9-3 Planned Facilities

(1) River

In order to avoid stoppages or losses caused by flooding of the Filyos River, the river course will be realigned into a straight line and the riverbank will be armored.

An area for the river up to 400 meters width as a whole will be reserved.

In the river area, there will be a river channel and water reserves.

The river has two composite sections. The low-water section has a riverbed of 100 meters' width. The high-water section has 200 meters' width between the banks. The remained space for water reserve will be utilized for greenbelts and port roads.

The river mouth will have a training wall and a jetty to prevent closure of the river by sedimentation.

The river will not face toward the port basin, in order to avoid difficulty in maneuvering vessels and avoid sedimentation.

(2) Roads

The road system will be planned so as to guarantee smooth traffic throughout the port. The traffic volume from the general cargo and container cargo wharves in the year 2010 is estimated as around 1,600 vehicles/hour.

The traffic volume from the industrial area will be 12 vehicles/hour/ha.

Considering the traffic volume and the lane capacity(about 600 vehicles/hr), the port trunk road(east-west route) shall have 6 lanes.

The north-to-south roads on both sides of the riverbanks shall have 4 lanes. The port trunk road will cross the railway by an overpass-type bridge.

(3) Railway

The total volume of railway cargo from Filyos to Karabuk will be 4,470,000 tons in 2010. The breakdown is as follows: ore, 1,700,000 tons; coal, 1,600,000 tons; scrap 225,000 tons; billet 900,000 tons; others, 45,000 tons.

The volume of cargo from Karabuk to Filyos will be 1,850,000 tons in 2010.

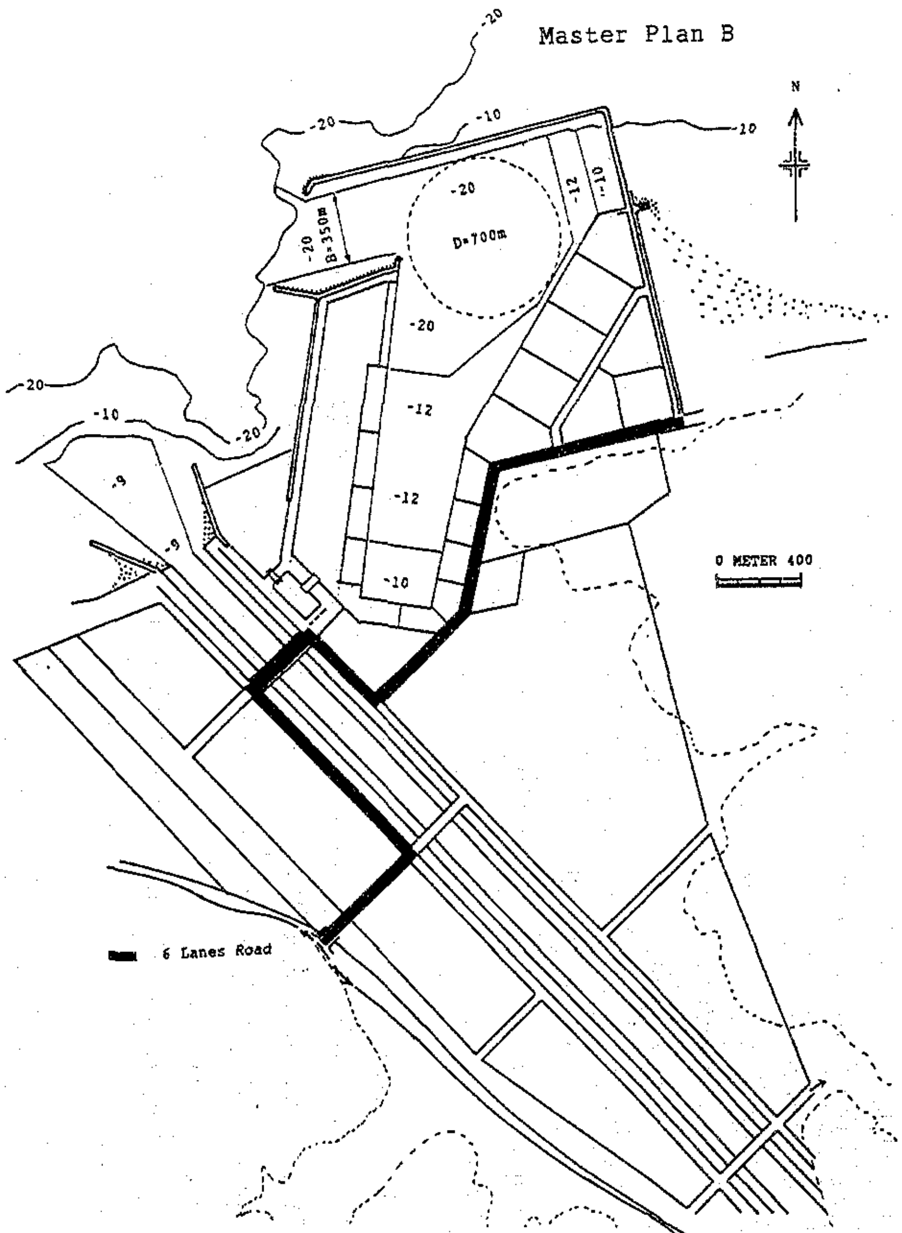


Fig. 9-2-2-2 Roads in Plan B

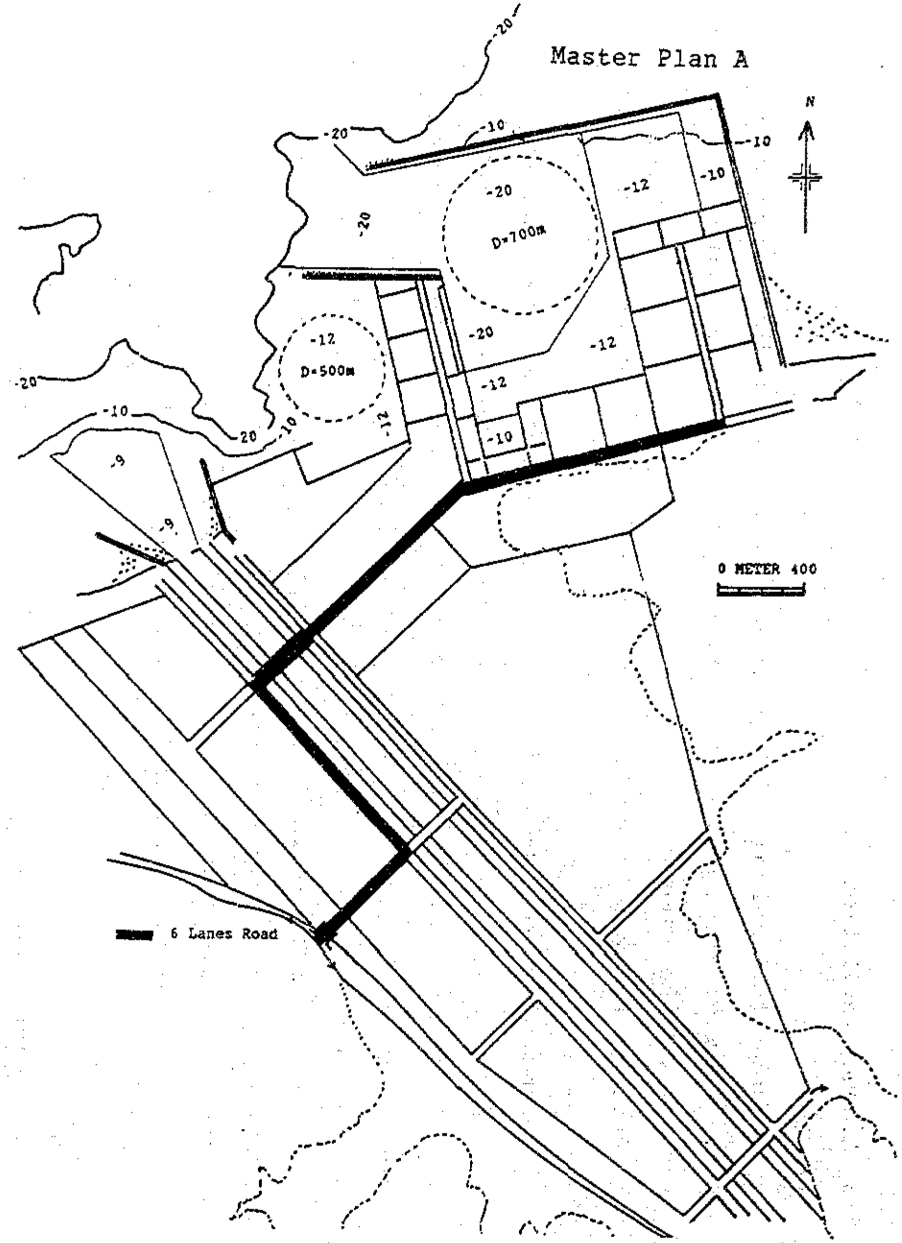


Fig. 9-2-2-1 Roads in Plan A

The railway station for Filyos port will be located on the western side of the river.

Bulky cargo, such as coal and ore, will be transported to the station by belt conveyors, and others will be transported by tractor-trailers.

There will be enough stacking space for port cargo next to the station area, and the space at the station will be wide and long enough for arrival, loading-unloading works and for leaving.

The cargo train will composed of two locomotives and 20 wagons carring 1,100 tons. The length of the train will be around 350 meters.

In the near future (within 5 years), the railway route from Karabuk to Filyos will have a signal system.

This will enable the number of passing cargo trains to be at least 1.5 times the present value, that is 5X1.5=8 trains for one direction.

By reforming the diagrams, at least 10 trains will be capable of traveling in each direction on the line daily before 1995.

(4) Wharves

1) Coal & Ore berth (C&Oberth), Iron/Steel berth

The location of the Coal and Ore berth is indicated as 1 in the layout plan, and Iron/Steel Berths are indicated as ②, ③, ④ and ⑤.

The size of the berths and the production of the cargo handling machine will be promoted when the cargo volume increases.

The location has soft soil from -15 meters to -40 meters, but there is bedrock at around -50 meters.

Considering the scale of the wharf and the soil conditions, the structure of this C&O berth will be a platform type wharf made of steel piles.

The backup space for wharves will be mainly consist of stock yards.

Assuming the stock volume to be 20% of annual throughput, and the average stock volume per unit space to be 4 t/m^2, the necessary area stacking coal, ore, billet and others amounting 4,470,000 tons per year will be 225,000m^2.

When a new 2 - million-ton integrated steel mill plant is built in the port area in year 2010, another 200,000m^2 stockyard for coal & ore will be located inside or outside the factory.

The size of products berths will be -12X240 meters to accommodate 30,000dwt class vessels. Machine for handling cargo at each berth will be

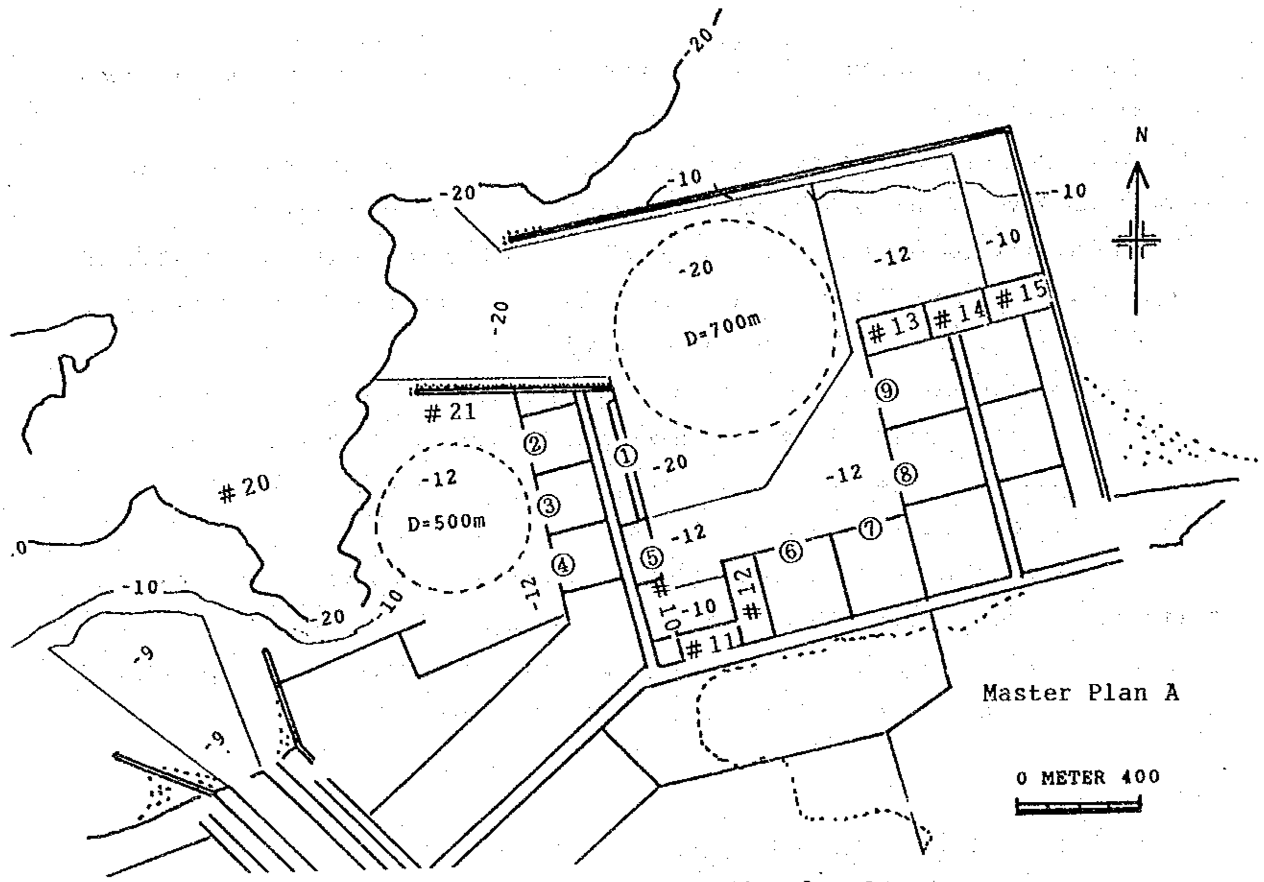


Fig. 9-2-3-1 Berths in Plan A

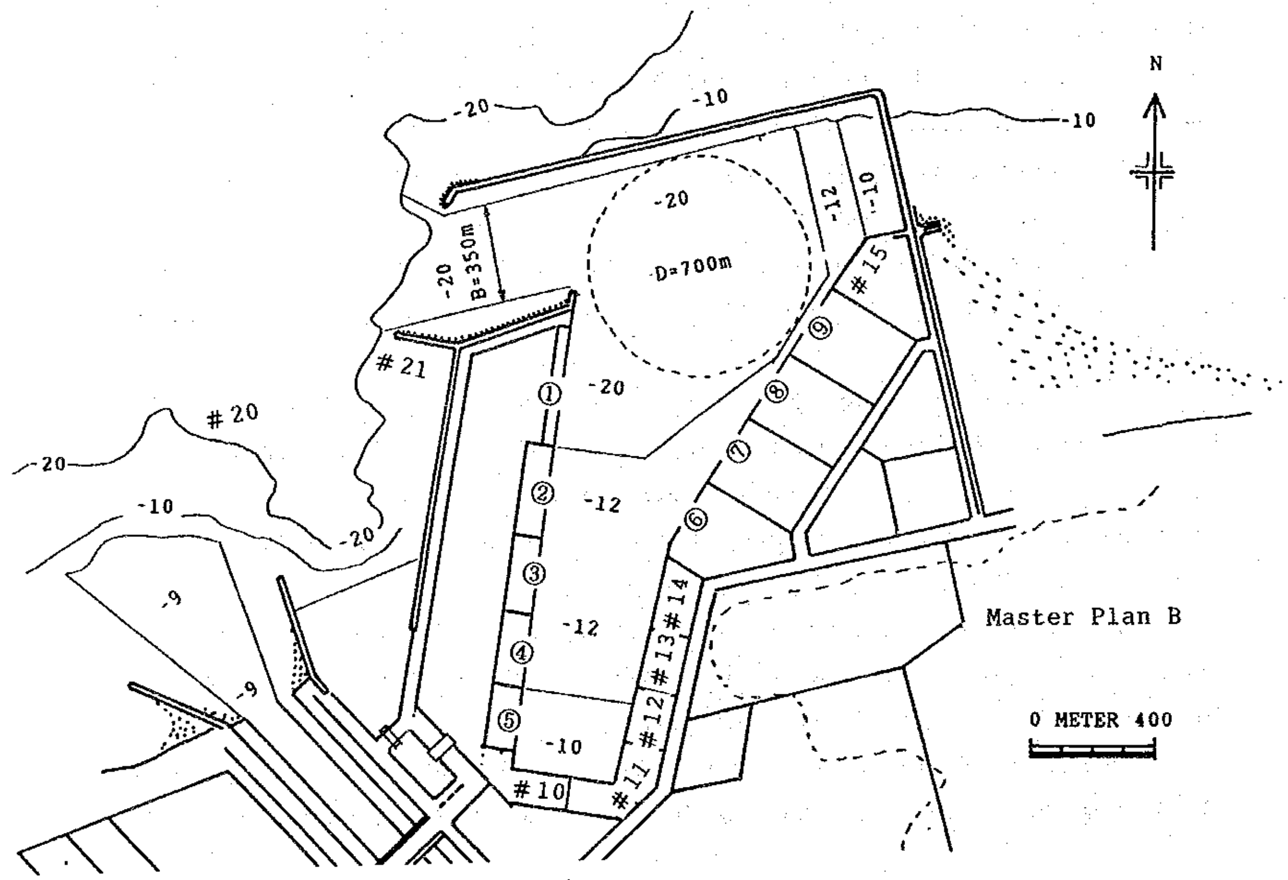


Fig. 9-2-3-2 Berths in Plan B

two quay cranes, ten sets of 100 ton tractor-trailers and a few lifts and cranes.

The backup space for loading steel products amounting to 1,850,000 tons is 95,000m^2.

In the year 2010, when a new integrated steel plant is constructed in the port area, another 100,000m^2 space will be necessary inside or outside the factory.

2) Container berths

Container berths are indicated as ⑥, ⑦, ⑧, and ⑨ in the layout plan.

Each container berth will have a -10 ～ -12 x 250 meter wharf which can accommodate 15,000 dwt class (880TEU) ship and 25,000 dwt class (1,500 TEU) vessels for Filyos Port.

The stacking yard will be wide enough (50,000m^2-100,000m^2) to attain maximum efficiency.

Among some ways of handling containers at yards, the team selected the transfer crane system for the master planning, since that system is said to have few breakdowns and is easy to operate.

Thus two gantry canes. 6 transfer cranes and 10 sets of tractor-trailers are assumed as the per-berth requirement for the purpose of cost estimation.

Concerning to the container freight station(CFS), one 5,000m^2 CFS at the port, and one 5000m^2 CFS with an open space of 60,000m^2 at Gerede or Ankara will be necessary for each container berth.

3) General Cargo berths

General Cargo berths are indicated as #10, #11, #12, #13, #14 and #15.

General cargo berths will have drafts -7.5 ～ -12m.

The backup area will have enough space for open storage, a shed (5,000m^2), and a cargo-handling opertion yard.

Although the cargo handling machine must be determined according to the actual cargo, we have assumed that grain will be handled by a pneumatic unloader, and that general cargo will be handled by ten forklifts per berth.

4) Oil berths

Oil berths will be located at #20 and #21 in the layout, if necessary.

Location #20 is at the -30 meter point for a Single Point Mooring Buoy(SPMB).

Crude oil will be handled here.

Wharf #21 will be used for loading oil products.

Location #21 can be used for additional wharves for coal or billet, if petro-chemical industries do not take part in the Filyos Project.

(5) Other facilities

1) Navigational aids, Meteorological information and communications systems.

Leading lights, light buoys, and lighthouses will be installed for the safety of vessels.

A meteorological information service and communications system shall be available, because these are fundamentals necessary for a 21st century port.

2) Bunkering, fresh-water supply, bilgewater treatment and ship repair Most of the services for supply, cleaning, and repair will be available at the port.

3) Hospitals, hotel and recreation facilities

The port will offer spaces for comfortable recreation facilities for seamen, factory workers, businessman and nearby residents.

9-4 Land Use

In the planning area, we will have the river area, railway station, stockyard, truck terminal and sheds, communication facilities, symbol park, hospitals, public offices, water supply station, power station, wastewater treatment, an industrial complex, mechanical shops, factories, bender shops, etc.

Beside the planned area, there are a lot of flat areas along the routes to Devrek and Bartin within 20Kms.

In case there is big demand for land throughout the Master Plan period, these areas will be able to meet all such demand.

Residential areas will be located in nearby towns, such as Hisaronu, Sartokova, etc.

Considering that there is a high possibility that heavy industry will locate in the planning area, as shown in Fig. 9-4-4-1 - 9-4-1-2 , we must be careful to maintain a pleasant environment.

For this purpose, greenbelts shall be planned for both the public-sector areas and the private-sector areas.

It is also necessary to have contracts between the public and private sectors to establish targets to prevent environmental pollution.

The planned land use is indicated in Table. 9-4-1 and Figs. 9-4-1-1 - 9-4-1-2.

Table 9-4-1 Land Use Plan

Place	Land use
Aa Ab	Waste water treatment
Ba Bb	Fuel tanks
Ca Cb	EPZ, or FTZ
Da Db	Stockyard
Ea Eb	Railway station
Fa Fb	EPZ, or FTZ
Ga Gb	Water supply station, Power station, Communication Center
	Recreation area, hospital, sports, hotels
Ha Hb	Industrial complex
Ia Ib	Industrial complex
Ja Jb	Stockyard
Ka Kb	Stockyard
La Lb	Ship repair, mechanical shop
Ma Mb	Symbol park
Na Nb	Grain silos, flour mills
Oa Ob	Saw mills

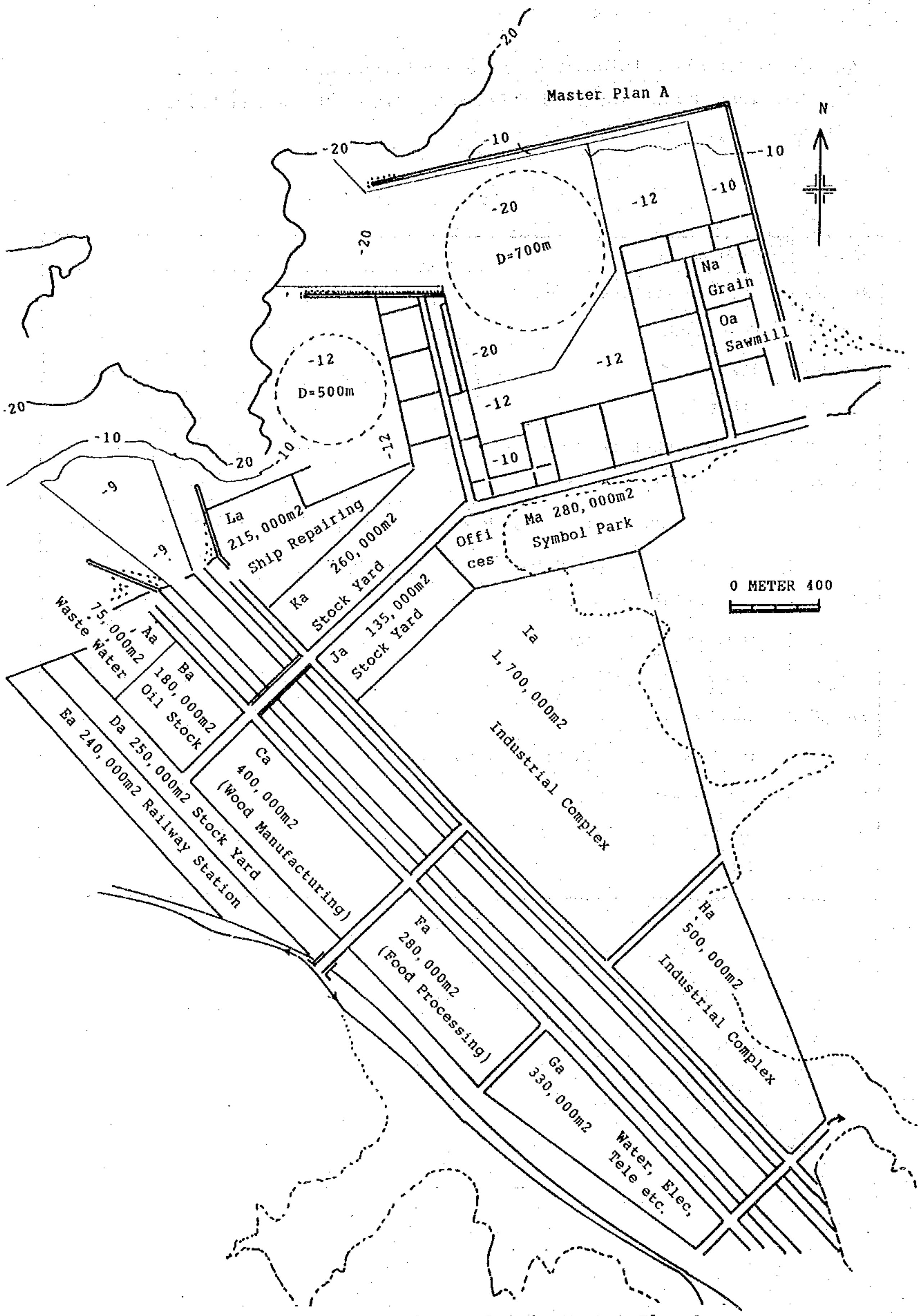


Fig. 9-4-1-1 Land Use Plan in Master Plan A

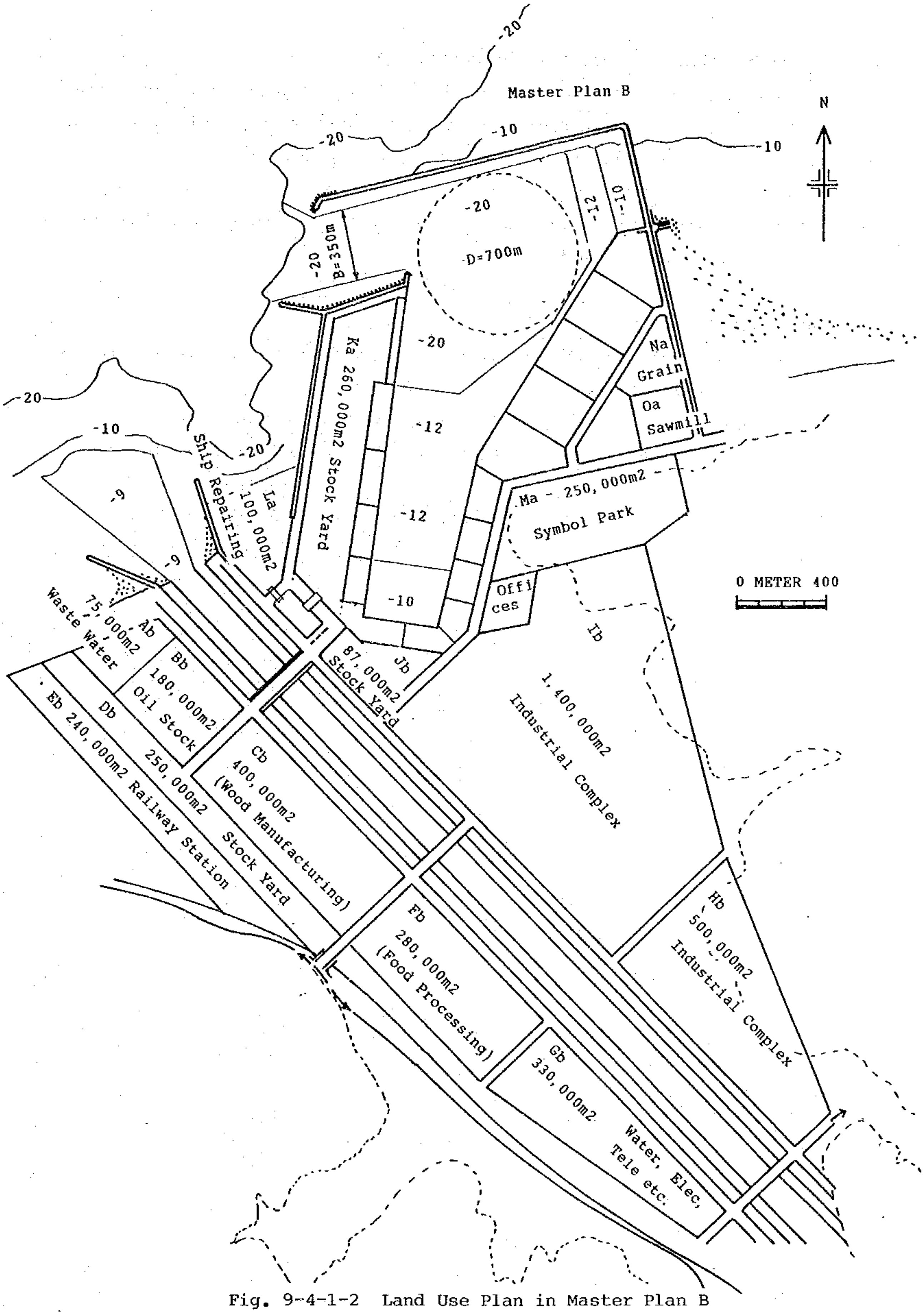


Fig. 9-4-1-2 Land Use Plan in Master Plan B

9-5 Implementation Schedule for the Master Plan

The development of Filyos Port is devided into two phases. The first stage, the year 2000 is the target stage for short term development, and the second stage, the year 2010 is that of master plan.

Based on the berth requirements, indicated in Table 11-1-1, implementation schedule is examined. The result is summarized in Table 9-5-1 as the form of bar-chart.

9-6 The Project Cost

The project cost for the two alternative master plans were estimated based upon 1990 year price.

The estimated costs with breakdown are indicated in Table 9-6-1.

The result of the estimation shows that there are small advantages in Plan B.

The project cost for the Master Plan is around 1,500 million US dollars.

Table 9-5-1 Implementing Steps for The Master Plan

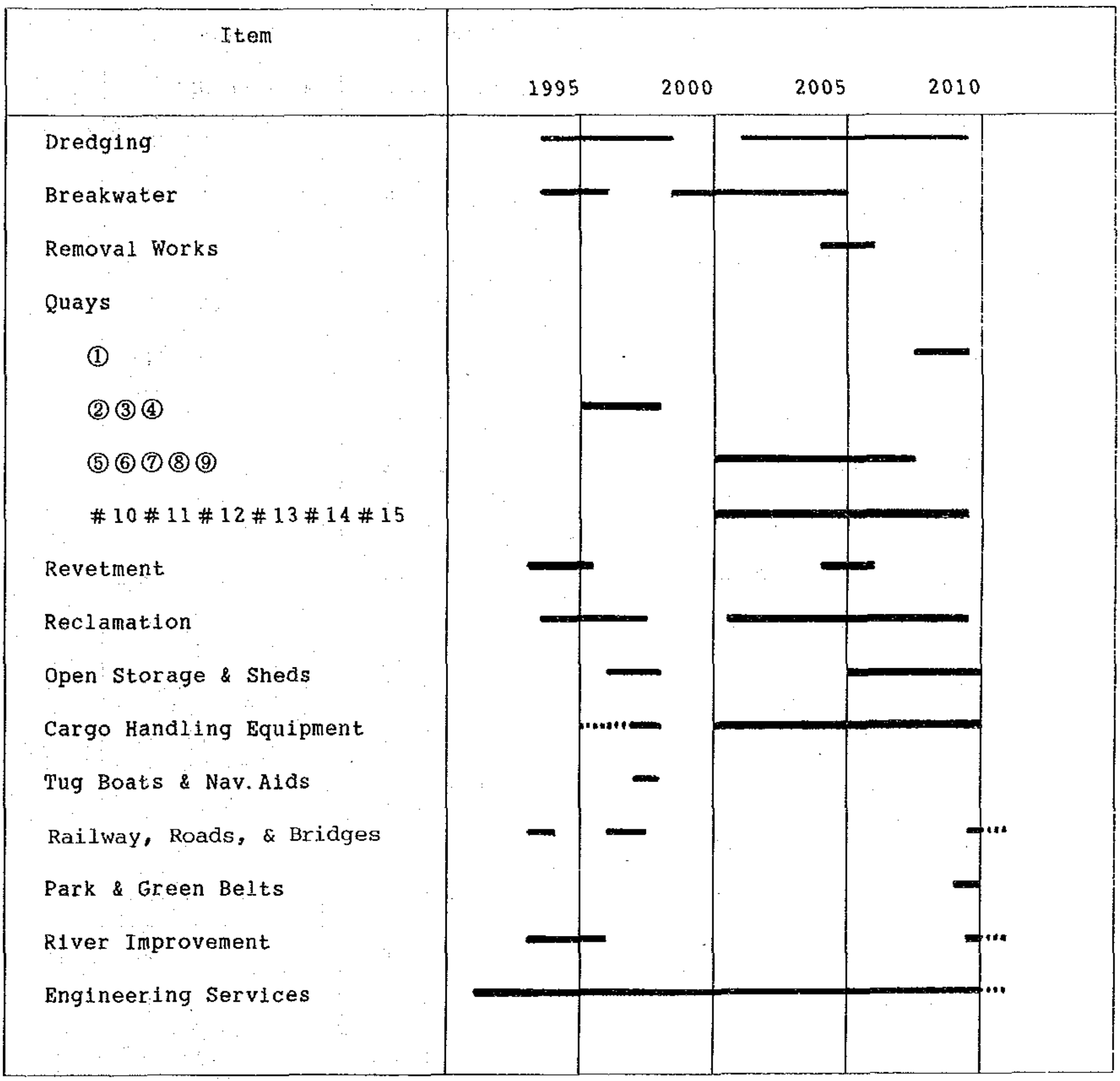


Table 9-6-1 Project Cost for two Alternative Plans

Item	Plan A million US$	Plan B million US$
Dredging	39.21	55.70
Breakwater	210.90	215.15
Removal Works	3.88	3.57
Quays	461.34	482.12
Revetment	104.83	24.24
Reclamation	37.27	55.70
Open Storage & Sheds	106.63	99.42
Cargo Handling Equipment	180.33	180.33
Tug Boats & Nav.Aids	3.73	3.73
Railway, Roads, & Bridges	75.80	74.51
Park & Green Belts	3.01	2.71
River Improvement	21.80	21.80
Sub Total(1)	1,248.73	1,218.98
Engineering Services	62.44	60.95
Sub Total(2)	1,311.17	1,279.93
Tax(10%)	131.12	127.99
Contingency(5%)	57.71	62.08
Grand Total	1,500.00	1,470.00

based on 1990 price

US$ 1.0 = J¥ 150 =TL 2,693

9-7 Engineering Aspects

9-7-1 Calmness in the Basin

Port activities mainly consisting of cargo-handling are disturbed by winds, waves, currents, seiches, etc. A port ought to be planned to keep its mooring facilities as calm as possible against the disturbance due to waves. The disturbance in the basin is evaluated for the proposed port layouts A and B at the stages of short term plan in 2000 and master plan in 2010. The reflection coefficients of facilities are given as Fig.9-7-1. The directional occurrence of waves is plotted in Fig.9-7-2, using the heights and periods of significant waves observed with a wave gauge in Filyos and the wind directions at each corresponding time observed in Zonguldak. Since the winds are supposedly affected by surrounding buildings and landform in Zonguldak, it is afraid that wave directions may not be represented by wind directions. Therefore the observation of wave direction is also recommended to be carried out during designing and constructing stages, in addition to the observation of wave height and period. Figs. 9-7-3 to 6 show the wave height ratios or the ratio of wave height at each location to incident wave height in all possible wave directions, Finally workable ratios or the ratios of workable days to total days were estimated for both plans A and B in 2000 (short term plan) and 2010 (master plan) in Tables 9-7-1 and 2.

The critical heights of cargo-handling are regarded between 0.5 to 1.0 m, depending on the types and tonnages of vessels, and affecting the efficiency of cargo-handling.

The plan B layout can keep the basin calmer than the plan A layout, and perfectly calm in 2010.

9-7-2 Beach Erosion and Sedimentation.

The estuary of Filyos River easily deforms its landform seasonally and suddenly by storms.

In rainy season the river mouth bifurcates, but the west outlet is usually blocked in dry season.

The prevalent direction of littoral drift is presumed to be westward, and some movement occurs in the opposite direction.

A few groins are planned to prevent the basin against the sediment due to littoral drift in each layout.

Some sand movement also occurs in on-offshore direction.

A long Hisarönü coast, low beach scarp was formed by beach erosion due to storms in the winter of 1990.

Some sedimentations will occur possibly along the channels and in the basins. However these sedimentations are expected to diminish with well planned breakwater.

9-7-3 Flood

Filyos River meanders and perpetually erodes the banks on concave side, increasing the curvatures of meandering.

On both banks, there exists a narrow range without vegetations as high as 1m or so above ordinary eater surface.

This level suggests the swollen floods in recent years, however no distinct traces remain on riparian flat lowland.

9-7-4 Assumed Sections

(1) General

In general, the proposed site for the Filyos Port has unfavourable soil conditions, and the foundation improvement works will be required.

Port facilities are broadly divided into two (2) categories; protective facilities and berthing facilities. The assumed sections of breakwater as protective facilities will be of rubble mound type using the stone materials which are abundant in Turkey.

It is assumed that the berthing facilities will be of piled type supported by bedrock which can cope with differential settlement, because the cargo handling equipment will usually be mounted on superstructure of the berthing facilities.

Fig.9-7-1(a) Reflection Coefficient

Plan A (2000)

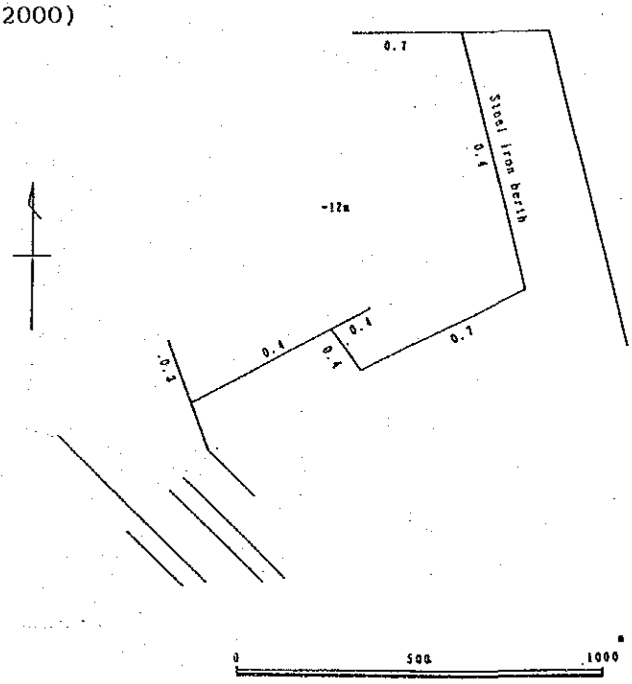


Fig.9-7-1(b) Reflection Coefficient

Plan B (2000)

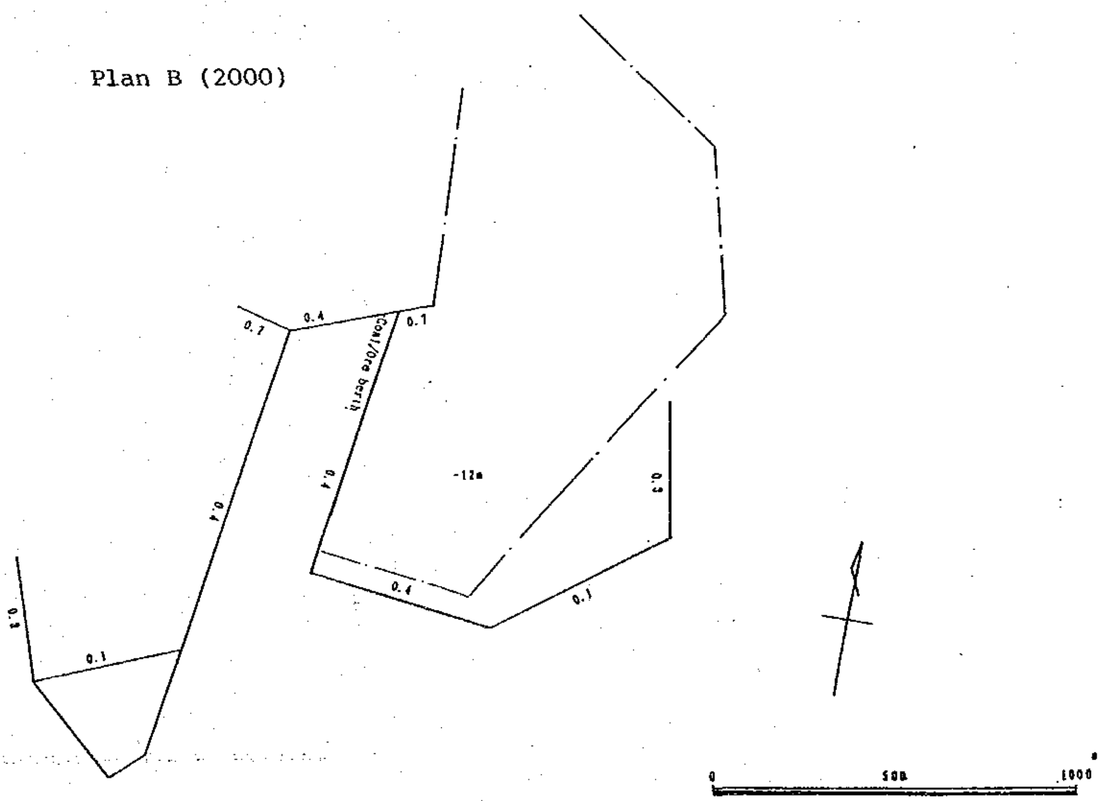


Fig.9-7-1(c) Reflection Coefficient

Master Plan A (2010)

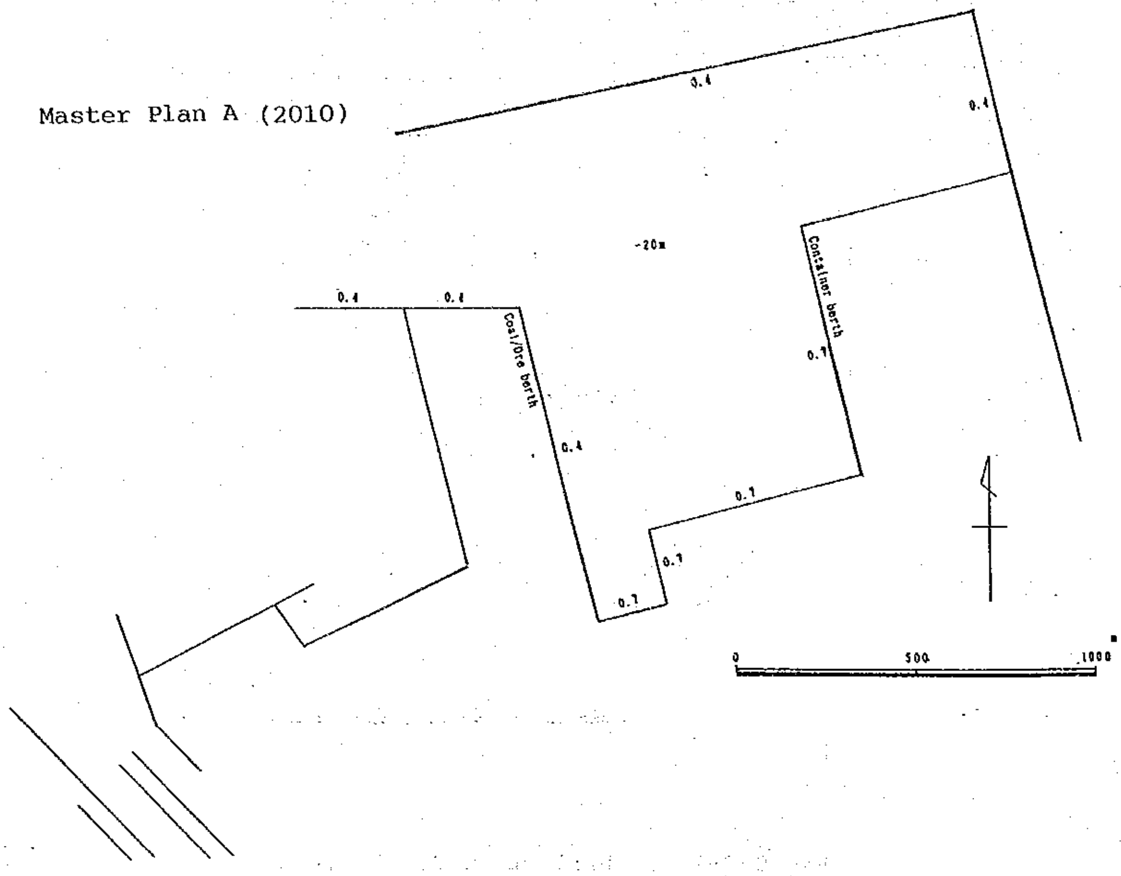


Fig.9-7-1(d) Reflection Coefficient

Master Plan B (2010)

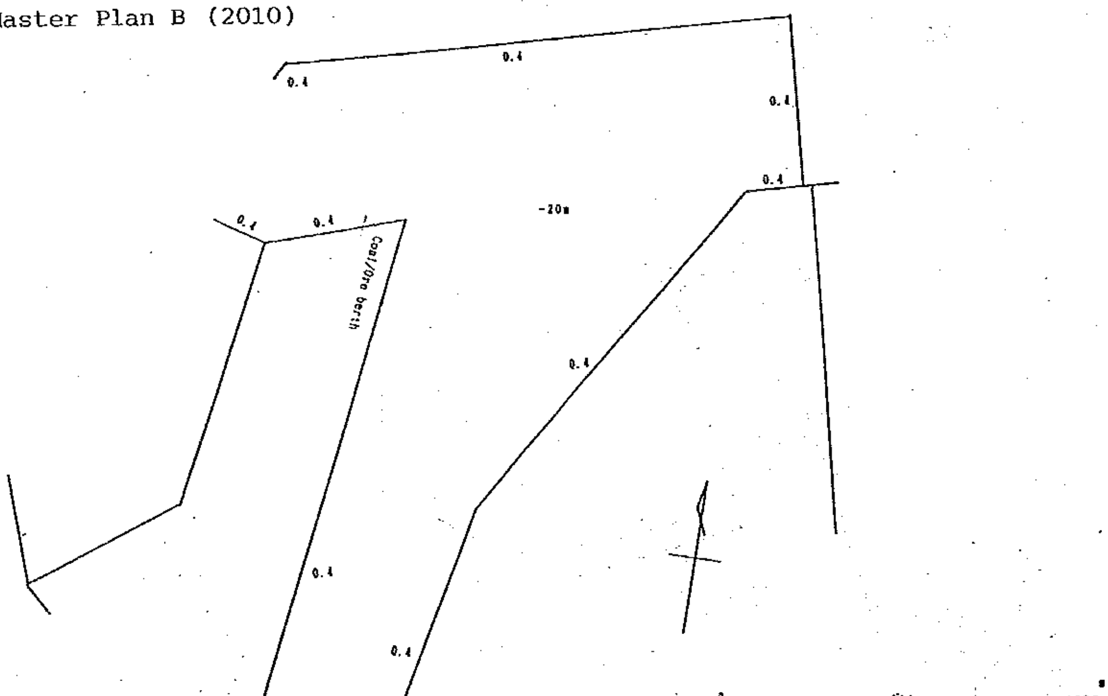


Fig.9-7-2 Frequency of Wave Occurrence

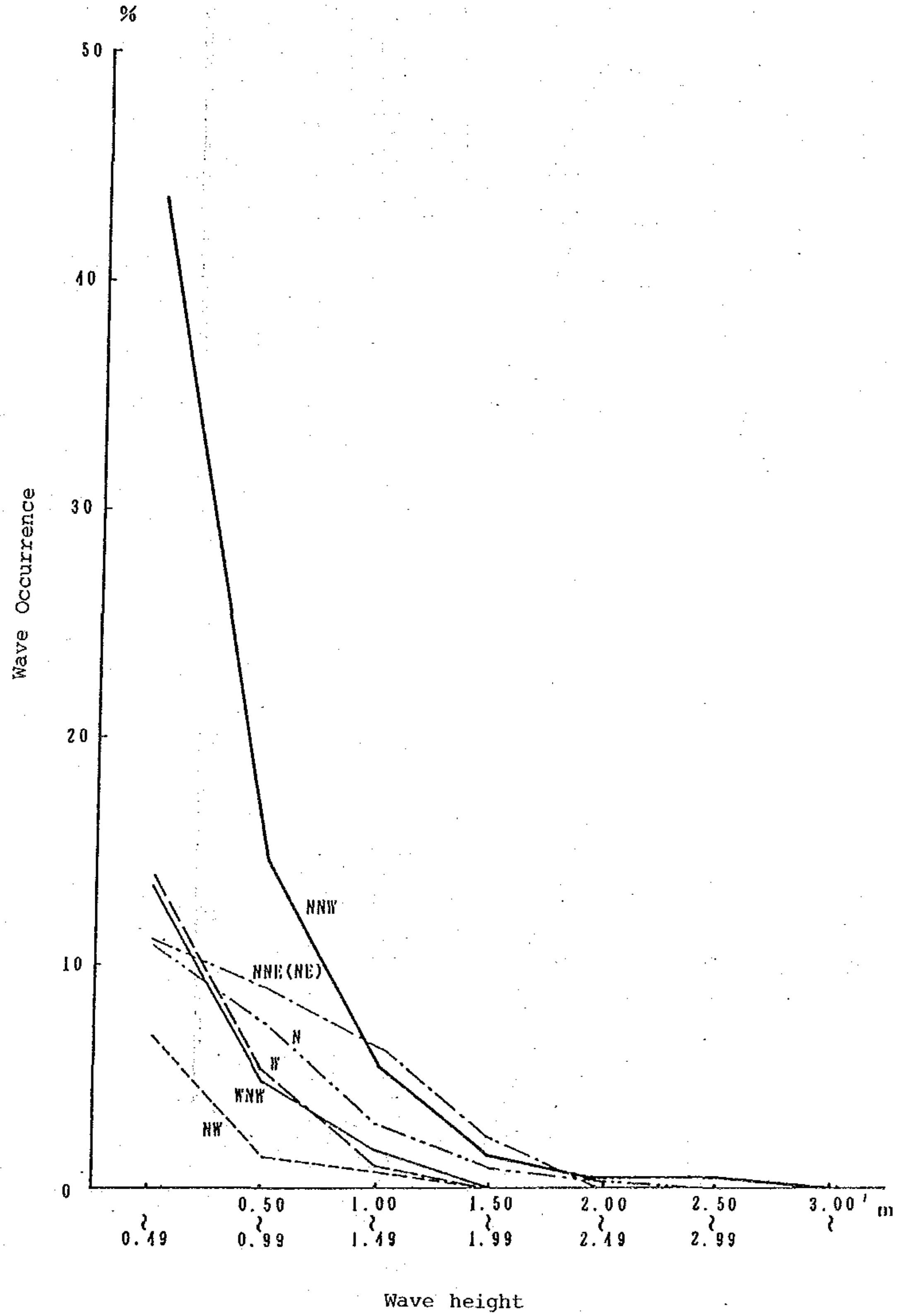


Fig.9-7-3(a) Wave Height Ratio

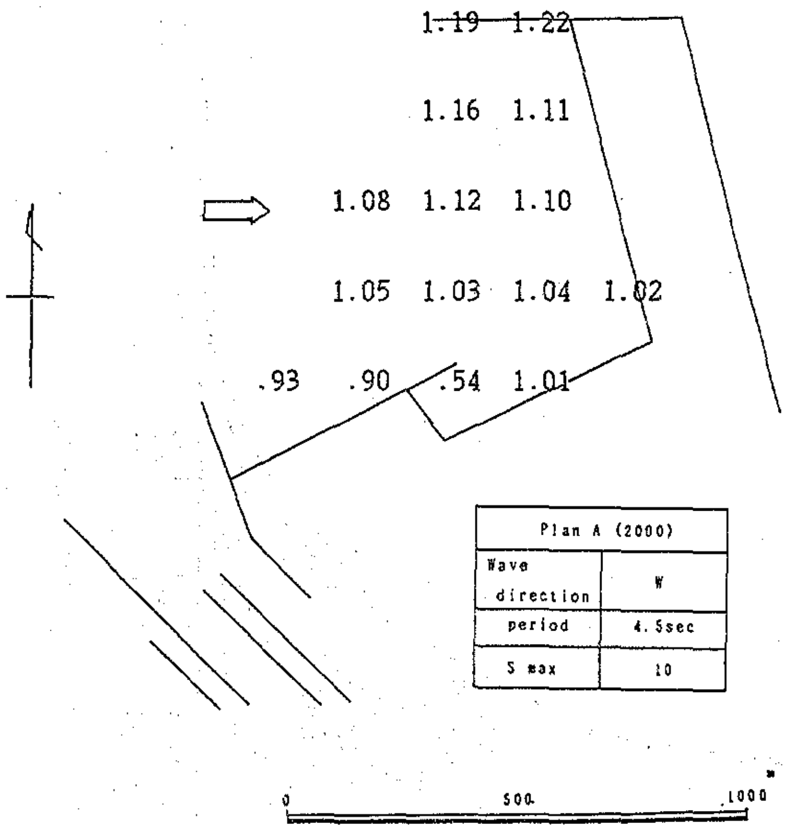


Fig.9-7-3(b) Wave Height Ratio

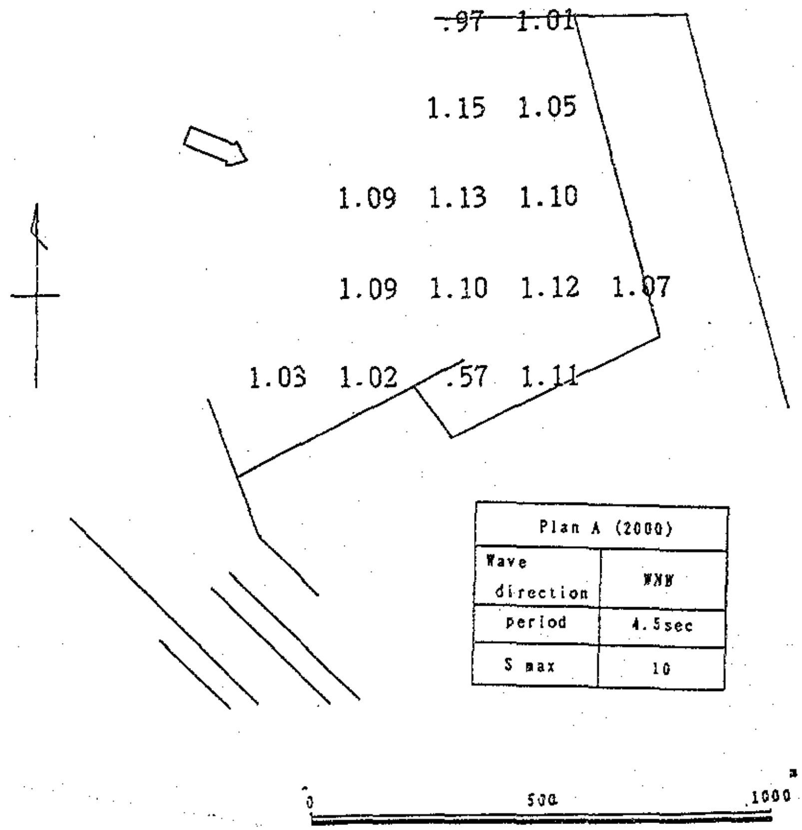


Fig.9-7-3(c) Wave Height Ratio

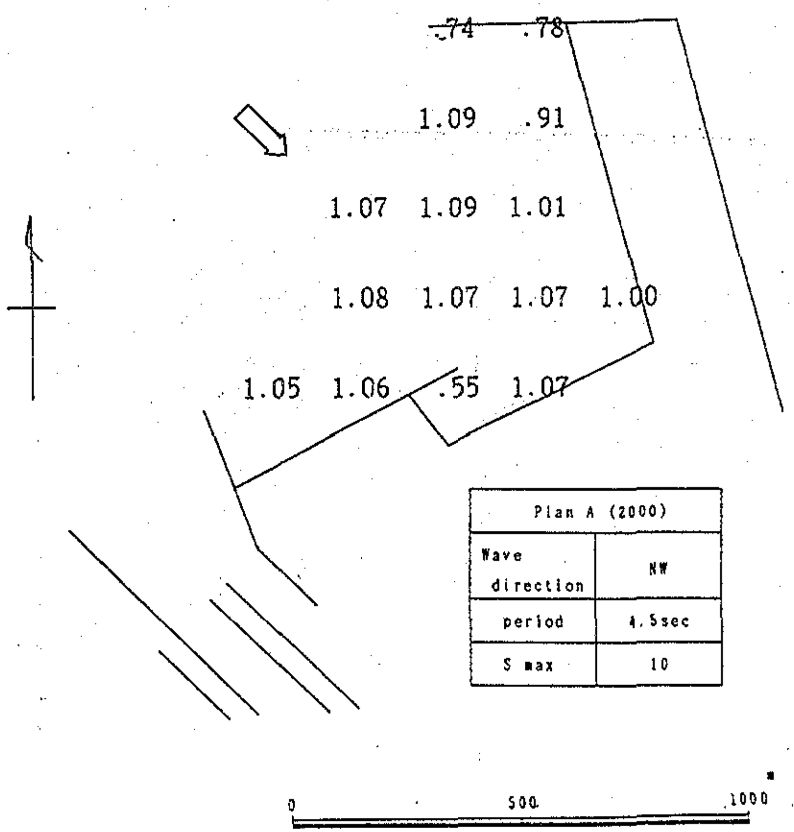


Fig.9-7-3(d) Wave Height Ratio

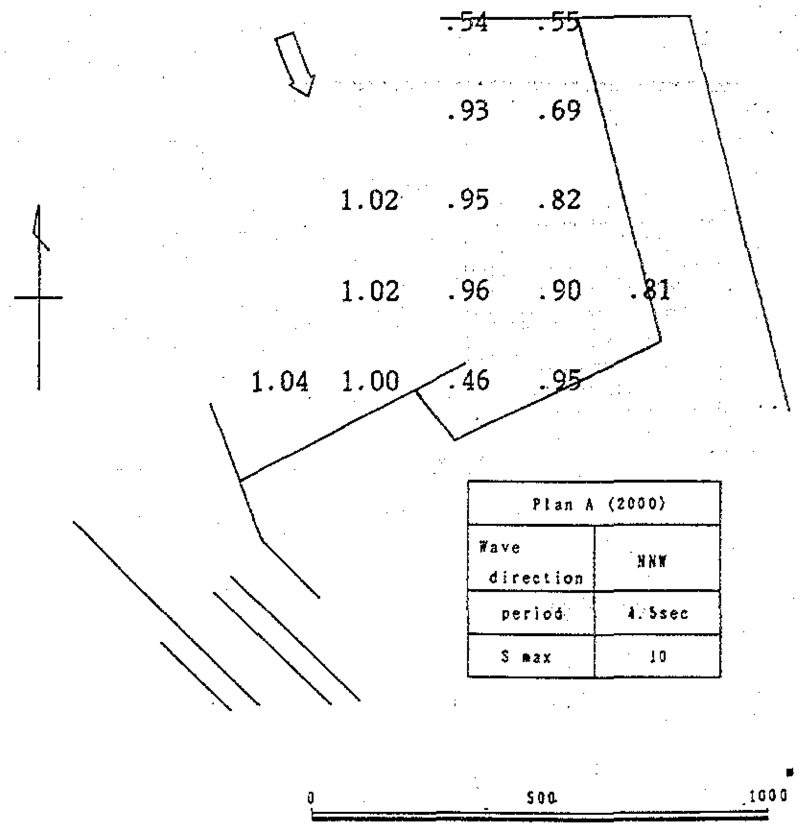


Fig.9-7-3(e) Wave Height Ratio

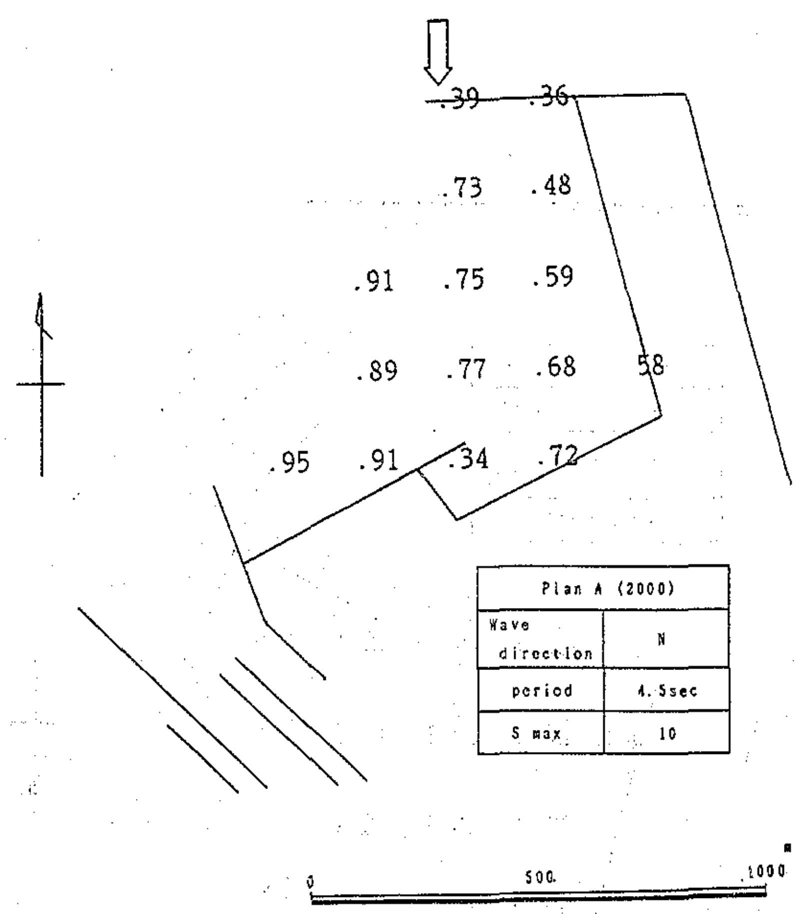


Fig.9-7-3(f) Wave Height Ratio

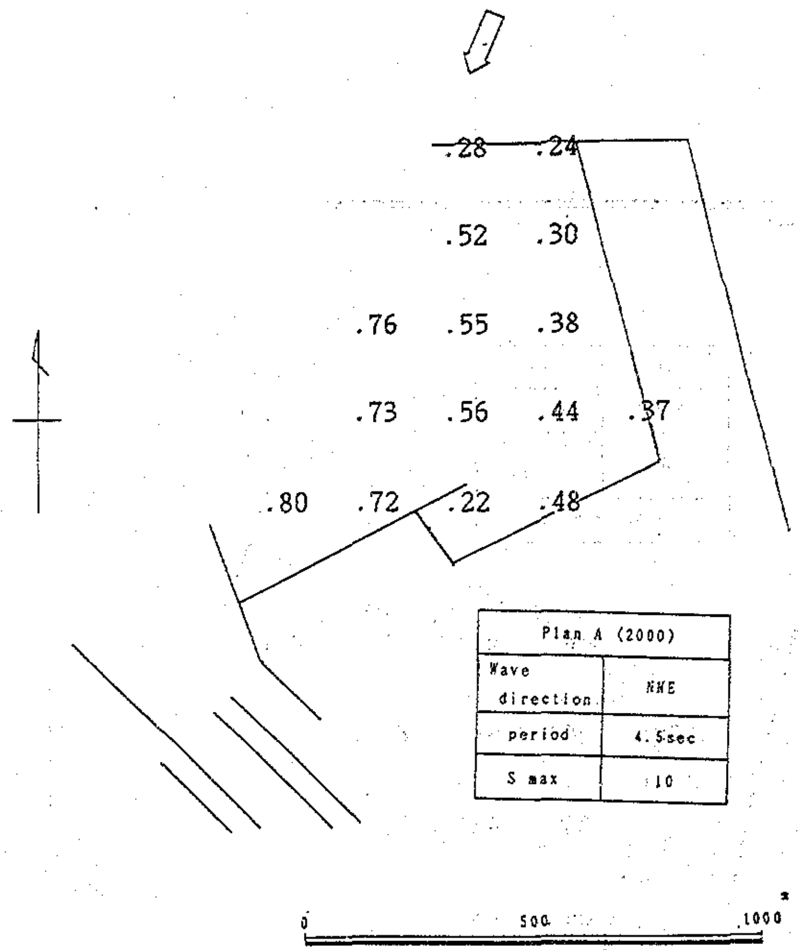
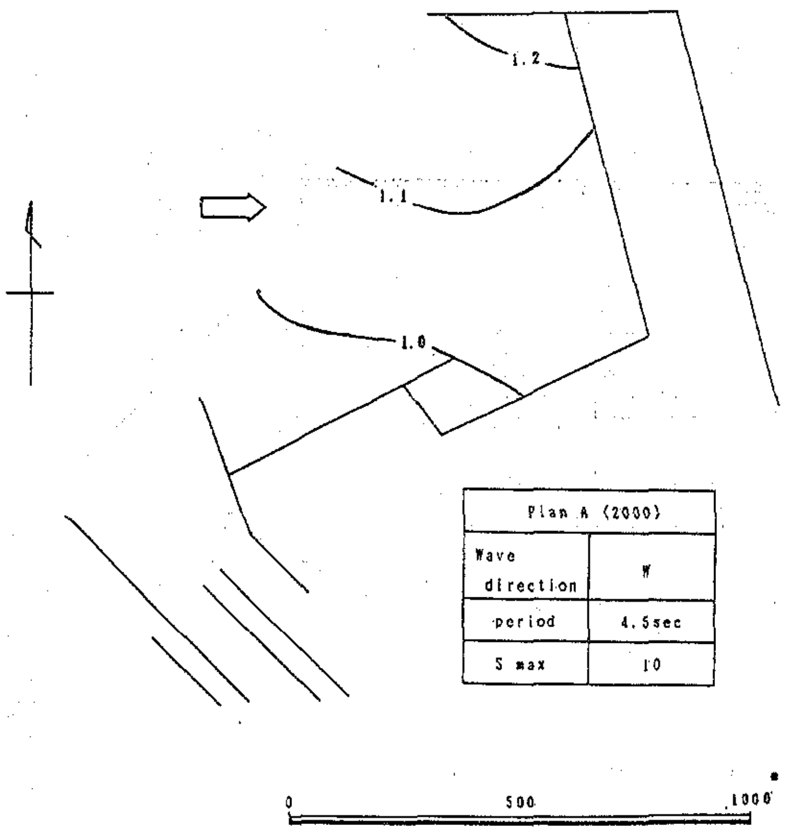
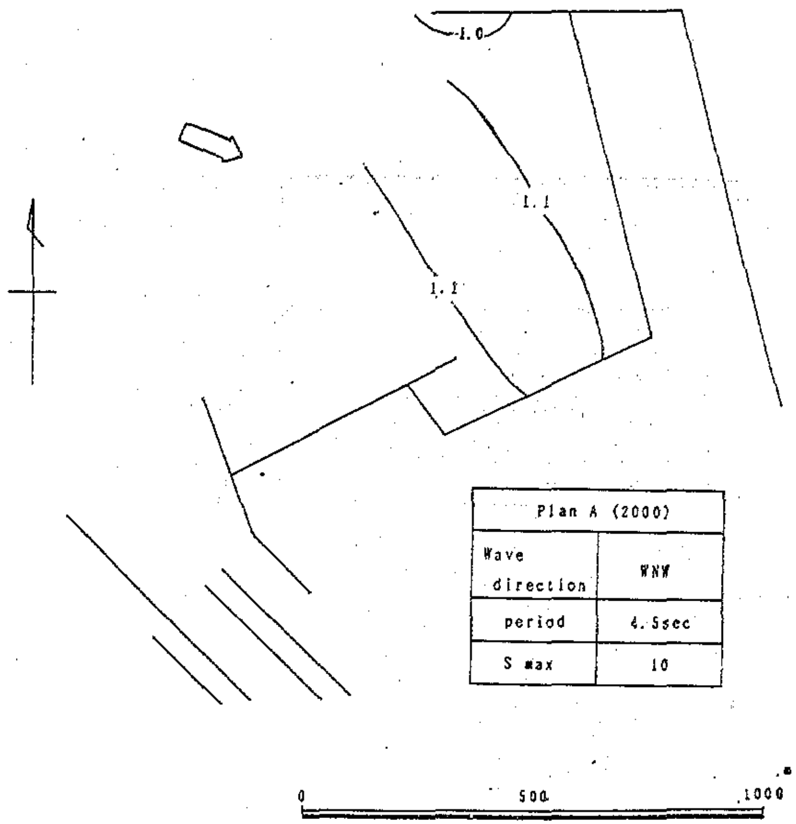


Fig.9-7-3(g) Wave Height Ratio



Plan A (2000)	
Wave direction	W
period	4.5sec
S max	10

Fig.9-7-3(h) Wave Height Ratio



Plan A (2000)	
Wave direction	WNW
period	4.5sec
S max	10

Fig.9-7-3(i) Wave Height Ratio

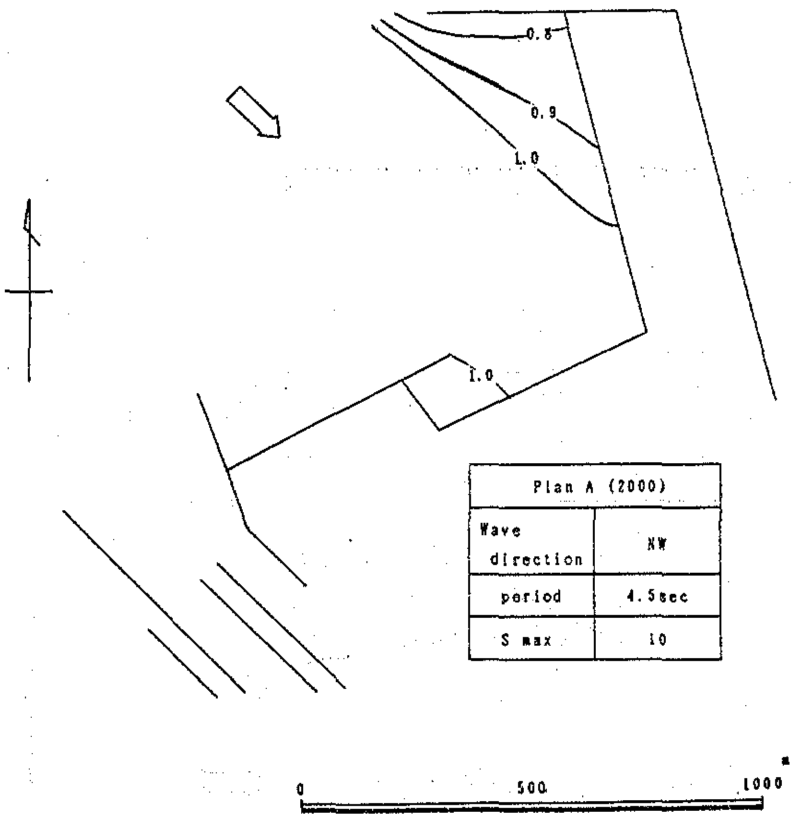


Fig.9-7-3(j) Wave Height Ratio

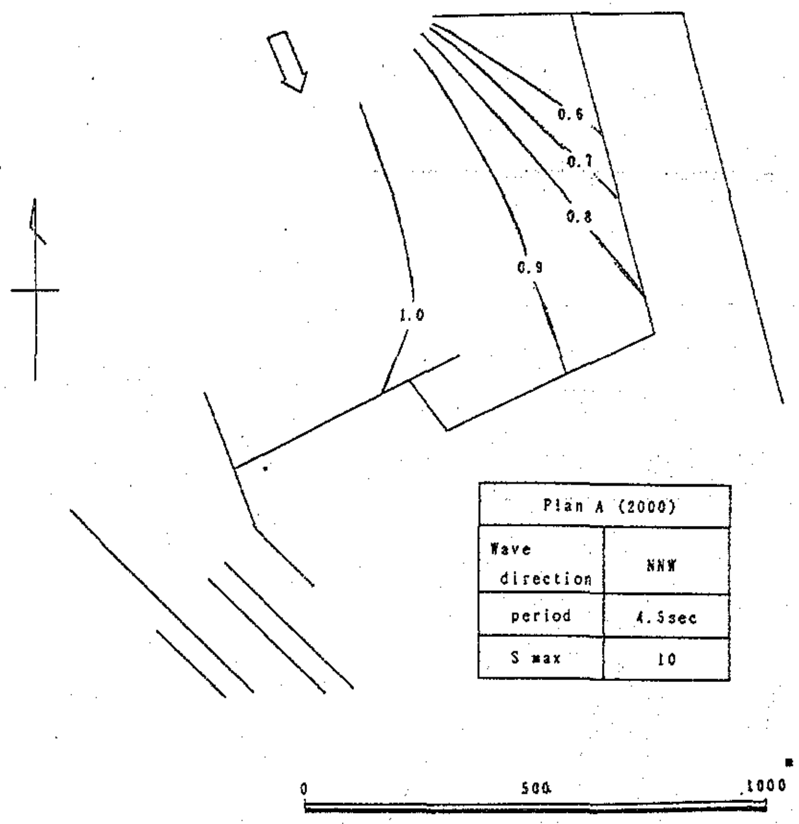
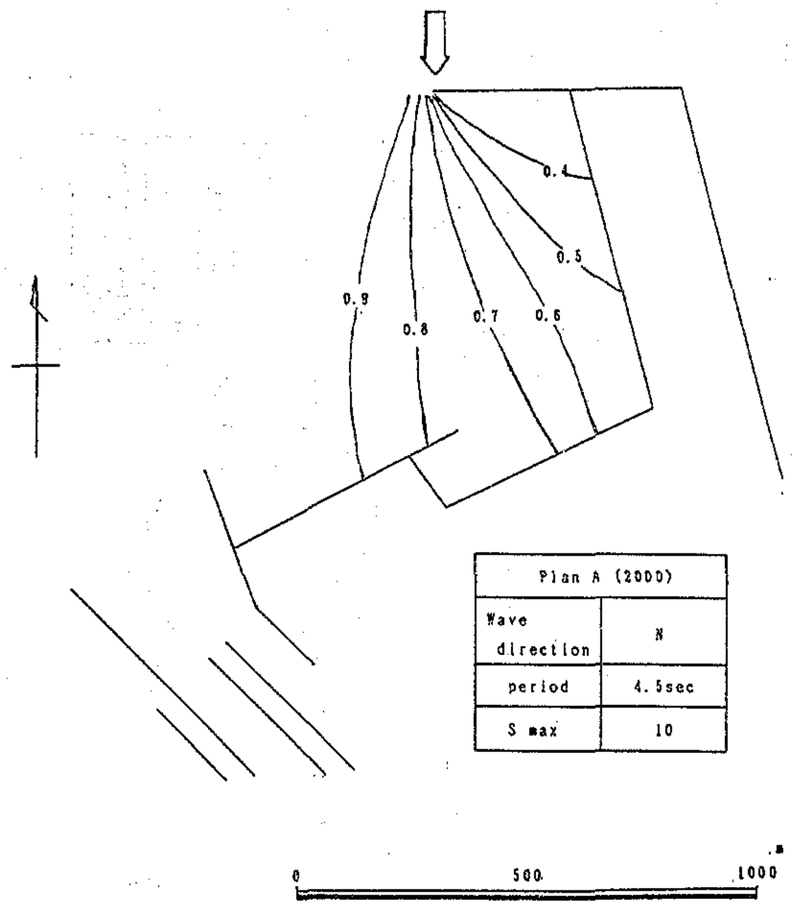
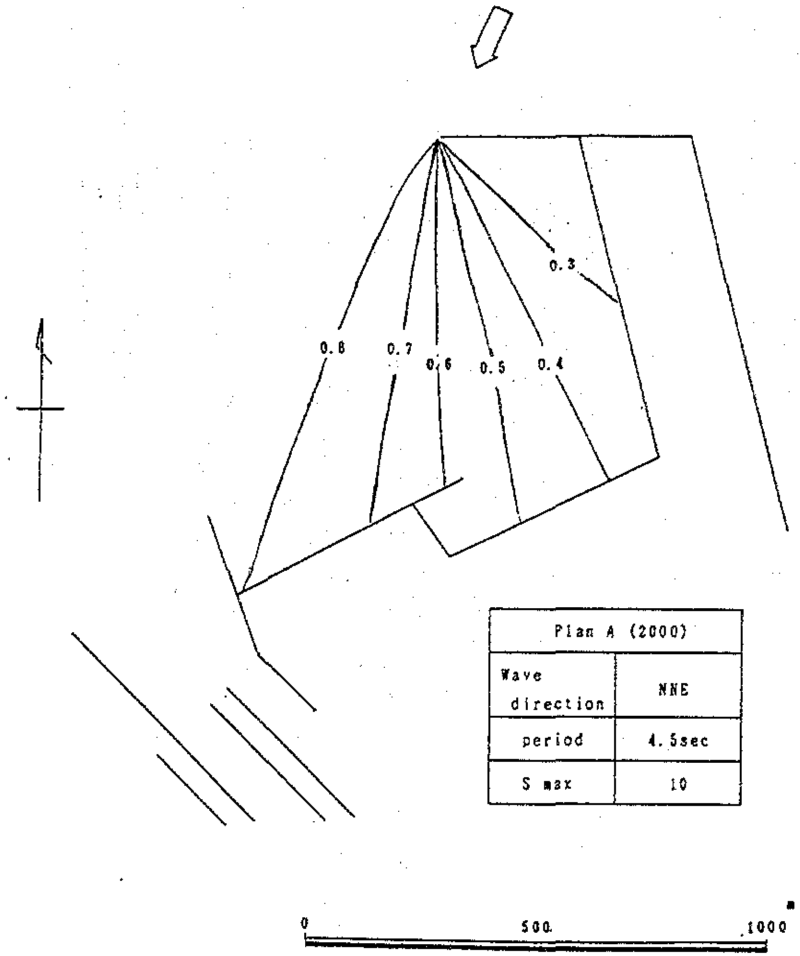


Fig.9-7-3(k) Wave Height Ratio



Plan A (2000)	
Wave direction	N
period	4.5sec
S max	10

Fig.9-7-3(e) Wave Height Ratio



Plan A (2000)	
Wave direction	NNE
period	4.5sec
S max	10

Fig.9-7-4(a) Wave Height Ratio

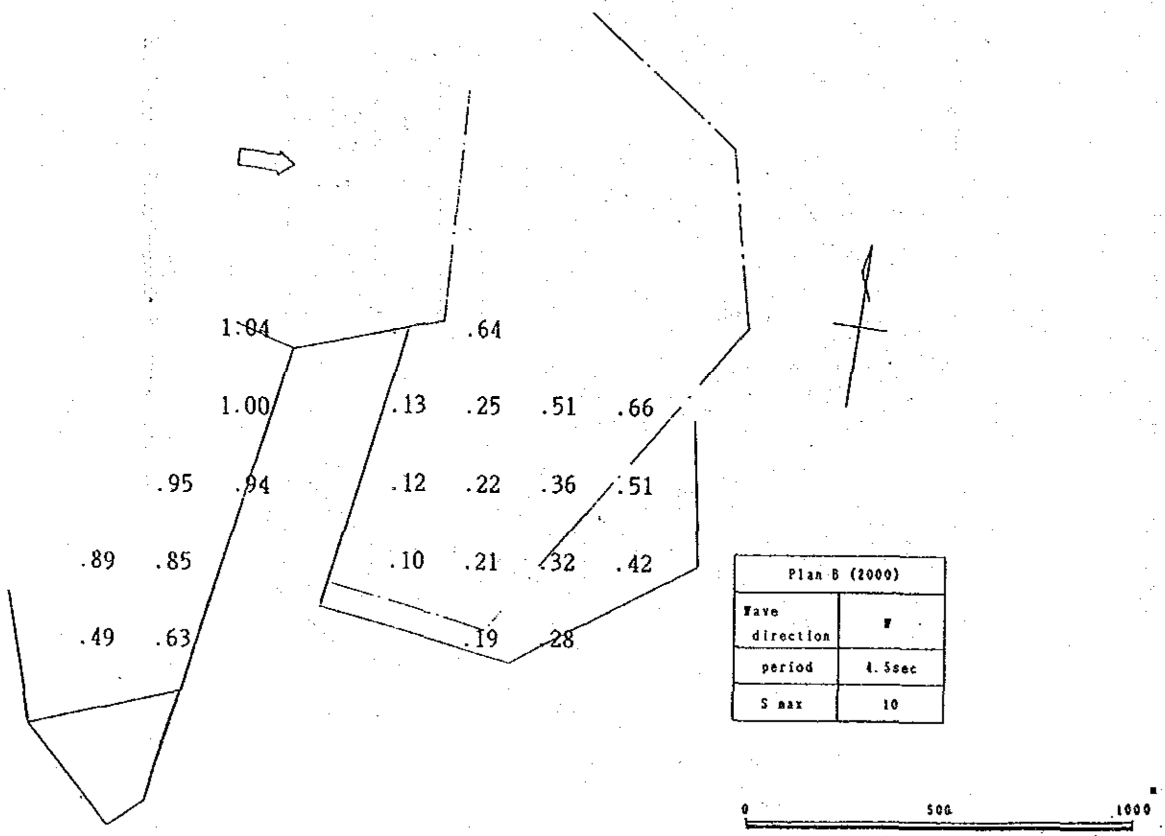


Fig.9-7-4(b) Wave Height ratio

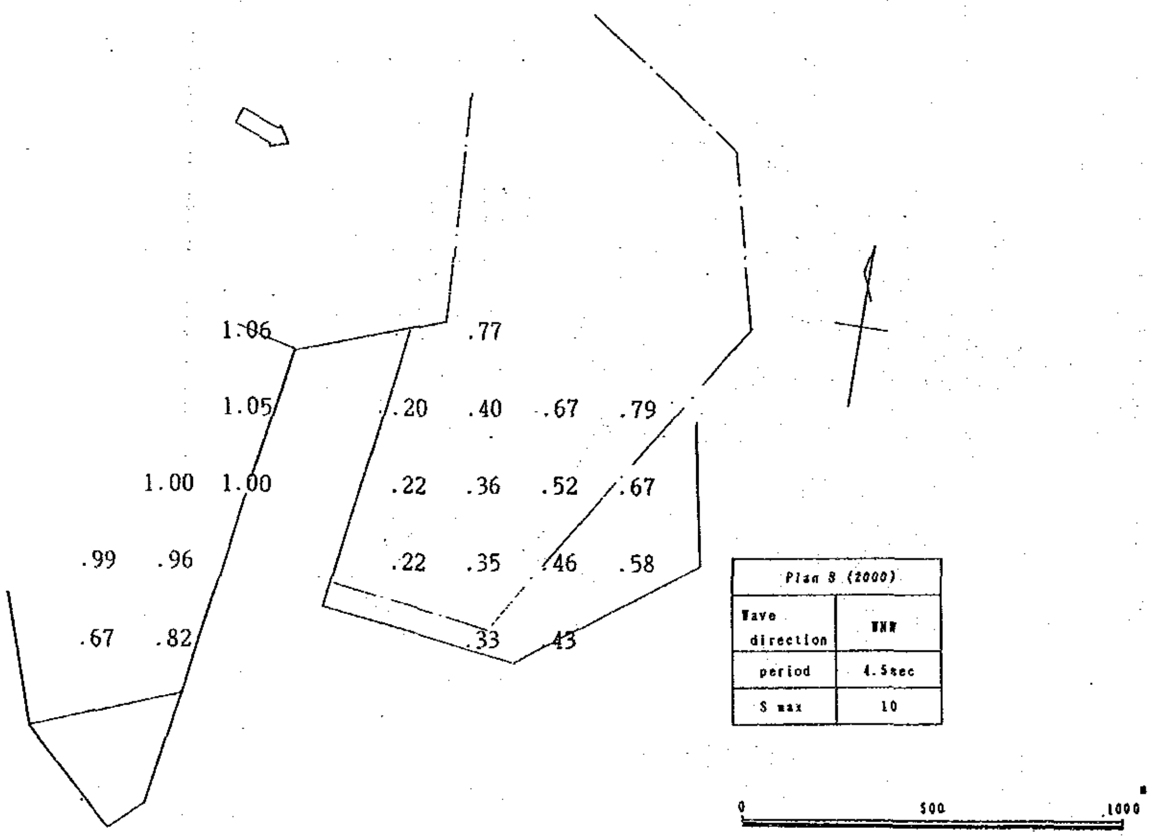


Fig.9-7-4(c) Wave Height Ratio

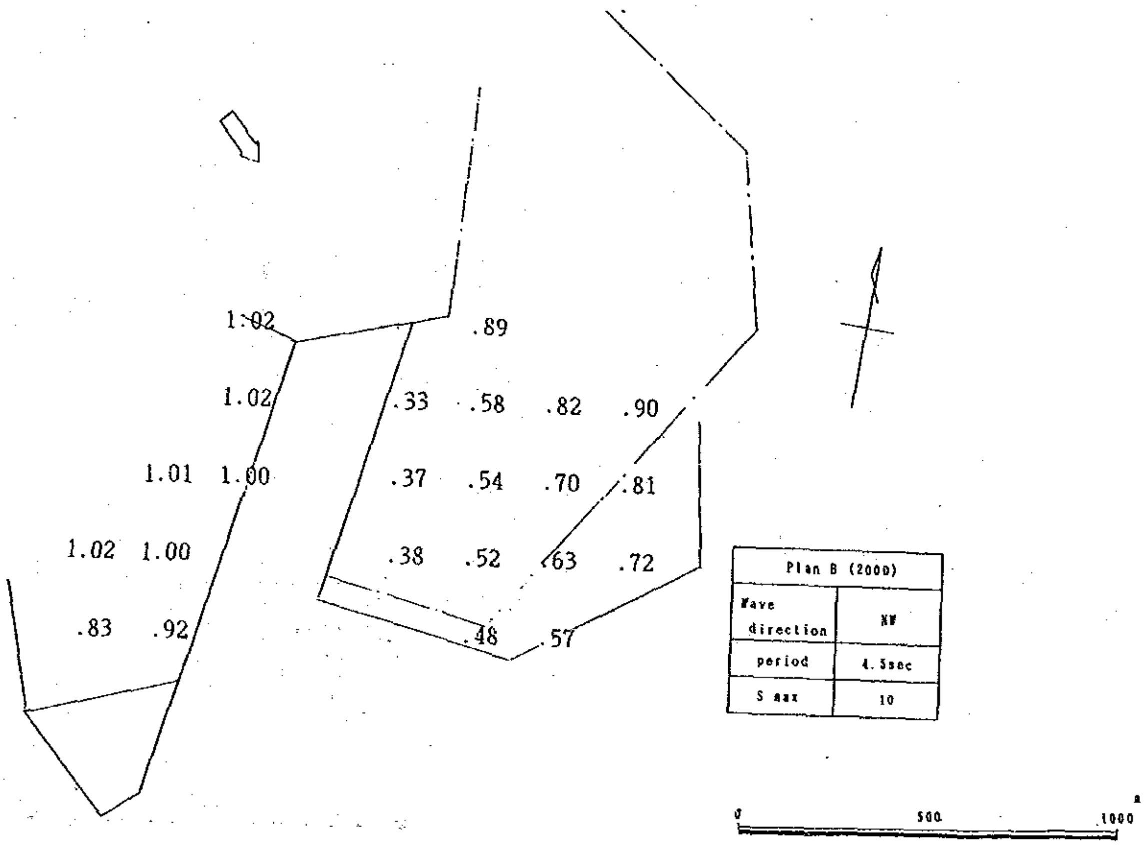


Fig.9-7-4(d) Wave Height Ratio

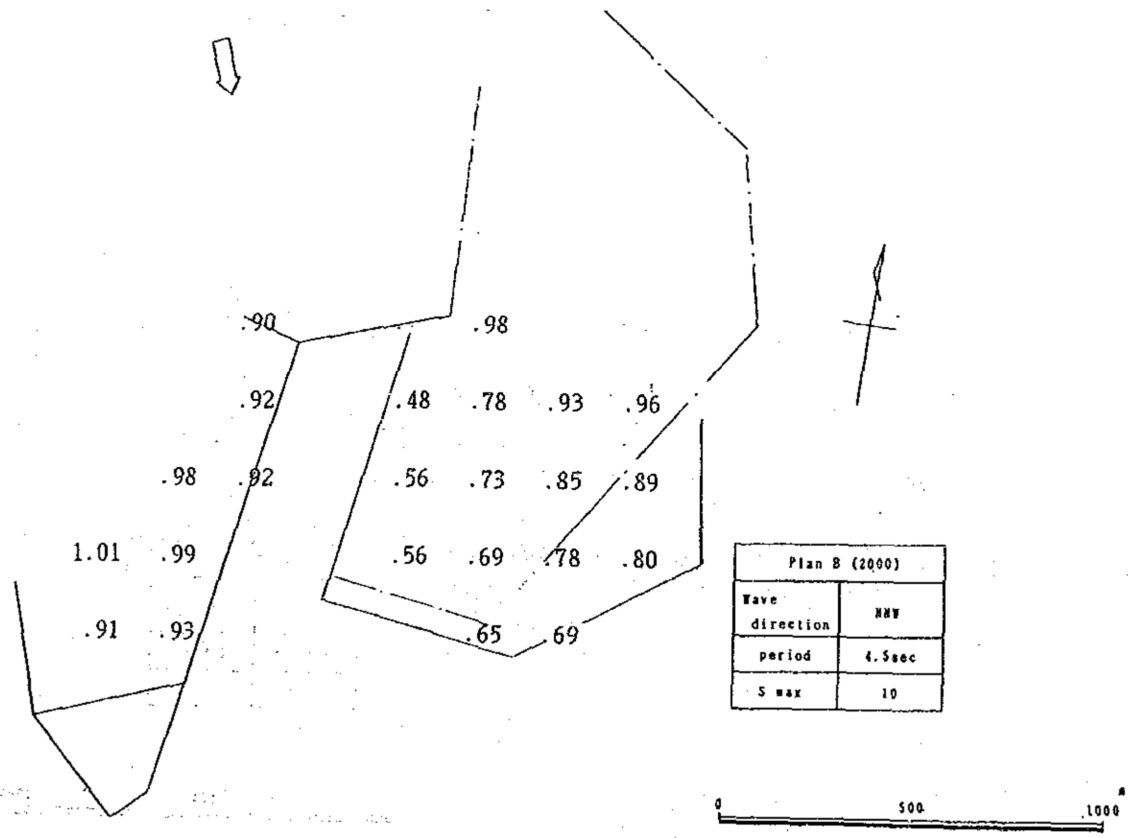


Fig.9-7-4(e) Wave Height Ratio

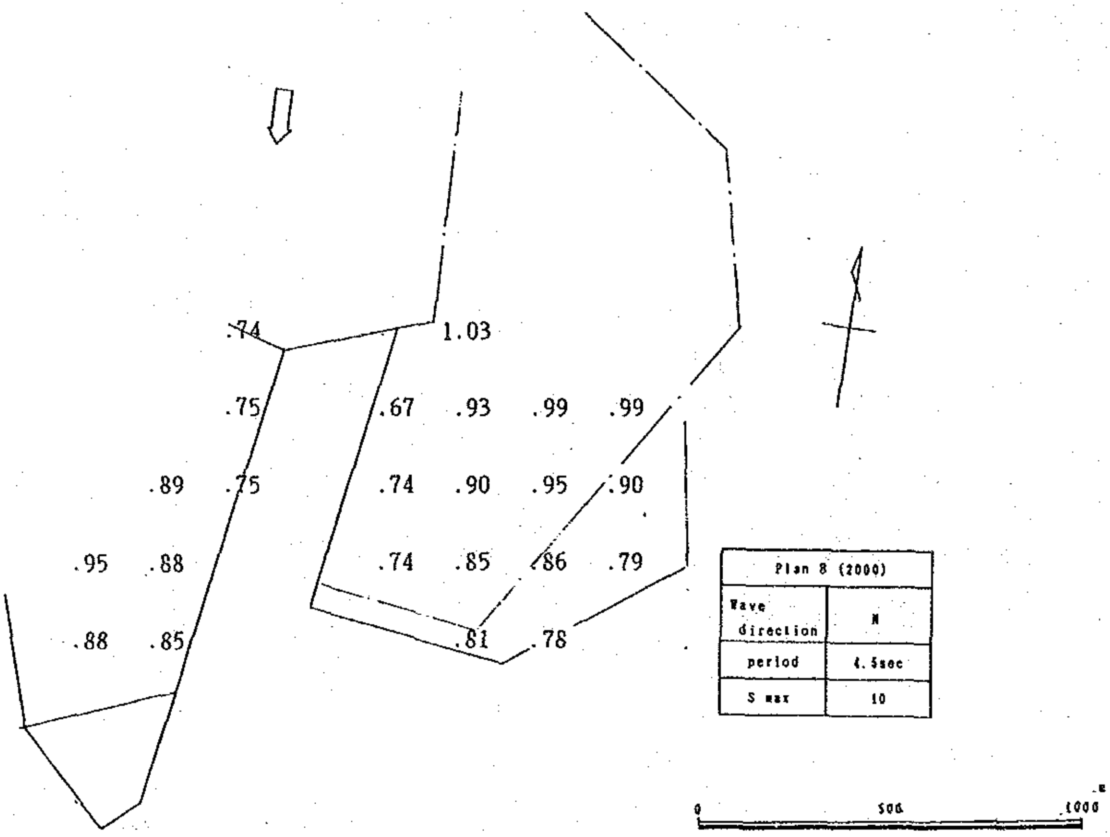


Fig.9-7-4(f) Wave Height Ratio

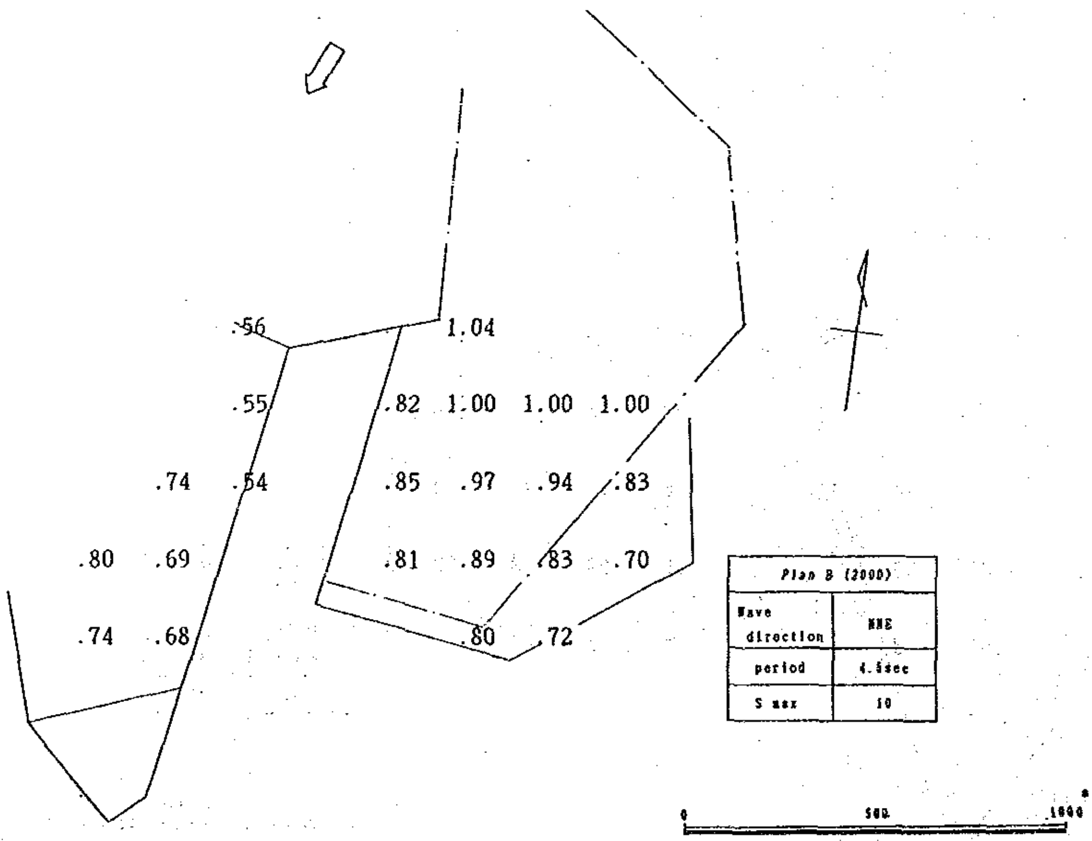


Fig.9-7-4(g) Wave Height Ratio

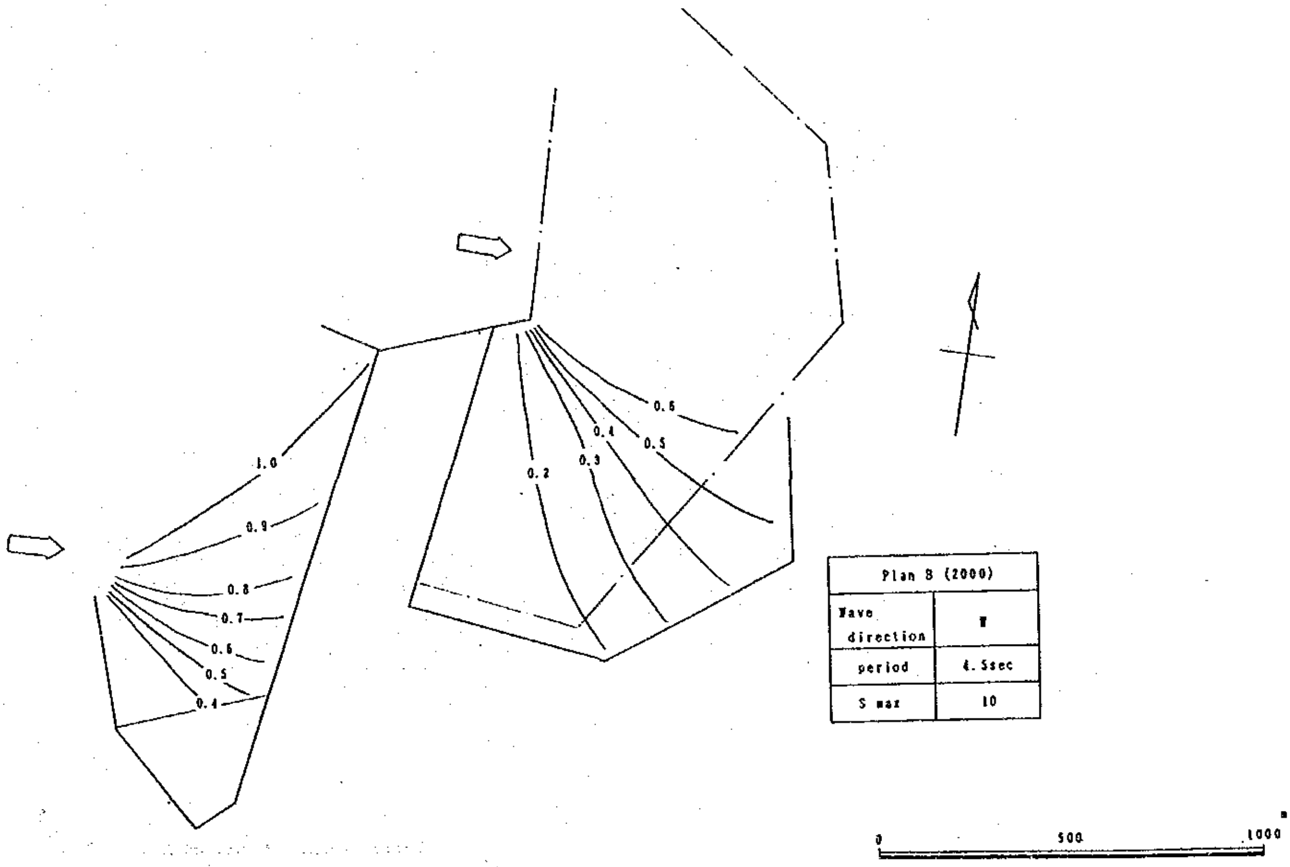


Fig.9-7-4(h) Wave Height Ratio

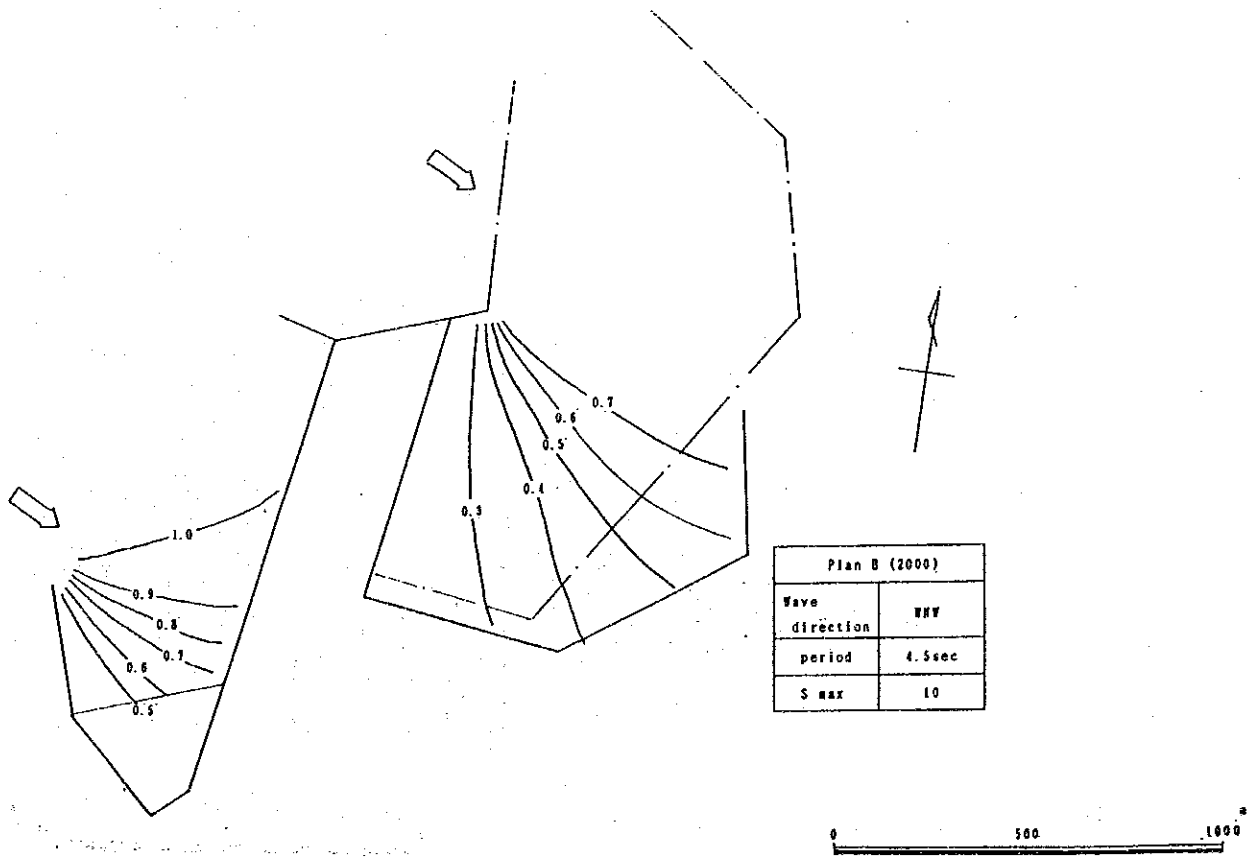


Fig.9-7-4(i) Wave Height Ratio

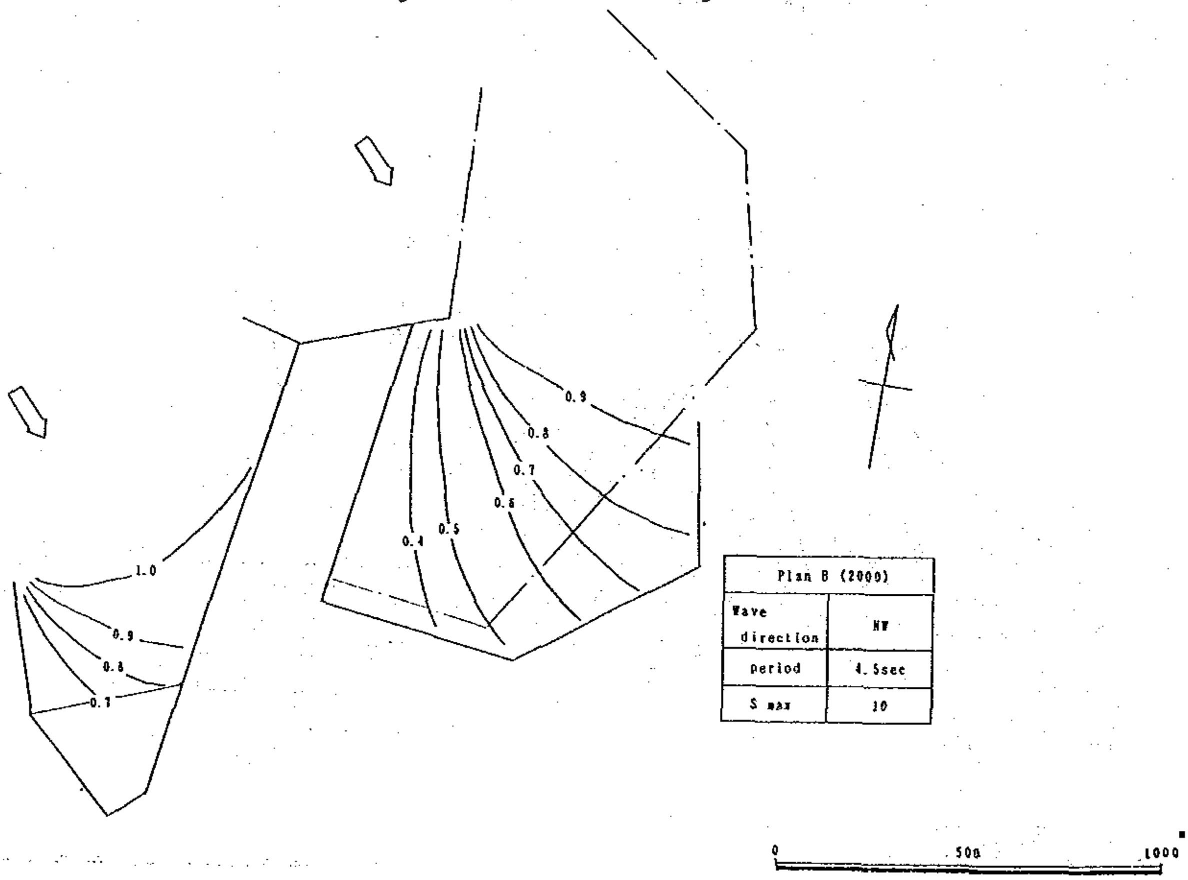


Fig.9-7-4(j) Wave Height Ratio

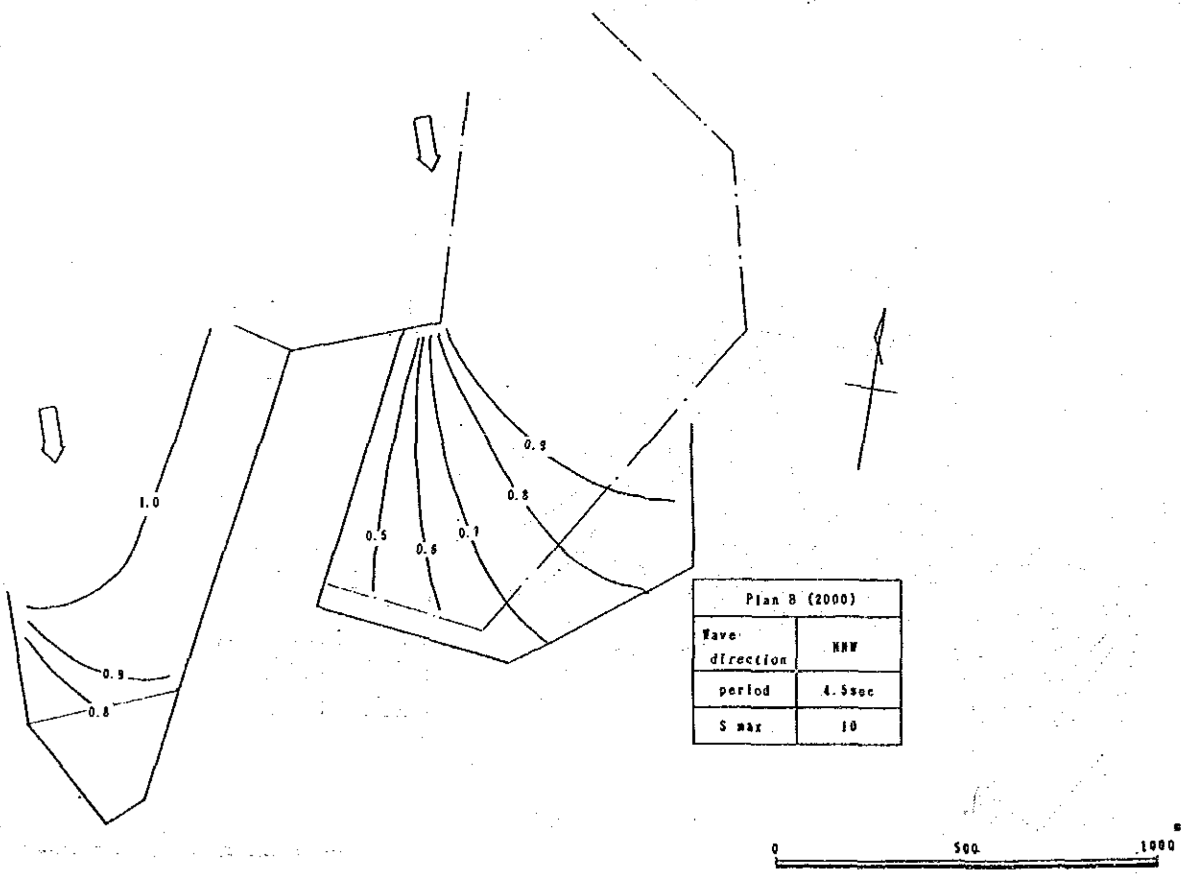


Fig.9-7-4(k) Wave Height Ratio

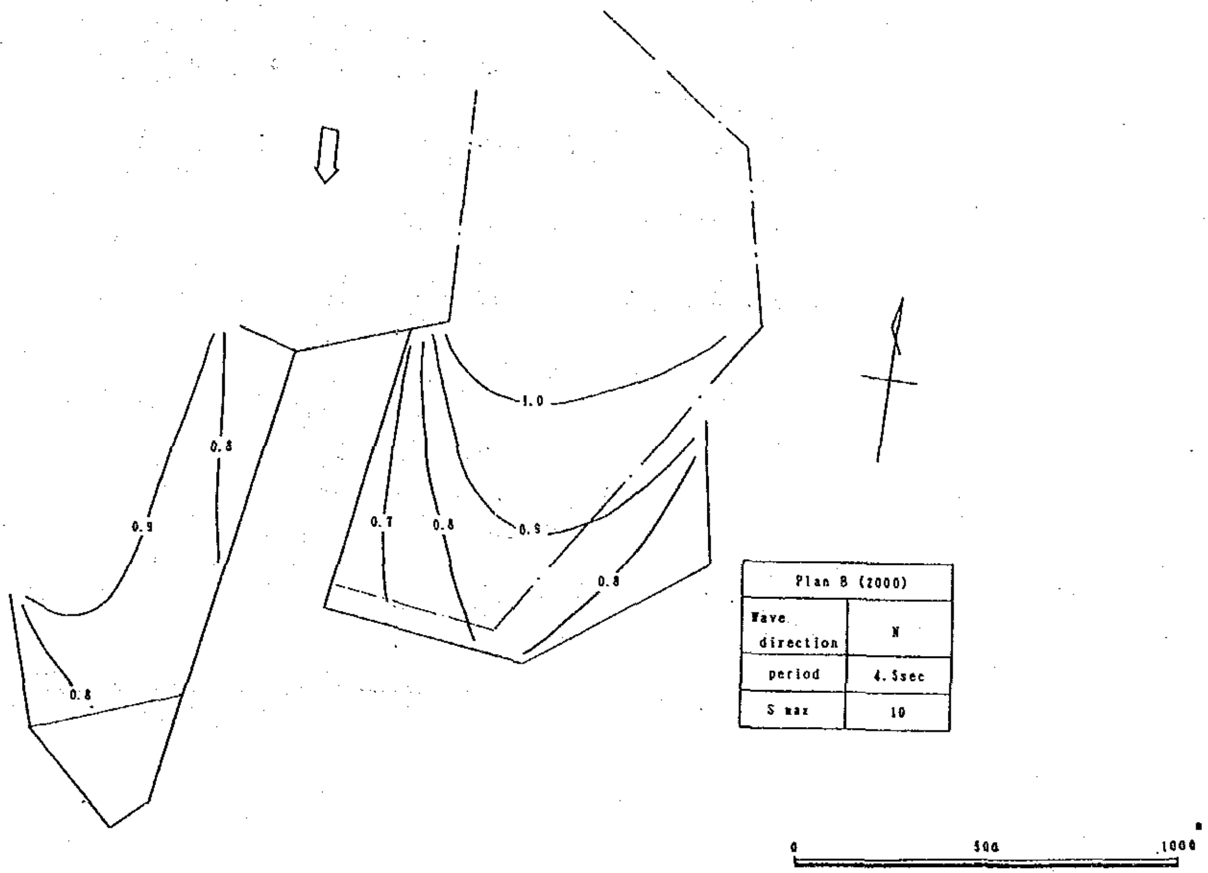


Fig.9-7-4(l) Wave Height Ratio

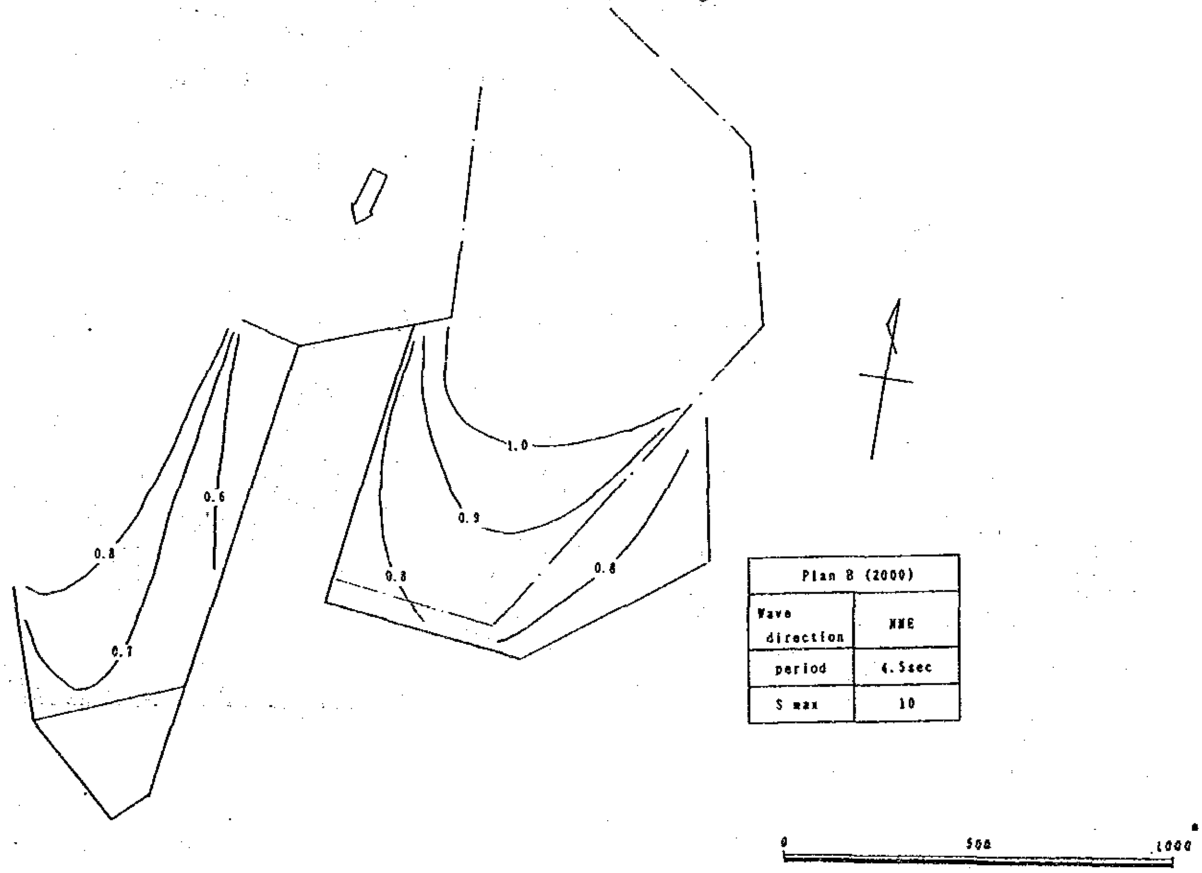


Fig.9-7-8(a) Wave Height Ratio

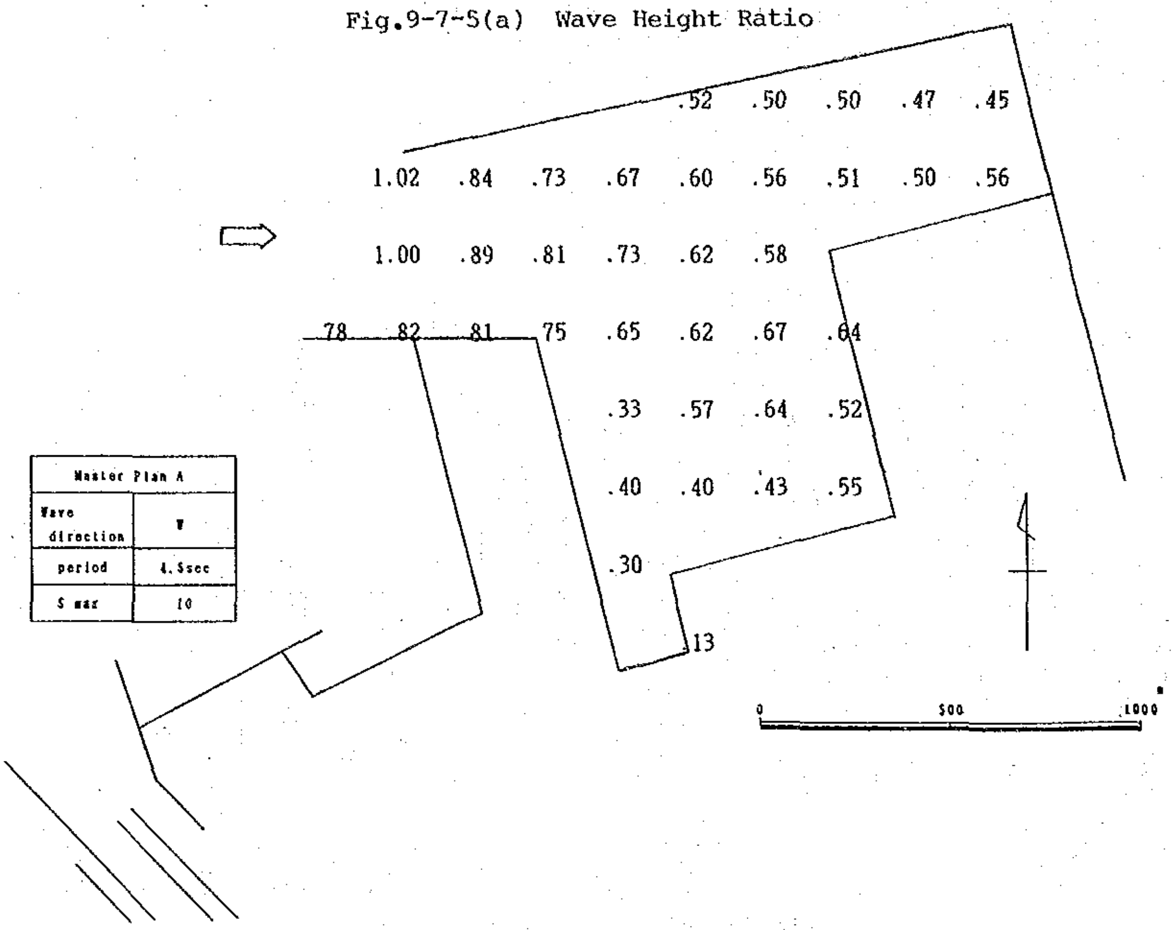


Fig.9-7-8(b) Wave Height Ratio

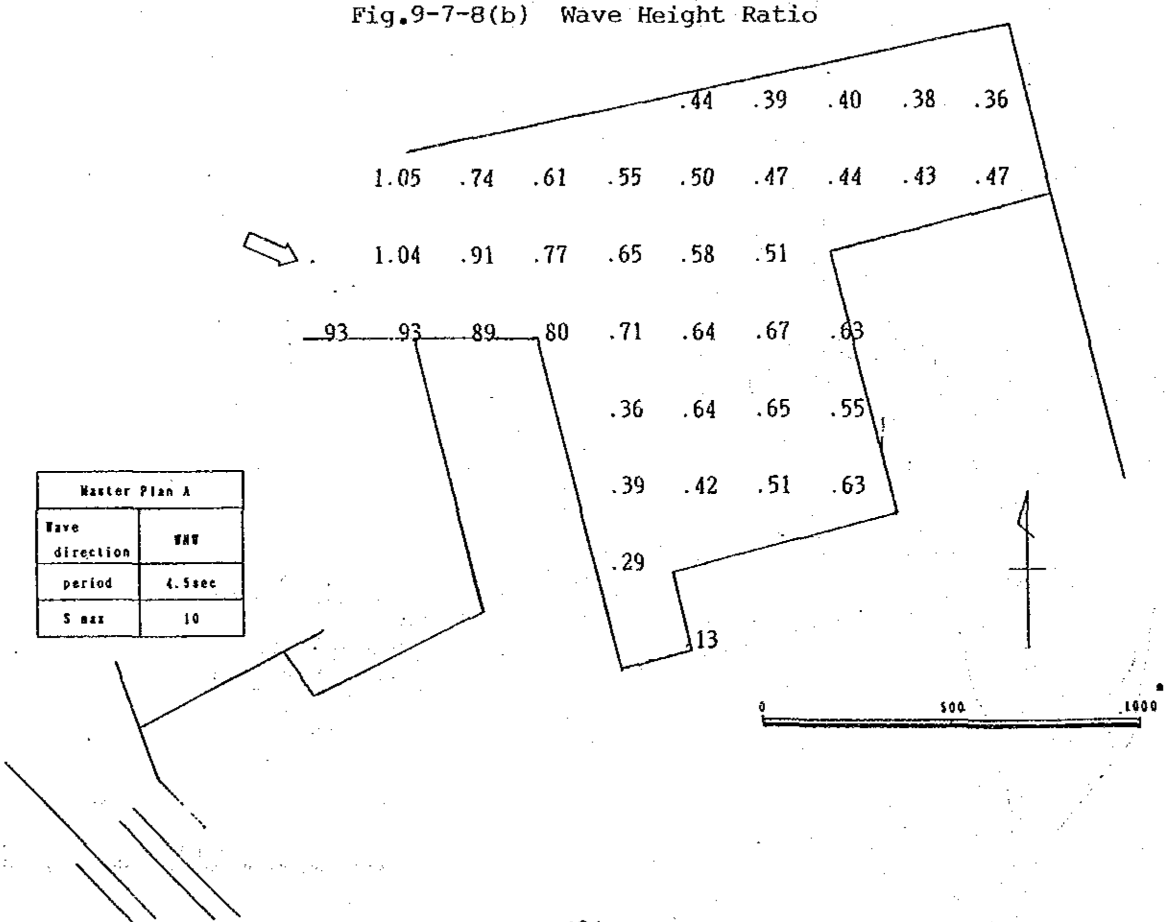


Fig.9-7-5(c) Wave Height Ratio

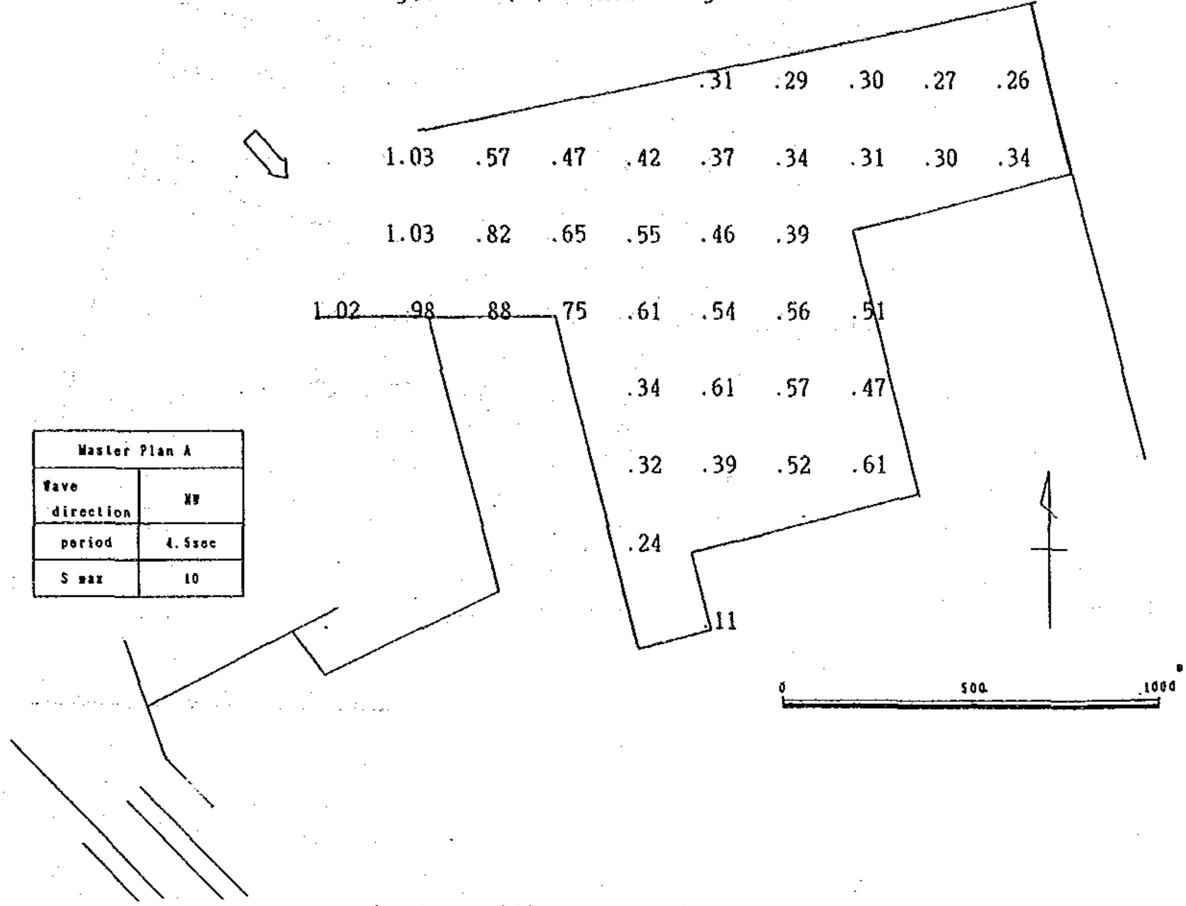


Fig.9-7-5(d) Wave Height Ratio

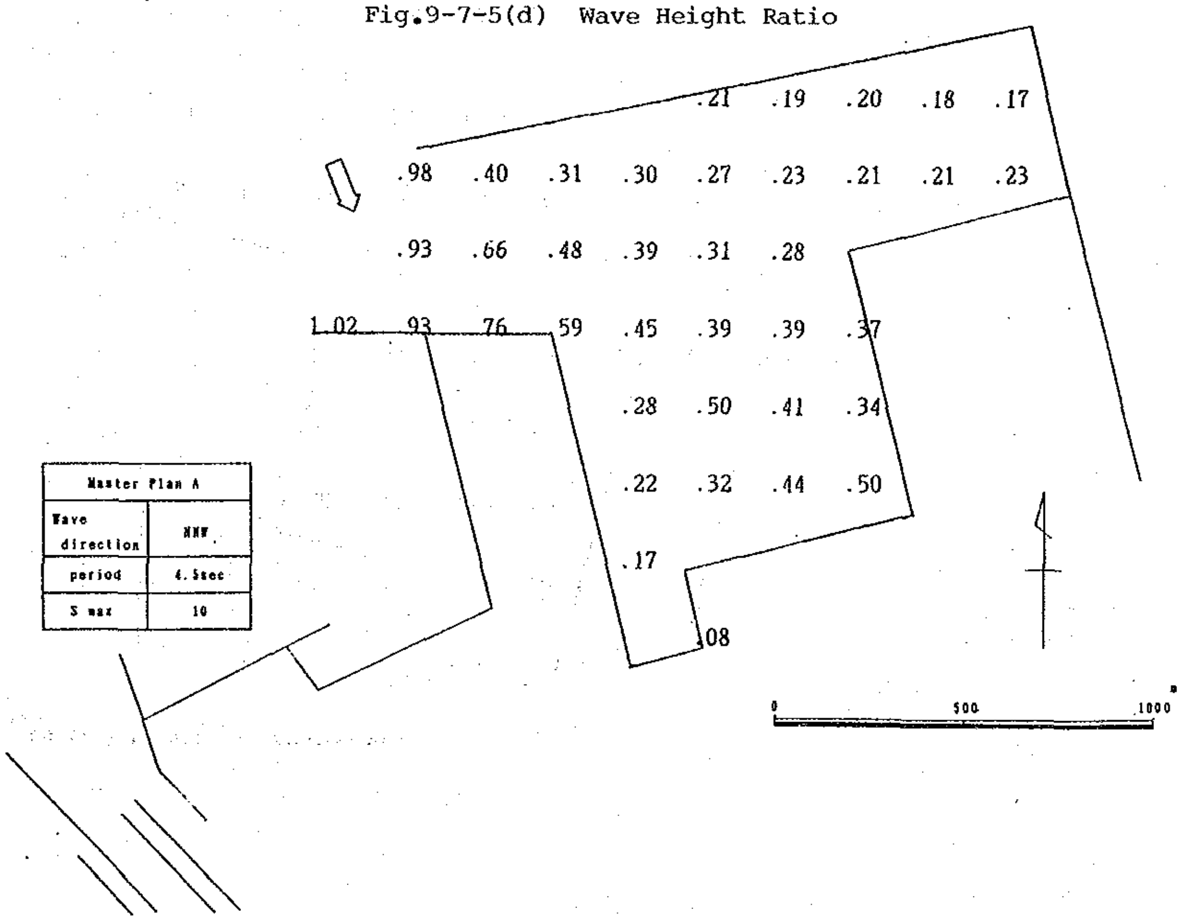


Fig.9-7-5(e) Wave Height Ratio

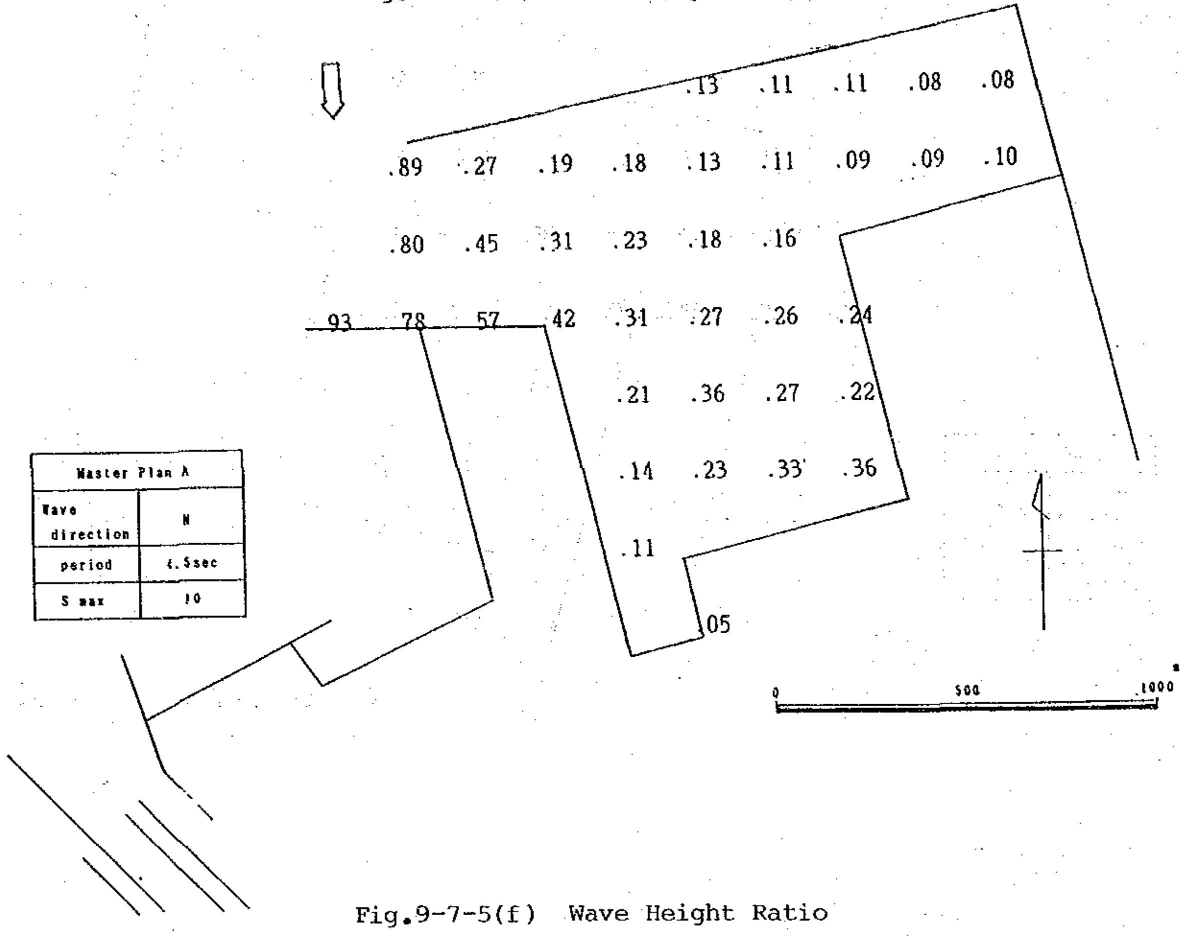


Fig.9-7-5(f) Wave Height Ratio

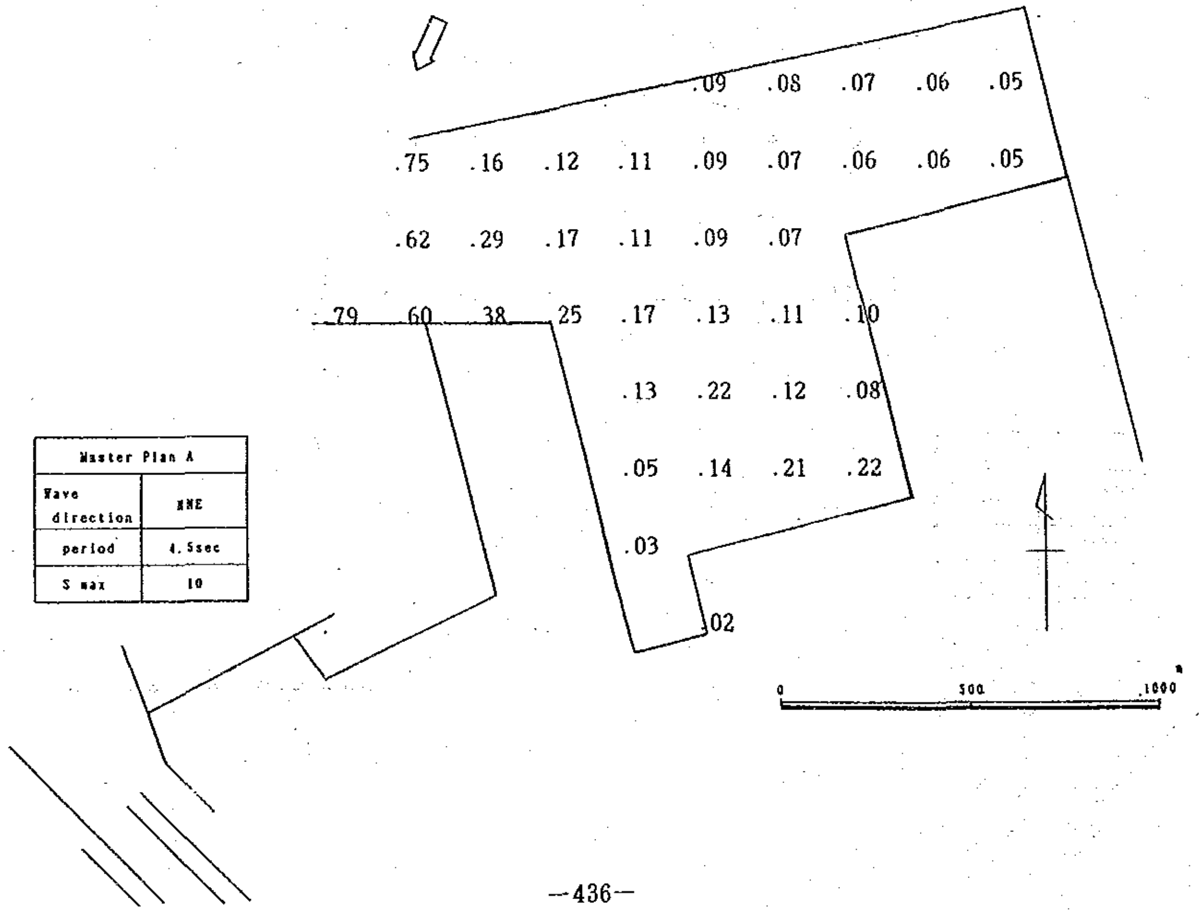


Fig.9-7-5(g) Wave Height Ratio

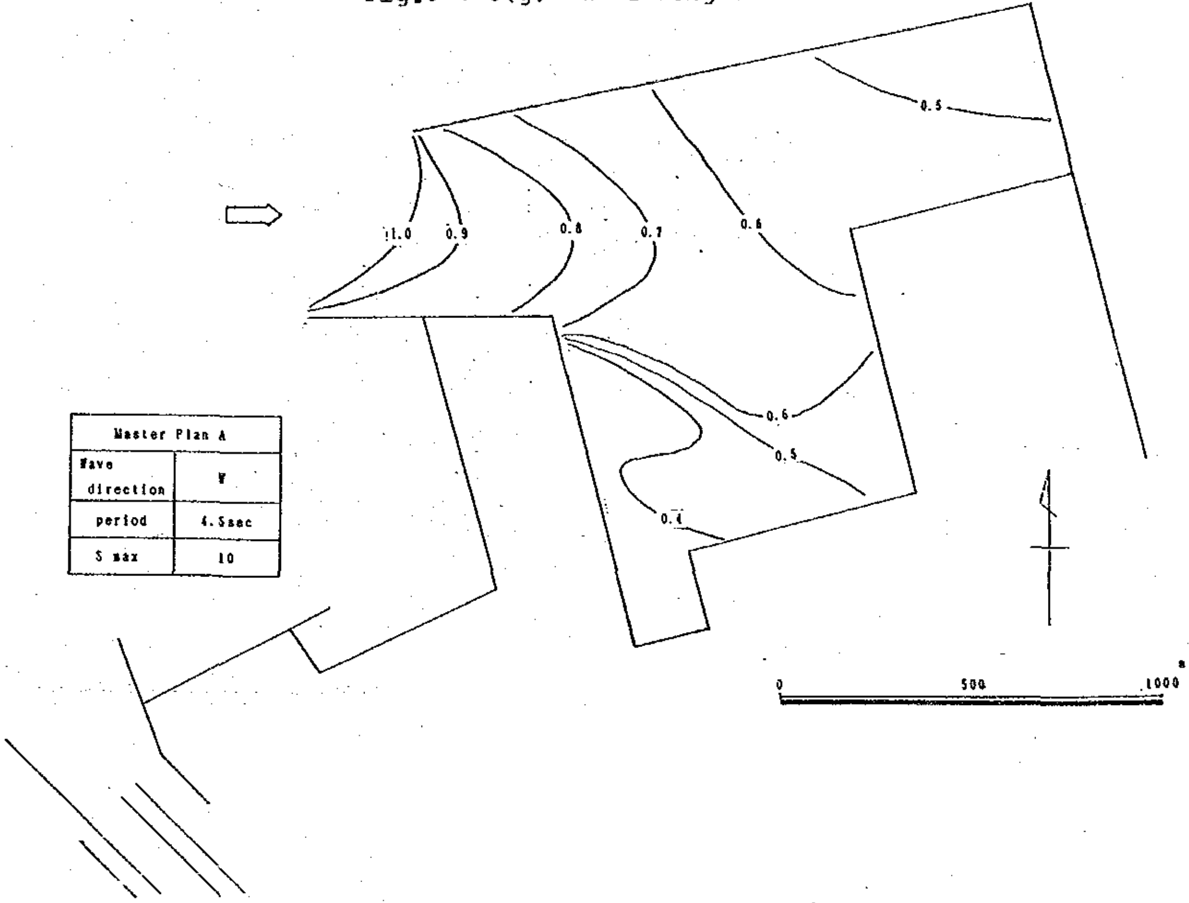


Fig.9-7-5(h) Wave Height Ratio

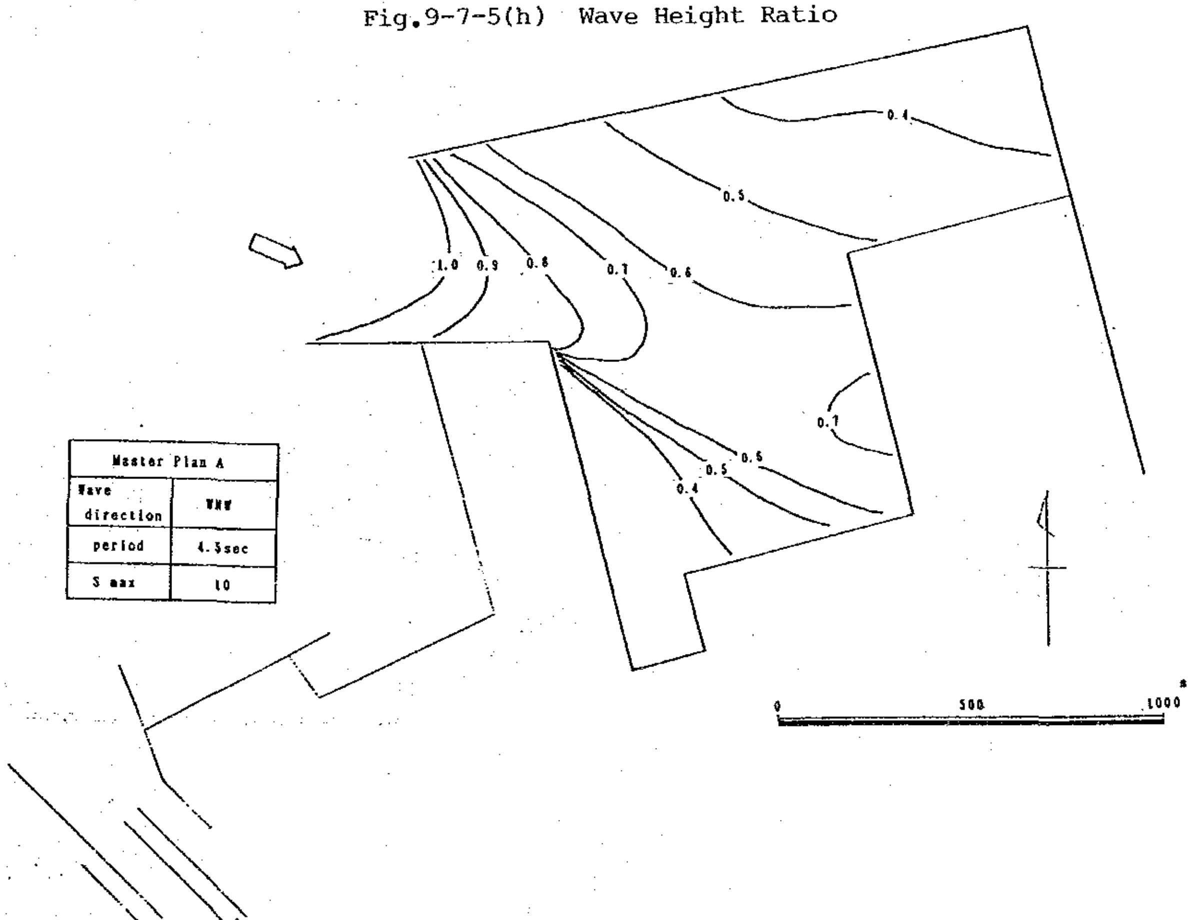


Fig.9-7-5(i) Wave Height Ratio

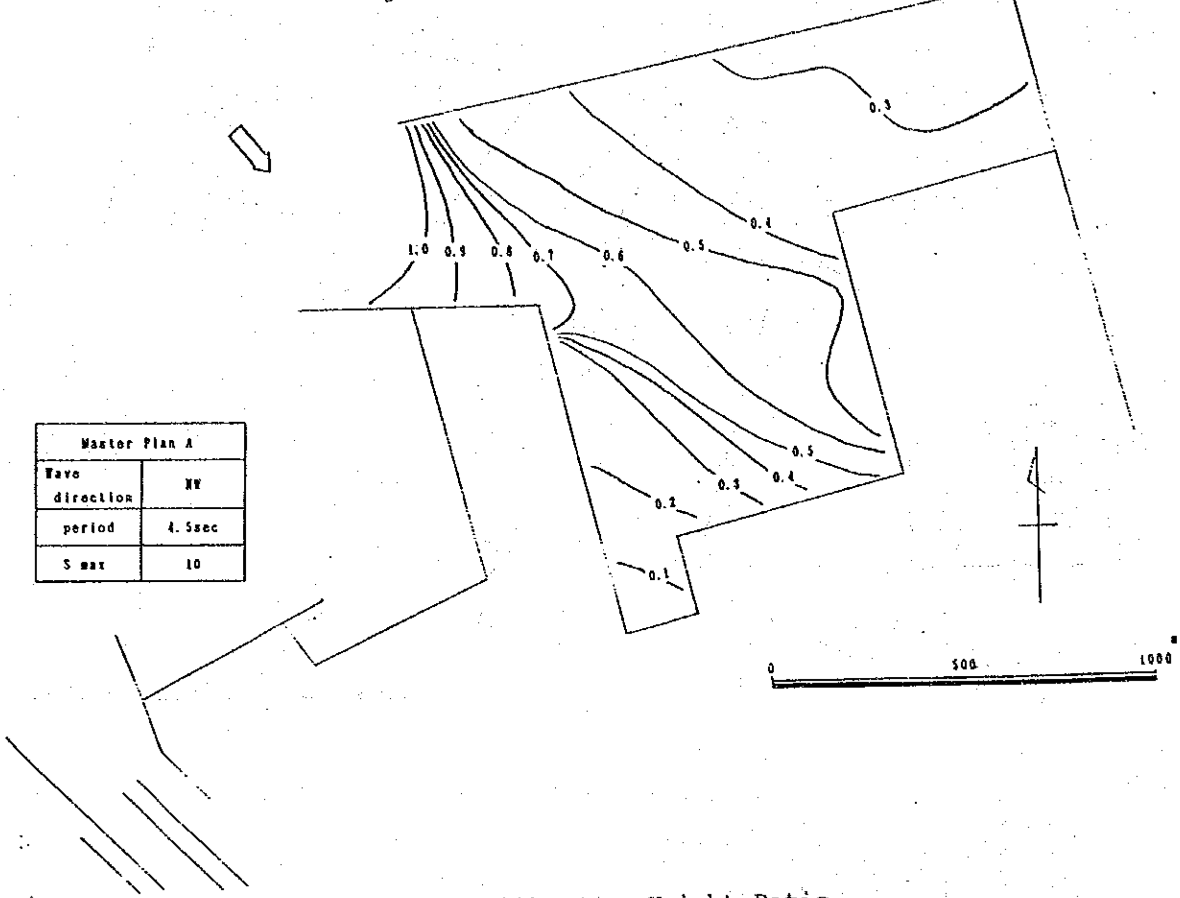


Fig.9-7-5(j) Wave Height Ratio

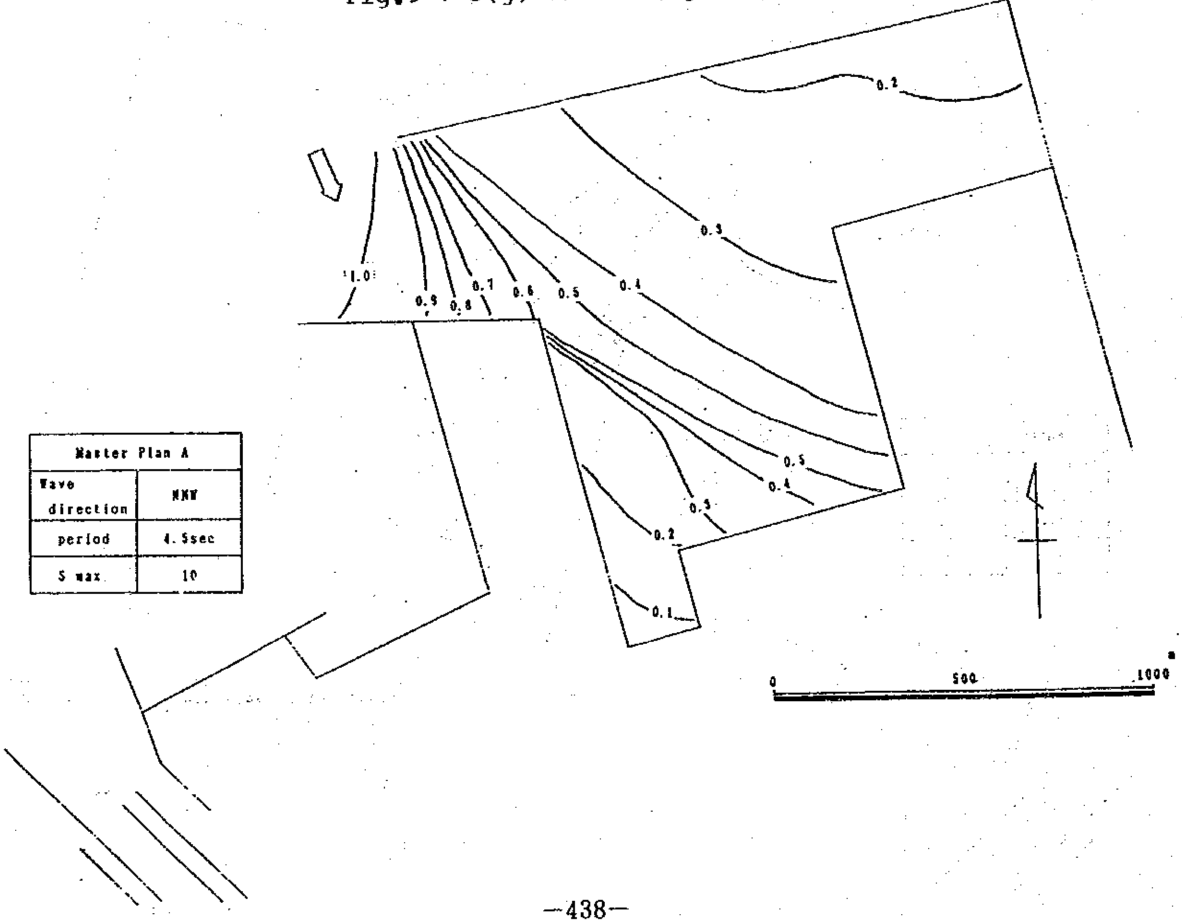
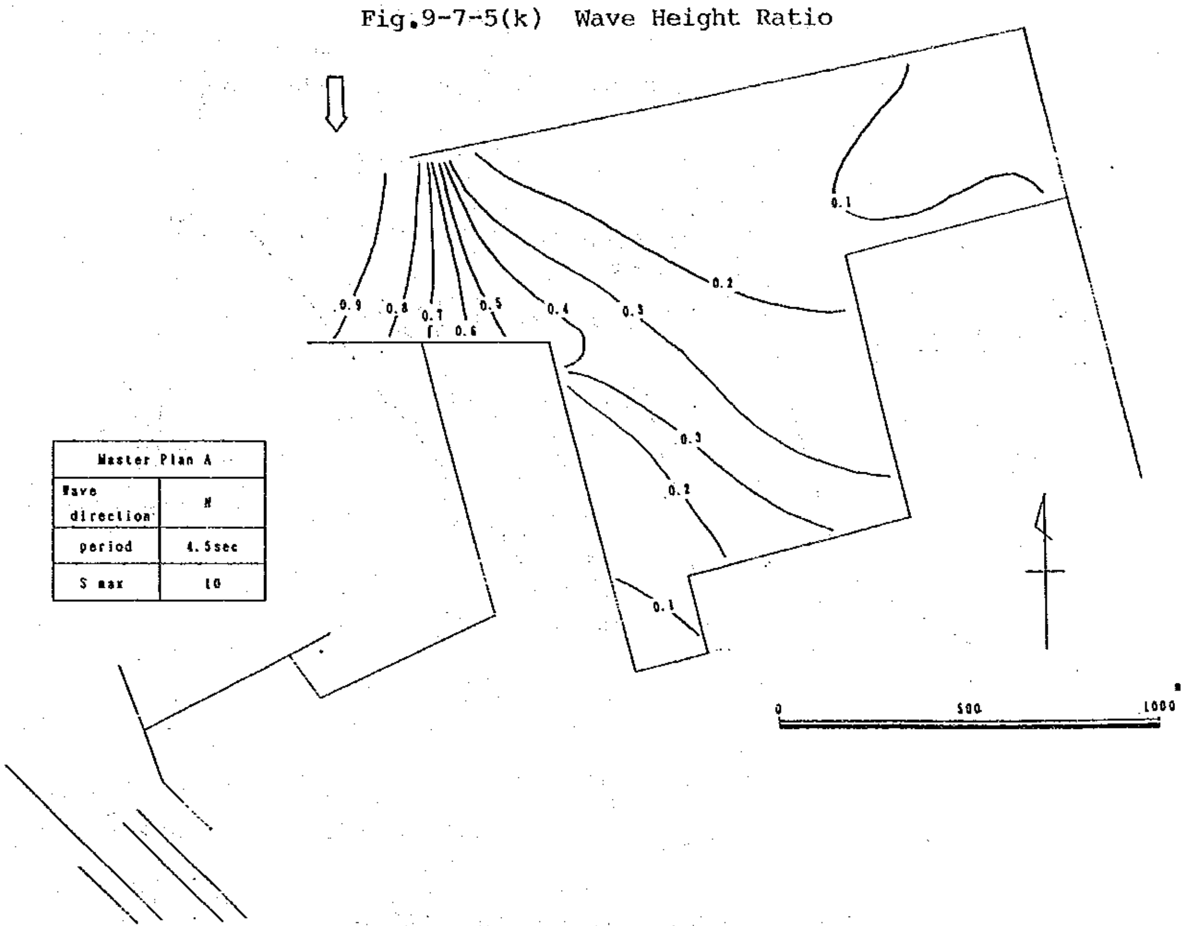
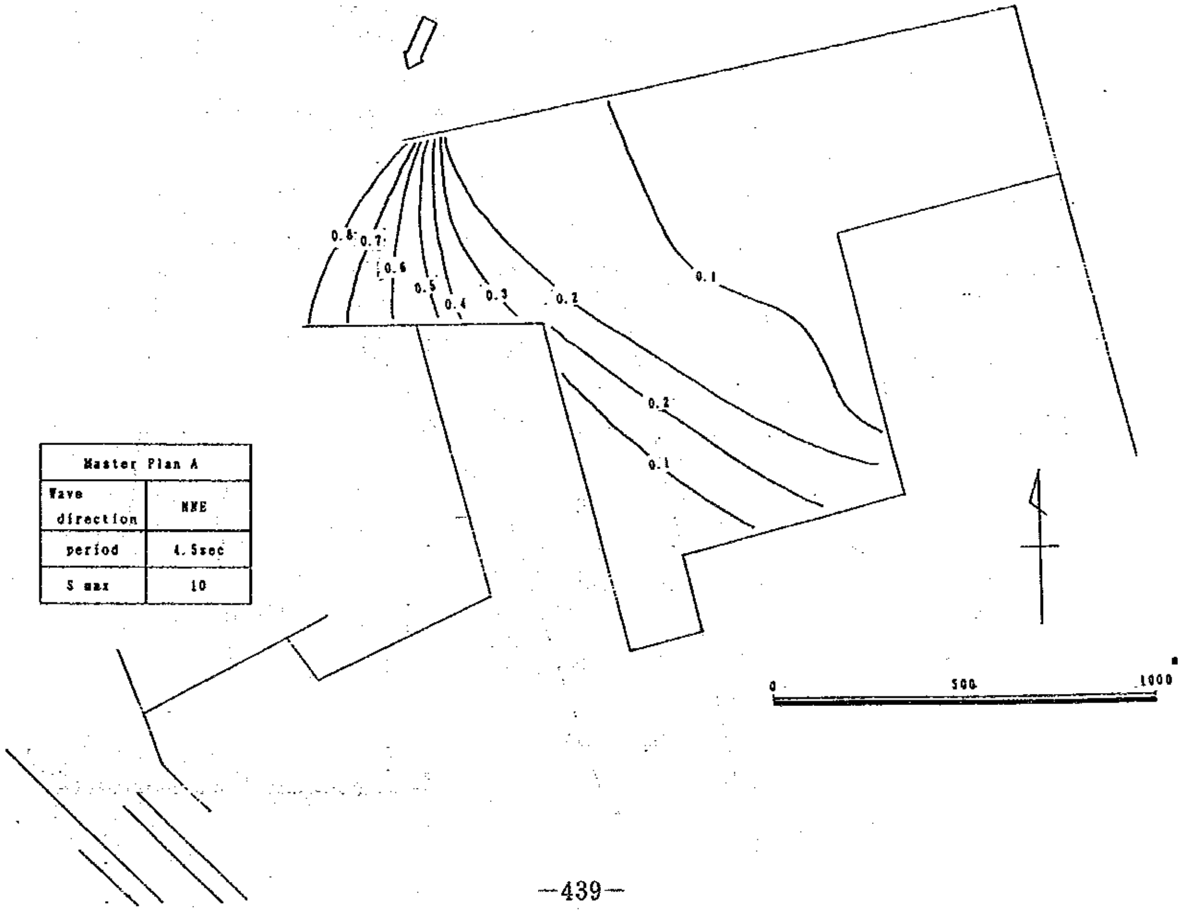


Fig.9-7-5(k) Wave Height Ratio



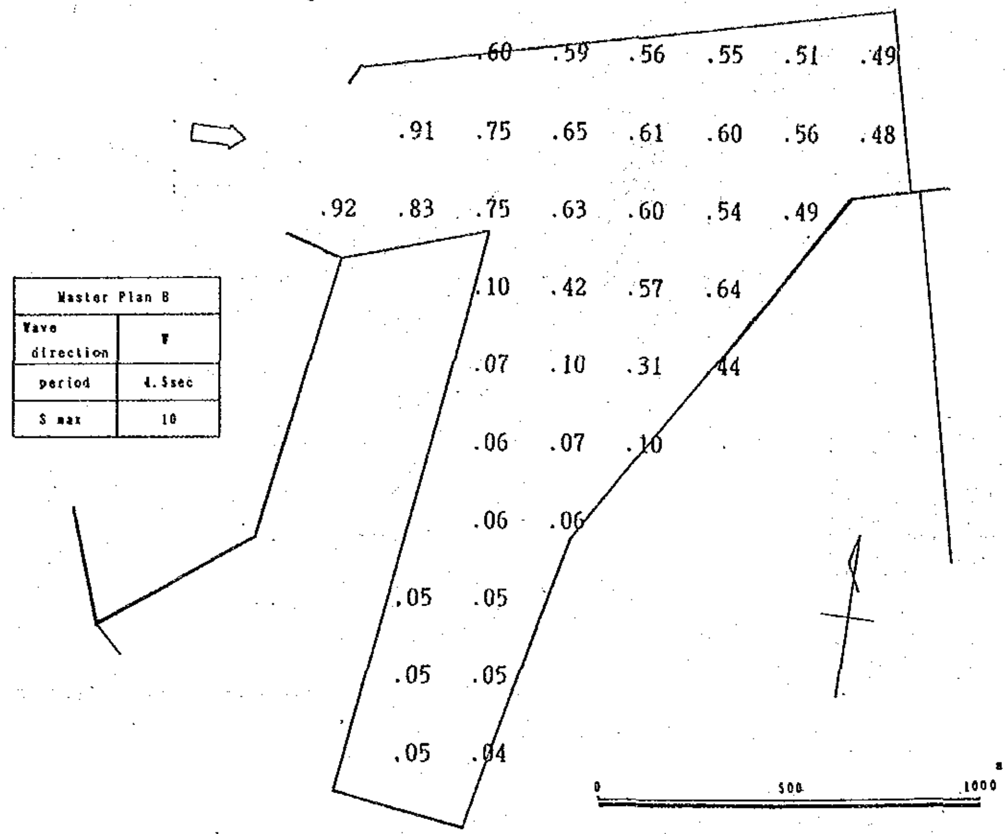
Master Plan A	
Wave direction	N
period	4.5sec
S max	10

Fig.9-7-5(l) Wave Height Ratio



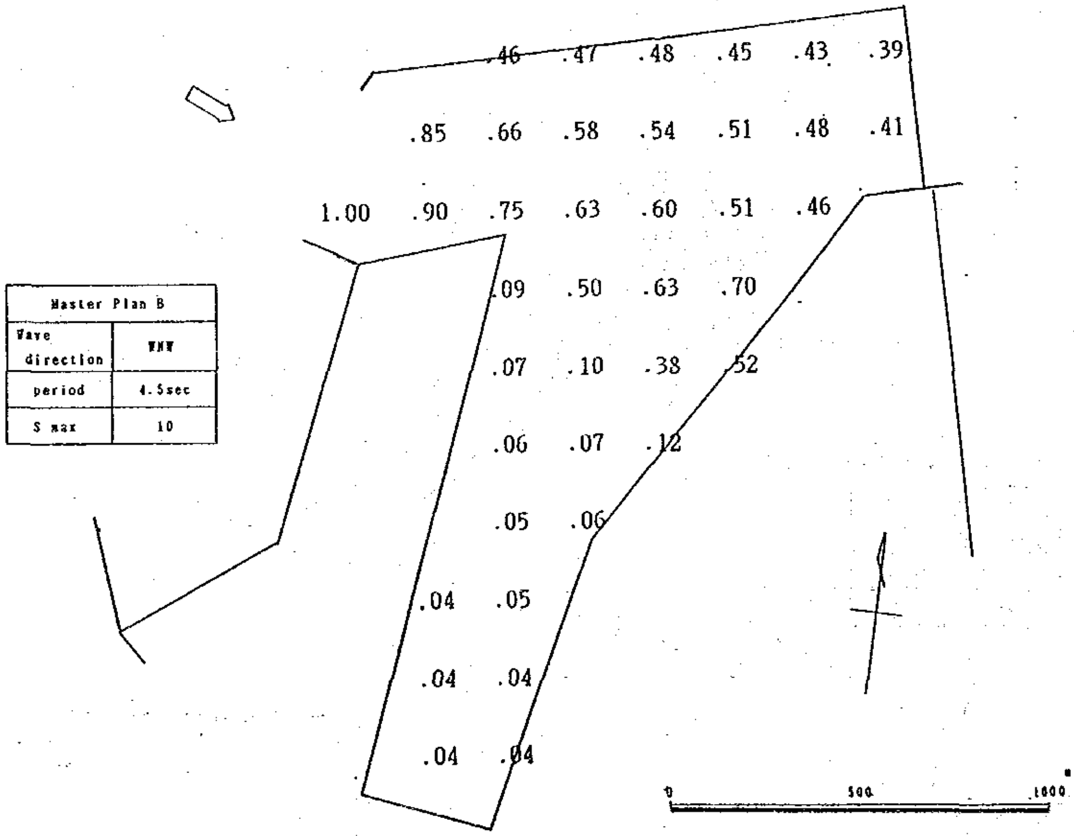
Master Plan A	
Wave direction	NNE
period	4.5sec
S max	10

Fig.9-7-6(a) Wave Height Ratio



Master Plan B	
Wave direction	W
period	4.5sec
S max	10

Fig.9-7-6(b) Wave Height Ratio



Master Plan B	
Wave direction	WNW
period	4.5sec
S max	10

Fig.9-7-6(c) Wave Height Ratio

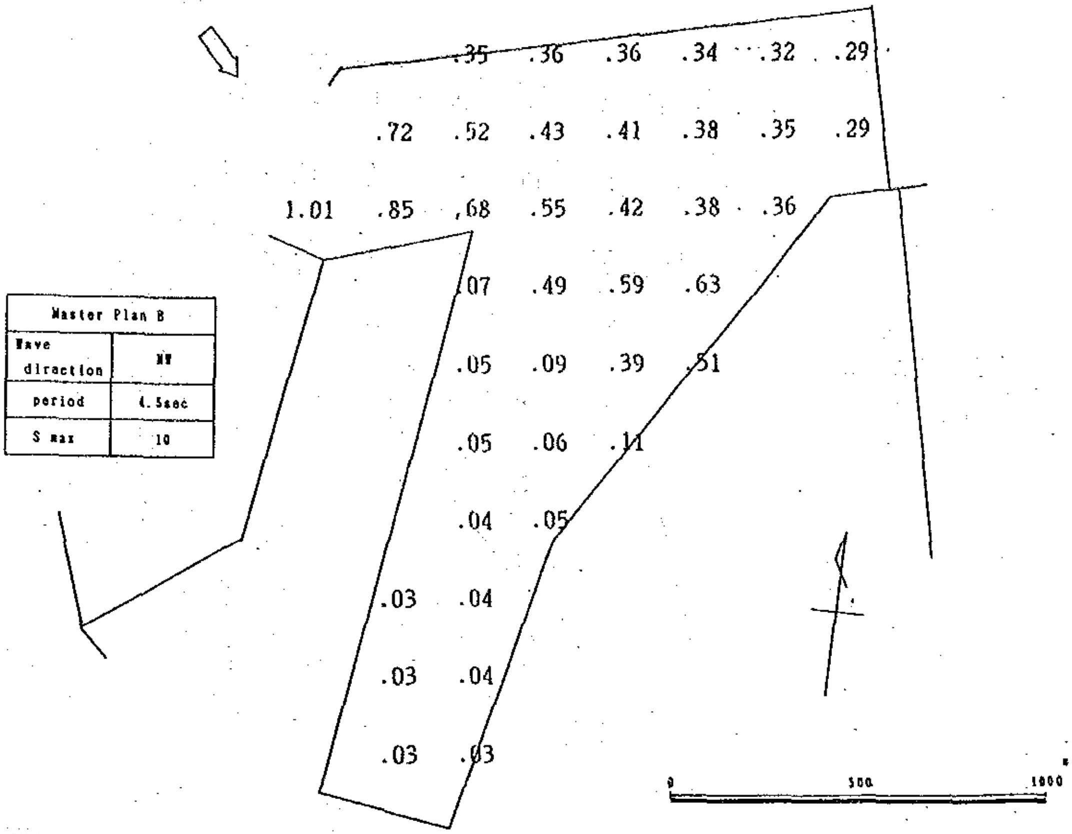


Fig.9-7-6(d) Wave Height Ratio

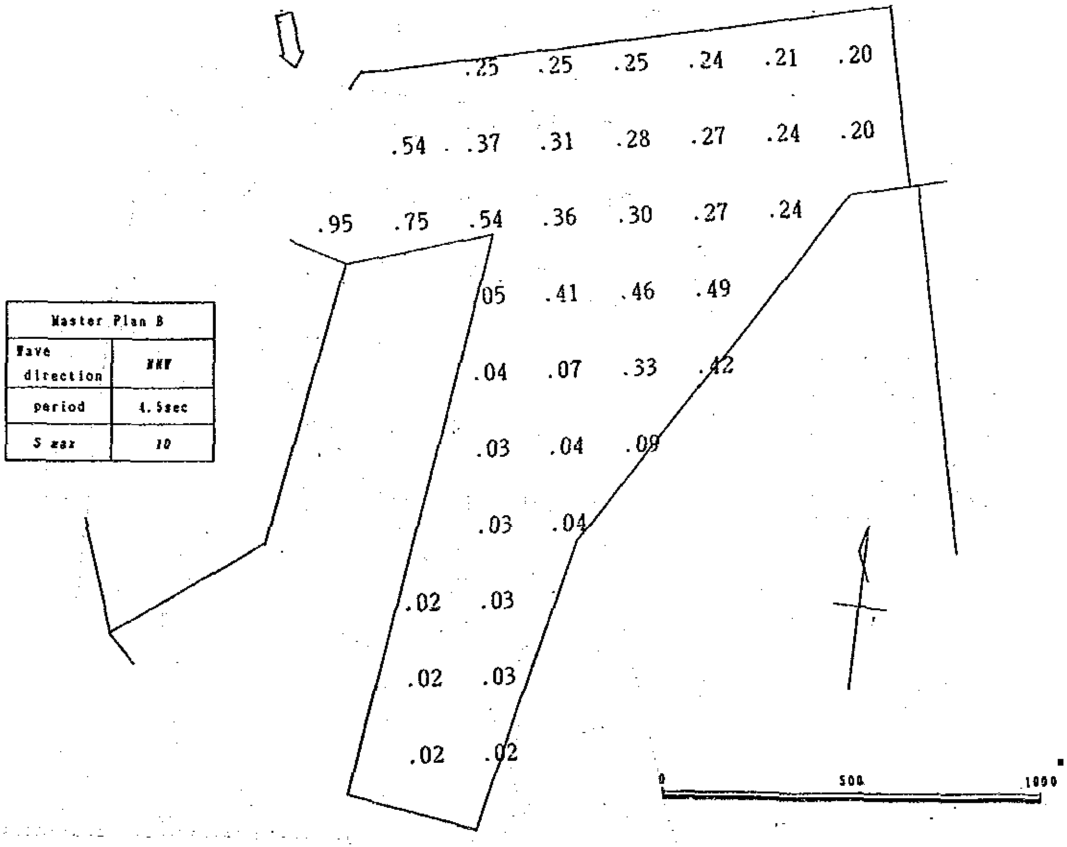


Fig.9-7-6(e) Wave Height Ratio

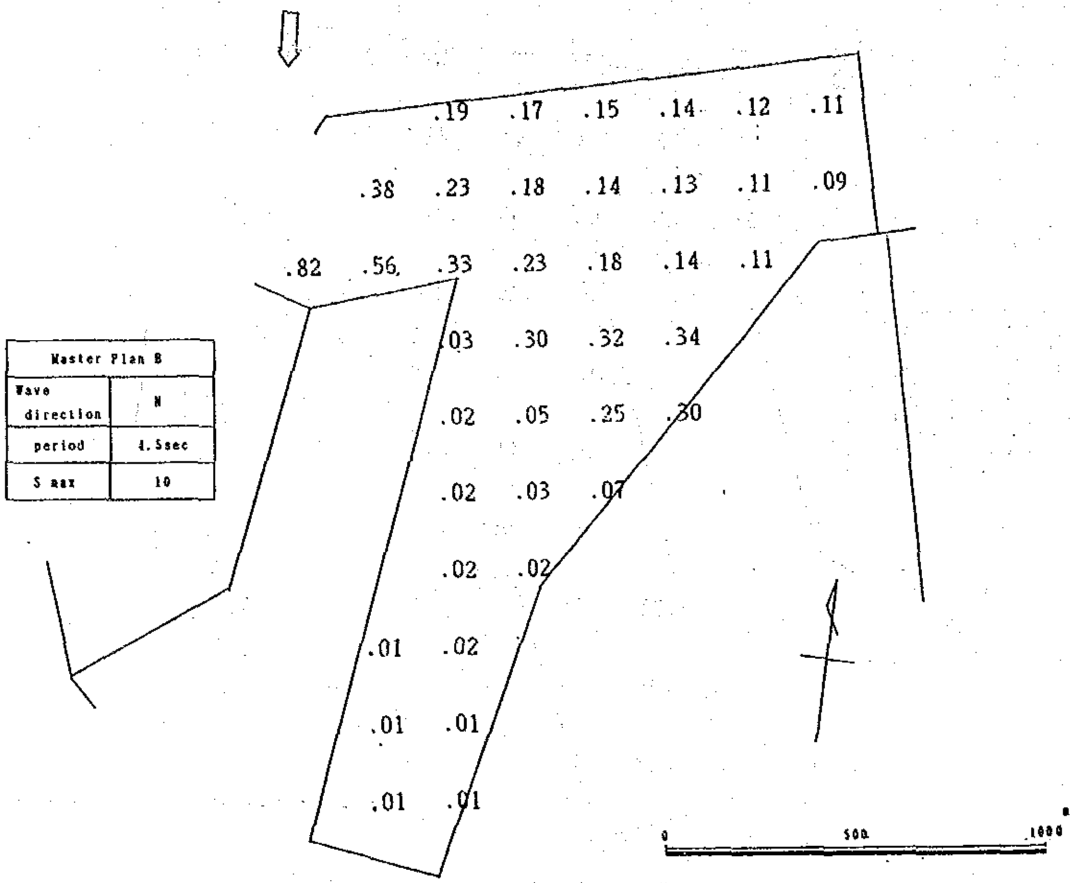


Fig.9-7-6(f) Wave Height Ratio

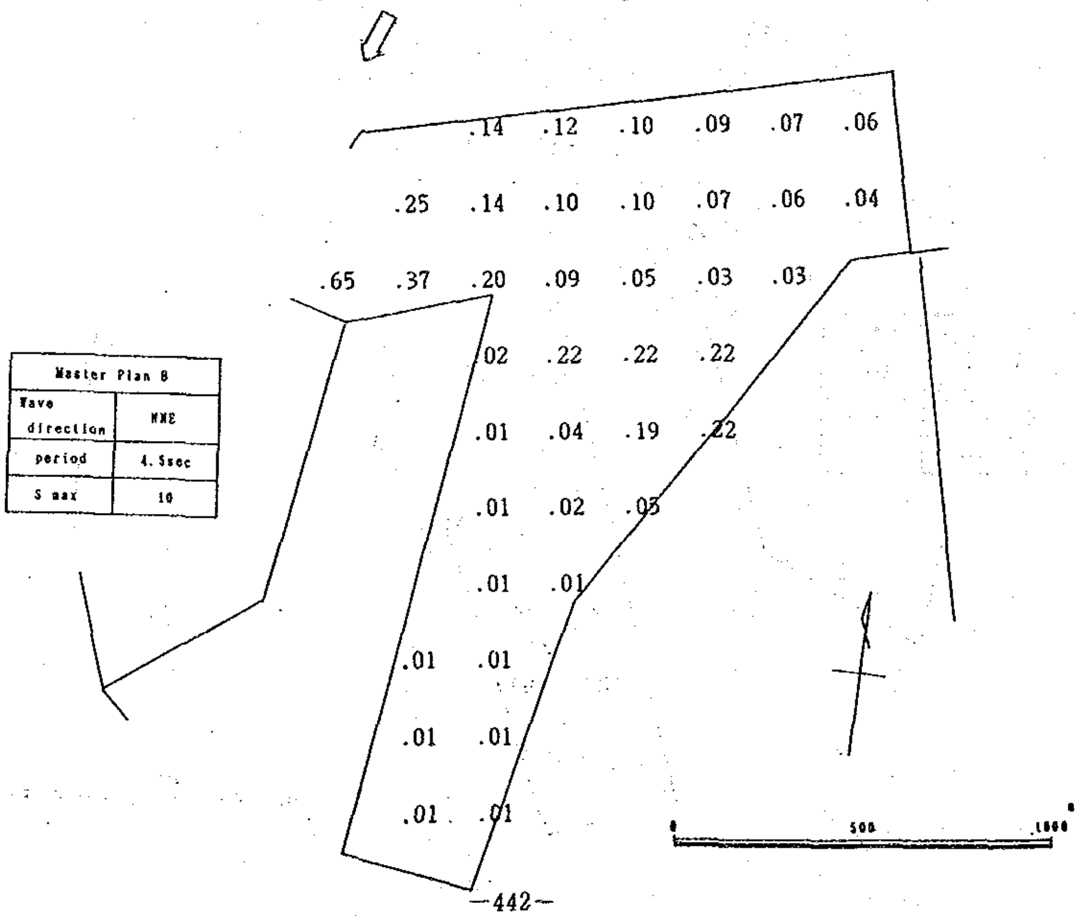


Fig.9-7-9(g) Wave Height Ratio

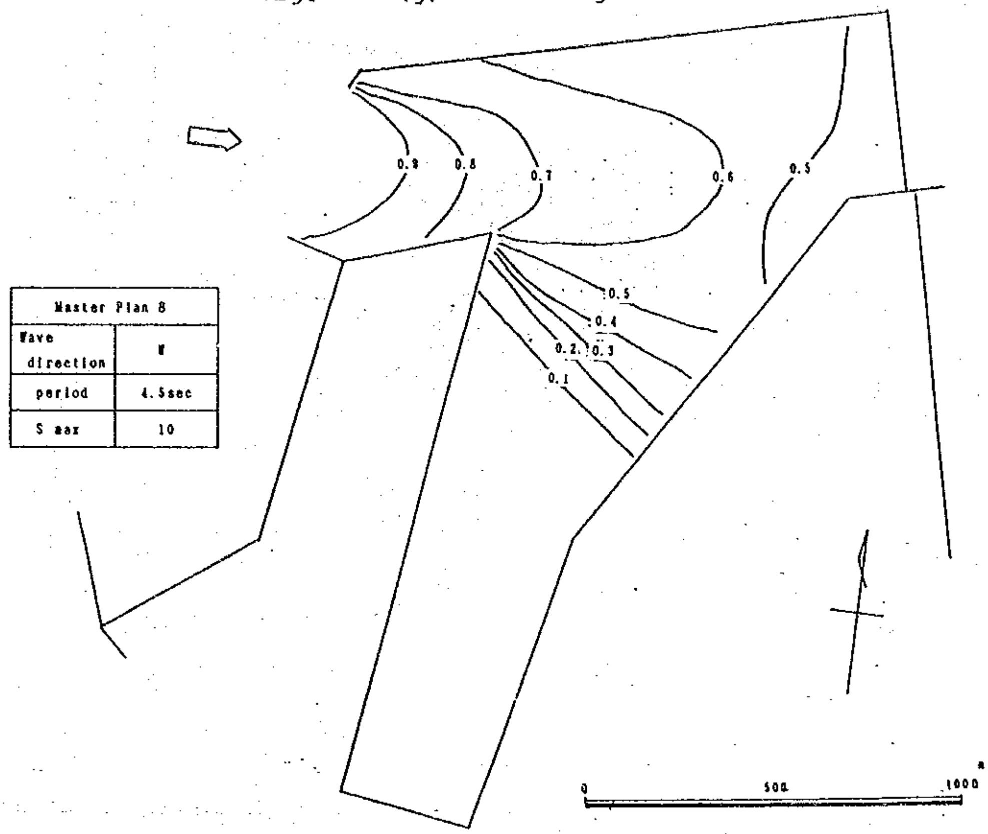


Fig.9-7-6(h) Wave Height Ratio

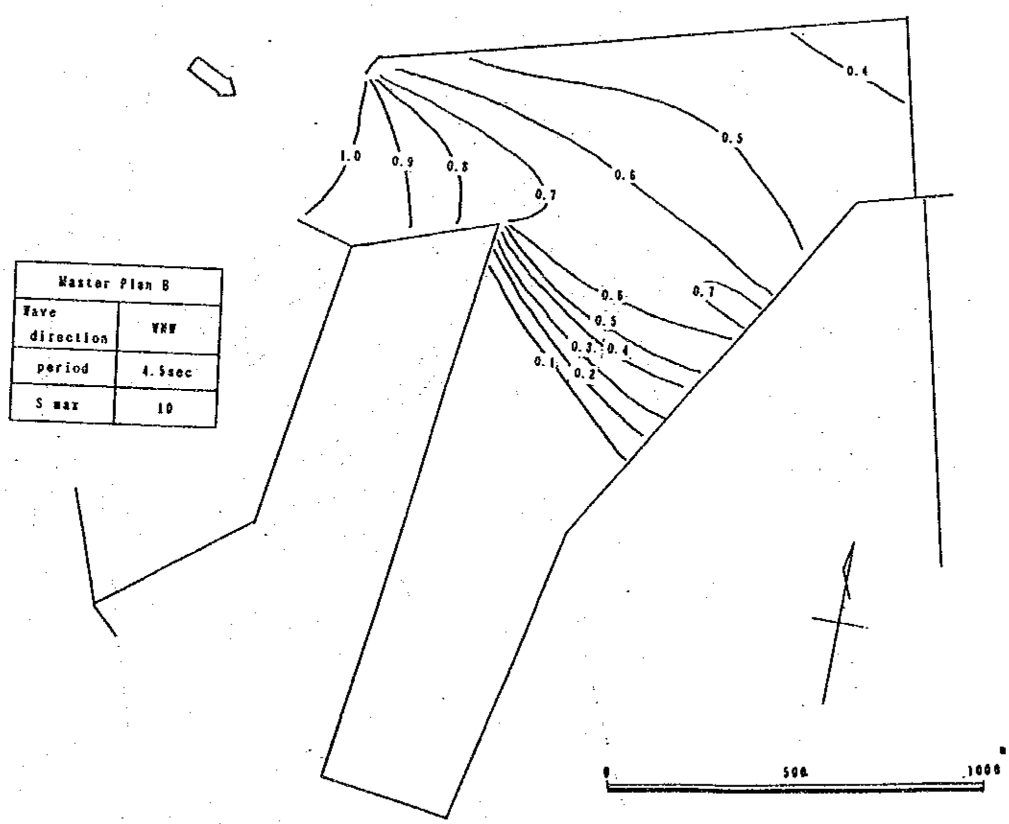


Fig.9-7-6(i) Wave Height Ratio

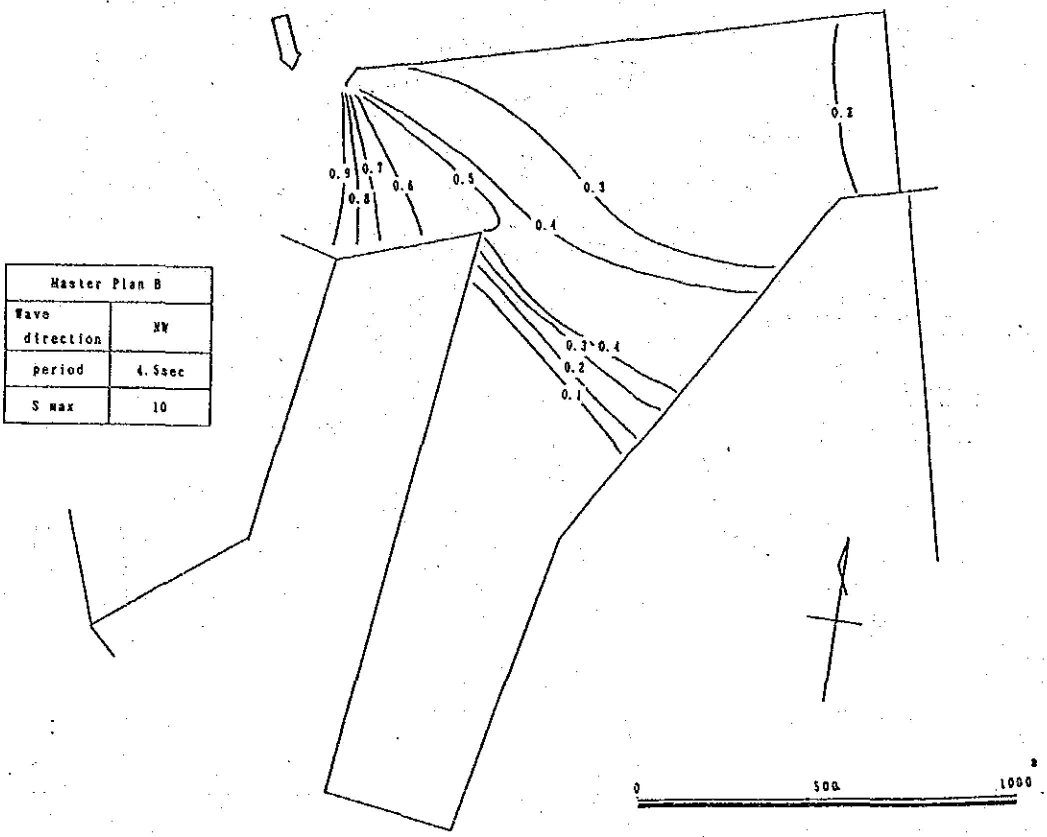


Fig.9-7-6(j) Wave Height Ratio

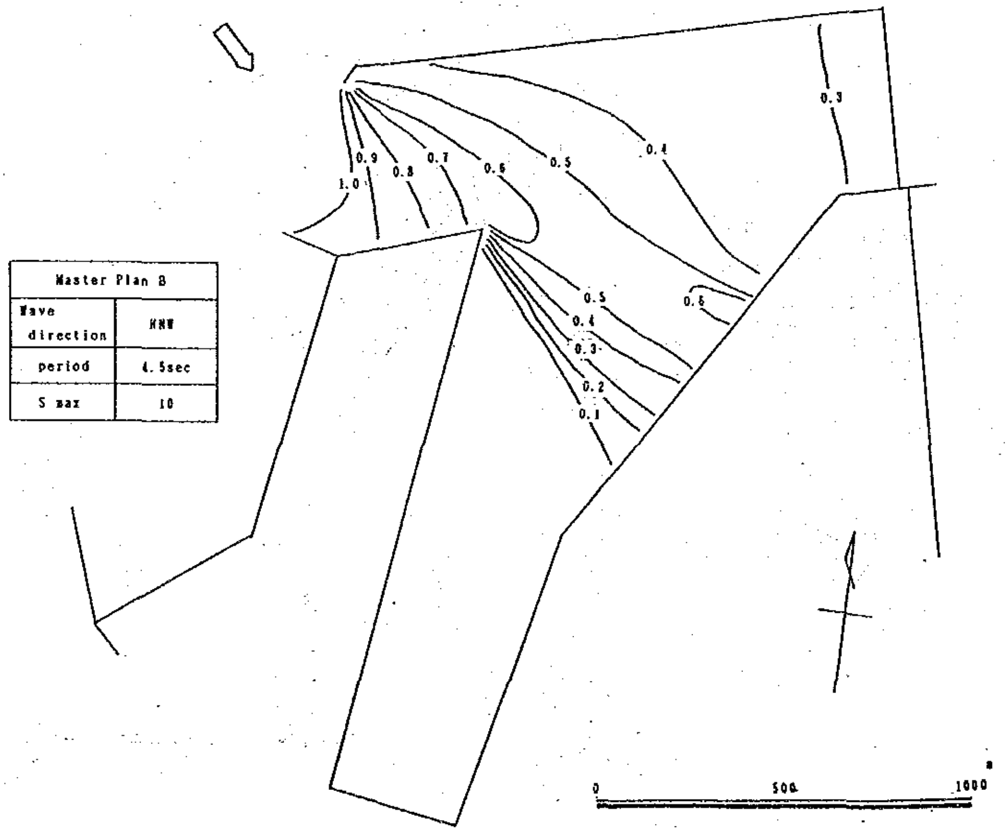


Fig.9-7-6(k) Wave Height Ratio

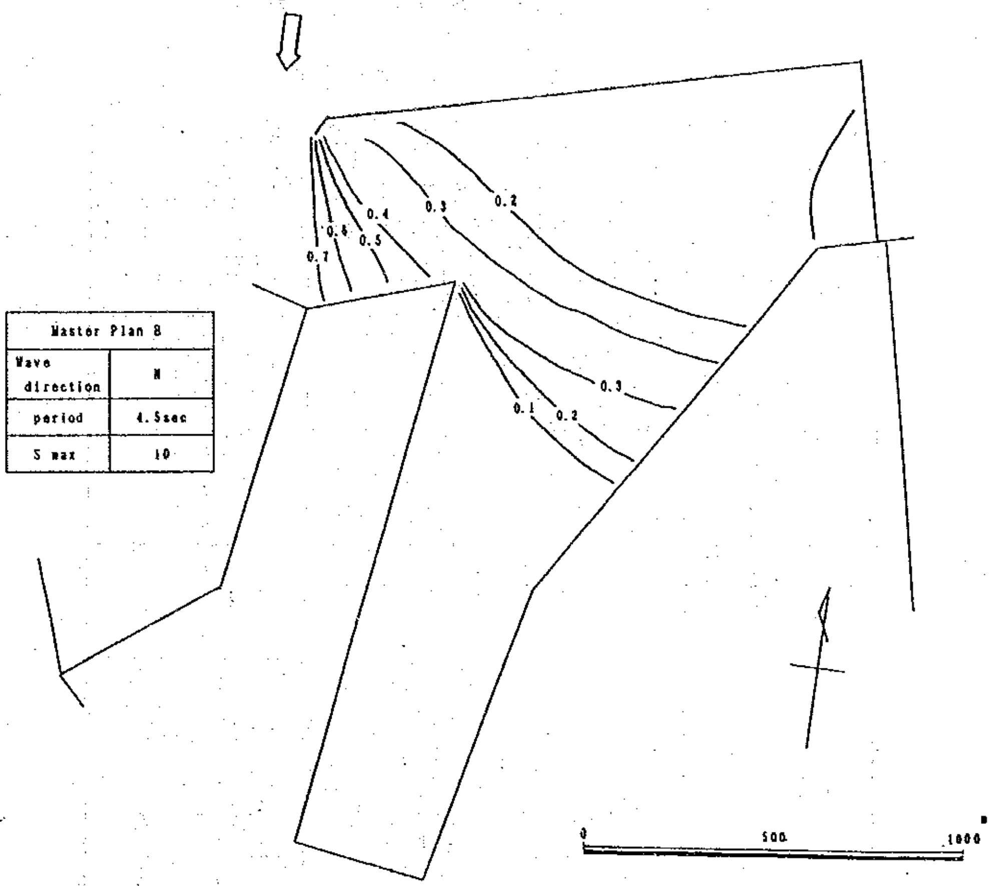


Fig.9-7-6(l) Wave Height Ratio

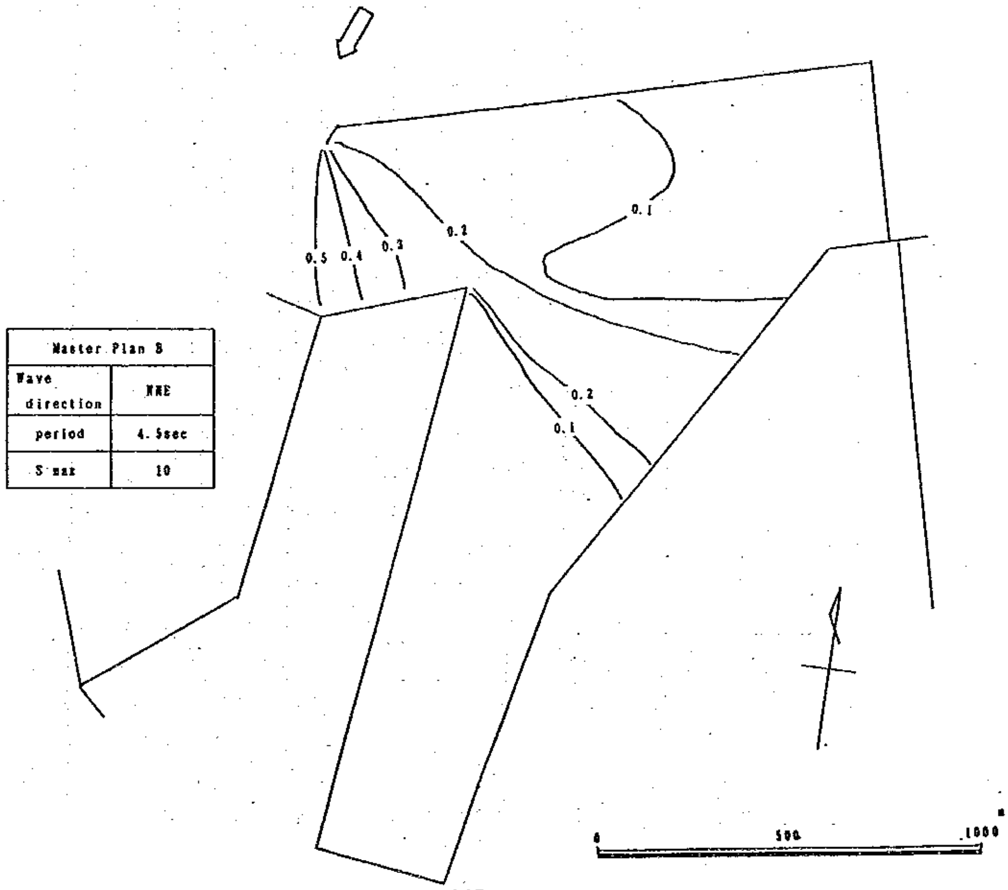


Table 9-7-1(a) Workable Ratio

- Plan A (2000) [Steel iron berth] -

wharf	critical wave height of cargo handling (Hc=0.5m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	1.07	0.47 m	10.5 %
W N W	1.09	0.46	10.1
N W	1.00	0.50	4.2
N N W	0.81	0.62	25.7
N	0.58	0.86	6.5
N N E	0.37	1.35	5.6
total(%)			62.6
workable ratio(%)			37.4

wharf	critical wave height of cargo handling (Hc=0.7m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	1.07	0.65	7.1 %
W N W	1.09	0.64	6.6
N W	1.00	0.70	2.1
N N W	0.81	0.86	13.2
N	0.58	1.21	3.4
N N E	0.37	1.89	1.7
total(%)			34.1
workable ratio(%)			65.9

wharf	critical wave height of cargo handling (Hc=1.0m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	1.07	0.93 m	3.7 %
W N W	1.09	0.92	3.7
N W	1.00	1.00	1.1
N N W	0.81	1.23	6.1
N	0.58	1.72	1.0
N N E	0.37	2.70	0.0
total(%)			15.6
workable ratio(%)			84.4

Table 9-7-1(b) Workable Ratio

- Plan B (2000) [Coal/Ore berth] -

wharf	critical wave height of cargo handling (Hc=0.5m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	0.13	3.85 m	0.0 %
WNW	0.21	2.38	0.0
NW	0.35	1.43	0.6
NNW	0.52	0.96	11.0
N	0.71	0.70	7.7
NNE	0.84	0.60	9.6
total(%)			28.3
workable ratio(%)			71.7
wharf	critical wave height of cargo handling (Hc=0.7m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	0.13	5.38	0.0 %
WNW	0.21	3.33	0.0
NW	0.35	2.00	0.0
NNW	0.52	1.35	4.8
N	0.71	0.99	5.2
NNE	0.84	0.83	8.6
total(%)			18.6
workable ratio(%)			81.4
wharf	critical wave height of cargo handling (Hc=1.0m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	0.13	7.69 m	0.0 %
WNW	0.21	4.76	0.0
NW	0.35	2.86	0.0
NNW	0.52	1.92	0.0
N	0.71	1.41	2.1
NNE	0.84	1.19	6.6
total(%)			8.7
workable ratio(%)			91.3

Table 9-7-2(a) Workable Ratio

- Master Plan A [Container berth] -

wharf	critical wave height of cargo handling (Hc=0.5m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	0.64	0.78 m	5.2 %
W N W	0.63	0.79	4.6
N W	0.51	0.98	1.0
N N W	0.37	1.35	4.7
N	0.24	2.08	0.6
N N E	0.10	5.00	0.0
total(%)			16.1
workable ratio(%)			83.9

wharf	critical wave height of cargo handling (Hc=0.7m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	0.64	1.09	2.5 %
W N W	0.63	1.11	3.3
N W	0.51	1.37	0.6
N N W	0.37	1.89	1.2
N	0.24	2.92	0.0
N N E	0.10	7.00	0.0
total(%)			7.6
workable ratio(%)			92.4

wharf	critical wave height of cargo handling (Hc=1.0m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	0.64	1.56 m	0.3 %
W N W	0.63	1.59	0.5
N W	0.51	1.96	0.0
N N W	0.37	2.70	0.5
N	0.24	4.17	0.0
N N E	0.10	10.00	0.0
total(%)			1.3
workable ratio(%)			98.7

Table 9-7-2(b) Workable Ratio

- Master Plan A [Coal/Ore berth] -

wharf	critical wave height of cargo handling (Hc=0.5m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	0.33	1.52 m	0.5 %
WNW	0.36	1.39	1.3
NW	0.34	1.47	0.4
NNW	0.28	1.79	1.6
N	0.21	2.38	0.2
NNE	0.13	3.85	0.0
total(%)			4.0
workable ratio(%)			96.0

wharf	critical wave height of cargo handling (Hc=0.7m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	0.33	2.12	0.0 %
WNW	0.36	1.94	0.0
NW	0.34	2.06	0.0
NNW	0.28	2.50	0.7
N	0.21	3.33	0.0
NNE	0.13	5.38	0.0
total(%)			0.7
workable ratio(%)			99.3

wharf	critical wave height of cargo handling (Hc=1.0m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	0.33	3.03 m	0.0 %
WNW	0.36	2.78	0.0
NW	0.34	2.94	0.0
NNW	0.28	3.57	0.0
N	0.21	4.76	0.0
NNE	0.13	7.69	0.0
total(%)			0.0
workable ratio(%)			100.0

Table 9-7-2(c) Workable Ratio

- Master Plan B [Coal/Ore berth] -

wharf	critical wave height of cargo handling (Hc=0.5m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	0.10	5.00 m	0.0 %
WNW	0.09	5.56	0.0
NW	0.07	7.14	0.0
NNW	0.05	10.00	0.0
N	0.03	16.67	0.0
NNE	0.02	25.00	0.0
total(%)			0.0
workable ratio(%)			100.0
wharf	critical wave height of cargo handling (Hc=0.7m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	0.10	7.00	0.0 %
WNW	0.09	7.78	0.0
NW	0.07	10.00	0.0
NNW	0.05	14.00	0.0
N	0.03	23.30	0.0
NNE	0.02	35.00	0.0
total(%)			0.0
workable ratio(%)			100.0
wharf	critical wave height of cargo handling (Hc=1.0m)		
wave direction	present conditions		
	wave height ratio	critical offshore wave ht.	wave occurrence
W	0.10	10.00 m	0.0 %
WNW	0.09	11.11	0.0
NW	0.07	14.29	0.0
NNW	0.05	20.00	0.0
N	0.03	33.33	0.0
NNE	0.02	50.00	0.0
total(%)			0.0
workable ratio(%)			100.0

(2) Assumed Sections

BREAKWATER (1)

Fig.9-7-4(a) SLOPING TYPE WITH DISSIPATING CONCRETE BLOCKS (PLAN A AND B)

(Unit;m)

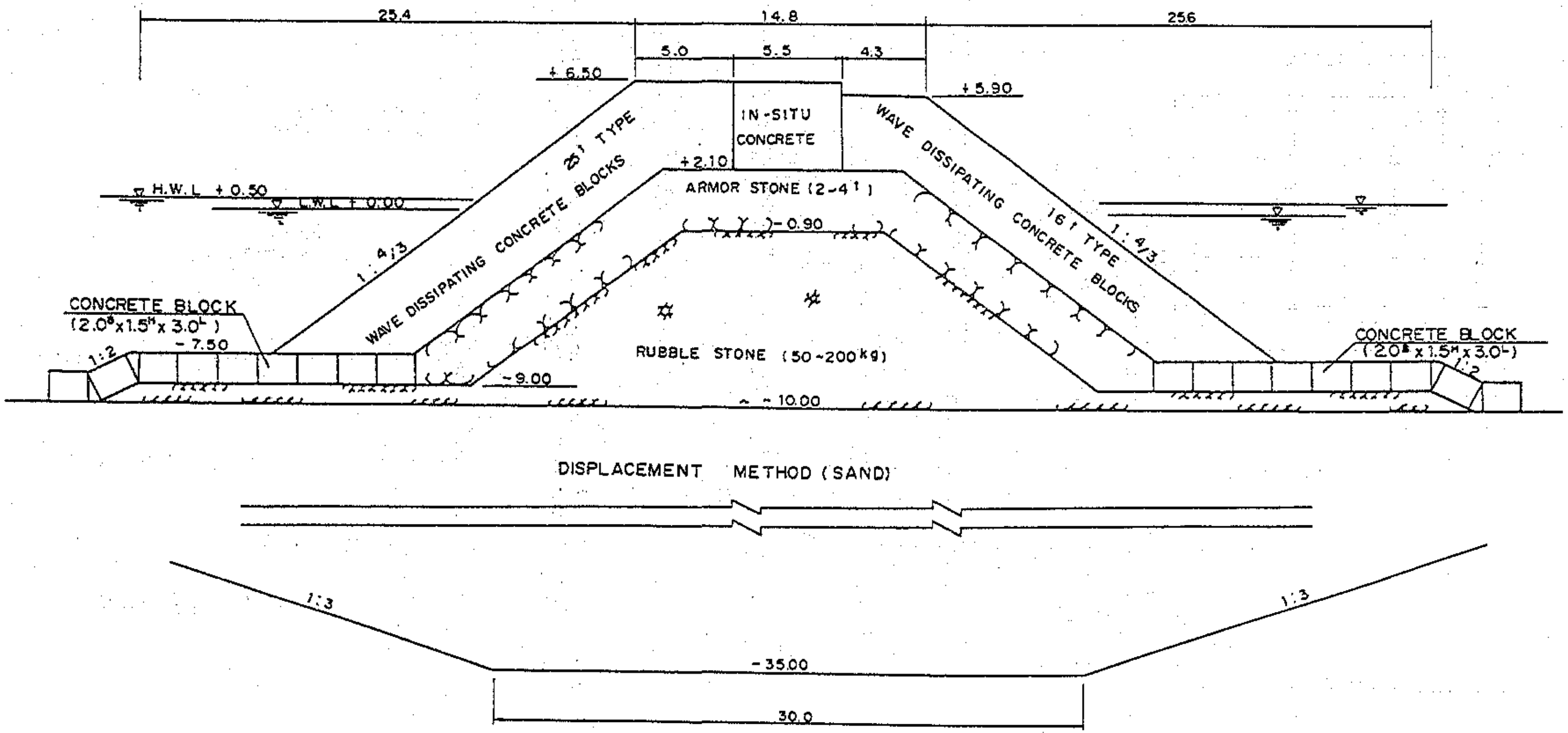


Fig.9-7-4(b) MULTI-PURPOSE BERTH (PLAN A AND B)

(Unit;m)

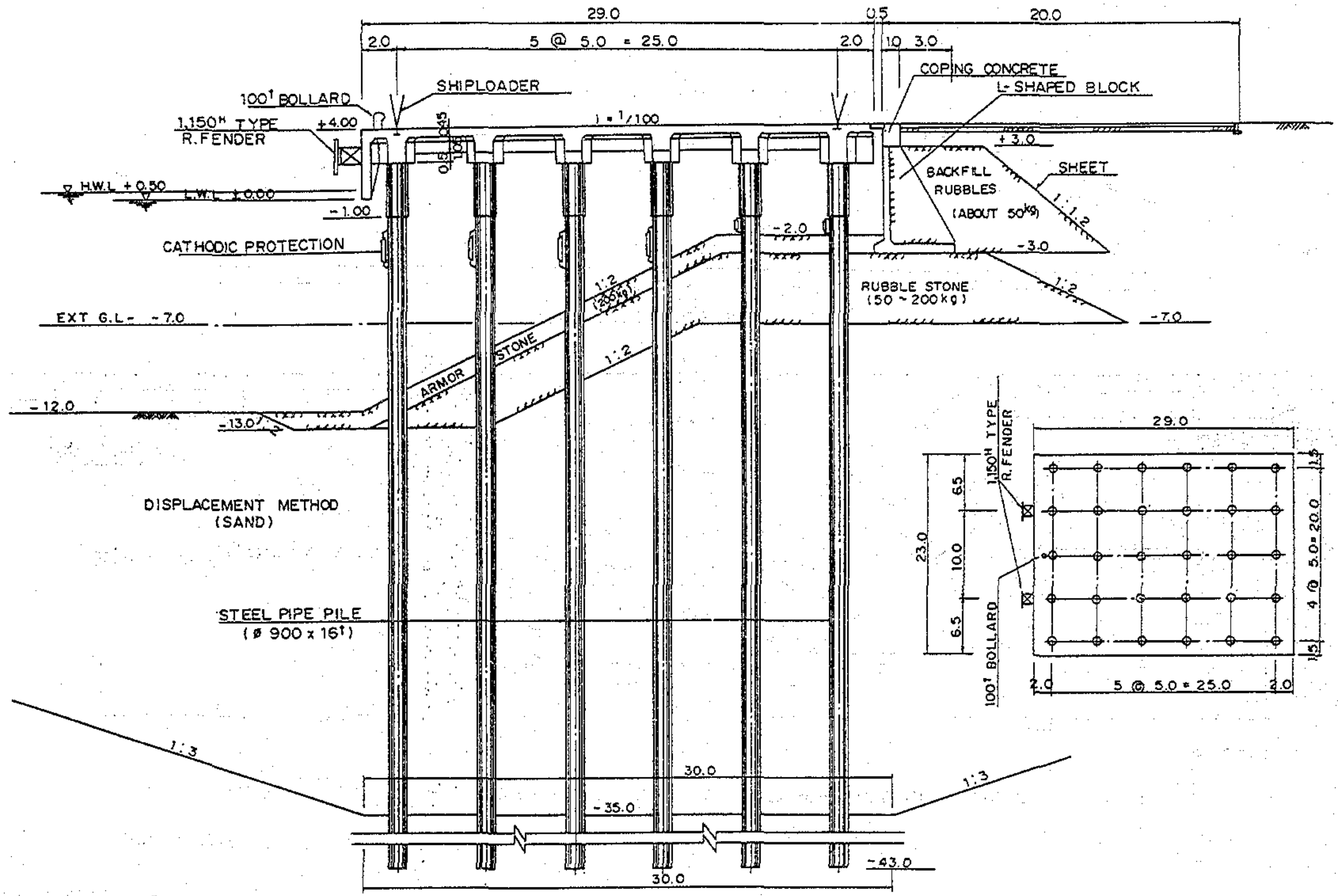


Fig.9-7-4(c) COAL/ORE BERTH (PLAN A AND B)

(Unit;m)

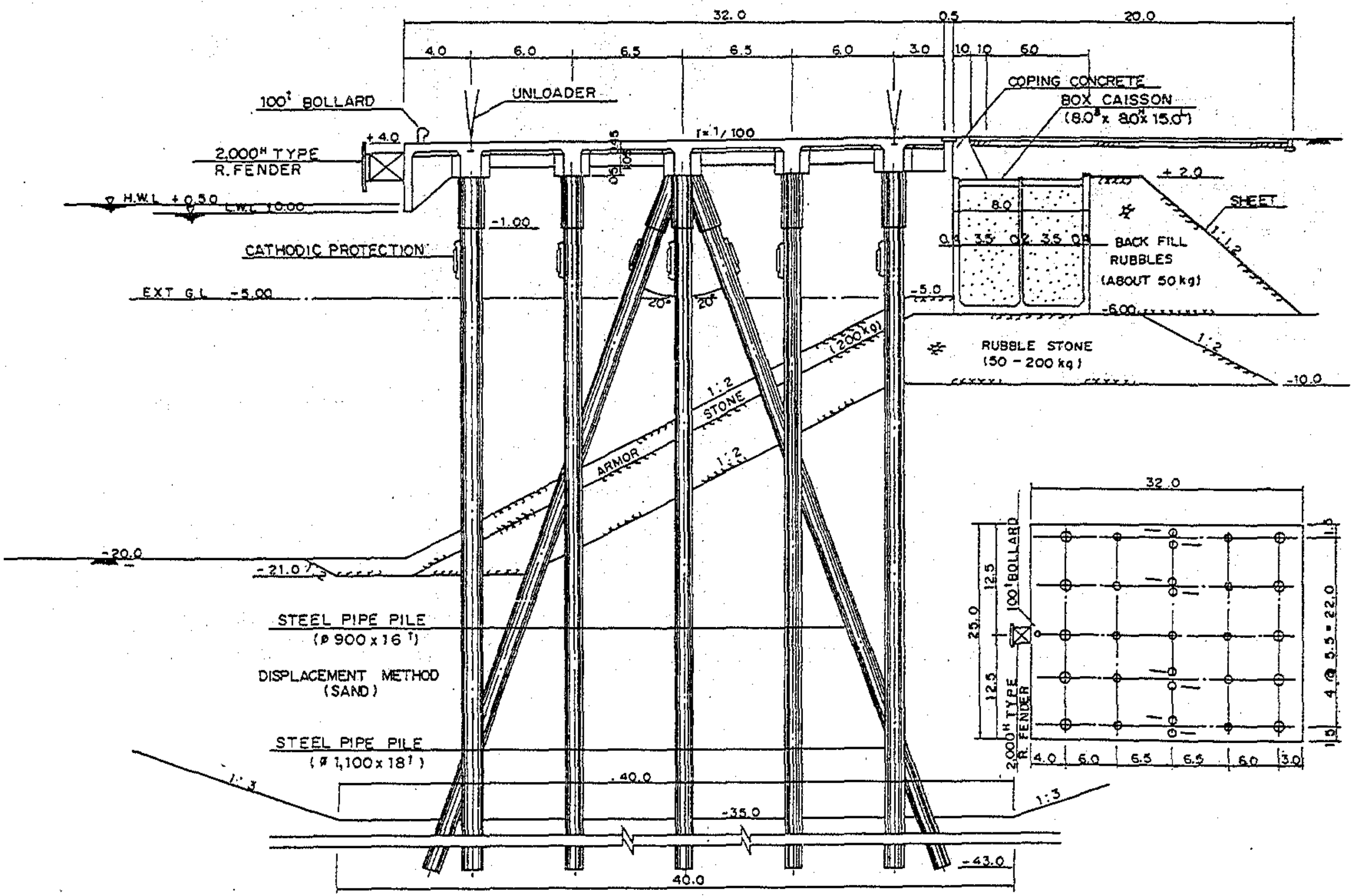


Fig.9-7-4(d) CONTAINER BERTH (-12.0)(PLAN A AND B)

(Unit;m)

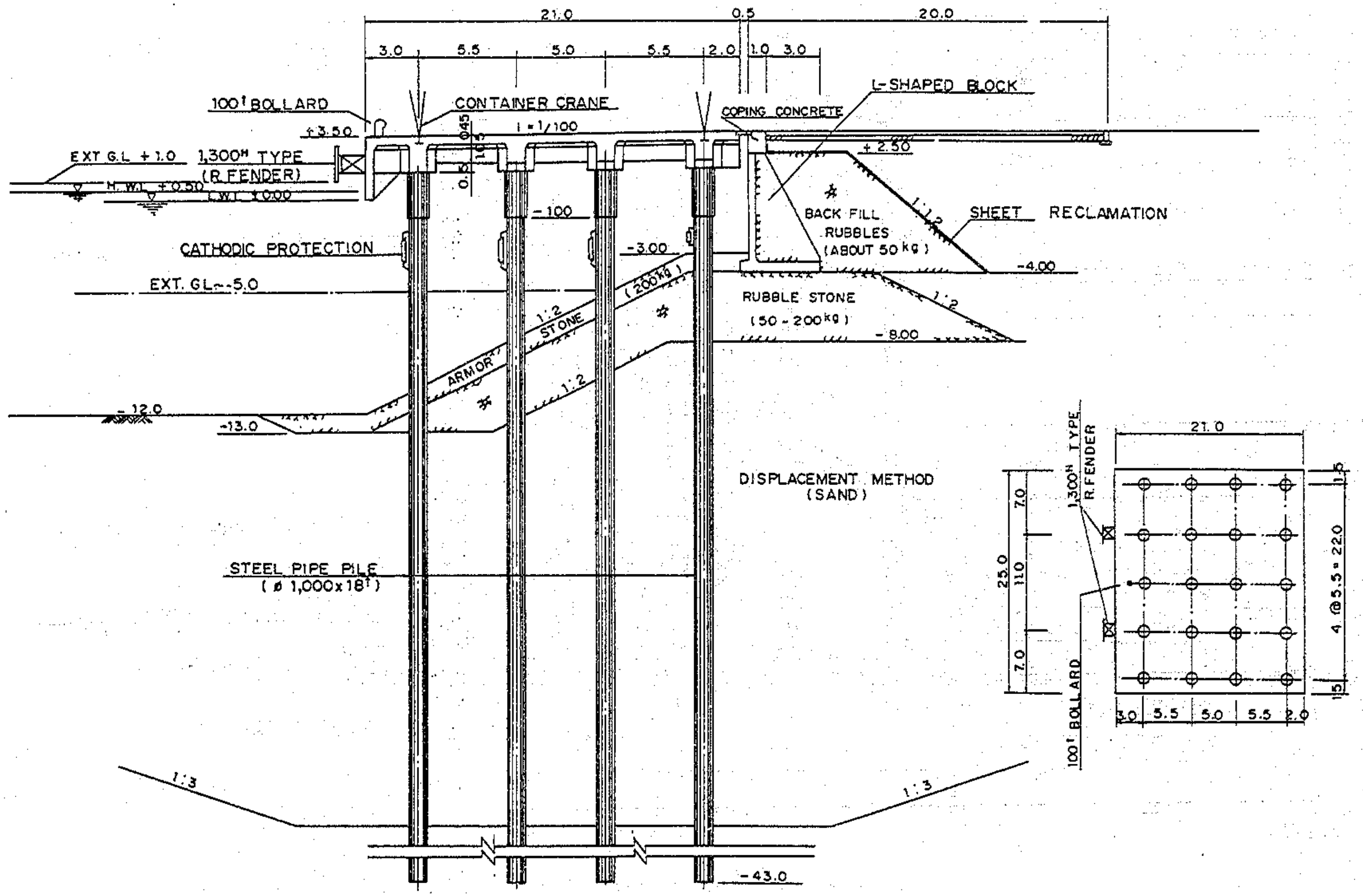


Fig.9-7-4(e) GENERAL CARGO BERTH (-12.0) (PLAN A)

(Unit;m)

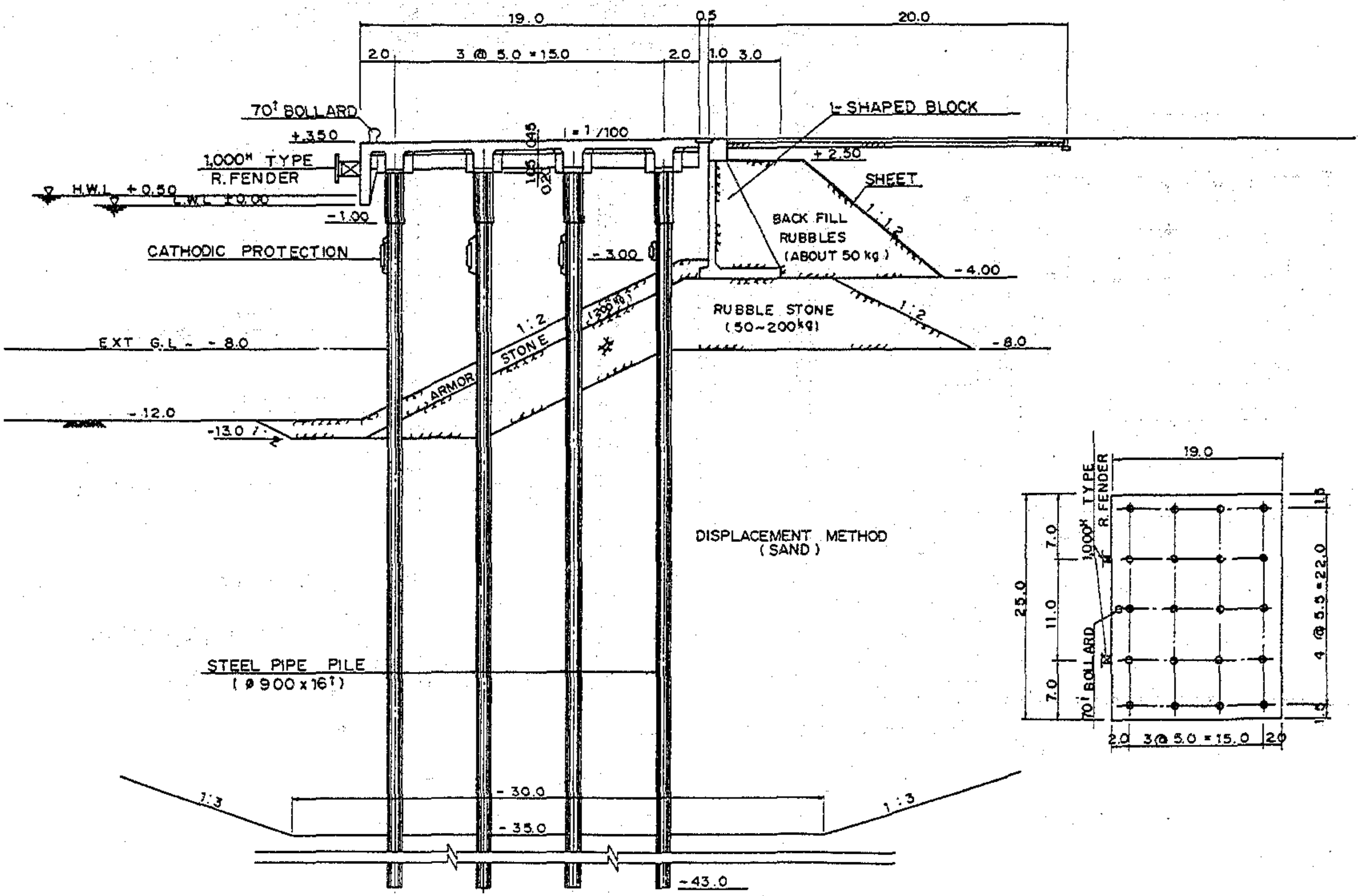


Fig.9-7-4(f)   GRAIN BERTH (PLAN A AND B)

(Unit;m)

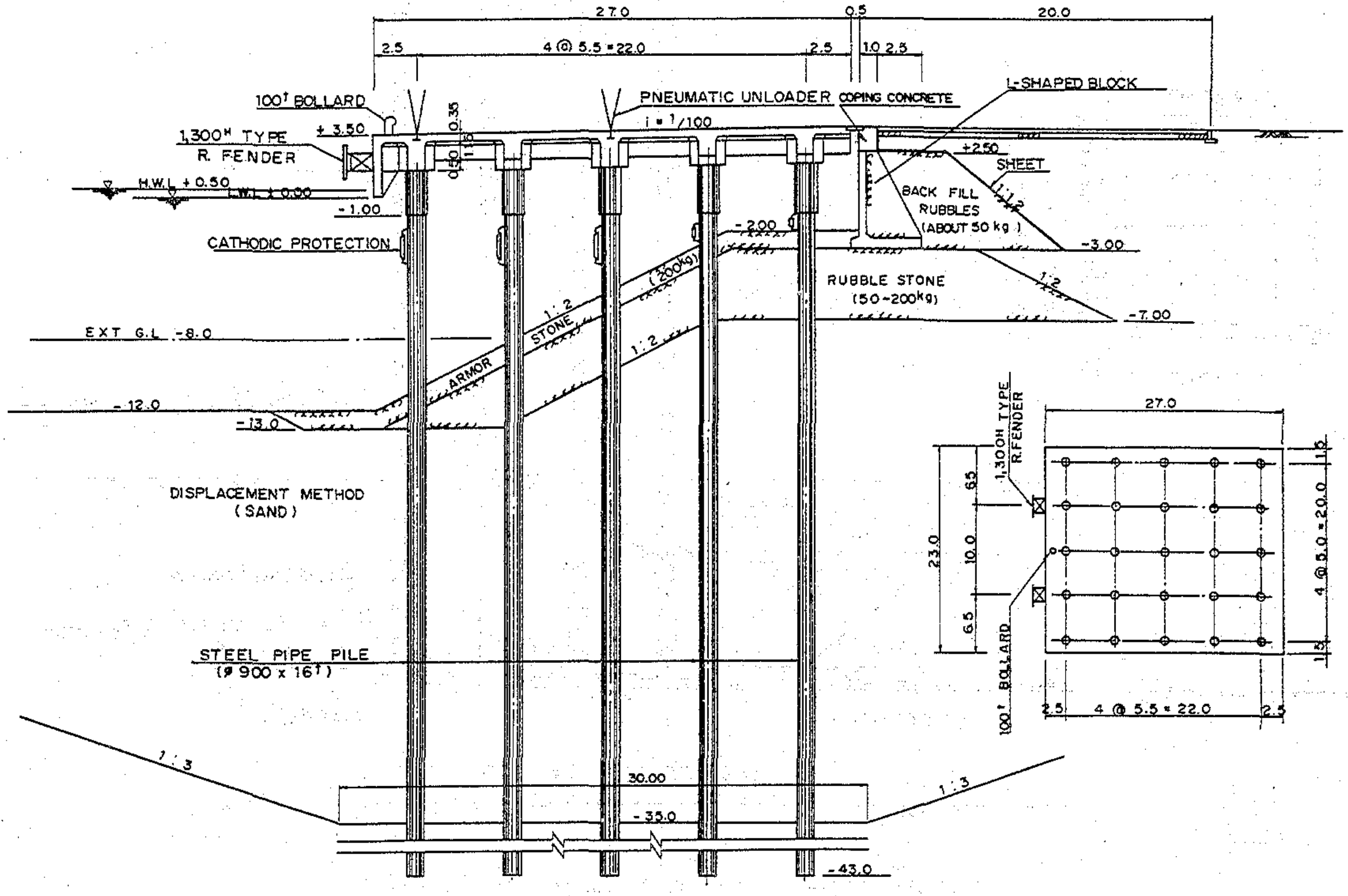
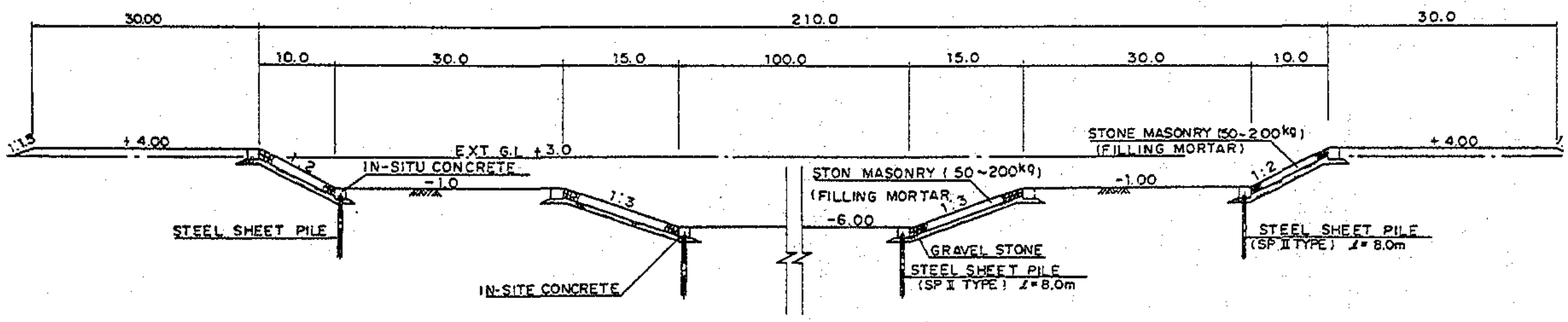


Fig.9-7-4(g) FIYOS RIVER IMPROVEMENT PLAN (PLAN A AND B)

(Unit:m)



9-8 The Master Plan Selected

Table 9-8-1 is the Merit & Demerit table for two alternative plans.

Table 9-8-1 Merit Demerit Table for Plan A and Plan B

Item	Plan-A	Plan-B
Safety	Yes	Yes
Workable Ratio	98.7% at C&O berth	100% at C & O berth
Space	Enough	Slightly narrower than A
Cost	1,500 million US$	1,470 million US$
Stage construction	Easy	Easy

There are a slight advantages in construction cost for plan B.

Calnmess and maneuvability of ships is better in Plan B than in Plan A.

But Plan A has slight advantages in future space reserves.

Considering all the above, the study team recommends plan-B as the Master Plan for the Filyos Port.

Chapter X Related Infrastructure

10-1 Introduction

Apart from the direct port development plans, some development plans for related infrastructures like as railways, roads and river in the nearby areas are necessary to support the new Port at Filyos. Also, the provision of electric power supply, telecommunications and other utilities must be considered.

10-2 Railways

10-2-1 Contents

National railways TCDD is outlined in the previous chapters. Here in this chapter Karabuk-Filyos and some other related sections are majored.

The present physical and economic conditions of the TCDD route to Filyos, transport demands and supplies and measures to serve Filyos Port in the planned period are important.

10-2-2 Current Condition and Problems

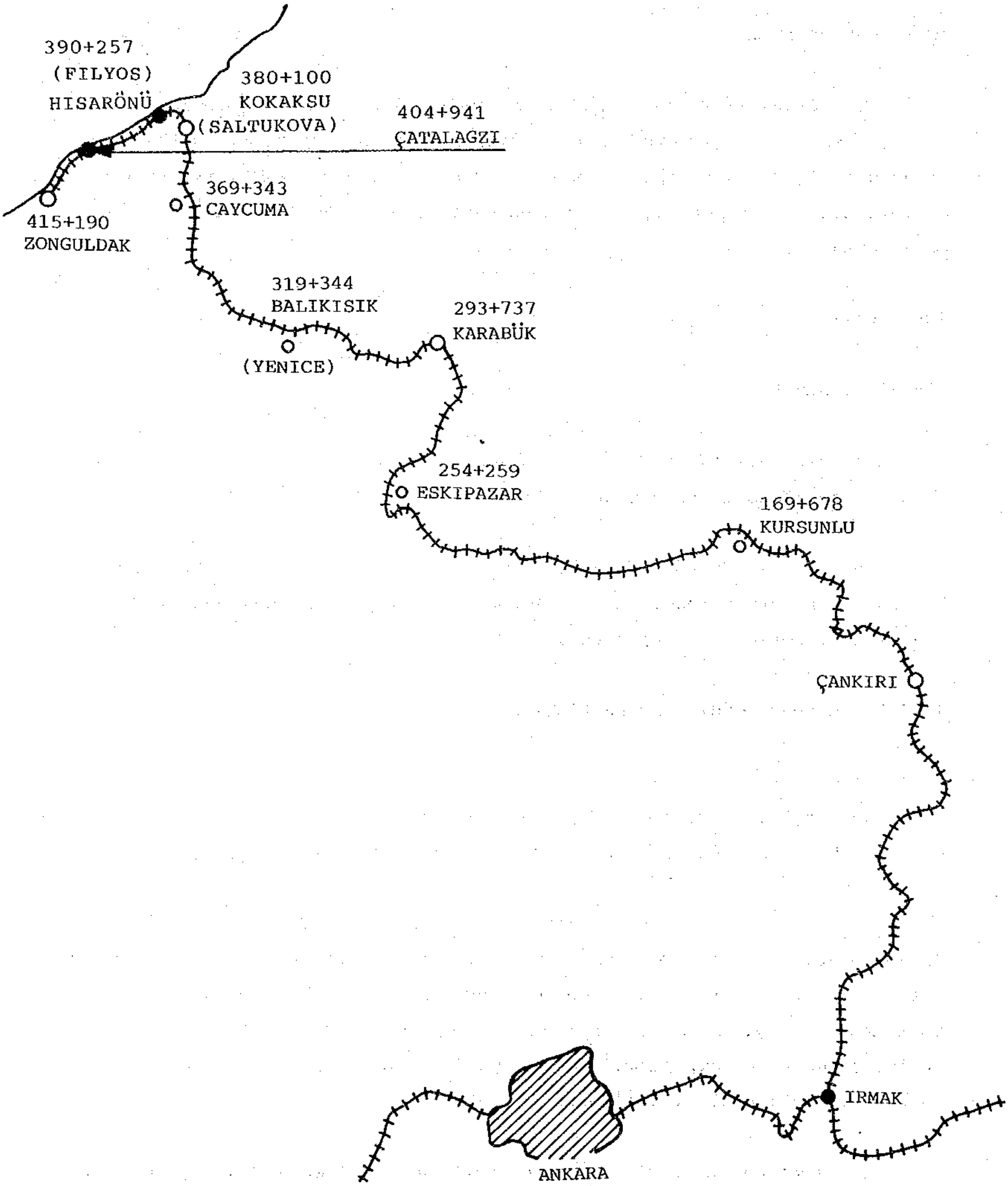
(1) Filyos-Karabük Section

The total rail distance from Ankara via Filyos to Zonguldak is about 415 km, and this route expected to handle cargoes, from the newport.

As the present cargo demands in the section between Zonguldak and Karabuk, about 122 km, are said to be approaching capacity, improvement of the section is important for the development at Filyos Port. The route map is shown in Fig. 10-2-1. In particular, the section between Hisaronu (Filyos) and Karabuk, about 97 km, must be improved to support the new cargo originating at Filyos Port.

This section is in the northern part of the TCDD's 2nd Region, which covers Ankara, Kayseri and Migde in the south. The total railway length of the 2nd Region is 1074.2 km, or about 10.4% of the TCDD's total operating

Fig. 10-2-1 Route Map, Railway



railway.

(2) Present Transport Demand

Total transport demand in the 2nd region is shown below, including passenger and freight.

Table 10-2-1 Passenger and Freight Grosston-Kilometers in the 2nd region

(1,000t-km)

	1984	1985	1986	1987	1988
Passenger	1,176,308	1,234,583	1,260,809	1,240,190	1,151,387
Freight	3,833,674	3,809,761	3,795,993	3,405,553	3,658,778
Service Trains	24,728	25,133	22,530	46,795	43,966
Total	5,034,710	5,069,477	5,079,332	4,692,538	4,854,131

As the length of the section between Zonguldak and Karabuk is 121.5 km, or about 11.4% of the whole 2nd region, freight ton-km on this 121.5 km of railway is assumed to be about 420 million ton-km, or 3.4 million tons as in 1988.

As average transport distances of hard coal and iron ore are 319 km and 607 km, respectively, based on from the TCDD statistics, cargo volumes of roughly 3,400,000 ton may be the maximum demand in this section.

Based on the same TCDD statistics , line section No.16(Karabuk-Zonguldak) carried 301,353,000 grosston-kilometers in 1988. Divided by the distance of 121.5 km, 2,480,000 gross tons or 1,720,000 net tons was calculated as the yearly demand of the section.

Based on another source of data, three months this year, in the section of Karabük to Catalagzi near Zonguldak (111.2 km), the ratio of "net ton" to "gross ton" is 51.8%, including up and down cargoes. Up trains to Karabük and down trains to C, atalagzi are respectively 66.4% and 20.2% between "net tons" and "gross tons".

This means down trains are almost empty, compared to fully loaded up train. Exact figures of ratio of down trains to up trains in "net tons" is 12.6% based on three months' data. By the way, despite the same absolute figures of about 1,220 net ton, in 10.3 km, the ratio of down traina to the total of up and down trains is 31.3% in the section of Catalagzi to Zonguldak, compared to 12.6% in the 11.2 km to Karabük.

Monthly figures over three and a half years are shown in Table 10-2-2 and Fig. 10-2-2 in thousand gross ton-km, including up and down trains. The figure in 1988 is 0.16% down, compared to 301,353,000 grosston km, referred to previously, but the difference may be said to be negligible.

Monthly data shows no trend of increase, or seasonal fluctuation. By our tentative analysis together with the TCDD's comment, these are the results of both economic difficulties and supply-side accidents, including strikes by labor unions.

Table 10-2-2 Freight Transportation
Karabük-Zonguldak

UNIT:1000 Grosston-km

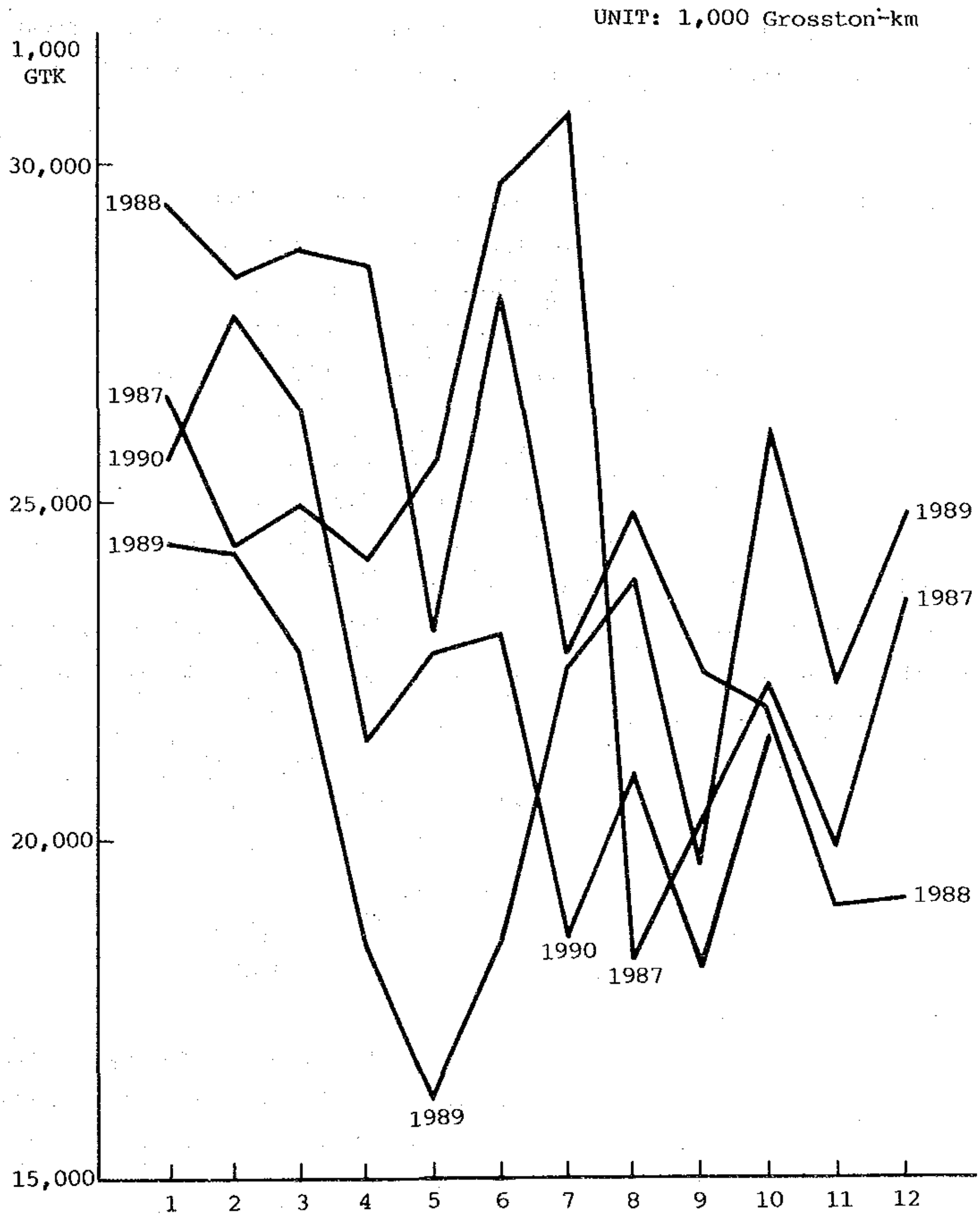
	1987	1988	1989	1990
January	26,607	29,405	24,427	25,602
February	24,390	28,356	24,293	27,798
March	24,981	28,733	22,718	26,341
April	24,165	28,503	18,481	21,505
May	25,569	23,085	16,197	22,718
June	29,710	27,964	18,483	22,969
July	30,546	22,689	22,452	18,545
August	18,136	24,775	23,761	20,960
September	20,164	22,476	19,574	18,109
October	22,264	21,888	25,967	21,594
	(246,532)	(257,874)	(216,353)	(226,111)
November	19,877	18,946	22,218	
December	23,439	24,037	24,637	
Total	289,848	300,857	263,208	

Source: TCDD

Based on other source of information offerrd by the TCDD, the actual demand of the Karabük-Filyos section is estimated as follows:
One locomotive with 13 wagons (each 55 net tons) makes 1 freigth train, carrying 750 net tons. "Going" means a train giung uo to Karabük.

Going:	4 trains, fully loaded	3,000 t/day
Returning:	4 trains, partially loaded	500 t/day

Fig. 10-2-2 Freight Transportation
Karabuk-Zongulpak



Total transport per day:	3,500 t/day
Yearly transport demand:	1,300,000 t/y

From this informations, we can assume the average demand of transport in the section from Filyos to Karabuk in the basic year of 1990 as follows:

Total demand:	300,000,000 Grosston-km/year
	156,000,000 Net ton-km/year
Demand in Net ton total:	1,280,000 Net ton/year
Down-train:	160,000 Net ton/year
Up-train:	1,120,000 Net ton/year
Up train cargo by kind	
Hard coal:	1,000,000 ton/year
Others:	120,000 ton/year

(3) Future Transport Demand in the Target Year

Based upon the forecast port cargoes in the new Filyos Port, railway transport demand in the section of Filyos-Karabük section in the year 2000 and 2010 are assumed as follos:

(1,000 ton)

	1990	2000	2010
Hard coal	1,000	1,300	1,300
Iron ore	0	1,700	1,700
Others	280	1,000	1,500
Total	1,280	4,000	4,500

All the hard coal, iron ore and as well as some others, totalling 3,600,000 tons in 2000 and 4,000,000 tons in 2010 are "going" to Karabük and the remaining are assumed to be "returning" to Filyos.

(4) Transport Capacity

As the "going" demand is about 90 percent of total, present and future, the "going" capacity from Filyos to Karabük is mainly considered here. The few "returning" few trains carrying many more empty wagons are not so critical compared to fully loaded "going" trains.

By way at comparison with the present capacity, the necessary capacity in the target year is shown below. Six trains to Karabuk are now ready to operate from the present operating time table. In the present operating table, 2 express trains, 5 passenger trains and 8 cargo trains are listed, including non-regular trains.

Present

1 train with 1 locomotive.
and 13 wagons (55t)
= 750 net tons

6 trains/day
= 4,500 tons/day
= 1,600,000 tons/year

2000

1 trains/with 1 locomotive
and 13 wagons
= 750 net tons

13 trains/day
= 10,000 tons/day
= 3,600,000 tons/year

2010

1 train with 2 locomotives
and 20 wagons
= 1,000 net tons

11 trains/day
= 11,000 tons/day
= 4,000,000 tons/year

Needless to say, in the case of hard difficulty for 13 trains per day, other compositions of 1 train with more than 13 wagons must be devised.

(5) Recommended Policy for the Expansion of Railway Capacity

In a railway system, the rated output is possible only through a well-balanced relationship between the three main capacity factors: facilities, rolling stock, and staff. Facilities include track, stations, and a base depot, and it is far difficult and needs long-range efforts to improve their capacity, compared with rolling stock and staff. Therefore, only the improvement of track and related facilities is recommended here.

In the section of Ankara through Karabük to Zonguldak, signalling and electrification installations are planned to be completed by 1994. So, the present capacity of 4,500 tons/day in the section will be increased by 150 percent. With the other continuing improvements to the present single track railway, such as to the irregular intervals between stations, the speed drop due to steep grades and sharp curves and train control functions, the capacity will be increased by another 150 percent or more.

With the increased number of wagons in one train, or number of trains per day, a capacity of 3.6 million tons a year will possibly be realized by 2000.

For the target year of 2010, double tracking, even partially, could be introduced. As the section between Yenice and Karabük, particularly about 20 km, runs along the bottom of a deep valley with many tunnels, improvement by double tracking would be likely be very expensive. Avoiding this section, investigation must focus on the flat sections around Caycuma and Yenice, about 40 km, which would lead to a possible capacity of as much as 5 million tons in 2010.

10-3 Access Roads to Filyos

10-3-1 Introduction

Roads in the new port area are referred in the planning part of this report. Only the access roads from Ankara, E-5 or Karabük to the Filyos area, are considered here.

10-3-2 Current Condition and Issues

(1) Current Characteristics of routes to Filyos

The main route from Ankara to Filyos is Ankara-Gerede-Mengen-Dorukhan Tunnel-Devrek-Caycuma-Filyos, which is 280 km in total.

Most of this 280 km is well improved and maintained as a whole network of roads, with a few exceptions referred to later.

Another important access route is Gerede-Eskipazar-Karabük-Safraubolu-Bartin-Filyos. This route is 70 km longer compared to the main route between Mengen and Devrek, but because of its connections with important hinterland cities such as Karabük and Bartin, it may be said to be the second important access route to the new port. Also the road conditions are very good, almost the same as the main route.

Another important access link is the Karabuk-Yenice-C, aycuma-Filyos route. Unfortunately, passage is very difficult between Karabuk and Yenice, becausde at improvement works which are going on. At present, only jeeps or trucks can get through in fine weather. Upgarding this section is one of the most important tasks in the near future.

(2) Traffic Demand

As appeared in the previous chapter, average annual daily traffic was observed total 1,054 - 2,756 vehicles near Devrek and Zonguldak in 1987 - 1989. Out of this total number of vehicles, 30 - 57 per cent were truck and trailers.

With other information and observation along the route, traffic demand are gradually increasing in a long range.

One of the characteristics along the road network near Filyos is that traffic demand of the two sections of Devrek-Zonguldak and Caycuma-Bartin are more than double compared with that of the section of Mengen-Devrek.

(3) On-going Improvement Works

The section between Caycuma and Bartin, distance about 51 km is now under construction since 1974. But, almost ninety per cent of the total length has been completed and up to the Filyos junction all the works, two lane pavement with total width of 9.50 meters, were already completed.

Only the remainder, about ten per cent near Bartin, is under construction and will be completed by 1991.

The other section, Devrek junction-Yenice-Karabuk about 62 km, is under construction since 1977. By the completed section, Devrek junction to Yenice, all the vehicles can get to the town of Yenice, including public bus. But the remainder of Yenice to Karabuk is now under construction and most vehicles can not get to Karabuk through this route.

From the junction inbetween Devrek and Caycuma to Zonguldak, there observed a fairly flat and little curved good road. But at the section near to the town of Zonguldak, some improvement works including tunnel are going on, with little obstacle to the traffic.

(4) Others

There is other access road from Zonguldak to the town of Hisaronu along the Black Sea shore. This route is very good for enjoying fine view of sea and mountain heads, with fairly speedy condition by pavement. But because of narrow and steep up-and-down, in winter snow weather, traffic must be stopped. Also, traffic demand looks few, probably under 500 vehicles a day even in good weather.

With some above mentioned exceptions, most of the flat section in the improved wide trunk road are enjoyable for speedy driving more than 100 kilometers an hour.

10-3-3 Guideline for Road Development

(1) Future Road Traffic

Cargo amount originated at the Filyos Port and nearby industrial complex will be the big burden to the access road from Ankara area. This is estimated in 2010 as following:

	Yearly cargo amount	Number of vehicle per day
4 Container berths	270,000 TEUs	1,200
6 General cargo berths		

(Conventional except wood)	840,000 ton	560
1 Grain berth	120,000 ton	80
Saw Mills	150,000 ton	100
Steel Mill and Others	250,000 ton	160
Total		2,100

With some induced cargoes, public bus and private cars in the nearby area, total about 4,000 vehicles per day will be created by the new port.

(2) Doubling Capacity of Dorukhan Tunnnel

Most of the above mentioned traffic about 4,000 vehicles, will reach to the section between Mengen and Devrek to get to Ankara and other hinterland of Filyos Port. Added by the present 1,200 vehicle, more than 5,000 vehicles must pass through the Dorukhan Tunnel.

As this amount is almost same to the present E-5 traffic. Four lane motorway is needed at the section of Gerede-Mengen-Devrek by the year 2010. Luckily enough, the TCK long term concept of an 11,000 km-long motorways includes the Zonguldak-Bolu section. To support the new Filyos port, this motorway is expected to be realized by the year.

Particularly, tunnel works of long distance taked a long time for digging. Therefore, earlier start of digging of the new one tunnel is expected.

Relating to the tunnel, there are other important problems to the section. From the outlet of the Dorukhan tunnel, about 15 kilometers near to Devrek is steep and continued downslope. Particularly in the snow season, that section is dangerous and takes a long time to drive both direction of up and down. Therefore, a separated new route between Mengen to Devrek including a new tunnel is desirable, at least upward direction. The slope under 6 per cent and occasional flat intervals are desirable. These are expected to be realized in the above 11,000 km motorways concept.

(3) The On-going Projects and Others

Except the above Dorukhan-Devrek section, most of the road network surrounding Filyos is not so difficult to improve. For example, from the

Filyos junction along the Bartin highway to the town of Hisaronu via the railway station of Kokaksu near Saltukova must be improved to support the much traffic at least 4,000 vehicles in 2010. But the stage construction of improvement looks feasible, including few more bridges over the Filyos River.

Other important matters to support the new port are the on-going projects, like as on Yenice-Karabuk section. All the on-going projects are expected to be completed on the schedule.

Also, other improvement projects are expected to be planned earlier enough along the expansion of traffic, even in the case of feasible stage construction.

10-4 River

10-4-1 General

Filyos Port is going to be built at the river mouth of Filyos River, which is the number five longest river of the Turkish Black Sea coast. A river mouth is usually not so good place to build a modern port. But because of mountainous and continued precipitous cliff along Black Sea shore in the norhwestern Turkey, Filyos river mouth can not be overlooked.

Black Sea shore is somewhat similar to the Japan Sea shore and flood is useually caused by spring thawing water by laid winter snow, not by heavy storm rain in summer like as typhoon. This looks the main reason of the comparatively narrow width of river mouth in the wider catchment area.

10-4-2 Characteristics of Filyos River

(1) Catchment area

A total catchment area of Filyos River is 13,300 km^2, extensive enough more than the Japanese mumber three Shinano River (12,050 km^2). It extends east to west about 200 km and north to south about 100 km.

There are two main branch streams at the thirty kilometer junction point up south from the river mouth. The bigger stream from the junction goes up east about 100 km via Karabuk to Boyali and turn to the west beyond City of Gerede. These Yenice, Soganli and Gerede Rivers have two thirds of total catchment area.

The other branch stream extends to the west as Deverek River up to Mengen and Bolu area, accounting about onethird of the total catchment area.

(2) Little rainfall in the catchment area

Annual average precipitation in the catehment area varies from 1,200 mm along the seashore to 400 mm the mountain area, and is also comparatively heavy in the western part. DSI data show average annual precipitation in Filyos River of 855.7 mm, or about one-third of that in the Shinano River area. This is one reason for the comparatively narrow width of the river is mouth.

Records are being taken at 17 of the 20 observation stations. Observations have been made at the Devecikiran Station near Filyos Estuary since 1963. The lowest discharge recorded was 3.86 m^3/sec.(31.7.1977) and the highest was 2,780m^3/sec(1.5.1975) while the average was 109m^3/sec. At another point on the Deverek branch of the Filyos creek, according to the observation records between 1959-1971, the average annual run off was 18.7 m^3/sec and max. was 327m^3 and min. was 3.28m^3/sec.

When dams are constructed on Devrek creek, the run off will be requlated as 430m^3/sec.

(3) Wide middle courses and occasional rapid stream sections

Wide river beds are found in the middle courses of the Filyos River. Most of the trunk stream beds are left in this natural condition, except for a few kilometers down the city of Devrek, where primitive enbankment works are going on.

One of the most important wide river beds is found in the section between Devrek and Caycuma, while an other is between Karabuk and Boyali along the Soganli River. In these sections, the river beds are more than two or three kilometers in width. These wide river beds work as natural retarding basin or regulating reservoir for flood discharge.

Also, these are some rapid stream sections, such as the 12 km west point of Yenice or the 7 km upstream from the river mouth. The rapid stream near Yenice is only about 30 meters wide and the river surface is only three meter below the nearby roadbed in an average amount of river flow (May). The latter is about 70 km in width and has five meters clearance from the railroad truss bridge. By the way, this bridge has never been touched even by the maximum flood discharge in the past century. This information was confirmed by the town office of Hisaronu. The major flood during September 21-26,1968, which greatly damaged the upstream railway bridge near koyadibi station or Teten Town, did not touch the above truss bridge. These rapid stream sections are shown in Fig. 10-4-1 & 2, *and serve as a natural dam, cutting off peak flood waves* downstream.

These two characteristics, ---- a wide river bed and rapid stream, ---- are fairly common in big Turkish rivers, not only the Filyos river but also like as the Kizilirmak river. This function, must be carefully observed and analysed.

10-4-3 On-going projects and remarks

The DSI has a master plan to develop the Filyos River, particularly for irrigation, flood control and water power. Some of These projects are under construction, such as embankment works in middle course near Devrek. But most of numerous dams and other projects outlined in the master plan are not yet under construction. See Fig. 10-4-3.

But a feasibility study is being prepared for only one dam on the Devrek river. This is theKöprübasi dam near Mengen. the main purpose of the project is to generate electric power of 60 MW, but because of the dam is height of 95 m and its reservoir volume of 200 million m^3, flood control function is noticed.

Fig. 10-4-1

Fig. 10-4-2

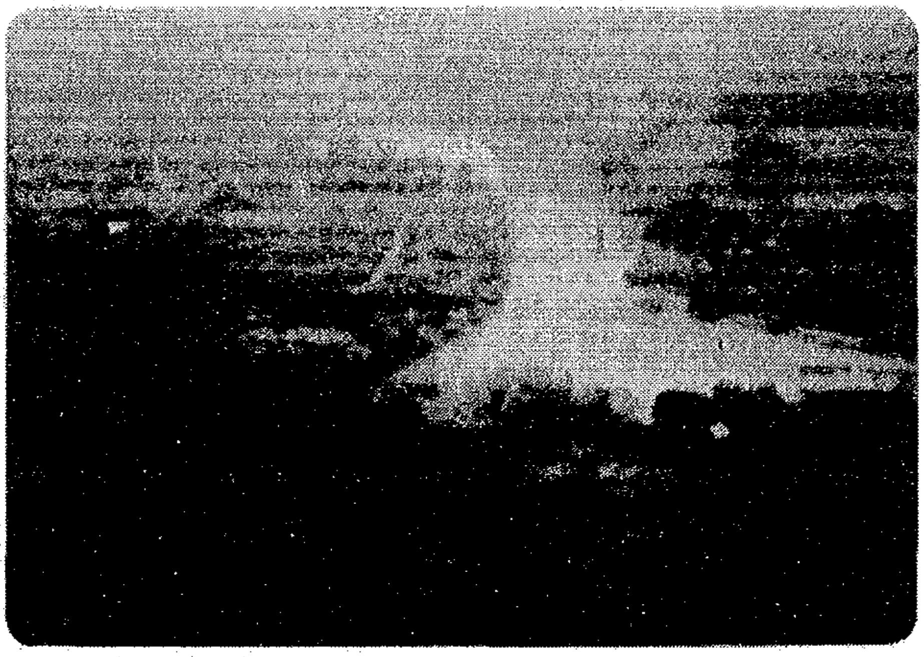
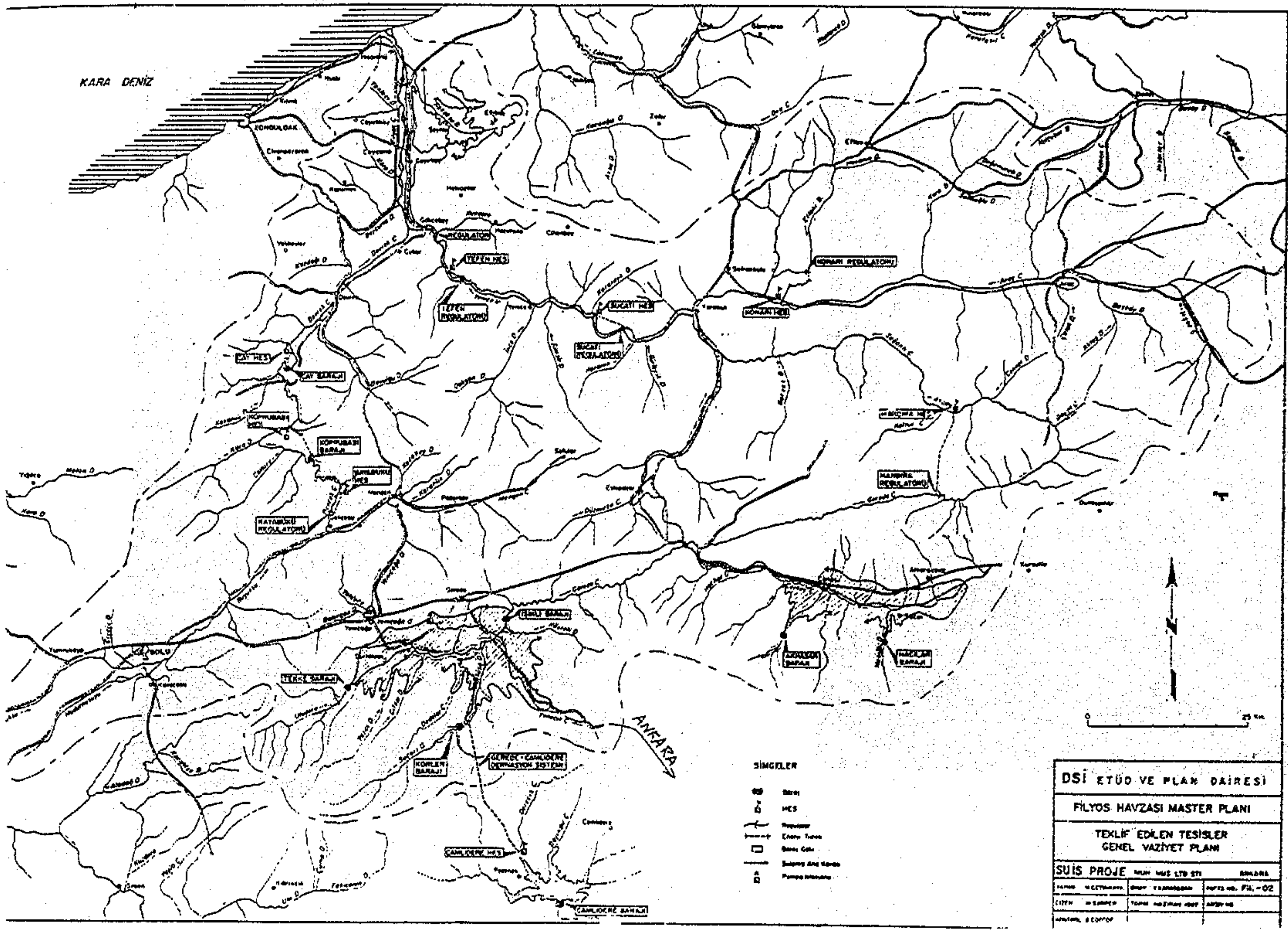


Fig. 10-4-3 Filyos River Master Plan



10-4-4 Recommendations

(1) Replacement of river mouth

Replacement and short cut of Filyos River mouth are recommended mostly due to considerations relating development of the port. But this will also contribute to increased speed at flood discharge. A detailed description will be referred in the chapter of the portmaster plan, but the setting up peak discharge 4,260 m^3/s, by a return period of 500 years is closely related to the following recommendations.

(2) Retarding basins

As mentioned previously, the Filyos River has a natural regulating reservoir function in its wide river beds in its middle courses. This function must be kept and rather increased, by setting up long but low dams, if necessary, at Caycuma and above the Devrek River junction. Of course this must be planned based upon detailed survey and the investigation, particularly on the longitutional slope and width of the river beds.

An example of a large retarding basin is the one in Japans' Tone river, which has a fklood control capacity of cutting of a flood discharge of 9,400m^3/s by 9km x 6km(33km^2) natural reservoir, out of a total 23,400m^3/s in some point of middle course. Given this example, there seems to be a possibility of cutting off flood discharge up to about 1,000m^3/s even in the Filyos River.

It will be necessary to review and amend the present embankment works in new retarding basins area, because of the opposite effect of cutting off flood discharge by narrowing the river's width. In the case of the Devrek River basin, it will also provide a good point of intake for drinking water for the new port and the city of Hisaronu. The idea plan for the retarding basins is shown in Fig.10-4-4.

(3) Flood control function by hydroelectric power and other types of dams

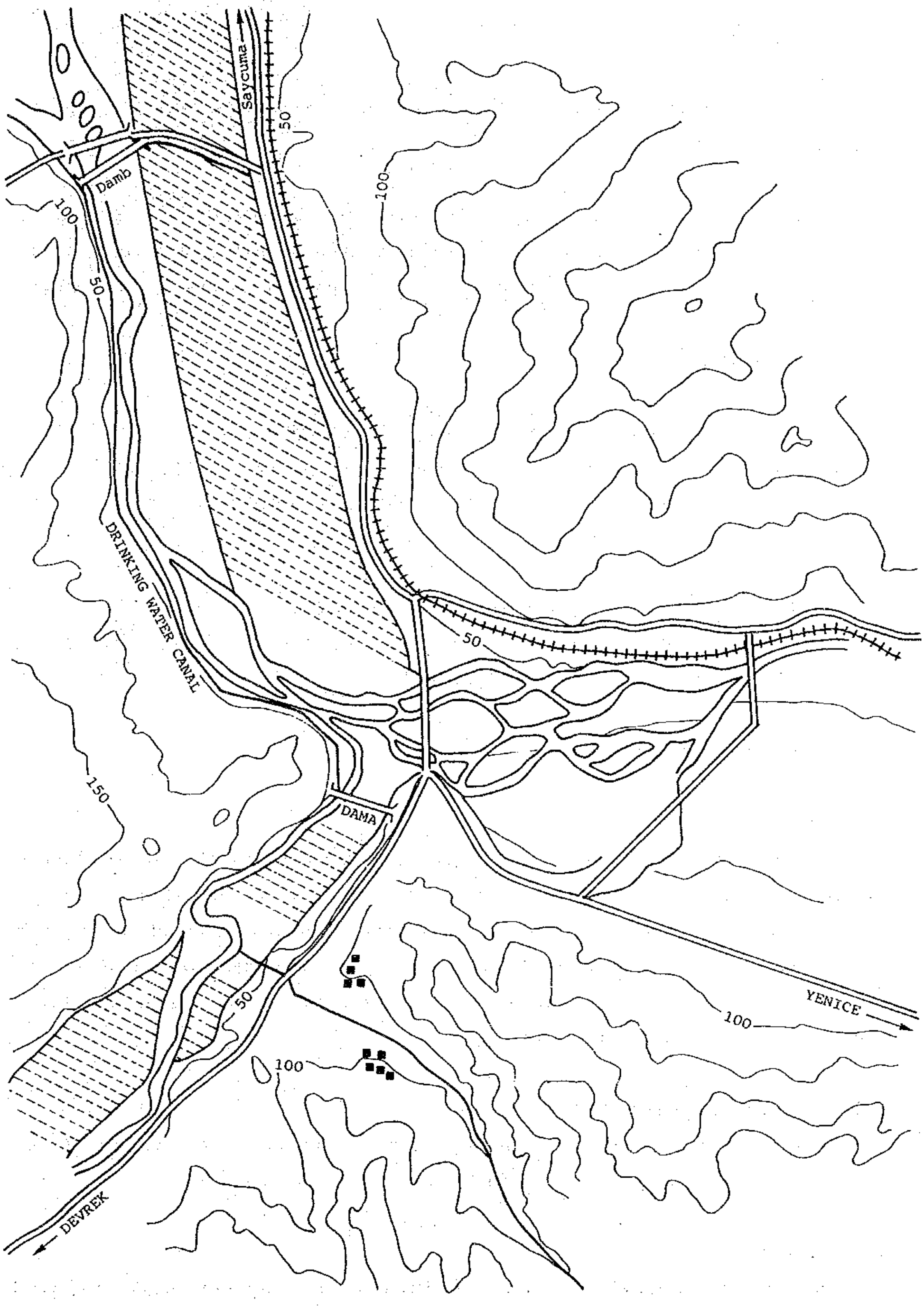
Generally speaking, all dams have a flood control function. There fore, dam construction should be promoted along with the master plan. Also, a quantitative analysis of flood control function should be studied, rarticulary regarding cutting off peak flood discharges.

Even in cases of low capacity in hydrop electric dams, if they have enough capacity for flood control or irrigation, their construction should be promoted. Thus, peak discharge of the Filyos River and the priority of implementation of the master plan are advised to be reviewed.

(4) Observation and survey

Because of the limited budget, observation and survey on actual precipitation, the water level of the river's flow and longitudinal leveling of river bed do not asem sufficient for detailed implementation design. Therefore, it is necessary to set up enough watermarks and other observation facilities. Also, a necessary survey should be promoted, well enough sufficiently in advance. the actual needs.

Fig. 10-4-4 Retarding Basins



10-5 Water Supply

10-5-1 General

There are no particular facilities for drinking water for the people of Hisaronu at present .

In the future, it will be necessary to construct water supply facilities for people and factories in port the and the Hisaronu area, because of increased demand for mater for drinking and processin purpose.

10-5-2 Quantity and Quality

The water resources provided by the Filyos River are sufficient. But quality must be studied carefully. Because of pollution by the Karabuk Steel Plant, river water along the Yenice River cannot be used for drinking purposes.

On the contrary, the Devrek River can be used for water supply, if the small amount of polution caused by the cities of Bolu and Mengen or Devrek is carefully treated, even in the future.

10-5-3 Recommendations

(1) Intake and water canal

Intake facilities, including the relevant reservoir, should be planned along the Devrek River beyond the Filyos junctions, as referred in the previous paragraph. A water supply canal with a length of about 30 km must be planned on the left bank of Filyos River. But in case of insufficient quality at the junction, the canal must be extended to C, aydam, resulting in a total canal length of 60 km.

(2) Purification plant

A purification plant of a faily big scale is necessary in the future. A site for it must be found between C, aycuma and Hisarönü.

(3) Consistency

The water supply plan must maintain consistency with related development plans, such as the port development plan and the Filyos River master plan.

10-6 Electric Power

10-6-1 General

Turkey is blessed by electric power resources, having both enormous coal deposit (lignite) and hydro power. About half of electric energy is supplied by hydro power, but this is only 13% of the estimated 118 billion KWH of large and small rivers hydro electric power potential. The remainder is undeveloped.

These resources supported the high rate of increase, averaging about 10%, in Turkey's electric energy consumption during the past 10 to 20 years.

10-6-2 Supply-Demand Balance

By the estimation of TEK and DSI, the natural total balance of electric energy in the future is shown in Table 10-6-1.

By this table, hydro generation in a dry year is estimated at about 36% below that of a normal precipitation year. As the deficit must be covered by the thermal generation, installed capacity in both hydro and thermal power stations must be enough to meet the demand fluctuation.

Estimated demand increase in electric consumption is set at more than 8% annually in the coming 20 years, and installed capacity is going to increase by about 4 times during this long range period. Even at present, more than 20 thermal and hydro power plants are under construction or in preparation by the TEK, EIE and DSI.

Also, a nation-wide transmission and distribution network has already been completed, including facilities for import and export use.

Therefore, the TEK is ready to meet the necessary energy consumption in the new port and the town of Hisaronu.

10-6-3 TEK Supply Capacity

In the nearby area, there are several thermal generating plants and transformer substations. Catalagzi thermal generators will be 300 MW (2 X 150 MW) by 1991, with 1 plant under construction. Osmanca 2 transformers are 380/154 KW (300 MW) and another 2 transformers are possible to install additionally.

Also hard coal thermal plant is scheduled to establish by 2010 at Amasra by latest coal mine development.

These plants are connected, as shown in Fig. 10-6-1.

Table 10-6-1 Electric Power Forecasted Supply-Demand Balance

	1990	1994	1995	2000	2005	2010
Installed Capacity						
Thermal (MW)	9,551	10,883	11,036	16,417	26,352	42,089
Hydro (MW)	6,707	10,777	10,865	13,773	17,926	21,384
Total (MW)	16,318	21,660	21,901	30,190	44,278	63,473
Demand (MW)	9,340	13,625	15,005	22,435	34,025	50,600
Reserve (%)	43	37	31	26	23	20
Thermal						
Generation (GWH)	60,746	70,718	71,556	110,226	182,923	293,078
Hidro Generation (GWH)	24,805	37,483	38,534	47,478	61,124	73,301
Total Generation (GWH)	85,551	108,201	110,090	157,704	244,047	366,379
Import (GWH)	(-)780	1,500	1,600	-	-	-
Total Supply (GWH)	84,821	109,701	111,690	157,704	244,047	366,379
Consumption (GWH)	57,563	84,480	92,984	139,213	197,056	307,963
Reserve (%)	32	23	17	13	18	16
Dry Year Hydro						
Generation (GWH)	19,499	29,084	29,658	35,313	43,307	49,265
Total Supply (GWH)	79,515	102,714	101,214	145,539	226,225	342,343
Reserve (%)	28	18	9	5	13	10

Note: 1) Source TEK & DSI

2) 1990-1994: The Sixth Five-Year Development Plan & actual figure
1995-2010: Different Estimation

Fig. 10-6-1 Electrification Nearby Hisaronu

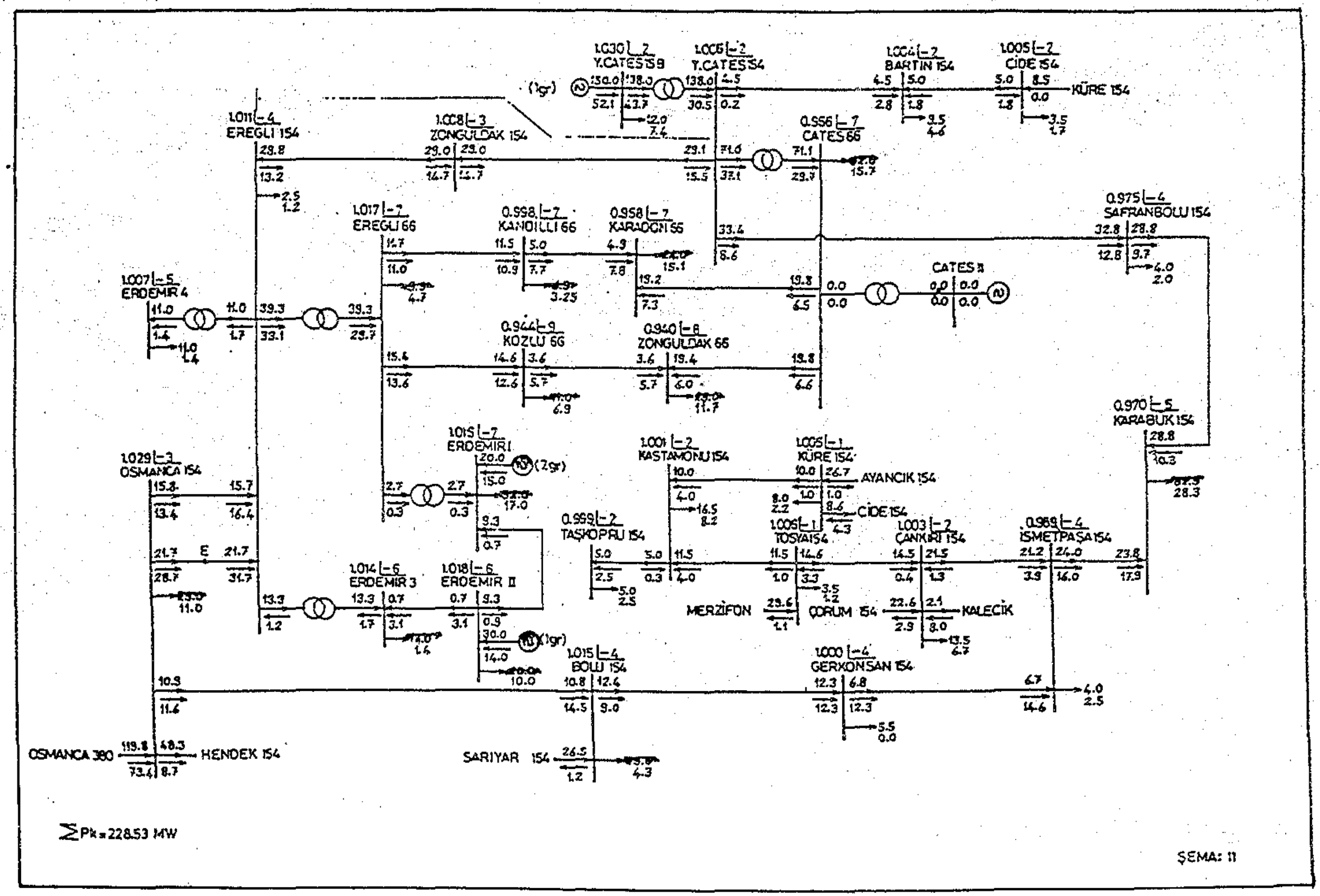
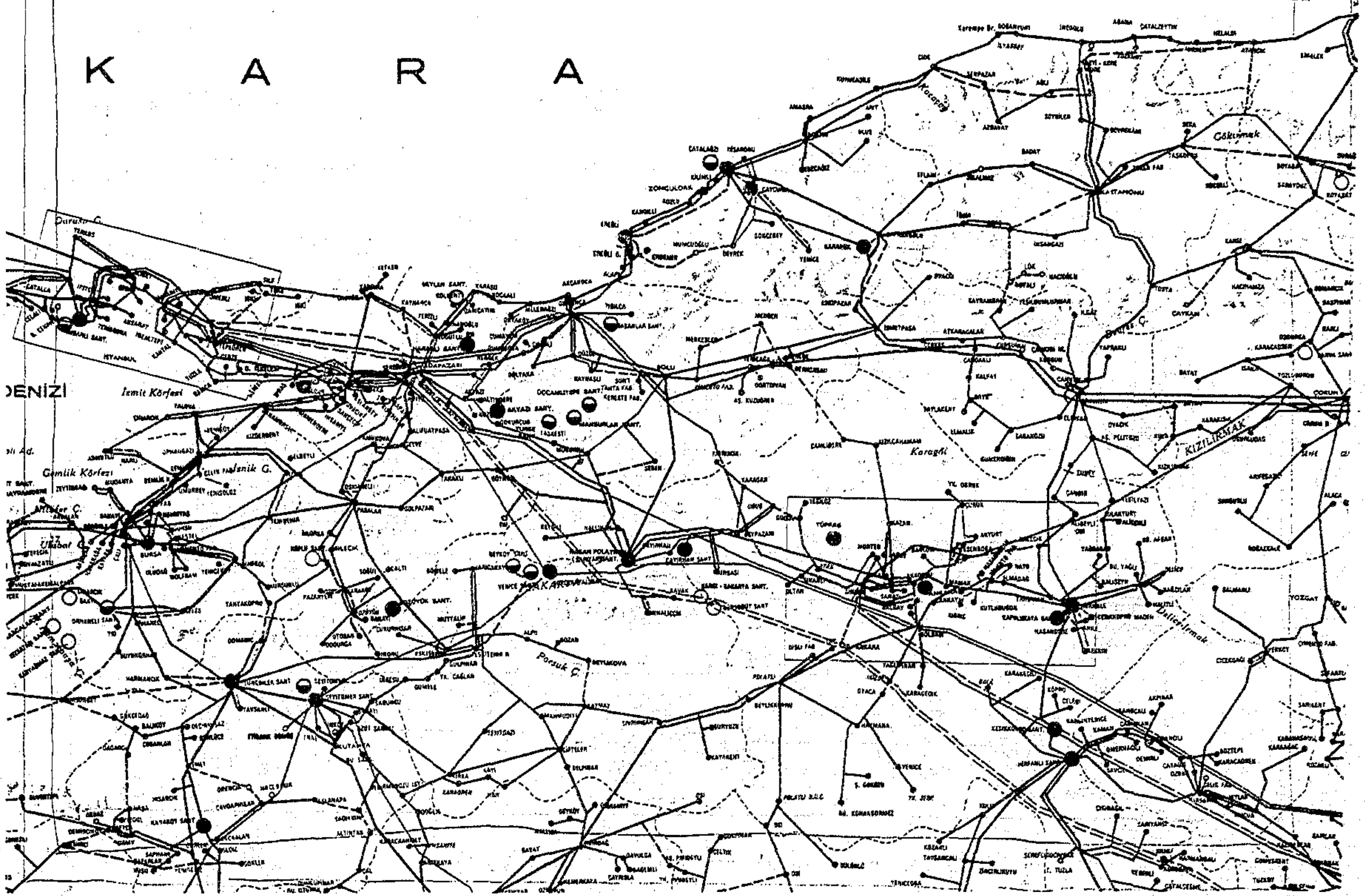


Fig. 10-6-2


K A R A
DENİZİ
İzmit Körfezi
Gemlik Körfezi
KIZILIRMAK
Porsuk Ç.

10-6-4 Possible Nearby Projects

It is fairy easy for the TEK to supply the necessary electric power to the port in the case of moderate increase rate. But in the case of rapid construction of the port and new industrial plant of mass consumption of electric power, there must be some additional projects, as shown below.

(1) Köprübasi Power Plant

As already mentioned in 10-4-3, Köprübasi dam and hydroelectric power plant is now in preparation for feasibility study, at the site of Bolu City on the Devrek River.

Annual mean natural flow	:	482 hm^3(= 15.3m^3/sec)
Catchement area	:	2,034 km^2
(=15.3% of total Filyos River)		
Type of dam	:	Clay cored rockfill
Height above thalweg	:	95 m
Installed capacity	:	60 MW(2X30 MW)
Annual firm energy	:	153 GWH
Mean annual energy	:	210 GWH

(2) Filyos Thermal Power Plant (See Chapter VIII)

A thermal power plant is recommended in the alternative complex(II), in case of mass consumption of electricity by an electric arc furnace and others.

Tentatively, a generating capacity of 600 MW is planned. Since this capacity is of ten times more than the above Köprübasi Plant, the scale must be studied deliverately.

(3) Expansion of Present Plant

The TEK has a thermal plant at C, atalagzi with some additional expansion under construction. In the case of a moderate increase of power consumption, this plant will be used for some more expansion.

Also, some help will be asked to private plants in Eregli and Karabuk.

In any case, The TEK must be informed at dicided power consumption projects as soon as possible.

10-7 Telecommunication

10-7-1 General

Telecommunications have rapidly developed in the last five years, mostly due to expanded telephone service.

At the end of 1988, the number of telephone sets reached 11.70 per 100 inhabitants, more than 2 times compared to the 5.54 sets in 1983. These figures are roughly similar to these of Japan in 1967 and 1960, respectively. Therefore, the Turkish telephone service is expanding only twenty years behind of that in Japan. Telephone services are now very popular even in rural areas. All villages are connected to the national telephone network.

10-7-2 Telephone Capacity in Nearby Area

At the present there is a line capacity of 94,250 in Zonguldak and provinces. In the year 2000 it will reach a capacity of 234,570 in Zonguldak and 324,000 in the region. This is a result of a faster-growing development and population rate compared to Eastern Anatolia.

There are 755 telephone sets in 78 villages in Zonguldak and the surrounding region at present, and a 500-line capacity operating with a full automatic system.

In Zonguldak and the surrounding region, line capacity will increase by 25 % in 2000, and one person out of 4 person will have a telephone set.

All kinds of telecommunication networks are available, such as telephone, radio, faxand telex, in this district.

No matter what the telecommunication demand of Zonguldak and Filyos region may be, the PTT guarantees that it can provide everything in a short time and also has the ability and technical competence to deal with such a task.

CHAPTER XI SHORT-TERM DEVELOPMENT PLAN

11-1 Targets and Strategy

The examined target year for short-term development plan is the year 2000. The forecast volume of cargo in the year 2000 is indicated in Table 11-1-1.

But, since Filyos Port is a new port, there are some risks that the full potential demand may not develop soon.

For this reason, in developing the short-term plan, it is preferable to carry it out assuming small scale rather than full potential demand occurs.

Table 11-1-1 Cargo Demand

Unit: 1000tons, 1000TEUs

Commodity	S/P (2000)	Remarks
Foreign Trade	97 TEUs 3,470 tonnes	
Container	97 TEUs	
Break Bulk	800	Export + Import
Iron Ore	700	Import
Coal	800	Import
Iron & Steel	1,170	Import (2000)
Grain	0	Export + Import
Logs/Wood Products	0	Export + Import
Domestic Trade	2,850 tonnes	
Iron Ore	1,000	Inboard from Samuson
Iron & Steel	1,850	Outboard
Grand Total	97 TEUs 6,320 tonnes	

(1) Target of Cargo Handling

Since for a short period, coal and ore will be handled at Hisaronu Pier which will be located 2 km away from the Filyos Site, the remaining handling demand will be for general cargo, container cargo, and steelproducts.

The berths to be furnished will total three.

The reasons for this are:

1) to handle three kinds of cargo

2) to decrease the waiting time by flexible use of berths.

The target volume must be limited to an economical berth capacity.

Thus, the target cargo volume decided on is as table 11-1-2 indicates.

Table 11-1-2 Target Volume in the Short-Term Development Plan

General Cargo	240,000 tons	Foreign trade, In/Out=50:50
Container Cargo	97,000 TEUS	Foreign trade, In/Out=50:50,Empty30%
Steel & Iron	1,200,000 tons	Foreign Trade, In,

The cargo for domestic trade can be handled utilizing river shore and this will be considered when it becomes necessary in the course of developing the port.

(2) Target Year for Opening the Port

It will take 8 years to finish all the construction works.

The first 3 years will be spent on preparatory works;

One year will be necessary for arrangements, such as discussion among the relevant organizations, preparation of implementation program, fund allocation and loan application.

One year will be for engineering, such as survey, boring, design, preparation of tender-documents and land acquisition.

One year will be for tendering and contracts.

The remaining 5 years will be spent on construction of and preparation for opening the port.

Thus, the target year of opening the port will be the year end of 1998.

(3) Acceleration of the project

There is a possibillity that the port will become saturated a few years after its opening.

In this case, construction of the north breakwater should be examined as well as construction of additional berths when the cargo volume reaches a certain level.

An early decision will save a lot of money by avoiding ship waiting later on.

11-2 Layout

The layout for the Short Term Development Plan is shown in Fig. 11-2-1.

It is based on Master Plan B.

The first development of the port will be the furnishing of a Multi-Purpose Quay. The quay will be located at the industrial pier indicated in the Master Plan, because this location offers enough space for three berths.

When it becomes necessary to locate the unloading berth for ore and coal in Filyos Port in future, the berths at the Multi-Purpose Quay will be shifted to the appropriate place shown in the Master Plan.

In the short-term plan, only a small breakwater beside the Multi-Purpose Quay is planned. This is designed to minimize the project cost.

As it does not give enough shelter, some operations will be interrupted by rough sea conditions.

The berthing quays must be strong enough to withstand forces from unusual sea conditions.

The entrance channel is planned to be laid out in a straight line northward, because this will make it far much easier to deberth and go out when there are rough seas.

When the main outer breakwater is constructed at a later stage, the entrance channel must be newly excavated according to the Master Plan Layout.

Even in this case, there will not be excessive expenditure, because the foundation of the outer breakwater most probably needs soil replacement.

In the land area, port roads are planned to connect berths with a new

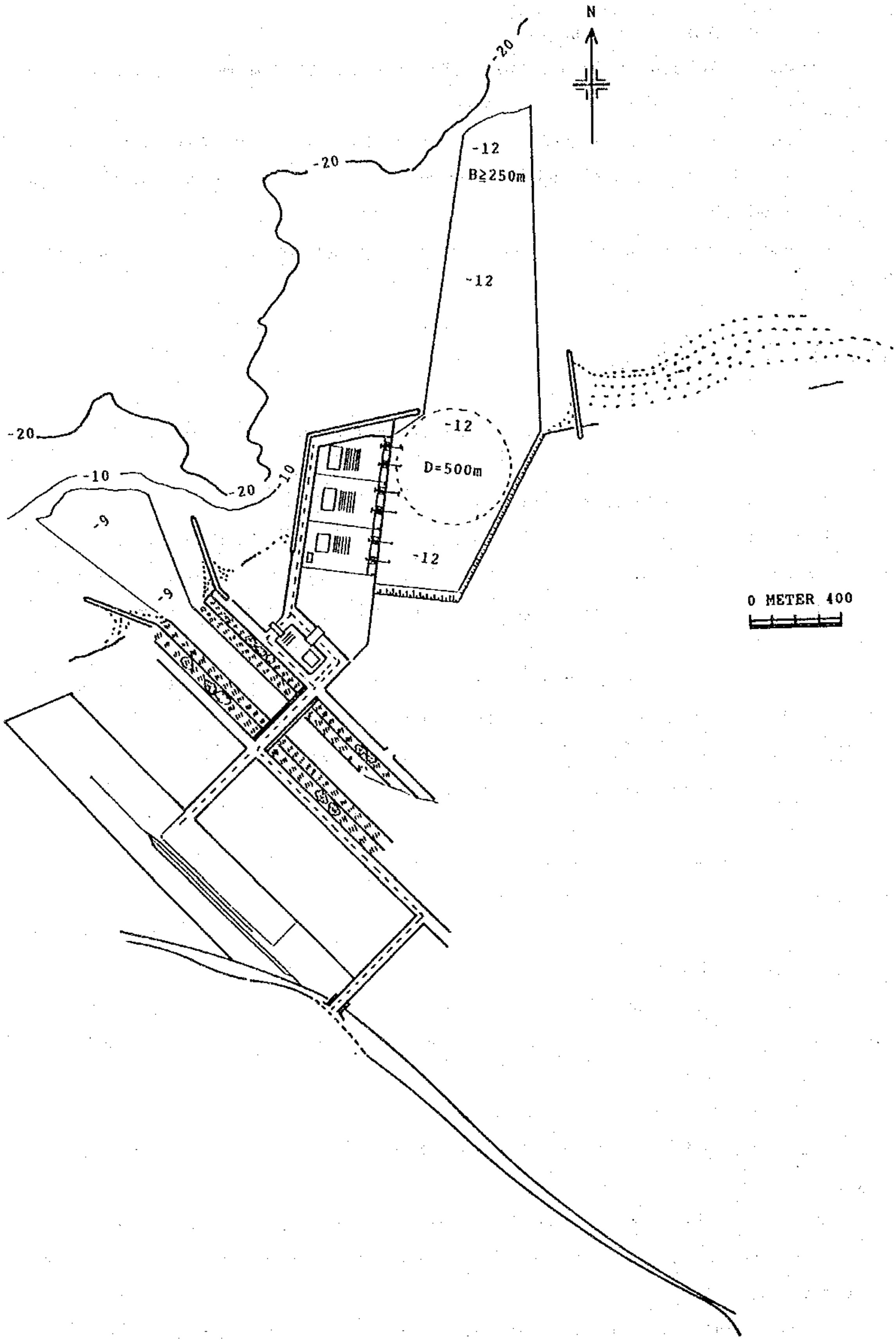


Fig. 11-2-1 The Layout of the Short-term Development Plan

railway yard and the existing rural road.

On the port road, two bridges are planned; one to passover the railway and another for crossing the new rivermouth.

The new river mouth will be excavated to avoid flood damage and ensure steady, uninterrupted port activities.

The river mouth can also offer a berthing place for work vessels.

On the east side of the basin, there is a jetty to protect sand sedimentation.

The open space on the eastern side of the jetty will be utilized for dumping the dredged soil.

Greenbelts alongside the roads, yard, and river banks will be prepared to preserve a pleasant atmosphere in the port area.

11-3 Planned facilities

The following are the planned facilities for the Short-Term Development Plan:

11-3-1 Berths

The planned berth will be called a Multi-Purpose Quay.

The berths can accomodate various kind of ships such as container ships, general cargo ships, etc., because they have a deep water basin, heavy duty-cranes with long outreach and wide backup space.

The dimension of the quay is:

depth -12 meters
length 600 meters

This quay can accommodate 2.5 ships of 30,000 dwt at a time or three ships of 15000 dwt in line.

Considering that the berths are semi-exposed to the open sea, and the motion of ships on high waves may cause trouble, a 10-meter draft will be the appropriate depth for the safe maneuvering of ships in the basin.

Mooring bollards should be of the quick-releasing type.

Fenders must be strong enough to deal with forces from various directions.

The backup space of the berths will be paved to ensure the smooth cargo handling.

11-3-2 Roads

The port roads are planned for transporting heavy cargo, containers, general goods, etc.

The port road is connected to the new railway yard and to the existing rural service road.

Since, the trucks are of very-heavy-duty type, the roads must be designed with a very small slope and constructed with at least 2 lanes in each direction. In the short-term development plan, an bridge is planned at the crossing point with the railway to avoid congestion and accidents.

There is also a river crossing bridge adjacent to the port entrance.

If the handling volume is small, the railway can be extended to the wharf.

But, assuming a very high rate of handling, only the road connection is acceptable for maintaining high productivity.

11-3-3 Railway Station

The terminal will handle heavy steel.

If we assume 1,200,000 tons of steel will be handled over 360 days, 3,300 tons of goods have to be transported daily.

This will require three double trains per day at least.

Assuming two tracks for arrival, one track for departure, and two tracks for loading, 5 tracks are necessary in total.

When we assume one track needs 500 meters including everything on an average, the total length of track in the railway yard will be around 2500 meters.

The yard space may be calculated as follows:

Stacking volume 20% of annual throughput = 0.2 X 1,200,000 =240,000 tons. Assuming average stacking weight as 4 ton/m^2 including all the facilities for loading unloading operation, the necessary space is 240,000/4=60,000m^2.

11-3-4 Equipments

(1) Transportation Machine

At the quay side, there will be six-heavy-duty cranes.

At yardside there will be 10 sets of forklifts for general cargo use, 6 sets of transfer cranes and 10 sets of tractor trailers for containers and 10 sets of heavy duty tractor trailers for heavy goods such as billets.

At the railway station, two traveling cranes will be used for loading goods.

(2) Computer and Communications System

For providing information service to port customers and ascertaining smooth port operations, computer and communications systems should be installed at Filyos Port.

The communication systems will consist of both the online and wireless types.

The computer system needed for the short-term development plan does not have to be very sophisticated.

(3) Navigational aids

For the safety of vessels calling at the port, a few sets of navigational aids will be installed, such as a set of leading lights, a sets of light buoys, a lighthouse, etc..

11-3-5 Work Vessels

Two tugboats with firefighting equipment shall be available mainly to assist very large vessel at Hisaronu Pier, as well as to the occational assist of medium-size vessel at Filyos Quay.

11-3-6 Stockyards (Marshalling Yards), Sheds, Buildings.

Stockyards (Marshalling Yards) at berths, or at railway station will have enough space for stacking goods and marshalling machines.

They will contribute much to the smooth flow of cargo.

Sheds are planned for minimum necessity, to avoid congestion at the quay.

Container Freight Stations should be located at Inland Container Depots (with customs service) whenever possible.

Most of the stores should be located on the factory side.

Offices will be located at the entrance of the port.

11-4 Implementation Program

The first 3 years will be used for preparation of the project, such as adjustment between concerned authorities, allocation of funds, loan application, survey and borings, design, preparation of tendering, land acquisition, tendering and contracting.

The following 5 years will be spent on construction of and preparation for opening the port.

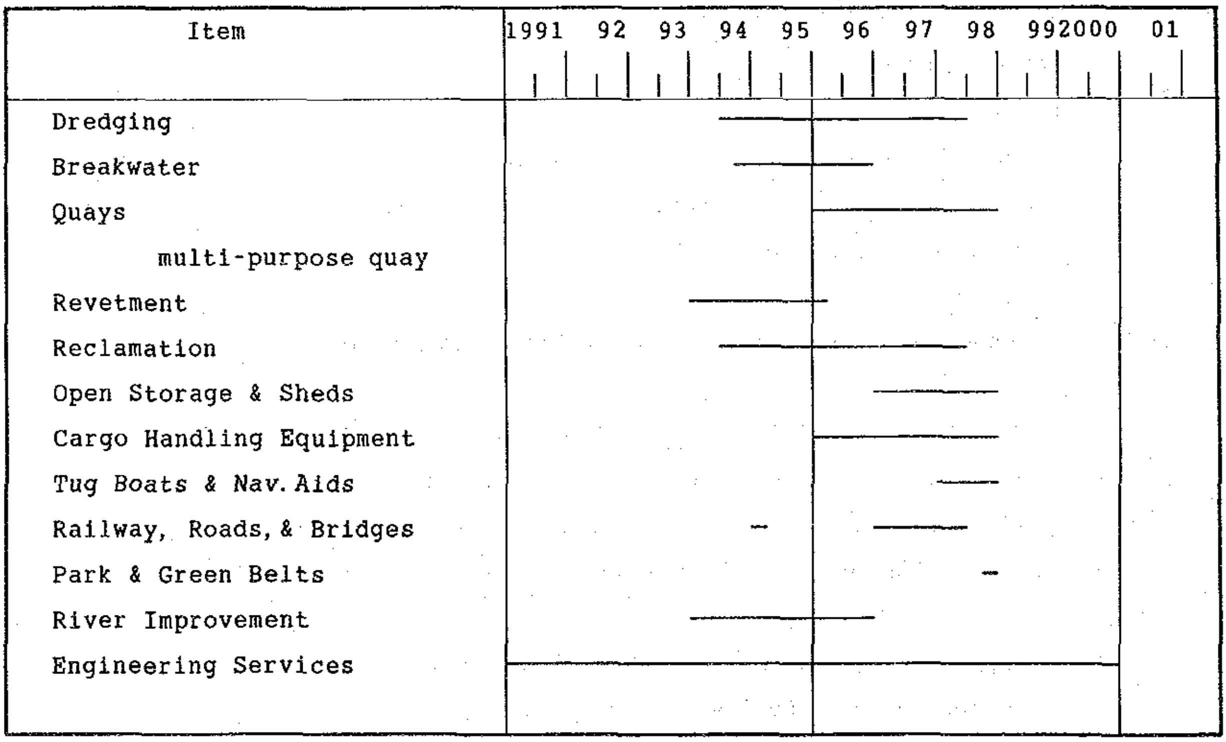
Thus the port will open in the end of 1998.

The time sequence is indicated in Table 11-4-1. in the form of a bar chart.

Although the short term development plan is formulated so as to minimize the project cost, there is still the possibility that cargo demand could explode soon after the commissioning of Filyos Port.

In this case, prompt action for expansion of the port will save a lot of money.

Table 11-4-1 Implementing Schedule for the Short Term Development Plan



11-5 The Project Cost

The total cost for the short term development plan is estimated at US$407 million based on the prices in 1990.

Locally Procurable materials are cement, gravel, woods, steel bars, small sized channels, etc.

The materials via overseas are oil, big size channels, machines, work vessels, etc.

The cost estimation made herein are based on the following assumptions.

(1) Exchange rate:

US$ 1.0 = J¥ 150 = TL 2,693.4

(TL 1.0 = J¥ 0.0557)

(2) Labour cost and material cost are based on the prices of August, 1990. Allowance for future price escalation is not included.

(3) Import duties are included in the costs of pipe pile, steel sheet pile, rail and rubber fender.

Import duties are not included in the cost of cargo handling machine, because there is possibility of exemption of them.

Table 11-4-2 Cost for Short Term Development Plan

Item	Short-term(2000) million US$
Dredging	20.90
Breakwater	31.40
Removal Works	-
Quays	90.80
Revetment	13.90
Reclamation	20.90
Open Storage & Sheds	21.50
Cargo Handling Equipment	53.30
Tug Boats & Nav.Aids	3.50
Railway, Roads, & Bridges	59.00
Park & Green Belts	-
River Improvement	21.80
Sub Total(1)	337.00
Engineering Services	16.85
Sub Total(2)	353.85
Tax(10%)	35.39
Contingency(5%)	17.76
Grand Total	407.00

Based on 1990 price

US$ 1.0 = J¥150 = TL 2,693.

CHAPTER XII ENGINEERING ASPECTS IN THE SHORT TERM DEVELOPMENT PLAN

12-1 Design Conditions

12-1-1 General

In many ports in Turkey, breakwaters are exclusively constructed using a huge amount of rubble and wave-dissipating concrete block. There are many quarries throughout the country, and a rubble mound breakwater is most convenient from the economic and construction viewpoints. For the proposed Filyos Port, this type will be also presumed to be advantageous. Rectangular concrete blocks are mainly used for the construction of quays. In some ports, quays are constructed with reinforced concrete piles. The preference for these types is due to their construction easiness and the small scale of earthquakes in Turkey. It is said that steel structures are far more expensive in Turkey compared with concrete structures.

In selecting the structural type for the proposed quay to be constructed on the soft foundation and the foundation improvement method, alternatives such as pipe pile type and replacement or counterweight method should be considered and studied for the quay construction and foundation improvement, respectively. Japanese design standards can be generally applied for port facilities.

12-1-2 Design Policy

(1) Facilities for Filyos Port

1) Channel and Basins

2) Protective Facilities for Haubour

- Breakwater
- Groin
- Training Dike

3) Mooring Facilities

- Multi-Purpose Berth

4) Revetment

- Rubble Mound Type
- Steel Sheet Pipe Pile Type (PLAN A)

5) Freight Handling Facilities

- Open Storage Yard
- Shed

6) Cargo Handling Equipment

7) Port Traffic Facilities

Railways

Roads

Bridges

8) Improvement Facilities for Filyos River

(2) Design Policy for Main Facilities

1) Protective Facilities for Harbour(Breakwater)

i) Selection of structure

Rubble mound breakwater

Composite breakwater

ii) Design depth: -9.0～-10.0m

iii) Foundation improvement

Displacement method or Counterweight method

iv) Wave force

Godas formula

v) Bearing capacity of foundation

Bishops theory or circular failure

vi) Weights of armor stones and blocks

Hudsons formula

Brebner Donnelly formula

vii) Crown height

$H = 0.6\ H\ 1/3 + H.W.L$

2) Channels and basins

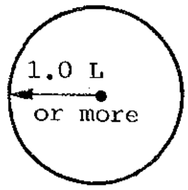
i) Channels

(L is the overall length of the ship)

Length of Channel	Condition of Navigation	Width
Relatively long channel	In case of channels where ships pass by each other frequently	2 L
	The other state than the above	1.5 L
Channels other than the above	In case the of channels where ships pass by each other frequently	1.5 L
	The other state than the above	L

ii) Basins(Turning basin)

Area of turning basin



L : Overall length of the ships

iii) Depth of basin

The depth of the basin should be 1.1 times the full load draft of a ship below the datum level.

3) Mooring Facilities

i) Selection of structure

Piles structure type

Gravity type quaywalls

ii) Improvement method of foundation

Displacement method

iii) Earth pressure

Coulombs theory

iv) Seismic force

Japan KH =	Regional Seismic Coefficient	x	Factors for subsoil Condition	x	Coefficient for Importance
Turkey	Filyos Zone(0.06) (By seismic distri- bution in Turkey)		x 1.0 (Live load coefficient)		x 1.0

KH = 0.06 x 1.0 x 1.0 = 0.06 = 0.1 (General theory in Turkey)

v) Residual water pressure

Water level

Gravity type H =(H.W.L - L.W.L)x 1/3 + L.W.L

Sheet pile type H =(H.W.L - L.W.L)x 2/3 + L.W.L

Water pressure

Gravity type Pw=(H.W.L - L.W.L)x 1/3 x γw

Sheet pile type Pw=(H.W.L - L.W.L)x 2/3 x γw

γw : Unit weight of seawater

vi) *Water depth and lengths of berths*

Water depths of berths :

Full load draft of ship +(0.5m - 1.5m)

Length of berth

Lengths of ships +(15m - 30m)

vii) Crown heights of quaywalls

Ship Size	Tidal Range 3.0m or more	Tidal Range less than 3.0m
Quaywall for Large Ship (with a water depth of 4.5m or more)	0.5 ~ 1.5m	1.0 - 2.0m
Quaywall for Small Ship (with a water depth of less than 4.5m)	0.3 ~ 1.0m	0.5 - 1.5m

4) Dimensions of Mooring Facilities and Ships

i) Dimensions of mooring facilities

Dimensions	General Cargo	Berth	Container Berth	Coal/Ore Berth	Multi-Purpose Berth	Grain Berth
Water Depth	-12.0	-10.0	-12m	-20m	-12	-12
Lengths of Berths (1 Berth)		185	250m	400m(Coal) (Iron ore)	250	280-350
Crown Heights	+3.5m	+3.5m	+3.5m	+4.0	+4.0	+3.5
Design Water Depths	12.0	10.0	12.0	20	12	12
Gradient of Apron	1%	1%	1%	1%	1%	1%

Data Sources:-Bureau of Ports and Harbours (Ministry of Transport)
-The Overseas Coastal Area Development Institute of Japan

Notes : Short Development Plan (2000) Multi - Purpose Berth
Master Plan Others Mooring Facilities

ii) Dimensions of Ships

Dimensions	General Cargo Ship	Container Ship	Multi-Purpose Ship	Coal/Ore Ship		Grain Ship
				Coal	Ore	
Tonnage (T)	15,000 DWT	32,000 DWT (Full Container Ship	30,000 DWT	150,000 DWT	15,000 DWT	30,000 DWT
Overall Length (m)	153	220	186	300	300	186
Molded Breadth (m)	22.3	32	27.1	43	43	27.1
Molded Depth (m)	12.5	21	15.2			15.2
Full Load Draft(m)	9.3	11.6	10.9	16.5	16.5	10.9
Berthing Speed	0.15m/sec	0.15m/sec	0.15m/sec	0.15m/sec		0.15m/sec

Data Source : Basic study on informations of overseas ports(OCDI)

12-1-3 Marine Conditions

(1) Design Tide Level

H.W.L +0.5

L.W.L +0.0

1) Design Water Level +0.50

Rational decision

The rise of water level by meteorological tide

i) Wind setup

$$\eta_0 = K\frac{F}{h} = (U\cos\alpha)^2$$

η_0 : The rise of water level by wind setup(cm)

K = 4.8×10^{-2} (Constant)

Observation data of Barthic by Colding

F : Fetch(About 600Km)

h : Water depth of Black Sea(100m - 1,000m)

Average 600m

U : Wind speed(storm wind average 20m/sec)

α : Degree of wind direction and angle of coastline(0°)

$$\eta_0 = 4.8 \times 10^{-2} \times \frac{600}{600} \times (20 \times 1)^2 = 19\text{cm}$$

ii) Rising water level by depression

$$\eta = 0.99\,\Delta P$$

η : Rising water level(cm)

ΔP : (Difference of pressure in around)mb

by observation data of Zonguldak stormy days

(Average 1,020-997mb)

Difference 23mb

$$\eta = 0.99 \times 23 = 23\text{cm}$$

The rise of tidal level in the Black Sea Maximum 25 cm

Conclusion

Design Water Level = (0-0.25m)+(0.19-0.23m)

= +0.48m ≑ + 0.50m

(2) Wave Conditions

1) Design Wave Conditions $\beta = 0°$

Deep Water Wave			Design Wave					
Wave Height	Wave Direction	Significant Wave Period	Equivalent Deep Water Wave Height	Significant Wave (m)			H max (m)	Remarks
				Depth	Slope of Sea Bottom	Wave Height		
5.8m	NE-NW	8.6 sec.	5.8m	-10.0	i=1/10	5.4	9.8	Offshore
					i=1/100	5.1	7.4	Breakwater
				- 9.0	i=1/100	5.0	6.7	Harbour Side Breakwater

2) Prbability Wave

Probability wave (years)		10	25	50	100
Meteorological data	H 1/3(m)	3.6	4.0	4.3	4.6
	T 1/3(sec)	7.2	7.6	7.8	8.1
Synoptic map	H 1/3(m)	4.3	5.2	5.8	6.5
	T 1/3(sec)	7.5	8.1	8.6	9.0

Determining the wave $Ho = H\ 1/3 = 5.8m$

$T\ 1/3 = 8.6m$

$Lo = 115.4m(1.56\ T^2)$

By bathymetrical map(Kr = Kd = 1.0)

Equivalent deepwater wave height Ho'

$Ho' = Kr.Kd.Ho = 1.0 \times 1.0 \times 5.8 = 5.8m$

$T = 8.6sec$

Design wave

Design depth -9.0 ~ -10.0

Slope of sea bottom 1/10 ~ 1/100

Case 1 Design depth -10.0m

Slope of sea bottom 1/10

Tide level +0.5

Water depth h=10.5m

h/Ho' = 10.5/5.8 = 1.81 Ho'/Lo = 5.8/115.4 = 0.05

h/Lo = 10.5/115.4 = 0.09

By example of calculation diagram

Ks = 0.93

H1/3 = Ks.Ho' = 0.93 x 5.8 = 5.4m

H max = 1.8 x 5.4 = 9.8m

Case 2 Design depth -10.0

Slope of sea bottom 1/100

Tide level +0.5

Water depth h = 10.5m

h/Ho' = 1.81 Ho'/Lo = 0.05

$H1/3/_{Ho'}$ = 0.87(By example of calculation diagram)

H1/3 = 0.87 x 5.8 = 5.1m

hb = 5.1 x 5/100 + 10.5 = 10.8m

hb/Ho' = 10.8/5.8 = 1.86

H max/Ho' = 1.26(By example of calculation diagram)

H max = 1.26 x 5.8 = 7.4m

Case 3 Design depth -9.0m

Slope of sea bottom 1/100

Tide level +0.5

Water depth h = 9.5m

h/Ho' = 9.5/5.8 = 1.64 Ho'/Lo = 5.8/115.4 = 0.05

h/Lo = 9.5/115.4 = 0.08

H 1/3 = Ks.Ho' = 0.85 x 5.8 = 5.0m

H max = 1.15 x 5.8 = 6.7m

12-1-4 Soil Conditions

(1) Soil Conditions of Main Port Facilities

Fig.12-1-4(a) SOIL CONDITION (Main Port Facilities)

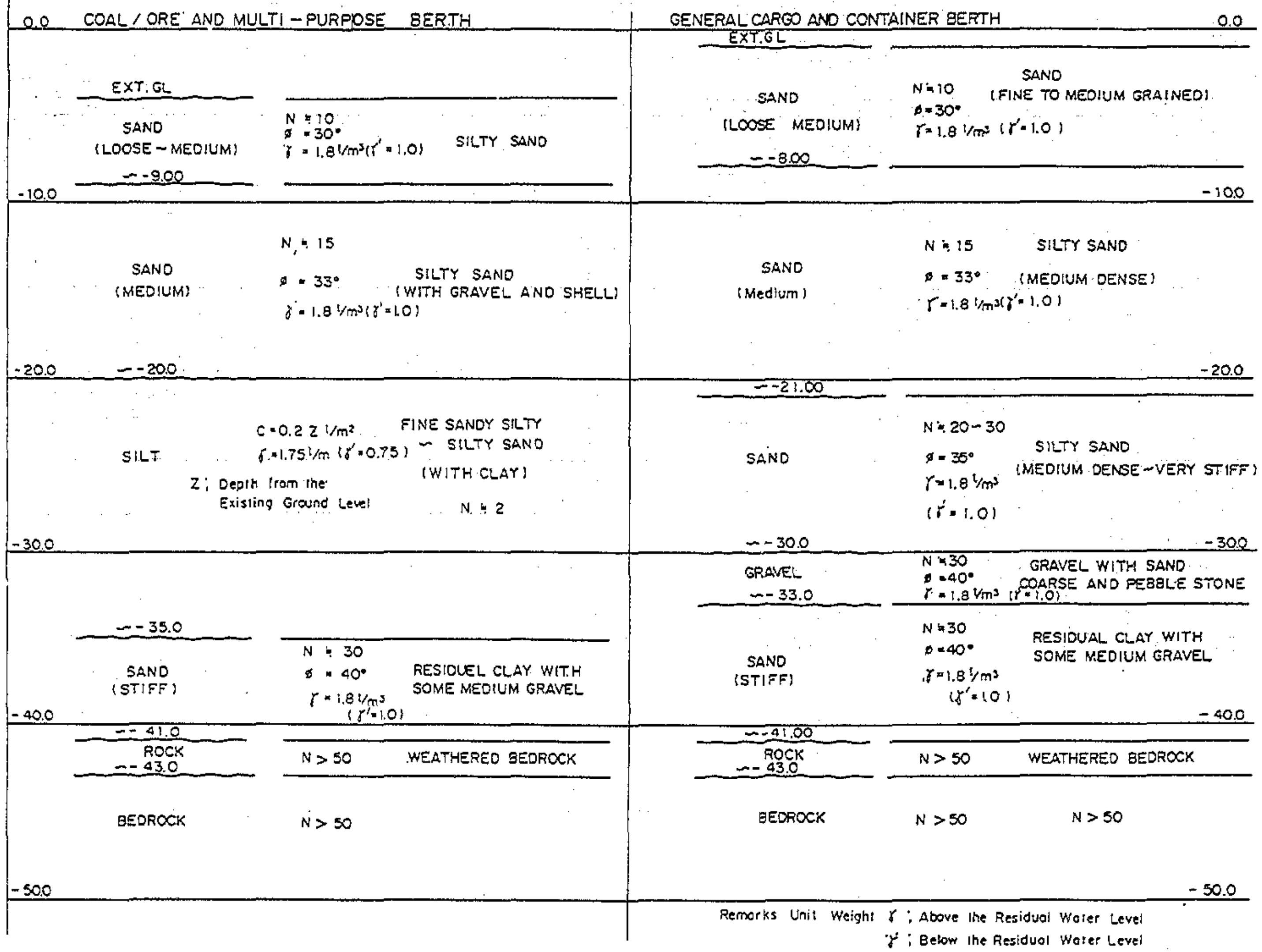
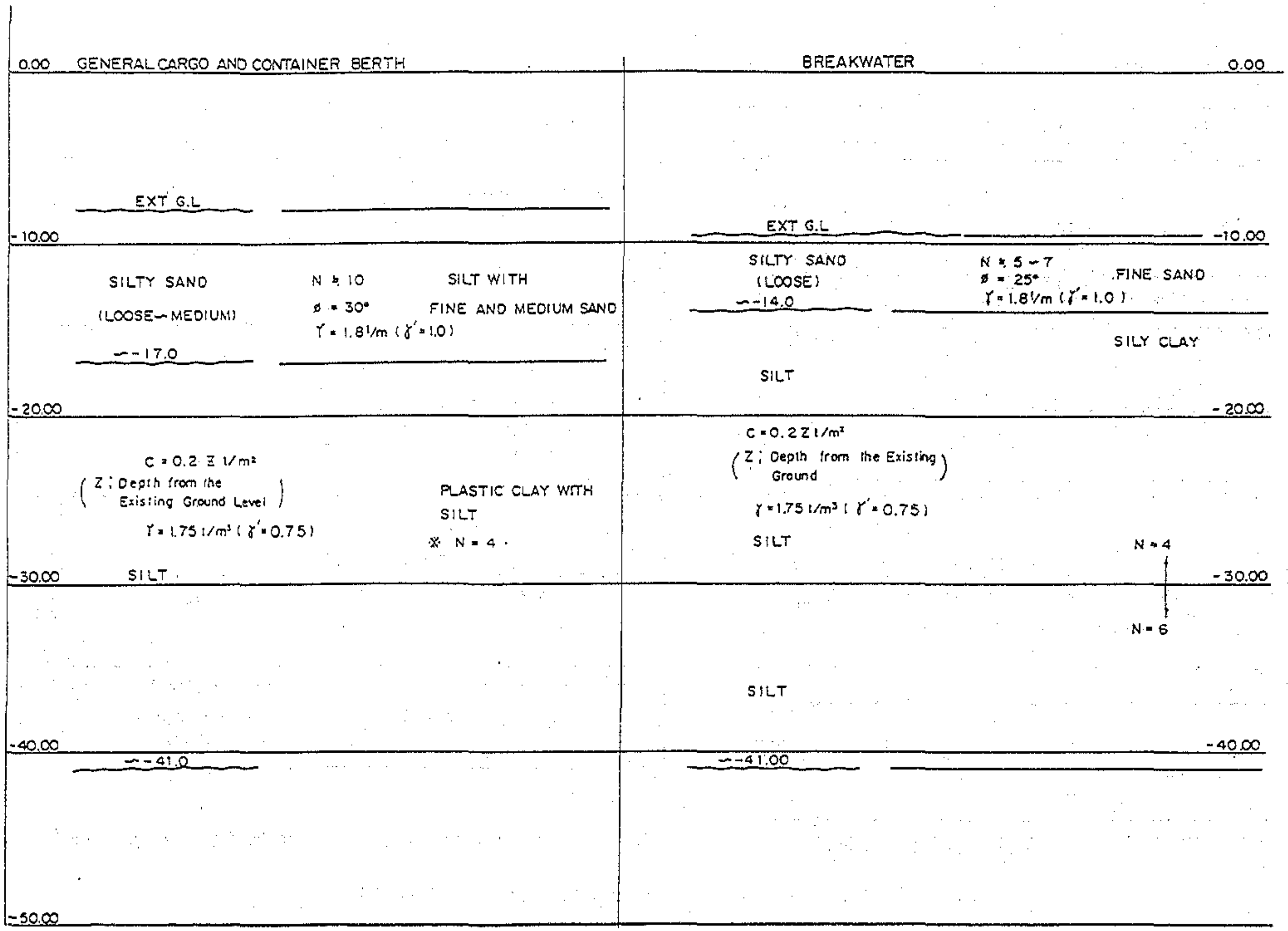
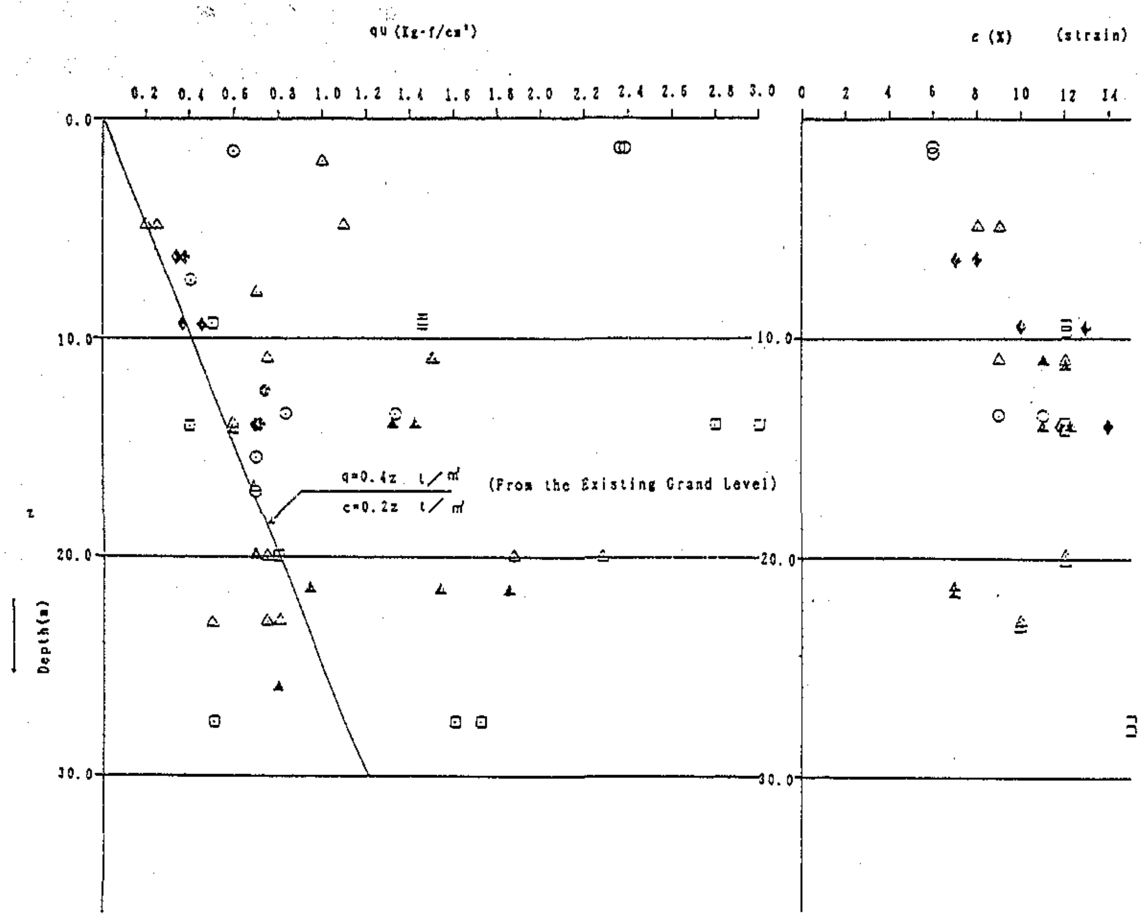


Fig.12-1-4(b) SOIL CONDITION (Main Port Facilities)



(2) Unconfined Compression Strength

Fig.12-1-4(c)



Remarks

Ground elevation

S1 -0.004
S2 +0.538
S3 +2.112
S4 +1.400
S5 +1.947
S6 +1.440

B1 -4.300
B2 -9.800
B3 -3.400

Off shore Bor S1. S2. S3.
B1. B2. B3.

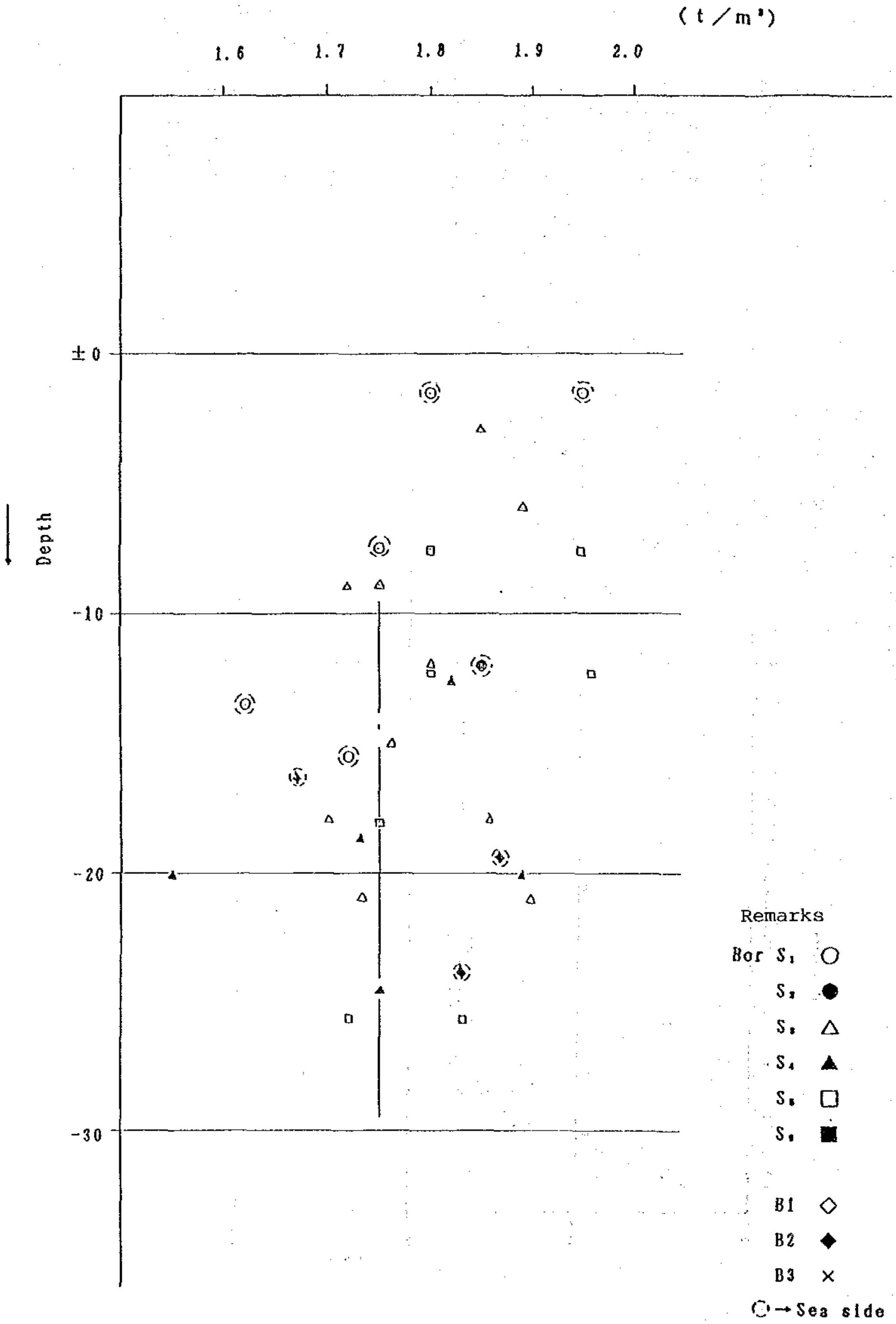
On shore Bor S3. S4. S5.

Legend

○ Bor S1	◇ Bor B1(Nothing)
● 〃 S2	◆ 〃 B2
△ 〃 S3	× 〃 B3(Nothing)
▲ 〃 S4	
□ 〃 S5	
■ 〃 S6(Nothing)	

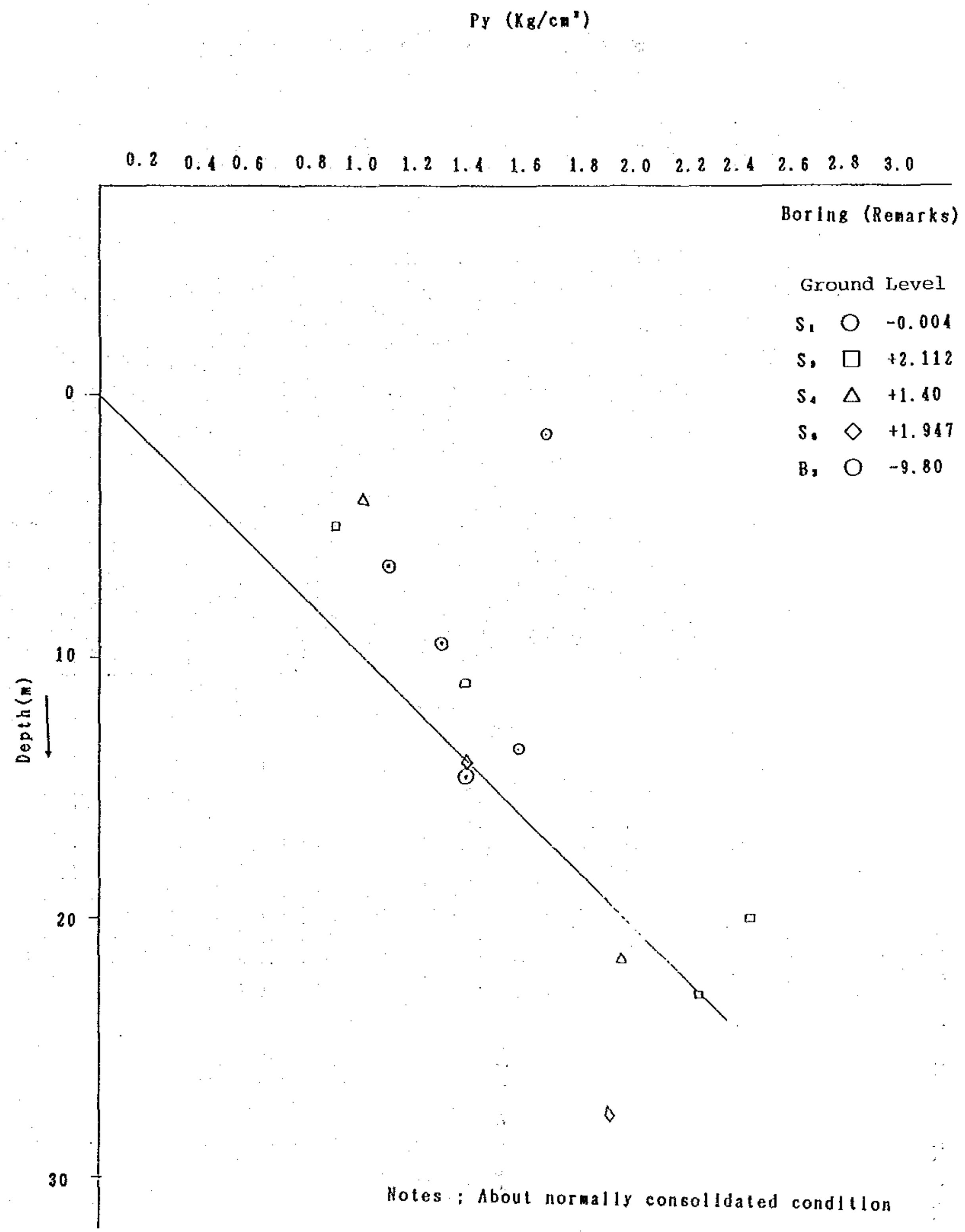
(3) Unit Weight of Silty Layer

Fig.12-1-4(d)



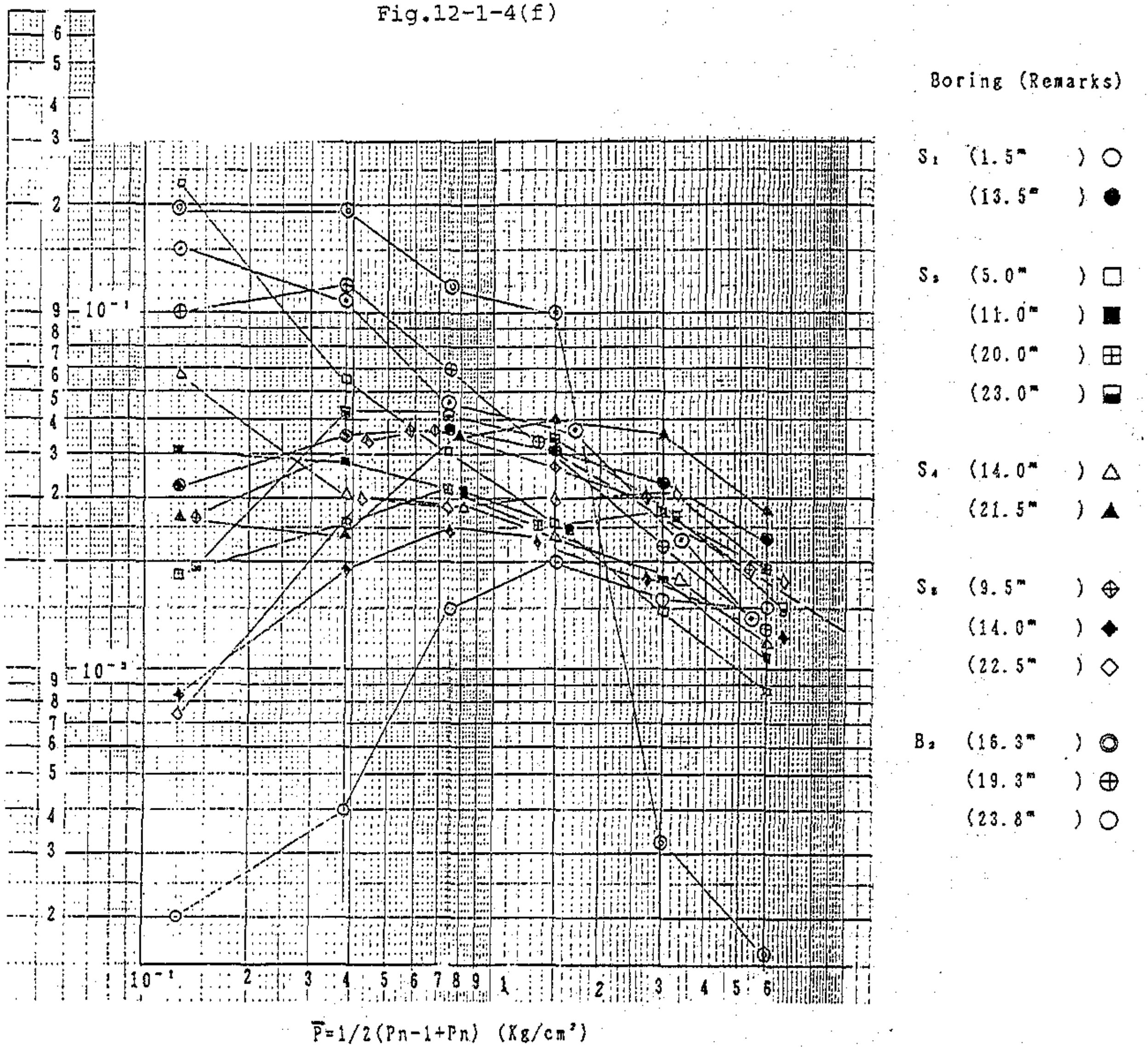
(4) Preconsolidation Pressure

Fig.12-1-4(e)



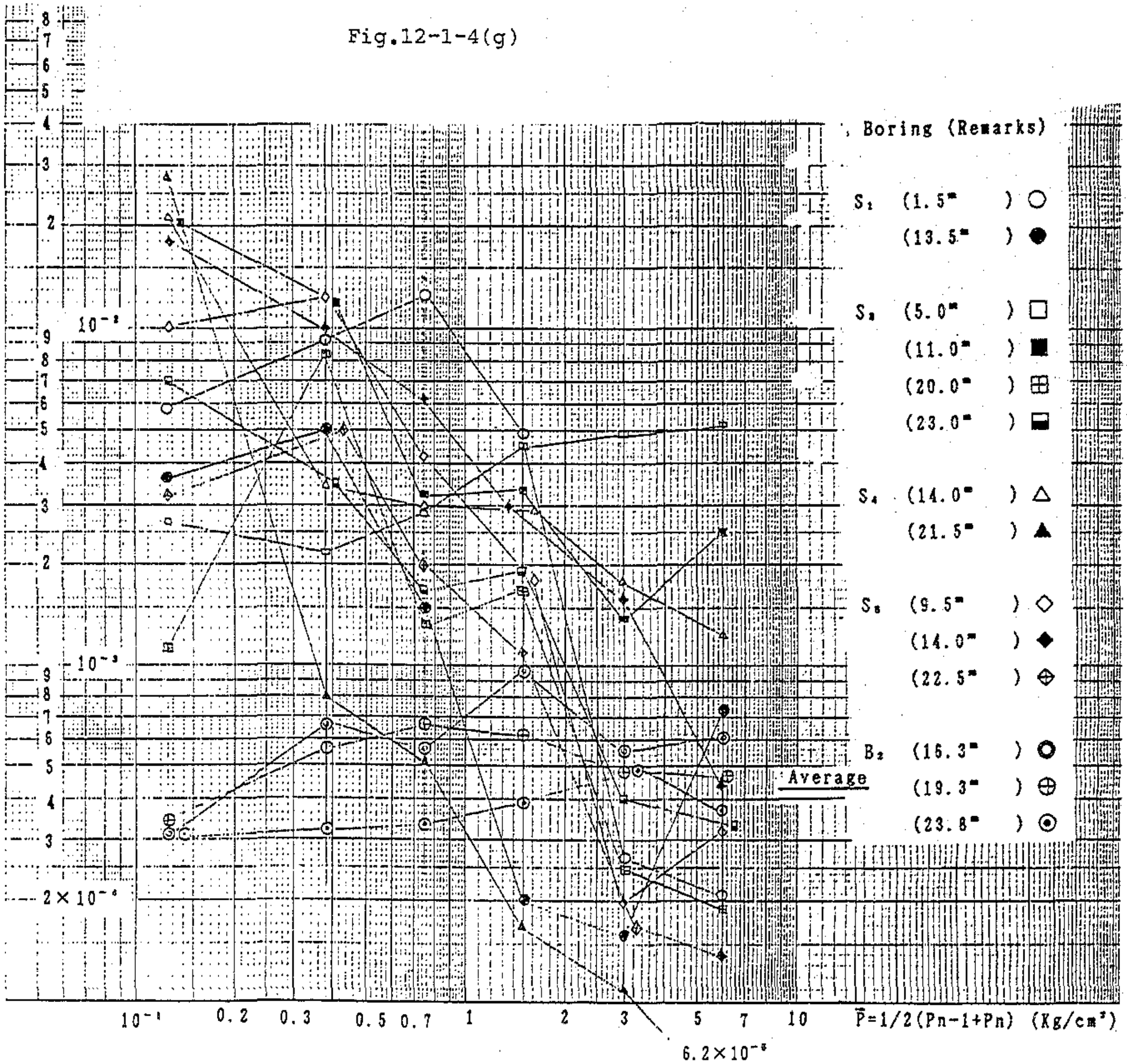
(5) Conffícient of Volume compressibility

Fig.12-1-4(f)



(6) Coefficient of Consolidation

Fig.12-1-4(g)



12-1-5 Design Seismic Coefficient

Regional seismic coefficients	0.06	Data of seismic distribution in Turkey
Factors subsoil condition	1.2	Subsoil classes Class 3
Coefficient of importance	1.5	Special class
KH = 0.06 x 1.2 x 1.5 = 0.108		KH = 0.1

12-1-6 Unit Weight of Construction Materials

Reinforced concrete : 2.45 t/m3

Plain concrete : 2.30 t/m3

Sea water(Black Sea) : 1.02 t/m3(1.016 t/m3)

Steel : 7.85 t/m3

12-1-7 Surcharge

Ordinary condition 2.0t/m2

During earthquakes 1.0t/m2

Others (Load of cargo handling equipment)

Quay crane (Multi-purpose)

Unloader (Coal/Ore)

Container crane

Pneumatic unloader (Grain)

Dead weights of materials

(Unit:tf/m3)

Materials	Unit Weight	Materials	Unit Weight
Steel	7.85	Asphalt concrete	2.3
Casting steel	7.85	Stone	2.6
Casting iron	7.25	Sand, gravel, rubble(Dry conditions)	1.6
Plain concrete	2.3	" " " (Wet conditions)	1.8
Reinforced concrete	2.45	" (Saturated conditions)	2.0
Timber	0.8	" (Effective weight in water)	1.0

12-1-8 **Coefficient of Static Friction**

Concrete against Concrete	0.5
Concrete against Bed rock	0.5
Concreting in Water against Bed rock	0.7-0.8(Note 1)
Concrete against Rubble	0.6
Rubble against Rubble	0.8
Timber against Timber	0.5(Dry)-0.2(Wet)

Note: 1) Under standard conditions, the value should be 0.8. However, when the bedrock is brittle or includes cracks, or when the sand movement over the bedrock is intensive, the value of the coefficient is to be reduced to about 0.7 depending on such conditions.

12-1-9 Materials

(1) Standard Design Strengths of Concrete

Description	Kind of structural member	Standard design strength (kgf/cm2)
Plain concrete	Filling concrete	135
	Crown concrete of breakwater, concrete cap of box caisson	160
	Wave dissipating concrete block, Concrete block	180
	Foot protection block	160
	Coping concrete of wharf, Parapet, Foundation of bollard (gravity type)	180
Reinforced concrete	Foundation of bollard(pile type), Parapet	240
	Coping concrete of wharf	240
	Caisson, cellular block, L-shaped retaining wharf	240
	Anchorage wall for sheet pile	240
Apron pavement		Bending stress 45

Allowable compression stress of reinforced concrete $90 kgf/cm^2$

(2) Allowable Tensile Stress of Reinforcement

(kgf/cm2)

Kind of stress / Kind of reinforcement	(a)Allowable tensile stress in general	(b)Allowable tensile stress determind by yield strength	(c)Allowable tensile stress by fatigue strength
SR 24	1,400	1,400	1,400
SR 30	1,600	1,800	1,600
SD 30A SD30B	1,800	1,800	1,600
SD 35	2,000	2,000	1,800

Notes: SR: Round Bar SD: Deformed Bar

(3) Allowable Stresses of Strucutural Steel (kgf/cm^2)

Kind of steel / Kind of stress	SSK41 SHK41 SHK41M SKY41
Axial tensile stress (per net sectional area)	1,400
Axial tensile stress (per gross sectional area)	$\frac{l}{r} \leq 20$ 1,400 $20 < \frac{l}{r} < 93$ $1,400 - 8.4\left(\frac{l}{r} - 20\right)$ $\frac{l}{r} \geq 93$ $\frac{12,000,000}{6,700 + (l/r)^2}$
Bending tensile stress (per net sectional area)	1,400
Bending compressive stress (per gross sectional area)	1,400
Member which receives combined axial and bending stresses	(1) In case of the axial tensile stress $\sigma_t + \sigma_{bt} \leq \sigma_{ta}$ and $-\sigma_t + \sigma_{bc} \leq \sigma_{ba}$ (2) In case of the axial compressive stress $\frac{\sigma_c}{\sigma_{ca}} + \frac{\sigma_{bc}}{\sigma_{ba}} \leq 1.0$
Shearing stress (per gross sectional area)	800

Note: During earthquakes 50% Extra

(4) Allowable Stresses of Steel Sheet Piles (kgf/cm^2)

Kind of steel / Kind of stress	SY 30	SY 40
Bending tensile stress (per net sectional area)	1,800	2,400
Bending compressive stress (per gross sectional area)	1,800	2,400
Shearing stress (per gross sectional area)	1,000	1,300

Note: During Earthquakes 50% Extra

(5) Allowable Streesses of Structural Steel (kgf/cm^2)

Kind of steel / Kind of stress	SS 41 SM 41 SMA 41	SM 50	SM 50Y SM 53 SMA 50
Axial tensile stress (per sectional area)	1,400	1,900	2,100
Axial compressive stress (per gross sectional area)	1,400	1,900	2,100
Bending tensile stress (per net sectional area)	1,400	1,900	2,100
Bending compressive stress (per gross sectional area)	1,400	1,900	2,100
Shearing stress (per gross sectional area)	800	1,100	1,200
Bearing stress (between steel plates)	2,100	2,800	3,100

Note: During Earthquakes 50% Extra

(6) Properties of Tie Rod Materials

Kind of Steel	Breaking Stregth (kgf/cm^2)	Yield Stress (kgf/cm^2)	Allowable Stress (kgf/cm^2)		Elongation (%)	Yield Stress / Breaking Strength	Safety Factor Breaking trengy / Allowable Strenght	
			Ordinary Condition	Special Condition			Oridinary Condition	Special Condition
S.S.41	4,100 or more	(40mm or less dia) 2,400 or more	960	1,440	24 or more	0.59	4.27	2.85
		(more than 40mm dia) 2,200 or more	880	1,320	24 or more	0.54	4.66	3.10
S.S.50	5,000 or more	(40mm or less dia) 2,800 or more	1,120	1,680	21 or more	0.56	4.46	2.98
		(more than 40mm dia) 2,600 or more	1,040	1,560	21 or more	0.52	4.81	3.21
High Tension Steel 30	5,000 or more	3,300 or more	1,320	1,980	24 or more	0.66	3.78	2.52
High Tension Steel 40	6,000 or more	4,000 or more	1,600	2,400	22 or more	0.67	3.75	2.50
High Tension Steel 45	7,000 or more	4,500 or more	1,800	2,700	20 or more	0.64	3.89	2.59

Our extra allowable stress of 50% is applicable to earthquake situation.

(7) Corrosion Control General

1) Corrosion Rates of Steel

	Corrosive environment	Corrosion rate (mm/year)
Sea side	Above H.W.L.	0.3
	Between H.W.L. and the LWL -1.00	0.1 ~ 0.3
	Between L.W.L -1.00 and the Sea bottom	0.1 ~ 0.2
	Below the sea bottom	0.03
Land side	In marine atmosphere	0.1
	In soil (above the residual water level)	0.03
	In soil (below the residual water level)	0.02

2) Residual Water Level

Sheet Pile Type R.W.L=(H.W.L-L.W.L)x2/3+L.W.L

Gravity Type R.W.L=(H.W.L-L.W.L)x1/3+L.W.L

12-1-10 Safety Factors

(1) Gravity Type

1) The safety factor against sliding

$$F \leqq \frac{f.w}{P}$$

W : The resultant of vertical forces acting on Wall(t)

P : The resultant of horizontal forces acting on the Wall(t)

f : Coefficient of friction between the bottom of the Wall and the foundation

F : Safety factor

Ordinary conditions : 1.2 or more

Special conditions : 1.0 or more

2) The safety factor against overturning

$$F \leqq \frac{W\ X}{P\ y}$$

W : The resultant of vertical forces acting on the Wall(t)

P : The resultant of horizontal forces acting on the Wall(t)

X : Distance of application line of the resultant force of the vertical forces acting on the Wall(m)

y : Height from the application line of the resultant force of the horizontal forces acting on the Wall

F : Safety factor

Ordinary conditions : 1.2 or more

Special conditions : 1.1 or more

3) Stability of circular failure

. Circular failure : Ordinary conditions; 1.3 or more

4) Bearing capacity of Foundation

Bishops Theory Ordinary conditions : 1.2 or more

Special conditions : 1.0 or more

(2) Axial Allowable Bearing Capacity

1) Standard Axial Allowable Bearing Capacity

Safety factor

Ordinary		2.5 or more
During Earthquakes	Bearing Pile	1.5 or more
	Friction Pile	2.0 or more

2) Standard Allowable Pulling Resistance

Safety factor

Ordinary	3 or more
During Earthquakes	2.5 or more

12-1-11 Design Discharge of Filyos River

(1) Catchment Area $A = 13{,}300 Km^2$

(2) Peak Discharge

Recurrent Period (years)	Peak Discharge (m^3/sec)
2.33	1,140.02
5	1,643.37
10	2,063.96
25	2,588.02
50	2,976.78
100	3,362.67
500	4,260
1,000	4,647