

DRILLHOLE PB-2

Sheet (21-21)

DEPTH

From 0 m

To 25 m

H.P. PIRRI'S PB-2

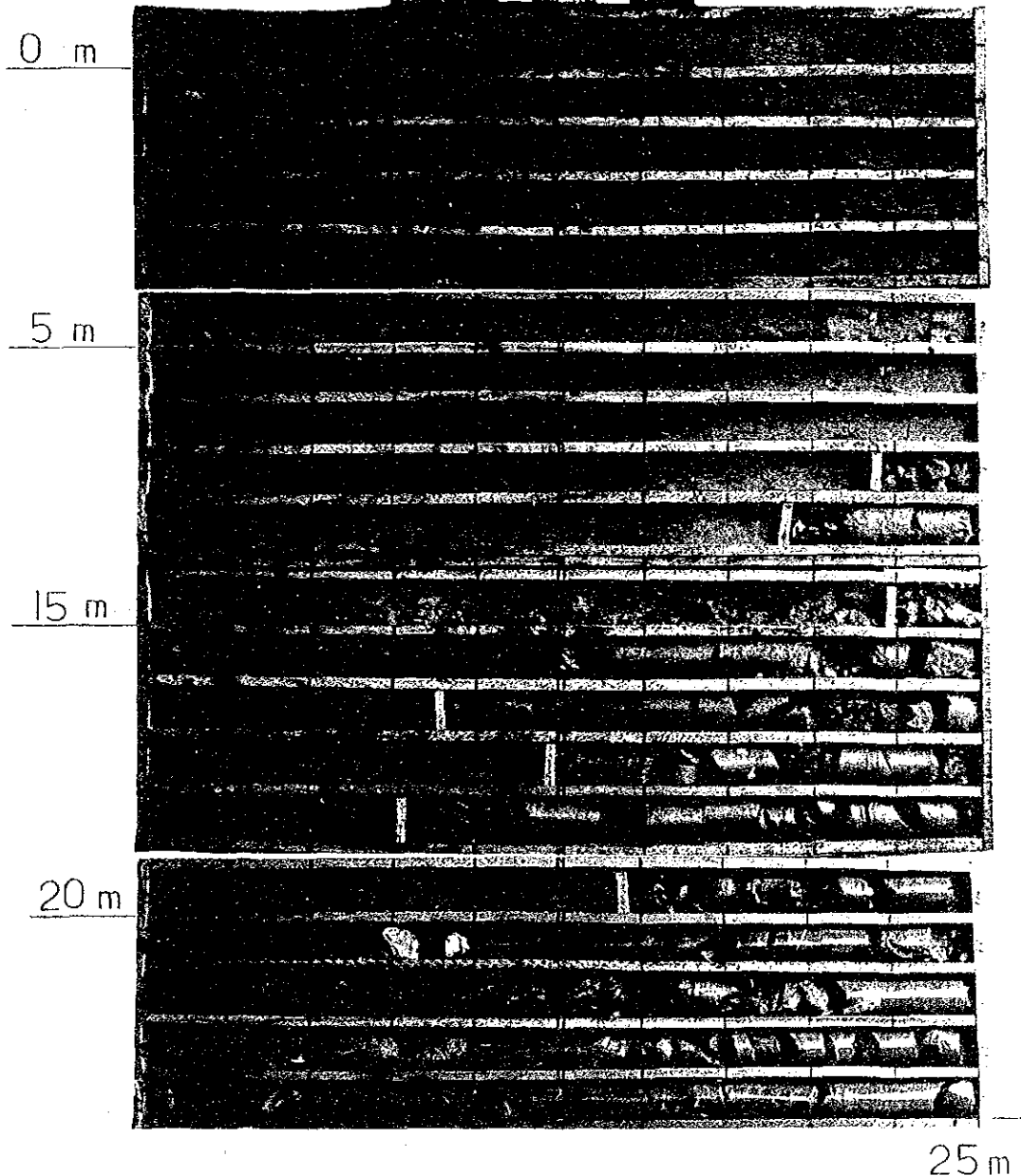


Table A3.7.1 Results of Lugeon Test

(Sheet 1-3)

Drill hole No.	Location Tested	Lugeon Value	Maximum Pressure	Water Level when tested	Remarks
	m~m		kg/cnf	m	
UB-1	21.8~25.0	(13.0)	7.5	24.15	
	25.0~30.0	(52.7)	3.8	30.0 <	
	30.0~35.0	1.6	13.3	35.0 <	
	35.0~40.0	0.15	14.0	39.45	
	40.0~45.0	3.3	13.2	31.4	
	45.0~50.0	2.1	13.4	33.6	
UB-2	1.8~ 5.0	(4.2)	5.24	2.3	
	5.0~10.0	(39.0)	5.2	1.57	
	10.0~15.0	8.0	10.16	1.40	
	15.0~20.0	19.5	10.23	2.28	
	20.0~25.0	0.2	10.2	1.95	
	25.0~30.0	0.6	10.24	2.45	
	30.0~35.0	0.95	10.24	2.40	
	35.0~40.0	1.65	10.23	2.30	
	40.0~45.0	0.85	10.23	2.30	
	45.0~50.0	2.2	10.23	2.30	
UB-3	36.5~40.0	(67.0)	4.28	32.0	Packer trouble
	40.0~45.0	(13.6)	9.0	39.0	
	45.0~50.0	(21.0)	9.5	50.0 <	

Note: (1) Lugeon value in parentheses is calculated value when maximum pressure is less than 10kg/cnf.

(2) Water Level value in UB-2 shows diagonal length.

Table A3.7.2 Results of Lugeon Test

(Sheet 2-3)

Drill hole No.	Location Tested	Lugeon Value	Maximum Pressure	Water Level when tested	Remarks
	m~m		kg/cm ²	m	
LB-1	5.8~10.0	(63.0)	3.8	10.0 <	
	11.0~15.0	(7.2)	5.9	9.0	
	15.0~20.0	0.4	11.6	15.9	
	21.0~25.0	0.2	11.5	15.0	
	25.0~30.0	19.0	11.9	18.5	
	30.0~35.0	0.2	11.9	18.5	
	35.0~40.0	0.2	13.2	31.8	
	40.0~45.0	16.0	11.5	36.2	
	45.0~50.0	0.1	14.2	41.6	
	50.0~55.0	0	14.2	41.6	
	55.0~60.0	0	14.9	48.12	
	60.0~65.0	0	14.8	48.12	
	65.0~70.0	0	14.9	48.12	
LB-2	5.8~10.0	(43.0)	3.8	10.0 <	
	11.6~15.0	(7.0)	6.3	13.05	
	15.0~20.0	(34.0)	6.8	20.0 <	
	20.0~25.0	(7.2)	6.9	19.0	
	25.0~30.0	(3.0)	7.1	20.6	
	30.0~35.0	(1.8)	7.4	23.73	
	35.0~40.0	(15.0)	7.3	23.0	
	40.0~45.0	18.0	10.6	26.0	
	45.0~50.0	14.0	13.8	37.37	
	50.5~55.0	0.7	13.8	37.5	
	55.5~60.0	1.2	13.7	37.0	
	60.0~65.0	0.2	13.9	39.0	
	65.0~70.0	0	13.9	39.0	

note: (1) The same as Table A3.7.1(Sheet 1-3).

Table A3.7.3 Results of Lugeon Test

(Sheet 3-3)

Drill hole No.	Location Tested	Lugeon Value	Maximum Pressure	Water Level when tested	Remarks
	m~m		kg/cmf	m	
LB-3	40.0~45.0	(100.0)	5.5	32.5	
	46.3~50.0	(48.0)	7.9	43.6	
	50.0~55.0	(32.0)	7.9	55.0 <	
	56.0~60.0	(47.0)	6.9	60.0 <	
	61.3~65.0	25.0	11.3	65.0 <	
	65.0~70.0	8.0	16.8	70.0 <	
	71.5~75.0	17.5	13.5	71.0	
	75.6~80.0	18.0	11.3	71.0	
	80.6~85.0	19.0	11.8	85.0 <	
	87.0~90.0	23.0	11.7	90.0 <	
	90.0~95.0	—	—	—	Packer trouble
	95.0~100.0	—	—	—	ditto
LB-4	25.5~30.0	(60.0)	4.4	30.0 <	
	30.0~35.0	—	—	—	Packer trouble
	35.5~40.0	2.5	12.3	26.0	
	40.9~45.0	2.7	12.4	27.0	
	45.0~50.0	(22.0)	3.4	27.0	

Note: (1) The same as Table A3.7.1 (Sheet 1-3).

(2) Water Level value in LB-4 shows diagonal length.

APPENDIX A-4 ROCK FOUNDATION TEST

APPENDIX A-4 ROCK FOUNDATION TEST

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Fig. A-4-1 Loading Diagram

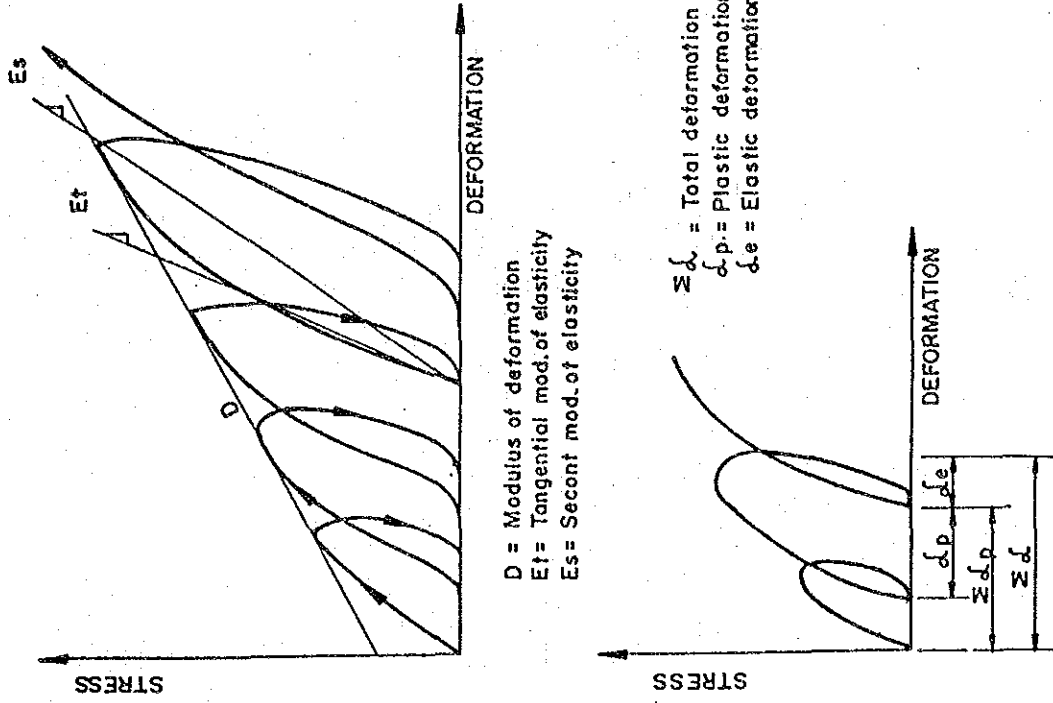
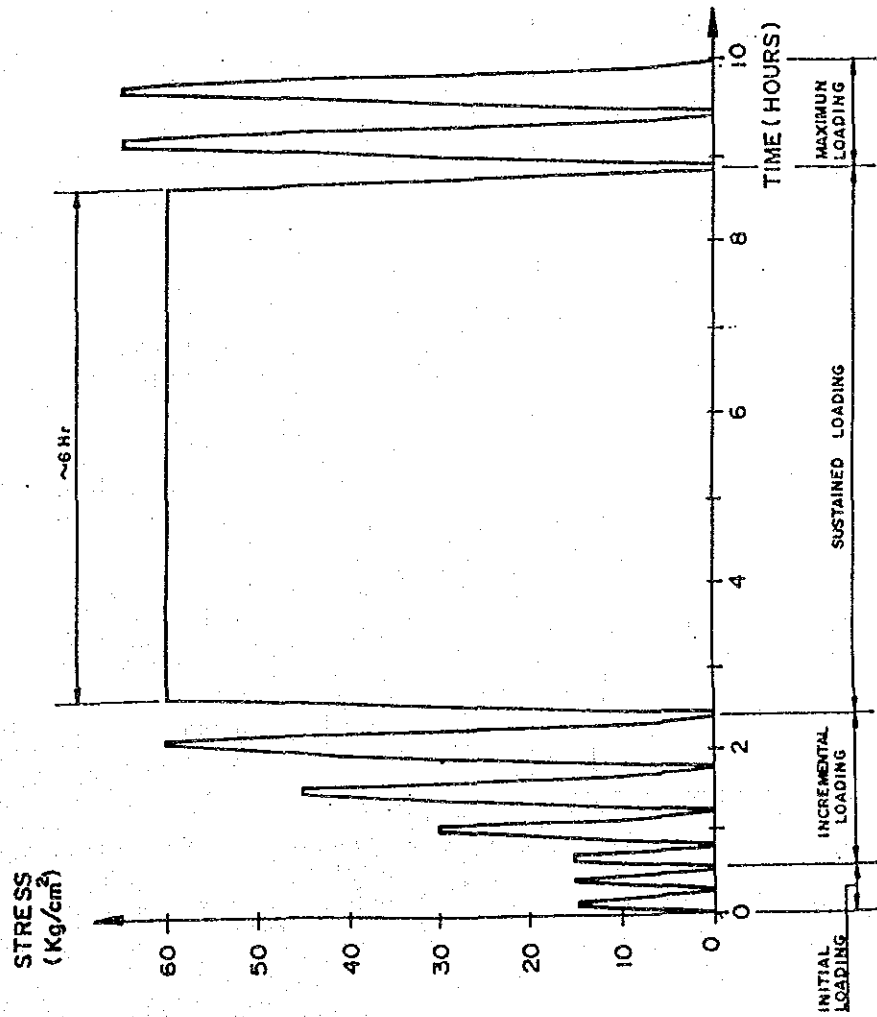


Fig. A-4-2 Plate Bearing Test Apparatus

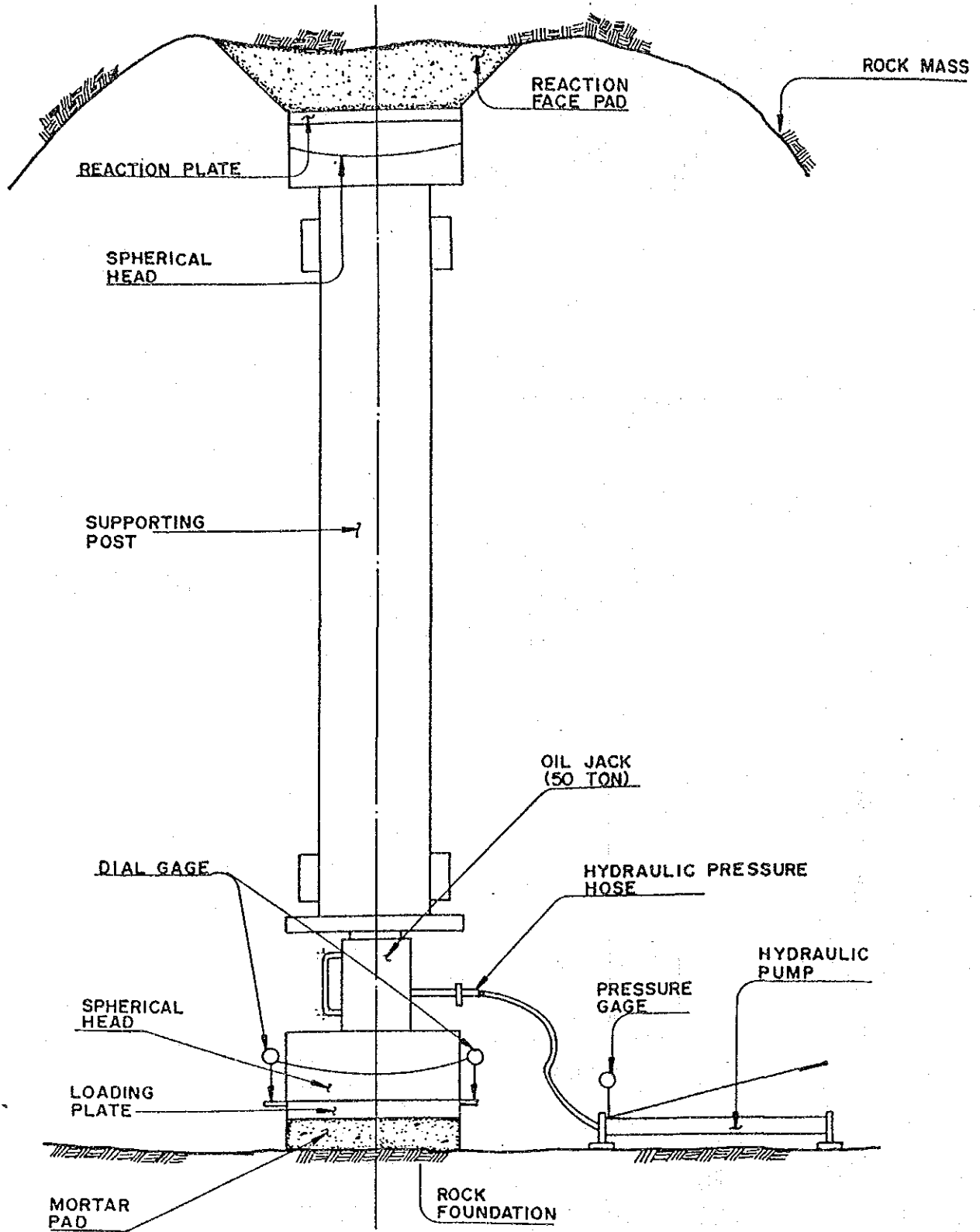


Fig. A-4-3 Modulus Characteristics of Rock Foundation

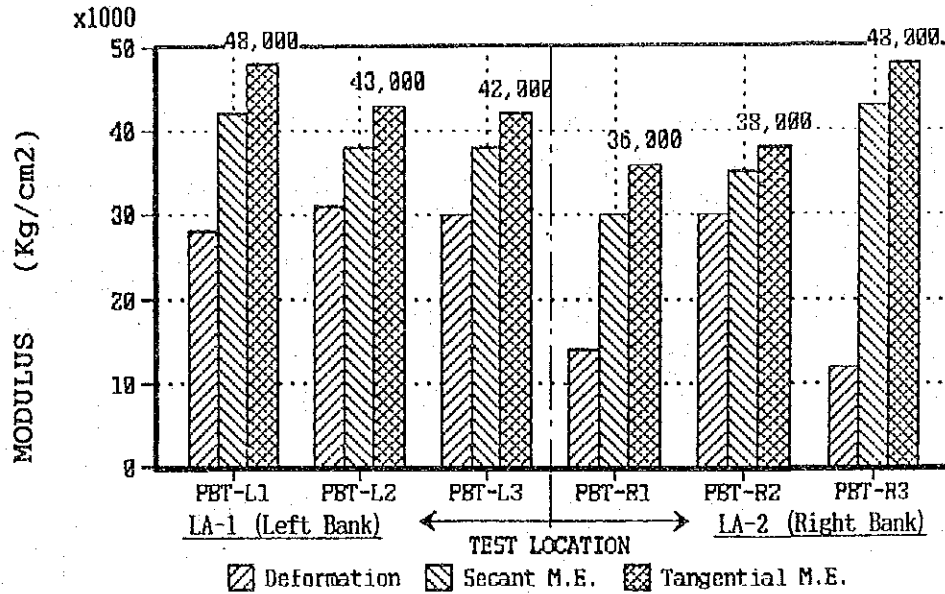


Fig. A-4-4 Deformation Characteristics of Rock Foundation

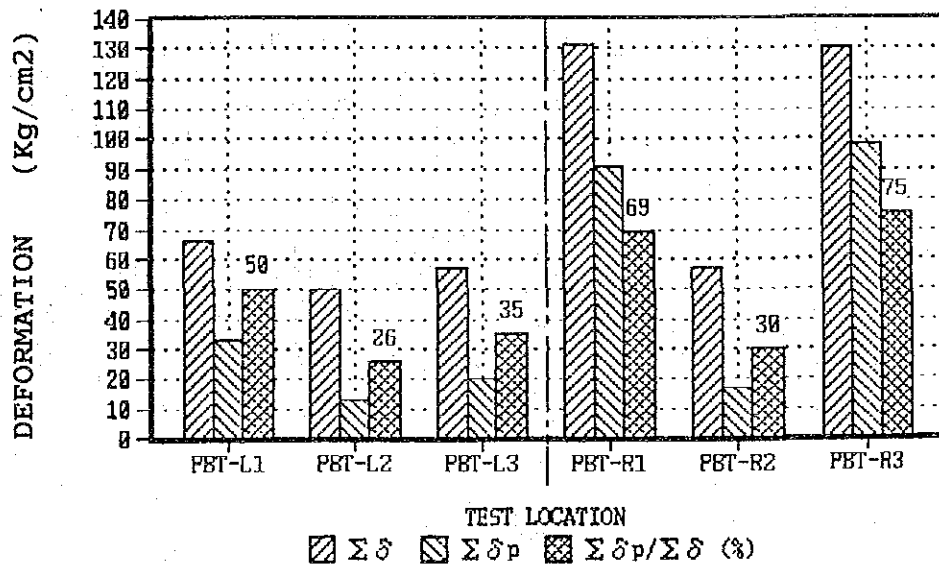


Fig. A-4-5 Creep Characteristics of Rock Foundation

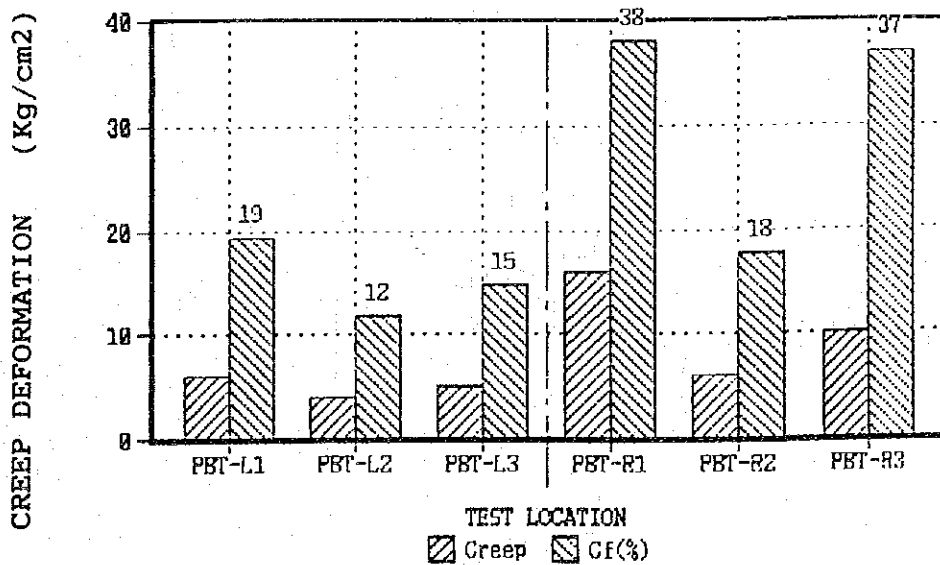


Fig. A-4-6 Geologic Condition of Test Location

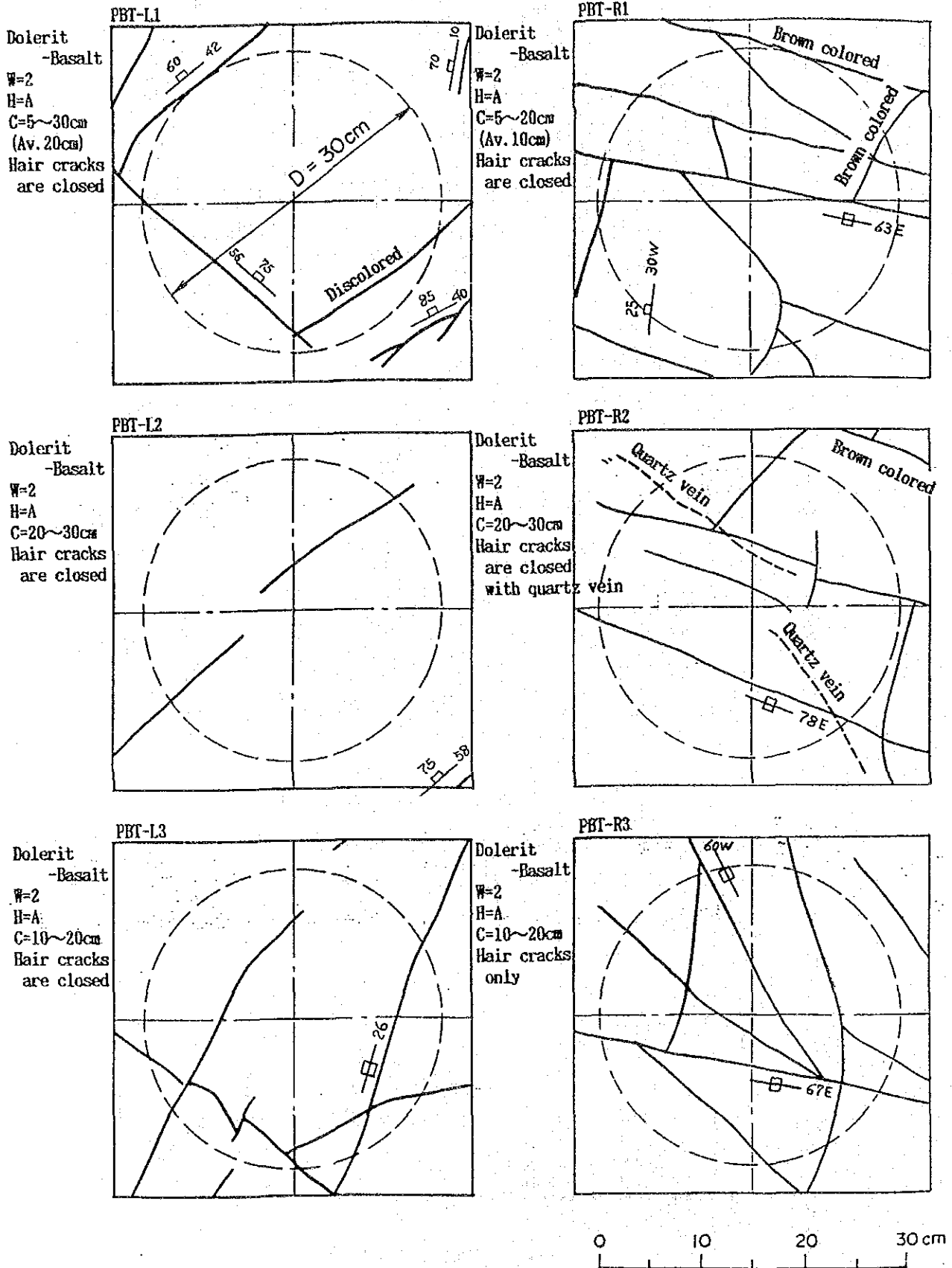


Fig. A-4-7 Load, Time, Deformation of PBT-L1

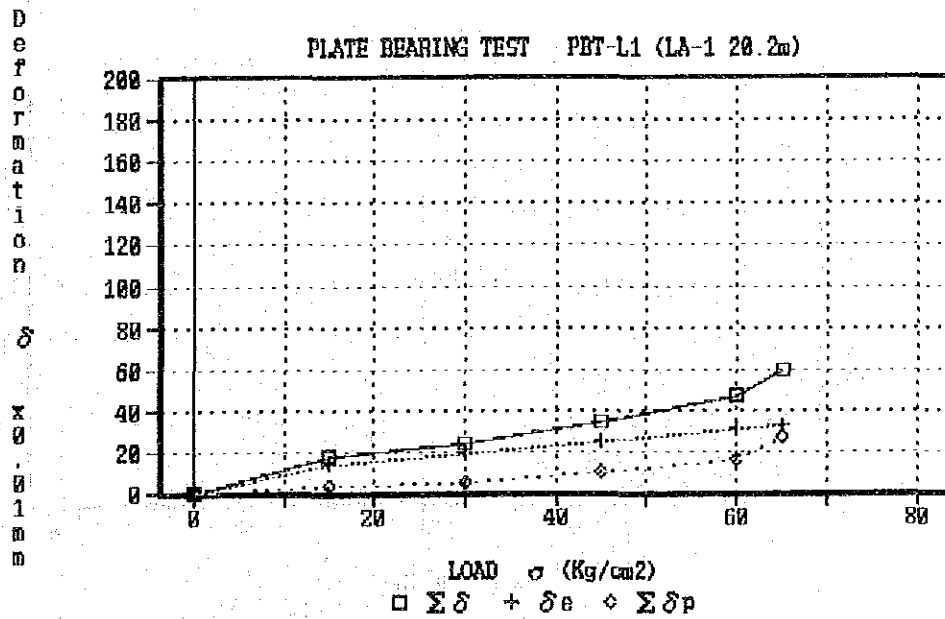
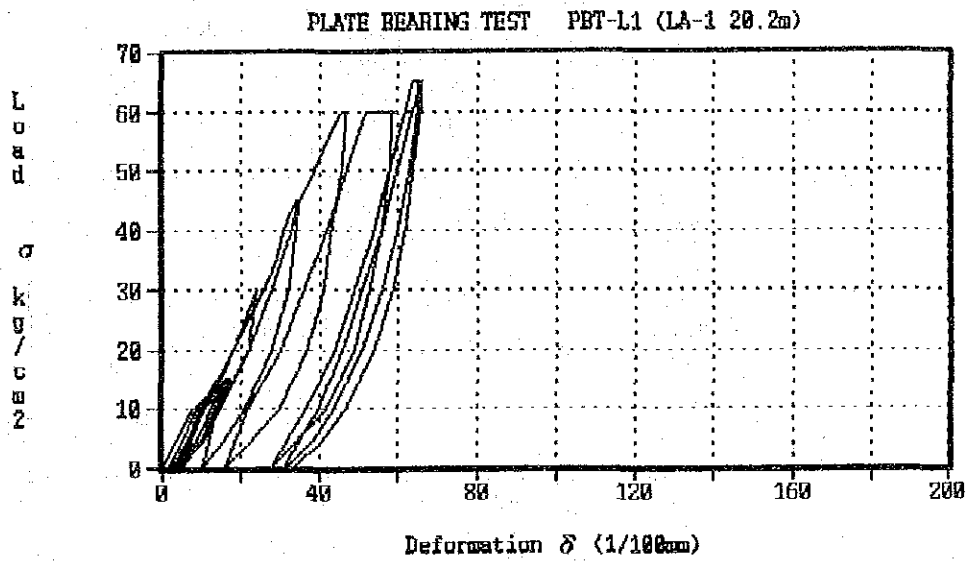
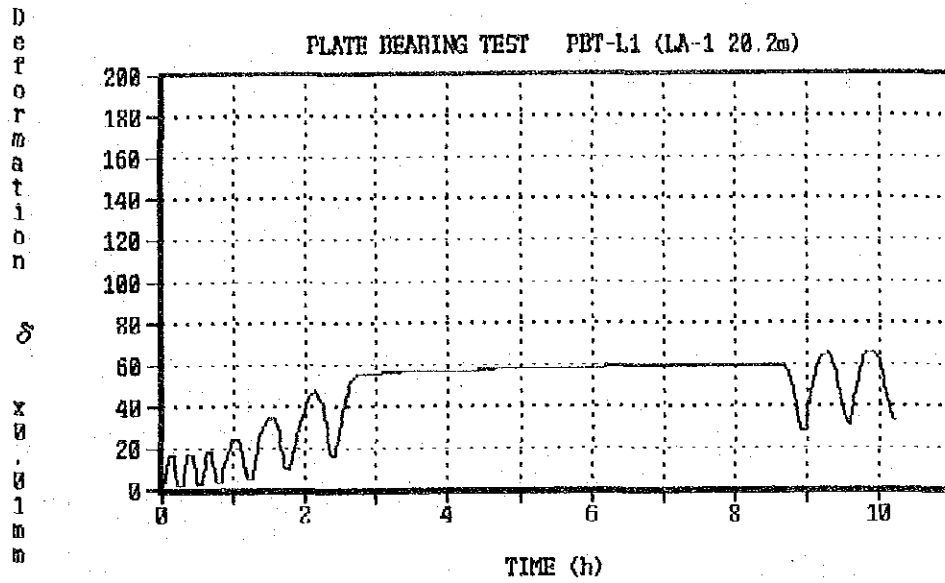
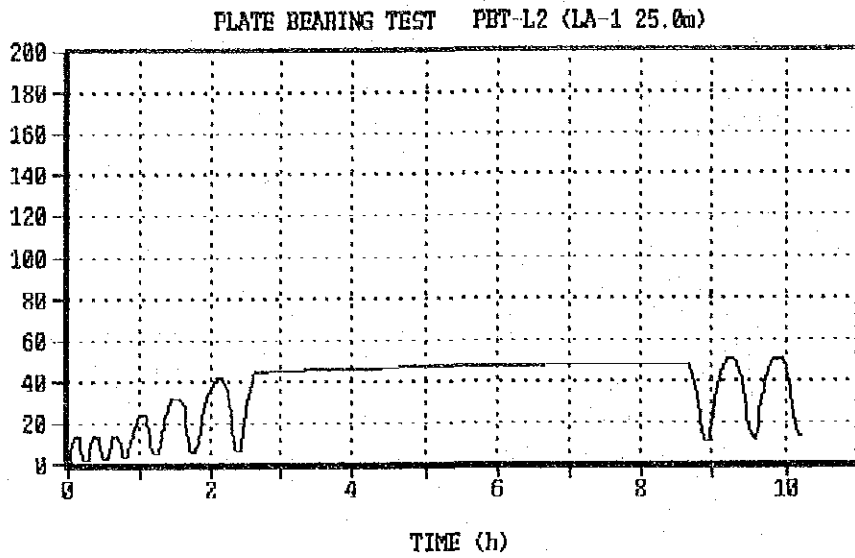
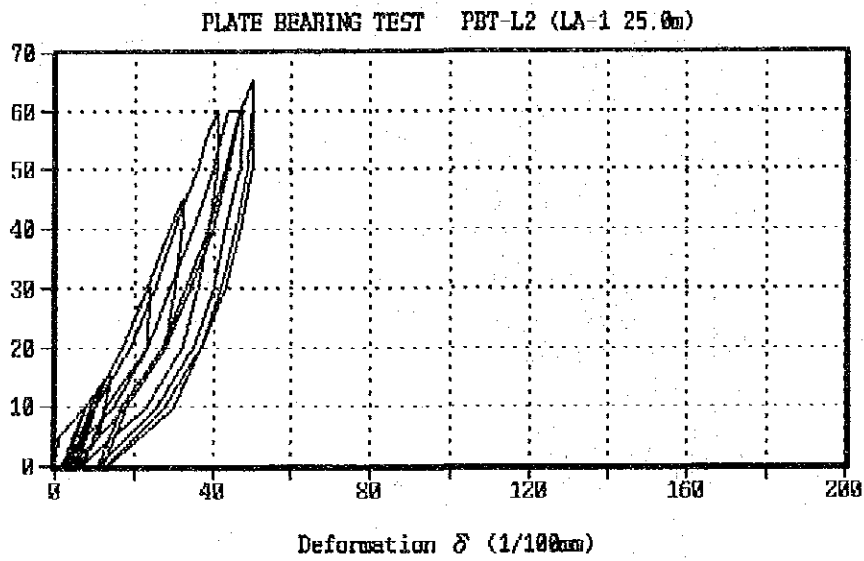


Fig. A-4-8 Load, Time, Deformation of PBT-L2

Deformation δ x 10⁻¹ mm



Load σ kg/cm²



Deformation δ x 10⁻¹ mm

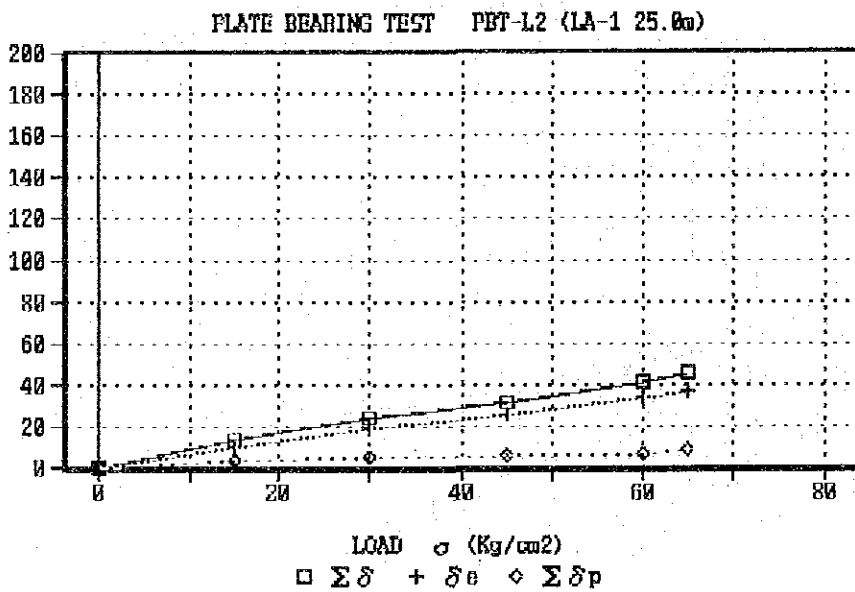
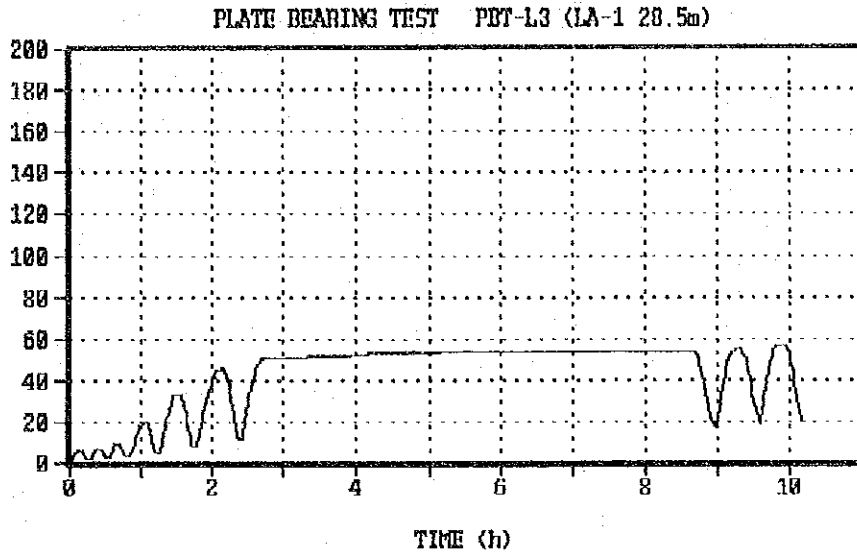


Fig. A-4-9 Load, Time, Deformation of PBT-L3

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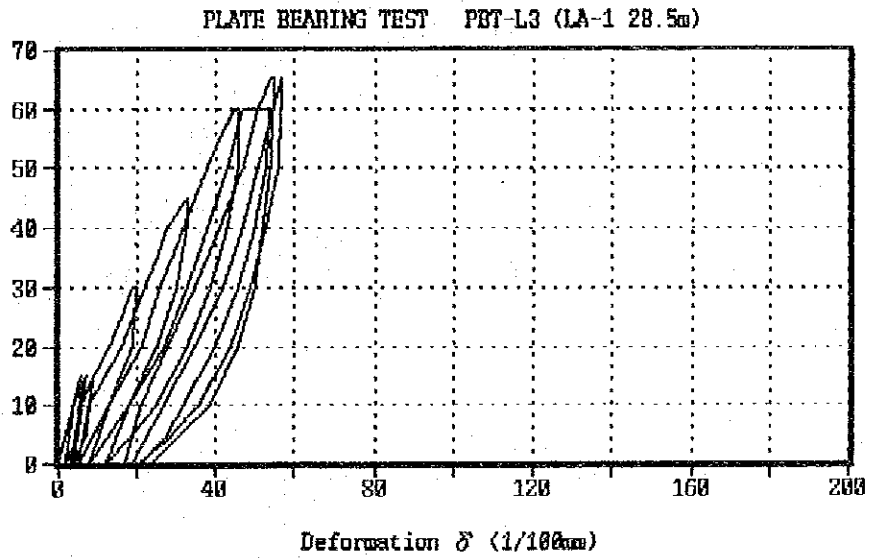
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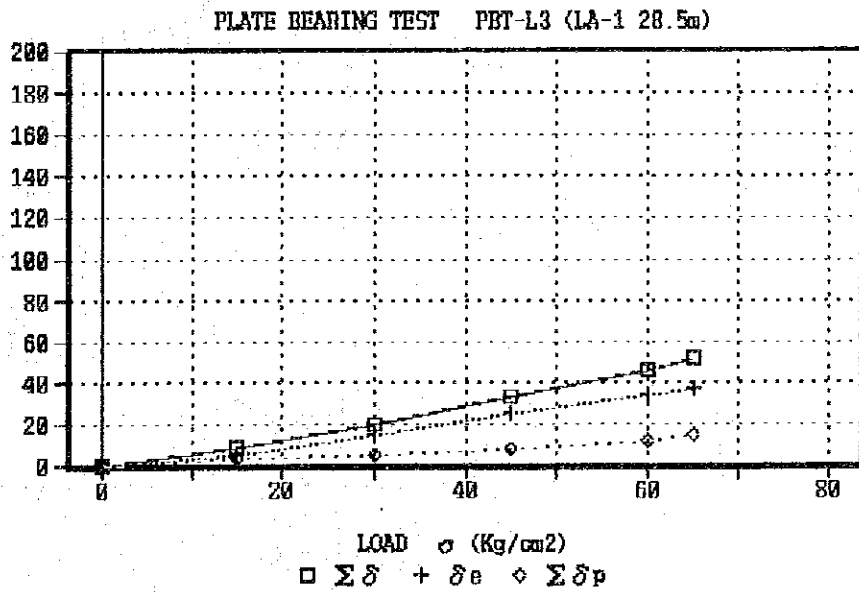
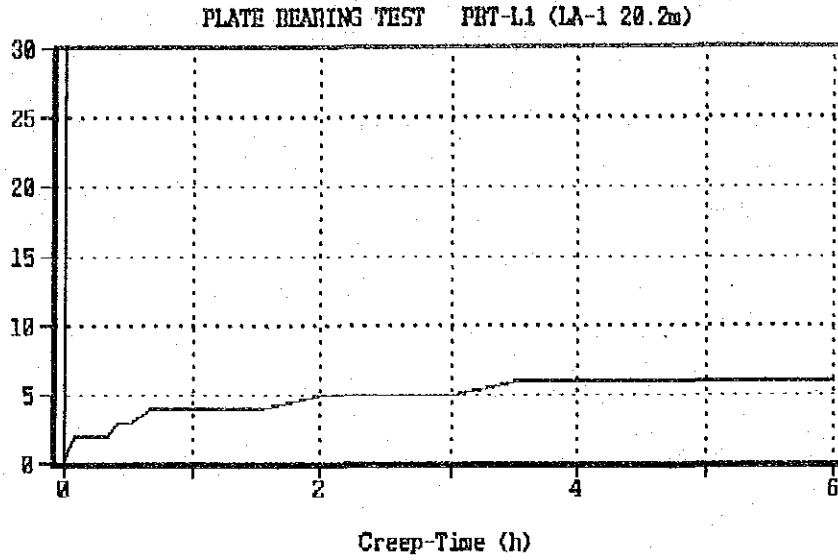


Fig. A-4-10 Creep-Time of PBT-L1, PBT-L2, PBT-L3

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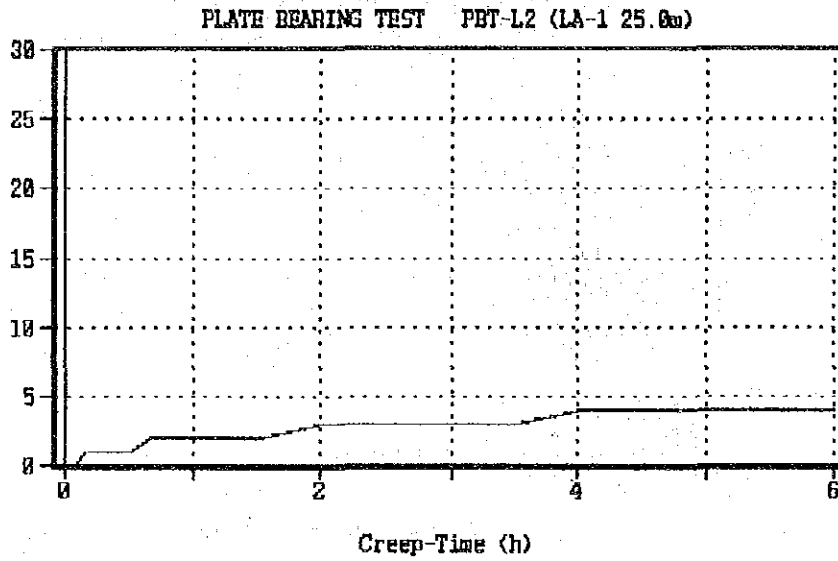
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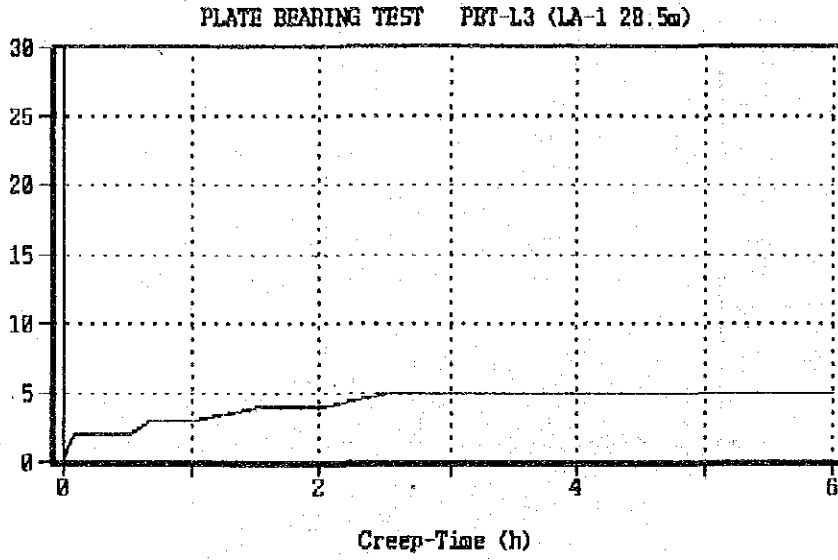
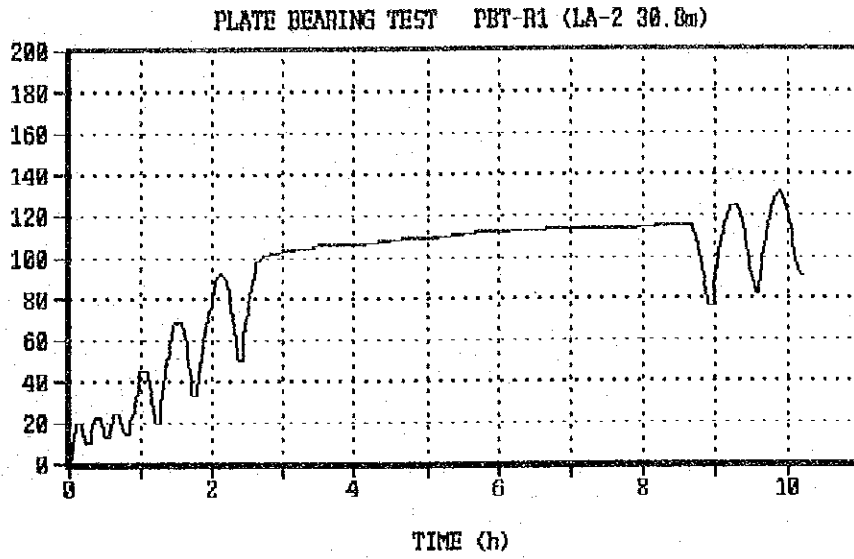
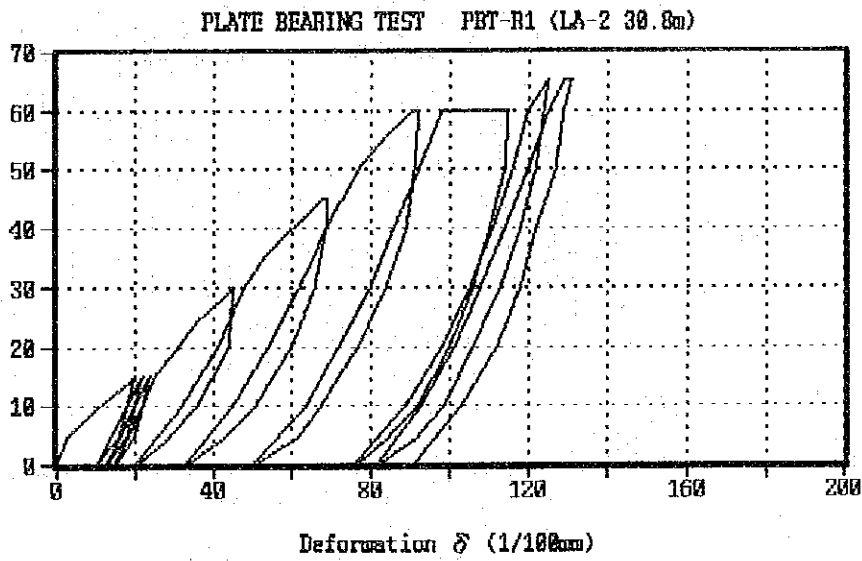


Fig. A-4-11 Load, Time, Deformation of PBT-R1

Deformation δ
x 0.01mm



Load σ
kg/cm²



Deformation δ
x 0.01mm

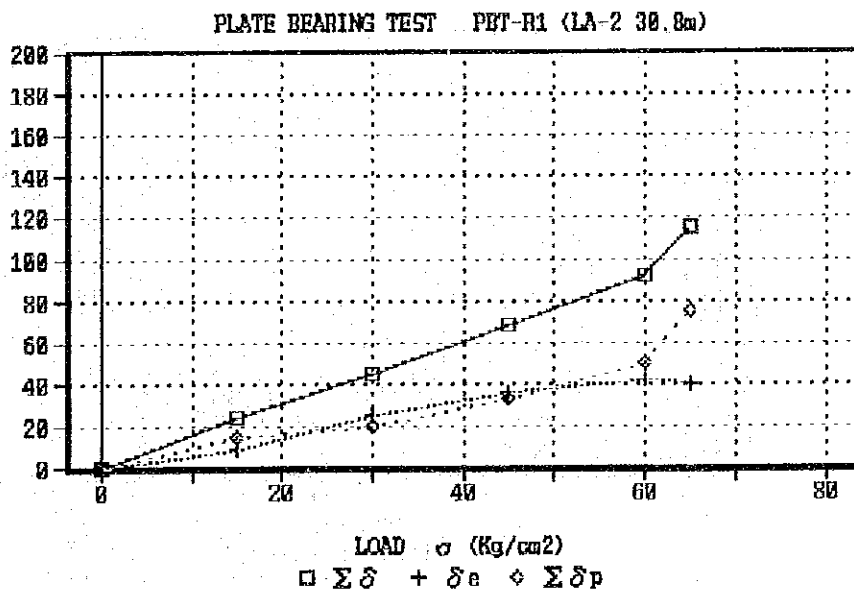
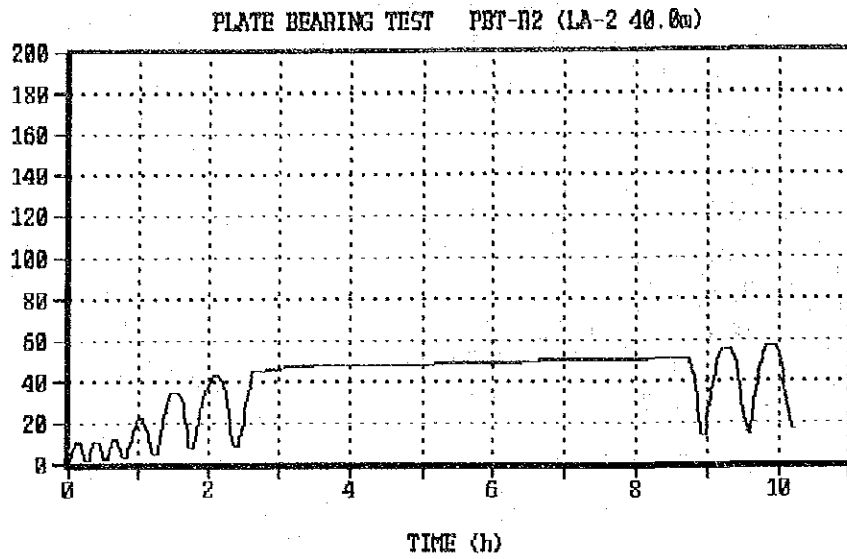
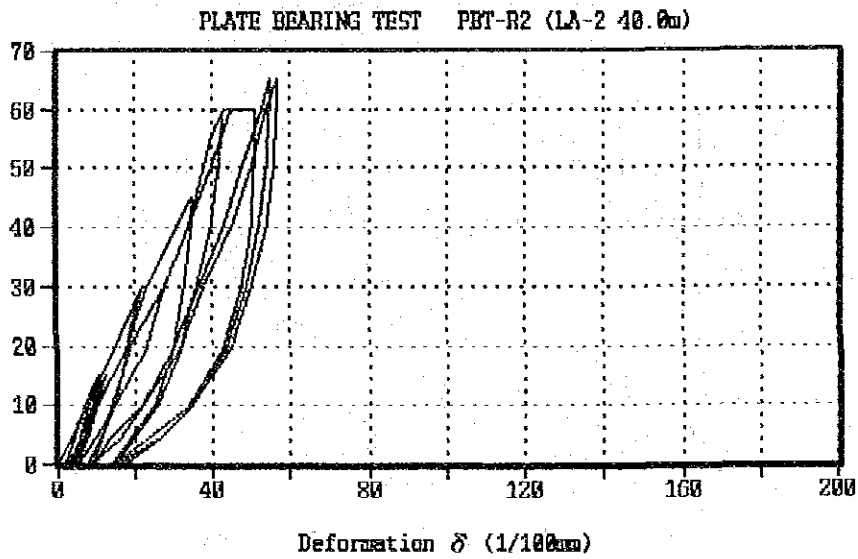


Fig. A-4-12 Load, Time, Deformation of PBT-R2

Deformation δ x 10⁻³ mm



Load σ kg/cm²



Deformation δ x 10⁻³ mm

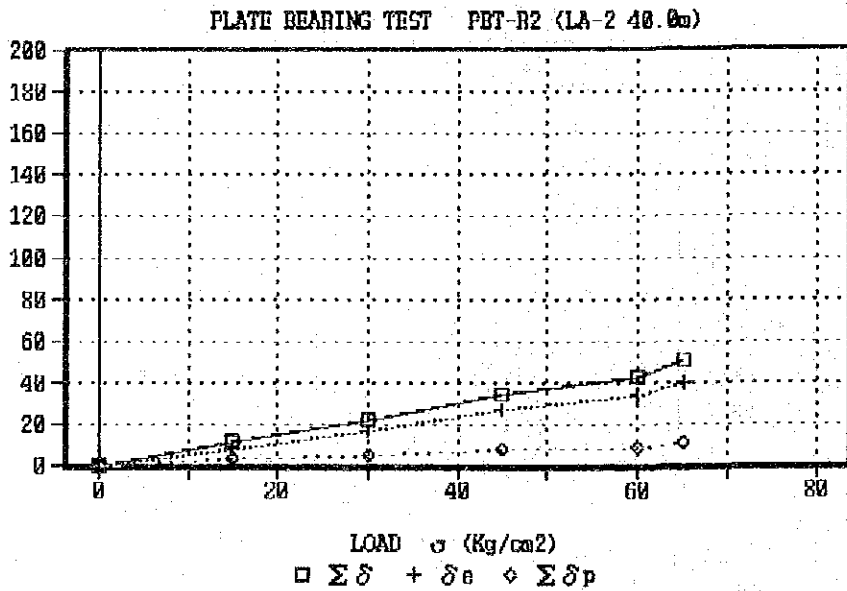


Fig. A-4-13 Load, Time, Deformation of PBT-R3

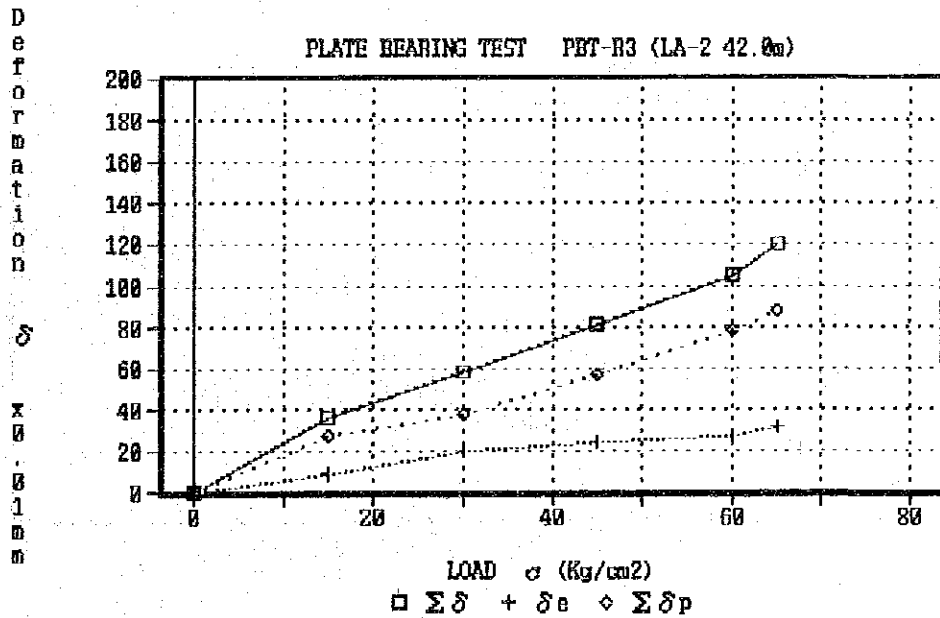
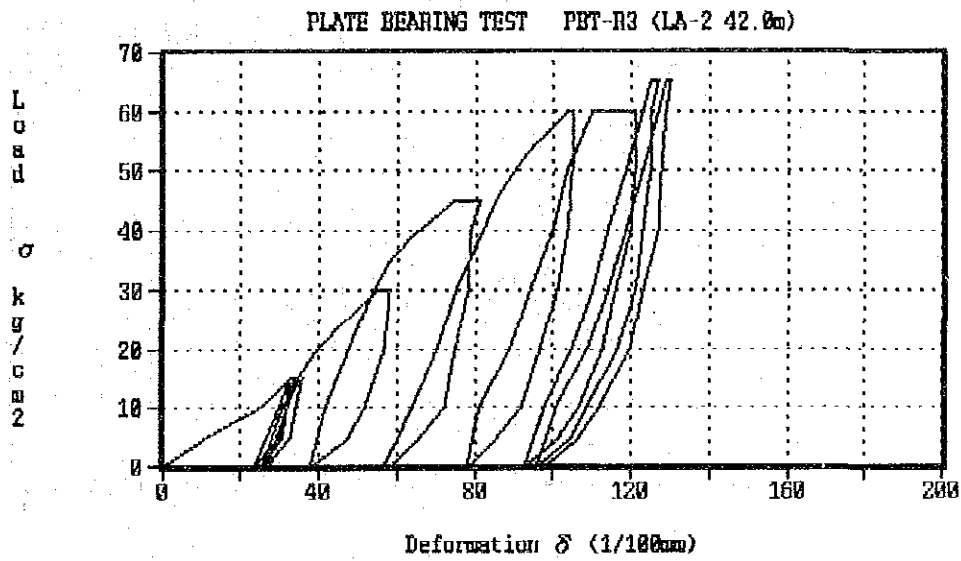
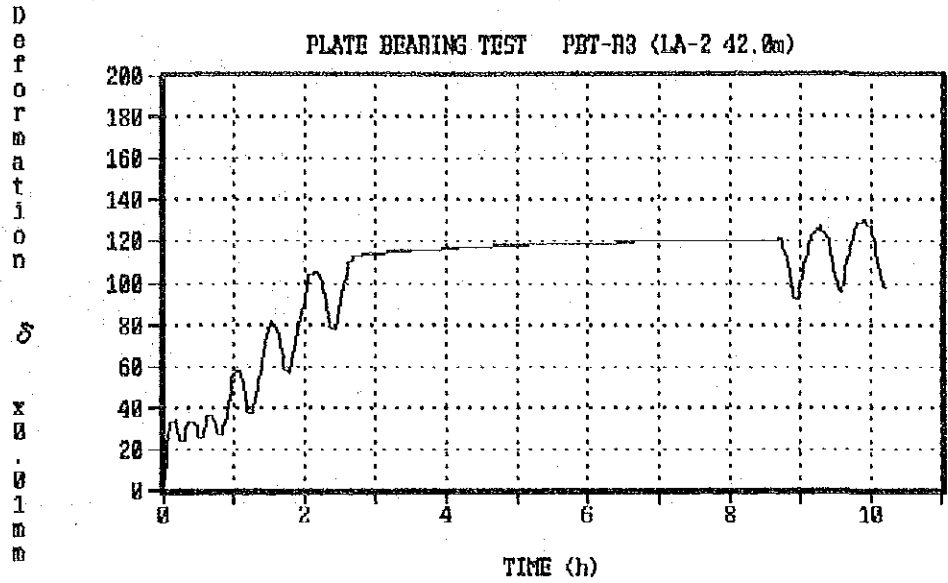
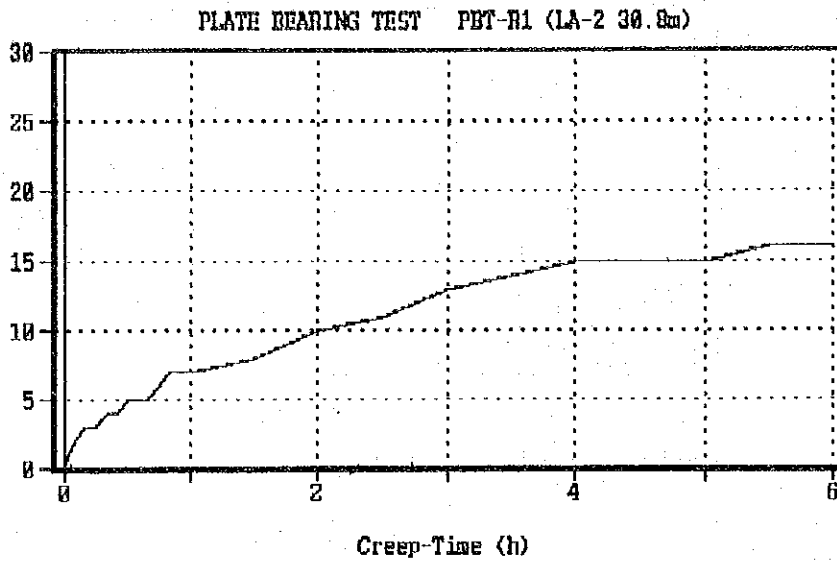


Fig. A-4-14 Creep-Time of PBT-R1, PBT-R2, PBT-R3

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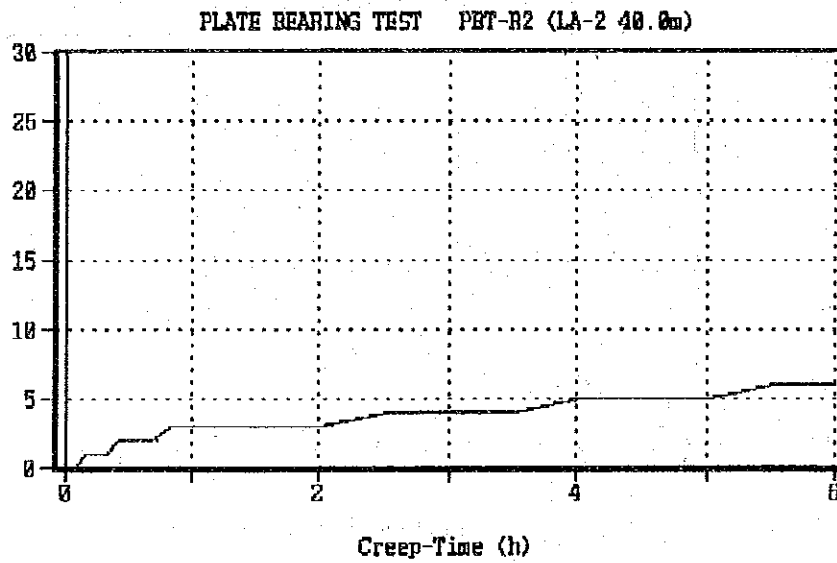
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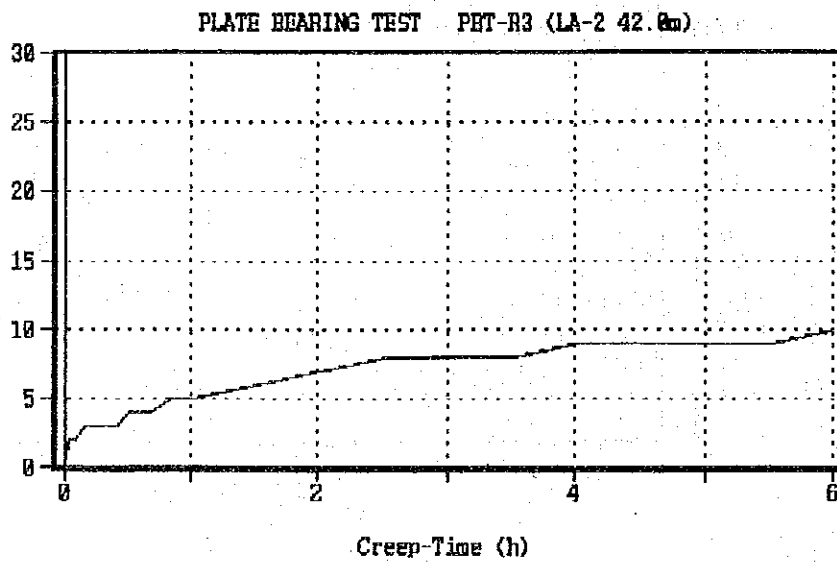
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June & July, 1991

Table A-4-1 Results of Plate Bearing Test

Adit	Rock Grade	Measuring Point	Accumulated Distance (m)	Maximum Deformation (1/100mm)	Final Deformation (1/100mm)	$\Sigma \Delta p$ ----- $\Sigma \delta$	Modulus of Deformation (kg/cm ²)	Secant Modulus of Elasticity (kg/cm ²)	Tangential Modulus of Elasticity (kg/cm ²)	Creep Deformation (1/100mm)	Creep Factor (%)	Remarks
LA-1	CH	PBT-L1	20.20	66	33	50	28,000	42,000	48,000	6	19	Sound. Little cracks and joint, but tight. Water Nothing.
	CH	PBT-L2	25.00	50	13	26	31,000	38,000	43,000	4	12	
	CH	PBT-L3	28.50	57	20	35	30,000	38,000	42,000	5	15	
	Average				58	22	30,000	39,000	44,000	5	15	
LA-2	CM	PBT-R1	30.80	131	91	69	14,000	30,000	36,000	16	38	Sound. Many cracks and joint. Water a little springing.
	CM	PBT-R2	40.00	57	17	30	30,000	35,000	38,000	6	18	
	CM	PBT-R3	42.00	130	98	75	12,000	43,000	48,000	10	37	
	Average				106	69	19,000	36,000	41,000	11	31	

Table A-4-2 Actual Schedule of In-Situ Rock Foundation Test

MONTH	1991					1991						
	JUNE	JUNE	JUNE	JUNE	JUNE	JULY	JULY	JULY	JULY	JULY		
DAY	5	10	15	20	25	30	5	10	15	20	25	30
WEEK	S S M T W T	F S S M T W T	F S S M T W T	F S S M T W T	F S S M T W T	F S S M T W T	F S S M T W T	F S S M T W T	F S S M T W T	F S S M T W T	F S S M T W T	F S S M T W T
Contract with R. V.	==											
Preparation Tests	==											
Carring Instruments to the Right Bank	==											
Arrangement Rockface (LA-2 of Adit)	=====											
Mortar Facing (LA-2 of Adit)	=====											
Installation for Tests (LA-2 of Adit)	=====											
Tests (LA-2 of Adit)	=====											
Carring Instruments to the Left Bank												
Arrangement Rockface (LA-1 of Adit)												
Mortar Facing (LA-1 of Adit)												
Installation for Tests (LA-1 of Adit)												
Tests (LA-1 of Adit)												
Disassemble & Moveing Out All of Instruments												
Analysis of All Datas												
Makeing Report												
Submitting Report of Tests												

Table A-4-3 Data Sheet of PBT-L1(1)

1991.6-7

PLATE BEARING TEST				Measuring Point <u>PBT-L1 (LA-1 20.2m)</u>				DATA SHEET (1)			
Test Location <u>LA-1 (Left Bank)</u>				Geological <u>Dolerite - Basalt</u>				Date Measured <u>91/6/20</u>			
Loading Plate Radius = <u>15.00</u> cm				Classification <u>CH</u>				Measured by <u>M. Rivas V.</u>			
Loading Plate area = <u>707</u> cm ²				Max. Load Stress <u>78</u> kg/cm ²				J. Capa. <u>55.2</u> ton			
Jack Ram Diameter = <u>10.00</u> cm				Max. Oil Pressure <u>703</u> kg/cm ²							
Time Interval = <u>00:02</u> (h:m)				Top = <u>00:04</u> (h:m)				Bottom = <u>00:04</u> (h:m)			
Load Rate (Virgin) = <u>5</u> (kg/cm ² /min)				Load Rate (Hysteresis) = <u>10</u> (kg/cm ² /min)							
Time (h.m)	Elapse (h.m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ <u>100</u> mm)				[(1) + (2)] / 2	Remarks		
				Dial Gauge Reading of Displacement							
				(1)		(2)					
D. Read	Disp.	D. Read	Disp.								
05:00	00:00	0.00	0	0	0	0	0	0	Start		
05:02	00:02	5.00	45	6	6	2	2	4			
05:04	00:04	10.00	90	11	11	5	5	8			
05:06	00:06	15.00	135	24	24	8	8	16			
05:10	00:10	15.00	135	24	24	8	8	16	Top15		
05:12	00:12	5.00	45	13	13	5	5	9			
05:14	00:14	0.00	0	2	2	1	1	2			
05:18	00:18	0.00	0	2	2	1	1	2	Bottom15		
05:20	00:20	10.00	90	13	13	4	4	9			
05:22	00:22	15.00	135	25	25	9	9	17			
05:26	00:26	15.00	135	25	25	9	9	17	T15-2		
05:28	00:28	5.00	45	14	14	6	6	10			
05:30	00:30	0.00	0	3	3	2	2	3			
05:34	00:34	0.00	0	3	3	2	2	3	B15-2		
05:36	00:36	10.00	90	15	15	5	5	10			
05:38	00:38	15.00	135	26	26	10	10	18			
05:42	00:42	15.00	135	26	26	10	10	18	T15-3		
05:44	00:44	5.00	45	15	15	7	7	11			
05:46	00:46	0.00	0	4	4	3	3	4			
05:50	00:50	0.00	0	4	4	3	3	4	B15-3		
05:52	00:52	10.00	90	16	16	5	5	11			
05:54	00:54	15.00	135	21	21	9	9	15			
05:56	00:56	20.00	180	24	24	11	11	18			
05:58	00:58	25.00	225	28	28	13	13	21			
06:00	01:00	30.00	270	32	32	15	15	24			
06:04	01:04	30.00	270	32	32	15	15	24	T30		
06:06	01:06	20.00	180	30	30	14	14	22			
06:08	01:08	10.00	90	20	20	9	9	15			
06:10	01:10	5.00	45	14	14	5	5	10			
06:12	01:12	0.00	0	6	6	4	4	5			
06:16	01:16	0.00	0	6	6	4	4	5	B30		
06:18	01:18	10.00	90	14	14	6	6	10			
06:20	01:20	20.00	180	24	24	11	11	18			
06:22	01:22	30.00	270	35	35	16	16	26			
06:24	01:24	35.00	315	40	40	17	17	29			
06:26	01:26	40.00	360	43	43	19	19	31			
06:28	01:28	45.00	405	47	47	21	21	34			
06:32	01:32	45.00	405	47	47	22	22	35	T45		
06:34	01:34	40.00	360	46	46	21	21	34			
06:36	01:36	30.00	270	43	43	20	20	32			
06:38	01:38	20.00	180	38	38	18	18	28			

Table A-4-4 Data Sheet of PBT-L1(2)

1991.6-7

PLATE BEARING TEST				Measuring Point PBT-L1 (LA-1 20.2m)				DATA SHEET (2)	
Time (h.m)	Elapse (h.m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ 100 mm)				Remarks	
				Dial Gauge Reading of Displacement					
				(1)		(2)			[(1)+(2)]/2
D. Read	Disp.	D. Read	Disp.						
06:40	01:40	10.00	90	26	26	15	15	21	
06:42	01:42	5.00	45	19	19	12	12	16	
06:44	01:44	0.00	0	11	11	9	9	10	
06:48	01:48	0.00	0	11	11	9	9	10	B45
06:50	01:50	10.00	90	16	16	12	12	14	
06:52	01:52	20.00	180	28	28	16	16	22	
06:54	01:54	30.00	270	35	35	20	20	28	
06:56	01:56	40.00	360	42	42	23	23	33	
06:58	01:58	45.00	405	45	45	25	25	35	
07:00	02:00	50.00	450	50	50	27	27	39	
07:02	02:02	55.00	495	54	54	29	29	42	
07:04	02:04	60.00	540	60	60	32	32	46	
07:08	02:08	60.00	540	61	61	32	32	47	T60
07:10	02:10	50.00	450	60	60	31	31	46	
07:12	02:12	40.00	360	56	56	30	30	43	
07:14	02:14	30.00	270	52	52	29	29	41	
07:16	02:16	20.00	180	47	47	27	27	37	
07:18	02:18	10.00	90	36	36	24	24	30	
07:20	02:20	5.00	45	26	26	20	20	23	
07:22	02:22	0.00	0	17	17	15	15	16	
07:26	02:26	0.00	0	17	17	15	15	16	B60
07:28	02:28	10.00	90	25	25	18	18	22	
07:30	02:30	20.00	180	35	35	24	24	30	
07:32	02:32	30.00	270	43	43	28	28	36	
07:34	02:34	40.00	360	52	52	31	31	42	
07:36	02:36	50.00	450	60	60	34	34	47	
07:38	02:38	60.00	540	68	68	36	36	52	
07:40	02:40	60.00	540	69	69	37	37	53	T60c
07:42	02:42	60.00	540	70	70	37	37	54	Beginning of Creep
07:45	02:45	60.00	540	71	71	38	38	55	
07:50	02:50	60.00	540	71	71	38	38	55	
07:55	02:55	60.00	540	72	72	38	38	55	
08:00	03:00	60.00	540	72	72	38	38	55	
08:05	03:05	60.00	540	73	73	38	38	56	
08:10	03:10	60.00	540	73	73	38	38	56	
08:20	03:20	60.00	540	74	74	39	39	57	
08:30	03:30	60.00	540	74	74	39	39	57	
08:40	03:40	60.00	540	75	75	39	39	57	1 hour
09:10	04:10	60.00	540	75	75	39	39	57	
09:40	04:40	60.00	540	76	76	39	39	58	2 hours
10:10	05:10	60.00	540	76	76	39	39	58	
10:40	05:40	60.00	540	77	77	39	39	58	3 hours
11:10	06:10	60.00	540	77	77	40	40	59	
11:40	06:40	60.00	540	77	77	40	40	59	4 hours
12:10	07:10	60.00	540	78	78	40	40	59	
12:40	07:40	60.00	540	78	78	40	40	59	5 hours
13:10	08:10	60.00	540	78	78	40	40	59	
13:40	08:40	60.00	540	78	78	40	40	59	6 hours
13:42	08:42	50.00	450	77	77	39	39	58	End of Creep

Table A-4-5 Data Sheet of PBT-L1(3)

1991.6-7

PLATE BEARING TEST				Measuring Point PBT-L1 (LA-1 20.2m) DATA SHEET (3)					
Time (h. m)	Elapse (h. m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ 100 mm)				Remarks	
				Dial Gauge Reading of Displacement					
				(1)		(2)			[(1)+(2)]/2
D. Read	Disp.	D. Read	Disp.						
13:44	08:44	40.00	360	74	74	38	38	56	
13:46	08:46	30.00	270	70	70	36	36	53	
13:48	08:48	20.00	180	64	64	33	33	49	
13:50	08:50	10.00	90	54	54	29	29	42	
13:52	08:52	5.00	45	45	45	25	25	35	
13:54	08:54	0.00	0	36	36	20	20	28	
13:58	08:58	0.00	0	36	36	20	20	28	B60c
14:00	09:00	10.00	90	48	48	25	25	37	
14:02	09:02	20.00	180	57	57	30	30	44	
14:04	09:04	30.00	270	64	64	34	34	49	
14:06	09:06	40.00	360	70	70	38	38	54	
14:08	09:08	50.00	450	75	75	41	41	58	
14:10	09:10	60.00	540	80	80	44	44	62	
14:12	09:12	65.00	585	82	82	46	46	64	
14:16	09:16	65.00	585	83	83	47	47	65	T65-1
14:18	09:18	60.00	540	82	82	47	47	65	
14:20	09:20	50.00	450	80	80	45	45	63	
14:22	09:22	40.00	360	76	76	43	43	60	
14:24	09:24	30.00	270	71	71	41	41	56	
14:26	09:26	20.00	180	65	65	37	37	51	
14:28	09:28	10.00	90	56	56	32	32	44	
14:30	09:30	5.00	45	50	50	28	28	39	
14:34	09:34	0.00	0	39	39	22	22	31	
14:36	09:36	0.00	0	39	39	22	22	31	B65-1
14:38	09:38	10.00	90	52	52	27	27	40	
14:40	09:40	20.00	180	61	61	31	31	46	
14:42	09:42	30.00	270	67	67	35	35	51	
14:44	09:44	40.00	360	72	72	39	39	56	
14:46	09:46	50.00	450	77	77	43	43	60	
14:48	09:48	60.00	540	82	82	46	46	64	
14:50	09:50	65.00	585	84	84	48	48	66	
14:54	09:54	65.00	585	84	84	48	48	66	T65-2
14:56	09:56	60.00	540	84	84	48	48	66	
14:58	09:58	50.00	450	82	82	46	46	64	
15:00	10:00	40.00	360	79	79	44	44	62	
15:02	10:02	30.00	270	75	75	42	42	59	
15:04	10:04	20.00	180	69	69	39	39	54	
15:06	10:06	10.00	90	60	60	34	34	47	
15:08	10:08	5.00	45	52	52	29	29	41	
15:12	10:12	0.00	0	42	42	24	24	33	
15:14	10:14	0.00	0	42	42	24	24	33	B65-2
									The End

Table A-4-6 Data Sheet of PBT-L1(4)

1991.6-7

PLATE BEARING TEST	Measuring Point	PBT-L1 (LA-1 20.2m)	DATA SHEET (4)
Test Location	LA-1 (Left Bank)	Geological	Dolerite - Basalt
Plate Radius (a) =	15.00 cm ²	Classification	CH
Loading Plate area =	707 cm ²	Max. Load Stress	78 kg/cm ²
		Date Measured	'91/6/20
		Measured by	M. Rivas V.
		Capacity	55.2 ton

Deformation Measurement Results

Stress (kg/cm ²)	Deformation (1/ 100 mm)				
	δ	δe	δp	Σ δ	Σ δp
0	0	0	0	0	0
15	16	14	2	16	2
0				2	
15	15	14	1	17	3
0				3	
15	15	14	1	18	4
0				4	
30	20	19	1	24	5
0				5	
45	30	25	5	35	10
0				10	
60	37	31	6	47	16
0 Creep				16	
60 0 h.	(	0 %)		53	
60 1 h.	(	67 %)		57	
60 3 h.	(	83 %)		58	
60 6 h.	(	100 %)		59	28
0				28	
65	37	34	3	65	31
0				31	
20 0	0			46	
30 10	5			51	
40 20	10			56	
50 30	14			60	
60 40	18			64	
65	35	33	2	66	33
0				33	

Remarks

- δ : Total Deformation
- δe : Elastic Deformation
- δp : Plastic Deformation
- Σ δ : Cumulative Total Deformation
- Σ δp : Cumulative Plastic Deformation

Creep Calculation

Elastic Deformation Just Before Creep δe (1/ 100 mm)	31
Creep Deformation δc (1/ 100 mm)	6
Creep Factor Cf (%) = (δc/δe)*100	19

Modulus of Deformation (D) and Modulus of Elasticity (E) Calculation Formula

$$D \text{ or } E = \frac{\pi a(1-\nu^2)}{2} * \frac{\Delta \sigma}{\Delta \delta}$$

- a : Plate radius 15 (cm)
- ν : Poisson's ratio 0.2
- Δσ : Stress increment (kg/cm²)
- Δδ : Deformation increment due to Δσ
- $\pi a(1-\nu^2)/2 = 22.6194 \text{ cm}$

Coefficients Related to Deformation

Modulus of Deformation	D =	28,000	kg/cm ²
Tangential Modulus of Elasticity	Et =	48,000	kg/cm ²
Secant Modulus of Elasticity	Es =	42,000	kg/cm ²

Table A-4-7 Data Sheet of PBT-L2(1)

1991.6-7

PLATE BEARING TEST				Measuring Point <u>PBT-L2 (LA-1 25.0m)</u>				DATA SHEET (1)			
Test Location <u>LA-1 (Left Bank)</u>		Geological <u>Dolerite - Basalt</u>		Date Measured <u>'91/6/19</u>		Loading Plate Radius = <u>15.00</u> cm		Classification <u>CH</u>		Measured by <u>M. Rivas V.</u>	
Loading Plate area = <u>707</u> cm ²		Max. Load Stress <u>78</u> kg/cm ²		J. Capa. <u>55.2</u> ton		Jack Ram Diameter = <u>10.00</u> cm		Max. Oil Pressur <u>703</u> kg/cm ²			
Time Interval = <u>00:02</u> (h:m)		Top = <u>00:04</u> (h:m)		Bottom = <u>00:04</u> (h:m)		Load Rate (Virgin) = <u>5</u> (kg/cm ² /min)		Load Rate (Hysteresis) = <u>10</u> (kg/cm ² /min)			
Time (h. m)	Elapse (h. m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ <u>100</u> mm)				Dial Gauge Reading of Displacement	Remarks		
				(1)		(2)				[(1)+(2)]/2	
				D. Read	Disp.	D. Read	Disp.				
06:00	00:00	0.00	0	0	0	0	0	0	Start		
06:02	00:02	5.00	45	1	1	0	0	1			
06:04	00:04	10.00	90	10	10	5	5	8			
06:06	00:06	15.00	135	15	15	10	10	13			
06:10	00:10	15.00	135	15	15	10	10	13	Top15		
06:12	00:12	5.00	45	9	9	5	5	7			
06:14	00:14	0.00	0	2	2	2	2	2			
06:18	00:18	0.00	0	2	2	2	2	2	Bottom15		
06:20	00:20	10.00	90	11	11	4	4	8			
06:22	00:22	15.00	135	16	16	9	9	13			
06:26	00:26	15.00	135	16	16	10	10	13	T15-2		
06:28	00:28	5.00	45	9	9	4	4	7			
06:30	00:30	0.00	0	3	3	2	2	3			
06:34	00:34	0.00	0	3	3	2	2	3	B15-2		
06:36	00:36	10.00	90	11	11	5	5	8			
06:38	00:38	15.00	135	15	15	10	10	13			
06:42	00:42	15.00	135	17	17	10	10	14	T15-3		
06:44	00:44	5.00	45	17	17	5	5	11			
06:46	00:46	0.00	0	4	4	3	3	4			
06:50	00:50	0.00	0	4	4	3	3	4	B15-3		
06:52	00:52	10.00	90	11	11	6	6	9			
06:54	00:54	15.00	135	16	16	10	10	13			
06:56	00:56	20.00	180	21	21	13	13	17			
06:58	00:58	25.00	225	24	24	16	16	20			
07:00	01:00	30.00	270	26	26	20	20	23			
07:04	01:04	30.00	270	27	27	20	20	24	T30		
07:06	01:06	20.00	180	26	26	19	19	23			
07:08	01:08	10.00	90	19	19	11	11	15			
07:10	01:10	5.00	45	11	11	5	5	8			
07:12	01:12	0.00	0	5	5	4	4	5			
07:16	01:16	0.00	0	5	5	4	4	5	B30		
07:18	01:18	10.00	90	11	11	7	7	9			
07:20	01:20	20.00	180	21	21	13	13	17			
07:22	01:22	30.00	270	26	26	19	19	23			
07:24	01:24	35.00	315	29	29	23	23	26			
07:26	01:26	40.00	360	32	32	26	26	29			
07:28	01:28	45.00	405	35	35	29	29	32			
07:32	01:32	45.00	405	35	35	29	29	32	T45		
07:34	01:34	40.00	360	35	35	29	29	32			
07:36	01:36	30.00	270	32	32	27	27	30			
07:38	01:38	20.00	180	29	29	27	27	28			

Table A-4-8 Data Sheet of PBT-L2(2)

1991.6-7

PLATE BEARING TEST				Measuring Point PBT-L2 (LA-1 25.0m)				DATA SHEET (2)	
Time (h. m)	Elapse (h. m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ 100 mm)				Remarks	
				Dial Gauge Reading of Displacement					
				(1)		(2)			[(1) + (2)]/2
D. Read	Disp.	D. Read	Disp.						
07:40	01:40	10.00	90	20	20	15	15	18	
07:42	01:42	5.00	45	12	12	9	9	11	
07:44	01:44	0.00	0	6	6	5	5	6	
07:48	01:48	0.00	0	6	6	5	5	6	B45
07:50	01:50	10.00	90	11	11	8	8	10	
07:52	01:52	20.00	180	21	21	17	17	19	
07:54	01:54	30.00	270	27	27	23	23	25	
07:56	01:56	40.00	360	32	32	28	28	30	
07:58	01:58	45.00	405	34	34	31	31	33	
08:00	02:00	50.00	450	37	37	35	35	36	
08:02	02:02	55.00	495	39	39	37	37	38	
08:04	02:04	60.00	540	42	42	40	40	41	
08:08	02:08	60.00	540	42	42	40	40	41	T60
08:10	02:10	50.00	450	42	42	40	40	41	
08:12	02:12	40.00	360	40	40	38	38	39	
08:14	02:14	30.00	270	37	37	35	35	36	
08:16	02:16	20.00	180	33	33	30	30	32	
08:18	02:18	10.00	90	24	24	22	22	23	
08:20	02:20	5.00	45	14	14	13	13	14	
08:22	02:22	0.00	0	7	7	7	7	7	
08:26	02:26	0.00	0	7	7	7	7	7	B60
08:28	02:28	10.00	90	13	13	12	12	13	
08:30	02:30	20.00	180	24	24	22	22	23	
08:32	02:32	30.00	270	30	30	28	28	29	
08:34	02:34	40.00	360	35	35	35	35	35	
08:36	02:36	50.00	450	40	40	40	40	40	
08:38	02:38	60.00	540	44	44	44	44	44	
08:40	02:40	60.00	540	44	44	44	44	44	T60c
08:42	02:42	60.00	540	44	44	44	44	44	Beginning of Creep
08:45	02:45	60.00	540	44	44	44	44	44	
08:50	02:50	60.00	540	45	45	44	44	45	
08:55	02:55	60.00	540	45	45	44	44	45	
09:00	03:00	60.00	540	45	45	44	44	45	
09:05	03:05	60.00	540	45	45	44	44	45	
09:10	03:10	60.00	540	45	45	44	44	45	
09:20	03:20	60.00	540	46	46	45	45	46	
09:30	03:30	60.00	540	46	46	45	45	46	
09:40	03:40	60.00	540	46	46	45	45	46	1 hour
10:10	04:10	60.00	540	46	46	46	46	46	
10:40	04:40	60.00	540	47	47	46	46	47	2 hours
11:10	05:10	60.00	540	47	47	46	46	47	
11:40	05:40	60.00	540	48	48	46	46	47	3 hours
12:10	06:10	60.00	540	48	48	46	46	47	
12:40	06:40	60.00	540	48	48	47	47	48	4 hours
13:10	07:10	60.00	540	48	48	47	47	48	
13:40	07:40	60.00	540	48	48	47	47	48	5 hours
14:10	08:10	60.00	540	48	48	47	47	48	
14:40	08:40	60.00	540	48	48	47	47	48	6 hours
14:42	08:42	50.00	450	47	47	46	46	47	End of Creep

Table A-4-9 Data Sheet of PBT-L2(3)

1991.6-7

PLATE BEARING TEST				Measuring Point PBT-L2 (LA-1 25.0m)				DATA SHEET (3)	
Time (h.m)	Elapse (h.m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ 100 mm)				Remarks	
				Dial Gauge Reading of Displacement					
				(1)		(2)			[(1)+(2)]/2
D. Read	Disp.	D. Read	Disp.						
14:44	08:44	40.00	360	44	44	42	42	43	
14:46	08:46	30.00	270	40	40	40	40	40	
14:48	08:48	20.00	180	34	34	35	35	35	
14:50	08:50	10.00	90	27	27	25	25	26	
14:52	08:52	5.00	45	18	18	18	18	18	
14:54	08:54	0.00	0	11	11	11	11	11	
14:58	08:58	0.00	0	11	11	11	11	11	B60c
15:00	09:00	10.00	90	17	17	16	16	17	
15:02	09:02	20.00	180	28	28	26	26	27	
15:04	09:04	30.00	270	34	34	32	32	33	
15:06	09:06	40.00	360	39	39	39	39	39	
15:08	09:08	50.00	450	43	43	43	43	43	
15:10	09:10	60.00	540	46	46	47	47	47	
15:12	09:12	65.00	585	49	49	50	50	50	
15:16	09:16	65.00	585	49	49	50	50	50	T65-1
15:18	09:18	60.00	540	49	49	50	50	50	
15:20	09:20	50.00	450	48	48	49	49	49	
15:22	09:22	40.00	360	45	45	46	46	46	
15:24	09:24	30.00	270	41	41	43	43	42	
15:26	09:26	20.00	180	35	35	38	38	37	
15:28	09:28	10.00	90	28	28	28	28	28	
15:30	09:30	5.00	45	19	19	21	21	20	
15:34	09:34	0.00	0	12	12	12	12	12	
15:36	09:36	0.00	0	12	12	12	12	12	B65-1
15:38	09:38	10.00	90	18	18	17	17	18	
15:40	09:40	20.00	180	29	29	27	27	28	
15:42	09:42	30.00	270	35	35	33	33	34	
15:44	09:44	40.00	360	40	40	40	40	40	
15:46	09:46	50.00	450	44	44	44	44	44	
15:48	09:48	60.00	540	47	47	47	47	47	
15:50	09:50	65.00	585	50	50	50	50	50	
15:54	09:54	65.00	585	50	50	50	50	50	T65-2
15:56	09:56	60.00	540	50	50	50	50	50	
15:58	09:58	50.00	450	49	49	50	50	50	
16:00	10:00	40.00	360	46	46	47	47	47	
16:02	10:02	30.00	270	42	42	44	44	43	
16:04	10:04	20.00	180	36	36	38	38	37	
16:06	10:06	10.00	90	29	29	30	30	30	
16:08	10:08	5.00	45	20	20	22	22	21	
16:12	10:12	0.00	0	13	13	12	12	13	
16:14	10:14	0.00	0	13	13	12	12	13	B65-2
									The End

Table A-4-10 Data Sheet of PBT-L2(4)

1991.6-7

PLATE BEARING TEST	Measuring Point	PBT-L2 (LA-1 25.0m)	DATA SHEET (4)
Test Location	LA-1 (Left Bank)	Geological	Dolerite - Basalt
Plate Radius (a) =	15.00 cm ²	Classification	CH
Loading Plate area =	707 cm ²	Max. Load Stress	78 kg/cm ²
		Date Measured	'91/6/19
		Measured by	M.Rivas V.
		Capacity	55.2 ton

Deformation Measurement Results

Stress (kg/cm ²)	Deformation (1/ 100 mm)				
	δ	δe	δp	Σ δ	Σ δp
0	0	0	0	0	0
15	13	11	2	13	2
0				2	
15	11	10	1	13	3
0				3	
15	11	10	1	14	4
0				4	
30	20	19	1	24	5
0				5	
45	27	26	1	32	6
0				6	
60	35	34	1	41	7
0 Creep				7	
60 0 h.	(	0 %)		44	
60 1 h.	(	50 %)		46	
60 3 h.	(	75 %)		47	
60 6 h.	(	100 %)		48	14
0				11	
65	39	38	1	50	12
0				12	
20 0	0			28	
30 10	6			34	
40 20	12			40	
50 30	16			44	
60 40	19			47	
65	38	37	1	50	13
0				13	

Remarks

- δ : Total Deformation
- δe : Elastic Deformation
- δp : Plastic Deformation
- Σ δ : Cumulative Total Deformation
- Σ δp : Cumulative Plastic Deformation

Creep Calculation

Elastic Deformation Just Before Creep δe (1/ 100 mm)	34
Creep Deformation δc (1/ 100 mm)	4
Creep Factor CF (%) = (δc/δe)*100	12

Modulus of Deformation (D) and Modulus of Elasticity (E)
Calculation Formula

$$D \text{ or } E = \frac{\pi a(1-\nu^2)}{2} * \frac{\Delta \sigma}{\Delta \delta}$$

- a : Plate radius 15 (cm)
- ν : Poisson's ratio 0.2
- Δσ : Stress increment (kg/cm²)
- Δδ : Deformation increment due to Δσ
πa(1-ν²)/2 = 22.6194 cm

Coefficients Related to Deformation

Modulus of Deformation	D =	31,000	kg/cm ²
Tangential Modulus of Elasticity	Et =	43,000	kg/cm ²
Secant Modulus of Elasticity	Es =	38,000	kg/cm ²

Table A-4-11 Data Sheet of PBT-L3(1)

1991.6-7

PLATE BEARING TEST				Measuring Point <u>PBT-L3 (LA-1 28.5m)</u>				DATA SHEET (1)			
Test Location <u>LA-1 (Left Bank)</u>		Geological <u>Dolerite - Basalt</u>		Date Measured <u>'91/6/18</u>		Loading Plate Radius = <u>15.00</u> cm		Classification <u>CH</u>		Measured by <u>M. Rivas V.</u>	
Loading Plate area = <u>707</u> cm ²		Max. Load Stress <u>78</u> kg/cm ²		J. Capa. <u>55.2</u> ton		Jack Ram Diameter = <u>10.00</u> cm		Max. Oil Pressur <u>703</u> kg/cm ²			
Time Interval = <u>00:02</u> (h:m)		Top = <u>00:04</u> (h:m)		Bottom = <u>00:04</u> (h:m)		Load Rate (Virgin) = <u>5</u> (kg/cm ² /min)		Load Rate (Hysteresis) = <u>10</u> (kg/cm ² /min)			
Time (h.m)	Elapse (h.m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ <u>100</u> mm)				Remarks			
				Dial Gauge Reading of Displacement							
				(1)		(2)			[(1)+(2)]/2		
D. Read	Disp.	D. Read	Disp.								
06:00	00:00	0.00	0	0	0	0	0	0	Start		
06:02	00:02	5.00	45	2	2	2	2	2			
06:04	00:04	10.00	90	4	4	3	3	4			
06:06	00:06	15.00	135	6	6	6	6	6			
06:10	00:10	15.00	135	6	6	6	6	6	Top15		
06:12	00:12	5.00	45	4	4	5	5	5			
06:14	00:14	0.00	0	1	1	2	2	2			
06:18	00:18	0.00	0	1	1	2	2	2	Bottom15		
06:20	00:20	10.00	90	3	3	4	4	4			
06:22	00:22	15.00	135	7	7	7	7	7			
06:26	00:26	15.00	135	7	7	7	7	7	T15-2		
06:28	00:28	5.00	45	5	5	5	5	5			
06:30	00:30	0.00	0	2	2	3	3	3			
06:34	00:34	0.00	0	2	2	3	3	3	B15-2		
06:36	00:36	10.00	90	4	4	7	7	6			
06:38	00:38	15.00	135	8	8	9	9	9			
06:42	00:42	15.00	135	8	8	9	9	9	T15-3		
06:44	00:44	5.00	45	6	6	7	7	7			
06:46	00:46	0.00	0	3	3	4	4	4			
06:50	00:50	0.00	0	3	3	4	4	4	B15-3		
06:52	00:52	10.00	90	5	5	6	6	6			
06:54	00:54	15.00	135	8	8	10	10	9			
06:56	00:56	20.00	180	11	11	15	15	13			
06:58	00:58	25.00	225	13	13	18	18	16			
07:00	01:00	30.00	270	17	17	21	21	19			
07:04	01:04	30.00	270	18	18	22	22	20	T30		
07:06	01:06	20.00	180	17	17	21	21	19			
07:08	01:08	10.00	90	12	12	14	14	13			
07:10	01:10	5.00	45	8	8	10	10	9			
07:12	01:12	0.00	0	4	4	6	6	5			
07:16	01:16	0.00	0	4	4	6	6	5	B30		
07:18	01:18	10.00	90	8	8	8	8	8			
07:20	01:20	20.00	180	14	14	17	17	16			
07:22	01:22	30.00	270	20	20	23	23	22			
07:24	01:24	35.00	315	23	23	26	26	25			
07:26	01:26	40.00	360	26	26	29	29	28			
07:28	01:28	45.00	405	29	29	36	36	33			
07:32	01:32	45.00	405	30	30	36	36	33	T45		
07:34	01:34	40.00	360	30	30	36	36	33			
07:36	01:36	30.00	270	27	27	33	33	30			
07:38	01:38	20.00	180	22	22	28	28	25			

Table A-4-12 Data Sheet of PBT-L3(2)

1991.6-7

PLATE BEARING TEST			Measuring Point PBT-L3 (LA-1 28.5m)				DATA SHEET (2)		
Time (h. m)	Elapse (h. m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ 100 mm) Dial Gauge Reading of Displacement				[(1)+(2)]/2	Remarks
				(1)		(2)			
				D. Read	Disp.	D. Read	Disp.		
07:40	01:40	10.00	90	16	16	20	20	18	
07:42	01:42	5.00	45	11	11	14	14	13	
07:44	01:44	0.00	0	6	6	9	9	8	
07:48	01:48	0.00	0	6	6	9	9	8	B45
07:50	01:50	10.00	90	12	12	14	14	13	
07:52	01:52	20.00	180	18	18	23	23	21	
07:54	01:54	30.00	270	24	24	28	28	26	
07:56	01:56	40.00	360	30	30	33	33	32	
07:58	01:58	45.00	405	33	33	36	36	35	
08:00	02:00	50.00	450	36	36	39	39	38	
08:02	02:02	55.00	495	40	40	41	41	41	
08:04	02:04	60.00	540	43	43	46	46	45	
08:08	02:08	60.00	540	45	45	47	47	46	T60
08:10	02:10	50.00	450	45	45	46	46	46	
08:12	02:12	40.00	360	43	43	43	43	43	
08:14	02:14	30.00	270	38	38	40	40	39	
08:16	02:16	20.00	180	30	30	36	36	33	
08:18	02:18	10.00	90	22	22	27	27	25	
08:20	02:20	5.00	45	17	17	20	20	19	
08:22	02:22	0.00	0	11	11	13	13	12	
08:26	02:26	0.00	0	11	11	13	13	12	B60
08:28	02:28	10.00	90	17	17	19	19	18	
08:30	02:30	20.00	180	27	27	26	26	27	
08:32	02:32	30.00	270	33	33	32	32	33	
08:34	02:34	40.00	360	38	38	38	38	38	
08:36	02:36	50.00	450	43	43	43	43	43	
08:38	02:38	60.00	540	47	47	47	47	47	
08:40	02:40	60.00	540	49	49	48	48	49	T60c
08:42	02:42	60.00	540	50	50	49	49	50	Beginning
08:45	02:45	60.00	540	51	51	50	50	51	of Creep
08:50	02:50	60.00	540	51	51	50	50	51	
08:55	02:55	60.00	540	51	51	50	50	51	
09:00	03:00	60.00	540	52	52	50	50	51	
09:05	03:05	60.00	540	52	52	50	50	51	
09:10	03:10	60.00	540	52	52	50	50	51	
09:20	03:20	60.00	540	53	53	51	51	52	
09:30	03:30	60.00	540	53	53	51	51	52	
09:40	03:40	60.00	540	53	53	51	51	52	1 hour
10:10	04:10	60.00	540	53	53	52	52	53	
10:40	04:40	60.00	540	53	53	52	52	53	2 hours
11:10	05:10	60.00	540	54	54	53	53	54	
11:40	05:40	60.00	540	54	54	53	53	54	3 hours
12:10	06:10	60.00	540	54	54	53	53	54	
12:40	06:40	60.00	540	54	54	53	53	54	4 hours
13:10	07:10	60.00	540	54	54	53	53	54	
13:40	07:40	60.00	540	54	54	53	53	54	5 hours
14:10	08:10	60.00	540	54	54	53	53	54	
14:40	08:40	60.00	540	54	54	53	53	54	6 hours
14:42	08:42	50.00	450	53	53	52	52	53	End of Creep

Table A-4-13 Data Sheet of PBT-L3(3)

1991.6-7

PLATE BEARING TEST				Measuring Point PBT-L3 (LA-1 28.5m)				DATA SHEET (3)	
Time (h. m)	Elapse (h. m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ 100 mm)				Remarks	
				Dial Gauge Reading of Displacement					
				(1)		(2)			[(1) + (2)]/2
D. Read	Disp.	D. Read	Disp.						
14:44	08:44	40.00	360	50	50	50	50	50	
14:46	08:46	30.00	270	45	45	47	47	46	
14:48	08:48	20.00	180	38	38	41	41	40	
14:50	08:50	10.00	90	30	30	33	33	32	
14:52	08:52	5.00	45	23	23	26	26	28	
14:54	08:54	0.00	0	16	16	18	18	21	
14:58	08:58	0.00	0	16	16	18	18	17	B60c
15:00	09:00	10.00	90	22	22	26	26	21	
15:02	09:02	20.00	180	31	31	33	33	28	
15:04	09:04	30.00	270	37	37	39	39	35	
15:06	09:06	40.00	360	45	45	44	44	41	
15:08	09:08	50.00	450	50	50	49	49	47	
15:10	09:10	60.00	540	53	53	52	52	51	
15:12	09:12	65.00	585	55	55	54	54	54	
15:16	09:16	65.00	585	55	55	54	54	55	T65-1
15:18	09:18	60.00	540	55	55	54	54	55	
15:20	09:20	50.00	450	54	54	52	52	54	
15:22	09:22	40.00	360	52	52	50	50	52	
15:24	09:24	30.00	270	48	48	47	47	50	
15:26	09:26	20.00	180	42	42	43	43	46	
15:28	09:28	10.00	90	34	34	35	35	39	
15:30	09:30	5.00	45	26	26	27	27	31	
15:34	09:34	0.00	0	17	17	20	20	23	
15:36	09:36	0.00	0	17	17	20	20	19	B65-1
15:38	09:38	10.00	90	25	25	28	28	27	
15:40	09:40	20.00	180	34	34	36	36	35	
15:42	09:42	30.00	270	41	41	42	42	42	
15:44	09:44	40.00	360	47	47	47	47	47	
15:46	09:46	50.00	450	51	51	51	51	51	
15:48	09:48	60.00	540	55	55	54	54	55	
15:50	09:50	65.00	585	57	57	56	56	57	
15:54	09:54	65.00	585	57	57	56	56	57	T65-2
15:56	09:56	60.00	540	57	57	56	56	57	
15:58	09:58	50.00	450	56	56	55	55	56	
16:00	10:00	40.00	360	53	53	52	52	53	
16:02	10:02	30.00	270	49	49	48	48	49	
16:04	10:04	20.00	180	44	44	44	44	44	
16:06	10:06	10.00	90	35	35	37	37	36	
16:08	10:08	5.00	45	28	28	30	30	29	
16:12	10:12	0.00	0	18	18	21	21	20	
16:14	10:14	0.00	0	18	18	21	21	20	B65-2
									The End

Table A-4-14 Data Sheet of PBT-L3(4)

1991.6-7

PLATE BEARING TEST	Measuring Point	PBT-L3 (LA-1 28.5m)	DATA SHEET (4)
Test Location	LA-1 (Left Bank)	Geological	Dolerite - Basalt
Date Measured	'91/6/18		
Plate Radius (a) =	15.00 cm ²	Classification	CH
Measured by	M.Rivas V.		
Loading Plate area =	707 cm ²	Max.Load Stress	78 kg/cm ²
Capacity	55.2 ton		

Deformation Measurement Results

Stress (kg/cm ²)	Deformation (1/ 100 mm)				
	δ	δe	δp	Σ δ	Σ δp
0	0	0	0	0	0
15	6	4	2	6	2
0				2	
15	5	4	1	7	3
0				3	
15	6	5	1	9	4
0				4	
30	16	15	1	20	5
0				5	
45	28	25	3	33	8
0				8	
60	38	34	4	46	12
0 Creep				12	
60 0 h.	(	0 %		49	
60 1 h.	(	60 %		52	
60 3 h.	(	100 %		54	
60 6 h.	(	100 %		54	20
0				17	
65	38	36	2	55	19
0				19	
20 0	0			35	
30 10	7			42	
40 20	12			47	
50 30	16			51	
60 40	20			55	
65	38	37	1	57	20
0				20	

Remarks

- δ : Total Deformation
- δe : Elastic Deformation
- δp : Plastic Deformation
- Σ δ : Cumulative Total Deformation
- Σ δp : Cumulative Plastic Deformation

Creep Calculation

Elastic Deformation Just Before Creep δe (1/ 100 mm)	34
Creep Deformation δc (1/ 100 mm)	5
Creep Factor Cf (%) = (δc/δe)*100	15

Modulus of Deformation (D) and Modulus of Elasticity (E)

Calculation Formula

$$D \text{ or } E = \frac{\pi a(1-\nu^2)}{2} * \frac{\Delta \sigma}{\Delta \delta}$$

- a : Plate radius 15 (cm)
- ν : Poisson's ratio 0.2
- Δσ : Stress increment (kg/cm²)
- Δδ : Deformation increment due to Δσ
- $\pi a(1-\nu^2)/2 = 22.6194 \text{ cm}$

Coefficients Related to Deformation

Modulus of Deformation	D =	30,000	kg/cm ²
Tangential Modulus of Elasticity	Et =	42,000	kg/cm ²
Secant Modulus of Elasticity	Es =	38,000	kg/cm ²

Table A-4-15 Data Sheet of PBT-R1(1)

1991.6-7

PLATE BEARING TEST				Measuring Point <u>PBT-R1 (LA-2 30.8m)</u>				DATA SHEET (1)			
Test Location <u>LA-2 (Right Bank)</u>		Geological <u>Dolerite - Basalt</u>		Date Measured <u>'91/6/14</u>		Loading Plate Radius = <u>15.00</u> cm		Classification <u>CM</u>		Measured by <u>M. Rivas V.</u>	
Loading Plate area = <u>707</u> cm ²		Max. Load Stress <u>78 kg/cm²</u>		J. Capa. <u>55.2</u> ton		Jack Ram Diameter = <u>10.00</u> cm		Max. Oil Pressur <u>703 kg/cm²</u>			
Time Interval = <u>00:02</u> (h:m)		Top = <u>00:04</u> (h:m)		Bottom = <u>00:04</u> (h:m)		Load Rate (Virgin) = <u>5</u> (kg/cm ² /min)		Load Rate (Hysteresis) = <u>10</u> (kg/cm ² /min)			
Time (h.m)	Elapse (h.m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ <u>100</u> mm)				[(1)+(2)]/2	Remarks		
				Dial Gauge Reading of Displacement							
				(1)		(2)					
D. Read	Disp.	D. Read	Disp.								
07:15	00:00	0.00	0	0	0	0	0	0	Start		
07:17	00:02	5.00	45	2	2	3	3	3			
07:19	00:04	10.00	90	12	12	10	10	11			
07:21	00:06	15.00	135	21	21	18	18	20			
07:25	00:10	15.00	135	21	21	19	19	20	Top15		
07:27	00:12	5.00	45	19	19	12	12	16			
07:29	00:14	0.00	0	16	16	4	4	10			
07:33	00:18	0.00	0	16	16	4	4	10	Bottom15		
07:35	00:20	10.00	90	20	20	16	16	18			
07:37	00:22	15.00	135	22	22	22	22	22			
07:41	00:26	15.00	135	22	22	22	22	22	T15-2		
07:43	00:28	5.00	45	20	20	16	16	18			
07:45	00:30	0.00	0	17	17	8	8	13			
07:49	00:34	0.00	0	17	17	8	8	13	B15-2		
07:51	00:36	10.00	90	20	20	20	20	20			
07:53	00:38	15.00	135	23	23	25	25	24			
07:57	00:42	15.00	135	23	23	25	25	24	T15-3		
07:59	00:44	5.00	45	20	20	19	19	20			
08:01	00:46	0.00	0	18	18	12	12	15			
08:05	00:50	0.00	0	18	18	12	12	15	B15-3		
08:07	00:52	10.00	90	21	21	22	22	22			
08:09	00:54	15.00	135	23	23	26	26	25			
08:11	00:56	20.00	180	29	29	33	33	31			
08:13	00:58	25.00	225	34	34	40	40	37			
08:15	01:00	30.00	270	39	39	50	50	45			
08:19	01:04	30.00	270	40	40	50	50	45	T30		
08:21	01:06	20.00	180	38	38	49	49	44			
08:23	01:08	10.00	90	34	34	37	37	36			
08:25	01:10	5.00	45	30	30	28	28	29			
08:27	01:12	0.00	0	23	23	17	17	20			
08:31	01:16	0.00	0	23	23	17	17	20	B30		
08:33	01:18	10.00	90	31	31	32	32	32			
08:35	01:20	20.00	180	36	36	45	45	41			
08:37	01:22	30.00	270	41	41	55	55	48			
08:39	01:24	35.00	315	44	44	61	61	53			
08:41	01:26	40.00	360	49	49	70	70	60			
08:43	01:28	45.00	405	55	55	80	80	68			
08:47	01:32	45.00	405	55	55	83	83	69	T45		
08:49	01:34	40.00	360	55	55	83	83	69			
08:51	01:36	30.00	270	54	54	78	78	66			
08:53	01:38	20.00	180	51	51	69	69	60			

Table A-4-16 Data Sheet of PBT-R1(2)

1991.6-7

PLATE BEARING TEST			Measuring Point		PBT-R1 (LA-2 30.8m)		DATA SHEET (2)		
Time (h. m)	Elapse (h. m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ 100 mm)				Remarks	
				Dial Gauge Reading of Displacement					
				(1)		(2)			[(1)+(2)]/2
D. Read	Disp.	D. Read	Disp.						
08:55	01:40	10.00	90	46	46	55	55	51	
08:57	01:42	5.00	45	42	42	43	43	43	
08:59	01:44	0.00	0	35	35	30	30	33	
09:03	01:48	0.00	0	35	35	30	30	33	B45
09:05	01:50	10.00	90	42	42	48	48	45	
09:07	01:52	20.00	180	46	46	62	62	54	
09:09	01:54	30.00	270	50	50	73	73	62	
09:11	01:56	40.00	360	54	54	83	83	69	
09:13	01:58	45.00	405	56	56	89	89	73	
09:15	02:00	50.00	450	58	58	95	95	77	
09:17	02:02	55.00	495	60	60	105	105	83	
09:19	02:04	60.00	540	63	63	116	116	90	
09:23	02:08	60.00	540	63	63	121	121	92	T60
09:25	02:10	50.00	450	63	63	118	118	91	
09:27	02:12	40.00	360	62	62	115	115	89	
09:29	02:14	30.00	270	60	60	108	108	84	
09:31	02:16	20.00	180	58	58	96	96	77	
09:33	02:18	10.00	90	55	55	81	81	68	
09:35	02:20	5.00	45	53	53	70	70	62	
09:37	02:22	0.00	0	50	50	50	50	50	
09:41	02:26	0.00	0	50	50	50	50	50	B60
09:43	02:28	10.00	90	54	54	73	73	64	
09:45	02:30	20.00	180	57	57	87	87	72	
09:47	02:32	30.00	270	59	59	100	100	80	
09:49	02:34	40.00	360	61	61	111	111	86	
09:51	02:36	50.00	450	63	63	120	120	92	
09:53	02:38	60.00	540	65	65	130	130	98	
09:55	02:40	60.00	540	65	65	133	133	99	T60c
09:57	02:42	60.00	540	65	65	134	134	100	Beginning of Creep
10:00	02:45	60.00	540	66	66	135	135	101	
10:05	02:50	60.00	540	67	67	136	136	102	
10:10	02:55	60.00	540	67	67	137	137	102	
10:15	03:00	60.00	540	67	67	138	138	103	
10:20	03:05	60.00	540	67	67	139	139	103	
10:25	03:10	60.00	540	68	68	140	140	104	
10:35	03:20	60.00	540	68	68	140	140	104	
10:45	03:30	60.00	540	69	69	142	142	106	
10:55	03:40	60.00	540	69	69	143	143	106	1 hour
11:25	04:10	60.00	540	70	70	144	144	107	
11:55	04:40	60.00	540	71	71	146	146	109	2 hours
12:25	05:10	60.00	540	72	72	148	148	110	
12:55	05:40	60.00	540	73	73	150	150	112	3 hours
13:25	06:10	60.00	540	74	74	152	152	113	
13:55	06:40	60.00	540	74	74	153	153	114	4 hours
14:25	07:10	60.00	540	74	74	153	153	114	
14:55	07:40	60.00	540	74	74	154	154	114	5 hours
15:25	08:10	60.00	540	74	74	155	155	115	
15:55	08:40	60.00	540	74	74	155	155	115	6 hours
15:57	08:42	50.00	450	73	73	154	154	114	End of Creep

Table A-4-17 Data Sheet of PBT-R1(3)

1991.6-7

PLATE BEARING TEST				Measuring Point PBT-R1 (LA-2 30.8m)				DATA SHEET (3)	
Time (h.m)	Elapse (h.m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ 100 mm)				Remarks	
				Dial Gauge Reading of Displacement					
				(1)		(2)			[(1)+(2)]/2
D. Read	Disp.	D. Read	Disp.						
15:59	08:44	40.00	360	72	72	148	148	110	
16:01	08:46	30.00	270	71	71	141	141	106	
16:03	08:48	20.00	180	69	69	130	130	100	
16:05	08:50	10.00	90	67	67	117	117	92	
16:07	08:52	5.00	45	65	65	105	105	85	
16:09	08:54	0.00	0	61	61	90	90	76	
16:13	08:58	0.00	0	61	61	90	90	76	B60c
16:15	09:00	10.00	90	64	64	114	114	89	
16:17	09:02	20.00	180	67	67	128	128	98	
16:19	09:04	30.00	270	69	69	140	140	105	
16:21	09:06	40.00	360	71	71	150	150	111	
16:23	09:08	50.00	450	73	73	158	158	116	
16:25	09:10	60.00	540	75	75	165	165	120	
16:27	09:12	65.00	585	78	78	171	171	125	
16:31	09:16	65.00	585	78	78	172	172	125	T65-1
16:33	09:18	60.00	540	77	77	171	171	124	
16:35	09:20	50.00	450	76	76	167	167	122	
16:37	09:22	40.00	360	74	74	162	162	118	
16:39	09:24	30.00	270	72	72	153	153	113	
16:41	09:26	20.00	180	70	70	142	142	106	
16:43	09:28	10.00	90	67	67	130	130	99	
16:45	09:30	5.00	45	66	66	118	118	92	
16:49	09:34	0.00	0	63	63	100	100	82	
16:51	09:36	0.00	0	63	63	100	100	82	B65-1
16:53	09:38	10.00	90	65	65	120	120	93	
16:55	09:40	20.00	180	68	68	133	133	101	
16:57	09:42	30.00	270	70	70	146	146	108	
16:59	09:44	40.00	360	72	72	155	155	114	
17:01	09:46	50.00	450	74	74	166	166	120	
17:03	09:48	60.00	540	76	76	173	173	125	
17:05	09:50	65.00	585	79	79	179	179	129	
17:09	09:54	65.00	585	79	79	182	182	131	T65-2
17:11	09:56	60.00	540	78	78	180	180	129	
17:13	09:58	50.00	450	77	77	176	176	127	
17:15	10:00	40.00	360	75	75	169	169	122	
17:17	10:02	30.00	270	73	73	162	162	118	
17:19	10:04	20.00	180	71	71	152	152	112	
17:21	10:06	10.00	90	69	69	137	137	103	
17:23	10:08	5.00	45	67	67	126	126	97	
17:27	10:12	0.00	0	64	64	117	117	91	
17:29	10:14	0.00	0	64	64	117	117	91	B65-2
									The End

Table A-4-18 Data Sheet of PBT-R1(4)

1991.6-7

PLATE BEARING TEST Measuring Point PBT-R1 (LA-2 30.8m) DATA SHEET (4)

Test Location LA-2 (Right Bank) Geological Dolerite - Basalt Date Measured 91/6/14

Plate Radius (a) = 15.00 cm² Classification CM Measured by M.Rivas V.

Loading Plate area = 707 cm² Max.Load Stress 78 kg/cm² Capacity 55.2 ton

Deformation Measurement Results

Stress (kg/cm ²)	Deformation (1/ 100 mm)				
	δ	δ _e	δ _p	Σ δ	Σ δ _p
0	0	0	0	0	0
15	20	10	10	20	10
0				10	
15	12	9	3	22	13
0				13	
15	11	9	2	24	15
0				15	
30	30	25	5	45	20
0				20	
45	49	36	13	69	33
0				33	
60	59	42	17	92	50
0 Creep				50	
60 0 h.	(	0	%)	99	
60 1 h.	(	44	%)	106	
60 3 h.	(	81	%)	112	
60 6 h.	(	100	%)	115	73
0				76	
65	49	43	6	125	82
0				82	
20 0	0			101	
30 10	7			108	
40 20	13			114	
50 30	19			120	
60 40	24			125	
65	49	40	9	131	91
0				91	

Remarks

- δ : Total Deformation
- δ_e : Elastic Deformation
- δ_p : Plastic Deformation
- Σ δ : Cumulative Total Deformation
- Σ δ_p : Cumulative Plastic Deformation

Creep Calculation

Elastic Deformation Just Before Creep δ _e (1/ 100 mm)	42
Creep Deformation δ _c (1/ 100 mm)	16
Creep Factor Cf (%) = (δ _c /δ _e)*100	38

Modulus of Deformation (D) and
Modulus of Elasticity (E)
Calculation Formula

$$D \text{ or } E = \frac{\pi a(1-\nu^2)}{2} * \frac{\Delta \sigma}{\Delta \delta}$$

- a : Plate radius 15 (cm)
- ν : Poisson's ratio 0.2
- Δ σ : Stress increment (kg/cm²)
- Δ δ : Deformation increment due to Δ σ
- π a(1-ν²)/2 = 22.6194 cm

Coefficients Related to Deformation

Modulus of Deformation	D =	14,000	kg/cm ²
Tangential Modulus of Elasticity	E _t =	36,000	kg/cm ²
Secant Modulus of Elasticity	E _s =	30,000	kg/cm ²

Table A-4-19 Data Sheet of PBT-R2(1)

1991.6-7

PLATE BEARING TEST				Measuring Point <u>PBT-R2 (LA-2 40.0m)</u>				DATA SHEET (1)			
Test Location <u>LA-2 (Right Bank)</u>		Geological <u>Dolerite - Basalt</u>		Date Measured <u>'91/6/13</u>		Loading Plate Radius = <u>15.00</u> cm		Classification <u>CM</u>		Measured by <u>M. Rivas V.</u>	
Loading Plate area = <u>707</u> cm ²		Max. Load Stress <u>78</u> kg/cm ²		J. Capa. <u>55.2</u> ton		Jack Ram Diameter = <u>10.00</u> cm		Max. Oil Pressur <u>703</u> kg/cm ²			
Time Interval = <u>00:02</u> (h:m)		Top = <u>00:04</u> (h:m)		Bottom = <u>00:04</u> (h:m)		Load Rate (Virgin) = <u>5</u> (kg/cm ² /min)		Load Rate (Hysteresis) = <u>10</u> (kg/cm ² /min)			
Time (h.m)	Elapse (h.m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ <u>100</u> mm)				Remarks			
				Dial Gauge Reading of Displacement							
				(1)		(2)			[(1)+(2)]/2		
D. Read	Disp.	D. Read	Disp.								
08:40	00:00	0.00	0	0	0	0	0	0	Start		
08:42	00:02	5.00	45	4	4	3	3	4			
08:44	00:04	10.00	90	8	8	6	6	7			
08:46	00:06	15.00	135	12	12	8	8	10			
08:50	00:10	15.00	135	12	12	9	9	11	Top15		
08:52	00:12	5.00	45	9	9	6	6	8			
08:54	00:14	0.00	0	2	2	2	2	2			
08:58	00:18	0.00	0	2	2	2	2	2	Bottom15		
09:00	00:20	10.00	90	9	9	5	5	7			
09:02	00:22	15.00	135	13	13	8	8	11			
09:06	00:26	15.00	135	13	13	8	8	11	T15-2		
09:08	00:28	5.00	45	9	9	5	5	7			
09:10	00:30	0.00	0	3	3	3	3	3			
09:14	00:34	0.00	0	3	3	3	3	3	B15-2		
09:16	00:36	10.00	90	10	10	8	8	9			
09:18	00:38	15.00	135	13	13	11	11	12			
09:22	00:42	15.00	135	13	13	11	11	12	T15-3		
09:24	00:44	5.00	45	9	9	6	6	8			
09:26	00:46	0.00	0	4	4	4	4	4			
09:30	00:50	0.00	0	4	4	4	4	4	B15-3		
09:32	00:52	10.00	90	10	10	6	6	8			
09:34	00:54	15.00	135	13	13	9	9	11			
09:36	00:56	20.00	180	18	18	12	12	15			
09:38	00:58	25.00	225	21	21	16	16	19			
09:40	01:00	30.00	270	24	24	20	20	22			
09:44	01:04	30.00	270	24	24	20	20	22	T30		
09:46	01:06	20.00	180	21	21	15	15	18			
09:48	01:08	10.00	90	18	18	11	11	15			
09:50	01:10	5.00	45	13	13	7	7	10			
09:52	01:12	0.00	0	5	5	5	5	5			
09:56	01:16	0.00	0	5	5	5	5	5	B30		
09:58	01:18	10.00	90	13	13	7	7	10			
10:00	01:20	20.00	180	21	21	14	14	18			
10:02	01:22	30.00	270	25	25	21	21	23			
10:04	01:24	35.00	315	29	29	25	25	27			
10:06	01:26	40.00	360	32	32	30	30	31			
10:08	01:28	45.00	405	35	35	34	34	35			
10:12	01:32	45.00	405	35	35	35	35	35	T45		
10:14	01:34	40.00	360	35	35	35	35	35			
10:16	01:36	30.00	270	33	33	32	32	33			
10:18	01:38	20.00	180	31	31	28	28	30			

Table A-4-20 Data Sheet of PBT-R2(2)

1991.6-7

PLATE BEARING TEST				Measuring Point PBT-R2 (LA-2 40.0m)				DATA SHEET (2)	
Time (h. m)	Elapse (h. m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ 100 mm)				Remarks	
				Dial Gauge Reading of Displacement					
				(1)		(2)			[(1) + (2)] / 2
D. Read	Disp.	D. Read	Disp.						
10:20	01:40	10.00	90	24	24	20	20	22	
10:22	01:42	5.00	45	18	18	16	16	17	
10:24	01:44	0.00	0	9	9	7	7	8	
10:28	01:48	0.00	0	9	9	7	7	8	B45
10:30	01:50	10.00	90	17	17	12	12	15	
10:32	01:52	20.00	180	25	25	20	20	23	
10:34	01:54	30.00	270	30	30	25	25	28	
10:36	01:56	40.00	360	35	35	32	32	34	
10:38	01:58	45.00	405	37	37	35	35	36	
10:40	02:00	50.00	450	39	39	37	37	38	
10:42	02:02	55.00	495	41	41	39	39	40	
10:44	02:04	60.00	540	43	43	42	42	43	
10:48	02:08	60.00	540	43	43	42	42	43	T60
10:50	02:10	50.00	450	42	42	42	42	42	
10:52	02:12	40.00	360	40	40	39	39	40	
10:54	02:14	30.00	270	38	38	34	34	36	
10:56	02:16	20.00	180	34	34	30	30	32	
10:58	02:18	10.00	90	24	24	20	20	22	
11:00	02:20	5.00	45	16	16	12	12	14	
11:02	02:22	0.00	0	10	10	8	8	9	
11:06	02:26	0.00	0	10	10	8	8	9	B60
11:08	02:28	10.00	90	13	13	14	14	14	
11:10	02:30	20.00	180	16	16	22	22	19	
11:12	02:32	30.00	270	25	25	30	30	28	
11:14	02:34	40.00	360	32	32	36	36	34	
11:16	02:36	50.00	450	39	39	40	40	40	
11:18	02:38	60.00	540	45	45	45	45	45	
11:20	02:40	60.00	540	45	45	45	45	45	T60c
11:22	02:42	60.00	540	45	45	45	45	45	Beginning of Creep
11:25	02:45	60.00	540	45	45	45	45	45	
11:30	02:50	60.00	540	45	45	46	46	46	
11:35	02:55	60.00	540	45	45	46	46	46	
11:40	03:00	60.00	540	46	46	46	46	46	
11:45	03:05	60.00	540	46	46	47	47	47	
11:50	03:10	60.00	540	46	46	47	47	47	
12:00	03:20	60.00	540	46	46	47	47	47	
12:10	03:30	60.00	540	47	47	48	48	48	
12:20	03:40	60.00	540	47	47	48	48	48	1 hour
12:50	04:10	60.00	540	47	47	48	48	48	
13:20	04:40	60.00	540	47	47	49	49	48	2 hours
13:50	05:10	60.00	540	48	48	49	49	49	
14:20	05:40	60.00	540	48	48	49	49	49	3 hours
14:50	06:10	60.00	540	48	48	50	50	49	
15:20	06:40	60.00	540	49	49	50	50	50	4 hours
15:50	07:10	60.00	540	49	49	50	50	50	
16:20	07:40	60.00	540	49	49	51	51	50	5 hours
16:50	08:10	60.00	540	50	50	51	51	51	
17:20	08:40	60.00	540	51	51	51	51	51	6 hours
17:22	08:42	50.00	450	50	50	51	51	51	End of Creep

Table A-4-21 Data Sheet of PBT-R2(3)

1991.6-7

PLATE BEARING TEST				Measuring Point PBT-R2 (LA-2 40.0m)				DATA SHEET (3)	
Time (h.m)	Elapse (h.m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ 100 mm)				Remarks	
				Dial Gauge Reading of Displacement					
				(1)		(2)			[(1)+(2)]/2
D. Read	Disp.	D. Read	Disp.						
17:24	08:44	40.00	360	49	49	50	50	50	
17:26	08:46	30.00	270	48	48	47	47	48	
17:28	08:48	20.00	180	42	42	43	43	43	
17:30	08:50	10.00	90	31	31	36	36	34	
17:32	08:52	5.00	45	21	21	27	27	24	
17:34	08:54	0.00	0	12	12	15	15	14	
17:38	08:58	0.00	0	12	12	15	15	14	B60c
17:40	09:00	10.00	90	22	22	28	28	25	
17:42	09:02	20.00	180	28	28	32	32	30	
17:44	09:04	30.00	270	36	36	38	38	37	
17:46	09:06	40.00	360	43	43	42	42	43	
17:48	09:08	50.00	450	48	48	47	47	48	
17:50	09:10	60.00	540	54	54	51	51	53	
17:52	09:12	65.00	585	56	56	53	53	55	
17:56	09:16	65.00	585	57	57	53	53	55	T65-1
17:58	09:18	60.00	540	57	57	53	53	55	
18:00	09:20	50.00	450	56	56	52	52	54	
18:02	09:22	40.00	360	54	54	50	50	52	
18:04	09:24	30.00	270	50	50	48	48	49	
18:06	09:26	20.00	180	43	43	44	44	44	
18:08	09:28	10.00	90	33	33	36	36	35	
18:10	09:30	5.00	45	24	24	29	29	27	
18:14	09:34	0.00	0	13	13	17	17	15	
18:16	09:36	0.00	0	13	13	17	17	15	B65-1
18:18	09:38	10.00	90	23	23	28	28	26	
18:20	09:40	20.00	180	30	30	34	34	32	
18:22	09:42	30.00	270	38	38	38	38	38	
18:24	09:44	40.00	360	45	45	44	44	45	
18:26	09:46	50.00	450	52	52	48	48	50	
18:28	09:48	60.00	540	56	56	52	52	54	
18:30	09:50	65.00	585	59	59	54	54	57	
18:34	09:54	65.00	585	59	59	54	54	57	T65-2
18:36	09:56	60.00	540	59	59	54	54	57	
18:38	09:58	50.00	450	58	58	53	53	56	
18:40	10:00	40.00	360	56	56	51	51	54	
18:42	10:02	30.00	270	51	51	48	48	50	
18:44	10:04	20.00	180	45	45	44	44	45	
18:46	10:06	10.00	90	34	34	36	36	35	
18:48	10:08	5.00	45	24	24	29	29	27	
18:52	10:12	0.00	0	14	14	19	19	17	
18:54	10:14	0.00	0	14	14	19	19	17	B65-2
									The End

Table A-4-22 Data Sheet of PBT-R2(4)

1991.6-7

PLATE BEARING TEST	Measuring Point	PBT-R2 (LA-2 40.0m)	DATA SHEET (4)
Test Location	LA-2 (Right Bank)	Geological	Dolerite - Basalt
Plate Radius (a) =	15.00 cm ²	Classification	CM
Loading Plate area =	707 cm ²	Max. Load Stress	78 kg/cm ²
		Capacity	55.2 ton
		Date Measured	'91/6/13
		Measured by	M.Rivas V.

Deformation Measurement Results

Remarks

Stress (kg/cm ²)	Deformation (1/ 100 mm)				
	δ	δ _e	δ _p	Σ δ	Σ δ _p
0	0	0	0	0	0
15	11	9	2	11	2
0				2	
15	9	8	1	11	3
0				3	
15	9	8	1	12	4
0				4	
30	18	17	1	22	5
0				5	
45	30	27	3	35	8
0				8	
60	35	34	1	43	9
0 Creep				9	
60 0 h.	(	0 %)		45	
60 1 h.	(	50 %)		48	
60 3 h.	(	67 %)		49	
60 6 h.	(	100 %)		51	17
0				14	
65	41	40	1	55	15
0				15	
20 0	0			32	
30 10	6			38	
40 20	13			45	
50 30	18			50	
60 40	22			54	
65	42	40	2	57	17
0				17	

- δ : Total Deformation
- δ_e : Elastic Deformation
- δ_p : Plastic Deformation
- Σ δ : Cumulative Total Deformation
- Σ δ_p : Cumulative Plastic Deformation

Creep Calculation

Elastic Deformation Just Before Creep δ _e (1/ 100 mm)	34
Creep Deformation δ _c (1/ 100 mm)	6
Creep Factor Cf (%) = (δ _c / δ _e)*100	18

Modulus of Deformation (D) and Modulus of Elasticity (E)
Calculation Formula

$$D \text{ or } E = \frac{\pi a(1-\nu^2)}{2} * \frac{\Delta \sigma}{\Delta \delta}$$

- a : Plate radius 15 (cm)
- ν : Poisson's ratio 0.2
- Δσ : Stress increment (kg/cm²)
- Δδ : Deformation increment due to Δσ
- πa(1-ν²)/2 = 22.6194 cm

Coefficients Related to Deformation

Modulus of Deformation	D =	30,000	kg/cm ²
Tangential Modulus of Elasticity	Et =	38,000	kg/cm ²
Secant Modulus of Elasticity	Es =	35,000	kg/cm ²

Table A-4-23 Data Sheet of PBT-R3(1)

1991.6-7

PLATE BEARING TEST				Measuring Point PBT-R3 (LA-2 42.0m)				DATA SHEET (1)		
Test Location		LA-2 (Right Bank)		Geological		Dolerite - Basalt		Date Measured '91/6/12		
Loading Plate Radius=		15.00 cm		Classification		CM		Measured by M. Rivas V.		
Loading Plate area =		707 cm ²		Max. Load Stress		78 kg/cm ²		J. Capa. 55.2 ton		
Jack Ram Diameter =		10.00 cm		Max. Oil Pressur		703 kg/cm ²				
Time Interval =			00:02 (h:m)			Top = 00:04 (h:m)			Bottom = 00:04 (h:m)	
Load Rate (Virgin) =			5 (kg/cm ² /min)			Load Rate (Hysteresis) =			10 (kg/cm ² /min)	
Time (h.m)	Elapse (h.m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/100 mm)				[(1) + (2)]/2	Remarks	
				Dial Gauge Reading of Displacement						
				(1)		(2)				
D. Read	Disp.	D. Read	Disp.							
06:00	00:00	0.00	0	0	0	0	0	0	Start	
06:02	00:02	5.00	45	11	11	10	10	11		
06:04	00:04	10.00	90	32	32	17	17	25		
06:06	00:06	15.00	135	42	42	24	24	33		
06:10	00:10	15.00	135	42	42	25	25	34	Top15	
06:12	00:12	5.00	45	38	38	22	22	30		
06:14	00:14	0.00	0	36	36	12	12	24		
06:18	00:18	0.00	0	36	36	12	12	24	Bottom15	
06:20	00:20	10.00	90	38	38	22	22	30		
06:22	00:22	15.00	135	39	39	26	26	33		
06:26	00:26	15.00	135	39	39	27	27	33	T15-2	
06:28	00:28	5.00	45	37	37	24	24	31		
06:30	00:30	0.00	0	35	35	16	16	26		
06:34	00:34	0.00	0	35	35	16	16	26	B15-2	
06:36	00:36	10.00	90	38	38	24	24	31		
06:38	00:38	15.00	135	40	40	32	32	36		
06:42	00:42	15.00	135	40	40	32	32	36	T15-3	
06:44	00:44	5.00	45	38	38	27	27	33		
06:46	00:46	0.00	0	35	35	19	19	27		
06:50	00:50	0.00	0	35	35	19	19	27	B15-3	
06:52	00:52	10.00	90	37	37	27	27	32		
06:54	00:54	15.00	135	39	39	31	31	35		
06:56	00:56	20.00	180	42	42	38	38	40		
06:58	00:58	25.00	225	45	45	48	48	47		
07:00	01:00	30.00	270	50	50	60	60	55		
07:04	01:04	30.00	270	50	50	66	66	58	T30	
07:06	01:06	20.00	180	49	49	65	65	57		
07:08	01:08	10.00	90	46	46	57	57	52		
07:10	01:10	5.00	45	44	44	52	52	48		
07:12	01:12	0.00	0	36	36	39	39	38		
07:16	01:16	0.00	0	36	36	39	39	38	B30	
07:18	01:18	10.00	90	37	37	47	47	42		
07:20	01:20	20.00	180	39	39	57	57	48		
07:22	01:22	30.00	270	42	42	65	65	54		
07:24	01:24	35.00	315	43	43	73	73	58		
07:26	01:26	40.00	360	45	45	85	85	65		
07:28	01:28	45.00	405	48	48	99	99	74		
07:32	01:32	45.00	405	50	50	111	111	81	T45	
07:34	01:34	40.00	360	48	48	110	110	79		
07:36	01:36	30.00	270	46	46	110	110	78		
07:38	01:38	20.00	180	44	44	106	106	75		

Table A-4-24 Data Sheet of PBT-R3(2)

1991.6-7

PLATE BEARING TEST				Measuring Point PBT-R3 (LA-2 42.0m)				DATA SHEET (2)	
Time (h. m)	Elapse (h. m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ 100 mm) Dial Gauge Reading of Displacement				Remarks	
				(1)		(2)			[(1)+(2)]/2
				D. Read	Disp.	D. Read	Disp.		
07:40	01:40	10.00	90	44	44	99	99	72	
07:42	01:42	5.00	45	41	41	90	90	66	
07:44	01:44	0.00	0	39	39	76	76	58	
07:48	01:48	0.00	0	38	38	76	76	57	B45
07:50	01:50	10.00	90	42	42	85	85	64	
07:52	01:52	20.00	180	45	45	95	95	70	
07:54	01:54	30.00	270	47	47	103	103	75	
07:56	01:56	40.00	360	51	51	112	112	82	
07:58	01:58	45.00	405	52	52	117	117	85	
08:00	02:00	50.00	450	54	54	125	125	90	
08:02	02:02	55.00	495	56	56	136	136	96	
08:04	02:04	60.00	540	59	59	148	148	104	
08:08	02:08	60.00	540	60	60	150	150	105	T60
08:10	02:10	50.00	450	60	60	150	150	105	
08:12	02:12	40.00	360	58	58	149	149	104	
08:14	02:14	30.00	270	55	55	147	147	101	
08:16	02:16	20.00	180	53	53	141	141	97	
08:18	02:18	10.00	90	50	50	133	133	92	
08:20	02:20	5.00	45	47	47	125	125	86	
08:22	02:22	0.00	0	44	44	111	111	78	
08:26	02:26	0.00	0	44	44	111	111	78	B60
08:28	02:28	10.00	90	45	45	117	117	81	
08:30	02:30	20.00	180	49	49	128	128	89	
08:32	02:32	30.00	270	52	52	136	136	94	
08:34	02:34	40.00	360	55	55	144	144	100	
08:36	02:36	50.00	450	58	58	150	150	104	
08:38	02:38	60.00	540	61	61	158	158	110	
08:40	02:40	60.00	540	61	61	161	161	111	T60c
08:42	02:42	60.00	540	62	62	163	163	113	Beginning of Creep
08:45	02:45	60.00	540	62	62	163	163	113	
08:50	02:50	60.00	540	62	62	165	165	114	
08:55	02:55	60.00	540	62	62	165	165	114	
09:00	03:00	60.00	540	62	62	165	165	114	
09:05	03:05	60.00	540	62	62	166	166	114	
09:10	03:10	60.00	540	62	62	167	167	115	
09:20	03:20	60.00	540	62	62	168	168	115	
09:30	03:30	60.00	540	63	63	169	169	116	
09:40	03:40	60.00	540	63	63	169	169	116	1 hour
10:10	04:10	60.00	540	63	63	171	171	117	
10:40	04:40	60.00	540	64	64	172	172	118	2 hours
11:10	05:10	60.00	540	65	65	173	173	119	
11:40	05:40	60.00	540	65	65	173	173	119	3 hours
12:10	06:10	60.00	540	65	65	173	173	119	
12:40	06:40	60.00	540	65	65	174	174	120	4 hours
13:10	07:10	60.00	540	65	65	174	174	120	
13:40	07:40	60.00	540	65	65	175	175	120	5 hours
14:10	08:10	60.00	540	65	65	175	175	120	
14:40	08:40	60.00	540	66	66	176	176	121	6 hours
14:42	08:42	50.00	450	66	66	176	176	121	End of Creep

Table A-4-25 Data Sheet of PBT-R3(3)

1991.6-7

PLATE BEARING TEST				Measuring Point PBT-R3 (LA-2 42.0m)				DATA SHEET (3)	
Time (h.m)	Elapse (h.m)	Stress (kg/cm ²)	Jack Pressure (kg/cm ²)	Deformation (1/ 100 mm)				Remarks	
				Dial Gauge Reading of Displacement					
				(1)		(2)			[(1)+(2)]/2
D. Read	Disp.	D. Read	Disp.						
14:44	08:44	40.00	360	65	65	174	174	120	
14:46	08:46	30.00	270	62	62	170	170	116	
14:48	08:48	20.00	180	59	59	166	166	113	
14:50	08:50	10.00	90	56	56	157	157	107	
14:52	08:52	5.00	45	53	53	151	151	102	
14:54	08:54	0.00	0	50	50	136	136	93	
14:58	08:58	0.00	0	50	50	136	136	93	B60c
15:00	09:00	10.00	90	53	53	143	143	98	
15:02	09:02	20.00	180	56	56	153	153	105	
15:04	09:04	30.00	270	60	60	160	160	110	
15:06	09:06	40.00	360	62	62	165	165	114	
15:08	09:08	50.00	450	65	65	173	173	119	
15:10	09:10	60.00	540	68	68	178	178	123	
15:12	09:12	65.00	585	69	69	181	181	125	
15:16	09:16	65.00	585	70	70	183	183	127	T65-1
15:18	09:18	60.00	540	69	69	181	181	125	
15:20	09:20	50.00	450	68	68	181	181	125	
15:22	09:22	40.00	360	66	66	180	180	123	
15:24	09:24	30.00	270	65	65	176	176	121	
15:26	09:26	20.00	180	62	62	171	171	117	
15:28	09:28	10.00	90	58	58	163	163	109	
15:30	09:30	5.00	45	55	55	155	155	105	
15:34	09:34	0.00	0	52	52	140	140	96	
15:36	09:36	0.00	0	52	52	140	140	96	B65-1
15:38	09:38	10.00	90	55	55	147	147	101	
15:40	09:40	20.00	180	59	59	158	158	109	
15:42	09:42	30.00	270	62	62	165	165	114	
15:44	09:44	40.00	360	65	65	173	173	119	
15:46	09:46	50.00	450	67	67	178	178	123	
15:48	09:48	60.00	540	70	70	184	184	127	
15:50	09:50	65.00	585	71	71	187	187	129	
15:54	09:54	65.00	585	71	71	188	188	130	T65-2
15:56	09:56	60.00	540	71	71	187	187	129	
15:58	09:58	50.00	450	69	69	186	186	128	
16:00	10:00	40.00	360	68	68	185	185	127	
16:02	10:02	30.00	270	65	65	180	180	123	
16:04	10:04	20.00	180	64	64	176	176	120	
16:06	10:06	10.00	90	59	59	165	165	112	
16:08	10:08	5.00	45	56	56	157	157	107	
16:12	10:12	0.00	0	53	53	143	143	98	
16:14	10:14	0.00	0	53	53	143	143	98	B65-2
									The End

Table A-4-26 Data Sheet of PBT-R3(4)

1991.6-7

PLATE BEARING TEST	Measuring Point	PBT-R3 (LA-2 42.0m)	DATA SHEET (4)
Test Location	LA-2 (Right Bank)	Geological	Dolerite - Basalt
Plate Radius (a) =	15.00 cm ²	Classification	CM
Loading Plate area =	707 cm ²	Max. Load Stress	78 kg/cm ²
		Capacity	55.2 ton
		Date Measured	'91/6/12
		Measured by	M. Rivas V.

Deformation Measurement Results

Stress (kg/cm ²)	Deformation (1/ 100 mm)				
	δ	δ _e	δ _p	Σ δ	Σ δ _p
0	0	0	0	0	0
15	34	10	24	34	24
0				24	
15	9	7	2	33	26
0				26	
15	10	9	1	36	27
0				27	
30	31	20	11	58	38
0				38	
45	43	24	19	81	57
0				57	
60	48	27	21	105	78
0 Creep				78	
60 0 h.	(	0 %)		111	
60 1 h.	(	50 %)		116	
60 3 h.	(	80 %)		119	
60 6 h.	(	100 %)		121	94
0				93	
65	34	31	3	127	96
0				96	
20 0	0			109	
30 10	5			114	
40 20	10			119	
50 30	14			123	
60 40	18			127	
65	34	32	2	130	98
0				98	

Remarks

- δ : Total Deformation
- δ_e : Elastic Deformation
- δ_p : Plastic Deformation
- Σ δ : Cumulative Total Deformation
- Σ δ_p : Cumulative Plastic Deformation

Creep Calculation

Elastic Deformation Just Before Creep δ _e (1/ 100 mm)	27
Creep Deformation δ _c (1/ 100 mm)	10
Creep Factor Cf (%) = (δ _c /δ _e)*100	37

Modulus of Deformation (D) and Modulus of Elasticity (E)
Calculation Formula

$$D \text{ or } E = \frac{\pi a(1-\nu^2)}{2} * \frac{\Delta \sigma}{\Delta \delta}$$

- a : Plate radius 15 (cm)
- ν : Poisson's ratio 0.2
- Δσ : Stress increment (kg/cm²)
- Δδ : Deformation increment due to Δσ
- πa(1-ν²)/2 = 22.6194 cm

Coefficients Related to Deformation

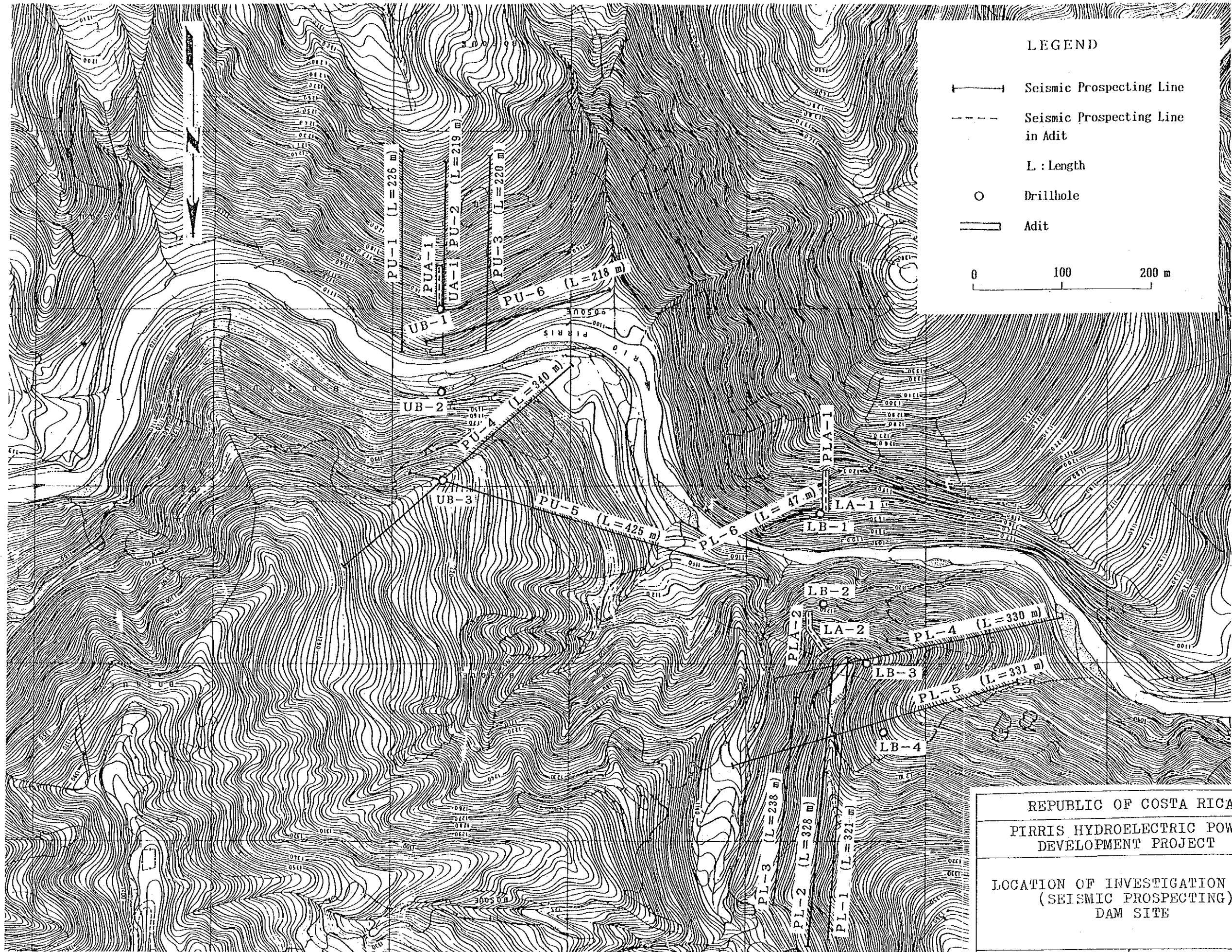
Modulus of Deformation	D =	12,000	kg/cm ²
Tangential Modulus of Elasticity	Et =	48,000	kg/cm ²
Secant Modulus of Elasticity	Es =	43,000	kg/cm ²

APPENDIX A-5 SEISMIC PROSPECTING

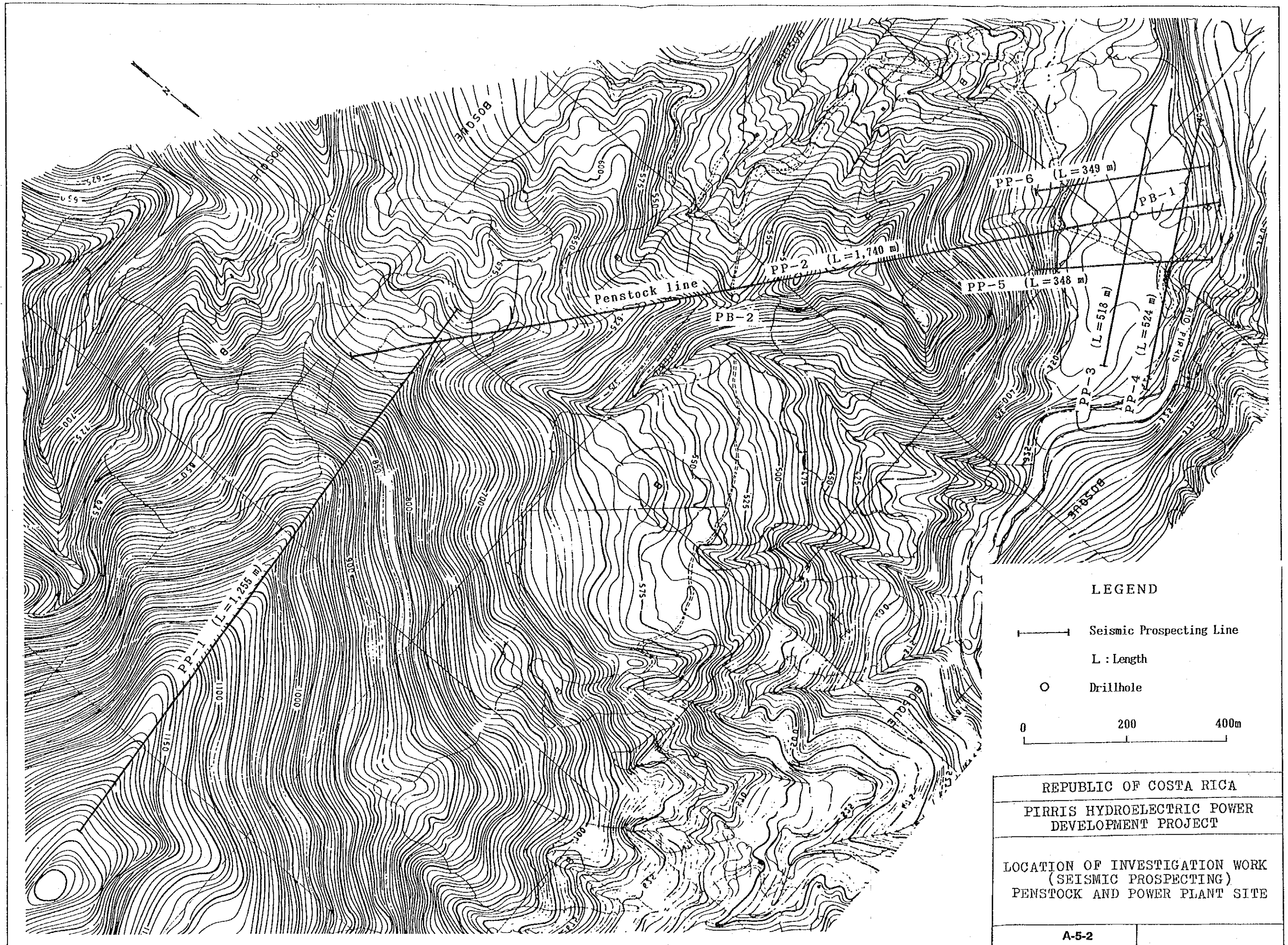
APPENDIX A-5 SEISMIC PROSPECTING

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A-5-1



LEGEND

- |— Seismic Prospecting Line
 - L : Length
 - Drillhole
- 0 200 400m

REPUBLIC OF COSTA RICA
 PIRRIS HYDROELECTRIC POWER
 DEVELOPMENT PROJECT

LOCATION OF INVESTIGATION WORK
 (SEISMIC PROSPECTING)
 PENSTOCK AND POWER PLANT SITE

A-5-2

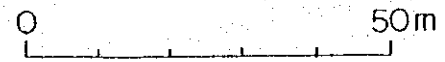
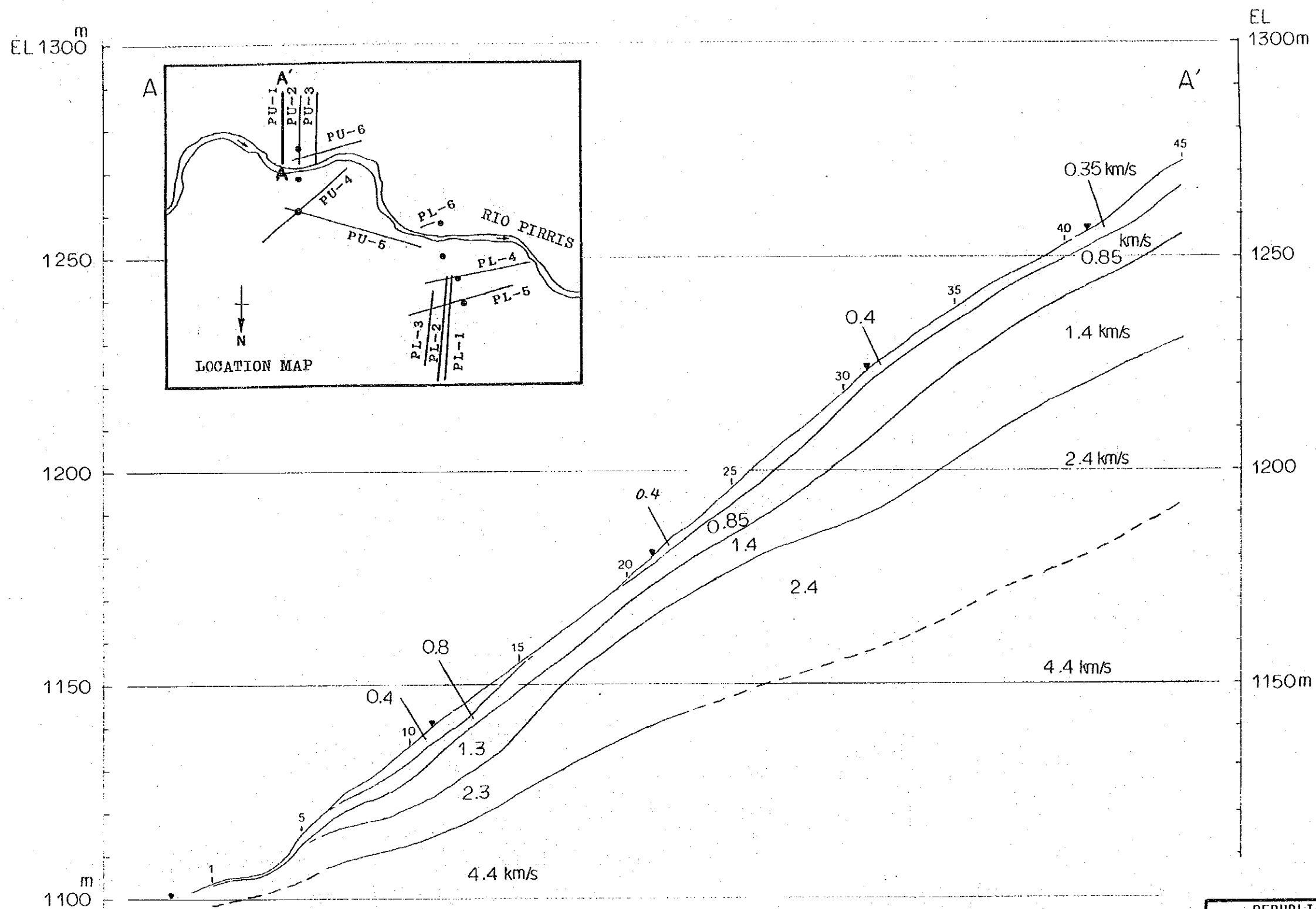
A-5-3 List of Seismic Prospecting Traverse

Location	Line No.	Coordinate		Elevation (m)	Length (m)	Work Period		Remarks
		X	Y			Field Work	Analysis	
Upper (Up-stream) Damsite	PU-1 (B.P.) (E.P.)	399,249.85	451,990.93	1,103.90	226.3	Dec. 1990	Jul. 1991	PS-12 (ICE) S-1 ~ S-45
		399,023.09	451,990.74	1,272.83				
		399,252.45	451,943.14	1,106.33				
	PU-2 (B.P.) (E.P.)	399,033.19	451,939.77	1,271.62	219.3	Dec. 1990	Jun. 1991	PS-11 (ICE) S-1 ~ S-45
		399,247.05	451,894.19	1,100.49				
		399,026.76	451,891.39	1,249.42				
	PU-3 (B.P.) (E.P.)	399,264.00	451,798.08	1,103.94	339.7	Aug. 1990	Jul. 1991	PS-9 (ICE) S-1 ~ S-35
		399,489.77	452,051.93	1,277.25				
		399,506.73	451,574.99	1,108.31				
	PU-4 (B.P.) (E.P.)	399,385.70	451,981.92	1,217.89	424.5	Jun. 1990	Mar. 1990	PS-8 (ICE) S-2 ~ S-45
		399,179.18	451,754.14	1,104.45				
		399,236.26	451,964.46	1,120.83				
Lower (Down-stream) Damsite	PL-1 (B.P.) (E.P.)	399,593.23	451,484.93	1,245.88	321.2	Jun. 1990	Jun. 1991	PS-1 (ICE) S-1 ~ S-68
		399,913.66	451,507.11	1,250.25				
		399,594.43	451,501.58	1,239.69				
	PL-2 (B.P.) (E.P.)	399,920.88	451,529.24	1,233.11	327.6	Feb. 1990	Mar. 1991	PS-2 (ICE) S-1 ~ S-68
		399,638.32	451,542.59	1,216.87				
		399,873.90	451,567.94	1,227.31				
	PL-3 (B.P.) (E.P.)	399,617.64	451,569.64	1,180.87	236.9	Mar. 1990	Jun. 1991	PS-3 (ICE) S-1 ~ S-46
		399,549.58	451,246.74	1,077.83				
		399,715.68	451,614.95	1,179.93				
	PL-4 (B.P.) (E.P.)	399,622.95	451,297.45	1,114.85	330.0	Apr. 1990	Jun. 1991	PS-4 (ICE) S-1 ~ S-68
		399,431.80	451,536.68	1,147.91				
		399,447.22	451,581.39	1,147.86				
Sub-total	12 Lines				3,241.8			
	PP-2 (B.P.) (E.P.)	398,162.55	441,322.11	292.44	1,740.2	Feb. 1991	Apr. 1991	P-5 (ICE) S-1 ~ S-175
		397,047.10	442,657.75	747.66				
		397,939.65	441,268.15	324.17				
	PP-3 (B.P.) (E.P.)	398,193.21	441,719.77	337.66	517.9	Apr. 1991	May 1991	P-3 (ICE) S-2 ~ S-52
		398,023.98	441,227.31	291.38				
		398,289.54	441,700.29	307.90				
	PP-4 (B.P.) (E.P.)	398,222.80	441,423.94	296.39	542.4	Mar. 1991	Jul. 1991	P-4 (ICE) S-1 ~ S-56
		397,969.76	441,662.67	392.92				
		398,098.84	441,285.04	294.27				
	PP-5 (B.P.) (E.P.)	397,867.44	441,546.59	378.94	347.9	Apr. 1991	Jul. 1991	P-2 (ICE) S-1 ~ S-36
		399,196.82	451,942.40	1,150.00				
		399,430.75	451,512.99	1,148.76				
Sub-total	6 Lines				4,753.0			
Adits at Dam sites	PUA-1 (B.P.)	399,196.82	451,942.40	1,150.00	50	Jun. 1991	Jun. 1991	B.P. AT 0+0.00 E.P. AT 0+0.50
		399,430.75	451,512.99	1,148.76				
		399,540.82	451,528.46	1,160.66				
	PLA-1 (B.P.)	399,540.82	451,528.46	1,160.66	50	Jun. 1991	Jun. 1991	B.P. AT 0+0.00 E.P. AT 0+10.50
		399,540.82	451,528.46	1,160.66				
		399,540.82	451,528.46	1,160.66				
Sub-total	3 Lines				150			
Total	21 Lines				8,144.8			

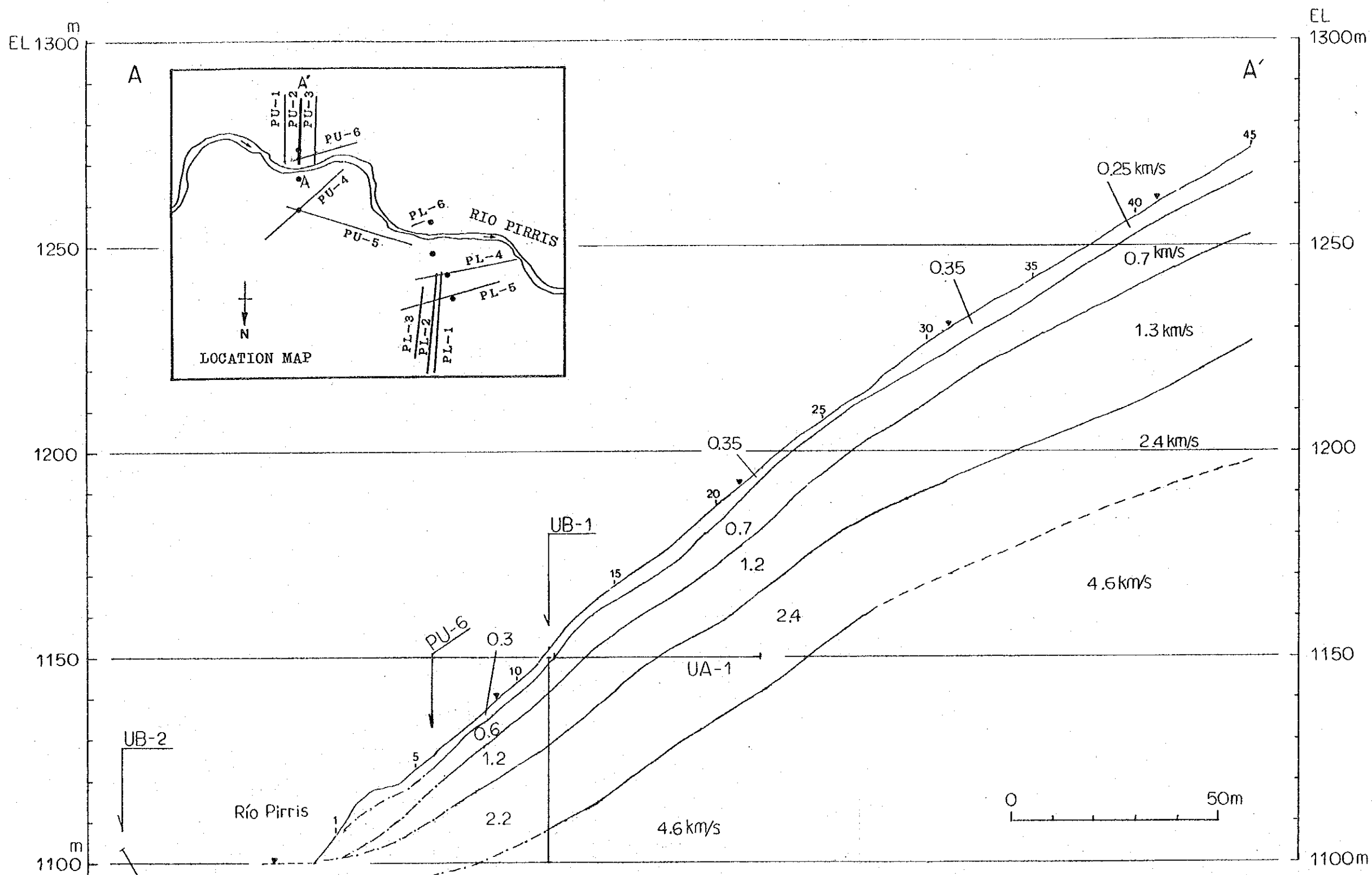
Note: (B.P.): Beginning Point
(E.P.): Ending Point

A-5-4 Seismic Profile (Sheet No. 1 ~ No. 16)

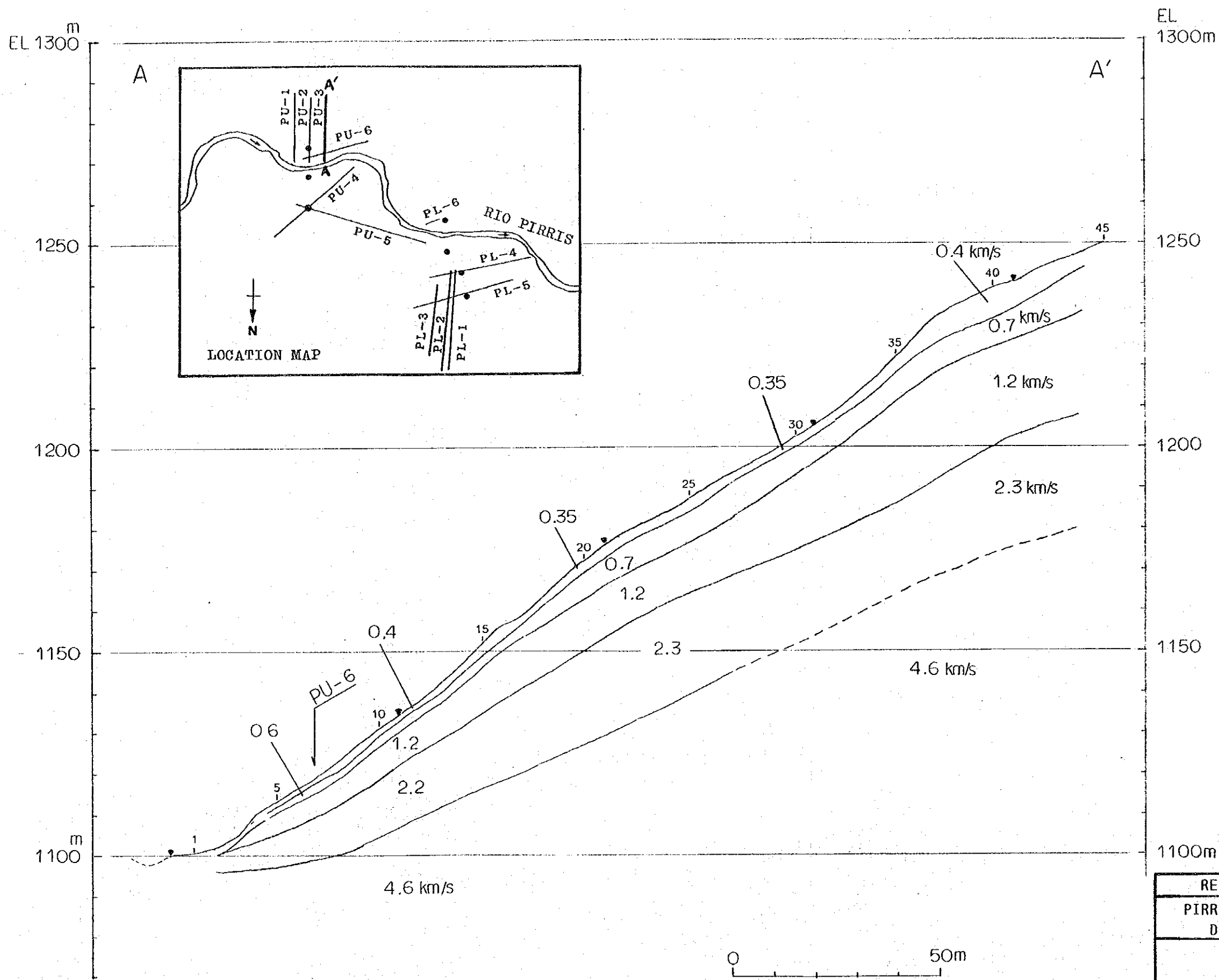
A-5-4-(1)	Seismic Profile	PU-1
A-5-4-(2)	Seismic Profile	PU-2
A-5-4-(3)	Seismic Profile	PU-3
A-5-4-(4)	Seismic Profile	PU-4
A-5-4-(5)	Seismic Profile	PU-5
A-5-4-(6)	Seismic Profile	PU-6
A-5-4-(7)	Seismic Profile	PL-1
A-5-4-(8)	Seismic Profile	PL-2
A-5-4-(9)	Seismic Profile	PL-3
A-5-4-(10)	Seismic Profile	PL-4
A-5-4-(11)	Seismic Profile	PL-5
A-5-4-(12)	Seismic Profile	PL-6
A-5-4-(13)	Seismic Profile	PP-1
A-5-4-(14)	Seismic Profile	PP-2
A-5-4-(15)	Seismic Profile	PP-3, PP-4
A-5-4-(16)	Seismic Profile	PP-5, PP-6



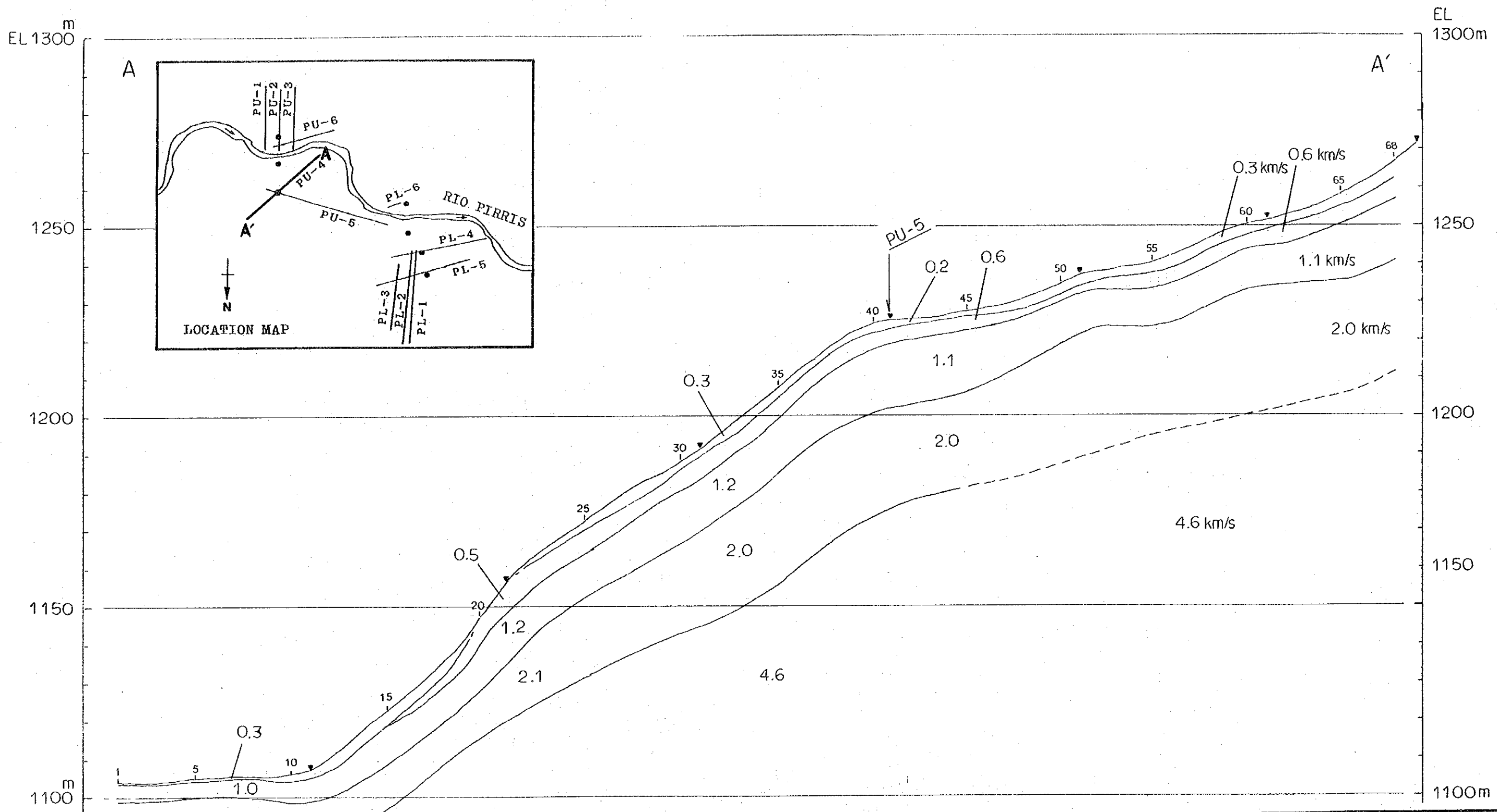
REPUBLIC OF COSTA RICA	
PIRRIS HYDROELECTRIC POWER DEVELOPMENT PROJECT	
SEISMIC PROFILE PU-1 (UPPER DAM SITE)	
A-5-4(1)	



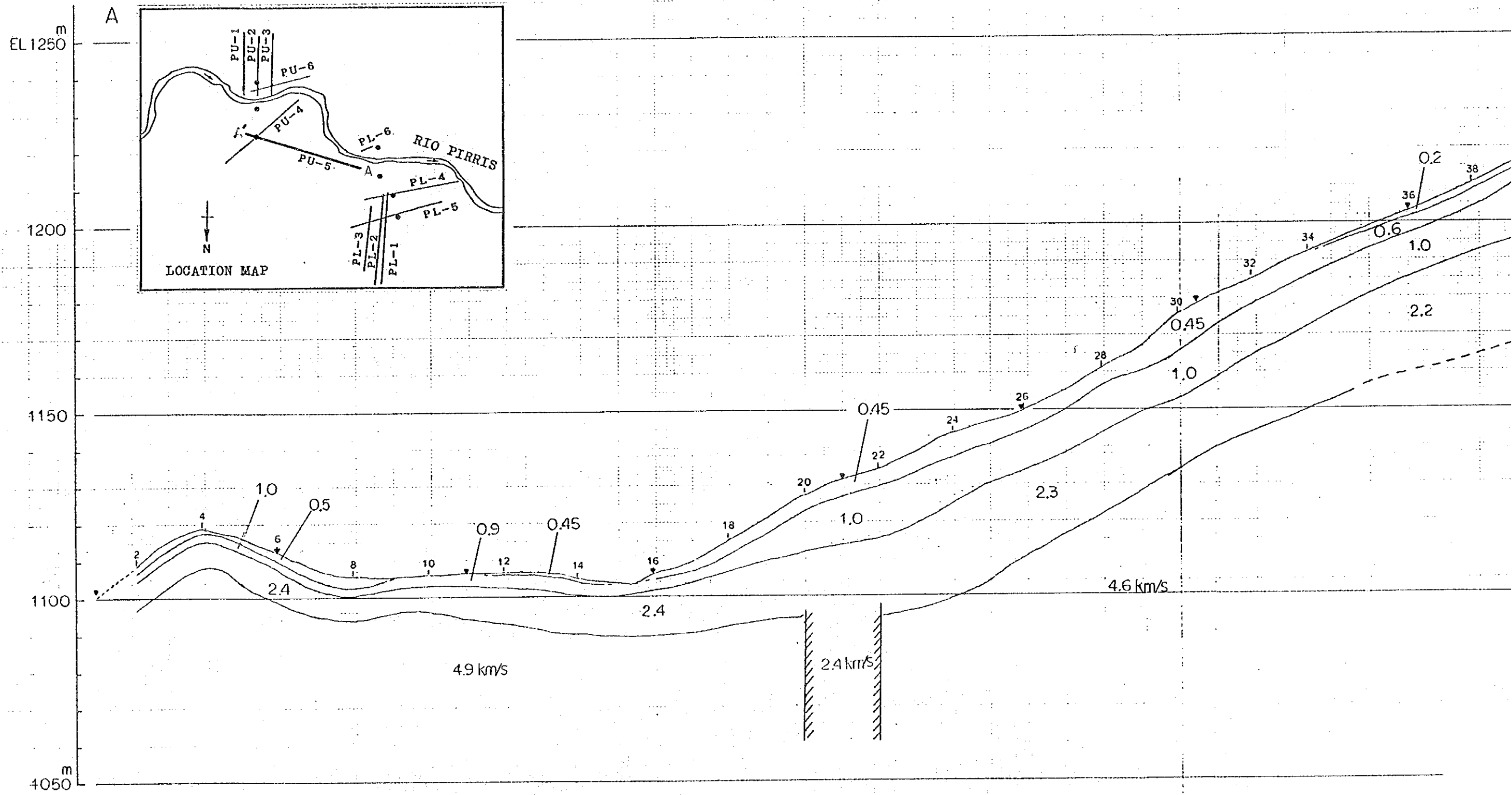
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PÍRRIS HYDROELECTRIC POWER DEVELOPMENT PROJECT	
SEISMIC PROFILE	
PU-2	
(UPPER DAM SITE)	
A-5-4-(2)	

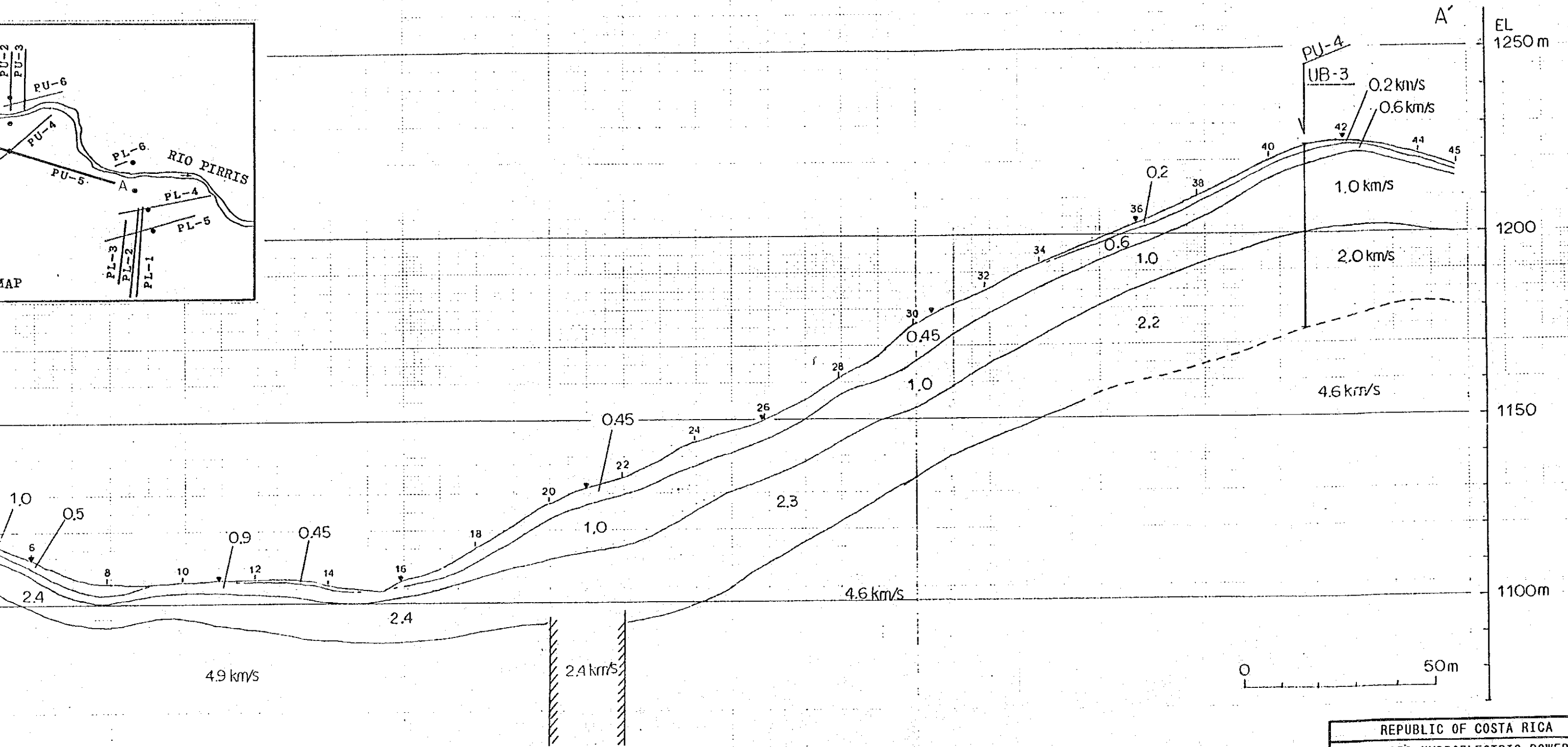
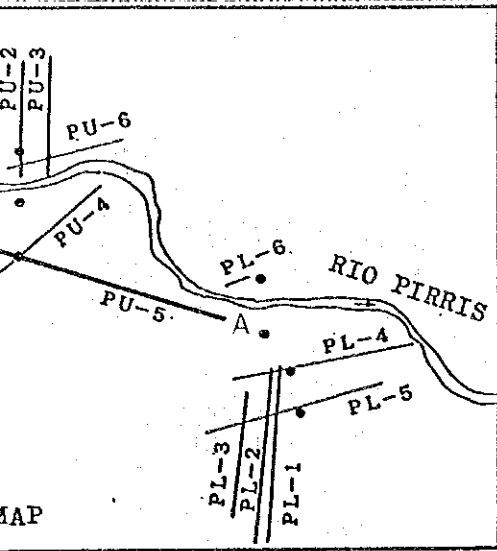


REPUBLIC OF COSTA RICA	
PIRRIS HYDROELECTRIC POWER DEVELOPMENT PROJECT	
SEISMIC PROFILE PU-3 (UPPER DAM SITE)	
A-5-4(3)	

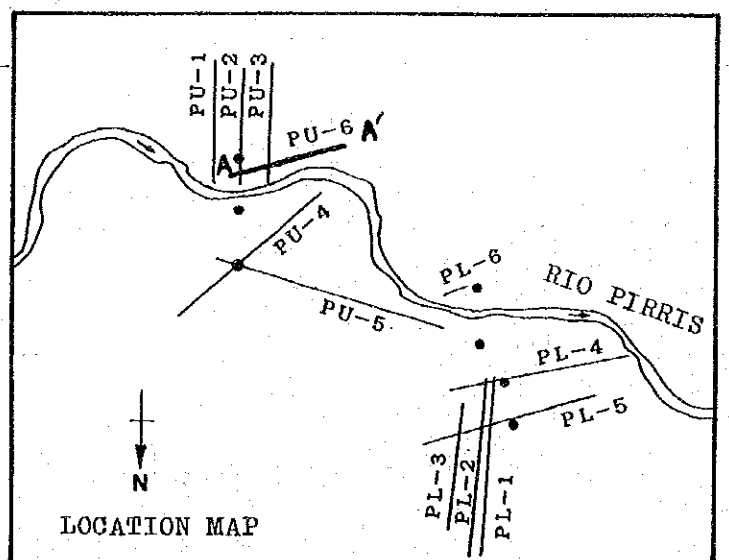
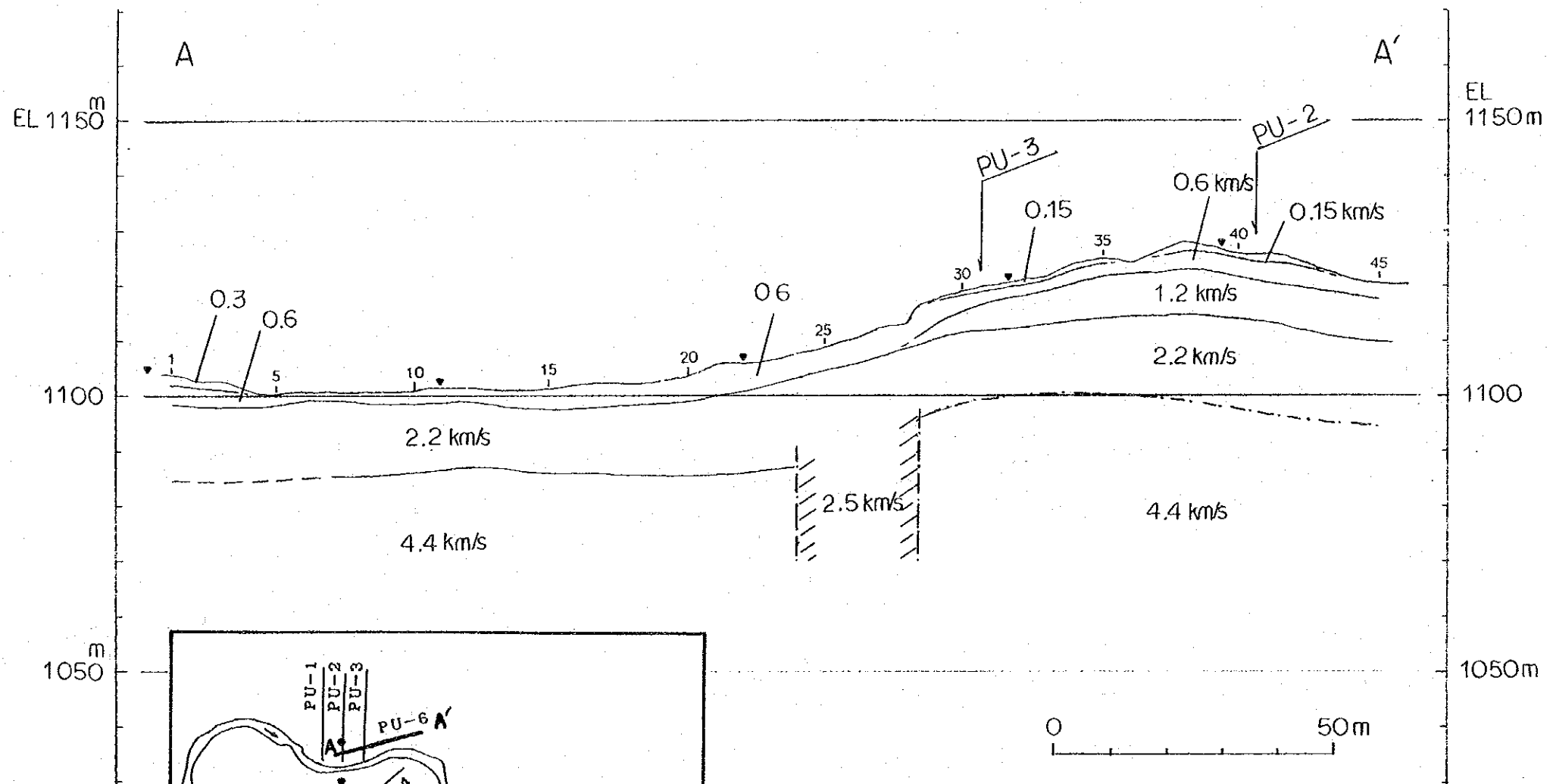


REPUBLIC OF COSTA RICA	
PIRRIS HYDROELECTRIC POWER DEVELOPMENT PROJECT	
SEISMIC PROFILE PU-4 (UPPER DAM SITE)	
A-5-4(4)	

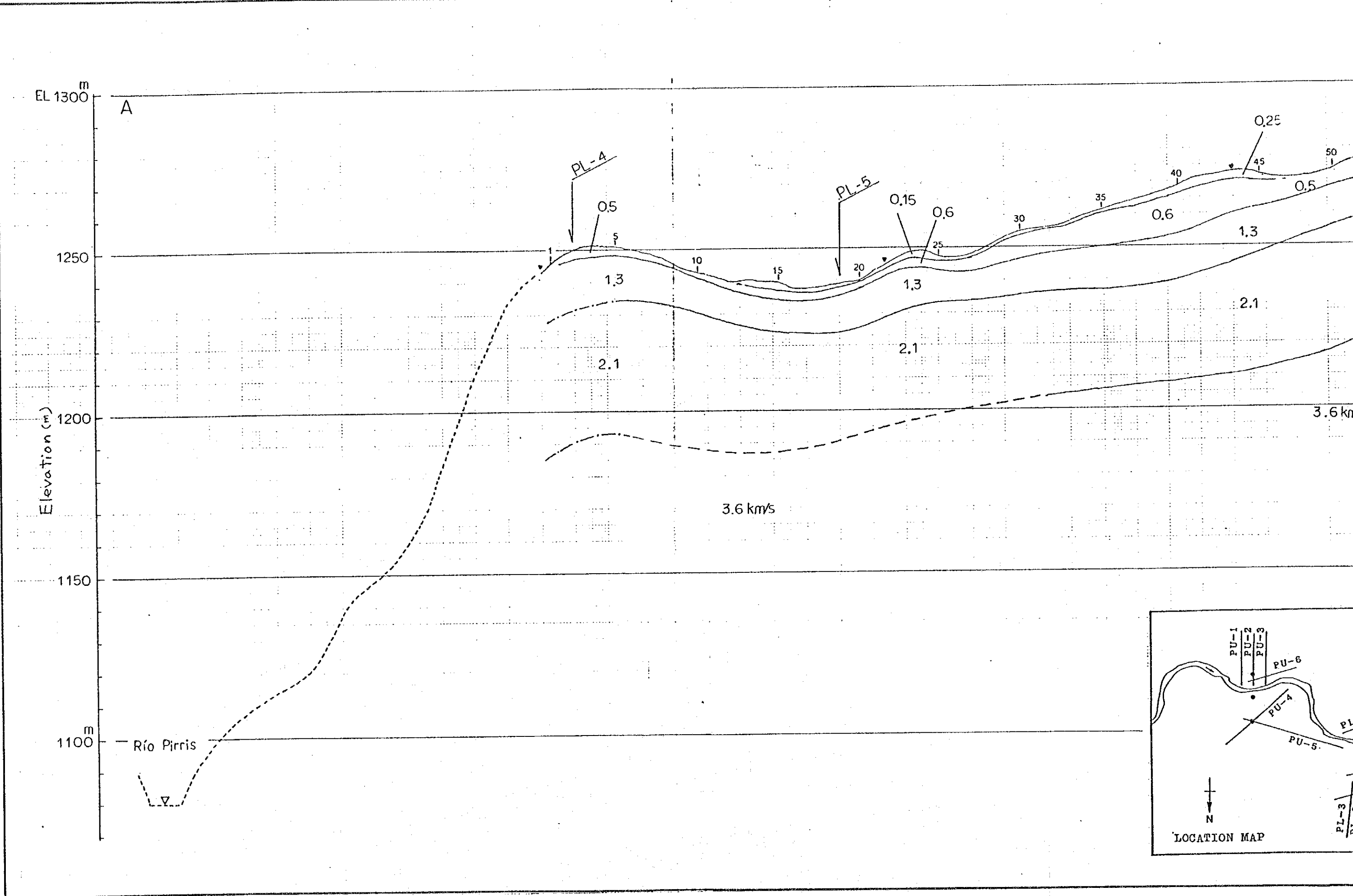


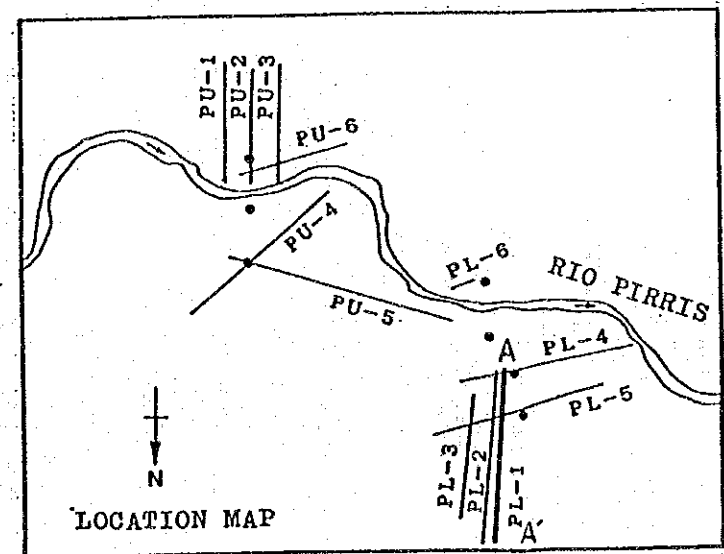
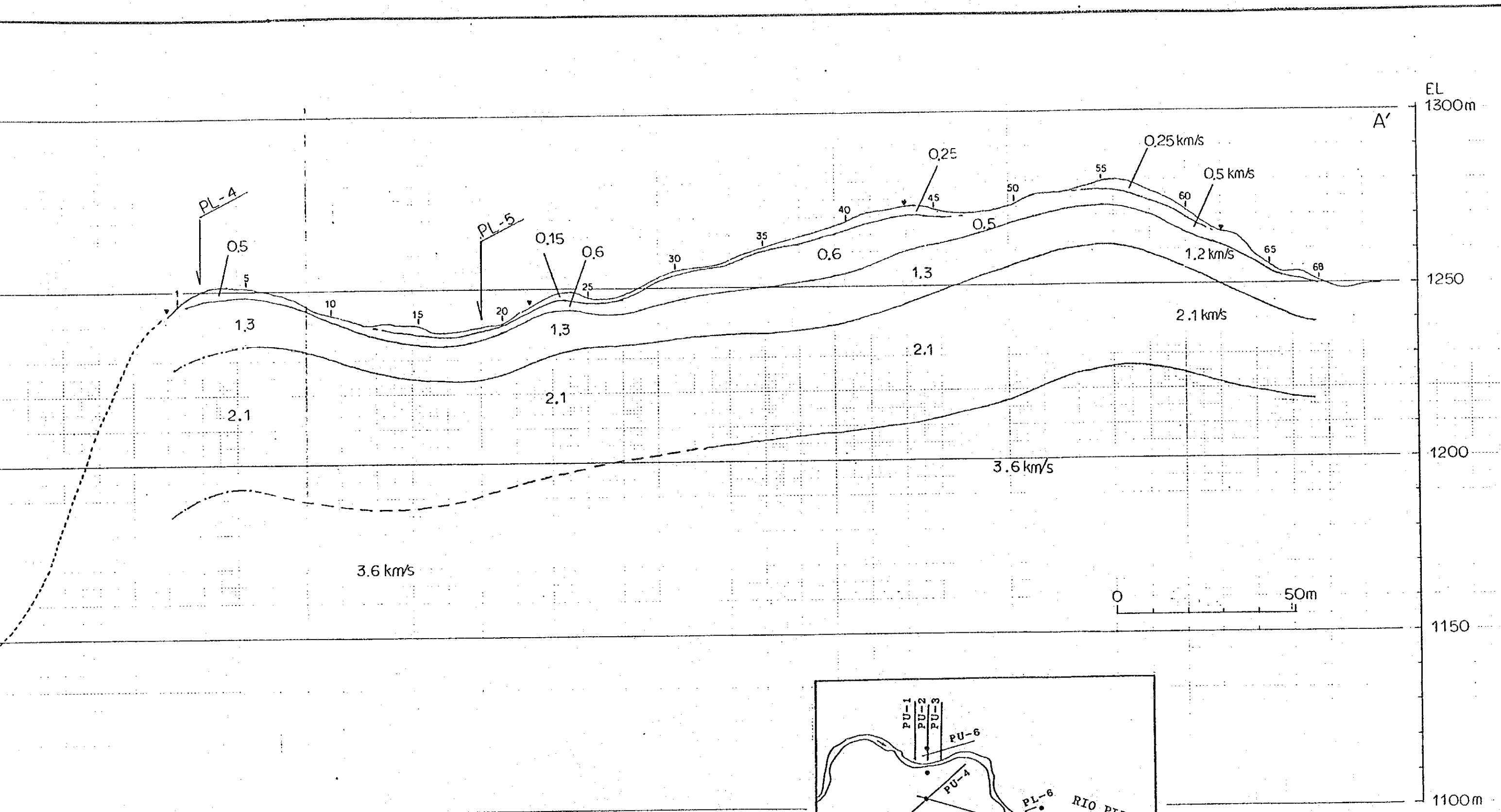


REPUBLIC OF COSTA RICA	
PIRRIS HYDROELECTRIC POWER DEVELOPMENT PROJECT	
SEISMIC PROFILE PU-5 (UPPER DAM SITE)	
A-5-4(5)	



REPUBLIC OF COSTA RICA	
PIRRIS HYDROELECTRIC POWER DEVELOPMENT PROJECT	
SEISMIC PROFILE PU-6 (UPPER DAM SITE)	
A-5-4(6)	

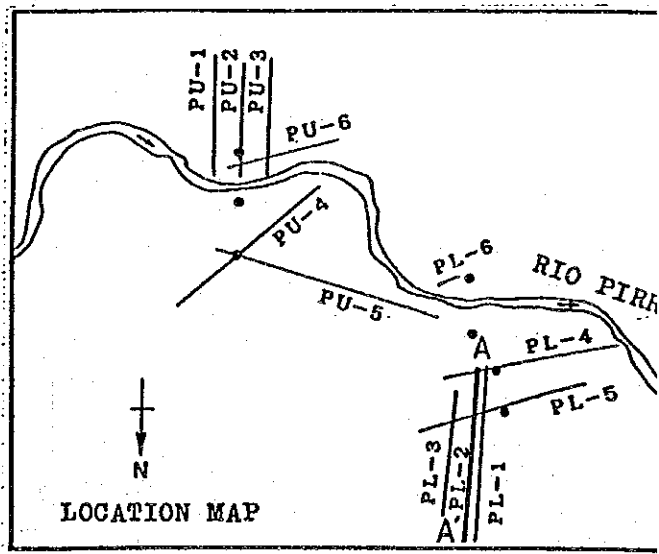
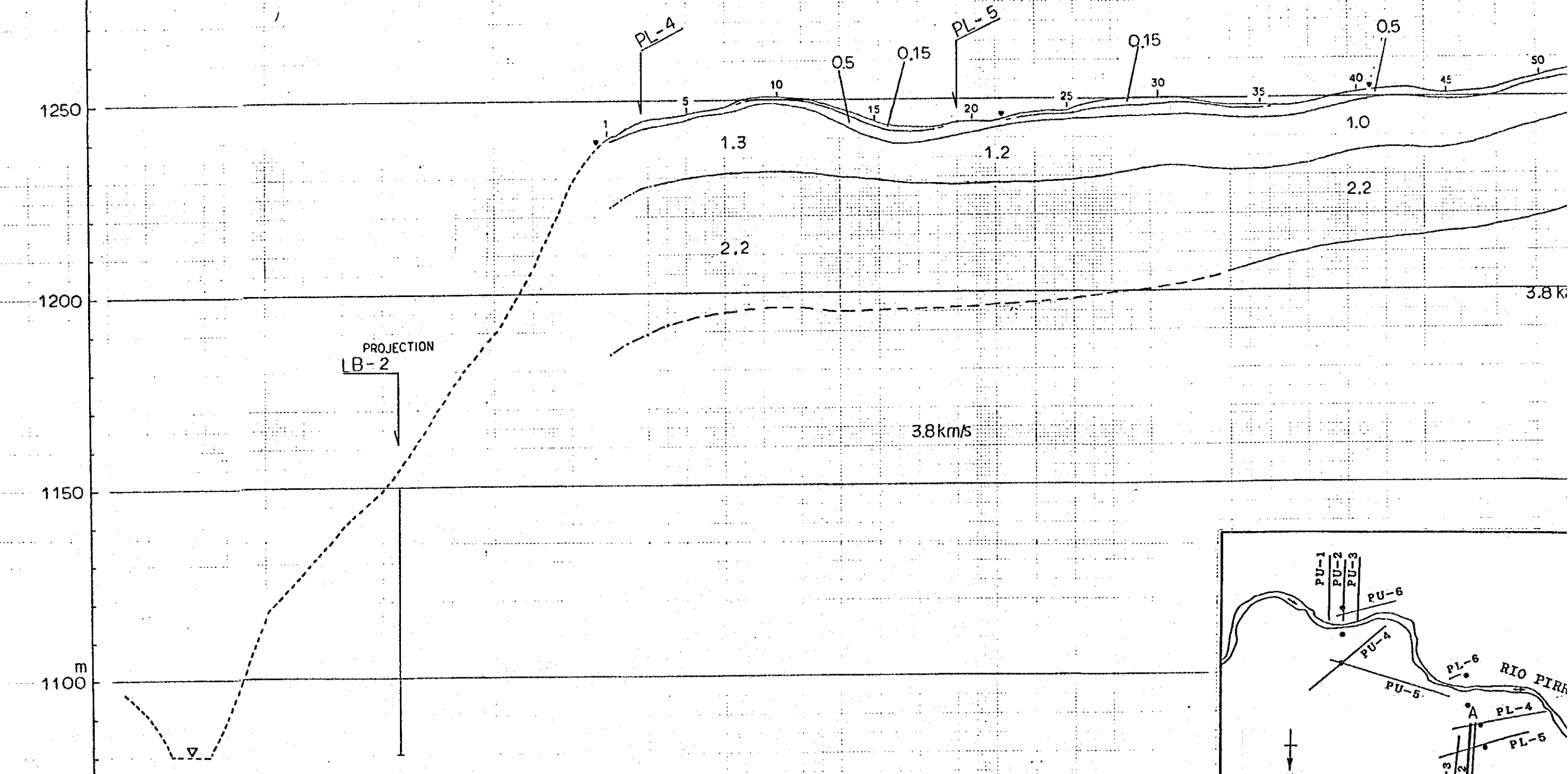




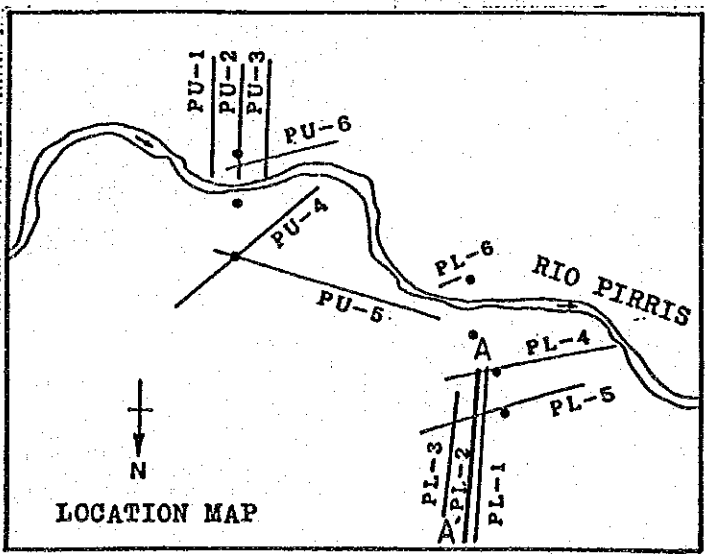
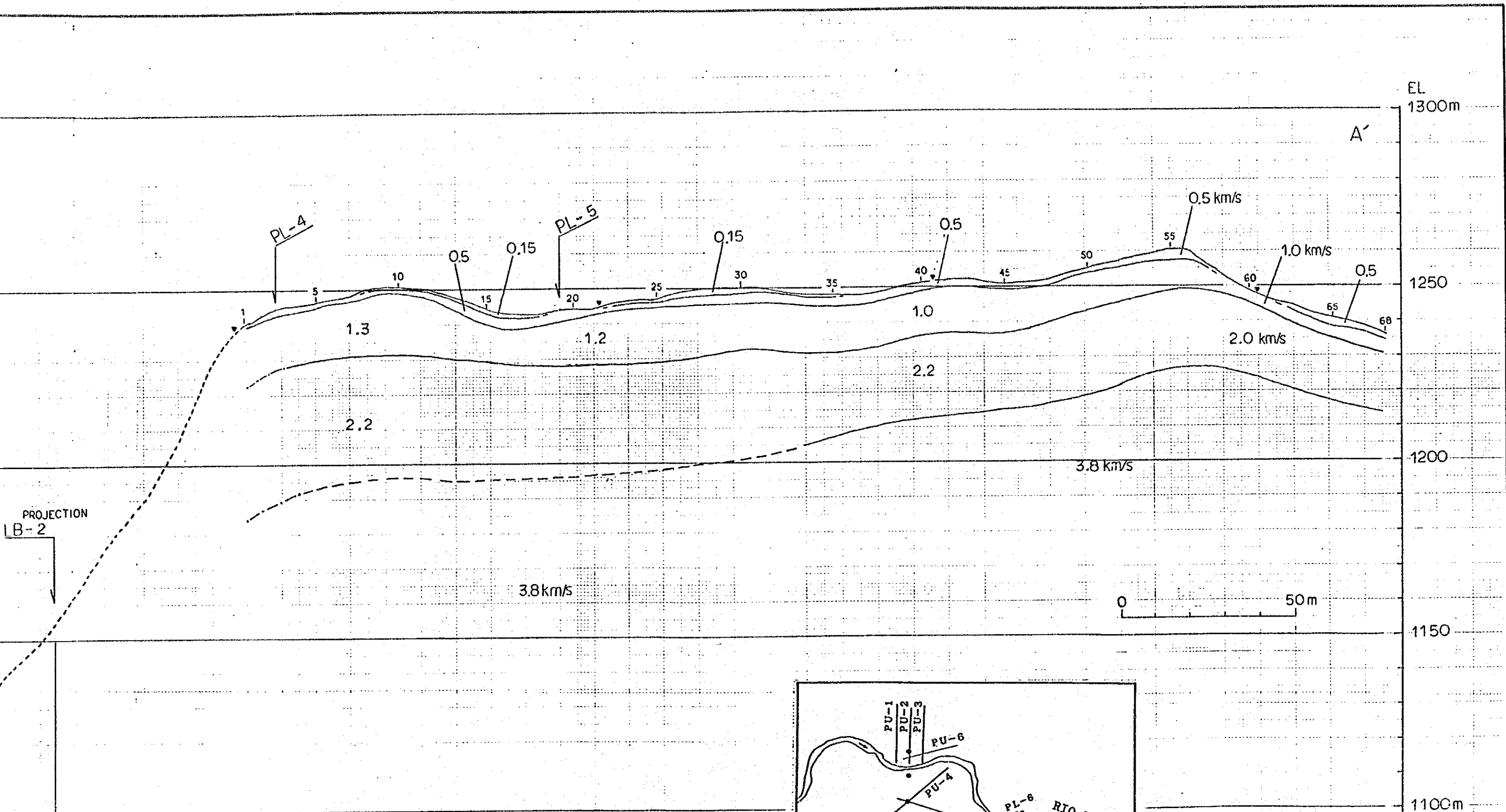
REPUBLIC OF COSTA RICA	
PIRIS HYDROELECTRIC POWER DEVELOPMENT PROJECT	
SEISMIC PROFILE PL-1 (LOWER DAM SITE)	
A-5-4(7)	

EL 1300^m

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APPENDIX X



REPUBLIC OF COSTA RICA
PIRRIS HYDROELECTRIC POWER DEVELOPMENT PROJECT
SEISMIC PROFILE PL-2 (LOWER DAM SITE)
A-5-4-(B)

