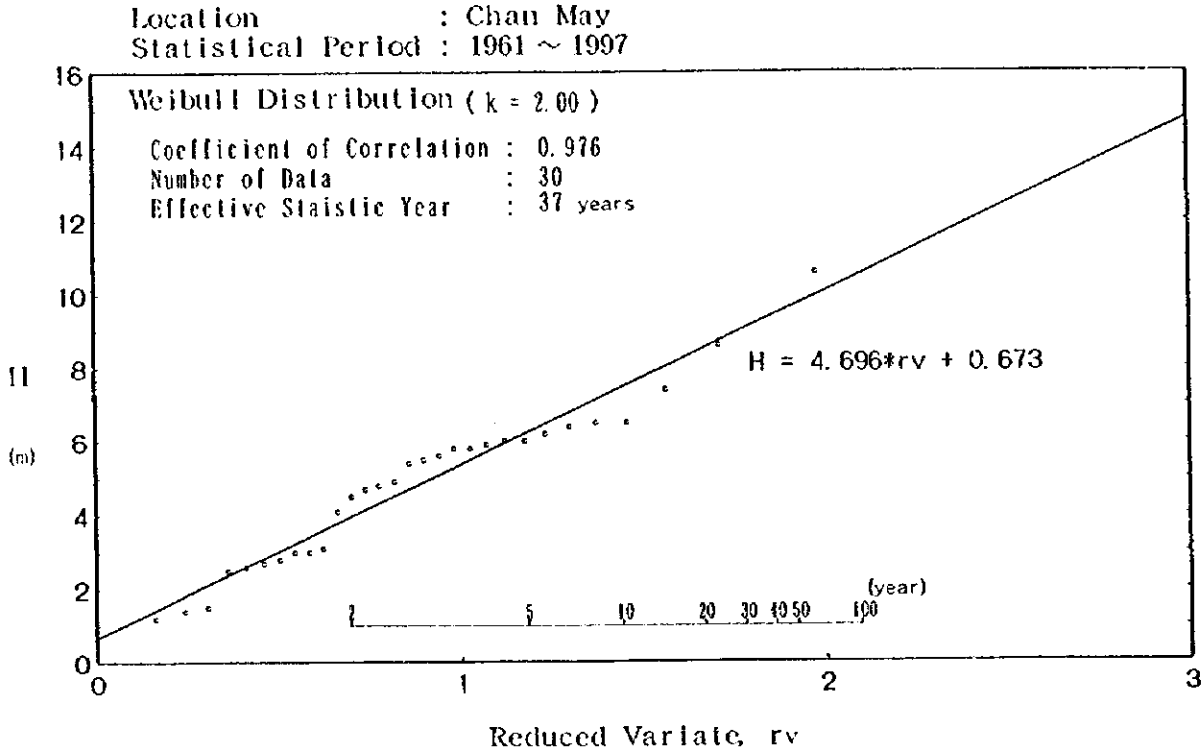
Table A 4.3.6 Hindcast Waves by Typhoons Affected the Central Coast of Viet Nam (1961-1997)

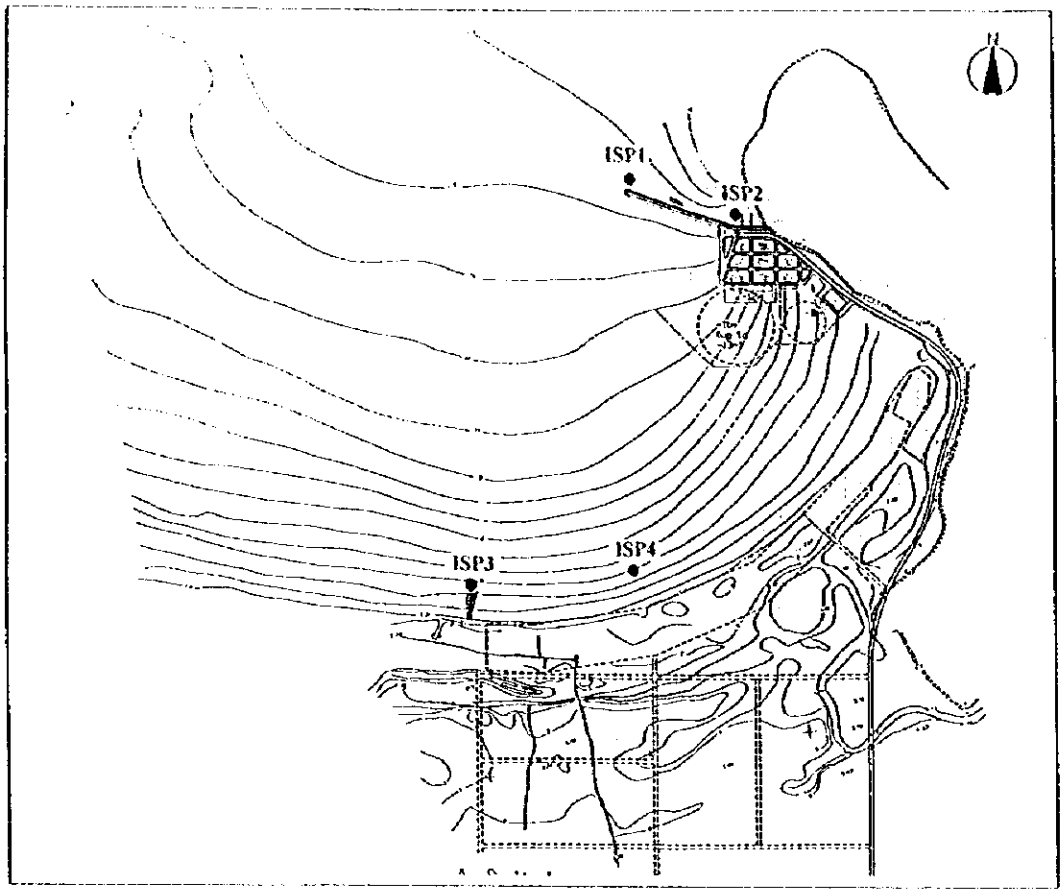
No.	Typhoon No.	Name	Chan May				Danang				Dung Quat (Ky Ha)			
			Time*	Height (m)	Period (sec)	Direction	Time*	Height (m)	Period (sec)	Direction	Time*	Height (m)	Period (sec)	Direction
1	9721	Fritz	09/25 11:12	5.8	9.5	E	09/25 11:12	6.1	9.7	E	09/25 02:42	5.0	9.0	NE
2	9622	Beth	10/21 02:30	1.2	8.8	ENE	10/21 05:00	1.3	8.7	ENE	10/21 04:42	1.3	9.1	ENE
3	9521	Zack	11/01 11:06	4.9	10.0	ESE	11/01 10:18	5.3	10.1	ESE	11/01 09:00	6.6	10.6	E
4	9325	Kyle	11/24 00:24	3.1	9.8	ESE	11/23 23:30	3.5	9.9	ESE	11/23 21:18	4.3	9.7	ESE
5	9226	Colleen	10/28 13:54	2.7	9.2	ESE	10/28 13:12	3.0	9.1	ESE	10/28 11:18	3.8	8.9	ESE
6	9224	Angela	10/23 10:42	2.8	8.2	ESE	10/23 10:12	3.1	8.4	ESE	10/23 03:48	3.6	8.1	ESE
7	9025	Mike	11/15 17:48	4.7	12.0	ESE	11/15 17:06	4.9	11.8	ESE	11/15 21:48	5.4	10.0	E
8	9018	Ed	09/18 14:48	6.0	9.9	ENE	09/18 13:36	5.9	9.9	ENE	09/18 07:00	5.3	9.8	NE
9	8926	Dan	10/13 06:00	4.8	10.7	ENE	10/13 05:12	4.8	10.7	NE	10/13 02:12	4.0	10.9	NE
10	8904	Cecil	05/25 01:12	6.5	9.9	ENE	05/24 23:00	6.2	9.7	ENE	05/24 15:12	4.7	9.1	NE
11	8829	Skip	11/12 23:00	1.4	6.1	ESE	11/12 23:00	1.6	6.1	E	11/11 23:24	1.6	7.2	E
12	8709	Betty	08/15 20:54	6.4	10.8	NE	08/15 18:36	6.3	10.9	NE	08/15 12:06	5.6	11.0	ENE
13	8622	Georgia	10/22 09:54	4.1	9.2	ESE	10/22 09:06	4.6	9.3	ESE	10/22 06:54	5.9	9.9	E
14	8619	Dom	10/11 06:12	1.5	6.9	NE	10/11 03:54	1.4	7.0	NE	10/10 23:24	1.0	7.7	NE
15	8521	Cecil	10/15 22:36	8.6	11.6	ENE	10/15 21:48	8.3	11.5	ENE	10/15 18:00	6.7	11.0	ENE
16	8424	Agnes	11/07 21:54	5.6	10.6	ESE	11/07 21:12	6.2	10.8	ESE	11/07 19:48	7.3	11.1	ESE
17	8401	Vernon	06/10 17:12	3.0	7.8	ESE	06/10 15:48	3.5	8.2	ESE	06/10 12:00	2.8	7.8	ENE
18	8316	Lex	10/26 02:30	2.6	8.3	NE	10/26 00:24	2.5	8.2	NE	10/25 18:42	2.0	9.1	NE
19	8301	Sarah	06/25 23:12	3.0	7.7	E	06/25 21:30	2.9	7.7	E	06/25 18:18	1.8	7.2	NE
20	8216	Hode	09/06 22:48	7.4	10.8	ENE	09/06 21:54	7.4	10.7	ENE	09/06 18:00	4.8	9.7	NE
21	7919	Sarah	10/11 23:48	2.5	8.7	ESE	10/12 08:24	2.6	8.8	ESE	10/12 04:54	2.8	8.3	ESE
22	7427	Faye	11/04 18:06	6.2	9.9	E	11/04 18:42	6.2	9.8	E	11/04 09:42	6.0	10.1	E
23	7218	Elsie	09/16 06:00	4.5	8.7	ESE	09/16 05:00	4.9	8.9	ESE	09/16 01:42	5.8	9.6	E
24	7217	Flossie	09/04 12:54	5.5	9.3	ESE	09/04 11:06	5.7	9.4	ESE	09/03 20:18	5.8	9.5	ENE
25	7134	Hester	10/23 16:30	5.4	9.6	ESE	10/23 15:12	5.8	9.8	ESE	10/23 11:36	7.0	10.5	ESE
26	7112	Harriot	07/06 04:48	10.6	12.9	ENE	07/06 04:00	10.8	13.0	ENE	07/06 02:36	8.4	12.9	NE
27	7020	Kate	10/25 11:54	6.0	9.8	E	10/25 10:30	6.1	9.8	ENE	10/25 05:42	4.8	9.1	NE
28	6904	Tess	07/11 09:36	5.9	10.0	E	07/11 08:12	5.8	10.1	ENE	07/11 04:30	4.9	10.1	ENE
29	6419	Tilea	09/22 01:12	6.5	10.6	NE	09/22 00:42	6.6	10.7	NE	09/21 21:48	5.0	10.7	NE
30	6121	Ruby	09/24 12:18	5.8	9.8	ENE	09/24 11:30	5.5	9.7	ENE	09/24 04:24	4.4	9.5	ENE

*[Month/day and Local time] when the waves in significant wave occured.



Return Period (year)	Non-exceeding Probabilty	Reduced Variate, rv	Wave Height (m)	Wave Period (sec)
100	0.988	2.097	10.5	14.5
50	0.975	1.924	9.7	13.9
40	0.969	1.865	9.4	13.7
30	0.959	1.786	9.1	13.4
20	0.938	1.669	8.5	13.0
10	0.877	1.447	7.5	12.2
5	0.753	1.183	6.2	11.1
2	0.383	0.695	3.9	8.9

Figure A 4.3.12 Statistical Analysis of Deepwater Waves Generated by Typhoons (Chan May)



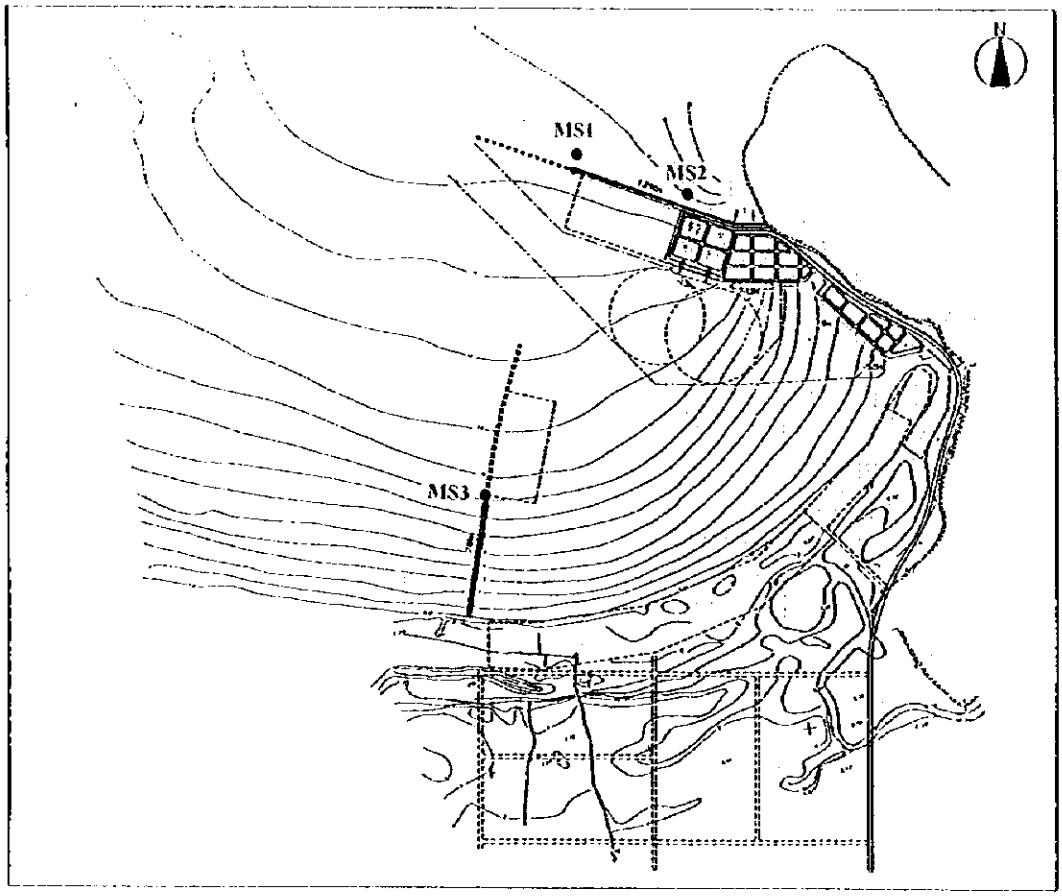


Figure A 4.3.13 Location of Wave Propagation Calculation (Chan May)

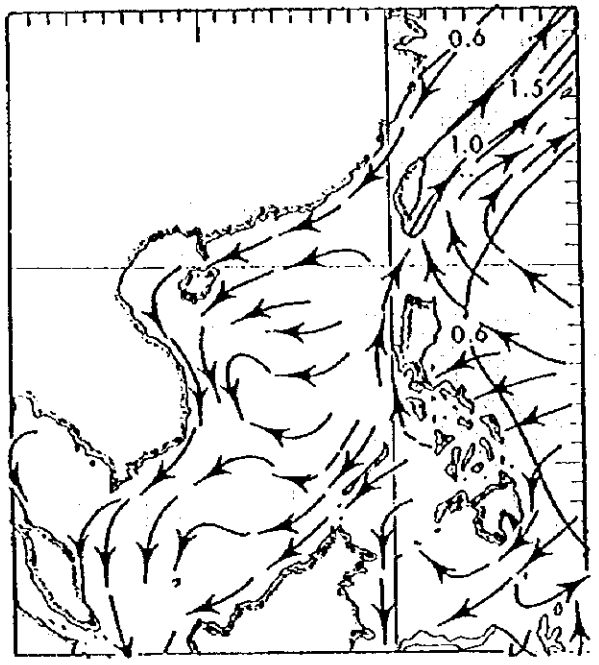
Table A 4.3.7 Waves by Typhoons with a Return Period of 50 Years (Chan May)

Offshore deepwater wave: H_0 = 9.7 m with T_0 = 13.9 sec.

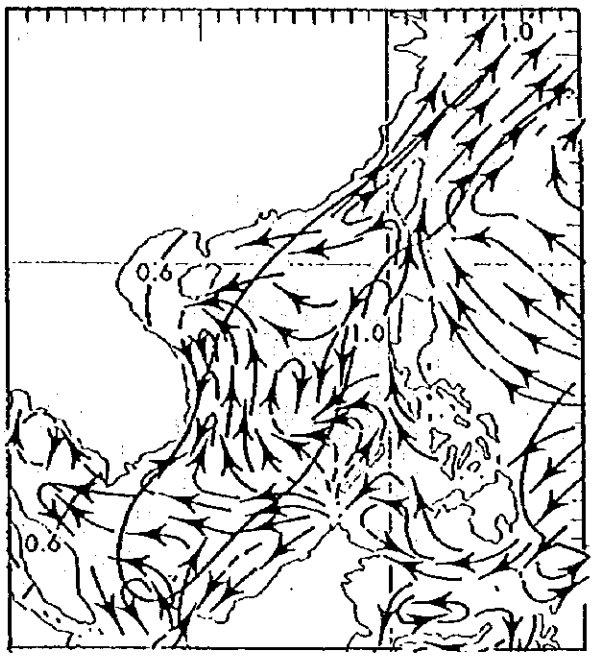
Offshore Wave Direction	Location	Water Depth (m)	K_{d1}	K_{d2}	K_r	K_{sb}	$H_{1/3}$ (m)	H_{max} (m)	H_D (m)	Incident wave angle (deg)
NE	MS1	14.6	0.83	-	0.93	0.96	7.2	11.2	11.4	20.0
	MS2	14.9	0.62	-	0.93	1.04	5.8	9.7	9.7	15.5
	MS3	8.9	0.83	0.13	0.93	1.10	1.1	2.0	2.0	N15.0E
	ISP1	14.6	0.71	-	0.93	1.00	6.4	10.6	10.6	20.0
	ISP2	14.6	0.36	-	0.93	1.03	3.3	5.9	5.9	-12.5
	ISP3	3.3	0.71	0.16	0.93	1.09	1.2	2.2	2.7	N21.5E
	ISP4	3.3	0.71	0.09	0.93	1.83	1.1	1.9	1.9	N177S
ENE	MS1	14.6	0.67	-	0.89	1.03	6.0	9.9	9.9	30.0
	MS2	14.9	0.41	-	0.89	1.03	3.6	6.5	6.5	15.5
	MS3	8.9	0.67	0.11	0.89	1.14	0.8	1.0	1.4	N15.0E
	ISP1	14.6	0.57	-	0.89	1.06	5.2	8.8	8.8	32.5
	ISP2	14.6	0.20	-	0.89	1.00	1.7	3.1	3.1	-12.5
	ISP3	3.3	0.57	0.13	0.89	1.71	1.2	2.1	2.1	N21.5E
	ISP4	3.3	0.57	0.06	0.89	1.33	0.4	0.8	0.8	N177S
E	MS1	14.6	0.46	-	0.82	1.03	3.8	6.9	6.9	42.5
	MS2	14.9	0.33	-	0.82	1.04	2.7	4.8	4.8	15.5
	MS3	8.9	0.46	0.05	0.82	1.00	0.2	0.4	0.4	N15.0E
	ISP1	14.6	0.50	-	0.82	1.05	4.2	7.5	7.5	32.5
	ISP2	14.6	0.07	-	0.82	1.00	0.6	1.1	1.1	-12.5
	ISP3	3.3	0.50	0.07	0.82	1.33	0.4	0.8	0.8	N21.5E
	ISP4	3.3	0.50	0.05	0.82	1.50	0.3	0.5	0.5	N177S

Note: The "incident wave angle" is the angle from the line perpendicular to the face line of a breakwater or a seawall. "N30E" implies the angle of 30 degrees measured clockwise from the north.

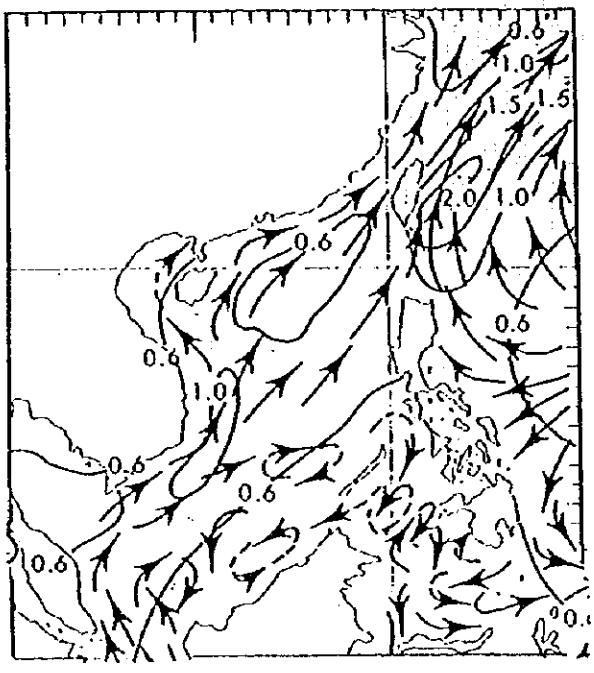
Source: JICA Study Team



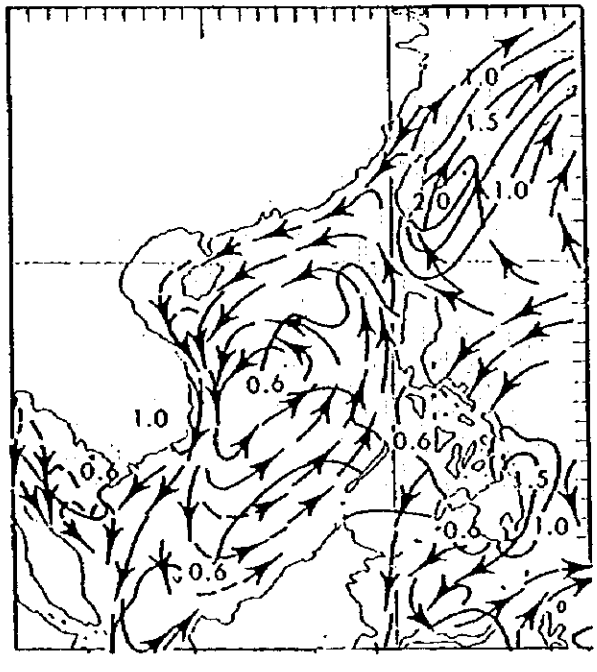
(1) January (North-east monsoon)



(2) April (Transition)



(3) July (South-west monsoon)



(4) October (Transition)

Figure A 4.4.1 Surface Current in the South China Sea

Source : US Navy "Marine Climate Atlas of the World, Vol III, Indian Ocean" March, 1976

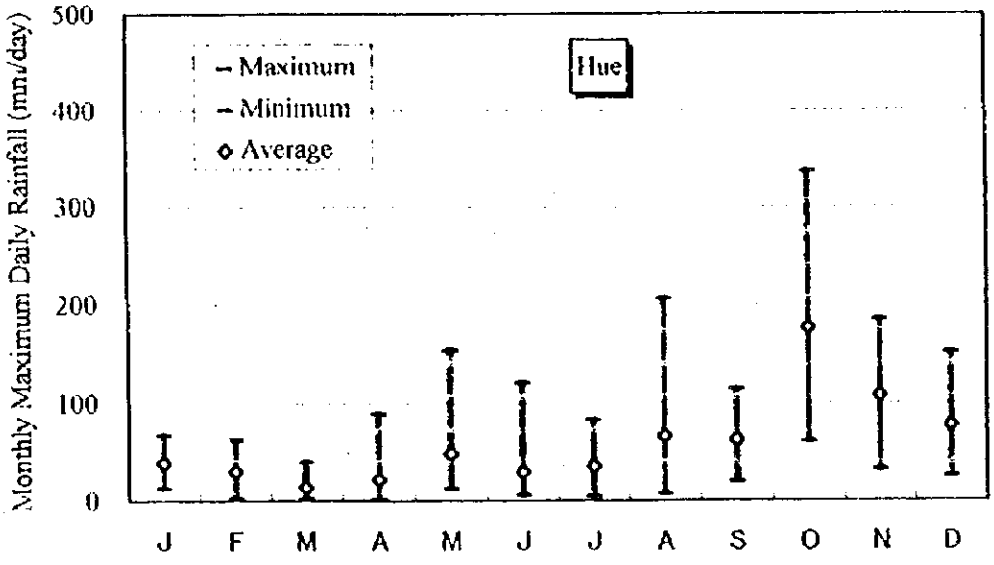


Figure A 4.6.1 Monthly Maximum Daily Rainfall at Hue (1986-1995)

Data source: Hydro-meteorological Data Center

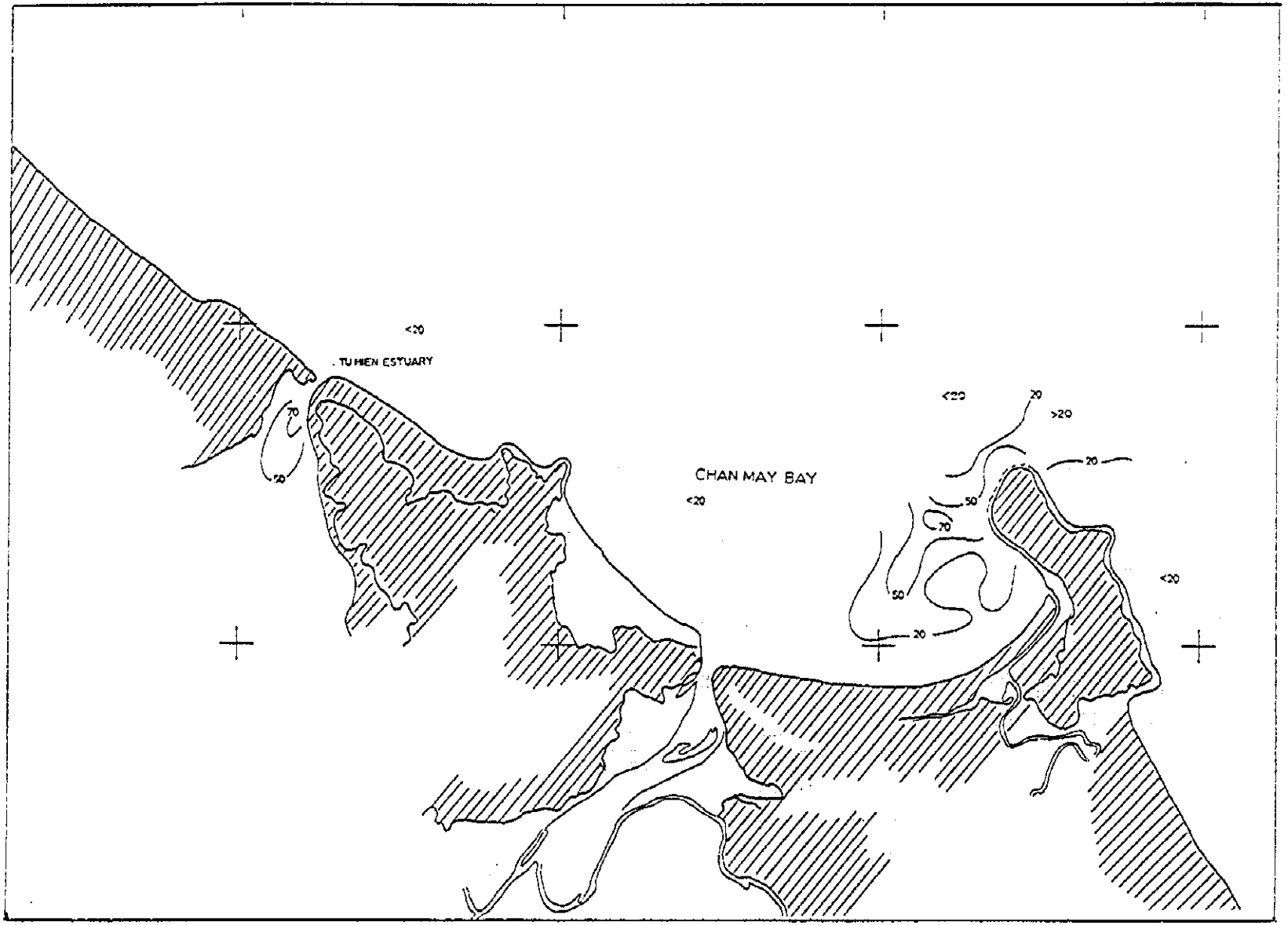


Figure A 4.7.1 Percentage Distribution of Silt/Clay of Bottom Sediment in Chan May

Source : JICA Study Team

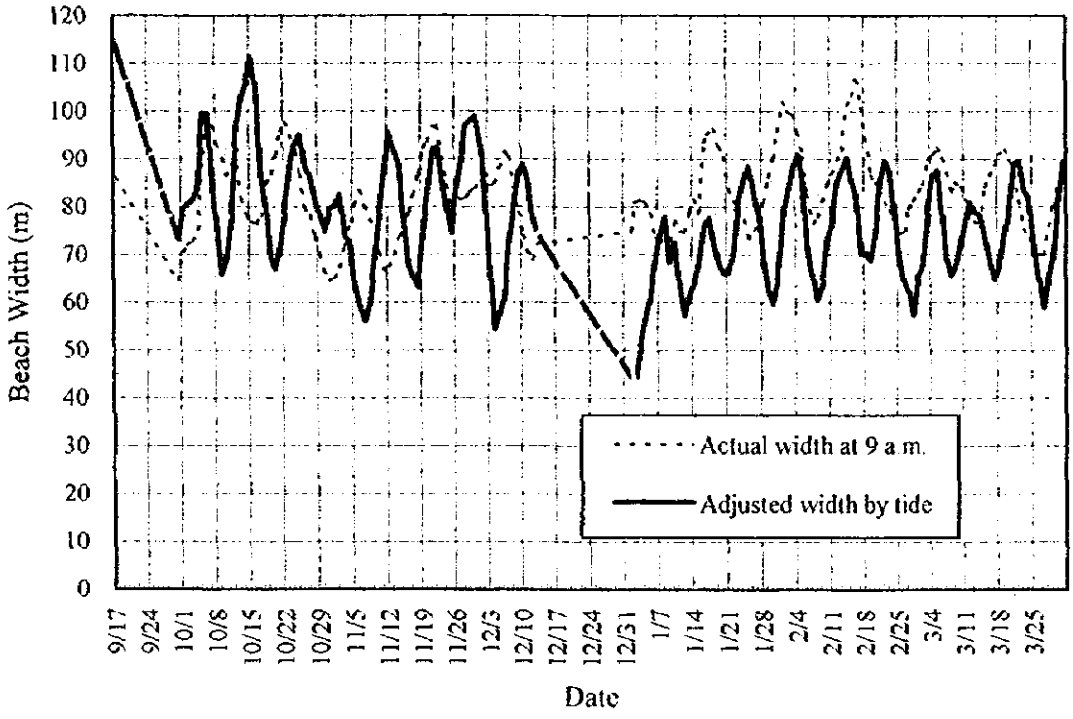


Figure A 4.7.2 Change of Shoreline Width at Chan May Bay

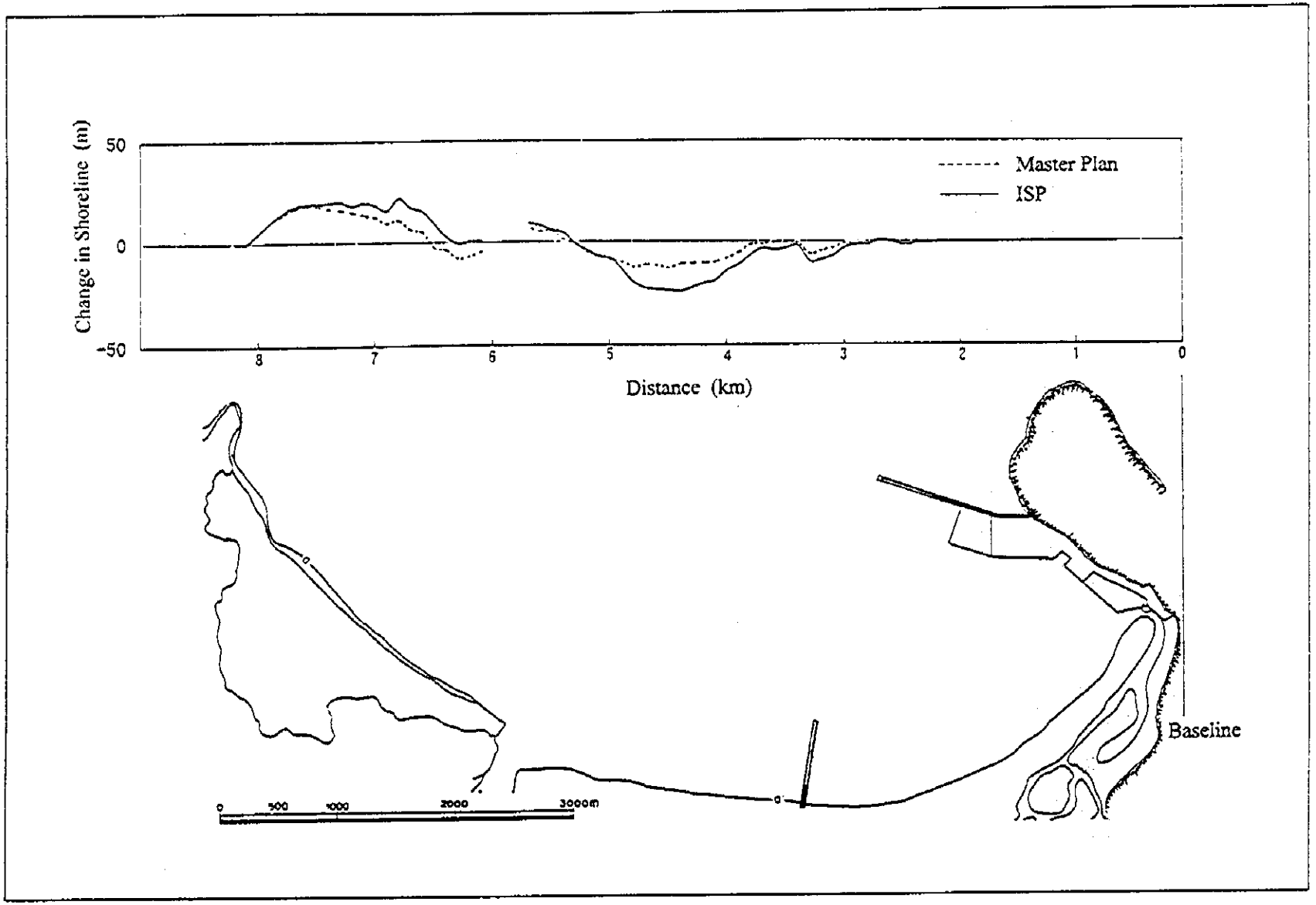


Figure A 4.7.3 Prediction of the Change in Shoreline by One Line Theory in Chan May Bay

Table A4.8.2 Result of Soil Test in Chan May
Physico-Mechanical Properties of Soil

Chan May in 1997

NO Boring No. (G.L.)	NO Sampling No.	Group Symbol	Sampling Depth (m) From	Sampling Depth (m) To	Sampling Depth (m) Mean	Particle Size Analysis Test: Particle Size(mm)(%) 3/4 19~	3/8 9.5~	No4 4.75~	No10 2.0~	No40 0.425~	No200 0.075~	0.005~	0.002~	Particle Size(mm)(%) Gravel ~2.0	Sand 2.0~0.075	Silt 0.075~0.005	Clay 0.005~	Coefficient of Uniformity	Coefficient of Curvature	Atterberg Limit: Liquid limit LL %	Plastic Limit PL %	Plastic Index PI %	Consistency Index	Water Content W (%)	Unit Weight Wet γw g/cm³	Unit Weight Dry γd g/cm³	Specific Gravity Gs g/cm³	Porosity n	Saturated Degree S %	Void Ratio e %	Unconfined Compression Test Qu kgf/cm²	Unconfined Compression Test ε %	Triaxial Compression Test Cohesive C (kg/cm²)	Triaxial Compression Test Internal F.A φ°	Consolidation Test Compression Ratio av (cm²/kg)	Consolidation Coefficient Cv(×10⁻³cm²/sec)	Compression Index Cc	Permeability k(10⁻⁶cm/sec)
CM 1-97	1	SM	1.50	1.95	1.73		100.0	99.9	99.8	95.8	12.2			0.20	87.60	12.20	0.00										2.65											
(-12.5m)	2	SM	3.20	3.65	3.43			100.0	99.9	94.8	11.7			0.10	88.70	11.20	0.00	2.70	0.82								2.67											
	3	CL	5.50	6.10	5.80			100.0	99.8	97.8	91.7	24.6	18.2	0.20	8.10	67.30	24.60			38.7	20.2	18.5	0.88	34.70	1.70	1.28	2.87	52.80	82.84	1.119	0.22	9.65			0.0740	1.4000	0.2500	0.0530
	4	CL	7.40	8.00	7.70			100.0	99.9	98.0	88.4	24.6	20.1	0.10	11.50	63.60	24.80			45.3	29.5	15.8	0.81	42.30	1.75	1.23	2.85	53.80	97.09	1.154	0.37	9.88	0.05	4° 41'				
	5	CL	9.90	10.50	10.20				100.0	97.8	91.2	23.5	17.2	0.00	8.60	67.70	23.50			39.9	26.8	13.1	0.76	37.00	1.77	1.29	2.87	51.70	92.39	1.070	0.41	8.86						
	6	CL	11.40	12.00	11.70				100.0	98.3	90.8	22.5	15.7	0.00	9.20	68.30	22.50			36.0	22.4	13.6	0.83	33.70	1.87	1.25	2.87	52.80	79.71	1.120	0.34	9.06			0.0720	0.8560	0.2400	0.0310
	7	SW-SM	13.10	13.55	13.33		100.0	95.9	84.4	54.1	11.7			15.60	72.70	11.70	0.00										2.66											
	8	SW-SM	14.70	15.15	14.93		100.0	96.3	83.7	58.1	10.6			16.30	73.10	10.60	0.00	6.81	0.73								2.66											
	9	SW-SM	16.20	16.65	16.43		100.0	94.9	86.1	53.6	9.7			13.90	76.40	9.70	0.00	6.93	0.74								2.65											
	10	SW-SM	17.80	18.25	18.03		100.0	95.1	89.0	54.2	10.1			11.00	78.90	10.10	0.00	6.67	0.71								2.64											
	11	SW-SM	19.20	19.65	19.43		100.0	97.3	88.3	55.0	10.8			11.70	77.50	10.80	0.00	6.94	0.80								2.65											
CM 2-97	12	CL-ML	1.50	1.95	1.73		100.0	99.8	98.6	97.1	88.8	11.2	9.8	0.20	33.00	55.60	11.20			23.2	18.6	4.6	1.24	24.20			2.66											
(+7.0m)	13	CL	3.90	4.50	4.20			100.0	99.9	98.3	76.2	27.4	23.5	0.10	21.70	50.80	27.40			35.5	20.2	15.3	0.79	32.30	1.68	1.27	2.68	52.30	78.47	1.094	0.35	10.71						
	14	CL	5.90	6.50	6.20			100.0	99.9	99.3	98.2	54.2	48.2	0.10	3.70	42.00	54.20			40.9	22.4	18.5	0.81	37.40	1.73	1.29	2.67	52.80	89.20	1.119	0.33	12.24	0.07	3° 12'	0.0780	0.2390	0.2800	0.0087
	15	CL	8.50	9.10	8.80			100.0	99.6	98.5	89.9	48.1	39.5	0.20	9.90	41.80	48.10			46.0	28.6	17.4	0.81	42.70	1.74	1.22	2.66	54.10	96.22	1.180	0.28	11.05						
	16	CL	9.80	10.40	10.10			100.0	99.9	99.4	91.2	55.7	41.2	0.10	8.70	35.50	55.70			46.0	25.9	20.1	0.83	42.60	1.77	1.24	2.67	53.60	98.59	1.153	0.25	9.77						
	17	SM	11.00	11.45	11.23			100.0	99.9	98.5	11.7			0.10	88.20	11.70	0.00	2.71	0.91								2.65											
	18	SW-SM	12.60	13.05	12.83		100.0	97.1	84.4	55.7	10.2			15.60	74.20	10.20	0.00	6.67	0.77								2.66											
	19	SM	14.10	14.55	14.33			100.0	99.4	98.1	12.5			0.60	86.90	12.50	0.00										2.66											
	20	SM	15.70	16.15	15.93		100.0	99.9	99.6	88.8	12.1			0.20	87.70	12.10	0.00										2.65											
	21	SM	17.10	17.55	17.33			100.0	99.6	90.1	9.9			0.20	89.90	9.90	0.00	2.60	0.91								2.65											
	22	SM	18.70	19.15	18.93		100.0	99.9	91.2	78.9	11.7			8.80	79.50	11.70	0.00	3.70	0.86								2.68											
	23	CL	21.40	22.00	21.70			100.0	99.9	99.2	85.7	48.1	38.5	0.10	14.20	37.60	48.10			40.0	21.8	18.2	0.88	33.80	1.78	1.35	2.68	50.40	89.27	1.019	0.50	8.97	0.13	2° 25'	0.0610	0.2480	0.2000	0.0081
	24	CL	24.30	24.90	24.60			100.0	99.6	99.1	86.0	50.4	42.2	0.20	11.60	37.80	50.40			50.4	30.2	20.2	0.71	44.50	1.72	1.19	2.67	55.40	95.62	1.244	0.45	10.23						
	25	CL	25.70	26.30	26.00			100.0	99.1	99.7	90.1	51.4	39.5	0.90	9.00	38.70	51.40			43.1	25.7	17.4	0.69	37.70	1.90	1.31	2.67	50.90	98.97	1.036	0.53	9.77			0.0690	0.4250	0.2000	0.0136
	26	CL	29.30	29.90	29.60			100.0	99.8	91.4	70.2	32.4	30.3	0.20	29.60	37.80	32.40			39.8	22.3	17.5	0.74	26.50	1.98	1.55	2.69	42.40	98.82	0.735	1.62	5.40						
	27	CL	31.20	31.80	31.50			100.0	99.9	95.2	81.4	29.7	28.3	0.10	18.50	51.70	29.70			40.3	23.1	17.2	0.21	28.70	1.98	1.56	2.72	42.60	97.71	0.744	1.78	5.23	0.40	6° 24'	0.0310	0.5840	0.1000	0.0107
CM 3-97	28	SM	1.50	1.95	1.73			100.0	99.9	90.8	13.0			0.10	86.90	13.00	0.00										2.70											
(+8.0m)	29	SM	3.20	3.65	3.43			100.0	99.9	90.6	11.9			0.10	88.00	11.90	0.00										2.65											
	30	CL	4.50	4.95	4.73				100.0	94.7	84.7	25.1	22.7	0.00	15.30	59.60	25.10			38.2	25.5	12.7	1.25	41.40			2.66											
	31	CL	6.10	6.55	6.33				100.0	96.8	88.8	30.2	25.1	0.00	11.20	58.60	30.20			42.4	26.0	16.4	1.04	43.10	1.60	1.12	2.65	57.70	83.52	1.366	0.23	15.17			0.1060	0.2950	0.3500	0.0146
	32	SM	7.60	8.05	7.83		100.0	99.9	98.2	90.8	10.1			1.80	88.10	10.10	0.00	2.84	0.93								2.64											
	33	SM	9.00	9.45	9.23			100.0	98.2	87.9	11.0			1.80	87.20	11.00	0.00	3.01	0.90								2.65											
	34	SM	10.50	10.95	10.73			100.0	99.7	89.9	9.9			0.30	89.80	9.90	0.00	2.60	0.91								2.64											
	35	SW-SM	12.40	12.85	12.63		100.0	99.7	97.9	73.4	5.8			2.10	92.30	5.60	0.00	3.54	0.71								2.69											
	36	SW-SM	13.00	13.45	13.23		100.0	97.2	85.0	57.2	10.4			15.00	74.60	10.40	0.00	6.87	0.77								2.66											
	37	SW-SM	14.50	14.95	14.73		100.0	98.7	86.3	54.7	9.8			13.70	76.50	9.80	0.00	7.33	0.79								2.68											
	38	SW-SM	16.10	16.55	16.33		100.0	97.4	82.8	52.1	8.9			17.40	73.70	8.90	0.00	8.02	0.79								2.65											
CM 4-97	39	CL-ML	1.50	1.95	1.73			100.0	99.9	98.0	86.2	13.2	8.9	0.10	31.70	55.00	13.20			25.0	20.1	4.9	1.18	25.90			2.64											
(+0.10m)	40	CL-ML	3.20	3.65	3.43			100.0	99.8	97.1	89.3	12.8	7.6	0.20	30.50	56.50	12.80			25.2	18.6	6.6	1.01	25.30			2.68											
	41	ML	4.50	4.95	4.73			100.0	99.9	98.0	84.2	12.9	10.1	0.10	35.70	51.30	12.90			23.0	19.1	3.9	0.98	22.90			2.65											
	42	CL-ML	6.20	6.65	6.43			100.0	99.8	97.8	88.2	11.8	9.1	0.20	31.60	56.40	11.80			24.4	19.1	5.3	1.17	25.30			2.66											
	43	CL-ML	7.50	7.95	7.73			100.0	99.7	94.9	83.5	12.0	9.2	0.30	36.20	51.50	12.00			24.5	18.4	6.1	1.03	24.70			2.67											
	44	CL	10.00	10.60	10.30			100.0	99.0	88.1	86.8	25.0	19.3	1.00	32.20	41.80	25.00			35.6	24.1	11.5	0.86	34.00	1.78	1.33	2.65	49.80	90.76	0.992	0.43	11.61	0.05	5° 11'				
	45	CL	11.40	12.00	11.70			100.0	99.5	91.5	73.2	26.8	21.7	0.50	26.30	44.40	28.80			38.0	25.3	12.7	0.94	37.30	1.77	1.29	2.65	51.30	93.60	1.054	0.50	10.11			0.0760	0.6520	0.2800	0.0272
	46	SM	13.50	13.95	13.73		100.0	98.9	93.2	85.9	12.2			6.80	81.00	12.20	0.00										2.65											
	47	SM	15.10	15.50	15.30			100.0	99.3	93.6	11.6			0.70	87.70	11.60	0.00										2.66											
	48	SM	16.60	17.50	17.05		100.0	99.2	91.7	79.9	9.4			8.30	82.30	9.40	0.00	3.42	0.73								2.66											
	49	SM	18.00	18.45	18.23		100.0	95.7	88.9	76.8	10.5			11.10	78.40	10.50	0.00	3.78	2.55								2.65											
	50	CL	20.10	20.70	20.40				100.0	93.8	79.2	31.3	26.8	0.00	20.80	47.90	31.30			40.1	23.3	16.8	0.72	35.40	1.75	1.29	2.67	51.70	88.34	1.070	0.60	11.38			0.0620	0.3600	0.2100	0.0125
	51	CL	23.40	24.00	23.70			100.0	99.8	91.7	81.4	31.3	23.8	0.10	18.50	50.10	31.30			43.2	24.7	18.5	0.65	36.70	1.79	1.28	2.68	52.60	87.92	1.111	0.65	10.49						
	52	CL	26.00	26.60	26.30				100.0	96.8	84.1	31.3	25.5	0.00	15.90	52.80	31.30			43.6	26.5	17.1	0.69	38.30	1.78	1.29	2.68	51.90	95.26	1.078	0.61	11.38	0.13	2° 12'				
	53	CL	27.00	27.45	27.23				100.0	91.1	79.8	28.7	22.8	0.00	20.40	50.90	28.70			47.2	30.4	16.8	0.59	40.30			2.67											
	54	CL	29.00	29.60	29.30			100.0	99.8	97.2	88.8	30.8	23.8	0.20	11.00	58.00	30.80			42.4	23.2	19.2	0.41	31.10	1.66	1.27	2.69	52.60	74.75	1.118	1.93	5.17	0.47	5° 29'	0.0310	0.5670	0.1000	0.0108

Table A 6.3.1 Historical Trend of Cargo Handling Volume of Main Port in Vietnam

Port		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Hai Phong	Export	177.5	162.0	193.5	211.6	333.7	751.0	524.4	408.9	381.5	415.6	440.8	494.0	635.0
	Import	1131.7	1299.6	1627.6	1452.9	1498.8	1068.2	976.4	621.2	848.9	1176.1	1702.2	2362.0	2500.0
	Domestic	1139.3	1048.0	783.7	910.6	1249.4	905.3	1015.2	1403.2	1147.7	1114.6	1106.8	1660.0	1670.0
	Total	**2448.5**	**2509.6**	**2604.8**	**2575.1**	**3081.9**	**2724.5**	**2516.0**	**2433.3**	**2378.1**	**2706.3**	**3249.8**	**4516.0**	**4805.0**
Danang	Export	53.0	84.9	92.7	67.0	71.6	175.1	107.5	69.6	62.7	69.4	119.5	149.5	212.7
	Import	264.0	303.2	370.5	400.7	345.1	327.4	255.7	127.0	163.5	211.0	489.8	631.6	560.0
	Domestic	204.4	159.9	181.0	160.1	168.3	64.4	67.1	63.8	87.1	91.5	57.4	49.2	77.3
	Total	**521.4**	**548.0**	**644.2**	**627.8**	**585.0**	**566.9**	**430.3**	**260.4**	**313.3**	**371.9**	**666.7**	**830.3**	**850.0**
Saigon	Export	473.0	496.0	589.1	593.8	661.9	2015.7	2085.6	1625.8	2495.9	2359.6	2551.7	2308.0	2540.0
	Import	906.0	869.0	1240.9	1402.9	1640.8	1543.7	1789.9	1883.0	1911.5	2727.8	3468.2	4259.0	4060.0
	Domestic	541.0	561.0	461.6	500.5	772.6	488.9	471.7	650.8	596.5	421.2	418.6	644.0	600.0
	Total	**1920.0**	**1926.0**	**2291.6**	**2497.2**	**3075.3**	**4048.3**	**4347.2**	**4159.6**	**5003.9**	**5508.6**	**6438.5**	**7211.0**	**7200.0**
Quang Ninh	Export						67.1	158.1	368.8	618.9	679.2	492.6	447.0	486.0
	Import	174.0	143.0	157.6	142.9	133.9	90.2	47.5	21.1	80.4	2.7	26.0	186.0	133.0
	Domestic	44.0	85.0	81.6	64.4	69.6	57.5	92.6	34.7	19.5	1.2	1.4	14.0	174.0
	Total	**218.0**	**228.0**	**239.2**	**207.3**	**203.5**	**214.8**	**298.2**	**424.6**	**718.8**	**683.1**	**520.0**	**647.0**	**793.0**
Nghe Tinh	Export	20.0	21.0	22.8	10.4	12.2	40.9	21.7	48.1	55.8	72.3	73.4	63.0	96.0
	Import	60.0	48.0	50.9	36.6	37.2	28.5	1.6	2.0	5.0	10.9	16.3	86.0	208.0
	Domestic	108.7	100.4	101.3	141.3	120.8	53.7	56.5	76.0	72.1	98.9	116.5	161.0	156.0
	Total	**188.7**	**169.4**	**175.0**	**188.3**	**170.2**	**123.1**	**79.8**	**126.1**	**132.9**	**182.1**	**206.2**	**310.0**	**460.0**
Qui Nhon	Export	31.8	33.1	60.6	60.6	82.8	189.1	242.6	241.7	225.8	276.9	152.5	171.0	180.0
	Import	29.3	15.2	49.9	54.4	64.9	34.6	8.8	6.7	9.0	30.5	89.2	152.0	198.0
	Domestic	98.4	103.2	93.8	104.1	117.2	46.3	48.8	51.9	100.2	104.4	161.3	124.0	172.0
	Total	**159.5**	**151.5**	**204.3**	**219.1**	**264.9**	**270.0**	**300.2**	**300.3**	**335.0**	**411.8**	**403.0**	**447.0**	**550.0**
Nha Trang	Export	53.0	72.8	96.3	84.1	67.9	119.4	144.3	81.9	28.1	24.9	28.3	16.5	45.0
	Import	28.6	22.3	56.4	27.2	80.2	57.5	27.6	7.4	25.5	14.8	59.3	214.5	260.0
	Domestic	108.9	91.7	92.4	99.2	114.5	61.7	49.3	58.6	100.9	141.5	126.3	112.0	115.0
	Total	**190.5**	**186.8**	**245.1**	**210.5**	**262.6**	**238.6**	**221.2**	**147.9**	**154.5**	**181.2**	**213.9**	**343.0**	**420.0**
Can Tho	Export					26.2	34.3	43.8	47.0	30.6		44.1	66.0	88.3
	Import					52.5	25.2	43.8	55.0	6.2		13.6	23.6	17.0
	Domestic					52.4	18.1	5.1	4.7	22.6		8.1	36.3	68.5
	Total	**0.0**	**0.0**	**0.0**	**0.0**	**131.1**	**77.6**	**92.7**	**106.7**	**59.4**	**0.0**	**65.8**	**125.9**	**173.8**
Total	Export	808.3	869.8	1055.0	1027.5	1256.3	3392.6	3328.0	2891.8	3899.3	3897.9	3902.9	3715.0	4283.0
	Import	2593.6	2700.3	3553.8	3517.6	3853.3	3175.3	3151.3	2723.4	3050.0	4173.8	5864.6	7914.7	7936.0
	Domestic	2244.7	2149.2	1795.4	1980.2	2664.8	1695.9	1806.3	2343.7	2146.6	1973.3	1996.4	2800.5	3032.8
	Total	**5646.6**	**5719.3**	**6404.2**	**6525.3**	**7774.5**	**8263.8**	**8285.6**	**7958.9**	**9095.9**	**10045.0**	**11763.9**	**14430.2**	**15251.8**

Source: Ministry of Transport

Table A 6.5.1 (1) Annual Growth Rate of GDP in Thailand from 1986-1995

Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Growth Rate (%)	4.95	4.35	10.26	4.39	4.94	9.15	9.46	10.40	5.03	5.04

Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Growth Rate(%)	5.94	5.23	5.54	5.75	4.69	5.58	9.60	13.29	12.17	11.75

Year	1991	1992	1993	1994	1995
Growth Rate(%)	8.04	8.11	8.34	8.79	8.68

Table A 6.5.1 (2) Growth Rates of Socioeconomic Data in Thailand

Year	Growth rate of Population	Growth rate of GDP	Growth rate of AgricultureGDP	Growth rate of Industry GDP	Growth rate of Service GDP
1996-2000	0.99	8.4	3.5	10.0	8.0
2001-2010	0.75	7.7	3.5	9.0	7.0
2011-2020	0.48	6.9	3.5	8.0	6.0

Source :Statistical Yearbook Thailand 1995

Northeast Thailand (Mukdahan Area) - R-9 Hinterland

Year	Growth rate of Population	Growth rate of GDP	Growth rate of AgricultureGDP	Growth rate of Industry GDP	Growth rate of Service GDP
1996-2000	0.99	7.2	4.0	9.0	8.0
2001-2010	0.75	7.4	4.0	9.0	8.0
2011-2020	0.48	7.6	4.0	9.0	8.0

Northeast Thailand (Ubon Ratchathani Area) - R-16.18 Hinterland

Year	Growth rate of Population	Growth rate of GDP	Growth rate of AgricultureGDP	Growth rate of Industry GDP	Growth rate of Service GDP
1996-2000	0.99	7.3	4.0	9.0	8.0
2001-2010	0.75	7.5	4.0	9.0	8.0
2011-2020	0.48	7.7	4.0	9.0	8.0

Table A 6.5.1 (3) Target Value of Socioeconomic Data in Lao PDR

Year	Population	GDP/ capita (US$)	GDP (million US$)	A-GDP (million US$) and Share(%)		I-GDP (million US$) and Share(%)		S-GDP (million US$) and Share(%)	
1995	4,581,000	380	1,760	971	55	326	19	463	26
2000	5,267,000 (5,200,000)	490 (500)	2,581	1,242	48	575	22	764	30
2010	6,845,000	830	5,705	2,020	35	1,705	30	1,980	35
2020	8,648,000	1,500	13,030	3,290	25	4,840	37	4,900	38

Note : ( ) indicates that GDP per capita is approximately 500 US$ when population is 5.2 million.

Central-Southern Lao (Savannakhet Area) - R-9 Hinterland

Year	Population	GDP/ capita (US$)	GDP (million US$)	A-GDP (million US$) and Share(%)		I-GDP (million US$) and Share(%)		S-GDP (million US$) and Share(%)	
1995	832,000	380	320	177	55	59	19	84	26
2010	1,243,000	830	1,040	368	35	310	30	360	35
2020	1,570,000	1,500	2,370	599	25	881	37	892	38

Southern Lao (Pakse Area) - R-16.18 Hinterland

Year	Population	GDP/ capita (US$)	GDP (million US$)	A-GDP (million US$) and Share(%)		I-GDP (million US$) and Share(%)		S-GDP (million US$) and Share(%)	
1995	748,000	380	286	158	55	53	19	75	26
2010	1,118,000	850	930	329	35	278	30	323	35
2020	1,413,000	1,500	2,120	536	25	789	37	799	38

Table A 6.5.1 (4) Target Value of Socioeconomic Data in Thailand

Year	Population	GDP/ capita (US$)	GDP (million US$)	A-GDP (million US$) and Share(%)		I-GDP (million US$) and Share(%)		S-GDP (million US$) and Share(%)	
1995	59,401,000	2,810	167,100	18,300	11	66,600	40	82,200	49
2010	67,230,000	7,350	522,000	30,600	6	254,000	49	238,000	46
2020	70,503,000	14,400	1,017,000	43,200	4	548,000	54	425,000	42

Northeast Thailand (Mukdahan Area) - R-9 Hinterland

Year	Population	GDP/ capita (US$)	GDP (million US$)	A-GDP (million US$) and Share(%)		I-GDP (million US$) and Share(%)		S-GDP (million US$) and Share(%)	
1995	3,303,000	760	2,520	620	25	358	14	1,540	61
2010	3,739,000	1,950	7,300	1,120	15	1,300	18	4,880	67
2020	3,921,000	3,890	15,200	1,660	11	3,080	20	10,500	69

Northeast Thailand (Ubon Ratchathani Area) - R-16.18 Hinterland

Year	Population	GDP/ capita (US$)	GDP (million US$)	A-GDP (million US$) and Share(%)		I-GDP (million US$) and Share(%)		S-GDP (million US$) and Share(%)	
1995	3,850,000	750	2,900	701	24	474	16	1,720	59
2010	4,357,000	1,940	8,450	1,260	15	1,730	20	4,970	65
2020	4,569,000	3,880	17,800	1,660	11	4,080	23	11,800	66

Table A 6.5.1 (5) GDP, Export cargo and Import cargo in Thailand

Year	GDP (million US$ in 1995 price)	Export Cargo (000 ton)	Import Cargo (000 ton)
1971	28,445	7,836	9,787
1972	29,682	9,191	12,684
1973	32,727	8,349	12,809
1974	34,165	9,905	11,578
1975	35,852	7,811	11,532
1976	39,132	12,665	13,087
1977	42,835	15,310	17,009
1978	47,288	12,866	17,582
1979	49,668	12,867	18,243
1980	52,170	13,206	18,86
1981	55,270	15,795	17,013
1982	58,162	20,001	15,555
1983	61,382	16,626	14,518
1984	64,909	19,377	18,504
1985	67,950	19,459	18,753
1986	71,742	21,067	16,488
1987	78,629	21,353	16,313
1988	89,077	25,451*	22,908*
1989	99,912	29,946*	28,544*
1990	111,652	27,659*	26,170*
1991	120,630	28,674*	39,782*
1992	130,410	32,123*	43,528*
1993	141,283	36,419*	39,450*
1994	153,707	39,431*	42,701*
1995	167,060	42,667*	46,200*

Source : Foreign Trade Statistics of Thailand /Department of Customs Bangkok
Transport Statistics /MOTC

Note : * mark means modified data by Bangkok Port statistics

Table A 6.5.3 (1) Forestry Products in Lao PDR

Year	Logs	Sawn Timbers	Plywood
1991	301,000 m3	110,000 m3	347,000 sheets
1992	218,000 m3	246,000 m3	304,000 sheets
1993	516,000 m3	271,000 m3	1,508,000 sheets
1994	595,000 m3	n.a.	1,800,000 sheets

Source:CPC basic Statistics

Table A 6.5.3 (2) Forest Product Export in Lao PDR

year	Logs Volume(m3)	Sawn timber Volume(m3)
1985	14,000	8,000
1989	26,000	94,000
1990	39,000	100,000
1993	32,000	130,000

Source:CPC basic Statistics

Table A 6.5.3 (3) Forest Plantation in Lao PDR

Total	8,828 ha	
R-9 Hinterland	824 ha	(9%)
Savannakhet(100%)	645 ha	
Saravane(50%)	112 ha	
Sekong(50%)	67 ha	
R-16/18 Hinterland	950 ha	(11%)
Saravane(50%)	112 ha	
Sekong(50%)	67 ha	
Champasack(100%)	726 ha	
Attapeu(100%)	5 ha	

Source:Department of Forestry, MAF

Table A 6.5.3 (4) Distribution of wood shops in Thailand

Region	Sawn Timber Shop	Wood Products Shop
Bangkok	844 (29 %)	1,035 (38 %)
Central Region	1,147 (39 %)	715 (26 %)
North Region	243 (8 %)	586 (22 %)
North East Region	413 (14 %)	336 (12 %)
South Region	259 (9 %)	48 (2 %)
Total	2,906 (100 %)	2,724 (100 %)

Source :Forestry Statistics 1990

Table A 6.5.3 (5) Export of Rice from Thailand to Northeast Asia

	1993	1994	Average
Japan	273,000	512,000	392,500
China	130,000	553,000	341,500
Hong Kong	241,000	238,000	239,500
Northeast Asian Economies	644,000	1,303,000	973,500
World	4,987,000	4,858,000	4,922,500

Source :Statistical Yearbook Thailand 1995

Table A 6.5.3 (6) Current Productivity and Fertilizer Consumption

Area	Yield (kg/ha)	Current Fertilizer Consumption (kg/ha)	Future Fertilizer Consumption (kg/ha)
Lao PDR	2700	6	100
Thailand	2340	55	100
Asian Average	3780	129	129

Table A6.4.1 Cargo Throughput in 2010 and 2020 (Excluding International Transit Cargo)

1. Cargo Volume of Export and Loaded

Kinds of products	Unit	2010		2020	
		Export	Loaded	Export	Loaded
1.1 Agricultural products					
1 Cassava	ton	10,000		15,000	
2 Groundnut	〃	10,000		16,000	
3 Refined sugar	〃	152,000		236,000	
4 Rubber products	〃	9,600		18,400	
5 Fruit trees products	〃	50,000		70,000	
6 Vegetables, peas, bean	〃	35,000		65,000	
7 Meat products	〃	25,500		43,300	
1 Processed marine products	〃	9,900		14,100	
Fodder products	〃	5,000		5,000	
Total		307,000	0	482,800	0
1.2 Mining products, Clinker and Bulk					
1 Mineral products	ton	10,000		30,000	
2 Refined Kaolin	〃	40,700		151,000	
1 Construction stone	〃	1,500		2,000	
2 Brick and concrete products	〃	2,400		4,000	
3 Ceramic products	〃	10,200		20,700	
4 Artificial marble products	〃	1,000		1,000	
7 Glass products	〃	25,000		115,000	
8 Porcelain insulator	〃	10,000		40,000	
Total		100,800	0	363,700	0
1.4 Fertilizer and Break Bulk					
1 Material wood (Vinachip)	ton	35,000		45,000	
2 Art wooden furniture	〃	10,000		15,000	
3 Man-made plywood	〃	12,000		36,000	
4 Turpentine products	〃	9,000		18,000	
1 Processed Lubricant	〃	25,000		50,000	
2 Insecticidial products	〃	100		200	
3 Micro-biological fertilizer	〃	5,000		10,000	
4 Produced Ferment	〃	200		2,000	
5 High-class paint	〃	400		800	
Total		96,700	0	177,000	0
1.5 Cement					
3 Luksvaxi cement	ton	0	200,000	100,000	200,000
10 Dong Lam cement	〃	200,000	250,000	730,000	250,000
Total		200,000	450,000	830,000	450,000
1.6 Manufacturing					
1. Textile, garment, leather industry	ton				
1 Consuming Garment	〃	13,200		17,500	
5 Hue textile	〃	8,000		10,000	
6 Fabric shoe products	〃	3,000		4,000	
8 Leather tanning and processing	〃	4,400		8,300	
2. Food Processing Industry					
1 Hue Brewery	ton	3,000		3,000	
2 Sake wine	〃	1,500		1,500	
3 Mineral water products	〃	10,000		10,000	
4 Confectionery	〃	1,000		2,000	
5 Liquors	〃	30,000		40,000	
3. Mechanical, Electrical, Chemicxal Industries					
1 Automobile assembling	ton	1,500		10,500	
2 Machinery repairing	〃	15,000	15,000	20,000	20,000

3 Machine manufacturing	〃	10,000		22,500	
4 Electronic equipments	〃	19,000		55,000	
5 Electrical equipments and parts	〃	25,000		40,000	
6 Aluminum can producing	〃	100		100	
7 Plastic products	〃	15,000		60,000	
8 Cosmetic and chemical products	〃	10,000		20,000	
Total		169,700	15,000	324,400	20,000

2. Cargo Volume of Import and Unloaded

No Kinds of products		2010		2020	
		Import	Unloaded	Import	Unloaded
2.1 Agricultural products					
1 Cotton and textile	ton	16,500		18,900	
2 Leather material	〃	600		800	
6 For agricultural, forest products	〃	12,000		15,000	
Total		29,100	0	34,700	0
2.2 Mining, Clinlker and Bulk					
4 Coal	ton	0	200,000	0	450,000
5 Clinker	〃	150,000		300,000	
3 For ceramic, glass products	〃	6,500		10,000	
6 For construction material products	〃	2,500		3,000	
Total		159,000	200,000	313,000	450,000
2.3 Oil and Oil products					
1 Refined oil for industries	ton	110,000		316,000	
2 Crude oil	〃	100,000		100,000	
3 Refined oil for PETROLIMEX	〃	400,000		1,000,000	
Total		610,000	0	1,416,000	0
2.4 Fertilizar and Break bulk					
1 Fertilizers and Insecticides	ton	30,000		40,000	
2 Iron and Steel	〃		33,000		86,000
Total		30,000	33,000	40,000	86,000
2.6 Manufacturing					
7 Mechanical parts materials	ton	45,500		68,800	
7' Automobile products	〃	8,100		21,300	
8 Electrical parts and materials	〃	82,500		171,000	
9 Chemical materials	〃	57,400		61,500	51,500
Subtotal		193,500	0	322,600	51,500

3. Total Cargo Throughput

No Kinds of products		2010		2020	
		Export	Loaded	Export	Loaded
1 Agricultural products	ton	307,000	0	482,800	0
2 Mining, Clinker and Bulk	〃	100,800	0	363,700	0
3 Oil and Oil products	〃	0	0	0	0
4 Fertilizer and Break bulk	〃	96,700	0	177,000	0
5 Cement	〃	200,000	450,000	830,000	450,000
6 Manufacturing	〃	169,700	15,000	324,400	20,000
Subtotal		874,200	465,000	2,177,900	470,000
		Import	Unloaded	Import	Unloaded
1 Agricultural products	ton	29,100	0	34,700	0
2 Mining, Clinker and Bulk	〃	159,000	200,000	313,000	450,000
3 Oil and Oil products	〃	610,000	0	1,416,000	0
4 Fertilizer and Break bulk	〃	30,000	33,000	40,000	86,000
5 Cement	〃	0	0	0	0
6 Manufacturing	〃	193,500	0	322,600	51,500
Subtotal		1,021,600	233,000	2,126,300	587,500
Total		2,593,800		5,361,700	

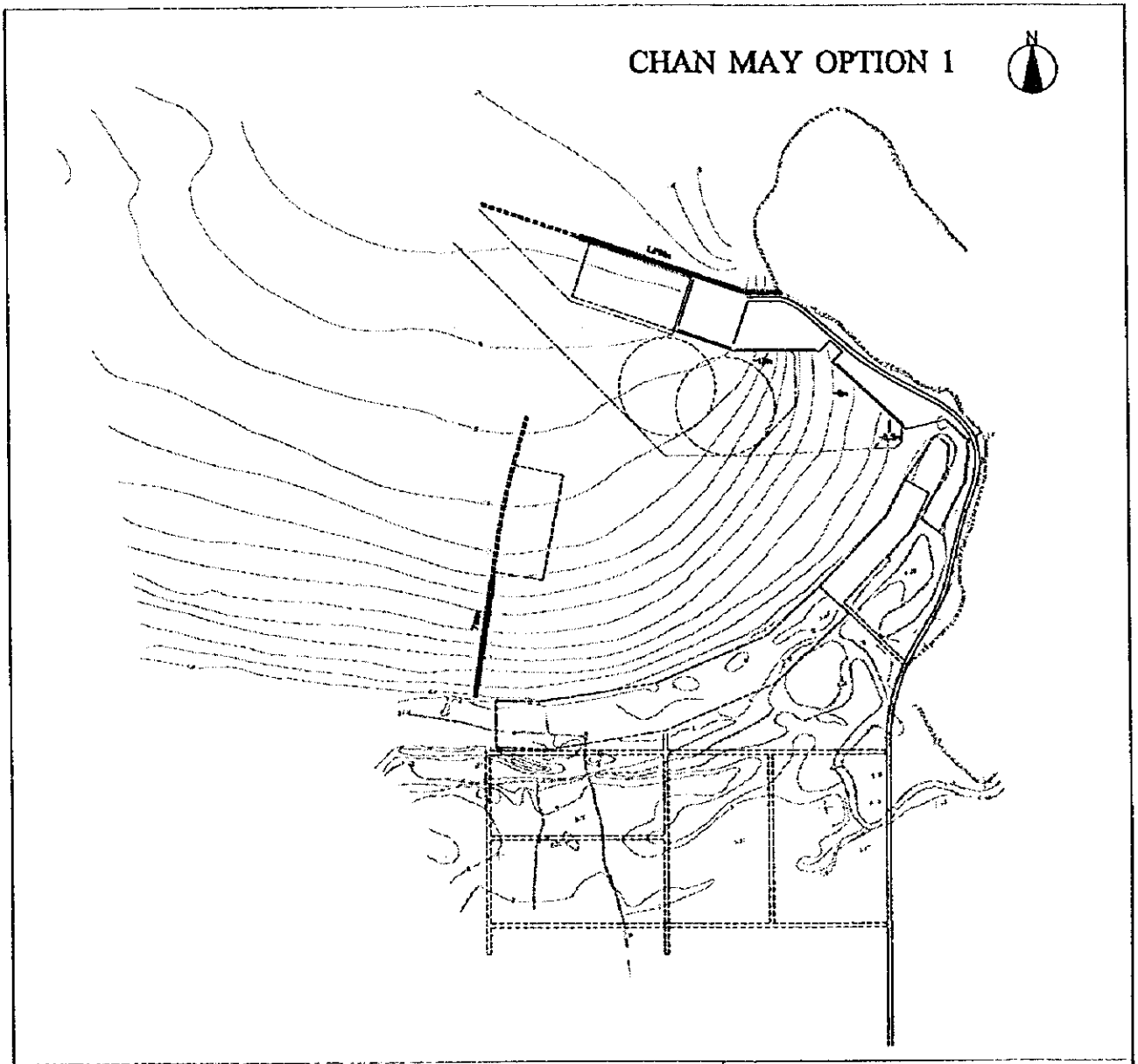
Table A7.3.1 Standard Size of Ships

(units in m)

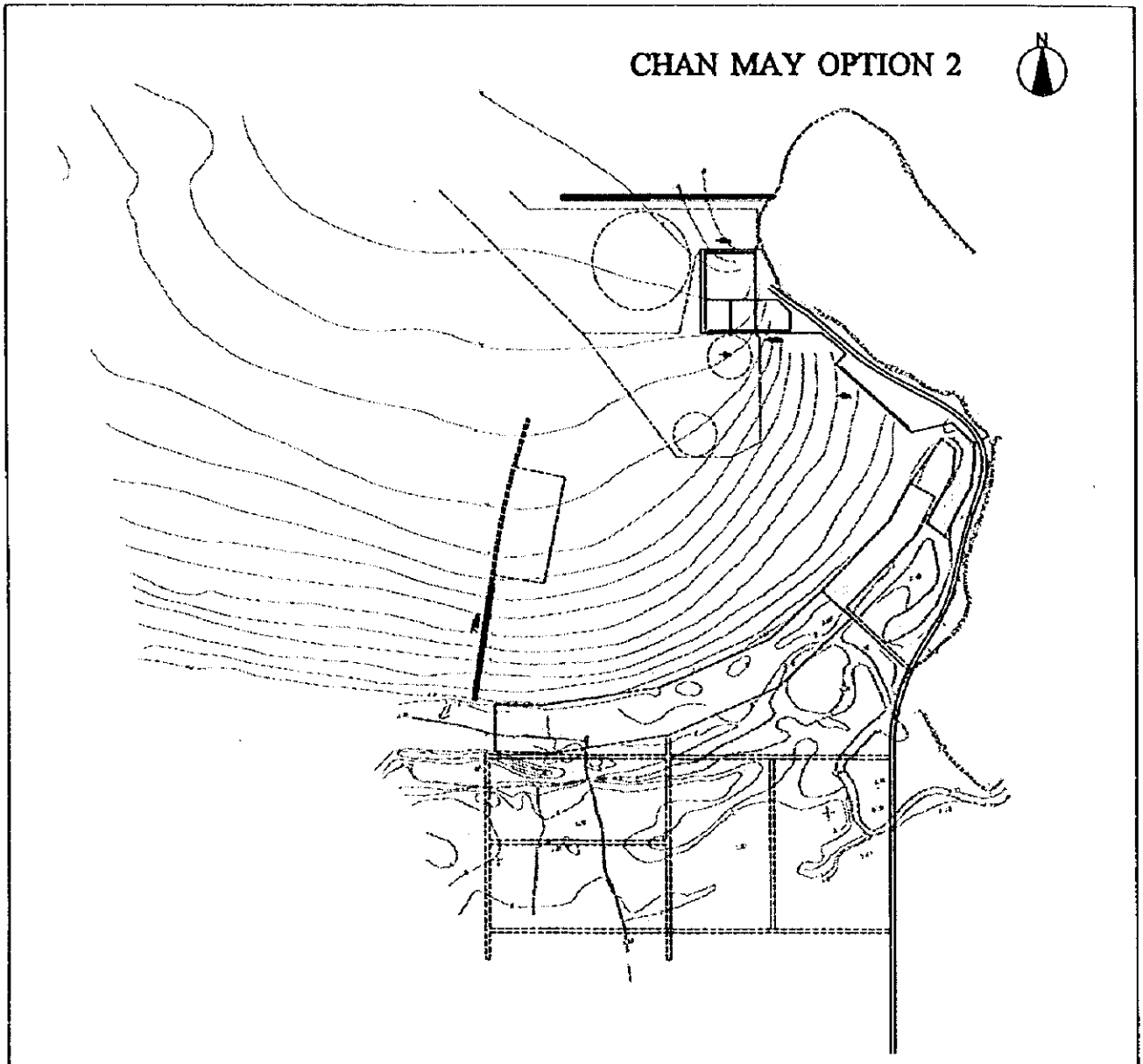
Type	Tonnage	Overall length	Moulded breadth	Moulded depth	Full load draft
Passenger ship	G.T				
	2,000	88	13.2	6.4	4.0
	3,000	99	14.7	7.6	4.5
	5,000	120	16.9	9.5	5.2
	8,000	142	19.2	11.6	5.8
	10,000	154	20.4	12.9	6.2
	15,000	179	22.8	14.7	6.8
	20,000	198	24.7	16.1	7.5
	30,000	230	27.5	18.3	8.5
Ferryboat	G.T				
	1,000	73	14.3	9.4	3.7
	2,000	69	17.1	10.7	4.4
	3,000	113	18.9	11.5	4.9
	4,000	127	20.2	12.2	5.3
	6,000	138	22.4	13.2	5.9
	10,000	170	25.4	14.5	6.5
	13,000	188	27.1	15.3	6.7
	15,000	200	28.1	15.7	6.9
Cargo ship	D.W				
	700	58	9.7	5.5	3.7
	1,000	64	10.4	5.8	4.2
	2,000	81	12.7	6.8	4.9
	3,000	92	14.2	7.7	5.7
	5,000	109	16.4	9.0	6.8
	8,000	126	18.7	10.3	8.0
	10,000	137	19.9	11.1	8.5
	15,000	153	22.3	12.5	9.3
	30,000	186	27.1	15.2	10.9
	40,000	201	29.4	16.5	11.7
	50,000	216	31.5	17.5	12.4
	70,000	235	33.8	19.2	13.4
	90,000	252	37.2	20.6	14.2
	100,000	259	38.7	21.2	15.8
	150,000	290	45.0	23.7	17.5
Container ship	D.W				
	20,000	201	27.1	15.6	10.6
	30,000	237	30.7	18.4	11.6

Type	Tonnage	Overall length	Moulded breadth	Moulded depth	Full load draft
Container ship	D.W				
	40,000	263	33.5	20.7	12.4
	50,000	280	35.8	22.6	13.0
Oil tanker	D.W				
	1,000	61	9.8	4.4	4.0
	2,000	77	12.2	5.6	5.0
	3,000	88	13.8	6.5	5.6
	5,000	104	16.2	7.8	6.5
	10,000	130	20.1	10.1	8.0
	15,000	148	22.8	11.7	9.0
	20,000	162	24.9	13.0	9.8
	30,000	185	28.3	15.2	10.9
	40,000	204	30.9	16.6	11.8
	50,000	219	33.1	17.5	12.7
	60,000	232	35.0	18.4	13.6
	70,000	244	36.7	19.2	14.3
	80,000	255	38.3	19.9	14.9
Pure car carrier	G.T				
	700	77	12.8	6.9	4.3
	1,000	86	14.1	8.0	4.7
	2,000	105	17.1	10.7	5.5
	3,000	117	19.1	12.7	6.0
	5,000	136	22.0	15.8	6.8
	6,000	144	23.1	17.1	7.1
	10,000	166	26.6	21.2	8.0
	15,000	187	29.8	25.1	8.8
	20,000	203	32.2	28.4	9.5
Gas tanker	G.T				
	1,000	70	11.7	5.7	5.0
	2,000	87	14.3	7.3	5.9
	3,000	99	16.1	8.5	6.6
	5,000	117	18.6	10.2	7.5
	10,000	145	22.7	13.1	9.0
	15,000	165	25.5	15.2	10.2
	20,000	181	27.7	16.9	11.0
	30,000	206	31.2	19.6	12.0
	50,000	242	36.1	23.6	13.5

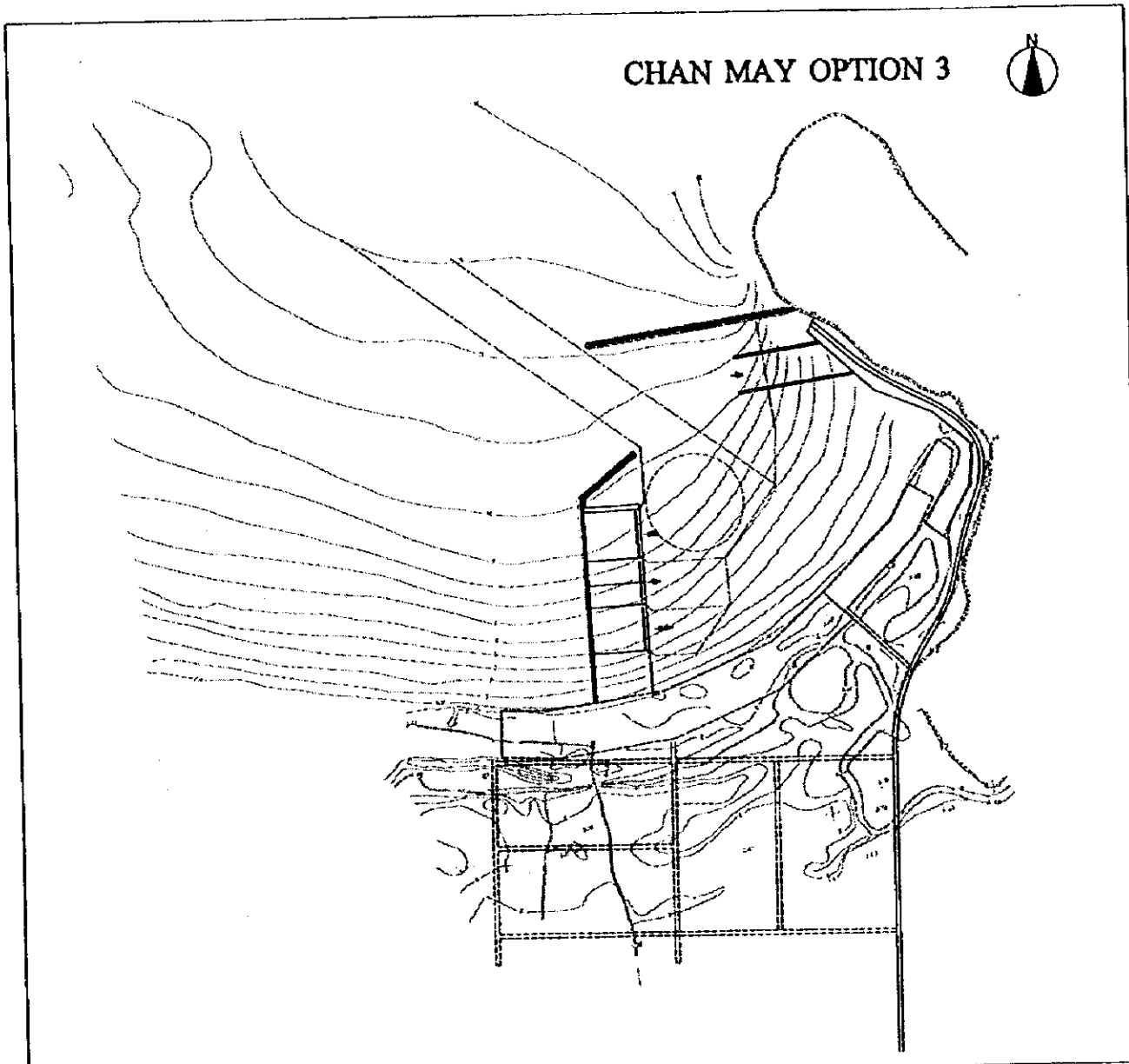
G.T : gross Tonnage
D.W : Dead Weight Tonnage



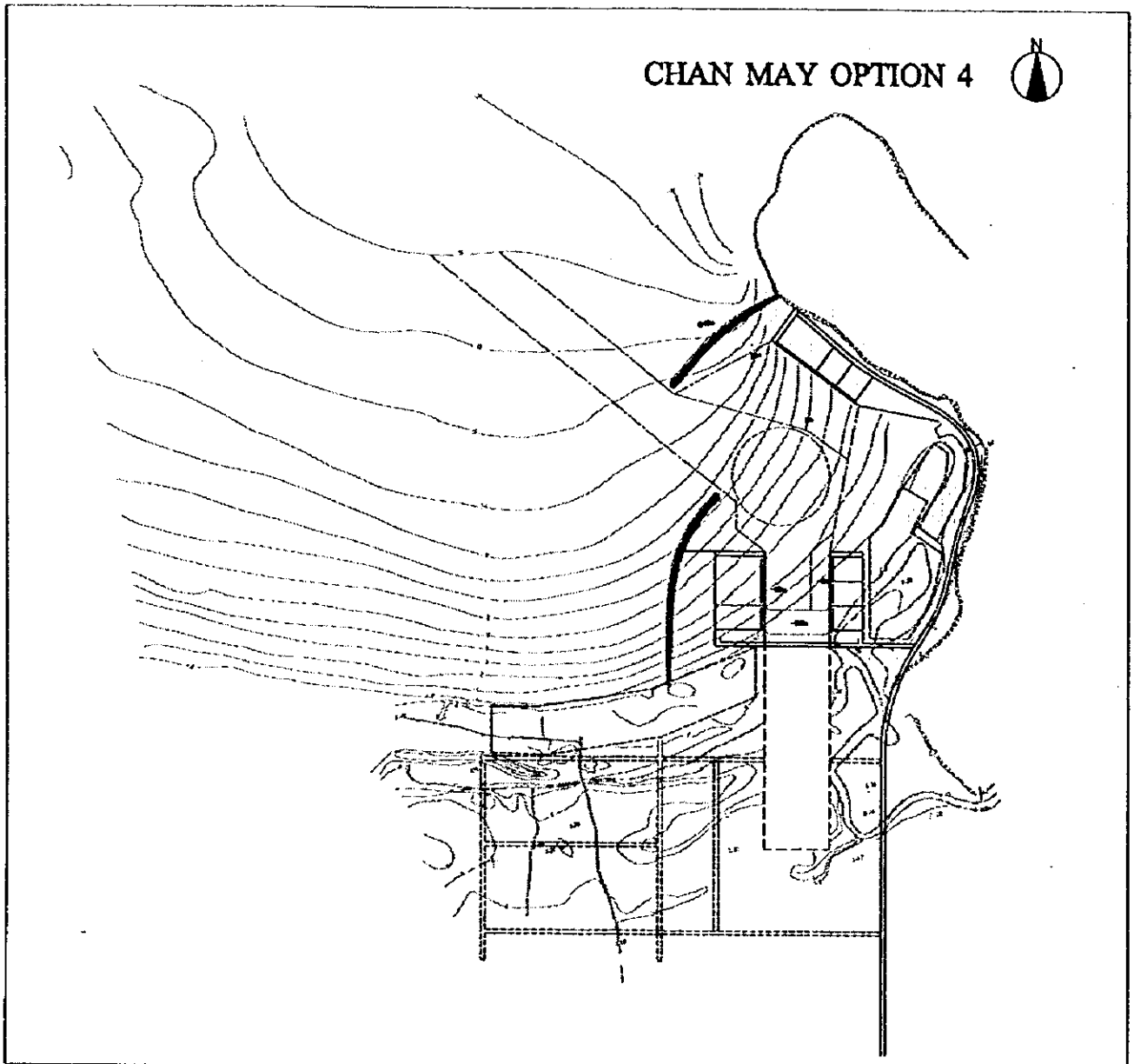
JICA Port Development Study in Central Region	Figure A7.4.1
Chan May Port Development Option 1	0 200 400 600 800 1,000 m
FILE CM-DP-A1	Final Report 1998



JICA Port Development Study in Central Region	Figure A7.4.2
Chan May Port Development Option 2	0 200 400 600 800 1,000 m
FILE CM-DF-A2	Final Report 1998



JICA Port Development Study in Central Region	Figure A7.4.3
Chan May Port Development Option 3	
FILE CM-DF-A3	Final Report 1998



JICA Port Development Study in Central Region	Figure A7.4.4
Chan May Port Development Option 4	0 200 400 600 800 1,000 m
FILE CM-DP-A4	Final Report 1998

TABLE A7.5.1 Direction-wise Offshore Wave Heights Occurrence (1)

Quang Tri Offshore (N17.5° E107.5°)

Wave Height	0.00-0.49 m	0.50-0.99 m	1.00-1.49 m	1.50-1.99 m	2.00-2.49 m	2.50-2.99 m	3.00-3.99 m	4.00-4.99 m	5.00 m-	Total
NNE		1	9	10	8	3				31
		0.03%	0.31%	0.34%	0.27%	0.10%				1.06%
NE		7	10	1						18
		0.24%	0.34%	0.03%						0.62%
ENE	13	650	545	170	63	24	15			1480
	0.45%	22.26%	18.66%	5.82%	2.16%	0.82%	0.51%			50.68%
E	26	382	109	94	79	46	13			749
	0.89%	13.08%	3.73%	3.22%	2.71%	1.58%	0.45%			25.65%
ESE		30	61	3						94
		1.03%	2.09%	0.10%						3.22%
SE		83	75	4						162
		2.84%	2.57%	0.14%						5.55%
SSE	1	46	8							55
	0.03%	1.58%	0.27%							1.88%
S		38	2	1						41
		1.30%	0.07%	0.03%						1.40%
SSW		54	9	2						65
		1.85%	0.31%	0.07%						2.23%
SW		58	55	4						117
		1.99%	1.88%	0.14%						4.01%
WSW		8	43	5						56
		0.27%	1.47%	0.17%						1.92%
W		4	3							7
		0.14%	0.10%							0.24%
WNW										0
										0.00%
NW		1	1							2
		0.03%	0.03%							0.07%
NNW		1	5		1					7
		0.03%	0.17%		0.03%					0.24%
N		2	13	18		2	1			36
		0.07%	0.45%	0.62%		0.07%	0.03%			1.23%
Total	40	1365	948	312	151	75	29	0		2920
	1.37%	46.75%	32.47%	10.68%	5.17%	2.57%	0.99%	0.00%		100.00%

Upper column: Estimated number of occurences of the wave height
Lower colum: Frequency of occurences of the wave height
Data: 1 Jan. 1993 - 31 Dec.1994
Site: N17.5° E107.5°
Estimated from wind data obtained by European Center for Medium Range Weather Forecast

TABLE A7.5.2 Direction-wise Offshore Wave Heights Occurrence (2)

Quang Ngai Offshore (N15° E110°)

Wave Height	0.00-0.49 m	0.50-0.99 m	1.00-1.49 m	1.50-1.99 m	2.00-2.49 m	2.50-2.99 m	3.00-3.99 m	4.00-4.99 m	5.00 m-	Total
NNE		8	57	57	35	33	30	1		221
		0.27%	1.95%	1.95%	1.20%	1.13%	1.03%	0.03%		7.57%
NE		42	146	67	25	10	5			295
		1.44%	5.00%	2.29%	0.86%	0.34%	0.17%			10.10%
ENE	2	623	465	167	45	26	23	1		1352
	0.07%	21.34%	15.92%	5.72%	1.54%	0.89%	0.79%	0.03%		46.30%
E		2	3	4	3	2	1			15
		0.07%	0.10%	0.14%	0.10%	0.07%	0.03%			0.51%
ESE	1	2	4							7
	0.03%	0.07%	0.14%							0.24%
SE		42	28	3						73
		1.44%	0.96%	0.10%						2.50%
SSE		118	184	15	1					318
		4.04%	6.30%	0.51%	0.03%					10.89%
S		147	159	9	1					316
		5.03%	5.45%	0.31%	0.03%					10.82%
SSW		68	70	4	1					143
		2.33%	2.40%	0.14%	0.03%					4.90%
SW		39	44	8						91
		1.34%	1.51%	0.27%						3.12%
WSW		2	8	1						11
		0.07%	0.27%	0.03%						0.38%
W		2								2
		0.07%								0.07%
WNW		1								1
		0.03%								0.03%
NW		1	2	1						4
		0.03%	0.07%	0.03%						0.14%
NNW		1	2	2						5
		0.03%	0.07%	0.07%						0.17%
N			10	17	16	10	8	5		66
			0.34%	0.58%	0.55%	0.34%	0.27%	0.17%		2.26%
Total	3	1098	1182	355	127	81	67	7		2920
	0.10%	37.60%	40.48%	12.16%	4.35%	2.77%	2.29%	0.24%		100.00%

Upper column: Estimated number of occurences of the wave height
Lower colum: Frequency of occurances of the wave height
Data: 1 Jan. 1993 - 31 Dec.1994
Site: N15° E110°
Estimated from wind data obtained by European Center for Medium Range Weather Forecast

Table A 7.5.4 Port Access Traffic

Unit; Vehicles per day

Type of Vehicle	2010	2020
Container Truck	57	94
Truck for Bulk Cargo	320	674
Truck for Break Bulk Cargo	130	237
Lorry for Petroleum	213	495
Car for Passenger	360	751
Total	1,080	2,251

Formula of Traffic Volume Estimation

$$Q = V \times \frac{\alpha}{\omega} \times \frac{\beta}{12} \times \frac{\gamma}{30} \times \frac{1+\delta}{\varepsilon} \times \sigma$$

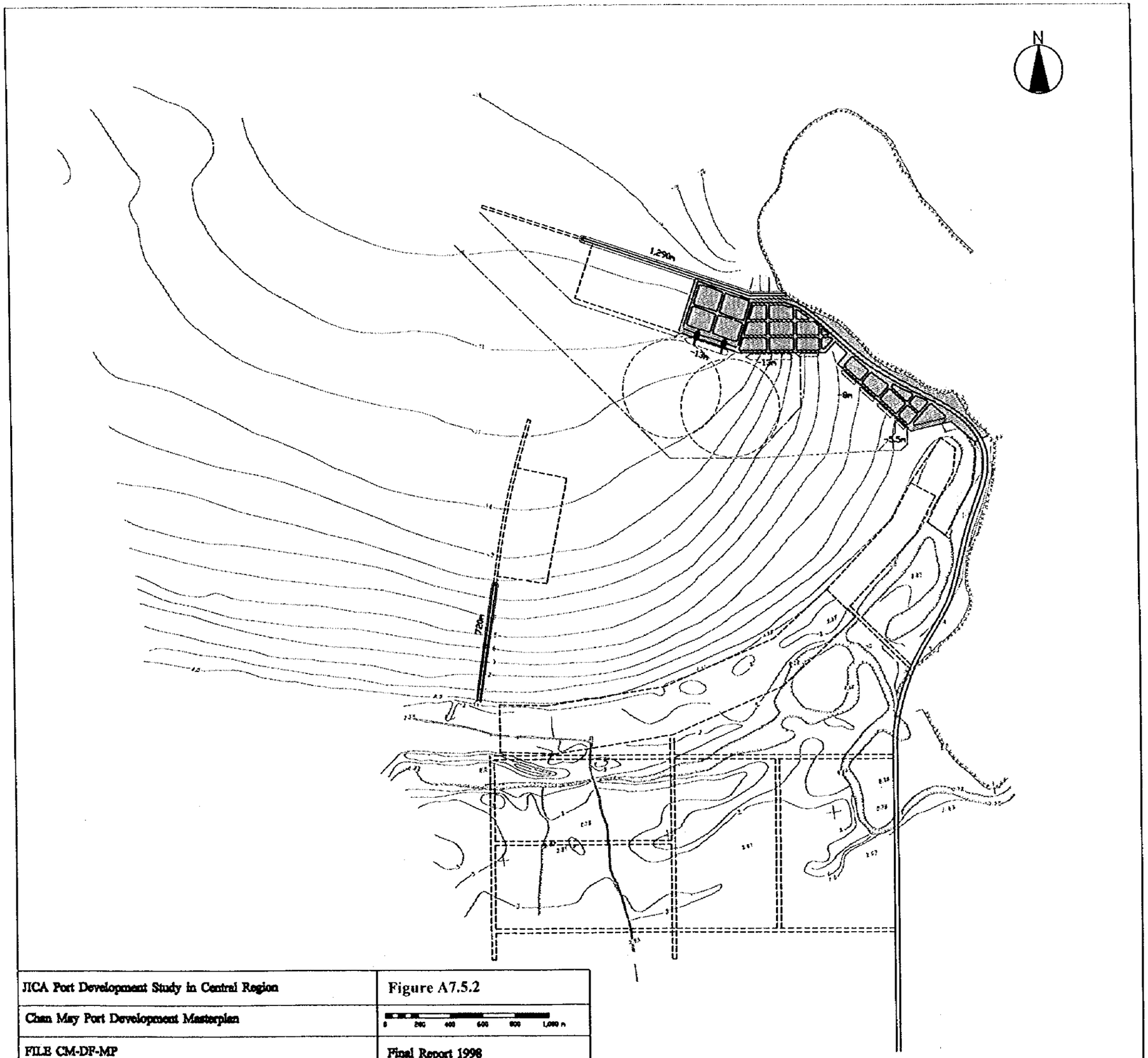
where α: 1.0
β: 1.2
γ: 1.3
δ: 0.5
ε: 0.5
σ: 0.14
ω: 1.0TEU(Container)
: 4.0(Break Bulk)
: 5.0(Bulk)
: 10.0(Liquid)

CHAN MAY

0 1,000 2,000 3,000 4,000 m

N

Figure A7.5.1



JICA Port Development Study in Central Region	Figure A7.5.2
Cam May Port Development Masterplan	0 200 400 600 800 1,000 m
FILE CM-DF-MP	Final Report 1998

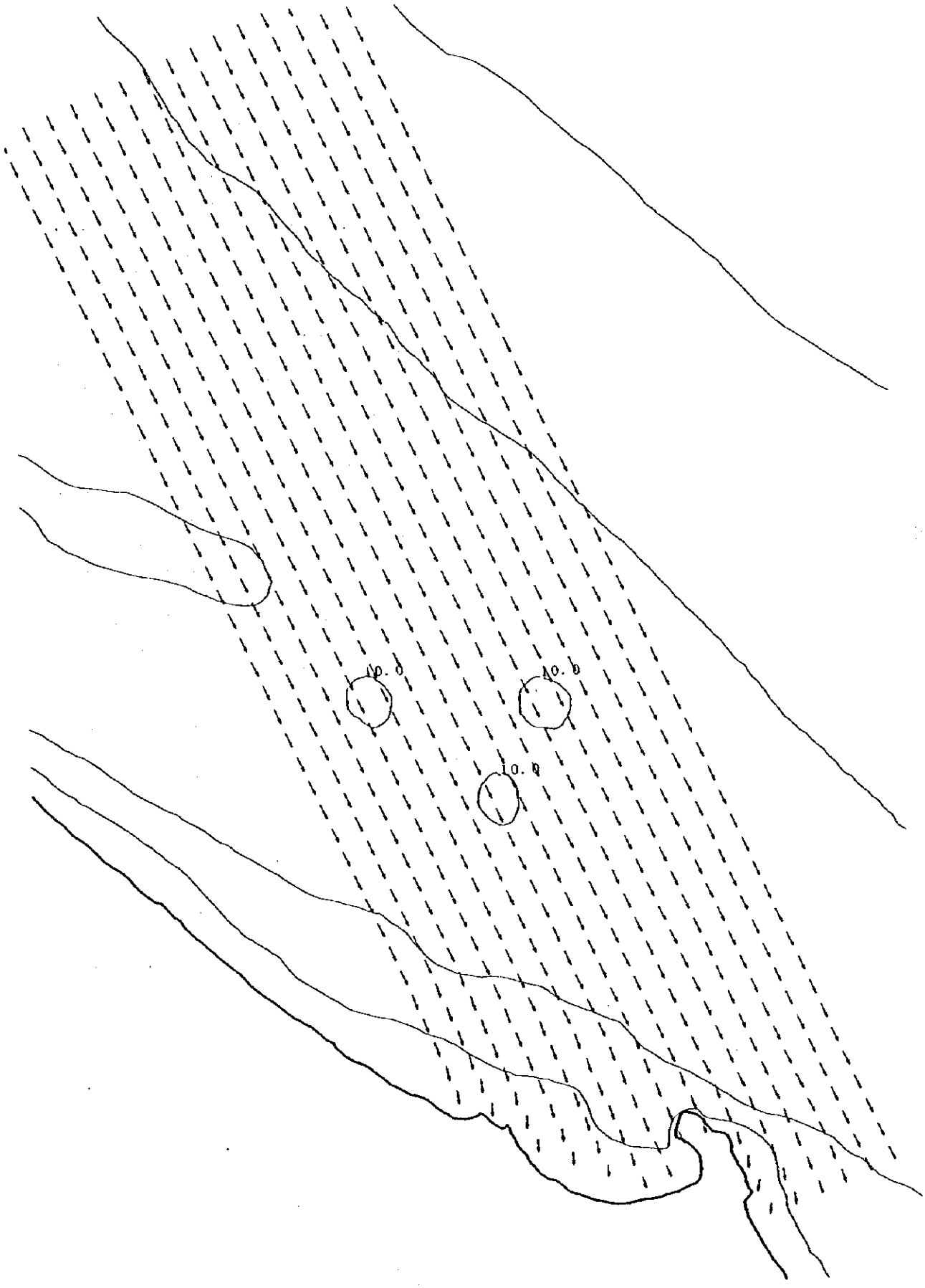


Figure A7.5.3 Wave Refraction and Shoaling (NNW)

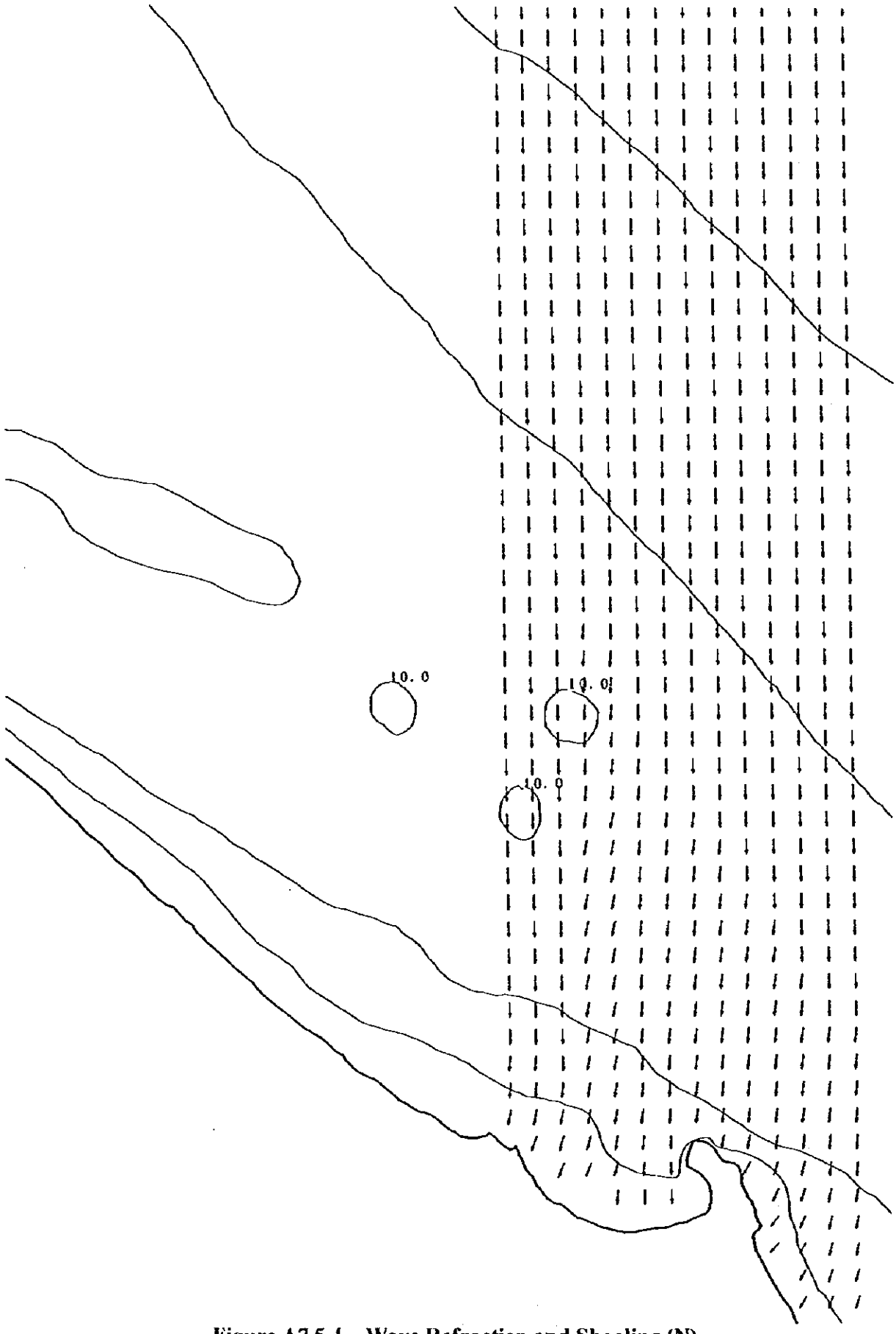


Figure A7.5.4 Wave Refraction and Shoaling (N)

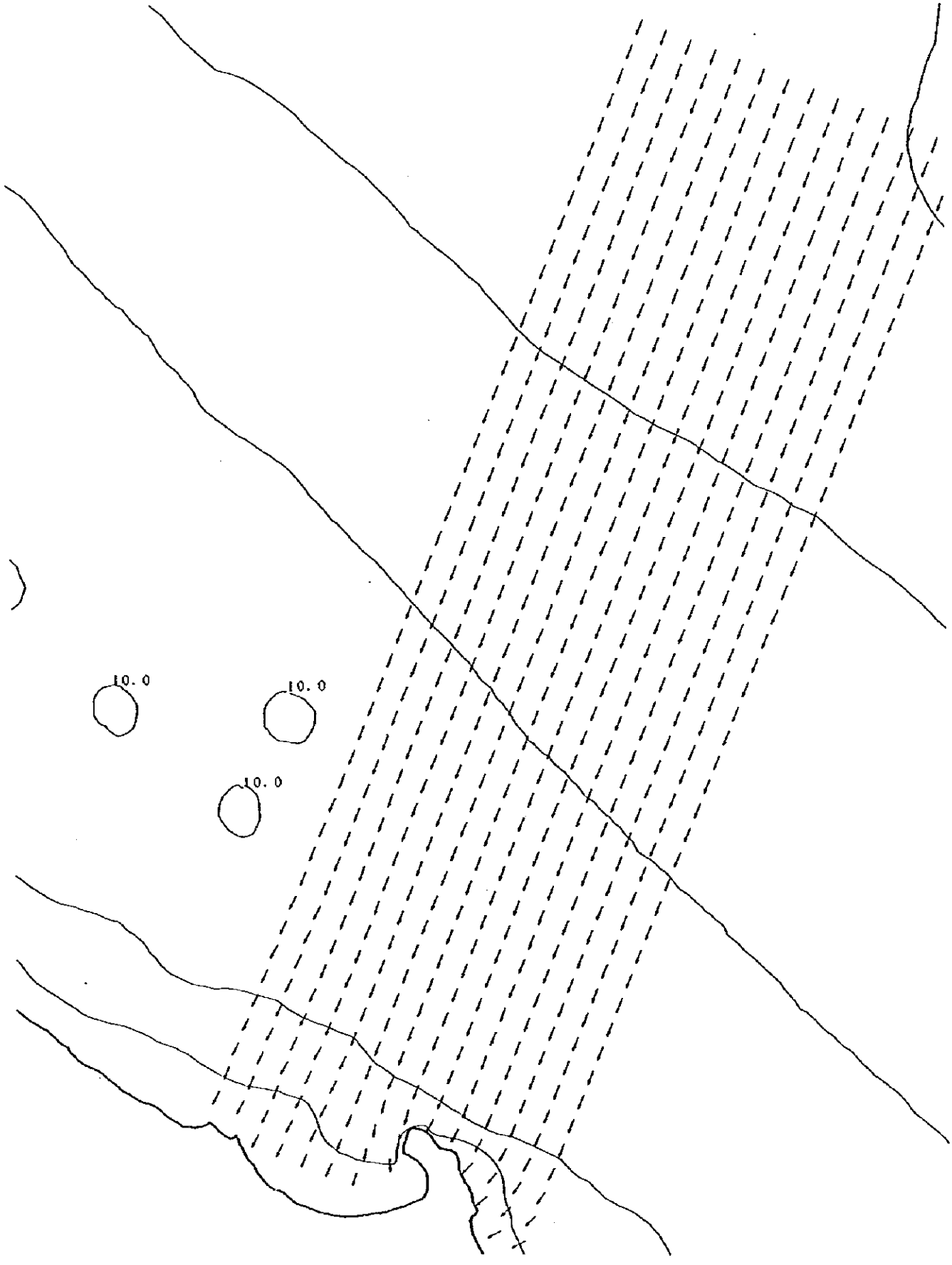


Figure A7.5.5 Wave Refraction and Shoaling (NNE)

Figure A7.5.6 Wave Refraction and Shoaling (NE)

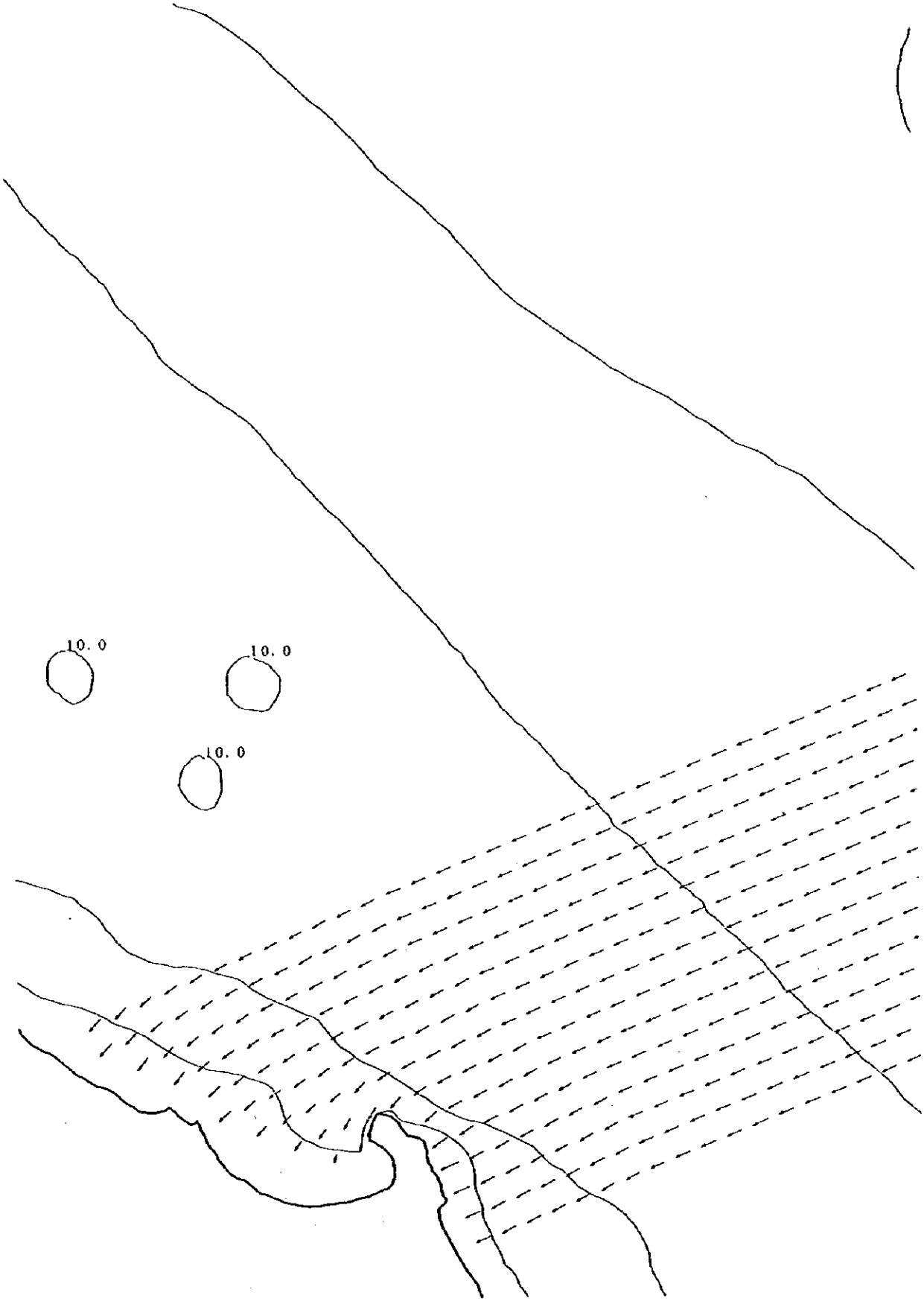


Figure A7.5.7 Wave Refraction and Shoaling (NNW)

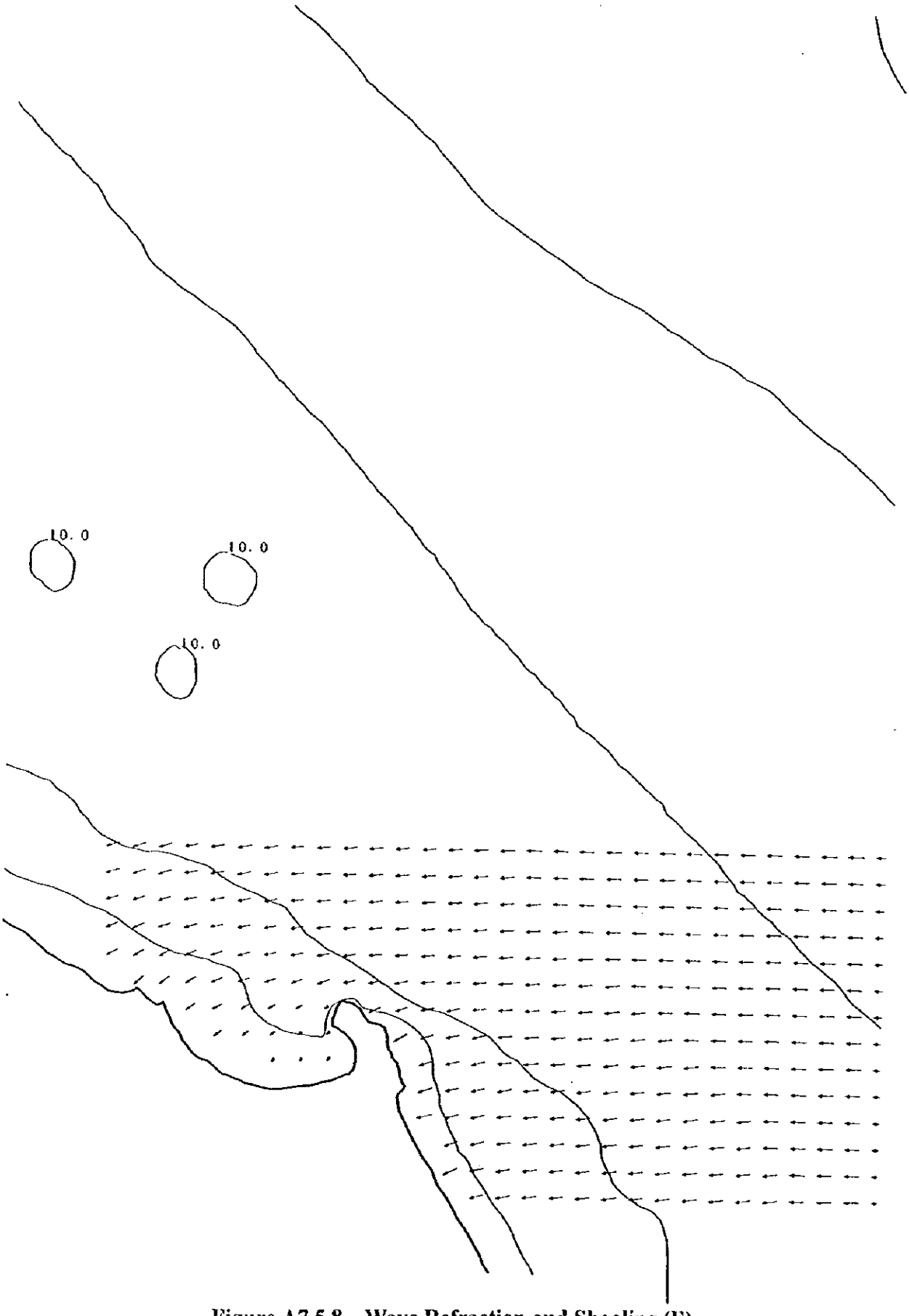


Figure A7.5.8 Wave Refraction and Shoaling (E)

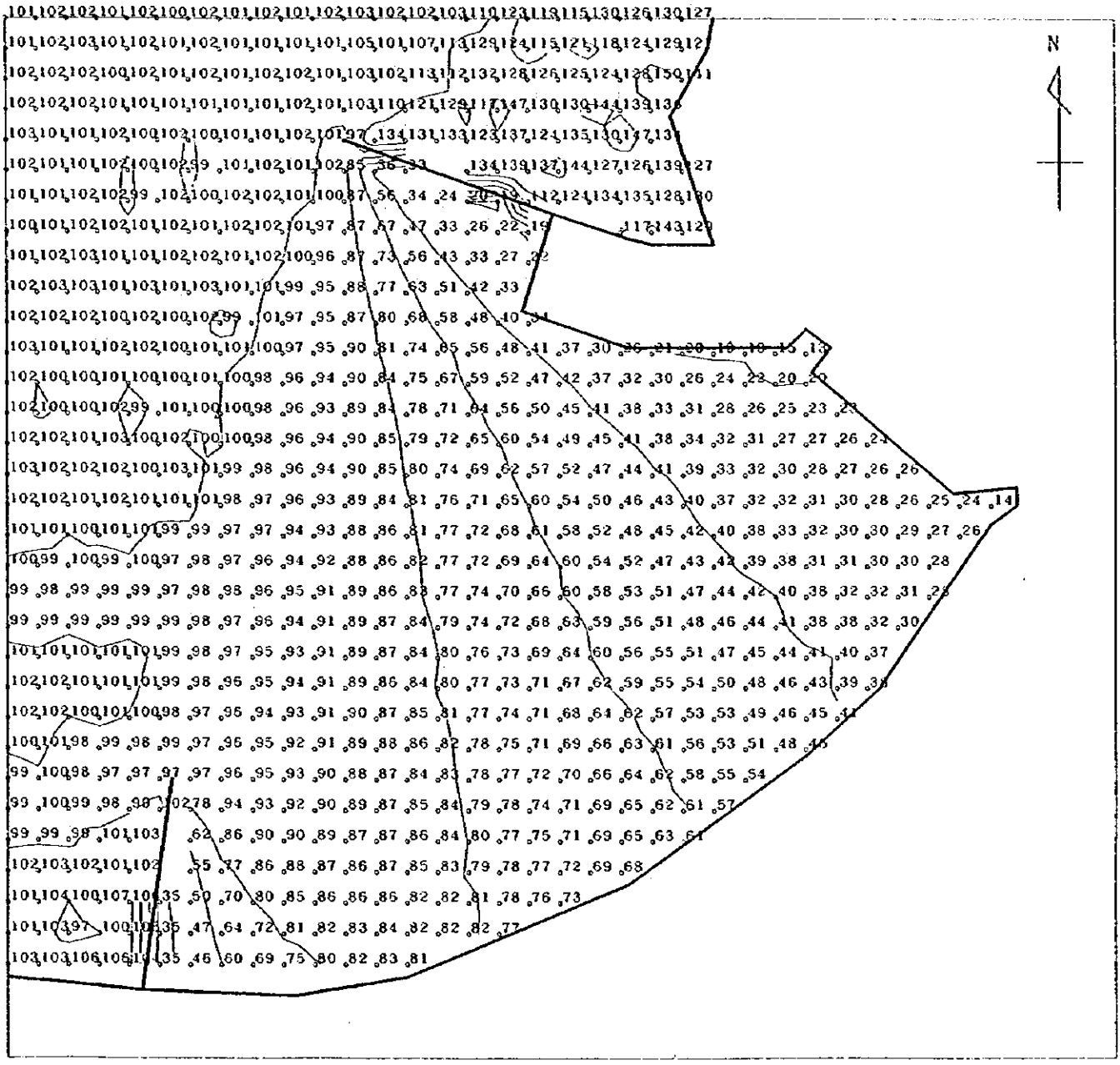


Figure A7.5.9 Wave Diffraction in Harbor (NNW)

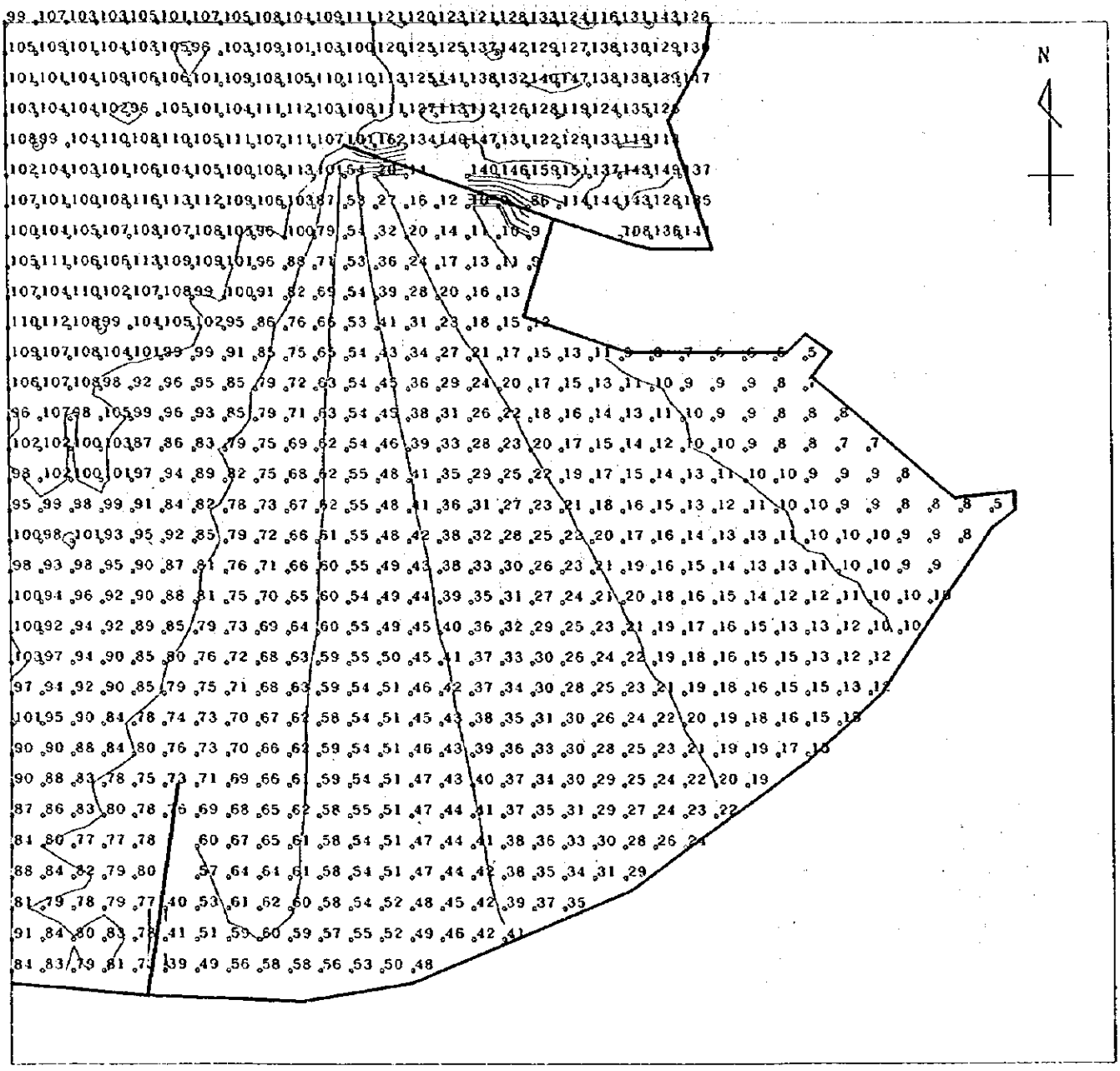


Figure A7.5.10 Wave Diffraction in Harbor (N)

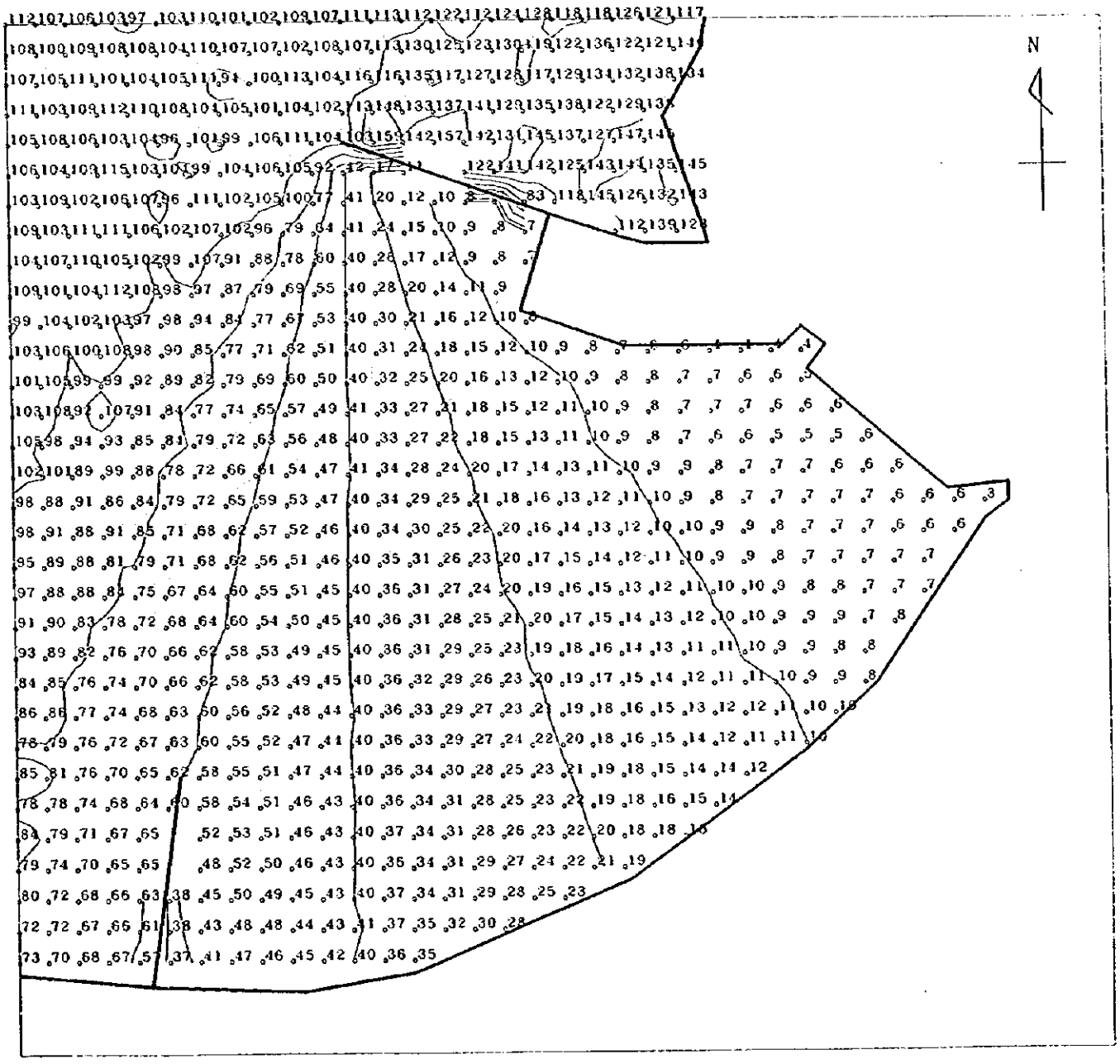
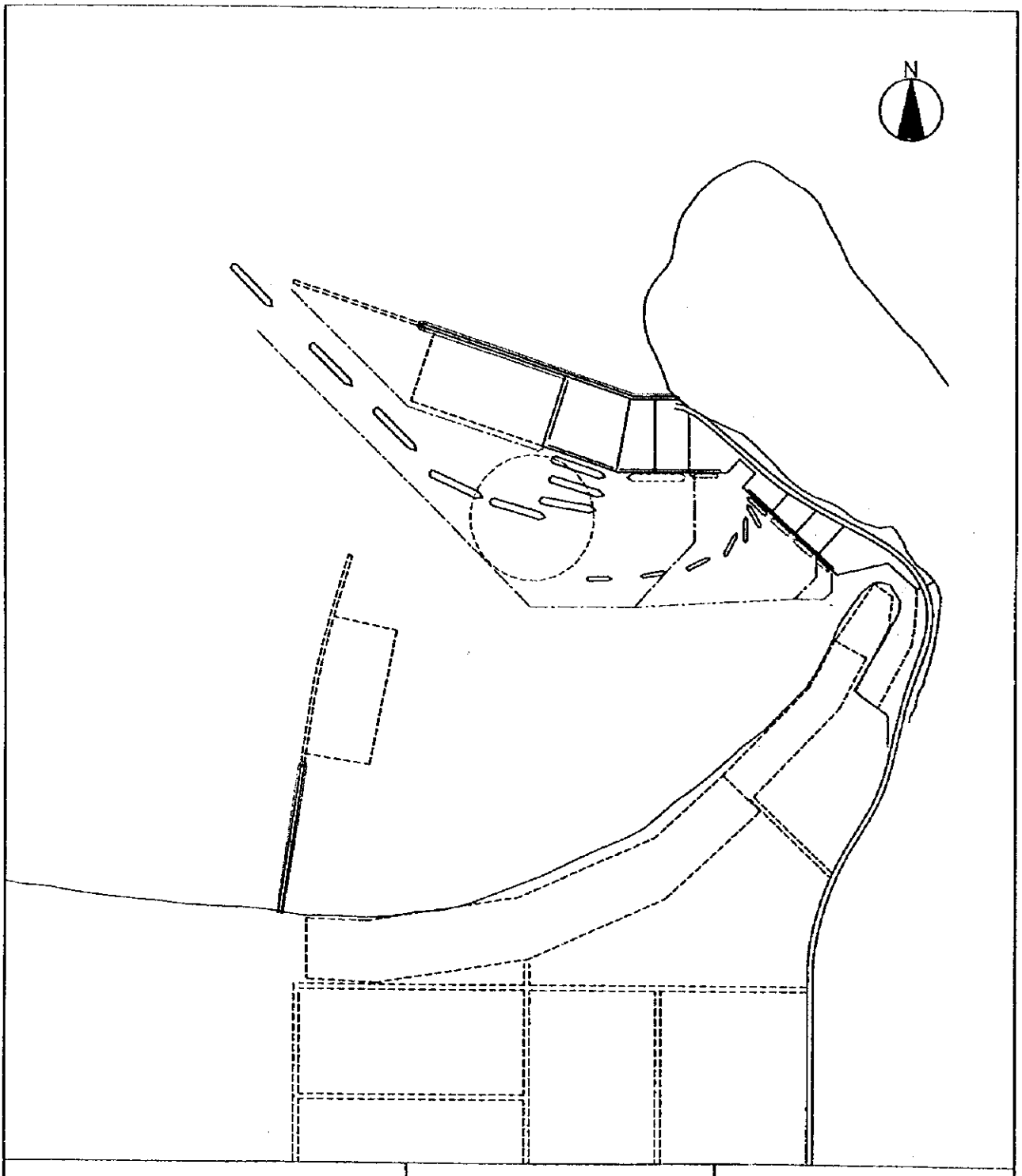


Figure A7.5.11 Wave Diffraction in Harbor (NNE)



JICA Port Development Study in Central Region	Figure A7.5.12	Final Report 1998
Chan May Port Ship Maneuvering Illustration		FILE CM-MP-Ship

Table A8.2.1 Cargo Throughput in Chan May CIZ

Commodoties	Productivity		Initial Stage Development Plan			
	Area/Product (ton/m²)	Area/Material (ton/m²)	Ratio (%)	Area (m²)	Product (ton)	Raw Mat. (ton)
Rubber products	0.06	0.17		160,000	9,600	0
Fruits trees products	0.15	0.61		334,000	50,000	0
Vegetable, peas, bean	0.15	0.61		200,000	30,000	0
Meat products	0.18	0.3		142,000	25,500	0
Processed marine products	0.03	0.12		330,000	9,900	0
			40%	1,166,000		
Construction stone	1.24	1.43		1,000	1,000	0
Brick and concrete products	0.91	1.45		1,000	600	0
Glass and pottery	1.24	1.43		13,000	15,000	2,500
Asphalt concrete	0.49	0.52		6,000	0	2,500
			1%	21,000		
Material wood	0.59	0.73		60,000	35,000	9,000
Lubricating processing	0.17	0.36		148,000	25,000	53,000
Insecticidial products	0.15	0.24		1,000	100	0
			7%	209,000		
Garment and Textile	0.04	0.07		530,000	21,200	14,500
Leather tanning and processing	0.08	0.09		55,000	4,400	600
Liquor distillery	2.44	1.65		13,000	30,000	0
Automobile assembling	0.05	0.09		30,000	1,500	8,100
Machine equipment	0.06	0.11		450,000	27,000	45,500
Electronic equipments	0.15	0.18		60,000	9,000	17,000
Electrical parts and equip.	0.19	0.22		79,000	15,000	28,500
Plastic products	0.06	0.18		167,000	10,000	38,800
Cosmetic and chemical products	0.03	0.04		167,000	5,000	6,500
			53%	1,551,000		
Total Cargo Volume (tons)					324,800	226,500
Net Area (m²)				2,947,000		-

Source : JICA Study Team

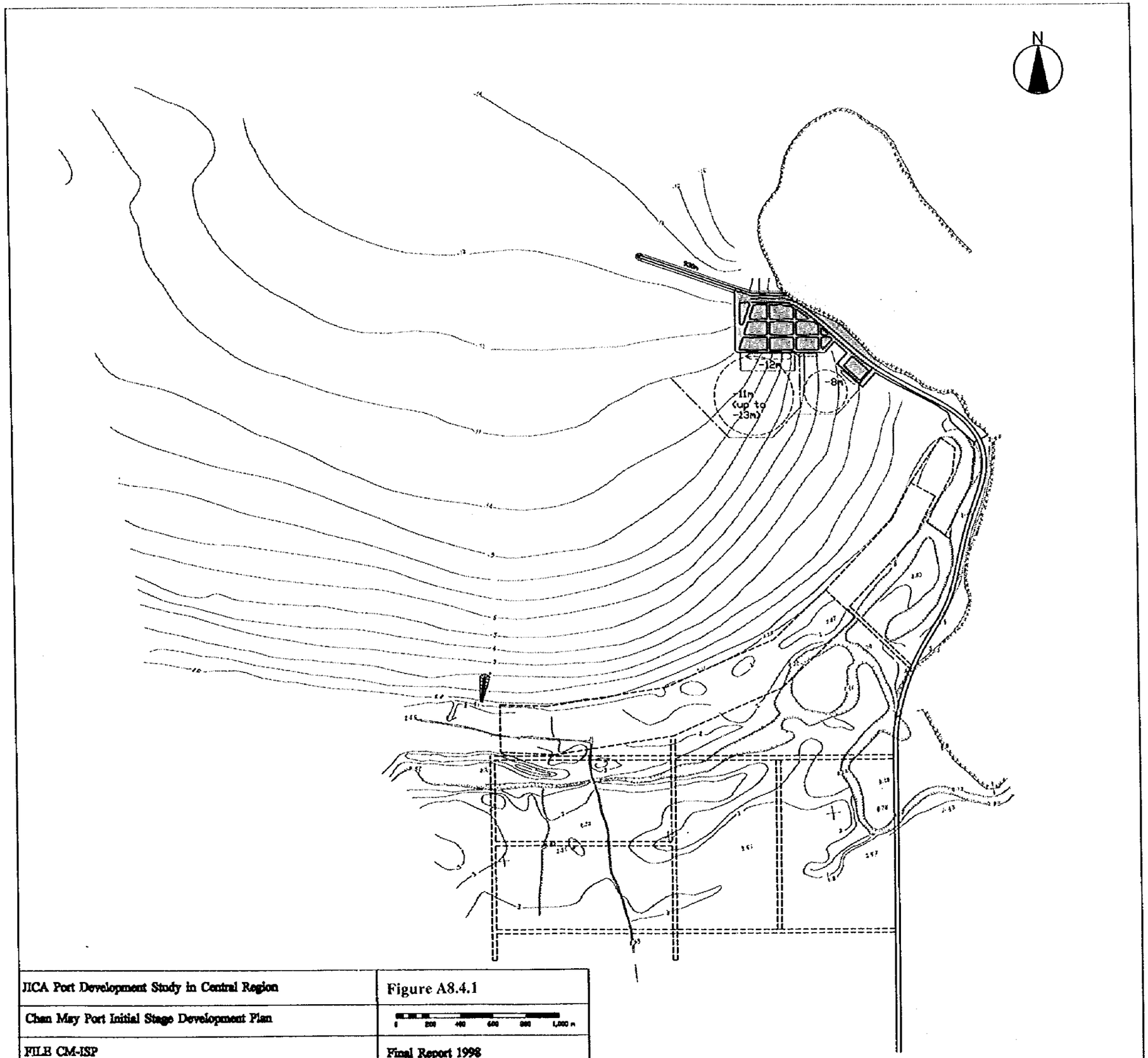
Table A8.3.1 Total Number of Ship Calls

Initial Stage Development Plan

Commodities		Cargo Volume (tons, *TEU*, unit)				Vessel size (DWT)		Number of vessels		
		Export	Import	Loading	Unload.	Foreign	Coastal	Foreign	Coastal	Total
Oil and Oil products	Oil Tanker	0	610,000	0	0	5,000	3,000-5,000	203	0	203
Agricultural products		307,000	29,100	0	0					
	Container	*8,493*	*1,933*	*0*	*0*	20,000	3,000-5,000	35	0	35
	General	183,000	5,907	0	0	3,000-10,000	1,000-3,000	105	0	105
Mining, Clinker and Bulk	Bulk	100,800	159,000	0	200,000	30,000	3,000-5,000	14	111	125
Fertilizer and Break bulk		111,700	75,000	0	0					
	Container	*1,205*	*0*	*0*	*0*	20,000	3,000-5,000	4	0	4
	General	94,100	75,000	0	0	10,000-20,000	1,000-3,000	28	0	28
Steel and Scrap	Bulk	0	0	0	33,000	50,000	1,000-3,000	0	21	21
Cement	Cement	200,000	0	450,000	0	7,000	1,000-3,000	36	563	599
Manufacturing		169,700	193,500	15,000	0					
	Container	*9,216*	*12,314*	*0*	*0*	20,000	3,000-5,000	87	0	87
	Car carrier	1,000	5,400	0	0	40,000	15,000	13	0	13
	Ro/Ro	0	0	15,000	0	-	7,000	0	15	15
	General	33,640	37,636	0	0	3,000-10,000	3,000-5,000	40	0	40
Subtotal								565	710	1275
Passenger Ship						20,000	-	40	0	40
Total								605	710	1,315

Year 2020

Commodities		Cargo Volume (tons, *TEU*, unit)				Vessel size (DWT)		Number of vessels		
		Export	Import	Loading	Unload.	Foreign	Coastal	Foreign	Coastal	Total
Oil and Oil products	Oil Tanker	0	1,416,000	0	0	5,000	3,000-5,000	472	0	472
Agricultural products		482,800	34,700	0	0					
	Container	*13,523*	*2,313*	*0*	*0*	20,000	3,000-5,000	53	0	53
	General	285,360	6,940	0	0	3,000-10,000	1,000-3,000	162	0	162
Mining, Clinker and Bulk	Bulk	363,700	313,000	0	450,000	30,000	3,000-5,000	38	250	288
Fertilizer and Break bulk		200,000	104,000	0	0					
	Container	*2,795*	*0*	*0*	*0*	20,000	3,000-5,000	9	0	9
	General	159,200	104,000	0	0	10,000-20,000	1,000-3,000	44	0	44
Steel and Scrap	Bulk	0	0	0	86,000	50,000	1,000-3,000	0	54	54
Cement	Cement	830,000	0	450,000	0	7,000	1,000-3,000	148	563	711
Manufacturing		324,400	322,600	20,000	51,500					
	Container	*17,200*	*20,087*	*0*	*0*	20,000	3,000-5,000	161	0	161
	Car carrier	7,000	14,200	0	0	40,000	15,000	42	0	42
	Ro/Ro	0	0	20,000	51,500	-	7,000	0	72	72
	General	62,780	60,260	0	0	3,000-10,000	3,000-5,000	68	0	68
Subtotal								1,197	939	2,136
Passenger Ship						20,000	-	54	0	54
Total								1,251	939	2,190



JICA Port Development Study in Central Region	Figure A8.4.1
Chan May Port Initial Stage Development Plan	0 200 400 600 800 1,000 m
FILE CM-ISP	Final Report 1998

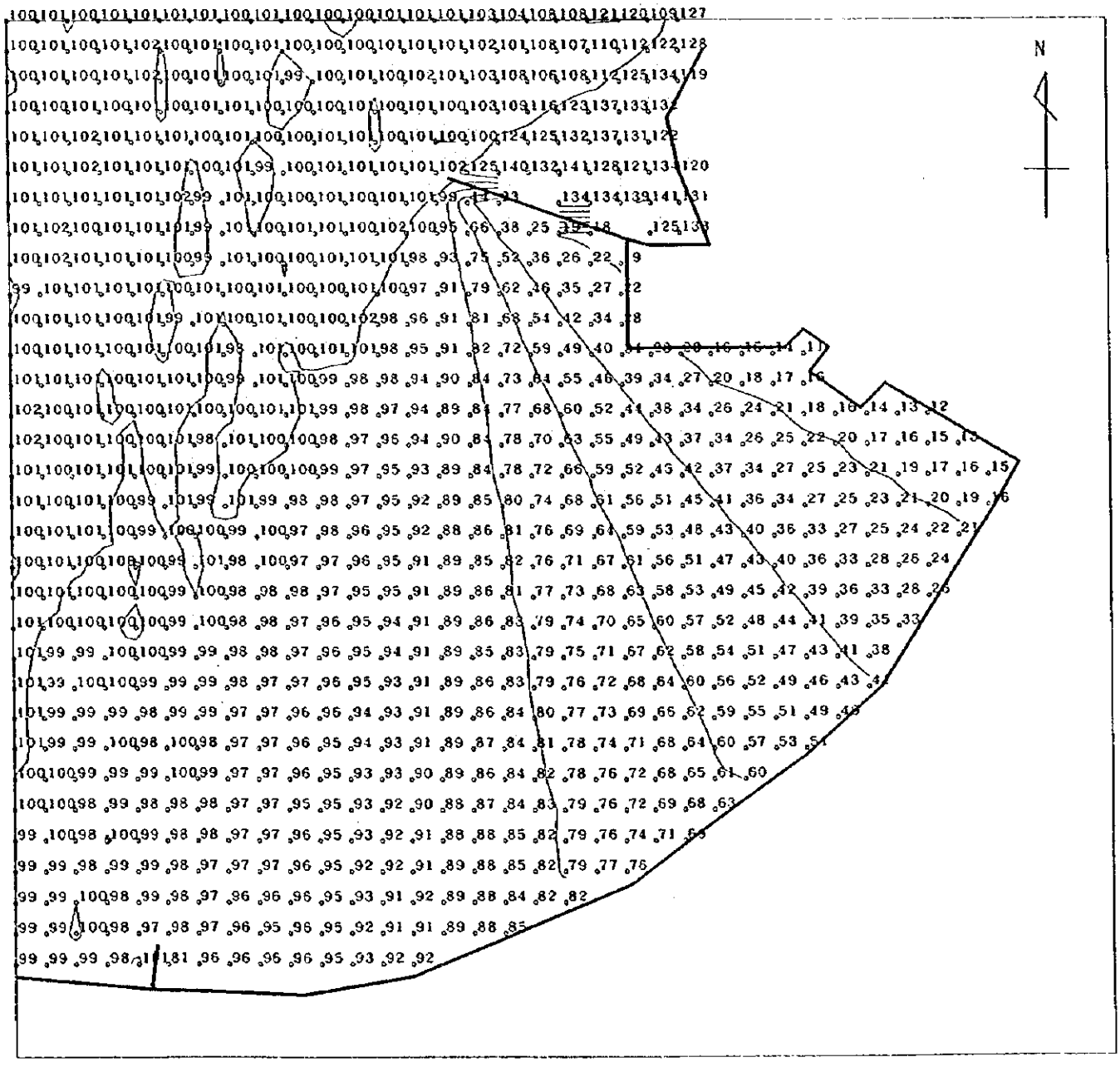


Figure A8.4.2 Wave Diffraction at the Stage of ISP (NNW)

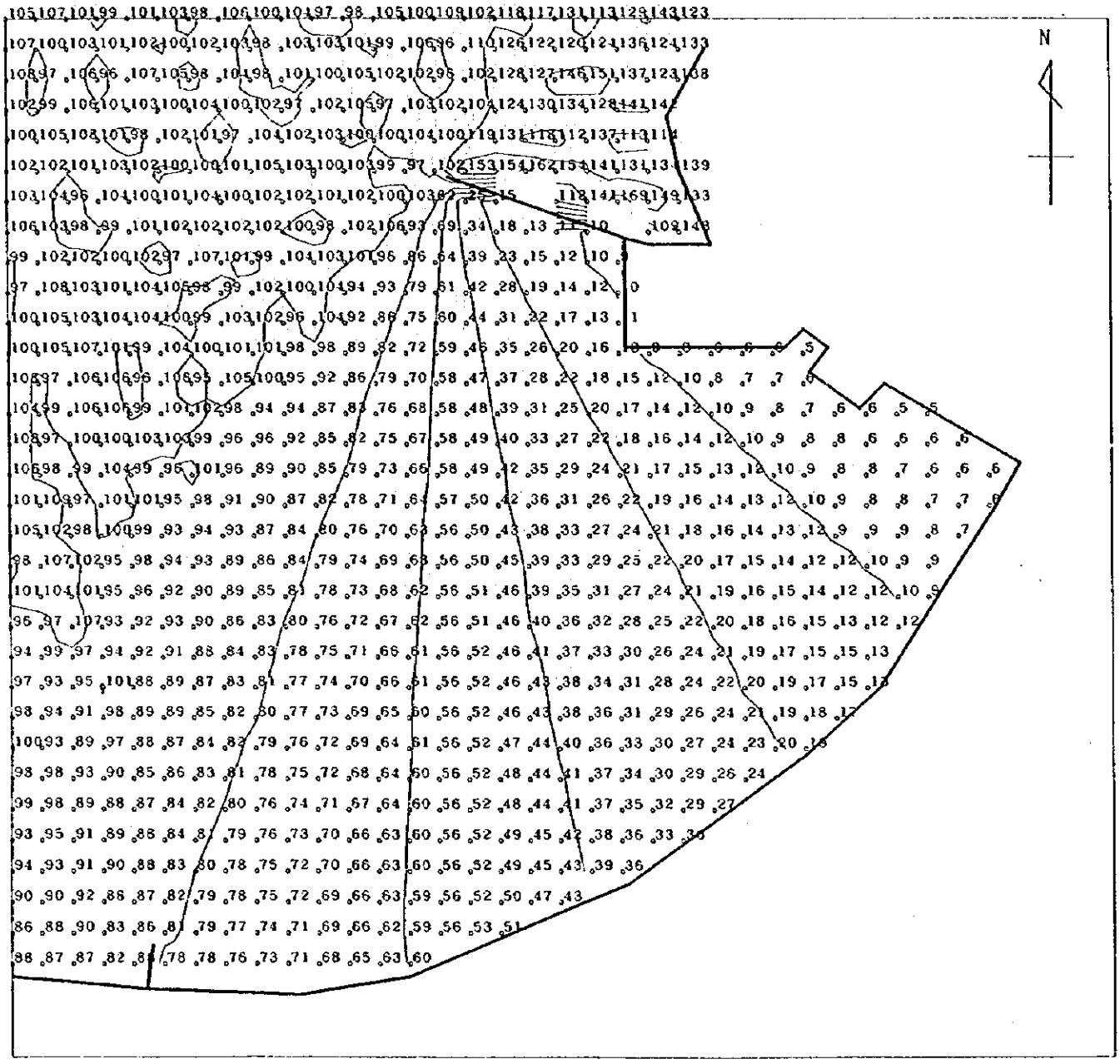


Figure A8.4.3 Wave Diffraction at the Stage of ISP (N)

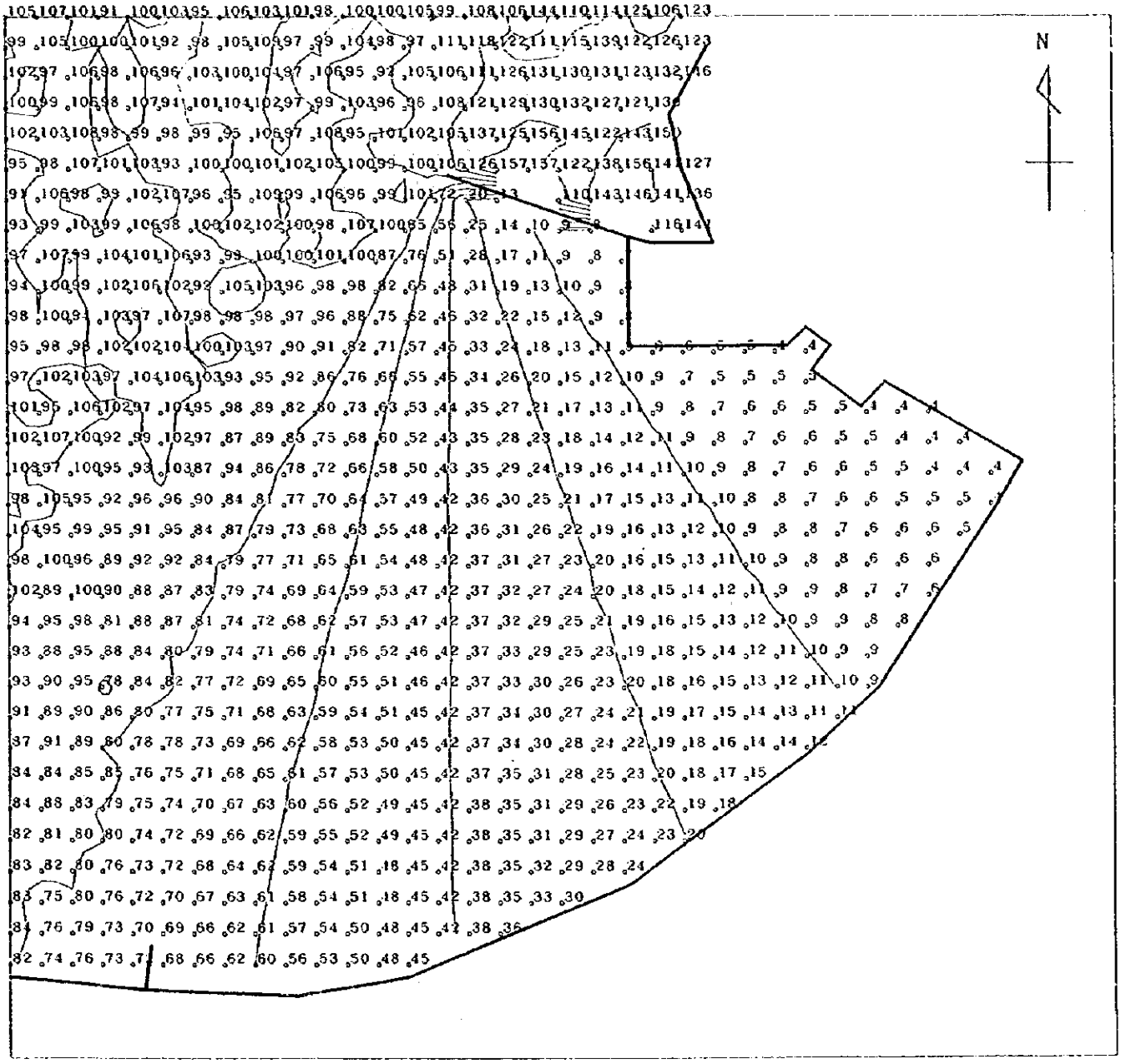


Figure A8.4.4 Wave Diffraction at the Stage of ISP (NNE)

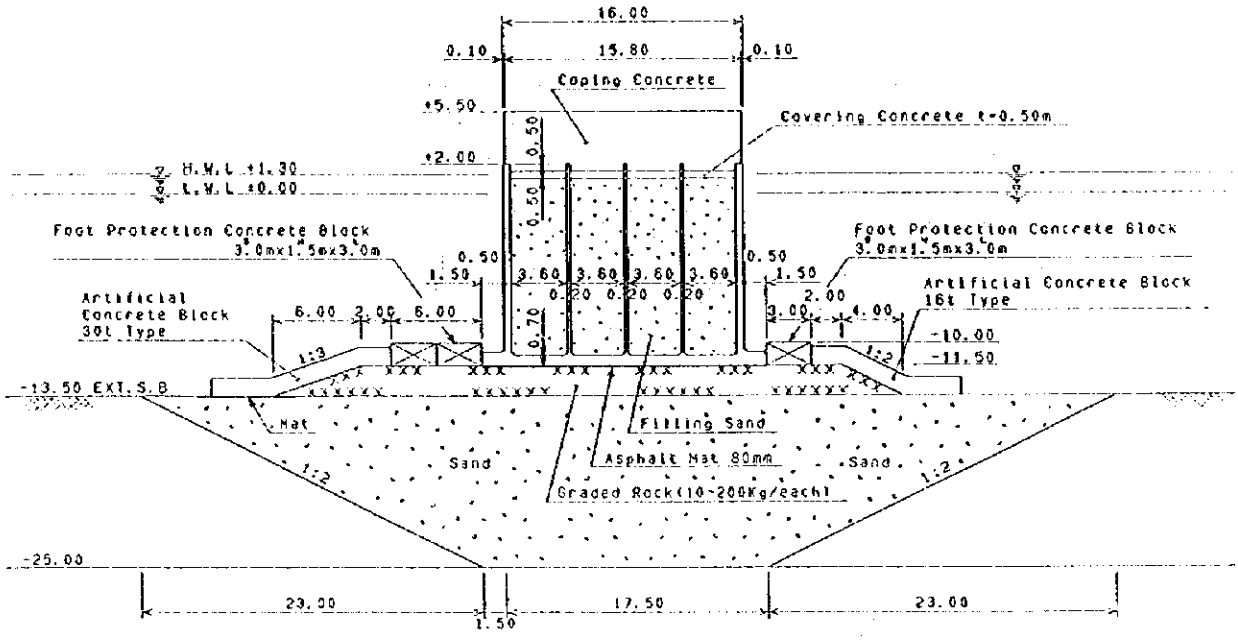


Figure A9.5.1(1) Typical Cross Section of Breakwater (RC Caisson)

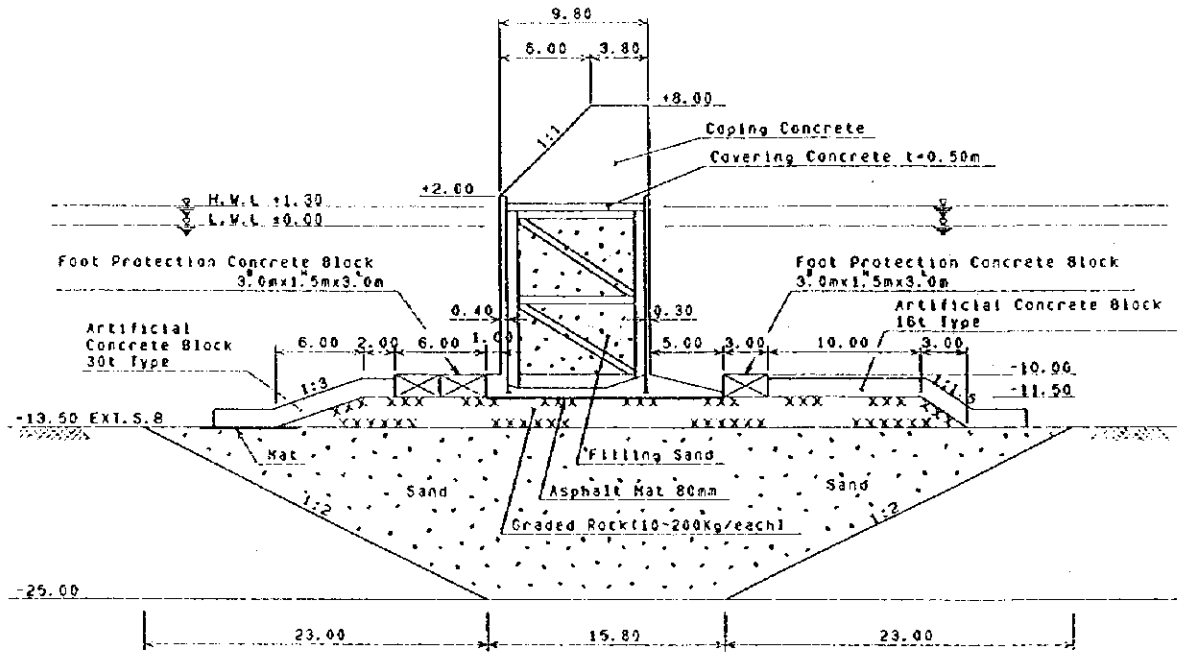


Figure A9.5.1(2) Typical Cross Section of Breakwater (Hybrid Caisson)

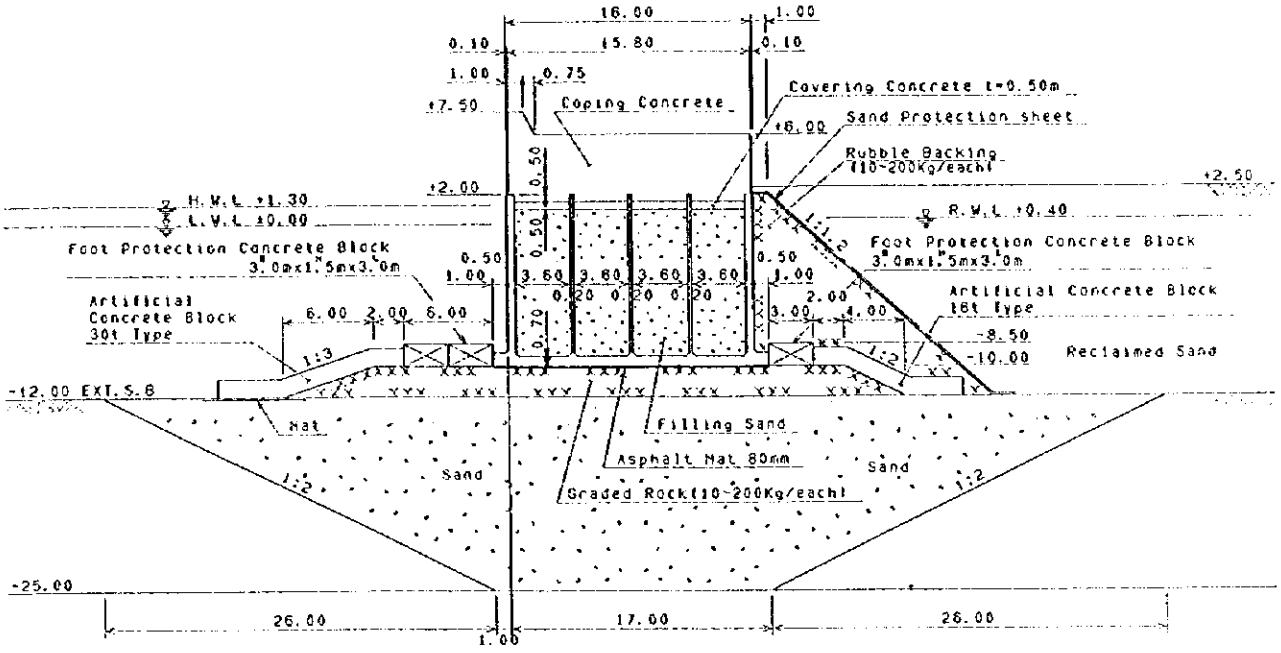


Figure A9.5.2(1) Typical Cross Section of Seawall (RC Caisson)

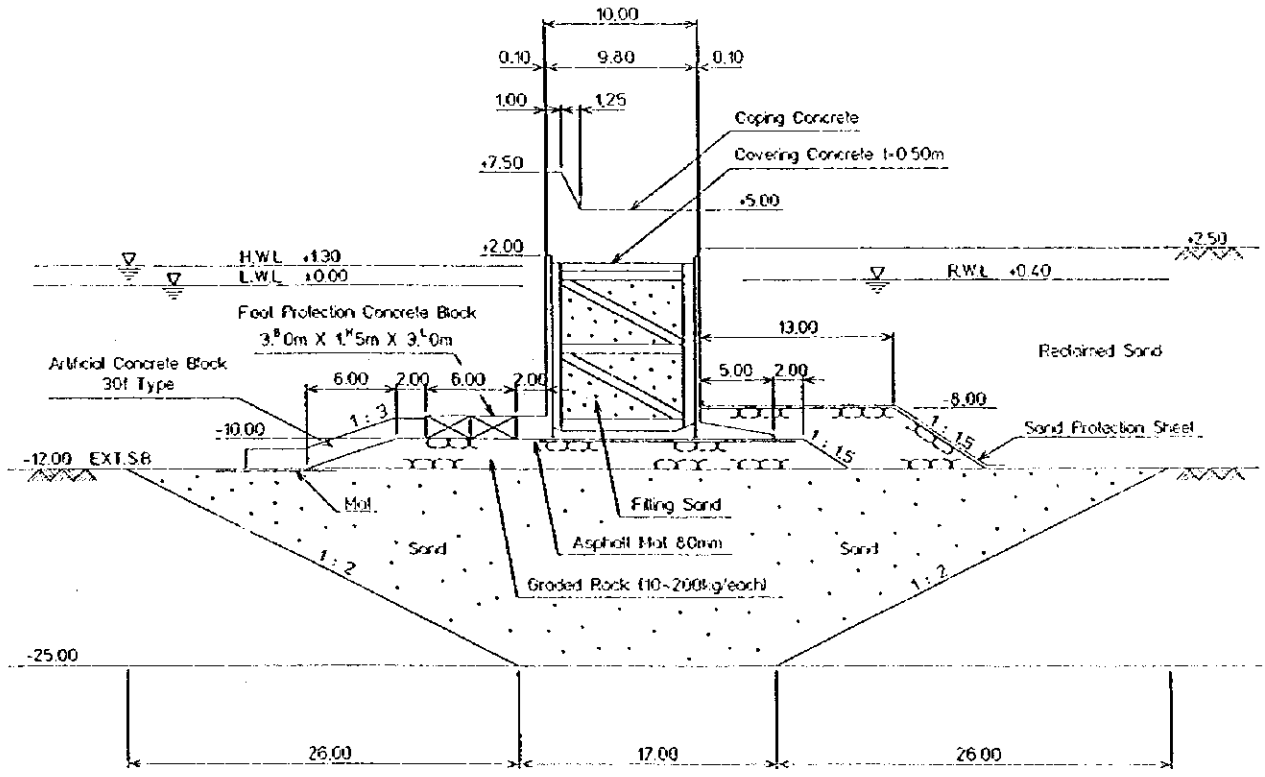


Figure A9.5.2(2) Typical Cross Section of Seawall (Hybrid Caisson)

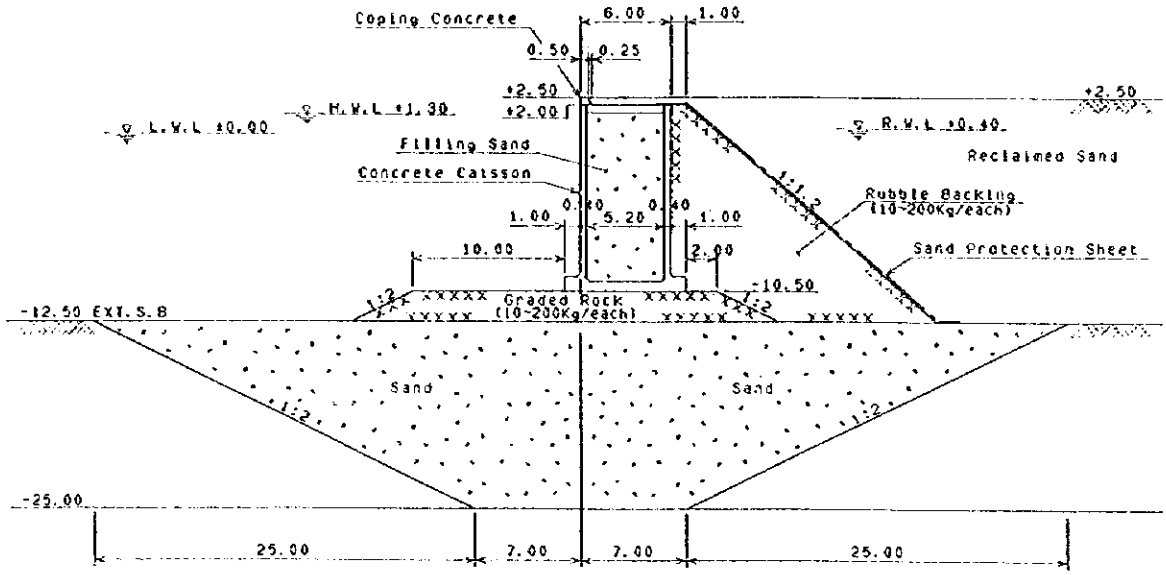


Figure A9.5.3(1) Typical Cross Section of Revetment 1 (RC Caisson)

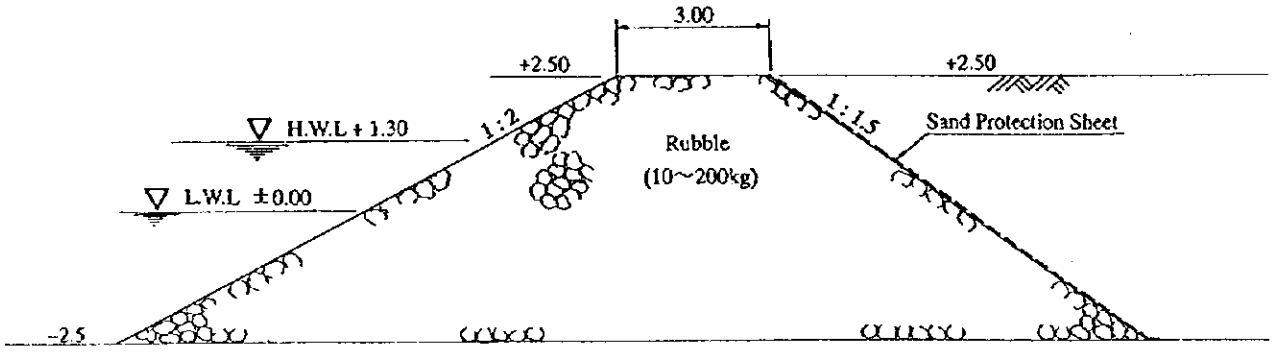


Figure A9.5.3(2) Typical Cross Section of Revetment 2 (Rubble)

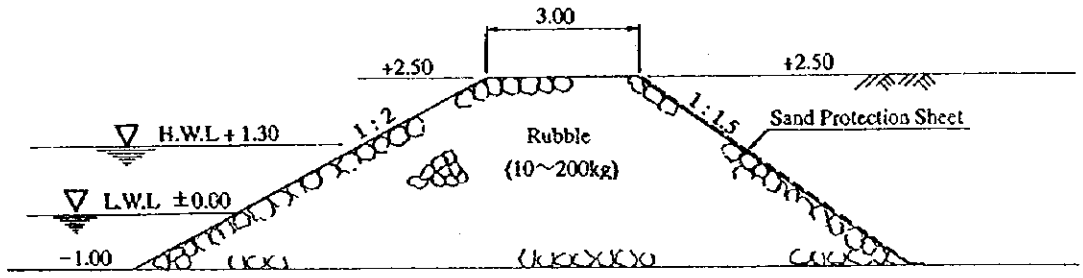


Figure A9.5.3(3) Typical Cross Section of Revetment for Road (Rubble)

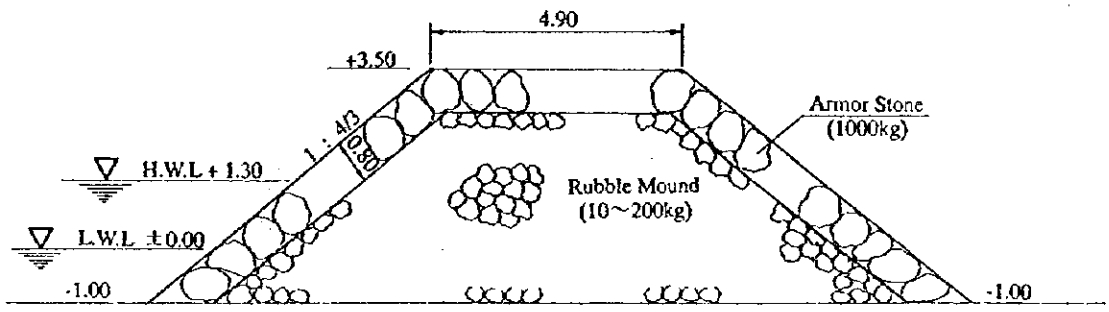


Figure A9.5.4 Typical Cross Section of Groin (Rubble Mound with Armor Stone)

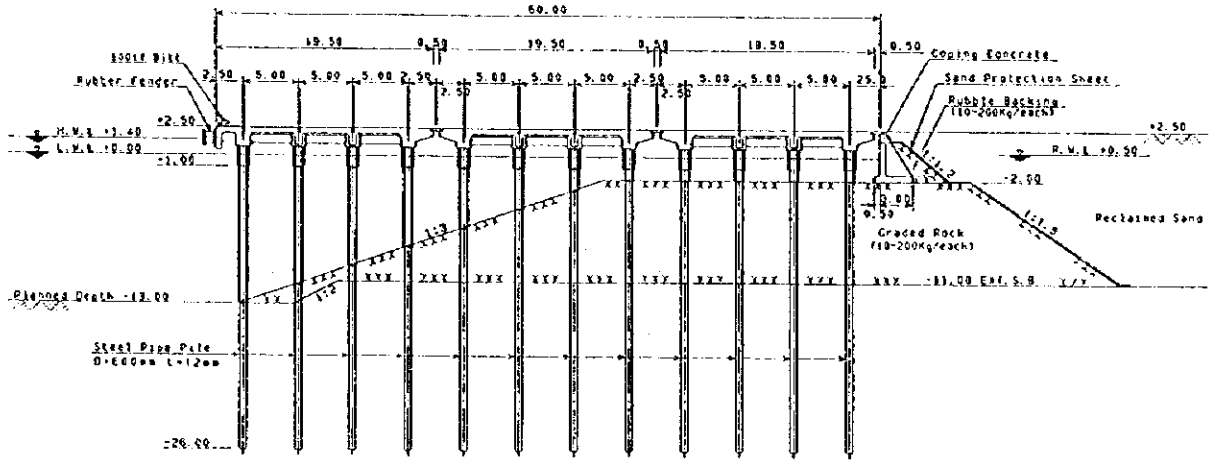


Figure A9.5.5(1) Typical Cross Section of Quaywall W2 (Open Pier with Retaining Wall)

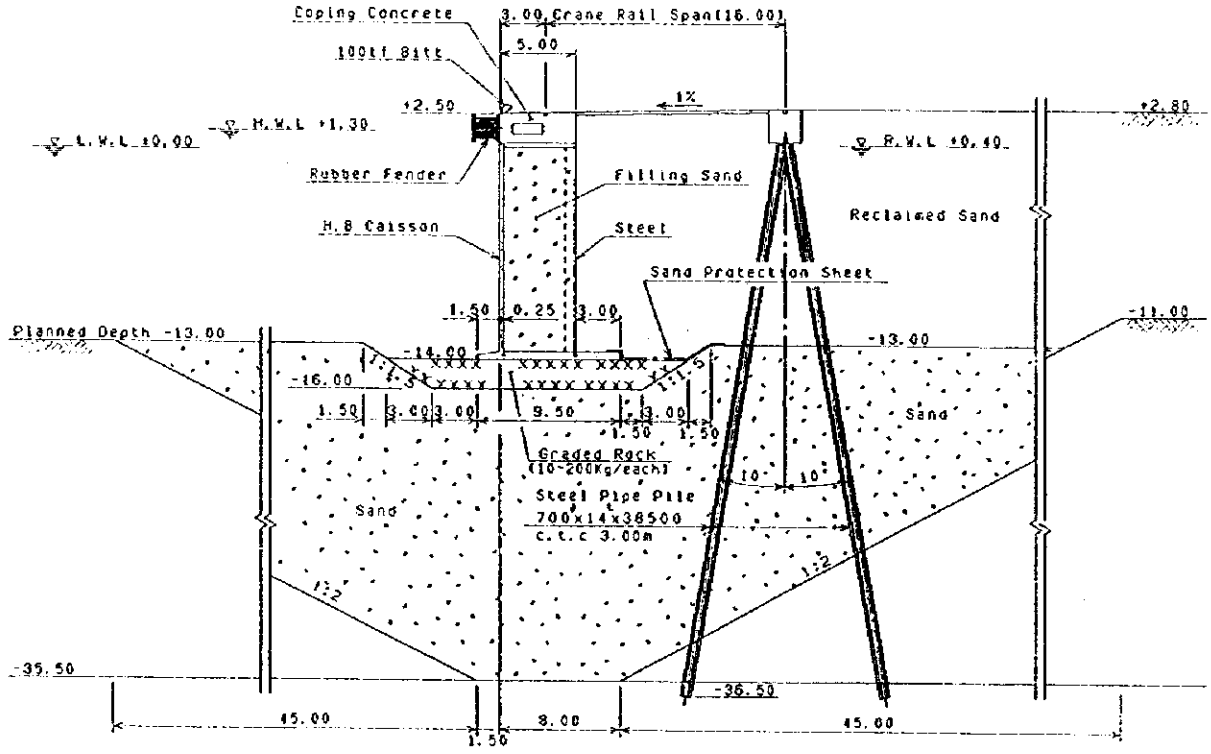


Figure A9.5.5(2) Typical Cross Section of Quaywall W2 (Hybrid Caisson)

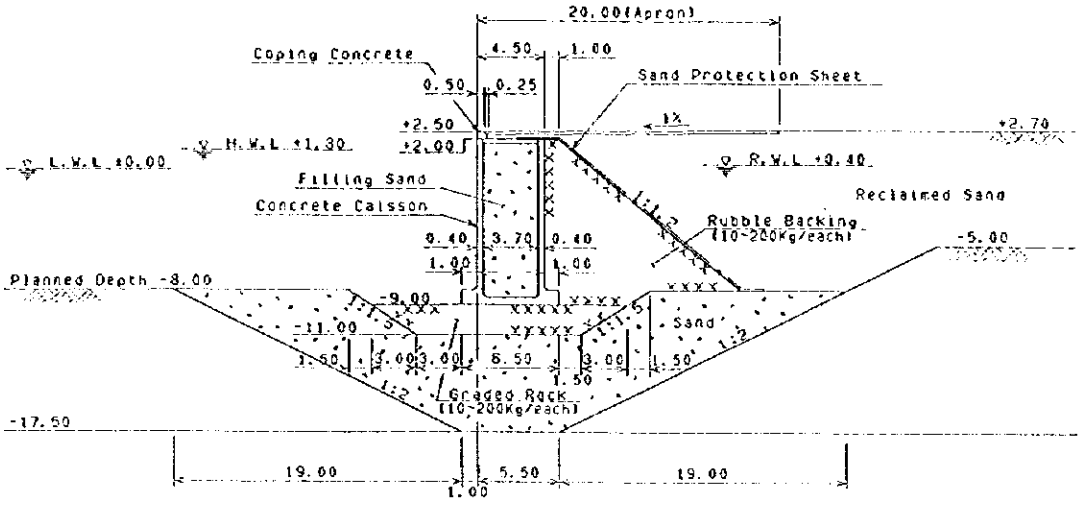


Figure A9.5.5(3) Typical Cross Section of Quaywall E1 (RC Caisson)

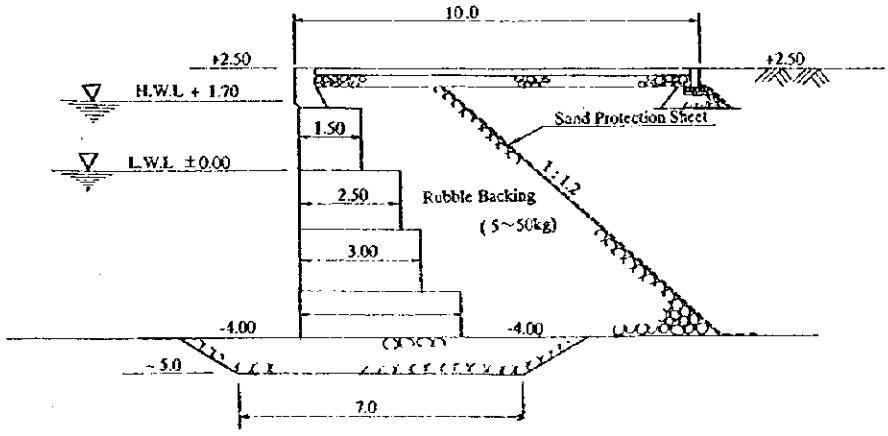


Figure A9.5.5(4) Typical Cross Section of Quaywall (Concrete Block)

Table A13.1.1 Port Dues and Charges Tariff

Port User Charges (Sea Port)

International or Domestic	Domestic (Unit: VND)	Export/Import (Unit: USD)
Effective	From May 1,1998	From January 1, 1998
Working Time Overtime Work	7:00 - 17:00 5:00 - 7:00 = *1.20 17:00 - 22:00 = *1.20 22:00 - 05:00 = *1.40 Holidays & Sundays (Including night) = *1.50	7:00 - 17:00 5:00 - 7:00 = *1.20 17:00 - 22:00 = *1.20 22:00 - 05:00 = *1.40 Holidays & Sundays (Including night) = *1.50
1. Berthage and Wharfage dues		
(1) On Vessels		
1) Berth	*240/GRT/day*	0.0035/GRT/hour
2) Buoy	*120/GRT/day*	0.0012/GRT/hour
3) Minimum	*100,000/Vessel day (For Sea Going Vessel)*	
(2) On Cargoes	*At Quay 1,000/ton* *At Buoy 500/ton*	At Quay 0.30/ton At Buoy 0.15/ton
2. Cargo Handling services	(unit: VND/ton)	(unit: USD/ton)

(1) Handling at Berth

	Ship ~Warehouse, Storage area		*Ship~Truck, Barge*	
Cargo Group	*Port's Crane*	*Ship Crane*	*Port's Crane*	*Ship Crane*
1	*12,070*	*9,260*	*9,200*	*6,070*
2	*16,270*	*11,470*	*12,630*	*7,830*
3	*22,840*	*15,080*	*16,510*	*11,710*
4	*24,900*	*16,260*	*19,660*	*11,980*
5	*27,720*	*20,040*	*23,300*	*15,620*
6	*28,270*	*20,950*	*23,640*	*15,960*
7	*32,540*	*24,870*	*26,970*	*19,110*
8	*47,320*	*37,720*	*34,500*	*22,980*

	Ship~Truck Barge		Ship~Warehouse Storage area	
Cargo Group	Ship Crane	Port's Crane	Ship Crane	Port's Crane
1	2.00		2.90	
2	2		3.66	
3	3.56		4.74	
4	3.86		5.14	
5	4.06		5.41	
6	4.36		5.81	
7	4.60		6.13	
8	4.85		6.46	
9	40/unit 55/unit		50/unit 70/unit 25/unit	

(2) Handling at Buoy

Cargo Group	*Loading/Unloading at Buoy*
1	*7,110*
2	*8,950*
3	*12,980*
4	*13,260*
5	*16,240*
6	*17,900*
7	*19,880*
8	*24,700*

Cargo Group	*Loading/Unloading at Buoy*
1	2.30
2	3.08
3	4.13
4	4.52
5	4.78
6	5.17
7	5.49
8	5.81
9	45/unit 55/unit

(3) Warehouse Strage Area ~ Truck, Trailer

Cargo Group	*Warehouse, Strage ~ Truck*
1	*4,070*
2	*4,590*
3	*5,280*
4	*6,200*
5	*6,340*
6	*6,910*
7	*8,630*
8	*17,620*

Cargo Group	Warehouse, Storage ~ Truck
1	0.73
2	0.90
3	1.27
4	1.32
5	1.47
6	1.60
7	1.69
8	1.79
9	30/unit 35/unit

(4) For Container	*20 feet: Empty 42,000/unit (Cargo Group 4)* *Min. 100,000/unit (Cargo Group 4)* *40 feet: Empty 80,000/unit (Cargo Group 4)* *Min. 170,000/unit (Cargo Group 8)*	(unit: UD$/UNIT)

	ship ~ truck	ship ~ yard, warehouse	yard, warehous ~ truck
20 feet			
full	26	50	20
empty	16	30	12
40 feet			
full	40	76	31
empty	23	44	18

3. Storing Charges	1) 1 - 30 days					
	General	*800/t/d*	in warehouse		0.2/ton/d	
	foodstuffs, agricultural prod.	*400/t/d*	in open storage		0.1/ton/d	
	Fertilizer, chemical, Cement	*600/t/d*	assembled facilities		4.0/pc/d	
	in storage area	*500/t/d*	container (unit/d)		full	empty
				20'	2.0	1.0
				40'	3.0	1.5
				Reef 20'	22day	1.1/h
				Reef 40'	40day	1.6/h

4. Other Fees (1) Tug Assistant Service Fees	*- Tug assistance fees*		- Tug assistance fees		
	<500HP	*2,500HP/h*	<500HP	0.34/HP/hour	
	500HP <1,000	*2,000HP/h*	500< - 1,000HP	(170+0.26HP)/h	
	1,000HP <	*1,500HP/h*	1,000HP<1,500	(300+0.15HP)/h	
			1,500HP<	(375+0.05HP)/h	

(2) Mooring Unmooring	*At Berth*		*At Buoy*				
	mooring	*unmo.*	*mooring*	*unmo.*	< 1,000 GRT	At Buoy 50/time	At Berth 17/time
< 2,000	*60,000*	*50,000*	*110,000*	*70,000*	1,001 < 4,000	80	33
2,000<4,000	*70,000*	*60,000*	*140,000*	*100,000*	4,001 < 10,000	116	50
4,000<6,000	*85,000*	*75,000*	*160,000*	*130,000*	10,001<15,000	132	66
6,000<	*150,000*	*140,000*	*170,000*	*165,000*	15,000 GRT <	149	83

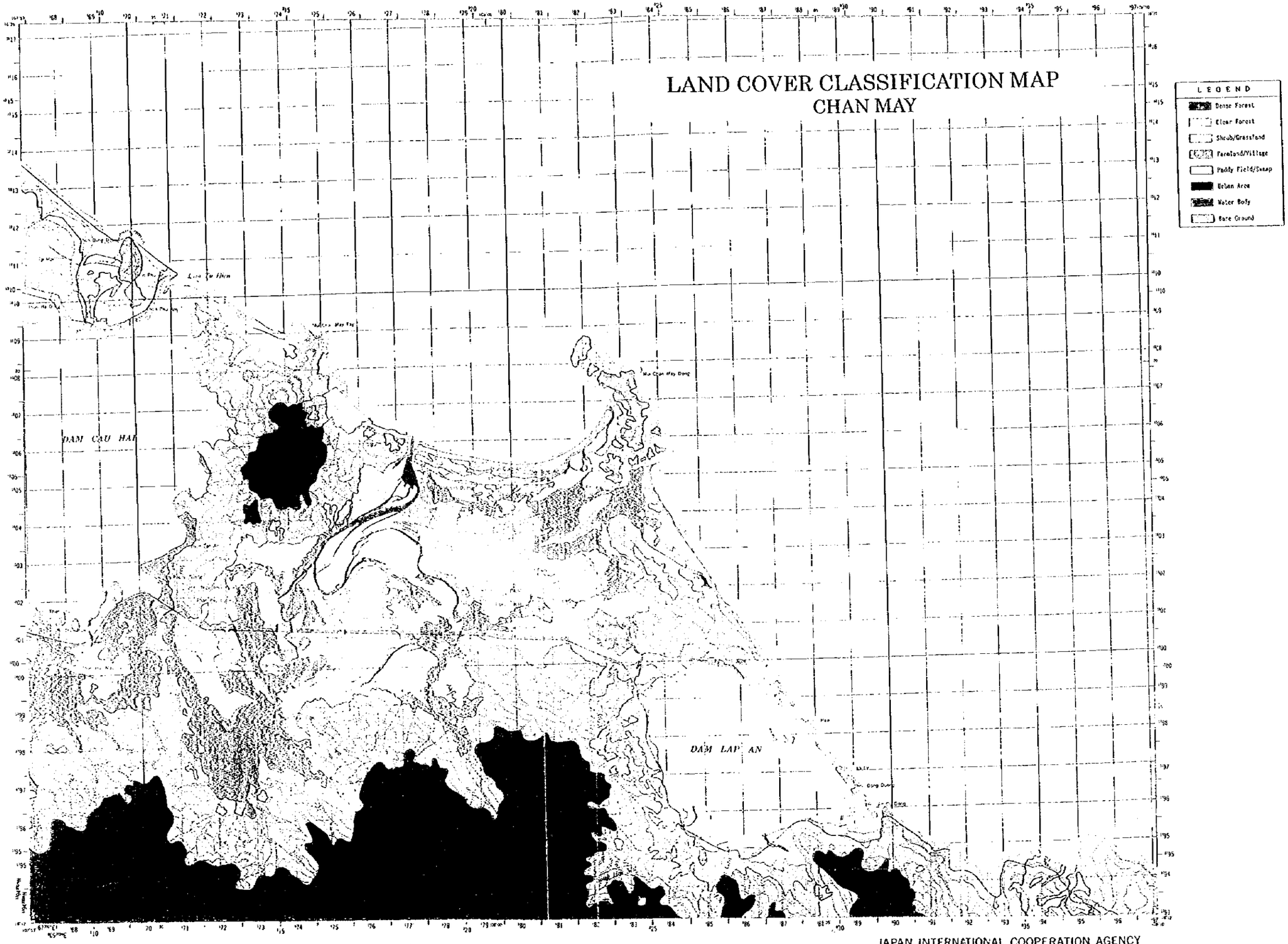
(3) Tallying	*Bulk cargo : 500/ton* *General cargo : 1,500/ton* *Cars and Container : 10,000/unit*	General and Bulk Cargo : 0.35/ton Container : 1/unit

(4) Others		*At Quay*	*At Buoy*		At Quay	At Buoy
	1)Dumping service	*200,000/time*	-	1)Dumping service	20/vessel	50/vessel
	2)Supplying water	*15,000/m^3*	*22,000/m^3*	2)Supplying water	2.5/m^3	3.5/m^3

		Port Entry Dues (SEAPORT)	
INTERNATIONAL or DOMESTIC		DOMESTIC (UNIT: VND)	EXPORT/IMPORT (UNIT: USD)
Effective		from January 1, 1998	from January 1, 1998
(1) Tonnage Dues	1) Entrance	200/GRT	0.10/GRT
	2) Exit	200/GRT	0.10/GRT
(2) Navigational Maintenance Dues		1) Entrance - < 2,000GRT: 200/GRT - 2,000GRT< : 400/GRT 2) Exit - < 2,000GRT: 200GRT - 2,000 GRT<: 400GRT	- Conventional Vessel Entrance 0.209/GRT Leaving 0.209/GRT
(3) Clearance Fees	Entrance & Exit	< 200GRT : 30,000	< 600 GRT = 20/trip
		200 - 1,000GRT : 50,000	600 < 1,000 GRT = 50/trip
		1,000 - 5,000 : 100,000	1,000 GRT = 100/trip
		5,000GRT : 200,000	
(4) Pilotage Dues	Entrance	15/GRT/sea mile	0.0032/GRT/sea mile
	Exit	15/GRT/sea mile	0.0032/GRT/sea mile
	Minimum	Ent, Exit : 150,000 Intra - port: 100,000	100/vessel

Source: Danang Port

LAND COVER CLASSIFICATION MAP
CHAN MAY



CONTOUR INTERVAL–20 METERS

SUPPLEMENTARY CONTOURS-10 METERS

This map was completed in May 1997.

This map was completed in May 1997, based on the interpretation of SPOT image shown on the following table.

	Scene No.	Date of Data Collection
CHAN MAY	KJ76-J317	Apr.10,1996

SPHEROID ..... EVEREST
GRID ..... 1,000 METERUTM ZONE 49
PROJECTION ..... TRANSVERSE MERCATOR
VERTICAL DATUM ..... MEAN SEA LEVEL AT HATIEN
HORIZONTAL DATUM ..... INDIAN DATUM 1960

JAPAN INTERNATIONAL COOPERATION AGENCY

Overseas Coastal Area Developmental Institute of Japan

Japan Port Consultants, Ltd (May, 1997)