

**APPENDIX
FIGURES & DRAWINGS
FOR
REPORT ON SECOND HARBOUR ENTRANCE PROJECT
OF KAOHSIUNG HARBOUR**

August 1968

**Overseas Technical Cooperation Agency
Tokyo, Japan.**

国際協力事業団

受入 月日 '84. 3. 23	121
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Table - 1

DIMENSION OF CAISSONS

	Mark	Size of Caisson Length x Width x Height m ³	Number		Volume m ³	Weight t	Draft m
			Dry Dock	Slip Way			
South Breakwater	S ₁	20 x 16 x 11.5	Caissons 41	Caissons	756.6	1,820	5.52
	S _①	15 x 16 x 11.5		54	586.9	1,410	5.70
	S ₂	20 x 16 x 10.0	15		680.4	1,640	4.97
	S _②	15 x 16 x 10.0		20	523.9	1,255	5.08
	S ₃	20 x 16 x 8.5	15	15	598.9	1,436	4.36
	S ₄	20 x 16 x 7.0	7	7	517.5	1,242	3.76
	S ₅	20 x 14 x 5.5	19	19	337.8	810	2.81
Subtotal			97	115			
North Breakwater	N ₁	20 x 12 x 11.0	8	8	616.5	1,480	6.00
	N ₂	20 x 12 x 10.0	9	9	569.6	1,360	5.52
	N ₃	20 x 12 x 8.5	10	10	499.5	1,199	4.84
	N ₄	20 x 12 x 7.0	6	6	428.8	1,029	4.17
	N ₅	20 x 12 x 5.5	15	15	251.2	603	2.92
Subtotal			48	48			
Grand Total			Caissons 145	Caissons 163			

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Table - 2

QUANTITY OF CONSTRUCTION WORKS

	Item	Caisson Site	Mound Site	Total	Grand Total
Rubble (m ³)	Foundation Rubbles (30 ~ 150kg)	(220, 839)	(45, 960)	(266, 799)	
	Rubble-Fillings for Caisson (30 ~ 150kg)	221, 855	45, 460	267, 315	
	Broken Stone (1, 000kg)	(37, 363)		(37, 363)	
	Broken Stone (2, 000kg)	(37, 618)	(585)	(37, 618)	(362, 638)
	Broken Stone (3, 000kg)	(43, 722)	585	(49, 271)	363, 371
	Sub Total	43, 844	5, 499	49, 343	
		(301, 924)	(8, 620)	(8, 620)	
		303, 317	8, 510	8, 510	
		(60, 714)	(60, 714)		
		60, 054	60, 054		
Leveling Works (m ²)	Main Leveling Works (under sea)	(73, 332)		(73, 332)	
	Main Leveling Works (on land)	73, 617		73, 617	
	Rough Leveling Works (under sea)	(29, 350)	(5, 650)	(33, 482)	(175, 429)
	Rough Leveling Works (on land)	29, 502	5, 580	33, 584	176, 018
	Armouring Works (under sea)	(46, 680)	(4, 549)	(4, 549)	
	Armouring Works (on land)	47, 132	4, 499	4, 499	
	Sub Total	(149, 362)	(4, 132)	(50, 812)	
		150, 251	4, 082	51, 214	
		(274, 150)	(7, 604)	(7, 604)	
		282, 730	7, 524	7, 524	
		(82, 597)(163 ea.)	(26, 067)	(26, 067)	(274, 150)
	81, 656 (145 ea.)	25, 767	25, 767	282, 730	
	(67, 190)			(82, 597)(163 ea.)	
	67, 520	(8, 888)	(76, 078)	81, 656 (145 ea.)	
	(29, 376)(3, 672 ea.)	8, 778	76, 298	(76, 078)	
	29, 488 (3, 686 ea.)			76, 298	
				(29, 376)(3, 672 ea.)	
				29, 488 (3, 686 ea.)	

Table - 3

ROUGH ESTIMATION OF BREAKWATER CONSTRUCTION COST

Unit : NT\$

Depth	Unit cost (NT\$/m)	North Breakwater		South Breakwater		Total	
		Length	Construction cost	Length	Construction cost	Length	Construction cost
± 0 m	North Breakwater	40 m	688,561.20	50 m	965,160.00	90 m	1,653,721.20
	South Breakwater						
-3	North Breakwater	160	4,613,721.60	210	6,392,895.60	370	11,006,617.20
	South Breakwater						
-5	North Breakwater	300	14,666,616.00	380	22,360,944.20	680	37,027,560.20
	South Breakwater						
-7	North Breakwater	120	7,477,365.60	140	10,368,940.40	260	17,846,306.00
	South Breakwater						
-8.5	North Breakwater	200	13,298,612.00	300	23,613,945.00	500	36,912,557.00
	South Breakwater						
-9.5	North Breakwater	180	12,479,842.80	300	24,814,062.00	480	37,293,904.80
	South Breakwater						
-10.5	North Breakwater	140	9,901,809.40			140	9,901,809.40
	South Breakwater						
-11.5	North Breakwater			800	71,740,000.00	800	71,740,000.00
	South Breakwater						
Head of Breakwater	North Breakwater	One set	2,107,266.40	One set	2,975,422.80	One set	5,082,689.20
	South Breakwater						
Grand Total			65,233,795.00	2,180	163,231,370.00	3,320	228,465,165.00

Table - 4

NECESSARY QUANTITY OF EXECUTION EQUIPMENTS & MACHINERY

Item	Capacity	Number	Unit	VS\$		NT\$	
				Unit Cost	Construction Cost	Unit Cost	Construction Cost
1. Construction of Breakwater							
Tug-Boat	1000hp	1	Vessel	300	300		
"	800hp. 90t	1	"	220	220		
"	180hp. 40t	4	"	60	240	1,200	6,000
Rubble-Loading Barge	150m ³ non-propelling	2	"	50	100		
Floating crane	30t non-propelling	1	"	350	350		
Dump Truck	7.5t 0	10	Car	10	100		
Bulldozer	1.5t	3	"	30	90		
Shovel loader	1.2m ³	3	"	30	90		
Caterpillar Crane	5t Movable radius 12m(31t)	2	"	70	140		
"	3t - 5t	8	"	20	160		
Truck	5t	4	"	7	28		
Mixer	0.4 - 0.8m ³	6	"	8	48		
Batcher plant	"	4	"	15	60		
Belt Conveyor	"	10	"	8	80		
Air Compressor	12.5m ³	2	"	15	30		
Air Compressor	2.7m ³	4	"	5	20		
Vibrater	Rod-Type	24	"	1	24		
Denick Winch	5t 80hp	4	"	10	40		
Disal Hamser	D-12 or D-22	2	"	40	80		
Miscellantors	Equipment for examination, pump etc.				204		
Wie Rope		100	Ton	0.4	40	500	2,000
Boats	100 hp	4	Vessel	15	60	1,500	1,500
Pontoon	300t	1	"	20	20	500	3,500
"	100t	7	"	8	56		

Winch	150t (Including Slipway)	1	Car	50	50		
Steel Materials	Steel sheet	500	Ton	0.15	75		
Steel Materials	Large-Scare Steel Pile	100		0.20	20		
Metal Form Sheet Pile		600 1,000		0.50 0.15	300 150		
Sub Total					3,175		13,000
2. Sheet pile in the base of construction of sea wall		1,000	Ton	0.15	150		
3. Dredger		1	Vessel	1,200	1,200		
Wie Rope		300	Ton	0.4	120		
Steel Materials		300	"	0.15	45	8	2,400
Spare etc.					60		
4. Coaching of design and execution				150	150		
Sub Total					1,725		2,400
Grand Total					4,900		15,400

Table - 5

WHOLE WORKING PROGRAMME

Items		1st	2nd	3rd	4th	5th	6th	7th	
Works	Quantity								
Construction work of Breakwater	Purchase of vessels and machinery								
	Working base including caisson	37,000 m ²							
	Working road	8.5 km							
	Mound site	Foundation rubble	45,460 m ³						
		Armor stone	14,594 m ³						
		Main leveling works	5,580 m ²						
		Rough leveling works	8,581 m ²						
		Armor works	11,606 m ²						
		Upper concrete	8,778 m ²						
	Caissons site	Upper stone	221,855 m ³						
		Armor stone	43,844 m ³						
		Main leveling works	73,617 m ²						
		Rough leveling works	29,502 m ²						
		Armor works	47,132 m ²						
		Construction of caissons	81,656 m ³						
		Placing works of caissons	145 caissons						
		Sand fillings	282,830 m ³						
		Other -fillings	37,618 m ³						
		Upper concrete	67,520 m ³						
		Construction of blocks	29,488 m ³						
Planing works of blocks	3,686 ea.								
Dredging and additional works	Interland sea wall	1,010 m							
	Tetra type breakwater	145 m							
	Working channel	1,000,000 m ³							
	Fairway	9,000,000 m ³							
	Sea wall outside of breakwater	3,000 m							
Miscellaneous works									

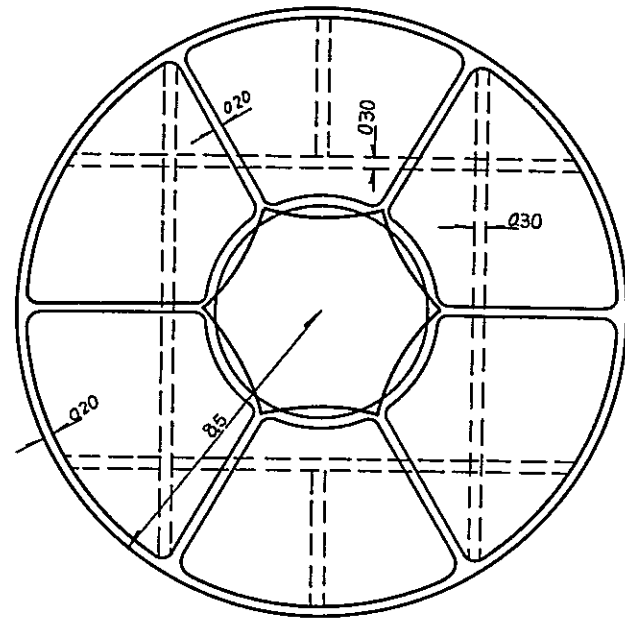
Table - 6

WHOLE CONSTRUCTION COST AND COST IN EACH YEAR

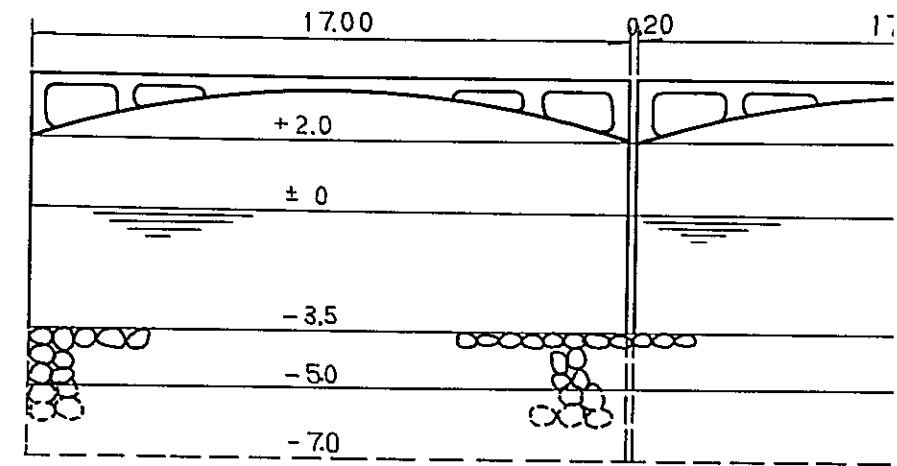
Unit : 1,000 NT\$

Item	Total cost	Cost in each year						
		1st	2nd	3rd	4th	5th	6th	7th
1. Construction of breakwater	280,840	31,310	29,930	49,480	44,070	49,070	49,840	26,460
Purchase of working boats and machinery	13,000	3,000	10,000					
Working base	25,440	21,740	3,700					
Working roads	1,330	1,330						
Construction of breakwater	241,070	5,240	16,230	49,480	44,070	49,750	49,840	26,460
2. Dredging works	105,500	5,600	9,000	15,900	15,000	20,000	20,000	20,000
Purchase of dredgers	2,400	2,400						
Working channel	12,200	3,200	9,000					
Fairway	10,900			15,900	15,000	20,000	20,000	20,000
3. Additional works	33,310	11,810	2,000	2,000	2,000	2,000	2,000	2,500
Interland sea wall	14,100	6,100						
Tetra breakwater	710	710						
Seawall out side of breakwater	10,000			2,000	2,000	2,000	2,000	2,000
Miscellaneous works	8,500	5,000						500
1 + 2 + 3	419,650	48,720	49,930	67,380	61,070	71,750	71,840	48,960
4. Indirect cost	90,350	39,050	25,300	5,500	5,000	5,000	5,000	5,500
Customs	38,393	21,593	16,800					
Compensation for removal of houses	15,000	12,000	3,000					
Management expenses	36,957	5,457	5,500	5,500	5,000	5,000	5,000	5,500
Total	510,000	87,770	75,230	72,880	66,070	76,750	76,840	54,460
Note: As Custom and Compensation for removal of houses are not calculated, they are carried according to the plan in January 1966.								

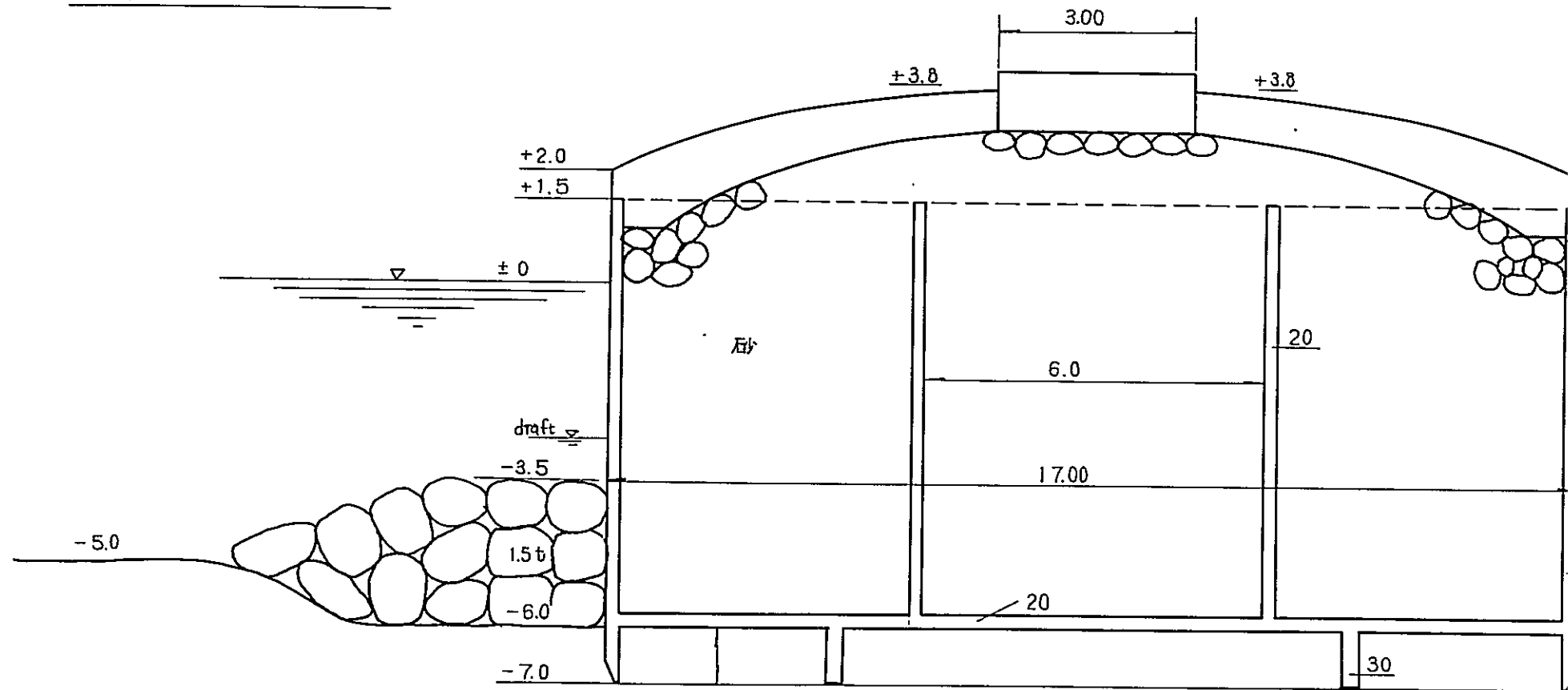
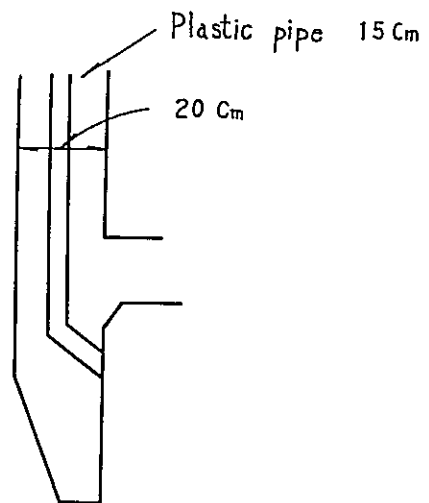
Fig-A



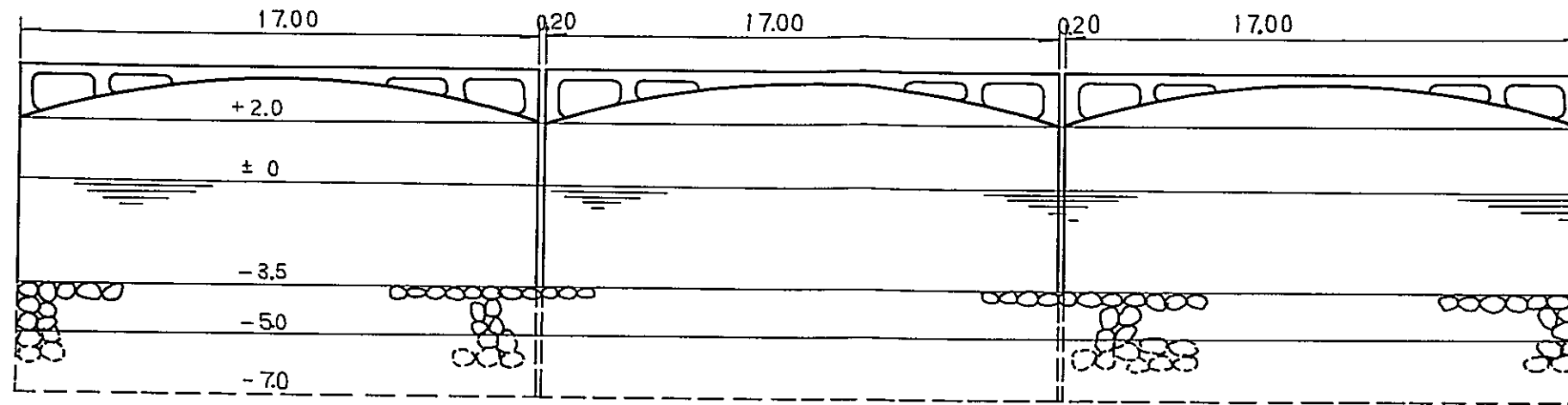
平面圖 S = 1/200



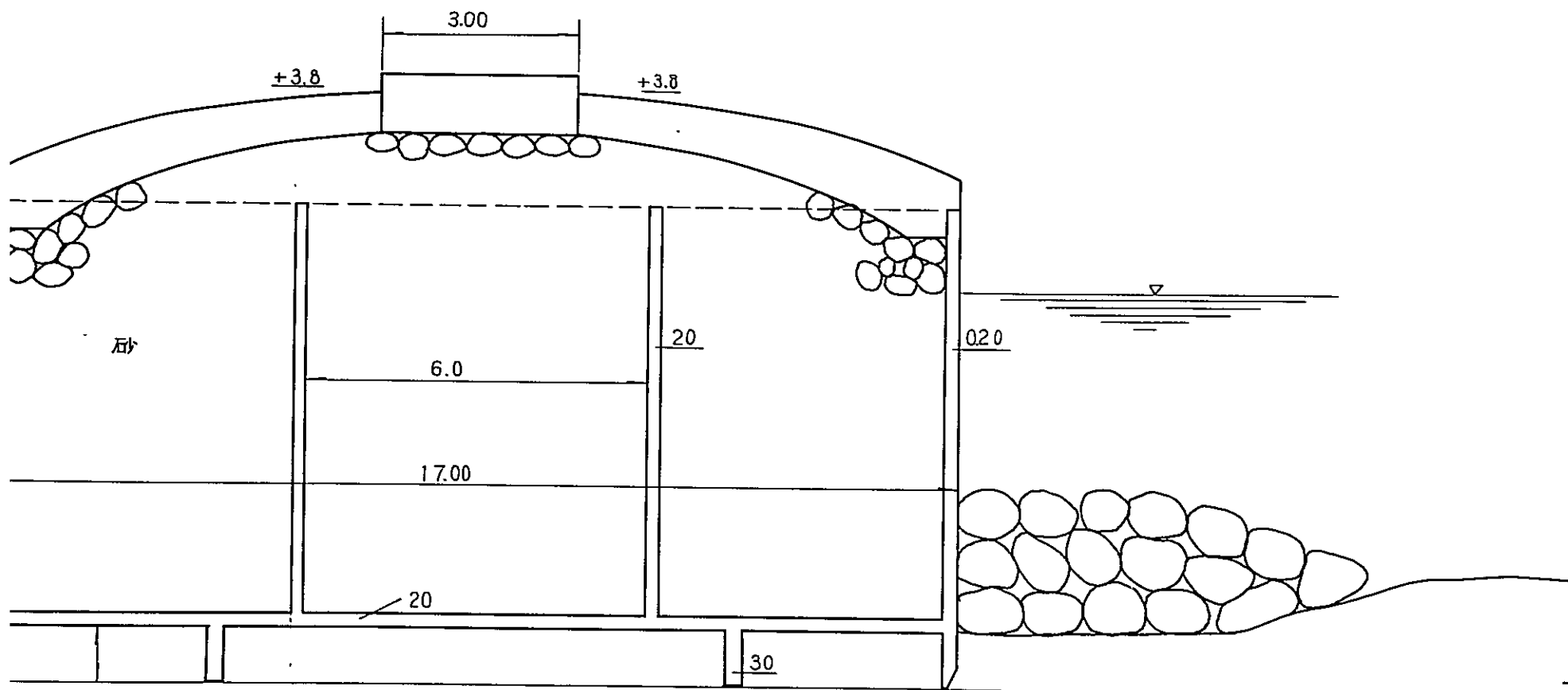
立面



剖面圖 S = 1/100



立面圖 $S = 1/200$



剖面圖 $S = 1/100$

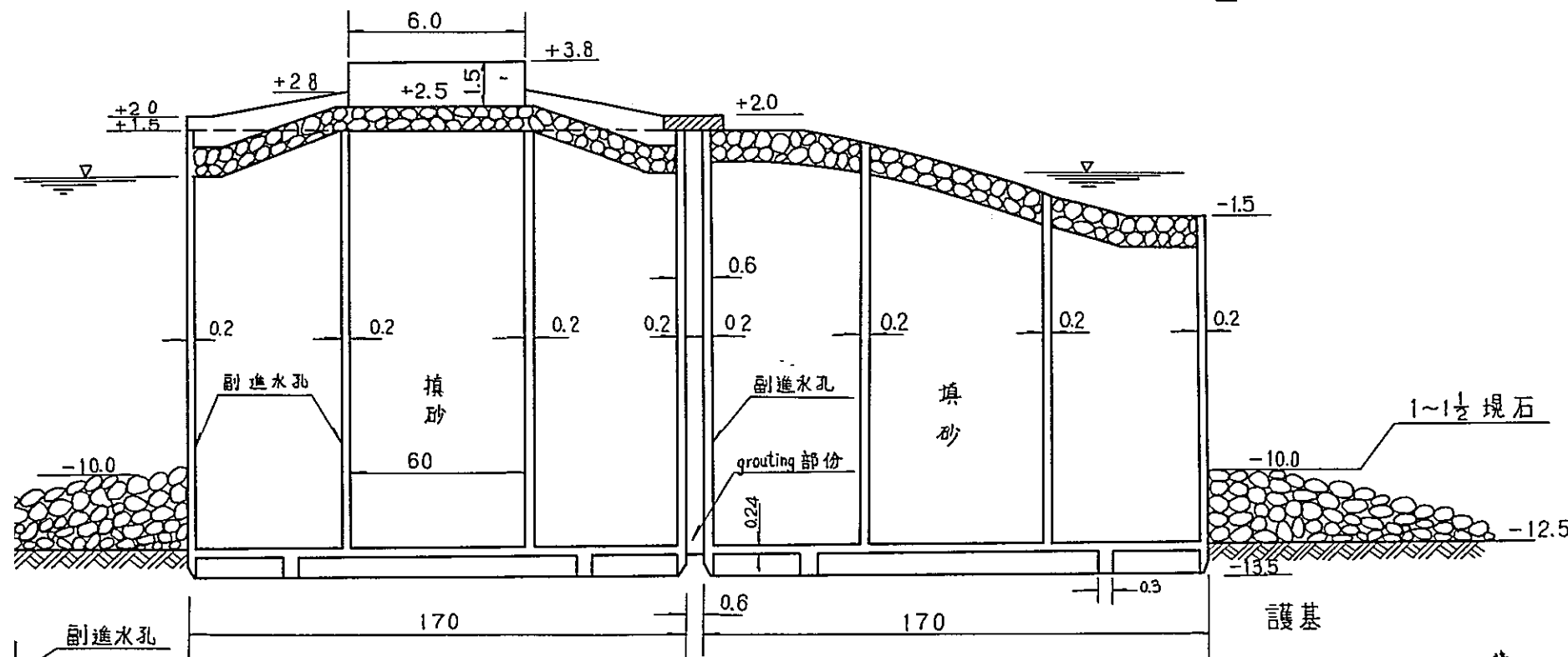
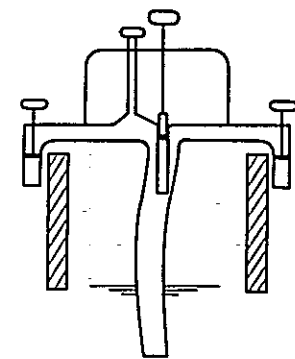
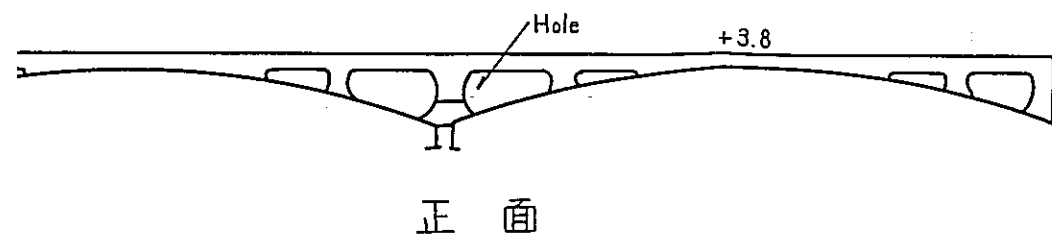
-5.0m 水深防波堤代表断面

1. R.C
 底 74.3
 身 136.9
 $74.3 + 136.9 = 231.2/17 = 13.6 \frac{m^3}{m}$

2. 吃水量
 $231.2 \times 2.4 - 74.3 \times 1.025 = 478.9$
 $\frac{478.9}{227 \times 1.025} = 2.05$
 $2.05 + 1.2 = 3.25$

3 概算

① R.C	14 @ 18	= 25200
② 安放	3400/17	= 2000
③ 控填	110 @ 12	= 1320
④ 護基		8000
⑤ 填石	16 @ 120	= 1920
⑥ 堤面胸壙	15 @ 650	= 9750
⑦ 雜頂		= 3810
		<u>52000 元/m</u>



利用副進水孔緩排出箱底下水以免自壁底擠出帶動泥層

- 1 R.C(最大一只) 底 800 身 3000 } 3800m³ (880⁺)
- 2 吃水 $\frac{38.0 \times 23}{226} + 0.8 = 3.85 + 1.0 = 5.0\text{m}$
- 3 概算 (元/m)

1 海底平	40@25	1,000
2 R.C	36@1800	64,800
3 施放		1,600
4 填砂	300@12	3,600
5 填石	25@150	3,750
6 護基		10,000
7 灌漿	25@1200	3,000
8 堤面胸土	15@650	9,750
9 雜填		2,500

100,000 元/m

1 護板 $2.25 \times 20\text{m}^2 = 45\text{m}^2$
 $45 \times 0.346 = 13\text{m}^3$

15 @ 2,000 = 2,600 } 8,000 元 Say 10,000
 2 拋石 30 @ 180 = 5,400

第二港口深水防波堤之構造型式一有底圓筒組合式

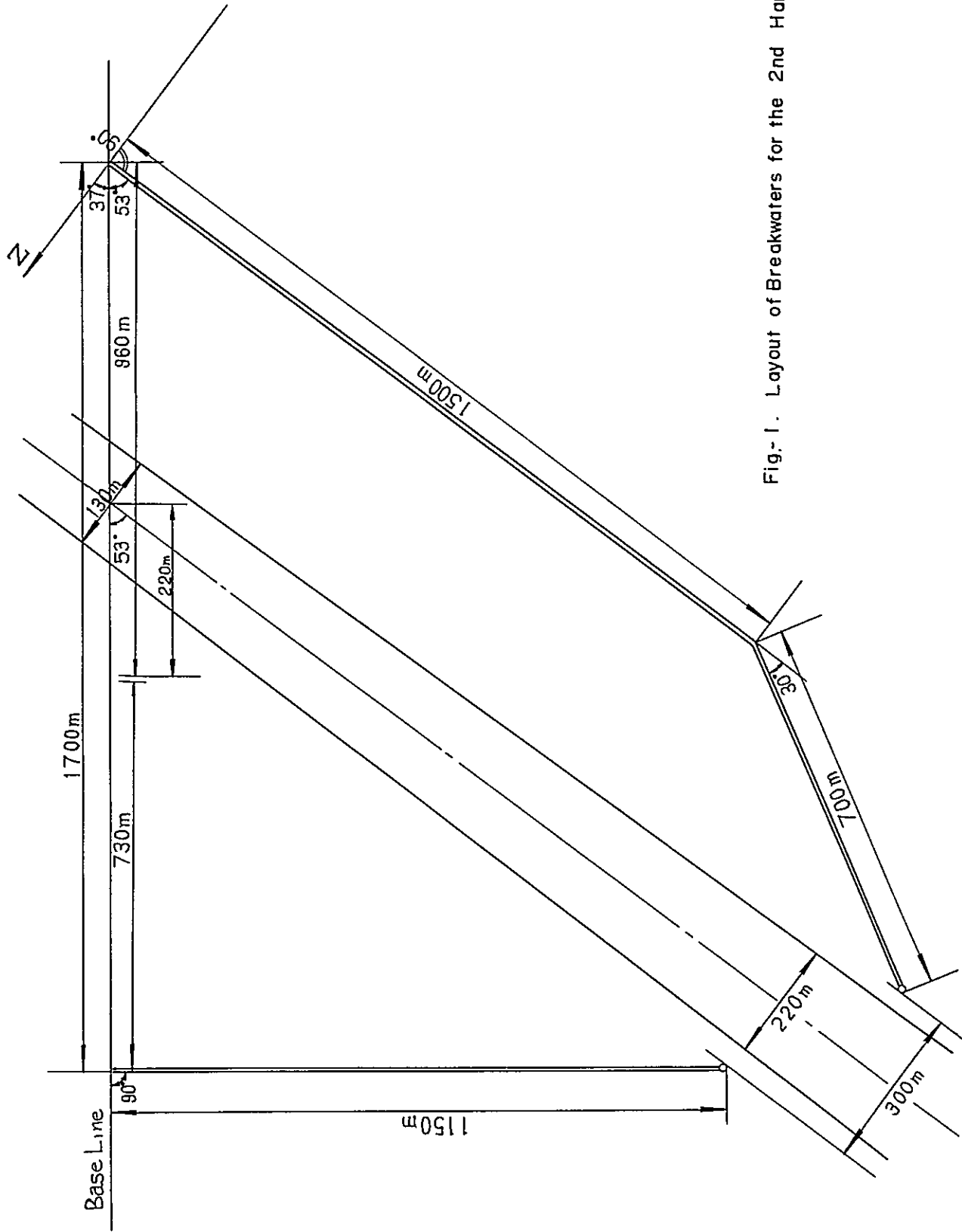


Fig. 1. Layout of Breakwaters for the 2nd Harbour Entrance.

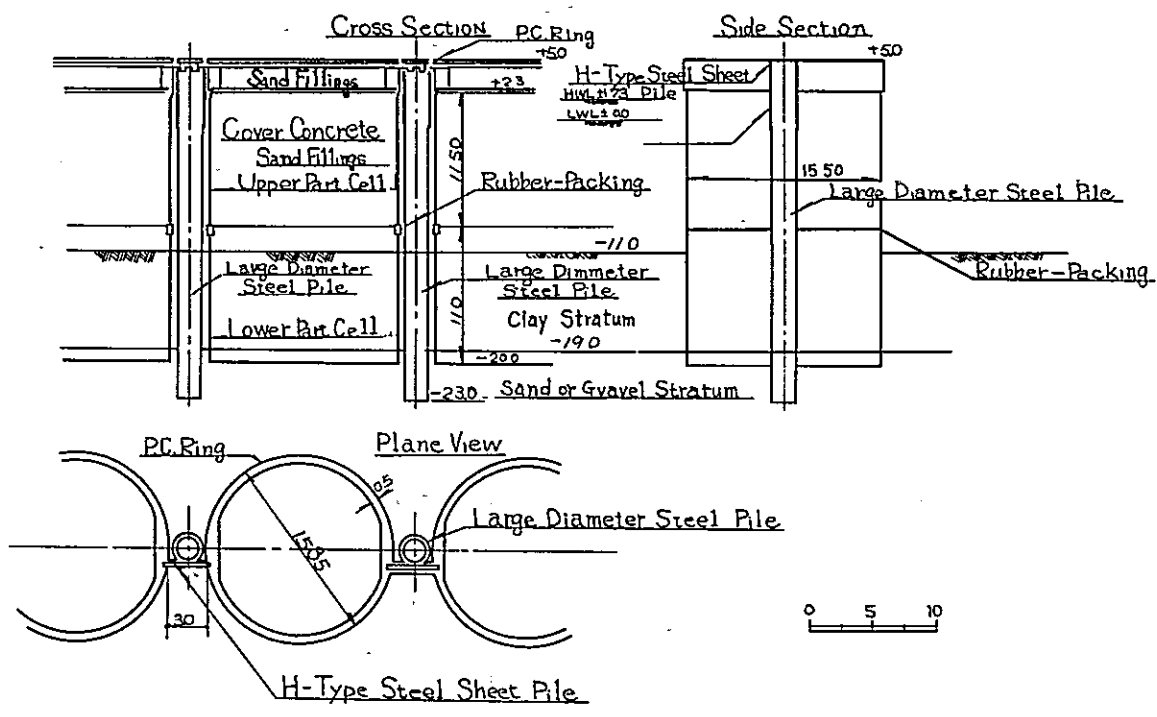


Fig-2 Sectional View of NO.5 Breakwater.

Fig-3. Plane of port of Tagonoura.

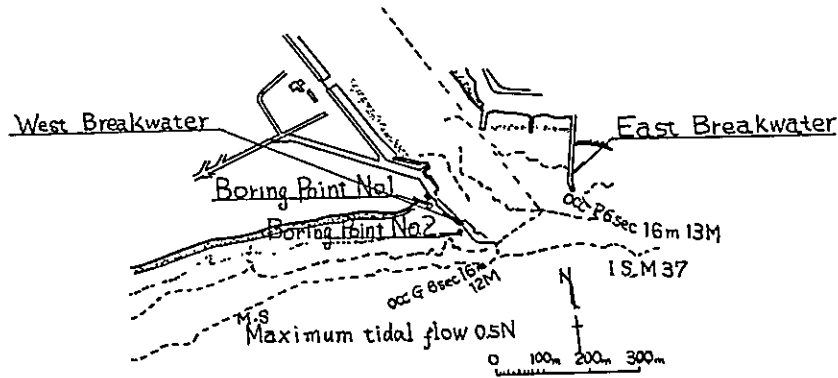
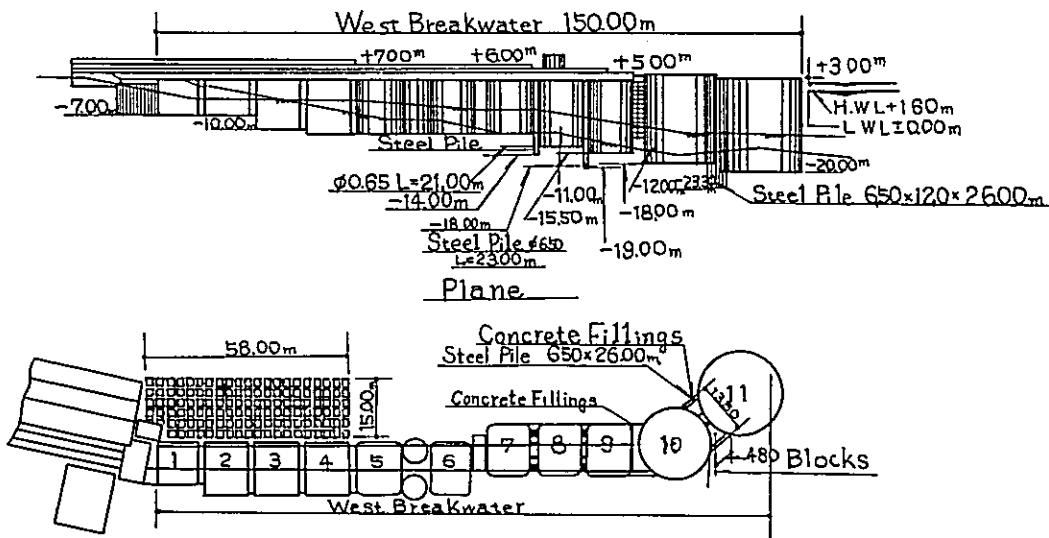


Fig-4. Plane and Vertical Section of West Breakwater.



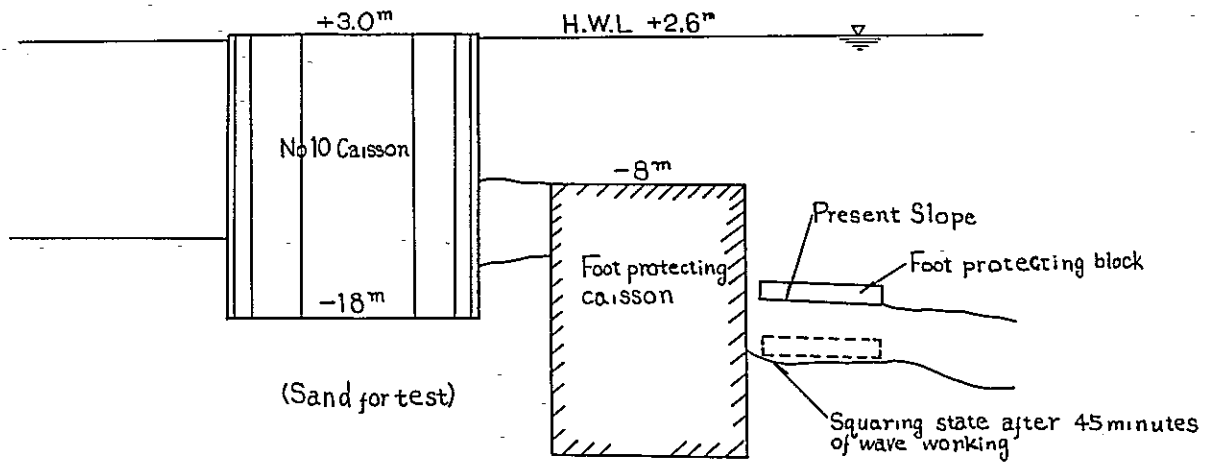


Fig-6. Examination in case of laying caissons and blocks with no joints for foot protection.

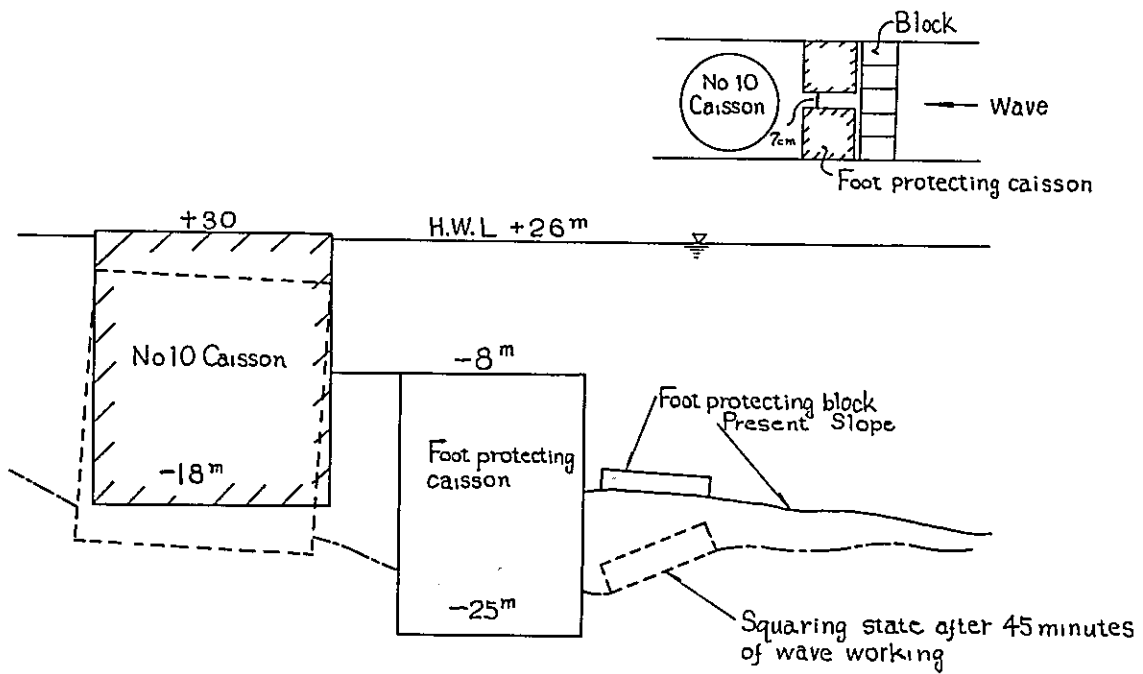
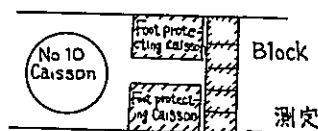


Fig-7 Examination in case of laying foot protective blocks and caissons with the space between them.



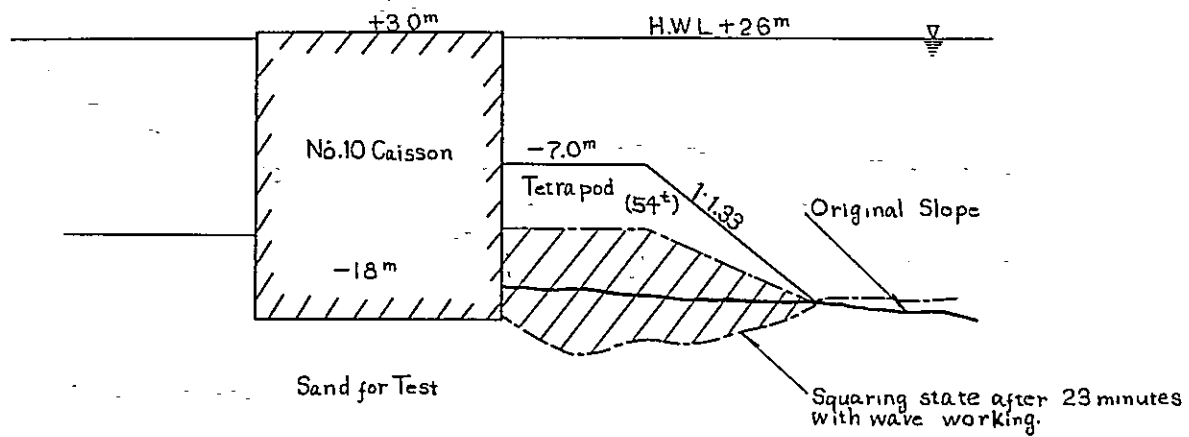


Fig-8. Examination in case of laying tetrapods with joints.

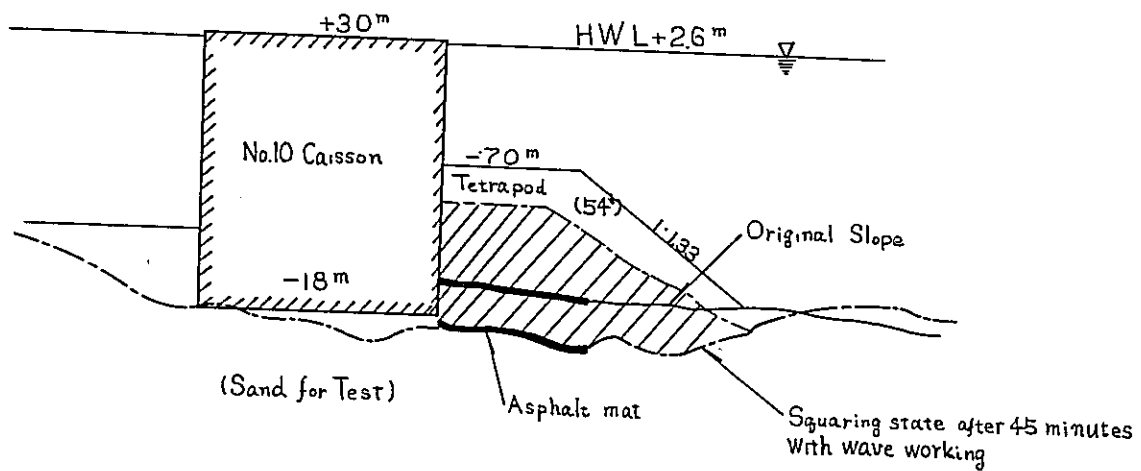


Fig-9 Examination in case of laying Asphalt mat.

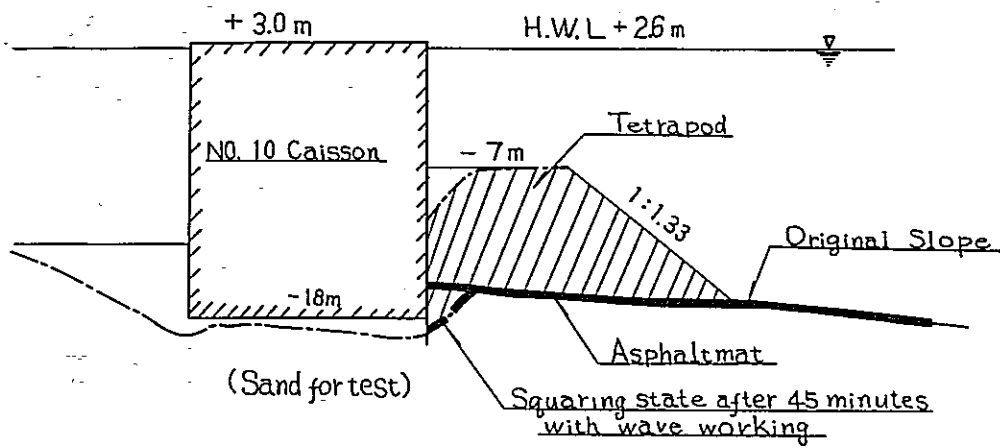


Fig-10. Examination in case of laying Asphalt mat (150cm)

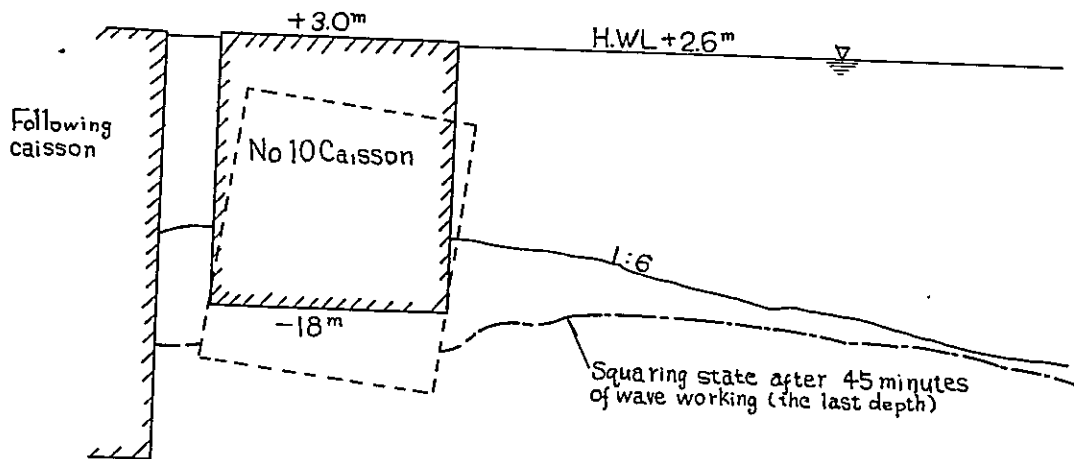


Fig-11. Squaring state on NO.3 side line.

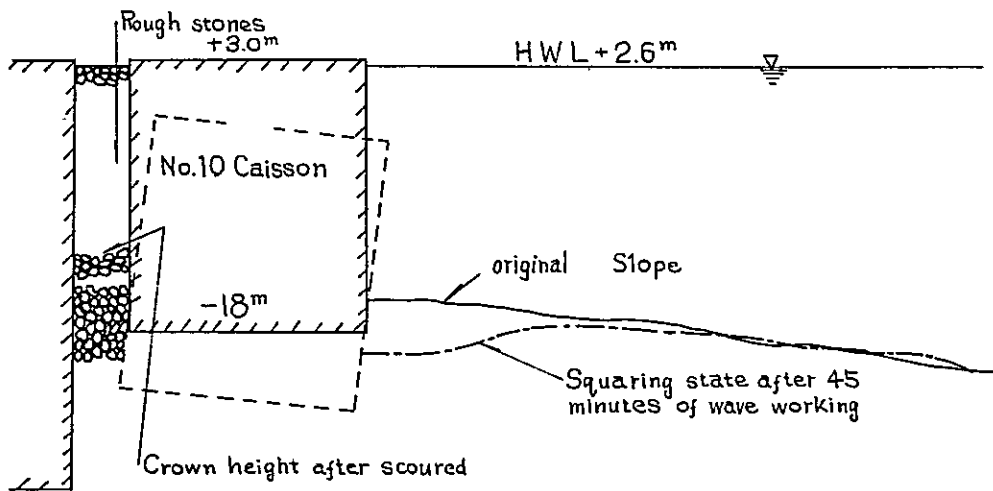


Fig-12. Squaring state on NO. 3 side line.

Fig-13

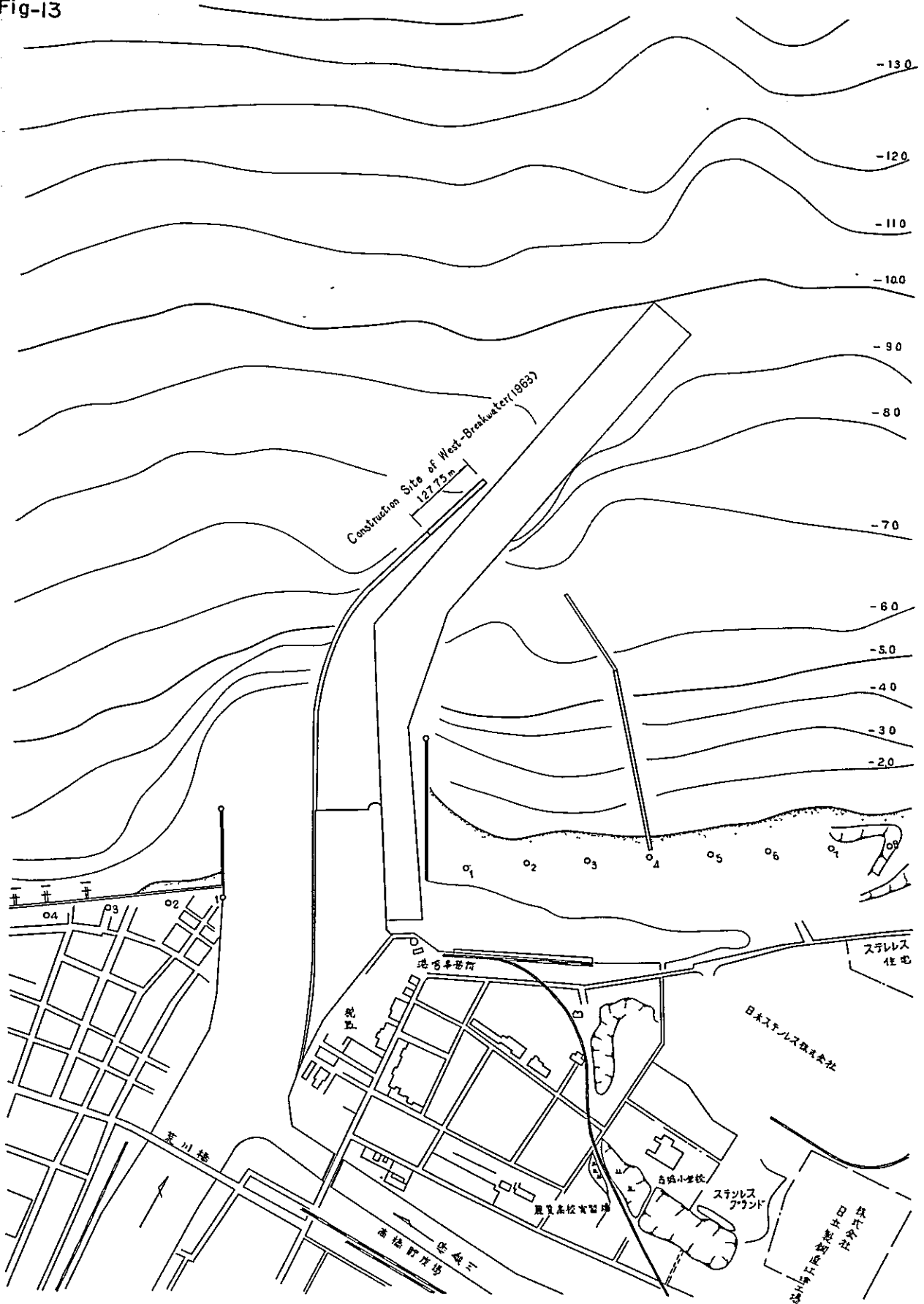


Fig-14

Plane

Scale 1:200

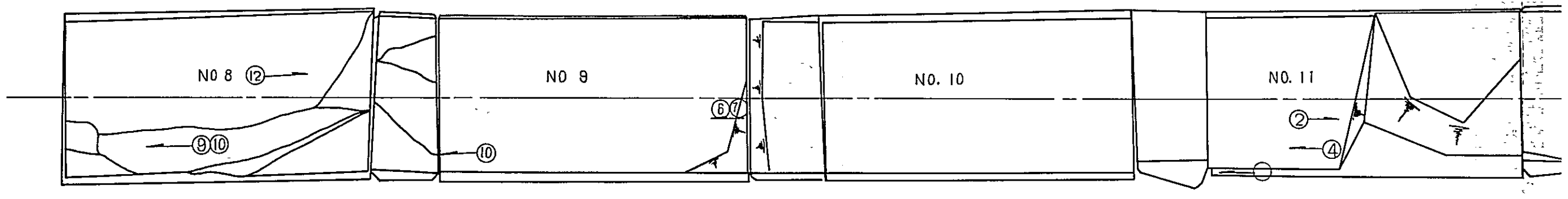
West - Breakwater Plane Figure

Feb. 19, 1964 Sounding

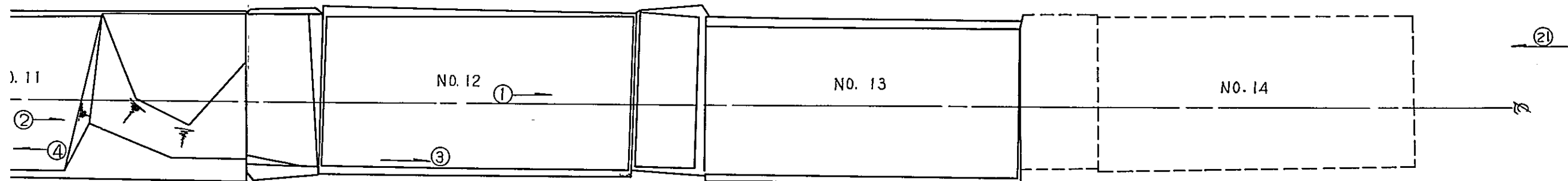
Sea side

22

Harbor side



Scale 1:200



Harbor side

Fig-15

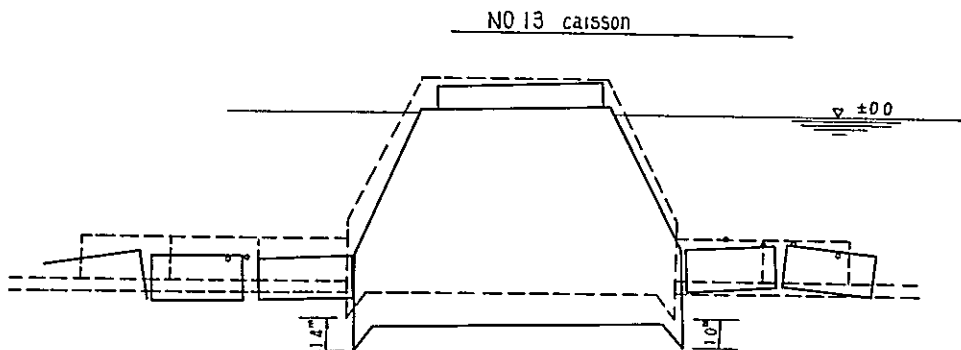
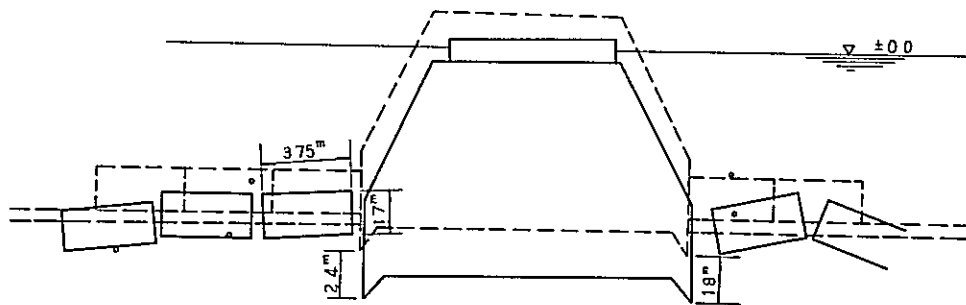
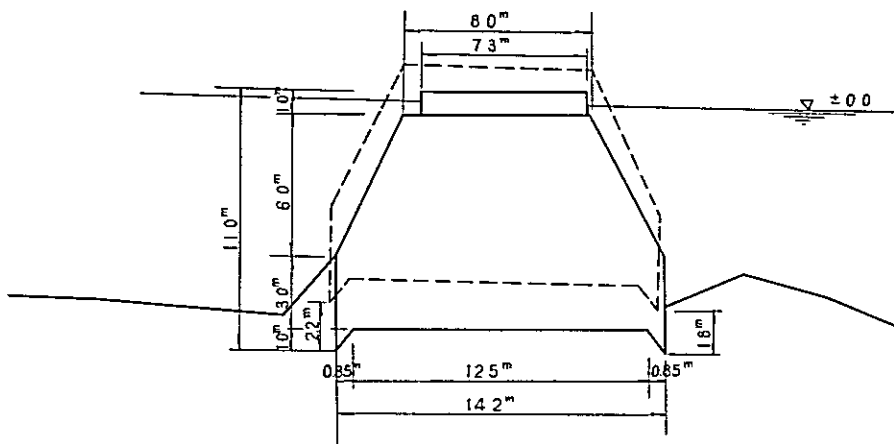
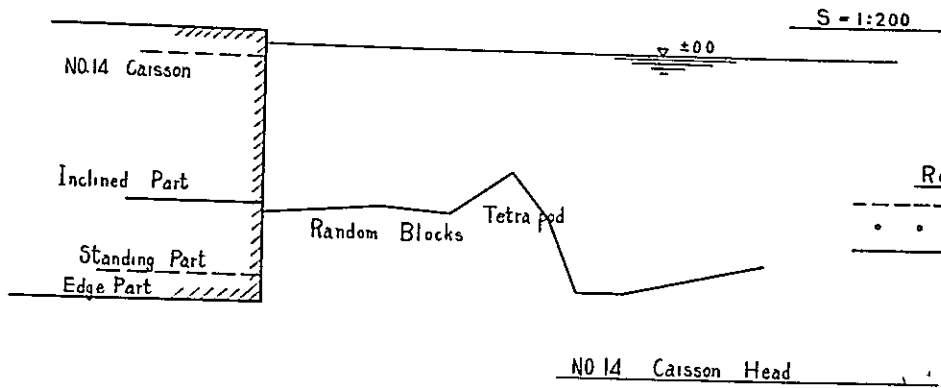
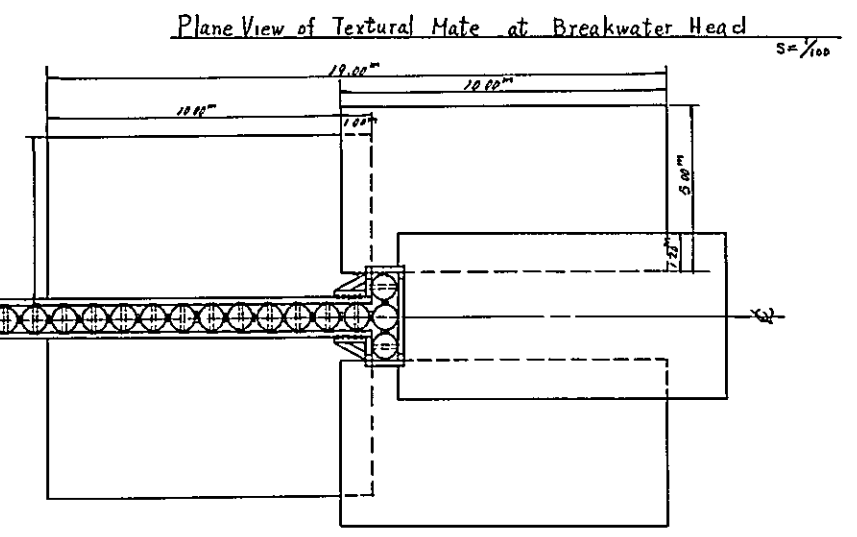
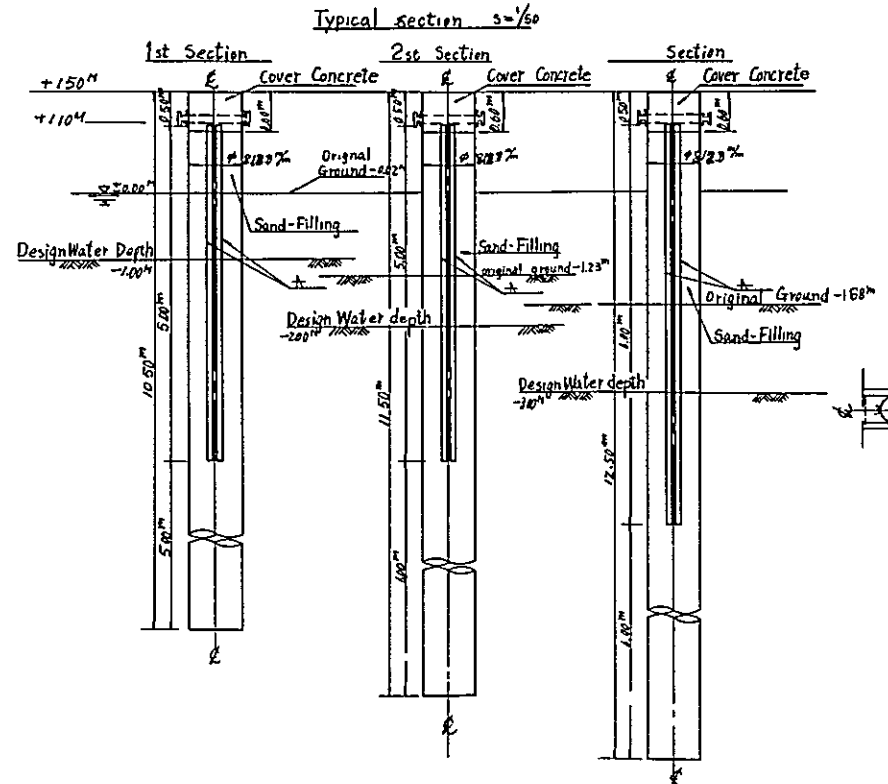
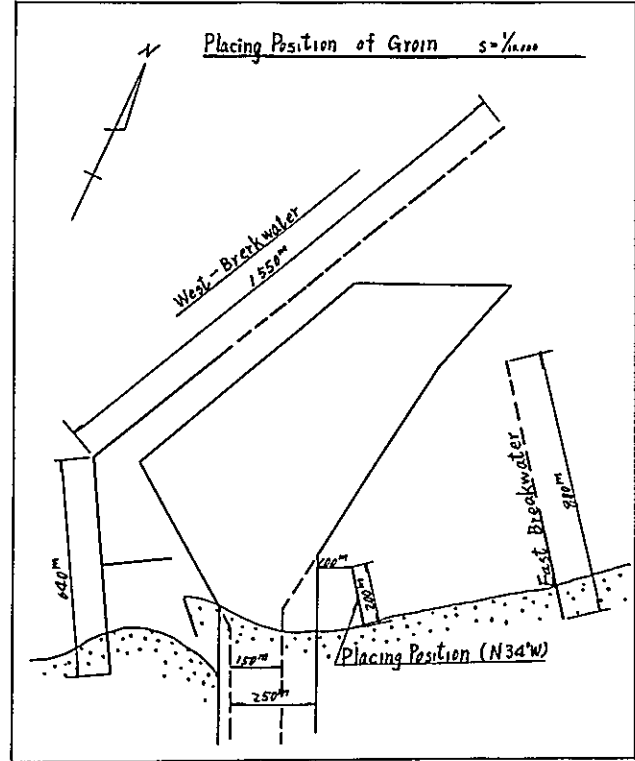
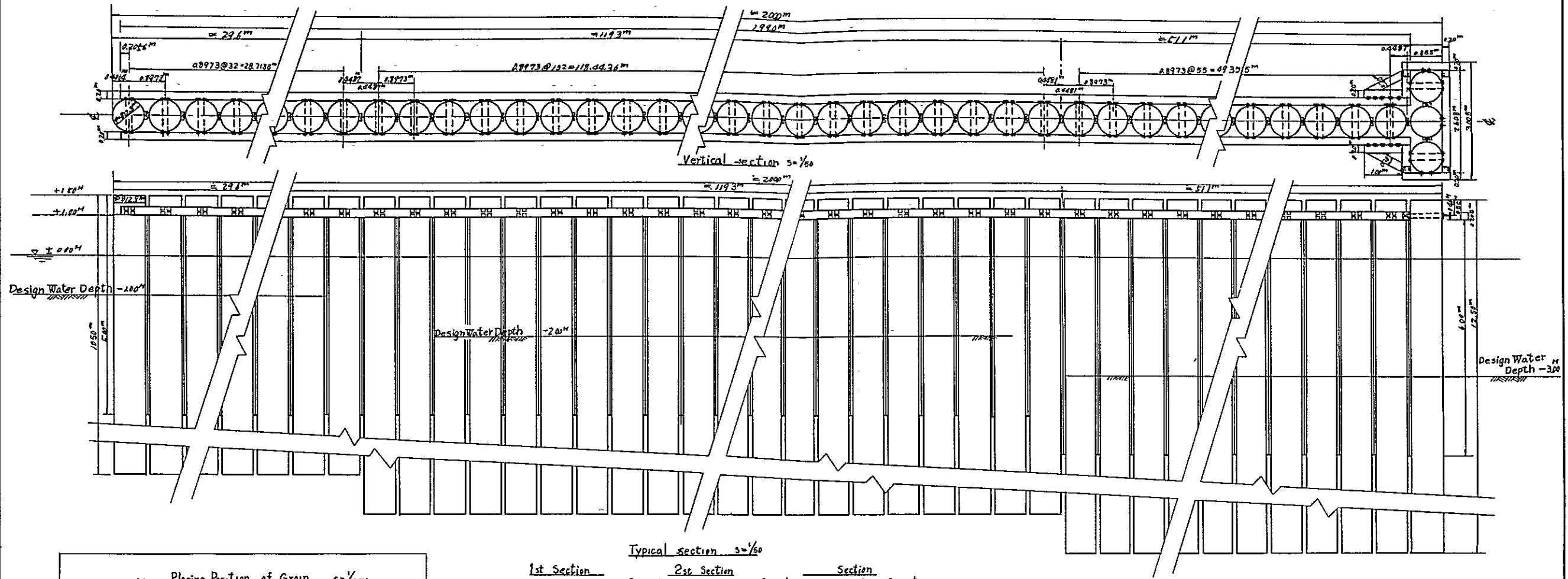


Fig-16

Plane $s=1/50$



Name of Structure	Mark for Mixture Works	Standard Strength for Design
Steel Pile Type with Cover Concrete	5-3	150 kg/cm ²

Fig-17

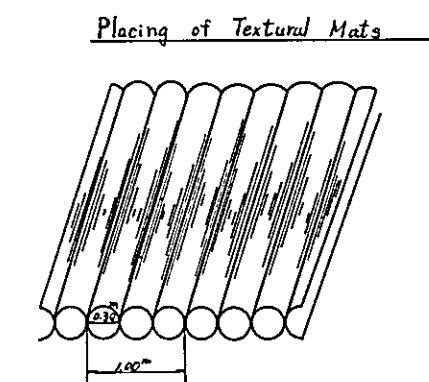
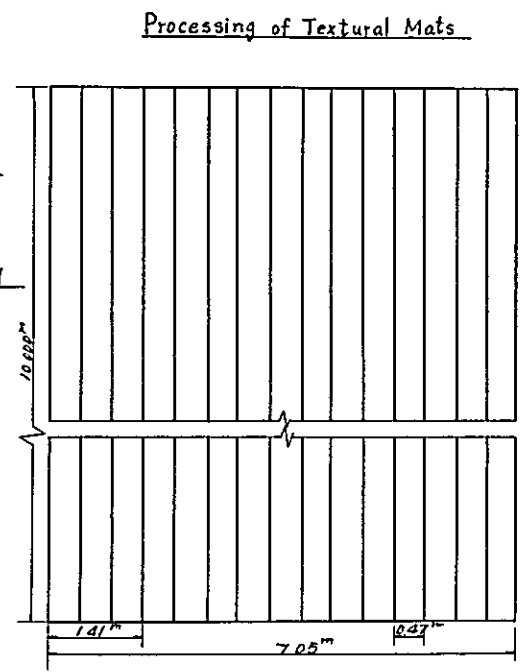
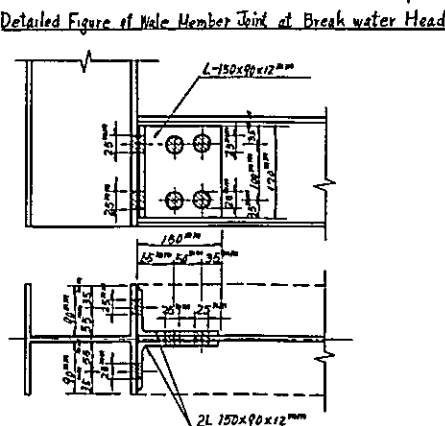
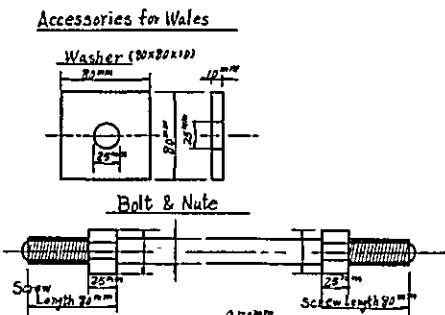
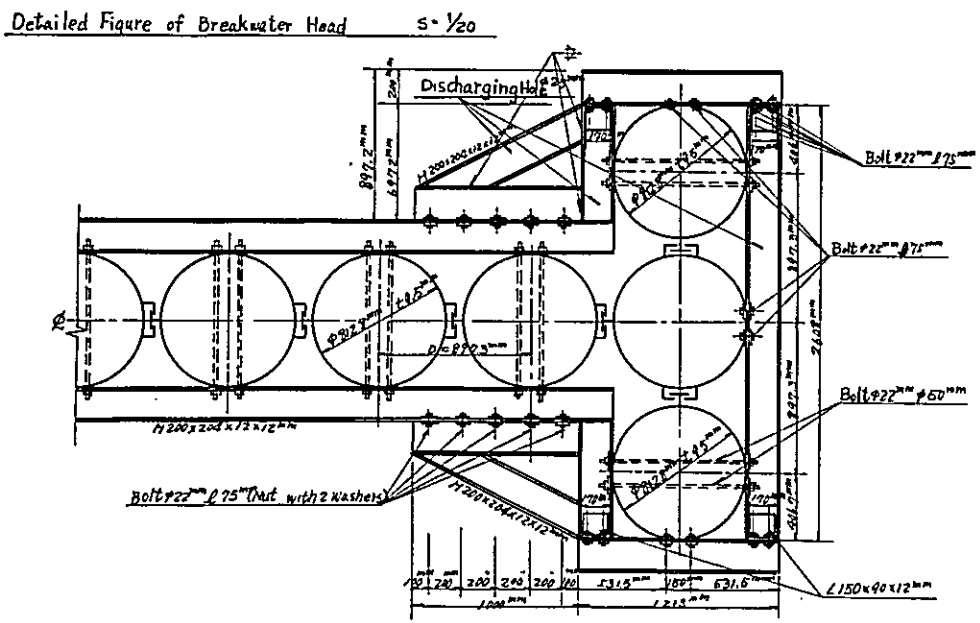
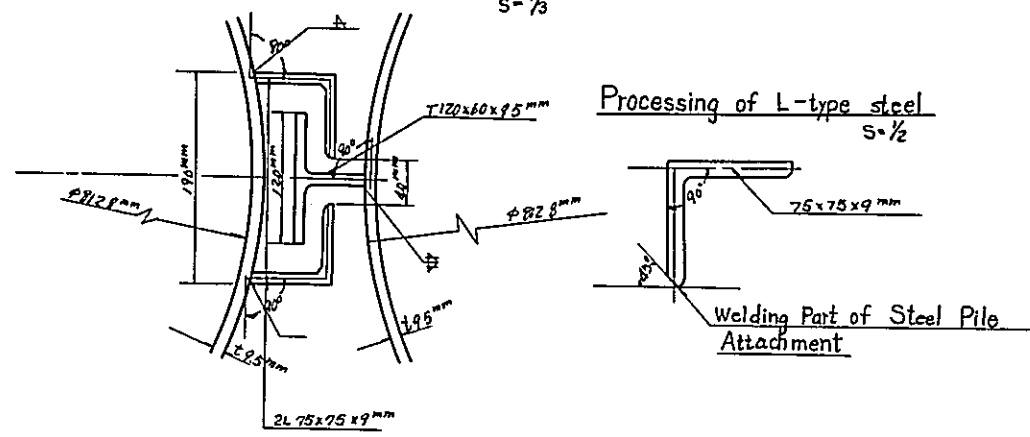
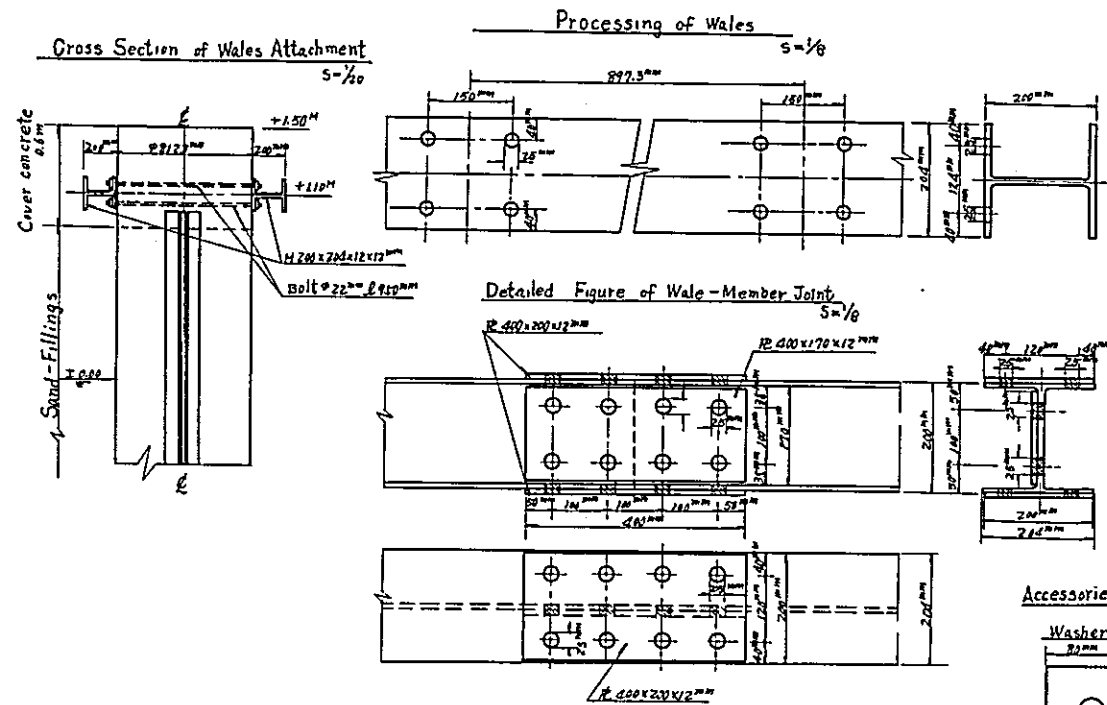
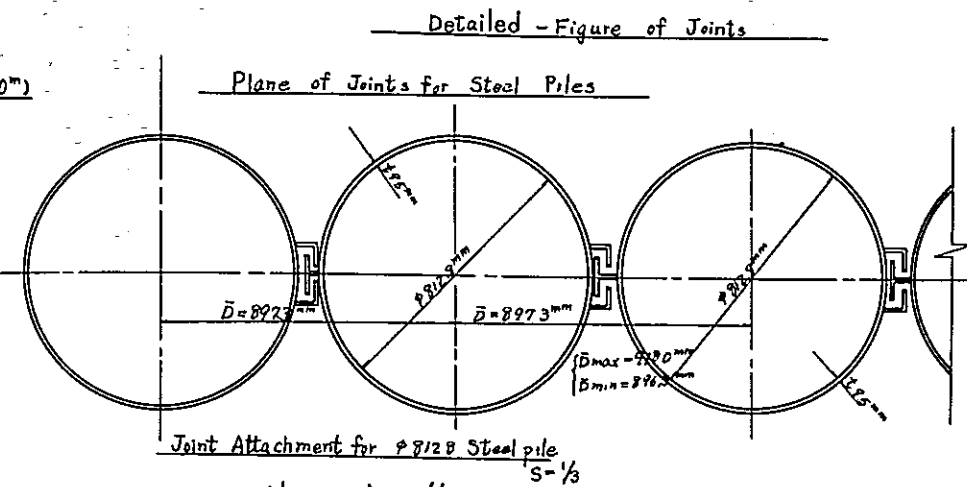
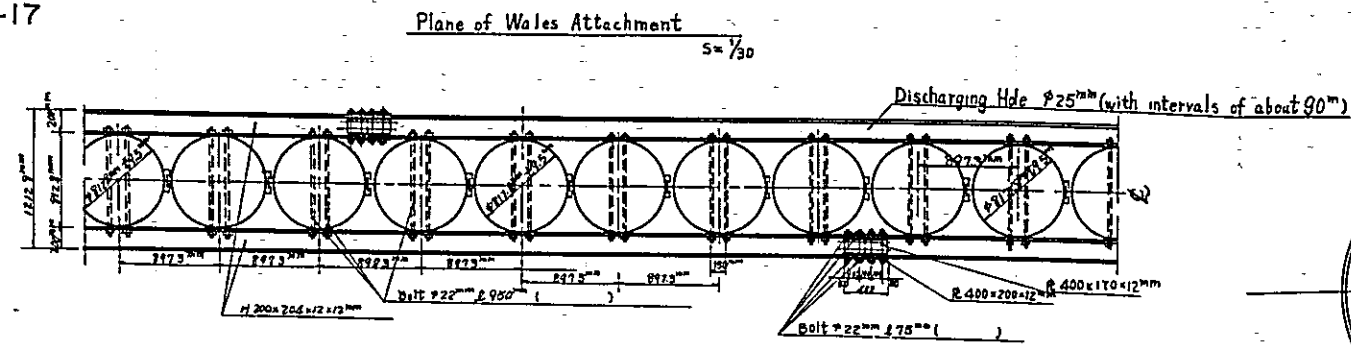
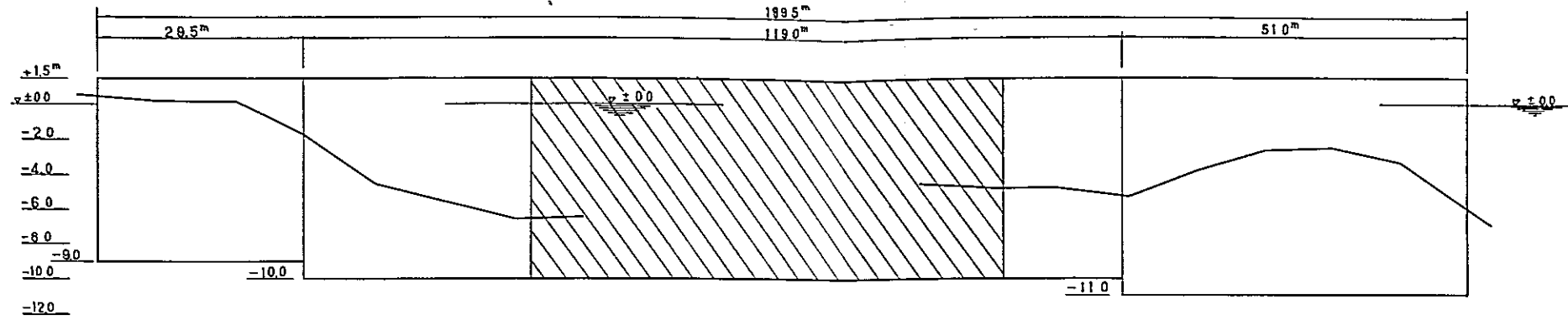


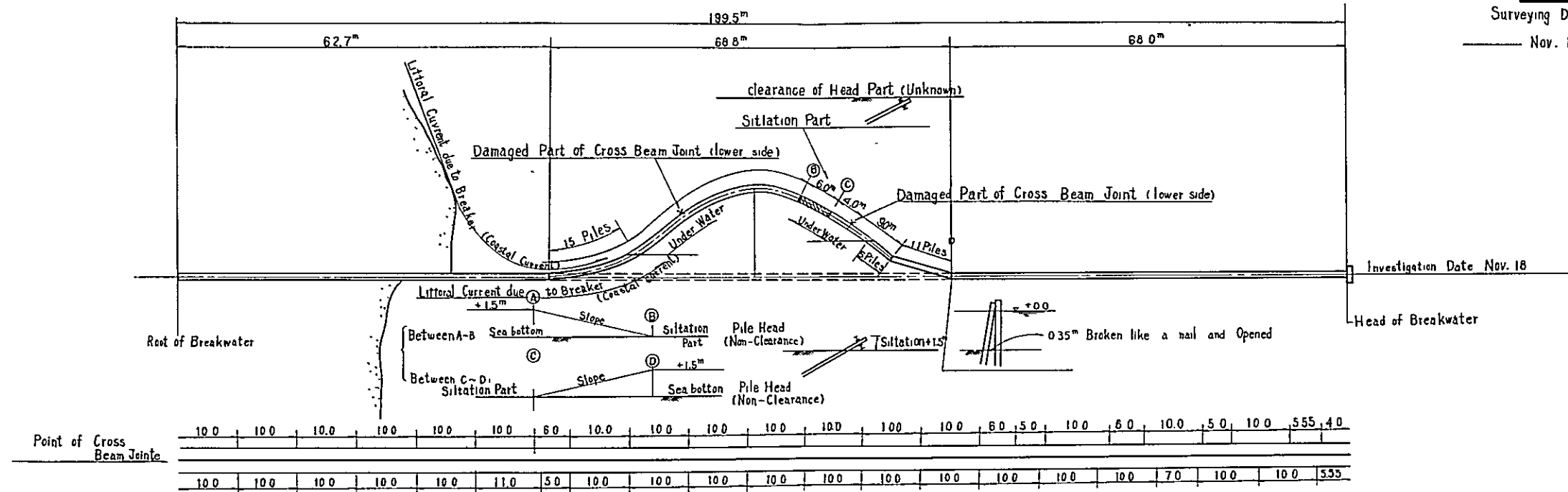
Fig-18

Damage of Breakwater in East Port of Niigata

Vertical Section of West Side



Remarks
 Surveying Date
 Nov. 17



Vertical Section of East Side

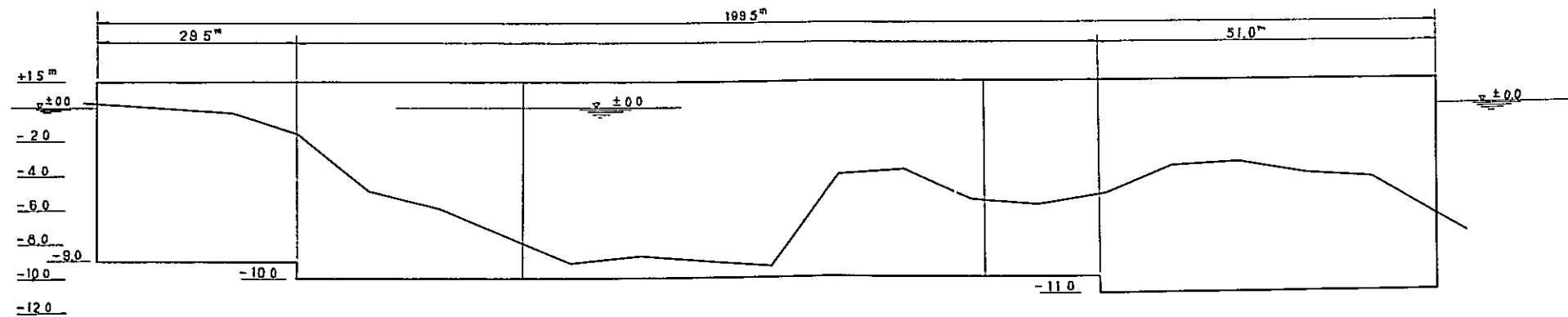
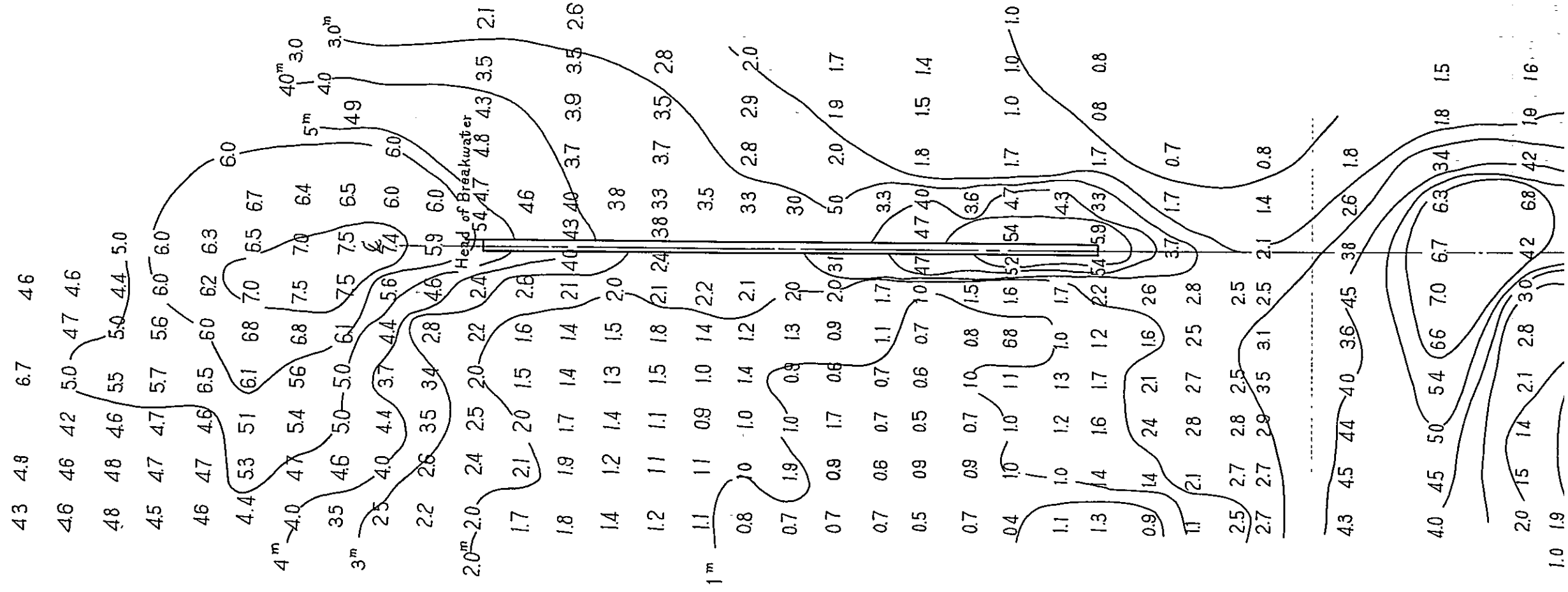


Fig-19

1967. 11.17 ~ 1967.11.18 Sounding Plane

S = 1:500



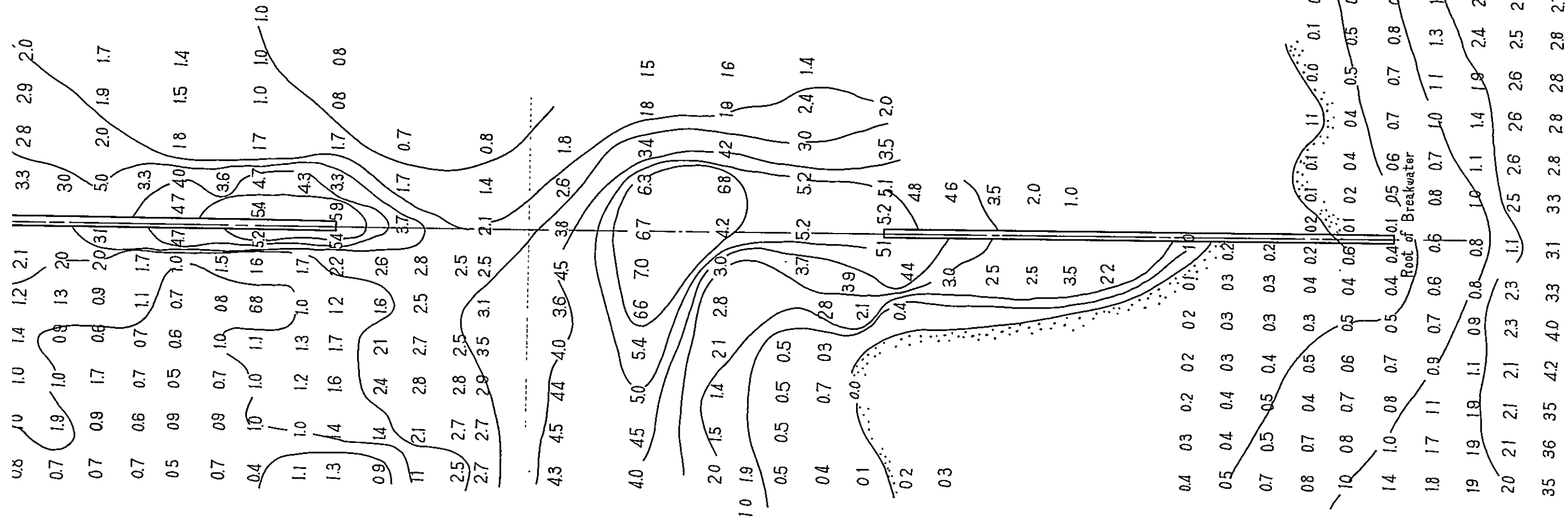


Fig-20

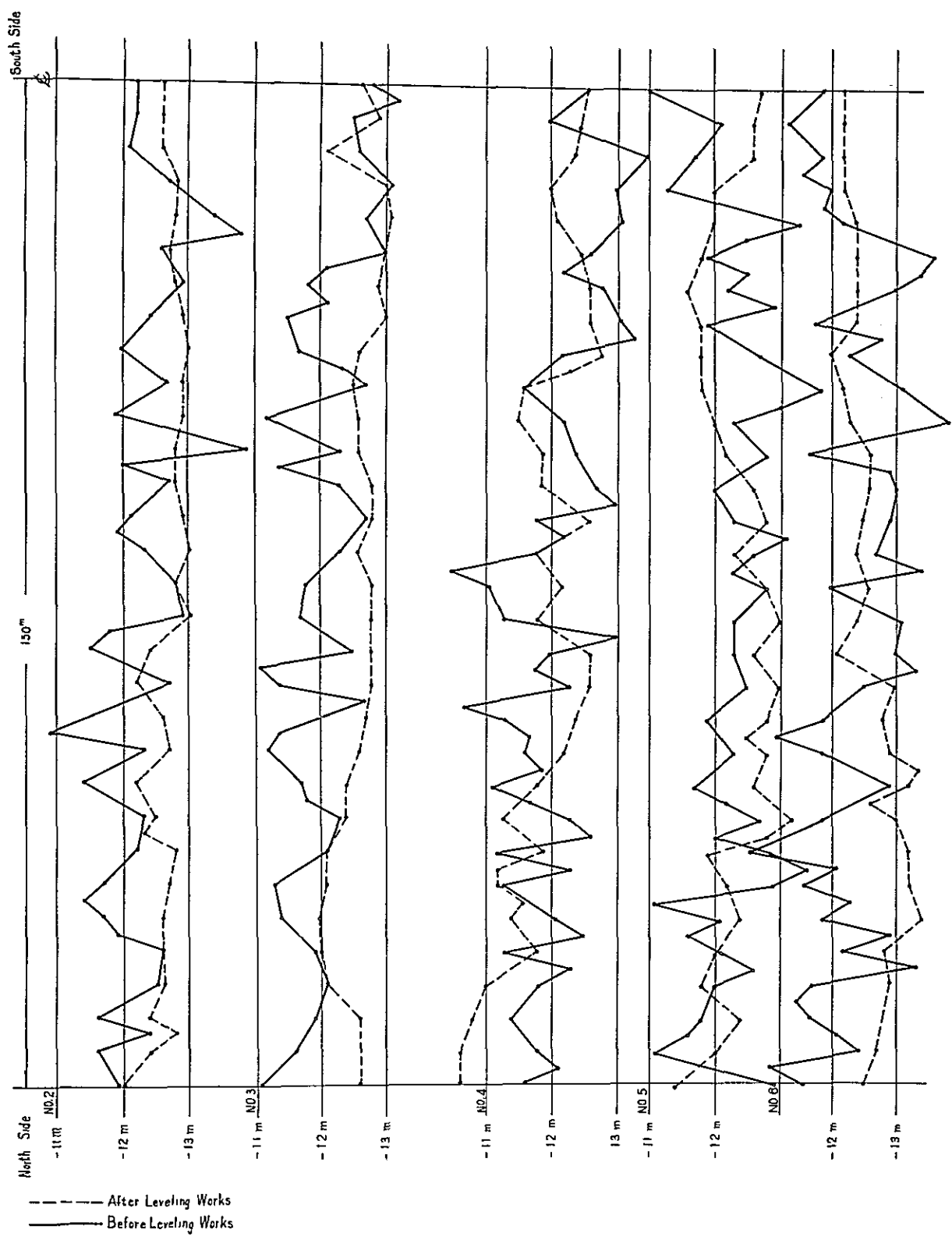


Fig-21

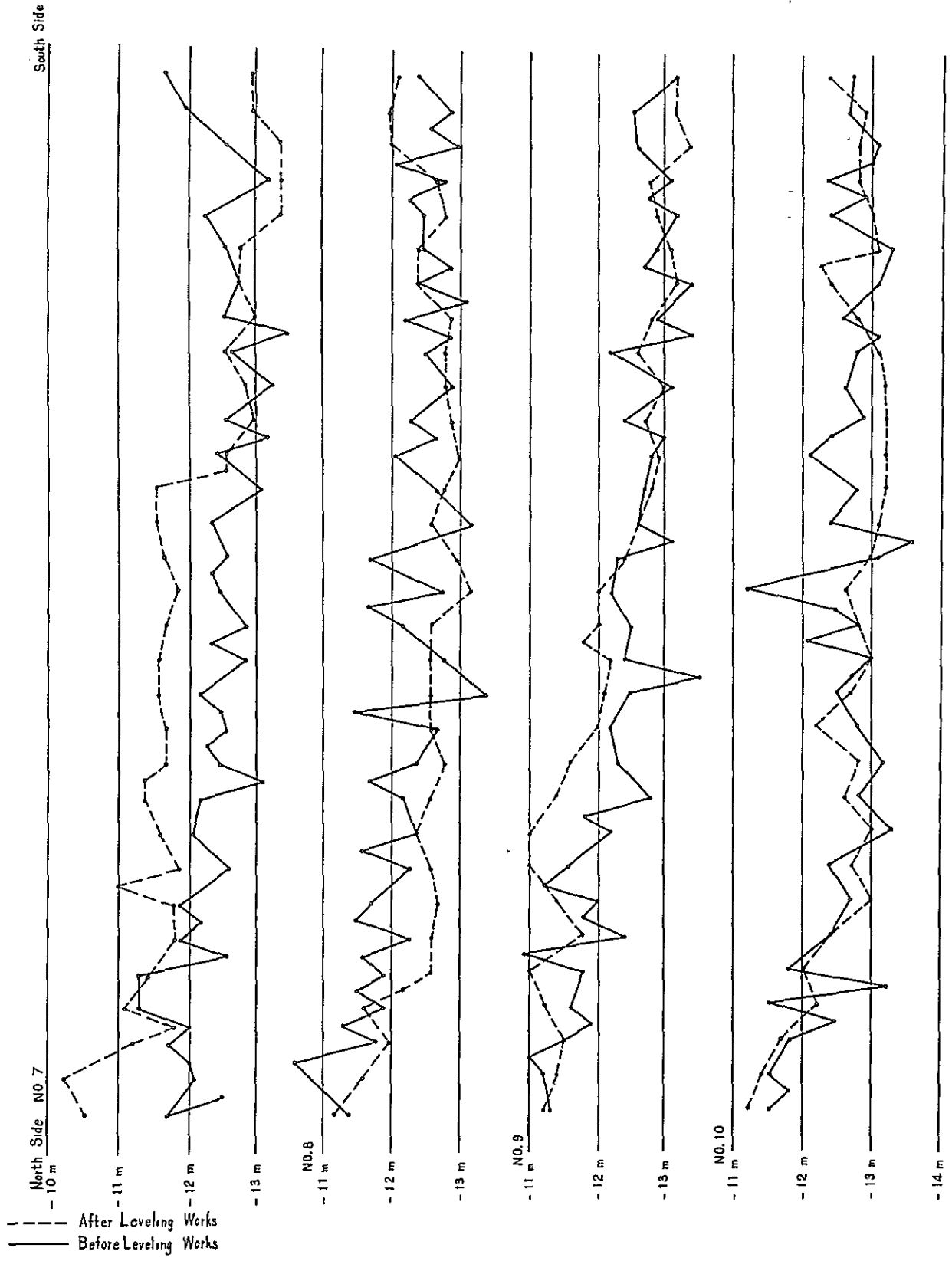
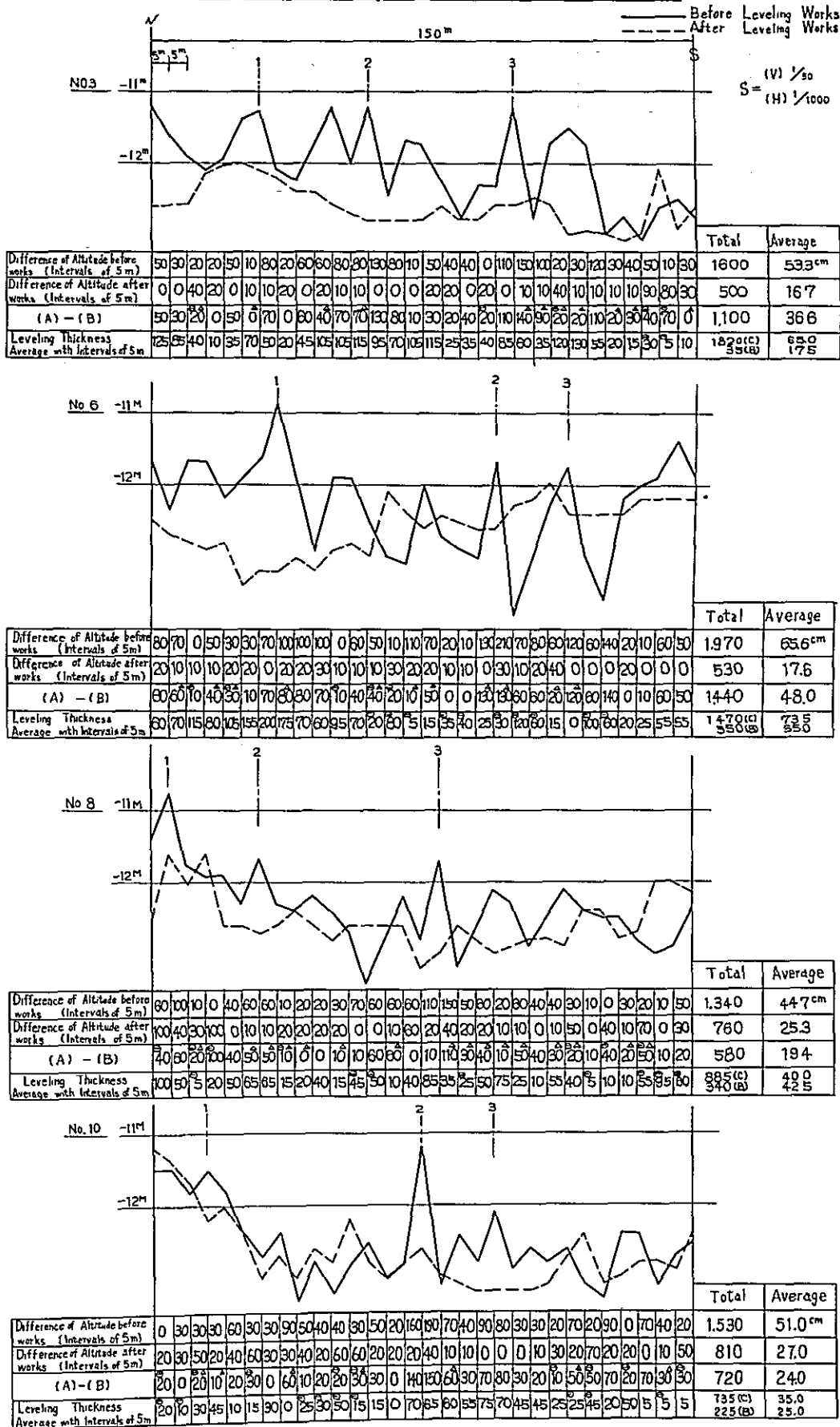
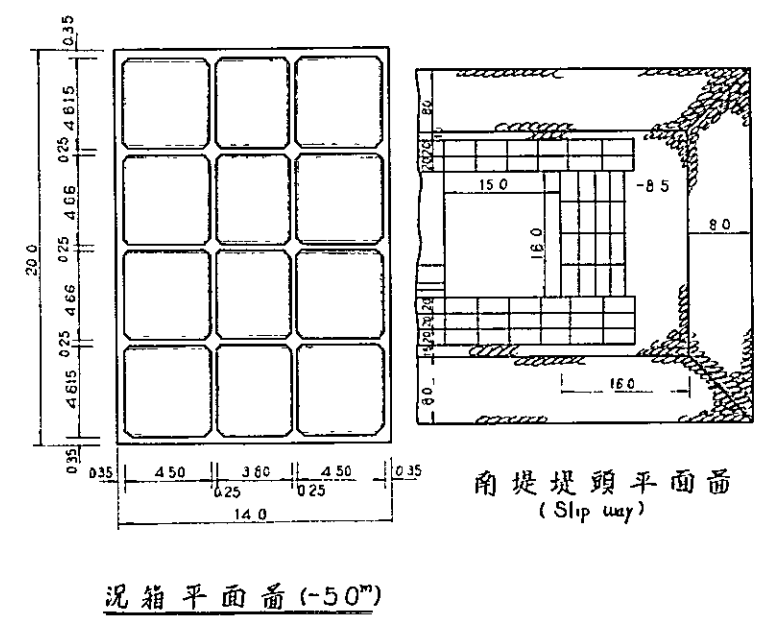
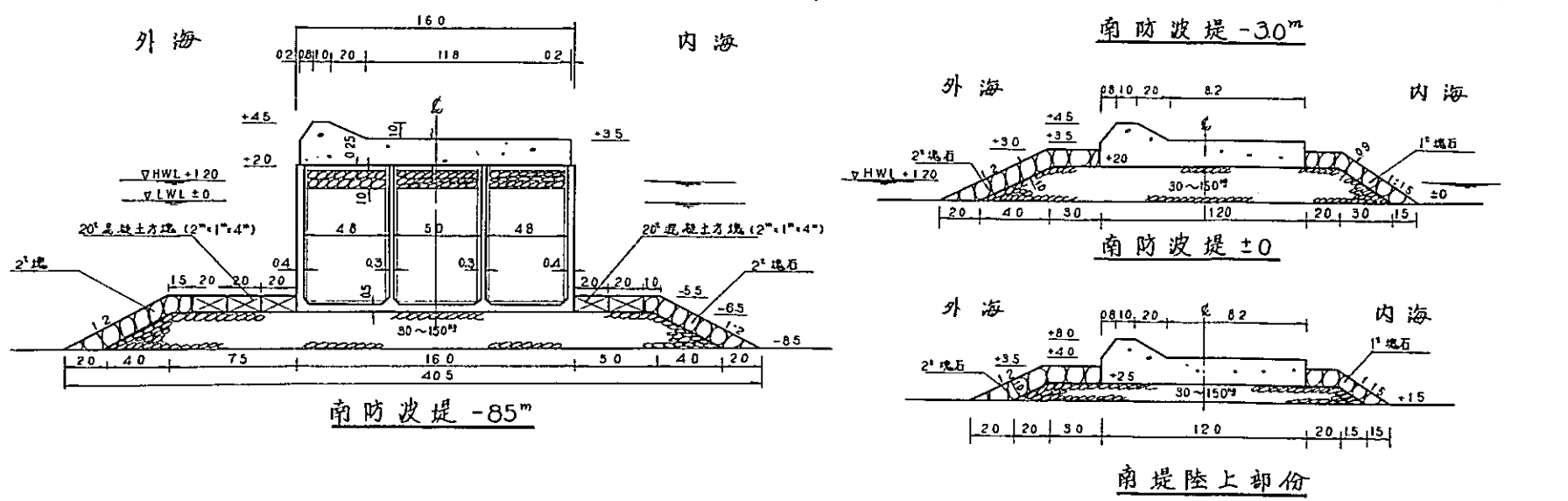
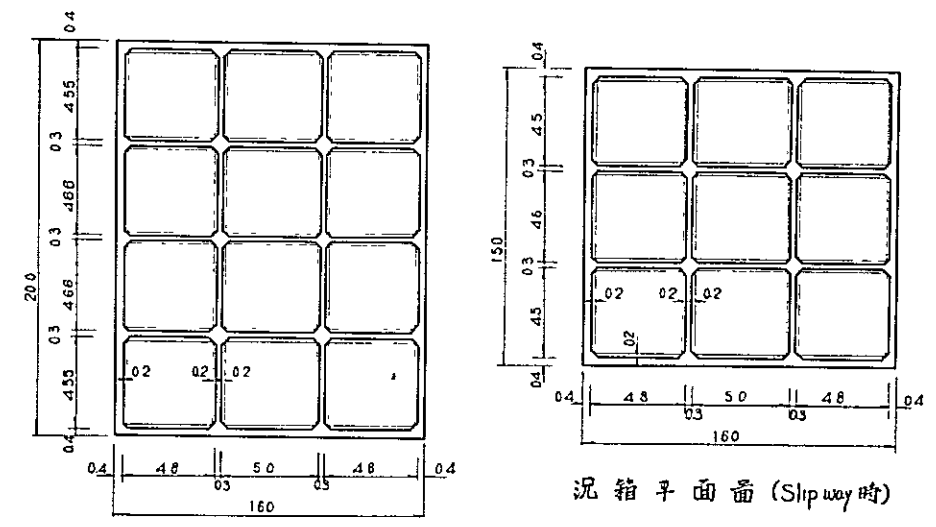
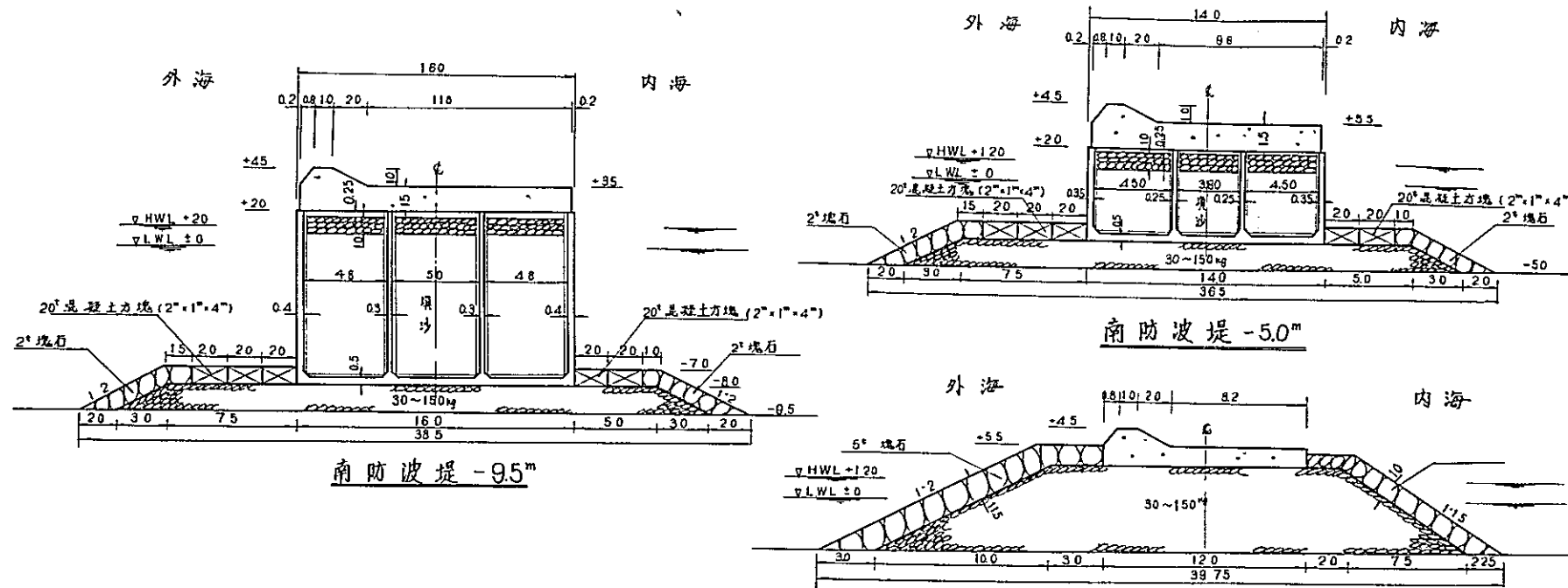
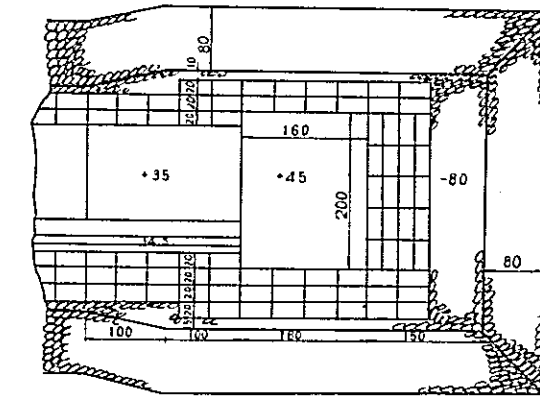
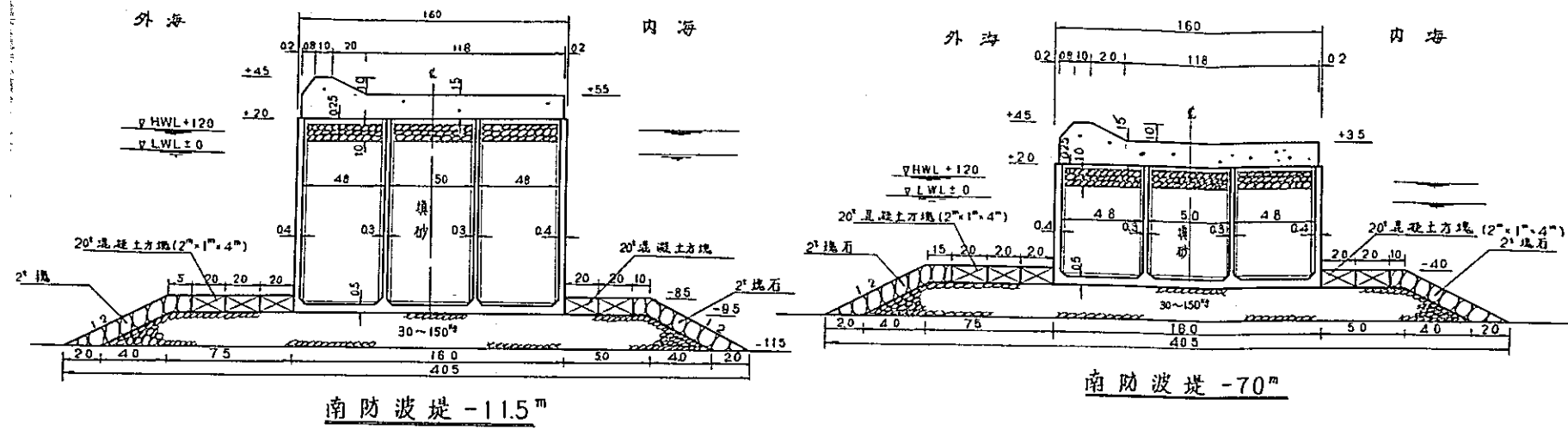


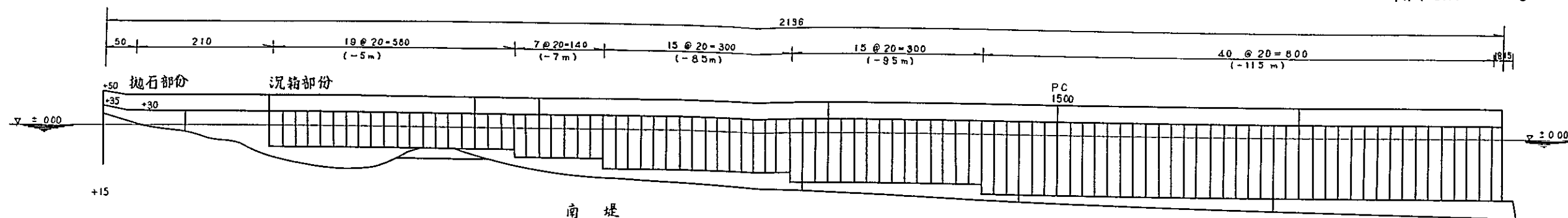
Fig-22

Gross Section of Leveling Works Site in South-East Channel



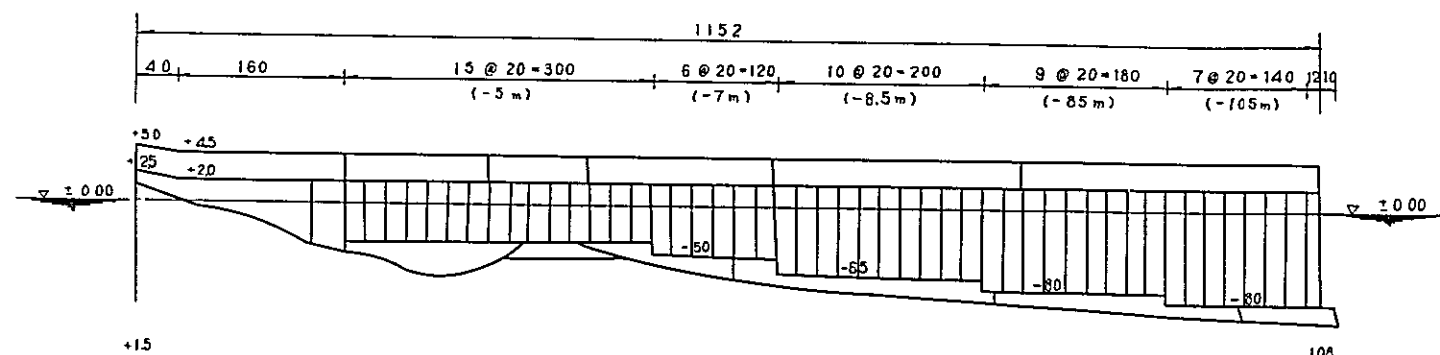
Appendix Fig-1





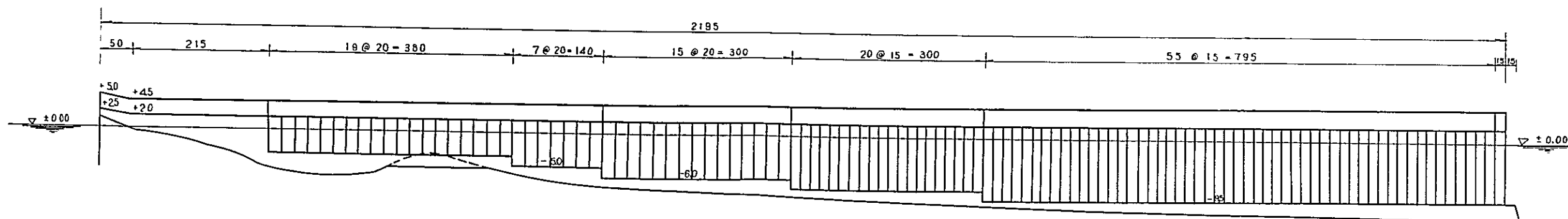
抛石部份 沉箱部份

26100	160351	(30~150 [#]) 基础抛石	6900	19200	15200	51670	24380	54400	34000
3380	51881	粗度整平	880	2500		18000	11480	9700	10800
4788	20227	粗度整平	1246	3540		8980	5970	3750	4180
8170	29800	覆抛块石	2100	6070		8940	6160	6440	6120
6499	31832	覆抛块石整平	1688	4810		9600	6010	6860	2145
60259		沉箱型点			5405 (16)			9220 (13)	6540
97		沉箱型放				15390 ()		12106 (16)	16100 (16)
219350		沉箱内填沙			34		18		20
27894		沉箱内抛石			45780		40480		4
49180		沉箱内整土			8390		5280	60850	60200
18632		方块型点			8600	18050		6180	5880
2454		方块型放				6000 (750)	4400 (550)	9650	8340
					750		550	4000 (525)	4000 (500)
								520	500
									1032 (15)



抛石部份 沉箱部份

19360	61504	(30~150 [#]) 基础抛石	15600	5760	26630	18860	12920	3051
2200	21736	粗度整平	1800	400	6500	7380	4140	3836
3795	8275	粗度整平	3068	689	3123	3099	1476	577
6424	14041	覆抛块石	5400	224	4590	3560	3150	1761
5107	15200	覆抛块石整平	4167	840	4910	3780	3496	
21397		沉箱型点			3770 (15)	5370 (12)	8544 (12)	(8)
48		沉箱型放			15	12	12	9
63380		沉箱内填沙			10650	15560	18840	17550
9724		沉箱内抛石			2760	2560	2370	1834
3478	18540	沉箱内整土			2350	5066	4750	8174
9856		方块型点			2800 (350)	2600 (325)	2400 (300)	2056 (25)
1232		方块型放			350	325	300	257



南堤

