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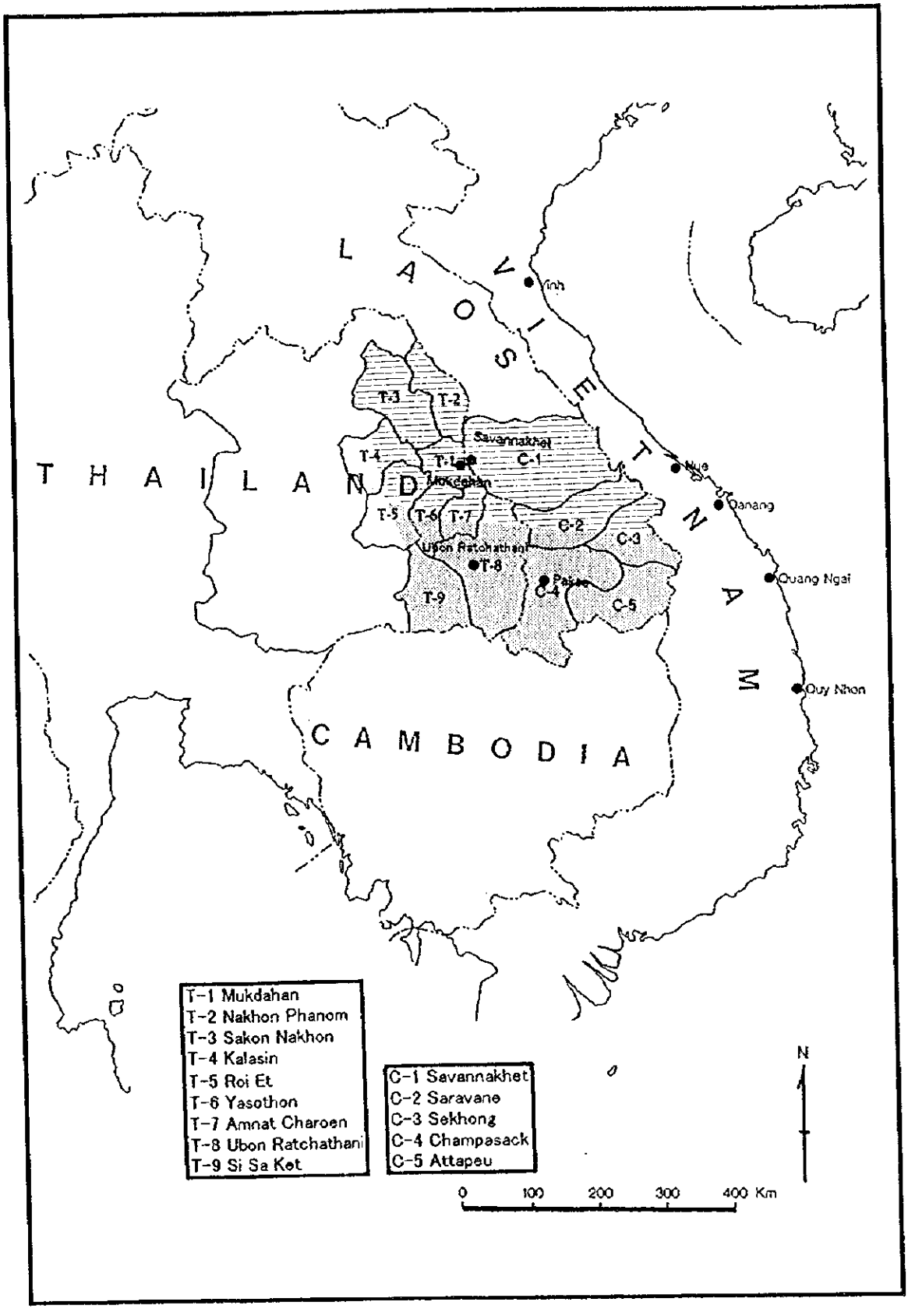


Figure A 2.2.2 Southern Lao and Northeast Thailand

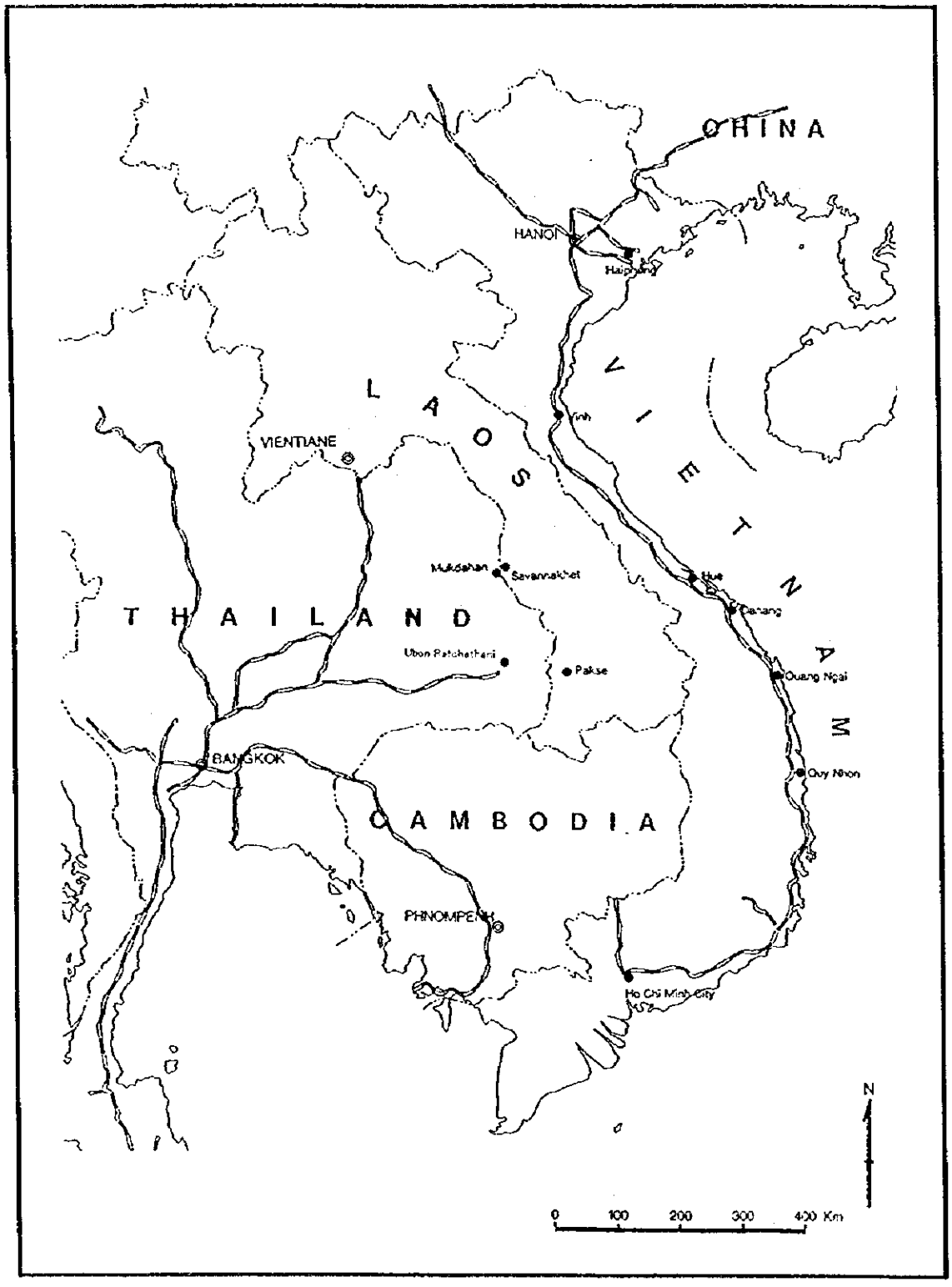
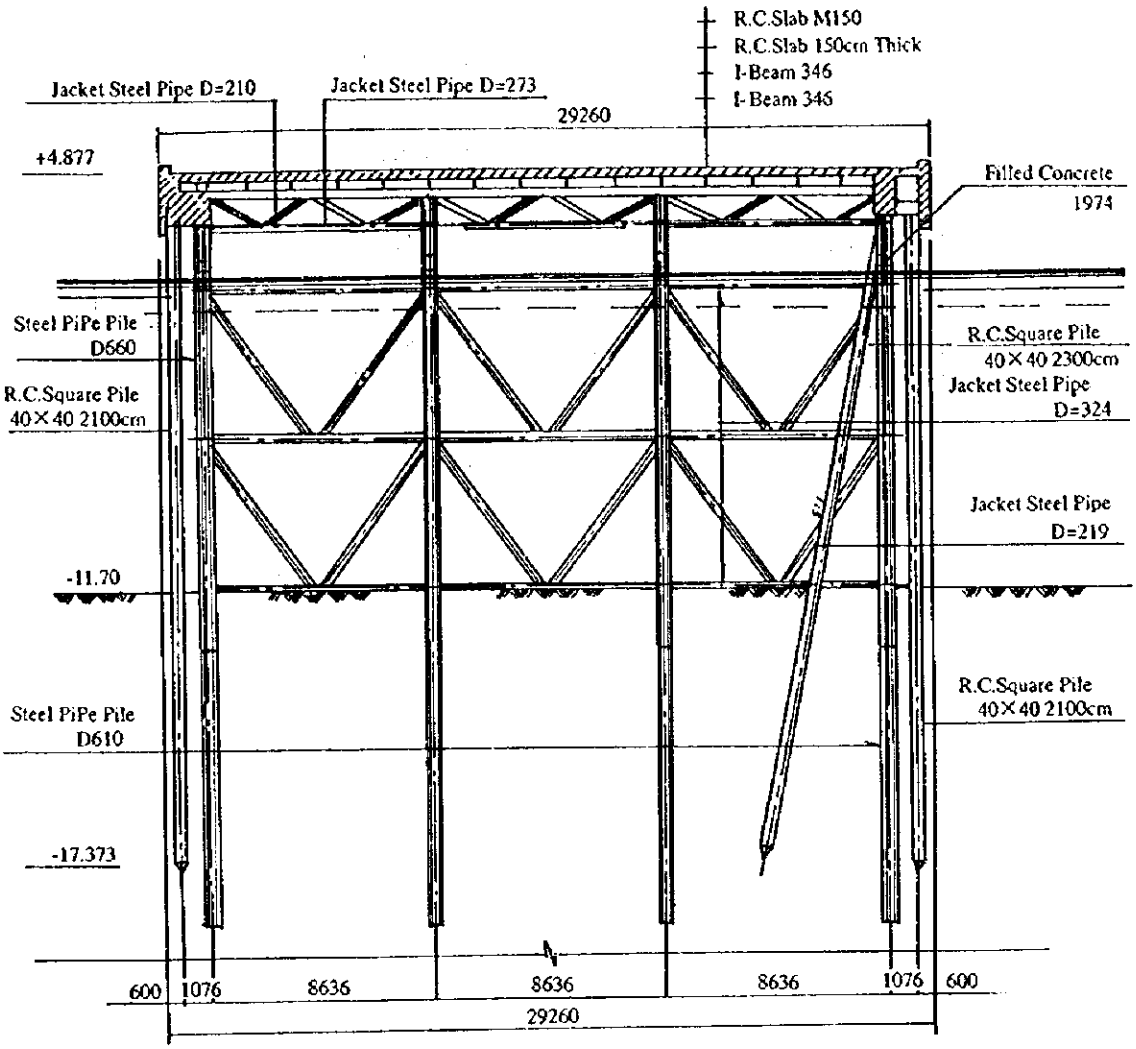
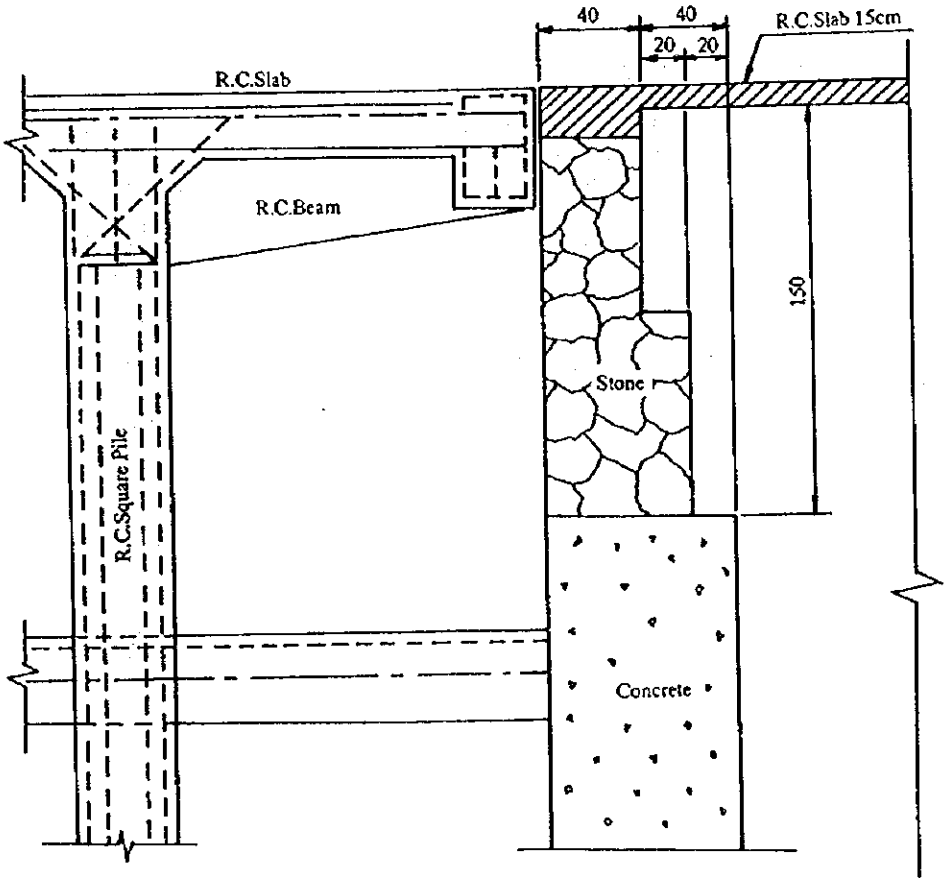


Figure A 2.3.3 Railway Map of Vietnam



Source : Marine Engineering in Hai Phong

Figure A3.1.1 The Typical Cross Section of No.1 and No.2 Jetty Piers



Source : Danang Port

Figure A3.1.2 Typical Cross Section of Wharf in Song Han Port

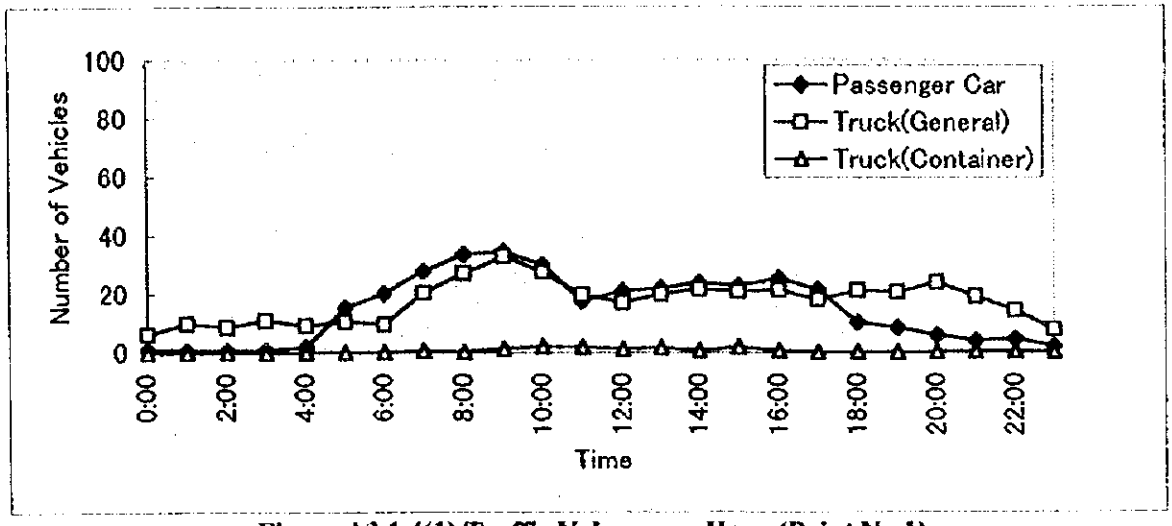


Figure A3.1.4(1) Traffic Volume per Hour (Point No.1)

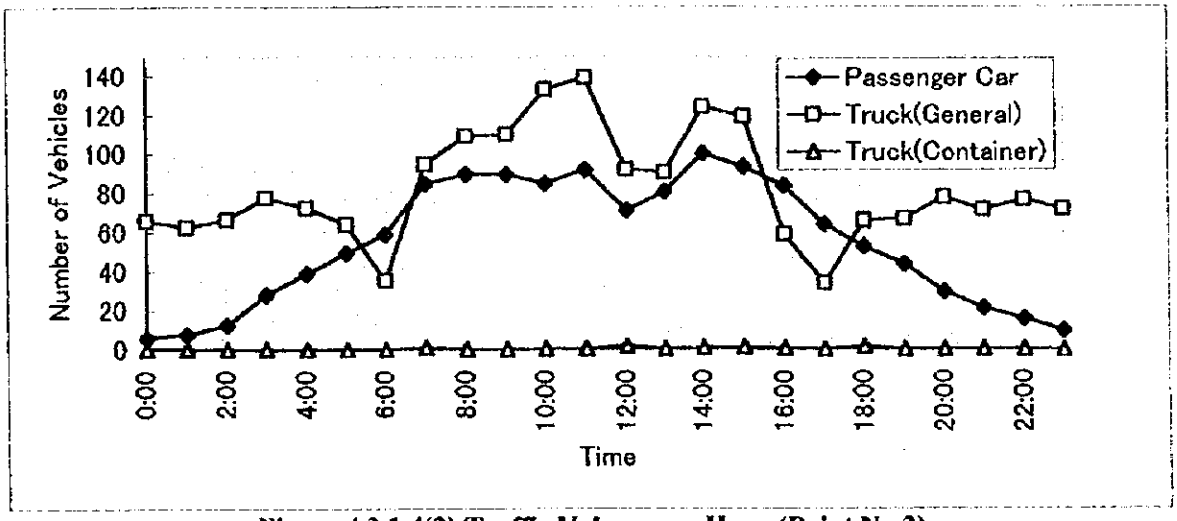


Figure A3.1.4(2) Traffic Volume per Hour (Point No.2)

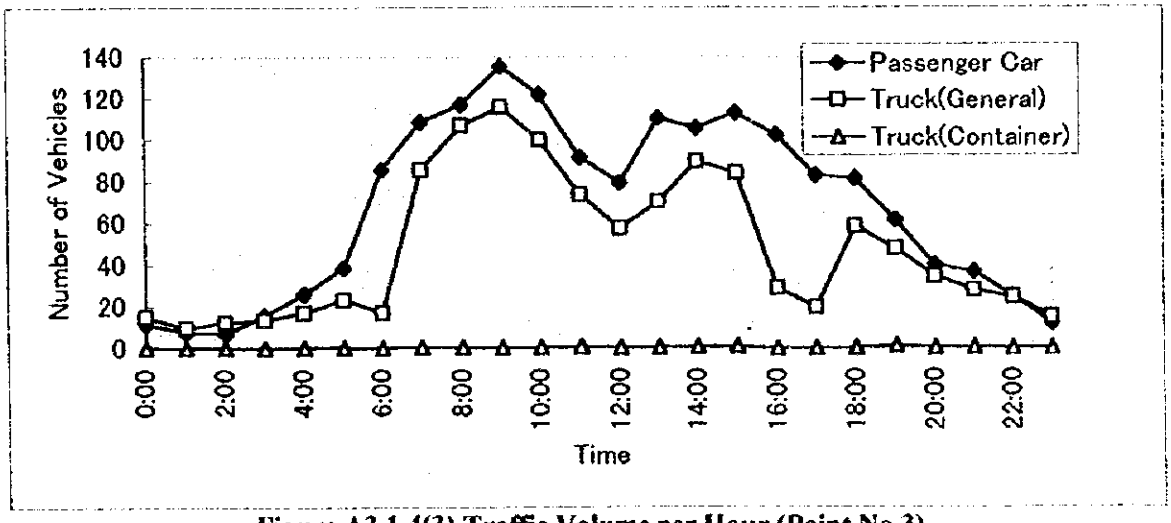


Figure A3.1.4(3) Traffic Volume per Hour (Point No.3)

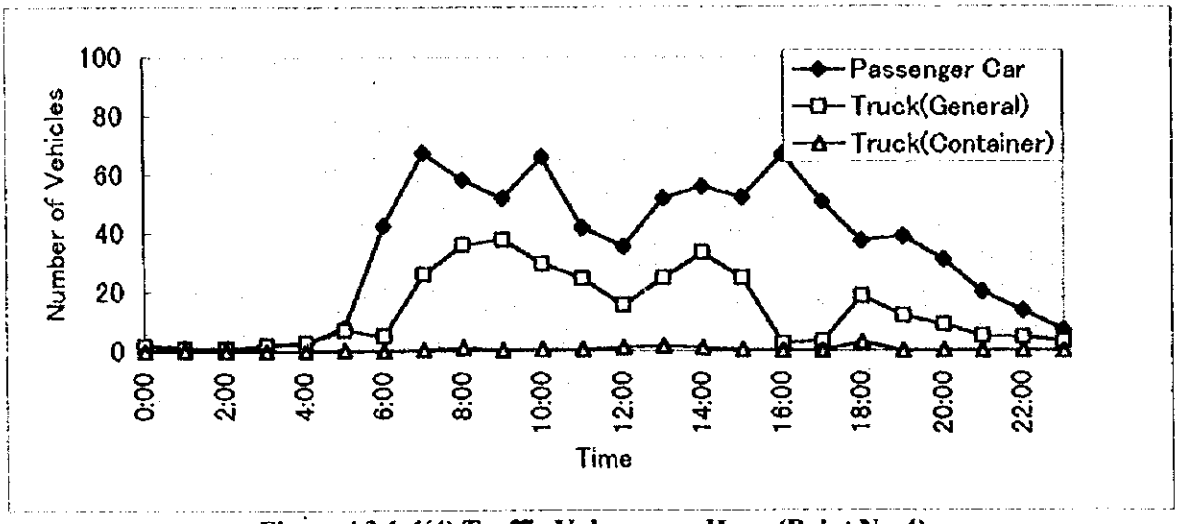
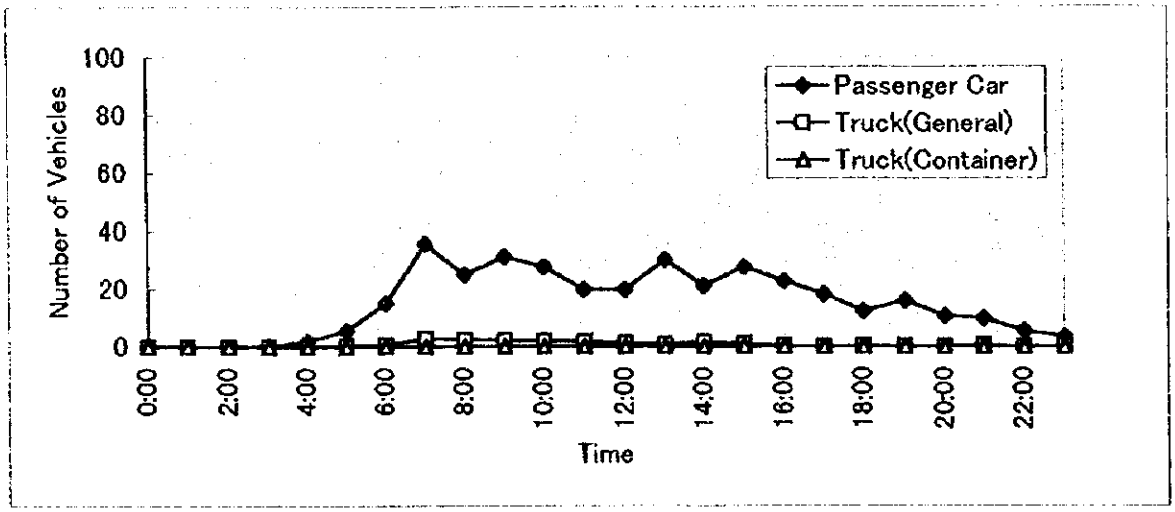


Figure A3.1.4(4) Traffic Volume per Hour (Point No.4)



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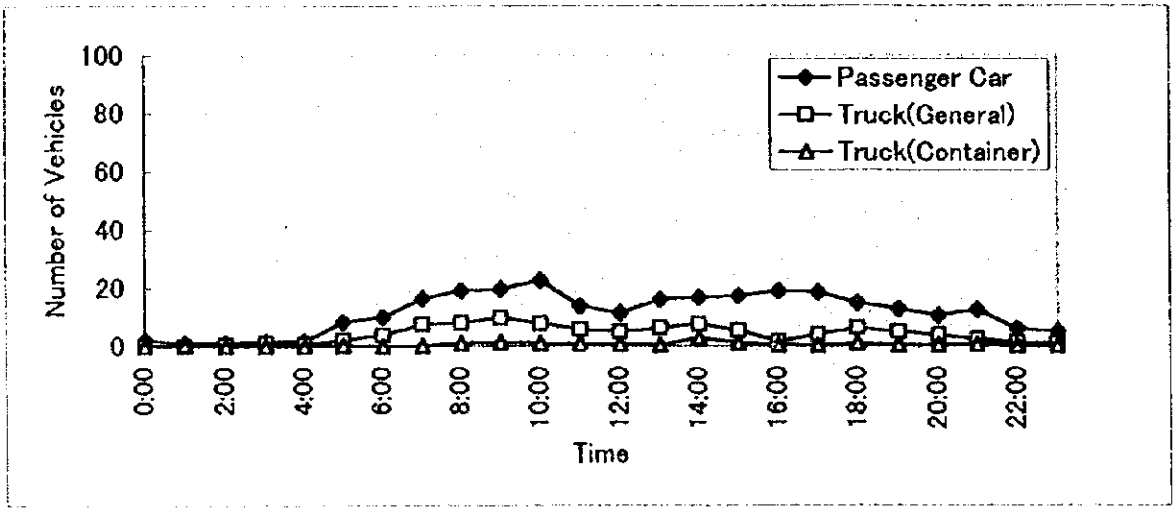


Figure A3.1.4(6) Traffic Volume per Hour (Point No.6)

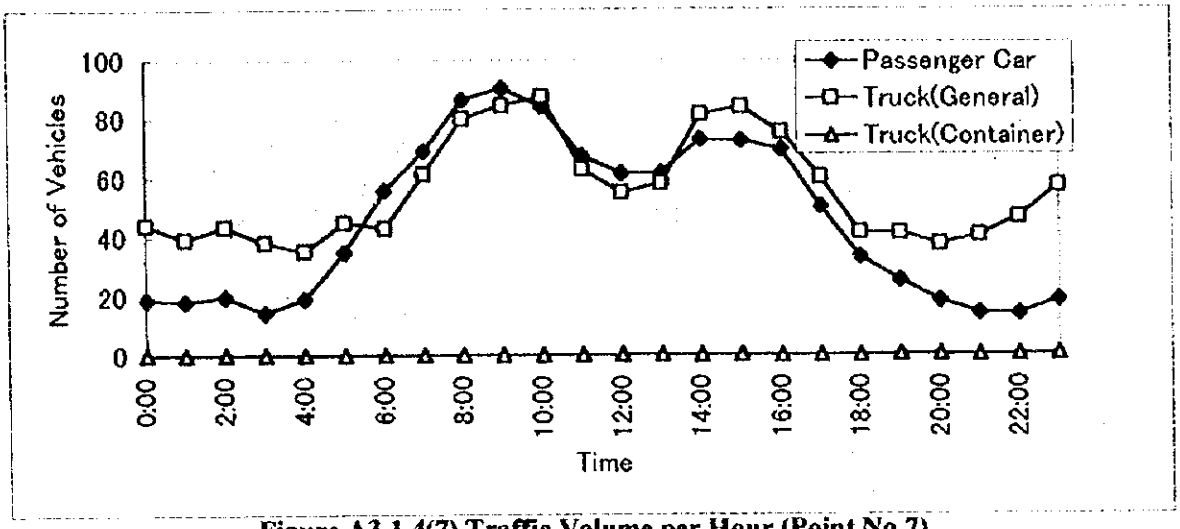


Figure A3.1.4(7) Traffic Volume per Hour (Point No.7)

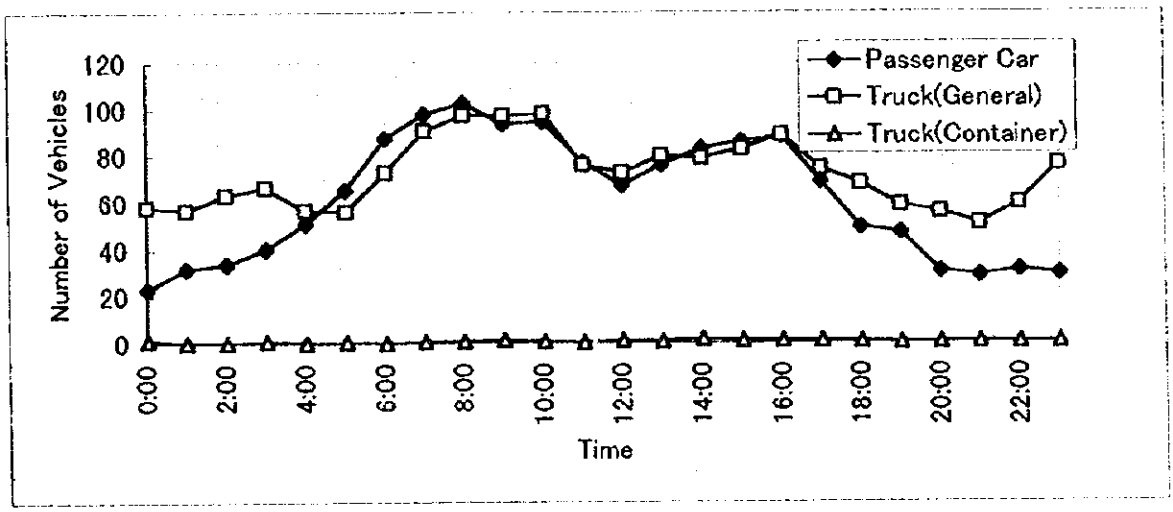


Figure A3.1.4(8) Traffic Volume per Hour (Point No.8)

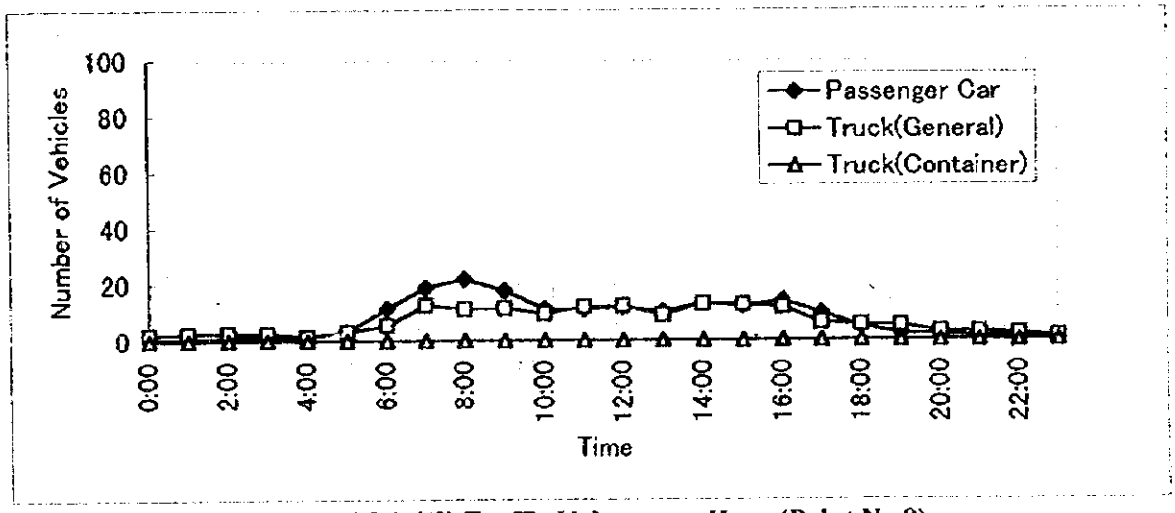


Figure A3.1.4(9) Traffic Volume per Hour (Point No.9)

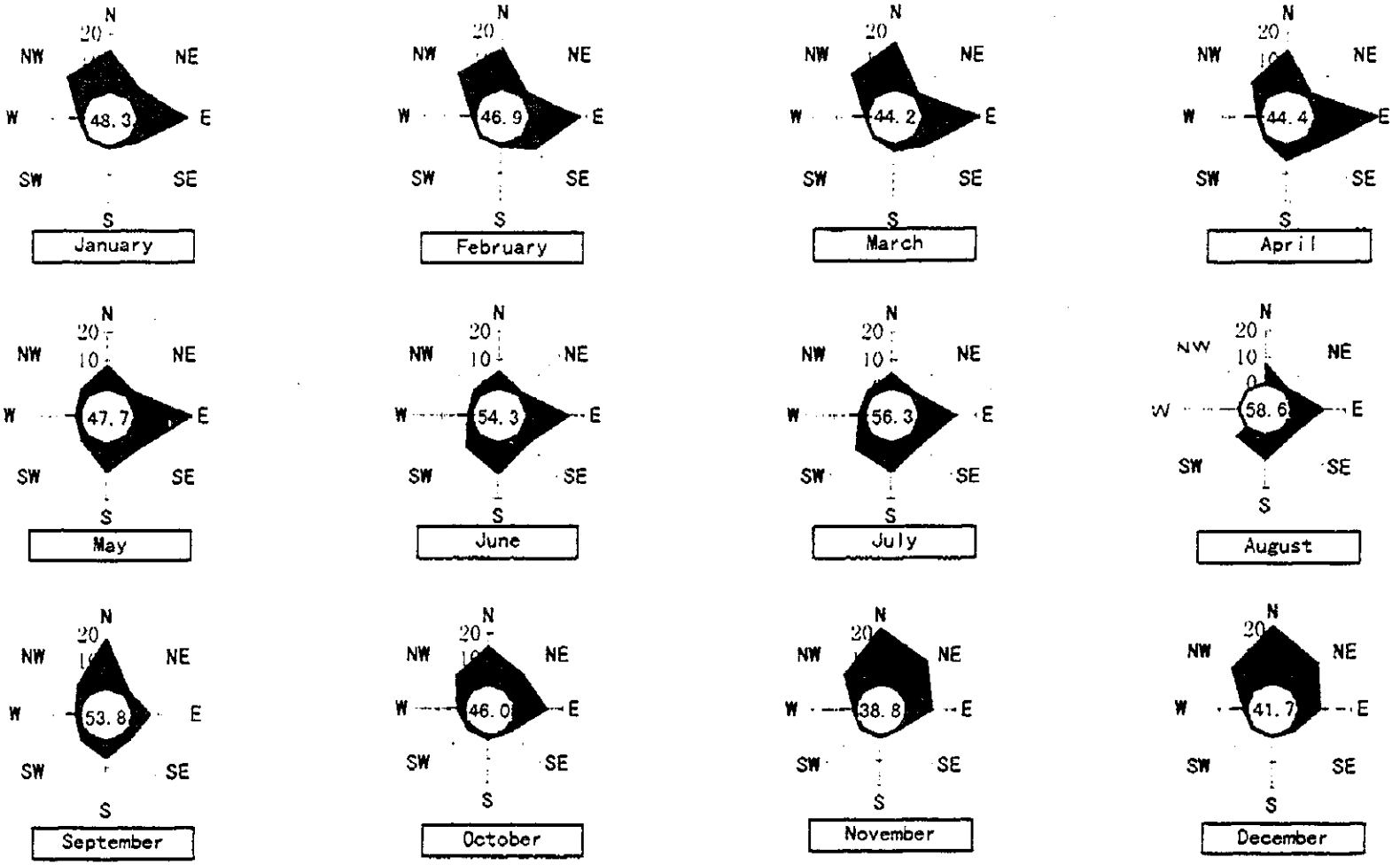


Figure A 4.2.1 Wind Roses at Observatories on the Land Danang Observatory

Data source: Institute of Meteorology and Hydrology

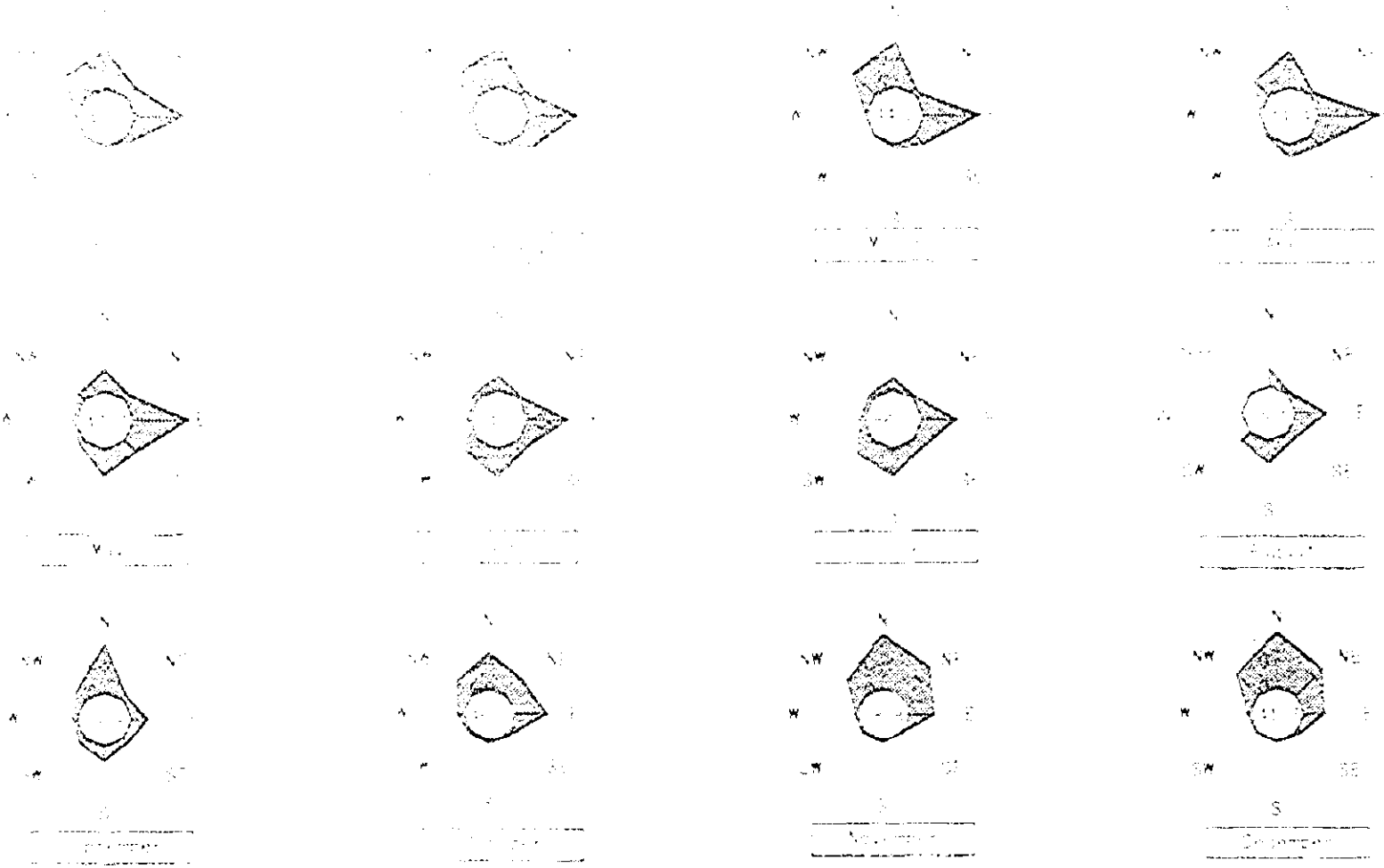


Figure X-2.1 Wind Roses at Observatories on the Land – Danang Observatory

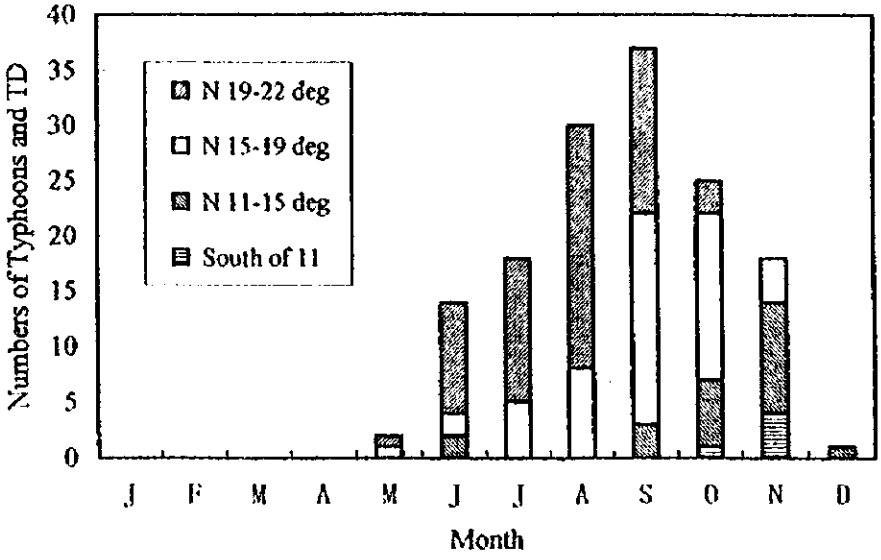


Figure A 4.2.2 Number of Typhoons by Region of Vietnam (1954-1980)

Data Source: MHMC "Report on Storm Characteristics" 1995

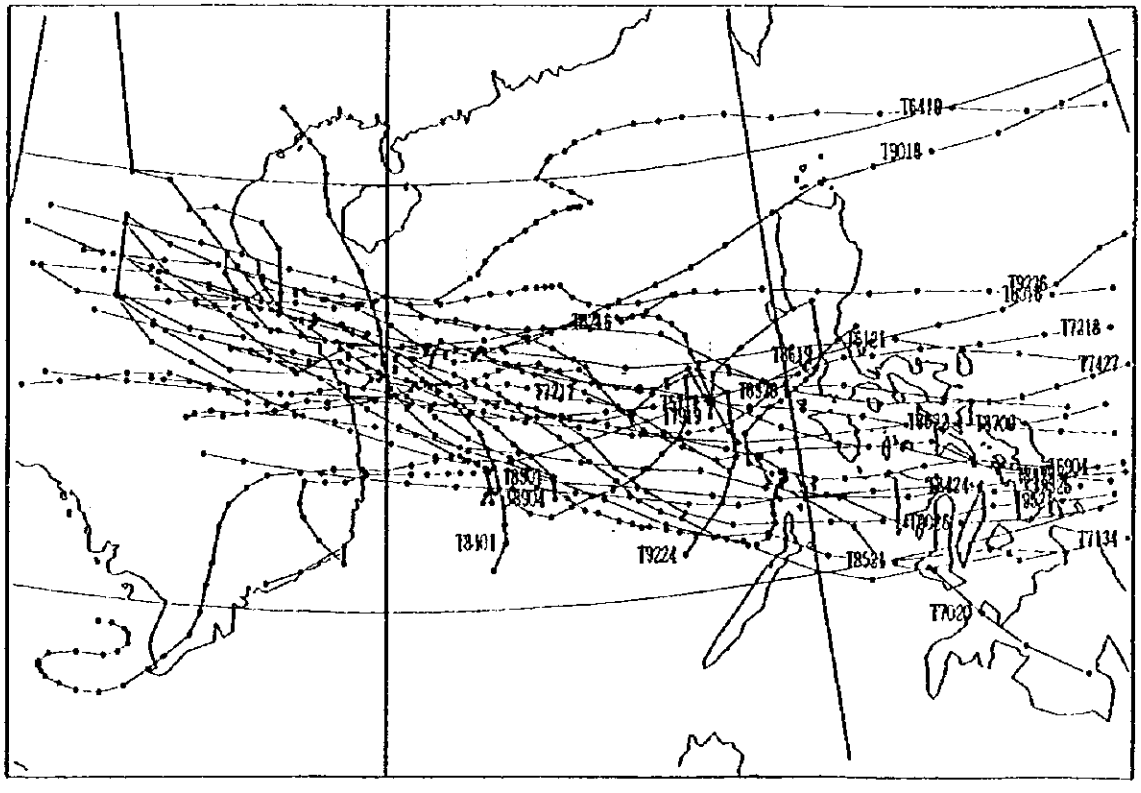


Figure A 4.2.3 Tracks of Typical Typhoons affected Central Vietnam

Table A 4.2.2 Typhoons Most Affected the Central Coast of Viet Nam (1961-1997)

No.	Typhoon No.	Name	Approach direction	Place landed**	Date landed	Pc* (hPa)	Wind*		Speed* U (km/hr)
							V (m/sec)	Direction	
1	9721	Fritz	E	DN-QN	25-Sep-97	980	24	NE	12
2	9622	Beth	ENE	DN-QN	22-Oct-96	1006	12	N	20
3	9521	**Zack**	**E**	South QN	1-Nov-95	965	34	N	13
4	9325	**Kyle**	E	South QN	23-Nov-93	960	44	NE	28
5	9226	Colleen	ESE	South QN	28-Oct-92	980	24	NNW	29
6	9224	Angela	NE	South QN	23-Oct-92	990	30	NW	10
7	9025	**Mike**	ESE	Offshore	16-Nov-90	970	20	NNE	12
8	9018	**Ed**	E, SE	Offshore	19-Sep-90	980	31	NNE	13
9	8926	**Dan**	ESE	North HU	13-Oct-89	965	40	-	25
10	8904	**Cecil**	E	DN-QN	24-May-89	980	22	-	12
11	8829	Skip	E, N	Offshore	12-Nov-88	995	16	NNW	10
12	8709	**Betty**	ESE	North HU	16-Aug-87	950	>40	NNE	18
13	8622	Georgia	ESE	South QN	22-Oct-86	990	20	-	18
14	8619	Dom	E	North HU	11-Oct-86	998	24	NNW	16
15	8521	**Cecil**	ESE	North HU	15-Oct-85	970	35	-	23
16	8424	**Agnes**	ESE	South QN	7-Nov-84	975	40	-	31
17	8401	Vernon	ESE	DN-QN	10-Jun-84	996	16	-	19
18	8316	Lex	E	North HU	26-Oct-83	985	40	-	20
19	8301	Sarah	SE	North HU	25-Jun-83	1000	14	-	15
20	8216	**Hode**	E	DN-QN	6-Sep-82	980	20	-	24
21	7919	Sarah	E	South QN	14-Oct-79	965	22	-	9
22	7427	**Faye**	E	South QN	4-Nov-74	992	26	-	23
23	7218	**Elsie**	NE	South QN	4-Nov-72	995	31	-	6
24	7217	Flossie	ENE	South QN	15-Sep-72	995	26	-	9
25	7134	**Hester**	**SE**	DN-QN	23-Oct-71	970	40	-	26
26	7112	**Harriot**	E	North HU	6-Jul-71	985	28	-	25
27	7020	Kate	E	DN-QN	25-Oct-70	990	33	-	19
28	6904	Tess	ESE	North HU	11-Jul-69	990	28	-	22
29	6419	Tilda	E	North HU	22-Sep-64	990	38	-	14
30	6121	Ruby	ESE	North HU	24-Sep-61	992	28	-	33

* Figures of wind are at the nearest in-land station. Pc, wind and speed are when the typhoon landed on the coast. Wind are maximum (gust) wind. (-) are lost data.

** DN-QN : Landed between Da Nang and Quang Ngai
South QN : Landed at south of Quang Ngai
North HU : Landed at north of Hue
Offshore : Passed offshore (not landed)

Data Source: Institute of Meteorogy and Hydrology, 1997

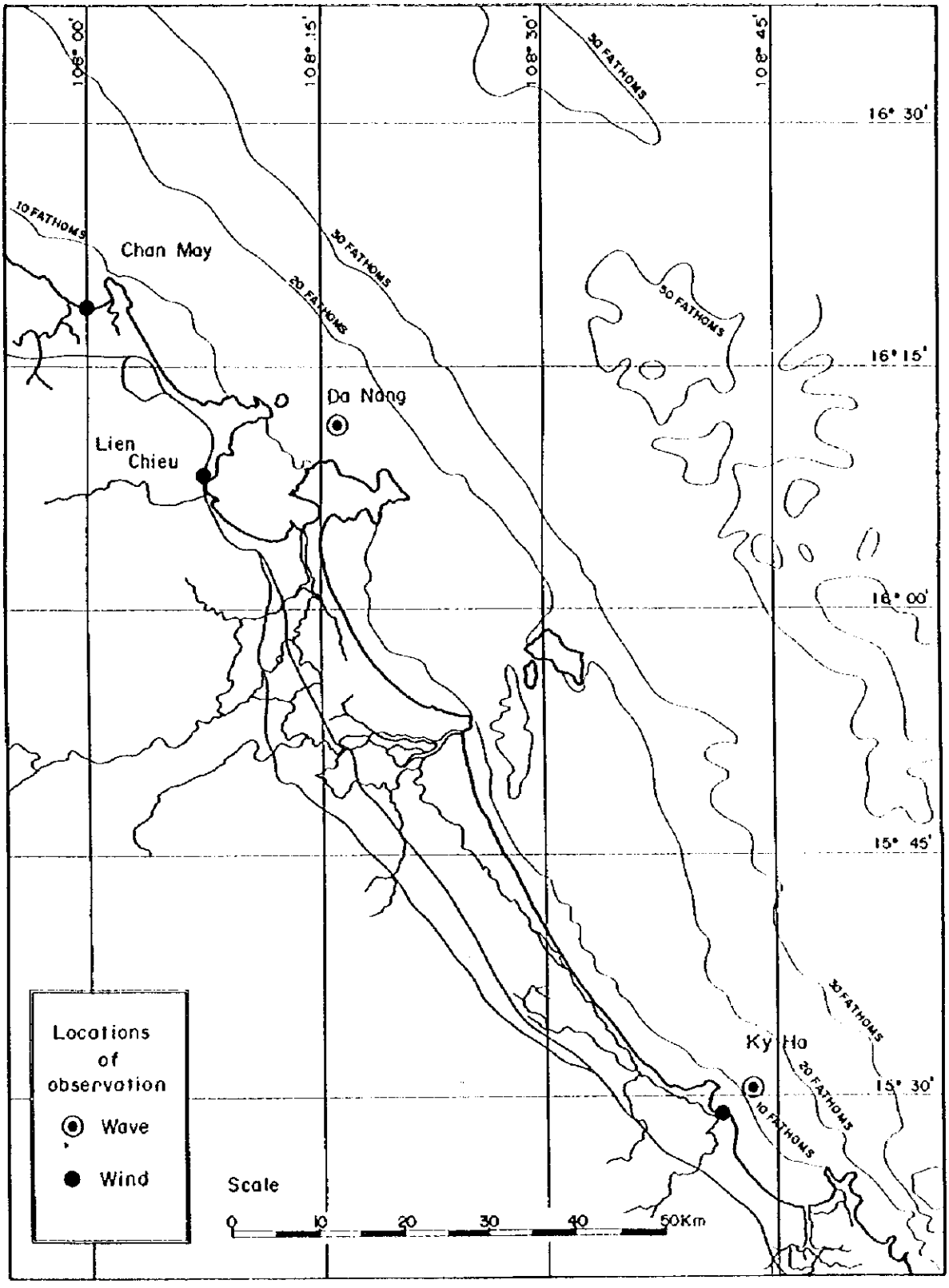
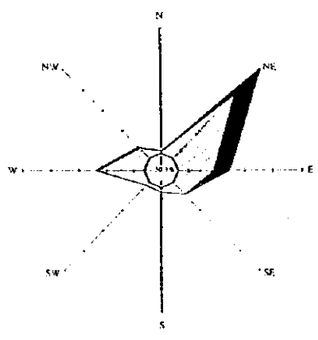
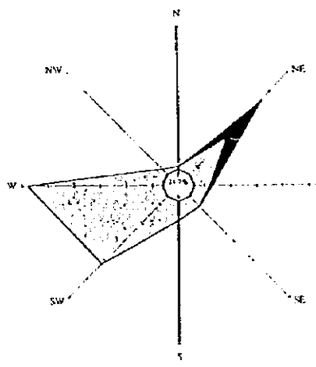


Figure A 4.2.4 Locations of Wind and Wave Observation by the JICA Study Team

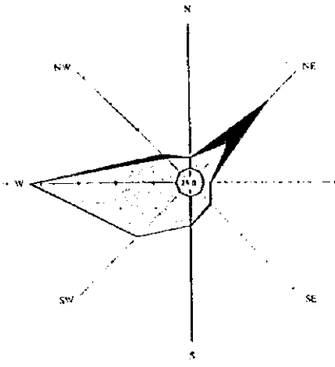
April/1997



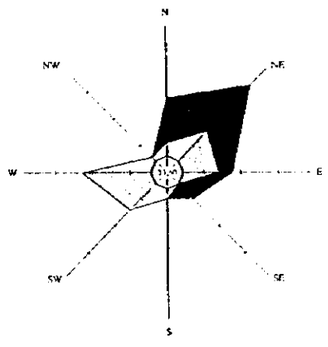
June/1997



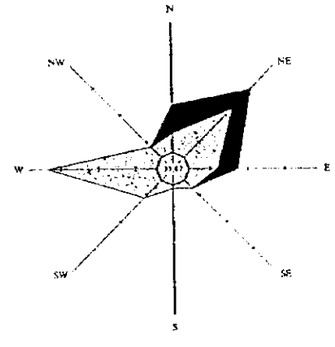
August/1997



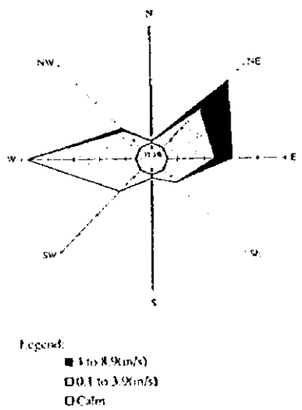
October/1997



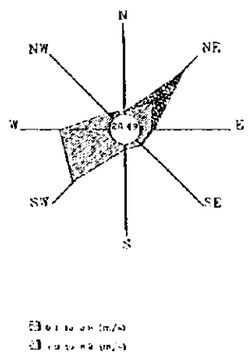
December/1997



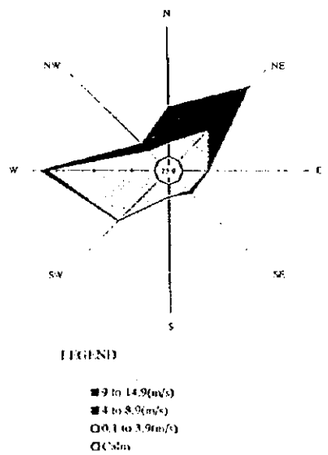
May/1997



July/1997



September/1997



November/1997

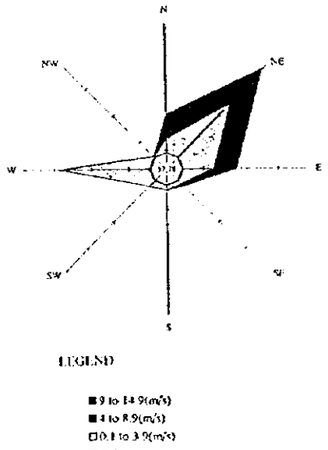


Figure A 4.2.5 Wind Observed at Lien Chieu by the Study Team

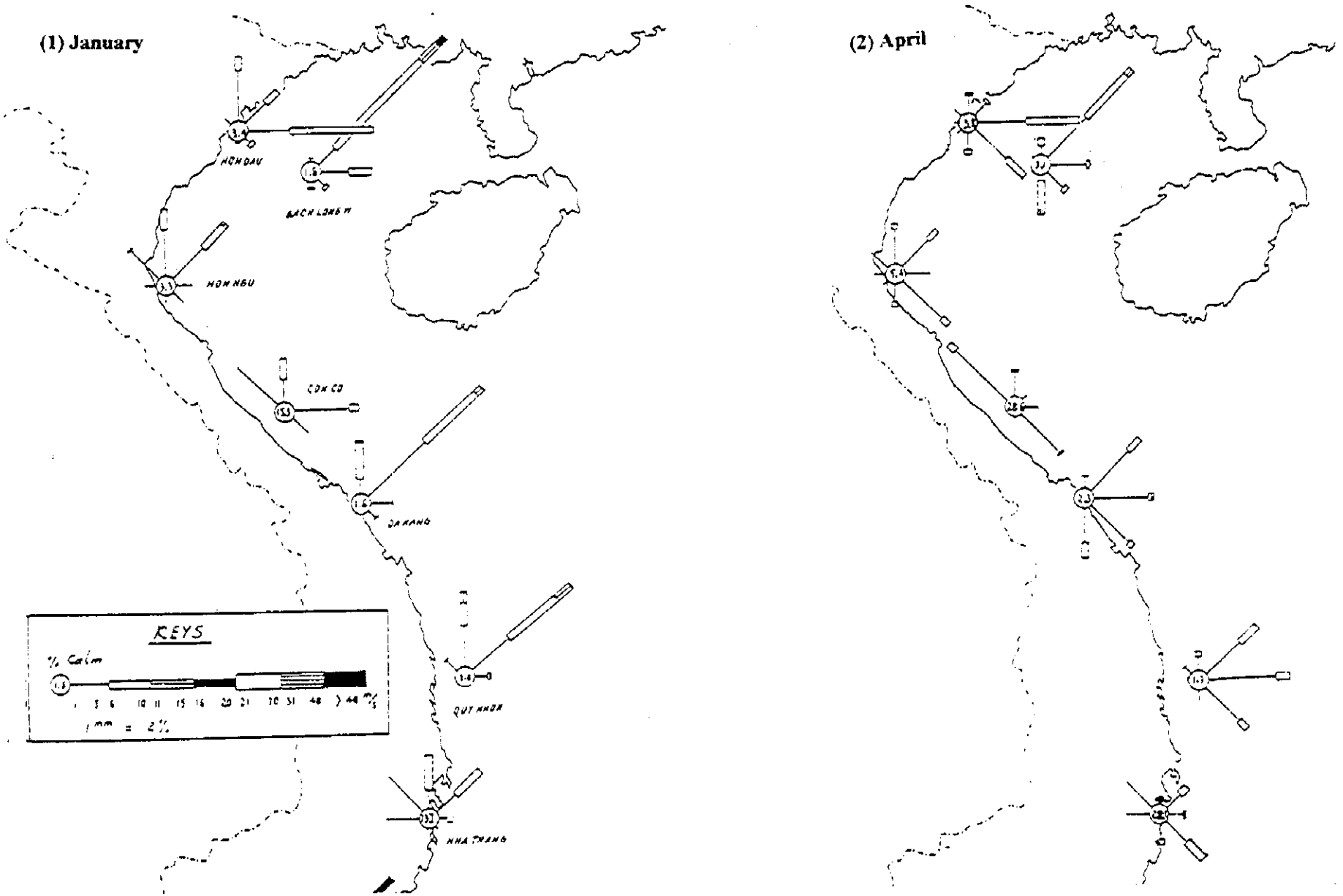


Figure A 4.3.1 Wave Roses at Northern and Central Stations on the Coast (1)

Source: MHMC "Report on Wave Statistics", July 1995

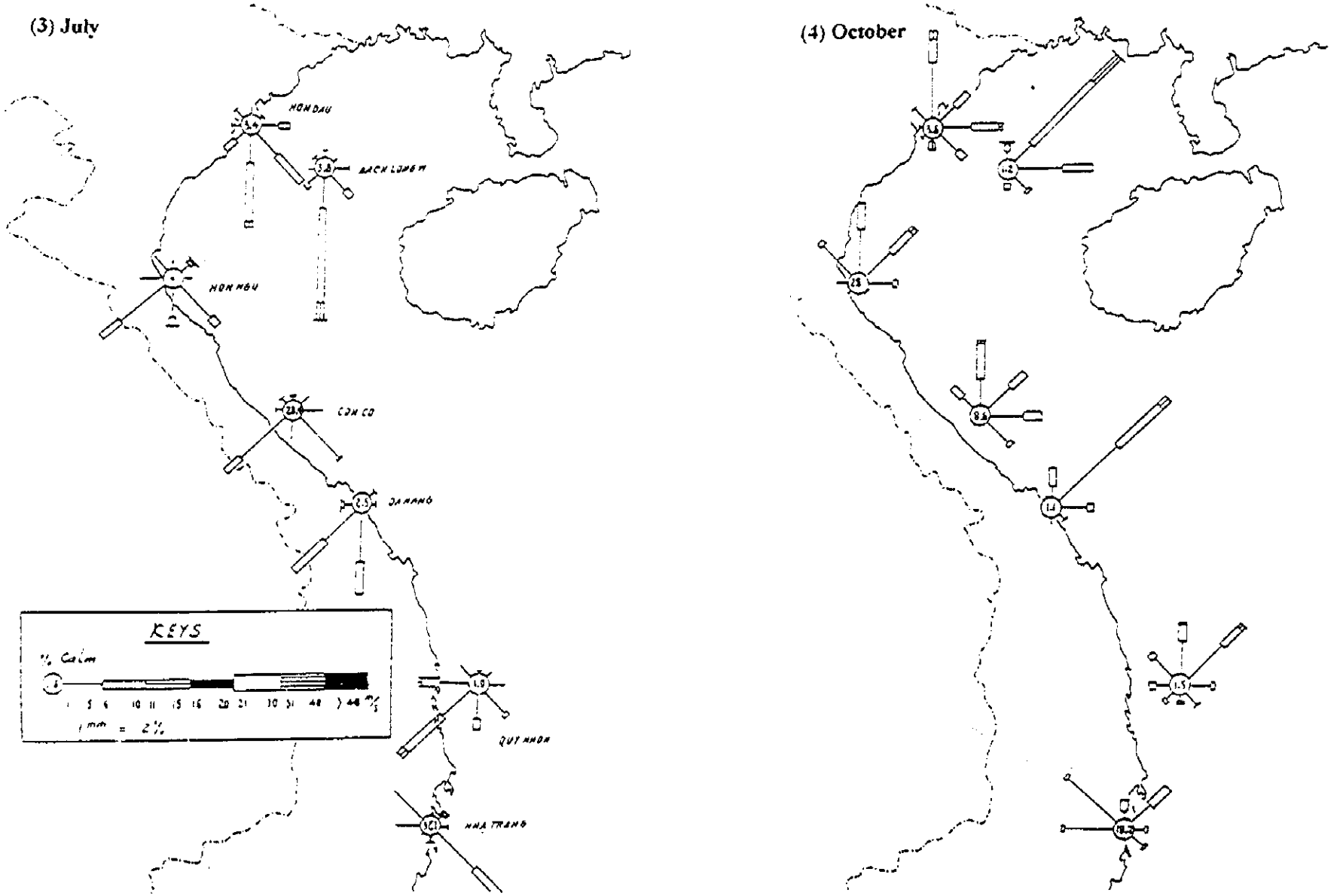


Figure A4.3.1 Wave Roses at Northern and Central Stations on the Coast (2)

Source: MHMC "Report on Wave Statistics", July 1995

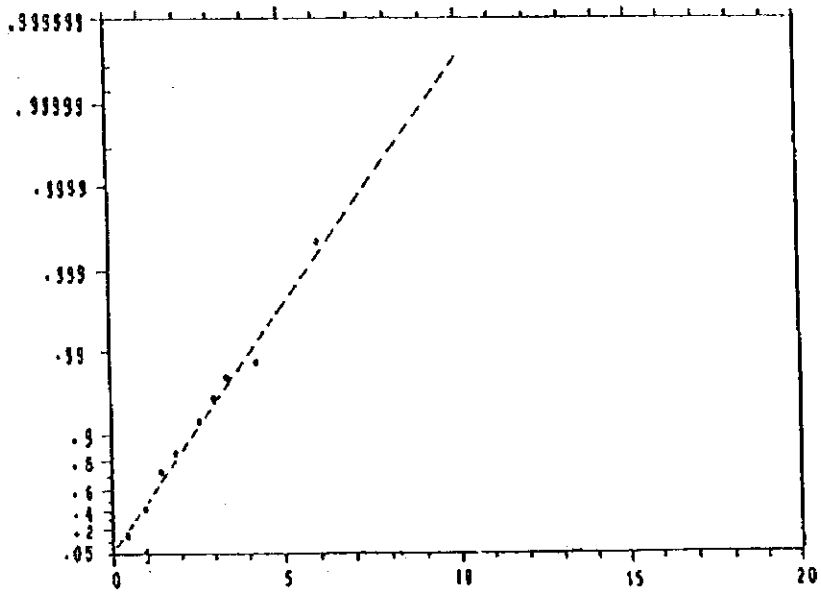


Figure A 4.3.2 Probability Distribution of Wave Height at Son Tra, Danang

* Source: MHMC "Report on Wave Characteristics", July 1995

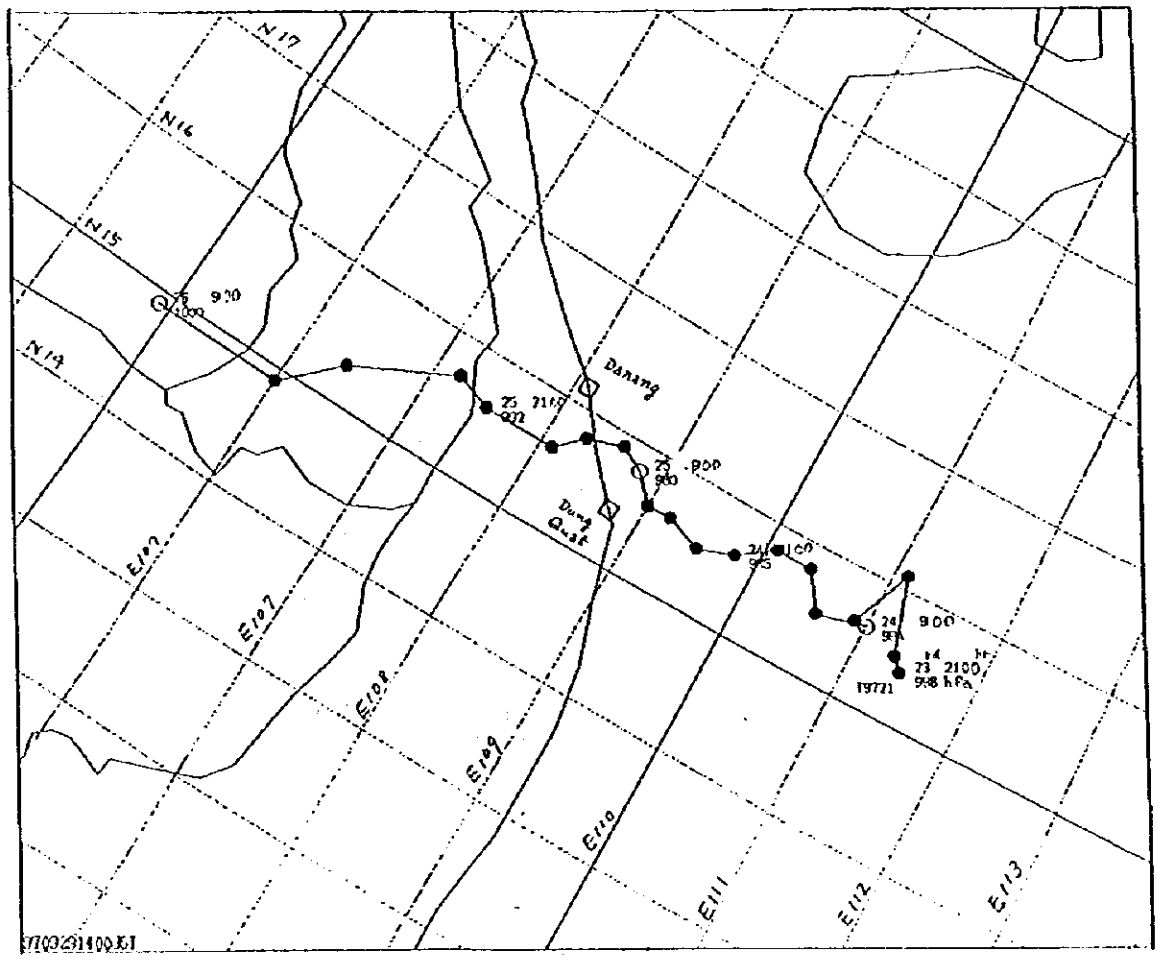


Figure A 4.3.3 Track and Central Air Pressure of Typhoon Fritz

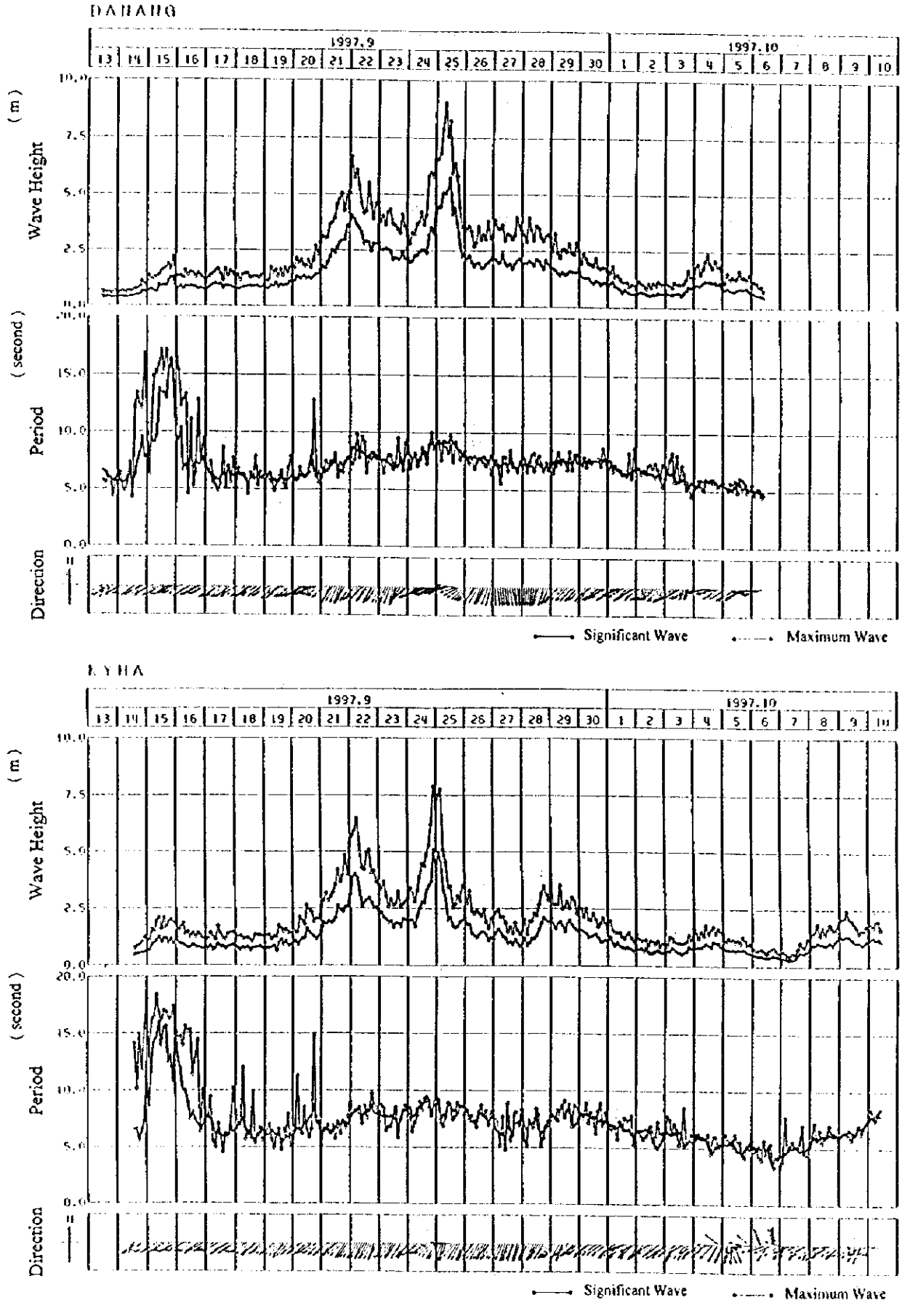


Figure A 4.3.4 Time Series of Wave Records at Danang and Ky Ha

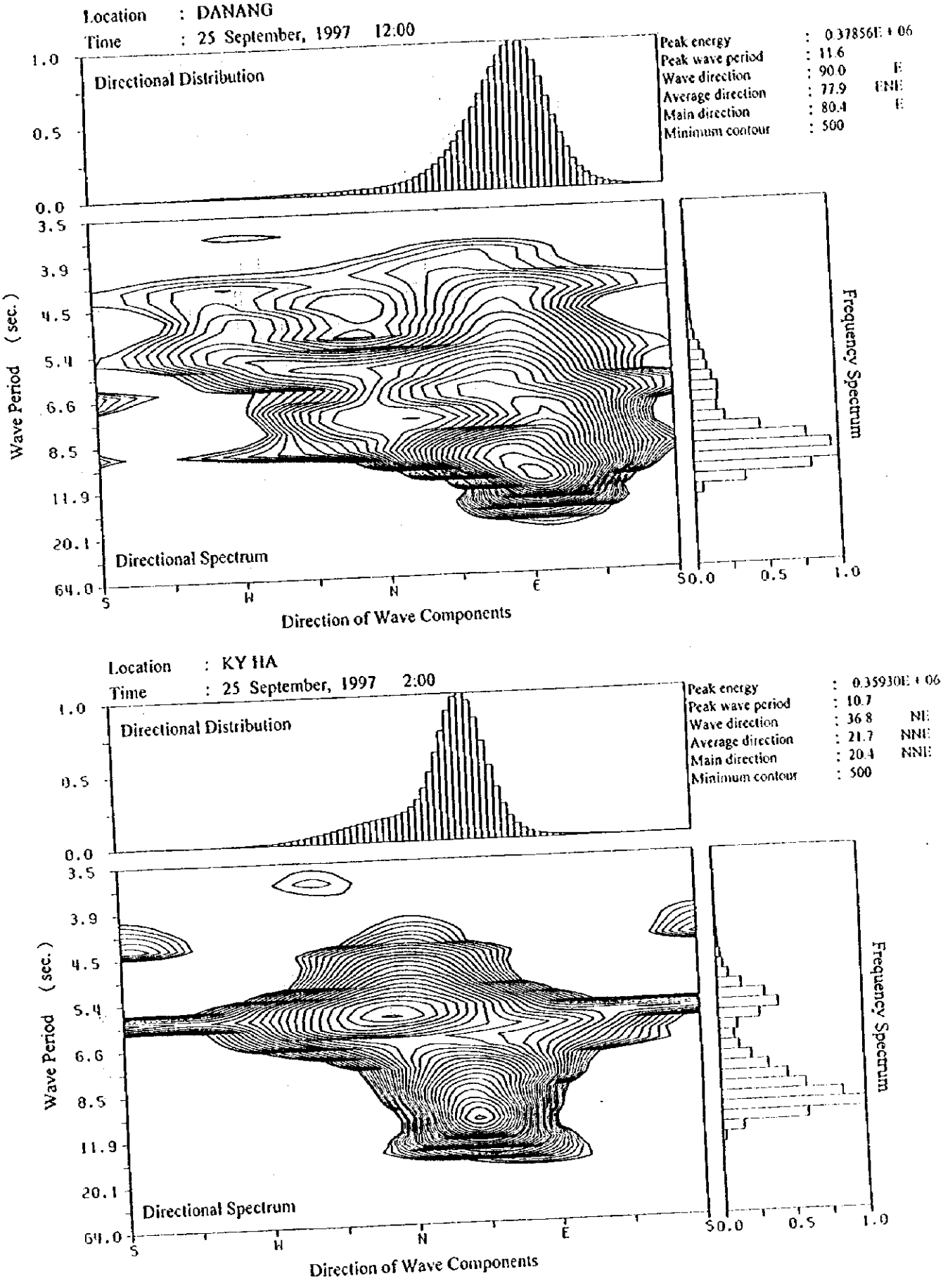
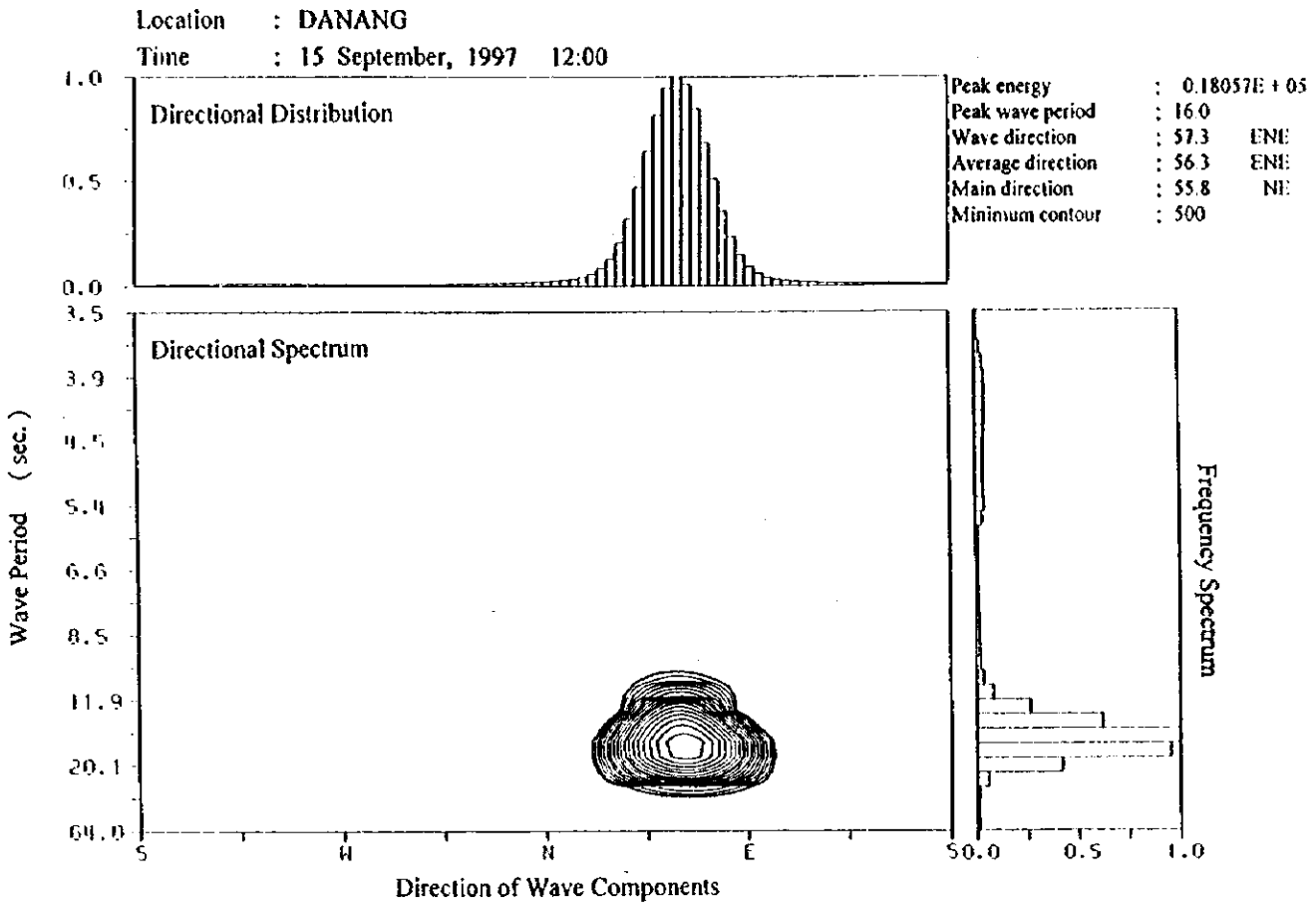


Figure A 4.3.5 Directional Spectra of Waves Generated by Typhoon Fritz



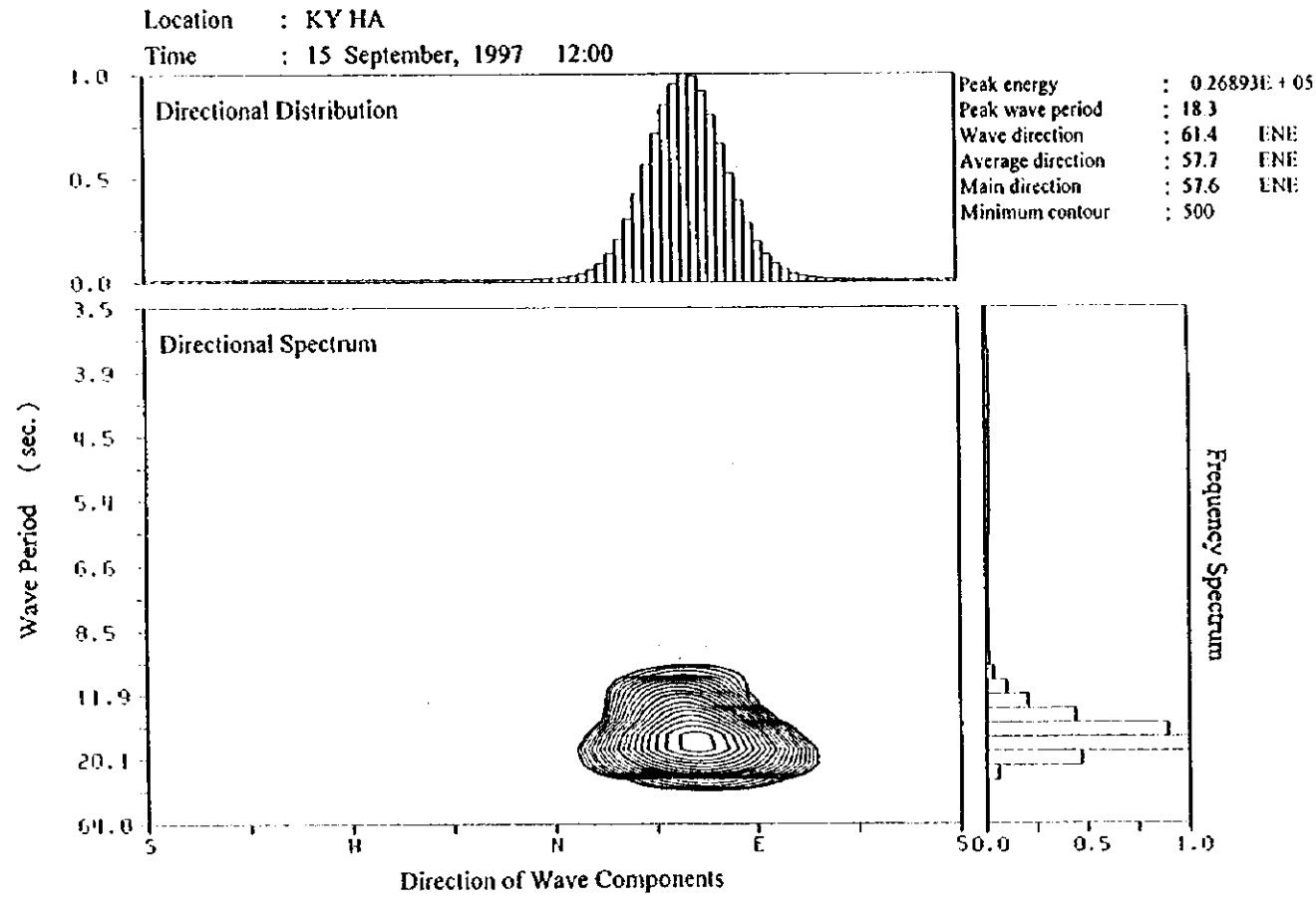
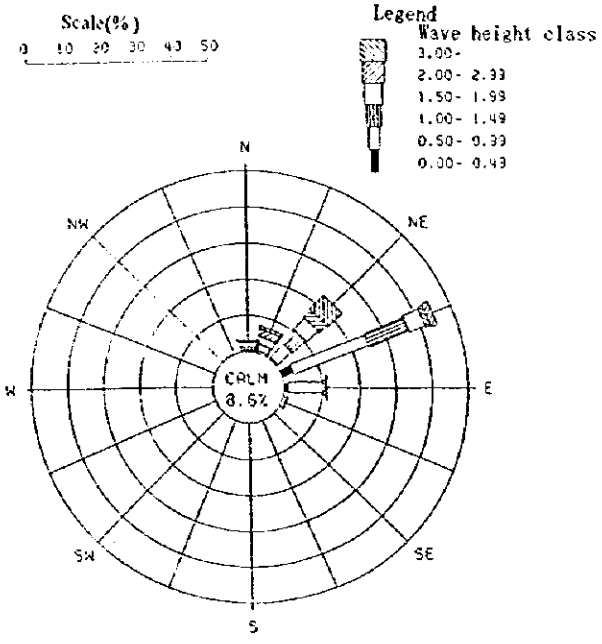
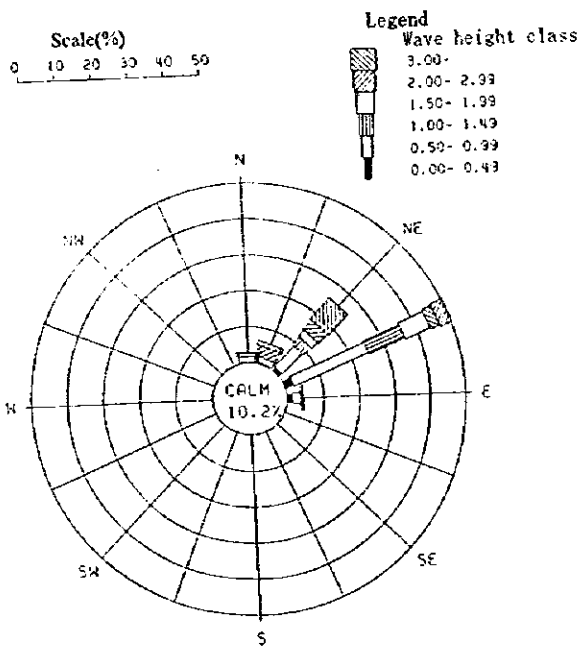


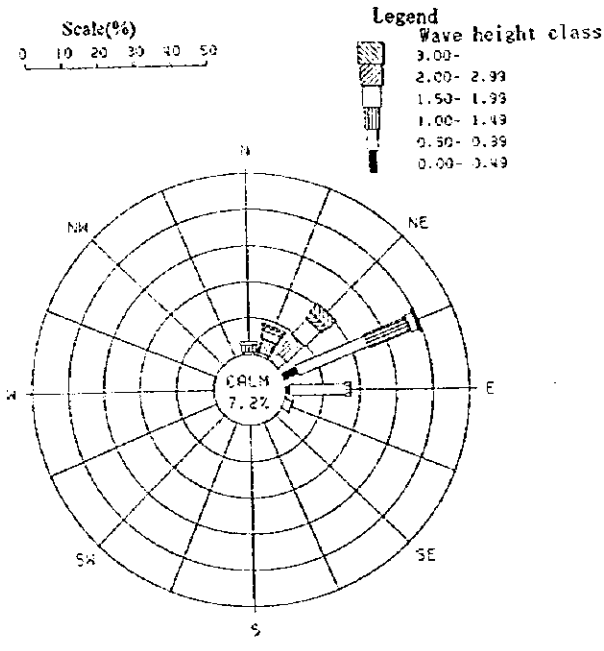
Figure A 4.3.6 Directional Spectra of Swells Propagated from Remote Typhoon



All period (Sep. 1997 ~ Feb. 1998)

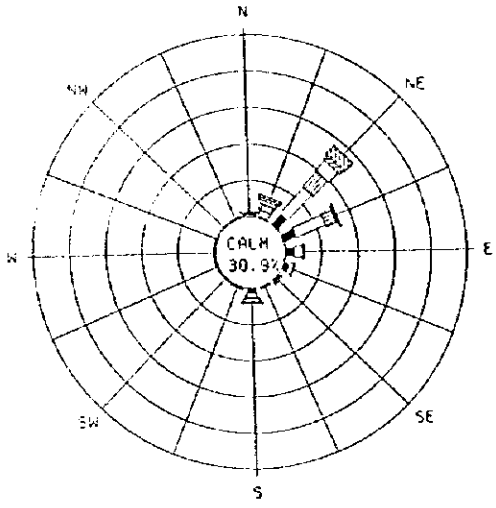


From Sep. to Nov. 1997

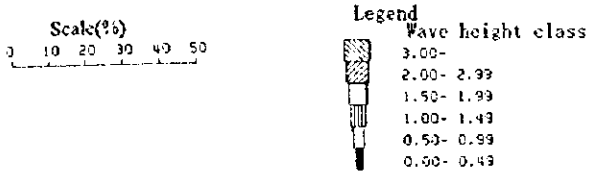


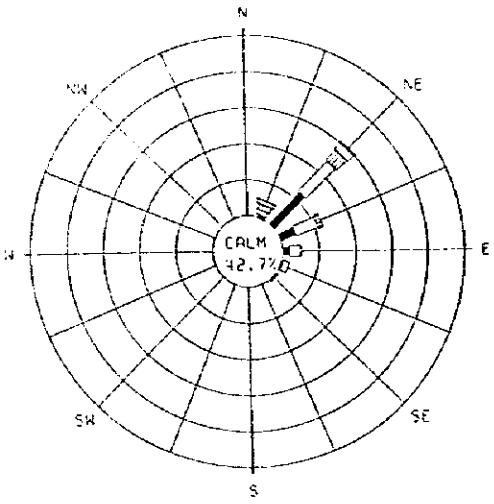
From Dec. 1997 to Feb. 1998

Figure A 4.3.7 Wave Roses of Observed Waves (1) Danang

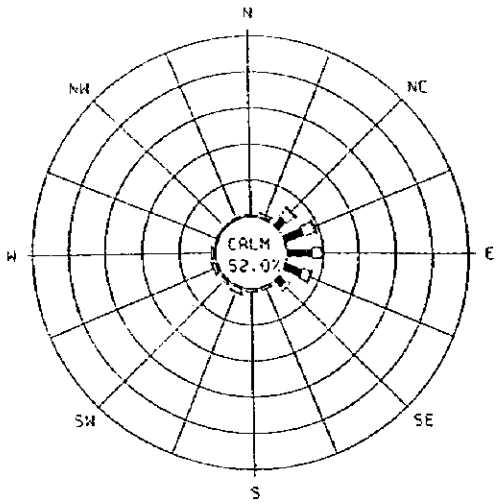


All period (Apr. 1997 ~ Feb. 1998)

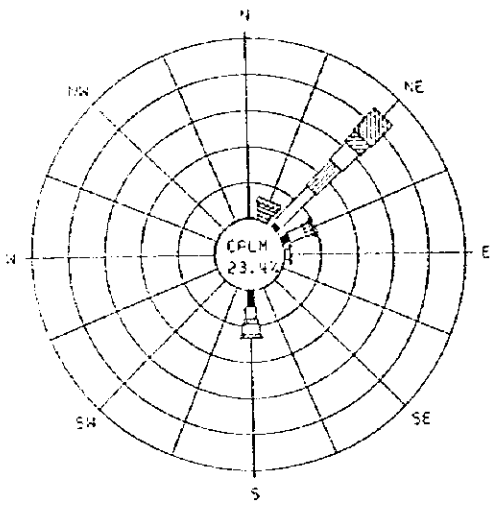




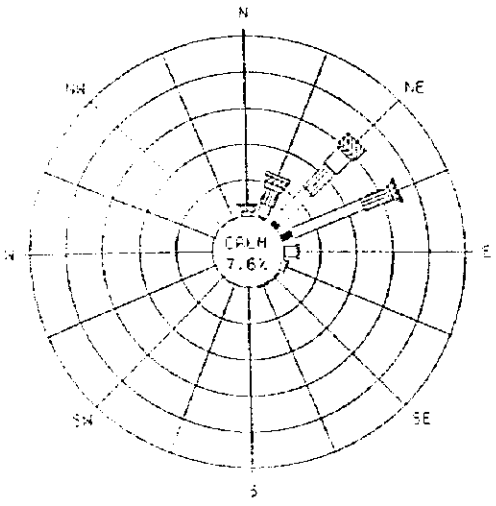
From Apr. to May. 1997



From Jun. To Aug. 1997



From Sept. to Nov. 1997



From Dec. 1997 to Feb. 1998

Figure A 4.3.7 Wave Roses of Observed Waves (2) Ky Ha

Table A 4.3.2 Frequency Distribution of Observed Waves by JICA Study Team

(1) Location : Mouth of Danang Bay Total no. of data: 1,731 % of successful observation: 79.7 %

Unit: %

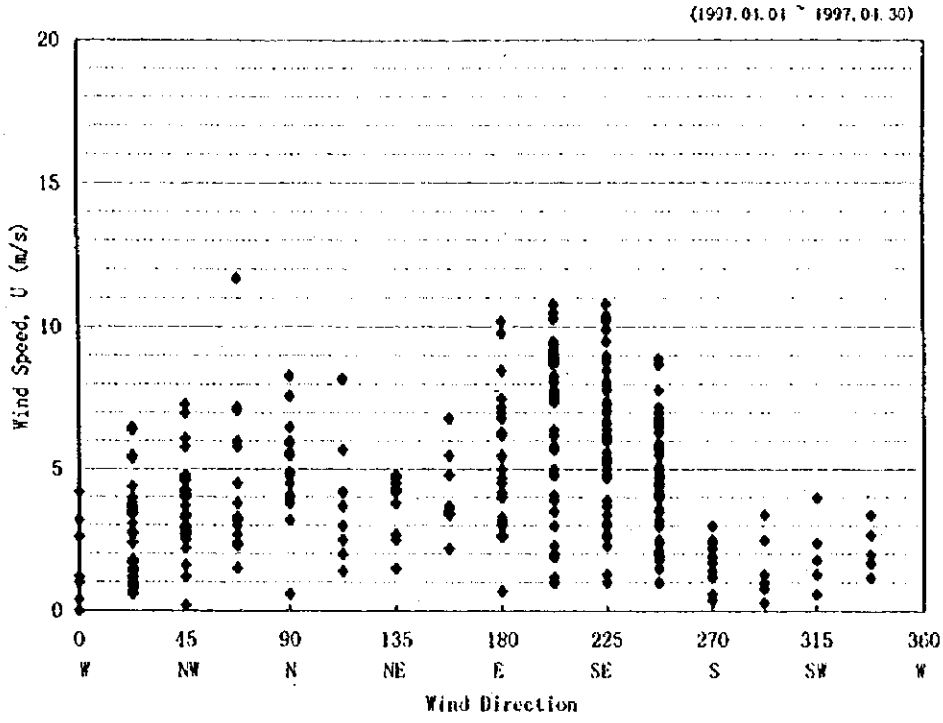
Height (m)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Calm*	Total
0.00-																		0.0
0.25-	0.1		0.6	3.4	1.3												2.8	8.2
0.50-		0.1	2.2	11.4	6.4	1.0	0.1										5.0	26.2
0.75-	0.3	0.5	2.9	10.1	2.5	0.2											0.8	17.3
1.00-	0.6	0.6	2.5	6.5	0.9	0.1												11.2
1.25-	0.4	1.4	2.3	5.3	0.1													9.5
1.50-	0.3	1.2	2.3	3.2												0.1		7.1
1.75-	1.0	0.8	1.8	1.6														5.2
2.00-	0.4	0.9	1.6	0.9														3.8
2.25-	0.1	1.1	1.2	0.5														2.9
2.50-	0.1	0.9	5.4	1.8	0.2													8.4
Total	3.3	7.5	22.8	44.7	11.4	1.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	8.6	100.0

(2) Location : Ky Ha Total no. of data: 3,794 % of successful observation: 94.8 %

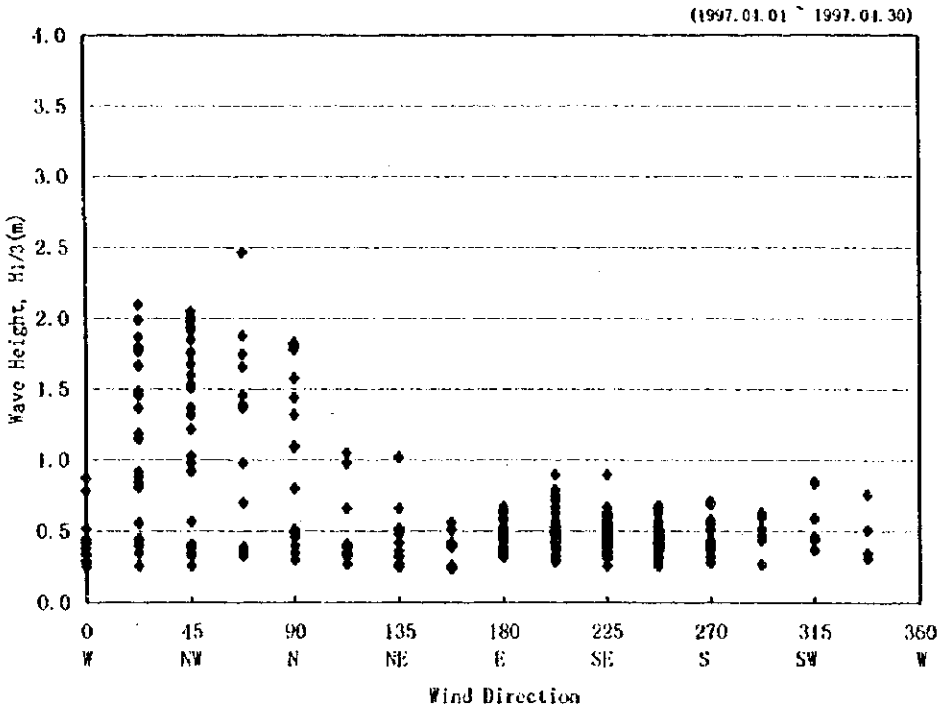
Unit: %

Height (m)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Calm*	Total
0.00-				0.1	0.1	0.0			0.0								2.2	2.4
0.25-	0.1	0.5	3.9	3.8	2.4	1.5	0.8	0.2	1.4	0.2	0.2	0.2	0.2	0.1		0.2	23.0	38.7
0.50-	0.3	0.9	4.9	5.6	1.9	1.3	0.5	0.3	0.7	0.2	0.1	0.2	0.1	0.0	0.0	0.2	4.8	22.0
0.75-	0.3	0.8	5.0	3.3	0.6	0.1	0.1	0.0	0.5	0.1	0.1	0.1	0.1	0.0	0.1		0.7	11.9
1.00-	0.3	0.9	3.1	2.5	0.1	0.1			0.2	0.1		0.1	0.0	0.0	0.0		0.2	7.6
1.25-	0.2	1.0	2.7	0.6	0.1				0.2									4.8
1.50-		0.4	1.8	0.3					0.4									2.9
1.75-		0.5	1.9	0.1	0.0				0.4									2.9
2.00-	0.1	0.5	0.8	0.1	0.0				0.2									1.7
2.25-	0.1	0.2	0.6	0.1					0.1									1.1
2.50-		0.7	3.3	0.1					0.1									4.2
Total	1.4	6.4	28.0	16.6	5.2	3.0	1.4	0.5	4.2	0.6	0.4	0.6	0.4	0.1	0.1	0.4	30.9	100.0

* "Calm" is defined by waves of which wave period is less than 5 seconds.



(1) Correlation between Wind Direction and Wind Speed



(2) Correlation Between Wind Direction and Wave Height

Figure A 4.3.8 Correlation of Wind and Waves observed at Ky Ha by JICA Study Team

Table A 4.3.3 Frequency Distribution of Hindcast Usual Wave Height by Direction (1993-1994)

(1) Location : N17.5 deg. E107.5 deg.

Total no. of data: 2,920
Unit: %

Height (m)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
0.0 -				0.5	0.9			0.0									1.4
0.5 -	0.1	0.0	0.2	22.3	13.1	1.0	2.8	1.6	1.3	1.9	2.0	0.3	0.1		0.0	0.0	46.7
1.0 -	0.5	0.3	0.3	18.7	3.7	2.1	2.6	0.3	0.1	0.3	1.9	1.5	0.1		0.0	0.2	32.5
1.5 -	0.6	0.3	0.0	5.8	3.2	0.1	0.1		0.0	0.1	0.1	0.2					10.7
2.0 -		0.3		2.2	2.7											0.0	5.2
2.5 -	0.1	0.1		0.8	1.6												2.6
3.0 -	0.0			0.5	0.5												1.0
4.0 -																	0.0
5.0 -																	0.0
Total	1.2	1.1	0.6	50.7	25.7	3.2	5.6	1.9	1.4	2.2	4.0	1.9	0.2	0.0	0.1	0.2	100.0

(2) Location : N15.0 deg. E110.0 deg.

Total no. of data: 2,920
Unit: %

Height (m)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
0.0 -				0.1		0.0											0.1
0.5 -		0.3	1.4	21.3	0.1	0.1	1.4	4.0	5.0	2.3	1.3	0.1	0.1	0.0	0.0	0.0	37.6
1.0 -	0.3	2.0	5.0	15.9	0.1	0.1	1.0	6.3	5.5	2.4	1.5	0.3			0.1	0.1	40.5
1.5 -	0.6	2.0	2.3	5.7	0.1		0.1	0.5	0.3	0.1	0.3	0.0			0.0	0.1	12.2
2.0 -	0.6	1.2	0.9	1.5	0.1			0.0	0.0	0.0							4.3
2.5 -	0.3	1.1	0.3	0.9	0.1												2.8
3.0 -	0.3	1.0	0.2	0.8	0.0												2.3
4.0 -	0.2	0.0		0.0													0.2
5.0 -																	0.0
Total	2.3	7.6	10.1	46.3	0.5	0.2	2.5	10.9	10.8	4.9	3.1	0.4	0.1	0.0	0.1	0.2	100.0

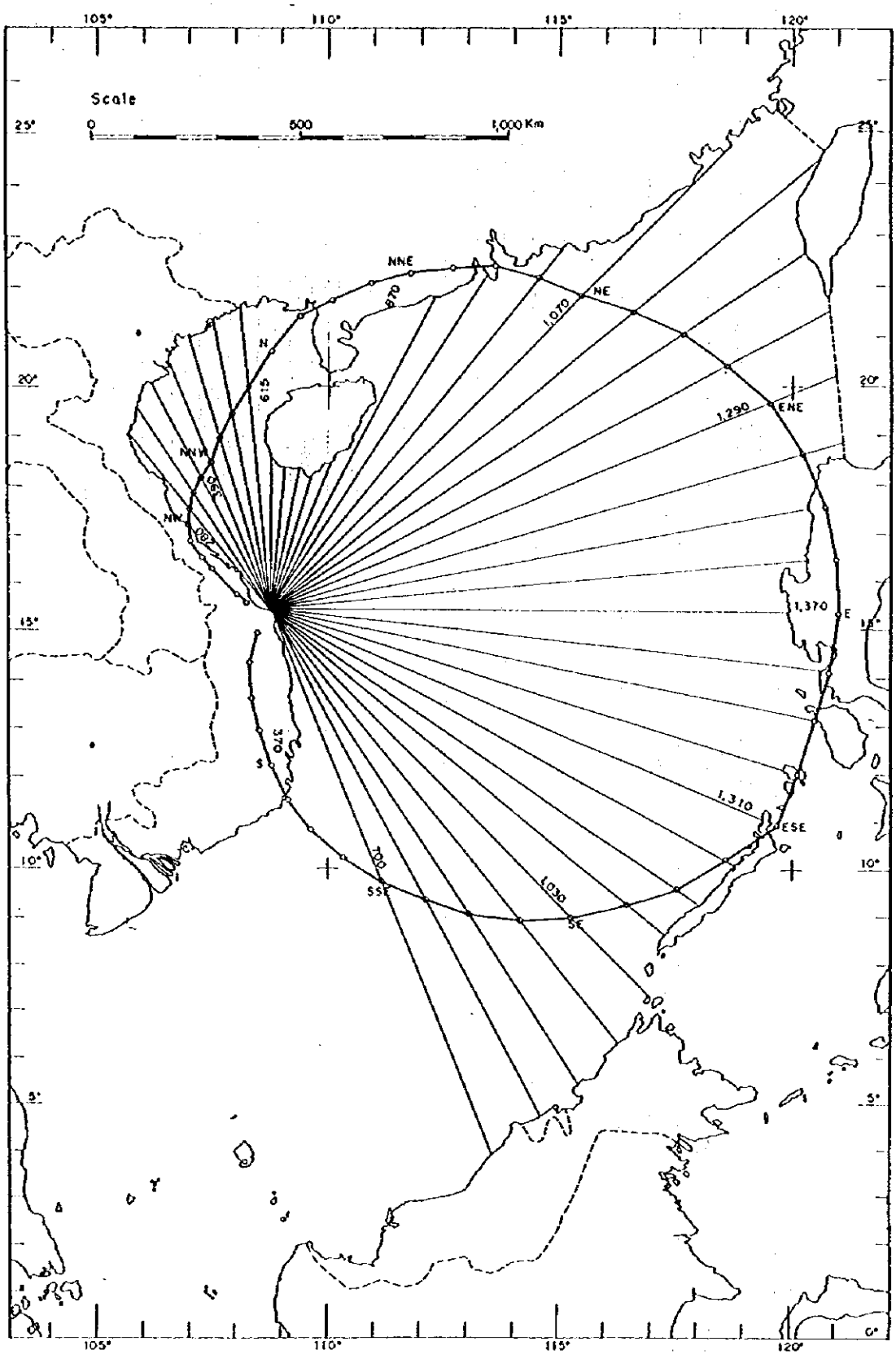
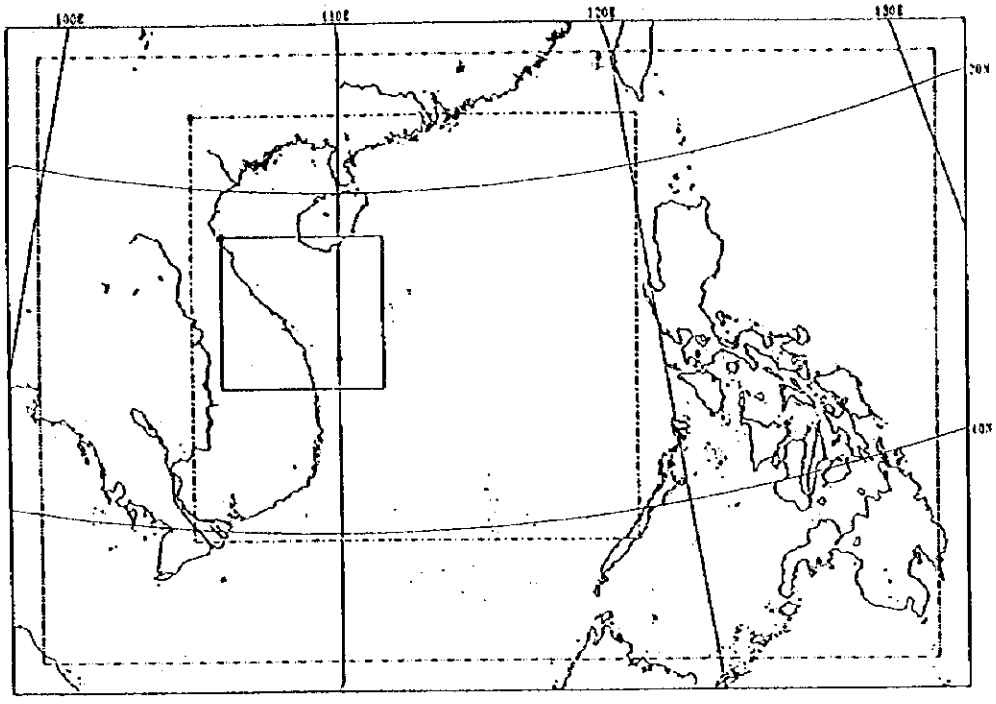


Figure A 4.3.9 Effective Fetch at Ky Ha / Dung Quat (Unit: km)

Source: JICA Study Team



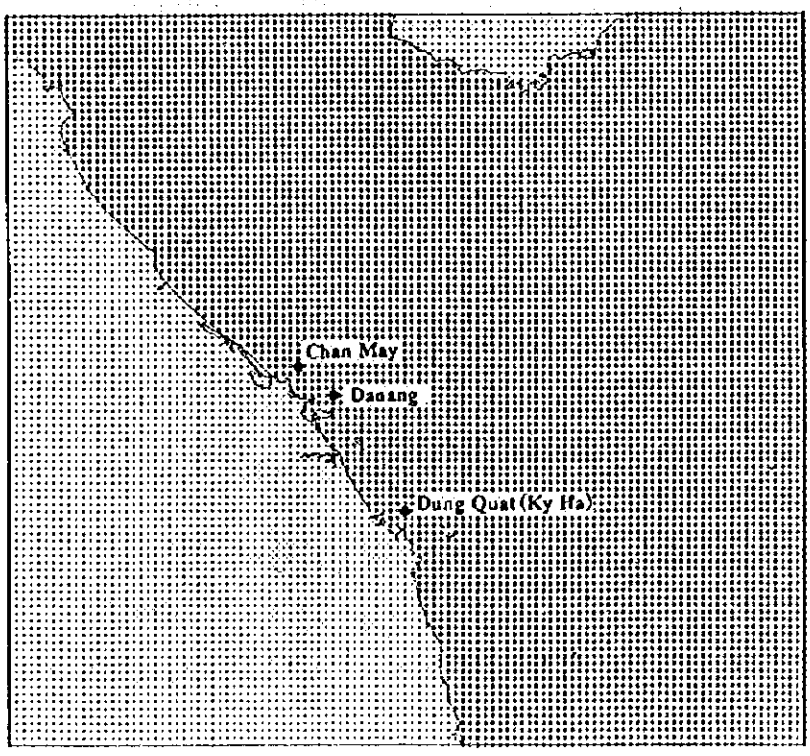
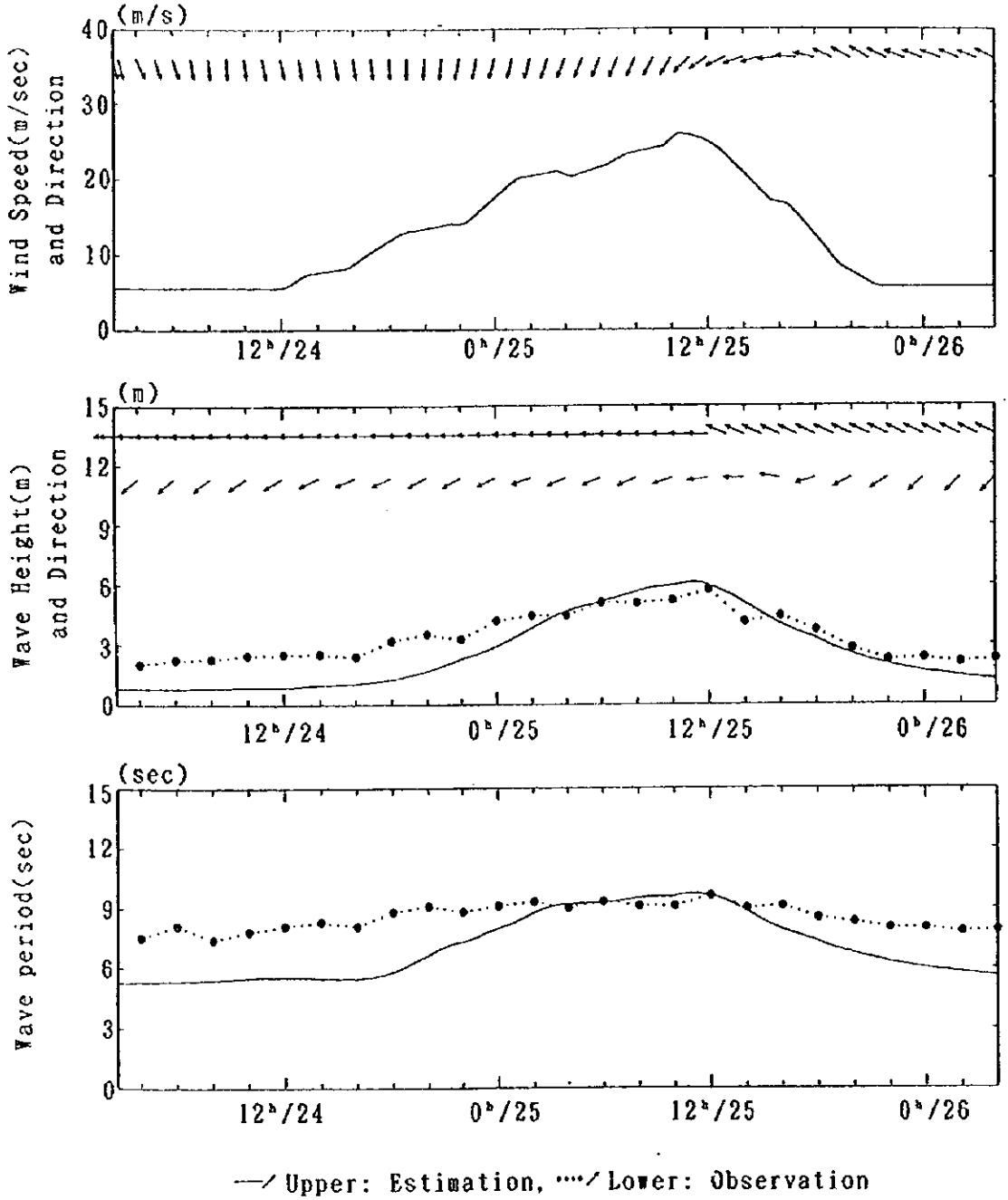


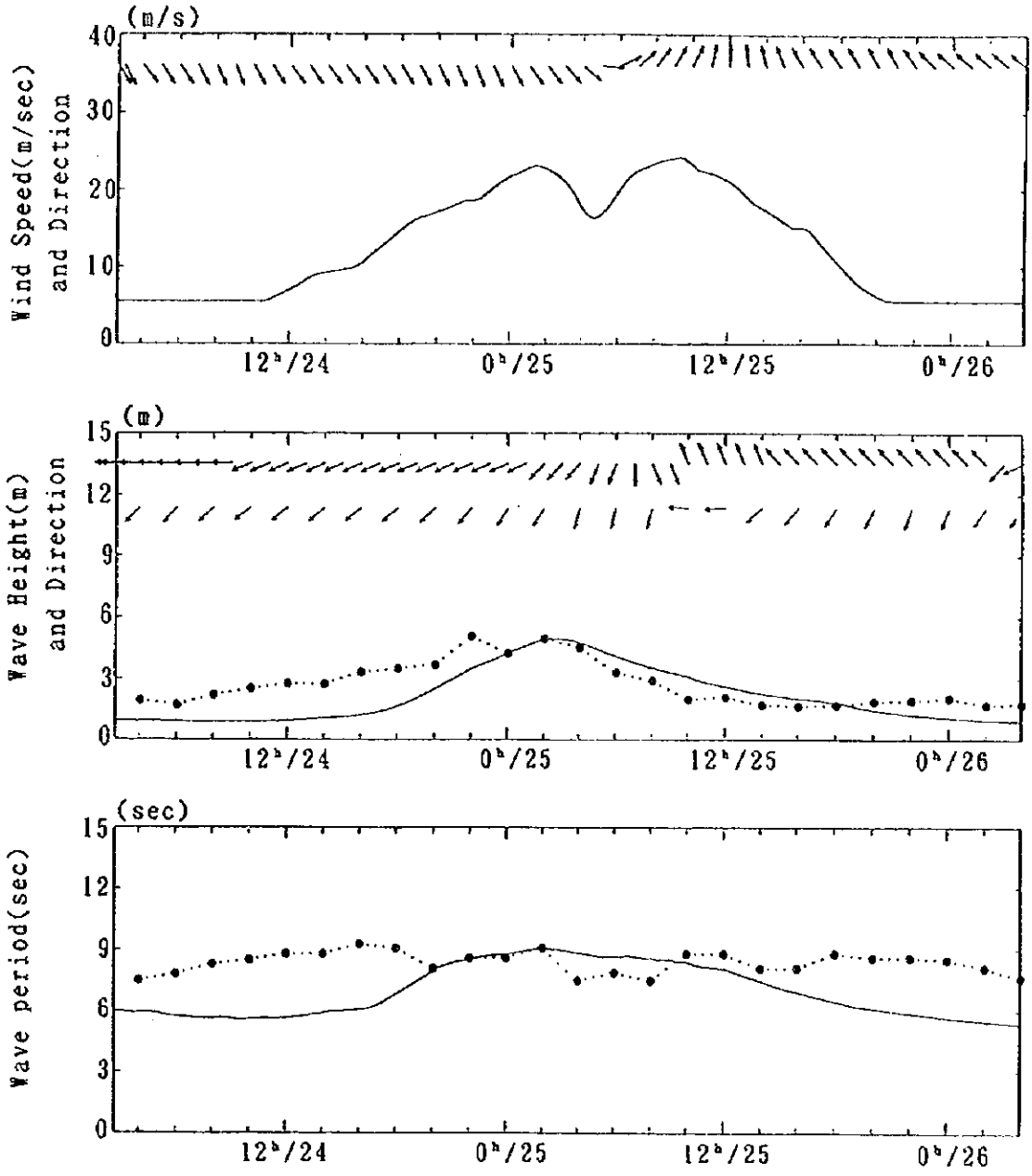
Figure A 4.3.10 Fields and Points of Wave Hindcast Calculation



Maximum Values					
	Wind		Wave		
	Speed (m/s)	Direction	Height (m)	Period (sec)	Direction
Estimated	25.9	NE	6.1	9.7	E
Obseeved	—	—	5.7	9.7	E

Figure A 4.3.11 Comparison of Estimated and Observed Waves due to Typhoon Fritz

(1) Danang from 02:42 24 Sept. to 04:00 26 Sept., 1997



—/ Upper: Estimation , ····/ Lower: Observation

	Maximum Values				
	Wind		Wave		
	Speed (m/s)	Direction	Height (m)	Period (sec)	Direction
Estimated	24.4	SSW	5.0	9.1	NE
Obseeved	—	—	5.1	8.7	NE

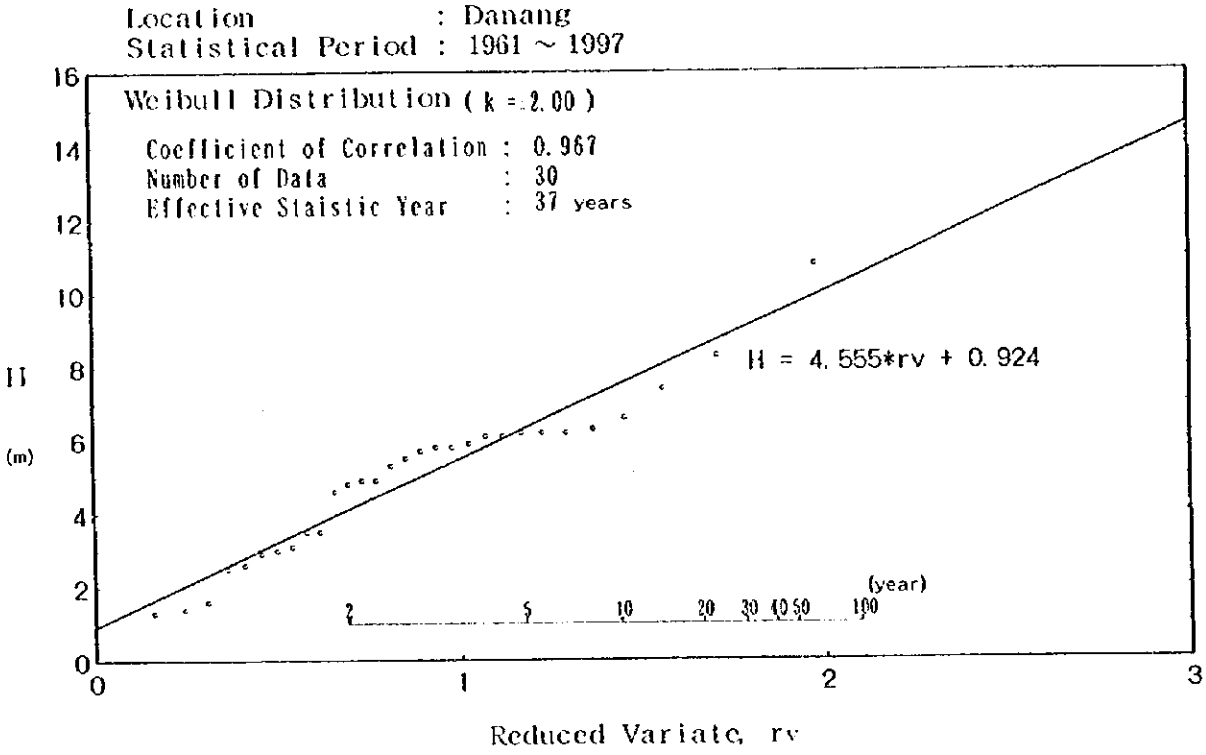
Figure A 4.3.11 Comparison of Estimated and Observed Waves due to Typhoon Fritz

(2) Dung Quat (Ky Ha) from 02:42 24 Sept. to 04:00 26 Sept., 1997

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

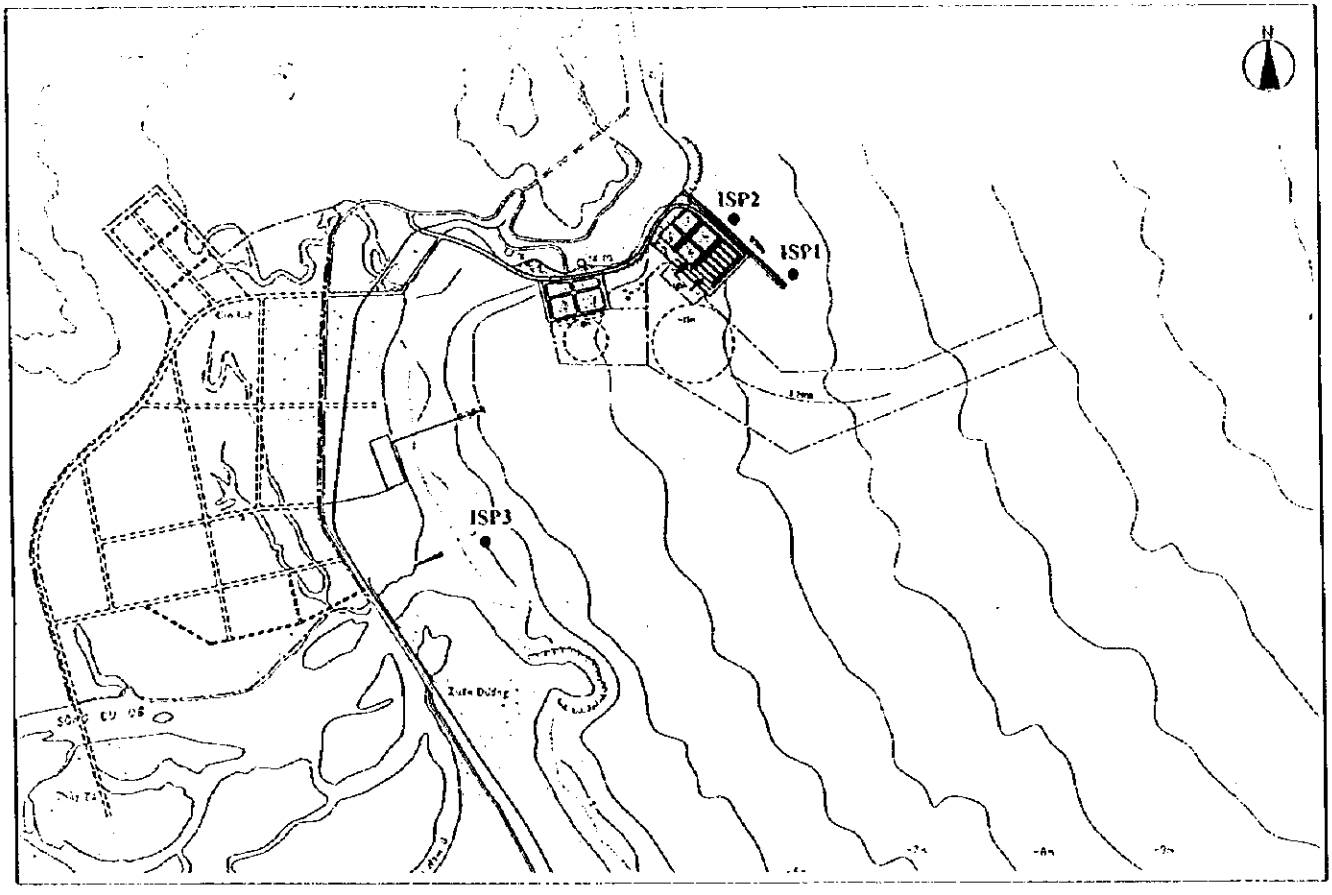
No.	Typhoon No.	Name	Chan May				Danang				Dung Quat (Ky Ha)			
			Time*	Height (m)	Period (sec)	Direction	Time*	Height (m)	Period (sec)	Direction	Time*	Height (m)	Period (sec)	Direction
1	9721	Fritz	09/25 11:12	5.8	9.5	E	09/25 11:12	6.1	9.7	E	09/25 02:42	5.0	9.0	NE
2	9622	Beth	10/21 02:30	1.2	8.8	ENE	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 Probability	Reduced Variate, rv	Wave Height (m)	Wave Period (sec)
100	0.988	2.097	10.5	14.3
50	0.975	1.924	9.7	13.8
40	0.969	1.865	9.4	13.6
30	0.959	1.786	9.1	13.3
20	0.938	1.669	8.5	12.9
10	0.877	1.447	7.5	12.1
5	0.753	1.183	6.3	11.1
2	0.383	0.695	4.1	8.9

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



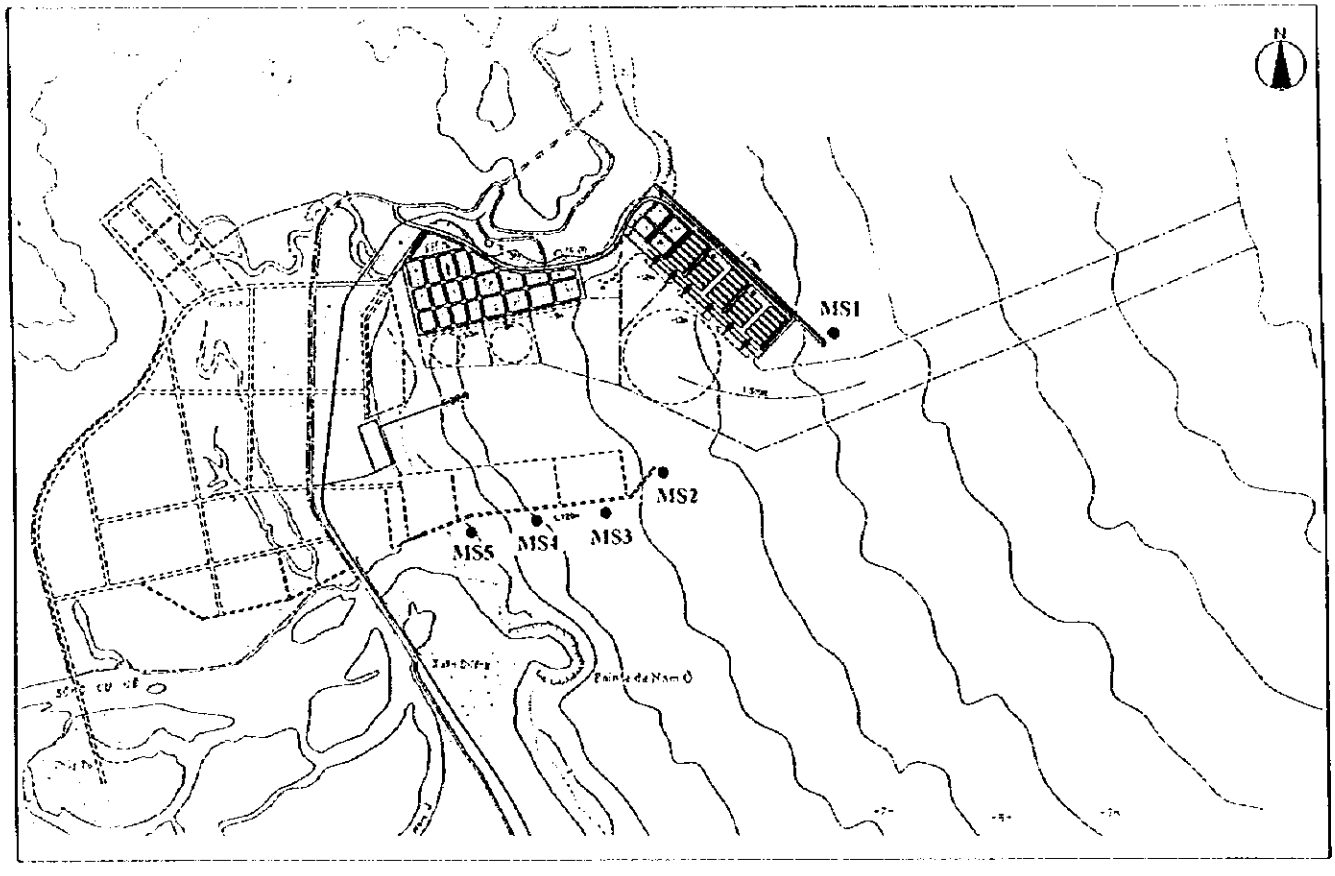


Figure A 4.3.13 Location of Wave Propagation Calculation (Lien Chieu)

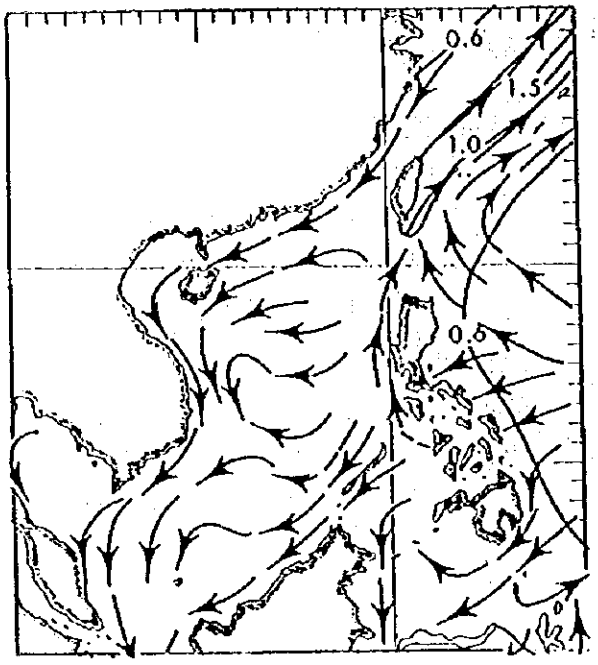
Table A 4.3.7 Waves by Typhoons with a Return Period of 50 Years (Lien Chieu)

Offshore deepwater wave: H_0 = 9.7 m with T_0 = 13.8 sec.

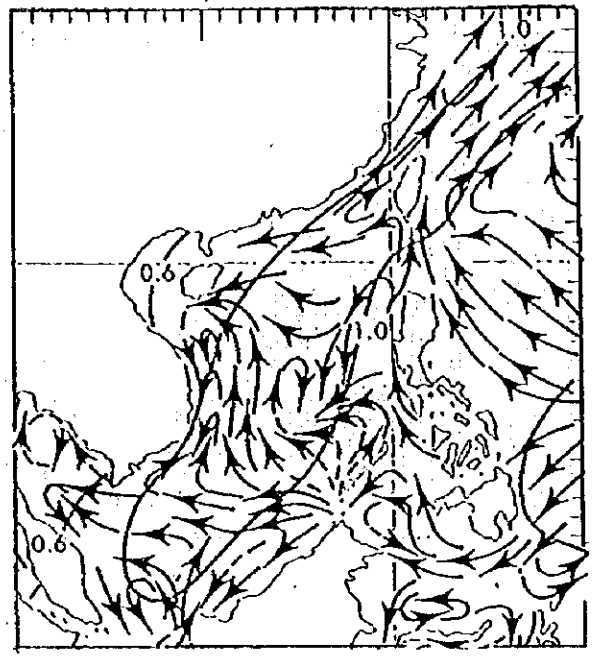
Offshore Wave Direction	Location	Water Depth (m)	K_{d1}	K_{d2}	K_r	K_{sb}	$H_{1/3}$ (m)	H_{max} (m)	H_D (m)	Incident wave angle (deg)
NE	MS1	10.6	0.64	-	0.93	1.03	6.0	8.3	8.5	3.5
	MS2	8.5	0.64	0.59	0.93	1.21	4.1	6.5	6.7	N56.0E
	MS3	8.1	0.64	0.62	0.93	1.17	4.2	6.3	6.5	N53.5E
	MS4	7.5	0.64	0.62	0.93	1.17	4.2	5.9	6.1	N53.5E
	MS5	4.4	0.64	0.62	0.93	0.81	2.9	3.9	4.0	N53.5E
	ISP1	9.9	0.63	-	0.93	1.04	5.9	7.8	8.0	3.5
	ISP2	9.7	0.63	-	0.93	1.04	5.9	7.7	7.9	3.5
	ISP3	4.4	0.63	0.85	0.93	0.63	3.1	4.1	4.2	N51.0E
ENE	MS1	10.6	0.64	-	0.92	1.04	5.9	8.3	8.5	11.0
	MS2	8.5	0.64	0.90	0.92	1.04	5.3	6.8	7.0	N56.0E
	MS3	8.1	0.64	0.91	0.92	0.98	5.1	6.6	6.8	N53.5E
	MS4	7.5	0.64	0.91	0.92	0.92	4.8	6.2	6.3	N53.5E
	MS5	4.4	0.64	0.91	0.92	0.60	3.1	4.2	4.3	N53.5E
	ISP1	9.9	0.65	-	0.92	1.03	6.0	7.9	8.0	11.0
	ISP2	9.7	0.64	-	0.92	1.04	5.9	7.7	7.9	11.0
	ISP3	4.4	0.65	0.93	0.92	0.57	3.1	4.2	4.3	N55.0E
E	MS1	10.6	0.55	-	0.87	1.09	5.1	8.1	8.3	34.5
	MS2	8.5	0.55	1.00	0.87	1.09	5.1	6.8	6.9	N78.5E
	MS3	8.1	0.55	1.00	0.87	1.06	5.0	6.5	6.7	N78.5E
	MS4	7.5	0.55	1.00	0.87	1.00	4.7	6.1	6.3	N78.5E
	MS5	4.4	0.55	1.00	0.87	0.64	3.0	4.1	4.2	N78.5E
	ISP1	9.9	0.54	-	0.87	1.09	5.0	7.5	7.7	34.5
	ISP2	9.7	0.55	-	0.87	1.09	5.1	7.6	7.7	34.5
	ISP3	4.4	0.54	1.00	0.87	0.65	3.0	4.1	4.2	N78.5E

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.

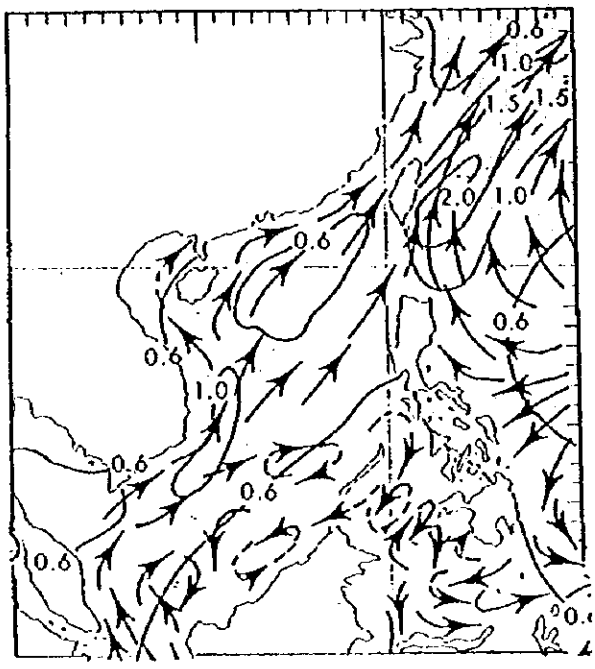
Source: JICA Study Team



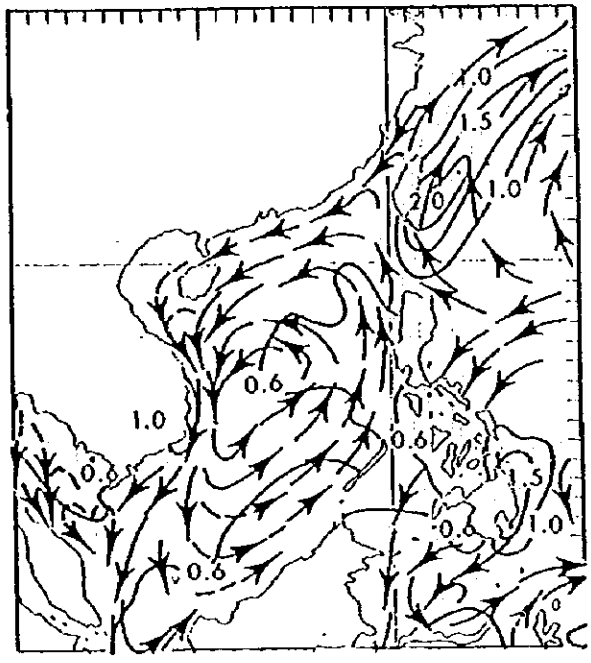
(1) January (North-east monsoon)



(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

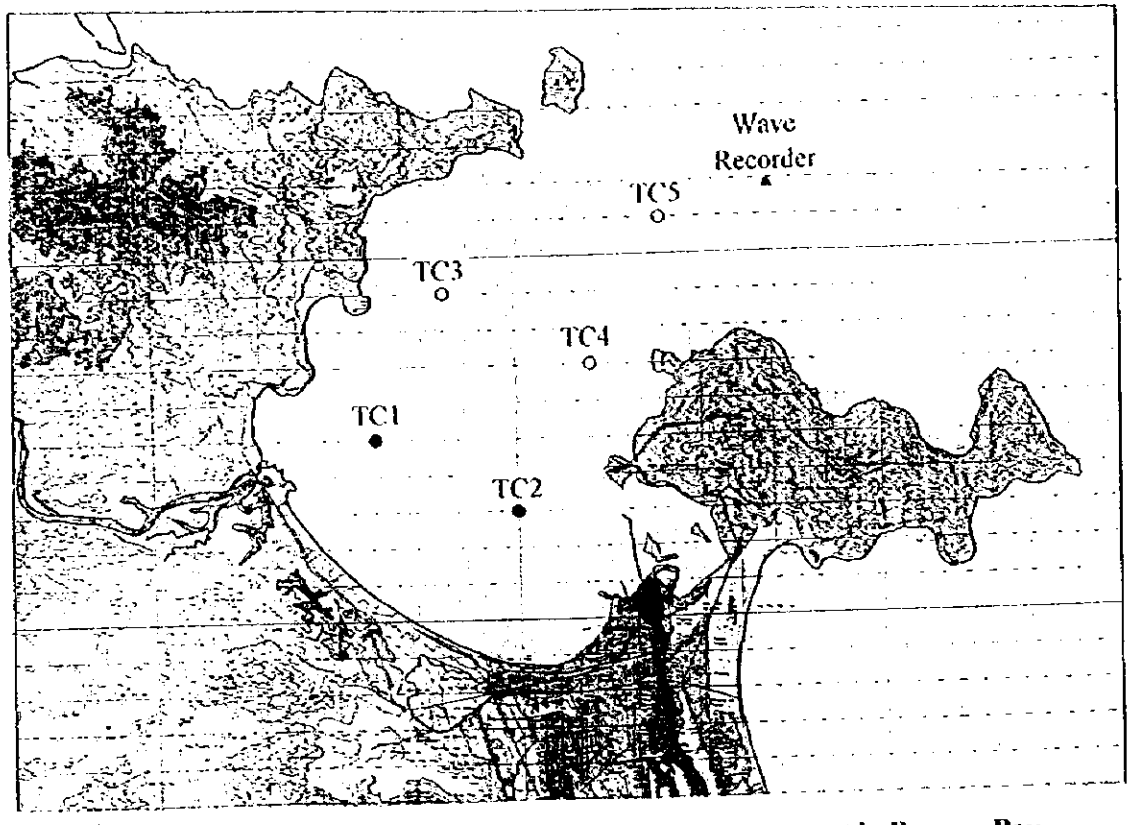


Figure A 4.4.2 Location of Tidal Current Measurement in Danang Bay

Table A 4.4.1 Harmonic Constants of the Major Four Components of Tidal Current in Danang Bay

Location	Component Direction	K1		O1		M2		S2		Residual Current	
		Speed cm/sec	*Phase deg.*	Speed cm/sec	*Phase deg.*	Speed cm/sec	*Phase deg.*	Speed cm/sec	*Phase deg.*	Speed cm/sec	*Phase deg.*
TC1	North	1.6	*133.5*	0.2	*89.8*	1.5	*162.7*	1.6	*265.3*	2.2	*230.0*
	East	5.2	*186.6*	3.3	*36.6*	1.8	*263.9*	0.9	*28.3*		
TC2	North	1.0	*136.2*	4.3	*10.0*	0.8	*9.1*	0.7	*51.2*	1.0	*78.0*
	East	2.6	*227.5*	1.9	*95.3*	0.4	*28.2*	0.7	*187.6*		
TC3	North	4.0	*3.0*	2.6	*210.8*	1.9	*273.5*	1.0	*42.4*	4.0	*232.1*
	East	5.9	*61.1*	3.8	*268.9*	5.1	*158.0*	2.8	*286.9*		
TC4	North	0.4	*75.8*	1.0	*267.7*	0.4	*196.4*	0.2	*270.3*	6.3	*29.6*
	East	3.6	*207.4*	9.6	*39.3*	0.8	*97.0*	0.4	*170.9*		
TC5	North	6.6	*75.8*	17.6	*267.7*	1.1	*357.2*	0.5	*71.1*	10.0	*290.1*
	East	6.1	*273.1*	16.3	*105.0*	0.9	*146.9*	0.4	*220.8*		
Wave Recorder	North	5.4	*320.5*	5.1	*256.2*	1.4	*230.7*	0.9	*270.1*	8.9	*147.7*
	East	6.9	*145.6*	7.4	*95.6*	2.6	*17.8*	0.8	*21.3*		

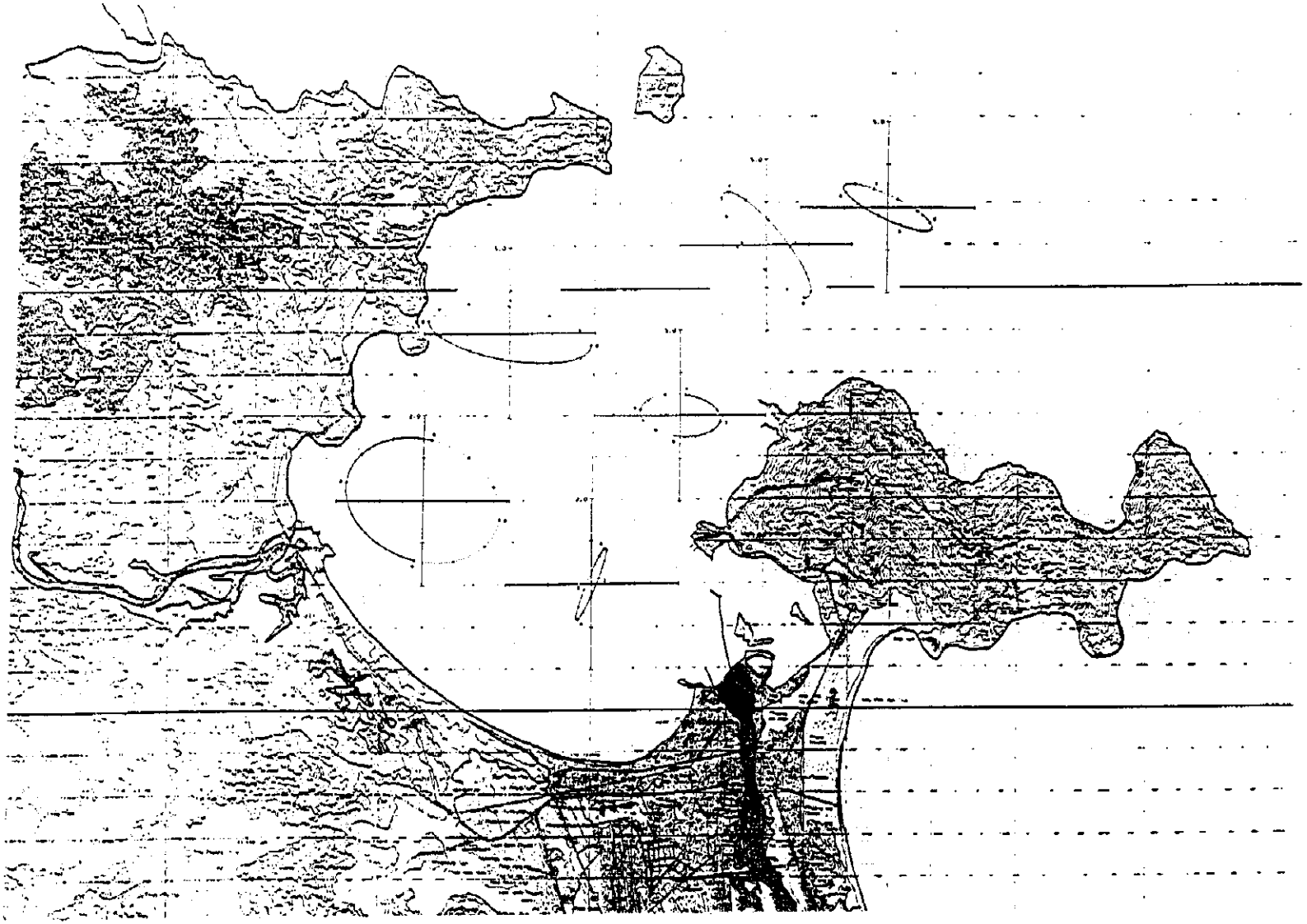


Figure A 4.4.3 Distribution of the Tidal Ellipses in the Danang Bay

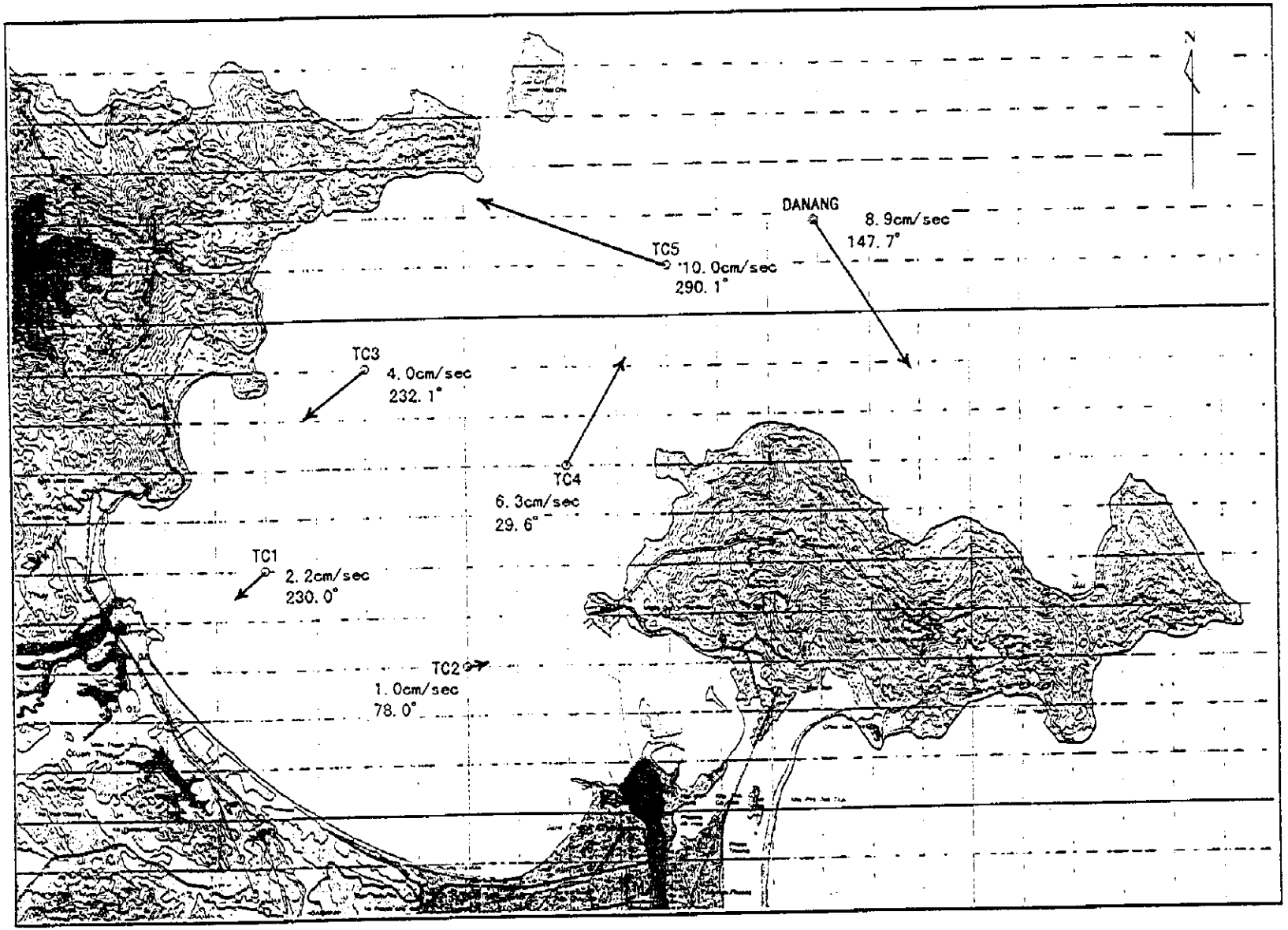


Figure A 4.4.4 Distribution of the Residual Current in Danang Bay

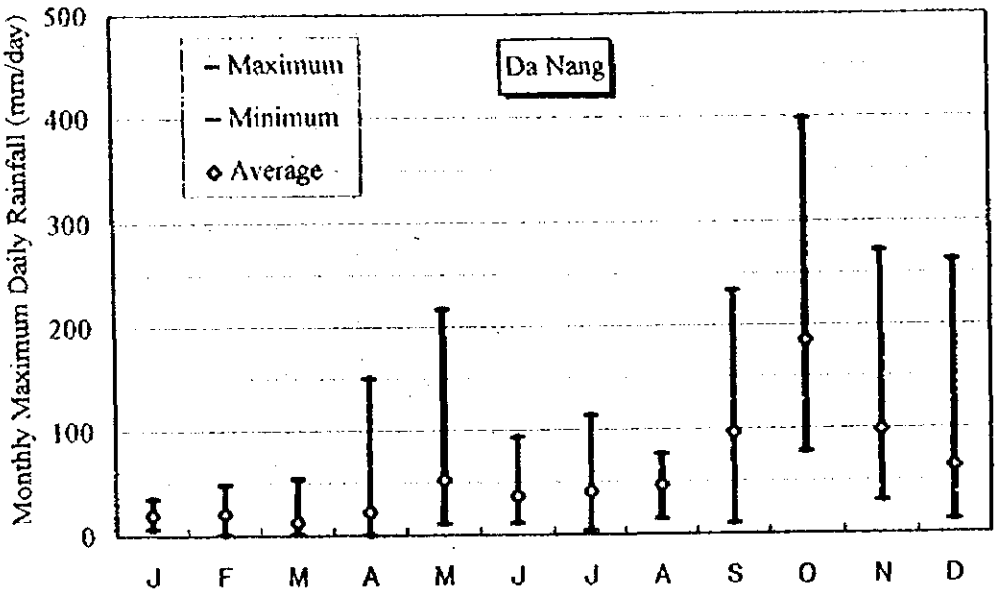


Figure A 4.6.1 Monthly Maximum Daily Rainfall at Danang (1986-1995)

Data source: Hydro-meteorological Data Center

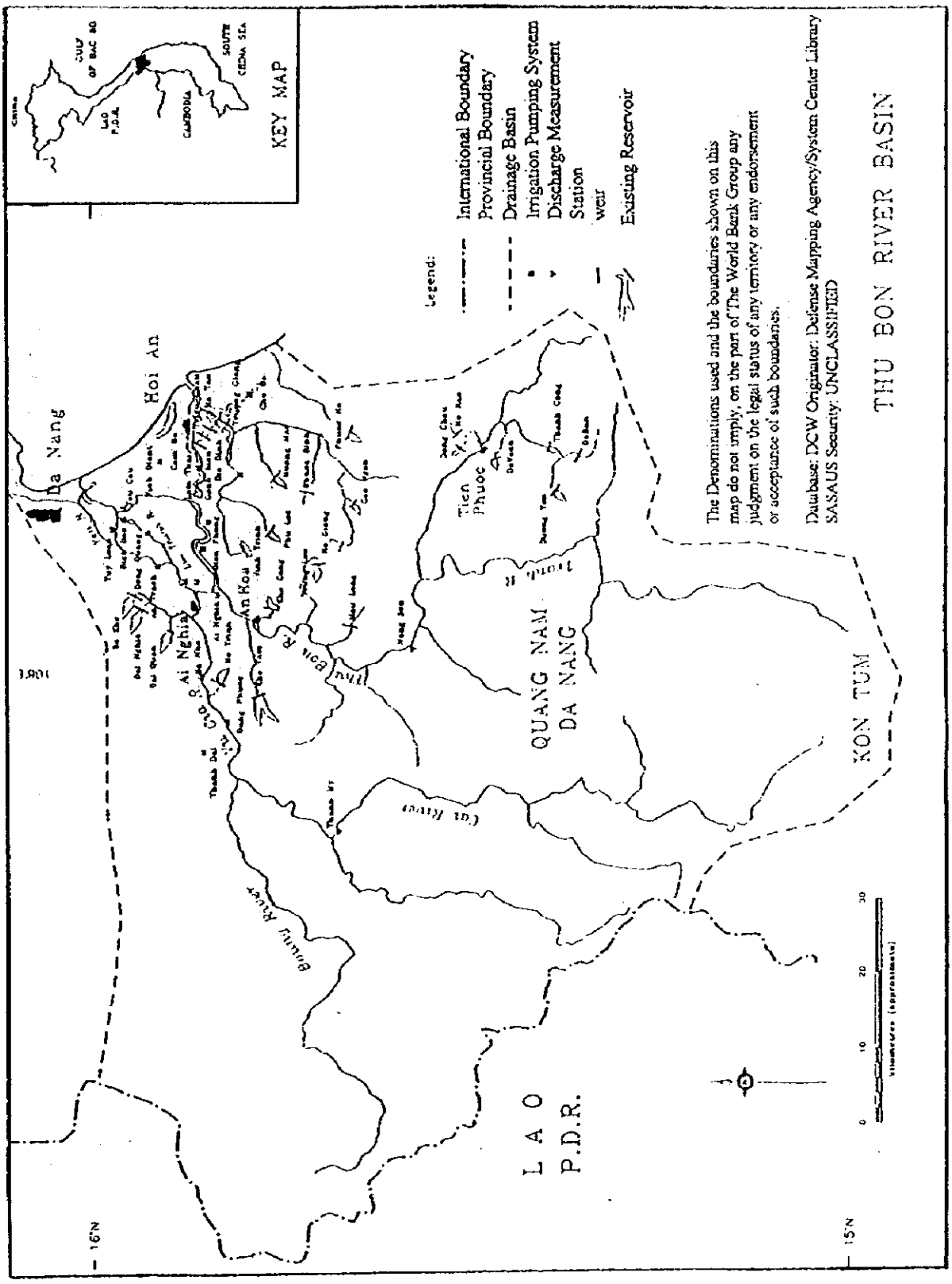


Figure A 4.7.1 Map of Thu Bon River Basin

Source: World Bank, ADB, FAO, UNDP, NGO Water Resources Group, and Inst. of Water Resources Planning "Socialist Republic Vietnam, Water Resources Sector Review" May 1996

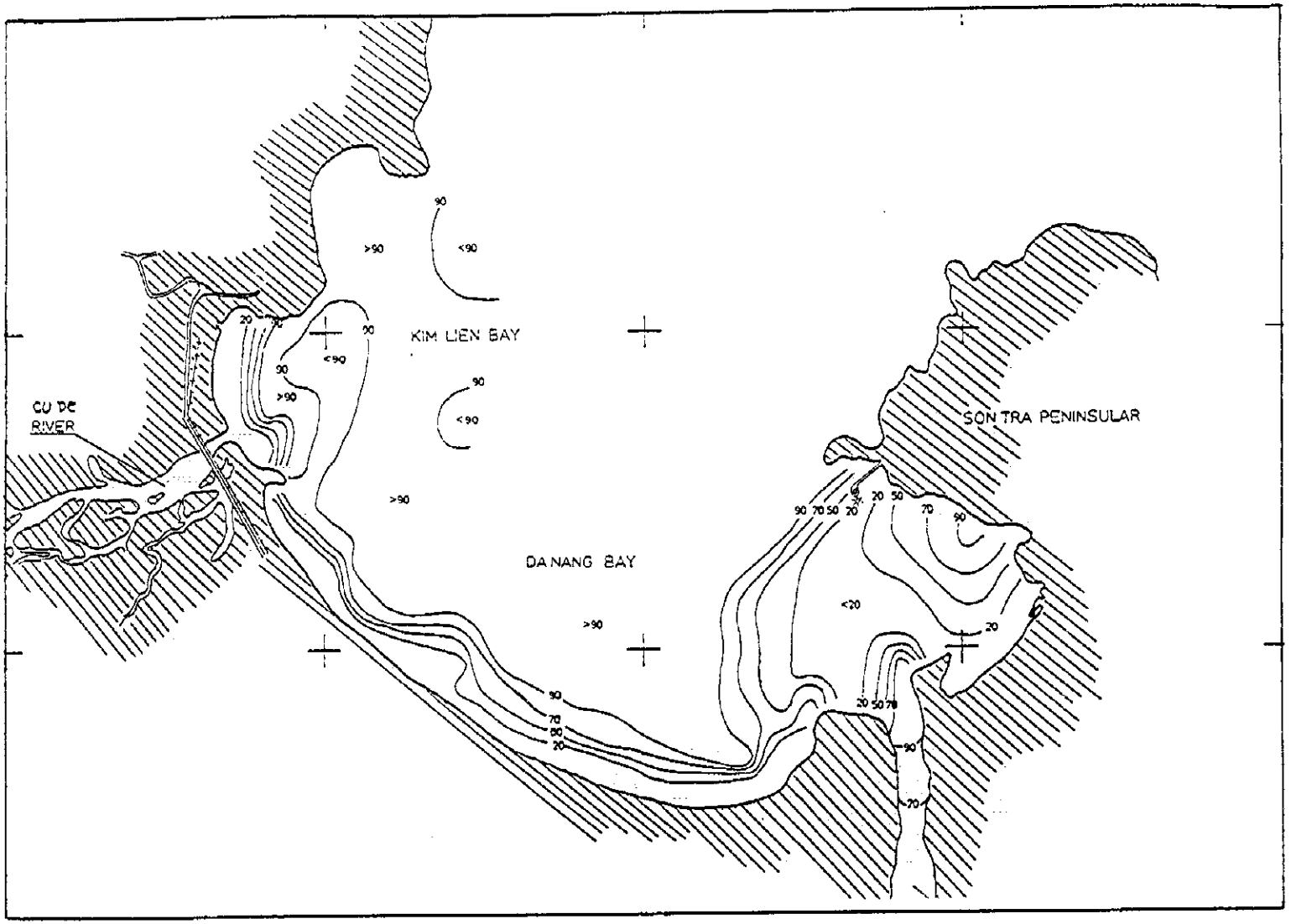


Figure A 4.7.2 Percentage Distribution of Silt/Clay of Bottom Sediment in Danang Bay

Source : JICA Study Team

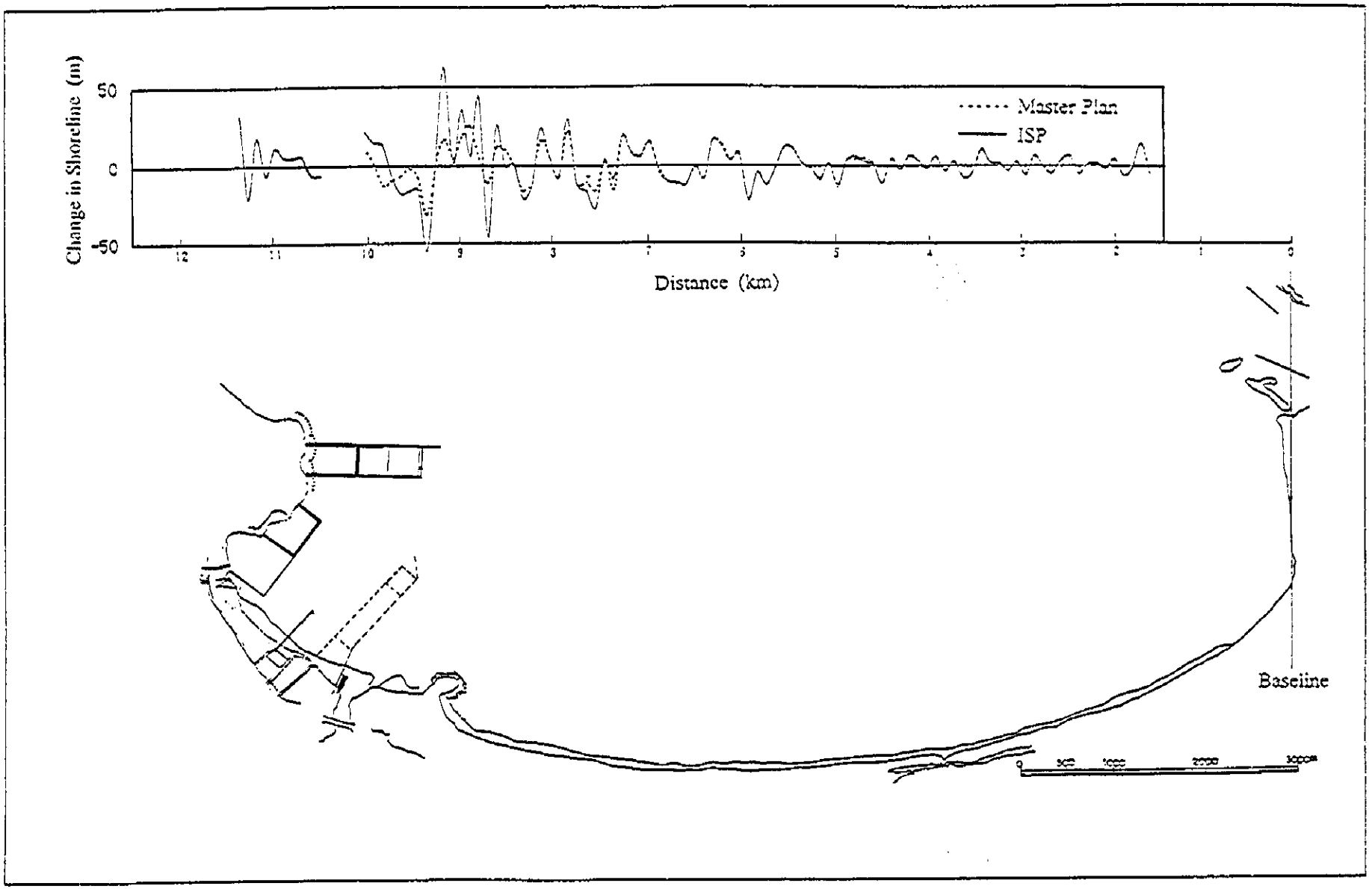
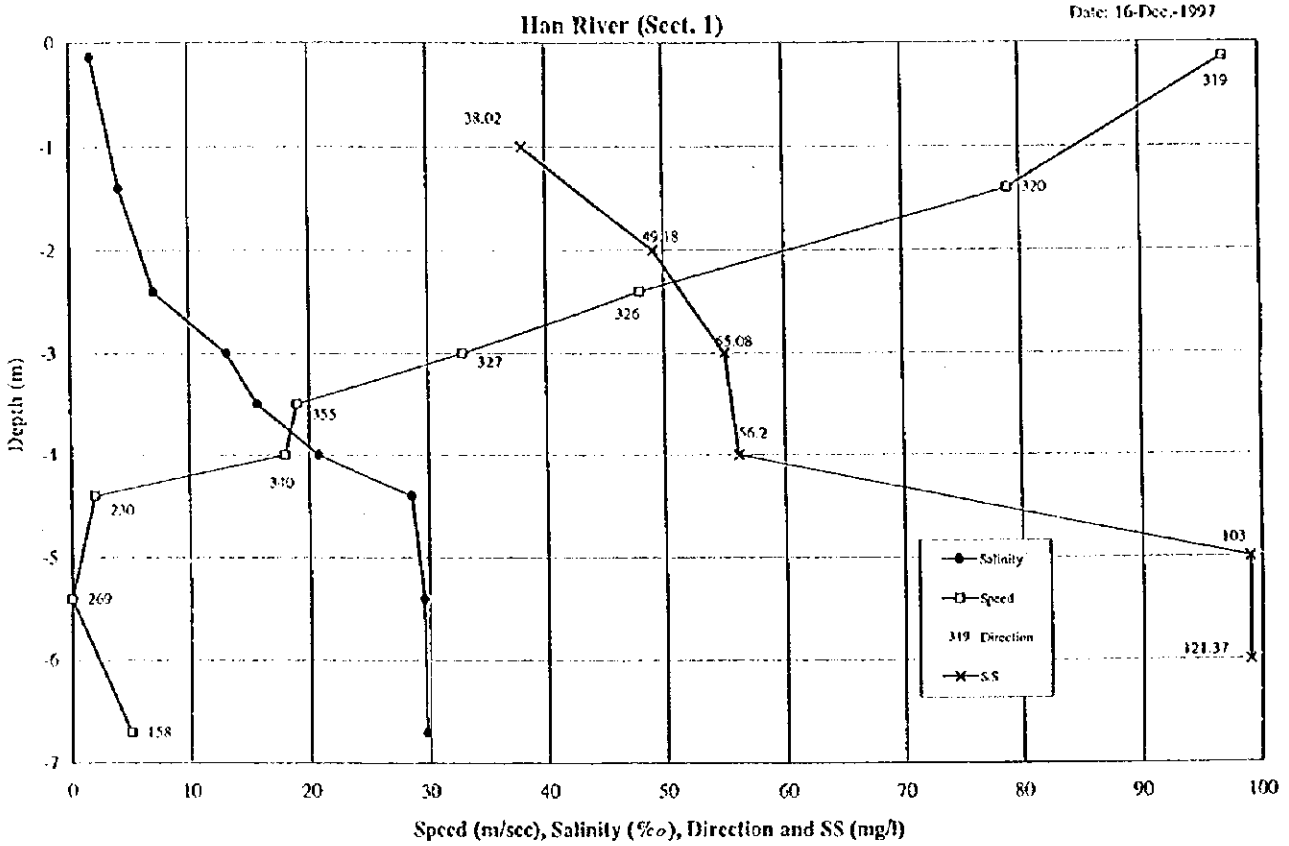


Figure A 4.7.3 Prediction of the Change in Shoreline by One Line Theory in Da Nang Bay



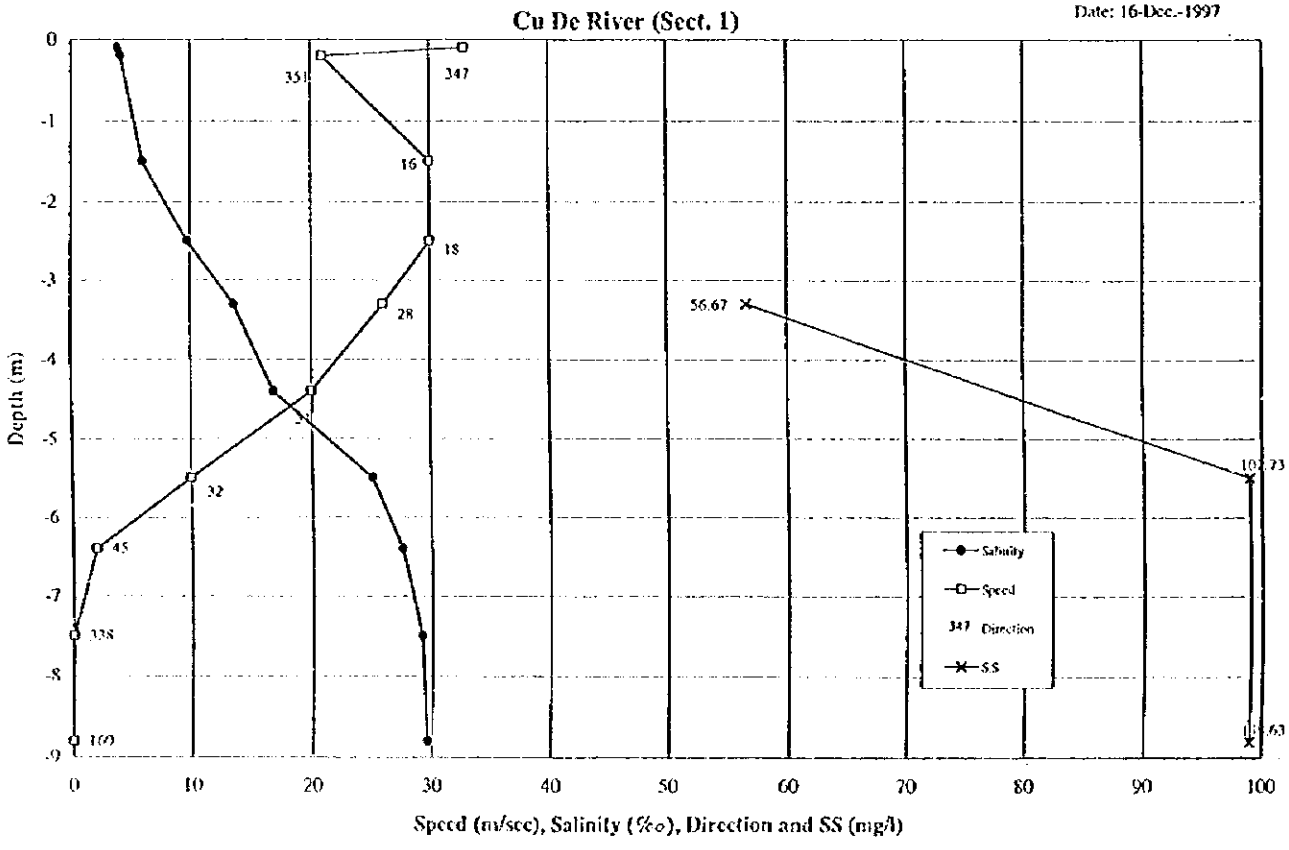


Figure A 4.7.4 River Discharge Vertical Profiles in Terms of Salt Water Wedge

Table A4.8.2 Result of Soil Test in Lien Chieu, Danang
Physico-Mechanical Properties of Soil

Lien Chieu ,Danang in 1997

No.	Sample No.	Group Symbol	Sampling Depth (m) From	To	Mean	Particle Size Analysis Test: Particle Size (mm)(%) 3/4	3/8	No4	No10	No40	No200	0.005~	0.002~	Particle Size (mm)(%) Gravel	Sand	Silt	Clay	Coefficient of Uniformity	Curvature	Atterberg Limit: Liquid Limit LL %	Plastic Limit PL %	Plastic Index PI %	Compaction Index	Water Content W (%)	Unit Weight: Wet γw g/cm³	Dry γd g/cm³	Specific Gravity Gs g/cm³	Porosity n	Saturated Degree S %	Void Ratio e %	Unconfined Compression Test: Cu kgf/cm²	E %	Triaxial Compression Test: Cohesion C (kg/cm²)	Internal F.A φ°	Consolidation Test: Compression Ratio	Consolidation Coefficient Cv (cm²/sec)	Compression Index Cc	Permeability K (10⁻⁴cm/sec)
LC 1-97 (+8.90m)	1	CL	3.00	2.60	2.80			100.0	99.8	96.8	87.9	27.5	23.8	0.2	11.9	60.4	27.5			38.60	23.5	15.1	1.75	42.4	1.49	1.02	2.66	61.65	70.19	1.808								
	2	CL	3.90	4.50	4.20			100.0	99.9	98.2	86.0	26.8	24.2	0.1	11.9	59.4	28.6			44.4	28.1	16.3	1.06	45.4	1.72	1.18	2.68	55.64	95.24	1.254			0.1150	0.4790	0.3800	0.0287
	3	CL	9.30	9.10	9.80				100.0	99.8	97.0	31.5	29.4	0.0	8.0	60.5	31.5			36.8	22.7	17.2	1.16	43	1.67	1.17	2.69	56.01	89.03	1.289								
	4	CL	7.90	8.50	8.20				100.0	99.2	89.4	29.0	23.3	0.0	9.0	61.4	29.6			42.7	26.3	16.4	1.26	47	1.78	1.21	2.65	54.34	104.56	1.190								
	5	CL	9.90	10.20	9.90				100.0	99.0	88.8	27.5	24.1	0.0	11.7	61.3	27.5			41.3	25.5	15.8	1.06	42.2	1.65	1.09	2.67	59.16	77.82	1.450								
	6	SW-SM	11.10	11.55	11.33		100.0	99.8	97.9	46.1	9.2			2.1	89.7	8.2	0.0	2.04	1.82								2.66										
	7	SW-SM	12.60	13.05	12.83			100.0	98.2	44.9	9.1			1.8	89.1	9.1	0.0	2.47	2.09								2.65										
	8	SW-SM	14.10	14.55	14.33			100.0	99.2	44.8	9.1			1.8	89.1	9.1	0.0	2.47	1.56								2.65										
	9	CL	13.10	13.70	13.40					100.0	92.4	32.0	25.2	0.0	7.6	60.4	32.0							38.6	1.73	1.25	2.67	53.18	90.77	1.196	0.45	8.61	0.98	8° 15'	0.0610	0.3590	0.2700	0.0232
	10	CL	19.60	17.20	18.90				100.0	99.8	89.7	30.8	24.4	0.0	10.2	58.9	30.8							42.1	1.82	1.28	2.66	51.66	103.94	1.026	0.18	9.93			0.0420	0.5610	0.2700	0.0756
	11	SW-SM	19.20	19.65	19.43		100.0	99.8	99.7	33.9	5.5			3.3	91.2	5.5	0.0	8.00	2.07								2.65										
	12	SW-SM	20.20	21.30	21.10			100.0	99.1	40.2	7.9			1.9	90.2	7.9	0.0	7.18	1.85								2.65										
	13	SW	22.50	22.95	22.73			100.0	97.7	39.1	4.9			2.3	92.8	4.9	0.0	6.42	1.56								2.66										
	14	SW-SM	24.10	24.55	24.33			100.0	98.3	46.8	8.8			1.7	91.7	8.6	0.0	6.63	1.27																		
LC 2-97 (+8.10m)	15	CL	1.50	1.95	1.73			100.0	98.2	94.2	78.9	29.1	22.9	1.8	19.3	57.8	29.7			41.3	24.5	16.8	1.32	48.70			2.65										
	16	CL	3.10	3.55	3.33			100.0	99.5	98.0	81.4	27.9	24.2	0.5	18.1	53.9	27.5			42.7	26.1	16.6	1.17	45.90			2.66										
	17	CL	4.00	4.60	4.30				100.0	99.0	89.7	29.4	21.9	0.0	10.3	63.3	29.4			40.8	24.7	15.9	1.05	43.40	1.73	1.22	2.66	54.14	93.29	1.180	0.17	10.34									
	18	CL	7.10	7.70	7.40				100.0	99.5	92.6	28.8	24.2	0.0	7.4	64.0	28.6			41.3	24.2	17.1	1.24	43.40	1.72	1.19	2.65	55.09	89.07	1.277	0.15	12.07			Sample was collapsed						
	19	CL	9.10	9.55	9.33			100.0	99.8	97.5	89.2	27.2	22.9	0.2	10.1	62.5	27.2			45.1	28.3	16.8	1.11	45.90			2.66										
	20	SW-SM	11.50	11.95	11.73			100.0	99.0	42.0	9.1			2.0	88.9	9.0	0.0	7.90	1.13								2.65										
	21	SW-SM	13.00	13.45	13.23			100.0	97.8	49.2	8.4			2.4	89.2	8.4	0.0	6.67	1.01								2.66										
	22	CL	15.40	15.85	15.63					100.0	97.2	33.2	25.1	0.0	7.8	60.0	32.2			46.3	29.1	20.2	0.92	44.20			2.67	92.61	96.49	1.139	0.50	12.14	0.07	4° 03'	0.0770	0.5770	0.2900	0.0232
	23	CL	16.40	17.00	16.70				100.0	98.5	88.9	31.1	26.1	0.0	11.1	57.8	31.1			43.4	24.9	18.5	0.84	40.40	1.77	1.26	2.65										
	24	SW-SM	18.50	18.85	18.73			100.0	98.31	54.1	9.1			1.7	89.2	9.1	0.0	6.41	0.93								2.66										
	25	SW	20.10	20.55	20.33			100.0	97.4	48.2	3.8			2.6	93.6	3.8	0.0	0.64	0.12								2.66										
	26	SW-SM	21.50	21.95	21.73		100.0	99.9	96.4	39.2	5.8			1.6	92.6	5.8	0.0	6.10	1.73								2.65										
	27	SW-SM	23.00	23.45	23.23			100.0	97.7	49.2	7.1			2.3	90.6	7.1	0.0	6.47	0.84								2.65										
	28	SW-SM	24.40	24.85	24.63			100.0	98.0	47.0	9.0			2.0	89.4	9.0	0.0	6.19	1.56																		
LC 3-97 (+7.90m)	29	CL	0.00	1.40	0.70			100.0	99.5	96.6	86.0	13.9	10.1	0.5	32.9	52.7	13.9			21.4	12.4	4.0	0.99	21.40			2.67										
	30	SW-SM	1.50	1.95	1.73			100.0	98.4	45.4	9.0			1.6	89.4	9.0	0.0	6.47	1.66								2.65										
	31	SP-SM	3.30	3.75	3.53			100.0	98.5	48.4	7.2			1.5	91.3	7.2	0.0	6.42	2.28								2.66										
	32	SW	4.90	5.05	4.83			100.0	97.6	36.8	4.1			2.4	93.5	4.1	0.0	6.42	1.66								2.66										
	33	CL	5.80	6.25	6.03					100.0	91.2	29.9	23.8	0.0	8.8	61.3	29.9			46.9	27.7	19.2	0.66	44.90			2.66										
	34	SW-SM	7.50	7.95	7.73		100.0	99.8	98.7	55.0	8.9			1.6	91.5	6.9	0.0	6.05	0.82								2.66										
	35	SP	9.00	9.45	9.23		100.0	99.4	97.3	16.2	2.2			2.7	95.1	2.2	0.0	2.67	1.24								2.65										
	36	SW-SM	10.40	10.85	10.63			100.0	97.9	53.0	8.6			2.1	89.1	8.6	0.0	6.33	0.82								2.65										
	37	SW-SM	12.00	12.45	12.23			100.0	99.1	55.0	8.6			1.9	91.5	6.6	0.0	5.78	0.69								2.66										
	38	SW-SM	13.60	14.05	13.83		100.0	99.8	92.8	53.9	7.7			2.4	90.4	7.2	0.0	5.68	0.76								2.66										
	39	SW-SM	15.00	15.45	15.23		100.0	99.7	94.2	58.1	9.1			5.8	85.1	9.1	0.0	6.18	0.61								2.65										
	40	SW-SM	16.60	17.05	16.83		100.0	99.9	97.5	49.9	9.7			7.5	86.8	5.7	0.0	6.44	0.77								2.65										
	41	SP-SM	18.00	18.45	18.23		100.0	99.7	97.0	56.1	7.7			3.0	89.3	7.7	0.0	6.00	0.71								2.66										
	42	SP	19.50	19.95	19.73		100.0	99.7	97.5	49.9	4.8			2.5	92.7	4.8	0.0	5.09	0.92																		
LC 4-97 (+7.70m)	43	CL	1.50	2.10	1.80				100.0	98.1	86.0	24.8	21.2	0.0	12.0	63.4	24.8			32.1	23.2	8.9	1.22	34.10			2.66										
	44	CL	4.00	4.90	4.20			100.0	99.9	97.2	84.7	29.8	23.8	0.1	15.2	57.9	26.8			41.0	26.5	14.5	0.88	39.20	1.75	1.26	2.67	57.81	93.67	1.119	0.19	9.43			0.0610	0.4010	0.2700	0.0334
	45	CL	5.40	6.00	5.70			100.0	99.9	94.6	79.8	28.2	22.6	0.1	20.1	53.6	26.2			40.0	24.6	15.2	0.78	36.70	1.75	1.28	2.66	51.88	80.44	1.076	0.48	10.12			0.0780	0.7870	0.2900	0.0314
	46	CL	7.30	7.90	7.60				100.0	99.3	90.0	25.1	21.5	0.0	20.0	54.9	25.1			39.8	25.1	14.7	0.82	37.20	1.80	1.31	2.66	50.75	85.90	1.031	0.17	9.54	0.03	7° 35'	0.0760	0.8090	0.2900	0.0331
	47	SM	10.75	10.70	10.68			100.0	98.7	58.5	19.0			1.3	79.7	19.0	0.0	2.67	1.24								2.66										
	48	CW	12.00	12.90	12.90	100.0	98.2	49.5	28.3	11.8	2.3			73.7	24.0	2.3	0.0	14.07	2.96								2.65										

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 A7.4.1 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

Table A 7.5.4 Port Access Traffic

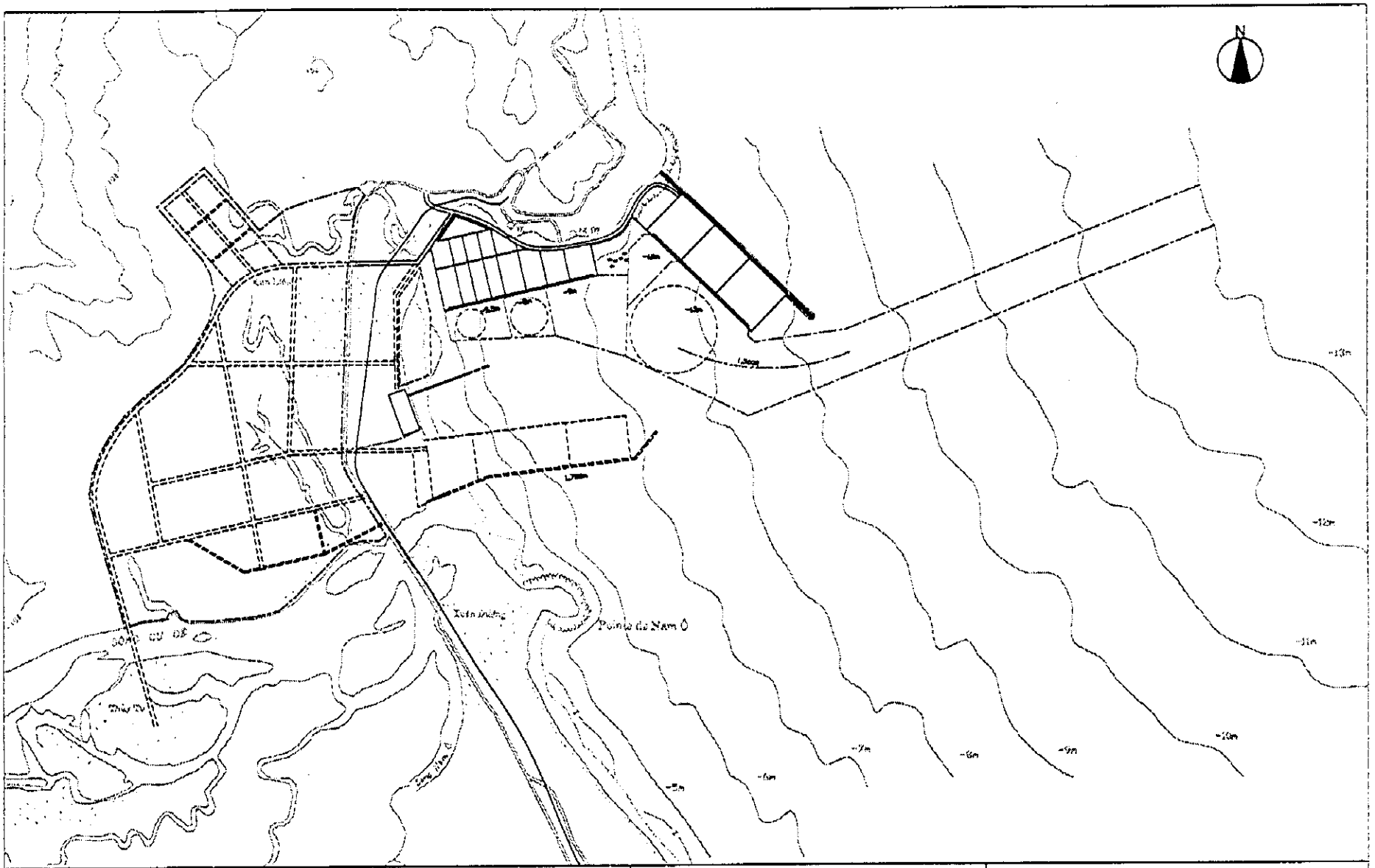
Unit; Vehicles per day

Type of Vehicle	2010	2020
Container Truck	81	263
Truck for Bulk Cargo	176	349
Truck for Break Bulk Cargo	292	768
Lorry for Petroleum	0	0
Car for Passenger	274	690
Total	823	2,071

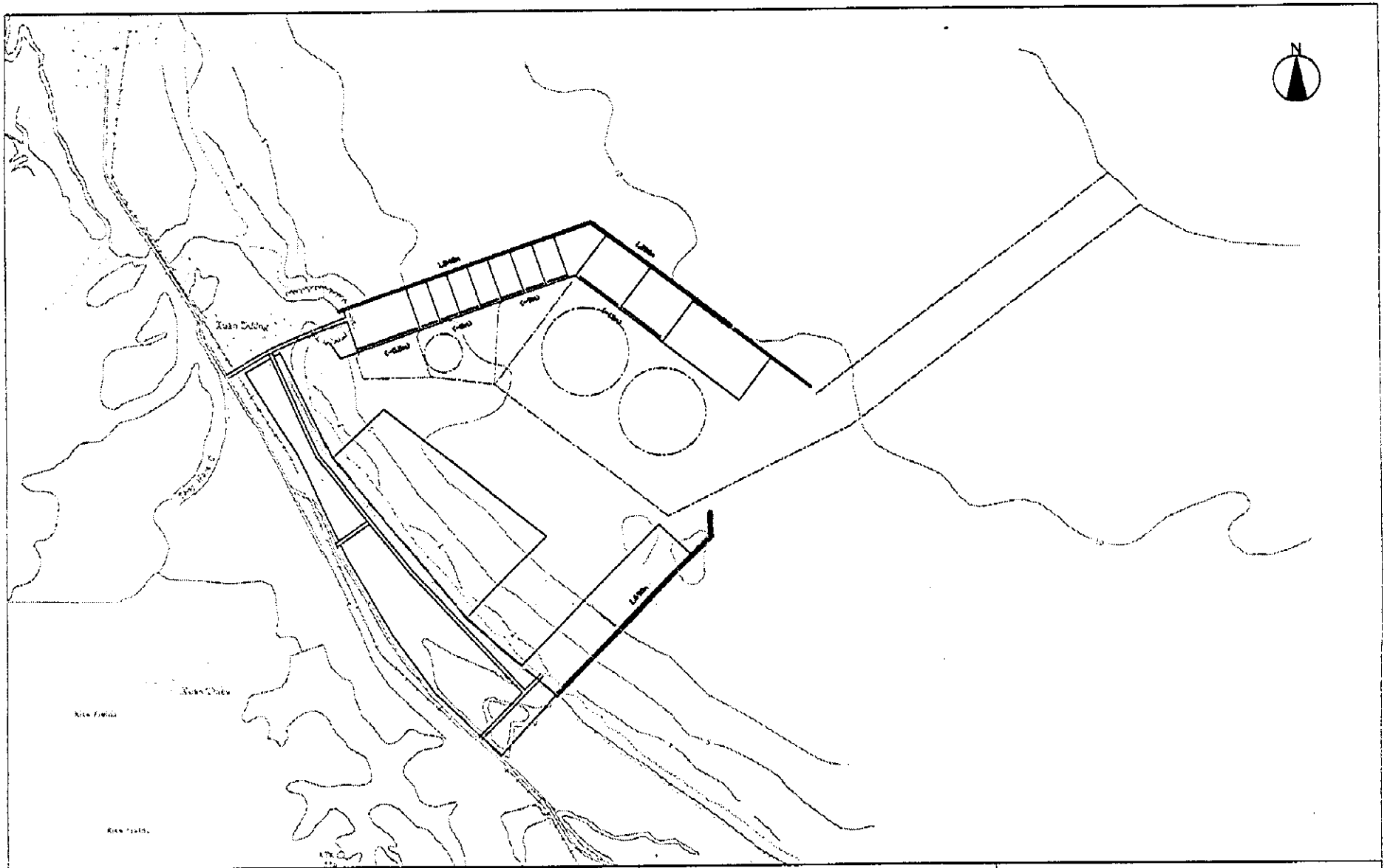
Formula of Traffic Volume Estimation

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

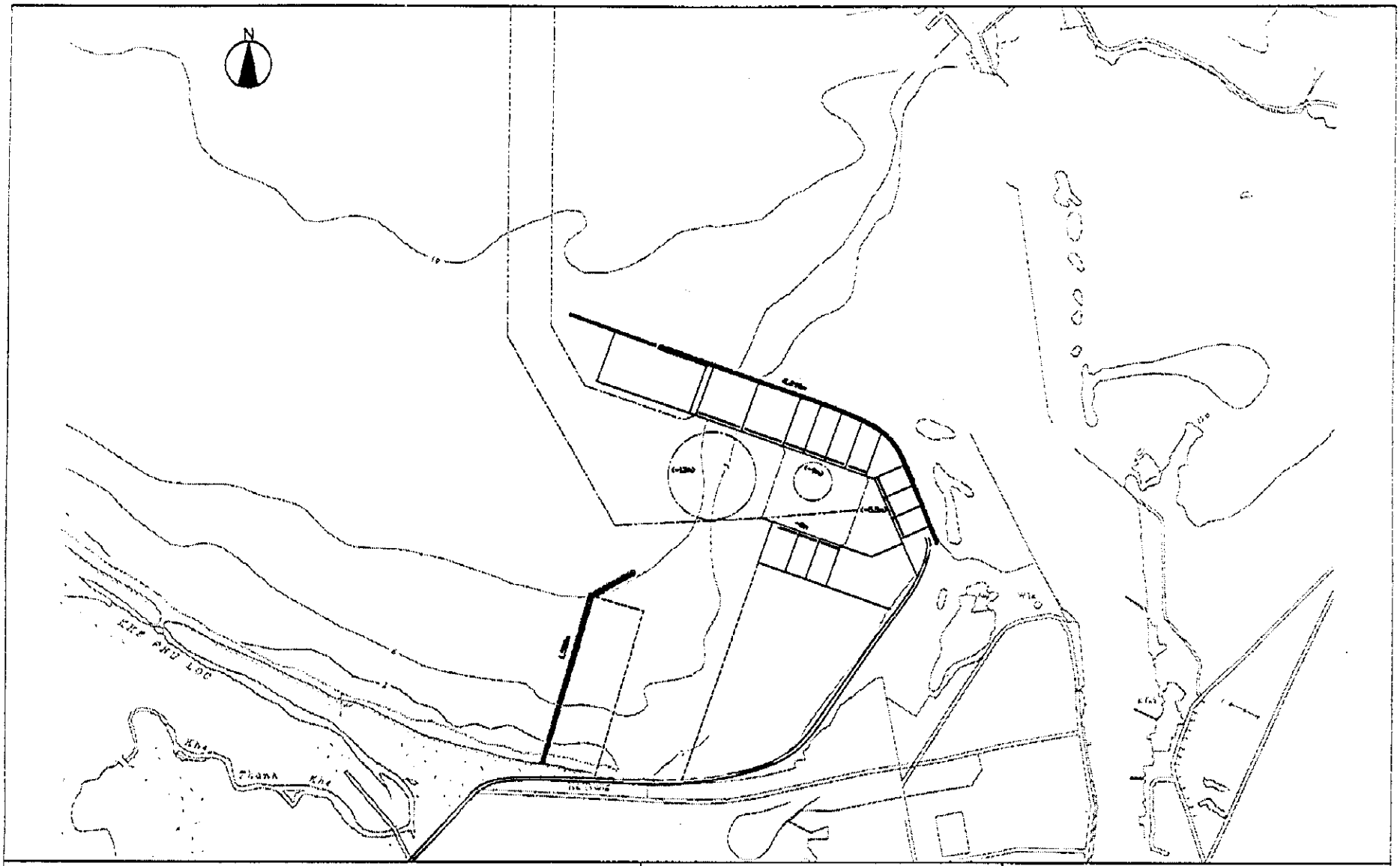
where α: 1.0
β: 1.2
γ: 1.3
δ: 0.5
ε: 0.5
σ: 0.14
ω: 1.0TEU(Container)
: 4.0(Break Bulk)
: 5.0(Bulk)
: 10.0(Liquid)



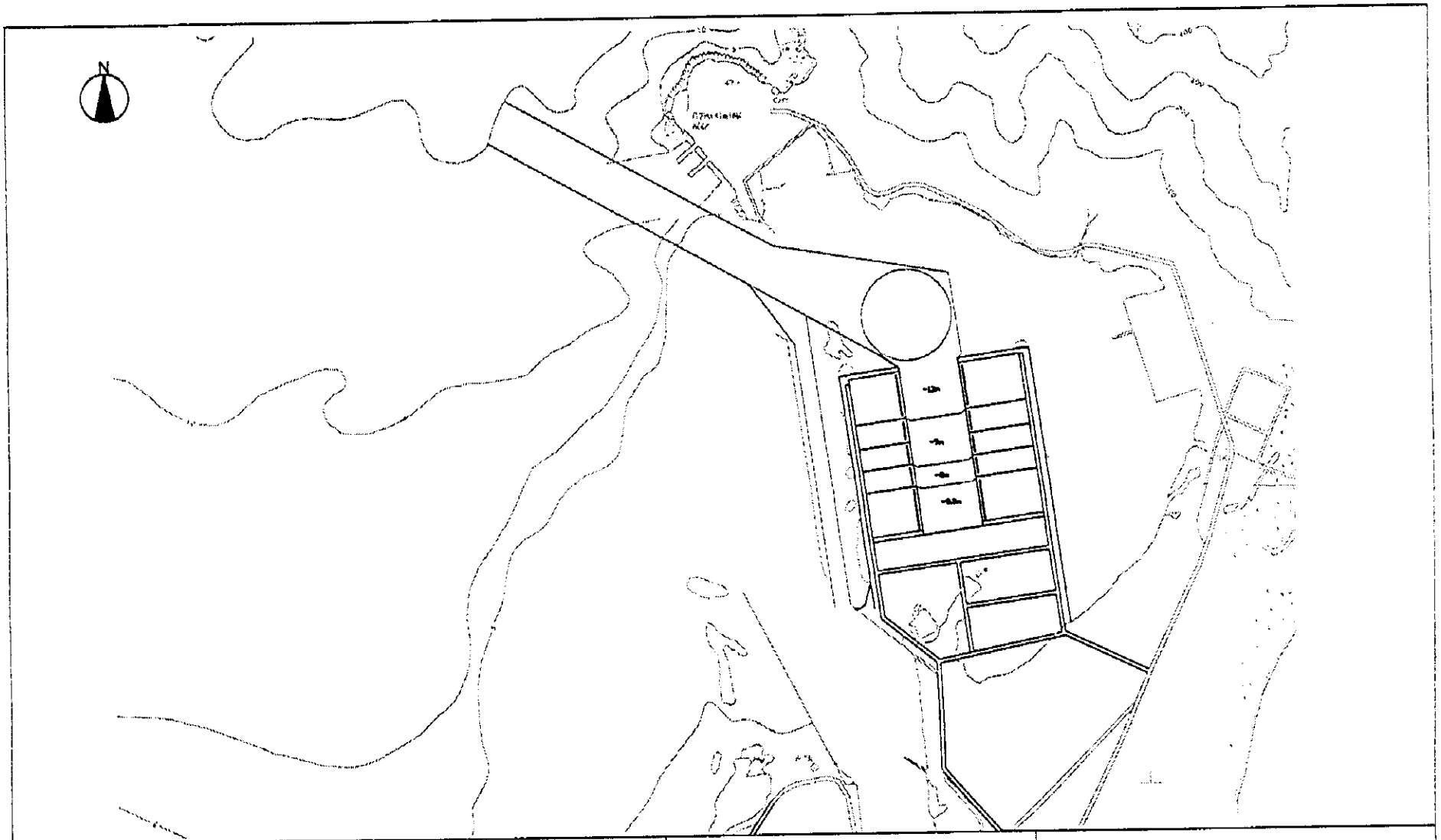
JICA Port Development Study in Central Region	Figure A7.5.1	Final Report 1998
Lien Chieu Port Development Option 1 (Lien Chieu)	0 500 1,000 2,000m	FILE LC-DF-MP



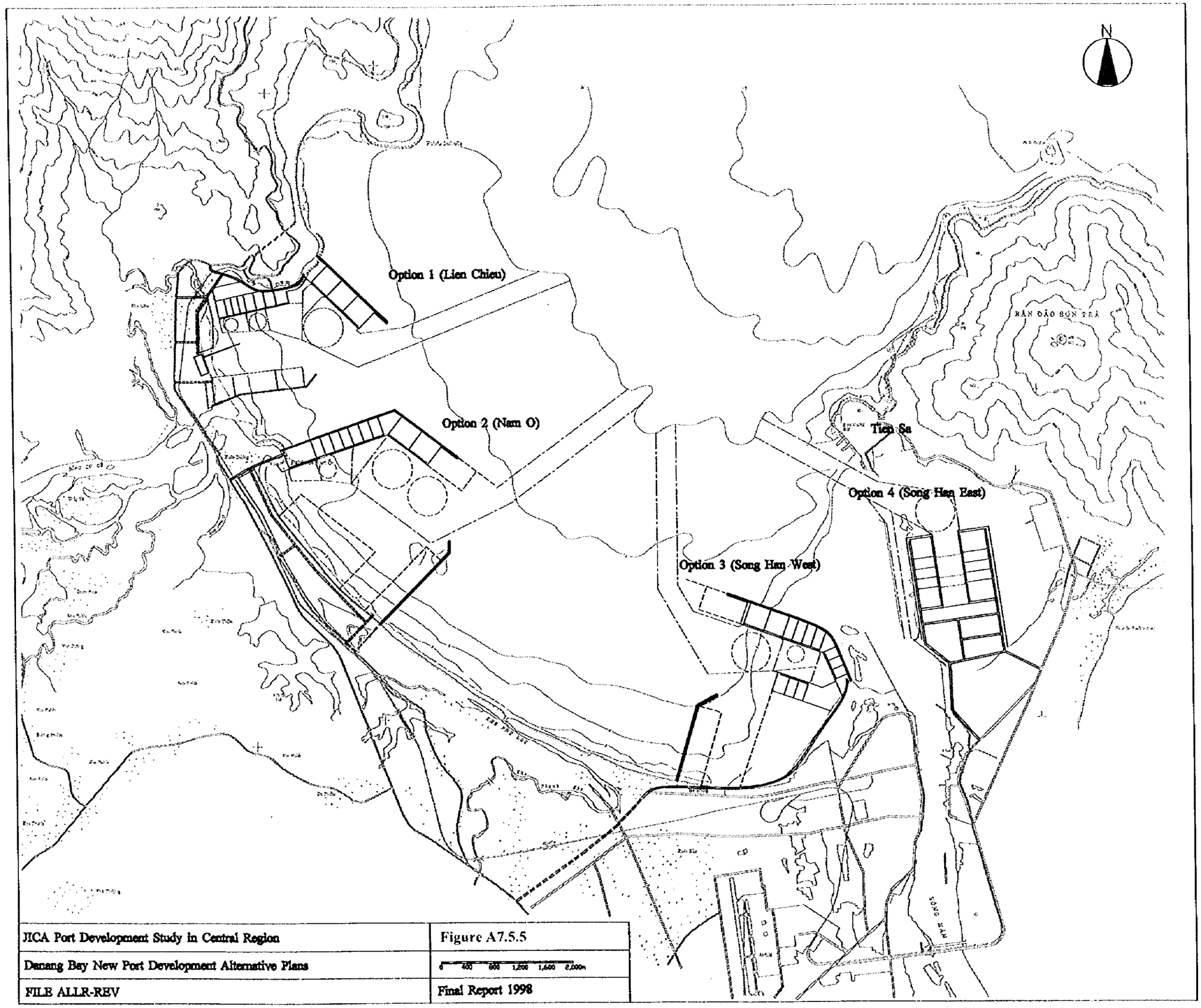
JICA Port Development Study in Central Region	Figure A7.5.2	Final Report 1998
Lien Chieu Port Development Option 2 (Nam O)	0 500 1,000 2,000m	FILE LC-DF-MP



JICA Port Development Study in Central Region	Figure A7.5.3	Final Report 1998
Lien Chieu Port Development Option 3 (Song Han West)	0 500 1,000 2,000m	FILE LC-DF-MP



JICA Port Development Study in Central Region	Figure A7.5.4	Final Report 1998
Lien Chieu Port Development Option 4 (Song Han West)	0 500 1,000 2,000m	FILE LC-DF-MP



JICA Port Development Study in Central Region	Figure A7.5.5
Danang Bay New Port Development Alternative Plans	0 400 800 1,200 1,600 2,000m
FILE ALLR-REV	Final Report 1998

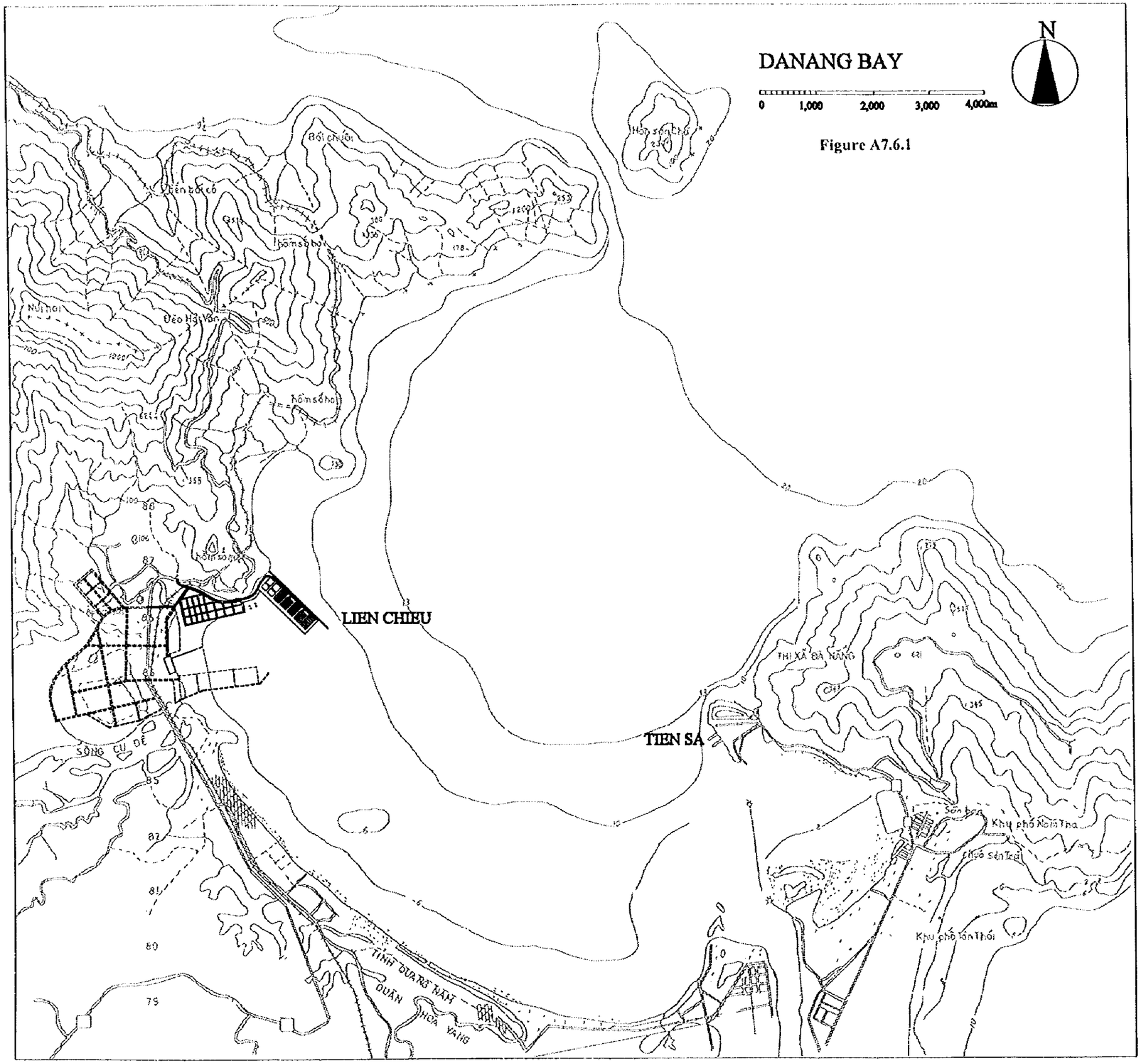
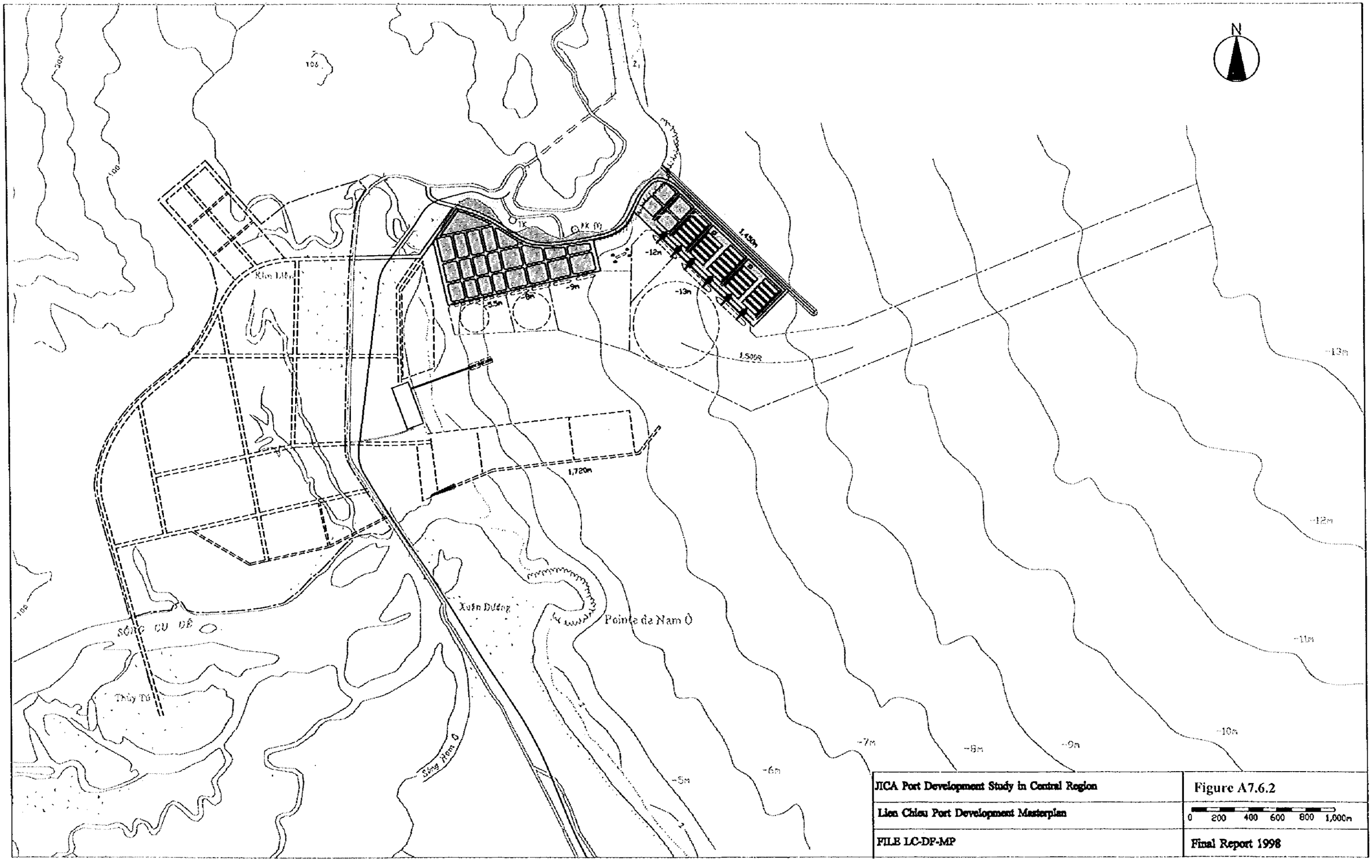

DANANG BAY
N
0 1,000 2,000 3,000 4,000m
LIEN CHIEU
TIEN SA
SÔNG CU DE
THỊ XÃ ĐÀ NẴNG
TỈNH QUẢNG NAM
QUẬN HÒA VANG
Khu phố Non Nha
Khu phố Non Thoi

Figure A7.6.1



JICA Port Development Study in Central Region	Figure A7.6.2
Lien Chieu Port Development Masterplan	0 200 400 600 800 1,000m
FILE LC-DF-MP	Final Report 1998

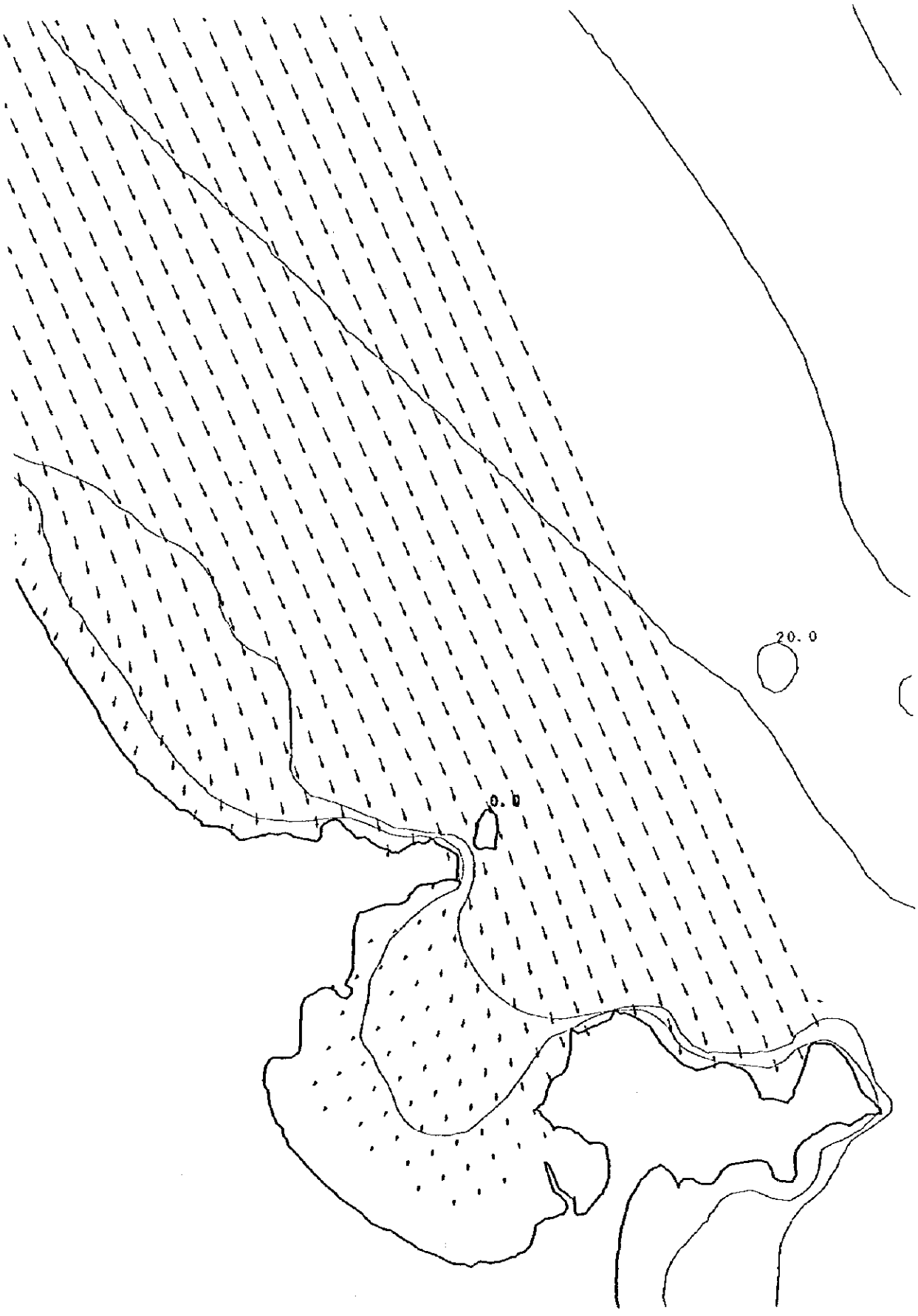


Figure A7.6.3 Wave Refraction and Shoaling (NNW)

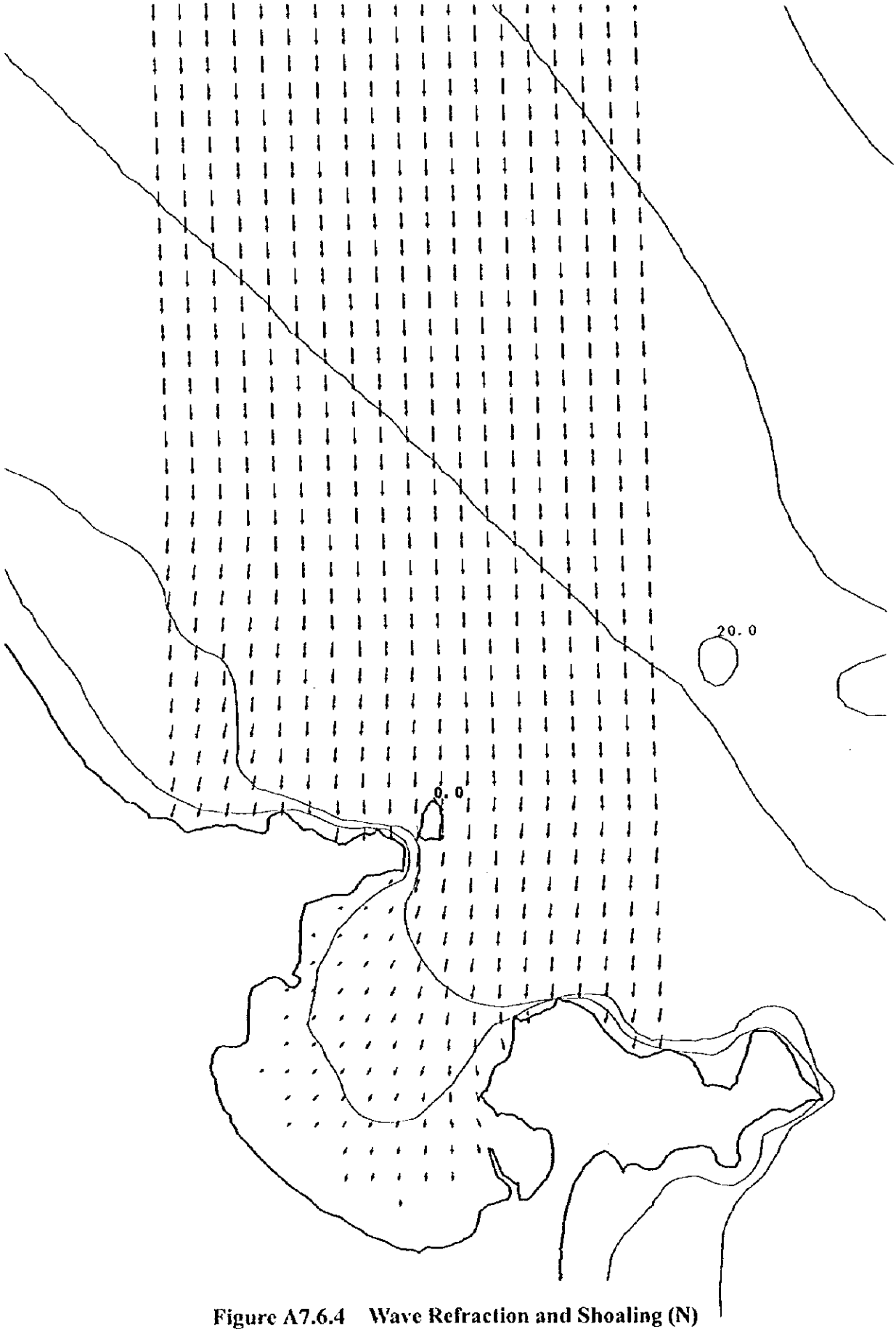


Figure A7.6.4 Wave Refraction and Shoaling (N)

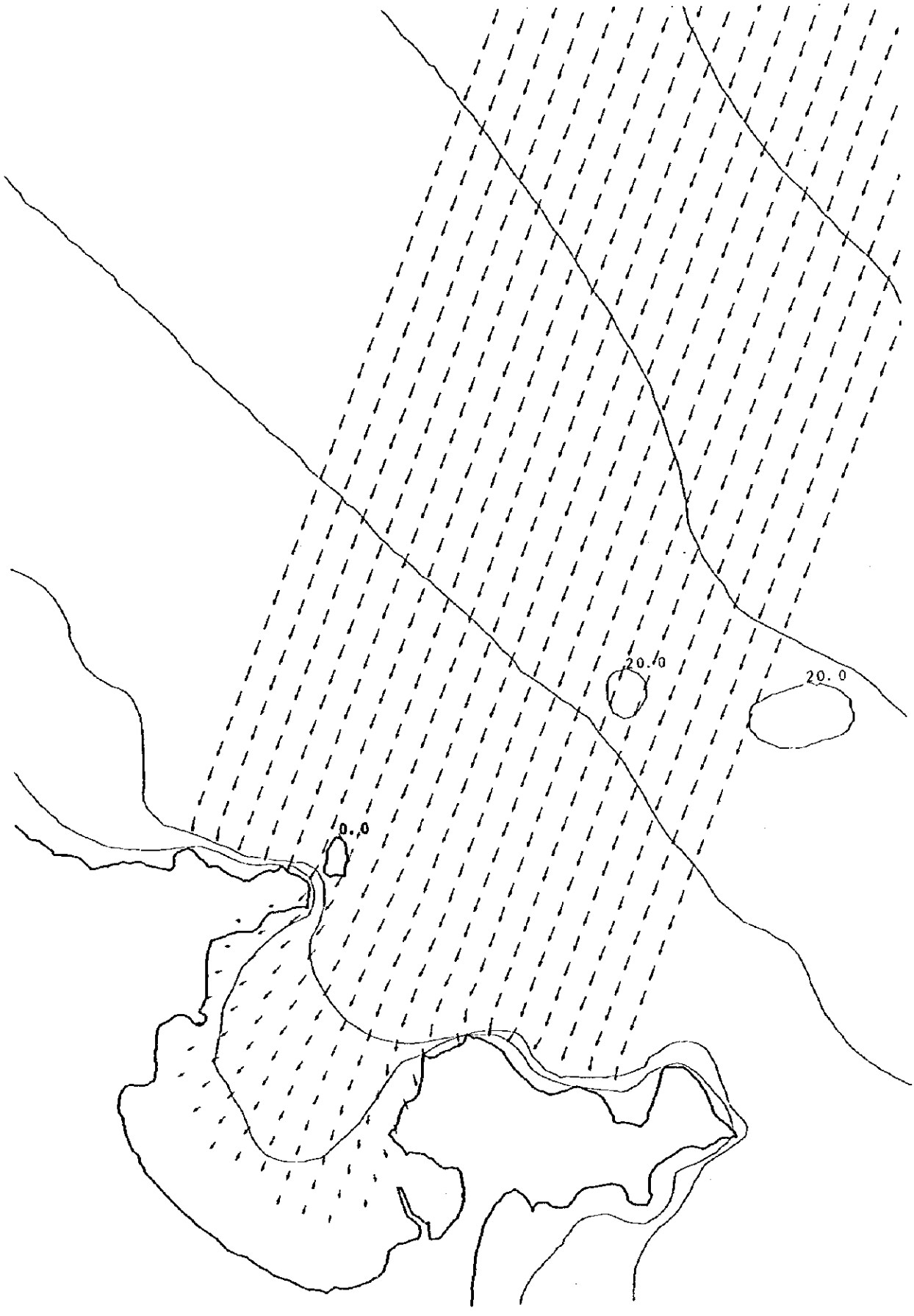


Figure A7.6.5 Wave Refraction and Shoaling (NNE)

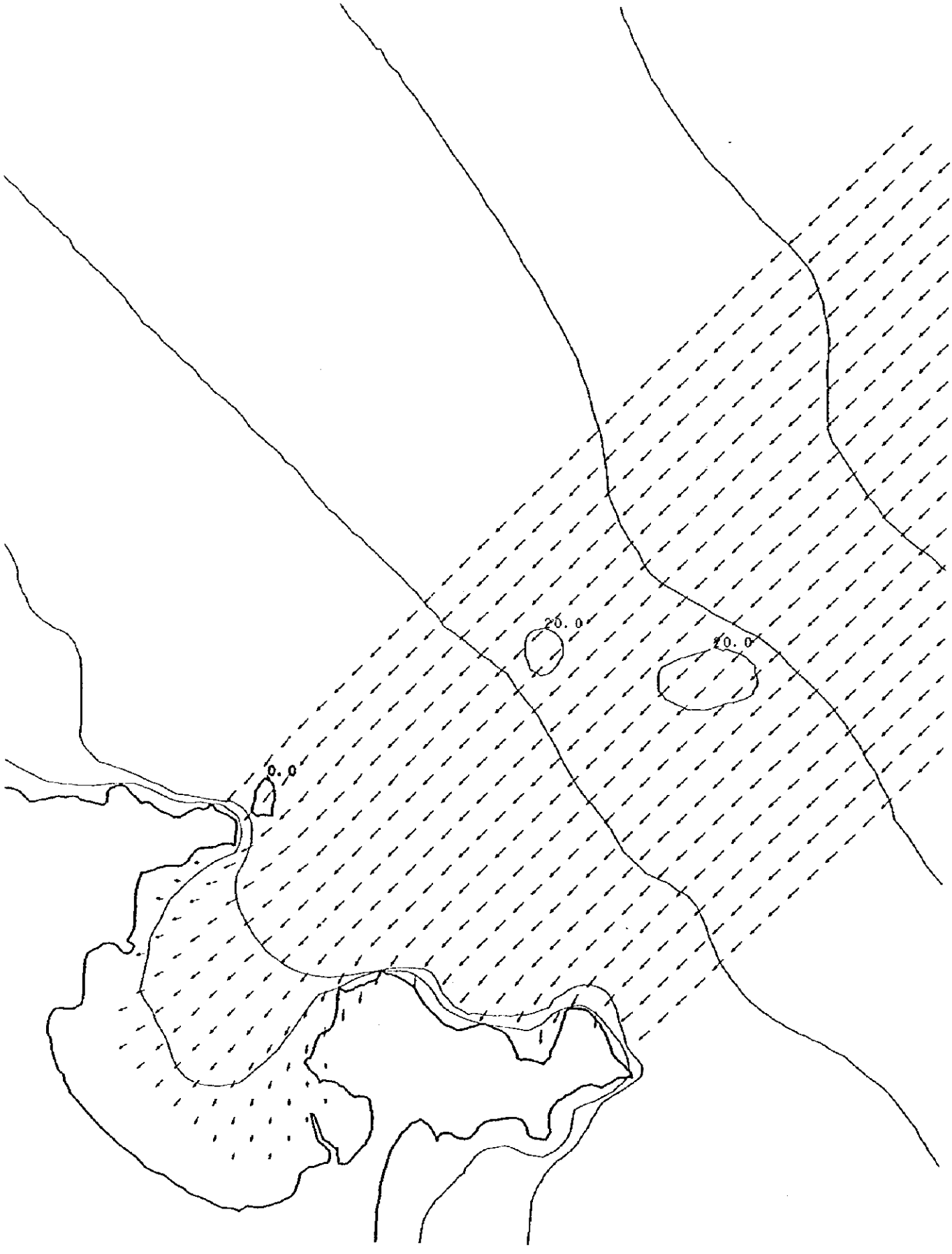


Figure A7.6.6 Wave Refraction and Shoaling (NE)

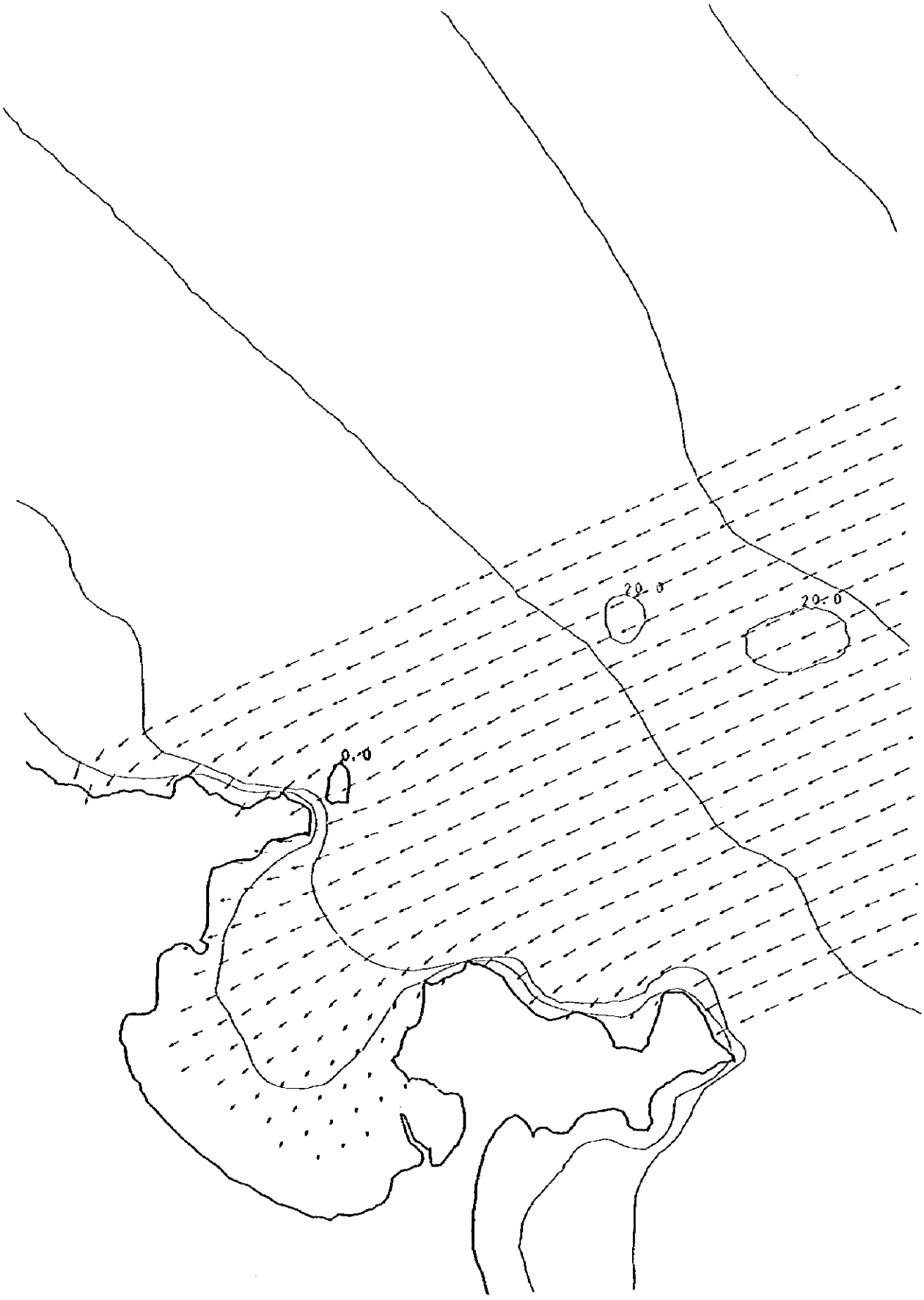


Figure A7.6.7 Wave Refraction and Shoaling (ENE)

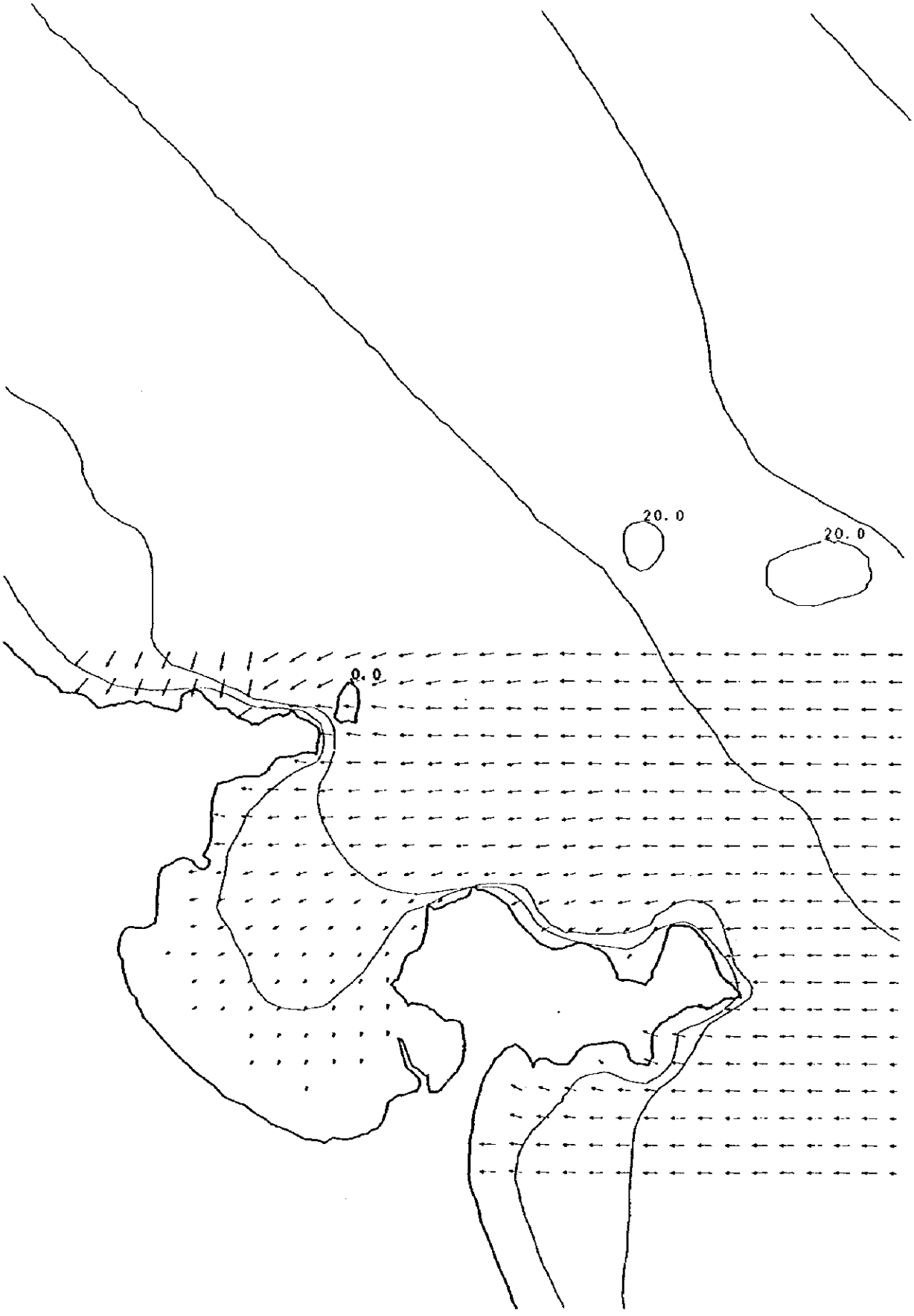


Figure A7.6.8 Wave Refraction and Shoaling (E)

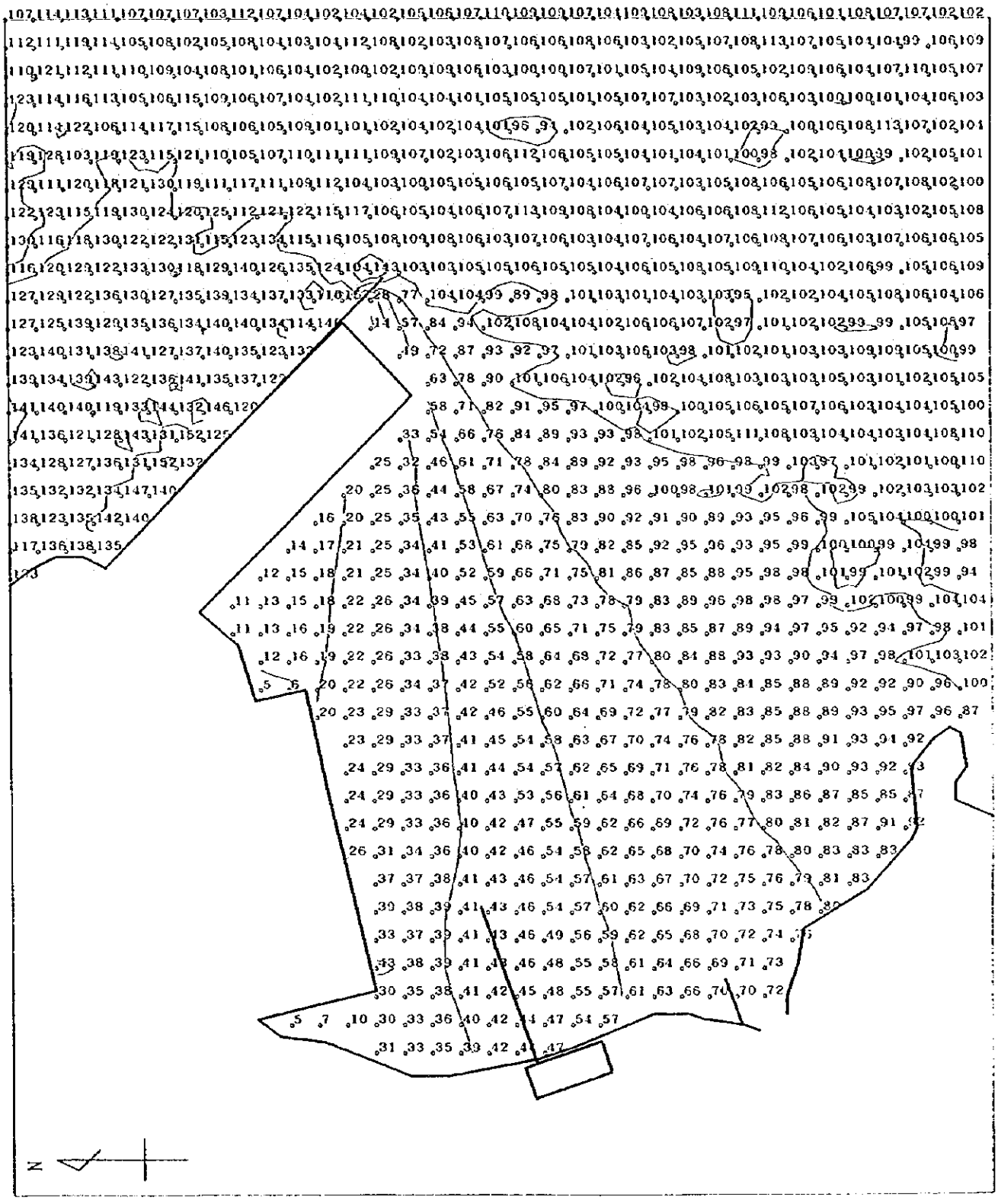


Figure A7.6.9 Wave Diffraction in Harbor (NE)

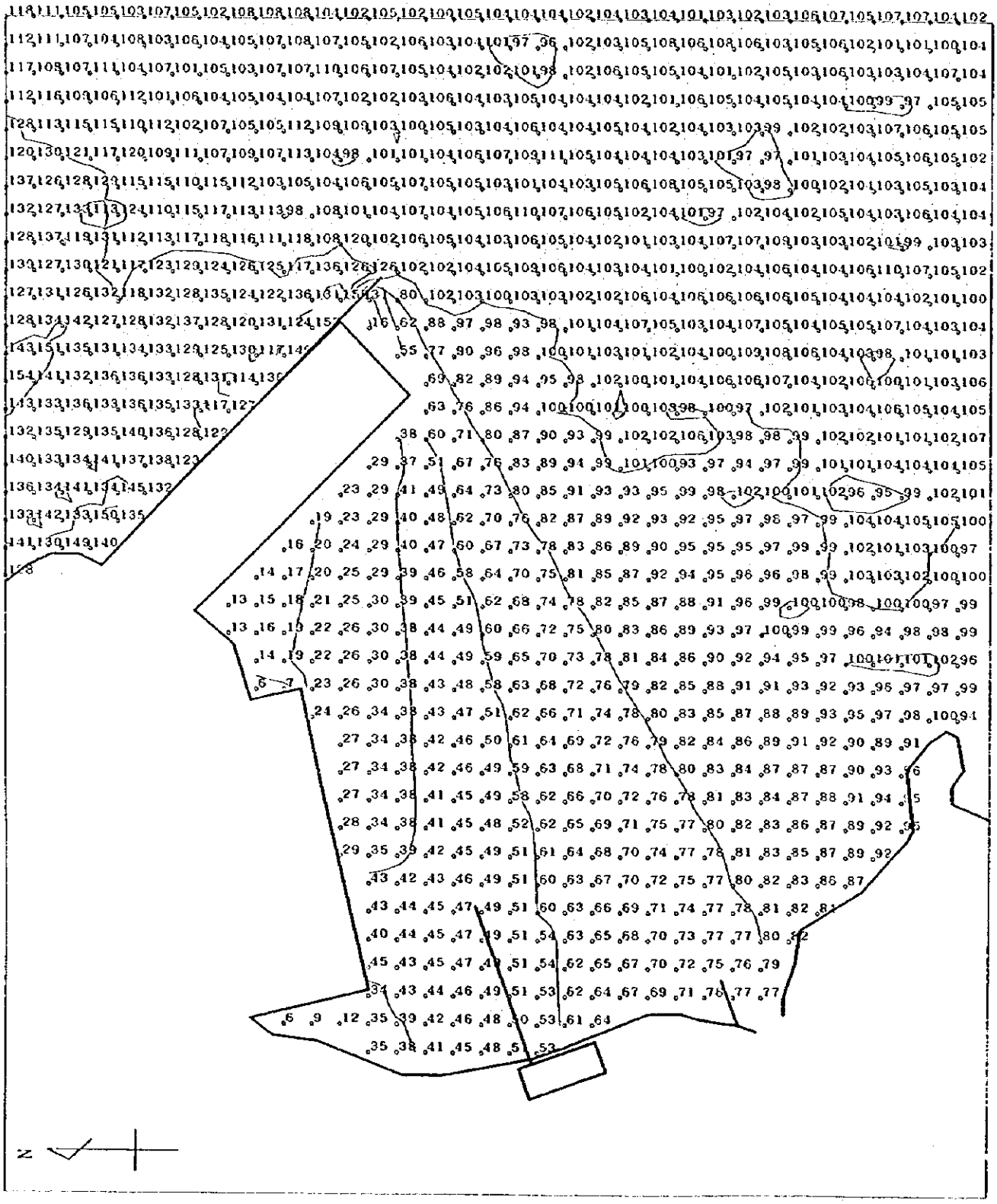


Figure A7.6.10 Wave Diffraction in Harbor (ENE)

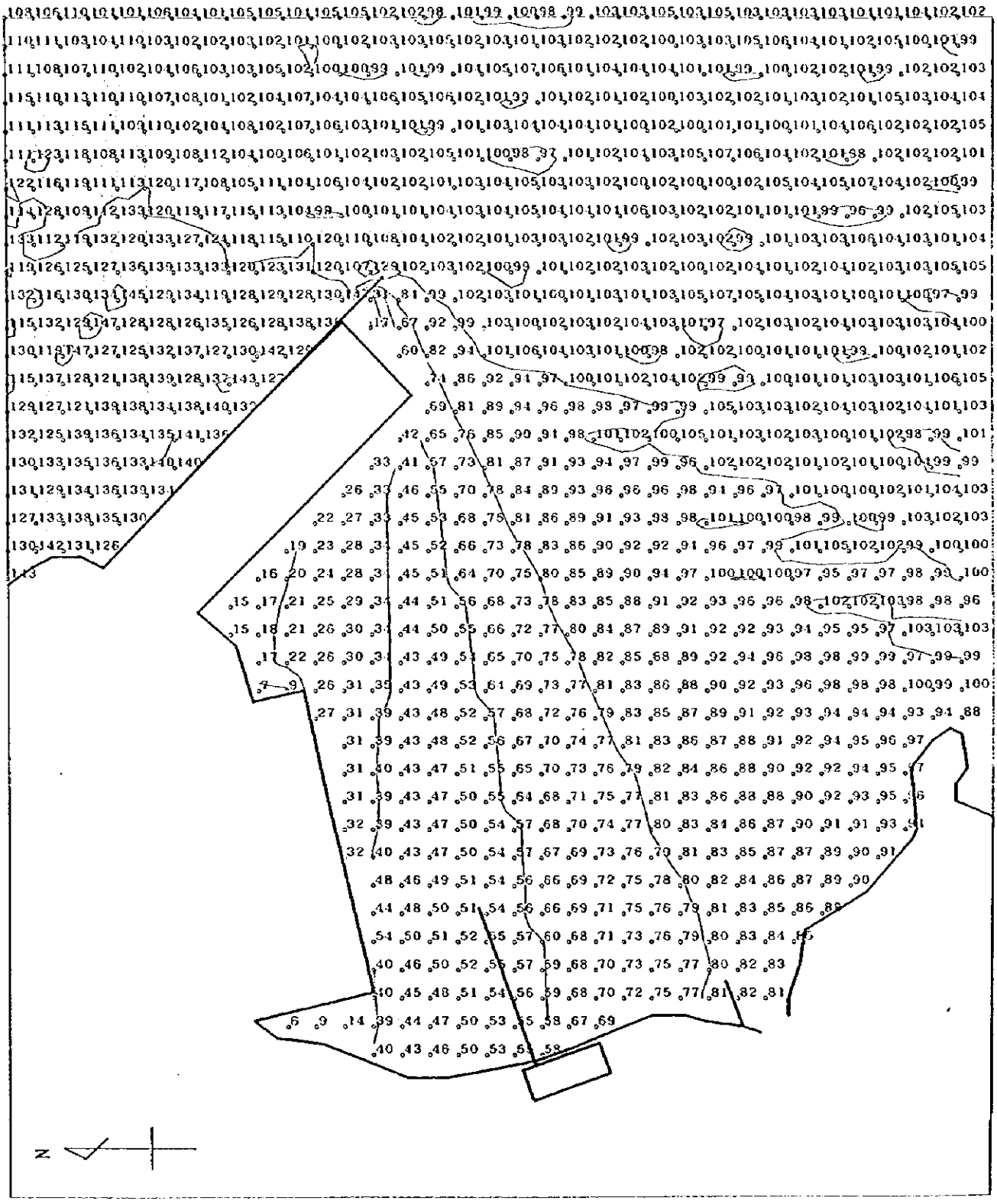
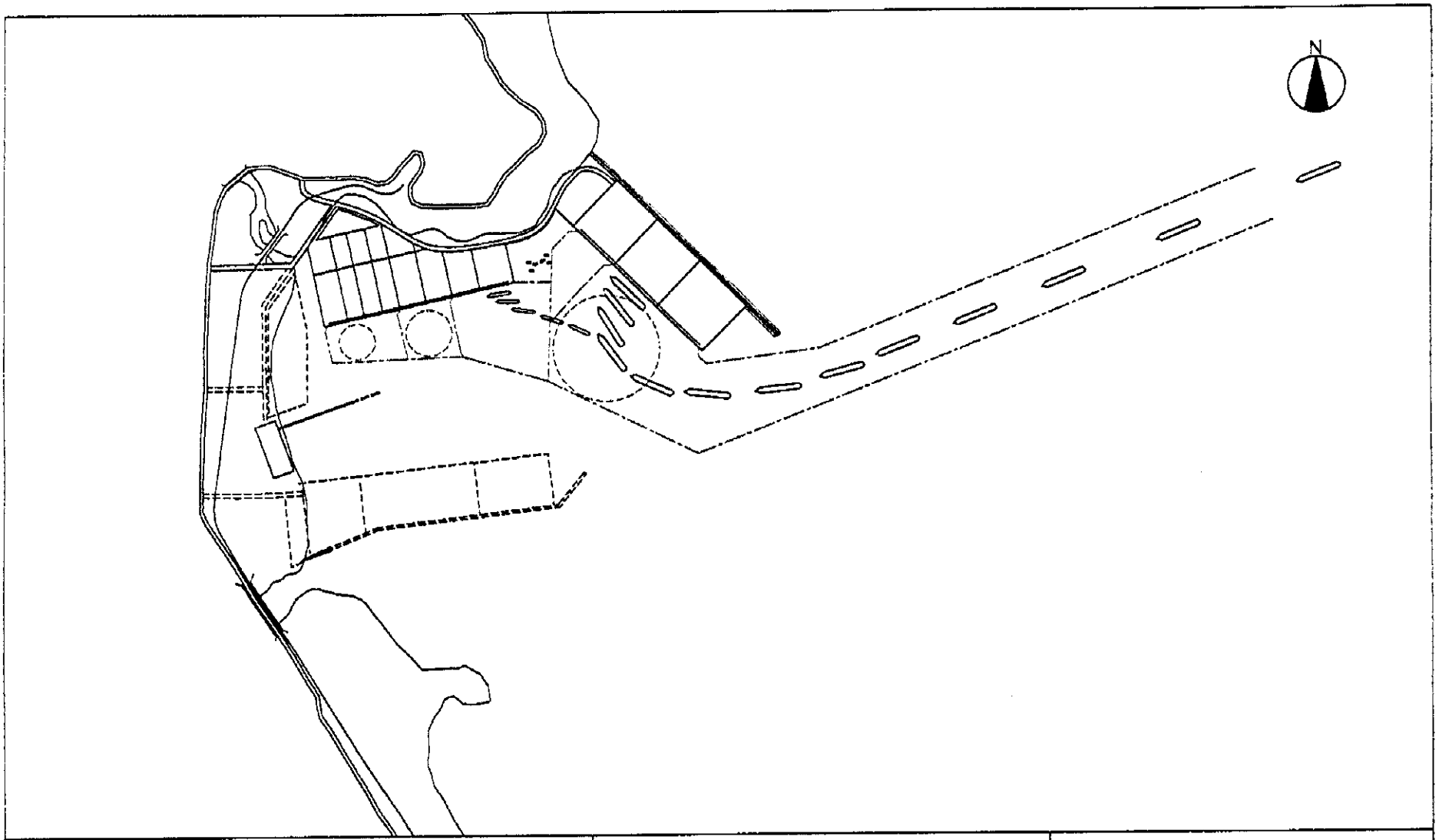


Figure A7.6.11 Wave Diffraction in Harbor (E)



JICA Port Development Study in Central Region	Figure A7.6.12	Final Report 1998
Lien Chieu Port Ship Maneuvering Illustration		FILE LC-MP-Ship