58	74000	3.44	76000	3.44	78000	3.29	80000	2.29	82000	4.01	84000	3.78	86000	3.13	88000	2.97	90000	2.76	92000	2.76	94000	2.90	96000	2.87	98000	2.88	100000	2.85	102000	2.84	104000	2.94	106000	2.94	108000	2.57	110000	2.99	112000	2.87	114000	2.90	116000	2.87	118000	3.00	120000	5.52	122000	5.38	124000	5.64	126000	5.53	128000	5.34	130000	5.10	132000	3.88	134000	2.49	136000	3.01	138000	3.76	140000	3.57	142000	3.68	144000	3.22	146000	4.31	148000	4.16	150000	3.77	152000	3.69	154000	3.65	156000	3.67	158000	3.65	160000	3.57	162000	3.65	164000	3.70	166000	3.76	168000	3.79	170000	3.72	172000	3.66	174000	3.65	176000	3.64	178000	3.64	180000	3.64
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To new NH1



● BH-R16
(Center)

● BH-R17
(Center)

100.00	2.90	
120.00	2.07	
140.00	3.00	
152	5.52	
158	5.38	
164	5.64	
170	5.51	
176	5.34	
182	5.10	
188	3.98	
194	2.49	
200	3.81	
206	2.76	
212	3.21	
218	3.06	
224	3.22	
230	4.31	
236	4.16	
242	3.27	
248	3.65	
254	3.67	
260	3.65	
266	3.57	
272	3.65	
278	3.70	
284	3.76	
290	3.79	
296	3.79	
302	3.72	
308	3.64	
314	3.65	
320	3.61	
326	3.64	
332	3.64	
338	3.59	
344	3.75	
350	3.59	
356	3.74	
362	4.68	
368	2.66	
374	2.01	
380	2.58	
386	4.83	
392	3.57	
398	3.27	
404	3.40	
410	3.36	
416	3.37	
422	3.30	
428	3.26	

Appendix 3.3.13 Result of laboratory test of physical properties on soil samples

Name of section	Name of borehole	No. of sample	Depth of sample (m)	Layer	Classification (ASTM)	Test No.	Water content (%)	Unit Weight (ton/m ³)		Specific gravity (ton/m ³)	Porosity (%)	Degree of saturation	Void ratio (initial)	Grain size analysis					Liquit and plastic limit test			
								Wet density (ton/m ³)	Dry density (ton/m ³)					Percentage of passing sieve size (mm)					Liquid limit (%)	Plastic limit (%)	Plastic index	Liquidity index
														2.000	0.425	0.075	0.002	0.002				
Road section Thanh Tr side	BH-R3	UD1	6.0-7.0	4	OH	9507	70.60	1.52	0.89	2.62	66.03	95.15	1.944	100.0	99.8	95.8	21.0	84.70	41.88	42.82	0.67	
		UD2	26.0-27.0	5	CL	9508	28.08	1.75	1.37	2.69	49.08	78.36	0.964	100.0	100.0	54.4	8.0	30.30	18.63	11.67	0.81	
		UD3	34.0-35.0	6	CL	9509	21.19	1.98	1.63	2.71	39.87	86.61	0.663	100.0	100.0	85.0	18.0	27.10	16.62	10.48	0.44	
		UD1	9.0-10.0	4	CL	9510	46.55	1.70	1.16	2.69	56.88	94.94	1.319	100.0	100.0	99.2	22.5	48.90	27.19	21.71	0.89	
		UD2	21.0-22.0	5	CL	9511	29.75	1.81	1.39	2.71	48.72	84.87	0.950	100.0	100.0	86.0	16.5	35.10	23.45	11.65	0.54	
		UD3	34.0-35.0	6	CL	9512	23.94	1.99	1.61	2.74	41.25	93.44	0.702	100.0	100.0	98.8	27.0	36.20	20.12	16.08	0.24	
		UD1	6.0-7.0	4	OH	9467	78.55	1.47	0.82	2.60	68.46	94.07	2.171	100.0	99.6	95.8	21.0	81.00	42.59	38.41	0.94	
		UD2	17.0-18.0	5	CL	9468	40.15	1.75	1.25	2.70	53.70	93.45	1.160	100.0	100.0	99.6	23.5	46.10	26.12	19.98	0.70	
		UD3	31.0-32.0	6	CL	9469	23.53	1.98	1.60	2.71	40.97	91.88	0.694	100.0	100.0	92.2	22.0	35.10	21.76	13.34	0.13	
		UD1	6.0-7.0	4	CL	9513	44.99	1.73	1.19	2.69	55.77	95.97	1.261	100.0	100.0	95.8	22.0	45.60	23.66	21.94	0.97	
		UD2	24.0-24.6	L1	SC	9514	28.20	1.76	1.37	2.68	48.88	79.05	0.956	100.0	99.8	93.8	7.5	29.90	18.64	11.26	0.85	
		UD3	33.0-34.0	6	CL	9515	40.64	1.77	1.26	2.71	53.51	95.69	1.151	100.0	100.0	99.6	32.0	43.70	25.64	18.06	0.83	
Bridge section	BH-B1	UD1	2.0-2.5	2	CL	9498	25.77	1.89	1.50	2.71	44.66	86.54	0.807	100.0	99.8	82.2	13.5	29.10	18.10	11.00	0.70	
		UD2	26.6-27.1	L	CL	9499	27.51	1.86	1.46	2.68	43.53	88.19	0.836	100.0	100.0	99.6	37.0	37.00	20.76	16.24	0.42	
		UD1	1.0-1.6	2	CL	9517A	27.13	1.90	1.49	2.72	45.24	89.34	0.826	100.0	99.0	97.8	21.0	39.80	22.28	17.52	0.28	
		UD1	0.85-1.45	2	CH	9500	51.25	1.70	1.12	2.73	58.98	97.30	1.438	100.0	100.0	99.8	26.0	53.20	26.91	26.29	0.93	
		UD1	3.9-4.5	5	CL	9516	28.20	1.92	1.50	2.73	45.05	93.89	0.820	100.0	100.0	91.8	20.5	43.20	20.21	22.99	0.35	
		UD2	8.3-8.9	5	CL	9517	27.79	1.94	1.52	2.72	44.10	95.80	0.789	100.0	100.0	95.9	25.5	41.00	17.49	23.51	0.44	
Road section Gia Lam side	BH-R13	UD1	5.5-5.9	2	CH	9501	36.09	1.84	1.35	2.73	50.54	96.40	1.022	100.0	94.0	89.6	21.0	55.00	26.62	28.38	0.33	
		UD2	8.5-8.9	4	CH	9502	43.17	1.73	1.21	2.67	54.69	95.40	1.207	100.0	99.6	99.0	33.0	53.70	28.82	24.88	0.58	
		UD3	12.6-13.0	5	CL	9503	26.96	1.91	1.50	2.71	44.66	90.53	0.807	100.0	99.8	60.6	15.0	32.00	18.86	13.14	0.62	
		UD1	3.0-3.4	4	MH	9504	70.24	1.56	0.92	2.68	65.67	98.40	1.913	100.0	99.4	97.8	26.0	72.20	35.26	36.94	0.95	
		UD2	6.0-6.4	5	CL	9505	27.58	1.91	1.50	2.70	44.44	93.08	0.800	100.0	99.8	98.4	22.0	41.40	21.55	19.85	0.30	
	UD3	9.0-9.4	5	CL	9506	24.12	1.98	1.60	2.72	41.18	93.72	0.700	100.0	100.0	98.4	86.2	20.0	42.80	20.05	22.75	0.18	

Appendix 3.3.14 Result of laboratory test of mechanical properties on soil samples

Name of section	Name of borehole	No. of sample	Depth of sample (m)	Layer	Classification (ASTM)	Triaxial compression test		Permeability (10^{-7} cm/s)	Consolidation test				Organic content (%)
						Cohesion (kg/cm ²)	Internal friction angle (degree)		Coefficient of consolidation (10^{-3} cm ² /s)	Coefficient of compressibility (10^{-7} cm ² /kg)	Coefficient of permeability (10^{-7} cm/s)	Compression index	
Road section Thanh Tri side	BH-R3	UD1	6.0 - 7.0	4	OH	0.164	0	1.93	1.77	0.47	0.61	10.80	
		UD2	26.0 - 27.0	5	CL	0.081	0	3.58	0.35	0.79	0.12		
		UD3	34.0 - 35.0	6	CL	0.172	0	2.05	0.29	1.73	0.10		
		BH-R5	UD1	9.0 - 10.0	4	CL	0.180	0	0.63	1.02	0.51	0.11	
			UD2	21.0 - 22.0	5	CL	0.154	0	1.15	0.32	0.36	0.08	
			UD3	34.0 - 35.0	6	CL	0.153	0	2.57	2.12	0.46	0.73	10.50
		BH-R7	UD1	6.0 - 7.0	4	OH	0.168	0	1.91	0.73	0.69	0.25	
			UD2	17.0 - 18.0	5	CL	0.180	0	0.52	0.17	0.32	0.06	
			UD3	31.0 - 32.0	6	CL	0.147	0	1.34	0.32	0.32	0.06	
		BH-R9	UD1	6.0 - 7.0	4	CL	0.130	0	1.01	0.90	0.82	0.31	
			UD2	24.0 - 24.6	L1	SC	0.069	0	10.01	0.38	1.01	0.13	
			UD3	33.0 - 34.0	6	CL	0.205	0	0.56	0.64	0.76	0.22	
Bridge section	BH-B1	UD1	2.0 - 2.5	2	CL	0.136	0	2.37	0.35	1.95	0.12		
		UD2	26.6 - 27.1	L	CL	0.226	0	1.42	0.35	0.29	0.12		
	BH-B2	UD1	1.0 - 1.6	2	CL	0.211	0	0.42	0.41	0.70	0.14		
	BH-B14	UD1	0.85 - 1.45	2	CH	0.162	0	0.45	0.87	0.52	0.30		
	BH-B16	UD1	3.9 - 4.5	5	CL	0.254	0	0.45	0.26	0.35	0.09		
		UD2	8.3 - 8.9	5	CL	0.236	0	0.87	0.26	0.20	0.09		
Road section Gia Lam side	BH-R13	UD1	5.5 - 5.9	2	CH	0.265	0	0.35	0.41	0.21	0.14		
		UD2	8.5 - 8.9	4	CH	0.152	0	0.41	0.32	0.27	0.11		
		UD3	12.6 - 13.0	5	CL	0.113	0	3.08	0.32	1.36	0.11		
	BH-R15	UD1	3.0 - 3.4	4	MH	0.172	0	0.64	1.62	0.24	0.56		
		UD2	6.0 - 6.4	5	CL	0.251	0	0.89	0.29	0.42	0.10		
		UD3	9.0 - 9.4	5	CL	0.256	0	0.79	0.32	0.21	0.11		

Appendix 3.3.15 Result of laboratory tests on soil materials

Name of section	Number of sample	Name of source	Classification (ASTM)	Uniformity coefficient				Compaction test		CBR		
				D10 diameter (mm)	D30 diameter (mm)	D60 diameter (mm)	Cu	Cc	Optimum m. content (%)	Maximum dry density (ton/m ³)	from (%)	to (%)
Road section Thanh Tri side	9	Water way repair enterprise sand pit	SW	0.140	0.400	1.000	7.14	1.14	12.2	1.80	20.5	31.0
	10		SW	0.130	0.370	1.000	7.69	1.05	12.0	1.81	20.5	31.0
Bridge section	1	Linh Nam sand pit	SP	0.088	0.140	0.240	2.73	0.93	18.0	1.58	9.0	18.0
	2		SP	0.088	0.135	0.240	2.73	0.86	17.5	1.59	10.0	19.5
	3		SP	0.085	0.130	0.230	2.71	0.86	18.0	1.58	9.0	20.0
	4		SP-SM	0.082	0.125	0.225	2.81	0.87	15.5	1.65	12.0	20.0
Road section Gia Lam side	5	Duong Ha sand pit	SP-SM	0.082	0.130	0.230	2.80	0.90	15.7	1.63	11.0	20.0
	6		SP-SM	0.080	0.125	0.220	2.75	0.89	15.6	1.65	14.0	21.0
	7		SP-SM	0.080	0.125	0.220	2.75	0.89	15.2	1.63	13.0	21.0
	8		SW	0.180	0.600	1.750	9.72	1.14	10.0	1.84	20.5	32.5

Appendix 3.3.16 Result of laboratory tests on quarry materials

Number of sample	Name of source	Uniformity coefficient				Abrasion resistance (%)	Chloride content (mg/g)	Alkali-silica reactivity	
		D10 diameter (mm)	D30 diameter (mm)	D60 diameter (mm)	Cu			Cc	Dissolved silica (mMol/litter)
1	Mieu Mon quarry	2.60	6.00	17.50	6.73	0.79	0.65	5.5	156
2		2.85	6.20	17.00	5.96	0.79	0.67	5.8	162
3		2.20	5.70	17.00	7.73	0.87	0.69	6.0	170
4		2.20	5.70	15.00	6.82	0.98	0.72	5.0	100
5		2.10	5.40	14.50	6.90	0.96	0.70	5.2	120
6		0.20	2.80	6.50	32.50	6.03	0.71	0.3	270
7	Kien Khe quarry	0.25	3.00	6.50	26.00	5.54	0.71	0.0	300
8		0.25	3.00	6.70	26.80	5.37	0.68	0.2	290
9		0.20	2.90	6.50	32.50	6.47	0.70	0.1	285
10		0.20	2.90	6.60	33.00	6.37	0.71	0.0	300

Appendix 3.3.17 Result of laboratory tests on water for making concrete

Name of section	Number of sample	Name of source or location	pH	Chloride content (mg/liter)
Road section Thanh Tri side	1	km 0+700	7.0	67.35
	2	Phap Van Lake (km 1+100)	7.2	63.81
	3	ditto	7.2	63.81
	4	Thanh Tri new dike (km 5+600, right > 100)	7.0	60.26
	5	ditto	7.0	60.26
Bridge section	6	Red River	7.0	10.64
	7	ditto	7.0	10.64
Road section Gia Lam side	8	Thach Ban road (left)	7.2	56.72
	9	ditto	7.2	56.72
	10	Thach Ban road (right)	7.2	56.72

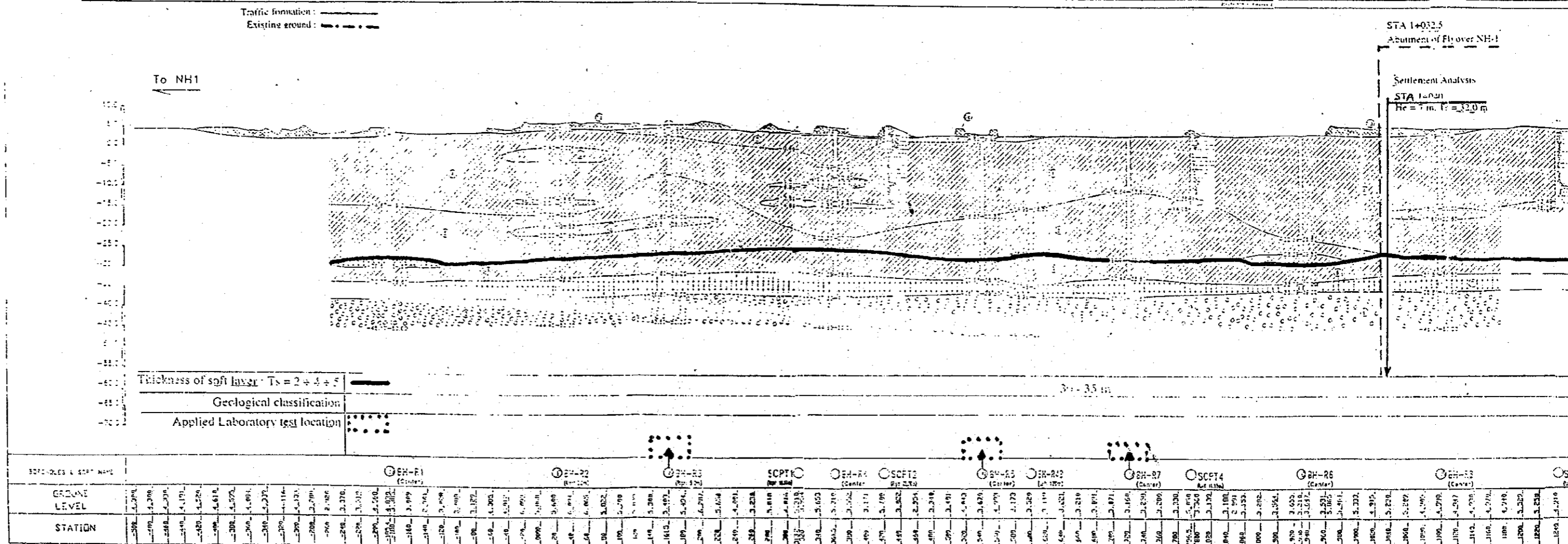
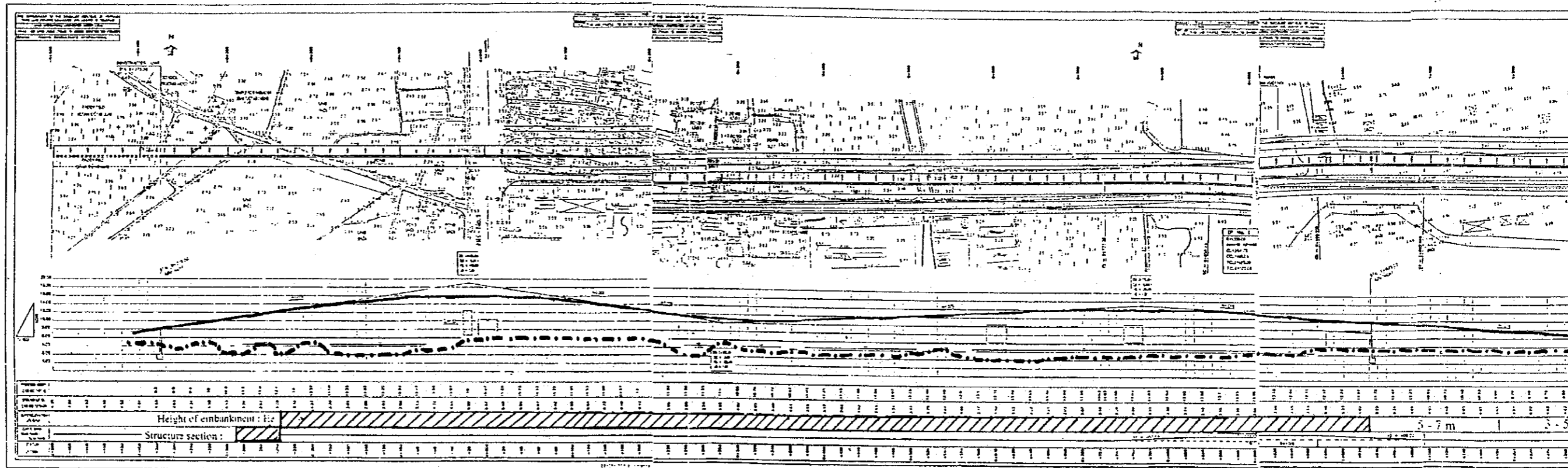
Appendix 3.3.18 Result of laboratory tests on ready mixed concrete

Classification	Number of sample	Type of used cement	Water/cement ratio	Mixing scale				Compressive strength		
				Cement	Sand	Rock	Water	Admix ture	7 days (MPa)	28 days (MPa)
210 kg/cm ²	1	Portland, PC30	0.48	1	2.42	3.58	0.48	0.015	20.0	21.0
	2	Portland, PC30	0.46	1	2.29	3.47	0.46	0.015	20.5	21.2
290 kg/cm ²	3	Portland, PC30	0.36	1	1.64	2.61	0.36	0.015	25.0	29.2
	4	Portland, PC30	0.35	1	1.56	2.56	0.35	0.015	25.5	29.3
400 kg/cm ²	5	Early-strength, PC40	0.36	1	1.47	2.45	0.37	0.015	34.0	40.8
	6	Early-strength, PC40	0.36	1	1.44	2.43	0.36	0.015	34.0	40.2
	7	Early-strength, PC40	0.36	1	1.44	2.43	0.36	0.015	34.0	40.2
	8	Portland, PC30	0.36	1	1.34	2.55	0.36	0.012	34.0	42.4
	9	Portland, PC30	0.35	1	1.31	2.53	0.35	0.012	33.0	41.5
	10	Portland, PC30	0.35	1	1.31	2.53	0.35	0.012	33.5	41.5

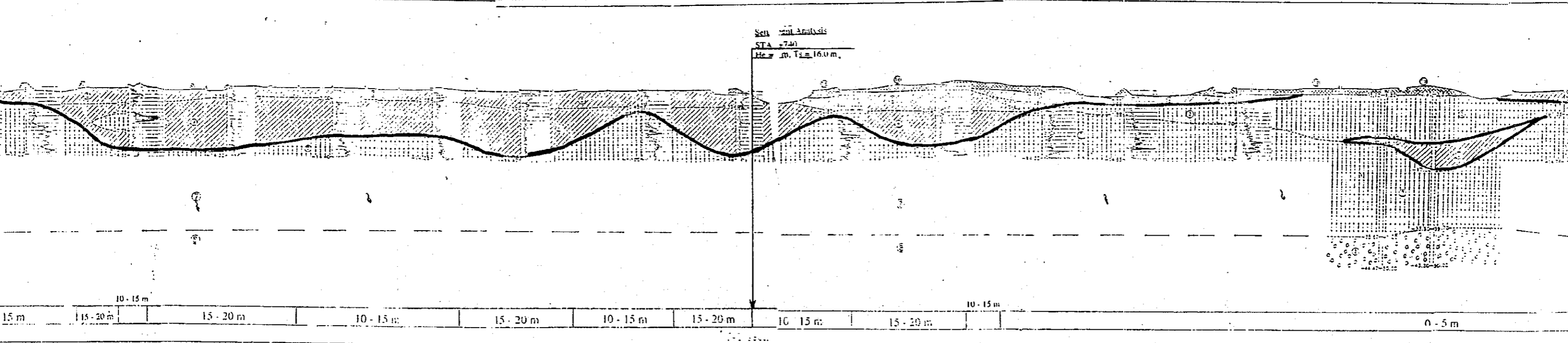
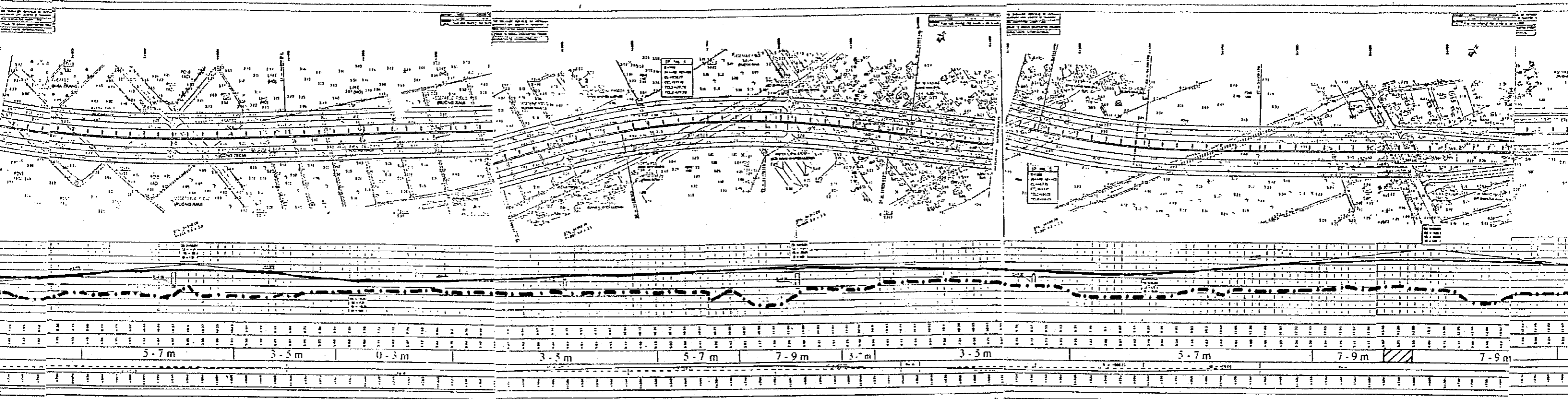
0.015: used Sika NN (1.5% of cement volume)

0.012: used RHEOBUILD R176-MBT(1.2% of cement volume)

Appendix 3.3.19 Combined drawings of soft soil analysis

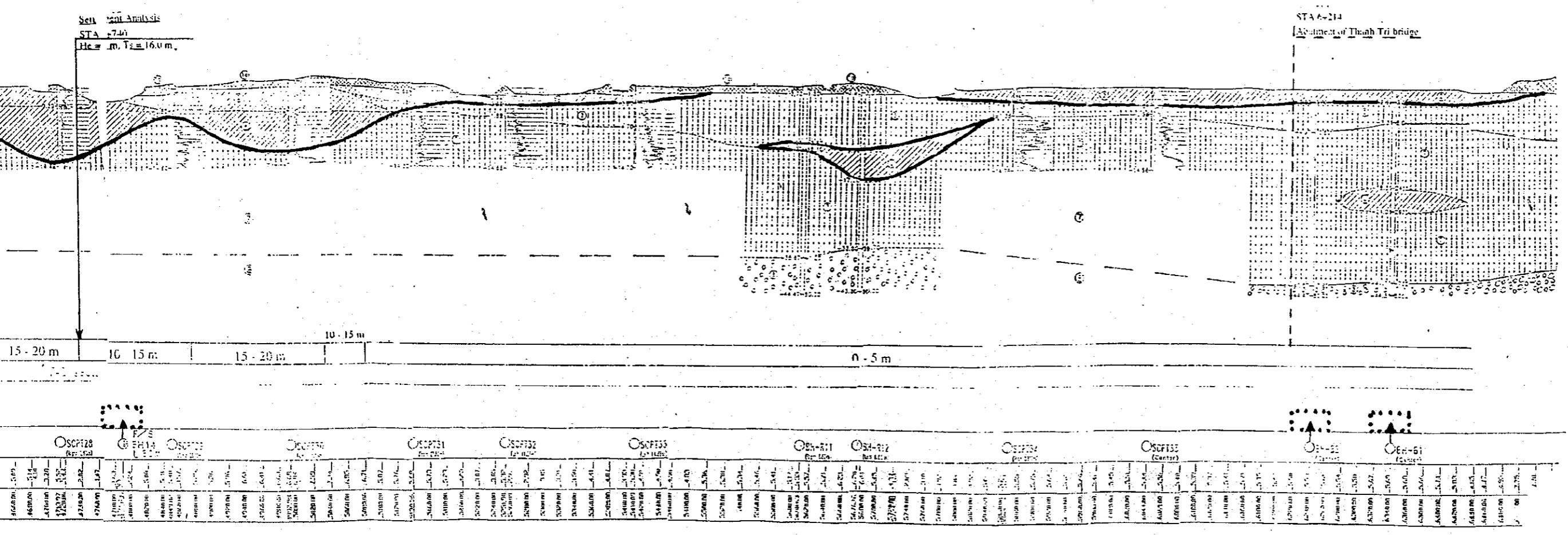
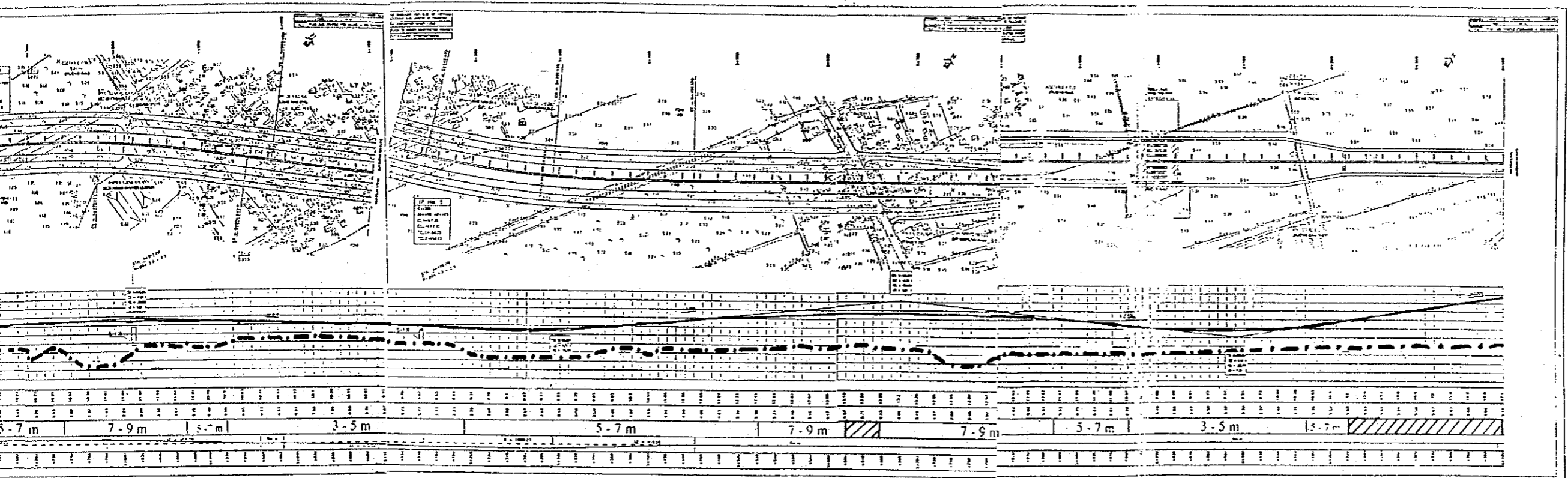


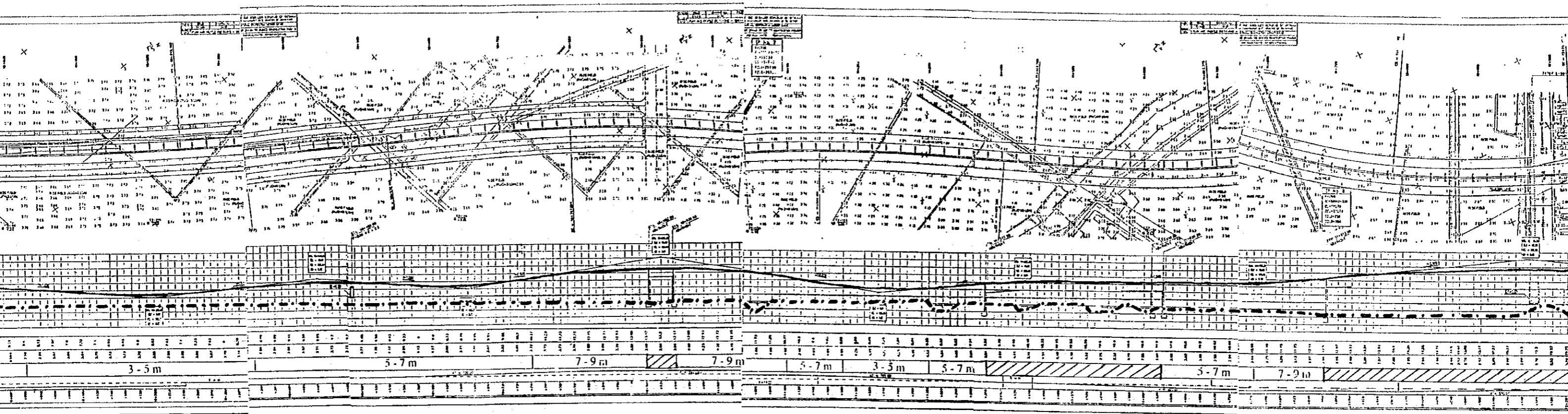
STATION	GROUND LEVEL	SOFT LAYER THICKNESS (m)	SCPT LOCATION
0+000	1.200	2.5	SCPT1
0+010	1.150	2.5	SCPT2
0+020	1.100	2.5	SCPT3
0+030	1.050	2.5	SCPT4
0+040	1.000	2.5	SCPT5
0+050	0.950	2.5	SCPT6
0+060	0.900	2.5	SCPT7
0+070	0.850	2.5	SCPT8
0+080	0.800	2.5	SCPT9
0+090	0.750	2.5	SCPT10
0+100	0.700	2.5	SCPT11
0+110	0.650	2.5	SCPT12
0+120	0.600	2.5	SCPT13
0+130	0.550	2.5	SCPT14
0+140	0.500	2.5	SCPT15
0+150	0.450	2.5	SCPT16
0+160	0.400	2.5	SCPT17
0+170	0.350	2.5	SCPT18
0+180	0.300	2.5	SCPT19
0+190	0.250	2.5	SCPT20
0+200	0.200	2.5	SCPT21
0+210	0.150	2.5	SCPT22
0+220	0.100	2.5	SCPT23
0+230	0.050	2.5	SCPT24
0+240	0.000	2.5	SCPT25
0+250	-0.050	2.5	SCPT26
0+260	-0.100	2.5	SCPT27
0+270	-0.150	2.5	SCPT28
0+280	-0.200	2.5	SCPT29
0+290	-0.250	2.5	SCPT30
0+300	-0.300	2.5	SCPT31
0+310	-0.350	2.5	SCPT32
0+320	-0.400	2.5	SCPT33
0+330	-0.450	2.5	SCPT34
0+340	-0.500	2.5	SCPT35
0+350	-0.550	2.5	SCPT36
0+360	-0.600	2.5	SCPT37
0+370	-0.650	2.5	SCPT38
0+380	-0.700	2.5	SCPT39
0+390	-0.750	2.5	SCPT40
0+400	-0.800	2.5	SCPT41
0+410	-0.850	2.5	SCPT42
0+420	-0.900	2.5	SCPT43
0+430	-0.950	2.5	SCPT44
0+440	-1.000	2.5	SCPT45
0+450	-1.050	2.5	SCPT46
0+460	-1.100	2.5	SCPT47
0+470	-1.150	2.5	SCPT48
0+480	-1.200	2.5	SCPT49
0+490	-1.250	2.5	SCPT50
0+500	-1.300	2.5	SCPT51
0+510	-1.350	2.5	SCPT52
0+520	-1.400	2.5	SCPT53
0+530	-1.450	2.5	SCPT54
0+540	-1.500	2.5	SCPT55
0+550	-1.550	2.5	SCPT56
0+560	-1.600	2.5	SCPT57
0+570	-1.650	2.5	SCPT58
0+580	-1.700	2.5	SCPT59
0+590	-1.750	2.5	SCPT60
0+600	-1.800	2.5	SCPT61
0+610	-1.850	2.5	SCPT62
0+620	-1.900	2.5	SCPT63
0+630	-1.950	2.5	SCPT64
0+640	-2.000	2.5	SCPT65
0+650	-2.050	2.5	SCPT66
0+660	-2.100	2.5	SCPT67
0+670	-2.150	2.5	SCPT68
0+680	-2.200	2.5	SCPT69
0+690	-2.250	2.5	SCPT70
0+700	-2.300	2.5	SCPT71
0+710	-2.350	2.5	SCPT72
0+720	-2.400	2.5	SCPT73
0+730	-2.450	2.5	SCPT74
0+740	-2.500	2.5	SCPT75
0+750	-2.550	2.5	SCPT76
0+760	-2.600	2.5	SCPT77
0+770	-2.650	2.5	SCPT78
0+780	-2.700	2.5	SCPT79
0+790	-2.750	2.5	SCPT80
0+800	-2.800	2.5	SCPT81
0+810	-2.850	2.5	SCPT82
0+820	-2.900	2.5	SCPT83
0+830	-2.950	2.5	SCPT84
0+840	-3.000	2.5	SCPT85
0+850	-3.050	2.5	SCPT86
0+860	-3.100	2.5	SCPT87
0+870	-3.150	2.5	SCPT88
0+880	-3.200	2.5	SCPT89
0+890	-3.250	2.5	SCPT90
0+900	-3.300	2.5	SCPT91
0+910	-3.350	2.5	SCPT92
0+920	-3.400	2.5	SCPT93
0+930	-3.450	2.5	SCPT94
0+940	-3.500	2.5	SCPT95
0+950	-3.550	2.5	SCPT96
0+960	-3.600	2.5	SCPT97
0+970	-3.650	2.5	SCPT98
0+980	-3.700	2.5	SCPT99
0+990	-3.750	2.5	SCPT100



Soil Analysis
 STA = 7+00
 H₀ = 16.0 m

Station	Soil Type	Soil Description	Soil Analysis
0+00	OSPT21	Clayey sand	...
0+10	OSPT22	Sandy clay	...
0+20	OSPT23	Clayey sand	...
0+30	OSPT24	Sandy clay	...
0+40	OSPT25	Clayey sand	...
0+50	OSPT26	Sandy clay	...
0+60	OSPT27	Clayey sand	...
0+70	OSPT28	Sandy clay	...
0+80	OSPT29	Clayey sand	...
0+90	OSPT30	Sandy clay	...
1+00	OSPT31	Clayey sand	...
1+10	OSPT32	Sandy clay	...
1+20	OSPT33	Clayey sand	...
1+30	OSPT34	Sandy clay	...
1+40	OSPT35	Clayey sand	...
1+50	OSPT36	Sandy clay	...
1+60	OSPT37	Clayey sand	...
1+70	OSPT38	Sandy clay	...
1+80	OSPT39	Clayey sand	...
1+90	OSPT40	Sandy clay	...
2+00	OSPT41	Clayey sand	...
2+10	OSPT42	Sandy clay	...
2+20	OSPT43	Clayey sand	...
2+30	OSPT44	Sandy clay	...
2+40	OSPT45	Clayey sand	...
2+50	OSPT46	Sandy clay	...
2+60	OSPT47	Clayey sand	...
2+70	OSPT48	Sandy clay	...
2+80	OSPT49	Clayey sand	...
2+90	OSPT50	Sandy clay	...
3+00	OSPT51	Clayey sand	...
3+10	OSPT52	Sandy clay	...
3+20	OSPT53	Clayey sand	...
3+30	OSPT54	Sandy clay	...
3+40	OSPT55	Clayey sand	...
3+50	OSPT56	Sandy clay	...
3+60	OSPT57	Clayey sand	...
3+70	OSPT58	Sandy clay	...
3+80	OSPT59	Clayey sand	...
3+90	OSPT60	Sandy clay	...
4+00	OSPT61	Clayey sand	...
4+10	OSPT62	Sandy clay	...
4+20	OSPT63	Clayey sand	...
4+30	OSPT64	Sandy clay	...
4+40	OSPT65	Clayey sand	...
4+50	OSPT66	Sandy clay	...
4+60	OSPT67	Clayey sand	...
4+70	OSPT68	Sandy clay	...
4+80	OSPT69	Clayey sand	...
4+90	OSPT70	Sandy clay	...
5+00	OSPT71	Clayey sand	...
5+10	OSPT72	Sandy clay	...
5+20	OSPT73	Clayey sand	...
5+30	OSPT74	Sandy clay	...
5+40	OSPT75	Clayey sand	...
5+50	OSPT76	Sandy clay	...
5+60	OSPT77	Clayey sand	...
5+70	OSPT78	Sandy clay	...
5+80	OSPT79	Clayey sand	...
5+90	OSPT80	Sandy clay	...
6+00	OSPT81	Clayey sand	...
6+10	OSPT82	Sandy clay	...
6+20	OSPT83	Clayey sand	...
6+30	OSPT84	Sandy clay	...
6+40	OSPT85	Clayey sand	...
6+50	OSPT86	Sandy clay	...
6+60	OSPT87	Clayey sand	...
6+70	OSPT88	Sandy clay	...
6+80	OSPT89	Clayey sand	...
6+90	OSPT90	Sandy clay	...
7+00	OSPT91	Clayey sand	...
7+10	OSPT92	Sandy clay	...
7+20	OSPT93	Clayey sand	...
7+30	OSPT94	Sandy clay	...
7+40	OSPT95	Clayey sand	...
7+50	OSPT96	Sandy clay	...
7+60	OSPT97	Clayey sand	...
7+70	OSPT98	Sandy clay	...
7+80	OSPT99	Clayey sand	...
7+90	OSPT100	Sandy clay	...

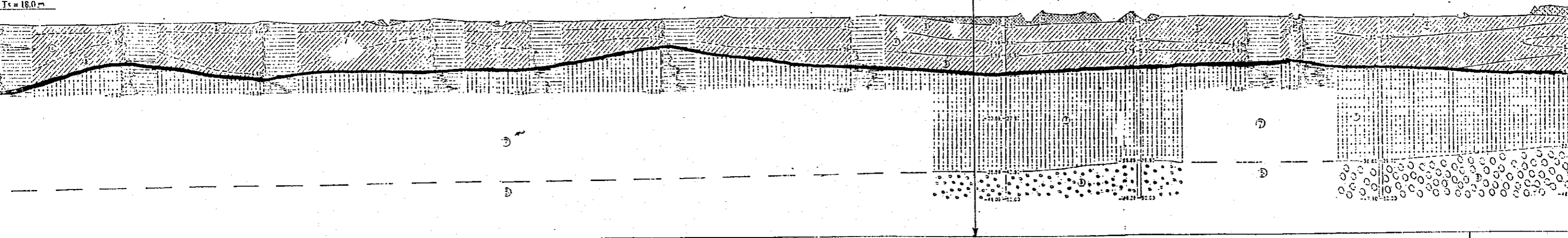




PROJECT : THANH TRI BRIDGE
 Scale: Vertical: 1/500
 Horizontal: 1/2500

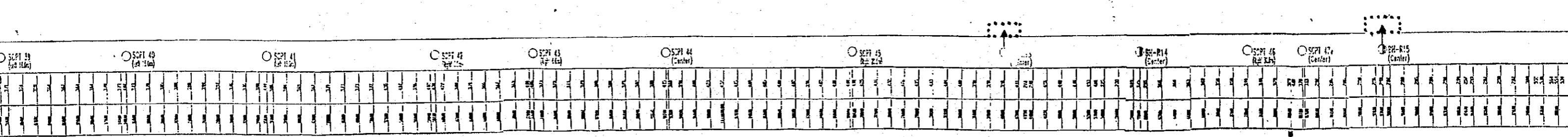
Analysis
 D
 Tc = 18.0 m

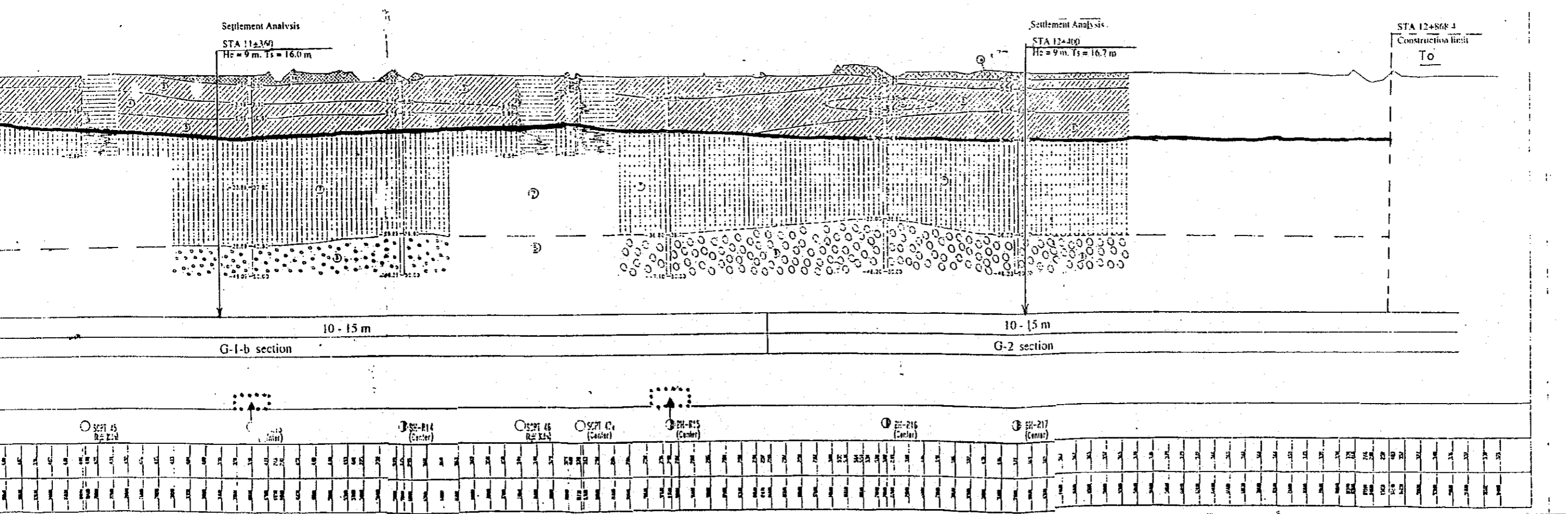
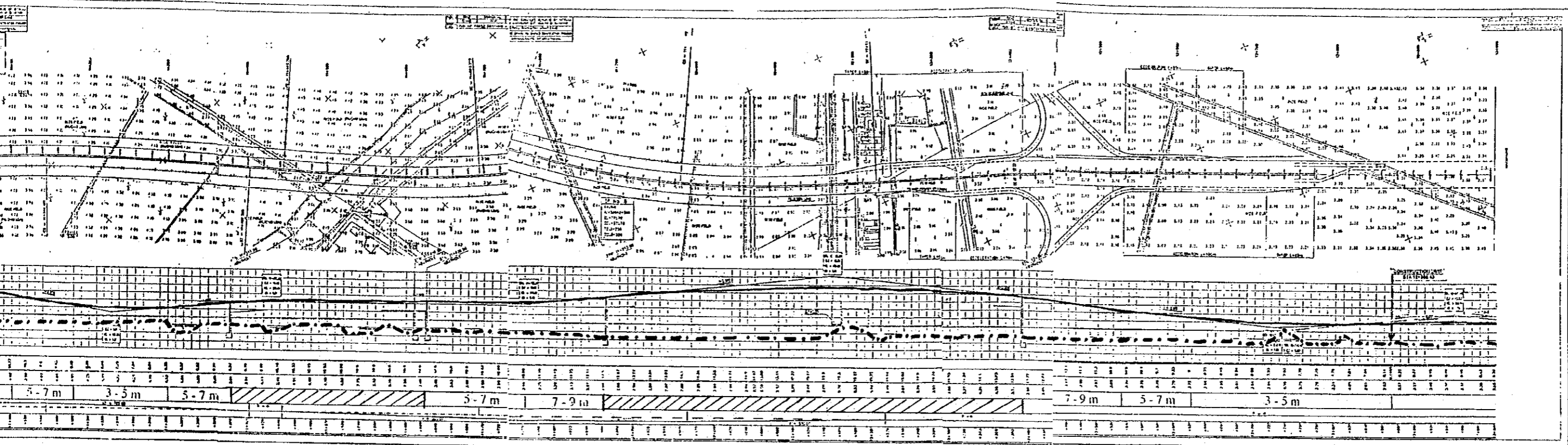
Settlement Analysis
 STA 11+160
 Hc = 9 m, Ts = 16.0 m



G-J-a section

G-I-b section





G-1-b	(No frontage)		Elevation (top)	Elevation (bottom)	Thickness	Const. days	Width		Left side		Center		Right side						
	Height (depth)	Height (depth)					Shoulder	Slope	x	y	x	y	x	y	x	y			
10+920	12+060	12+060	13.0	4.0	9.0	180	26.5	18.0	62.5	-100.0	4.0	-13.3	13.0	13.0	31.3	4.0	100.0	4.0	
Embankment	Traffic	Traffic	9.0	4.0	9.0	180	26.5	18.0	62.5	-100.0	4.0	-13.3	13.0	13.0	31.3	4.0	100.0	4.0	
Layer 1	2	2	4.0	2.4	6.4					-100.0	2.4						100.0	2.4	
Layer 2	4	4	-11.0	-7.0	4.6					-100.0	-7.0						100.0	-7.0	
Layer 3	5	5	-16.0	-12.0	5.0					-100.0	-12.0						100.0	-12.0	
Layer 4	7	7	-42.6	-38.6	26.6					-100.0	-38.6						100.0	-38.6	
G-2	(No frontage)																		
12+060	12+832	12+832	12.7	3.7	9.0	180	26.5	18.0	62.5	-100.0	3.7	-31.3	12.7	13.3	12.7	31.3	3.7	100.0	3.7
Embankment	Traffic	Traffic	9.0	3.7	9.0	180	26.5	18.0	62.5	-100.0	3.7	-31.3	12.7	13.3	12.7	31.3	3.7	100.0	3.7
Layer 1	2	2	3.7	2.2	1.5					-100.0	2.2						100.0	2.2	
Layer 2	4	4	-3.9	-0.2	2.4					-100.0	-0.2						100.0	-0.2	
Layer 3	5	5	-9.6	-5.9	5.7					-100.0	-5.9						100.0	-5.9	
Layer 4	6	6	-16.7	-13.0	7.1					-100.0	-13.0						100.0	-13.0	
Layer 5	7	7	-41.0	-37.3	24.3					-100.0	-37.3						100.0	-37.3	
12+060	12+832	12+832	11.7	3.7	8.0	160	26.5	16.0	58.5	-100.0	3.7	-29.3	11.7	13.3	11.7	29.3	3.7	100.0	3.7
Embankment	Traffic	Traffic	8.0	3.7	8.0	160	26.5	16.0	58.5	-100.0	3.7	-29.3	11.7	13.3	11.7	29.3	3.7	100.0	3.7
Layer 1	2	2	3.7	2.2	1.5					-100.0	2.2						100.0	2.2	
Layer 2	4	4	-3.9	-0.2	2.4					-100.0	-0.2						100.0	-0.2	
Layer 3	5	5	-9.6	-5.9	5.7					-100.0	-5.9						100.0	-5.9	
Layer 4	6	6	-16.7	-13.0	7.1					-100.0	-13.0						100.0	-13.0	
Layer 5	7	7	-41.0	-37.3	24.3					-100.0	-37.3						100.0	-37.3	
12+060	12+832	12+832	10.7	3.7	7.0	140	26.5	14.0	54.5	-100.0	3.7	-27.3	10.7	10.7	27.3	3.7	100.0	3.7	
Embankment	Traffic	Traffic	7.0	3.7	7.0	140	26.5	14.0	54.5	-100.0	3.7	-27.3	10.7	10.7	27.3	3.7	100.0	3.7	
Layer 1	2	2	3.7	2.2	1.5					-100.0	2.2						100.0	2.2	
Layer 2	4	4	-3.9	-0.2	2.4					-100.0	-0.2						100.0	-0.2	
Layer 3	5	5	-9.6	-5.9	5.7					-100.0	-5.9						100.0	-5.9	
Layer 4	6	6	-16.7	-13.0	7.1					-100.0	-13.0						100.0	-13.0	
Layer 5	7	7	-41.0	-37.3	24.3					-100.0	-37.3						100.0	-37.3	

(Near pond)		(LF+RF)		Elevation		Thickness		Const.		Width		Left side		Center		Right side	
T-1-a	Height	(top)	(bottom)	days	Shoulder	Slope	Total	x	y	x	y	x	y	x	y	x	y
1+300	1+300	10.6	6.0	4.6	26.5	9.2	44.9	-36.5	6.0	-22.5	6.0	-13.3	10.6	13.3	10.6	22.5	6.0
Embankment	Traffic	5.5	6.0	0.9	14.0	1.8	76.5	-100.0	5.1	-38.3	5.1					38.3	5.1
	Frontage	5.1	5.1	2.7	2.4											71.6	2.7
Ground	Layer 1	-2.4	5.1	2.7	2.4											74.9	0.5
Layer 2	4	-21.0	2.7	-15.9	18.6			-150.0	-15.9							150.0	-15.9
Layer 3	5	-32.0	-15.9	-26.9	11.0			-150.0	-26.9							150.0	-26.9
Layer 4	6	-37.3	-26.9	-32.2	5.3			-150.0	-32.2							150.0	-32.2
Layer 5	7	-41.3	-32.2	-36.2	4.0			-150.0	-36.2							150.0	-36.2
(Near pond)		(LF+RF)		Elevation		Thickness		Const.		Width		Left side		Center		Right side	
T-1-a	Height	(top)	(bottom)	days	Shoulder	Slope	Total	x	y	x	y	x	y	x	y	x	y
1+560	1+647	9.2	6.0	3.2	26.5	6.4	39.3	-33.7	6.0	-19.7	6.0	-13.3	9.2	13.3	9.2	19.7	6.0
Embankment	Traffic	4.1	6.0	0.9	18	1.8	70.9	-100.0	5.1	-35.5	5.1					35.5	5.1
	Frontage	5.1	5.1	2.7	2.4											41.6	2.7
Ground	Layer 1	-2.4	5.1	2.7	2.4											44.9	0.5
Layer 2	4	-21.0	2.7	-15.9	18.6			-150.0	-15.9							150.0	-15.9
Layer 3	5	-32.0	-15.9	-26.9	11.0			-150.0	-26.9							150.0	-26.9
Layer 4	6	-37.3	-26.9	-32.2	5.3			-150.0	-32.2							150.0	-32.2
Layer 5	7	-41.3	-32.2	-36.2	4.0			-150.0	-36.2							150.0	-36.2

With counter weight as frontage road width 14 m																			
(LCW6+RCW6 : height=EL6.0)																			
12+060		12+332		Height		Elevation		Thickness		Const.		Width		Left side		Center		Right side	
He=9.0 m		He=9.0 m		(depth)		(top) (bottom)		(top) (bottom)		days		Shoulder Slope Total		x y		x y		x y	
Embankment		Embankment		9.0		12.7 6.0		6.7 6.0		180 46		26.5 13.4 53.3		-40.7 6.0 -26.7 6.0		-13.3 12.7 13.3 12.7		26.7 6.0 40.7 6.0	
Counter weight		Counter weight		3.7		3.7 2.2		2.3 2.3		46		14.0 4.6 90.5		-100.0 3.7 -45.3 3.7		-100.0 3.7		45.3 3.7 100.0 3.7	
Layer 1		Layer 1		-1.5		3.7 2.2		1.5											
Layer 2		Layer 2		-3.9		2.2 -0.2		2.4											
Layer 3		Layer 3		-9.6		-0.2 -5.9		5.7											
Layer 4		Layer 4		-16.7		-5.9 -13.0		7.1											
Layer 5		Layer 5		-41.0		-13.0 -37.3		24.3											
(LCW6+RCW6 : height=EL6.0)																			
12+060		12+332		Height		Elevation		Thickness		Const.		Width		Left side		Center		Right side	
He=8.0 m		He=8.0 m		(depth)		(top) (bottom)		(top) (bottom)		days		Shoulder Slope Total		x y		x y		x y	
Embankment		Embankment		8.0		11.7 6.0		5.7 6.0		160 46		26.5 11.4 49.3		-38.7 6.0 -24.7 6.0		-13.3 11.7 13.3 11.7		24.7 6.0 38.7 6.0	
Counter weight		Counter weight		3.7		3.7 2.2		2.3 2.3		46		14.0 4.6 86.5		-100.0 3.7 -43.3 3.7		-100.0 3.7		43.3 3.7 100.0 3.7	
Layer 1		Layer 1		-1.5		3.7 2.2		1.5											
Layer 2		Layer 2		-3.9		2.2 -0.2		2.4											
Layer 3		Layer 3		-9.6		-0.2 -5.9		5.7											
Layer 4		Layer 4		-16.7		-5.9 -13.0		7.1											
Layer 5		Layer 5		-41.0		-13.0 -37.3		24.3											
(LCW6+RCW6 : height=EL6.0)																			
12+060		12+332		Height		Elevation		Thickness		Const.		Width		Left side		Center		Right side	
He=7.0 m		He=7.0 m		(depth)		(top) (bottom)		(top) (bottom)		days		Shoulder Slope Total		x y		x y		x y	
Embankment		Embankment		7.0		10.7 6.0		4.7 6.0		140 46		26.5 9.4 45.3		-36.7 6.0 -22.7 6.0		-13.3 10.7 13.3 10.7		22.7 6.0 36.7 6.0	
Counter weight		Counter weight		3.7		3.7 2.2		2.3 2.3		46		14.0 4.6 82.5		-100.0 3.7 -41.3 3.7		-100.0 3.7		41.3 3.7 100.0 3.7	
Layer 1		Layer 1		-1.5		3.7 2.2		1.5											
Layer 2		Layer 2		-3.9		2.2 -0.2		2.4											
Layer 3		Layer 3		-9.6		-0.2 -5.9		5.7											
Layer 4		Layer 4		-16.7		-5.9 -13.0		7.1											
Layer 5		Layer 5		-41.0		-13.0 -37.3		24.3											

G-2 12+060 12+400	(Ramp way) 12+832 He=8.0 m	Height (depth)	Elevation (top) (bottom)	Thickness (days)	Const. (days)	Width			Left side			Center			Right side			
						Shoulder	Slope	Total	x	y	z	x	y	z	x	y	z	x
Embankment:	Traffic	8.0	11.7 3.7	8.0	160	10.0	15.0	42.0										
Ground			3.7															
Layer 1	2	-1.5	3.7 2.2	1.5					-100.0	3.7	-21.0	3.7				21.0	3.7	100.0
Layer 2	4	-3.9	2.2 -0.2	2.4					-100.0	2.2								100.0
Layer 3	5	-9.6	-0.2 -5.9	5.7					-100.0	-0.2								100.0
Layer 4	6	-16.7	-5.9 -13.0	7.1					-100.0	-5.9								100.0
Layer 5	7	-41.0	-13.0 -37.3	24.3					-100.0	-13.0								100.0
12+060 12+400	12+832 He=7.0 m	Height (depth)	Elevation (top) (bottom)	Thickness (days) <td>Const. (days) <td colspan="3">Width</td> <td colspan="3">Left side</td> <td colspan="3">Center</td> <td colspan="3">Right side</td> </td>	Const. (days) <td colspan="3">Width</td> <td colspan="3">Left side</td> <td colspan="3">Center</td> <td colspan="3">Right side</td>	Width			Left side			Center			Right side			
Embankment:	Traffic	7.0	10.7 3.7	7.0	140	10.0	14.0	38.0										
Ground			3.7															
Layer 1	2	-1.5	3.7 2.2	1.5					-100.0	3.7	-19.0	3.7				19.0	3.7	100.0
Layer 2	4	-3.9	2.2 -0.2	2.4					-100.0	2.2								100.0
Layer 3	5	-9.6	-0.2 -5.9	5.7					-100.0	-0.2								100.0
Layer 4	6	-16.7	-5.9 -13.0	7.1					-100.0	-5.9								100.0
Layer 5	7	-41.0	-13.0 -37.3	24.3					-100.0	-13.0								100.0

With counter weight as 10 m width																			
T-1-a (Ramp way) (LCW6+RCW6 : height=EL6.0)																			
I-109	2+600	Height (depth)	Elevation (top) (bottom)	Thickness days	Const.	Width			Left side			Center			Right side				
						Shoulder	Slope	Total	x	y	z	x	y	z		x	y	z	
Embankment	Traffic	8.0	13.1	6.0	7.1	16.0	10.0	14.2	38.4	-29.2	6.0	-19.2	6.0	19.2	6.0	29.2	6.0		
Ground			5.1																
Layer 1	2	-2.4	5.1	2.7	2.4					-100.0	5.1	-31.0	5.1			31.0	5.1	100.0	5.1
Layer 2	4	-21.0	2.7	-15.9	18.6					-100.0	2.7							100.0	2.7
Layer 3	5	-32.0	-15.9	-26.9	11.0					-100.0	-15.9							100.0	-15.9
Layer 4	6	-37.3	-26.9	-32.2	5.3					-100.0	-32.2							100.0	-32.2
Layer 5	7	-41.3	-32.2	-36.2	4.0					-100.0	-36.2							100.0	-36.2
G-1-a (Ramp way) (LCW6+RCW6 : height=EL6.0)																			
9-920	10+920	Height (depth)	Elevation (top) (bottom)	Thickness days	Const.	Width			Left side			Center			Right side				
						Shoulder	Slope	Total	x	y	z	x	y	z		x	y	z	
Embankment	Traffic	8.0	11.2	6.0	5.2	16.0	10.0	10.4	30.8	-25.4	6.0	-15.4	6.0	15.4	6.0	25.4	6.0		
Ground			3.2																
Layer 1	2	-2.2	3.2	1.0	2.2					-100.0	3.2	-31.0	3.2			31.0	3.2	100.0	3.2
Layer 2	4	-15.0	1.0	-11.8	12.8					-100.0	1.0							100.0	1.0
Layer 3	5	-18.0	-11.8	-14.8	3.0					-100.0	-14.8							100.0	-14.8
Layer 4	7	-46.0	-14.8	-42.8	28.0					-100.0	-42.8							100.0	-42.8
G-2 (Ramp way) (LCW6+RCW6 : height=EL6.0)																			
12+060	12+832	Height (depth)	Elevation (top) (bottom)	Thickness days	Const.	Width			Left side			Center			Right side				
						Shoulder	Slope	Total	x	y	z	x	y	z		x	y	z	
Embankment	Traffic	8.0	11.7	6.0	5.7	16.0	10.0	11.4	32.8	-26.4	6.0	-16.4	6.0	16.4	6.0	26.4	6.0		
Ground			3.7																
Layer 1	2	-1.5	3.7	2.2	1.5					-100.0	3.7	-31.0	3.7			31.0	3.7	100.0	3.7
Layer 2	4	-3.9	2.2	-0.2	2.4					-100.0	2.2							100.0	2.2
Layer 3	5	-9.6	-0.2	-5.9	5.7					-100.0	-0.2							100.0	-0.2
Layer 4	6	-16.7	-5.9	-13.0	7.1					-100.0	-13.0							100.0	-13.0
Layer 5	7	-41.0	-13.0	-37.3	24.3					-100.0	-37.3							100.0	-37.3
12+060 (Ramp way) (LCW6+RCW6 : height=EL6.0)																			
12+400	12+832	Height (depth)	Elevation (top) (bottom)	Thickness days	Const.	Width			Left side			Center			Right side				
						Shoulder	Slope	Total	x	y	z	x	y	z		x	y	z	
Embankment	Traffic	7.0	10.7	6.0	4.7	14.0	10.0	9.4	28.8	-24.4	6.0	-14.4	6.0	14.4	6.0	24.4	6.0		
Ground			3.7																
Layer 1	2	-1.5	3.7	2.2	1.5					-100.0	3.7	-29.0	3.7			29.0	3.7	100.0	3.7
Layer 2	4	-3.9	2.2	-0.2	2.4					-100.0	2.2							100.0	2.2
Layer 3	5	-9.6	-0.2	-5.9	5.7					-100.0	-0.2							100.0	-0.2
Layer 4	6	-16.7	-5.9	-13.0	7.1					-100.0	-13.0							100.0	-13.0
Layer 5	7	-41.0	-13.0	-37.3	24.3					-100.0	-37.3							100.0	-37.3

Appendix 3.3.21 Adopted general soil index for soft soil analysis						
T-1-a and T-1-b						
1+109 - 3+300						
Layer	Items	Symbol	Unit	Adopted soil value	Elevation of layer bottom	
					T-1-a	T-1-b
Embankment	Wet density	γ_t	g/cm ³	1.88		
	Optimum moisture content	w	%	16.5		
	Internal f. a.	ϕ	Degree	27	Ground	Ground
	Cohesion	C	kg/cm ²	0	5.1	2.0
Layer-2	N value average	N		3		
	Moisture content	w	%	25.77		
	Wet density	γ_t	g/cm ³	1.89		
	Plastic index	Ip		11		
	Liquidity index	Il		0.7		
	Specific gravity	Gs	g/cm ³	2.71		
	Porosity	n	%	44.66		
	Degree of saturation	S	%	86.54		
	Initial void ratio	e ₀		0.807		
	Internal f. a.	ϕ	Degree	0		
	Cohesion	C	kg/cm ²	0.136		
	Pre-consolidated pressure	Pc	kg/cm ²	0.35		
	Coefficient of consolidation	Cv	10 ⁻³ E-3 cm ² /s	9.34		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.35		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	1.95		
		Compression index	Cc		0.12	-2.4
Layer-4	N value average	N		1		
	Moisture content	w	%	44.99		
	Wet density	γ_t	g/cm ³	1.73		
	Plastic index	Ip		21.94		
	Liquidity index	Il		0.97		
	Specific gravity	Gs	g/cm ³	2.69		
	Porosity	n	%	55.77		
	Degree of saturation	S	%	95.97		
	Initial void ratio	e ₀		1.261		
	Internal f. a.	ϕ	Degree	0		
	Cohesion	C	kg/cm ²	0.130		
	Pre-consolidated pressure	Pc	kg/cm ²	0.40		
	Coefficient of consolidation	Cv	10 ⁻³ E-3 cm ² /s	1.82		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.90		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.82		
		Compression index	Cc		0.31	-21.0
Layer-5	N value average	N		5		
	Moisture content	w	%	40.15		
	Wet density	γ_t	g/cm ³	1.75		
	Plastic index	Ip		19.98		
	Liquidity index	Il		0.7		
	Specific gravity	Gs	g/cm ³	2.7		
	Porosity	n	%	53.7		
	Degree of saturation	S	%	93.45		
	Initial void ratio	e ₀		1.16		
	Internal f. a.	ϕ	Degree	0		
	Cohesion	C	kg/cm ²	0.180		
	Pre-consolidated pressure	Pc	kg/cm ²	0.70		
	Coefficient of consolidation	Cv	10 ⁻³ E-3 cm ² /s	1.89		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.73		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.69		
		Compression index	Cc		0.25	-32.0
Layer-6	N value average	N		16		
	Moisture content	w	%	23.53		
	Wet density	γ_t	g/cm ³	1.98		
	Plastic index	Ip		13.34		
	Liquidity index	Il		0.13		
	Specific gravity	Gs	g/cm ³	2.71		
	Porosity	n	%	46.97		
	Degree of saturation	S	%	91.88		
	Initial void ratio	e ₀		0.694		
	Internal f. a.	ϕ	Degree	0		
	Cohesion	C	kg/cm ²	0.147		
	Pre-consolidated pressure	Pc	kg/cm ²	3.00		
	Coefficient of consolidation	Cv	10 ⁻³ E-3 cm ² /s	3.14		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.17		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.32		
		Compression index	Cc		0.06	-37.3
Layer-7	N value average	N		17		
	Moisture content	w	%	29.97		
	Wet density	γ_t	g/cm ³	1.94		
	Plastic index	Ip		22.35		
	Liquidity index	Il		0.05		
	Specific gravity	Gs	g/cm ³	2.74		
	Porosity	n	%	45.62		
	Degree of saturation	S	%	97.88		
	Initial void ratio	e ₀		0.839		
	Internal f. a.	ϕ	Degree	15.53		
	Cohesion	C	kg/cm ²	0.411		
	Pre-consolidated pressure	Pc	kg/cm ²	1.92		
	Coefficient of consolidation	Cv	10 ⁻³ E-3 cm ² /s	0.12		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.43		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.09		
		Compression index	Cc		0.35	-41.3

T-2						
3+300 - 6+218						
Layer	Items	Symbol	Unit	Adopted soil value	Elevation of layer bottom	
Embankment	Wet density	γ_t	g/cm ³	1.88		
	Optimum moisture content	w	%	16.5		
	Internal f. a.	ϕ	Degree	27	Ground	
Layer-2	Cohesion	C	kg/cm ²	0	2.8	
	N value average	N		3		
	Moisture content	w	%	25.77		
	Wet density	γ_t	g/cm ³	1.89		
	Plastic index	Ip		11		
	Liquidity index	Il		0.7		
	Specific gravity	Gs	g/cm ³	2.71		
	Porosity	n	%	44.66		
	Degree of saturation	S	%	86.54		
	Initial void ratio	e ₀		0.807		
	Internal f. a.	ϕ	Degree	0		
	Cohesion	C	kg/cm ²	0.136		
	Pre-consolidated pressure	P _c	kg/cm ²	0.35		
	Coefficient of consolidation	C _v	10 ⁻³ E-3 cm ² /s	9.34		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.35		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	1.95		
	Compression index	C _c		0.12		-3.6
Layer-4	N value average	N		7		
	Moisture content	w	%	46.25		
	Wet density	γ_t	g/cm ³	1.69		
	Plastic index	Ip		20.5		
	Liquidity index	Il		0.92		
	Specific gravity	Gs	g/cm ³	2.7		
	Porosity	n	%	57.04		
	Degree of saturation	S	%	94.3		
	Initial void ratio	e ₀		1.328		
	Internal f. a.	ϕ	Degree	0		
	Cohesion	C	kg/cm ²	0.173		
	Pre-consolidated pressure	P _c	kg/cm ²	1.03		
	Coefficient of consolidation	C _v	10 ⁻³ E-3 cm ² /s	0.30		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.74		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.30		
	Compression index	C _c		0.87		-16.0
	Layer-7	N value average	N		17	
Moisture content		w	%	29.97		
Wet density		γ_t	g/cm ³	1.94		
Plastic index		Ip		22.35		
Liquidity index		Il		0.05		
Specific gravity		Gs	g/cm ³	2.74		
Porosity		n	%	45.62		
Degree of saturation		S	%	97.88		
Initial void ratio		e ₀		0.839		
Internal f. a.		ϕ	Degree	15.33		
Cohesion		C	kg/cm ²	0.411		
Pre-consolidated pressure		P _c	kg/cm ²	1.92		
Coefficient of consolidation		C _v	10 ⁻³ E-3 cm ² /s	0.12		
Coefficient of compressibility		a	10 ⁻¹ E-1 cm ² /kg	0.43		
Coefficient of permeability		K	10 ⁻⁷ E-7 cm/s	0.09		
Compression index		C _c		0.35		-38.5

G-1-a and G-1-b						
9+302 - 12+060						
Layer	Items	Symbol	Unit	Adopted soil value	Elevation of layer bottom	
					G-1-a	G-1-b
Embankment	Wet density	γ_t	g/cm ³	1.88		
	Optimum moisture content	w	%	16.5		
	Internal f. a.	ϕ	Degree	27		
	Cohesion	C	kg/cm ²	0	3.2	4.0
Layer-2	N value average	N		8		
	Moisture content	w	%	36.09		
	Wet density	γ_t	g/cm ³	1.84		
	Plastic index	Ip		28.38		
	Liquidity index	Il		0.33		
	Specific gravity	Gs	g/cm ³	2.73		
	Porosity	n	%	50.54		
	Degree of saturation	S	%	96.4		
	Initial void ratio	e ₀		1.022		
	Internal f. a.	ϕ	Degree	0		
	Cohesion	C	kg/cm ²	0.265		
	Pre-consolidated pressure	Pc	kg/cm ²	0.45		
	Coefficient of consolidation	Cv	10 ⁻³ E-3 cm ² /s	0.99		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.41		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.21		
	Compression index	Cc		0.14	-2.2	-6.4
Layer-4	N value average	N		4		
	Moisture content	w	%	43.17		
	Wet density	γ_t	g/cm ³	1.73		
	Plastic index	Ip		24.88		
	Liquidity index	Il		0.58		
	Specific gravity	Gs	g/cm ³	2.67		
	Porosity	n	%	54.69		
	Degree of saturation	S	%	95.5		
	Initial void ratio	e ₀		1.207		
	Internal f. a.	ϕ	Degree	0		
	Cohesion	C	kg/cm ²	0.152		
	Pre-consolidated pressure	Pc	kg/cm ²	0.65		
	Coefficient of consolidation	Cv	10 ⁻³ E-3 cm ² /s	1.77		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.32		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.27		
	Compression index	Cc		0.11	-15.0	-11.0
Layer-5	N value average	N		8		
	Moisture content	w	%	26.96		
	Wet density	γ_t	g/cm ³	1.91		
	Plastic index	Ip		13.14		
	Liquidity index	Il		0.62		
	Specific gravity	Gs	g/cm ³	2.71		
	Porosity	n	%	44.66		
	Degree of saturation	S	%	90.53		
	Initial void ratio	e ₀		0.807		
	Internal f. a.	ϕ	Degree	0		
	Cohesion	C	kg/cm ²	0.113		
	Pre-consolidated pressure	Pc	kg/cm ²	0.80		
	Coefficient of consolidation	Cv	10 ⁻³ E-3 cm ² /s	7.28		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.32		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	1.36		
	Compression index	Cc		0.11	-18.0	-16.0
Layer-7	N value average	N		17		
	Moisture content	w	%	29.97		
	Wet density	γ_t	g/cm ³	1.94		
	Plastic index	Ip		22.35		
	Liquidity index	Il		0.05		
	Specific gravity	Gs	g/cm ³	2.74		
	Porosity	n	%	45.62		
	Degree of saturation	S	%	97.88		
	Initial void ratio	e ₀		0.839		
	Internal f. a.	ϕ	Degree	15.53		
	Cohesion	C	kg/cm ²	0.411		
	Pre-consolidated pressure	Pc	kg/cm ²	1.92		
	Coefficient of consolidation	Cv	10 ⁻³ E-3 cm ² /s	0.12		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.43		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.09		
	Compression index	Cc		0.35	-46.0	-42.6

G-2						
12+060 - 12+832						
Layer	Items	Symbol	Unit	Adopted soil value	Elevation of layer bottom	
Embankment	Wet density	γ_t	g/cm ³	1.88	Ground	
	Optimum moisture content	w	%	16.5		
	Internal f. a.	ϕ	Degree	27		
Layer-2	Cohesion	C	kg/cm ²	0	3.7	
	N value average	N		8		
	Moisture content	w	%	36.09		
	Wet density	γ_t	g/cm ³	1.84		
	Plastic index	I _p		28.38		
	Liquidity index	I _l		0.33		
	Specific gravity	G _s	g/cm ³	2.73		
	Porosity	n	%	50.54		
	Degree of saturation	S	%	96.4		
	Initial void ratio	e ₀		1.022		
	Internal f. a.	ϕ	Degree	0		
	Cohesion	C	kg/cm ²	0.265		
	Pre-consolidated pressure	P _c	kg/cm ²	0.45		
	Coefficient of consolidation	C _v	10 ⁻³ E-3 cm ² /s	0.99		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.41		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.21		
	Compression index	C _c		0.14	-1.5	
	Layer-4	N value average	N		4	
		Moisture content	w	%	43.17	
Wet density		γ_t	g/cm ³	1.73		
Plastic index		I _p		24.88		
Liquidity index		I _l		0.58		
Specific gravity		G _s	g/cm ³	2.67		
Porosity		n	%	54.69		
Degree of saturation		S	%	95.5		
Initial void ratio		e ₀		1.207		
Internal f. a.		ϕ	Degree	0		
Cohesion		C	kg/cm ²	0.152		
Pre-consolidated pressure		P _c	kg/cm ²	0.65		
Coefficient of consolidation		C _v	10 ⁻³ E-3 cm ² /s	1.77		
Coefficient of compressibility		a	10 ⁻¹ E-1 cm ² /kg	0.32		
Coefficient of permeability		K	10 ⁻⁷ E-7 cm/s	0.27		
Compression index		C _c		0.11	-3.9	
Layer-5		N value average	N		8	
		Moisture content	w	%	26.96	
		Wet density	γ_t	g/cm ³	1.91	
	Plastic index	I _p		13.14		
	Liquidity index	I _l		0.62		
	Specific gravity	G _s	g/cm ³	2.71		
	Porosity	n	%	44.66		
	Degree of saturation	S	%	90.53		
	Initial void ratio	e ₀		0.807		
	Internal f. a.	ϕ	Degree	0		
	Cohesion	C	kg/cm ²	0.113		
	Pre-consolidated pressure	P _c	kg/cm ²	0.80		
	Coefficient of consolidation	C _v	10 ⁻³ E-3 cm ² /s	7.28		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.32		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	1.36		
	Compression index	C _c		0.11	-9.6	
	Layer-6	N value average	N		16	
		Moisture content	w	%	23.53	
		Wet density	γ_t	g/cm ³	1.98	
Plastic index		I _p		13.34		
Liquidity index		I _l		0.13		
Specific gravity		G _s	g/cm ³	2.71		
Porosity		n	%	40.97		
Degree of saturation		S	%	91.88		
Initial void ratio		e ₀		0.694		
Internal f. a.		ϕ	Degree	0		
Cohesion		C	kg/cm ²	0.147		
Pre-consolidated pressure		P _c	kg/cm ²	3.00		
Coefficient of consolidation		C _v	10 ⁻³ E-3 cm ² /s	3.14		
Coefficient of compressibility		a	10 ⁻¹ E-1 cm ² /kg	0.17		
Coefficient of permeability		K	10 ⁻⁷ E-7 cm/s	0.32		
Compression index		C _c		0.06	-16.7	
Layer-7		N value average	N		17	
		Moisture content	w	%	29.97	
		Wet density	γ_t	g/cm ³	1.94	
	Plastic index	I _p		22.35		
	Liquidity index	I _l		0.05		
	Specific gravity	G _s	g/cm ³	2.74		
	Porosity	n	%	45.62		
	Degree of saturation	S	%	97.88		
	Initial void ratio	e ₀		0.839		
	Internal f. a.	ϕ	Degree	15.53		
	Cohesion	C	kg/cm ²	0.411		
	Pre-consolidated pressure	P _c	kg/cm ²	1.92		
	Coefficient of consolidation	C _v	10 ⁻³ E-3 cm ² /s	0.12		
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.43		
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.09		
	Compression index	C _c		0.35	-41.0	
	Case 2					

F-1-a and T-1-b							
11109 - 3+300							
Layer	Items	Symbol	Unit	Adopted soil value	Elevation of layer bottom		
					T-1-a	T-1-b	
Embankment	Wet density	γ_t	g/cm ³	1.88			
	Optimum moisture content	w	%	16.5			
	Internal f. a.	ϕ	Degree	27	Ground	Ground	
	Cohesion	C	kg/cm ²	0	5.1	2.0	
Layer-2	N value average	N		3			
	Moisture content	w	%	25.77			
	Wet density	γ_t	g/cm ³	1.89			
	Plastic index	I _p		11			
	Liquidity index	I _l		0.7			
	Specific gravity	G _s	g/cm ³	2.71			
	Porosity	n	%	44.66			
	Degree of saturation	S	%	86.54			
	Initial void ratio	e ₀		0.807			
	Internal f. a.	ϕ	Degree	0			
	Cohesion	C	kg/cm ²	0.136			
	Pre-consolidated pressure	P _c	kg/cm ²	0.35			
	Coefficient of consolidation	C _v	10 ⁻³ E-3 cm ² /s	9.34			
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.35			
Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	1.95				
Compression index	C _c		0.12	-2.4	Nil		
Layer-4	N value average	N		0			
	Moisture content	w	%	78.55			
	Wet density	γ_t	g/cm ³	1.47			
	Plastic index	I _p		38.41			
	Liquidity index	I _l		0.94			
	Specific gravity	G _s	g/cm ³	2.6			
	Porosity	n	%	68.46			
	Degree of saturation	S	%	94.07			
	Initial void ratio	e ₀		2.171			
	Internal f. a.	ϕ	Degree	0			
	Cohesion	C	kg/cm ²	0.168			
	Pre-consolidated pressure	P _c	kg/cm ²	0.40			
	Coefficient of consolidation	C _v	10 ⁻³ E-3 cm ² /s	0.57			
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	2.12			
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.46			
	Compression index	C _c		0.73	-21.0	-13.8	
	Layer-5	N value average	N		5		
		Moisture content	w	%	40.15		
		Wet density	γ_t	g/cm ³	1.75		
Plastic index		I _p		19.98			
Liquidity index		I _l		0.7			
Specific gravity		G _s	g/cm ³	2.7			
Porosity		n	%	53.7			
Degree of saturation		S	%	93.45			
Initial void ratio		e ₀		1.16			
Internal f. a.		ϕ	Degree	0			
Cohesion		C	kg/cm ²	0.180			
Pre-consolidated pressure		P _c	kg/cm ²	0.70			
Coefficient of consolidation		C _v	10 ⁻³ E-3 cm ² /s	1.89			
Coefficient of compressibility		a	10 ⁻¹ E-1 cm ² /kg	0.73			
Coefficient of permeability		K	10 ⁻⁷ E-7 cm/s	0.69			
Compression index		C _c		0.25	-32.0	-26.2	
Layer-6	N value average	N		16			
	Moisture content	w	%	23.53			
	Wet density	γ_t	g/cm ³	1.98			
	Plastic index	I _p		13.34			
	Liquidity index	I _l		0.13			
	Specific gravity	G _s	g/cm ³	2.71			
	Porosity	n	%	40.97			
	Degree of saturation	S	%	91.88			
	Initial void ratio	e ₀		0.694			
	Internal f. a.	ϕ	Degree	0			
	Cohesion	C	kg/cm ²	0.147			
	Pre-consolidated pressure	P _c	kg/cm ²	3.00			
	Coefficient of consolidation	C _v	10 ⁻³ E-3 cm ² /s	3.14			
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.17			
	Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.32			
	Compression index	C _c		0.06	-37.3	Nil	
Layer-7	N value average	N		17			
	Moisture content	w	%	29.97			
	Wet density	γ_t	g/cm ³	1.94			
	Plastic index	I _p		22.35			
	Liquidity index	I _l		0.05			
	Specific gravity	G _s	g/cm ³	2.74			
	Porosity	n	%	45.62			
	Degree of saturation	S	%	97.88			
	Initial void ratio	e ₀		0.839			
	Internal f. a.	ϕ	Degree	15.33			
	Cohesion	C	kg/cm ²	0.411			
	Pre-consolidated pressure	P _c	kg/cm ²	1.92			
	Coefficient of consolidation	C _v	10 ⁻³ E-3 cm ² /s	0.12			
	Coefficient of compressibility	a	10 ⁻¹ E-1 cm ² /kg	0.43			
Coefficient of permeability	K	10 ⁻⁷ E-7 cm/s	0.09				
Compression index	C _c		0.35	-41.3	-40.0		

Appendix 3.3.22 Detailed soil index tables in the road sections

T-1-a and T-1-b from 1+109 to 3+309		Road section Thanh Tri side															F/S
					Interchange NH-1			Interchange new NH-1			Flyover for road			Flyover canal			
Layer	Items	Symbol	Unit	Typical Value	Average value	BH-R1 0+185	BH-R2 0+020	BH-R3 0+162	BH-R4 0+371	BH-R5 0+540	BH-R4b 0+600	BH-R7 0+720	BH-R6 0+910	BH-R8 1+100	BH-R9 1+660	BH-R10 1+720	BH-15 3+410
Embank.	Wet density	γ_t	g/cm ³	2													
	Opti. moisture content	w	%	16.50													
	Internal f. ϕ	ϕ	Degree	27.00													
	Cohesion	C	kg/cm ²	0.000													
Layer-2	N value average	N		3	3	Estimated from geological section T-2											
	Moisture content	w	%	25.77	26.45												
	Wet density	γ_t	g/cm ³	1.89	1.90												
	Plastic index	Ip		11.00	14.76												
	Liquidity index	Il		0.70	0.49												
	Specific gravity	Gs	g/cm ³	2.71	2.72												
	Porosity	n	%	41.06	44.95												
	Degree of saturation	S	%	86.34	87.94												
	Initial void ratio	e0		0.807	0.817												
	Internal f. ϕ	ϕ	Degree	0.00	0.00												
	Cohesion	C	kg/cm ²	0.136	0.174												
	Pre-consolidated pressure	Pc	kg/cm ²	0.35	0.43												
	Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	9.34	6.14												
	Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	0.35	0.38												
	Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	1.95	1.33												
Compression index	Cc		0.12	0.13													
Layer-4	N value average	N		1	2			0		3		0		1		7	
	Moisture content	w	%	44.99	57.39			70.60		46.55		78.55		44.99		46.25	
	Wet density	γ_t	g/cm ³	1.73	1.62			1.52		1.70		1.47		1.73		1.69	
	Plastic index	Ip		21.94	29.08			42.82		21.71		38.41		21.94		20.50	
	Liquidity index	Il		0.97	0.88			0.67		0.89		0.94		0.97		0.82	
	Specific gravity	Gs	g/cm ³	2.69	2.66			2.67		2.69		2.60		2.69		2.70	
	Porosity	n	%	53.77	60.84			66.03		56.85		68.46		53.77		57.04	
	Degree of saturation	S	%	95.97	94.89			95.15		94.94		94.07		95.97		94.30	
	Initial void ratio	e0		1.261	1.205			1.544		1.519		2.171		1.261		1.328	
	Internal f. ϕ	ϕ	Degree	0.00	0.00			0.00		0.00		0.00		0.00		(6.12)	
	Cohesion	C	kg/cm ²	0.130	0.163			0.164		0.180		0.168		0.130		0.173	
	Pre-consolidated pressure	Pc	kg/cm ²	0.40	0.52			0.25		0.50		0.40		0.40		1.03	
	Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	1.82	1.69			0.67		2.11		0.37		1.82		0.36	
	Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	0.90	1.31			1.77		1.02		2.12		0.90		0.74	
	Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	0.82	0.61			0.47		1.01		0.46		0.82		0.30	
Compression index	Cc		0.31	0.37			0.61		0.35		0.73		0.31		0.87		
Lens 1	N value average	N		9	9											9	
	Moisture content	w	%	28.20	28.20											28.20	
	Wet density	γ_t	g/cm ³	1.76	1.76											1.76	
	Plastic index	Ip		11.26	11.26											11.26	
	Liquidity index	Il		0.85	0.85											0.85	
	Specific gravity	Gs	g/cm ³	2.68	2.68											2.68	
	Porosity	n	%	48.88	48.88											48.88	
	Degree of saturation	S	%	79.05	79.05											79.05	
	Initial void ratio	e0		0.956	0.956											0.956	
	Internal f. ϕ	ϕ	Degree	0.00	0.00											0.00	
	Cohesion	C	kg/cm ²	0.069	0.069											0.069	
	Pre-consolidated pressure	Pc	kg/cm ²	0.50	0.50											0.50	
	Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	4.98	4.98											4.98	
	Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	0.38	0.38											0.38	
	Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	1.01	1.01											1.01	
Compression index	Cc		0.13	0.13											0.13		
Layer-5	N value average	N		5	9			8		13		5					
	Moisture content	w	%	40.15	32.66			28.08		29.75		40.15					
	Wet density	γ_t	g/cm ³	1.75	1.77			1.75		1.81		1.75					
	Plastic index	Ip		19.98	14.43			11.67		11.65		19.98					
	Liquidity index	Il		0.70	0.68			0.81		0.54		0.70					
	Specific gravity	Gs	g/cm ³	2.70	2.70			2.69		2.71		2.70					
	Porosity	n	%	53.70	50.50			49.08		48.72		53.70					
	Degree of saturation	S	%	93.45	85.36			78.36		84.87		93.45					
	Initial void ratio	e0		1.160	1.025			0.854		0.850		1.160					
	Internal f. ϕ	ϕ	Degree	0.00	0.00			0.00		0.00		0.00					
	Cohesion	C	kg/cm ²	0.180	0.138			0.081		0.154		0.180					
	Pre-consolidated pressure	Pc	kg/cm ²	0.70	0.50			0.90		0.80		0.70					
	Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	1.89	1.04			4.23		3.00		1.89					
	Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	0.73	0.47			0.35		0.32		0.73					
	Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	0.69	0.66			0.79		0.51		0.69					
Compression index	Cc		0.25	0.16			0.12		0.11		0.25						
Layer-6	N value average	N		16	16			18		14		16			15		
	Moisture content	w	%	23.53	27.33			21.19		23.94		23.53			40.64		
	Wet density	γ_t	g/cm ³	1.98	1.93			1.98		1.99		1.98			1.77		
	Plastic index	Ip		13.34	14.49			10.48		16.08		13.34			18.06		
	Liquidity index	Il		0.13	0.41			0.44		0.24		0.13			0.83		
	Specific gravity	Gs	g/cm ³	2.71	2.72			2.71		2.74		2.71			2.71		
	Porosity	n	%	40.97	43.90			39.87		41.25		40.97			53.51		
	Degree of saturation	S	%	91.88	91.91			86.61		93.44		91.88			95.09		
	Initial void ratio	e0		0.694	0.803			0.663		0.702		0.694			1.151		
	Internal f. ϕ	ϕ	Degree	0.00	0.00			0.00		0.00		0.00			0.00		
	Cohesion	C	kg/cm ²	0.147	0.169			0.172		0.153		0.147			0.205		
	Pre-consolidated pressure	Pc	kg/cm ²	1.00	2.00			1.60		2.00		1.00			1.00		
	Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	3.14	4.31			9.14		2.57		3.14			2.38		
	Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	0.17	0.33			0.29		0.23		0.17			0.64		
	Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	0.32	0.79			1.73		0.36		0.32			0.76		
Compression index	Cc		0.06	0.12			0.10		0.08		0.06			0.22			
Layer-7	N value average	N		17	17	Estimated from geological section T-2											
	Moisture content	w	%	29.97	29.97												
	Wet density	γ_t	g/cm ³	1.94	1.94												
	Plastic index	Ip		22.35	22.35												
	Liquidity index	Il		0.05	0.05												
	Specific gravity	Gs	g/cm ³	2.74	2.74												
	Porosity	n	%	45.62	45.62												
	Degree of saturation	S	%	97.88	97.88												
	Initial void ratio	e0		0.839	0.839												
	Internal f. ϕ	ϕ	Degree	13.33	15.55												
	Cohesion	C	kg/cm ²	0.411	0.411												
	Pre-consolidated pressure	Pc	kg/cm ²	1.92	1.92												
	Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	0.12	0.12												
	Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg														

T-2 from 3+300 to 6+218					Road section						Approach bridge section			
	Layer	Items	Symbol	Unit	Typical Value	Flyover for canal		Bank Tr side		Flyover for road				
					Average value	BH-R9 1+660	BH-R10 1+720	BH-15 3+410	BH-14 4+790	BH-R11 5+809	BH-R12 3+676	BH-B2 6+240	BH-B1 6+340	BH-B3 6+810
Embank.	Wet density	γ_t	g/cm ³	2										
	Opti. moisture content	w	%	16.50										
	Internal f. a	ϕ	Degree	27.00										
	Cohesion	C	kg/cm ²	0.000										
Layer-2	N value average	N		3								3	3	
	Moisture content	w	%	25.77	26.45							27.13	28.77	
	Wet density	γ_t	g/cm ³	1.89	1.90							1.90	1.89	
	Plastic index	Ip		11.00	14.26							17.52	11.00	
	Liquidity index	I _L		0.70	0.49							0.78	0.70	
	Specific gravity	G _s	g/cm ³	2.71	2.72							2.72	2.71	
	Porosity	n	%	44.06	44.95							45.24	44.60	
	Degree of saturation	S	%	86.54	87.94							89.34	86.54	
	Initial void ratio	e ₀		0.807	0.817							0.826	0.897	
	Internal f. a	ϕ	Degree	0.00	0.00							0.00	0.00	
	Cohesion	C	kg/cm ²	0.136	0.174							0.211	0.136	
	Pre-consolidated pressure	P _c	kg/cm ²	0.35	0.43							0.50	0.35	
	Coef. of consolidation	C _v	10 ⁻⁴ E-3 cm ² /s	9.34	6.14							2.94	9.34	
	Coef. of compressibility	a	10 ⁻⁴ E-1 cm ² /kg	0.35	0.38							0.41	0.35	
	Coef. of permeability	K	10 ⁻⁴ E-7 cm/s	1.95	1.33							0.70	1.95	
	Compression index	C _c		0.12	0.13							0.14	0.12	
Layer-4	N value average	N		7	4	1		7						
	Moisture content	w	%	46.25	45.62	44.99		46.15						
	Wet density	γ_t	g/cm ³	1.69	1.71	1.73		1.69						
	Plastic index	Ip		20.50	21.22	21.94		20.50						
	Liquidity index	I _L		0.92	0.95	0.97		0.92						
	Specific gravity	G _s	g/cm ³	2.70	2.70	2.69		2.70						
	Porosity	n	%	57.04	56.41	55.77		57.04						
	Degree of saturation	S	%	94.70	95.14	95.97		94.70						
	Initial void ratio	e ₀		1.338	1.295	1.261		1.338						
	Internal f. a	ϕ	Degree	0.00	0.00	0.00		(6.13)						
	Cohesion	C	kg/cm ²	0.173	0.152	0.130		0.173						
	Pre-consolidated pressure	P _c	kg/cm ²	1.03	0.72	0.40		1.03						
	Coef. of consolidation	C _v	10 ⁻⁴ E-3 cm ² /s	0.30	1.06	1.82		0.30						
	Coef. of compressibility	a	10 ⁻⁴ E-1 cm ² /kg	0.74	0.82	0.90		0.74						
	Coef. of permeability	K	10 ⁻⁴ E-7 cm/s	0.30	0.56	0.82		0.30						
	Compression index	C _c		0.87	0.59	0.31		0.87						
Layer-1	N value average	N		11	10	9							11	
	Moisture content	w	%	27.51	27.86	28.20								27.51
	Wet density	γ_t	g/cm ³	1.86	1.81	1.76								1.86
	Plastic index	Ip		16.24	13.75	11.26								16.24
	Liquidity index	I _L		0.42	0.64	0.83								0.42
	Specific gravity	G _s	g/cm ³	2.68	2.68	2.68								2.68
	Porosity	n	%	45.53	47.21	48.88								45.53
	Degree of saturation	S	%	88.19	83.62	79.05								88.19
	Initial void ratio	e ₀		0.836	0.896	0.956								0.836
	Internal f. a	ϕ	Degree	0.00	0.00	0.00								0.00
	Cohesion	C	kg/cm ²	0.226	0.148	0.069								0.226
	Pre-consolidated pressure	P _c	kg/cm ²	1.50	1.00	0.50								1.50
	Coef. of consolidation	C _v	10 ⁻⁴ E-3 cm ² /s	1.42	3.20	4.98								1.42
	Coef. of compressibility	a	10 ⁻⁴ E-1 cm ² /kg	0.35	0.37	0.38								0.35
	Coef. of permeability	K	10 ⁻⁴ E-7 cm/s	0.29	0.65	1.01								0.29
	Compression index	C _c		0.12	0.13	0.13								0.12
Layer-7	N value average	N		17				17						
	Moisture content	w	%	29.97	29.97			29.97						
	Wet density	γ_t	g/cm ³	1.94	1.94			1.94						
	Plastic index	Ip		22.35	22.35			22.35						
	Liquidity index	I _L		0.05	0.05			0.05						
	Specific gravity	G _s	g/cm ³	2.74	2.74			2.74						
	Porosity	n	%	45.62	45.62			45.62						
	Degree of saturation	S	%	97.88	97.88			97.88						
	Initial void ratio	e ₀		0.839	0.839			0.839						
	Internal f. a	ϕ	Degree	15.53	15.53			15.53						
	Cohesion	C	kg/cm ²	0.411	0.411			0.411						
Pre-consolidated pressure	P _c	kg/cm ²	1.92	1.92			1.92							
Coef. of consolidation	C _v	10 ⁻⁴ E-3 cm ² /s	0.12	0.12			0.12							
Coef. of compressibility	a	10 ⁻⁴ E-1 cm ² /kg	0.43	0.43			0.43							
Coef. of permeability	K	10 ⁻⁴ E-7 cm/s	0.09	0.09			0.09							
Compression index	C _c		0.35	0.35			0.35							

G-1-a and to Layer	G-1-b from 12+060	Items	Symbol	Unit	Typical Value	Average value	Approach bridge section					Road section					G1a Lam side	
							BH-B14 8+720	BH-B15 8+880	BH-B16 9+070	BH-B16 9+070	BH-2 9+560	Flyover for canal					Interchange NH-5	
												BH-R13 11+400	BH-R14 11+590	BH-R15 11+920	BH-R15 11+930	BH-R16 12+210	BH-R17 12+380	
Embank.		Wet density	γ_t	g/cm ³	2													
		Opt. moisture content	w	%	16.50													
		Internal f. a.	ϕ	Degree	27.00													
		Cohesion	C	kg/cm ²	0.000													
Layer-2		N value average	N		8	4	0					8						
		Moisture content	w	%	36.09	43.67	31.25						36.69					
		Wet density	γ_t	g/cm ³	1.84	1.77	1.70						1.84					
		Plastic index	Ip		28.38	27.34	26.29						28.38					
		Liquidity index	Il		0.33	0.63	0.93						0.33					
		Specific gravity	Gs	g/cm ³	2.73	2.73	2.73						2.73					
		Porosity	n	%	50.34	54.76	58.98						50.54					
		Degree of saturation	S	%	96.40	96.85	97.30						96.40					
		Initial void ratio	e ₀		1.022	1.230	1.438						1.022					
		Internal f. a.	ϕ	Degree	0.00	0.00	0.00						0.00					
		Cohesion	C	kg/cm ²	0.365	0.214	0.163						0.365					
		Pre-consolidated pressure	Pc	kg/cm ²	0.45	0.38	0.30						0.45					
		Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	0.99	1.15	1.31						0.99					
		Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	0.41	0.64	0.87						0.41					
		Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	0.21	0.37	0.52						0.21					
		Compression index	Cc		0.14	0.22	0.30						0.14					
Layer-4		N value average	N		4	3				4			4					
		Moisture content	w	%	43.17	51.01				39.63	43.17		43.17			70.24		
		Wet density	γ_t	g/cm ³	1.73	1.89				1.78	1.73		1.73			1.56		
		Plastic index	Ip		24.88	27.58				20.91	24.88		24.88			36.94		
		Liquidity index	Il		0.58	0.78				0.81	0.58		0.58			0.95		
		Specific gravity	Gs	g/cm ³	2.67	2.68				2.70	2.67		2.67			2.68		
		Porosity	n	%	54.69	57.77				52.96	54.69		54.69			65.87		
		Degree of saturation	S	%	95.50	96.31				95.03	95.50		95.50			98.40		
		Initial void ratio	e ₀		1.207	1.415				1.126	1.207		1.207			1.913		
		Internal f. a.	ϕ	Degree	0.00	0.00				(7.52)	0.00		0.00			0.00		
		Cohesion	C	kg/cm ²	0.152	0.155				0.142	0.152		0.152			0.172		
		Pre-consolidated pressure	Pc	kg/cm ²	0.65	0.53				0.70	0.65		0.65			0.25		
		Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	1.77	0.76				0.16	1.77		1.77			0.34		
		Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	0.33	0.59				0.42	0.33		0.33			1.62		
		Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	0.27	0.30				0.10	0.27		0.27			0.34		
		Compression index	Cc		0.11	0.38				0.46	0.11		0.11			0.36		
Layer-5		N value average	N		8	8		8	8			8	8	8				
		Moisture content	w	%	26.96	26.93		28.20	27.79			26.96	26.96	27.38		24.12		
		Wet density	γ_t	g/cm ³	1.91	1.91		1.92	1.94			1.91	1.91	1.91		1.98		
		Plastic index	Ip		13.14	20.45		22.99	23.51			13.14	19.85	22.75				
		Liquidity index	Il		0.62	0.38		0.35	0.44			0.61	0.30	0.18				
		Specific gravity	Gs	g/cm ³	2.71	2.72		2.73	2.72			2.71	2.70	2.72				
		Porosity	n	%	44.66	43.89		45.05	44.10			44.66	44.44	41.18				
		Degree of saturation	S	%	90.53	93.40		93.89	95.80			90.53	93.08	93.72				
		Initial void ratio	e ₀		0.807	0.783		0.820	0.789			0.807	0.800	0.700				
		Internal f. a.	ϕ	Degree	0.00	0.00		0.00	0.00			0.00	0.00	0.00				
		Cohesion	C	kg/cm ²	0.113	0.222		0.254	0.236			0.113	0.251	0.256				
		Pre-consolidated pressure	Pc	kg/cm ²	0.80	1.03		1.00	1.30			0.80	0.55	1.50				
		Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	7.28	2.91		2.37	1.33			7.28	2.30	1.09				
		Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	0.32	0.29		0.26	0.26			0.32	0.29	0.32				
		Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	1.36	0.51		0.35	0.20			1.36	0.42	0.21				
		Compression index	Cc		0.11	0.10		0.09	0.09			0.11	0.10	0.11				
Layer-7		N value average	N		17	17	Estimated from geological section T-2											
		Moisture content	w	%	29.97	29.97	ditto											
		Wet density	γ_t	g/cm ³	1.94	1.94	ditto											
		Plastic index	Ip		22.35	22.35	ditto											
		Liquidity index	Il		0.05	0.05	ditto											
		Specific gravity	Gs	g/cm ³	2.74	2.74	ditto											
		Porosity	n	%	45.62	45.62	ditto											
		Degree of saturation	S	%	97.88	97.88	ditto											
		Initial void ratio	e ₀		0.839	0.839	ditto											
		Internal f. a.	ϕ	Degree	15.33	15.33	ditto											
		Cohesion	C	kg/cm ²	0.411	0.411	ditto											
		Pre-consolidated pressure	Pc	kg/cm ²	1.920	1.920	ditto											
		Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	0.12	0.12	ditto											
		Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	0.43	0.43	ditto											
		Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	0.09	0.09	ditto											
		Compression index	Cc		0.35	0.35	ditto											

G-2 from to	12+060 12+832	Approach bridge section								Road section G14 L2m side							
		Flyover for canal				Interchange NH-3				Flyover for canal				Interchange NH-3			
Layer	Items	Symbol	Unit	Typical Value	Average value	BH-R14 8+720	BH-R15 8+880	BH-R16 9+070	BH-B16 9+070	F/S 9+860	BH-R13 11+400	BH-R14 11+590	BH-R15 11+930	BH-R13 11+930	BH-R16 12+210	BH-R17 12+380	
Embank	Wet density	γ_t	g/cm ³	2													
	Opti. moisture content	w	%	16.50													
	Internal f. a.	ϕ	Degree	27.00													
	Cohesion	c	kg/cm ²	0.000													
Layer-2	N value average	N		4	0												
	Moisture content	w	%	36.09	43.67	51.35											
	Wet density	γ_t	g/cm ³	1.84	1.97	1.70											
	Plastic index	Ip		28.38	27.54	28.29											
	Liquidity index	Il		0.33	0.63	0.93											
	Specific gravity	Gs	g/cm ³	2.73	2.73	2.73											
	Porosity	n	%	50.54	54.76	58.98											
	Degree of saturation	S	%	96.40	96.85	97.30											
	Initial void ratio	e0		1.072	1.230	1.438											
	Internal f. a.	ϕ	Degree	0.00	0.00	0.00											
	Cohesion	c	kg/cm ²	0.265	0.214	0.162											
	Pre-consolidated pressure	Pc	kg/cm ²	0.45	0.38	0.30											
	Coef. of consolidation	Cv	10 ⁸ E-3 cm ² /s	0.39	1.15	1.31											
	Coef. of compressibility	a	10 ⁸ E-1 cm ² /kg	0.41	0.64	0.87											
Coef. of permeability	K	10 ⁸ E-7 cm/s	0.21	0.37	0.52												
Compression index	Cc		0.14	0.22	0.30												
Layer-4	N value average	N		4	3												
	Moisture content	w	%	43.17	51.01												
	Wet density	γ_t	g/cm ³	1.73	1.69												
	Plastic index	Ip		24.88	27.58												
	Liquidity index	Il		0.58	0.78												
	Specific gravity	Gs	g/cm ³	2.87	2.88												
	Porosity	n	%	44.69	57.17												
	Degree of saturation	S	%	95.50	96.31												
	Initial void ratio	e0		1.207	1.415												
	Internal f. a.	ϕ	Degree	0.00	0.00												
	Cohesion	c	kg/cm ²	0.132	0.155												
	Pre-consolidated pressure	Pc	kg/cm ²	0.65	0.53												
	Coef. of consolidation	Cv	10 ⁸ E-3 cm ² /s	1.77	0.76												
	Coef. of compressibility	a	10 ⁸ E-1 cm ² /kg	0.32	0.79												
Coef. of permeability	K	10 ⁸ E-7 cm/s	0.27	0.20													
Compression index	Cc		0.11	0.38													
Layer-5	N value average	N		8	8												
	Moisture content	w	%	26.96	26.93												
	Wet density	γ_t	g/cm ³	1.91	1.93												
	Plastic index	Ip		13.14	20.45												
	Liquidity index	Il		0.62	0.38												
	Specific gravity	Gs	g/cm ³	2.71	2.72												
	Porosity	n	%	44.66	43.89												
	Degree of saturation	S	%	90.53	93.40												
	Initial void ratio	e0		0.887	0.763												
	Internal f. a.	ϕ	Degree	0.00	0.00												
	Cohesion	c	kg/cm ²	0.113	0.222												
	Pre-consolidated pressure	Pc	kg/cm ²	0.80	1.03												
	Coef. of consolidation	Cv	10 ⁸ E-3 cm ² /s	7.28	2.91												
	Coef. of compressibility	a	10 ⁸ E-1 cm ² /kg	0.32	0.29												
Coef. of permeability	K	10 ⁸ E-7 cm/s	1.36	0.51													
Compression index	Cc		0.11	0.10													
Layer-6	N value average	N		16	16	Estimated from geological section T-1-a&b											
	Moisture content	w	%	23.53	27.33	ditto											
	Wet density	γ_t	g/cm ³	1.98	1.93	ditto											
	Plastic index	Ip		13.34	14.49	ditto											
	Liquidity index	Il		0.13	0.41	ditto											
	Specific gravity	Gs	g/cm ³	2.71	2.72	ditto											
	Porosity	n	%	40.97	43.90	ditto											
	Degree of saturation	S	%	91.85	91.91	ditto											
	Initial void ratio	e0		0.694	0.803	ditto											
	Internal f. a.	ϕ	Degree	0.00	0.00	ditto											
	Cohesion	c	kg/cm ²	0.147	0.169	ditto											
	Pre-consolidated pressure	Pc	kg/cm ²	3.00	2.00	ditto											
	Coef. of consolidation	Cv	10 ⁸ E-3 cm ² /s	3.14	4.31	ditto											
	Coef. of compressibility	a	10 ⁸ E-1 cm ² /kg	0.17	0.33	ditto											
Coef. of permeability	K	10 ⁸ E-7 cm/s	0.32	0.79	ditto												
Compression index	Cc		0.06	0.12	ditto												
Layer-7	N value average	N		17	17	Estimated from geological section T-2											
	Moisture content	w	%	29.97	29.97	ditto											
	Wet density	γ_t	g/cm ³	1.94	1.94	ditto											
	Plastic index	Ip		22.35	22.35	ditto											
	Liquidity index	Il		0.05	0.05	ditto											
	Specific gravity	Gs	g/cm ³	2.74	2.74	ditto											
	Porosity	n	%	45.62	45.62	ditto											
	Degree of saturation	S	%	97.88	97.88	ditto											
	Initial void ratio	e0		0.839	0.839	ditto											
	Internal f. a.	ϕ	Degree	15.33	15.33	ditto											
	Cohesion	c	kg/cm ²	0.411	0.411	ditto											
	Pre-consolidated pressure	Pc	kg/cm ²	1.92	1.92	ditto											
	Coef. of consolidation	Cv	10 ⁸ E-3 cm ² /s	0.12	0.12	ditto											
	Coef. of compressibility	a	10 ⁸ E-1 cm ² /kg	0.43	0.43	ditto											
Coef. of permeability	K	10 ⁸ E-7 cm/s	0.09	0.09	ditto												
Compression index	Cc		0.35	0.35	ditto												

Appendix 3.3.23 Detailed soil index table in the bridge section

Bridge section				Approach ridge section Thamb Tri side										Main ridge section							Approach ridge section Thamb Tri side															
Layer	Items	Symbol	Unit	Typical Value	Average Value	BH-B2	BH-B1	BH-B4	BH-B5	BH-B6	BH-B7	BH-B8	BH-B9	BH-B10	BH-B11	BH-B12	BH-B13	BH-B14	BH-B15	BH-B16	BH-B17	BH-B18	BH-B19	BH-B20	BH-B21	BH-B22	BH-B23	BH-B24	BH-B25	BH-B26	BH-B27	BH-B28	BH-B29	BH-B30		
2	N value average	N		3	1	0	3																													
	Moisture content	w	%	25.77	34.72	27.13	25.77																													
	Wet density	γ_t	g/cm ³	1.89	1.83	1.90	1.89																													
	Plastic index	Ip		11.00	18.27	17.52	11.00																													
	Liquidity index	Il		0.70	0.64	0.28	0.70																													
	Specific gravity	Gs	g/cm ³	2.71	2.72	2.72	2.71																													
	Porosity	n	%	44.66	49.63	45.24	44.66																													
	Degree of saturation	S	%	86.54	91.06	89.34	86.54																													
	Initial void ratio	e0		0.807	1.024	0.826	0.807																													
	Internal f.a.	ϕ	Degree	0.00	0.00	0.00	0.00																													
	Cohesion	C	kg/cm ²	0.136	0.170	0.211	0.136																													
	Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	9.34	4.53	7.94	9.34																													
	Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	0.35	0.54	0.41	0.35																													
	Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	1.95	1.06	0.70	1.95																													
	Compression index	Cc		0.12	0.19	0.14	0.12																													
	Pressure modulus	Ep	kPa	o s.3optc	4,479																															
	Liquid Pressure	Pl	kPa	o s.3optc	490																															
	Limit pressure	Pl	kPa	o s.3optc	785																															
3	N value average	N		No laboratory test data																																
	Moisture content	w	%	ditto																																
	Wet density	γ_t	g/cm ³	ditto																																
	Plastic index	Ip		ditto																																
	Liquidity index	Il		ditto																																
	Specific gravity	Gs	g/cm ³	ditto																																
	Porosity	n	%	ditto																																
	Degree of saturation	S	%	ditto																																
	Initial void ratio	e0		ditto																																
	Internal f.a.	ϕ	Degree	ditto																																
	Cohesion	C	kg/cm ²	ditto																																
	Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	ditto																																
	Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	ditto																																
	Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	ditto																																
	Compression index	Cc		ditto																																
	Pressure modulus	Ep	kPa	675	675	1,211																														
	Liquid Pressure	Pl	kPa	83	83	150							281	697																						
	Limit pressure	Pl	kPa	180	180	255							50	80																						
5	N value average	N		8	8																															
	Moisture content	w	%	28.00	28.00																															
	Wet density	γ_t	g/cm ³	1.93	1.93																															
	Plastic index	Ip		23.25	23.25																															
	Liquidity index	Il		0.40	0.40																															
	Specific gravity	Gs	g/cm ³	2.73	2.73																															
	Porosity	n	%	44.58	44.58																															
	Degree of saturation	S	%	94.85	94.85																															
	Initial void ratio	e0		0.805	0.805																															
	Internal f.a.	ϕ	Degree	0.00	0.00																															
	Cohesion	C	kg/cm ²	0.245	0.245																															
	Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	1.85	1.85																															
	Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	0.26	0.26																															
	Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	0.28	0.28																															
	Compression index	Cc		0.09	0.09																															
	Pressure modulus	Ep	kPa	No test data in-site																																
	Liquid Pressure	Pl	kPa	ditto																																
	Limit pressure	Pl	kPa	ditto																																
1 esse	N value average	N		11	11																															
	Moisture content	w	%	27.51	27.51																															
	Wet density	γ_t	g/cm ³	1.86	1.86																															
	Plastic index	Ip		16.24	16.24																															
	Liquidity index	Il		0.42	0.42																															
	Specific gravity	Gs	g/cm ³	2.68	2.68																															
	Porosity	n	%	45.53	45.53																															
	Degree of saturation	S	%	88.19	88.19																															
	Initial void ratio	e0		0.836	0.836																															
	Internal f.a.	ϕ	Degree	0.00	0.00																															
	Cohesion	C	kg/cm ²	0.226	0.226																															
	Coef. of consolidation	Cv	10 ⁻⁶ E-3 cm ² /s	1.42	1.42																															
	Coef. of compressibility	a	10 ⁻⁶ E-1 cm ² /kg	0.35	0.35																															
	Coef. of permeability	K	10 ⁻⁶ E-7 cm/s	0.29	0.29																															
	Compression index	Cc		0.12	0.12																															
	Pressure modulus	Ep	kPa	No test data in-site																																
	Liquid Pressure	Pl	kPa	ditto																																
	Limit pressure	Pl	kPa	ditto																																

Appendix 3.3.24 Soil consolidation indexes													
Geological section T-1-a and T-1-b													
from 1+109 to 3+300													
Layer	Applied borehole	Sampling depth (from) (to)	No. of consolidation test	Preconsolidated Pressure P _c kg/cm ²	Consolidation Pressure P kgf/cm ²	Void ratio e	Average pressure P _{av} kgf/cm ²	Coefficient of consolidation C _v		Coefficient of compression C _{av}			
								cm/sec	cm/day	cm ² /kgf	cm ² /kgf		
2	BH-B1	-2.0 -2.5	9498	0.35	0	0.807							
					0.0625	0.780							
					0.125	0.765	0.19	1.25E-02	1,075.68	1.16E-01	0.1160		
					0.25	0.751	0.38	1.21E-02	1,045.44	1.04E-01	0.1040		
					0.50	0.724	0.75	9.72E-03	839.81	6.40E-02	0.0640		
					1	0.691	1.50	9.34E-03	806.98	3.50E-02	0.0350		
					2	0.654	3.00	7.62E-03	658.37	1.90E-02	0.0190		
					4	0.615	6.00	7.31E-03	631.58	9.00E-03	0.0090		
					8	0.575	12.00	8.11E-03	700.70	5.00E-03	0.0050		
					16	0.534							
					4	0.540							
					0.0625	0.576							
					4	BH-R9	-6.0 -7.0	9513	0.40	0	1.261		
0.0625	1.222												
0.125	1.199	0.19	3.82E-03	330.05						2.78E-01	0.2780		
0.25	1.162	0.38	2.67E-03	230.69						2.20E-01	0.2200		
0.50	1.106	0.75	1.84E-03	158.98						1.39E-01	0.1390		
1	1.034	1.50	1.82E-03	157.25						9.00E-02	0.0900		
2	0.941	3.00	1.64E-03	141.70						4.80E-02	0.0480		
4	0.841	6.00	1.38E-03	119.23						2.30E-02	0.0230		
8	0.744	12.00	1.09E-03	94.18						1.20E-02	0.0120		
16	0.648												
4	0.663												
0.0625	0.789												
Lense 1	BH-R9	-24.0 -24.6	9514	0.50						0	0.956		
					0.0625	0.950							
					0.125	0.936	0.19	9.14E-03	789.70	9.30E-02	0.0930		
					0.25	0.924	0.38	7.87E-03	679.97	7.00E-02	0.0700		
					0.50	0.907	0.75	6.15E-03	531.36	4.10E-02	0.0410		
					1	0.886	1.50	4.98E-03	430.27	3.80E-02	0.0380		
					2	0.848	3.00	5.72E-03	494.21	1.70E-02	0.0170		
					4	0.811	6.00	3.66E-03	316.22	9.00E-03	0.0090		
					8	0.773	12.00	3.77E-03	325.73	5.00E-03	0.0050		
					16	0.734							
					4	0.739							
					0.0625	0.787							
					5	BH-R7	-17.0 -18.0	9468	0.70	0	1.160		
0.0625	1.149												
0.125	1.143	0.19	4.00E-03	345.60						1.62E-01	0.1620		
0.25	1.123	0.38	3.13E-03	270.43						1.04E-01	0.1040		
0.50	1.095	0.75	2.01E-03	173.66						1.04E-01	0.1040		
1	1.041	1.50	1.89E-03	163.30						7.30E-02	0.0730		
2	0.966	3.00	1.53E-03	132.19						4.80E-02	0.0480		
4	0.868	6.00	1.57E-03	135.65						2.00E-03	0.0020		
8	0.783	12.00	1.07E-03	92.45						1.00E-03	0.0010		
16	0.698												
4	0.724												
0.0625	0.889												
6	BH-R7	-31.0 -32.0	9469	3.00						0	0.694		
					0.0625	0.692							
					0.125	0.689	0.19	4.64E-03	400.90	4.60E-02	0.0460		
					0.25	0.682	0.38	4.61E-03	398.30	2.30E-02	0.0230		
					0.50	0.675	0.75	3.99E-03	344.74	2.30E-02	0.0230		
					1	0.664	1.50	3.14E-03	271.30	1.70E-02	0.0170		
					2	0.647	3.00	2.78E-03	240.19	1.50E-02	0.0150		
					4	0.618	6.00	2.09E-03	180.58	9.00E-03	0.0090		
					8	0.580	12.00	1.54E-03	133.06	6.00E-03	0.0060		
					16	0.531							
					4	0.541							
					0.0625	0.602							
					7	BH-14 (F/S)	-22.0 -23.0	1629	1.92	0	0.845		
0.0625	0.824												
0.125	0.816	0.38	1.58E-03	136.51						3.50E-02	0.0350		
0.50	0.807	0.75	1.04E-03	89.86						4.10E-02	0.0410		
1	0.787	1.50	6.70E-04	57.89						2.90E-02	0.0290		
2	0.757	3.00	4.50E-04	38.88						2.00E-02	0.0200		
4	0.716												
2	0.716												
0.125	0.731												

Geological section T-2											
from 3+300											
to 6+218											
Layer	Applied borehole	Sampling depth (from) (to)	No. of consolidation test	Preconsolidated Pressure Pc kg/cm2	Consolidation Pressure P kgf/cm2	Void ratio e	Average pressure Pav kgf/cm2	Coefficient of consolidation Cv		Coefficient of compression av	
								cm/sec	cm/day	cm2/kgf	cm2/kgf
2	BH-B1	-2.0 -2.5	9498	0.35	0	0.807					
					0.0625	0.780					
					0.125	0.765	0.19	1.25E-02	1,075.68	1.16E-01	0.1160
					0.25	0.751	0.38	1.21E-02	1,045.44	1.04E-01	0.1040
					0.50	0.724	0.75	9.72E-03	839.81	6.40E-02	0.0640
					1	0.691	1.50	9.34E-03	806.98	3.50E-02	0.0350
					2	0.654	3.00	7.62E-03	658.37	1.90E-02	0.0190
					4	0.615	6.00	7.31E-03	631.58	9.00E-03	0.0090
					8	0.575	12.00	8.11E-03	700.70	5.00E-03	0.0050
					16	0.534					
					4	0.540					
					0.0625	0.576					
4	BH-15 (F/S)	-15.0 -16.0	1626	1.03	0	1.328					
					0.0625						
					0.125	1.287					
					0.25	1.273	0.38	1.55E-03	133.92	1.04E-01	0.1040
					0.50	1.247	0.75	1.03E-03	88.99	8.70E-02	0.0870
					1	1.203	1.50	7.40E-04	63.94	8.70E-02	0.0870
					2	1.113	3.00	3.40E-04	29.38	6.10E-02	0.0610
					4	0.987					
					2	0.987					
					0.125	1.025					
Lense-1	BH-B1	-26.6 -27.1	9499	1.50	0	0.834					
					0.0625	0.802					
					0.125	0.792	0.19	4.45E-03	384.48	1.16E-01	0.1160
					0.25	0.778	0.38	3.05E-03	263.52	8.10E-02	0.0810
					0.50	0.757	0.75	1.48E-03	127.87	5.80E-02	0.0580
					1	0.726	1.50	1.42E-03	122.69	3.50E-02	0.0350
					2	0.689	3.00	1.23E-03	106.27	2.30E-02	0.0230
					4	0.641	6.00	1.27E-03	109.73	1.50E-02	0.0150
					8	0.582	12.00	1.12E-03	96.77	8.00E-03	0.0080
					16	0.513					
					4	0.538					
					0.0625	0.653					
7	BH-14 (F/S)	-22.0 -23.0	1629	1.92	0	0.845					
					0.0625						
					0.125	0.824					
					0.25	0.816	0.38	1.58E-03	136.51	3.50E-02	0.0350
					0.50	0.807	0.75	1.04E-03	89.86	4.10E-02	0.0410
					1	0.787	1.50	6.70E-04	57.89	2.90E-02	0.0290
					2	0.757	3.00	4.50E-04	38.88	2.00E-02	0.0200
					4	0.716					
					2	0.716					
					0.125	0.731					

Geological section G-1-a, G-1-b and G-2												
from 9+302												
to 12+832												
Layer	Applied borehole	Sampling depth (from) (to)	No. of consolidation test	Preconsolidated Pressure Pc kg/cm2	Consolidation Pressure P kgf/cm2	Void ratio e	Average pressure Pav kgf/cm2	Coefficient of consolidation Cv		Coefficient of compression av		
								cm/sec	cm/day	cm2/kgf	cm2/kgf	
2	BH-R13	-5.5 -5.9	9501	0.45	0	1.022						
					0.0625	1.017						
					0.125	1.007	0.19	2.29E-03	197.86	1.16E-01	0.1160	
					0.25	0.992	0.38	1.97E-03	170.21	8.10E-02	0.0810	
					0.50	0.971	0.75	1.54E-03	133.06	5.80E-02	0.0580	
					1	0.941	1.50	9.90E-04	85.54	4.10E-02	0.0410	
					2	0.899	3.00	1.13E-03	97.63	2.20E-02	0.0220	
					4	0.855	6.00	1.00E-03	86.40	1.00E-02	0.0100	
					8	0.813	12.00	9.60E-04	82.94	5.00E-03	0.0050	
					16	0.769						
					4	0.779						
	0.0625	0.874										
4	BH-R13	-8.5 -8.9	9502	0.65	0	1.207						
					0.0625	1.190						
					0.125	1.182	0.19	2.45E-03	211.68	9.30E-02	0.0930	
					0.25	1.171	0.38	2.25E-03	194.40	7.00E-02	0.0700	
					0.50	1.152	0.75	2.06E-03	177.98	4.10E-02	0.0410	
					1	1.130	1.50	1.77E-03	152.93	3.20E-02	0.0320	
					2	1.097	3.00	1.61E-03	139.10	2.30E-02	0.0230	
					4	1.050	6.00	1.63E-03	140.83	1.00E-02	0.0100	
					8	1.008	12.00	1.16E-03	100.22	5.00E-03	0.0050	
					16	0.965						
					4	0.975						
	0.0625	1.030										
5	BH-R13	-12.6 -13.0	9503	0.80	0	0.807						
					0.0625	0.784						
					0.125	0.777	0.19	1.58E-02	1,365.12	9.30E-02	0.0930	
					0.25	0.766	0.38	1.54E-02	1,327.97	8.10E-02	0.0810	
					0.50	0.745	0.75	1.21E-02	1,041.12	4.60E-02	0.0460	
					1	0.721	1.50	7.28E-03	628.99	3.20E-02	0.0320	
					2	0.689	3.00	4.69E-03	405.22	1.70E-02	0.0170	
					4	0.653	6.00	3.16E-03	273.02	1.10E-02	0.0110	
					8	0.607	12.00	2.53E-03	218.59	5.00E-03	0.0050	
					16	0.561						
					4	0.565						
	0.0625	0.596										
6	BH-R7	-31.0 -32.0	9469	3.00	0	0.694						
					0.0625	0.692						
					0.125	0.689	0.19	4.64E-03	400.90	4.60E-02	0.0460	
					0.25	0.682	0.38	4.61E-03	398.30	2.30E-02	0.0230	
					0.50	0.675	0.75	3.99E-03	344.74	2.30E-02	0.0230	
					1	0.664	1.50	3.14E-03	271.30	1.70E-02	0.0170	
					2	0.647	3.00	2.78E-03	240.19	1.50E-02	0.0150	
					4	0.618	6.00	2.09E-03	180.58	9.00E-03	0.0090	
					8	0.580	12.00	1.54E-03	133.06	6.00E-03	0.0060	
					16	0.531						
					4	0.541						
	0.0625	0.602										
7	BH-14 (F/S)	-22.0 -23.0	1629	1.92	0	0.845						
					0.0625	0.824						
					0.125	0.816	0.38	1.58E-03	136.51	3.50E-02	0.0350	
					0.50	0.807	0.75	1.04E-03	89.86	4.10E-02	0.0410	
					1	0.787	1.50	6.70E-04	57.89	2.90E-02	0.0290	
					2	0.757	3.00	4.50E-04	38.88	2.00E-02	0.0200	
					4	0.716						
	0.125	0.731										

Case 2											
Geological section T-1-a and T-1-b											
from 1+109											
to 3+300											
Layer	Applied borehole	Sampling depth (from) (to)	No. of consolidation test	Preconsolidated Pressure Pc kg/cm2	Consolidation Pressure P kg/cm2	Void ratio e	Average pressure Pav kgf/cm2	Coefficient of consolidation Cv		Coefficient of compression av	
								cm/sec	cm/day	cm2/kgf	cm2/kgf
2	BH-B1	-2.0	9498	0.35	0	0.807					
					0.0625	0.780					
		-2.5			0.125	0.765	0.19	1.25E-02	1,075.68	1.16E-01	0.1160
					0.25	0.751	0.38	1.21E-02	1,045.44	1.04E-01	0.1040
		0.50			0.724	0.75	9.72E-03	839.81	6.40E-02	0.0640	
		1			0.691	1.50	9.34E-03	806.98	3.50E-02	0.0350	
		2			0.654	3.00	7.62E-03	658.37	1.90E-02	0.0190	
		4			0.615	6.00	7.31E-03	631.58	9.00E-03	0.0090	
		8			0.575	12.00	8.11E-03	700.70	5.00E-03	0.0050	
		16			0.534						
		4			0.540						
		0.0625			0.576						
4	BH-R9	-6.0	9467	0.40	0	2.175					
					0.0625	2.143					
		-7.0			0.125	2.095	0.19	1.46E-02	1,261.44	4.87E-02	0.0487
					0.25	2.032	0.38	9.60E-03	829.44	4.60E-02	0.0460
		0.50			1.913	0.75	7.40E-03	639.36	3.54E-02	0.0354	
		1			1.730	1.50	5.70E-03	492.48	2.12E-02	0.0212	
		2			1.510	3.00	4.70E-03	406.08	1.07E-02	0.0107	
		4			1.287	6.00	3.90E-03	336.96	5.30E-03	0.0053	
		8			1.067	12.00	3.10E-03	267.84	2.70E-03	0.0027	
		16			0.844						
		4			0.890						
		0.0625			1.189						
Lense 1	BH-R9	-24.0	9514	0.50	0	0.956					
					0.0625	0.950					
		-24.6			0.125	0.936	0.19	9.14E-03	789.70	9.30E-02	0.0930
					0.25	0.924	0.38	7.87E-03	679.97	7.00E-02	0.0700
		0.50			0.907	0.75	6.15E-03	531.36	4.10E-02	0.0410	
		1			0.886	1.50	4.98E-03	430.27	3.80E-02	0.0380	
		2			0.848	3.00	5.72E-03	494.21	1.70E-02	0.0170	
		4			0.811	6.00	3.66E-03	316.22	9.00E-03	0.0090	
		8			0.773	12.00	3.77E-03	325.73	5.00E-03	0.0050	
		16			0.734						
		4			0.739						
		0.0625			0.787						
5	BH-R7	-17.0	9468	0.70	0	1.160					
					0.0625	1.149					
		-18.0			0.125	1.143	0.19	4.00E-03	345.60	1.62E-01	0.1620
					0.25	1.123	0.38	3.13E-03	270.43	1.04E-01	0.1040
		0.50			1.095	0.75	2.01E-03	173.66	1.04E-01	0.1040	
		1			1.041	1.50	1.89E-03	163.30	7.30E-02	0.0730	
		2			0.966	3.00	1.53E-03	132.19	4.80E-02	0.0480	
		4			0.868	6.00	1.57E-03	135.65	2.00E-02	0.0020	
		8			0.783	12.00	1.07E-03	92.45	1.00E-03	0.0010	
		16			0.698						
		4			0.724						
		0.0625			0.889						
6	BH-R7	-31.0	9469	3.00	0	0.694					
					0.0625	0.692					
		-32.0			0.125	0.689	0.19	4.64E-03	400.90	4.60E-02	0.0460
					0.25	0.682	0.38	4.61E-03	398.30	2.30E-02	0.0230
		0.50			0.675	0.75	3.99E-03	344.74	2.30E-02	0.0230	
		1			0.664	1.50	3.14E-03	271.30	1.70E-02	0.0170	
		2			0.647	3.00	2.78E-03	240.19	1.50E-02	0.0150	
		4			0.618	6.00	2.09E-03	180.58	9.00E-03	0.0090	
		8			0.580	12.00	1.54E-03	133.06	6.00E-03	0.0060	
		16			0.531						
		4			0.541						
		0.0625			0.602						
7	BH-14 (F/S)	-22.0	1629	1.92	0	0.845					
					0.0625	0.824					
		-23.0			0.125	0.816	0.38	1.58E-03	136.51	3.50E-02	0.0350
					0.25	0.807	0.75	1.04E-03	89.86	4.10E-02	0.0410
		1			0.787	1.50	6.70E-04	57.89	2.90E-02	0.0290	
		2			0.757	3.00	4.50E-04	38.88	2.00E-02	0.0200	
		4			0.716						
		2			0.716						
0.125	0.731										

Appendix 3.3.25 Results of settlement analysis

1. Traffic way center from		Elevation		No treatment			Sand drain			Plastic board drain				
Geological sections	Analysis location (STA)	Ground (EL)	Frontage road (EL)	Height of embank (m)	Settlements of traffic center			Settlements of traffic center			Settlements of traffic center			
					Final (cm)	450 days (cm)	Residual (cm)	Final (cm)	450 days (cm)	Residual (cm)	Final (cm)	450 days (cm)	Residual (cm)	
	to				Interval (m)	Depth (m)		Interval (m)	Depth (m)		Interval (m)	Depth (m)		
T-1-a	1+109													
	1+040	5.1	6.0	7.0	2.50	30.00	150.404	2.75	30.00	150.404	2.53	20.00	150.758	23.461
				(L&R)										
T-1-b	2+600													
	2+740	2.0	6.0	11.0	2.75	26.20	184.181	3.00	26.20	184.181	2.848	20.00	184.894	13.417
				(L&R)										
T-2	3+300													
	4+740	2.8	6.0	9.0	1.75	16.00	113.694	2.00	16.00	113.694	2.102	16.00	113.694	0.089
				(L&R)										
G-1-a	6+218													
	9+302													
G-1-b	10+920													
	11+360	4.0	6.0	8.0	2.25	18.00	121.571	3.00	18.00	121.571	2.738	18.00	121.571	0.18
				(L)										
G-2	12+060													
	12+400	3.7	9.0	9.0	2.00	16.00	103.054	2.50	16.00	103.054	0.665	16.00	103.054	0.350
Bold : Recommended pretreatment	12+832													

(Near pond)	Elevation			No treatment			Sand drain			Plastic board drain															
	from	Analysis location	Frontage road embank.	Settlements of traffic center	Specifications	Settlements of traffic center	Specifications	Settlements of traffic center	Specifications	Settlements of traffic center	Specifications	Settlements of traffic center													
	to	(STA)	(EL)	Final (cm)	Interval (m)	Final (cm)	Interval (m)	Final (cm)	Interval (m)	Final (cm)	Interval (m)	Final (cm)													
T-1-a	1+109	1+114	5.1	6.0	5.5	124.290	42.261	82.029	2.25	30.00	124.290	122.924	1.366												
	1+300																								
(Near pond)	from																								
Geological sections	Analysis location	Frontage road embank.	Height of embank.	Settlements of traffic center			Settlements of traffic center			Settlements of traffic center			Settlements of traffic center												
	(STA)	(EL)	(m)	Final	Interval	Depth	Final	Interval	Depth	Final	Interval	Depth	Final	Interval	Depth	Final	Interval	Depth	Final	Interval	Depth	Final	Interval	Depth	
				(cm)	(m)	(m)	(cm)	(m)	(m)	(cm)	(m)	(m)	(cm)	(m)	(m)	(cm)	(m)	(m)	(cm)	(m)	(m)	(cm)	(m)	(m)	(cm)
T-1-a	1+560	5.1	6.0	4.1	98.272	33.906	64.366	2.25	30.00	98.272	97.248	1.024													
	1+647																								
2. Traffic way center with counter weight as frontage road width 14 m																									
Geological sections	Analysis location	Counter weight embank.	Height of embank.	No treatment			Sand drain			Settlements of traffic center			Settlements of traffic center			Settlements of traffic center			Settlements of traffic center			Settlements of traffic center			
	(STA)	(EL)	(m)	Final	Interval	Depth	Final	Interval	Depth	Final	Interval	Depth	Final	Interval	Depth	Final	Interval	Depth	Final	Interval	Depth	Final	Interval	Depth	
				(cm)	(m)	(m)	(cm)	(m)	(m)	(cm)	(m)	(m)	(cm)	(m)	(m)	(cm)	(m)	(m)	(cm)	(m)	(m)	(cm)	(m)	(m)	(cm)
	12+060																								
G-2																									
	12+400	3.7	CW6 (L&R)																						
	12+832																								
Bold : Recommended pretreatment																									

Geological sections	from to	Analysis location (STA)		Elevation		No treatment			Sand drain			Plastic board drain						
		Ground (EL)	Frontage road (EL)	Height of embank (m)	Settlements of traffic center Final (cm)	450 days (cm)	Residual (cm)	Specifications Interval (m)	Depth (m)	Final (cm)	450 days (cm)	Residual (cm)	Specifications Interval (m)	Depth (m)	Final (cm)	450 days (cm)	Residual (cm)	
T-1-a	1+109	1+040	5.1	6.0	7.0	48.185	17.513	30.672	2.25	30.00	48.185	47.359	0.826	0.75	20.00	48.122	37.809	10.313
									2.50	30.00	48.185	47.310	0.875	1.00	20.00	48.122	37.809	10.313
									2.75	30.00	48.185	47.122	1.063	1.25	20.00	48.122	37.809	10.313
T-1-b	2+600																	
	2+600								2.00	26.20	90.666	90.666	0.000	0.75	20.00	91.007	84.188	6.819
		2+740	2.0	6.0	11.0	90.666	23.922	66.744	2.75	26.20	90.666	90.395	0.271	1.00	20.00	91.007	84.188	6.819
									3.00	26.20	90.666	89.789	0.877	1.25	20.00	91.007	84.188	6.819
T-2	3+300																	
	3+300								1.75	16.00	56.464	56.461	0.003	1.25	16.00	56.464	56.460	0.004
		4+740	2.8	6.0	9.0	56.464	23.834	32.630	2.00	16.00	56.464	56.414	0.050	1.50	16.00	56.464	56.361	0.103
									2.25	16.00	56.464	56.152	0.312	1.75	16.00	56.464	55.827	0.637
G-1-a	6+218																	
	9+302																	
									2.25	18.00	64.449	64.446	0.003	1.75	18.00	64.449	64.437	0.012
		9+920	3.2	6.0	8.0	64.449	28.904	35.545	2.75	18.00	64.449	64.283	0.166	2.00	18.00	64.449	64.335	0.114
									3.00	18.00	64.449	63.895	0.554	2.25	18.00	64.449	63.928	0.521
G-1-b	10+920																	
	10+920								2.00	16.00	23.819	23.819	0.000	1.50	16.00	23.819	23.819	0.000
									2.50	16.00	23.819	23.798	0.021	1.75	16.00	23.819	23.811	0.008
		11+360	4.0		9.0	23.819	13.691	10.128	2.75	16.00	23.819	23.719	0.100	2.00	16.00	23.819	23.748	0.071
									3.00	16.00	23.819	23.520	0.299	2.25	16.00	23.819	23.537	0.282
G-2	12+060																	
	12+060																	
									3.25	16.70	16.375	16.325	0.050	2.50	16.70	16.375	16.339	0.036
									3.50	16.70	16.375	16.254	0.121	2.75	16.70	16.375	16.288	0.087
									3.75	16.70	16.375	16.133	0.242	3.00	16.70	16.375	16.052	0.323
									3.25	16.70	16.105	16.051	0.054	2.25	16.70	16.105	16.089	0.016
		12+400	3.7		8.0	16.105	13.301	2.804	3.50	16.70	16.105	15.976	0.129	2.50	16.70	16.105	16.044	0.061
									3.75	16.70	16.105	15.851	0.254	2.75	16.70	16.105	15.942	0.163
									3.25	16.70	15.750	15.692	0.058	2.25	16.70	15.750	15.732	0.018
									3.50	16.70	15.750	15.614	0.136	2.50	16.70	15.750	15.684	0.066
									3.75	16.70	15.750	15.484	0.266	2.75	16.70	15.750	15.579	0.171
	12+832																	

Appendix 3.3.26 Tables of strength increased for calculation of ground stability

1. No pretreatment		Geological condition		Embankment		Interval		Diameter		No pretreatment		Strength of increased for consolidation		Degree of consolidation					
Geological section	Boarder from	Length	Section	Soft layer	Is (m) from GL	He (m) from GL	Interval (square)	D (m)	d (m)	Ratio of replacement	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of strength increased	Period of embank (days)	U1	U2	Period2 (days)	U
	to									$\lambda_{As}=0.785*(d/D)^2$									
T-1-a	1+109	1.491	1+040	Layer-2 Layer-4 Layer-5 Layer-6	32.0	7	0.00	0.00	0.00	0.000	0	0.00	0.00	0.25	140	0.10	0.20	146	0.19
T-1-b	2+600	700	2+740	Layer-2 Layer-4 Layer-5	26.2	11	0.00	0.00	0.00	0.000	0	0.00	0.00	0.25	180	0.00	0.10	204	0.09
T-2	3+300	2.918	4+740	Layer-2 Layer-4 Layer-5	16.0	9	0.00	0.00	0.00	0.000	0	0.00	0.00	0.25	180	0.20	0.30	224	0.25
G-1-a	6+218	1.618	9+920	Layer-2 Layer-4 Layer-5	18.0	8	0.00	0.00	0.00	0.000	0	0.00	0.00	0.25	180	0.20	0.30	338	0.20
G-1-b	10+920	1.140	11+360	Layer-2 Layer-4 Layer-5	16.0	9	0.00	0.00	0.00	0.000	0	0.00	0.00	0.25	180	0.20	0.30	286	0.20
G-2	12+060	772	12+400	Layer-2 Layer-4 Layer-5 Layer-6	16.7	8	0.00	0.00	0.00	0.000	0	0.00	0.00	0.25	160	0.40	0.50	162	0.49
	12+832					7	0.00	0.00	0.00	0.000	0	0.00	0.00	0.25	140	0.40	0.50	150	0.46

2) Traffic way near pond		Geological condition		Embankment		No pretreatment		Strength of increased for consolidation											
Geological section	Boarder from	Length	Section	Soft layer	Ts (m) from GL	He (m) from GL	Interval (square) D (m)	Diameter d (m)	Ratio of replacement $A_s=0.785*(d/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of strength increased	Period of embank. (days)	U1	U2	Period1 (days)	Period2 (days)	Degree of consolidation U
	I+109			Layer-2			0.00	0.00	0.000	0	0.00	0.00	0.25	110	0.10	0.20	75	138	0.16
T-1-a		191	I+114	Layer-4 Layer-5 Layer-6	32.0	5.5													
	I+300																		
3) Traffic way with counter weight as frontage road width 14 m																			
Geological section	Boarder from	Length	Section	Soft layer	Ts (m) from GL	Embankment He (m) from GL	Interval (square) D (m)	Diameter d (m)	Ratio of replacement $A_s=0.785*(d/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of strength increased	Period of embank. (days)	U1	U2	Period1 (days)	Period2 (days)	Degree of consolidation U
	I+300			Layer-2			0.00	0.00	0.000	0	0.00	0.00	0.25	85	0.10	0.20	52	101	0.17
T-1-a		247	I+560	Layer-4 Layer-5 Layer-6	32.0	4.1													
	I+647																		
3) Traffic way with counter weight as frontage road width 14 m																			
	I2+060					9	0.00	0.00	0.000	0	0.00	0.00	0.25	180	0.50	0.60	173	217	0.52
						CW6													
G-2		772	12+400	Layer-2 Layer-4 Layer-5 Layer-6	16.7	8	0.00	0.00	0.000	0	0.00	0.00	0.25	160	0.40	0.50	137	169	0.47
						CW6													
						7	0.00	0.00	0.000	0	0.00	0.00	0.25	140	0.40	0.50	131	161	0.43
						CW6													
	12+832																		

2. Pretreatment sand drain																				
Geological section	Boarder from to	Length	Section	Soft layer	Geological condition	Ts (m) from GL	Embankment He (m) from GL	Interval D (m)	Diameter d (m)	Ratio of replacement $A_s=0.785(d/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of length increase	period of embankment (days)	Strength of increased for consolidation			Degree of consolidation U	
																U1	U2	Period2 (days)		
T-1-a	1+109	1,491	1+040	Layer-2 Layer-4 Layer-5 Layer-6		32.0	7	2.00 2.25 2.50	0.40 0.40 0.40	0.031 0.025 0.020	1 1 1	1.85 1.85 1.85	20.00 20.00 20.00	0.25 0.25 0.25	140 140 140	0.70 0.60 0.60	129 126 139	0.80 0.70 0.70	144 142 163	0.77 0.69 0.60
T-1-b	2+600	700	2+740	Layer-2 Layer-4 Layer-5		26.2	11	1.75 2.00 2.25	0.40 0.40 0.40	0.041 0.031 0.025	1 1 1	1.85 1.85 1.85	20.00 20.00 20.00	0.25 0.25 0.25	220 220 220	0.90 0.80 0.70	211 204 199	0.90 0.90 0.80	230 230 221	0.90 0.86 0.80
T-2	3+300	2,918	4+740	Layer-2 Layer-4 Layer-5		16.0	9	1.75 2.00 2.25	0.40 0.40 0.40	0.041 0.031 0.025	1 1 1	1.85 1.85 1.85	20.00 20.00 20.00	0.25 0.25 0.25	180 180 180	0.70 0.60 0.60	164 159 176	0.80 0.70 0.70	188 183 216	0.77 0.69 0.61
G-1-a	6+218	1,618	9+920	Layer-2 Layer-4 Layer-5		18.0	8	2.00 2.25 2.50	0.40 0.40 0.40	0.031 0.025 0.020	1 1 1	1.85 1.85 1.85	20.00 20.00 20.00	0.25 0.25 0.25	160 160 160	0.80 0.70 0.70	145 140 159	0.90 0.80 0.80	195 165 195	0.83 0.78 0.70
G-1-b	10+920	1,140	11+360	Layer-2 Layer-4 Layer-5		15.2	9	1.75 2.00 2.25	0.40 0.40 0.40	0.041 0.031 0.025	1 1 1	1.85 1.85 1.85	20.00 20.00 20.00	0.25 0.25 0.25	180 180 180	0.70 0.80 0.90	177 177 178	0.80 0.90 0.90	207 214 190	0.71 0.81 0.90
G-2	12+060	772	12+400	Layer-2 Layer-4 Layer-5 Layer-6		16.7	8	1.00 1.00	0.40 0.40	0.126 0.126	1 1	1.85 1.85	20.00 20.00	0.25 0.25	180 160	0.90 0.90	162 144	0.90 0.90	162 144	0.90 0.90
	12+832			Layer-2 Layer-4 Layer-5 Layer-6		7	7	1.75 2.00 2.25	0.40 0.40 0.40	0.041 0.031 0.025	1 1 1	1.85 1.85 1.85	20.00 20.00 20.00	0.25 0.25 0.25	140 140 140	0.90 0.90 0.80	131 138 133	0.90 0.90 0.90	156 156 156	0.90 0.90 0.83

2) Traffic way near pond										Strength of increased for consolidation										
Geological section	Boarder from	Length	Section	Geological condition Soft layer	Ts (m) from GL	Embankment He (m) from GL	Interval (square) D (m)	Diameter d (m)	Ratio of replacement $As=0.785*(d/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of ength increase m	period of		U1	Consolidation index		Degree of consolidation U	
														U1	U2		Period1 (days)	Period2 (days)		
	1+109																			
T-1-a		1,491	1+114	Layer-2 Layer-4 Layer-5 Layer-6	32.0	5.5	2.25	0.40	0.025	1	1.85	20.00	0.25		110	0.50	108	0.60	124	0.51
	2+600																			
3) Traffic way with counter weight as frontage road width 14 m										Strength of increased for consolidation										
Geological section	Boarder from	Length	Section	Geological condition Soft layer	Ts (m) from GL	Embankment He (m) from GL	Interval (square) D (m)	Diameter d (m)	Ratio of replacement $As=0.785*(d/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of ength increase m	period of		U1	Consolidation index		Degree of consolidation U	
														U1	U2		Period1 (days)	Period2 (days)		
	1+030																			
T-1-a		1,570	1+560	Layer-2 Layer-4 Layer-5 Layer-6	32.0	4.1	2.25	0.40	0.025	1	1.85	20.00	0.25		85	0.50	78	0.60	91	0.55
	2+600																			
3) Traffic way with counter weight as frontage road width 14 m										Strength of increased for consolidation										
Geological section	Boarder from	Length	Section	Geological condition Soft layer	Ts (m) from GL	Embankment He (m) from GL	Interval (square) D (m)	Diameter d (m)	Ratio of replacement $As=0.785*(d/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of ength increase m	period of		U1	Consolidation index		Degree of consolidation U	
														U1	U2		Period1 (days)	Period2 (days)		
	12+060																			
G-2		772	12+400	Layer-2 Layer-4 Layer-5 Layer-6	16.7	9	1.50 1.75 2.00	0.40 0.40 0.40	0.056 0.041 0.031	1 1 1	1.85 1.85 1.85	20.00 20.00 20.00	0.25 0.25 0.25		160 160 160	0.90 0.90 0.90	161 166 175	0.90 0.90 0.90		0.90 0.90 0.90
	12+832																			

4) Ramp way		Boarder		Geological condition		Embankment		Sand drain pile		Strength of increased for consolidation		Degree of consolidation									
Geological section	from	Length	Section	Soft layer	Geological condition	He (m) from GL	He (m) from GL	Interval D (m)	Diameter d (m)	Ratio of replacement $A_s=0.785*(d/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of length increase embankment m	period of period of embankment (days)	U1	Period1 (days)	U2	Period2 (days)	Degree of consolidation	
	to							(square)												U	
	1+109			Layer-2				2.25	0.40	0.025	1	1.85	20.00	0.25	160	0.70	153	0.80	176	0.73	
T-1-a		1,491	1+040	Layer-4		8		2.50	0.40	0.020	1	1.85	20.00	0.25	160	0.60	150	0.70	171	0.65	
				Layer-5				2.75	0.40	0.017	1	1.85	20.00	0.25	160	0.50	145	0.60	165	0.58	
				Layer-6																	
	2+600																				
	9+302																				
						9		1.75	0.40	0.041	1	1.85	20.00	0.25	180	0.90	156	0.90	178	0.90	
								2.00	0.40	0.031	1	1.85	20.00	0.25	180	0.90	180	0.90	175	0.90	
								2.25	0.40	0.025	1	1.85	20.00	0.25	180	0.80	176	0.90	219	0.81	
				Layer-2																	
G-1-a		0	9+920	Layer-4		18.0		2.00	0.40	0.031	1	1.85	20.00	0.25	160	0.80	154	0.90	178	0.83	
				Layer-5				2.25	0.40	0.025	1	1.85	20.00	0.25	160	0.70	154	0.80	175	0.73	
						8		2.50	0.40	0.020	1	1.85	20.00	0.25	160	0.60	153	0.70	174	0.63	
	10+920																				
	12+060																				
						8		1.00							160						
				Layer-2																	
G-2		772	12+400	Layer-4		16.7		1.75	0.40	0.041	1	1.85	20.00	0.25	140	0.90	144	0.90		0.90	
				Layer-5				2.00	0.40	0.041	1	1.85	20.00	0.25	140	0.90	138	0.90		0.90	
				Layer-6				2.25	0.40	0.041	1	1.85	20.00	0.25	140	0.80	133	0.90	157	0.83	
	12+832																				
5) Ramp way with counter weight as 10 m width																					
Geological section	Boarder	Length	Section	Soft layer	Geological condition	Embankment	He (m) from GL	Interval D (m)	Diameter d (m)	Ratio of replacement $A_s=0.785*(d/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of length increase embankment m	period of period of embankment (days)	U1	Period1 (days)	U2	Period2 (days)	Degree of consolidation	
	from	to						(square)												U	
	12+060																				
G-2		772	12+400	Layer-2		8		1.50	0.40	0.056	1	1.85	20.00	0.25	160	0.90	159	0.90		0.90	
				Layer-4				1.75	0.40	0.041	1	1.85	20.00	0.25	160	0.80	142	0.90	165	0.88	
				Layer-5		(CW6)		2.00	0.40	0.031	1	1.85	20.00	0.25	160	0.80	150	0.90	173	0.84	
				Layer-6																	
	12+832																				

3. Pretreatment plastic board drain																				
1) Traffic way																				
Geological section	Boarder from	Length	Section	Geological condition	Soft layer	Ts (m) from GL	Embankment He (m) from GL	Plastic board drain pile			Strength of increased for consolidation			Degree of consolidation						
								Interval (square)	Diameter d (m)	Ratio of replacement $\lambda_s=0.785 \cdot (d/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle		Rate of length increment	period of U1 (days)	Consolidation index U2	Period2 (days)	U	
	1+109			Layer-2				0.75	0.10	0.000	0	0.00	0.00	0.25	140	0.70	124	0.80	180	0.73
T-1-a	1+491	1+040		Layer-4	32.0		7	1.00	0.10	0.000	0	0.00	0.00	0.25	140	0.70	127	0.80	187	0.72
				Layer-5				1.25	0.10	0.000	0	0.00	0.00	0.25	140	0.70	137	0.80	216	0.70
				Layer-6																
	2+600																			
	2+600			Layer-2				0.75	0.10	0.000	0	0.00	0.00	0.25	220	0.80	197	0.90	339	0.82
T-1-b	700	2+740		Layer-4	26.2		11	1.00	0.10	0.000	0	0.00	0.00	0.25	220	0.80	201	0.90	339	0.81
				Layer-5				1.25	0.10	0.000	0	0.00	0.00	0.25	220	0.80	213	0.90	347	0.81
	3+300																			
	3+300			Layer-2				1.25	0.10	0.000	0	0.00	0.00	0.25	180	0.70	166	0.80	193	0.75
T-2	2,918	4+740		Layer-4	16.0		9	1.50	0.10	0.000	0	0.00	0.00	0.25	180	0.60	165	0.70	193	0.65
				Layer-5				1.75	0.10	0.000	0	0.00	0.00	0.25	180	0.50	158	0.60	188	0.57
	6+218																			
	9+302			Layer-2				1.25	0.10	0.000	0	0.00	0.00	0.25	160	0.90	155	0.90		0.90
G-1-a	1,618	9+920		Layer-4	18.0		8	1.50	0.10	0.000	0	0.00	0.00	0.25	160	0.80	151	0.90	187	0.83
				Layer-5				1.75	0.10	0.000	0	0.00	0.00	0.25	160	0.70	150	0.80	181	0.73
	10+920																			
	10+920			Layer-2				1.25	0.10	0.000	0	0.00	0.00	0.25	180	0.90	180	0.90		0.90
G-1-b	1,140	11+360		Layer-4	15.2		9	1.50	0.10	0.000	0	0.00	0.00	0.25	180	0.70	166	0.80	184	0.78
				Layer-5				1.75	0.10	0.000	0	0.00	0.00	0.25	180	0.60	168	0.90	189	0.77
	12+060																			
	12+060						9	0.75	0.10	0.000	0	0.00	0.00	0.25	180	0.90	163	0.90		0.90
								2.75	0.10											
G-2	772	12+400		Layer-2			8	0.75	0.10	0.000	0	0.00	0.00	0.25	160	0.90	145	0.90		0.90
				Layer-4	16.7			2.50	0.10											
				Layer-5																
				Layer-6																
								1.50	1.00	0.000	0	0.00	0.00	0.25	140	0.90	140	0.90		0.90
							7	1.75	1.00	0.000	0	0.00	0.00	0.25	140	0.80	138	0.90	172	0.81
								2.50	1.00	0.000	0	0.00	0.00	0.25	140	0.50	126	0.60	144	0.58
	12+832																			

3) Ramp way Geological section	Boarder from	Boarder to	Length	Section	Geological condition Soft layer	Ts (m) from GL	Embankment He (m) from GL	Interval D (m)	Diameter d (m)	Ratio of replacement $A_s=0.785*(D/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of length increase	period of embankment (days)	Strength of increased for consolidation		Degree of consolidation U			
																U1	U2				
T-1-a	1+030	1+040	1,570	1+040	Layer-2 Layer-4 Layer-5 Layer-6	32.0	8	0.75	0.10	0.000	0	0.00	0.00	0.25	160	0.80	0.90	1,415	0.80		
G-1-a	2+600	9+298	0	9+298	Layer-2 Layer-4 Layer-5	18.0	9	1.00 1.25 1.50	0.10 0.10 0.10	0.000 0.000 0.000	0 0 0	0.00 0.00 0.00	0.00 0.00 0.00	0.25 0.25 0.25	180 180 180	0.90 0.90 0.80	0.90 0.90 0.90	147 157 159	0.90 0.90 0.90	192	0.86
	10+920	12+060					8	1.25 1.50 1.75	0.10 0.10 0.10	0.000 0.000 0.000	0 0 0	0.00 0.00 0.00	0.00 0.00 0.00	0.25 0.25 0.25	160 160 160	0.90 0.80 0.60	0.90 0.90 0.70	157 158 147	0.90 0.90 0.70	163	0.68
G-2	12+868	12+868	808	12+400	Layer-2 Layer-4 Layer-5 Layer-6	16.7	7	1.25 1.50 1.75	0.10 0.10 0.10	0.000 0.000 0.000	0 0 0	0.00 0.00 0.00	0.00 0.00 0.00	0.25 0.25 0.25	140 140 140	0.90 0.90 0.80	0.90 0.90 0.90	132 140 138	0.90 0.90 0.90	172	0.81
4) Ramp way with counter weight as 10 m width Geological section	Boarder from	Boarder to	Length	Section	Geological condition Soft layer	Ts (m) from GL	Embankment He (m) from GL	Interval D (m)	Diameter d (m)	Ratio of replacement $A_s=0.785*(D/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of length increase	period of embankment (days)	Strength of increased for consolidation		Degree of consolidation U			
																U1	U2	(days)	U		
G-2	12+060	12+868	808	12+400	Layer-2 Layer-4 Layer-5 Layer-6	16.7	8 (CW/6)	1.00 1.25 1.50	0.10 0.10 0.10	0.000 0.000 0.000	0 0 0	0.00 0.00 0.00	0.00 0.00 0.00	0.25 0.25 0.25	160 160 160	0.90 0.80 0.80	0.90 0.90 0.90	158 143 154	0.90 0.90 0.90	176	0.83

Case 2		1. No pretreatment		1) Traffic way		Geological section		Boarder		Geological condition		Embankment		No pretreatment		Strength of increased for consolidation		Degree of consolidation			
Geological section	Boarder from	Length	Section	Soft layer	Ts (m) from GL	He (m) from GL	He (m) from GL	Interval D (m)	Diameter d (m)	Ratio of replacement $A_s=0.785*(d/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of strength increased	Period of embankment (days)	U1	U2	Period1 (days)	Period2 (days)		
	1+109																				
T-1-a	1+491	1+040		Layer-2 Layer-4 Layer-5 Layer-6	32.0	7		0.00	0.00	0.000	0	0.00	0.00	0.25	140	0.10	0.20	82	0.20	142	0.20
	2+600																				
Case 2		2. Pretreatment sand drain		1) Traffic way		Geological section		Boarder		Geological condition		Embankment		Sand drain pile		Strength of increased for consolidation		Degree of consolidation			
Geological section	Boarder from	Length	Section	Soft layer	Ts (m) from GL	He (m) from GL	He (m) from GL	Interval D (m)	Diameter d (m)	Ratio of replacement $A_s=0.785*(d/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of strength increased	Period of embankment (days)	U1	U2	Period1 (days)	Period2 (days)		
	1+109																				
T-1-a	1+491	1+040		Layer-2 Layer-4 Layer-5 Layer-6	32.0	7		2.25 2.50 2.75	0.40 0.40 0.40	0.025 0.020 0.017	1 1 1	1.85 1.85 1.85	20.00 20.00 20.00	0.25 0.25 0.25	140 140 140	0.90 0.80 0.70	0.90 0.90 0.80	136 133 126	0.90 160 140	0.90 0.83 0.80	
	2+600																				
Case 2		3. Pretreatment plastic board drain		1) Traffic way		Geological section		Boarder		Geological condition		Embankment		Plastic board drain pile		Strength of increased for consolidation		Degree of consolidation			
Geological section	Boarder from	Length	Section	Soft layer	Ts (m) from GL	He (m) from GL	He (m) from GL	Interval D (m)	Diameter d (m)	Ratio of replacement $A_s=0.785*(d/D)^2$	Shear ratio of drain pile	Saturated unit weight	Internal friction angle	Rate of strength increased	Period of embankment (days)	U1	U2	Period1 (days)	Period2 (days)		
	1+109																				
T-1-a	1+491	1+040		Layer-2 Layer-4 Layer-5 Layer-6	32.0	7		0.75 1.00 1.25	0.10 0.10 0.10	0.000 0.000 0.000	0 0 0	0.00 0.00 0.00	0.00 0.00 0.00	0.25 0.25 0.25	140 140 140	0.80 0.80 0.80	0.90	135 135 135	0.90 1.077 1.077	0.80 0.80 0.80	
	2+600																				

Appendix 3.3.27 Results of calculation for ground stability

1. Traffic way		Elevation		Construction		No treatment		Sand drain			Plastic board drain					
from	to	Analysis location (STA)	Ground (EL)	Frontage road (EL)	Height of embank. (m)	period of embankment (days)	Stability Fs	Moment (tfm)	Interval (m)	Depth (m)	Fs	Moment (tfm)	Interval (m)	Depth (m)	Fs	Moment (tfm)
Geological sections		(STA)	(EL)	(EL)	(m)	(days)	Resisted	Sliding	(m)	(m)	Resisted	Sliding	(m)	(m)	Resisted	Sliding
T-1-a	1+109	1+040	5.1	6.0	7.0	140	0.723	6,680	2.00	30.00	1.275	12,126	0.75	20.00	1.012	9,908
	2+600								2.25	30.00	1.230	11,095	1.00	20.00	1.010	9,884
	2+600								2.50	30.00	1.180	11,214	1.25	20.00	1.005	9,835
T-1-b	2+740	2+740	2.0	6.0	11.0	220	0.508	5,770	1.75	30.00	1.235	16,727	0.75	20.00	0.740	9,141
	3+300								2.00	30.00	1.203	16,287	1.00	20.00	0.738	9,118
	3+300								2.25	30.00	1.161	15,711	1.25	20.00	0.738	9,118
T-2	4+740	4+740	2.8	6.0	9.0	180	0.687	3,217	1.75	16.00	1.303	6,716	1.25	16.00	1.268	6,338
	6+218								2.00	16.00	1.246	6,026	1.50	16.00	1.201	5,813
	9+302								2.25	16.00	1.187	5,757	1.75	16.00	1.146	5,550
G-1-a	9+920	9+920	3.2	6.0	8.0	160	0.674	2,520	2.00	18.00	1.282	6,311	1.25	18.00	1.302	6,401
	10+920								2.25	18.00	1.240	5,894	1.50	18.00	1.290	6,343
	10+920								2.50	18.00	1.189	5,057	1.75	18.00	1.199	5,698
G-1-b	11+360	11+360	4.0	9.0	9.0	180	0.737	2,980	1.75	16.00	1.285	7,443	1.25	16.00	1.278	7,399
	12+060								2.00	16.00	1.238	7,170	1.50	16.00	1.215	7,039
	12+060								2.25	16.00	1.186	6,869	1.75	16.00	1.153	6,678
G-2	12+400	12+400	3.7	8.0	8.0	160	0.499	1,657	1.00	16.70	1.087	5,332	0.75	16.70	1.048	5,141
									2.75	16.70	0.894	4,206	2.75	16.70	0.894	4,206
									1.00	16.70	1.189	4,991	0.75	16.70	1.118	4,908
									2.50	16.70	0.949	4,166	2.50	16.70	0.949	4,166
									1.75	16.70	1.227	4,916	1.50	16.70	1.211	4,854
									2.00	16.70	1.223	4,901	1.75	16.70	1.158	4,046
									2.25	16.70	1.150	4,021	2.50	16.70	1.017	3,558
	12+832															
Bold : Countermeasure recommended																
(Near pond)																

1. Traffic way center from		Elevation		Settlement analysis		Ground stability analysis		Comprehensive countermeasure															
Geological sections	Analysis location	Frontage road	Height of embank.	Settlement analysis		Ground stability analysis		Comprehensive countermeasure															
				No pretreatment	Residual settlement 450 days	Sand drain Interval	Paper drain Interval	No pretreatment	Residual settlement 450 days	Sand drain Interval	Plastic board drain Interval												
				Final (cm)	Residual (cm)	(m)	(m)	Final (cm)	Residual settlement 450 days (cm)	Sand drain Depth (m)	Plastic board drain Depth (m)	Final (cm)	Residual settlement 450 days (cm)										
T-1-a	1+040	5.1	6	150.404	51.316	99.088	2.50	30.0	1.840	0.75	20.0	23.461	140	0.723	1.15	30.0	1.230	2.25	30.0	1.230	1.648		
T-1-b	2+740	2.0	6	184.181	46.190	137.991	2.75	26.5	0.996	0.75	20.0	13.417	220	0.508	2.00	26.5	1.203	2.00	26.5	1.203	0.001		
T-2	4+740	2.8	6	113.694	43.965	69.729	2.00	16.0	0.555	1.50	16.0	0.935	180	0.687	2.00	16.0	1.201	1.50	16.0	1.201	0.955		
G-1-a	9+920	3.2	6	121.571	49.571	72.000	2.75	18.0	1.166	2.00	18.0	0.900	160	0.574	2.25	18.0	1.240	1.50	18.0	1.240	0.018		
G-1-b	11+360	4.0	9.0	103.054	48.094	54.960	2.75	15.0	1.963	2.00	16.0	1.544	180	0.737	2.00	16.0	1.238	1.50	16.0	1.238	0.031		
G-2	12+400	3.7	8.0	86.754	76.379	10.375	3.50	17.0	1.898	2.75	17.0	1.984	180	0.500	1.00	17.0	1.087	0.75	17.0	1.048			
12+832				80.060	70.230	9.830	3.50	17.0	1.767	2.50	17.0	0.978	140	0.636	2.00	17.0	1.223	1.50	17.0	1.211	0.001		
Bold : Recommendation																							
(Near pond)																							
Geological sections	Analysis location	Frontage road	Height of embank.	Settlement analysis		Ground stability analysis		Comprehensive countermeasure															
				No pretreatment	Residual settlement 450 days	Sand drain Interval	Paper drain Interval	No pretreatment	Residual settlement 450 days	Sand drain Interval	Plastic board drain Interval												
				Final (cm)	Residual (cm)	(m)	(m)	Final (cm)	Residual settlement 450 days (cm)	Sand drain Depth (m)	Plastic board drain Depth (m)	Final (cm)	Residual settlement 450 days (cm)										
T-1-a	1+114	5.1	6	5.5																			
T-1-a	1+560	5.1	6	4.1																			
Bold : Recommendation																							

3) Ramp way		Geological section		Boarder of countermeasure		Average		Soft layer thickness		Average of ground level		Traffic		Counter weight		Width		Length of boarder to boarder		Area of boarder		Interval		Sand drain (D=0.4 m)		Plastic board drain (D=0.1 m)		(Unit: m or m ²)					
from	to	Begining	End	Length	He	from GL	to GL	from GL	to GL	Shoulder	Slope	Shoulder	Slope	Counter weight	Shoulder	Slope	Counter weight	Shoulder	Slope	boarder	boarder	Interval	Interval	x-side	y-side	x-side	y-side	Length	Total	Length	Total		
	9+302	0+000	0+240	240	3	18.0	8.0	10.0	6.0	10.0	6.0	10.0	6.0	40.0	8.0	40.0	240	9,600					1.00	40	240	9,600	17.0	163,200					
		0+240	0+920	680	2	18.0	4.0	10.0	2.0	10.0	6.0	10.0	6.0	36.0	8.0	36.0	680	24,480					1.00	36	680	24,480	17.0	418,180					
	G-1-a	0+000	0+260	260	3	18.0	8.0	10.0	6.0	10.0	6.0	10.0	6.0	40.0	8.0	40.0	260	10,400					1.00	40	260	10,400	17.0	176,800					
		0+260	0+920	660	2	18.0	4.0	10.0	2.0	10.0	6.0	10.0	6.0	36.0	8.0	36.0	660	24,840					1.00	36	660	24,840	17.0	422,280					
	10+920																																
	G-2	0+000	0+350	350	4	17.0	3.5	10.0	10.0	10.0	6.0	10.0	6.0	44.0	8.0	44.0	350	15,400					1.00	44	350	15,400	17.0	261,800					
		0+350	0+832	482	4	17.0	3.5	10.0	10.0	10.0	6.0	10.0	6.0	44.0	8.0	44.0	350	15,400					1.00	44	350	15,400	17.0	261,800					
	Total			2,570													2,570	100,120					0				100,120	17.0	1,702,040				
4) Total of G1a Lam side																																	
Traffic way																																	
Counter weight																																	
Ramp way																																	
Grand total																																	
																	2,556	143,989					0				63,921	1,114,672					
																	372	14,136					0				100,120	1,702,040					
																	2,570	100,120					0				164,041	2,816,712					
																	5,498	238,245					0										
3 Grand total																																	
Geological section																																	
Traffic way																																	
Counter weight																																	
Ramp way																																	
Grand total																																	
																	7,448	549,083					31,493			894,351							
																	372	14,136					0				139,920						
																	5,840	187,540					13,560			406,800							
																	13,660	750,739					49,717			1,441,271							
3 Grand total																																	
Geological section																																	
Traffic way																																	
Counter weight																																	
Ramp way																																	
Grand total																																	
																	13,660	750,739					49,717			1,441,271							
																	7,448	549,083					31,493			894,351							
																	372	14,136					0			139,920							
																	5,840	187,540					13,560			406,800							
																	13,660	750,739					49,717			1,441,271							
3 Grand total																																	

Appendix 3.3.30 Roughly estimation of earth work volume

1) Traffic way	from	to	Embankment section	Length of embankment section	Average height of embankment	Embankment form				Width				Cross section area				Volume of embankment									
						Traffic way		Slope		Traffic way		Slope		Height of embankment	Prontage road	Total area	Final		Area of settlement		Volume of settlement						
						Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom				Traffic center	Prontage center	Traffic way	Shoulder	Prontage	Slope	Traffic way	Shoulder			
T-1-a	1+109	1+180	71	4.5	6	9.0	26.5	26.5	44.5	3.0	14.0	72.5	78.5	4.5	159.8	1.5	113.3	273.0	19.383	150.404	48.185	39.9	8.9	13.5	3.464	9.58	
	1+180	1+430	160	4.5	6	4.0	26.5	26.5	36.5	3.0	14.0	64.5	70.5	2.5	78.8	1.5	101.3	180.0	28.800	150.404	48.185	39.9	5.0	13.5	7.171	2.159	
	1+430	1+660	120	4.5	6	2.0	26.5	26.5	28.5	3.0	14.0	64.5	70.5	0.5	13.8	1.5	89.3	103.0	12.560	150.404	48.185	39.9	1.0	13.5	4.002	1.619	
	1+660	1+900	40	4.5	6	4.0	26.5	26.5	36.5	3.0	14.0	64.5	70.5	2.5	78.8	1.5	101.3	180.0	26.460	150.404	48.185	39.9	5.0	13.5	1.783	5.40	
	1+900	1+647	147	4.5	6	4.0	26.5	26.5	36.5	3.0	14.0	64.5	70.5	2.5	78.8	1.5	101.3	180.0	26.460	150.404	48.185	39.9	5.0	13.5	6.589	1.983	
	1+647	1+764	117	4.5	6	4.0	26.5	26.5	36.5	3.0	14.0	64.5	70.5	2.5	78.8	1.5	101.3	180.0	136.080	150.404	48.185	39.9	5.0	13.5	33.885	10.200	
	1+764	2+520	756	4.5	6	4.0	26.5	26.5	34.5	3.0	14.0	72.5	78.5	4.5	159.8	1.5	113.3	273.0	16.380	150.404	48.185	39.9	8.9	13.5	2.928	8.10	
	2+520	2+580	60	4.5	6	8	13.0	26.5	26.5	52.5	3.0	14.0	80.5	86.5	6.5	256.8	1.5	123.3	382.0	7.640	150.404	48.185	39.9	12.9	13.5	1.055	2.70
	2+580	2+600	20	4.5	6																						
	2+600	2+600																									
	2+600	2+620	20	3.0	6	8	10.0	26.5	26.5	46.5	6.0	14.0	74.5	86.5	5.0	182.5	3.0	241.5	424.0	8.480	184.181	90.666	48.8	13.7	25.4	1.251	5.08
	2+620	2+775	155	3.0	6	10	14.0	26.5	26.5	34.5	6.0	14.0	82.5	94.5	7.0	283.5	3.0	265.5	549.0	85.095	184.181	90.666	48.8	19.2	25.4	10.547	3.935
	2+775	2+825	50	3.0	6	8	10.0	26.5	26.5	46.5	6.0	14.0	74.5	86.5	5.0	182.5	3.0	241.5	424.0	57.240	184.181	90.666	48.8	13.7	25.4	8.444	3.427
	2+825	2+960	135	3.0	6	6	6.0	26.5	26.5	38.5	6.0	14.0	66.5	78.5	3.0	97.5	3.0	217.5	315.0	12.600	184.181	90.666	48.8	8.2	25.4	2.282	1.015
	2+960	3+000	40	3.0	6	4	2.0	26.5	26.5	30.5	6.0	14.0	53.5	70.5	1.0	28.5	3.0	193.5	222.0	13.320	184.181	90.666	48.8	2.7	25.4	3.093	1.523
	3+000	3+100	40	3.0	6	4	2.0	26.5	26.5	30.5	6.0	14.0	53.5	70.5	1.0	28.5	3.0	193.5	222.0	8.880	184.181	90.666	48.8	2.7	25.4	2.062	1.015
	3+100	3+180	40	3.0	6	2	-2.0	26.5	26.5	22.5	6.0	14.0	50.5	62.5	-1.0	-24.5	3.0	169.5	145.0	11.600	184.181	90.666	48.8	-2.7	25.4	3.885	2.031
	3+180	3+220	40	3.0	6	4	2.0	26.5	26.5	30.5	6.0	14.0	53.5	70.5	1.0	28.5	3.0	193.5	222.0	8.880	184.181	90.666	48.8	2.7	25.4	2.062	1.015
	3+220	3+300	80	3.0	6	6	6.0	26.5	26.5	38.5	6.0	14.0	66.5	78.5	3.0	97.5	3.0	217.5	315.0	25.200	184.181	90.666	48.8	8.2	25.4	4.564	2.031
	3+300	3+300																									
	3+300	3+510	210	4.0	6	6	8.0	26.5	26.5	42.5	4.0	14.0	70.5	78.5	4.0	138.0	2.0	149.0	287.0	60.270	113.694	56.465	30.1	6.8	15.8	7.256	3.320
	3+510	3+560	50	4.0	6	4	4.0	26.5	26.5	34.5	4.0	14.0	62.5	70.5	2.0	61.0	2.0	139.0	194.0	9.700	113.694	56.465	30.1	3.4	15.8	1.677	791
	3+560	3+800	240	4.0	6	4	4.0	26.5	26.5	34.5	4.0	14.0	62.5	70.5	2.0	61.0	2.0	139.0	194.0	46.560	113.694	56.465	30.1	3.4	15.8	8.048	3.784
	3+800	3+810	10	4.0	6	4	4.0	26.5	26.5	34.5	4.0	14.0	62.5	70.5	2.0	61.0	2.0	139.0	194.0	1.940	113.694	56.465	30.1	3.4	15.8	3.35	1.58
	3+810	3+860	50	4.0	6	6	8.0	26.5	26.5	42.5	4.0	14.0	70.5	78.5	4.0	138.0	2.0	149.0	287.0	14.350	113.694	56.465	30.1	6.8	15.8	1.847	791
	3+860	3+900	40	4.0	6	6	8.0	26.5	26.5	42.5	4.0	14.0	70.5	78.5	4.0	138.0	2.0	149.0	287.0	34.440	113.694	56.465	30.1	6.8	15.8	4.432	1.897
	3+900	4+020	120	4.0	6	6	8.0	26.5	26.5	42.5	4.0	14.0	70.5	78.5	2.0	61.0	2.0	139.0	194.0	17.460	113.694	56.465	30.1	3.4	15.8	4.821	2.530
	4+020	4+110	90	4.0	6	4	4.0	26.5	26.5	34.5	4.0	14.0	62.5	70.5	2.0	61.0	2.0	139.0	194.0	18.720	113.694	56.465	30.1	3.4	15.8	5.365	2.055
	4+110	4+160	50	4.0	6	4	4.0	26.5	26.5	34.5	4.0	14.0	62.5	70.5	2.0	61.0	2.0	139.0	194.0	31.040	113.694	56.465	30.1	3.4	15.8	4.359	2.055
	4+160	4+320	160	4.0	6	4	4.0	26.5	26.5	34.5	4.0	14.0	62.5	70.5	2.0	61.0	2.0	139.0	194.0	25.220	113.694	56.465	30.1	3.4	15.8	5.365	2.055
	4+320	4+490	170	4.0	6	4	4.0	26.5	26.5	34.5	4.0	14.0	62.5	70.5	2.0	61.0	2.0	139.0	194.0	28.700	113.694	56.465	30.1	6.8	15.8	3.691	1.58
	4+490	4+620	130	4.0	6	6	8.0	26.5	26.5	42.5	4.0	14.0	70.5	78.5	4.0	138.0	2.0	149.0	287.0	39.960	113.694	56.465	30.1	6.8	15.8	4.03	1.58
	4+620	4+730	110	4.0	6	8	12.0	26.5	26.5	50.5	4.0	14.0	78.5	86.5	6.0	231.0	2.0	169.0	386.0	31.960	113.694	56.465	30.1	10.2	15.8	5.244	2.055
	4+730	4+740	10	4.0	6	8	12.0	26.5	26.5	50.5	4.0	14.0	78.5	86.5	6.0	231.0	2.0	169.0	386.0	14.350	113.694	56.465	30.1	6.8	15.8	1.847	791
	4+740	4+870	130	4.0	6	6	8.0	26.5	26.5	42.5	4.0	14.0	70.5	78.5	4.0	138.0	2.0	149.0	287.0	21.340	113.694	56.465	30.1	3.4	15.8	1.677	791
	4+870	4+920	50	4.0	6	6	8.0	26.5	26.5	42.5	4.0	14.0	70.5	78.5	4.0	138.0	2.0	149.0	287.0	21.340	113.694	56.465	30.1	3.4	15.8	1.677	791
	4+920	5+080	160	4.0	6	4	4.0	26.5	26.5	34.5	4.0	14.0	62.5	70.5	2.0	61.0	2.0	139.0	194.0	9.700	113.694	56.465	30.1	3.4	15.8	1.677	791
	5+080	5+190	110	4.0	6	4	4.0	26.5	26.5	34.5	4.0	14.0	62.5	70.5	2.0	61.0	2.0	139.0	194.0	21.340	113.694	56.465	30.1	3.4	15.8	1.677	791
	5+190	5+520	330	4.0	6	4	4.0	26.5	26.5	42.5	4.0	14.0	70.5	78.5	2.0	61.0	2.0	139.0	194.0	94.710	113.694	56.465	30.1	6.8	15.8	12.189	1.739
	5+520	5+606	86	4.0	6	8	12.0	26.5	26.5	50.5	4.0	14.0	78.5	86.5	6.0	231.0	2.0	169.0	386.0	34.056	113.694	56.465	30.1	10.2	15.8	3.469	1.360
	5+606	5+655	49	4.0	6	8	12.0	26.5	26.5	50.5	4.0	14.0	78.5	86.5	6.0	231.0	2.0	169.0	386.0	85.140	113.694	56.465	30.1	10.2	15.8	8.673	3.392
	5+655	5+870	215	4.0	6	8	12.0	26.5	26.5	42.5	4.0	14.0	70.5	78.5	4.0	138.0	2.0	149.0	287.0	25.830	113.694	56.465	30.1	6.8	15.8	3.304	1.423
	5+870	5+960	90	4.0	6	4	4.0	26.5	26.5	34.5	4.0	14.0	62.5	70.5	2.0	61.0	2.0	139.0	194.0	40.740	113.694	56.465	30.1	3.4	15.8	7.042	3.320
	5+960	6+170	210	4.0	6	4	4.0	26.5	26.5	34.5	4.0	14.0	62.5	70.5	2.0	61.0	2.0	139.0	194.0								

APPENDIX 2 Chapter 8 Detailed Design of Drainage System

- 8.1 Evaluation of Drainage Facilities
 - 8.1.1 Drainage Facilities Arrangement on the Road
 - 8.1.2 Drainage Facilities on Throughway
 - 8.1.3 Frontage Road Drainage

- 8.2 Rainfall Data and Probability Calculation
 - 8.2.1 Rainfall Probability
 - 8.2.2 Rainfall Data

- 8.3 Rainfall Discharge Calculation
 - 8.3.1 Discharge calculation for Road Crossing
 - 8.3.2 Discharge calculation for Road Side Drain

CHAPTER 8 DETAILED DESIGN OF DRAINAGE SYSTEM

8.1 Evaluation of Drainage Facilities

8.1.1 Drainage Facilities Arrangement on the Road

In order to retain the smooth traffic for vehicles, motorcycles and so on, the following drainage facilities shall be introduced on the planned through way and frontage road for the Project. Consequently their dimension and installation interval are basically evaluated in comparison with the calculated runoff discharge from their catchment area as follows and then reflected in the drainage system.

Basic arrangement of the drainage facilities is shown in Figure 8.1.1 Schematic Road Drainage in the Report (attached as the reference) and the detailed drainage facilities arrangement including the road side drain and road crossing are shown in the drainage system of the detailed drawings compiled separately.

8.1.2 Drainage Facilities on Throughway

(1) Median Drainage

The drainage facilities for draining out the runoff through the median have to be considered and introduced, in case at the stretch of super-elevation in road formation. The dimensions of channel and interval of catch basin for the median drainage are as follows;

-Median Drainage Channel : 300mm*300mm (This dimension was decided in terms of safety side. Refer to Figure A 8.1.1, Table A 8.1.1)

-Median Catch Basin : about 100m interval installation(Refer to Figure A 8.1.1, Table A 8.1.1)

(2) Shoulder Catch Basin for Throughway Drainage

To drain out the runoff born on the throughway, road shoulder catch basin, which collects the runoff to be introduced along asphalt curb, shall be installed on the throughway's shoulder. The interval of road shoulder catch basin are as follows;

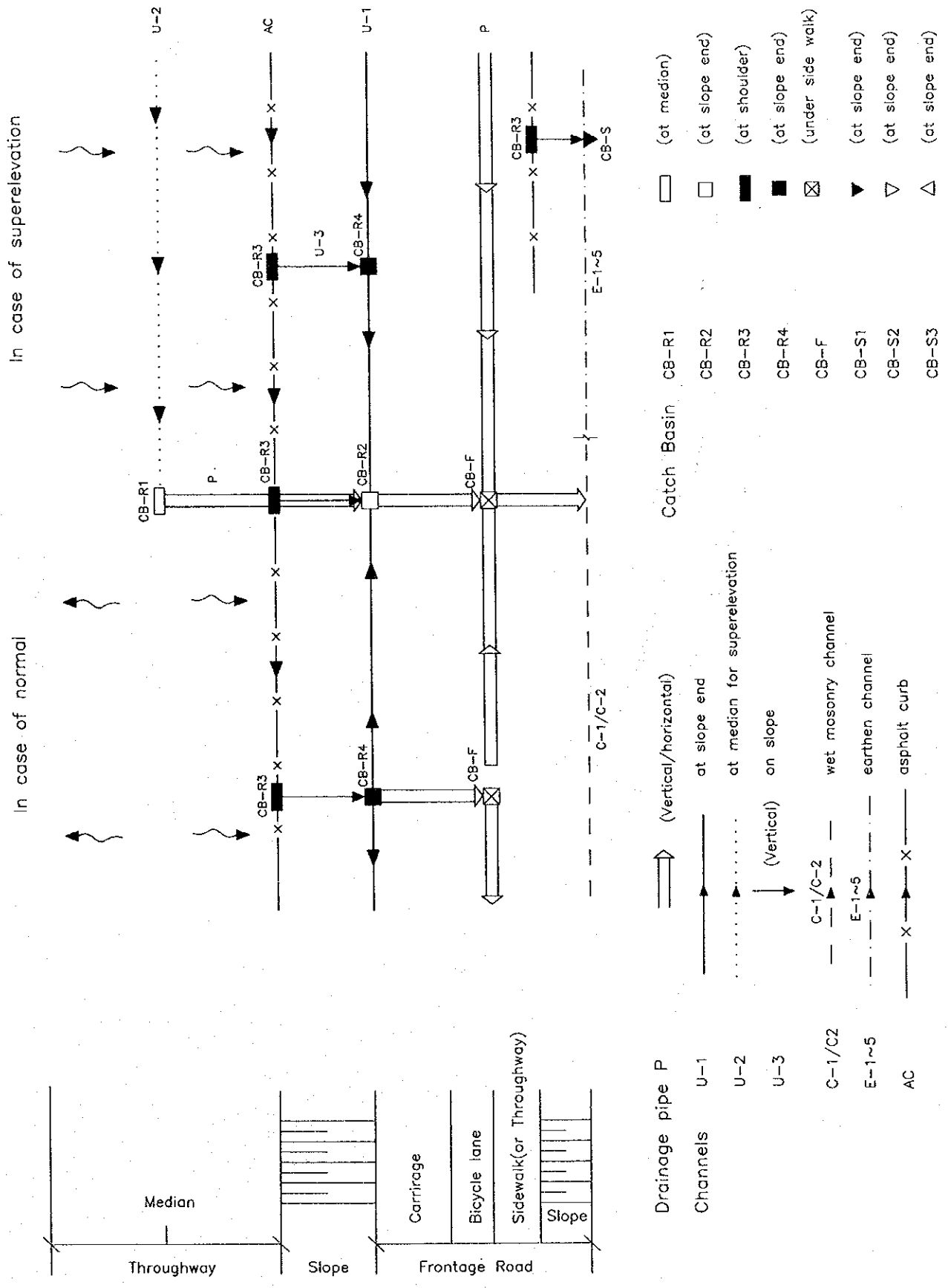


Figure 8.1.2 Schematic Road Drainage

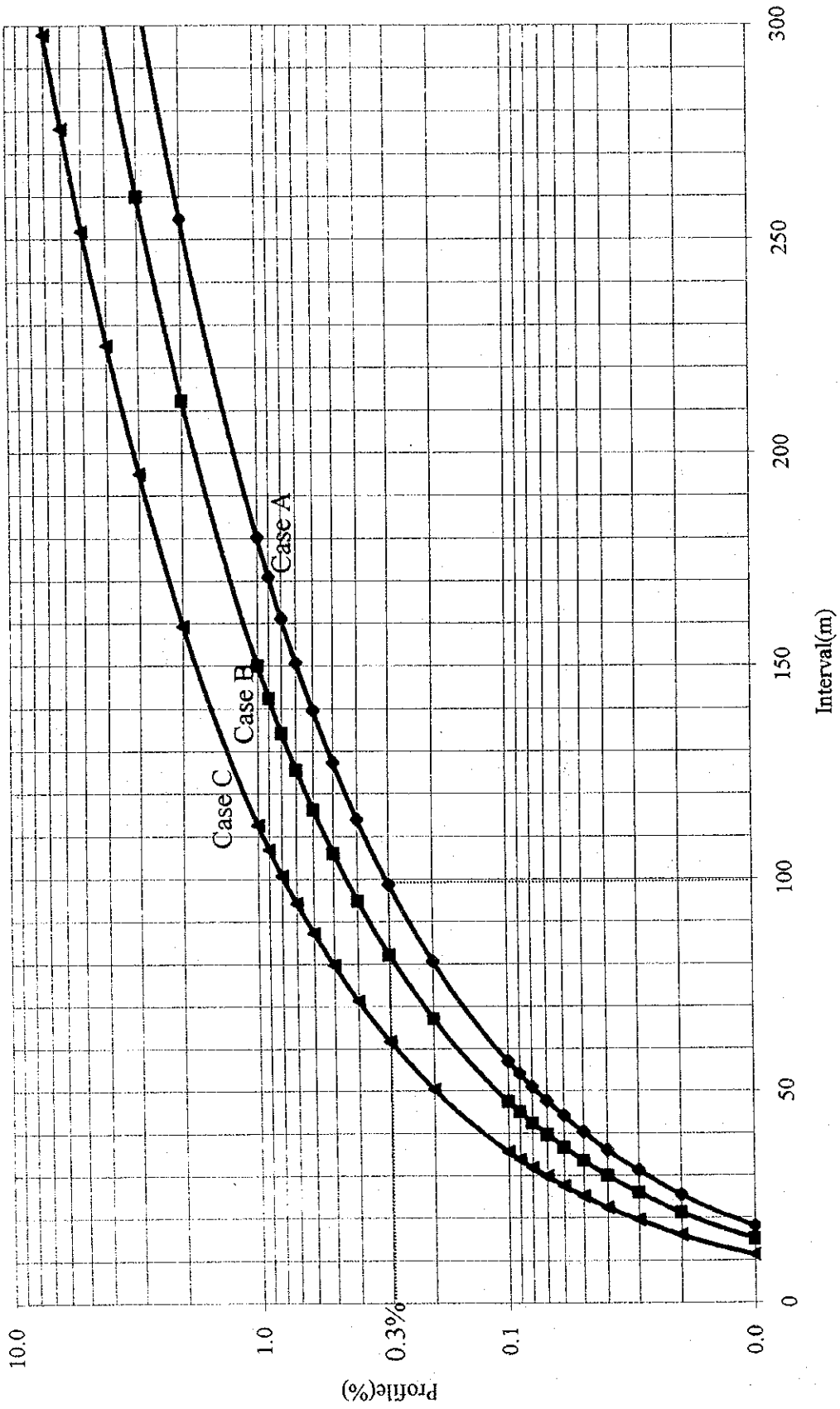


Figure A 8.1.1 Median Drainage

Table A 8.1.1 Median Drainage(taking 80% water depth into consideration in channel)

Gradient	Case A				Case B				Case C							
	Channel Area	0.3X0.3 0.072	Channel Area	0.3X0.3 0.072	Channel Area	0.3X0.3 0.072	Channel Area	0.3X0.3 0.072	Channel Area	0.3X0.3 0.072	Channel Area	0.3X0.3 0.072	Channel Area	0.3X0.3 0.072		
	Perimeter	0.78	Perimeter	0.78	Perimeter	0.78	Perimeter	0.78	Perimeter	0.78	Perimeter	0.78	Perimeter	0.78		
	R2/3	0.204248	R2/3	0.204248	R2/3	0.204248	R2/3	0.204248	R2/3	0.204248	R2/3	0.204248	R2/3	0.204248		
	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m		
0.01	9.803923	18.01295	9.803923	15.01079	9.803923	15.01079	9.803923	11.25809	9.803923	11.25809	9.803923	11.25809	9.803923	11.25809		
0.02	13.86484	25.47416	13.86484	21.22847	13.86484	21.22847	13.86484	15.92135	13.86484	15.92135	13.86484	15.92135	13.86484	15.92135		
0.03	16.98089	31.19934	16.98089	25.99945	16.98089	25.99945	16.98089	19.49959	16.98089	19.49959	16.98089	19.49959	16.98089	19.49959		
0.04	19.60785	36.0259	19.60785	30.02158	19.60785	30.02158	19.60785	22.51619	19.60785	22.51619	19.60785	22.51619	19.60785	22.51619		
0.05	21.92224	40.27818	21.92224	33.56515	21.92224	33.56515	21.92224	25.17386	21.92224	25.17386	21.92224	25.17386	21.92224	25.17386		
0.06	24.01461	44.12254	24.01461	36.76878	24.01461	36.76878	24.01461	27.57658	24.01461	27.57658	24.01461	27.57658	24.01461	27.57658		
0.07	25.93874	47.65779	25.93874	39.71482	25.93874	39.71482	25.93874	29.78612	25.93874	29.78612	25.93874	29.78612	25.93874	29.78612		
0.08	27.72968	50.94832	27.72968	42.45693	27.72968	42.45693	27.72968	31.8427	27.72968	31.8427	27.72968	31.8427	27.72968	31.8427		
0.09	29.41177	54.03885	29.41177	45.03237	29.41177	45.03237	29.41177	33.77428	29.41177	33.77428	29.41177	33.77428	29.41177	33.77428		
0.1	31.00273	56.96195	31.00273	47.46829	31.00273	47.46829	31.00273	35.60122	31.00273	35.60122	31.00273	35.60122	31.00273	35.60122		
0.2	43.84448	80.55636	43.84448	67.1303	43.84448	67.1303	43.84448	50.34773	43.84448	50.34773	43.84448	50.34773	43.84448	50.34773		
0.3	53.6983	98.66099	53.6983	82.21749	53.6983	82.21749	53.6983	61.66312	53.6983	61.66312	53.6983	61.66312	53.6983	61.66312		
0.4	62.00545	113.9239	62.00545	94.93658	62.00545	94.93658	62.00545	71.20244	62.00545	71.20244	62.00545	71.20244	62.00545	71.20244		
0.5	69.32421	127.3708	69.32421	106.1423	69.32421	106.1423	69.32421	79.60674	69.32421	79.60674	69.32421	79.60674	69.32421	79.60674		
0.6	75.94086	139.5277	75.94086	116.2731	75.94086	116.2731	75.94086	87.20482	75.94086	87.20482	75.94086	87.20482	75.94086	87.20482		
0.7	82.02551	150.7072	82.02551	125.5893	82.02551	125.5893	82.02551	94.19197	82.02551	94.19197	82.02551	94.19197	82.02551	94.19197		
0.8	87.68896	161.1127	87.68896	134.2606	87.68896	134.2606	87.68896	100.6955	87.68896	100.6955	87.68896	100.6955	87.68896	100.6955		
0.9	93.00818	170.8858	93.00818	142.4049	93.00818	142.4049	93.00818	106.8037	93.00818	106.8037	93.00818	106.8037	93.00818	106.8037		
1.0	98.03923	180.1295	98.03923	150.1079	98.03923	150.1079	98.03923	112.5809	98.03923	112.5809	98.03923	112.5809	98.03923	112.5809		
2.0	138.6484	254.7416	138.6484	212.2847	138.6484	212.2847	138.6484	159.2135	138.6484	159.2135	138.6484	159.2135	138.6484	159.2135		
3.0	169.8089	311.9934	169.8089	259.9945	169.8089	259.9945	169.8089	194.9959	169.8089	194.9959	169.8089	194.9959	169.8089	194.9959		
4.0	196.0785	360.259	196.0785	300.2158	196.0785	300.2158	196.0785	225.1619	196.0785	225.1619	196.0785	225.1619	196.0785	225.1619		
5.0	219.2224	402.7818	219.2224	335.6515	219.2224	335.6515	219.2224	251.7386	219.2224	251.7386	219.2224	251.7386	219.2224	251.7386		
6.0	240.1461	441.2254	240.1461	367.6878	240.1461	367.6878	240.1461	275.7658	240.1461	275.7658	240.1461	275.7658	240.1461	275.7658		
7.0	259.3874	476.5779	259.3874	397.1482	259.3874	397.1482	259.3874	297.8612	259.3874	297.8612	259.3874	297.8612	259.3874	297.8612		
8.0	277.2968	509.4852	277.2968	424.5693	277.2968	424.5693	277.2968	318.427	277.2968	318.427	277.2968	318.427	277.2968	318.427		
9.0	294.1177	540.3885	294.1177	450.3237	294.1177	450.3237	294.1177	337.7428	294.1177	337.7428	294.1177	337.7428	294.1177	337.7428		
10.0	310.0273	569.6195	310.0273	474.6829	310.0273	474.6829	310.0273	356.0122	310.0273	356.0122	310.0273	356.0122	310.0273	356.0122		
Runoff	0.544271	litter/sec/m	(Case A)	12.5m*0.95	(12.5m is the standard width of throughway)	0.544271	litter/sec/m	(Case A)	12.5m*0.95	(12.5m is the standard width of throughway)	0.544271	litter/sec/m	(Case A)	12.5m*0.95	(12.5m is the standard width of throughway)	
Runoff	0.653125	litter/sec/m	(Case B)	15.0m*0.95	0.653125	litter/sec/m	(Case B)	15.0m*0.95	0.653125	litter/sec/m	(Case B)	15.0m*0.95	0.653125	litter/sec/m	(Case B)	15.0m*0.95
Runoff	0.870833	litter/sec/m	(Case C)	20.0m*0.95	0.870833	litter/sec/m	(Case C)	20.0m*0.95	0.870833	litter/sec/m	(Case C)	20.0m*0.95	0.870833	litter/sec/m	(Case C)	20.0m*0.95

-Minimum Interval : about 40.0m (This is derived from the standard specification of road formation profile gradient (minimum 0.3%), road crossing slope(2.0%) and road width 12.5m in principal. refer to Figure A 8.1.2 and Table A 8.1.2)

-Maximum Interval : about 100m(in consideration of the drainage capacity of lower drainage facilities and past project drainage system.)

(3) Throughway Slope End Drainage Channel and Catch Basin

The drainage channel and catch basin to collect the runoff born on the throughway and its slope shall be installed at the toe of throughway slope. The dimensions of channel and interval of catch basin for the throughway and its slope drainage are as follows;

-Throughway Slope End Channel : 500mm*500mm

-Throughway Slope End Catch Basin Maximum Interval : about 200m

(The above 200m is derived from the standard gradient of profile (minimum 0.3%) and road crossing slope (2.0%) of frontage road and applied for deciding the interval of catch basin to be connected to the catch basin of the frontage road. However actually the interval of catch basin of the drainage channel shall be regulated by the interval of road shoulder catch basin for throughway drainage. Refer to Figure A 8.1.3, Table A 8.1.3)

8.1.3 Frontage Road Drainage

(1) Catch Basin under Sidewalk

The runoff born on the frontage road shall be drained out to the lower area through this catch basin and its drainage pipe to be installed under the sidewalk.

The interval of catch basin is about 50.0m at the minimum standard profile gradient (0.3%) and road crossing slope (2.0%) of the frontage road. However as the drainage pipe to be installed under the sidewalk shall be evaluated in terms of its maintenance, the interval of catch basin is 20.0m in accordance with the standard of Vietnam. (refer to Figure A 8.1.4, Table A 8.1.4)

- Interval of catch basin : 20.0m(It is decided based on the Vietnam standard that is 17.0m catch basin interval for ϕ 750 pipe.)

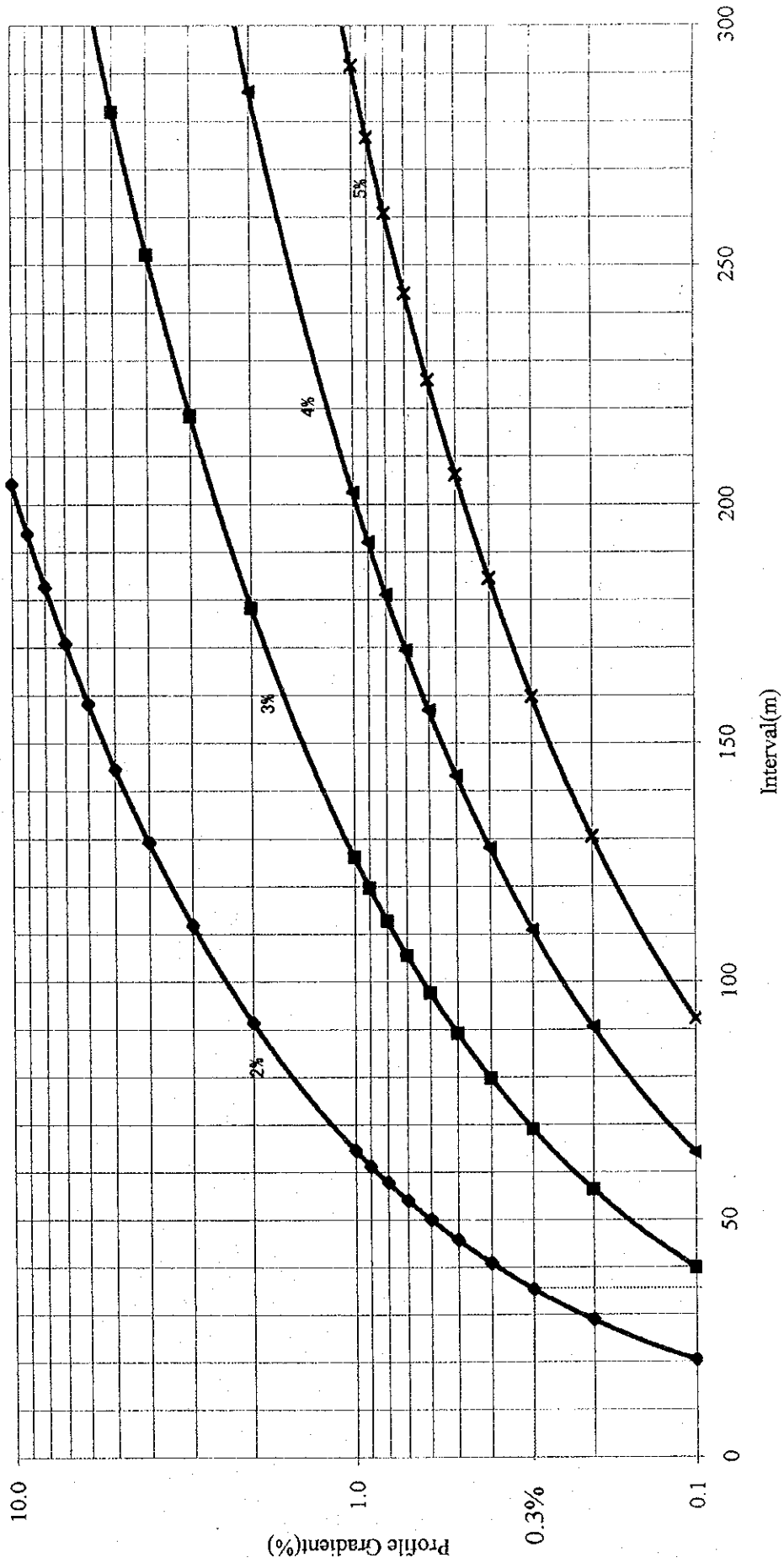


Figure A 8.1.2(1/3) Throughway(12.5m) Road Shoulder Catch Basin

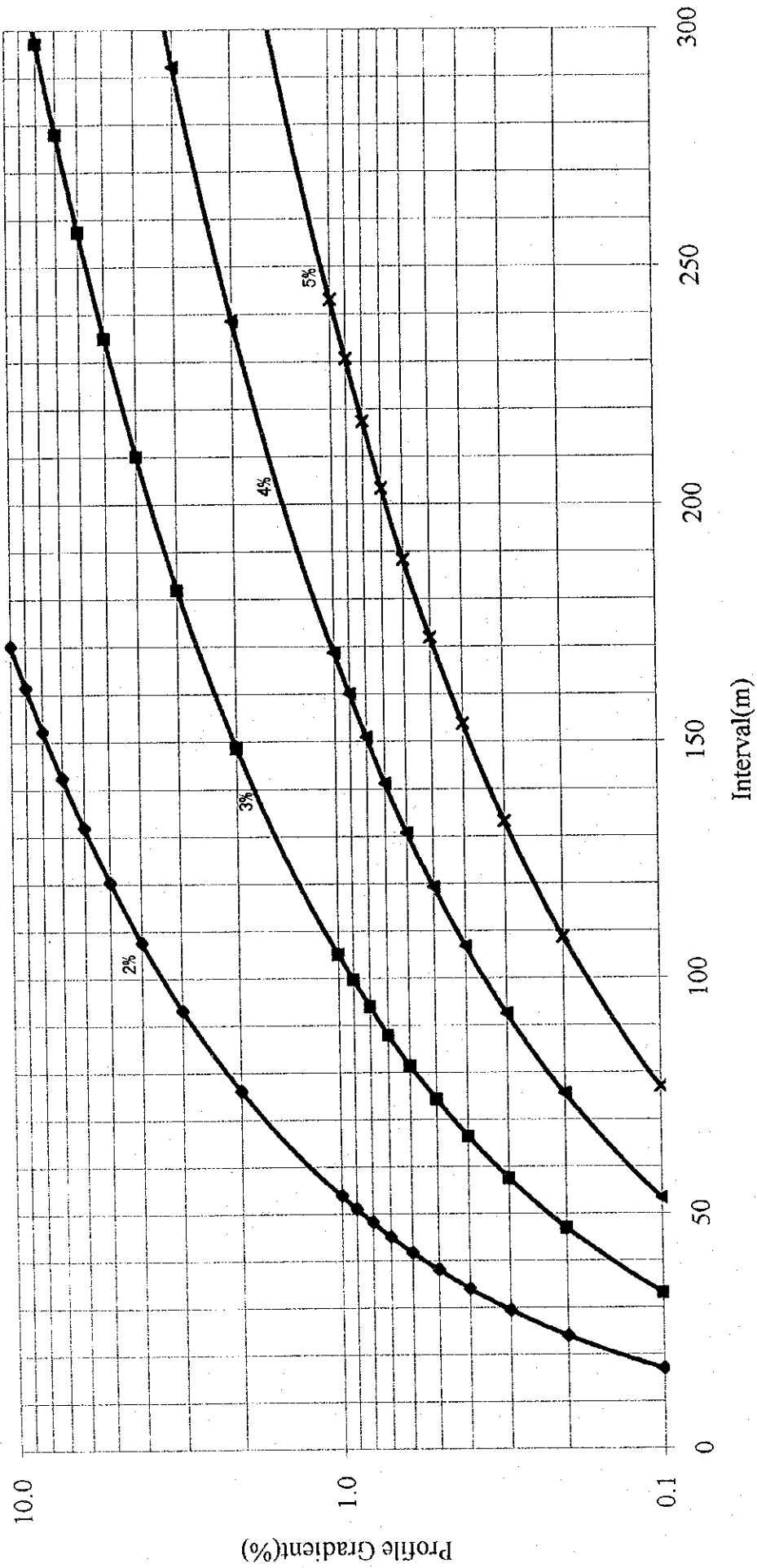


Figure A 8.1.2(2/3) Throughway(15.0m) Road Shoulder Catch Basin

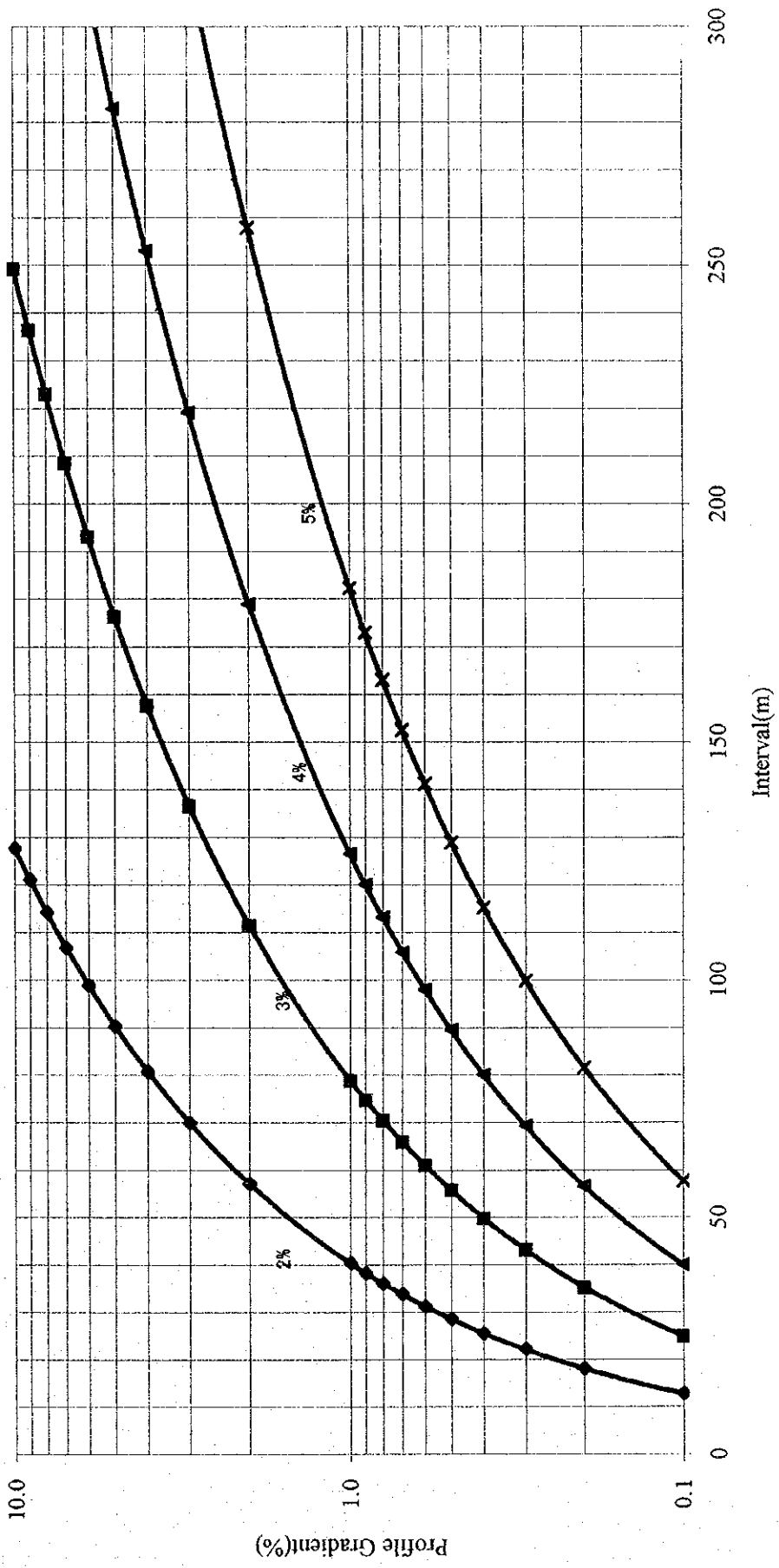


Figure A 8.1.2(3/3) Throughway(20.0m) Road Shoulder Catch Basin

Table A 8.1.2.(1/3) Throughway(12.5m) Road Shoulder Catch Basin(Road Width=12.5m)

Gradient	2%			3%			4%			5%		
	Area	Perimeter	R2/3	Area	Perimeter	R2/3	Area	Perimeter	R2/3	Area	Perimeter	R2/3
0.1	11.11748	20.42637	21.7098	39.88787	64.01169	50.21123	92.25413	92.25413	92.25413	92.25413	92.25413	92.25413
0.2	15.72249	28.88726	30.7023	56.40997	90.52619	71.0094	130.467	130.467	130.467	130.467	130.467	130.467
0.3	19.25604	35.37952	37.60248	69.08782	110.8715	86.9684	159.7888	159.7888	159.7888	159.7888	159.7888	159.7888
0.4	22.23496	40.85275	43.41961	79.77574	128.0234	100.4225	184.5083	184.5083	184.5083	184.5083	184.5083	184.5083
0.5	24.85944	45.67476	48.5446	89.19199	143.1345	112.2757	206.2865	206.2865	206.2865	206.2865	206.2865	206.2865
0.6	27.23215	50.03419	53.17794	97.70493	156.796	122.9919	225.9755	225.9755	225.9755	225.9755	225.9755	225.9755
0.7	29.41409	54.04311	57.43874	105.5334	169.359	132.8464	244.0815	244.0815	244.0815	244.0815	244.0815	244.0815
0.8	31.44498	57.77451	61.4046	112.8199	181.0524	142.0188	260.9341	260.9341	260.9341	260.9341	260.9341	260.9341
0.9	33.35244	61.27912	65.12941	119.6636	192.0351	150.6337	276.7624	276.7624	276.7624	276.7624	276.7624	276.7624
1.0	35.15656	64.59387	68.65243	126.1365	202.4227	158.7818	291.7332	291.7332	291.7332	291.7332	291.7332	291.7332
2.0	49.71888	91.34952	97.0892	178.384	286.269	224.5514	412.573	412.573	412.573	412.573	412.573	412.573
3.0	60.89294	111.8799	118.9095	218.4749	350.6064	275.0182	505.2967	505.2967	505.2967	505.2967	505.2967	505.2967
4.0	70.31311	129.1877	137.3049	252.273	404.8454	317.5637	583.4663	583.4663	583.4663	583.4663	583.4663	583.4663
5.0	78.61245	144.4363	153.5115	282.0498	452.631	355.047	652.3352	652.3352	652.3352	652.3352	652.3352	652.3352
6.0	86.11563	158.222	168.1634	308.9701	495.8324	388.9345	714.5974	714.5974	714.5974	714.5974	714.5974	714.5974
7.0	93.01551	170.8993	181.6373	333.7259	535.5602	420.0973	771.8534	771.8534	771.8534	771.8534	771.8534	771.8534
8.0	99.43776	182.699	194.1784	356.768	572.5379	449.1029	825.146	825.146	825.146	825.146	825.146	825.146
9.0	105.4697	193.7816	205.9573	378.4096	607.2682	476.3455	875.1995	875.1995	875.1995	875.1995	875.1995	875.1995
10.0	111.1748	204.2637	217.098	398.8787	640.1169	502.1123	922.5413	922.5413	922.5413	922.5413	922.5413	922.5413

Runoff 0.544271 litter/sec/m Throughway: 12.5m*0.95

Note: 1. The profile gradient for the stretch of widened throughway shall be larger (more than 1.0%).
 2. The standard road cross section slope is 2.0%.

Table A 8.1.2.(2/3) Throughway(15.0m) Road Shoulder Catch Basin(Road Width=15.0m)

Gradient	2%			3%			4%			5%		
	Area	Perimeter	R2/3	Area	Perimeter	R2/3	Area	Perimeter	R2/3	Area	Perimeter	R2/3
	0.0625	2.55008	0.084376	0.09375	2.57518	0.109844	0.125	2.60032	0.132207	0.125	2.60032	0.132207
	Discharge	Interval	Discharge	Interval	Discharge	Interval	Discharge	Interval	Discharge	Interval	Discharge	Interval
	litter/sec	m	litter/sec	m	litter/sec	m	litter/sec	m	litter/sec	m	litter/sec	m
0.1	11.11748	17.02198	21.7098	33.23989	34.83969	53.34307	71.0094	108.7225	50.21123	76.87844	71.0094	108.7225
0.2	15.72249	24.07271	30.7023	47.00831	49.27077	75.43849	86.9684	133.1574	71.0094	108.7225	86.9684	133.1574
0.3	19.25604	29.48293	37.60248	57.57318	60.34412	92.39291	106.6861	153.7569	86.9684	133.1574	106.6861	153.7569
0.4	22.23496	34.04396	43.41961	66.47978	69.67939	106.6861	112.2757	171.9054	100.4225	153.7569	112.2757	171.9054
0.5	24.85944	38.0623	48.5446	74.32666	77.90392	112.2757	119.2787	188.3129	112.2757	171.9054	119.2787	188.3129
0.6	27.32215	41.69516	53.17794	81.42077	85.33947	130.6633	141.1325	203.4012	122.9919	188.3129	141.1325	203.4012
0.7	29.41409	45.03592	57.43874	87.94449	92.17716	141.1325	150.877	217.4451	132.8464	203.4012	150.877	217.4451
0.8	31.44498	48.14543	61.4046	94.01661	98.54153	150.877	160.0292	230.6353	142.0188	217.4451	160.0292	230.6353
0.9	33.35244	51.06593	65.12941	99.71967	104.5191	160.0292	170.1728	243.111	150.6337	230.6353	170.1728	243.111
1.0	35.15656	53.82822	68.65243	105.1138	110.1728	168.6856	182.0624	256.111	158.7818	243.111	182.0624	256.111
2.0	49.71888	76.1246	97.0892	148.6533	155.8078	238.5575	292.172	343.8108	224.5514	343.8108	292.172	421.0805
3.0	60.89294	93.23321	118.9095	182.0624	190.8249	292.172	337.3712	421.0805	275.0182	421.0805	337.3712	486.2219
4.0	70.31311	107.6564	137.3049	210.2275	220.3456	337.3712	377.1925	486.2219	317.5637	486.2219	377.1925	543.6126
5.0	78.61245	120.3636	153.5115	235.0415	246.3538	377.1925	413.1937	543.6126	355.047	543.6126	413.1937	595.4978
6.0	86.11563	131.8517	168.1634	257.4751	269.8671	413.1937	446.3002	595.4978	388.9345	595.4978	446.3002	643.2112
7.0	93.01551	142.4161	181.6373	278.1049	291.4898	446.3002	477.1149	643.2112	420.0973	643.2112	477.1149	687.6216
8.0	99.43776	152.2492	194.1784	297.3066	311.6157	477.1149	506.0568	729.3329	449.1029	687.6216	506.0568	729.3329
9.0	105.4697	161.4847	205.9573	315.3413	330.5184	506.0568	533.4307	768.7844	476.3455	729.3329	533.4307	768.7844
10.0	111.1748	170.2198	217.098	332.3989	348.3969	533.4307			502.1123	768.7844		

Runoff 0.653125 litter/sec/m Throughway: 15m*0.95

Note: 1. The profile gradient for the stretch of widened throughway shall be larger (more than 1.0%).
2. The standard road cross section slope is 2.0%.

Table A 8.1.2.(3/3) Throughway(20.0m) Road Shoulder Catch Basin(Road Width=20.0m)

Gradient	2%			3%			4%			5%		
	Area	Perimeter	R2/3	Area	Perimeter	R2/3	Area	Perimeter	R2/3	Area	Perimeter	R2/3
	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m
0.1	11.11748	12.76648	21.7098	24.92992	34.83969	40.0073	50.21123	57.65883	71.0094	81.5419	99.86802	115.3177
0.2	15.72249	18.05453	30.7023	35.25623	49.27077	56.57887	69.29468	86.9684	100.4225	112.2757	128.9291	141.2347
0.3	19.25604	22.1122	37.60248	43.17989	60.34412	69.67939	80.01461	97.99748	105.8494	113.1577	126.5142	132.8464
0.4	22.23496	25.53297	43.41961	49.85984	55.74499	61.06558	77.90392	89.45905	105.8494	120.0219	142.0188	152.5509
0.5	24.85944	28.54673	48.5446	55.74499	61.06558	77.90392	89.45905	105.8494	120.0219	142.0188	152.5509	163.0838
0.6	27.23215	31.27137	53.17794	61.06558	65.95836	72.17716	85.33947	97.99748	105.8494	113.1577	126.5142	132.8464
0.7	29.41409	33.77694	57.43874	65.95836	72.17716	85.33947	97.99748	105.8494	113.1577	126.5142	132.8464	141.2347
0.8	31.44498	36.10907	61.4046	70.51246	74.78976	85.33947	97.99748	105.8494	113.1577	126.5142	132.8464	141.2347
0.9	33.35244	38.29945	65.12941	74.78976	85.33947	97.99748	105.8494	113.1577	126.5142	132.8464	141.2347	152.5509
1.0	35.15656	40.37117	68.65243	78.83532	85.33947	97.99748	105.8494	113.1577	126.5142	132.8464	141.2347	152.5509
2.0	49.71888	57.09345	97.0892	111.49	155.8078	178.9181	224.5514	257.8581	275.0182	315.8104	364.6664	407.7095
3.0	60.89294	69.92491	118.9095	136.5468	190.8249	219.129	275.0182	315.8104	364.6664	407.7095	446.6234	482.4084
4.0	70.31311	80.74233	137.3049	157.6706	220.3456	253.0284	317.5637	364.6664	407.7095	446.6234	482.4084	515.7162
5.0	78.61245	90.27267	153.5115	176.2811	246.3538	282.8944	355.047	407.7095	446.6234	482.4084	515.7162	546.9997
6.0	86.11563	98.88876	168.1634	193.1063	269.8671	309.8952	388.9345	446.6234	482.4084	515.7162	546.9997	576.5883
7.0	93.01551	106.8121	181.6373	208.5787	291.4898	334.7251	420.0973	482.4084	515.7162	546.9997	576.5883	
8.0	99.43776	114.1869	194.1784	222.98	311.6157	357.8362	449.1029	515.7162	546.9997	576.5883		
9.0	105.4697	121.1135	205.9573	236.506	330.5184	379.5426	476.3455	546.9997	576.5883			
10.0	111.1748	127.6648	217.098	249.2992	348.3969	400.073	502.1123	576.5883				

Runoff 0.870833 litter/sec/m Throughway: 20m*0.95

Note: 1. The profile gradient for the stretch of widened throughway shall be larger (more than 1.0%).
2. The standard road cross section slope is 2.0%.

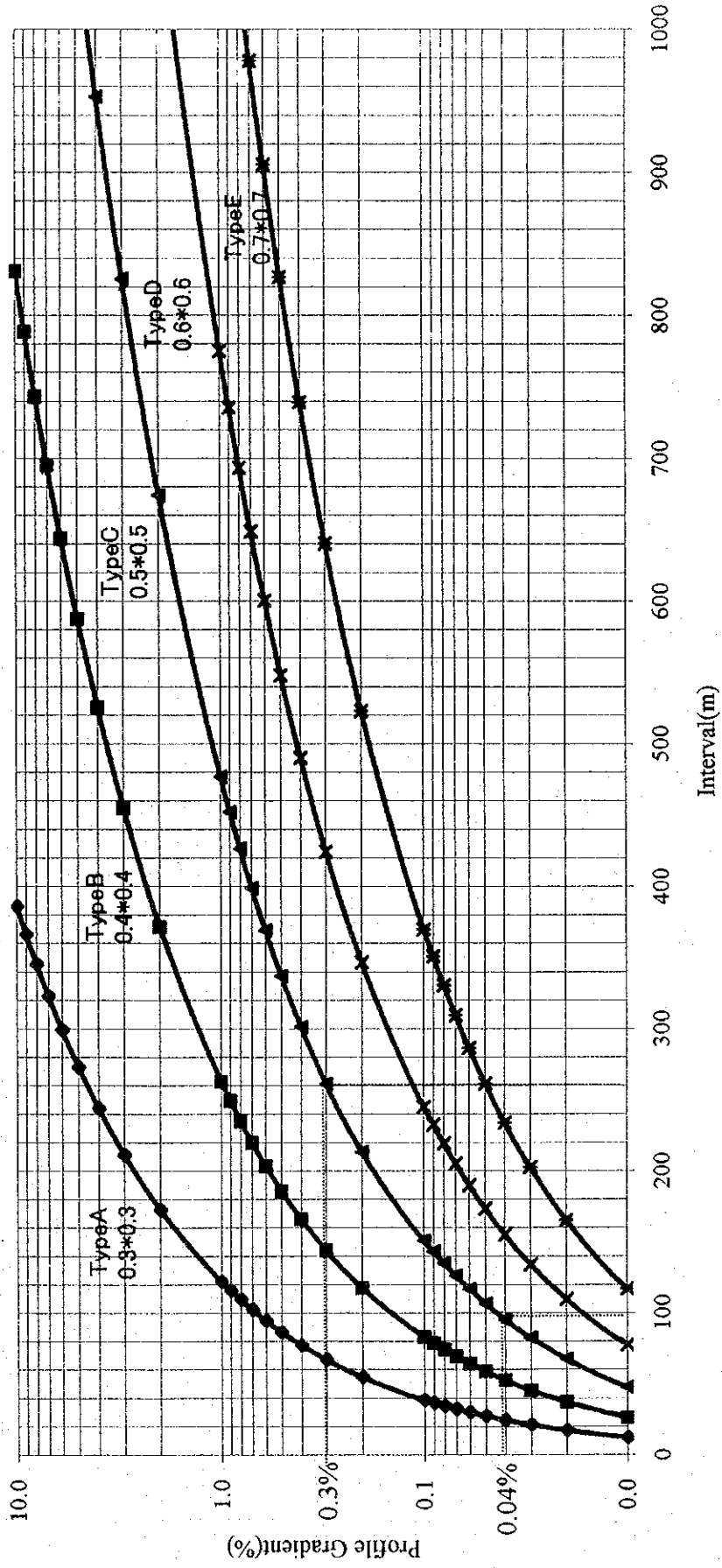


Figure A 8.1.3 Throughway Slope End Drainage Channel

Table A 8.1.3 Throughway Slope End Drainage(taking 80% water depth into consideration)

Gradient	Type A 0.3X0.3		Type B 0.4X0.4		Type C 0.5X0.5		Type D 0.6X0.6		Type E 0.7X0.7	
	Area 0.072	Perimeter 0.78	Area 0.128	Perimeter 1.04	Area 0.2	Perimeter 1.3	Area 0.288	Perimeter 1.56	Area 0.49	Perimeter 1.92
	R2/3 0.204248	R2/3 0.247429	R2/3 0.247429	R2/3 0.247429	R2/3 0.287116	R2/3 0.324224	R2/3 0.324224	R2/3 0.324224	R2/3 0.324224	R2/3 0.359316
	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m
0.01	9.803923	12.20564	21.11397	26.28636	38.28217	47.66033	62.251029	77.50096	93.90124	116.9047
0.02	13.86484	17.26138	29.85966	37.17452	54.13916	67.40189	88.03625	109.6029	132.7964	165.3282
0.03	16.98089	21.14078	36.57047	45.5293	66.30666	82.55012	107.82195	134.2356	162.6417	202.4848
0.04	19.60785	24.41127	42.22794	52.57271	76.56434	95.32067	124.50206	155.0019	187.8025	233.8093
0.05	21.92224	27.29263	47.21227	58.77808	85.60154	106.5717	139.19753	173.2974	209.9695	261.4068
0.06	24.01461	29.89758	51.71845	64.38816	93.77178	116.7435	152.48326	189.8378	230.0101	286.3568
0.07	25.93874	32.29308	55.86231	69.54716	101.2851	126.0974	164.70074	205.0483	248.4393	309.3007
0.08	27.72968	34.52275	59.71932	74.34904	108.2783	134.8038	176.0725	219.2058	265.5928	330.6563
0.09	29.41177	36.61691	63.3419	78.85907	114.8465	142.981	186.75309	232.5029	281.7037	350.714
0.1	31.00273	38.59761	66.76823	83.12476	121.0589	150.7152	196.85504	245.0795	296.9418	369.685
0.2	43.84448	54.58527	94.42454	117.5562	171.2031	213.1435	278.39507	346.5948	419.9391	522.8135
0.3	53.6983	66.85302	115.646	143.9763	209.6801	261.0464	340.96293	424.4902	514.3182	640.3132
0.4	62.00545	77.19522	133.5365	166.2495	242.1177	301.4304	393.71008	490.1591	593.8836	739.37
0.5	69.32421	86.30688	149.2983	185.8726	270.6958	337.0095	440.18125	548.0145	663.982	826.6408
0.6	75.94086	94.54445	163.5481	203.6132	296.5324	369.1754	482.1944	600.3198	727.3558	905.5396
0.7	82.02551	102.1197	176.6521	219.9274	320.2916	398.755	520.82948	648.4195	785.6341	978.0946
0.8	87.68896	109.1705	188.8491	235.1123	342.4061	426.287	556.79013	693.1896	839.8782	1045.627
0.9	93.00818	115.7928	200.3047	249.3743	363.1766	452.1456	590.56512	735.2386	890.8253	1109.055
1.0	98.03923	122.0564	211.1397	262.8636	382.8217	476.6033	622.51029	775.0096	939.0124	1169.047
2.0	138.6484	172.6138	298.5966	371.7452	541.3916	674.0189	880.3625	1096.029	1327.964	1653.282
3.0	169.8089	211.4078	365.7047	455.293	663.0666	825.5012	1078.2195	1342.356	1626.417	2024.848
4.0	196.0785	244.1127	422.2794	525.7271	765.6434	953.2067	1245.0206	1550.019	1878.025	2338.093
5.0	219.2224	272.9263	472.1227	587.7808	856.0154	1065.717	1391.9753	1732.974	2099.695	2614.068
6.0	240.1461	298.9758	517.1845	643.8816	937.7178	1167.435	1524.8326	1898.378	2300.101	2863.568
7.0	259.3874	322.9308	558.6231	695.4716	1012.851	1260.974	1647.0074	2050.483	2484.393	3093.007
8.0	277.2968	345.2275	597.1932	743.4904	1082.783	1348.038	1760.725	2192.058	2655.928	3306.563
9.0	294.1177	366.1691	633.419	788.5907	1148.465	1429.81	1867.5309	2325.029	2817.037	3507.14
10.0	310.0273	385.9761	667.6823	831.2476	1210.589	1507.152	1968.5504	2450.795	2969.418	3696.85
Runoff	0.803229 litter/sec/m		Throughway: 12.5m*0.95, Slope: 7.0m*0.7, Plain Lot: 1.5m*0.5							

Note: The objectives of the runoff are throughway and slope.

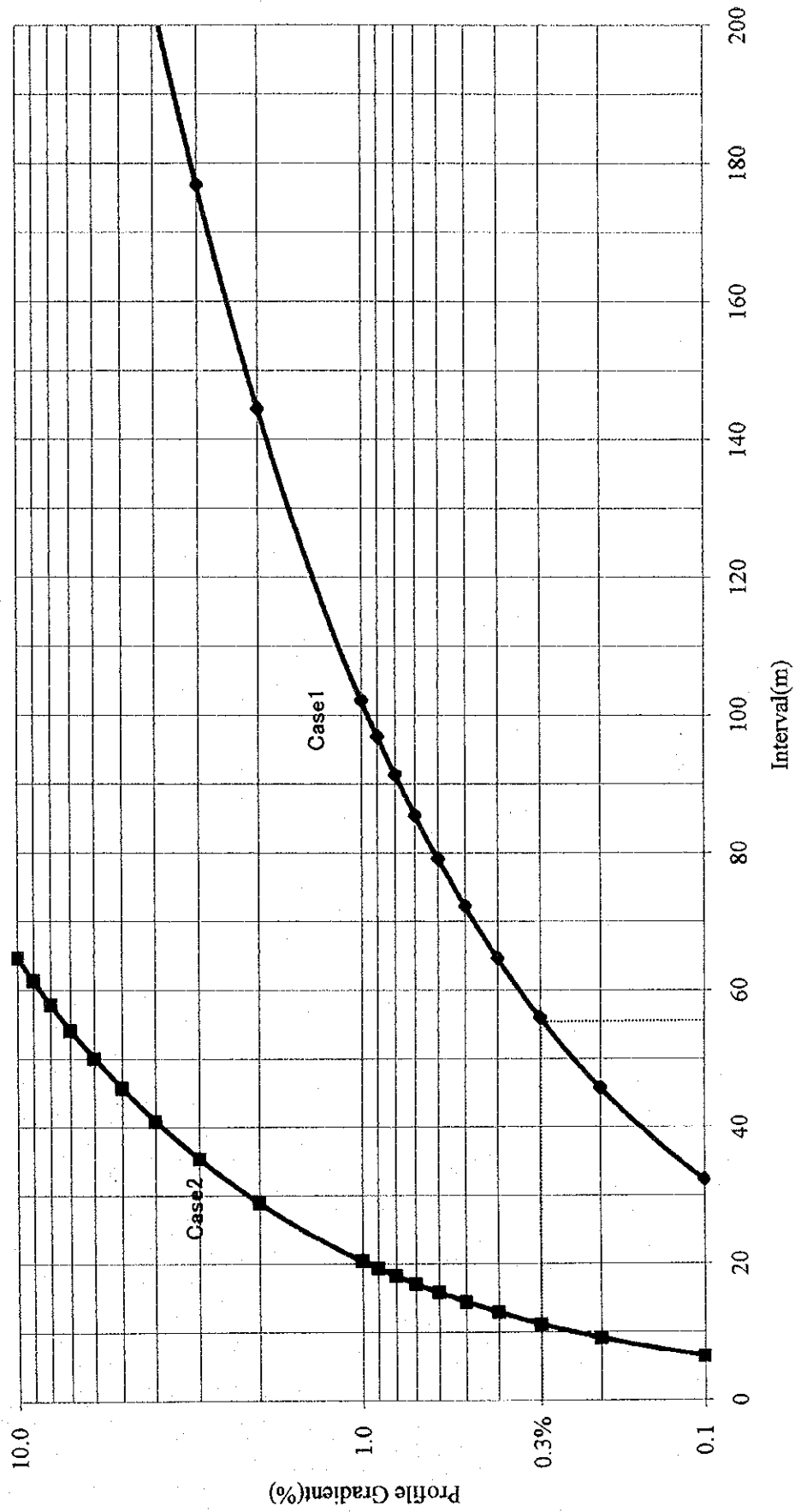
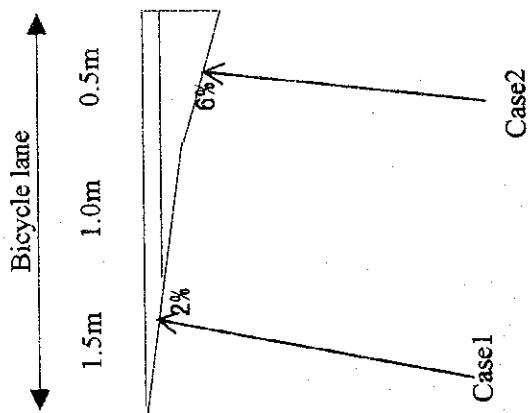


Figure A 8.1.4 Frontage Road Drainage

Table A 8.1.4 Frontage Road Drainage

Gradient	Frontage Road Case1		Frontage Road Case2	
	Discharge litter/sec	Interval m	Discharge litter/sec	Interval m
0.1	19.69168	32.303516	3.941882	6.4665189
0.2	27.84825	45.6840704	5.574663	9.1450388
0.3	34.107	55.951331	6.82754	11.200339
0.4	39.38337	64.607032	7.883764	12.933038
0.5	44.03195	72.2328577	8.814316	14.459576
0.6	48.23458	79.1271311	9.6556	15.839672
0.7	52.0993	85.4670698	10.42924	17.108801
0.8	55.6965	91.3681409	11.14933	18.290078
0.9	59.07505	96.910548	11.82565	19.399557
1.0	62.27058	102.152687	12.46533	20.448928
2.0	88.06389	144.465715	17.62863	28.919152
3.0	107.8558	176.933644	21.59058	35.418583
4.0	124.5412	204.305374	24.93065	40.897857
5.0	139.2412	228.420352	27.87332	45.725194
6.0	152.5311	250.221959	30.53369	50.08944
7.0	164.7525	270.270605	32.98015	54.102779
8.0	176.1278	288.931431	35.25727	57.838304
9.0	186.8117	306.458061	37.39598	61.346785
10.0	196.9168	323.03516	39.41882	64.665189
Runoff	0.609583 litter/sec/m			
	Carriage: 8.0m*0.95,			
	Bicycle lane/Sidewalk: 6.0m*0.95			



(4) Drainage Pipe under Sidewalk

The profile gradient of frontage road shall be kept more than 0.3% in principal, keeping the installation gradient(0.3%) of drainage pipe(ϕ 750) line, about 0.5m³/s discharge could be flown. Considering other physical condition at the site especially flat terrain, ϕ 750 drainage pipe has to be suitable as it is difficult to secure the appropriate depth and its profile gradient for installing pipe in case of a larger diameter pipe. Therefore ϕ 750 drainage pipe is applied.(Refer to Table A 8.1.5)

Table A 8.1.5 Estimation of Pipe Diameter

80% Water Depth ($Q \cdot n / I^{1/2} \cdot r^{8/3} = 2.105$, Q =Discharge, $n=0.015$, I =Slope, r =Radius)

Q (m ³ /s)	n	I=1/100	I=1/200	I=1/300	I=1/400	I=1/500	I=1/600	I=1/700	I=1/800	I=1/900	I=1/1000
		1.00%	0.50%	0.33%	0.25%	0.20%	0.17%	0.14%	0.13%	0.11%	0.10%
0.1	0.015	0.313	0.357	0.385	0.406	0.424	0.438	0.451	0.463	0.473	0.482
0.2	0.015	0.406	0.463	0.499	0.527	0.549	0.568	0.585	0.600	0.613	0.626
0.3	0.015	0.473	0.539	0.581	0.613	0.639	0.662	0.681	0.698	0.714	0.728
0.4	0.015	0.527	0.600	0.647	0.683	0.712	0.737	0.759	0.778	0.795	0.811
0.5	0.015	0.573	0.652	0.704	0.743	0.774	0.801	0.825	0.846	0.865	0.882
0.6	0.015	0.613	0.698	0.754	0.795	0.829	0.858	0.883	0.906	0.926	0.944
0.7	0.015	0.650	0.740	0.798	0.843	0.879	0.909	0.936	0.960	0.981	1.001
0.8	0.015	0.683	0.778	0.839	0.886	0.924	0.956	0.984	1.009	1.031	1.052
0.9	0.015	0.714	0.813	0.877	0.926	0.965	0.999	1.028	1.054	1.078	1.099
1.0	0.015	0.743	0.846	0.913	0.963	1.004	1.039	1.070	1.097	1.121	1.144

Note: Range of Pipe ϕ 750

Full Water Depth ($Q \cdot n / I^{1/2} \cdot r^{8/3} = 1.979$, Q =Discharge, $n=0.015$, I =Slope, r =Radius)

Q (m ³ /s)	n	I=1/100	I=1/200	I=1/300	I=1/400	I=1/500	I=1/600	I=1/700	I=1/800	I=1/900	I=1/1000
		1.00%	0.50%	0.33%	0.25%	0.20%	0.17%	0.14%	0.13%	0.11%	0.10%
0.1	0.015	0.321	0.365	0.394	0.416	0.433	0.449	0.462	0.473	0.484	0.494
0.2	0.015	0.416	0.473	0.511	0.539	0.562	0.582	0.599	0.614	0.628	0.640
0.3	0.015	0.484	0.551	0.595	0.628	0.654	0.677	0.697	0.715	0.731	0.745
0.4	0.015	0.539	0.614	0.662	0.699	0.729	0.754	0.776	0.796	0.814	0.830
0.5	0.015	0.586	0.668	0.720	0.760	0.793	0.820	0.844	0.866	0.885	0.903
0.6	0.015	0.628	0.715	0.771	0.814	0.849	0.878	0.904	0.927	0.948	0.967
0.7	0.015	0.665	0.757	0.817	0.862	0.899	0.930	0.958	0.982	1.004	1.024
0.8	0.015	0.699	0.796	0.859	0.907	0.945	0.978	1.007	1.032	1.056	1.077
0.9	0.015	0.731	0.832	0.898	0.948	0.988	1.022	1.052	1.079	1.103	1.125
1.0	0.015	0.760	0.866	0.934	0.986	1.028	1.064	1.095	1.123	1.148	1.171

Note: Range of Pipe ϕ 750

8.2 Rainfall Data and Probability Calculation

8.2.1 Rainfall Probability

The rainfall probabilities are calculated and attached as follows;

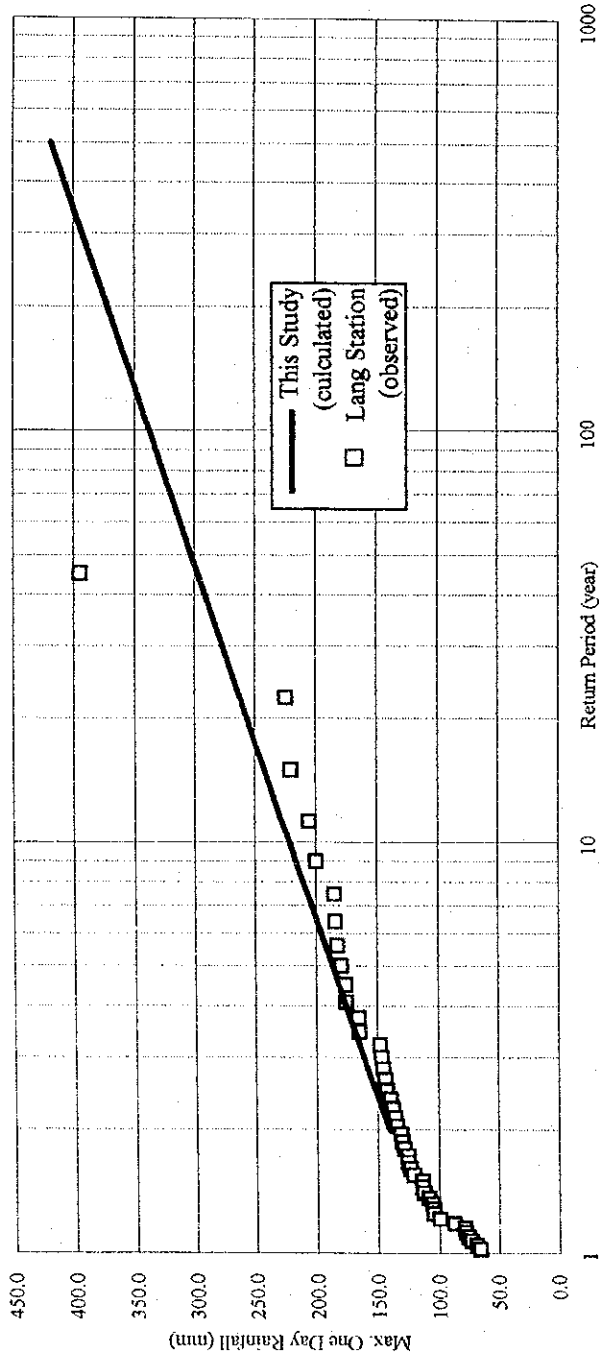
- Figure A 8.2.1 Relationship between One Day Rainfall and Return Period by Gumbel
- Figure A 8.2.2 Relationship between One Day Rainfall and Return Period by Hazen
- Figure A 8.2.3 Relationship between 10 Minutes Rainfall and Return Period by Gumbel
- Figure A 8.2.4 Relationship between 60 Minutes Rainfall and Return Period by Gumbel
- Table A 8.2.1 Rainfall Probability Calculation by Iwai

8.2.2 Rainfall Data

Collected rainfall data are attached as follows;

- Table A 8.2.2 Annual Maximum One Day and 2 Days Rainfall
- Table A 8.2.3 Annual Maximum One Day Rainfall
- Table A 8.2.4 Annual Maximum 10 and 60 Minutes Rainfall

Year T	F(%)	y	x (mm)
400	99.8	5.99021	405.256
300	99.7	5.70212	391.277
250	99.6	5.51946	382.413
200	99.5	5.29581	371.560
150	99.3	5.00730	357.560
100	99.0	4.60015	337.803
80	98.8	4.37574	326.913
60	98.3	4.08596	312.852
50	98.0	3.90194	303.922
40	97.5	3.67625	292.970
30	96.7	3.38429	278.803
25	96.0	3.19853	269.789
20	95.0	2.97020	258.709
15	93.3	2.67375	244.323
10	90.0	2.25037	223.779
8	87.5	2.01342	212.281
7	85.7	1.86982	205.312
6	83.3	1.70199	197.168
5	80.0	1.49994	187.364
4	75.0	1.24590	175.036
3	66.7	0.90273	158.384
2	50.0	0.36651	132.363



**Figure A 8.2.1 Relationship between One Day Rainfall and Return Period
(Data from 1955 to 1998) by Gumbel Method**

Return Period	Rainfall (mm)
2	124
3	147
4	163
5	176
8	202
10	214
15	237
20	253
25	265
30	275
40	292
50	304
60	314
80	330
100	343
150	365
200	381
250	394
300	404
400	420
500	432

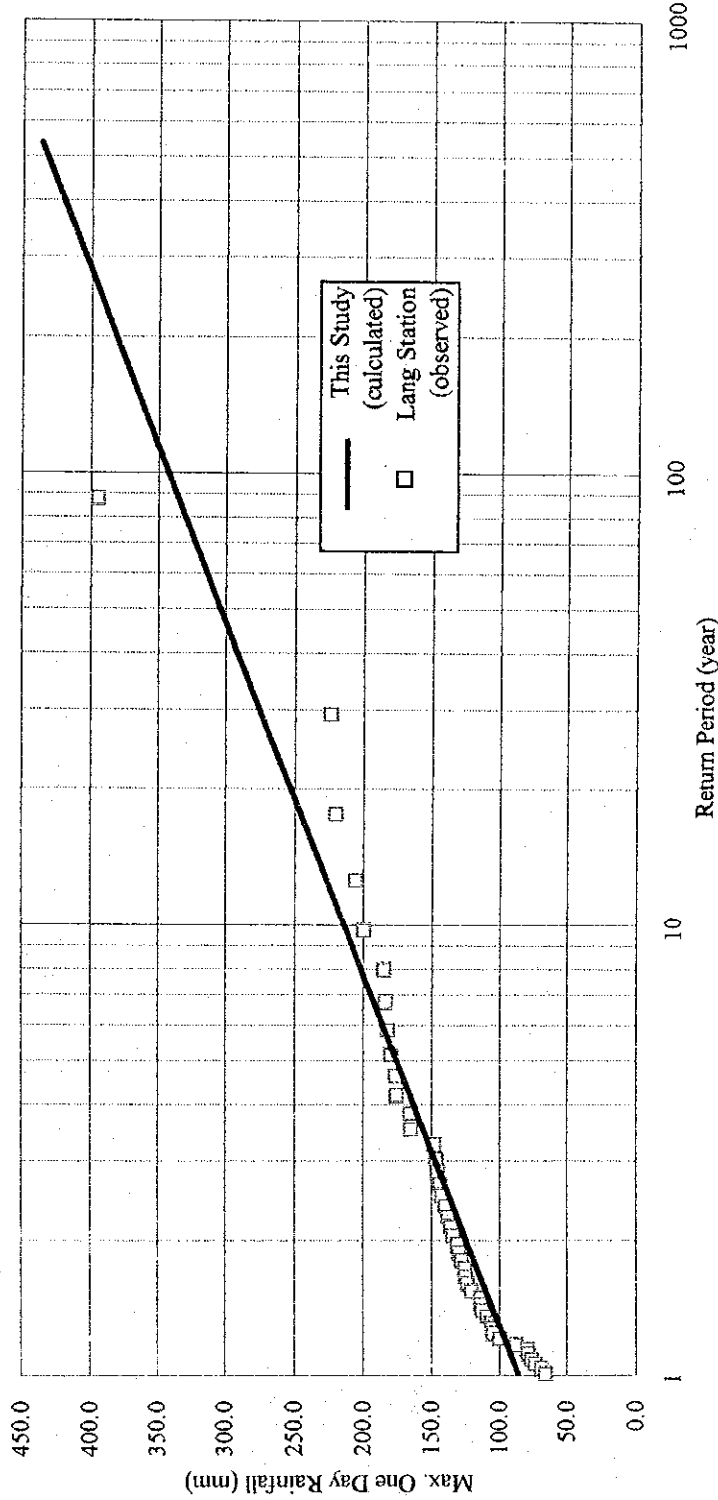


Figure A 8.2.2 Relationship between One Day Rainfall and Return Period
 (Data from 1955 to 1998) by Hazen Method
 $R=85.70167+55.800\ln(T)$

Year	T	F(%)	Y	X (mm)
500	99.8	6.21361	49.853	
400	99.8	5.99021	48.801	
300	99.7	5.70212	47.443	
250	99.6	5.51946	46.582	
200	99.5	5.29581	45.528	
150	99.3	5.00730	44.168	
100	99.0	4.60015	42.249	
80	98.8	4.37574	41.192	
60	98.3	4.08596	39.826	
50	98.0	3.90194	38.959	
40	97.5	3.67625	37.895	
30	96.7	3.38429	36.519	
25	96.0	3.19853	35.644	
20	95.0	2.97020	34.568	
15	93.3	2.67375	33.171	
10	90.0	2.25037	31.175	
8	87.5	2.01342	30.059	
7	85.7	1.86982	29.382	
6	83.3	1.70199	28.591	
5	80.0	1.49994	27.639	
4	75.0	1.24590	26.442	
3	66.7	0.90273	24.824	
2	50.0	0.36651	22.297	

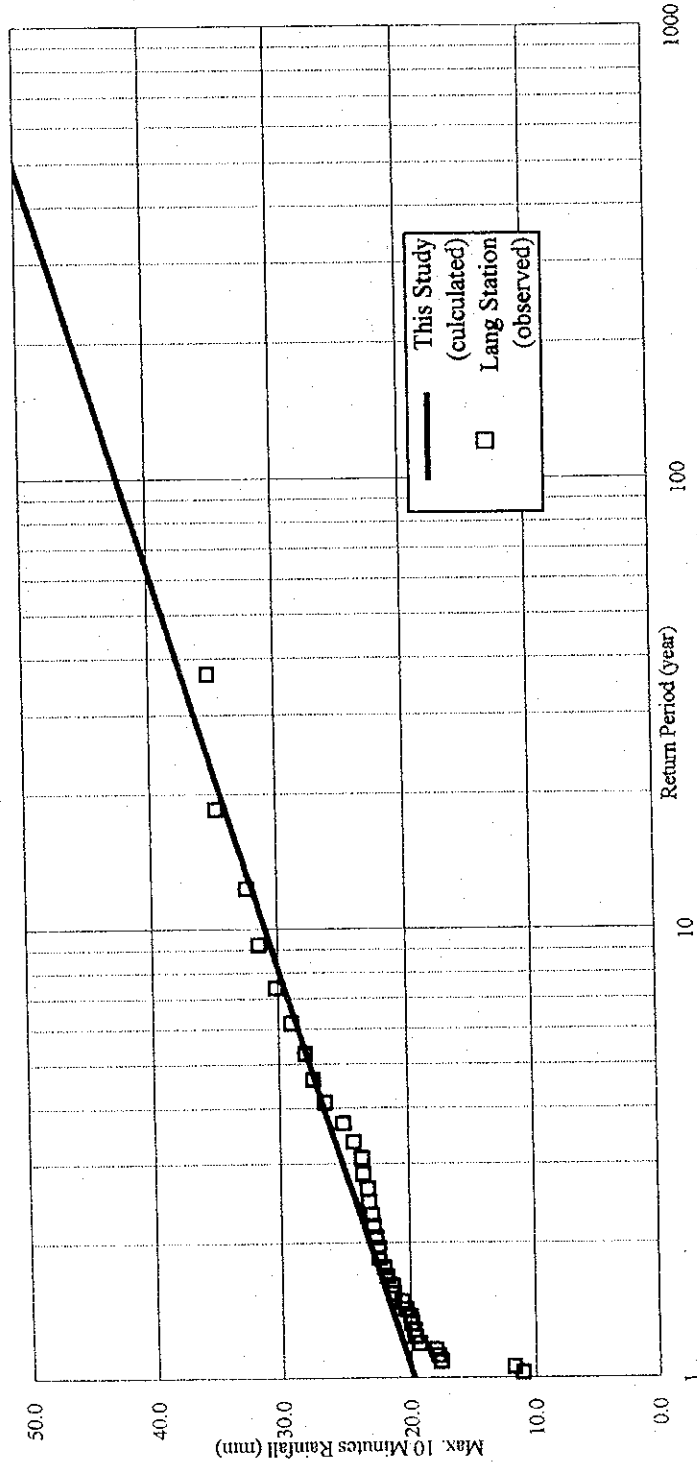


Figure A 8.2.3 Relationship between 10 Minutes Rainfall and Return Period
(Data from 1957 to 1992) by Gumbel Method

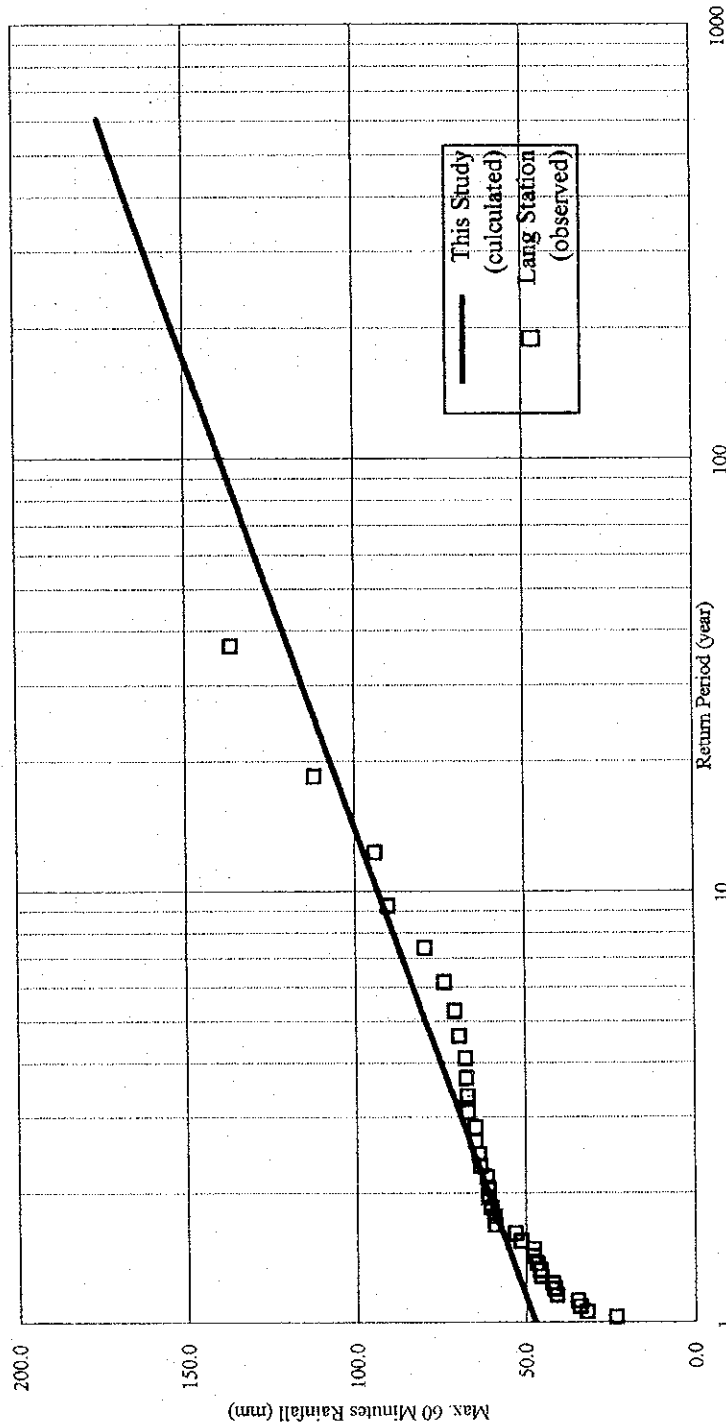


Figure A 8.2.4 Relationship between 60 Minutes Rainfall and Return Period
(Data from 1957 to 1992) by Gumbel Method

Year	T	F(%)	y	x (mm)
500	500	99.8	6.21361	170.407
400	400	99.8	5.99021	166.100
300	300	99.7	5.70212	160.546
250	250	99.6	5.51946	157.024
200	200	99.5	5.29581	152.712
150	150	99.3	5.00730	147.150
100	100	99.0	4.60015	139.301
80	80	98.8	4.37574	134.974
60	60	98.3	4.08596	129.388
50	50	98.0	3.90194	125.840
40	40	97.5	3.67625	121.489
30	30	96.7	3.38429	115.860
25	25	96.0	3.19853	112.279
20	20	95.0	2.97020	107.877
15	15	93.3	2.67575	102.162
10	10	90.0	2.25037	93.999
8	8	87.5	2.01342	89.431
7	7	85.7	1.86982	86.663
6	6	83.3	1.70199	83.427
5	5	80.0	1.49994	79.532
4	4	75.0	1.24590	74.634
3	3	66.7	0.90273	68.018
2	2	50.0	0.36651	57.680

Table A.8.2.1 Rainfall Probability Calculation by Iwai Method (1/3)

RESULT OF IWAI'S METHOD

1/T	x	(1/a)x	Xo + (1/a)x	Log10(Xo + (1/a)x)	Rainfall
1/2	0.0000	0.0000	2.2494	177.5995	134
1/3	0.3045	0.0505	2.2999	199.4962	156
1/4	0.4769	0.0791	2.3285	213.0700	170
1/5	0.5951	0.0987	2.3481	222.9064	180
1/8	0.8134	0.1349	2.3843	242.2823	199
1/10	0.9062	0.1503	2.3997	251.0209	208
1/15	1.0614	0.1760	2.4254	266.3456	223
1/20	1.1631	0.1929	2.4423	276.8916	234
1/25	1.2379	0.2053	2.4547	284.9136	242
1/30	1.2971	0.2151	2.4645	291.4271	248
1/40	1.3859	0.2298	2.4793	301.4775	258
1/50	1.4522	0.2408	2.4902	309.2068	266
1/60	1.5049	0.2495	2.4990	315.4916	272
1/80	1.5851	0.2628	2.5123	325.3020	282
1/100	1.6540	0.2743	2.5237	333.9735	291
1/150	1.7499	0.2902	2.5396	346.4291	303
1/200	1.8214	0.3020	2.5515	356.0169	313
1/250	1.8753	0.3110	2.5604	363.4197	320
1/300	1.9227	0.3188	2.5683	370.0569	327
1/400	1.9840	0.3290	2.5784	378.8204	335
1/500	2.0352	0.3375	2.5869	386.2989	343

VARIATION OF x FIGURE

T	W(x)=1/T	x	T	W(x)=1/T	x
500	0.00200	2.0352	30	0.03333	1.2971
400	0.00250	1.9840	25	0.04000	1.2379
300	0.00333	1.9227	20	0.05000	1.1631
250	0.00400	1.8753	15	0.06667	1.0614
200	0.00500	1.8214	10	0.10000	0.9062
150	0.00667	1.7499	8	0.12500	0.8134
100	0.01000	1.6540	5	0.20000	0.5951
80	0.01250	1.5851	4	0.25000	0.4769
60	0.01667	1.5049	3	0.33333	0.3045
50	0.02000	1.4522	2	0.50000	0.0000
40	0.02500	1.3859			

Table A.8.2.1 Rainfall Probability Calculation by Iwai method(2/3)

(For one day)

Oder	x_i (Rainfall)	$Lg x_i$	$x_i + b$	$Lg (x_i + b)$	$(Lg (x_i + b))^2$
1	394.90	2.5965	438.29	2.6418	6.9789
2	224.40	2.3510	267.79	2.4278	5.8942
3	220.60	2.3436	263.99	2.4216	5.8641
4	205.70	2.3132	249.09	2.3964	5.7425
5	199.80	2.3006	243.19	2.3859	5.6927
6	185.00	2.2672	228.39	2.3587	5.5633
7	184.00	2.2648	227.39	2.3568	5.5543
8	182.50	2.2613	225.89	2.3539	5.5408
9	179.60	2.2543	222.99	2.3483	5.5144
10	176.20	2.2460	219.59	2.3416	5.4831
11	175.70	2.2448	219.09	2.3406	5.4785
12	165.30	2.2183	208.69	2.3195	5.3801
13	165.00	2.2175	208.39	2.3189	5.3772
14	148.00	2.1703	191.39	2.2819	5.2071
15	146.60	2.1661	189.99	2.2787	5.1926
16	145.30	2.1623	188.69	2.2757	5.1790
17	143.40	2.1565	186.79	2.2713	5.1590
18	142.10	2.1526	185.49	2.2683	5.1452
19	139.50	2.1446	182.89	2.2622	5.1175
20	137.80	2.1392	181.19	2.2581	5.0991
21	135.50	2.1319	178.89	2.2526	5.0741
22	134.10	2.1274	177.49	2.2492	5.0587
23	130.80	2.1166	174.19	2.2410	5.0221
24	129.90	2.1136	173.29	2.2388	5.0121
25	128.00	2.1072	171.39	2.2340	4.9907
26	125.40	2.0983	168.79	2.2273	4.9610
27	125.10	2.0973	168.49	2.2266	4.9576
28	123.50	2.0917	166.89	2.2224	4.9392
29	120.50	2.0810	163.89	2.2145	4.9042
30	113.80	2.0561	157.19	2.1964	4.8242
31	113.80	2.0561	157.19	2.1964	4.8242
32	112.40	2.0508	155.79	2.1925	4.8072
33	108.70	2.0362	152.09	2.1821	4.7615
34	105.70	2.0241	149.09	2.1734	4.7238
35	104.80	2.0204	148.19	2.1708	4.7124
36	104.40	2.0187	147.79	2.1696	4.7073
37	99.60	1.9983	142.99	2.1553	4.6453
38	87.50	1.9420	130.89	2.1169	4.4812
39	79.20	1.8987	122.59	2.0884	4.3616
40	78.40	1.8943	121.79	2.0856	4.3497
41	76.20	1.8820	119.59	2.0777	4.3168
42	73.60	1.8669	116.99	2.0681	4.2772
43	68.70	1.8370	112.09	2.0496	4.2007
44	65.80	1.8182	109.19	2.0382	4.1541
Total	6206.80	93.3354	8115.8113	98.9754	223.2306
1/n	141.06	2.1213	184.4503	2.2494	5.0734

$$\log_{10} x_0 = \frac{1}{n} \sum \log_{10} x_i$$

→

$$x_0 = 132.2085$$

Table A.8.2.1 Rainfall Probability Calculation by Iwai method(3/3)

value 1/a and b (FOR ONE DAY)

No	x_s	x_t	$x_s x_t$	$x_s + x_t$	$x_s x_t - x_o^2$	$2x_o - (x_s + x_t)$	b_i
1	394.90	65.80	25984.42	460.70	8505.3347	-196.2830	-43.331995
2	224.40	68.70	15416.28	293.10	-2062.8053	-28.6830	71.9173061
3	220.60	73.60	16236.16	294.20	-1242.9253	-29.7830	41.7326861
4	205.70	76.20	15674.34	281.90	-1804.7453	-17.4830	103.228483
						TOTAL	173.54648
						b=	43.38662

$$\frac{1}{a} = \sqrt{2n/(n-1)} * \sqrt{X - X_o^2} = 0.165822$$

$$b_i = \frac{x_s x_t - x_o^2}{2x_o - (x_s + x_t)}$$

Table A.8.2.2 Annual Maximum One Day and 2 Days Rainfall

Lang station

One day Rainfalls

Two days Rainfalls

Order	Year	Month	Date	R(mm)
1	1984	11	10	394.9
2	1955	9	26	224.4
3	1989	6	12	220.6
4	1972	8	23	205.7
5	1959	7	30	199.8
6	1978	9	22	185
7	1958	6	16	184
8	1968	8	14	182.5
9	1994	8	29	179.6
10	1975	9	21	176.2
11	1967	7	25	175.7
12	1992	6	30	165.3
13	1986	6	18	165
14	1998	6	25	148
15	1974	9	7	146.6
16	1996	11	5	145.3
17	1993	9	30	143.4
18	1983	10	4	142.1
19	1979	8	4	139.5
20	1981	6	12	137.8
21	1964	7	3	135.5
22	1965	7	24	134.1
23	1963	8	17	130.8
24	1966	10	28	129.9
25	1990	9	20	128
26	1980	8	19	125.4
27	1971	5	12	125.1
28	1961	10	21	123.5
29	1991	6	11	120.5
30	1995	8	30	113.8
31	1997	8	23	113.8
32	1985	9	12	112.4
33	1956	9	16	108.7
34	1977	7	15	105.7
35	1960	7	1	104.8
36	1973	7	24	104.4
37	1987	8	30	99.6
38	1969	6	11	87.5
39	1970	7	25	79.2
40	1982	7	10	78.4
41	1976	9	17	76.2
42	1988	10	23	73.6
43	1962	5	9	68.7
44	1957	8	28	65.8

Order	Year	Month	Date	R(mm)
1	1984	11	9	560.4
2	1955	9	26	304.5
3	1994	8	29	301.0
4	1986	6	18	292.4
5	1989	6	11	286.7
6	1972	8	22	260.5
7	1980	8	19	245.5
8	1992	6	29	233.7
9	1979	8	3	228.3
10	1978	9	21	226.6
11	1985	9	11	219.3
12	1964	6	3	202.8
13	1959	7	29	201.7
14	1968	8	13	200.8
15	1991	6	11	199.8
16	1967	7	24	199.2
17	1998	6	26	196.5
18	1996	11	5	193.5
19	1958	6	15	184.6
20	1975	9	20	181.8
21	1993	9	29	180.1
22	1965	7	24	171.6
23	1983	10	4	169.1
24	1963	9	9	162.8
25	1971	8	19	162.5
26	1966	10	27	160.5
27	1977	7	15	153.7
28	1987	8	30	153.6
29	1961	10	20	152.6
30	1974	9	7	147.8
31	1982	8	19	143.7
32	1956	9	15	143.5
33	1997	8	23	142.0
34	1981	6	12	137.8
35	1990	9	20	136.5
36	1960	6	30	135.0
37	1995	8	30	133.1
38	1973	9	2	132.8
39	1976	9	17	114.9
40	1957	5	26	100.5
41	1969	9	4	91.4
42	1988	10	3	88.2
43	1970	7	24	81.0
44	1962	9	22	69.3

Table A.8.2.3 Annual Maximam One Day Rainfall

Thanh Tri station

One Day Rainfalls

Oder	Year	R(mm)
1	1984	316.0
2	1972	253.0
3	1986	239.0
4	1989	208.0
5	1985	163.0
6	1975	159.0
7	1992	158.0
8	1983	156.0
9	1978	152.0
10	1990	146.0
11	1980	134.0
12	1981	124.0
13	1977	117.0
14	1987	117.0
15	1974	111.0
16	1979	109.0
17	1976	106.0
18	1971	105.0
19	1973	103.0
20	1982	89.0
21	1991	84.0
22	1988	68.0

Period : 1971-1992

Gia Lam station

One Day Rainfalls

Oder	Year	R(mm)
1	1984	404.0
2	1985	261.0
3	1989	227.0
4	1994	212.0
5	1978	191.0
6	1968	172.0
7	1975	171.0
8	1965	157.0
9	1987	155.0
10	1972	154.0
11	1967	151.0
12	1964	144.0
13	1963	139.0
14	1992	139.0
15	1981	138.0
16	1993	138.0
17	1966	123.0
18	1982	123.0
19	1990	121.0
20	1974	120.0
21	1983	117.0
22	1961	113.0
23	1980	111.0
24	1976	108.0
25	1960	104.0
26	1971	103.0
27	1979	102.0
28	1995	96.0
29	1986	94.0
30	1991	92.0
31	1973	91.0
32	1977	91.0
33	1970	67.0
34	1988	66.0
35	1962	63.0
36	1969	60.0

Period : 1960-1995

Table A.8.2.4 Annual Maximum 10 and 60 Minutes Rainfall

Lang station

10 Minutes Rainfalls

60 Minutes Rainfalls

Order	Year	R(mm)
1	1968	35.2
2	1973	34.7
3	1986	32.4
4	1982	31.5
5	1984	30.2
6	1971	29.0
7	1964	27.9
8	1957	27.3
9	1985	26.4
10	1961	25.0
11	1980	24.2
12	1977	23.6
13	1974	23.5
14	1978	23.2
15	1975	23.1
16	1976	22.9
17	1972	22.8
18	1963	22.6
19	1962	22.4
20	1990	22.4
21	1969	22.0
22	1987	21.8
23	1967	21.4
24	1965	21.3
25	1983	20.6
26	1979	20.3
27	1966	20.0
28	1988	19.9
29	1981	19.7
30	1991	19.6
31	1970	19.3
32	1989	18.0
33	1959	17.8
34	1960	17.6
35	1992	11.7
36	1958	11.0

Order	Year	R(mm)
1	1984	136.3
2	1986	111.8
3	1967	93.9
4	1980	90.3
5	1977	79.4
6	1966	73.8
7	1978	70.7
8	1973	69.5
9	1963	67.7
10	1975	67.4
11	1968	67.0
12	1987	67.0
13	1969	64.8
14	1982	64.8
15	1989	63.6
16	1976	63.3
17	1981	61.4
18	1974	60.9
19	1972	60.9
20	1983	60.1
21	1964	59.1
22	1961	58.9
23	1971	53.0
24	1965	51.3
25	1979	47.7
26	1962	47.6
27	1985	46.6
28	1991	45.6
29	1957	45.4
30	1960	42.0
31	1990	41.3
32	1970	40.8
33	1959	34.5
34	1992	33.9
35	1988	31.9
36	1958	23.4

Period : 1957-1992

8.3 Runoff Discharge Calculation

Discharge calculation was carried out for deciding the capacity of road crossing, box and pipe culvert, and road side drain. In case that the runoff discharge from road such as road itself, its slope and plain lot, is larger than that from surrounding catchment area of road crossing, the runoff discharge from the road is applied for deciding the capacity of road crossing.

8.3.1 Discharge calculation for Road Crossing

Discharge calculation sheets for road crossing are attached as follows;

8.3.2 Discharge calculation for Road Side Drain

Discharge calculation sheets for road side drain are attached as follows:

- Thanh Tri Side
- Gia Lam Side

Discharge Calculation Sheet for Road Crossing

Calculation of Peak Runoff Discharge for Road Crossing Channel

Station	Runoff Coefficient	Area km ²	Daily Rainfall (mm)	Rainfall Intensity (mm)	Channel Length, Slope	Drainage Intensity (m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Thanh Tri Side (1/2) Sta.0+310/0+517 at fringe road					L=0.35km, I=1/10000			
Residential Area	0.8	0.39	215	66		14.66666667	5.72	It is considered that this area shall be developed as residential area based on the town planning.
Paddy & Aquatic Vegetable	0.7		215	214/24		1.741898148	0	
Farmland	0.35		215	214/4		5.225694444	0	
Pond	1.0	0.05	215	214/24		2.488425926	0.124421296	
Total		0.44					5.844421296	
Sta.2+397					L=0.5km, I=1/10000			
Residential Area	0.8	0.44	215	52		11.55555556	5.084444444	Remarks
Paddy & Aquatic Vegetable	0.7	0.27	215	214/24		1.741898148	0.4703125	
Farmland	0.35		215	214/4		5.225694444	0	
Pond	1.0	0.3	215	214/24		2.488425926	0.746527778	
Total		1.01					6.301284722	
Sta.3+656								
Residential Area	0.8		215			0	0	For connecting ponds affected by embankment.
Paddy & Aquatic Vegetable	0.7	0.04	215	214/24		1.741898148	0	
Farmland	0.35		215	214/4		5.225694444	0	
Pond	1.0	0.11	215	214/24		2.488425926	0.273726852	
Total		0.11					0.273726852	
Sta.3+973								
Residential Area	0.8		215			0	0	This channel shall be connected to the channel to be improved by DPEIH.
Paddy & Aquatic Vegetable	0.7	0.04	215	214/24		1.741898148	0.069675926	
Farmland	0.35		215	214/4		5.225694444	0	
Pond	1.0	0.02	215	214/24		2.488425926	0.049768519	
Total		0.06					0.119444444	
Sta.4+553								
Residential Area	0.8	0.17	215	43		9.55555556	1.624444444	Including the catchment area of Sta. 3+973. This channel shall be connected to the channel to be improved by DPEIH.
Paddy & Aquatic Vegetable	0.7	0.11	215	214/24	L=1.0km, I=1/5000	1.741898148	0.191608796	
Farmland	0.35		215	214/4		5.225694444	0	
Pond	1.0		215	214/24		2.488425926	0	
Total		0.28					1.816053241	
Sta.4+890								
Residential Area	0.8	0.15	215	43		9.55555556	1.433333333	Including the catchment area of Sta. 5+390 and Sta. 5+650. This channel shall be connected to the channel to be improved by DPEIH.
Paddy & Aquatic Vegetable	0.7		215	214/24	L=1.0km, I=1/5000	1.741898148	0	
Farmland	0.35		215	214/4		5.225694444	0	
Pond	1.0	0.13	215	214/24		2.488425926	0.32349537	
Total		0.28					1.756828704	2.562789352

Thanh Tri Sidc(2/2)

Station	Ruoff Coefficient	Area km2	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m3/s/Km2)	Discharge m3/s	Remarks
Sta.5+390								
Residential Area	0.8		215	214/24		0	0	Including the catchment area of Sta. 5+650. This channel shall be connected to the channel to be improved by DPEIH.
Paddy & Aquatic Vegetable Farmland	0.7	0.13	215	214/4		1.741898148	0.226446759	
Pond	0.35	0.08	215	214/4		5.225694444	0	
Total	1.0	0.21	215	214/24		2.488425926	0.199074074	
Sta.5+550								
Residential Area	0.8		Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m3/s/Km2)	Discharge m3/s	Remarks The pump station installed in this channel has not been operated. Then as the channel at Sta. 5+390 shall be relocated instead of this channel road crossing shall not be required.
Paddy & Aquatic Vegetable Farmland	0.7		215					
Pond	0.35		215					
Total	1.0		215					
Sta.5+650								
Residential Area	0.8	0.02	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m3/s/Km2)	Discharge m3/s	Remarks This channel shall be connected to the channel to be improved by DPEIH.
Paddy & Aquatic Vegetable Farmland/ Green & Park	0.7		215	80	L=0.4km, I=1/5000	17.77777778	0.355555556	
Pond	0.35		215	214/24		1.741898148	0	
Total	1.0	0.01	215	214/24		5.225694444	0	
Sta.6+170								
Residential Area	0.8	0.03	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m3/s/Km2)	Discharge m3/s	Remarks This channel shall be connected to the channel to be improved by DPEIH.
Paddy & Aquatic Vegetable Farmland	0.7	0.06	215	60	L=0.6km, I=1/5000	13.33333333	0.8	
Pond	0.35	0.01	215	214/4		1.741898148	0	
Total	1.0	0.10	215	214/24		5.225694444	0.313541667	
Total		0.13				2.488425926	1.138425926	

Note: Daily rainfall is 10 year return period

Gia Lam(1/3)		Runoff Coefficient	Area km ²	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Sta.9+383						L=1.0km, I=1/5000			This channel shall be relocated and connected to its existing channel.
Residential Area	0.8	0.15	215	43			1.433333333		
Paddy & Aquatic Vegetable	0.7	0.22	215	214/24			0.383217593		
Farmland	0.35	0.05	215	214/4			0		
Pond	1.0	0.05	215	214/24			0.124421296		
Total		0.42					1.940972222		
Sta.9+695						L=1.0km, I=1/5000			This channel shall be relocated to be diversion drain for Gia Lam interchange.
Residential Area	0.8	0.06	215	43			0.573333333		
Paddy & Aquatic Vegetable	0.7	0.05	215	214/24			0.087094907		
Farmland	0.35	0.05	215	214/4			0		
Pond	1.0	0.05	215	214/24			0		
Total		0.11					0.660428241		
Sta.9+932						L=1.0km, I=1/5000			
Residential Area	0.8	0.08	215	43			0.764444444		
Paddy & Aquatic Vegetable	0.7	0.22	215	214/24			0.383217593		
Farmland	0.35	0.01	215	214/4			0		
Pond	1.0	0.01	215	214/24			0.024884259		
Total		0.31					1.172546296		
Sta.10+170						L=1.0km, I=1/5000			Based on the re-observation at the site, it is judged that Sta. 10+170 is really not road crossing. Therefore this channel shall be connected to the above channel Sta. 9+932 directly.
Residential Area	0.8	0.07	215	43			0		
Paddy & Aquatic Vegetable	0.7	0.22	215	214/24			1.741898148		
Farmland	0.35	0.07	215	214/4			5.225694444		
Pond	1.0	0.07	215	214/24			2.488425926		
Total		0.00					0		
Sta.10+301						L=1.0km, I=1/5000			
Residential Area	0.8	0.07	215	43			0		
Paddy & Aquatic Vegetable	0.7	0.07	215	214/24			1.741898148		
Farmland	0.35	0.07	215	214/4			5.225694444		
Pond	1.0	0.07	215	214/24			2.488425926		
Total		0.00					0		
Sta.10+490						L=1.0km, I=1/5000			This channel shall be connected to the next channel Sta. 9+529 directly in consideration of re-arrangement of the next channel and road crossing for pedestrians.
Residential Area	0.8	0.07	215	43			0		
Paddy & Aquatic Vegetable	0.7	0.06	215	214/24			1.741898148		
Farmland	0.35	0.06	215	214/4			5.225694444		
Pond	1.0	0.06	215	214/24			2.488425926		
Total		0.07					0.12193287		
Sta.10+529						L=1.0km, I=1/5000			
Residential Area	0.8	0.06	215	43			0		
Paddy & Aquatic Vegetable	0.7	0.06	215	214/24			1.741898148		
Farmland	0.35	0.06	215	214/4			5.225694444		
Pond	1.0	0.06	215	214/24			2.488425926		
Total		0.06					0.104513889		

Gia Lam(2/3)									
Station	Runoff Coefficient	Area km ²	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks	
Sta.10+529									
Residential Area	0.8	0.08	215	60	L=0.6km, I=1/5000	13.33333333	1.066666667	The discharge from Sta. 10+301 and Sta. 10+490 shall be added.	
Paddy & Aquatic Vegetable Farmland	0.7	0.37	215	214/24		1.741898148	0.644502315		
	0.35		215	214/4		5.225694444	0		
Pond	1.0	0.01	215	214/24		2.488425926	0.024884259		
Total		0.46					1.736053241	1.9625	
Sta.10+694									
Residential Area	0.8	0.05	215	80	L=0.4km, I=1/5000	17.77777778	0.888888889	The discharge from Sta. 10+874 shall be added.	
Paddy & Aquatic Vegetable Farmland	0.7	0.04	215	214/24		1.741898148	0.069675926		
	0.35		215	214/4		5.225694444	0		
Pond	1.0	0.01	215	214/24		2.488425926	0.024884259		
Total		0.10					0.983449074	1.070543981	
Sta.10+874									
Residential Area	0.8	0.05	215			0	0		
Paddy & Aquatic Vegetable Farmland	0.7	0.05	215			1.741898148	0.087094907		
	0.35		215			5.225694444	0		
Pond	1.0		215			2.488425926	0		
Total		0.05					0.087094907		
Sta.11+009									
Residential Area	0.8	0.08	215			0	0		
Paddy & Aquatic Vegetable Farmland	0.7	0.08	215			1.741898148	0.139351852		
	0.35		215			5.225694444	0		
Pond	1.0		215			2.488425926	0		
Total		0.08					0.139351852		
Sta.11+228									
Residential Area	0.8	0.06	215			0	0		
Paddy & Aquatic Vegetable Farmland	0.7	0.06	215			1.741898148	0.104513889		
	0.35		215			5.225694444	0		
Pond	1.0		215			2.488425926	0		
Total		0.06					0.104513889		
Sta.11+460									
Residential Area	0.8	0.14	215	44	L=1.0km, I=1/5000	9.77777778	1.368888889	This channel shall be crossed under the bridge to be planned by the Project and led to Cau Bay river. The discharge from Sta. 11+009 and 11+228 shall be added.	
Paddy & Aquatic Vegetable Farmland	0.7	0.70	215	214/24		1.741898148	1.219328704		
	0.35		215	214/4		5.225694444	0		
Pond	1.0	0.04	215	214/24		2.488425926	0.099537037		
Total		0.88					2.68775463	2.93162037	

Station	Runoff Coefficient	Area km ²	Daily Rainfall (mm)	Rainfall Intensity (mm)	Channel Length, Slope	Drainage Intensity (m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Gua Lam(3/3)								
Sta. 11+810								
Residential Area	0.8		215			0	0	The water of this channel shall flow to the pump station.
Paddy & Aquatic Vegetable	0.7	0.15	215			1.741898148	0.261284722	
Farmland	0.35		215			5.225694444	0	
Pond	1.0		215			2.488425926	0	
Total		0.15					0.261284722	
Sta. 12+050								
Residential Area	0.8		215					This channel shall be crossed under the bridge to be planned by the Project.
Paddy & Aquatic Vegetable	0.7	0.02	215			1.741898148	0.034837963	
Farmland	0.35		215			5.225694444	0	
Pond	1.0	0.01	215			2.488425926	0.024884259	
Total		0.03					0.059722222	
Sta. 12+220								
Residential Area	0.8		215					It is considered that this area shall be developed as residential area along NHW No.5.
Paddy & Aquatic Vegetable	0.7	0.10	215	52	L=1.0km, I=1/3000	1.741898148	1.155555556	
Farmland	0.35	0.13	215			5.225694444	0.226446759	
Pond	1.0		215			2.488425926	0	
Total		0.23					1.382002315	
Sta. 12+320								
Residential Area	0.8		215					
Paddy & Aquatic Vegetable	0.7	0.06	215			1.741898148	0.104513889	
Farmland	0.35		215			5.225694444	0	
Pond	1.0		215			2.488425926	0	
Total		0.06					0.104513889	
Sta. 12+585								
Residential Area	0.8		215					
Paddy & Aquatic Vegetable	0.7	0.06	215			1.741898148	0.097546296	
Farmland	0.35		215			5.225694444	0	
Pond	1.0		215			2.488425926	0	
Total		0.06					0.097546296	

Discharge Calculation Sheet for Road Side Drain

Thanh Tri Side

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 0 + 000 Sta. 0 + 380	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215			0	0	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00475	380	12.5		165		43.54166667	0.206822917	Discharge from bridge and plain lot, Right side and
Bridge(widened)	0.95	0.00088	220	4		165		43.54166667	0.038316667	Left side shall be one channel, Channel shall be
Frontage road	0.95	0.00000				165		43.54166667	0	passed under the bridge to drain out to pond.
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00000				165		32.08333333	0	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00323	380	8.5		165		22.91666667	0.074020833	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00886							0.319160417	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 0 + 000 Sta. 0 + 380	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215			0	0	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00475	380	12.5		165		43.54166667	0.206822917	Discharge from bridge and plain lot, Right side and
Bridge(widened)	0.95	0.00035	70	5		165		43.54166667	0.015239583	Left side shall be one channel, Channel shall be
Frontage road	0.95	0.00000				165		43.54166667	0	passed under the bridge to drain out to pond.
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00000				165		32.08333333	0	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00323	380	8.5		165		22.91666667	0.074020833	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00833							0.296083333	0.61524375

Q=0.615m³/s
I=1/1500
B1=0.6m
B2=1.6m
H=1.0m
h=0.8m

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 0+820 Sta. 1+110	Runoff Coefficient	Area km2	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(rmm)	Channel Length, Slope	Drainage Intensity(m3/s/Km2)	Discharge m3/s	Remarks
Residential Area	0.80				215			0	0	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00350	280	12.5		165		43.54166667	0.152395833	Discharge from bridge and plain lot, Right side and Left side shall be one channel, Channel shall be passed under the bridge, Pond under the bridge shall be backfilled.
Traveled way	0.95	0.00000				165		43.54166667	0	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00000				165		32.08333333	0	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00238	280	8.5		165		22.91666667	0.054341667	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00588							0.2069375	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 0+820 Sta. 1+110	Runoff Coefficient	Area km2	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(rmm)	Channel Length, Slope	Drainage Intensity(m3/s/Km2)	Discharge m3/s	Remarks
Residential Area	0.80				215			0	0	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00350	280	12.5		165		43.54166667	0.152395833	Discharge from bridge and plain lot, Right side and Left side shall be one channel, Channel shall be passed under the bridge, Pond under the bridge shall be backfilled.
Traveled way	0.95	0.00000				165		43.54166667	0	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00000				165		32.08333333	0	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00238	280	8.5		165		22.91666667	0.054341667	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00588							0.2069375	0.413875

$Q=0.414m^3/s$
 $I=1/3000$
 $B1=0.6m$
 $B2=1.6m$
 $H=1.0m$
 $h=0.8m$

Calculation of Peak Runoff Discharge

(right & left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 0 + 820 Sta. 0 + 980	Runoff Coefficient	Area km2	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km2)	Discharge m ³ /s	Remarks
Residential Area	0.80				215			0	0	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	The runoff calculation from frontage road for a evaluation of drainage pipe. The runoff shall be drained out to the regulation reservoir,
Traveled way	0.95	0.00000				165		43.54166667	0	
Frontage road	0.95	0.00128	160	8		165		43.54166667	0.055733333	
Sidewalk & cycle path	0.95	0.00096	160	6		165		43.54166667	0.0418	
Slope 1	0.70	0.00016	160	1		165		32.08333333	0.005133333	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00240							0.102666667	

(right & left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 1 + 100 Sta. 1 + 640	Runoff Coefficient	Area km2	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km2)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.00000			215			0	0	
Paddy & Aquatic Vegetable	0.70	0.00000			215	215/24		1.741898148	0	
Farmland	0.35	0.00000			215	215/4		5.225694444	0	
Pond	1.00	0.00000			215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Road side drain shall be drained to Kim Ngau river. Q=0.909m/s I=1/1700 B1=1.0m B2=2.0m H=1.0m h=0.8m
Traveled way	0.95	0.00675	540	12.5		165		43.54166667	0.29390625	
Frontage road	0.95	0.00432	540	8		165		43.54166667	0.1881	
Sidewalk & cycle path	0.95	0.00324	540	6		165		43.54166667	0.141075	
Slope 1	0.70	0.00486	540	9		165		32.08333333	0.155925	
Slope 2	0.70	0.00405	540	7.5		165		32.08333333	0.1299375	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.02322							0.90894375	

Calculation of Peak Runoff/Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

(right or left)

Sta. 0 + 820 Sta. 0 + 970	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	The runoff calculation from frontage road for a
Traveled way	0.95	0.00000				165		43.54166667	0	evaluation of drainage pipe. The runoff shall be
Frontage road	0.95	0.00128	150	8.5		165		43.54166667	0.055515625	drained out to the regulation reservoir.
Sidewalk & cycle path	0.95	0.00090	150	6		165		43.54166667	0.0391875	
Slope 1	0.70	0.00010	50	2		165		32.08333333	0.003208333	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00228							0.097911458	

Calculation of Peak Runoff/Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

(right or left)

Sta. 1 + 000 Sta. 1 + 450	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Road side drain shall be drained to the regulation
Traveled way	0.95	0.00438	350	12.5		165		43.54166667	0.190494792	reservoir.
Frontage road	0.95	0.00360	450	8		165		43.54166667	0.15675	
Sidewalk & cycle path	0.95	0.00270	450	6		165		43.54166667	0.1175625	
Slope 1	0.70	0.00383	450	8.5		165		32.08333333	0.12271875	
Slope 2	0.70	0.00225	450	5		165		32.08333333	0.0721875	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.01675							0.659713542	

Q=0.659m/s
I=1/1300
B1=0.6m
B2=1.6m
H=1.0m
h=0.8m

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. +	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Sta. 1 + 450 Sta. 1 + 650					215	215/24		0	0	
Residential Area	0.80				215	215/24		1.741898148	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		5.225694444	0	
Farmland	0.35				215	215/24		2.488425926	0	
Pond	1.00								0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Road side drain shall be drained to Kim Nguu river. <div style="border: 1px solid black; padding: 5px; width: fit-content;"> Q=0.341m/s I=1/5000 B1=0.6m B2=1.6m H=1.0m h=0.8m </div>
Traveled way	0.95	0.00250	200	12.5		165		43.54166667	0.108854167	
Frontage road	0.95	0.00170	200	8.5		165		43.54166667	0.074020833	
Sidewalk & cycle path	0.95	0.00120	200	6		165		43.54166667	0.05225	
Slope 1	0.70	0.00170	200	8.5		165		32.08333333	0.054541667	
Slope 2	0.70	0.00160	200	8		165		32.08333333	0.051333333	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00870							0.341	

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. +	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Sta. +					215	215/24		0	0	
Residential Area	0.80	0.00000			215	215/24		1.741898148	0	
Paddy & Aquatic Vegetable	0.70	0.00000			215	215/4		5.225694444	0	
Farmland	0.35	0.00000			215	215/24		2.488425926	0	
Pond	1.00	0.00000							0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	
Traveled way	0.95	0.00000				165		43.54166667	0	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00000				165		32.08333333	0	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00000							0	

Calculation of Peak Runoff Discharge

(Right of left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 1 + 720 Sta. 1 + 840	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from the residential area of the existing road at the Sta. 1+860, to Kim Nguu river, To be drain out to Kim Nguu river.
Traveled way	0.95	0.00150	120	12.5		165		43.54166667	0.0653125	
Frontage road	0.95	0.00096	120	8		165		43.54166667	0.0418	
Sidewalk & cycle path	0.95	0.00072	120	6		165		43.54166667	0.03135	
Slope 1	0.70	0.00102	120	8.5		165		32.08333333	0.032725	
Slope 2	0.70	0.00050	100	5		165		32.08333333	0.016041667	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00470							0.187229167	

$$Q=0.187\text{m}^3/\text{s}$$

$$I=1/15000$$

$$B1=0.6\text{m}$$

$$B2=1.6\text{m}$$

$$H=1.0\text{m}$$

$$h=0.8\text{m}$$

(Right of left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 1 + 860 Sta. 2 + 200	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.00000			215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70	0.00000			215	215/4		1.741898148	0	
Farmland	0.35	0.00000			215	215/4		5.225694444	0	
Pond	1.00	0.00000			215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from the residential area of the existing road at the Sta. 1+860 to paddy field nearby Sta. 2+200, To be drain out to pond directly, Road side drain is not required,
Traveled way	0.95	0.00100	80	12.5		165		43.54166667	0.043541667	
Frontage road	0.95	0.00272	340	8		165		43.54166667	0.118433333	
Sidewalk & cycle path	0.95	0.00204	340	6		165		43.54166667	0.088825	
Slope 1	0.70	0.00289	340	8.5		165		32.08333333	0.092720833	
Slope 2	0.70	0.00204	340	6		165		32.08333333	0.06545	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.01069							0.408970833	

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 2 + 220 Sta. 2 + 400	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from paddy field nearby Sta. 2+100 to box culvert at Sta. 2+240. To be drain out to box culvert directly.
Traveled way	0.95	0.00175	140	12.5		165		43.54166667	0.076197917	
Frontage road	0.95	0.00144	180	8		165		43.54166667	0.0627	
Sidewalk & cycle path	0.95	0.00108	180	6		165		43.54166667	0.047025	
Slope 1	0.70	0.00153	180	8.5		165		32.08333333	0.0490875	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00580							0.235010417	

Q=0.235m³/s
I=1/10000
B1=0.6m
B2=1.6m
H=1.0m
h=0.8m

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 1 + 720 Sta. 2 + 080	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.00000			215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70	0.00000			215	215/4		1.741898148	0	
Farmland	0.35	0.00000			215	215/4		5.225694444	0	
Pond	1.00	0.00000			215	215/24		2.488425926	0	
Total		0.00000							0	
Traveled way	0.95	0.00175	140	12.5		165		43.54166667	0.076197917	Discharge calculation stretch from Kim Ngau river to residential area. To be drain out to pond.
Traveled way	0.95	0.00450	360	12.5		165		43.54166667	0.1959375	
Frontage road	0.95	0.00288	360	8		165		43.54166667	0.1254	
Sidewalk & cycle path	0.95	0.00216	360	6		165		43.54166667	0.09405	
Slope 1	0.70	0.00306	360	8.5		165		32.08333333	0.098175	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.01435							0.589760417	

Q=0.590m³/s
I=1/1600
B1=0.6m
B2=1.6m
H=1.0m
h=0.8m

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 2 + 080 Sta. 2 + 400	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215			0	0	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Traveled way	0.95	0.00400	320	12.5		165		43.54166667	0.174166667	Discharge calculation stretch from residential area nearby Sta. 2+080 to box culvert at Sta. 2+240. To be drain out to box culvert directly. Q=0.544m/s I=1/1900 B1=0.6m B2=1.6m H=1.0m h=0.8m
Traveled way	0.95	0.00200	160	12.5		165		43.54166667	0.087083333	
Frontage road	0.95	0.00256	320	8		165		43.54166667	0.111466667	
Sidewalk & cycle path	0.95	0.00192	320	6		165		43.54166667	0.0836	
Slope 1	0.70	0.00272	320	8.5		165		32.08333333	0.087266667	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.01320							0.543583333	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Residential Area	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.00000			215			0	0	
Paddy & Aquatic Vegetable	0.70	0.00000			215	215/24		1.741898148	0	
Farmland	0.35	0.00000			215	215/4		5.225694444	0	
Pond	1.00	0.00000			215	215/24		2.488425926	0	
Total		0.00000							0	
Traveled way	0.95	0.00000				165		43.54166667	0	
Traveled way	0.95	0.00000				165		43.54166667	0	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00000				165		32.08333333	0	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00000							0	

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 2 +400 Sta. 2 + 780	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000						43.54166667	0.070755208	Discharge calculation stretch from box culvert at Sta. 2+400 to Nguyen Tam Trinh road. To be drained out to its box culvert and pond separately through drainage pipe, Road side drain is not required.
Traveled way	0.95	0.00163	130	12.5		165		43.54166667	0.185052083	
Traveled way	0.95	0.00425	250	17		165		43.54166667	0.132366667	
Frontage road	0.95	0.00304	380	8		165		43.54166667	0.099275	
Sidewalk & cycle path	0.95	0.00228	380	6		165		43.54166667	0.069666667	
Ramp road	0.95	0.00160	200	8		165		43.54166667	0.0693	
Slope 1	0.70	0.00216	180	12		165		32.08333333	0.086625	
Slope 2	0.70	0.00270	150	18		165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.01766							0.713040625	

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 2 +400 Sta. 2 + 780	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000						43.54166667	0.076197917	Discharge calculation stretch from box culvert at Sta. 2+400 to Nguyen Tam Trinh road. To be drained out to its box culvert through road side drain.
Traveled way	0.95	0.00175	140	12.5		165		43.54166667	0.15675	
Traveled way	0.95	0.00360	240	15		165		43.54166667	0.132366667	
Frontage road	0.95	0.00304	380	8		165		43.54166667	0.099275	
Sidewalk & cycle path	0.95	0.00228	380	6		165		43.54166667	0.080116667	
Ramp road	0.95	0.00184	230	8		165		43.54166667	0.086625	
Slope 1	0.70	0.00270	180	15		165		32.08333333	0.083416667	
Slope 2	0.70	0.00260	130	20		165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.01781							0.714747917	

Q=0.357m/s
I=1/4500
B1=0.6m
B2=1.6m
H=1.0m
h=0.8m

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 2 + 820 Sta. 3 + 100	Runoff Coefficient	Area km2	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m3/s/Km2)	Discharge m3/s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00100	40	25		165		43.541666667	0.0435416667	Discharge calculation stretch from Nguyen Tam Trinh road to Sta. 3+080, To be drained out to existing pond at Sta. 3+000, Road side drain is not required,
Traveled way	0.95	0.00000				165		43.541666667	0	
Frontage road	0.95	0.00224	280	8		165		43.541666667	0.097533333	
Sidewalk & cycle path	0.95	0.00168	280	6		165		43.541666667	0.07315	
Slope 1	0.70	0.00213	250	8.5		165		32.083333333	0.068177083	
Slope 2	0.70	0.00345	230	15		165		32.083333333	0.1106875	
Slope 3	0.70	0.00000				165		32.083333333	0	
Plain lot 1	0.50	0.00000				165		22.916666667	0	
Plain lot 2	0.50	0.00000				165		22.916666667	0	
Plain lot 3	0.50	0.00000				165		22.916666667	0	
Total		0.01050							0.393089383	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 2 + 820 Sta. 3 + 080	Runoff Coefficient	Area km2	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m3/s/Km2)	Discharge m3/s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Traveled way	0.95	0.00325	260	12.5		165		43.541666667	0.141510417	Discharge calculation stretch from Nguyen Tam Trinh road to Sta. 3+080, To be drained out to existing pond at Sta. 3+080.
Traveled way	0.95	0.00325	260	12.5		165		43.541666667	0.141510417	
Frontage road	0.95	0.00208	260	8		165		43.541666667	0.090566667	
Sidewalk & cycle path	0.95	0.00156	260	6		165		43.541666667	0.067925	
Slope 1	0.70	0.00390	260	15		165		32.083333333	0.125125	
Slope 2	0.70	0.00000				165		32.083333333	0	
Slope 3	0.70	0.00000				165		32.083333333	0	
Plain lot 1	0.50	0.00000				165		22.916666667	0	
Plain lot 2	0.50	0.00000				165		22.916666667	0	
Plain lot 3	0.50	0.00000				165		22.916666667	0	
Total		0.01404							0.5666375	

Q=0.567m/s
I=1/1800
B1=0.6m
B2=1.6m
H=1.0m
h=0.8m

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 3 + 100 Sta. 3 + 300	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.541666667	0	This is a evaluation of drainage pipe, The runoff is drained out through pipe, Road side drain is not required,
Traveled way	0.95	0.00000				165		43.541666667	0	
Frontage road	0.95	0.00160	200	8		165		43.541666667	0.069666667	
Sidewalk & cycle path	0.95	0.00120	200	6		165		32.083333333	0	
Slope 1	0.70	0.00000				165		32.083333333	0	
Slope 2	0.70	0.00000				165		32.083333333	0	
Slope 3	0.70	0.00000				165		22.916666667	0	
Plain lot 1	0.50	0.00000				165		22.916666667	0	
Plain lot 2	0.50	0.00000				165		22.916666667	0	
Plain lot 3	0.50	0.00000				165		22.916666667	0	
Total		0.00280							0.121916667	

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 3 + 080 Sta. 3 + 300	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.00000			215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70	0.00000			215	215/4		1.741898148	0	
Farmland	0.35	0.00000			215	215/4		5.225694444	0	
Pond	1.00	0.00000			215	215/24		2.488425926	0	
Total		0.00000							0	
Traveled way	0.95	0.00450	360	12.5		165		43.541666667	0.1959375	This is a evaluation of drainage pipe, The runoff is drained out through pipe, Road side drain is not required,
Traveled way	0.95	0.00275	220	12.5		165		43.541666667	0.119739583	
Frontage road	0.95	0.00176	220	8		165		43.541666667	0.076633333	
Sidewalk & cycle path	0.95	0.00132	220	6		165		43.541666667	0.057475	
Slope 1	0.70	0.00136	160	8.5		165		32.083333333	0.043633333	
Slope 2	0.70	0.00032	160	2		165		32.083333333	0.010266667	
Slope 3	0.70	0.00000				165		32.083333333	0	
Plain lot 1	0.50	0.00000				165		22.916666667	0	
Plain lot 2	0.50	0.00000				165		22.916666667	0	
Plain lot 3	0.50	0.00000				165		22.916666667	0	
Total		0.01201							0.503685417	

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 4 + 080 Sta. 4 + 500	Runoff Coefficient	Area km2	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m3/s/Km2)	Discharge m3/s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Traveled way	0.95	0.00325	260	12.5		165		43.54166667	0.141510417	Discharge calculation stretch from aquatic vegetable field nearby Sta. 4+080 to existing road at Sta. 4+500, To be drained out to existing channel through drainage pipe, Road side drain in not required,
Traveled way	0.95	0.00175	140	12.5		165		43.54166667	0.076197917	
Frontage road	0.95	0.00208	260	8		165		43.54166667	0.090566667	
Sidewalk & cycle path	0.95	0.00156	260	6		165		43.54166667	0.067925	
Slope 1	0.70	0.00208	260	8		165		32.08333333	0.066733333	
Slope 2	0.70	0.00156	260	6		165		32.08333333	0.05005	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.01228							0.492983333	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 4 + 080 Sta. 4 + 500	Runoff Coefficient	Area km2	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m3/s/Km2)	Discharge m3/s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from aquatic vegetable field nearby Sta. 4+080 to existing road at Sta. 4+500, To be drained out to existing pond at Sta. 4+160 through earthen channel planned.
Traveled way	0.95	0.00350	280	12.5		165		43.54166667	0.152395833	
Frontage road	0.95	0.00336	420	8		165		43.54166667	0.1463	
Sidewalk & cycle path	0.95	0.00252	420	6		165		43.54166667	0.109725	
Slope 1	0.70	0.00357	420	8.5		165		32.08333333	0.1145375	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.01295							0.522958333	

Q=0.529m/s
j=1/2100
B1=1.0m
B2=3.0m
H=1.0m
h=0.75m

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 4 + 820 Sta. 5 + 000	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from planned road to residential area over road crossing of Sta. 4+880. To be drained out to road crossing Sta. Sta. 4+ 890.
Traveled way	0.95	0.00075	60	12.5		165		43.54166667	0.03265625	
Frontage road	0.95	0.00144	180	8		165		43.54166667	0.0627	
Sidewalk & cycle path	0.95	0.00108	180	6		165		43.54166667	0.047025	
Slope 1	0.70	0.00153	180	8.5		165		32.08333333	0.0490875	
Slope 2	0.70	0.00032	160	2		165		32.08333333	0.010266667	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00512							0.201735417	

Q=0.202m/s
I=1/14000
B1=0.6m
B2=1.6m
H=1.0m
h=0.8m

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 4 + 920 Sta. 5 + 300	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Traveled way	0.95	0.00550	440	12.5		165		43.54166667	0.239479167	Discharge calculation stretch from residential area to pond at Sta. 5+240. To be drained out to its pond at Sta. Sta. 5+ 240. The runoff is included it from right side at the stretch of super-elevation.
Traveled way	0.95	0.00475	380	12.5		165		43.54166667	0.206822917	
Frontage road	0.95	0.00216	270	8		165		43.54166667	0.09405	
Sidewalk & cycle path	0.95	0.00162	270	6		165		43.54166667	0.0705375	
Slope 1	0.70	0.00374	440	8.5		165		32.08333333	0.119991667	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.01777							0.73088125	

Q=0.751m/s
I=1/2700
B1=1.0m
B2=2.0m
H=1.0m
h=0.8m

Calculation of Peak Runoff Discharge

(right & left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 5 + 660 Sta. 6 + 220	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.05500			215	60	L=0.6km, I=1/5000	13.33333333	0.733333333	Discharge calculation stretch from Lini Nam road to the road crossing of Sta. 6+170, The road crossing shall be installed for crossing existing road.
Paddy & Aquatic Vegetable	0.70	0.06300			215	215/24	1.741898148	0		
Farmland	0.35	0.06300			215	215/4	5.225694444	0.32921875		
Pond	1.00	0.00750			215	215/24	2.488425926	0.018663194		
Total		0.12550						1.081215278		
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch is same as above. The object of the runoff are traveled road, access road and slope including plain lot surrounding tollgate. The above discharge shall be larger than this, The above Q is therefore used.
Traveled way	0.95	0.00891				165	43.54166667	0.38795625		
Frontage road	0.95	0.00686				165	43.54166667	0.298695833		
Sidewalk & cycle path	0.95					165	43.54166667	0		
Slope 1	0.70	0.00096				165	32.08333333	0.0308		
Slope 2	0.70	0.00566				165	32.08333333	0.181591667		
Slope 3	0.70	0.00021				165	32.08333333	0.0067375		
Plain lot 1	0.95	0.00350				165	43.54166667	0.152395833		
Plain lot 2	0.50	0.00000				165	22.91666667	0		
Plain lot 3	0.50	0.00000				165	22.91666667	0		
Total		0.02610						1.058177083		

Q=1.08 km/s
I=1/1000
B1=1.0m
B2=2.0m
F=1.0m
b=0.75m

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 5 + 650 Sta. 6 + 220	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.00000			215			0	0.000	Discharge calculation stretch is same as above. The object of the runoff are traveled road, access road and slope including plain lot surrounding tollgate.
Paddy & Aquatic Vegetable	0.70	0.00000			215	215/24	1.741898148	0		
Farmland	0.35	0.00000			215	215/4	5.225694444	0		
Pond	1.00	0.00000			215	215/24	2.488425926	0		
Total		0.00000						0	0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch is same as above. The object of the runoff are traveled road, access road and slope including plain lot surrounding tollgate.
Traveled way	0.95	0.00891				165	43.54166667	0.38795625		
Frontage road	0.95	0.01577				165	43.54166667	0.686652083		
Sidewalk & cycle path	0.95					165	43.54166667	0		
Slope 1	0.70	0.00108				165	32.08333333	0.03465		
Slope 2	0.70	0.00360				165	32.08333333	0.11155		
Slope 3	0.70	0.00023				165	32.08333333	0.00721875		
Plain lot 1	0.95	0.00384				165	43.54166667	0.1672		
Plain lot 2	0.50	0.00000				165	22.91666667	0		
Plain lot 3	0.50	0.00000				165	22.91666667	0		
Total		0.03343						1.399177083		

Q=1.399m/s
I=1/1000
B1=1.0m
B2=2.0m
F=1.0m
h=0.87m

Discharge Calculation Sheet for Road Side Drain

Gia Lam Side

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 9 + 120 Sta. 9 + 320	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable Farmland	0.70 0.35				215 215	215/4		1.741898148 5.225694444	0 0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation for road side drain for ramp road, To be drained out to pond. <div style="border: 1px solid black; padding: 5px; width: fit-content;"> $Q=0.076m^3/s$ $I=1/10000$ $B1=0.6m$ $B2=1.6m$ $H=1.0m$ $h=0.42m$ </div>
Traveled way	0.95	0.00000				165		43.54166667	0	
Ramp road	0.95	0.00100	200	5		165		43.54166667	0.043541667	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00100	200	5		165		32.08333333	0.032083333	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00200							0.075625	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 9 + 380	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.15000			215	43	L=1.0km, I=1/5000	9.555555556	1.433333333	Discharge calculation for the road crossing of Sta. 9+383, The beginning point of relocation is the pond, <div style="border: 1px solid black; padding: 5px; width: fit-content;"> $Q=1.940m^3/s$ $I=1/450$ $B1=1.0m$ $B2=2.0m$ $H=1.0m$ $h=0.84m$ </div>
Paddy & Aquatic Vegetable Farmland	0.70 0.35	0.22000			215 215	215/24 215/4		1.741898148 5.225694444	0.383217593 0	
Pond	1.00	0.05000			215	215/24		2.488425926	0.124421296	
Total		0.42000							1.940972222	
Bridge	0.95	0.00000				165		43.54166667	0	
Traveled way	0.95	0.00000				165		43.54166667	0	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00000				165		32.08333333	0	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00000							0	The above discharge shall be applied for road side drain and relocation channel.

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

(right or left)		Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Sta. 9 + 700											
Residential Area	0.80	0.06000				215	43	L=1.0km, I=1/5000	9.555555556	0.573333333	Discharge calculation for the road crossing of Sta. 9+695, The relocated channel shall be installed along toe of slope of frontage road to the dyke.
Paddy & Aquatic Vegetable	0.70	0.05000			215	215/24		1.741898148	0.087094907		
Farmland	0.35				215	215/4		5.225694444	0		
Pond	1.00				215	215/24		2.488425926	0		
Total		0.11000							0.660428241		
Bridge	0.95	0.00000					165		43.541666667	0	The above discharge shall be applied for road side drain, <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> Q=0.660m/s I=1/3500 B1=1.0m B2=2.0m H=1.0m h=0.82m </div>
Traveled way	0.95	0.00000					165		43.541666667	0	
Frontage road	0.95	0.00000					165		43.541666667	0	
Sidewalk & cycle path	0.95	0.00000					165		43.541666667	0	
Slope 1	0.70	0.00000					165		32.083333333	0	
Slope 2	0.70	0.00000					165		32.083333333	0	
Slope 3	0.70	0.00000					165		32.083333333	0	
Plain lot 1	0.50	0.00000					165		22.916666667	0	
Plain lot 2	0.50	0.00000					165		22.916666667	0	
Plain lot 3	0.50	0.00000					165		22.916666667	0	
Total		0.00000							0		

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

(right or left)		Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Sta. 9 + 380											
Sta. 9 + 700											
Residential Area	0.80					215			0	0	Discharge calculation stretch from the road crossing of Sta. 9+383 to the road crossing of Sta. 9+695, the runoff discharge from interchange shall be divided into 2 portions, outside and inside. This is for inside calculation, Road side drain after road crossing at Sta. 9+584 <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> Q=0.755m/s I=1/4000 B1=2.15m B2=3.95m H=0.9m h=0.77m </div>
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	0	
Farmland	0.35				215	215/4		5.225694444	0	0	
Pond	1.00				215	215/24		2.488425926	0	0	
Total		0.00000							0	0	
Bridge	0.95	0.00000					165		43.541666667	0	
Traveled way	0.95	0.00513		410	12.5		165		43.541666667	0.223151042	
Ramp road	0.95	0.00530		550	10		165		43.541666667	0.230770833	
Sidewalk & cycle path	0.95	0.00000					165		43.541666667	0	
Slope 1	0.70	0.00391		460	8.5		165		32.083333333	0.125445833	
Slope 2	0.70	0.00125		250	5		165		32.083333333	0.040104167	
Slope 3	0.70	0.00424		550	8		165		32.083333333	0.136033333	
Plain lot 1	0.50	0.00000					165		22.916666667	0	
Plain lot 2	0.50	0.00000					165		22.916666667	0	
Plain lot 3	0.50	0.00000					165		22.916666667	0	
Total		0.01983							0.75505208		

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 9 + 380 Sta. 9 + 700	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from the road crossing of Sta. 9+383 to the road crossing of Sta. 9+695, This is the discharge from right side interchange, The abovementioned runoff 0.755 is larger than this, Therefore 0.755 is applied.
Traveled way	0.95	0.00513	410	12.5		165		43.54166667	0.223151042	
Ramp road	0.95	0.00530	530	10		165		43.54166667	0.230770833	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00468	550	8.5		165		32.08333333	0.149989583	
Slope 2	0.70	0.00424	530	8		165		32.08333333	0.136033333	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.01934							0.739944792	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. + Sta. +	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.00000			215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70	0.00000			215	215/4		1.741898148	0	
Farmland	0.35	0.00000			215	215/4		5.225694444	0	
Pond	1.00	0.00000			215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	
Traveled way	0.95	0.00000				165		43.54166667	0	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00000				165		32.08333333	0	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00000							0	

Calculation of Peak Runoff Discharge

(right ← left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 9 + 700 Sta. 9 + 940	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215			0	0	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from the road crossing of Sta. 9+695 to the road crossing of Sta. 9+932. <div style="border: 1px solid black; padding: 5px; width: fit-content;"> Q=0.196m/s I=1/10000 B1=1.0m B2=3.0m H=1.0m h=0.67m </div>
Traveled way	0.95	0.00300	240	12.5		165		43.54166667	0.130625	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00204	240	8.5		165		32.08333333	0.06545	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00504							0.196075	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 9 + 700 Sta. 9 + 940	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215			0	0	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from the road crossing of Sta. 9+695 to the road crossing of Sta. 9+932. Though there are paddy fields nearby, road side drain shall be installed at this stretch in consideration of drainage from the site office and village. <div style="border: 1px solid black; padding: 5px; width: fit-content;"> Q=0.819m/s I=1/1900 B1=2.0m B2=2.5m H=0.5m h=0.5m </div>
Traveled way	0.95	0.01145	240	12.5		165		43.54166667	0.498552083	
Frontage road	0.95	0.00192	240	8		165		43.54166667	0.0836	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00204	240	8.5		165		32.08333333	0.06545	
Slope 2	0.70	0.00095	190	5		165		32.08333333	0.030479167	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.95	0.00250	50	50		165		43.54166667	0.108854167	
Plain lot 2	0.50	0.00072	240	3		165		22.91666667	0.0165	
Plain lot 3	0.50	0.00072	240	3		165		22.91666667	0.0165	
Total		0.02030							0.819935417	

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10-year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 9 + 940 Sta. 10 + 170	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from the road crossing of Sta. 932 to Sta. 10+170, Q=0.188m ³ /s I=1/10000 B1=1.0m B2=3.0m H=1.0m h=0.66m
Traveled way	0.95	0.00288	230	12.5		165		43.54166667	0.125182292	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00196	230	8.5		165		32.08333333	0.062722917	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00483							0.187903208	

Note: Daily rainfall is 10-year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 9 + 940 Sta. 10 + 170	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from the road crossing of Sta. 9+932 to Sta. 10+170. Road side drain shall be installed at this stretch in consideration of existing drainage system. Q=0.343m ³ /s I=1/2000 B1=1.0m B2=2.6m H=0.6m h=0.59m
Traveled way	0.95	0.00288	230	12.5		165		43.54166667	0.125182292	
Frontage road	0.95	0.00184	230	8		165		43.54166667	0.080116667	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00196	230	8.5		165		32.08333333	0.062722917	
Slope 2	0.70	0.00138	230	6		165		32.08333333	0.044275	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00069	230	3		165		22.91666667	0.0158125	
Plain lot 2	0.50	0.00069	230	3		165		22.91666667	0.0158125	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00943							0.343921875	

Calculation of Peak Runoff/Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 10 + 170 Sta. 10 + 300	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from Sta. 10+170 to the road crossing of Sta. 10+301, As there are paddy fields nearby, <div style="border: 1px solid black; padding: 5px; width: fit-content;"> Q=0.106m/s i=1/10000 B1=1.0m B2=3.0m H=1.0m h=0.5m </div>
Traveled way	0.95	0.00163	130	12.5		165		43.54166667	0.070755208	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00111	130	8.5		165		32.08333333	0.035452083	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00273							0.106207292	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 10 + 170 Sta. 10 + 300	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from Sta. 10+170 to the road crossing of Sta. 10+301, <div style="border: 1px solid black; padding: 5px; width: fit-content;"> Q=0.194m/s i=1/10000 B1=1.0m B2=3.0m H=1.0m h=0.68m </div>
Traveled way	0.95	0.00163	130	12.5		165		43.54166667	0.070755208	
Frontage road	0.95	0.00104	130	8		165		43.54166667	0.045283333	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00111	130	8.5		165		32.08333333	0.035452083	
Slope 2	0.70	0.00078	130	6		165		32.08333333	0.025025	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00039	130	3		165		22.91666667	0.0089375	
Plain lot 2	0.50	0.00039	130	3		165		22.91666667	0.0089375	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00533							0.194390625	

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 10+300 Sta. 10+490	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from the road crossing of Sta. 10+301 to Sta. 10+490, <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;"> Q=0.164m³/s I=1/10000 B1=1.0m B2=3.0m H=1.0m h=0.61m </div>
Traveled way	0.95	0.00238	190	12.5		165		43.54166667	0.103411458	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00190	190	10		165		32.08333333	0.060958333	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00428							0.164369792	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 10+300 Sta. 10+490	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	43	L=1.0km, I=1/5000	9.555555556	0	Discharge calculation stretch from the road crossing of Sta. 10+301 to Sta. 10+490, <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;"> Q=0.284m³/s I=1/7500 B1=1.0m B2=3.0m H=1.0m h=0.75m </div>
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	
Traveled way	0.95	0.00238	190	12.5		165		43.54166667	0.103411458	
Frontage road	0.95	0.00152	190	8		165		43.54166667	0.066183333	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00162	190	8.5		165		32.08333333	0.051814583	
Slope 2	0.70	0.00114	190	6		165		32.08333333	0.036575	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00057	190	3		165		22.91666667	0.0130625	
Plain lot 2	0.50	0.00057	190	3		165		22.91666667	0.0130625	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00779							0.284109375	

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 10 + 490 Sta. 10 + 520	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	The channel is relocated and connected to the channel of the road crossing of Sta. 10+529,
Paddy & Aquatic Vegetable	0.70	0.06000			215	215/24	1.741898148	0.104513889		
Farmland	0.35				215	215/4	5.225694444	0		
Pond	1.00				215	215/24	2.488425926	0		
Total		0.06000						0.104513889		
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from Sta. 10+490 to the road crossing of Sta. 10+520. The above runoff is applied.
Traveled way	0.95	0.00038	30	12.5		165	43.54166667	0.016328125	0	
Frontage road	0.95	0.00000				165	43.54166667	0		
Sidewalk & cycle path	0.95	0.00000				165	43.54166667	0		
Slope 1	0.70	0.00030	30	10		165	32.08333333	0.009625		
Slope 2	0.70	0.00015	30	5		165	32.08333333	0.0048125		
Slope 3	0.70	0.00000				165	32.08333333	0		
Plain lot 1	0.50	0.00000				165	22.91666667	0		
Plain lot 2	0.50	0.00000				165	22.91666667	0		
Plain lot 3	0.50	0.00000				165	22.91666667	0		
Total		0.00083						0.030765625		

Q=0.104m³/s
I=1/10000
B1=1.0m
B2=3.0m
H=1.0m
h=0.48m

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 10 + 490 Sta. 10 + 620	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0.000	Discharge calculation stretch from Sta. 10+490 to Sta. 10+620. As there are paddy fields nearby.
Paddy & Aquatic Vegetable	0.70				215	215/24	1.741898148	0		
Farmland	0.35				215	215/4	5.225694444	0		
Pond	1.00				215	215/24	2.488425926	0		
Total		0.00000						0		
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from Sta. 10+490 to Sta. 10+620. As there are paddy fields nearby.
Traveled way	0.95	0.00163	130	12.5		165	43.54166667	0.070755208	0	
Frontage road	0.95	0.00104	130	8		165	43.54166667	0.045283333	0	
Sidewalk & cycle path	0.95	0.00000				165	43.54166667	0		
Slope 1	0.70	0.00111	130	8.5		165	32.08333333	0.035452083		
Slope 2	0.70	0.00078	130	6		165	32.08333333	0.025025		
Slope 3	0.70	0.00000				165	32.08333333	0		
Plain lot 1	0.50	0.00039	130	3		165	22.91666667	0.0089375		
Plain lot 2	0.50	0.00039	130	3		165	22.91666667	0.0089375		
Plain lot 3	0.50	0.00000				165	22.91666667	0		
Total		0.00533						0.194390625		

Q=0.194m³/s
I=1/10000
B1=1.0m
B2=3.0m
H=1.0m
h=0.67m

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 10 + 520 Sta. 10 + 700	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
	0.80				215	215/24		0	0	
	0.70				215	215/4		1.741898148	0	
	0.35				215	215/4		5.225694444	0	
	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from Sta. 10+520 to the road crossing of Sta. 10+694,
Traveled way	0.95	0.00225	180	12.5		165		43.54166667	0.09796875	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00110	110	10		165		32.08333333	0.035291667	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00335							0.133260417	

Q=0.133m/s
I=1/10000
B1=1.0m
B2=3.0m
H=1.0m
h=0.55m

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 10 + 620 Sta. 10 + 700	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
	0.80				215	215/24		0	0	
	0.70				215	215/4		1.741898148	0	
	0.35				215	215/4		5.225694444	0	
	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from Sta. 10+520 to the road crossing of Sta. 10+694,
Traveled way	0.95	0.00100	80	12.5		165		43.54166667	0.043541667	
Frontage road	0.95	0.00080	100	8		165		43.54166667	0.034833333	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00068	80	8.5		165		32.08333333	0.021816667	
Slope 2	0.70	0.00052	130	4		165		32.08333333	0.016683333	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00027	90	3		165		22.91666667	0.0061875	
Plain lot 2	0.50	0.00036	120	3		165		22.91666667	0.00825	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00363							0.1313125	

Q=0.131m/s
I=1/10000
B1=0.6m
B2=1.6m
H=1.0m
h=0.58m

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 10+700 Sta. 10+860	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215			0	0	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.541666667	0	Discharge calculation stretch from Sta. 10+694 to the road crossing of Sta. 10+874, <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 5px auto;"> $Q=0.189\text{m}^3/\text{s}$ $I=1/10000$ $B1=1.0\text{m}$ $B2=3.0\text{m}$ $H=1.0\text{m}$ $b=0.66\text{m}$ </div>
Traveled way	0.95	0.00200	160	12.5		165		43.541666667	0.087083333	
Frontage road	0.95	0.00000				165		43.541666667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.541666667	0	
Slope 1	0.70	0.00320	200	16		165		32.083333333	0.102666667	
Slope 2	0.70	0.00000				165		32.083333333	0	
Slope 3	0.70	0.00000				165		32.083333333	0	
Plain lot 1	0.50	0.00000				165		22.916666667	0	
Plain lot 2	0.50	0.00000				165		22.916666667	0	
Plain lot 3	0.50	0.00000				165		22.916666667	0	
Total		0.00520							0.18975	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 10+700 Sta. 10+860	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215			0	0.000	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.541666667	0	Discharge calculation stretch from Sta. 10+695 to the road crossing of Sta. 10+874, <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 5px auto;"> $Q=0.244\text{m}^3/\text{s}$ $I=1/10000$ $B1=1.0\text{m}$ $B2=3.0\text{m}$ $H=1.0\text{m}$ $b=0.75\text{m}$ </div>
Traveled way	0.95	0.00200	160	12.5		165		43.541666667	0.087083333	
Frontage road	0.95	0.00128	160	8		165		43.541666667	0.055733333	
Sidewalk & cycle path	0.95	0.00000				165		43.541666667	0	
Slope 1	0.70	0.00192	160	12		165		32.083333333	0.0616	
Slope 2	0.70	0.00060	150	4		165		32.083333333	0.01925	
Slope 3	0.70	0.00000				165		32.083333333	0	
Plain lot 1	0.50	0.00048	160	3		165		22.916666667	0.011	
Plain lot 2	0.50	0.00045	150	3		165		22.916666667	0.0103125	
Plain lot 3	0.50	0.00000				165		22.916666667	0	
Total		0.00673							0.244979167	

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 10 + 860 Sta. 11 + 000	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00044	35	12.5	165	165		43.541666667	0.019049479	Discharge calculation stretch from Sta. 10+874 to the road crossing of Sta. 11+009,
Traveled way	0.95	0.00131	105	12.5	165	165		43.541666667	0.057148438	
Frontage road	0.95	0.00000			165	165		43.541666667	0	
Sidewalk & cycle path	0.95	0.00000			165	165		43.541666667	0	
Slope 1	0.70	0.00054	30	18	165	165		32.083333333	0.017325	
Slope 2	0.70	0.00108	60	18	165	165		32.083333333	0.03465	
Slope 3	0.70	0.00000			165	165		32.083333333	0	
Plain lot 1	0.50	0.00000			165	165		22.916666667	0	
Plain lot 2	0.50	0.00000			165	165		22.916666667	0	
Plain lot 3	0.50	0.00000			165	165		22.916666667	0	
Total		0.00337							0.128172917	

Q=0.128m³/s
I=1/10000
B1=1.0m
B2=3.0m
H=1.0m
h=0.54m

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 10 + 860 Sta. 11 + 000	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0.000	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00044	35	12.5	165	165		43.541666667	0.019049479	Discharge calculation stretch from Sta. 10+874 to the road crossing of Sta. 11+009,
Traveled way	0.95	0.00131	105	12.5	165	165		43.541666667	0.057148438	
Frontage road	0.95	0.00032	40	8	165	165		43.541666667	0.013933333	
Sidewalk & cycle path	0.95	0.00000			165	165		43.541666667	0	
Slope 1	0.70	0.00072	40	18	165	165		32.083333333	0.0231	
Slope 2	0.70	0.00016	40	4	165	165		32.083333333	0.005133333	
Slope 3	0.70	0.00153	85	18	165	165		32.083333333	0.0490875	
Plain lot 1	0.50	0.00012	40	3	165	165		22.916666667	0.00275	
Plain lot 2	0.50	0.00012	40	3	165	165		22.916666667	0.00275	
Plain lot 3	0.50	0.00000			165	165		22.916666667	0	
Total		0.00472							0.172952083	

Q=0.173m³/s
I=1/10000
B1=1.0m
B2=3.0m
H=1.0m
h=0.63m

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 11 + 000 Sta. 11 + 220	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable Farmland	0.70				215	215/24		1.741898148	0	
Pond	0.35				215	215/24		5.225694444	0	
Total	1.00				215	215/24		2.488425926	0	
Bridge	0.95	0.00000				165		43.541666667	0	Discharge calculation stretch from Sta. 11+009 to the road crossing of Sta. 11+228.
Traveled way	0.95	0.00275	220	12.5		165		43.541666667	0.119739583	
Frontage road	0.95	0.00000				165		43.541666667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.541666667	0	
Slope 1	0.70	0.00330	220	15		165		32.083333333	0.105875	
Slope 2	0.70	0.00000				165		32.083333333	0	
Slope 3	0.70	0.00000				165		32.083333333	0	
Plain lot 1	0.50	0.00000				165		22.916666667	0	
Plain lot 2	0.50	0.00000				165		22.916666667	0	
Plain lot 3	0.50	0.00000				165		22.916666667	0	
Total		0.00605				165		22.916666667	0.225614583	

Q=0.225m³/s
I=1/10000
B1=1.0m
B2=3.0m
H=1.0m
h=0.72m

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 11 + 000 Sta. 11 + 220	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable Farmland	0.70				215	215/24		1.741898148	0	
Pond	0.35				215	215/24		5.225694444	0	
Total	1.00				215	215/24		2.488425926	0	
Bridge	0.95	0.00000				165		43.541666667	0	Discharge calculation stretch from Sta. 11+009 to the road crossing of Sta. 11+228.
Traveled way	0.95	0.00275	220	12.5		165		43.541666667	0.119739583	
Frontage road	0.95	0.00000				165		43.541666667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.541666667	0	
Slope 1	0.70	0.00330	220	15		165		32.083333333	0.105875	
Slope 2	0.70	0.00000				165		32.083333333	0	
Slope 3	0.70	0.00000				165		32.083333333	0	
Plain lot 1	0.50	0.00000				165		22.916666667	0	
Plain lot 2	0.50	0.00000				165		22.916666667	0	
Plain lot 3	0.50	0.00000				165		22.916666667	0	
Total		0.00605				165		22.916666667	0.225614583	

Q=0.225m³/s
I=1/10000
B1=1.0m
B2=3.0m
H=1.0m
h=0.72m

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

(right or left)		Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Sta. 11 + 220											
Sta. 11 + 380											
Residential Area	0.80					215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70					215	215/4		1.741898148	0	
Farmland	0.35					215	215/4		5.225694444	0	
Pond	1.00					215	215/24		2.488425926	0	
Total		0.00000								0	
Bridge	0.95	0.00000					165		43.541666667	0	Discharge calculation stretch from the road crossing of Sta. 11+228 to Sta. 11+380, abutment of bridge, Bridge is from Sta. 11+380 to Sta. 11+620. <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;"> Q=0.133m/s I=1/10000 B1=1.0m B2=3.0m H=1.0m h=0.55m </div>
Traveled way	0.95	0.00200		160	12.5		165		43.541666667	0.087083333	
Frontage road	0.95	0.00000					165		43.541666667	0	
Sidewalk & cycle path	0.95	0.00000					165		43.541666667	0	
Slope 1	0.70	0.00144		160	9		165		32.083333333	0.0462	
Slope 2	0.70	0.00000					165		32.083333333	0	
Slope 3	0.70	0.00000					165		32.083333333	0	
Plain lot 1	0.50	0.00000					165		32.083333333	0	
Plain lot 2	0.50	0.00000					165		22.916666667	0	
Plain lot 3	0.50	0.00000					165		22.916666667	0	
Total		0.00344								0.133283333	

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

(right or left)		Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Sta. 11 + 220											
Sta. 11 + 380											
Residential Area	0.80					215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70					215	215/4		1.741898148	0	
Farmland	0.35					215	215/4		5.225694444	0	
Pond	1.00					215	215/24		2.488425926	0	
Total		0.00000								0	
Bridge	0.95	0.00000					165		43.541666667	0	Discharge calculation stretch from the road crossing of Sta. 11+228 to Sta. 11+380, abutment of bridge. <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;"> Q=0.133m/s I=1/10000 B1=1.0m B2=3.0m H=1.0m h=0.55m </div>
Traveled way	0.95	0.00200		160	12.5		165		43.541666667	0.087083333	
Frontage road	0.95	0.00000					165		43.541666667	0	
Sidewalk & cycle path	0.95	0.00000					165		43.541666667	0	
Slope 1	0.70	0.00144		160	9		165		32.083333333	0.0462	
Slope 2	0.70	0.00000					165		32.083333333	0	
Slope 3	0.70	0.00000					165		32.083333333	0	
Plain lot 1	0.50	0.00000					165		32.083333333	0	
Plain lot 2	0.50	0.00000					165		22.916666667	0	
Plain lot 3	0.50	0.00000					165		22.916666667	0	
Total		0.00344								0.133283333	

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 11 + 620 Sta. 11 + 810	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215			0	0	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00050	40	12.5		165		43.54166667	0.021770833	Discharge calculation stretch from the abutment of bridge to Sta. 11+810. <div style="border: 1px solid black; padding: 5px; width: fit-content;"> Q=0.200m/s I=1/10000 B1=1.0m B2=3.0m H=1.0m h=0.68m </div>
Traveled way	0.95	0.00188	150	12.5		165		43.54166667	0.081640625	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00304	190	16		165		32.08333333	0.097533333	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00542							0.200944792	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 11 + 620 Sta. 11 + 810	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215			0	0	
Paddy & Aquatic Vegetable	0.70				215	215/24		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00050	40	12.5		165		43.54166667	0.021770833	Discharge calculation stretch from the abutment of bridge to Sta. 11+810. <div style="border: 1px solid black; padding: 5px; width: fit-content;"> Q=0.190m/s I=1/10000 B1=1.0m B2=3.0m H=1.0m h=0.66m </div>
Traveled way	0.95	0.00188	150	12.5		165		43.54166667	0.081640625	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00272	170	16		165		32.08333333	0.087266667	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00510							0.190678125	

Calculation of Peak Runoff Discharge

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 11 + 810	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Sta. 12 + 050					215	215/24		0	0	
Residential Area	0.80				215	215/24		1.741898148	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		5.225694444	0	
Farmland	0.35				215	215/24		2.488425926	0	
Pond	1.00				215				0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Under the bridge over NH.No.5, Road side drain is considered the standard one B1=1.0m B2=3.0m,
Traveled way	0.95	0.00000				165		43.54166667	0	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00000				165		32.08333333	0	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00000							0	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 11 + 620	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Sta. 11 + 810					215	215/24		0	0	
Residential Area	0.80				215	215/24		1.741898148	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		5.225694444	0	
Farmland	0.35				215	215/24		2.488425926	0	
Pond	1.00				215				0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	
Traveled way	0.95	0.00000				165		43.54166667	0	
Frontage road	0.95	0.00000				165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00000				165		32.08333333	0	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00000							0	

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 12 + 180 Sta. 12 + 320	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope L=1.0km, I=1/3000	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.10000			215	52		11.55555556	1.155555556	Discharge calculation for the road crossing of Sta. 12+220 for access road to the interchange. Two road crossings for access road are required, the channel relocation is slightly necessary.
Paddy & Aquatic Vegetable	0.70	0.13000			215	215/24		1.741898148	0.226446759	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.23000							1.382002315	
Bridge	0.95	0.00270	150	18		165		43.54166667	0.1175625	Discharge calculation stretch from NH No.5 to the road crossing of Sta. 12+320. Area of NH No.5 and access road to interchange shall be considered. As the runoff is born at the inside interchange road side drain is not required.
Traveled way	0.95	0.01500	1000	15		165		43.54166667	0.653125	
Frontage road	0.95	0.00310				165		43.54166667	0.134979167	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00035				165		32.08333333	0.011229167	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.02115							0.916893833	

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 12 + 180 Sta. 12 + 320	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope L=1.0km, I=1/3000	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.10000			215	52		11.55555556	1.155555556	As same as above,
Paddy & Aquatic Vegetable	0.70	0.13000			215	215/24		1.741898148	0.226446759	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.23000							1.382002315	
Bridge	0.95	0.00270	150	18		165		43.54166667	0.1175625	As same as above,
Traveled way	0.95	0.01500	1000	15		165		43.54166667	0.653125	
Frontage road	0.95	0.00370				165		43.54166667	0.161104167	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00100				165		32.08333333	0.032083333	
Slope 2	0.70	0.00000				165		32.08333333	0	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.02240							0.963875	

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 12+320 Sta. 12+580	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from the road crossing of Sta. 12+320 to the road crossing of Sta. 12+585.
Traveled way	0.95	0.00161	70	23		165		43.54166667	0.070102083	
Frontage road	0.95	0.00210	280	10		165		43.54166667	0.0914375	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00091	70	13		165		32.08333333	0.029195833	
Slope 2	0.70	0.00196	280	7		165		32.08333333	0.062883333	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00658							0.25361875	

Q=0.253m/s
I=1/9300
B1=1.0m
B2=3.0m
H=1.0m
h=0.75m

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 12+320 Sta. 12+580	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80				215	215/24		0	0	
Paddy & Aquatic Vegetable	0.70				215	215/4		1.741898148	0	
Farmland	0.35				215	215/4		5.225694444	0	
Pond	1.00				215	215/24		2.488425926	0	
Total		0.00000							0	
Bridge	0.95	0.00000				165		43.54166667	0	Discharge calculation stretch from the road crossing of Sta. 12+320 to the road crossing of Sta. 12+585 same as above.
Traveled way	0.95	0.00144	60	24		165		43.54166667	0.0627	
Frontage road	0.95	0.00210	220	10		165		43.54166667	0.0914375	
Sidewalk & cycle path	0.95	0.00000				165		43.54166667	0	
Slope 1	0.70	0.00078	60	13		165		32.08333333	0.025025	
Slope 2	0.70	0.00242	220	11		165		32.08333333	0.077641667	
Slope 3	0.70	0.00000				165		32.08333333	0	
Plain lot 1	0.50	0.00000				165		22.91666667	0	
Plain lot 2	0.50	0.00000				165		22.91666667	0	
Plain lot 3	0.50	0.00000				165		22.91666667	0	
Total		0.00674							0.256804167	

Q=0.257m/s
I=1/9000
B1=1.0m
B2=3.0m
H=1.0m
h=0.75m

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

(right or left)

Sta. 12 + 320 Sta. 12 + 580	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.00000			215	215/24		0	0	Discharge calculation for the road crossing of Sta. 12+320 for ramp road to the interchange, Two road crossings are required, Channel relocation is required,
Paddy & Aquatic Vegetable	0.70	0.06000			215	215/4	1.741898148	0.104513889		
Farmland	0.35	0.00000			215	215/4	5.225694444	0		
Pond	1.00	0.00000			215	215/24	2.488425926	0		
Total		0.06000						0.104513889		
Bridge	0.95	0.00208	130	16		165		43.541666667	0.090366667	Discharge calculation stretch from the road crossing of Sta. 12+320 to the road crossing of Sta. 12+585 in the interchange, This runoff is larger than above and it is applied for deciding capacity of road crossing.
Traveled way	0.95	0.00180	180	10		165		43.541666667	0.078375	
Ramp road	0.95	0.00210				165		43.541666667	0.0914375	
Sidewalk & cycle path	0.95	0.00000				165		43.541666667	0	
Slope 1	0.70	0.00255	170	15		165		32.083333333	0.0818125	
Slope 2	0.70	0.00300	200	15		165		32.083333333	0.09625	
Slope 3	0.70	0.00337				165		32.083333333	0.108120833	
Plain lot 1	0.50	0.00000				165		22.916666667	0	
Plain lot 2	0.50	0.00000				165		22.916666667	0	
Plain lot 3	0.50	0.00000				165		22.916666667	0	
Total		0.01490							0.5465625	

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 12 + 320 Sta. 12 + 580	Runoff Coefficient	Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
Residential Area	0.80	0.00000			215	215/24		0	0	As same as above,
Paddy & Aquatic Vegetable	0.70	0.06000			215	215/4	1.741898148	0.104513889		
Farmland	0.35	0.00000			215	215/4	5.225694444	0		
Pond	1.00	0.00000			215	215/24	2.488425926	0		
Total		0.06000							0.104513889	
Bridge	0.95	0.00208	130	16		165		43.541666667	0.090366667	As same as above,
Traveled way	0.95	0.00150	150	10		165		43.541666667	0.0653125	
Ramp road	0.95	0.00210				165		43.541666667	0.0914375	
Sidewalk & cycle path	0.95	0.00000				165		43.541666667	0	
Slope 1	0.70	0.00210	140	15		165		32.083333333	0.067375	
Slope 2	0.70	0.00413	165	25		165		32.083333333	0.13234375	
Slope 3	0.70	0.00473				165		32.083333333	0.151754167	
Plain lot 1	0.50	0.00000				165		22.916666667	0	
Plain lot 2	0.50	0.00000				165		22.916666667	0	
Plain lot 3	0.50	0.00000				165		22.916666667	0	
Total		0.01654							0.598789383	

Calculation of Peak Runoff Discharge

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 12 + 580 Sta. 12 + 800	(right or left)		Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
	Runoff Coefficient	Discharge									
Residential Area	0.80	0.00000				215	215/24		0	0.097546296	Discharge calculation for the road crossing of Sta. 12+585.
Paddy & Aquatic Vegetable	0.70	0.05600				215	215/4		1.741898148	0	
Farmland	0.35	0.00000				215	215/4		5.225694444	0	
Pond	1.00	0.00000				215	215/24		2.488425926	0	
Total		0.05600								0.097546296	
Bridge	0.95	0.00000					165		43.54166667	0	Discharge calculation stretch from the road crossing of Sta. 12+585 to the end point of road.
Traveled way	0.95	0.00418		220	19		165		43.54166667	0.182004167	
Frontage road	0.95	0.00000					165		43.54166667	0	
Sidewalk & cycle path	0.95	0.00000					165		43.54166667	0	
Slope 1	0.70	0.00176		220	8		165		32.08333333	0.056466667	
Slope 2	0.70	0.00000					165		32.08333333	0	
Slope 3	0.70	0.00000					165		32.08333333	0	
Plain lot 1	0.50	0.00000					165		22.91666667	0	
Plain lot 2	0.50	0.00000					165		22.91666667	0	
Plain lot 3	0.50	0.00000					165		22.91666667	0	
Total		0.00594								0.238470833	

Q=0.238m/s
I=1/10000
B1=1.0m
B2=3.0m
H=1.0m
h=0.74m

(right or left)

Note: Daily rainfall is 10 year return period / rainfall intensity 165 is 3 year return period with 5 minutes concentration time

Sta. 12 + 580 Sta. 12 + 800	(right or left)		Area km ²	Length m	Width mean(m)	Daily Rainfall(mm)	Rainfall Intensity(mm)	Channel Length, Slope	Drainage Intensity(m ³ /s/Km ²)	Discharge m ³ /s	Remarks
	Runoff Coefficient	Discharge									
Residential Area	0.80	0.00000				215	215/24		0	0.097546296	Discharge calculation for the road crossing of Sta. 12+585.
Paddy & Aquatic Vegetable	0.70	0.05600				215	215/4		1.741898148	0	
Farmland	0.35	0.00000				215	215/4		5.225694444	0	
Pond	1.00	0.00000				215	215/24		2.488425926	0	
Total		0.05600								0.097546296	
Bridge	0.95	0.00000					165		43.54166667	0	Discharge calculation stretch from the road crossing of Sta. 12+585 to the end point of road. As this discharge is larger than the above it is also applied for deciding capacity road crossing.
Traveled way	0.95	0.00462		220	21		165		43.54166667	0.2011625	
Frontage road	0.95	0.00070					165		43.54166667	0.030479167	
Sidewalk & cycle path	0.95	0.00000					165		43.54166667	0	
Slope 1	0.70	0.00198		220	9		165		32.08333333	0.063525	
Slope 2	0.70	0.00000					165		32.08333333	0	
Slope 3	0.70	0.00000					165		32.08333333	0	
Plain lot 1	0.50	0.00000					165		22.91666667	0	
Plain lot 2	0.50	0.00000					165		22.91666667	0	
Plain lot 3	0.50	0.00000					165		22.91666667	0	
Total		0.00730								0.295166667	

Q=0.295m/s
I=1/6800
B1=1.0m
B2=3.0m
H=1.0m
h=0.75m

APPENDIX 3 Chapter 19 Economic and Financial Analysis

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Appendix Table 19.1.1 Basic Data for the Estimation of Project Cost (Market Price)

Unit: Million Dong

Item	2000			2001			2002			2003			2004			2005			Total			
	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	
																						Total
2000 Constant Price																						
Construction Work																						
a Red River Brg. Construction Work (Base cost)																						
b Included Physical contingency 10% of a																						
c Administration Cost(2% of b)																						
Total (b+c)																						
d Hwy Construction Work (Base cost)																						
e (Included Physical contingency 10%)																						
f Administration Cost(2% of e)																						
Total (e+f)																						
Total																						
Consultant Service																						
g a. Review of Detailed Design (Base Cost)																						
h Review of DD (inc. Physical contingency 10%)																						
i b. Construction Supervision (Base Cost)																						
j Supervision (inc. Physical contingency 10%)																						
Total (h+j)																						
Land Acquisition																						
k Land Acquisition (Base Cost)																						
l (Included Physical contingency 5%)																						
Grand Total																						

Appendix Table 19.1.2 Standard Conversion Factor to Economic Price for Local Product

Unit: US\$Million

	1,993	1994	1995	1996	1997	1998	Average
Import (CIF)	3,532	5,245	7,543	10,483	10,460	10,350	7,936
Import Tax	297	465	616	701	629	688	566
Export (FOB)	2,985	4,054	5,198	7,330	9,145	9,365	6,346
Export Tax Subsidy	160	250	332	377	338	371	305

Note: 1) S.C.F=(Import + Export)/(Import + Export + Import Tax – Export Tax + Subsidy)=0.982

2) Assumed ratio between export and input taxes, 65 : 35

Source: Statistical Year Book 1996-9998

Appendix Table 19.1.3 Shadow Price for Unskilled Labor

Unit: Dong

	Rich	Upper Rich	Middle	Lower Middle	Poor
Income per capita by class	445,690	173,750	94,540	62,050	38,980
Distribution of class	2.5%	15.1%	36.6%	24.5%	21.3%
	11,053	26,236	34,573	15,215	8,314
Component		38%			62%

Note: Marginal rate 62% - unemployment rate 7.4 = 54.6%

Appendix Table 19.1.4 Vehicle Km Without and With Project

Unit: Vehicle km/day

Year	Without Expressway				With Expressway				Total
	P. Car	Bus	Truck	M.Cycle	P. Car	Bus	Truck	M.Cycle	
2006	97,854	117,261	287,083	2,199,679	70,064	83,779	205,106	1,580,614	1,939,563
2007	116,933	125,471	308,611	2,243,571	83,725	89,645	220,487	1,612,154	2,006,011
2008	139,733	134,256	331,754	2,288,340	100,050	95,921	237,021	1,644,323	2,077,315
2009	166,978	143,656	356,632	2,334,001	119,557	102,638	254,795	1,677,134	2,154,124
2010	199,536	153,714	383,375	2,380,574	142,869	109,824	273,982	1,710,599	2,237,194
2011	232,834	158,520	398,508	2,227,129	166,710	113,258	284,713	1,600,339	2,165,020
2012	271,688	163,476	414,238	2,083,575	194,530	116,799	295,952	1,497,186	2,104,467
2013	317,026	168,587	430,589	1,949,274	226,993	120,450	307,634	1,400,682	2,055,759
2014	369,930	173,859	447,586	1,823,629	264,872	124,216	319,777	1,310,398	2,019,264
2015	431,663	179,294	463,254	1,706,084	309,073	128,100	332,400	1,225,934	1,995,507
2016	503,697	184,900	483,619	1,596,115	360,650	132,105	345,521	1,146,914	1,985,190
2017	587,752	190,681	502,709	1,493,234	420,834	136,236	359,159	1,072,987	1,989,216
2018	685,834	196,643	522,552	1,396,984	491,061	140,495	373,336	1,003,825	2,008,718
2019	800,283	202,791	543,179	1,306,939	573,007	144,888	388,073	939,122	2,045,090
2020	988,654	219,685	594,730	1,343,802	705,751	156,591	423,918	960,171	2,246,430
2021	988,654	219,685	594,730	1,343,802	705,751	156,591	423,918	960,171	2,246,430
2022	988,654	219,685	594,730	1,343,802	705,751	156,591	423,918	960,171	2,246,430
2023	988,654	219,685	594,730	1,343,802	705,751	156,591	423,918	960,171	2,246,430
2024	988,654	219,685	594,730	1,343,802	705,751	156,591	423,918	960,171	2,246,430
2025	988,654	219,685	594,730	1,343,802	705,751	156,591	423,918	960,171	2,246,430
2026	988,654	219,685	594,730	1,343,802	705,751	156,591	423,918	960,171	2,246,430
2027	988,654	219,685	594,730	1,343,802	705,751	156,591	423,918	960,171	2,246,430
2028	988,654	219,685	594,730	1,343,802	705,751	156,591	423,918	960,171	2,246,430
2029	988,654	219,685	594,730	1,343,802	705,751	156,591	423,918	960,171	2,246,430
2030	988,654	219,685	594,730	1,343,802	705,751	156,591	423,918	960,171	2,246,430

**Appendix Table 19.1.5 Estimation of Population and Number of Workers
In Study Area**

Unit: 1000 Persons

Year		1996	1997	1998	1999	2000	Inc.Rate
Whole Country	Population	75,355	75,677	76,000	76,325	76,651	0.43%
	Labor Force	35,791	36,994	38,237	39,523	40,851	3.36%
	Ratio	47%	49%	50%	52%	53%	
Study Area	Hanoi	2,268	2,395	2,530	2,672	2,822	5.62%
	T.Nguyen	952	982	1,014	1,046	1,079	3.19%
	Bac Giang	1,453	1,466	1,479	1,492	1,505	0.89%
	Bac Ninh	925	930	936	941	946	0.57%
	Hung Yen	1,084	1,079	1,074	1,069	1,064	-0.46%
	Ha Tay	2,330	2,349	2,368	2,387	2,406	0.81%
	Vinh Phuc	1,067	1,075	1,084	1,092	1,100	0.77%
	Total Population	10,079	10,282	10,488	10,699	10,914	2.01%
Labor Force	4,787	5,026	5,277	5,540	5,817	4.99%	

Source: Sicio-Economic Statistical Data of 61 Provinces and Cities in Vietnam

Appendix Table 19.1.6 Estimation of GRDP in Study Area

Unit: Billion Dong

	1966	1997	1998	1999	2000	Note
Whole Country						
1)1989constant price	47,888				66,972	F/S
2)1994constant price	213,833	231,265	244,676	254,463	264,642	Revision
PreviousYear=100	109.34	108.18	105.8	104.0	104.0	
Study Area						
1)1989constant price	6,121				8,641	F/S
2)1994constant price	27,332				34,145	Revision

Source: 1) World Bank Economic Report, December, 1999, Appendix Table 2.2

2) Sicio-Economic Statistical Data of 61 Provinces and Cities in Vietnam

Appendix Table 19.1.7 Passenger Time Value of Trip by Vehicle Types

Usage of Vehicle	Trip Purpose			Time Productivity			Utilization of Time	Time Value/h(dong)	
	Work	Non-Leisure	Leisure	Work	Non-Leisure	Leisure		Working	Trip
	a	b	c	d	e=bx0.60	f	g=d+c	h	I=gxh
Passenger Car	35%	45%	20%	35%	27%	0%	62%	8,131	5,041
Bus	15%	60%	25%	15%	36%	0%	51%	2446	1,247
Motorcycle	35%	45%	20%	35%	27%	0%	62%	5,625	3,487

	No. of Passengers	Adjusted by Workers		Trip Time Value/Hour	Trip Time Value/Minute
		Ratio			
Passenger Car	2.8	70%	1.96	9,880 Dong	164.67 Dong
Bus	29.3	70%	20.51	25,585 Dong	426.41 Dong
Motorcycle	1.06	70%	0.742	2,588 Dong	43.13 Dong

Appendix Table 19.1.8 Financial and Economic Cost of Diesel

Unit: Dong/Litter, Year 1999

Item	% of Charges	Economic Cost	Financial Cost	
			Tax/duty	Cumulative
a) Border price		1,500		1,500
b) Transport margin	11%	165		1,665
c) Import tax	50%		750	2,415
Luxury tax	0%		0	2,415
Special surcharge	23%		345	2,760
d) Transportation fee		500		3,260
e) Whole sale price				3,260
f) Retail commission	3%	98		98
g) Retail price				3,358
h) Maximum retail price				3,500
I) Extra commission		142		3,500
Economic & Financial Price		2,405	1,095	3,500
Cost Component %		68.7%	31%	100%

Source: Transport Development Strategy Institute(TEDI), Ministry of Finance

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**Appendix Table 19.1.9 Input Data for Unit Vehicle Operating Cost Calculation
by Base Speed**

Unit : Dong

Items	P. Car	Van	Mid-Bus	Large Bus	Medium Truck	Heavy Truck	MotorCycle
Vehicle Price(Excl.Tyres)Fin-Dong	214,000,000	236,300,000	262,000,000	945,000,000	277,200,000	558,000,000	19,760,000
Vehicle Price(excl.Tyres)Econ-Dong	173,205,000	200,855,000	227,939,000	822,149,000	252,252,000	505,680,000	17,629,500
Vehicle Life(Years)	8	9	9	8	8	8	6
Vehicle Life Km	104,000	255,000	382,500	320,000	224,000	322,500	90,000
Vehicle Annual Km	13,000	30,000	45,000	40,000	28,000	43,000	15,000
Vehicle Life Operating Hours	4,000	10,200	12,750	12,800	9,600	11,250	3,600
Vehicle Annual Operating Hours	500	1,200	1,500	1,600	1,200	1,500	600
Fuel Price (Fin-Dong/Liter)	4,500	3,600	3,500	3,500	3,500	3,500	4,200
Fuel Price (Econ-Dong/Liter)	2,675	2,140	2,405	2,405	2,405	2,405	2,496
Fuel Consumption (Liter/Km)	0.13	0.14	0.18	0.25	0.27	0.30	0.03
Tyre Unit Price (Fin-Dong /Price)	855,460	855,460	1,657,636	2,334,321	2,334,321	2,334,321	855,460
Tyre Unit Price (Econ-Dong/Price)	777,691	777,691	1,823,400	2,122,110	2,122,110	2,122,110	777,691
Number of Tyres	4	4	4	6	6	10	2
Tyre Life -Km	30,000	30,000	30,000	40,000	40,000	40,000	30,000
Lubricants Price(Fin-Gong/Liter)	3,300	9,417	13,320	20,038	9,417	18,067	3,300
Lubricants Price(Econ-Dong/Liter)	2,310	6,592	9,324	14,026	6,592	13,550	2,310
Lubri.OilConsumpt.(Liter/100km)	1.2	1.3	2.0	2.2	3.0	3.4	0.2
Maintenance Spares/Year (%)	7	8	8	10	8	8	3
Maintenance Labor(Hour/1000km)	3	7	15	15	12	15	2
Maintenance LaborCost(Fin-Dong/h)	11,116	11,224	12,784	12,784	14,451	22,233	11,224
Maintenance LaborCost(Econ-D./h)	10,005	10,102	11,506	11,506	13,006	20,010	10,102
Depreciation.Distance Related(%)	60	70	80	85	70	70	60
Depreciation.Time Related(%)	40	30	20	15	30	30	40
Opportunity Cost of Capital(%)	12	12	12	12	12	12	12
Real Rate of Interest of Capital (%)	8	8	8	8	8	8	8
Overhead cost(Annum Fin-Dong)	0	3,547,800	7,982,550	709,560	3,311,280	7,627,770	0
Overhead cost(Annum Econ-Dong)	0	3,193,020	7,184,295	638,604	2,980,152	6,864,993	0
Crew-Number(Driver)	0	1	1	1	1	1	0
Crew-Number(Assistant)	0	0	1	1	1	1	0
Crew Unit Cost (Fin-Dong/Hour)	0	9,841	9,841	11,316	11,316	11,316	0
Crew Unit Cost(Econ-Dong/Hour)	0	8,857	8,857	10,185	10,185	10,185	0

Appendix Table 19.1.10 Cost Benefit Analysis for Investment Justification of Thanh Tri Project

(Benefit is the same with the case of F/S)

Internal Economic Rate of Return: 12.10% (Total discounted cost = Total discounted Benefit) Unit: Million Dong

No.	year	Economic Cost			Economic Benefits			Present Worth		
		Capital	Routine Operation	Total	Vehicle Op. Cost	Passenger Time Cost	Total	Discount Factor	Cost	Benefit
1	2000	288,700		288,700				1.000	288,700	
2	2001	399,475		399,475				0.892	356,356	
3	2002	946,863		946,863				0.796	753,488	
4	2003	1,247,648		1,247,648				0.710	885,679	
5	2004	1,238,957		1,238,957				0.633	784,576	
6	2005	425,016		425,016				0.565	240,093	
7	2006		16,587	16,587	389,055	57,459	446,514	0.504	8,359	225,011
8	2007		16,587	16,587	422,816	62,658	485,474	0.450	7,456	218,237
9	2008		16,587	16,587	460,575	68,361	528,936	0.401	6,652	212,110
10	2009	2,752	16,587	19,339	502,939	74,620	577,559	0.358	6,918	206,609
11	2010		16,587	16,587	550,623	81,493	632,116	0.319	5,293	201,718
12	2011		16,587	16,587	580,576	84,270	664,846	0.285	4,722	189,262
13	2012		16,587	16,587	615,104	87,786	702,890	0.254	4,212	178,494
14	2013		16,587	16,587	654,863	92,158	747,021	0.227	3,757	169,225
15	2014	2,752	16,587	19,339	700,625	97,528	798,153	0.202	3,908	161,292
16	2015		16,587	16,587	753,302	104,067	857,369	0.180	2,990	154,557
17	2016		16,587	16,587	813,974	111,974	925,948	0.161	2,667	148,902
18	2017		16,587	16,587	883,909	121,491	1,005,400	0.143	2,379	144,228
19	2018		16,587	16,587	964,608	132,905	1,097,513	0.128	2,123	140,447
20	2019	2,752	16,587	19,339	1,057,838	146,557	1,204,395	0.114	2,208	137,489
21	2020		16,587	16,587	1,165,435	162,856	1,328,291	0.102	1,689	135,265
22	2021		16,587	16,587	1,165,435	162,856	1,328,291	0.091	1,507	120,665
23	2022		16,587	16,587	1,165,435	162,856	1,328,291	0.081	1,344	107,641
24	2023		16,587	16,587	1,165,435	162,856	1,328,291	0.072	1,199	96,022
25	2024	2,752	16,587	19,339	1,165,435	162,856	1,328,291	0.064	1,247	85,658
26	2025		16,587	16,587	1,165,435	162,856	1,328,291	0.058	954	76,412
27	2026		16,587	16,587	1,165,435	162,856	1,328,291	0.051	851	68,164
28	2027		16,587	16,587	1,165,435	162,856	1,328,291	0.046	759	60,806
29	2028		16,587	16,587	1,165,435	162,856	1,328,291	0.041	677	54,243
30	2029	2,752	16,587	19,339	1,165,435	162,856	1,328,291	0.036	704	48,388
31	2030		16,587	16,587	1,165,435	162,856	1,328,291	0.032	539	43,165
		4,560,419	414,675	4,975,094	22,170,592	3,114,743	25,285,335	12.10%	3,384,008	3,384,008

Appendix Table 19.2.1 Toll Rate of Thang Long Bridge and TL-NB Highway in 2000

Unit: Dong

Classification	Toll Fee	Traffic Component	Weighted	Average Toll Fee
Passenger Cars	12,000	100%	12,000	12,000
Bus				21,480
Small Bus	20,000	63%	12,600	
Large Bus	24,000	37%	8,880	
Truck				22,840
Small Truck	20,000	50%	10,000	
Truck	24,000	43%	10,320	
Trailer	36,000	7%	2,520	
Motor Cycles				667
Each Payment	1,000	50%	500	
Monthly Payment	333	50%	167	

Toll fee: Toll rate on Thang Long bridge and 15km of TL-NB Highway
Toll on Chuong Duong Bridge is 50% of the Thang Long Bridge.

Table 19.2.2 Users Benefit, Toll Level and Toll Benefit Ratio

Year	Total Users Benefit(Dong/One Trin)				Toll Charge(Dong/One Trin)				Toll Benefit Ratio			
	P. Car	Bus	Truck	M.Cycl	P. Car	Bus	Truck	M.Cycl	P. Car	Bus	Truck	M.Cycle
2000	39,378	52,447	49,473	4,214	12,000	21,480	22,840	1,000	30%	41%	46%	24%
2001	40,342	53,340	50,132	4,298	12,000	21,480	22,840	1,000	30%	40%	46%	23%
2002	41,302	54,242	50,785	4,384	12,000	21,480	22,840	1,000	29%	40%	45%	23%
2003	42,259	55,152	51,430	4,471	12,000	21,480	22,840	1,000	28%	39%	44%	22%
2004	43,211	56,071	52,069	4,559	12,000	21,480	22,840	1,000	28%	38%	44%	22%
2005	44,160	56,998	52,700	4,648	12,000	21,480	22,840	1,000	27%	38%	43%	22%
2006	45,105	57,935	53,323	4,738	12,000	21,480	22,840	1,000	27%	37%	43%	21%
2007	46,046	58,880	53,939	4,829	12,000	21,480	22,840	1,000	26%	36%	42%	21%
2008	46,983	59,835	54,547	4,922	12,000	21,480	22,840	1,000	26%	36%	42%	20%
2009	47,917	60,800	55,147	5,016	12,000	21,480	22,840	1,000	25%	35%	41%	20%
2010	48,847	61,774	55,739	5,110	12,000	21,480	22,840	1,000	25%	35%	41%	20%
2011	49,773	62,759	56,323	5,207	12,000	21,480	22,840	1,000	24%	34%	41%	19%
2012	50,697	63,754	56,899	5,304	12,000	21,480	22,840	1,000	24%	34%	40%	19%
2013	51,618	64,760	57,467	5,402	12,000	21,480	22,840	1,000	23%	33%	40%	19%
2014	52,537	65,777	58,027	5,502	12,000	21,480	22,840	1,000	23%	33%	39%	18%
2015	53,453	66,805	58,578	5,603	12,000	21,480	22,840	1,000	22%	32%	39%	18%
2016	54,368	67,845	59,121	5,705	12,000	21,480	22,840	1,000	22%	32%	39%	18%
2017	55,282	68,897	59,655	5,809	12,000	21,480	22,840	1,000	22%	31%	38%	17%
2018	56,196	69,962	60,182	5,914	12,000	21,480	22,840	1,000	21%	31%	38%	17%
2019	57,109	71,040	60,700	6,020	12,000	21,480	22,840	1,000	21%	30%	38%	17%
2020	58,022	72,131	61,210	6,128	12,000	21,480	22,840	1,000	21%	30%	37%	16%
2021	58,936	73,236	61,711	6,237	12,000	21,480	22,840	1,000	20%	29%	37%	16%
2022	59,852	74,355	62,205	6,347	12,000	21,480	22,840	1,000	20%	29%	37%	16%
2023	60,769	75,488	62,690	6,459	12,000	21,480	22,840	1,000	20%	28%	36%	15%
2024	61,689	76,637	63,167	6,572	12,000	21,480	22,840	1,000	19%	28%	36%	15%
2025	62,612	77,802	63,636	6,687	12,000	21,480	22,840	1,000	19%	28%	36%	15%
2026	63,539	78,983	64,097	6,804	12,000	21,480	22,840	1,000	19%	27%	36%	15%
2027	64,471	80,180	64,550	6,922	12,000	21,480	22,840	1,000	19%	27%	35%	14%
2028	64,471	81,395	64,995	7,042	12,000	21,480	22,840	1,000	19%	26%	35%	14%
2029	64,471	82,627	65,433	7,164	12,000	21,480	22,840	1,000	19%	26%	35%	14%
2030	64,471	83,878	65,862	7,288	12,000	21,480	22,840	1,000	19%	26%	35%	14%

Table 19.2.3 Toll and Toll Revenue Applied the Same Toll Benefit Ratio in Year 2000

	Toll (Dong / one trip)				Toll Revenue (Billion Dong/Year)				
	P. Car	Bus	Truck	M.Cycle	P. Car	Bus	Truck	M.Cycle	Total
T/B Ratio	30%	41%	46%	24%					
2000	12,000	21,480	22,840	1,000					
2001	12,294	21,846	23,144	1,020					
2002	12,586	22,215	23,446	1,040					
2003	12,878	22,588	23,744	1,061					
2004	13,168	22,964	24,038	1,082					
2005	13,457	23,344	24,330	1,103					
2006	13,745	23,728	24,618	1,124	18	36	89	36	179
2007	14,032	24,115	24,902	1,146	22	40	96	37	196
2008	14,317	24,506	25,183	1,168	27	43	105	39	214
2009	14,602	24,901	25,460	1,190	33	47	114	40	234
2010	14,885	25,300	25,733	1,213	41	51	124	42	257
2011	15,168	25,704	26,003	1,236	48	53	130	40	271
2012	15,449	26,111	26,269	1,259	57	56	136	38	288
2013	15,730	26,523	26,531	1,282	68	59	143	36	306
2014	16,010	26,940	26,789	1,306	81	61	150	34	327
2015	16,289	27,361	27,044	1,330	96	64	158	33	351
2016	16,568	27,787	27,294	1,354	114	67	165	31	378
2017	16,847	28,218	27,541	1,378	135	71	173	30	409
2018	17,125	28,654	27,784	1,403	161	74	182	28	445
2019	17,403	29,095	28,023	1,429	191	77	191	27	486
2020	17,681	29,542	28,259	1,454	244	86	214	29	573
2021	17,960	29,994	28,490	1,480	247	88	215	30	580
2022	18,239	30,453	28,718	1,506	251	89	217	30	587
2023	18,519	30,917	28,942	1,533	255	90	219	31	595
2024	18,799	31,388	29,162	1,560	259	92	220	31	602
2025	19,080	31,864	29,379	1,587	263	93	222	32	610
2026	19,363	32,348	29,592	1,615	267	94	224	32	617
2027	19,647	32,838	29,801	1,643	271	96	225	33	625
2028	19,647	33,336	30,006	1,671	271	97	227	34	628
2029	19,647	33,841	30,208	1,700	271	99	228	34	632
2030	19,647	34,353	30,407	1,729	271	100	230	35	635

Table 19.2.4 Toll and Toll Revenue Applied 20% Increase to Toll Benefit Ratio

Vehicle	Toll (Dong / one trip)				Toll Revenue (Billion Dong/Year)				
	P. Car	Bus	Truck	M.Cycle	P. Car	Bus	Truck	M.Cycle	Total
T/B Ratio	37%	49%	55%	28%					
2000	14,400	25,776	27,408	1,200					
2001	14,752	26,215	27,773	1,224					
2002	15,104	26,658	28,135	1,248					
2003	15,453	27,106	28,492	1,273					
2004	15,802	27,557	28,846	1,298					
2005	16,149	28,013	29,196	1,323					
2006	16,494	28,473	29,541	1,349	22	44	106	43	215
2007	16,838	28,938	29,882	1,375	27	48	116	45	235
2008	17,181	29,407	30,219	1,402	33	52	126	46	257
2009	17,522	29,881	30,552	1,428	40	56	137	48	281
2010	17,862	30,360	30,880	1,455	49	61	148	50	308
2011	18,201	30,844	31,203	1,483	58	64	156	48	326
2012	18,539	31,333	31,522	1,510	69	67	164	46	345
2013	18,876	31,828	31,837	1,538	82	70	172	43	367
2014	19,212	32,327	32,147	1,567	97	74	180	41	393
2015	19,547	32,833	32,452	1,596	115	77	189	39	421
2016	19,882	33,344	32,753	1,625	137	81	198	38	454
2017	20,216	33,861	33,049	1,654	163	85	208	36	491
2018	20,550	34,384	33,341	1,684	193	89	218	34	534
2019	20,884	34,914	33,628	1,714	229	93	229	32	583
2020	21,218	35,450	33,910	1,745	292	104	256	35	687
2021	21,552	35,993	34,188	1,776	297	105	258	36	696
2022	21,887	36,543	34,462	1,807	301	107	260	36	705
2023	22,222	37,100	34,730	1,839	306	108	262	37	714
2024	22,559	37,665	34,995	1,872	311	110	264	38	723
2025	22,896	38,237	35,255	1,904	315	112	266	38	732
2026	23,235	38,818	35,510	1,938	320	113	268	39	741
2027	23,576	39,406	35,761	1,971	325	115	270	40	750
2028	23,576	40,003	36,008	2,005	325	117	272	40	754
2029	23,576	40,609	36,250	2,040	325	119	274	41	758
2030	23,576	41,223	36,488	2,075	325	120	276	42	763

Appendix Table 19.2.5 Capital Investment Cost by Fund Resources

(at Constant Price in Year 2000)

Unit: Billion Dong

Year	Case 1			Case 2		
	Foreign	Local	Total	Foreign	Local	Total
	56%:Soft Loan	44%:G.Finance		56%:Soft Loan	44%:Bank Loan	
2000	184	143	326	184	157	341
2001	259	197	456	259	239	498
2002	625	468	1,092	625	622	1,247
2003	838	616	1,454	838	902	1,740
2004	847	612	1,459	847	985	1,832
2005	296	219	515	296	381	677
	3,048	2,254	5,303	3,048	3,286	6,334
Year	Case 3			Case 4		
	Foreign	Local	Total	Foreign	Local	Total
	80%:Soft Loan	20%:G.Finance		80%:Soft Loan	20%:Bank Loan	
2000	263	65	328	263	71	334
2001	371	89	460	371	108	479
2002	894	212	1,106	894	282	1,176
2003	1,200	279	1,479	1,200	409	1,609
2004	1,213	277	1,490	1,213	447	1,659
2005	424	104	528	424	178	601
	4,364	1,027	5,391	4,364	1,495	5,859
Year	Case 5			Case 6		
	Foreign	Local	Total	Foreign	Local	Total
	70%:Soft Loan	30%: Equity		56%Soft. 14%Bank	30%: Equity	
2000	230	97	327	234	97	330
2001	324	134	458	335	134	469
2002	783	318	1,100	822	318	799
2003	1,050	419	1,469	1,124	419	1,543
2004	1,061	416	1,477	1,160	416	1,576
2005	371	152	523	414	152	3,119
	3,819	1,536	5,354	4,088	1,536	5,624

Note(1) Working Capital 9,269Million Dong is included in local fund in Year 2005

(2) Working capital requirements are estimated at 30% of Annual O and M requirements

Appendix Table 19.2.6 Total Cashflow and Debt Service Analysis After Long-term Financing

Case-1 (56% of Soft Loan and 44% from Government Finance)

Unit: Billion Dong

No.	Year	Net Cash Flow Before Financing						Financing Cash Flow						Net Cash Flow after L.T.Fina	Corporate Tax Payments	Net Cash Flow after L.T.Financing	
		Inflow Revenues	Investment Cost	O.&M. Cost	Total Outflow	Composite Flow	Equity	Fund Resources Soft Loan	G.Finance	Total Inflow	Comulative Inflow	Repayment Soft Loan	G.Finance				Total Debt Service
1	2000				326	-326	0	184	143	326	326				326		
2	2001		456		456	-456	0	259	197	456	782				456		
3	2002		1,092		1,092	-1,092	0	625	468	1,092	1,875				1,092		
4	2003		1,454		1,454	-1,454	0	838	616	1,454	3,329				1,454		
5	2004		1,459		1,459	-1,459	0	847	612	1,459	4,788				1,459		
6	2005		515		515	-515		296	219	515	5,303				515		
7	2006	179		31	31	148						55	10	64	84	23	61
8	2007	196		31	31	165						55	23	78	87	27	60
9	2008	214		31	31	183						55	54	109	74	32	42
10	2009	234		31	31	203						55	95	150	54	37	16
11	2010	257	5	31	36	221						55	136	191	30	42	-11
12	2011	271		31	31	240						61	150	211	29	46	-17
13	2012	288		31	31	257						70	150	220	37	50	-14
14	2013	306		31	31	275						90	150	240	35	55	-20
15	2014	327		31	31	296						117	150	268	29	61	-32
16	2015	351	5	31	36	315						144	150	295	20	66	-45
17	2016	378		31	31	347						153	150	303	44	74	-38
18	2017	409		31	31	378						151	150	301	77	82	-5
19	2018	445		31	31	414						149	150	299	115	92	23
20	2019	486		31	31	455						147	150	297	157	102	55
21	2020	573		31	36	537						145	150	296	241	123	118
22	2021	580	5	31	31	549						144	141	284	265	127	138
23	2022	587		31	31	557						142	128	269	287	129	158
24	2023	595		31	31	564						140	96	236	328	131	196
25	2024	602		31	31	571						138	55	193	378	134	244
26	2025	610	5	31	36	574						136	15	151	423	135	288
27	2026	617		31	31	586						134		134	452	138	314
28	2027	625		31	31	594						133		133	461	141	321
29	2028	628		31	31	597						131		131	467	142	325
30	2029	632		31	31	601						129		129	472	143	329
31	2030	635	5	31	36	599						127		127	472	144	329
Total		11,025	5,328	772	6,100	4,925	0	3,048	2,254	5,303		2,855	2,254	5,109	194	952	2,841

Appendix Table 19.2.7 Total Cashflow and Debt Service Analysis After Long-term Financing

Unit: Billion Dong

No.	Year	Net Cash Flow Before Finance										Financing Cash Flow						Net Cash Corporate		Net Cash Flow after LT.Financing&Tas						
		Inflow					Outflow					Equity		Fund Resources		Tot.Fin. Inflow		Repayment			Total Debt Service		Net Financing Stream	Flow after LT.Fina	Tax Pymnts	
		Revenues		Investment		O.&M. Cost	Total Outflow		Composite Flow		Equity	Soft Loan	G.Finance	Soft Loan	G.Finance	Soft Loan	G.Finance	Soft Loan	G.Finance		Soft Loan	G.Finance				
		Investment	Cost	O.&M. Cost	Total Outflow	Composite Flow	Equity	Soft Loan	G.Finance	Tot.Fin. Inflow	Soft Loan	G.Finance	Soft Loan	G.Finance	Soft Loan	G.Finance	Soft Loan	G.Finance	Soft Loan		G.Finance	Soft Loan	G.Finance			
1	2000		328		328	-328	0	263	65	328	328											328				
2	2001		460		460	-460	0	371	89	460	788											460				
3	2002		1,106		1,106	-1,106	0	894	212	1,106	1,894											1,106				
4	2003		1,479		1,479	-1,479	0	1,200	279	1,479	3,373											1,479				
5	2004		1,490		1,490	-1,490	0	1,213	277	1,490	4,863											1,490				
6	2005		528		528	-528	0	424	104	528	5,391											528				
7	2006	179			31	148	31					79	4	83										65	17	48
8	2007	196			31	165	31					79	10	89										76	22	54
9	2008	214			31	183	31					79	24	103										80	26	54
10	2009	234			31	203	31					79	43	122										82	31	51
11	2010	257		5	31	221	36					79	62	140										81	36	45
12	2011	271			31	240	31					87	68	156										85	40	44
13	2012	288			31	257	31					100	68	168										89	45	44
14	2013	306			31	273	31					129	68	197										78	49	28
15	2014	327			31	296	31					168	68	236										60	55	5
16	2015	351		5	31	315	36					207	68	275										40	60	-20
17	2016	378			31	347	31					219	68	287										60	69	-8
18	2017	409			31	378	31					216	68	284										94	77	17
19	2018	445			31	414	31					213	68	282										132	87	46
20	2019	486			31	455	31					211	68	279										176	97	78
21	2020	573		5	31	537	36					208	68	277										260	118	142
22	2021	580			31	549	31					205	64	270										279	122	157
23	2022	587			31	557	31					203	58	261										295	125	171
24	2023	595			31	564	31					200	44	244										320	127	192
25	2024	602			31	571	31					198	25	223										348	130	219
26	2025	610		5	31	574	36					195	7	202										372	131	241
27	2026	617			31	586	31					192	0	192										394	135	259
28	2027	625			31	594	31					190	0	190										404	137	267
29	2028	628			31	597	31					187	0	187										410	139	271
30	2029	632			31	601	31					185	0	185										416	140	276
31	2030	635		5	31	599	36					182	0	182										418	141	277
Total		11,025	5,416	772	6,189	4,836	0	4,364	1,027	5,391	4,087	1,027	5,114	277	5,114	809	2,957									

Appendix Table 19.2.8 Total Cashflow and Debt Service Analysis After Long-term Financing

Unit: Billion Dong

No.	Year	Net Cash Flow Before Financing						Financing Cash Flow						Net Cash/Corporate		Net Cash Flow after LT.Fin.	Net Cash Flow after LT.Fin. - Long Term Tax
		Inflow		Outflow		Compos. Flow		Equity	Inflow		Outflow		Net Financing Stream	Tax Payments			
		Revenues	Investment Cost	O.&M. Cost	Total	Total	Outflow		Fund Recourses	Total	Comulative Inflow	Repayment			Total Debt Service		
							Soft Loan	G.Finance	Total	Total	Total	Soft Loan	G.Finance	Service			
1	2000		334		334	334	0	263	71	334	334	334					
2	2001		479		479	479	0	371	108	479	813						
3	2002		1,176		1,176	-1,176	0	894	282	1,176	1,990						
4	2003		1,609		1,609	-1,609	0	1,200	409	1,609	3,598						
5	2004		1,659		1,659	-1,659	0	1,213	447	1,659	5,257						
6	2005		601		601	-601		424	178	601	5,859						
7	2006	179		31	148	31						79	154	232	-84	0	-84
8	2007	196		31	165	31						79	160	238	-74	0	-74
9	2008	214		31	183	31						79	175	254	-71	0	-71
10	2009	234		31	203	31						79	197	275	-72	0	-72
11	2010	257	5	31	221	36						79	218	296	-75	3	-79
12	2011	271		31	240	31						87	220	307	-67	10	-77
13	2012	288		31	257	31						100	210	309	-53	17	-70
14	2013	306		31	275	31						129	200	329	-54	24	-78
15	2014	327		31	296	31						168	190	358	-62	32	-94
16	2015	351	5	31	315	36						207	180	387	-72	40	-112
17	2016	378		31	347	31						219	170	389	-41	51	-92
18	2017	409		31	378	31						216	160	376	2	62	-60
19	2018	445		31	414	31						213	150	363	51	74	-23
20	2019	486		31	455	31						211	140	351	104	87	17
21	2020	573	5	31	537	36						208	130	338	198	111	87
22	2021	580		31	549	31						205	116	321	228	117	111
23	2022	587		31	557	31						203	100	303	254	122	132
24	2023	595		31	564	31						200	74	274	290	126	164
25	2024	602		31	571	31						198	43	240	331	130	201
26	2025	610	5	31	574	36						195	12	207	367	131	236
27	2026	617		31	586	31						192	0	192	394	135	259
28	2027	625		31	594	31						190	0	190	404	137	267
29	2028	628		31	597	31						187	0	187	410	139	271
30	2029	632		31	601	31						185	0	185	416	140	276
31	2030	635	5	31	599	36						182	0	182	418	141	277
Total		11,025	5,884	772	6,657	4,369	0	4,364	1,495	5,859	4,087	2,998	7,085	1,227	3,142	316	1,313

Appendix Table 19.2.9 Total Cashflow and Debt Service Analysis After Long-term Financing

Unit: Billion Dong

No.	Year	Net Cash Flow Before Financing				Financing Cash Flow										Net Cash Corporate		Net Cash Flow after LT.Fin. Payments	Net Cash Flow after LT.Fin. Payments
		Inflow Revenues	Outflow Investment Cost	Outflow O.&M. Cost	Total Outflow	Composite Flow	Equity	Fund Recourses	Inflow	Tot.Fin. Inflow	Cumulative Inflow	Repayment	Outflow	Net Financing Stream	Flow after LT.Fin.	Tax Payments	Net Cash		
							Soft Loan	Bank Loan			Soft Loan	G.Financ.	Service						
1	2000		330		330	-330	187	47	330	330				330					
2	2001		469		469	-469	268	67	469	799				469					
3	2002		1,140		1,140	-1,140	658	164	1,140	1,939				1,140					
4	2003		1,543		1,543	-1,543	899	225	1,543	3,482				1,543					
5	2004		1,576		1,576	-1,576	928	232	1,576	5,058				1,576					
6	2005		566		566	-566	331	83	566	5,624				566					
7	2006	179		31	31	148					59	85	143	143				5	3
8	2007	196		31	31	165					59	88	147	147				18	6
9	2008	214		31	31	183					59	97	156	156				27	11
10	2009	234		31	31	203					59	109	168	168				35	17
11	2010	257	5	31	36	221					59	120	178	178				43	23
12	2011	271		31	31	240					65	120	185	185				56	29
13	2012	288		31	31	257					74	114	188	188				69	35
14	2013	306		31	31	275					96	109	204	204				71	41
15	2014	327		31	31	296					125	103	228	228				68	47
16	2015	351	5	31	36	315					155	98	252	252				63	54
17	2016	378		31	31	347					164	92	256	256				91	64
18	2017	409		31	31	378					160	81	241	241				129	73
19	2018	445		31	31	414					158	76	234	234				172	84
20	2019	486		31	31	455					156	71	227	227				221	96
21	2020	573	5	31	36	537					154	62	216	216				310	118
22	2021	580		31	31	549					152	53	205	205				333	123
23	2022	587		31	31	557					150	39	189	189				351	127
24	2023	595		31	31	564					148	22	170	170				375	130
25	2024	602		31	31	571					146	6	152	152				402	133
26	2025	610	5	31	36	574					144	0	144	144				422	134
27	2026	617		31	31	586					142	0	142	142				442	138
28	2027	625		31	31	594					140	0	140	140				452	140
29	2028	628		31	31	597					138	0	138	138				457	142
30	2029	632		31	31	601					136	0	136	136				463	143
31	2030	635	5	31	36	599												463	143
Total		11,025	5,649	772	6,422	4,604	1,536	3,271	818	5,624	3,060	1,631	4,691	932	5,536	647	3,483		

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