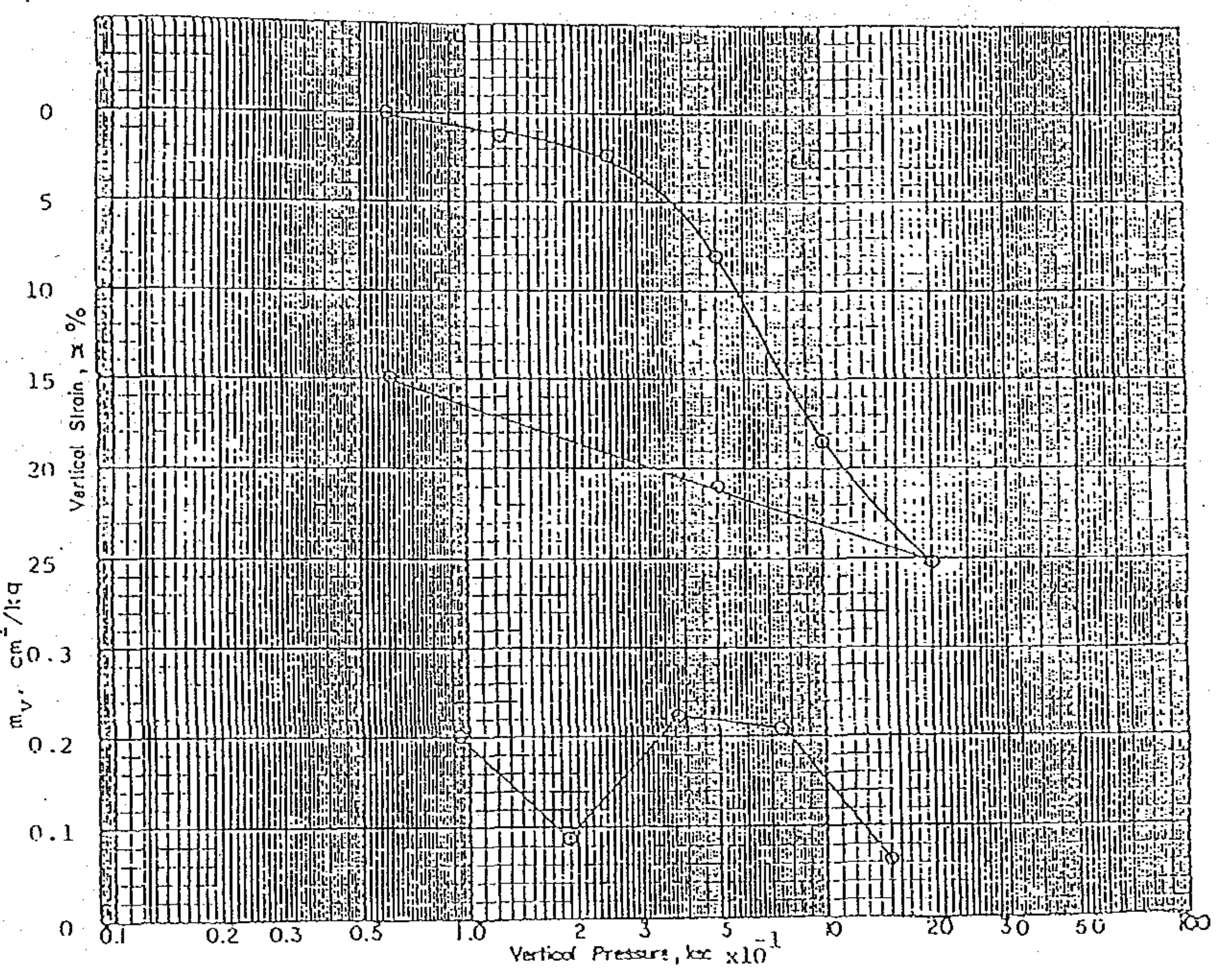
CONSOLIDATION TEST RESULTS

Project Model Infrastructure Projec	Location Chareonraj Pumping station Bang Bo, Samut Prakan Province	Job No. 1488

Boring No. B-2	Sample No. PST-5	Depth 5.00-5.80 m.	Date 9/3/88



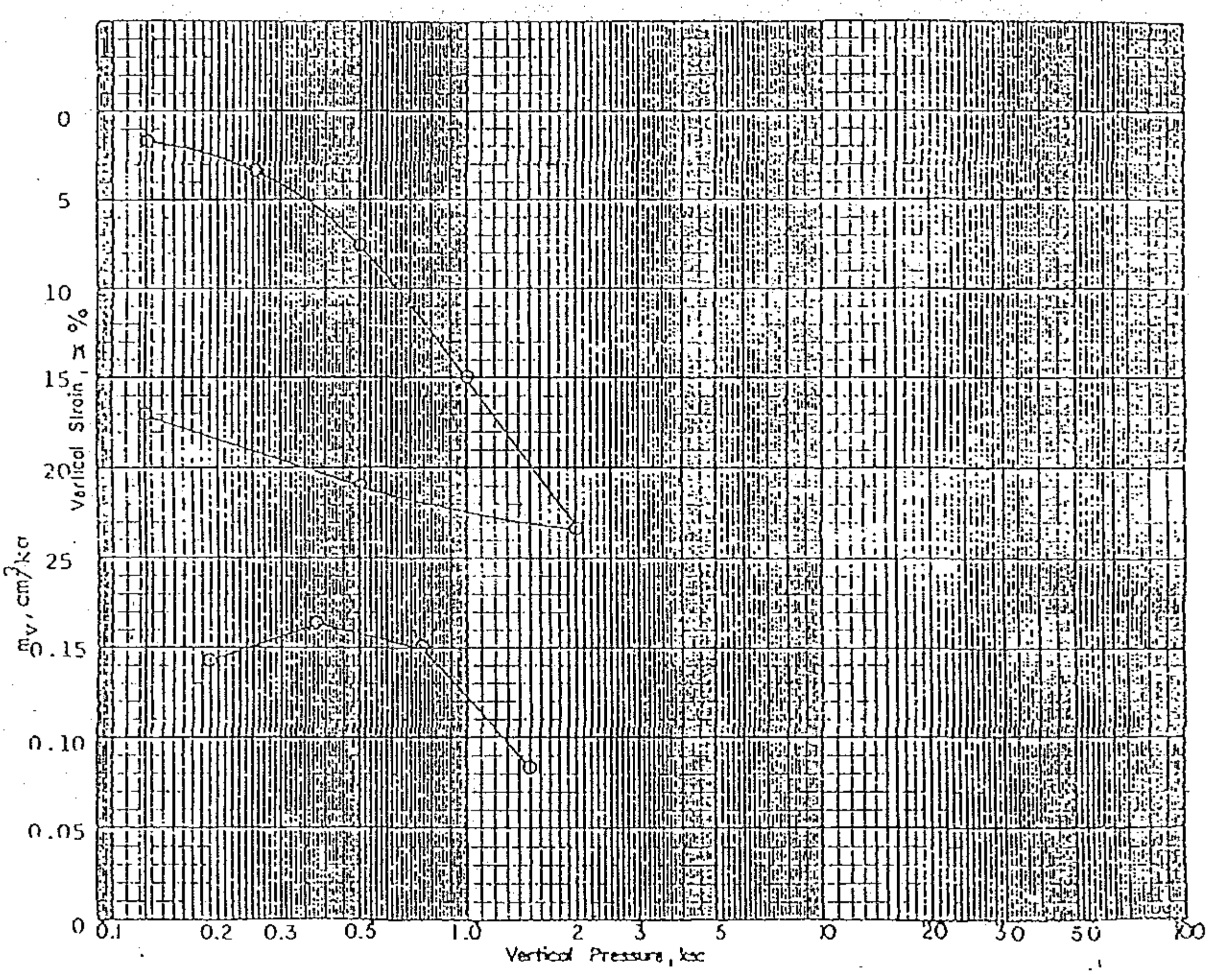
Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %
Initial	—	—		
0.06	-			0.02
0.125	25.0	8.6	1.72	1.32
0.25	25.0	8.4	0.74	2.42
0.50	73.96	2.6	0.58	7.97
1	50.41	3.0	0.63	18.54
2	26.52	4.9	0.33	25.19
8				
16				

$\bar{\sigma}_{vm}$ = 0.35 ksc		initial	Final
Height of Sample, H	cm.	2.5	
Water Content, W	%	92.6	
Degree of Saturation, S	%	96	
Solid Height of Sample, Hs	cm.	0.698	
Diameter of Sample D	cm.	6.35	
Wet Unit Weight γ_t	g/cc	1.43	
Dry Unit Weight γ_d	g/cc	0.75	
Liquid Limit LL	%	86.6	
Plastic Limit PL	%	34.9	
Compression Ratio CR		0.36	
Recompression Ratio RR		0.04	
Specific Gravity G		2.67	

CONSOLIDATION TEST RESULTS

Project Model Infrastructure Projec	Location Chareonraj Pumping statio Bang Bo, Samut Prakan Province	Job No. 1488

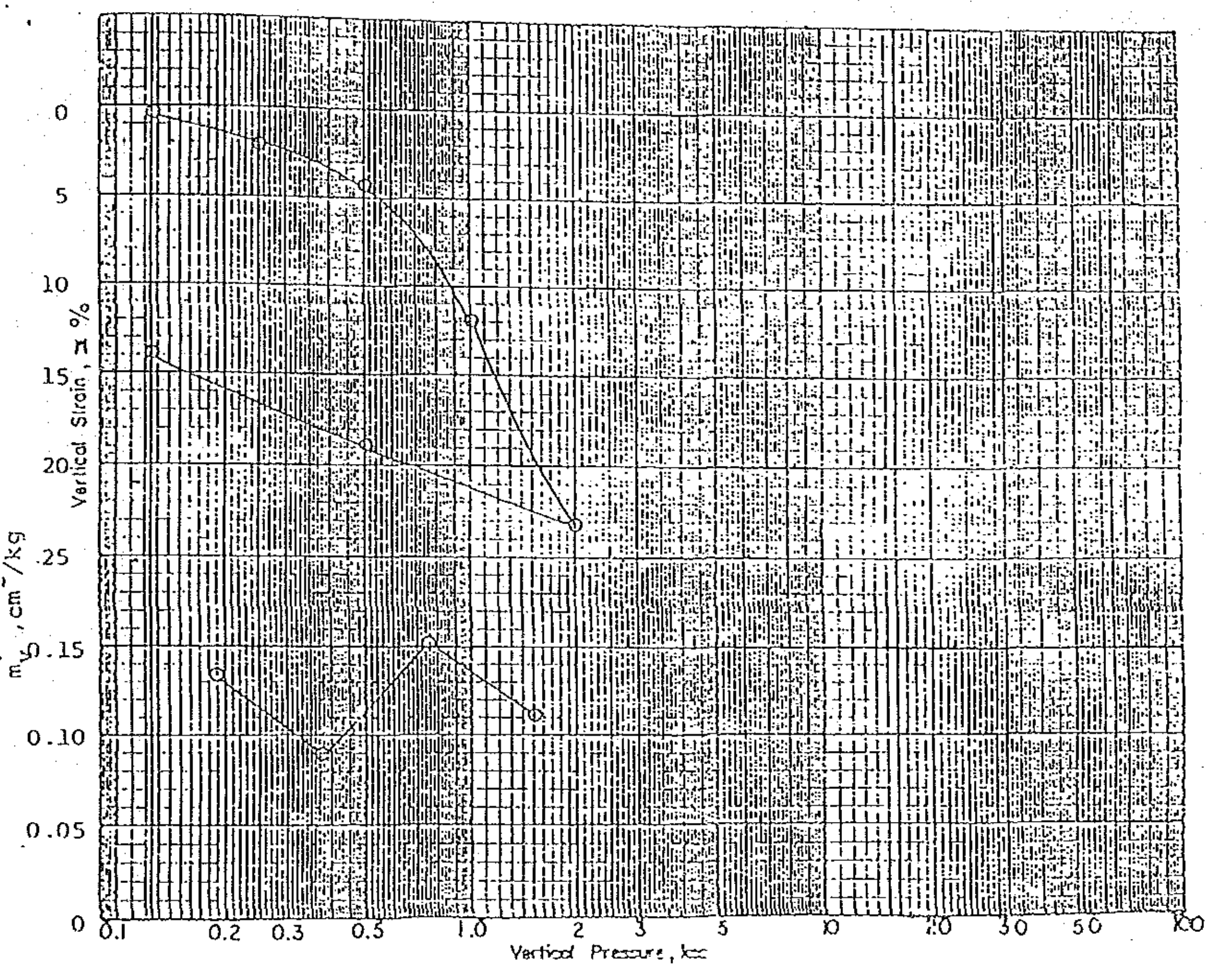
Boring No. B-2	Sample No. PST-7	Depth 7.0-7.80 m.	Date 9/3/88



Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %	$\bar{\sigma}_{vm}$ = 0.4 ksc		initial	Final
					Height of Sample, H	cm.	2.5	
					Water Content, W	%	87.8	
Initial	—	—			Degree of Saturation, S	%	96	
0.125	3.61	59.9	7.76	1.62	Solid Height of Sample, Hs		0.73	cm.
0.25	23.04	9.0	1.28	3.40	Diameter of Sample D		6.35	cm.
0.50	21.16	9.1	1.49	7.49	Wet Unit Weight γ_t		1.45	g/cc
1	42.90	3.8	0.57	14.99	Dry Unit Weight γ_d		0.77	g/cc
2	43.56	3.1	0.26	23.36	Liquid Limit LL			%
4					Plastic Limit PL			%
8					Compression Ratio CR		0.26	
16					Recompression Ratio RR		0.06	
					Specific Gravity G		2.66	

CONSOLIDATION TEST RESULTS

Project Model Infrastructure Projec	Location Chareonraj Pumping station Bang Bo, Samut Prakan Province		Job No. 1488
Boring No. B-2	Sample No. PST-9	Depth 9.10-9.90 m.	Date 9/3/88



Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %
Initial	—	—		
0.125	-	-	-	0.41
0.25	11.56	18.6	2.49	2.09
0.50	17.64	11.2	0.99	4.32
1	60.0	2.7	0.41	11.97
2	67.24	1.8	0.20	23.20
4				
8				
16				

$\bar{\sigma}_{vm}$ = 0.62 ksc			initial	Final
Height of Sample, H		cm.	2.5	
Water Content, W		%	97.2	
Degree of Saturation, S		%	99	
Solid Height of Sample, Hs			0.69	cm.
Diameter of Sample	D		6.35	cm.
Wet Unit Weight	γ_t		1.45	g/cc
Dry Unit Weight	γ_d		0.74	g/cc
Liquid Limit	LL		107.4	%
Plastic Limit	PL		36.8	%
Compression Ratio CR			0.40	
Recompression Ratio RR			0.055	
Specific Gravity	G		2.65	

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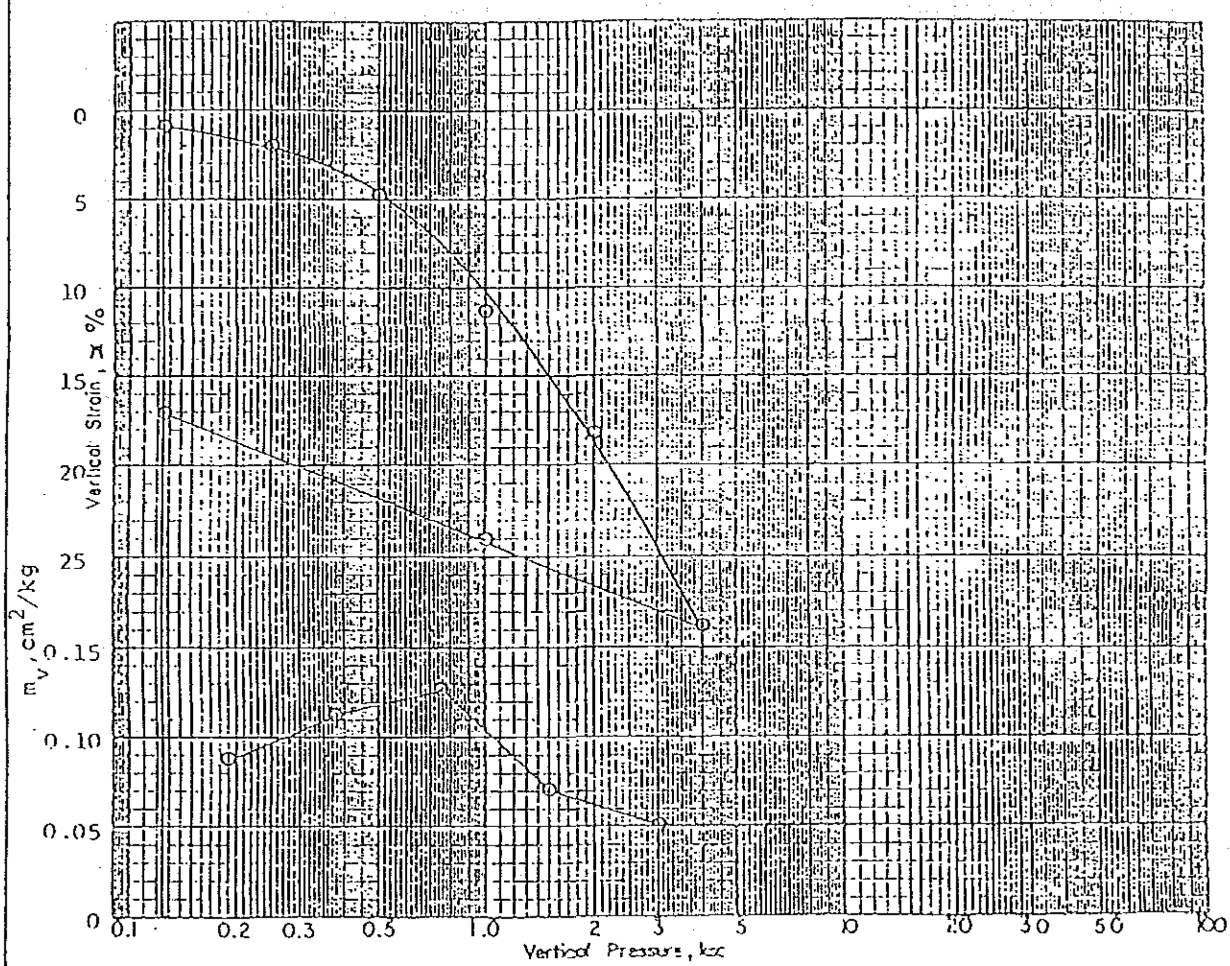
CONSOLIDATION TEST RESULTS

Project Model Infrastructure Project	Location Chareonraj Pumping station Bang Bo, Samut Prakan Province	Job No 1488
Boring No. B-2	Sample No. PST-11	Depth 11.00-11.80 m.
		Date 9/3/88



Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %
Initial	—	—		
0.125	7.84	27.8	2.07	0.93
0.25	19.36	11.0	0.97	2.03
0.50	27.04	7.5	0.85	4.86
1	104.04	1.7	0.22	11.27
2	40.96	3.7	0.27	18.44
4	44.89	2.7	0.14	28.75
8				
16				

$\bar{\sigma}_{vm}$ = 0.78 ksc		initial	Final
Height of Sample, H	cm.	2.5	
Water Content, W	%	102.5	
Degree of Saturation, S	%	98	
Solid Height of Sample, Hs		0.66	cm.
Diameter of Sample D		6.35	cm.
Wet Unit Weight γ_t		1.43	g/cc
Dry Unit Weight γ_d		0.70	g/cc
Liquid Limit LL			%
Plastic Limit PL			%
Compression Ratio CR		0.35	
Recompression Ratio RR		0.042	
Specific Gravity G		2.65	

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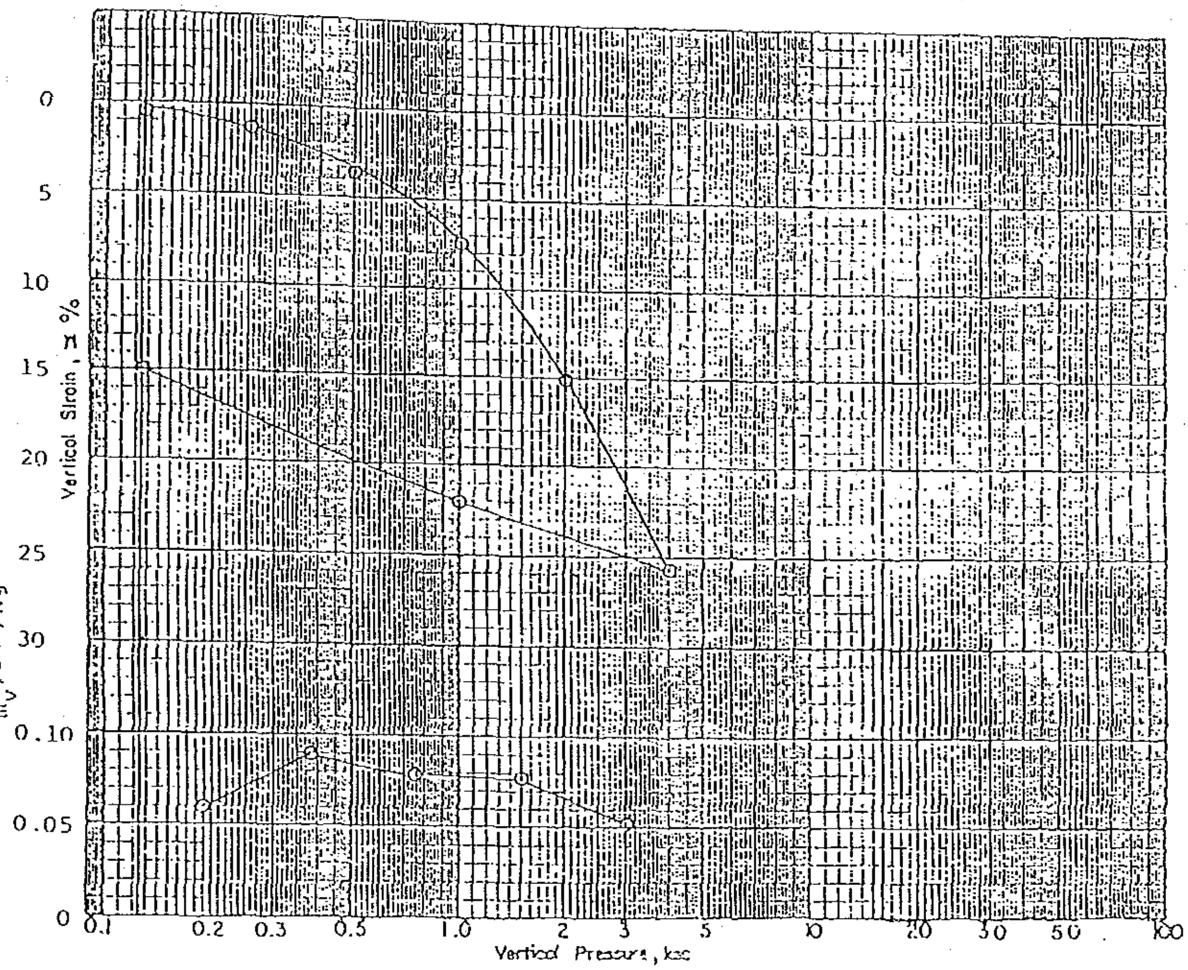
CONSOLIDATION TEST RESULTS

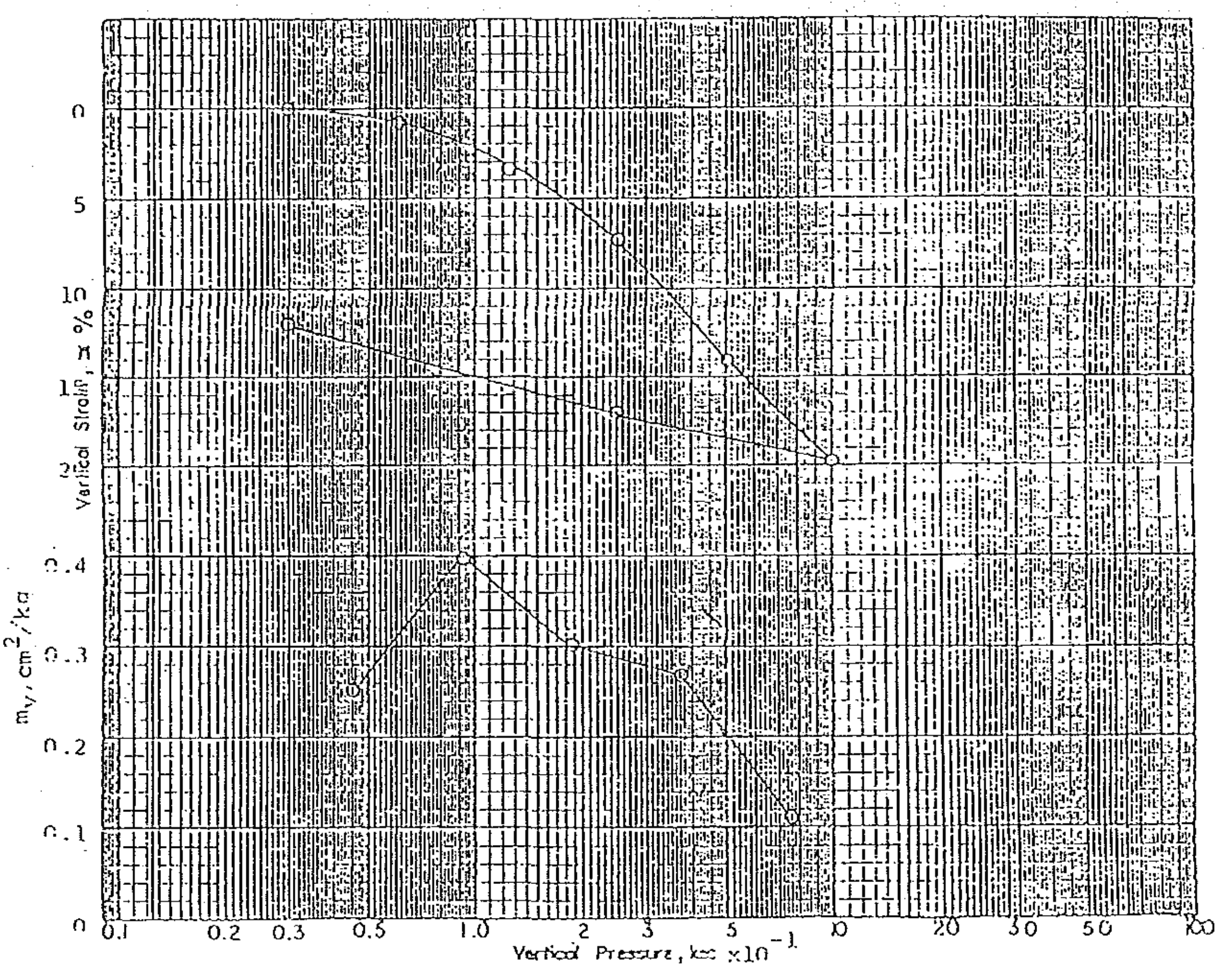
Project Model Infrastructure Project	Location Chareonraj Pumping station Bang Bo, Samut Prakan Province		Job No. 1488
Boring No. B-2	Sample No. PST-14	Depth 14.00-14.80 m.	Date 9/3/88



Pressure Ksc	90% Consol Time min	Coef. of Consolidation Cv, 10^{-4} cm²/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %	$\bar{\sigma}_{vm}$ = 1.0 ksc		initial	Final
					Height of Sample, H	cm.	2.5	
					Water Content, W	%	88.9	
Initial	—	—			Degree of Saturation, S	%	97	
0.125	3.61	60.7	2.77	0.57	Solid Height of Sample, Hs		0.73	cm.
0.25	17.64	12.2	0.72	1.31	Diameter of Sample	D	6.35	cm.
0.50	17.64	11.7	1.06	3.57	Wet Unit Weight	γ_t	1.45	g/cc
1	30	6.4	0.51	7.52	Dry Unit Weight	γ_d	0.77	g/cc
2	60	2.7	0.21	15.26	Liquid Limit	LL	112.4	%
4	49	2.7	0.14	25.60	Plastic Limit	PL	42.3	%
8					Compression Ratio CR		0.37	
16					Recompression Ratio RR		0.045	
					Specific Gravity	G	2.64	

CONSOLIDATION TEST RESULTS

Project: Model Infrastructure Project	Location: Chareonraj Pumping station Bang Bo, Samut Prakan Province	Job No. 1488
Boring No. B-3	Sample No. PST-1	Depth 1.00-1.80 m.
Date 8/3/83		

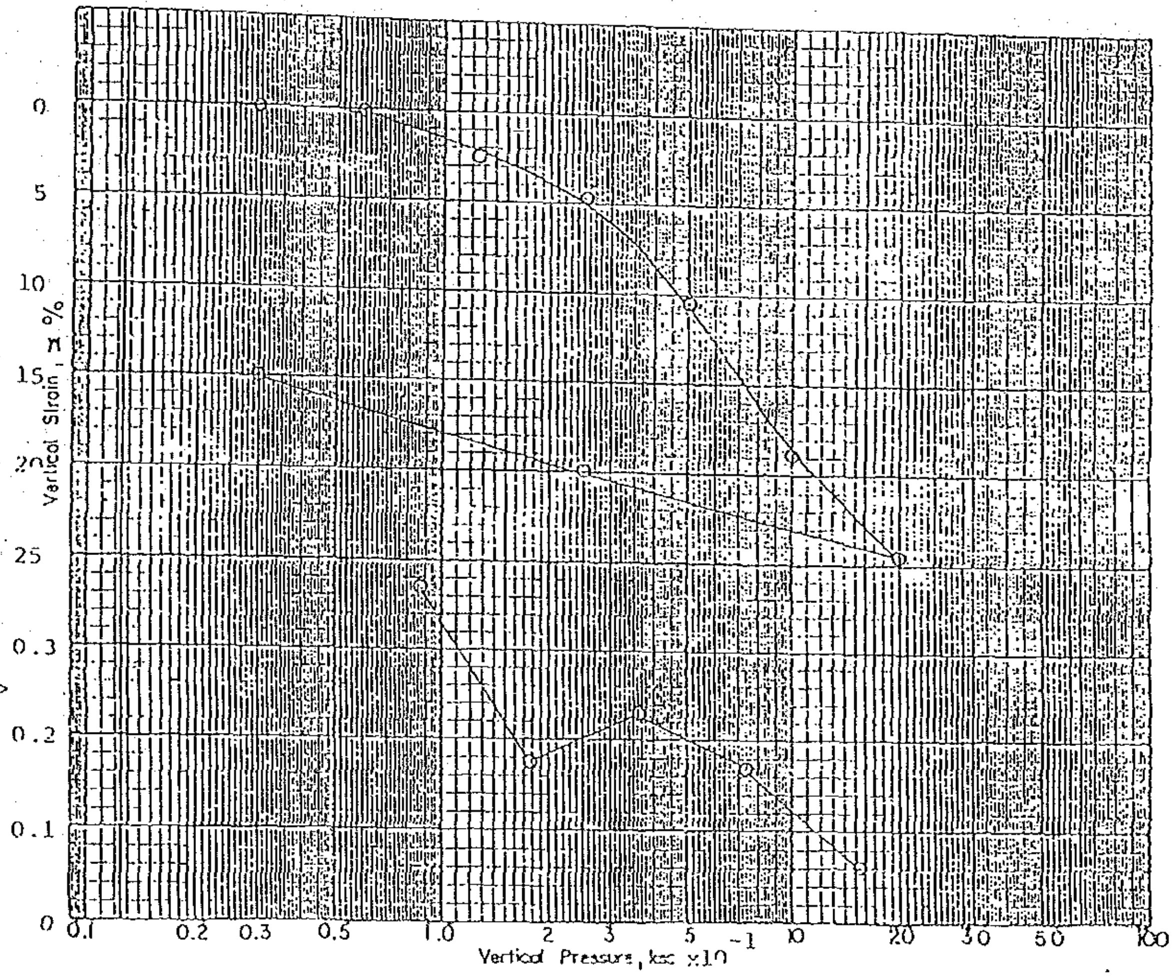


Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %
Initial	—	—		
0.03	—	—	—	0.01
0.06	7.34	27.3	6.95	0.76
0.125	15.0	13.9	5.60	3.38
0.25	31.36	6.2	1.92	7.24
0.50	36.0	4.7	1.28	14.05
1	36.0	4.1	0.46	19.70
2				
4				

$\bar{\sigma}_{vm}$ = 0.16 ksc		initial	Final
Height of Sample, H	cm.	2.50	
Water Content, W	%	94.2	
Degree of Saturation, S	%	97	
Solid Height of Sample, Hs	0.70	cm.	
Diameter of Sample D	6.35	cm.	
Wet Unit Weight γ_t	1.44	g/cc	
Dry Unit Weight γ_d	0.74	g/cc	
Liquid Limit LL	92.5	%	
Plastic Limit PL	34.4	%	
Compression Ratio CR	0.21		
Recompression Ratio RR	0.03		
Specific Gravity G	2.65		

CONSOLIDATION TEST RESULTS

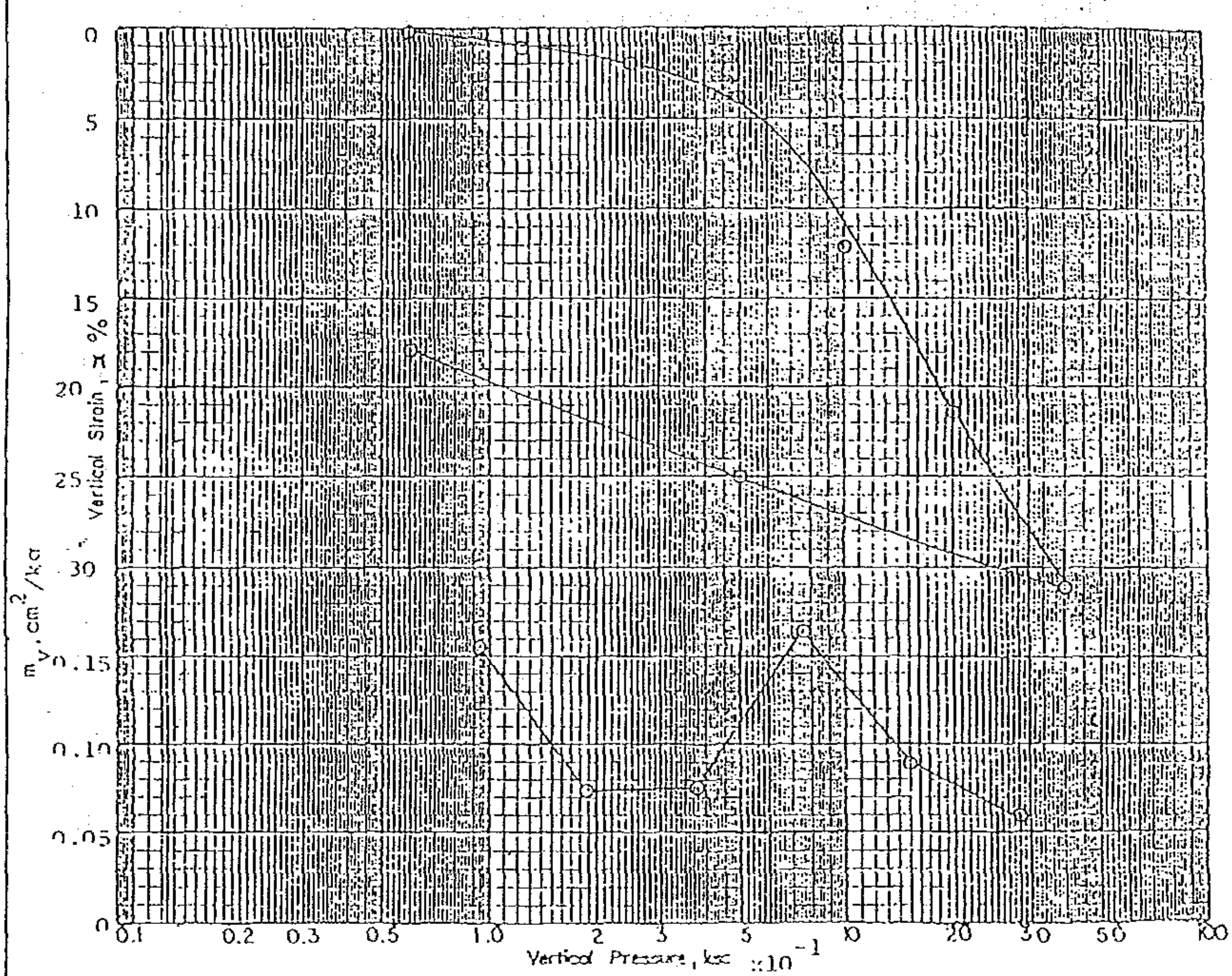
Project Model Infrastructure Projec		Location Chareonraj Pumping station Bang Bo, Samut Prakan Province		Job No. 1488	
Boring No. B-3	Sample No. PST-5	Depth 5.00-5.80 m.		Date 8/3/88	



Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ɛ %	$\bar{\sigma}_{vm}$ = 0.3 ksc		initial	Final
Initial	—	—			Height of Sample, H	cm.	2.5	
0.03	-	-		0.01	Water Content, W	%	90.3	
0.06	-	-		0.03	Degree of Saturation, S	%	98	
0.125	10.24	20.6	7.70	2.46	Solid Height of Sample, Hs		0.73	cm.
0.25	23.04	8.7	1.54	4.67	Diameter of Sample D		6.35	cm.
0.50	33.44	4.7	1.09	10.46	Wet Unit Weight γ_t		1.47	g/cc
1	34.81	4.4	0.74	18.83	Dry Unit Weight γ_d		0.77	g/cc
2	38.44	3.3	0.19	24.79	Liquid Limit LL		86.2	%
4					Plastic Limit PL		35.5	%
6					Compression Ratio CR		0.28	
					Recompression Ratio RR		0.06	
					Specific Gravity G		2.65	

CONSOLIDATION TEST RESULTS

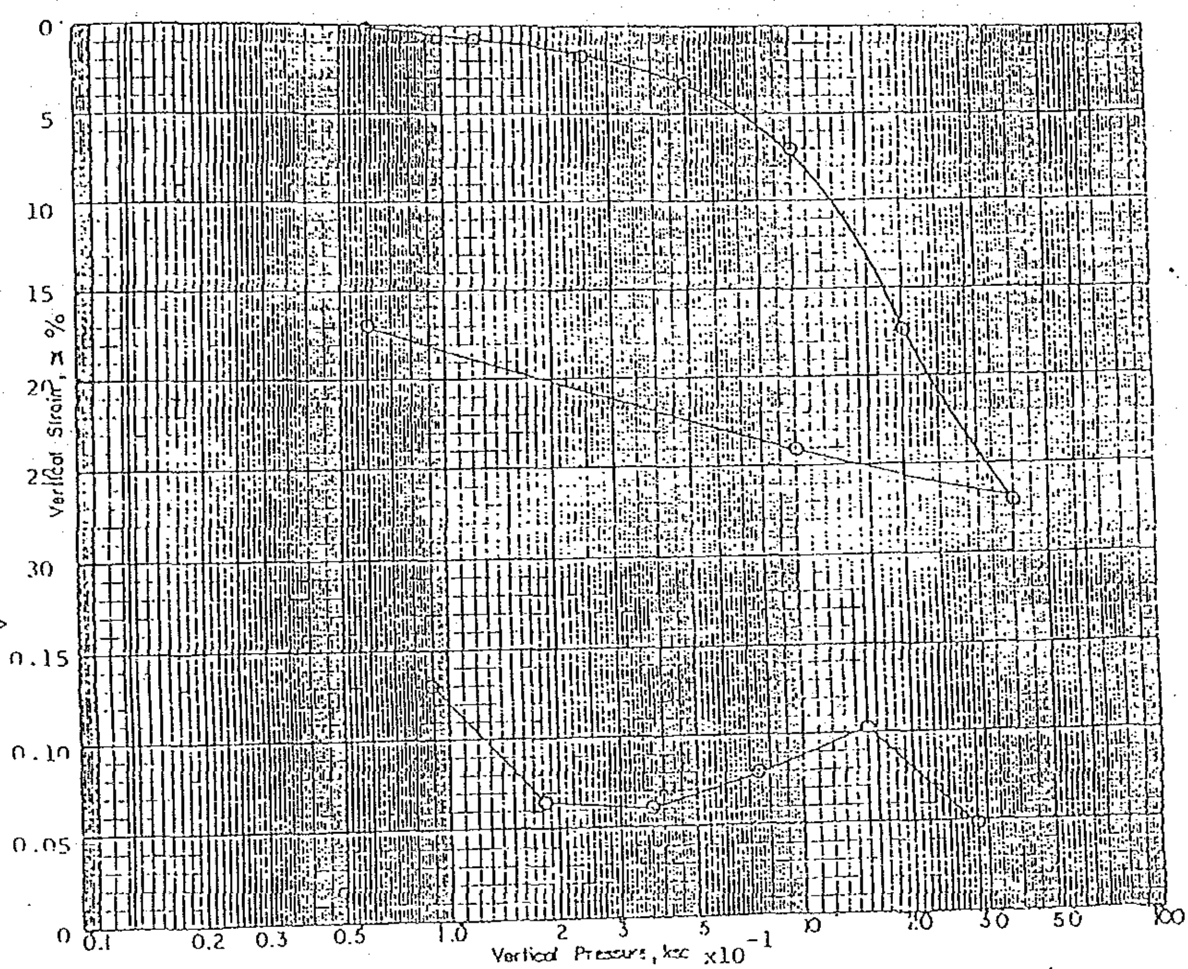
Project Model Infrastructure Project	Location Chareonraj Pumping station Bang Bo Samut Prakan Province		Job No. 1483
Boring No. B-3	Sample No. PST-9	Depth 9.00-9.80 m.	Date 8/3/88



Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %	$\bar{\sigma}_{vm}$ = 0.6 ksc		initial	Final
					Height of Sample, H	cm.	2.50	
					Water Content, W	%	93.4	
Initial	—	—			Degree of Saturation, S	%	98	
0.06				0.12	Solid Height of Sample, Hs		0.67	cm.
0.125	4.84	44.7	6.95	1.13	Diameter of Sample D		6.35	cm.
0.25	6.76	31.5	2.34	2.06	Wet Unit Weight γ_t		1.44	g/cc
0.50	13.69	15.0	1.14	3.96	Dry Unit Weight γ_d		0.73	g/cc
1	51.34	3.4	0.56	12.17	Liquid Limit LL		109.7	%
2	39.69	3.7	0.33	21.08	Plastic Limit PL		38.2	%
4	34.31	3.3	0.19	31.25	Compression Ratio CR		0.34	
8					Recompression Ratio RR		0.036	
					Specific Gravity G		2.70	

CONSOLIDATION TEST RESULTS

Project Model Infrastructure Project	Location Chareonraj Pumping station Bang Bo, Samut Prakan Province		Job No 1488
Boring No. B-3	Sample No. PST-13	Depth 13.0-13.8 m.	Date 11/3/88



Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %
Initial	—	—		
0.06	-			0.016
0.125	7.29	29.7	3.95	0.88
0.25	17.64	12.0	0.78	1.69
0.50	26.01	7.8	0.48	3.22
1	33.06	5.6	0.43	7.08
2	75.69	1.9	0.19	17.43
4	68.89	1.4	0.007	27.13
8				

$\bar{\sigma}_{vm}$ = 0.85 ksc			initial	Final
Height of Sample, H		cm.	2.5	
Water Content, W		%	92.3	
Degree of Saturation, S		%	97	
Solid Height of Sample, Ht			0.71	cm.
Diameter of Sample	D		6.35	cm.
Wet Unit Weight	γ_t		1.44	g/cc
Dry Unit Weight	γ_d		0.75	g/cc
Liquid Limit	LL		119.8	%
Plastic Limit	PL		42.1	%
Compression Ratio CR			0.35	
Recompression Ratio RR			0.025	
Specific Gravity	G		2.65	

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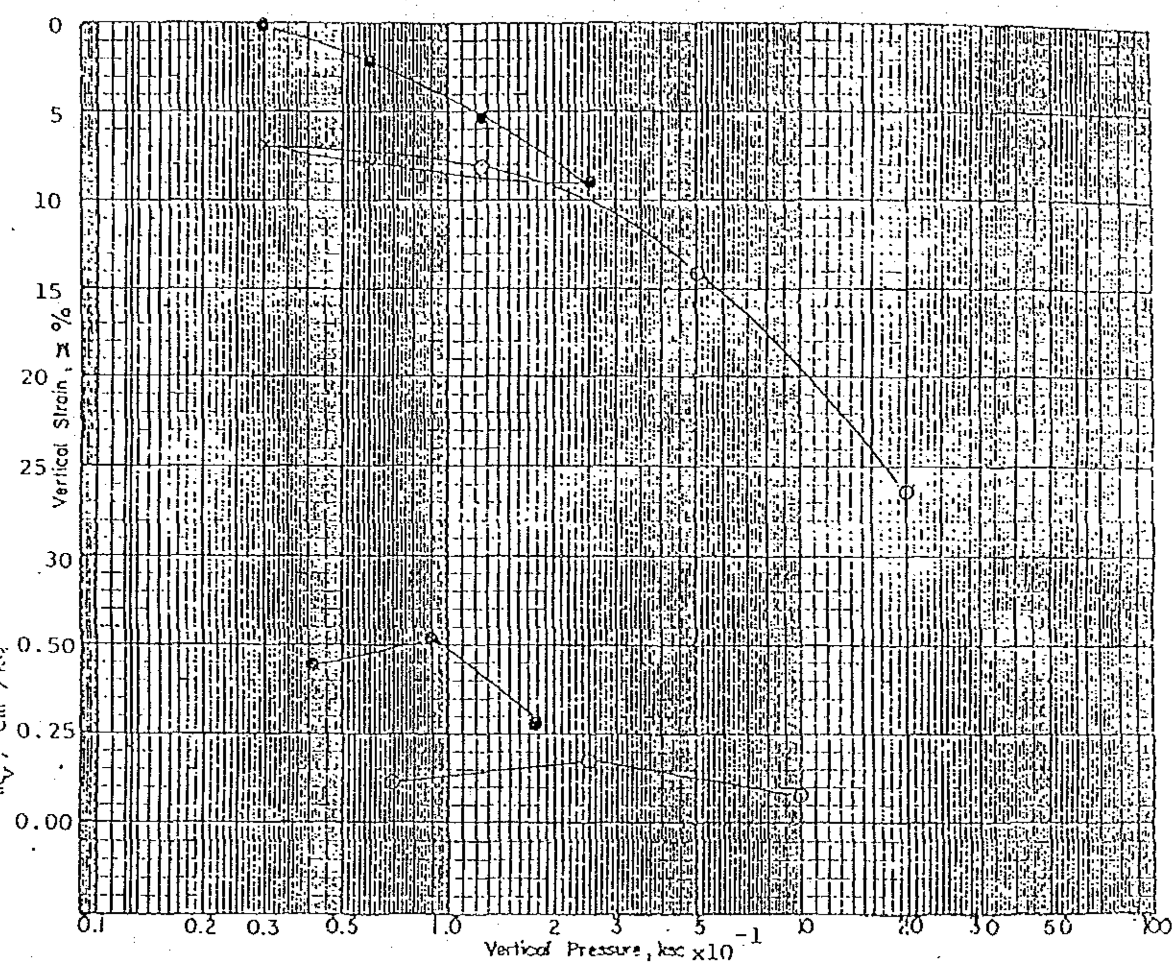
CONSOLIDATION TEST RESULTS

Project Model Infrastructure Projec	Location Chareonraj Pumping Station Bang Bo, Samut Prakan Province.		Job no 1488
Boring No. B-5	Sample No. PST-1	Depth 1.00-1.80 m.	Date 4/4/98



Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm²/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %	σ_{vm} = 0.19 ksc		initial	Final
					Height of Sample, H	cm.	2.5	
					Water Content, W	%	66.8	
Initial	—	—			Degree of Saturation, S	%	98	
0.03	7.18	3.07	0.73	0.71	Solid Height of Sample, Hs		0.39	cm.
0.06	43.56	4.90	2.16	2.03	Diameter of Sample	D	6.35	cm.
0.125	51.84	3.85	1.98	5.38	Wet Unit Weight	γ_t	1.57	g/cc
0.25	77.44	2.39	0.69	8.99	Dry Unit Weight	γ_d	0.94	g/cc
0.125	13.32	1.38	0.02	8.82	Liquid Limit	LL	35.0	%
0.06	21.62	8.62	1.06	8.02	Plastic Limit	PL	33.3	%
0.03	34.44	5.53	1.95	6.96	Compression Ratio CR		0.195	
0.125	23.23	8.04	0.98	8.12	Recompression Ratio RR		0.08	
0.5	55.95	2.97	0.47	14.02	Specific Gravity	G	2.64	
2	61.62	2.02	0.17	26.42				

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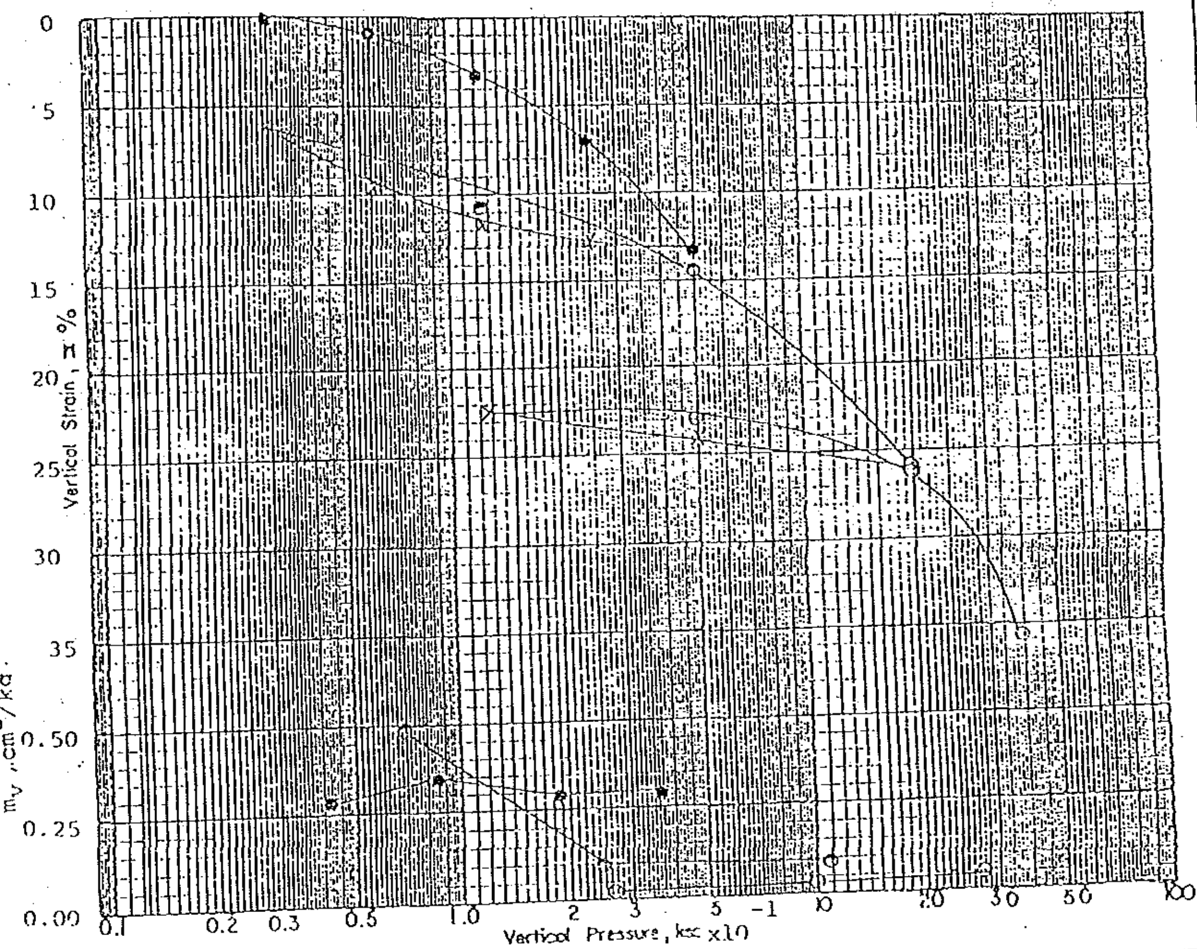
CONSOLIDATION TEST RESULTS

Project Model Infrastructure Project	Location Chareonraj Pumping Station Bang Bo, Samut Prakan Province.	Job No 1488	
Boring No. B-5	Sample No. PST-3	Depth 3.00-3.80 m.	Date 29/3/98



Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm^2/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %
0.06	8	27.22	6.99	0.79
0.125	25	8.30	3.22	3.31
0.25	46.74	4.19	1.18	6.83
0.50	55.95	3.03	0.79	13.31
0.125	23.04	7.68	3.74	10.72
0.5	23.81	6.39	0.66	14.32
2.0	32.04	3.92	0.30	25.81
0.125	4.84	27.42	1.19	22.35
0.5	6	21.89	0.33	22.92
2.0	21.8	5.53	0.13	26.31
4.0	8.29	13.09	0.61	35.56

$\bar{\sigma}_{vm}$ = 0.21 ksc		Initial	Final
Height of Sample, H	cm.	2.5	
Water Content, W	%	93.0	
Degree of Saturation, S	%	97	
Solid Height of Sample, Hs		0.67	cm.
Diameter of Sample D		6.35	cm.
Wet Unit Weight γ_t		1.44	g/cc
Dry Unit Weight γ_d		0.75	g/cc
Liquid Limit LL		95.5	%
Plastic Limit PL		36.2	%
Compression Ratio CR		0.97	
Recompression Ratio RR		0.23	
Specific Gravity G		2.65	

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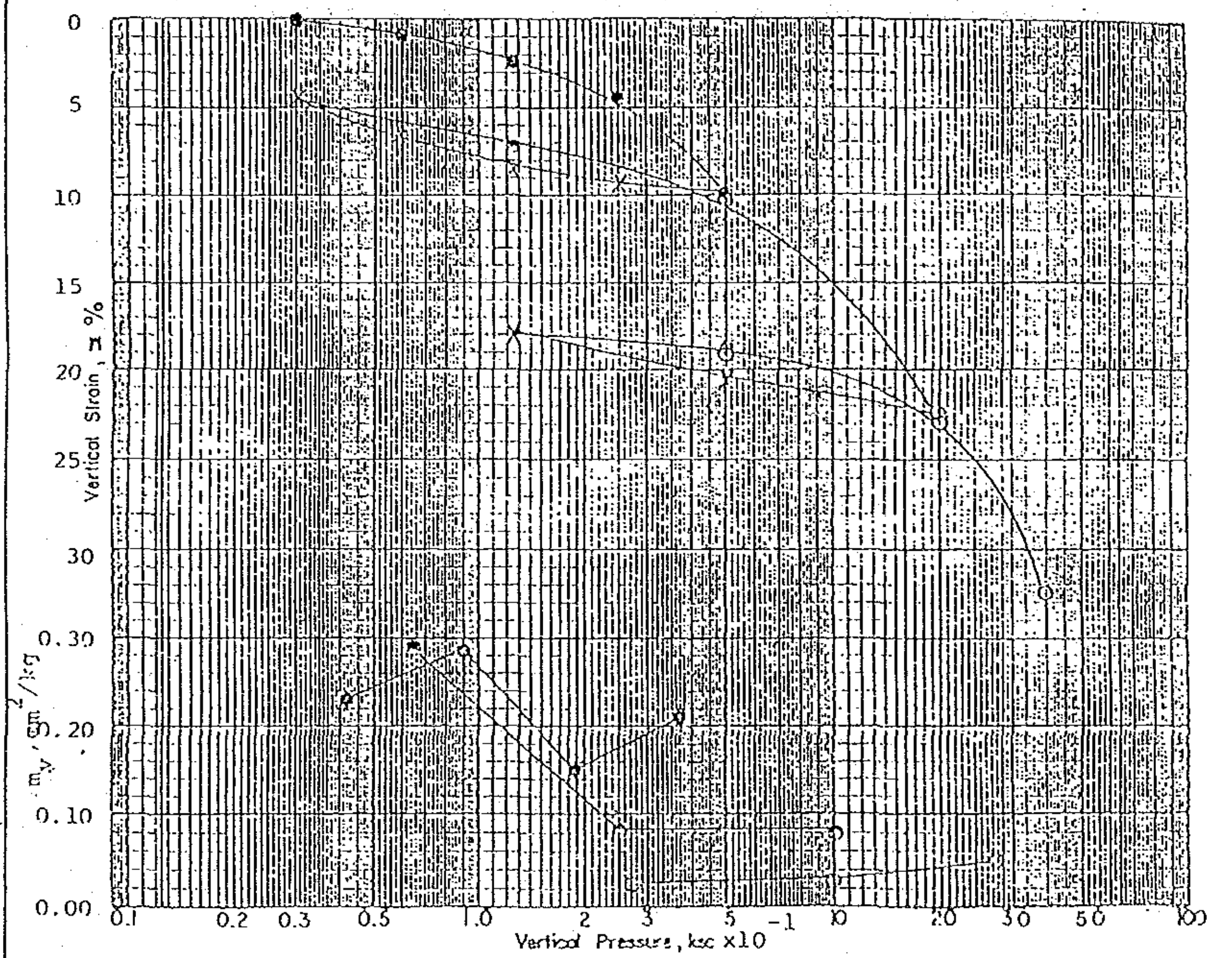
CONSOLIDATION TEST RESULTS

Project Model Infrastructure Project	Location Chareonraj Pumping Station Bang Bo, Samut Prakan Province	Job No. 1488	
Boring No. B-5	Sample No. PST-5	Depth 5.00-5.80 m.	Date 4/4/88



Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm²/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %
0.06	16.4	13.28	3.10	0.70
0.125	19.8	10.64	3.04	2.56
0.25	27.04	7.50	1.16	4.49
0.50	58.83	3.11	0.65	9.75
0.125	9.3	20.56	5.87	7.15
0.5	10.24	17.67	1.48	10.30
2.0	25	5.56	0.45	22.40
0.125	32.38	4.54	0.34	18.04
0.5	7.13	20.40	0.49	18.94
2.0	5.76	23.35	0.57	22.62
4.0	31.92	3.42	0.17	32.51

$\bar{\sigma}_{vm}$ = 0.35 ksc		initial	Final
Height of Sample, H	cm.	2.5	
Water Content, W	%	90.0	
Degree of Saturation, S	%	98	
Solid Height of Sample, Hs	cm.	0.73	
Diameter of Sample D	cm.	6.35	
Wet Unit Weight γ_t	g/cc	1.46	
Dry Unit Weight γ_d	g/cc	0.77	
Liquid Limit LL	%	97.0	
Plastic Limit PL	%	36.6	
Compression Ratio CR		0.26	
Recompression Ratio RR		0.04	
Specific Gravity G		2.66	

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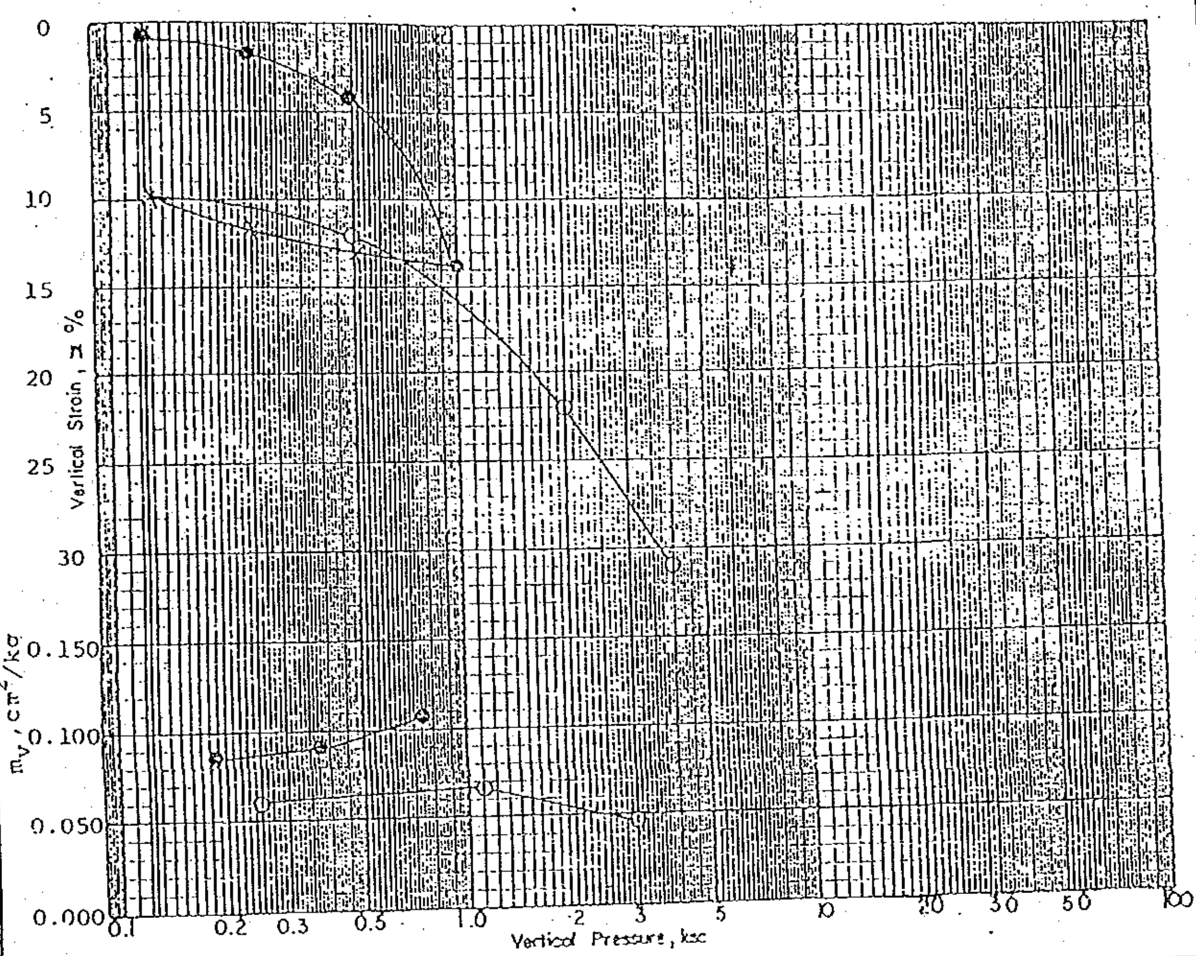
CONSOLIDATION TEST RESULTS

Project: Model Infrastructure Project	Location: Chareonraj Pumping Station Bang Bo, Samut Prakan Province		Job No. 1488
Boring No. B-5	Sample No. PST-7	Depth: 7.00-7.80 m.	Date: 24/3/88



Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm²/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %
Initial	—	—		
0.125	8	27.21	1.39	0.64
0.25	8	26.53	2.25	1.70
0.50	10.24	19.71	1.77	3.95
1	60.0	2.62	0.51	13.62
0.5	9.61	15.94	0.19	13.04
0.25	29.16	5.47	0.29	11.70
0.125	60.0	2.80	0.41	9.86
0.5	23.04	6.93	0.41	12.08
2.0	38.44	3.09	0.20	22.0
4.0	43.56	1.95	0.09	

$\bar{\sigma}_{vm}$ = 0.46 ksc		initial	Final
Height of Sample, H	cm.	2.5	
Water Content, W	%	85.4	
Degree of Saturation, S	%	99	
Solid Height of Sample, Hs	cm.	0.76	
Diameter of Sample D	cm.	6.35	
Wet Unit Weight γ_t	g/cc	1.50	
Dry Unit Weight γ_d	g/cc	0.81	
Liquid Limit LL	%	94.4	
Plastic Limit PL	%	35.8	
Compression Ratio CR		0.31	
Recompression Ratio RR		0.03	
Specific Gravity G		2.65	

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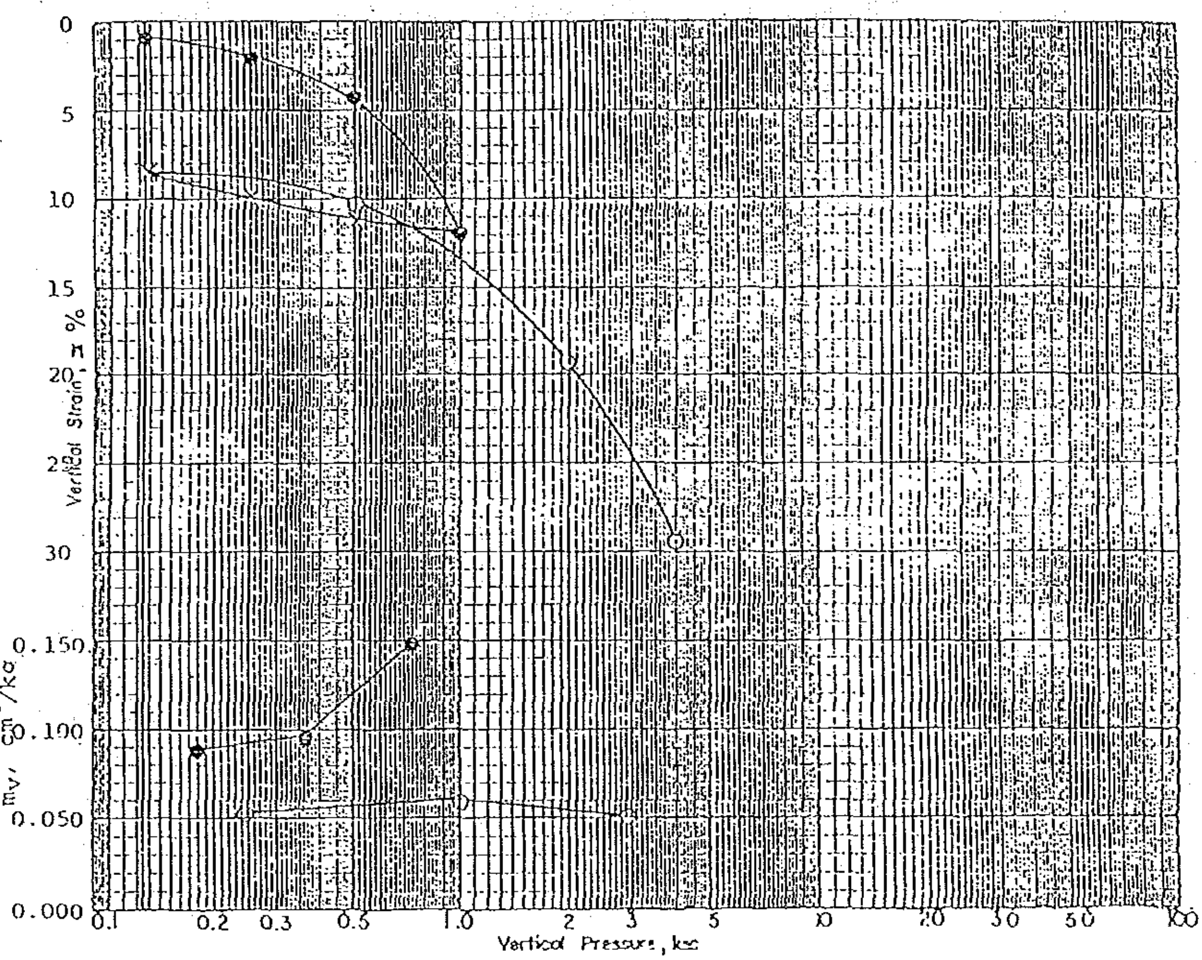
CONSOLIDATION TEST RESULTS

Project Model Infrastructure Project	Location Chareonraj Pumping Station Bang Bo, Samut Prakan Province	Job No. 1488

Boring No. B-5	Sample No. PST-9	Depth 9.00-9.80 m.	Date 24/3/88

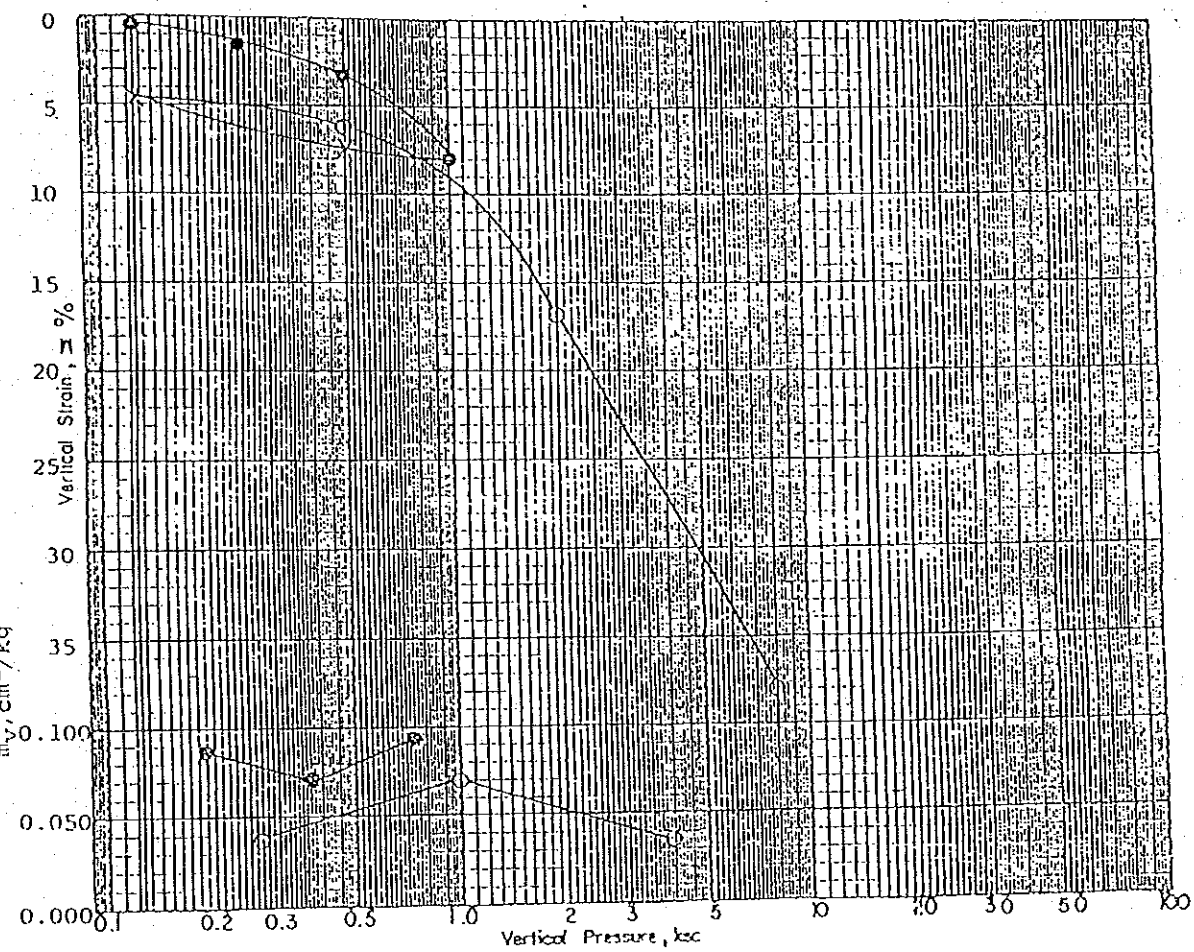


Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm²/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %	$\bar{\sigma}_{vm}$ =0.56 ksc		initial	Final
					Height of Sample, H	cm.	2.5	
					Water Content, W	%	93.1	
Initial	—	—			Degree of Saturation, S	%	98	
0.125	8	27.19	1.87	0.86	Solid Height of Sample, Hs		0.71	cm.
0.25	12.96	16.40	1.44	1.96	Diameter of Sample	D	6.35	cm.
0.50	20.25	10.04	0.97	4.37	Wet Unit Weight	γ_t	1.45	g/cc
1	94.09	1.86	0.28	11.85	Dry Unit Weight	γ_d	0.75	g/cc
0.5	9.0	19.29	0.22	11.29	Liquid Limit	LL	116.2	%
0.25	21.16	8.42	0.52	9.76	Plastic Limit	PL	38.9	%
0.125	51.84	3.57	0.42	8.30	Compression Ratio CR		0.31	
0.5	21.16	8.45	0.44	10.27	Recompression Ratio RR		0.038	
2.0	37.21	3.96	0.24	19.19	Specific Gravity	G	2.63	
4.0	54.76	2.11	0.11	29.4				

STS ENGINEERING CONSULTANTS CO., LTD.

CONSOLIDATION TEST RESULTS

Project Model Infrastructure Project	Location Chareonraj Pumping Station Bang Bo, Samut Prakan Province		Job No. 1488
Boring No. B-5	Sample No. PST-11	Depth 11.00-11.80 m.	Date 5/4/88



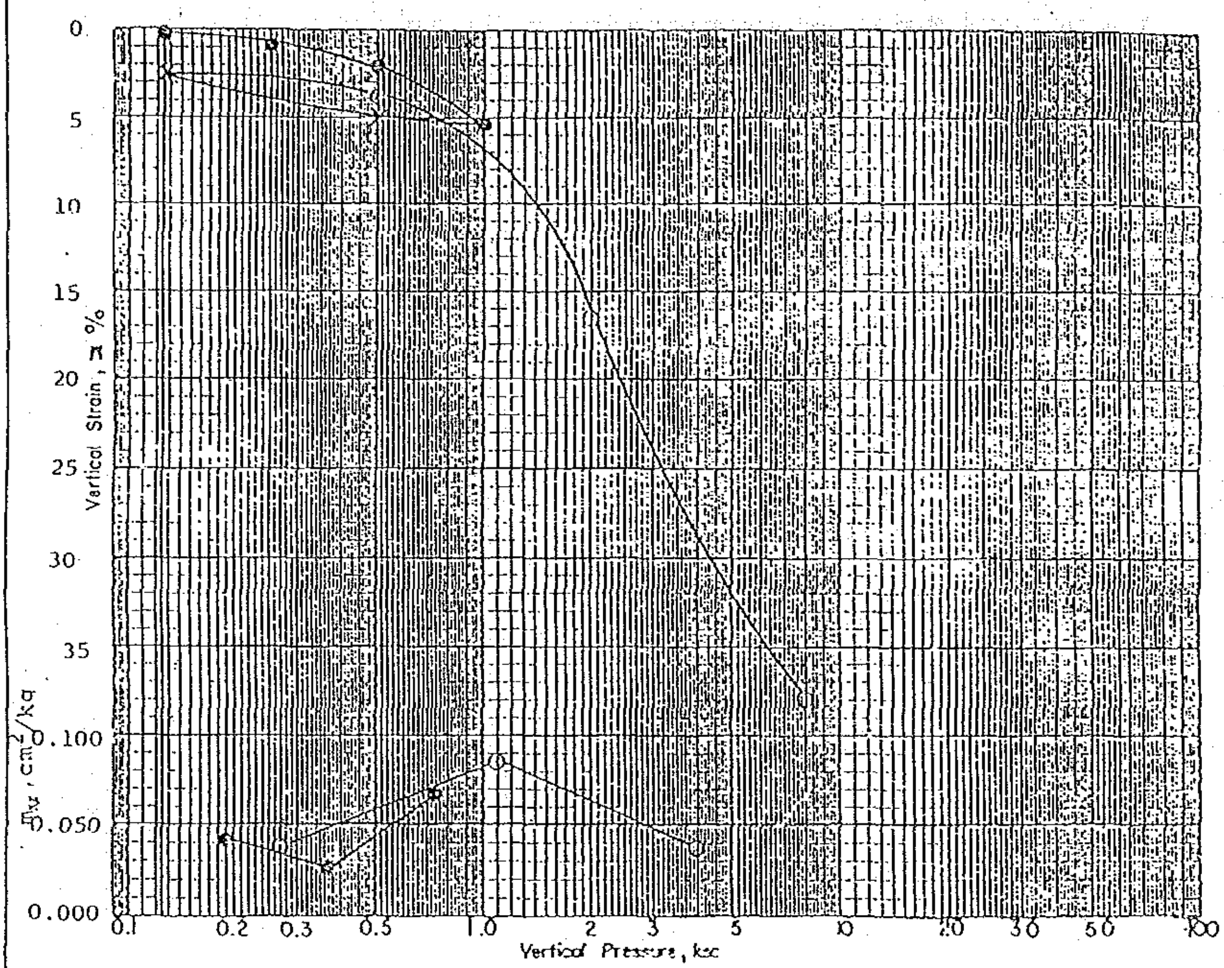
Pressure Ksc	90% Consol. Time min	Coef. of Consolidation Cv, 10^{-4} cm²/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %
Initial	—	—		
0.125	-			0.45
0.25	11.56	18.56	1.59	1.52
0.50	19.36	10.69	0.75	3.28
1	26.01	7.34	0.68	7.92
0.5	9.0	21.06	0.29	7.23
0.125	18.49	10.71	0.67	4.87
0.5	19.36	10.06	0.38	6.29
2	39.36	3.95	0.28	16.81
8	51.84	1.84	0.06	37.91

$\bar{\sigma}_{vm}$ =0.75 ksc		initial	Final
Height of Sample, H	cm.	2.5	
Water Content, W	%	98.8	
Degree of Saturation, S	%	95	
Solid Height of Sample, Hs	cm.	0.67	
Diameter of Sample D	cm.	6.35	
Wet Unit Weight γ_t	g/cc	1.40	
Dry Unit Weight γ_d	g/cc	0.71	
Liquid Limit LL	%	119.5	
Plastic Limit PL	%	41.8	
Compression Ratio CR		0.31	
Recompression Ratio RR		0.04	
Specific Gravity G		2.65	

STS ENGINEERING CONSULTANTS CO.,LTD.

CONSOLIDATION TEST RESULTS

Project Model Infrastructure Projec	Location Chareonraj Pumping Station Bang Bo, Samut Prakan Province		Job No. 1488
Boring No. B-5	Sample No. PST-13	Depth 13.00-13.80 m.	Date 5/4/88



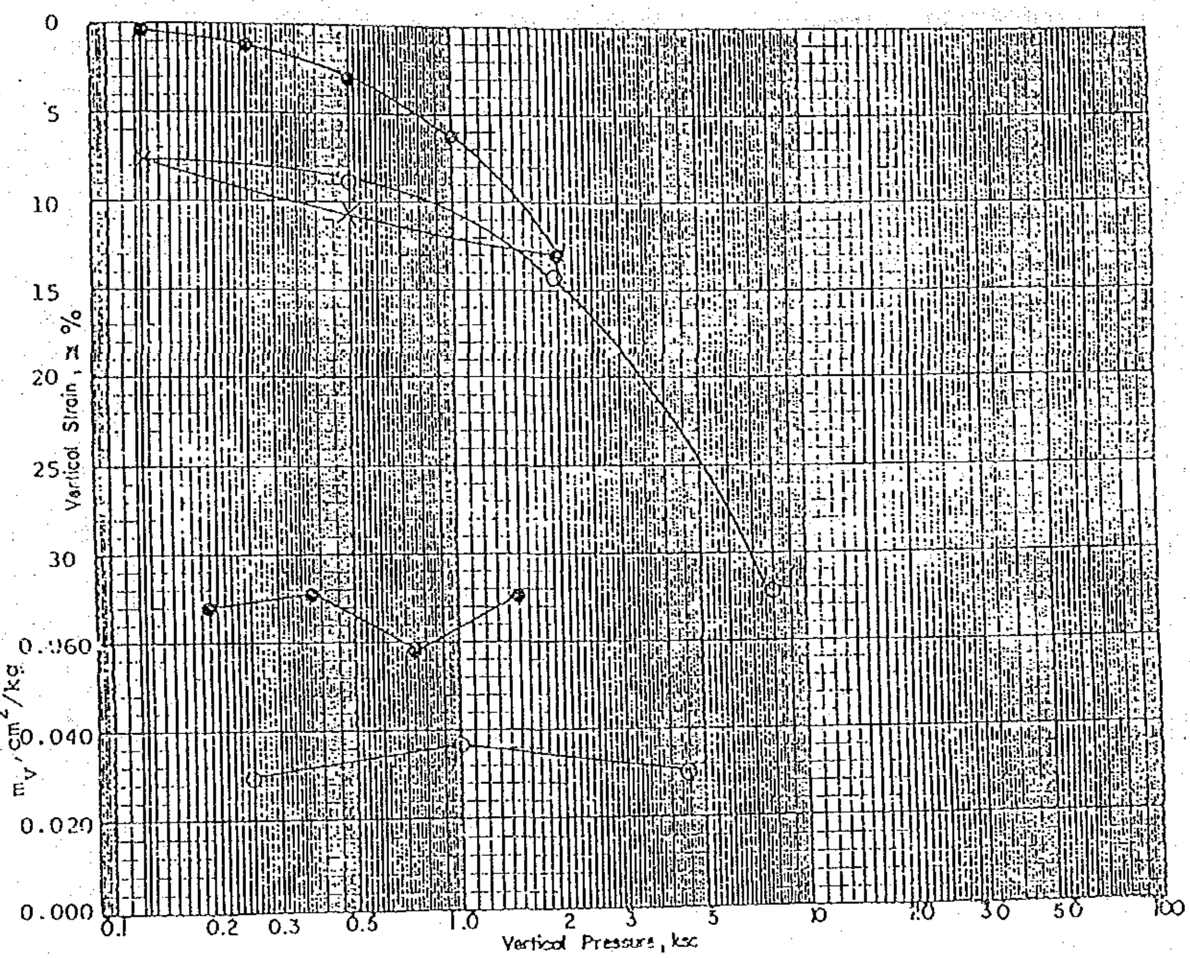
Pressure Ksc	90% Consol. Time min	Coef. of Consolidation $C_v, 10^{-4}$ cm²/sec	Coef. of Permeability $K, 10^{-7}$ cm/sec	Vertical Strain, ε %
Initial	—	—		
0.125	-			0.18
0.25	7.84	27.69	1.17	0.71
0.50	8.0	26.40	0.69	2.03
1	36.0	5.36	0.37	5.44
0.5	15.0	12.99	0.18	4.73
0.125	30.0	6.87	0.43	2.40
0.5	11.56	17.37	0.66	3.82
2	73.96	1.91	0.16	16.56
8	60.0	1.19	0.04	37.86

$\bar{\sigma}_{vm}$=0.85 ksc		initial	Final
Height of Sample, H	cm.	2.5	
Water Content, W	%	100.2	
Degree of Saturation, S	%	97	
Solid Height of Sample, Hs		0.67	cm.
Diameter of Sample D		6.35	cm.
Wet Unit Weight γ_t		1.42	g/cc
Dry Unit Weight γ_d		0.71	g/cc
Liquid Limit LL		115.8	%
Plastic Limit PL		42.2	%
Compression Ratio CR		0.37	
Recompression Ratio RR		0.035	
Specific Gravity G		2.64	

STS ENGINEERING CONSULTANTS CO.,LTD.

CONSOLIDATION TEST RESULTS

Project	Model Infrastructure Project	Location	Chareonraj Pumping Station, Bang Bo, Samut Prakan Province	Job No.	1488
Boring No.	B-5	Sample No.	PST-15	Depth	15.00-15.80 m.
Date	4/4/88				



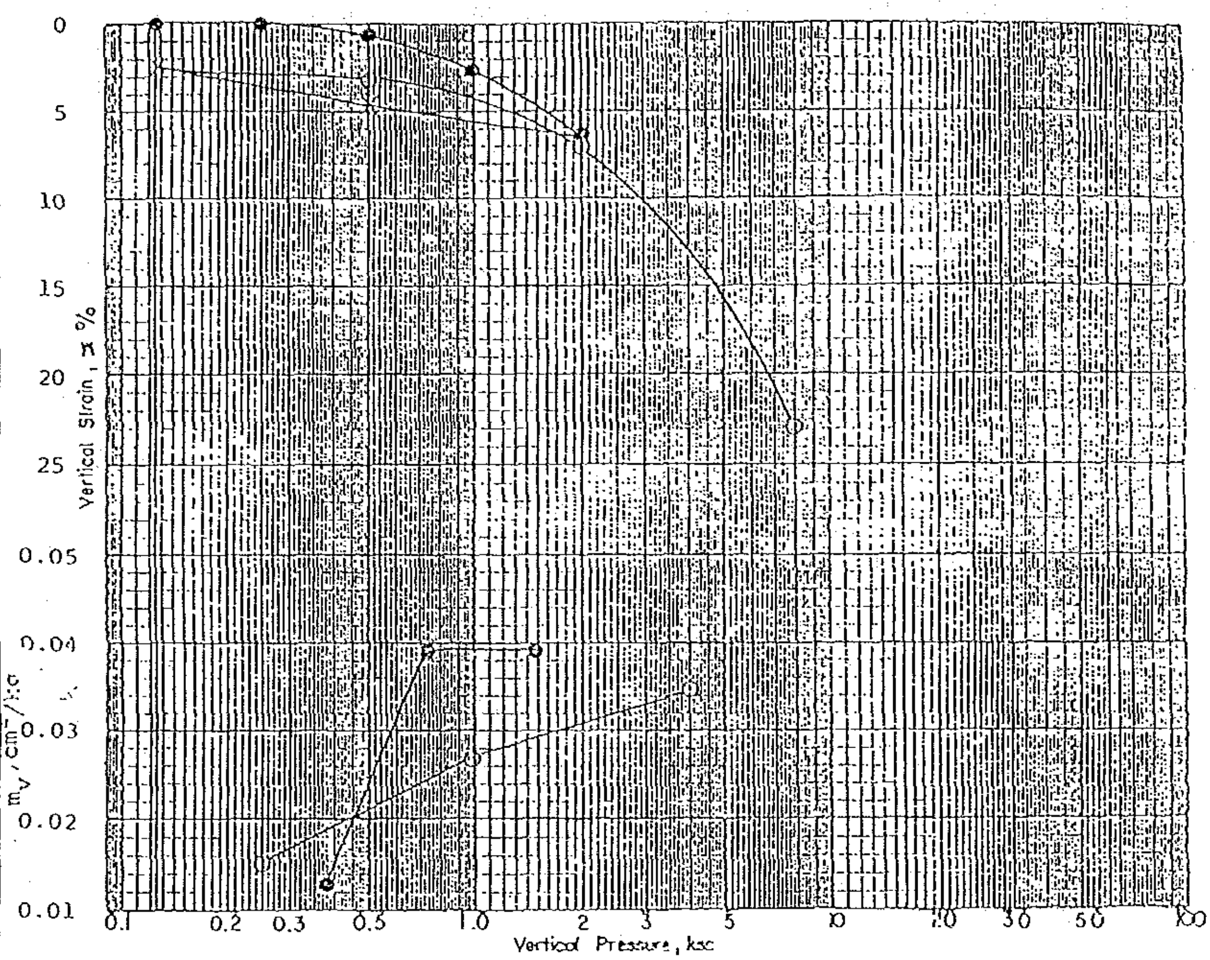
Pressure Ksc	90% Consol. Time min	Coef. of Consolidation C_v, 10^{-4} cm²/sec	Coef. of Permeability K, 10^{-7} cm/sec	Vertical Strain, ε %
Initial	—	—		
0.125	3.24	67.6	2.22	0.41
0.25	7.29	29.5	2.03	1.27
0.50	31.36	6.64	0.47	3.05
1	32.49	6.04	0.36	5.99
2	62.41	2.73	0.19	13.09
0.5	30.0	5.85	0.01	10.57
0.125	43.56	4.29	0.33	7.69
0.5	15.0	12.30	0.35	8.77
2	23.04	7.20	0.26	14.22
8	65.61	1.68		32.14

$\bar{\sigma}_{vm}$ =1.1 ksc		initial	Final
Height of Sample, H	cm.	2.5	
Water Content, W	%	79.2	
Degree of Saturation, S	%	96	
Solid Height of Sample, Hs		0.78 cm.	
Diameter of Sample D		6.35 cm.	
Wet Unit Weight γ_T		1.59 g/cc	
Dry Unit Weight γ_d		0.84 g/cc	
Liquid Limit LL		110.4 %	
Plastic Limit PL		38.0 %	
Compression Ratio CR		0.325	
Recompression Ratio RR		0.045	
Specific Gravity G		2.68	

~~STS ENGINEERING CONSULTANTS CO.,LTD.~~

CONSOLIDATION TEST RESULTS

Project Model Infrastructure Project	Location Chareonraj Pumping Station, Bang Bo, Samut Prakan Province	Job No 1488	
Boring No. B-5	Sample No. PST-17	Depth 17.00-17.80 m.	Date 4/4/88

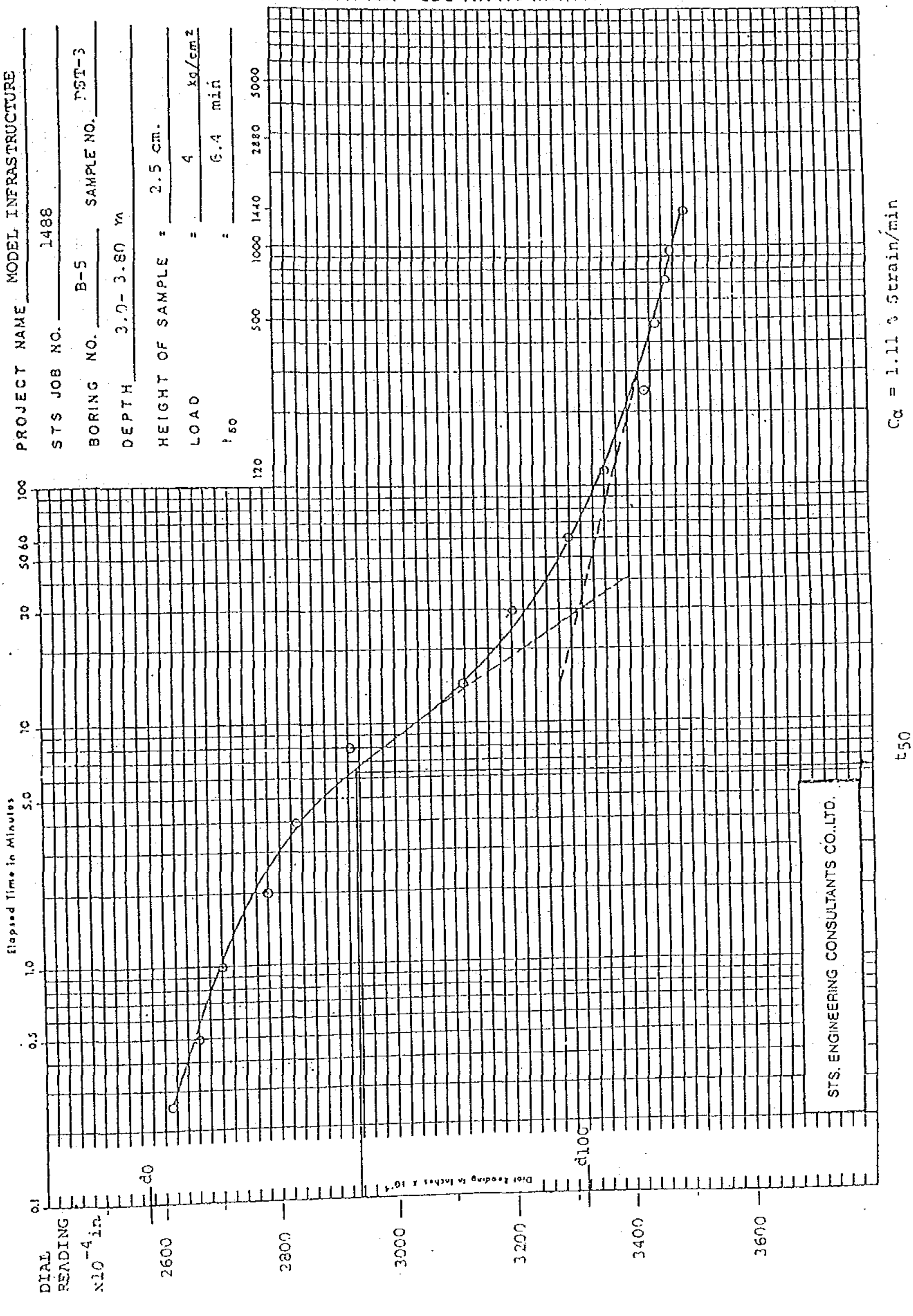


Pressure Ksc	90% Consol. Time min	Coef. of Consolidation $C_v, 10^{-4}$ cm^2/sec	Coef. of Permeability $K, 10^{-7}$ cm/sec	Vertical Strain, ε %
Initial	—	—		
0.125	-			0
0.25	-			0
0.50	14.44	15.11	0.19	0.63
1	18.49	11.40	0.45	2.60
2	21.16	9.26	0.36	6.50
0.5	26.01	7.67	0.09	4.77
0.125	37.21	5.59	0.31	2.69
0.5	15.0	13.80	0.21	3.25
2	17.64	10.89	0.29	7.25
8	64.0	1.96	0.07	27.81

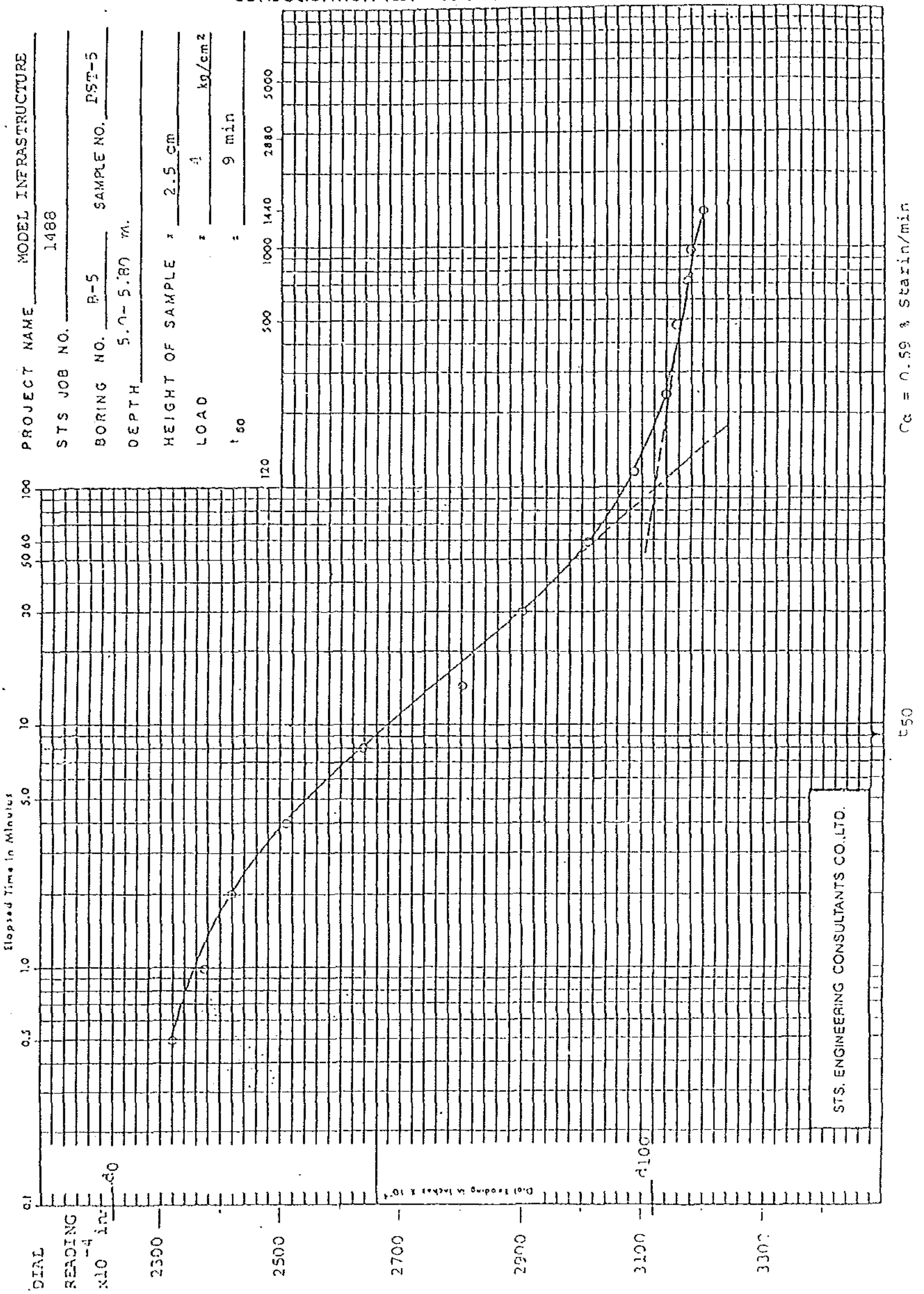
$\bar{\sigma}_{vm}$ = 1.6 ksc			initial	Final
Height of Sample, H		cm.	2.5	
Water Content, W		%	70.9	
Degree of Saturation, S		%	99	
Solid Height of Sample, Hs			0.86	cm.
Diameter of Sample	D		6.35	cm.
Wet Unit Weight	γ_t		1.58	g/cc
Dry Unit Weight	γ_d		0.92	g/cc
Liquid Limit	LL		91.1	%
Plastic Limit	PL		34.9	%
Compression Ratio CR			0.25	
Recompression Ratio RR			0.06	
Specific Gravity	G		2.69	

STS ENGINEERING CONSULTANTS CO., LTD.

CONSOLIDATION TEST - LOG FITTING METHOD



CONSOLIDATION TEST - LOG FITTING METHOD



CONSOLIDATION TEST - LOG FITTING METHOD

PROJECT NAME: MODEL INFRASTRUCTURE

STS JOB NO.: 1488

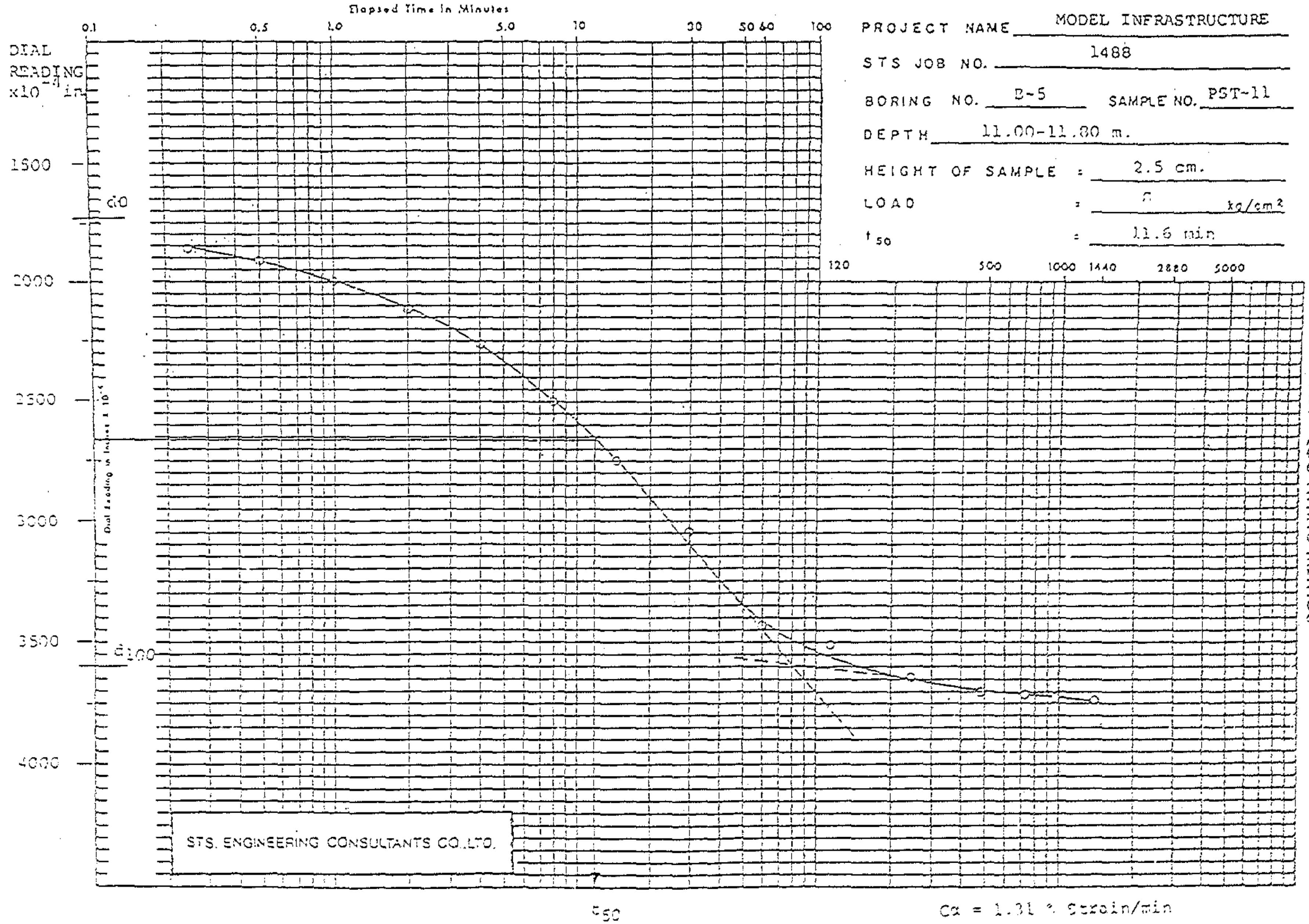
BORING NO.: B-5 SAMPLE NO.: PST-11

DEPTH: 11.00-11.80 m.

HEIGHT OF SAMPLE = 2.5 cm.

LOAD = [illegible] kg/cm²

t_{50} = 11.6 min



CONSOLIDATION TEST - LOG FITTING METHOD

PROJECT NAME MODEL INFRASTRUCTURE

STS JOB NO. 1488

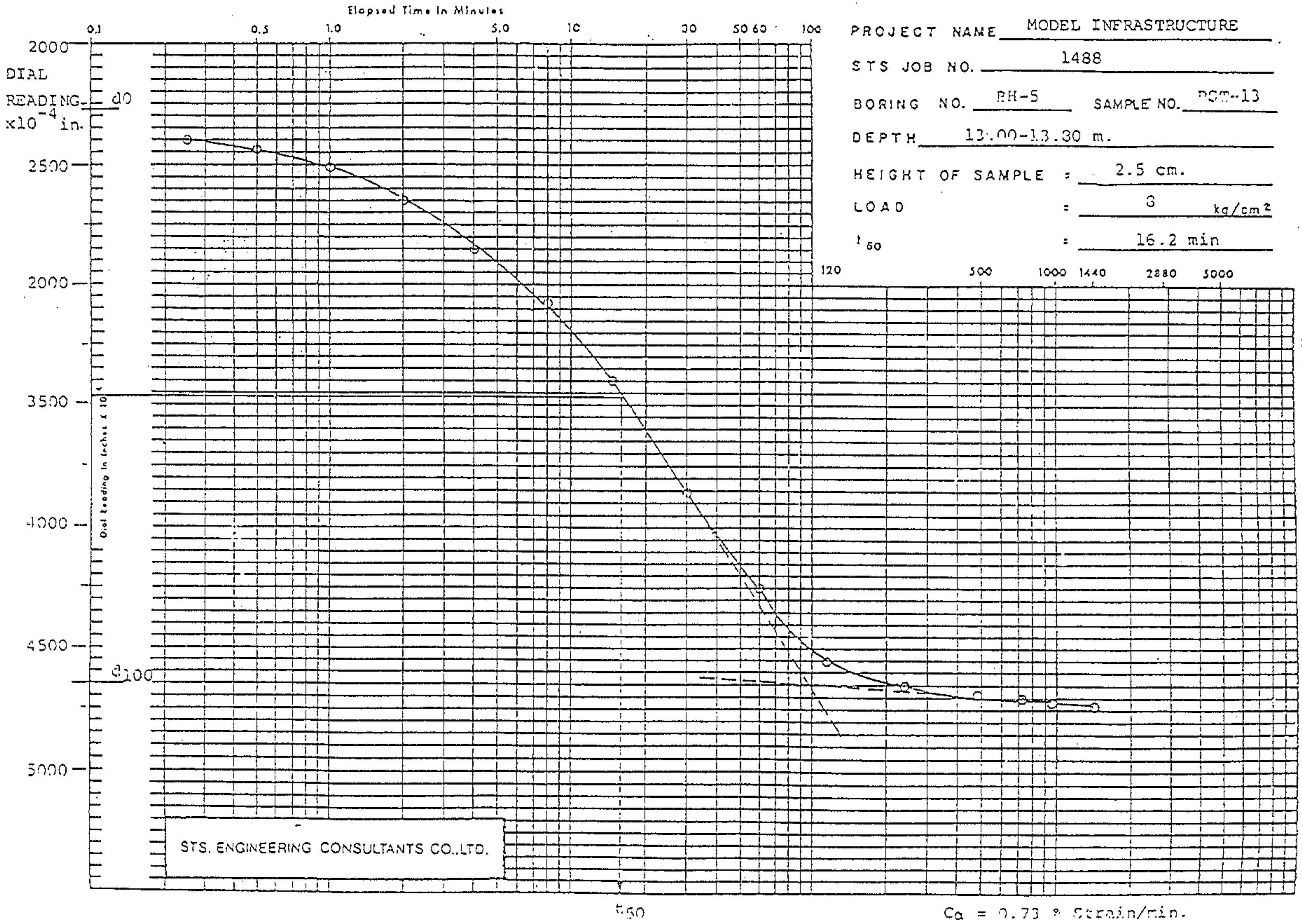
BORING NO. BH-5 SAMPLE NO. PSM-13

DEPTH 13.00-13.30 m.

HEIGHT OF SAMPLE = 2.5 cm.

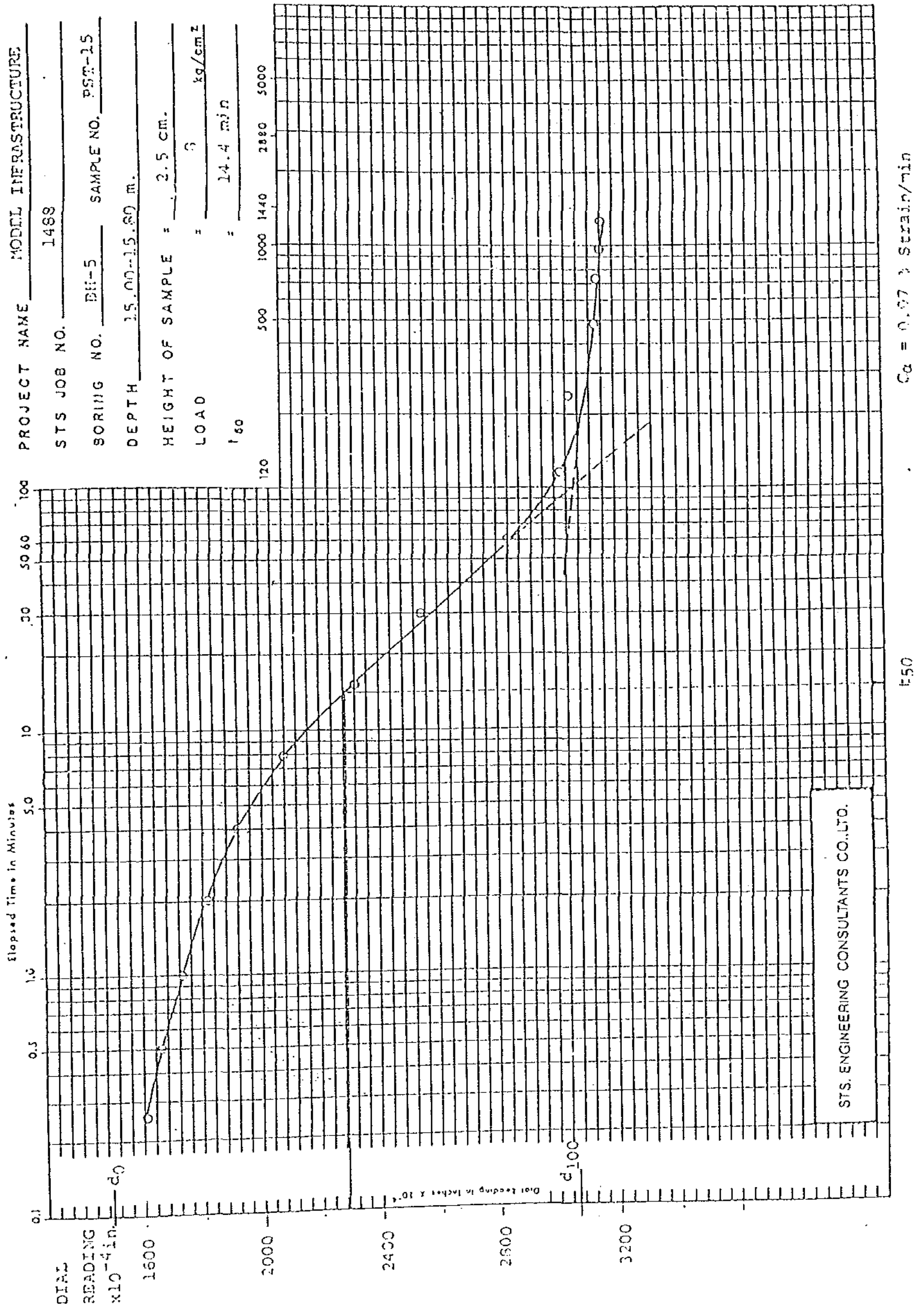
LOAD = 3 kg/cm²

t_{50} = 16.2 min

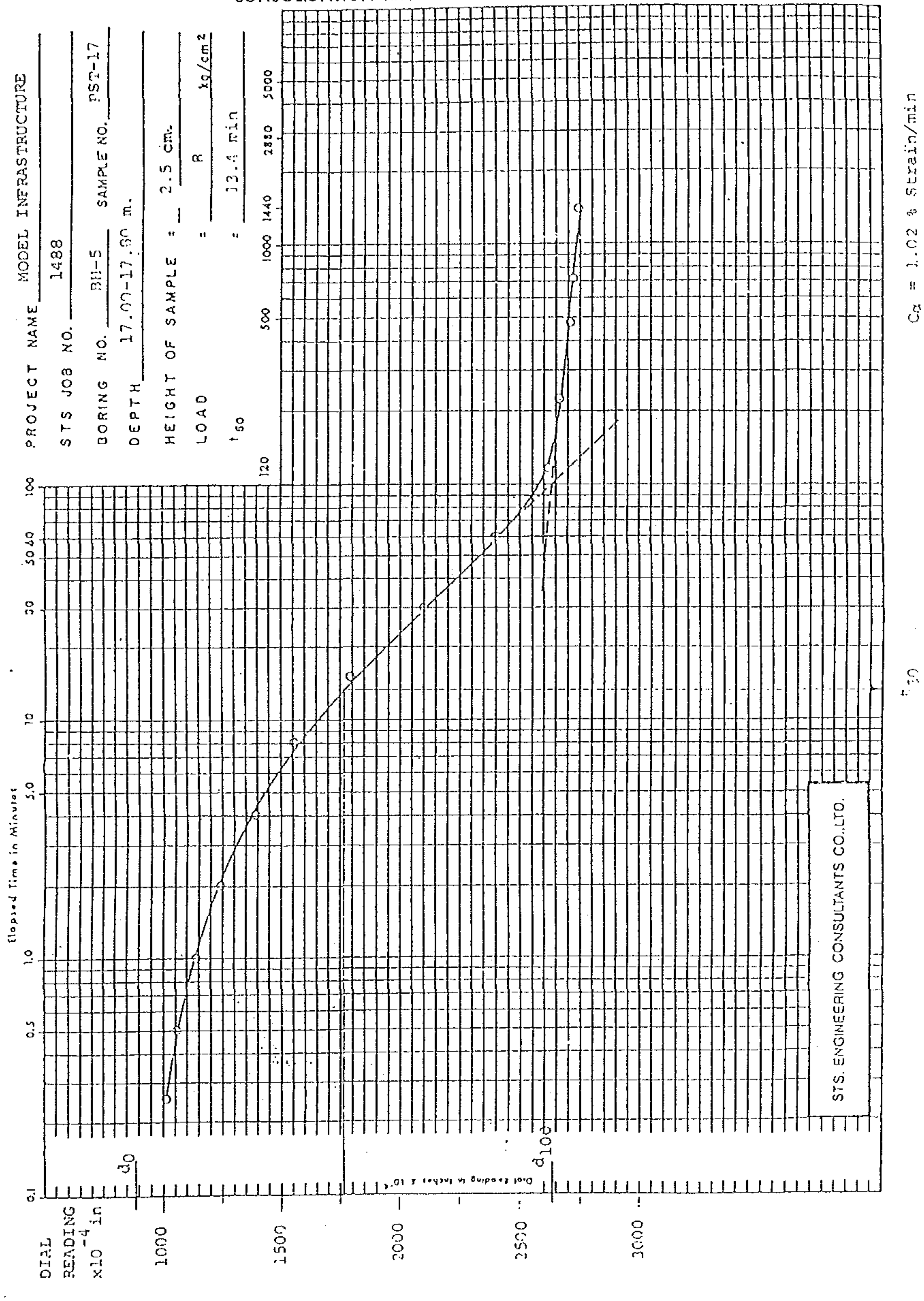


Cα = 0.73 % Strain/min.

CONSOLIDATION TEST - LOG FITTING METHOD



CONSOLIDATION TEST - LOG FITTING METHOD



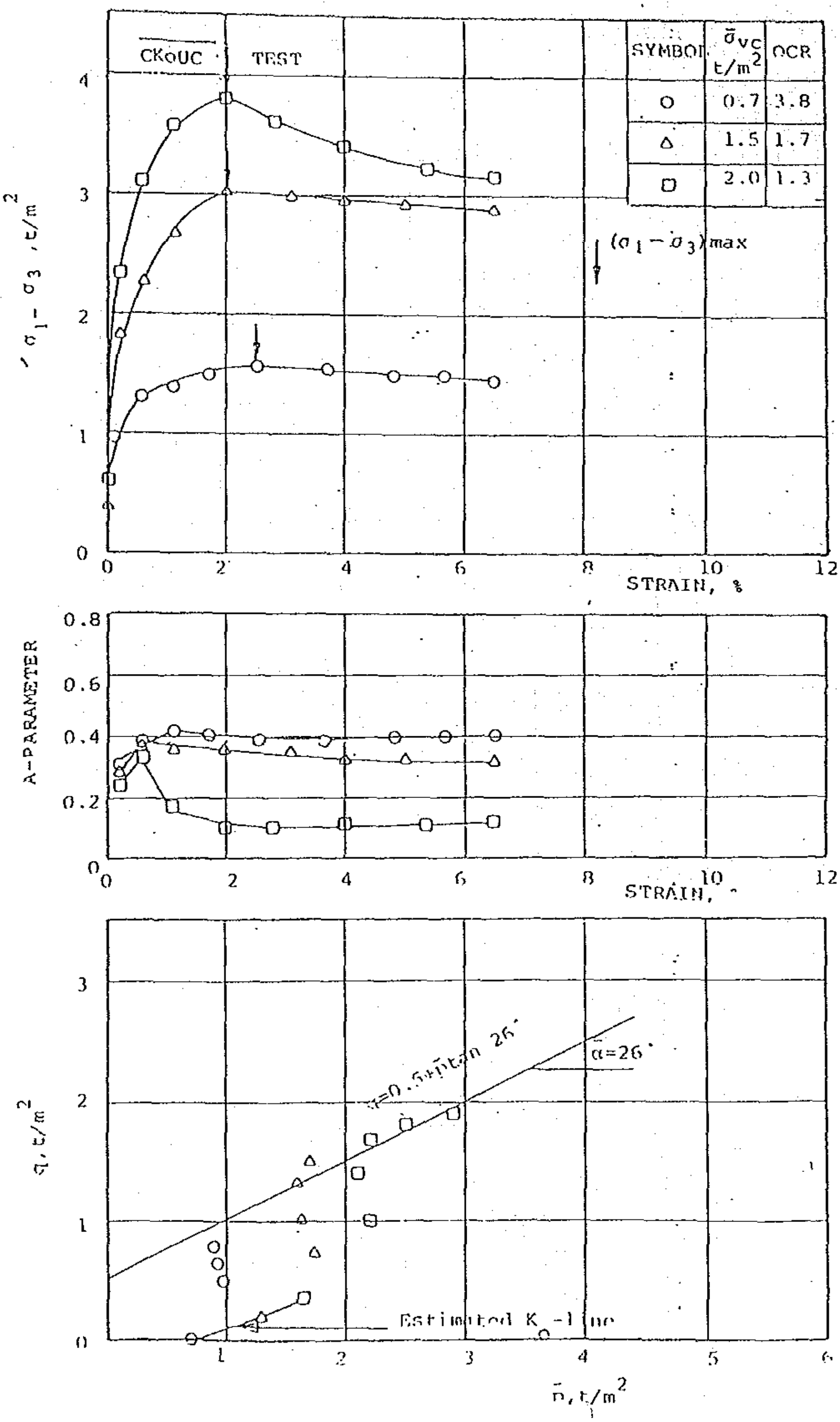
D

ANISOTROPICALLY CONSOLIDATED UNCRAINED TRIAXIAL COMPRESSION TEST RESULTS

MODEL INFRASTRUCTURE PROJECT

BORING No. B-1 SAMPLE No. PST-1

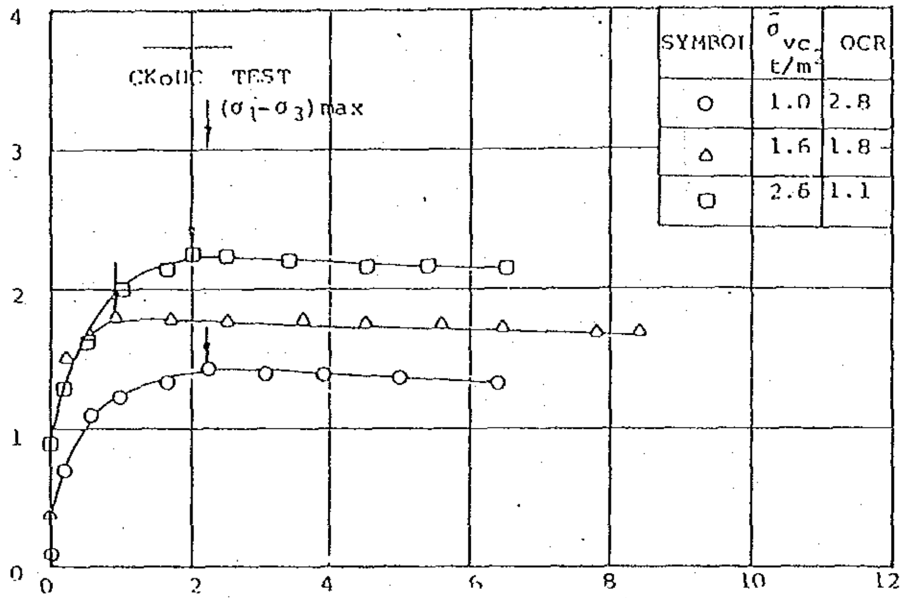
DEPTH 1.00-1.80 m.

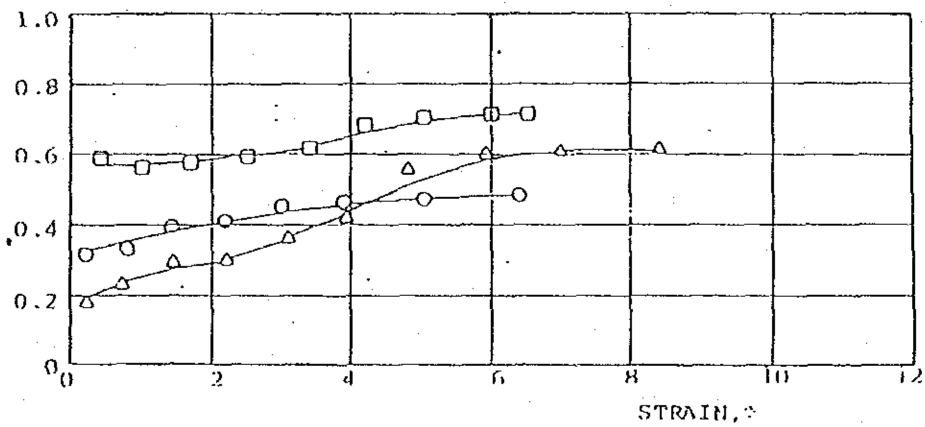


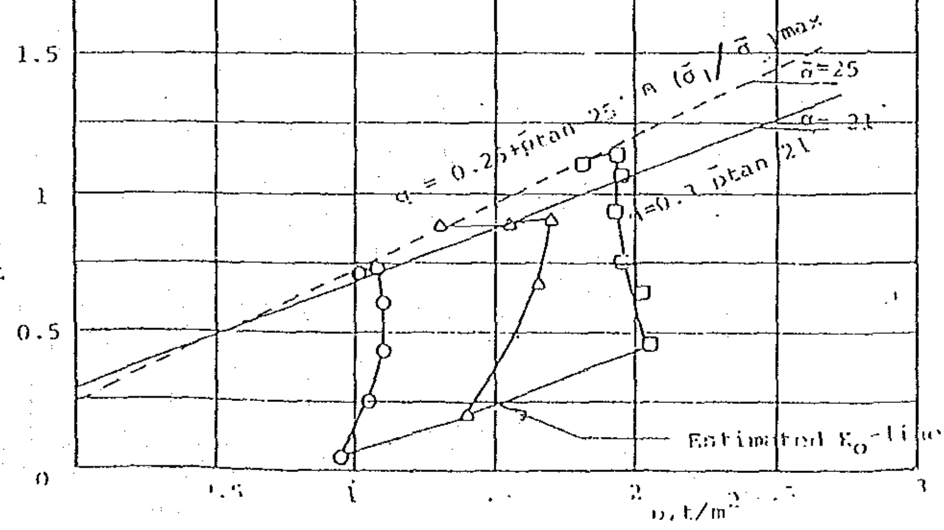
MODEL INFRASTRUCTURE PROJECT

BORING No. B-1 SAMPLE No. PST-2

DEPTH 3.00-3.80 m



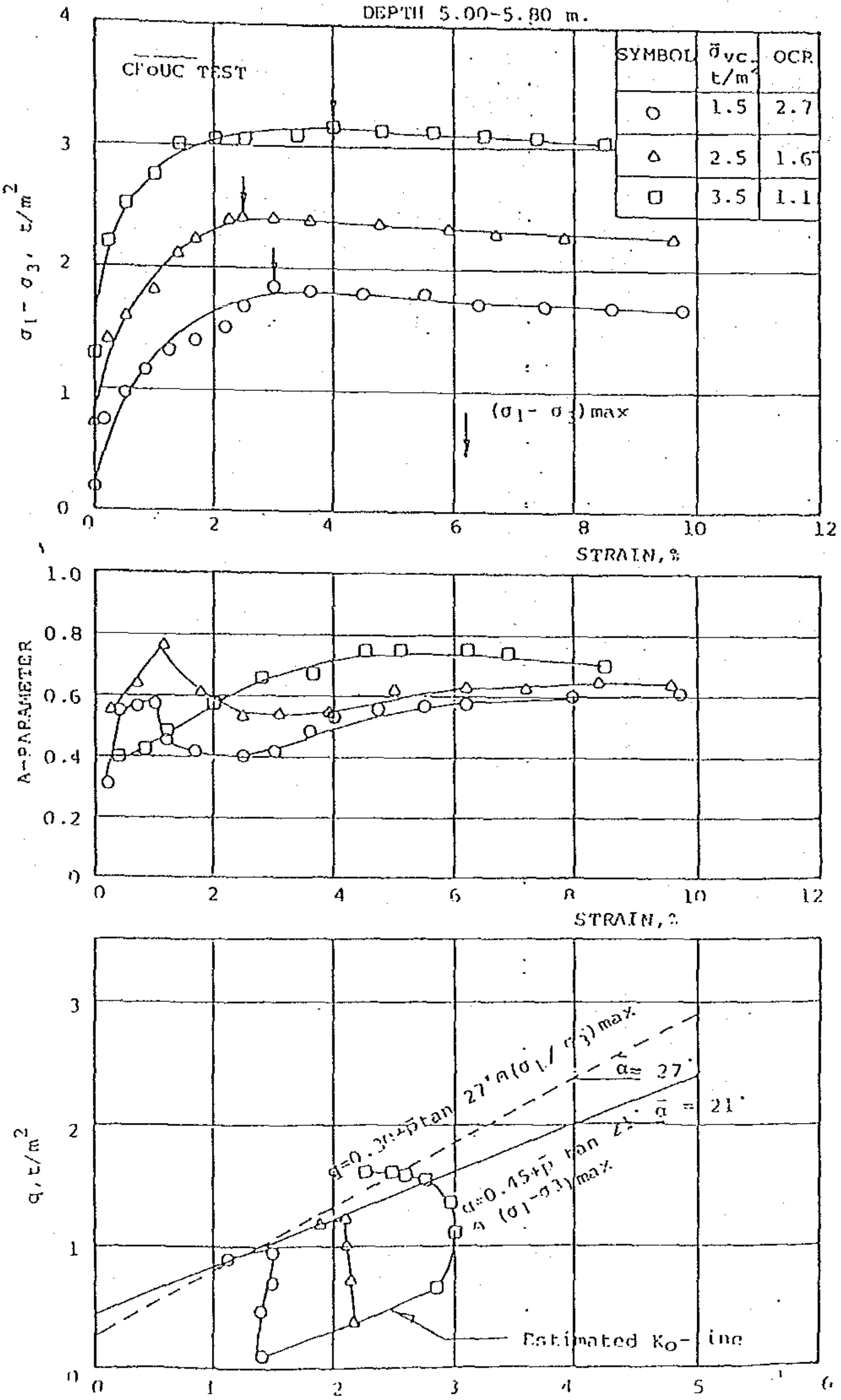




MODEL INFRASTRUCTURE PROJECT

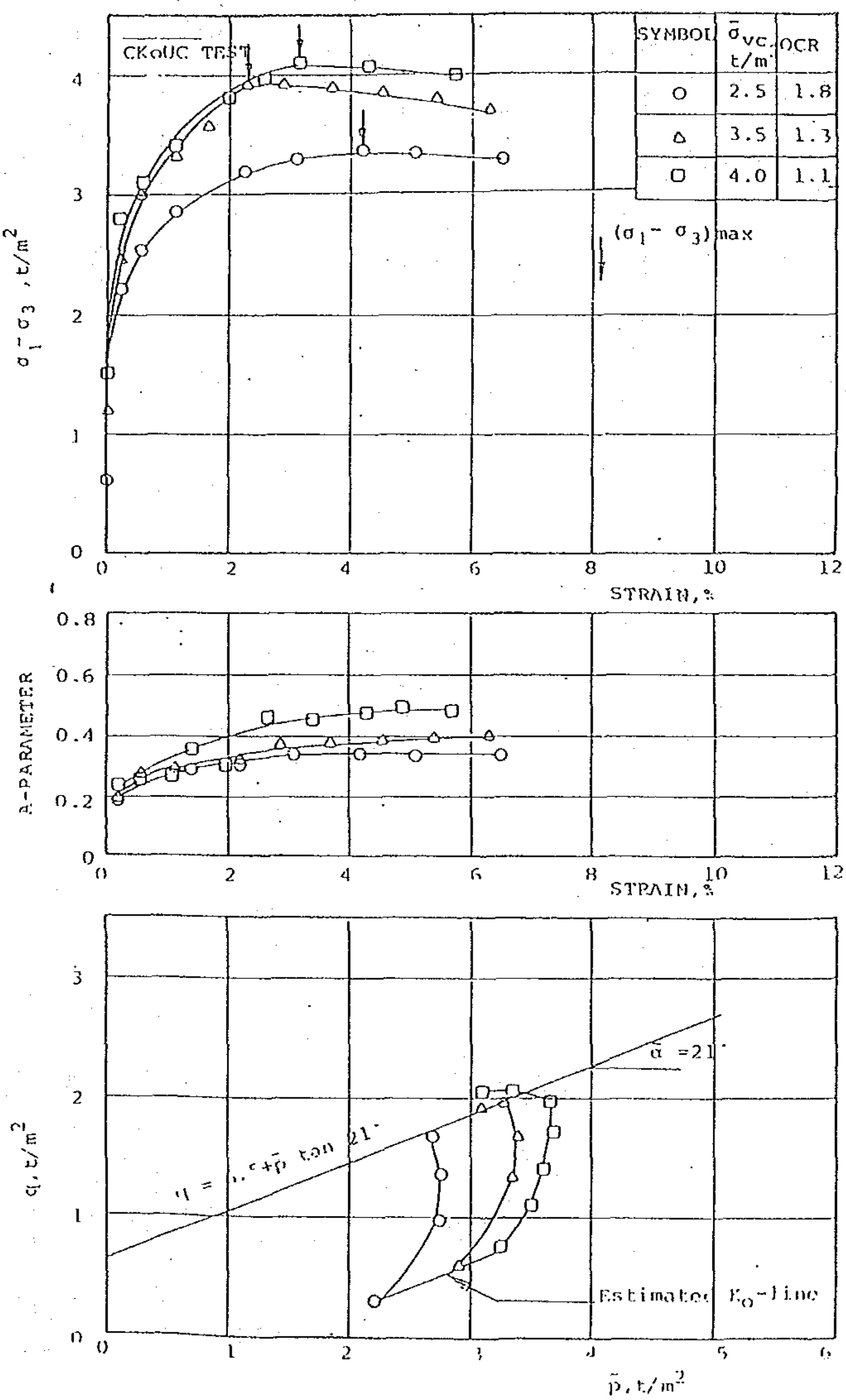
BORING No. B-1 SAMPLE No. PST-3

DEPTH 5.00-5.80 m.



BORING No. B-1 SAMPLE No. PST-4

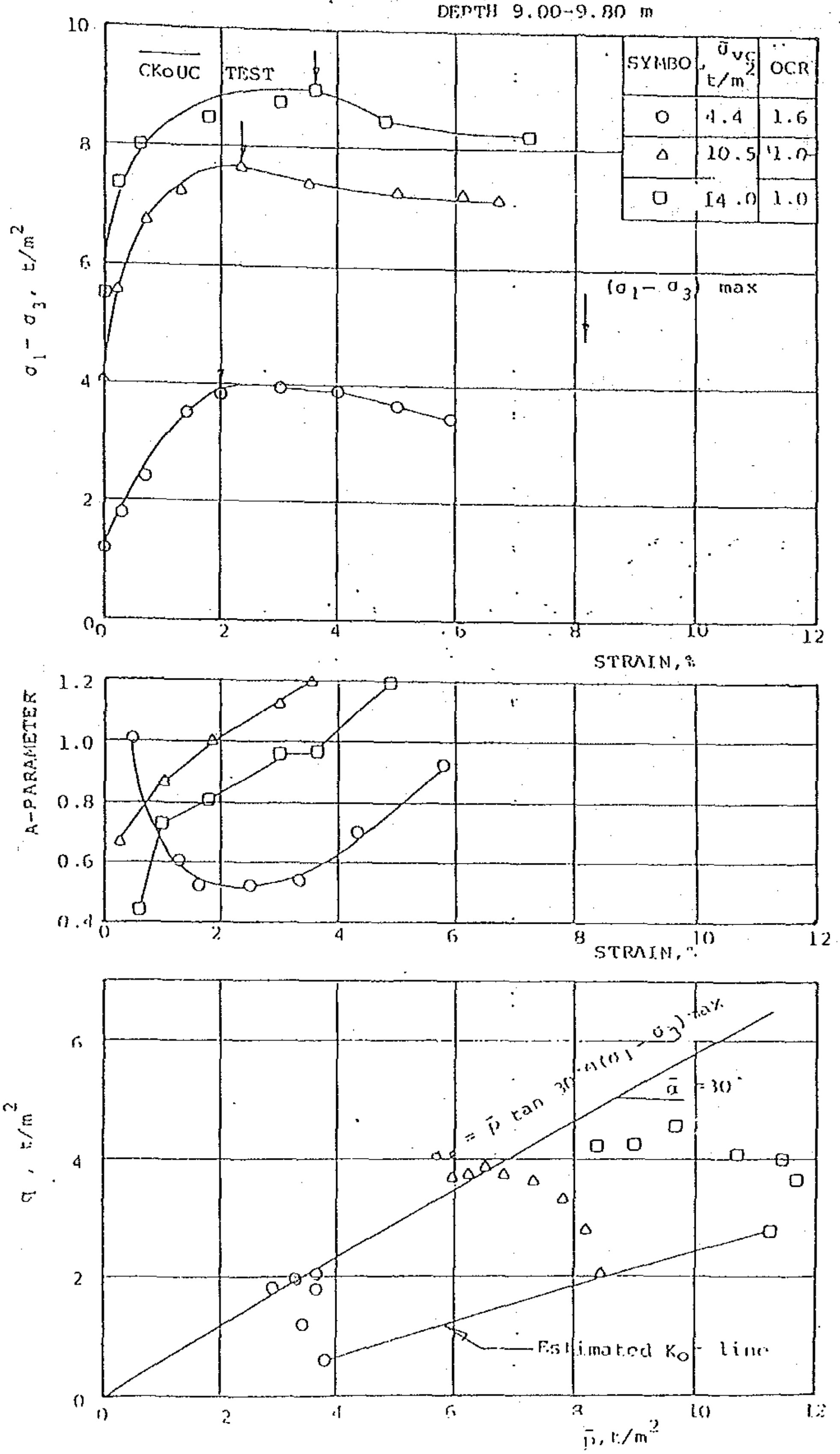
DEPTH 7.0-7.8 m



MODEL INFRASTRUCTURE PROJECT

BORING No. B-1 SAMPLE No. PST-5

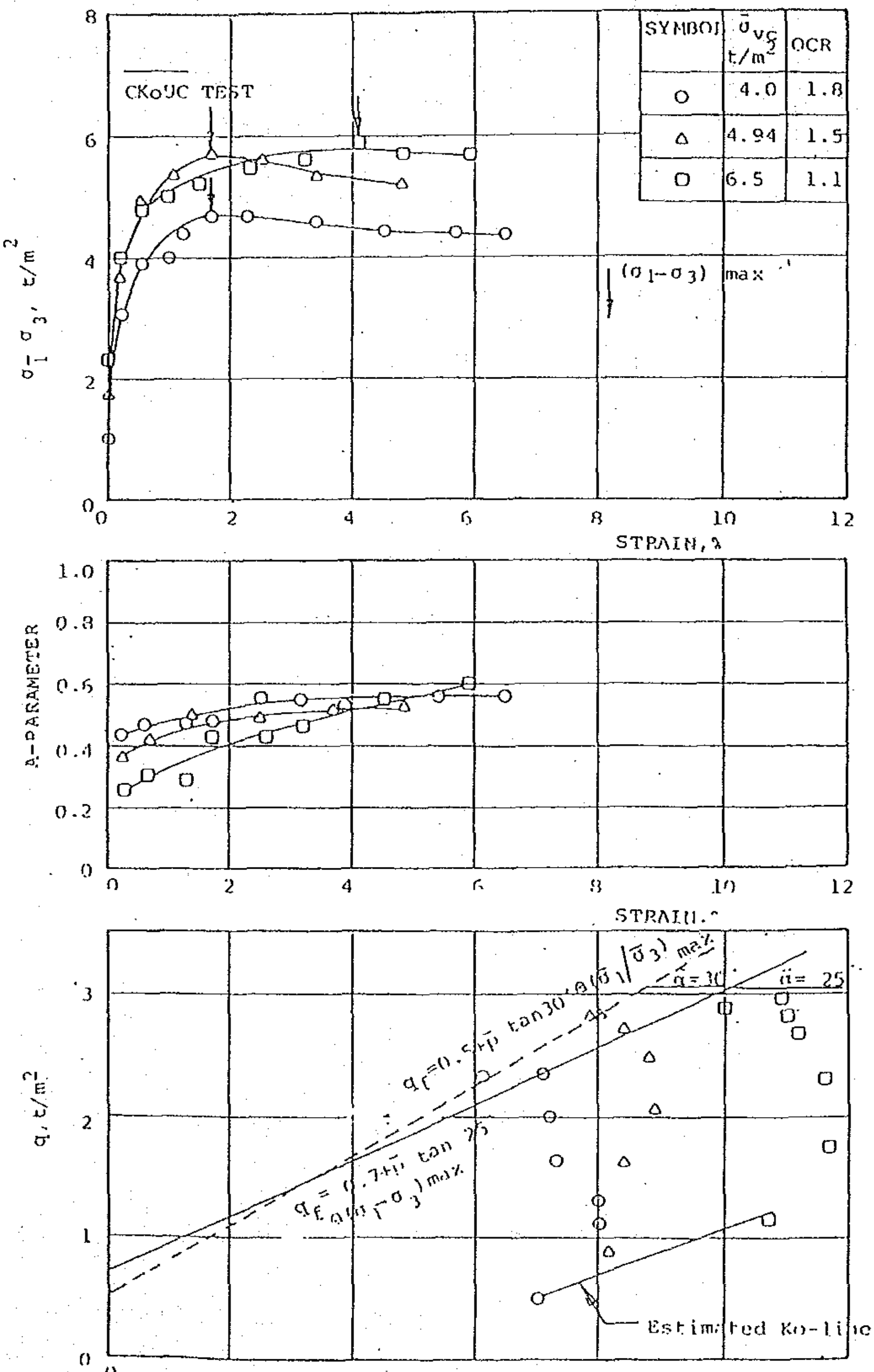
DEPTH 9.00-9.80 m



MODEL INFRASTRUCTURE PROJECT

BORING No. B-1 SAMPLE No. PST-6

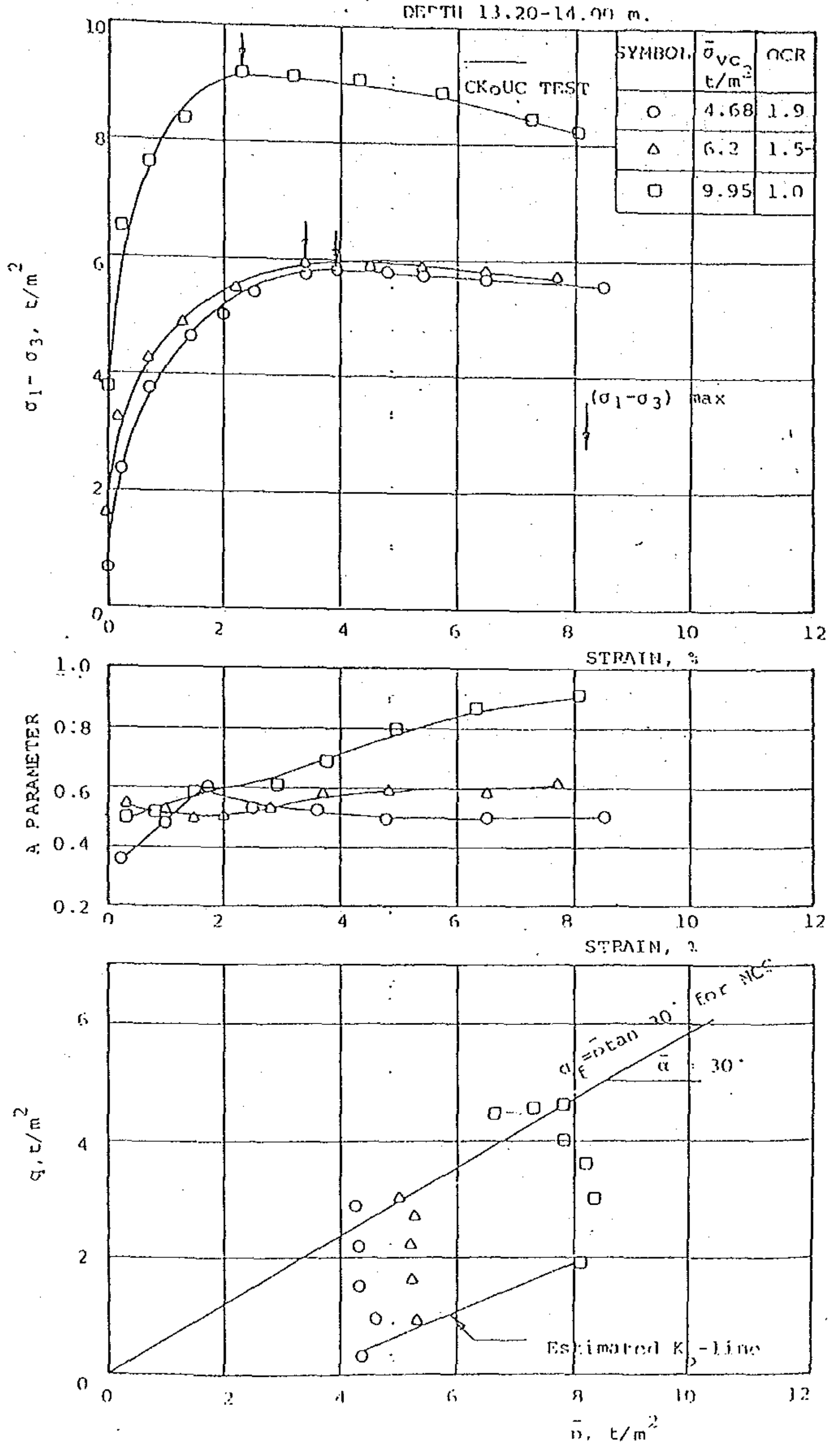
DEPTH 11.00-11.80 m.



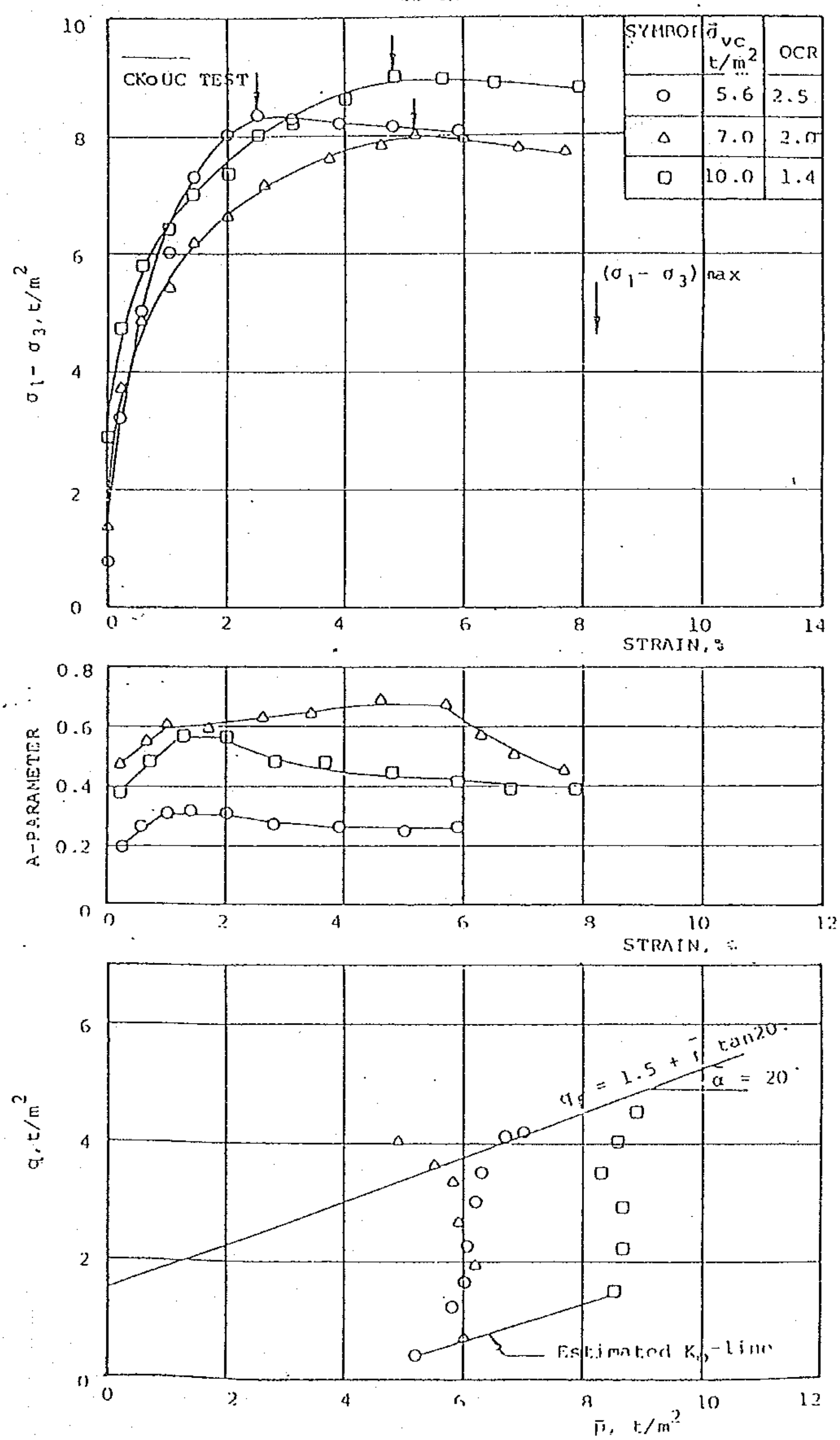
MODEL INFRASTRUCTURE PROJECT

BORING No. B-1 SAMPLE No. PST-7

DEPTH 13.20-14.00 m.



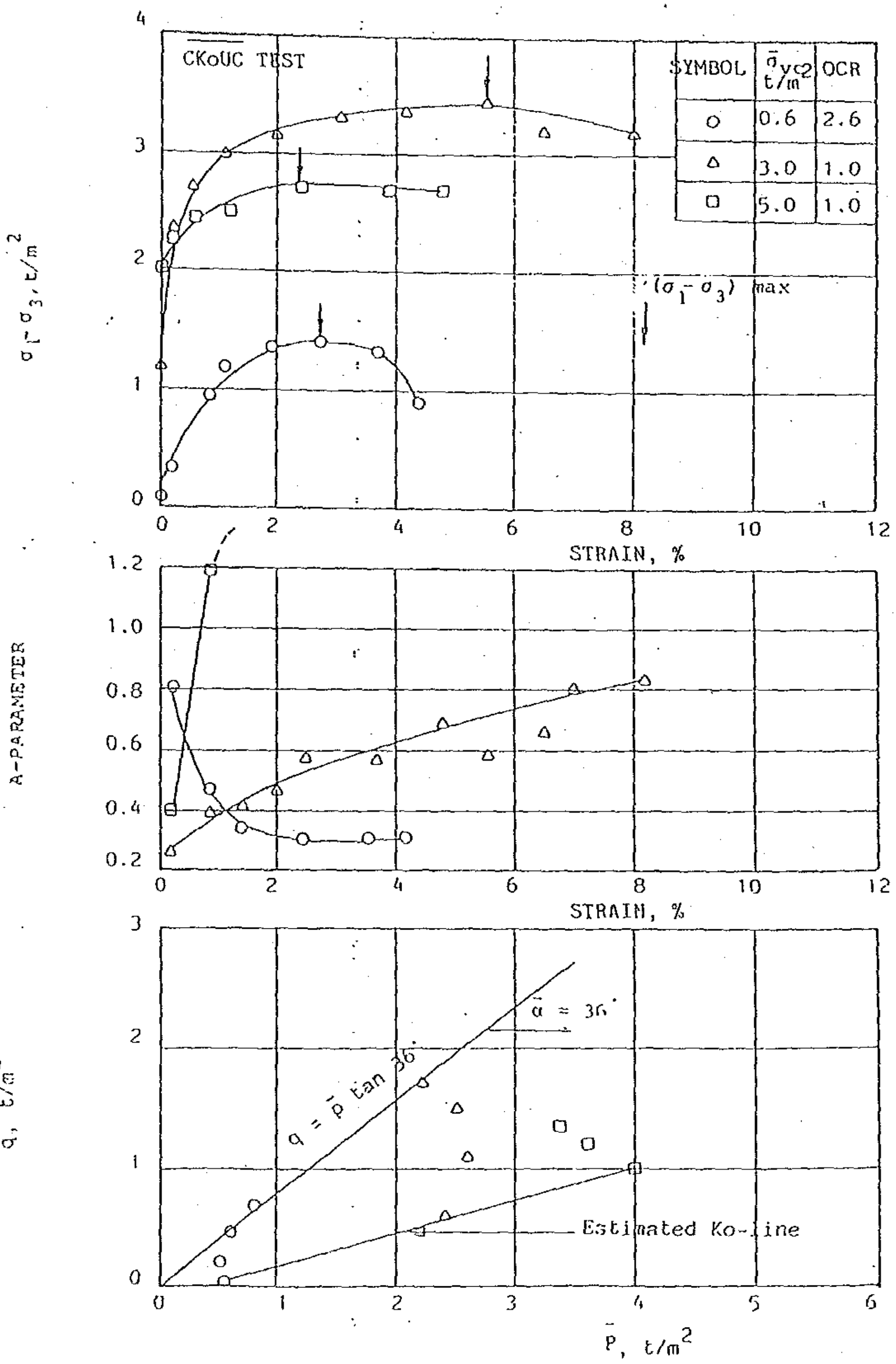
BORING No. B-1 SAMPLE No. PST-8
DEPTH 15.00-15.80 m.



MODEL INFRASTRUCTURE PROJECT

BORING NO.B-3 SAMPLE NO.PST-1

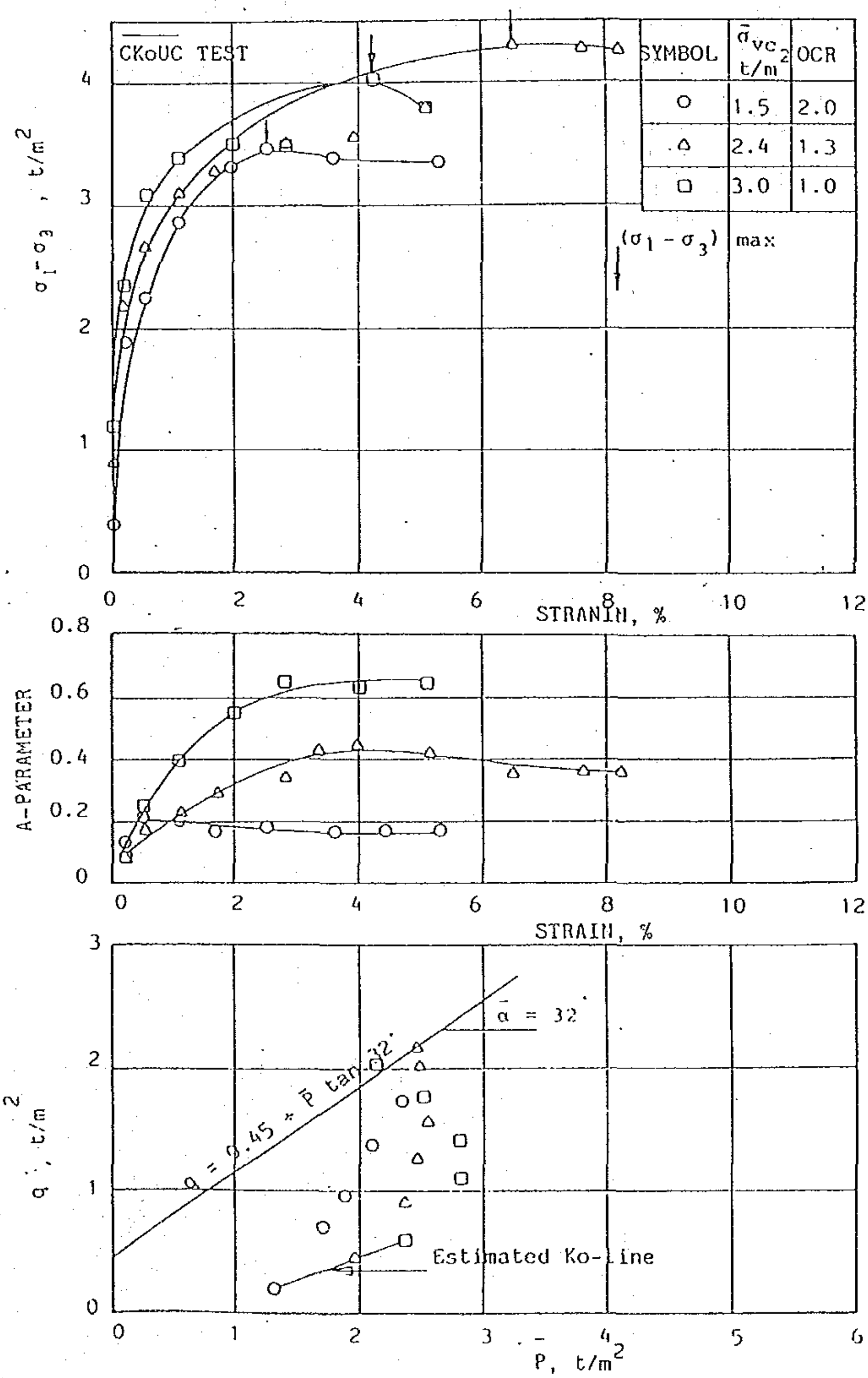
DEPTH 1.00-1.80 m.



MODEL INFRASTRUCTURE PROJECT

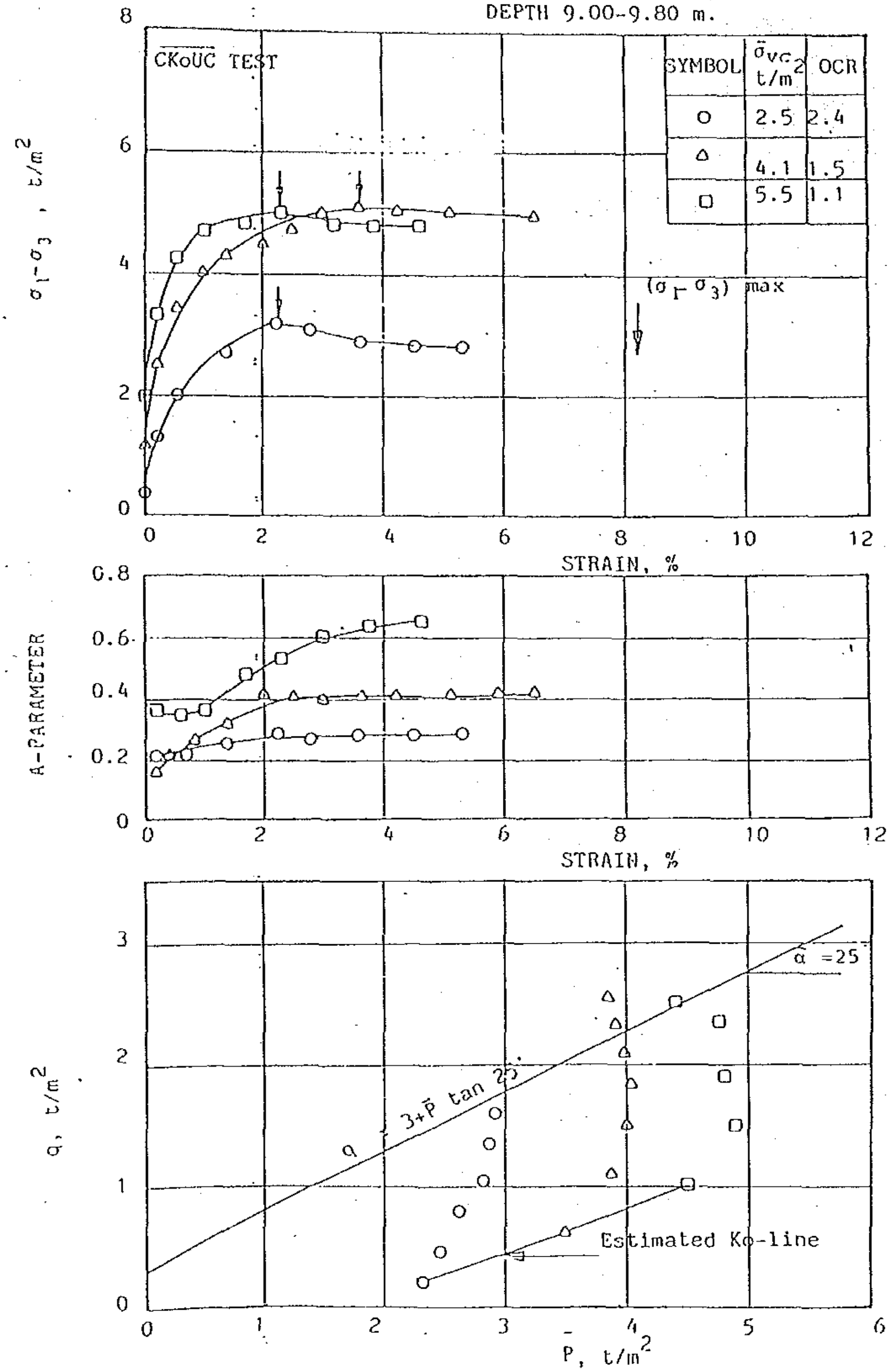
BORING NO.B-3 SAMPLE NO.PST-5

DEPTH 5.00-5.80 m.



MODEL INFRASTRUCTURE PROJECT

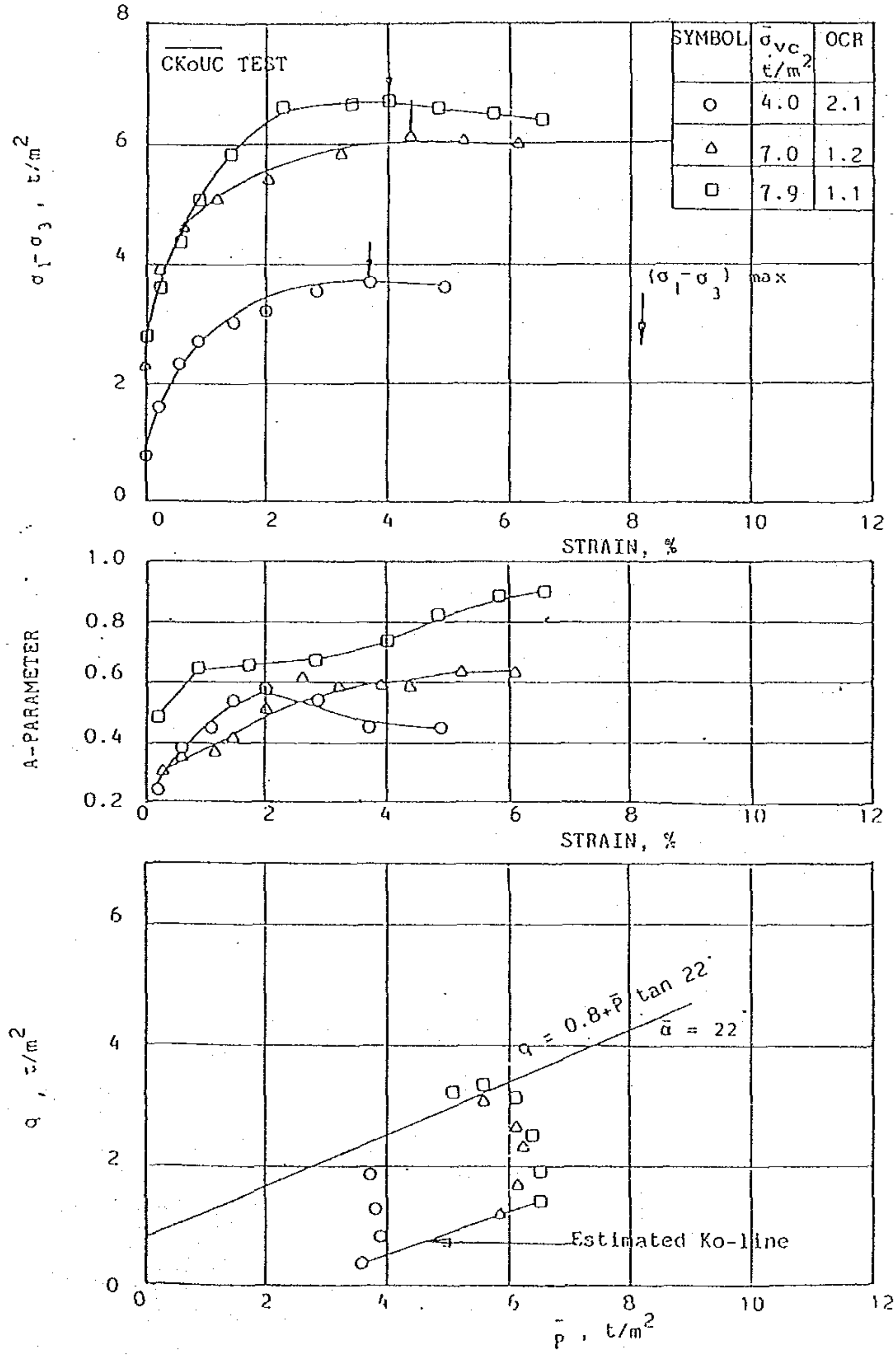
BORING NO.B-3 SAMPLE NO.PST-9



MODEL INFRASTRUCTURE PROJECT

BORING NO.B-3 SAMPLE NO.PST-13

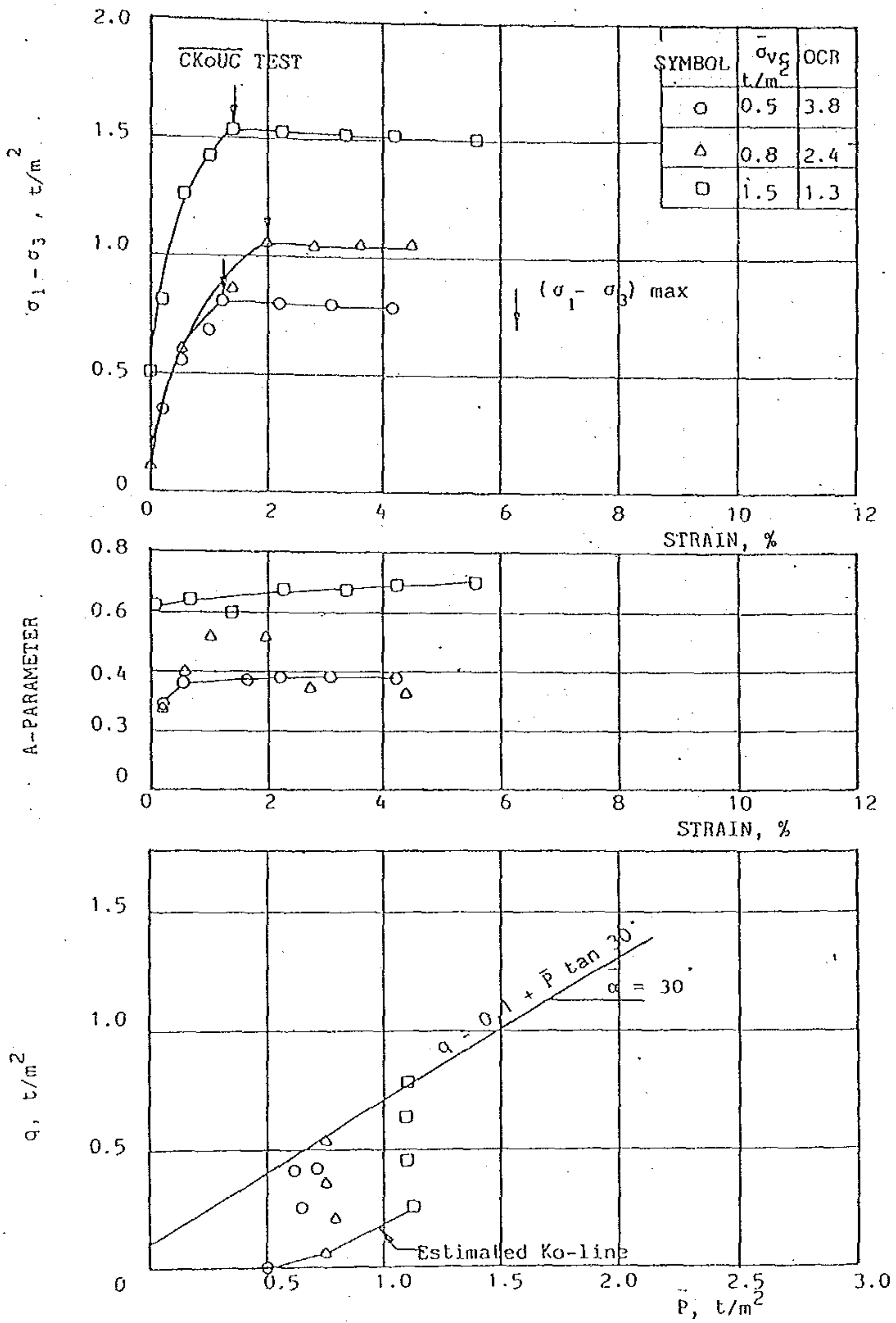
DEPTH 13.00-13.80 m.



MODEL INFRASTRUCTURE PROJECT

BORING NO. B-5 SAMPLE NO.PST-1

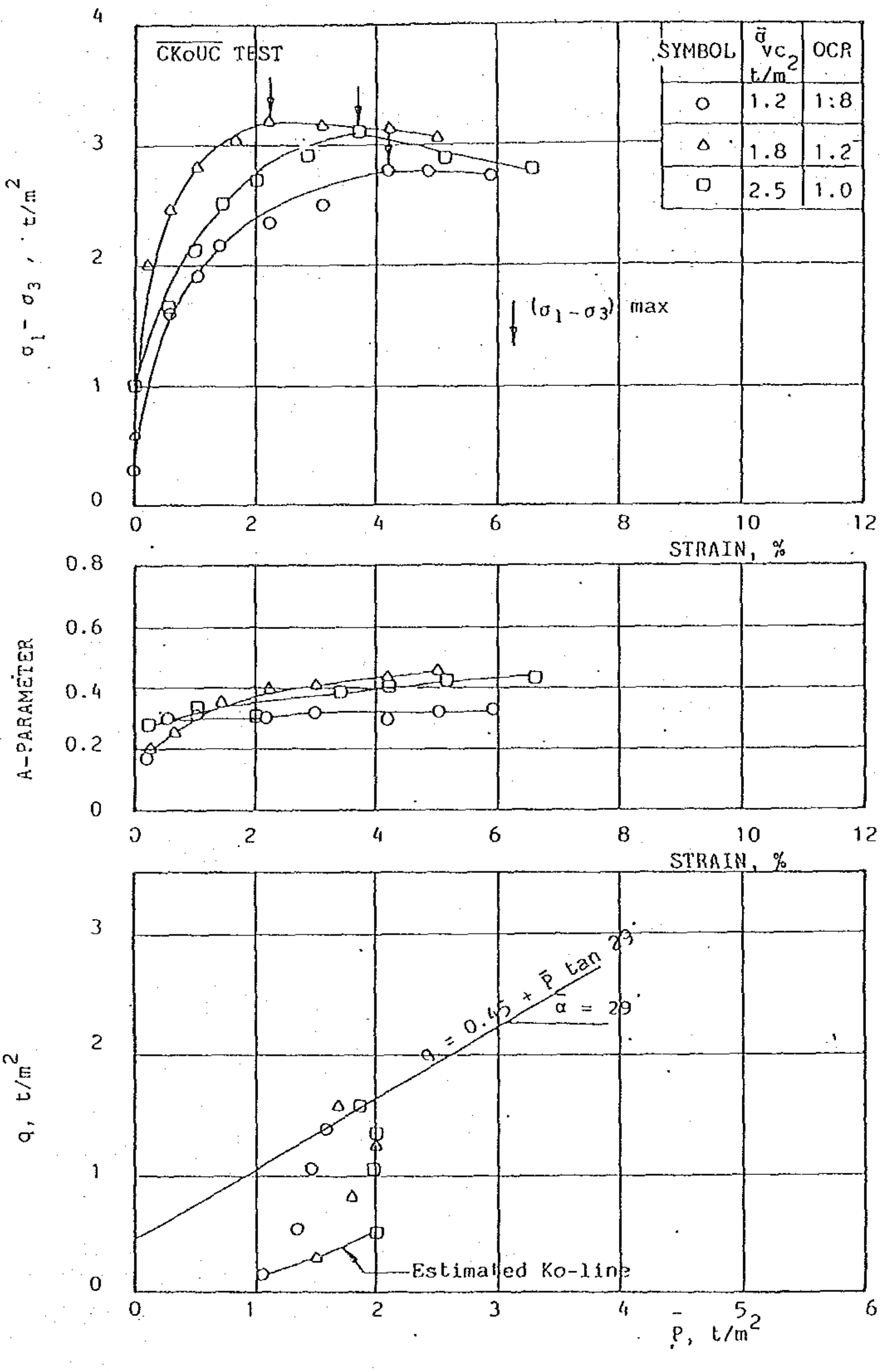
DEPTH 1.00-1.40 m.



MODEL INFRASTRUCTURE PROJECT

BORING NO. B-5 SAMPLE NO. PST-3

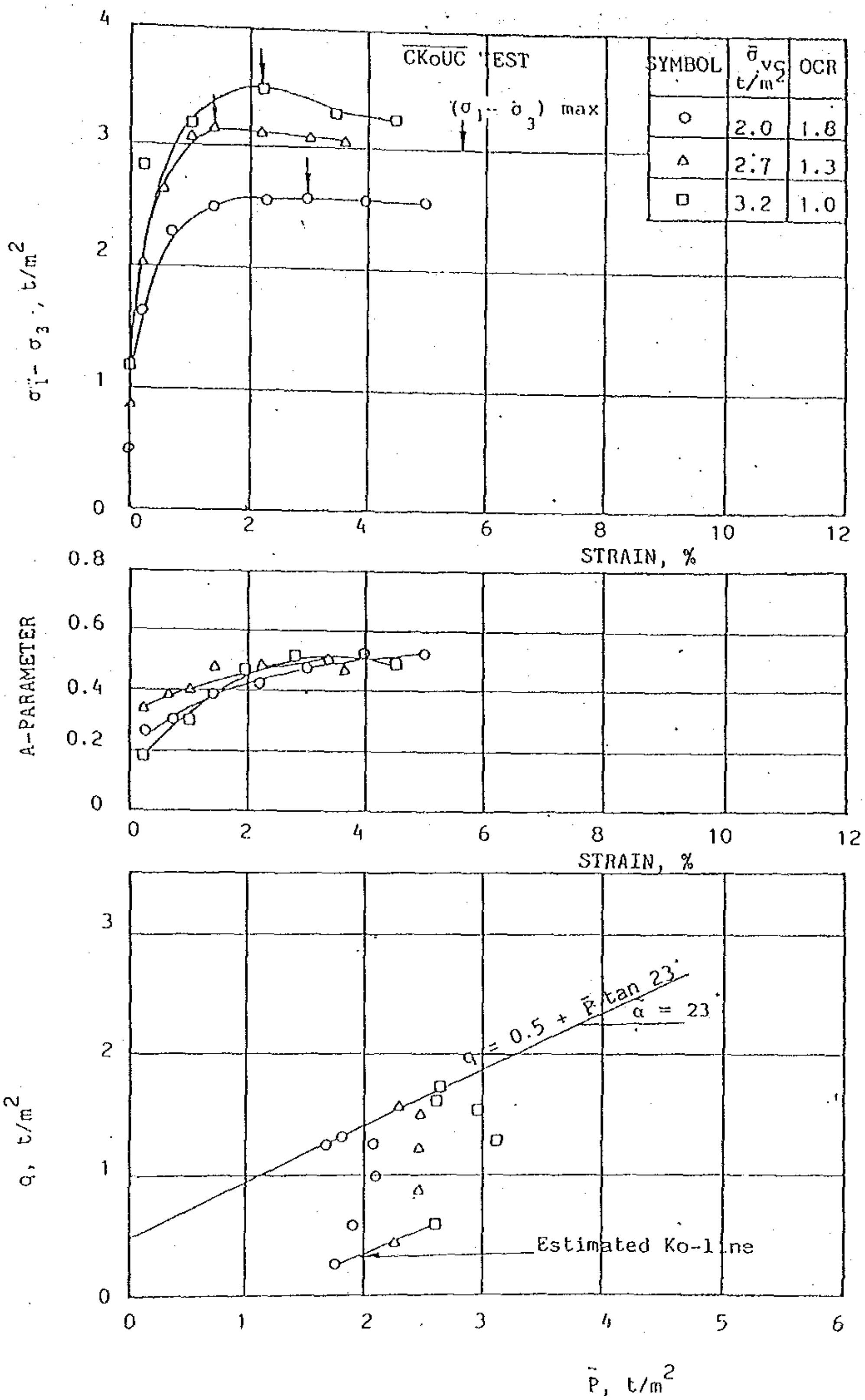
DEPTH 3.00-3.80 m.



MODEL INFRASTRUCTURE PROJECT

BORING NO. B-5 SAMPLE NO. PST-5

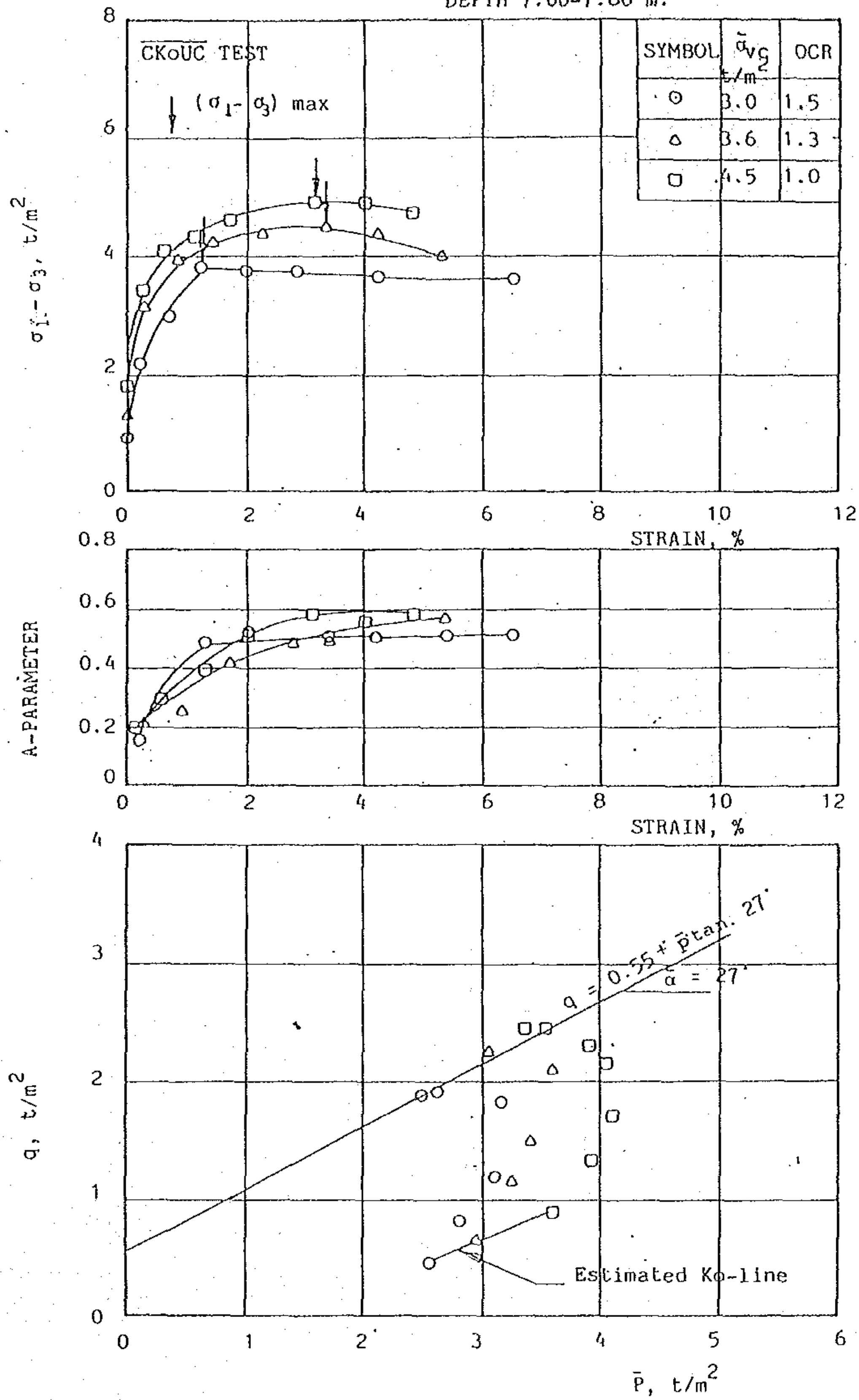
DEPTH 5.00-5.80 m.



MODEL INFRASTRUCTURE PROJECT

BORING NO. B-5 SAMPLE NO. PST-7

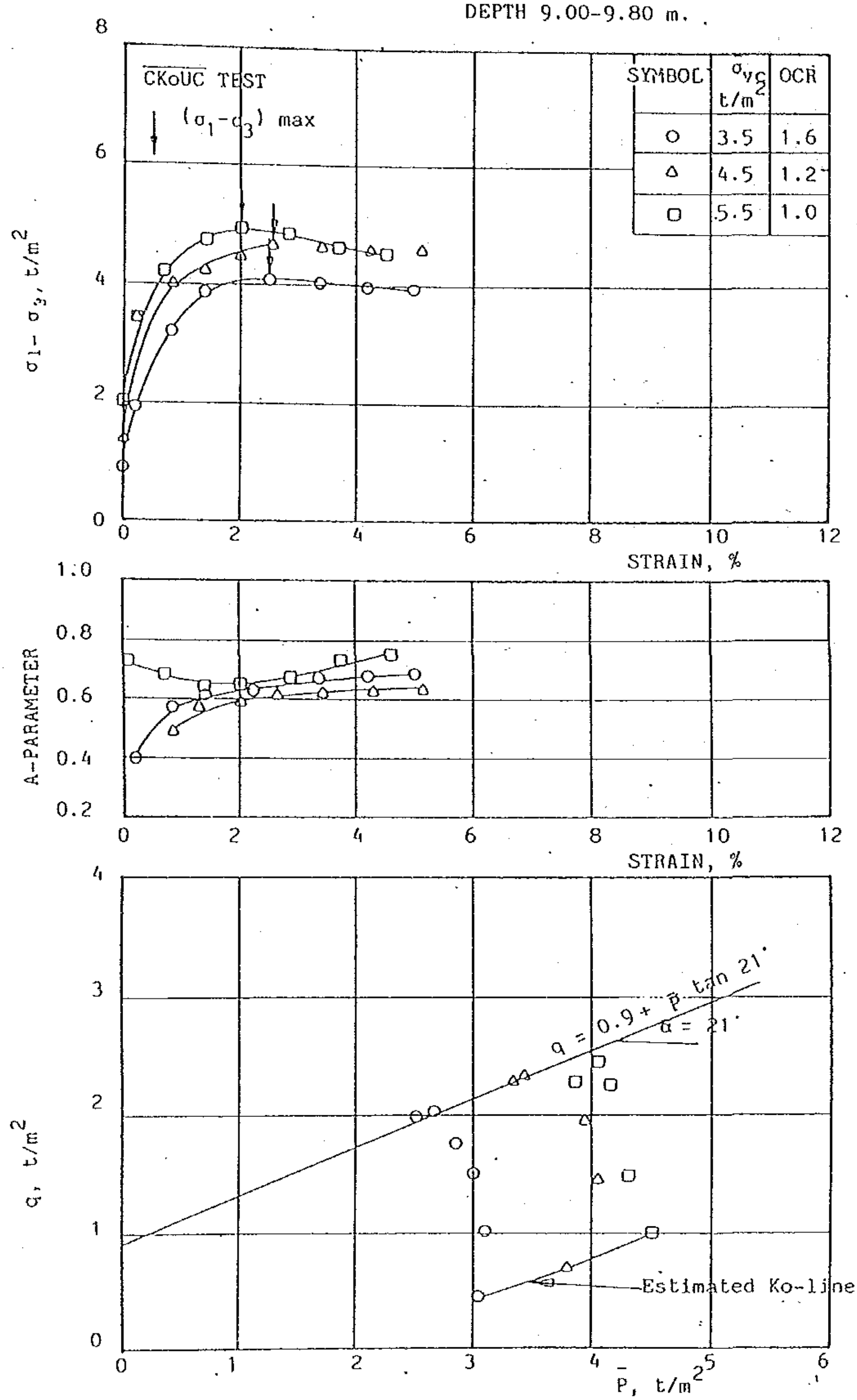
DEPTH 7.00-7.80 m.



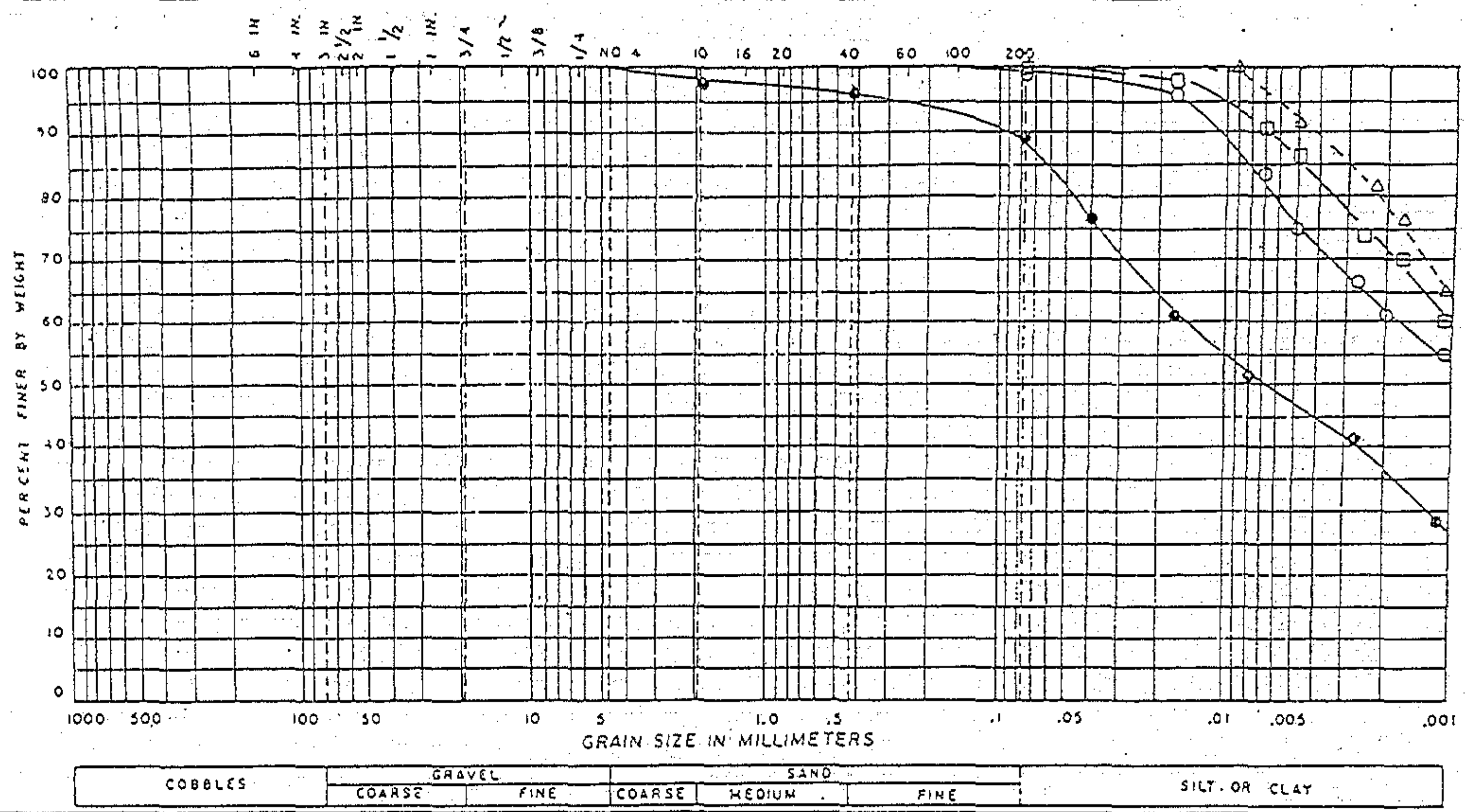
MODEL INFRASTRUCTURE PROJECT

BORING NO. B-5 SAMPLE NO. PST-9

DEPTH 9.00-9.80 m.



GRADATION CURVES RESULTS



SAMPLE	NO.	ELEV. or DEPTH	CLASSIFICATION	NAT WC	LL	PL	PI	REMARKS
B-1								
PST-1	○	1.00-1.50 m.	CH	83.2	95	35	60	
PST-3	□	5.00-5.80 m.	CH	34.9	90.8	35.8	55.0	
PST-5	△	9.00-9.30 m.	CH	64.7	106	40	66	
PST-7	●	13.30-14.10 m.	CH	[illegible]4.7	119	42	77	

GRADATION CURVES

PROJECT: Model Infrastructure

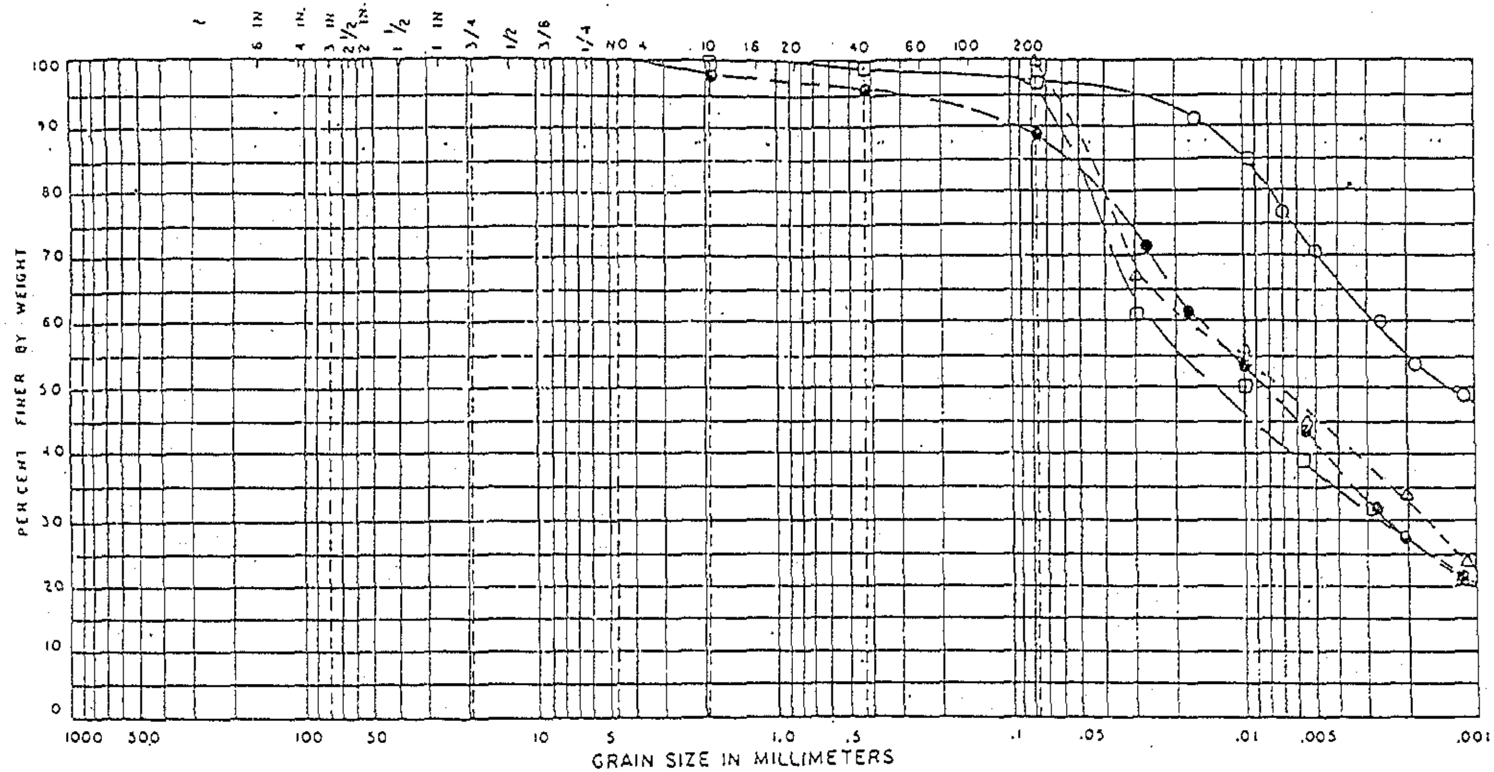
MATERIAL:

SOURCE: Chareonraj Pumping Station, Samut Prakan Province

DATE: 3/2/88

SHEET 1 OF 4

STS ENGINEERING CONSULTANTS CO., LTD.



SAMPLE	NO.	ELEV. or DEPTH	CLASSIFICATION	NAT WC	LL	PL	PI	REMARKS
B-2								
PST-1	○	1.00-1.80 m	CH	37.5	86.2	32.6	53.6	
PST-5	□	5.00-5.80 m.	CH	92.6	86.6	34.9	51.7	
PST-9	△	9.10-9.90 m.	CH	97.2	107	37	70	
PST-14	●	14.00-14.80 m.	CH	88.9	112	42	70	

PROJECT Model Infrastructure

MATERIAL:

SOURCE : Chareonraj Pumping Station

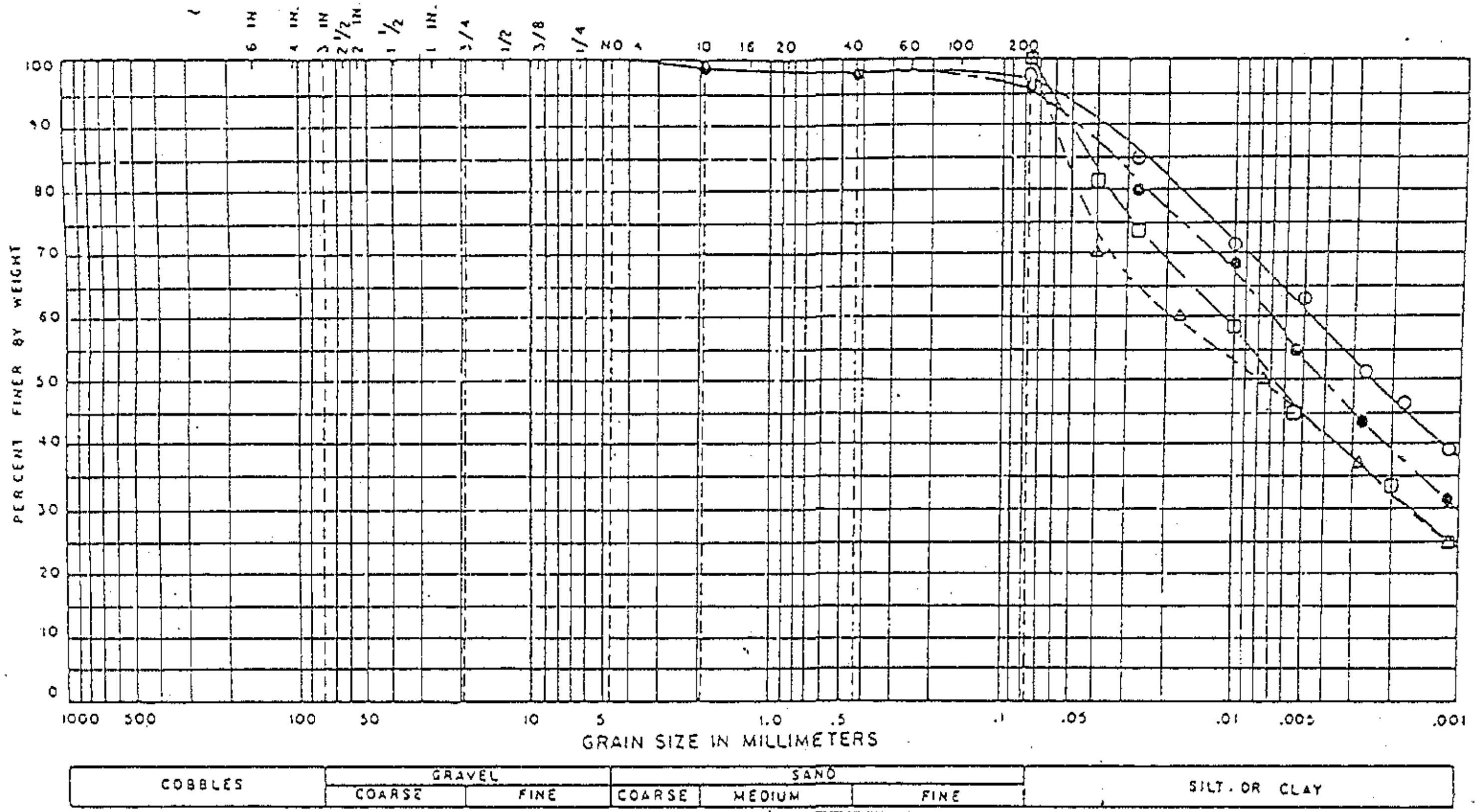
Saumt Prakan Province

DATE 17/3/88

GRADATION CURVES

SHEET 2 OF 4

STS ENGINEERING CONSULTANTS CO., LTD.



SAMPLE	NO.	ELEV. or DEPTH	CLASSIFICATION	NAT.WC	LL	PL	PI	REMARKS
BH-3								
PST-1	○	1.00-1.80m.	CH	94.2	92.5	34.4	58.1	
PST-5	□	5.00-5.80m.	CH	90.3	86.2	35.5	50.7	
PST-9	△	9.00-9.80m.	CH	98.4	110	38	72	
PST-13	●	13.00-13.80m.	CH	92.3	120	42	78	

GRADATION CURVES

PROJECT Model Infrastructure

MATERIAL:

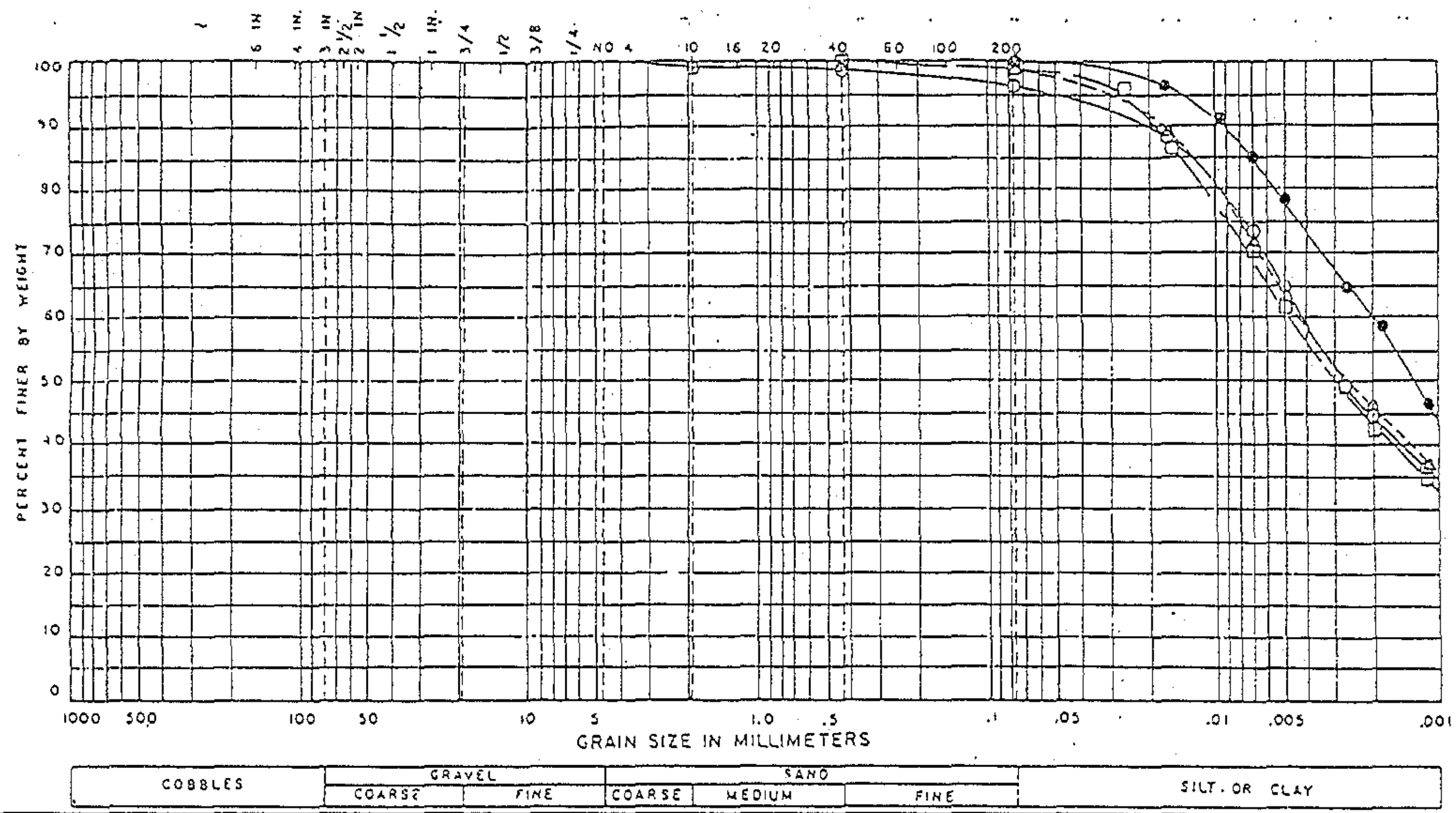
SOURCE :Chareonraj Pumping Station

Saumt Prakan Province

DATE 17/3/88

SHEET 3 OF 4

STS ENGINEERING CONSULTANTS CO., LTD.



SAMPLE	NO.	ELEV. or DEPTH	CLASSIFICATION	NAT WC	LL	PL	PI	REMARKS
B-4								
PST-1	○	1.00-1.80m.	CH	66.4	92.0	36.3	55.7	
PST-2	□	2.96-3.76m.	CH	79.4	87.0	33.2	53.9	
PST-3	△	5.00-5.80m.	CH	73.8	95.4	33.9	61.5	
PST-4	●	[illegible].99-7.79m.	CH	85.3	89.3	31.5	57.3	

GRADATION CURVES

PROJECT Model Infrastructure

MATERIAL:

SOURCE : Chareonraj Pumping Station

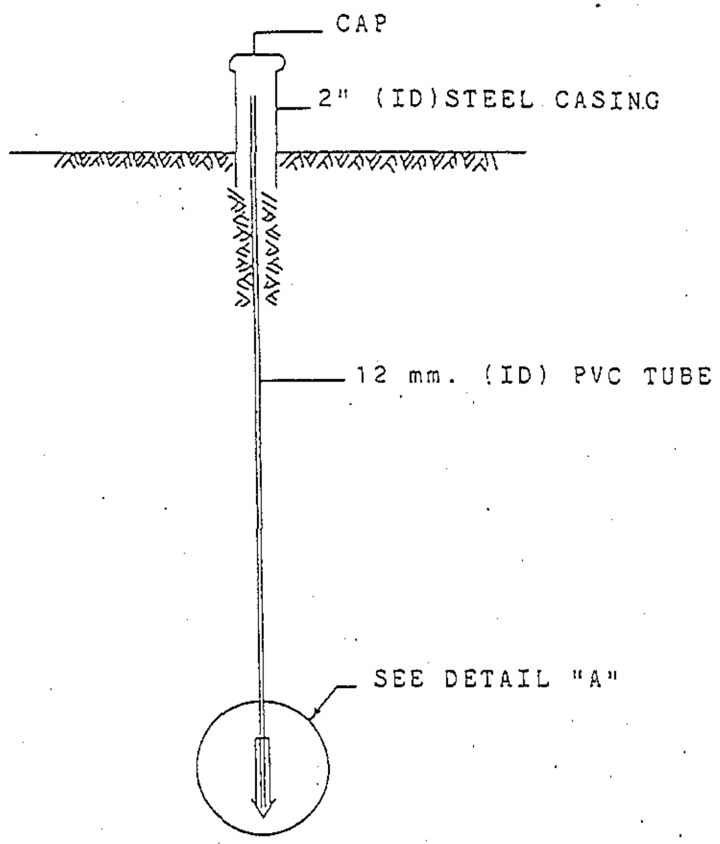
Saumt Prakan Province

DATE 18/3/88

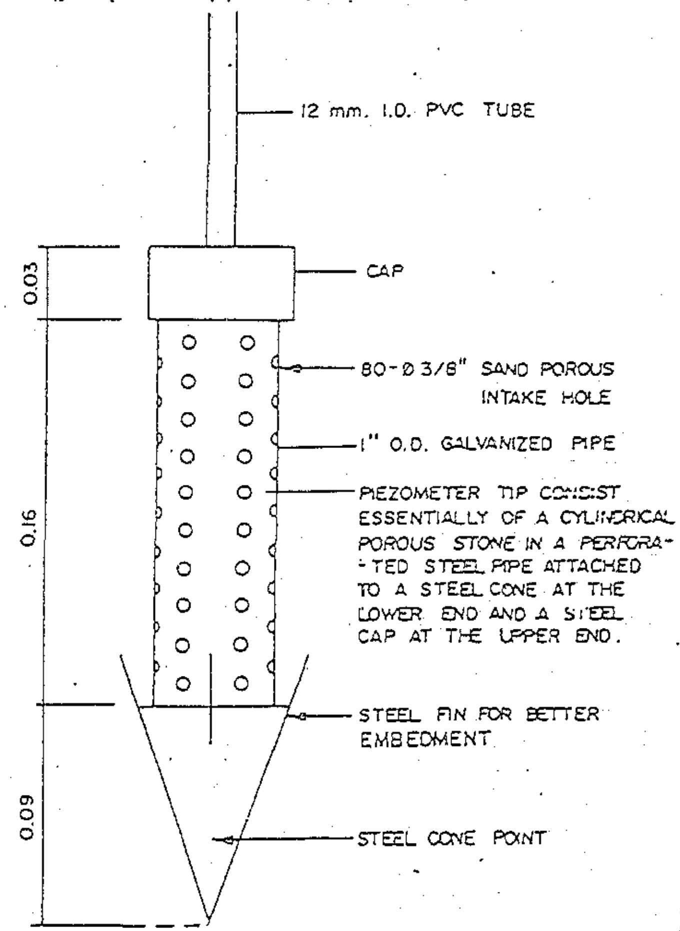
SHEET 3 OF 4

STS ENGINEERING CONSULTANTS CO., LTD.

TYPICAL OF PIEZOMETER INSTALLATION & RECORDS

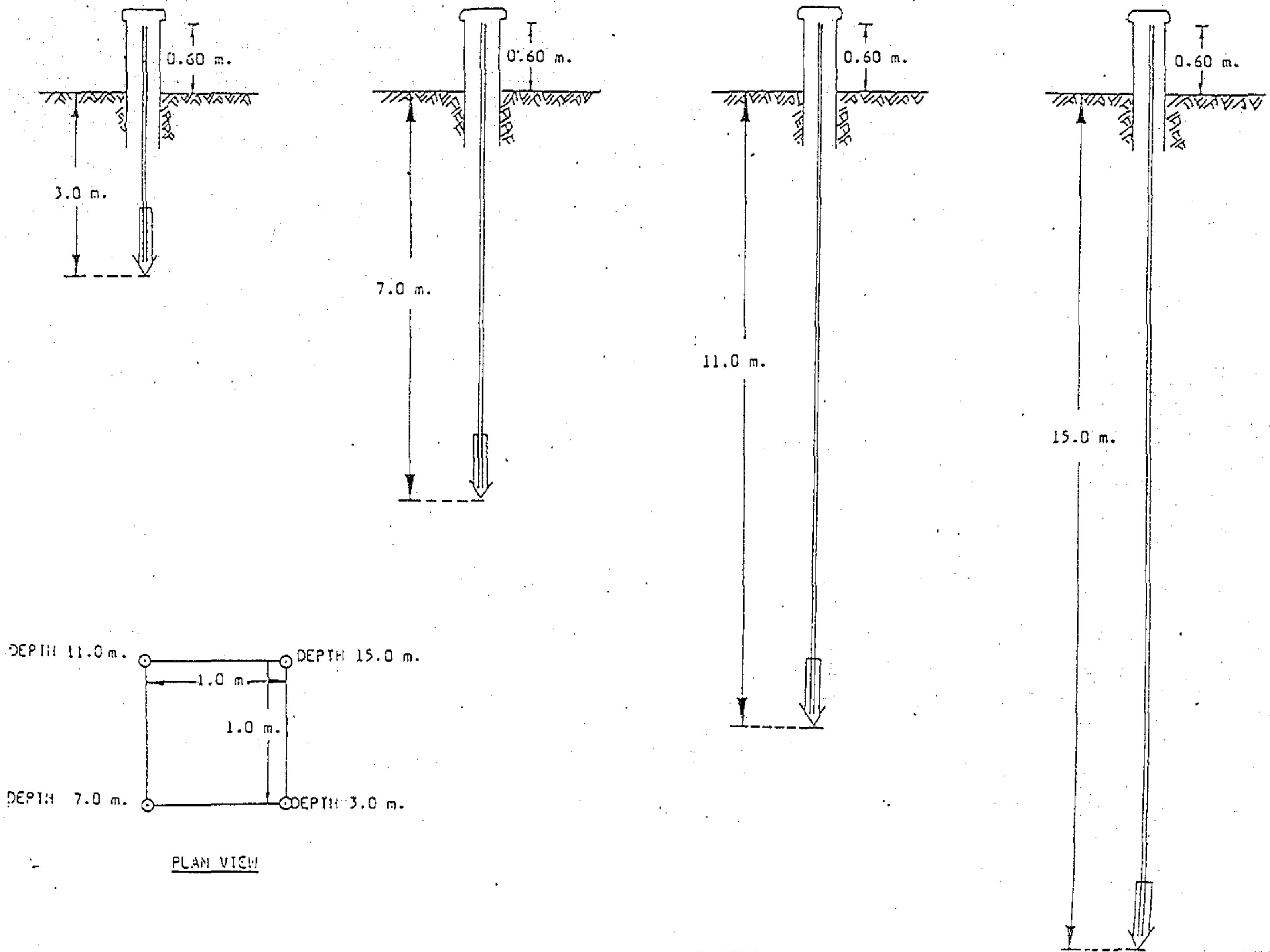


SECTION PIEZOMETER



DETAIL "A"

INSTALLATION DETAIL OF PIEZOMETER (P-1 , P-2)



PLAN VIEW

PIEZOMETRIC LEVEL RECORD
(m)

STATION CHAREONRAJ PUMPING   DATE OF INSTALLATION 5/2/88

PROJECT: MODEL INFRASTRUCTURE

Date	$P_{1/1}$ (TIP -3.0 M)	$P_{1/2}$ (TIP -7.0 M.)	$P_{1/3}$ (TIP -11.0 M.)	$P_{1/4}$ (TIP -15.0 M.)		Remark
/2/88	0.35	0.095	0.18	0.80		Piezometer
5/2/88	0.52	0.39	0.472	2.58		level is
7/2/88	0.57	0.43	0.50	2.62		below the
/3/88	0.51	0.40	0.49	2.64		top of PVC
/3/88	0.52	0.35	0.51	2.70		tube
)/3/88	0.51	0.34	0.51	2.71		
1/3/88	0.525	0.32	0.51	2.72		
2/3/88	0.525	0.315	0.515	2.73		

PIEZOMETRIC LEVEL RECORD
(m)

STATION CHAREONRAJ PUMPING   DATE OF INSTALLATION 5/2/88

PROJECT: MODEL INFRASTRUCTURE

Date	$P_{2/1}$ (TIP -3.0 M)	$P_{2/2}$ (TIP -7.0 M.)	$P_{2/3}$ (TIP -11.0 M.)	$P_{2/4}$ (TIP -15.0 M.)		Remark
5/2/88	0.66	0.15	0.21	0.66		Piezometer
26/2/88	0.78	0.382	0.626	2.15		level is
27/2/88	0.79	0.384	0.636	2.20		below the
/3/88	0.785	0.38	0.635	2.25		top of PVC
/3/88	-	0.40	0.66	2.29		tube
0/3/88	0.775	0.395	0.64	2.30		
/3/88	0.615	0.385	0.66	2.30		
2/3/88	0.465	0.39	0.67	2.32		

CHEMICAL TEST & X-RAY DIFFRACTION TEST RESULTS

CHEMICAL TEST RESULTS

Project : Model Infrastructure

Location : Chareonraj Pumping Station, Bang Bo, Samut Prakan Province.

Boring No.	Sample No.	Depth, m	pH	Salinity ppt	Cl^- ppm	$SO_4^=$ ppm	O.M. %	Remark
B-1	PST-1	1.00-1.80	6.7	26	14576	400	4.8	
	PST-3	5.00-5.80	7.2	21	11162	268	2.9	
	PST-5	9.00-9.80	7.8	16	9291	345	3.5	in the ponded area
	PST-7	13.30-14.10	7.9	14	7616	365	3.6	
B-2	PST-1	1.00-1.80	7.6	23	11080	91	3.8	
	PST-5	5.00-5.80	7.4	22	13181	31	2.9	on land
	PST-9	9.10-9.90	7.1	12	9438	38	3.2	
	PST-14	14.00-14.80	8.3	14	7731	90	3.7	

4. Basic Plan

BASIC PLAN

OF

DETAILED DESIGN

OF

MODEL INFRASTRUCTURE PROJECT

FEBRUARY 24th, 1988

I. OBJECTIVES OF THE MODEL INFRASTRUCTURE PROJECT

The objectives of the Model Infrastructure Project throughout the execution of the detailed design, construction and monitoring are as follows;

1) Setting up the monitoring system for mechanical behaviour of the excavated soft soil foundation.

2) Obtaining the mechanical behaviour of the excavated soft soil foundation.

3) Examining the applicability of the method of slope stability analysis using circular slip surface for the excavated soft soil foundation.

4) Studying the applicability of prediction for the stress and deformation occurring in the excavated soft soil foundation by the Finite Element Method (F.E.M.) using an Elasto-viscoplastic model.

5) Suggestions and recommendations on the design and investigation for the soft soil foundation.

II. SCOPE OF WORKS FOR DETAILED DESIGN

In order to achieve the objectives mentioned above, the detailed design of the testing canal facility and its monitoring system are conducted on the basis of the following basic viewpoints.

1. *Project site*

The Model Infrastructure Project for soft soil foundation will be carried out in the area neighbouring the Charoenraj Pumping Station. The site of the Model Infrastructure project has been provided by RID.

2. Basic Plan for the Testing Canal Facility

The testing canal facility consists of four slopes which take into consideration the project site condition. Since the main purpose of this project is to obtain the behaviour of the soft soil foundation caused by excavation work, surcharge load will not be carried out in principle.

3. Untreated Slope Structures

Two slope sections are planned to be constructed to leave them in the form of an untreated natural state. One of the non-treatment slope structures is to be applied for the study of long-term stability. The other non-treatment slope structure is to be used for the study of short-term stability.

4. Improved Slope Structures

The improved slope structures will be undertaken for the following purposes;

1) Countermeasures against damage and failure of the existing structures, and preparation work.
2) Study of the effects of improved methods in the improved slope structures.

As examples of countermeasures among the various available improvement methods for the soft soil foundation, the final improvement methods will be selected from three already proposed methods (sand compaction pile treatment, soil cement column treatment, and gravel compaction pile treatment)

5. Monitoring System

The monitoring system will be utilized in the following way;

1) Auto-measurement monitoring system
2) Measurement and observation by topo-survey work.

The auto-measurement monitoring system will be installed at the project site. Also, the observation data obtained from the auto-measurement monitoring system will be recorded at the project site. The data obtained from the monitoring system will be analyzea in the I.E.C.. Efforts should be made to ensure that the monitoring instruments will be installed before the start of the excavation work.

6. Others

The construction work of the testing canal facility will be conducted using Model Infrastructure Improvement Work funds. The hardware and software for the auto-measurement monitoring system are to be purchased using IEC project funds. The budget for the monitoring system will be decided by the JICA taking into account the limitations of IEC project funds.

III. IMPLEMENTATION PROCESS OF DETAILED DESIGN

The implementation process of the detailed design shown in Fig-1 is as follows;

1. Investigation

1.1 Geotechnical Investigation

In order to obtain as much accurate data as possible, the following geotechnical investigation will be performed.

1) In-situ Tests
   a. Field Vane Tests
   b. Boring and Sampling

2) Laboratory Tests
   a. Standard triaxial compression tests for clay samples obtained from the project area.
   b. Unconfined compression tests for clay samples obtained from the project area.
   c. Physical property tests for materials of the sand compaction piles and the gravel compaction piles.

1.2 Topo-survey Work

Additional topo-survey work for the area surrounding the Project site will be made.

2. Preliminary Analysis

The preliminary analysis for the detailed design work will be performed by the circular slip method using the computer system in the IEC.

The preliminary analysis conditions are as follows;

1) The depths of the testing canal facility are 4m and 3m.
2) The preliminary analysis are conducted on the basis of the trial and error method using the several different slope gradients of the testing canal facility.

3. Preliminary Design

The depth and slope gradients of the testing canal facility will be decided from the results of the preliminary analysis. A value of a little less than 1.0 for the safety factor will be adopted as the safety factor for the slope applied for the short-term slope stability study. The safety factor for the slope used for the examination of long-term slope stability study will be selected as about 1.5 the value of the safety factor.

The strength of the piles used for the improved slope structures will be determined by taking into account the design examples learned from experienced knowledge of similar phenomena. It is necessary to consider whether to carry out protection of the slope surfaces of the testing canal facility.

4. Decisions Regarding the Form the Testing Canal Facility and Monitoring System

The size and shape of the testing canal facility will be decided by taking into account the space allocated to the project site, the construction plan, and the construction cost.

The detailed design work will be continued in Japan on the basis of the agreement and decisions mentioned above.

The basic installation plan for the monitoring system is presented in Table-1.

The instrument installation plan will be formulated after having recived the results of the analyses and used as reference taking into account other relevant data.

5. Field Report

The field report will be prepared at the end of the field work in Thailand. The field report may cover the following items:

a. Layout and preliminary design for the preparatory work for the construction of the testing canal facility.
b. Layout and preliminary design for the foundation improvement work.
c. Preliminary slope stability analysis for excavated slopes using the circular slip method.
d. Preliminary design on the monitoring system
e. Draft construction plan
f. Rough estimated construction cost
g. Preparation of basic drawings

6. Office Work in Japan

The detailed design work in Japan will be carried out on the basis of the agreement between the detailed design team and R.I.D in the field report.

At the stage when the office work is completed, the draft and final report of the detailed design of the Model Infrastructure Project for the soft soil foundation will be submitted to RID through the JICA Thailand office.

The geotechnical data obtained from the in-situ tests and laboratory tests will be altered and, if necessary, analysis using the circular slip surface method will be conducted in Japan. Analysis using the compound slip surface method will also be carried out.

In order to predict the behaviour of the non-treatment slope structures, the elasto-visco plastic analysis using FEM will be carried out and conducted in Japan.

The main contents of the final report are as follows:

1) Results of investigation work
2) Results of analysis work
3) Design of testing canal facility
4) Plan of monitoring system for the canal testing facility
5) Construction plan of the testing canal facility and installation plan of monitoring system
6) Amounts and construction cost of the testing canal facility
7) Specifications of monitoring system
8) Design drawing
9) Draft of tender documents
10) Reference of design and construction plan

7. Others

In the case of no heavy deformation occurring clearly in the non-treatment slope structure to examine short-term stability after construction of the excavation work, studies should be made into whether the embankment work shall be embarked upon or not.

IV. CONDITIONS FOR CARRYING OUT THE MODEL INFRASTRUCTURE PROJECT

In order to carry out the investigation,design and construction of the testing canal facility, RID has very generously assumed responsibility for the following collaboration with the Detailed Design Team.

1. Necessary Collaboration for the Investigation and Design Work
   1) STS Co. conducts in-situ tests and laboratory tests, if it meets with the approval of the RID. Some in-situ and laboratory tests will be kindly performed by the RID.
   2) RID has agreed to support the geotechnical investigation of sand and gravel used in construction.
   3) Consultation with the construction company concerning the construction cost and construction planning.

4) RID has granted permission for the use of the computer system at the IEC for performing the slope stability analysis and will provide the necessary computer people.

2. Preparation Work Necessary for Construction

1) RID will kindly provide the spoil area.

2) The existing pumping operation facility will be used for setting up the monitoring system, if necessary arises.

3) If re-location of the existing staff accomodation is necessary as a result of the construction work, if possibleit will have to be moved.

4) The Detailed Design Team would appriciate efforts by the RID to provide engineers for the monitoring work of the testing canal facility.

5) Unfortunately the RID will have to pay for the electricity charges for the drainage pumps after construction of the testing canal facility because the IEC has no budget to cover these charge.

Fig - 1

WORK FLOW CHART FOR DETAILED DESIGN TEAM

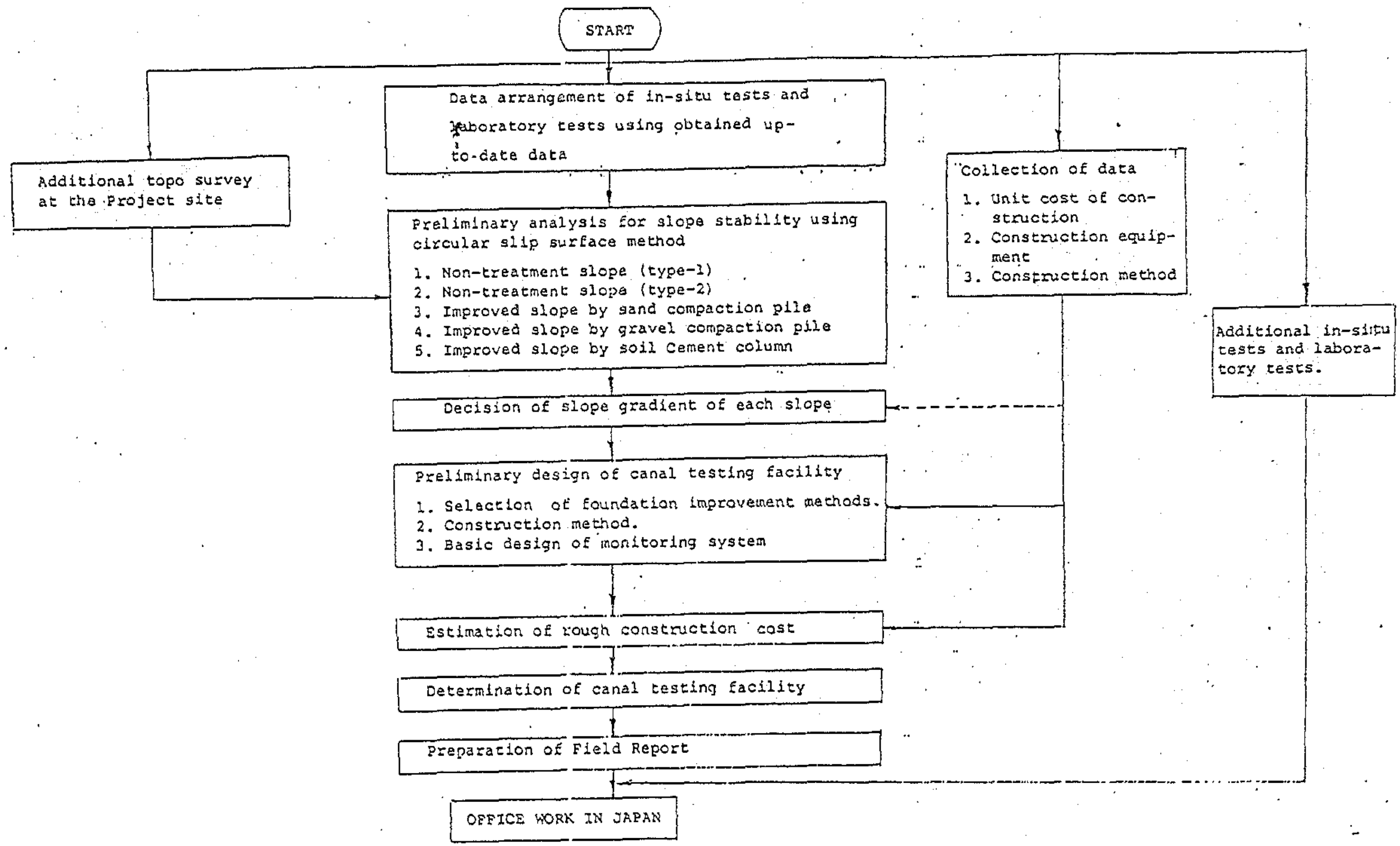


Table - 1 Purpose of Installation

Name of Instrument	Measured item	Purpose of Installation	Non-Treament slope 1	Non-Treament slope 2	Improvement slope 3 4
1. Surface displacement gauge and Piles for topo-survey	Slope surface deformation and relative displacement	To measure slope surface deformations in the excavated slopes.	○	○	△ (Pile for topo-survey)
2. Indinometer	Horizontal deformation in slope foundation	To measure horizontal deformation in the slope foundations causing failure, lateral flow and heaving.	○	○	○
3. Piezometer	Pore pressure in slope foundation	To measure the groundwater level and pore pressure behaviour occuring in the slope foundation.	○	○	○
4. Open piezometer	"	"	○	○	○
5. Differential settlement gauge (Non-treatment slope 1)	In the case that the embankment is filled, settlement of foundation.	To measure the vertical differential settlement of the slope foundation.	○	—	—

Fig. - 2

OUTLINE OF THE TENTATIVE SCHEDULE FOR THE PROJECT

1988	Japanese Side	Thai Side
February	Detailed Design Survey (mission) Basic Plan of Detailed Design --- 26th Feb. ---	Preparation of land etc.
March	Field report --- 23rd Mar. ---	
April	Detailed Design (in Japan) --- late in April --- * * *	
May	Final Report → (to Thai Side) --- middle of May ---	Form A4 for equipment Request of Construction work --late in May-- through JICA Office → (to JICA HQ)
June	JICA HQ ←	← Form A1, for expert --early in Jun.--
	Consultation with Ministry of Forein Affairs -- late in June -- →	
July		Exchange of Verbal Note --late in Jul.--
August	Dispatch of Supervising Expert --early in Aug.-- Remittance of Budget --early in Aug.-- Contract assigning Procedure --early in Aug.--	
September	Start of Construction work --early in Sep.--	

JICA