3.3.3 Detailed Design

(1) Dredging & Reclamation

1) Dredging is required to provide an appropriate navigational channel, turning basin and mooring basin for safe maneuvering of the objective vessels.

2) Whilst, the fill material for the reclamation of Ataqa I.E. Coastal is sought from the dredged material.

3) In this sense, the dredging is to be designed not only for safe maneuvering of the objective vessels but also for the fill material to be used for the reclamation of Ataqa I.E. Coastal taking the balance of both required quantities into consideration.

4). The estimated volumes of the dredging and reclamation are as follows (as design net):

Dredging Volume	:	5.0 Million cu.m
Reclamation Volume	:	6.1 Million cu.m

(a) Dredging

1) Required dredging depth

From the required water depth for safe maneuvering of the objected vessels, the following dredging depths have been determined:

a) Quay Front and Basin

- Grain Terminal:	C.D. -15.0 m, 80,000 DWT Grain Carrier Full Draft -14.5m
- Bulk Cargo Terminal:	C.D. -13.0 m, 20,000 DWT Container Ship or Bulk Carrier Full Draft 10.6m
- Small Boat Basin:	C.D. -5.0m, Tugboat or other Service Boats

b) Channels

For main channel, the dredging depth up to C.D.-15.0 m has been determined as required for safe navigation of vessels under the reasons that:

- the most of portions of the channel is deep enough for navigation except the area within 1.2 km from the quay wall line,
- the area around is generally calm wave condition, and neither remarkable siltation nor littoral drift has been observed.

For sub-channel for small boat basin, designed depth C.D. -5.0m is determined for the same reasons above.

c) Trenches for structural foundation

In addition to the dredging for basin and channels, the dredging for quaywall foundation trench is required. The dredging depths have been determined from structural stability;

- Grain Wharf	:	C.D. -17.5 m
- Bulk Cargo Wharf	:	C.D. -15.5 m
- Small Boat Wharf	:	C.D. -7.0 to -8.0 m

2) Dredging Area

The dredging area of the turning basin and access channel have been drawn-up with the following points taking into consideration.

- Sufficient space for safe maneuvering of the objective vessels.
- Smooth and safe vessel moving from/to turning basin and access channel. In this sense, the existing shallow spots in front of the port area will be removed.
- Economy of construction cost.
- Balance of volumes of materials in dredging and reclamation.

The determined dredging area is shown together with its depth in Figure 3.3.3-1.

3) Material condition and side slope determination

a) Materials of the area to be dredged

The soil investigation reveals that the seabed sub-soil along the quay consists of typical three layers: the sand layer having N-Value of 2 to 10 with thickness about 4 m (C.D. -6 m to -10 m), the clay layer with silt and shale having N-Value of 8 to 15, and sandy or silty gravel layer having. N-Value of 50 to 100 as it goes deeper. Figure 3.3.2-1 shows the subsoil conditions along the quay line.

Seabed of the offshore shallow spots consists of sand with shales and cemented sand pieces. Thickness of this layer is about 6 m (from -2 m to -8 m (C.D.)), and N-Value is about 7 to 27. Below the layer, existing are the coral layer with thickness of 1.5 m having N-Value of 81, from -8 m to -15 m (C.D.), sandy layer with coral pieces and clayey layer with limestone pieces having N-Value of 6 to 10.

From the results of the soil investigation, the following material proportion of dredging is estimated as average figure of 6 boreholes (A1 - A6) subsoil condition.

a. Sand	Approx. 40 %	N= 2 - 9
b. Silty Clay	Approx. 35 %	N= 8 - 15
c. Sandy or Silty Gravel	Approx. 25 %	N> 50

b) Side slope

The general guideline for stable dredging slopes according to the soil conditions is as follows :

Soil conditions	N-Value	Stable slope
Cohesive soil	Less than 4 4 to 8 8 to 20 over 20	1:3 to 1:5 1:2 to 1:3 1:1.5 to 1:2 1:2 to 1:1.5
Sandy soil	Less than 10 10 to 30 over 30	1:2 to 1:3 1:1.5 to 1:2 1:1 to 1:1.5
Gravel		1:1 to 1:1.5

Recommended stable slopes;

Soil	Slope
Sand (N= 2 - 9)	1:2 to 1:3
Clay (N= 8 -15)	1:1.5 to 1:2

From the above figure and considering the past dredging experience in Suez area, the side slope of 1:3 is determined for permanent works.

As for the trench dredging for quay foundation, a slope of 1:2 is determined, since the trench will be backfilled as the construction proceeds.

4) Dredging volume

The dredging volume in design sections is estimated about 50 million cubic meters.

When the percentage of each classified soil layer, the following volumes will be expected as design net volume:

Sand : 2.0 Million cu.m
Clay : 1.7 Million cu.m
Gravel: 1.3 Million cu.m

5) Dredging plant

It will be necessary to employ Cutter Suction Type dredgers in order to implement the work efficiently and economically. Because of the total volume of the dredging (6.1 million cu.m) and soil conditions (layers of N-Value over 50 exist).

(b) Reclamation

1) The area for Ataqa I.E. Coastal including Port area is to be reclaimed with the dredged material. The estimated volume required for the reclamation of the area is approximately 5.9 million cubic meters. The fill material to be obtained from the dredging consists of sand, clay and silty or sandy gravel as mentioned in 3.3.3 (1)(a).

2) However, in the Port area it is necessary to use a selected sand and gravel materials so as not to cause any serious settlement or lack of bearing capacity under the port facilities.

3) Protection of the reclaimed land
The reclaimed land other than quay area and existing land will be protected by revetments designed appropriately to meet the project requirements and Site conditions which will be described in 3.3.3 (2) Revetments and Temporary Revetments. The slope of reclaimed material should be 1:2.

4) Volume balance estimation

- Reclamation volume required	:	6,100,000 cu.m
Dredging volume in the design section	:	5,000,000 cu.m
Expected dredgies volume of tolelance in the dredging area (200 ha x 0.3)	:	600,000 cu.m

- Available volume by dredging

$$Vd = Vm \times (1+a) \times (1-b)$$

Vd : Available volume

Vm : Net volume dredged

a : Ratio of out-break dredge: (0.05)assumed

b : Loss ratio - sand,gravel 2 %
- clay 15 %assumed

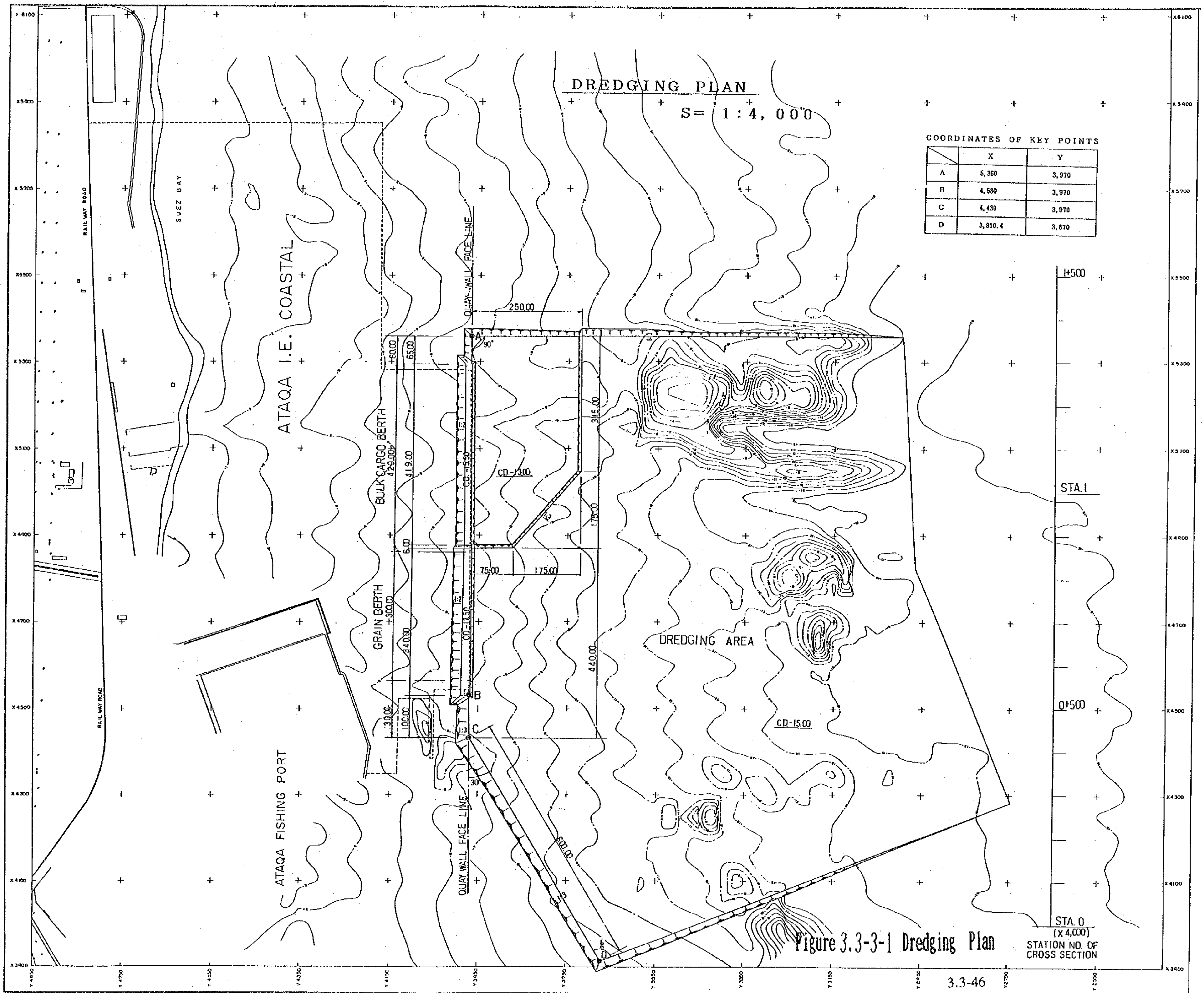
	M.cu.m		a		b		M.cu.m
Sand :	2.2	X	1.05	X	0.98	=	2.26
Gravel :	1.3	X	1.05	X	0.98	=	1.34
Clay :	2.1	X	1.05	X	0.85	=	1.87
Total			5.60				5.47 (98% of NET volume)

Required dredging volume for reclamation (V_R) is calculated as follows.

Required dredging volume : V_R million m^3

$$VR = 6.1 \text{ mil.m3} \times \frac{5.60 \text{ mil.m3}}{5.47 \text{ mil.m3}} = 6.2 \text{ mil.m3}$$

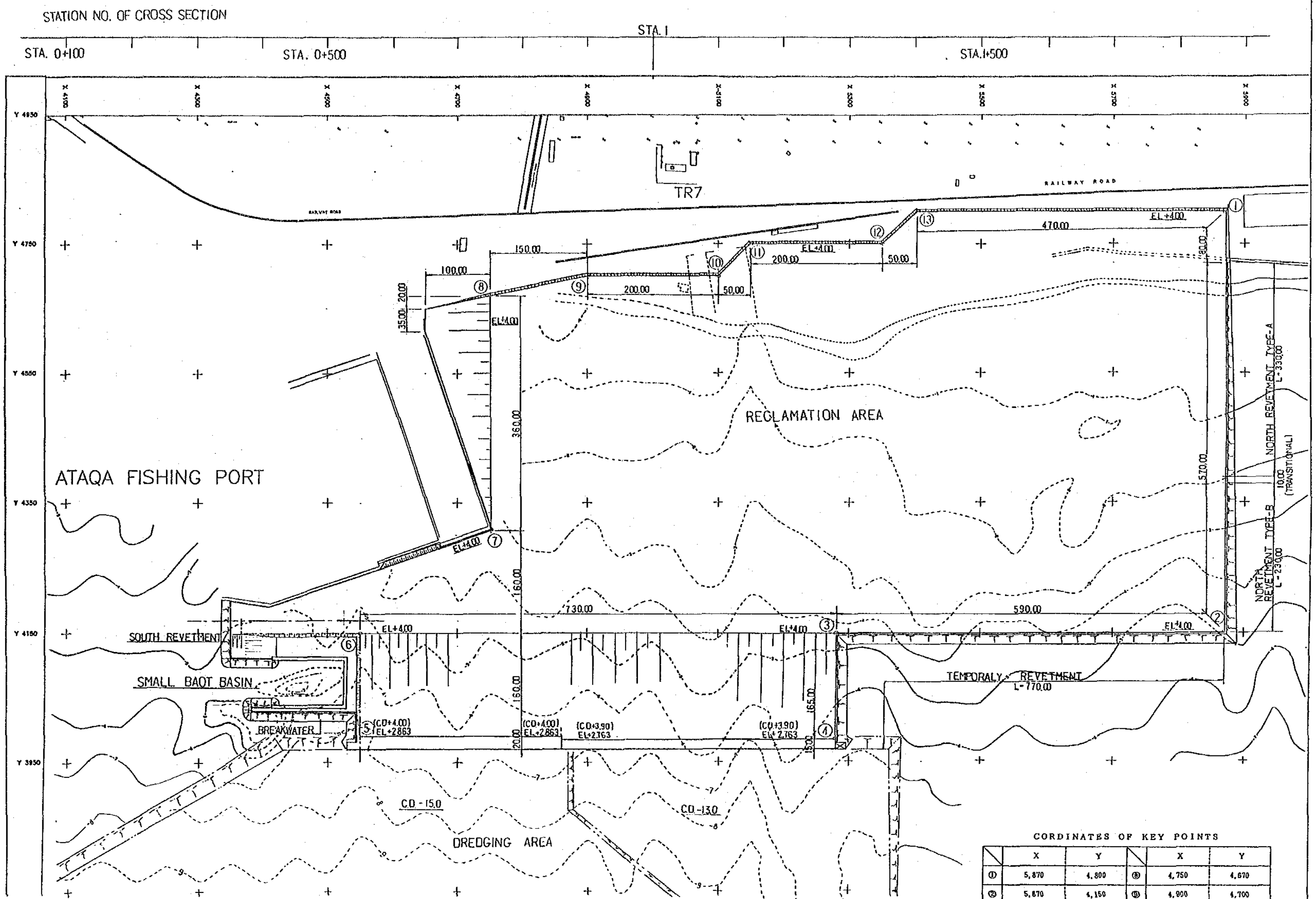
Reclamation area is shown in Figure 3.3-3-2.



COORDINATES OF KEY POINTS

	X	Y
A	5,360	3,970
B	4,530	3,970
C	4,430	3,970
D	3,910.4	3,670

Figure 3.3-3-1 Dredging Plan



CORDINATES OF KEY POINTS

	X	Y		X	Y
①	5,870	4,800	⑧	4,750	4,670
②	5,870	4,150	⑨	4,900	4,700
③	5,280	4,150	⑩	5,100	4,700
④	5,280	3,885	⑪	5,150	4,750
⑤	4,550	3,890	⑫	5,350	4,750
⑥	4,550	4,150	⑬	5,400	4,800
⑦	4,750	4,310			

RECLAMATION PLAN
SCALE 1:3,000

Figure 3.3-3-2 Reclamation Plan

(2) Revetment and Temporary Revetment

In general, a construction of revetment needs a big amount of stones. Ataqa quarries located near the Project site which have the huge sources and are producing stones to meet the demands of Suez, Cairo, Canal Zone and Delta Zone including Damietta.

Therefore, the structural type of revetments, in principal, are selected a stone rubble mound type in the design.

Figure 3.3.3-3 shows Plan of Revetment and Slope Protection.

(a) South Revetment

South revetment E-E is to protect the reclaimed land of the grain terminal from rough waves and to keep the elevation of the grain terminal.

The height of the south revetment varies from C.D. +3.60 m at the apron to C.D. +4.00 m at the breakwater according to the formation of the grain terminal. The existing seabed level is approximately C.D. -6 meters. However, a trench dredging of C.D. -17.5 m for the foundation works of the caisson will be carried out before the construction of the revetment.

At the corner of the revetment and the breakwater, artificial concrete blocks are placed on the armor stone to absorb the wave energy concentrated on the corner.

The South Revetment E-E will be constructed with rock mound with a concrete parapet block.

Typical cross section of the South Revetment E-E is shown in Figure 3.3.3-4.

South revetment F-F is located on the extension line of West Quay Wall of the Small Boat Basin. The total length is longer than 75 meters. The type of the revetment is concrete block with rock mound. Figure 3.3.3-5 shows cross section of the revetment.

South revetment G-G is located at the corner of the revetment F-F to the breakwater of Ataqa Fishing Port. The revetment is designed with rubble mound with L-shaped parapet. The length of the revetment is 67 meters.

Figure 3.3.3-6 shows the typical cross section of the revetment G-G.

(b) Temporary Revetment

Temporary revetment is located at the northern end of the Ataqa port and eastern end of the Ataqa I.E.Coastal. In future, the construction of a coal terminal having 2 berths (L=540 m) is to be planned at the sea side of the temporary revetment of the Ataqa I.E. Coastal.

The structural type of the Temporary Revetment is the same as the Type B of the North Revetment. However the crown height of the Temporary Revetment at the Ataqa Port area varies according to the formation level of the bulk cargo terminal.

Figure 3.3.3-7 and 3.3.3-8 show the typical cross section of the temporary revetment.

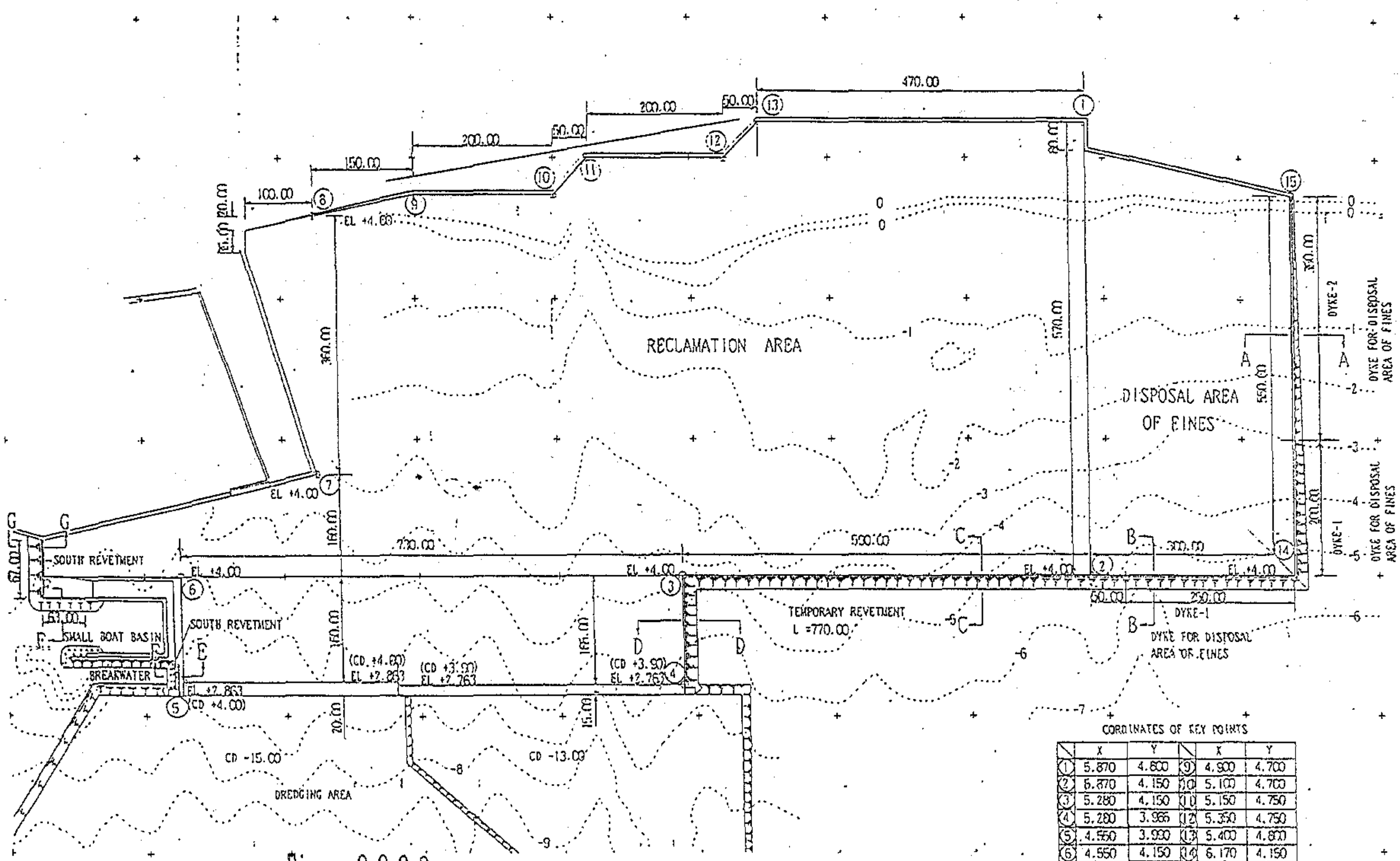
(c) Dike for Disposal Area of Fines

A dike to retain the dredged fine material will be constructed in the north shore from the reclamation area. The length of dike is 300 m on the extension line of Temporary Revetment (dike of 40 m is the same type as Temporary Revetment and 250 m will be constructed with dredged material and armor stone covered on the sea side slope). The length of dike perpendicular to the shore line is 550 m of which offshore part 200 m will be constructed with armor stone and dredged material, and land side 350 m will be made of dredged material.

Figure 3.3.3-9 and 3.3.3-10 show the typical cross section of the dike.

(d) Boundary Concrete Block

Concrete blocks will be placed on the boundary line between the reclamation area and disposal area of fines. Figure 3.3.3-11 shows the cross section of concrete block on the boundary line.



	X	Y		X	Y
1	5.870	4.600	9	4.900	4.700
2	6.870	4.150	10	5.100	4.700
3	5.280	4.150	11	5.150	4.750
4	5.280	3.986	12	5.350	4.750
5	4.550	3.930	13	5.400	4.800
6	4.550	4.150	14	6.170	4.150
7	4.750	4.310	15	6.170	4.700
8	4.750	4.670			

Figure 3.3-3-3 PLAN OF REVETMENT AND SLOPE PROTECTION

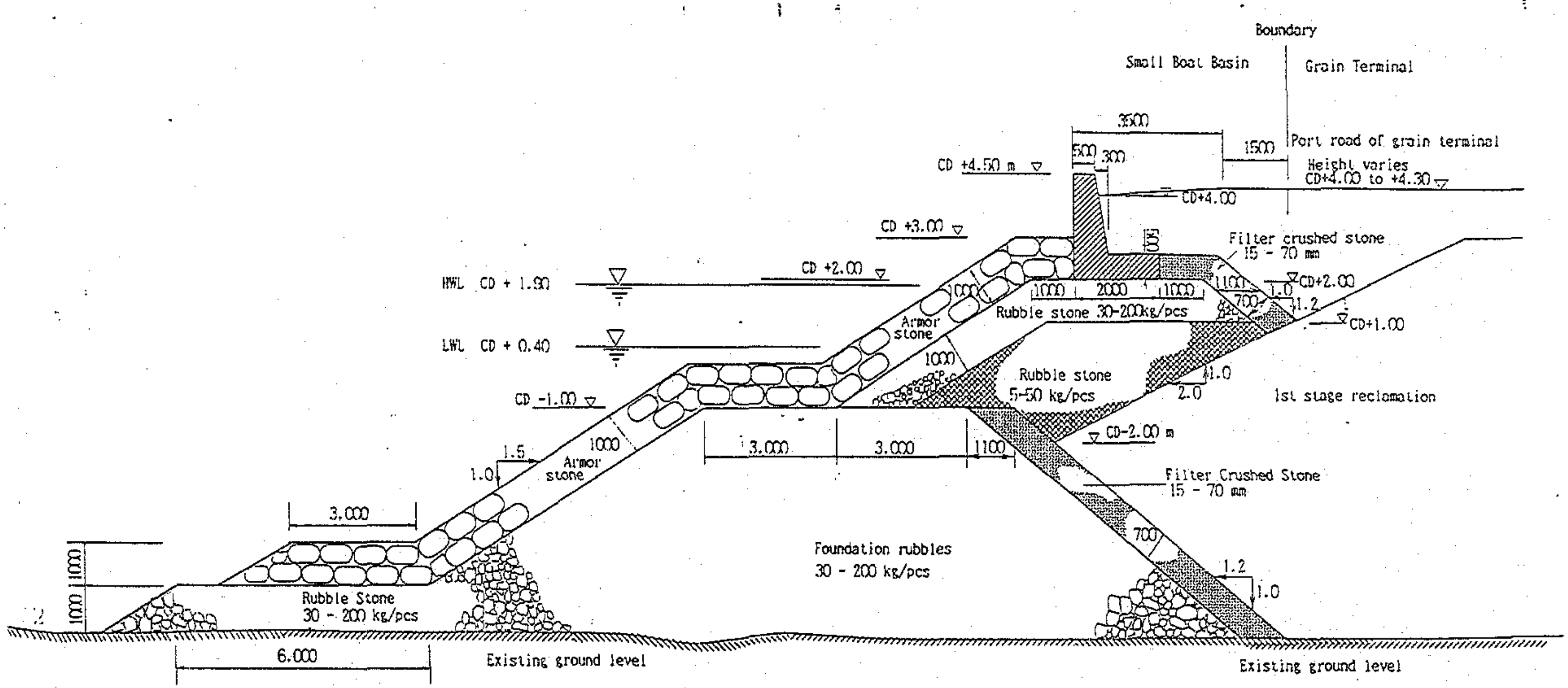


Figure 3.3-3-4 **TYPICAL CROSS SECTION OF SOUTH REVETMENT - 1**
SECTION E - E

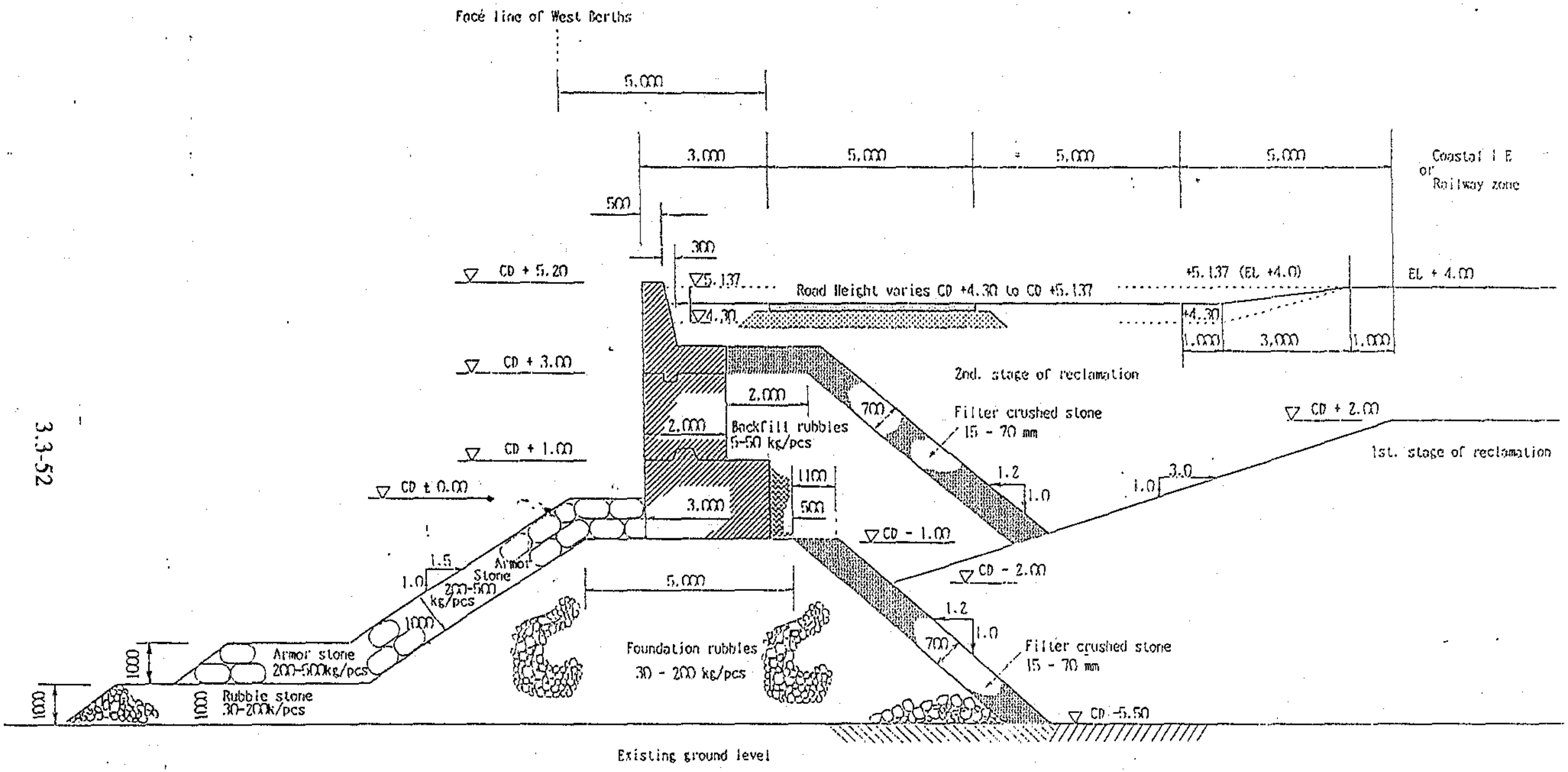


Figure 3.3-3-5 ***TYPICAL CROSS SECTION OF SOUTH REVETMENT - 2***
SECTION F - F

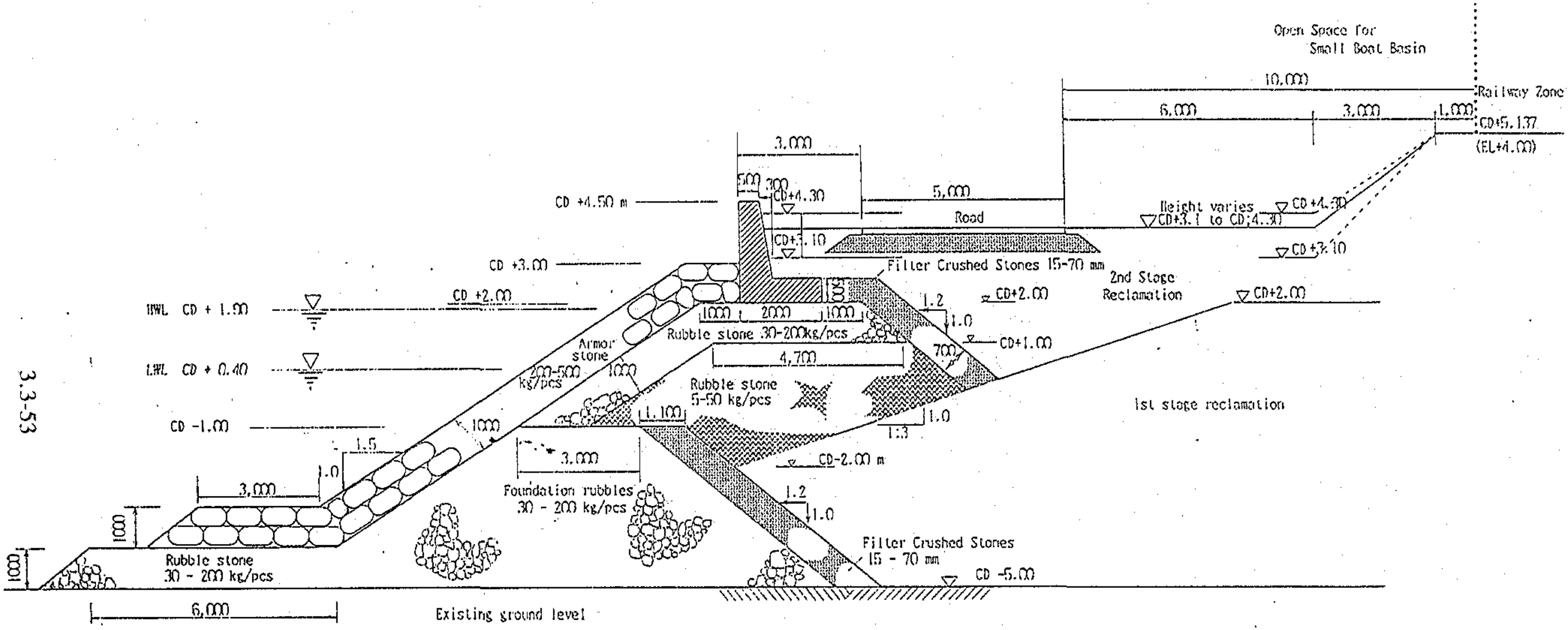


Figure 3.3-3-6 ***TYPICAL CROSS SECTION OF SOUTH REVETMENT - 3***
SECTION G - G

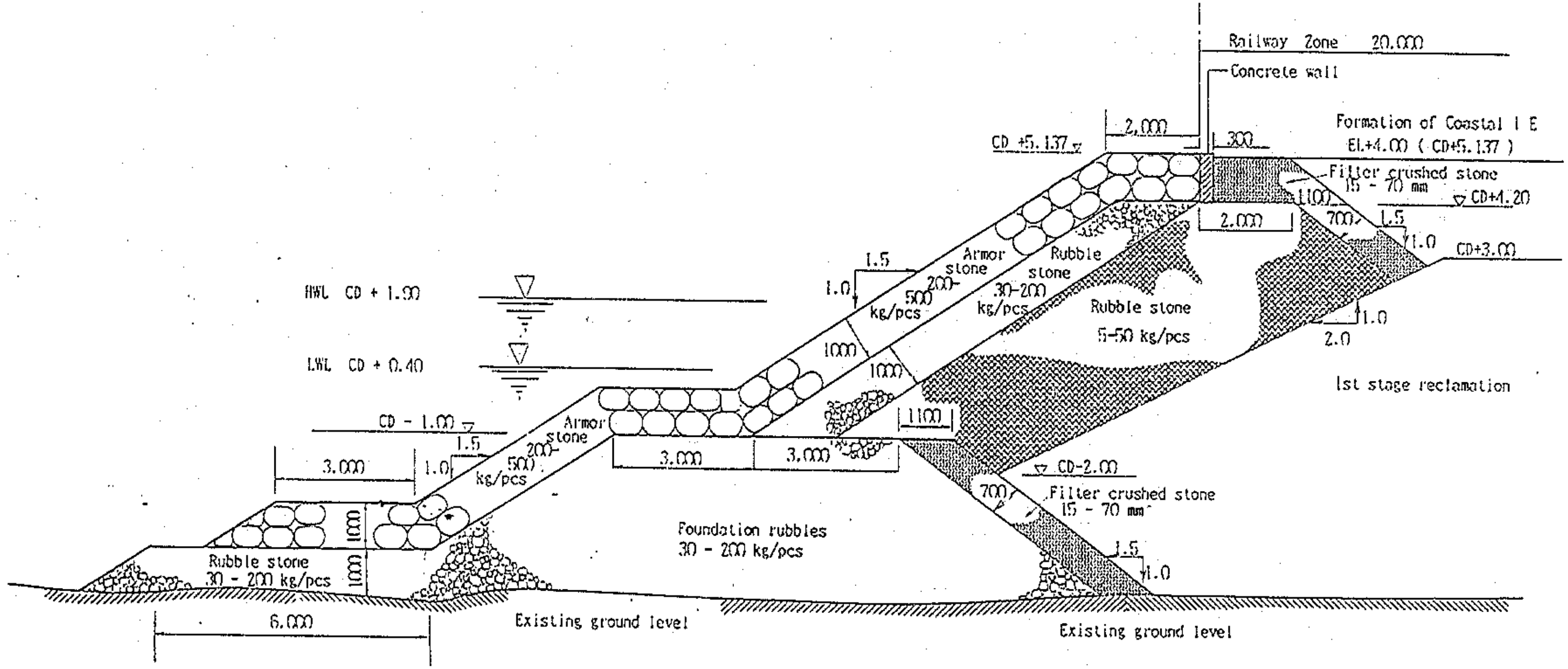


Figure 3.3-3-7 ***TYPICAL CROSS SECTION OF TEMPORARY REVETMENT***

SECTION C - C

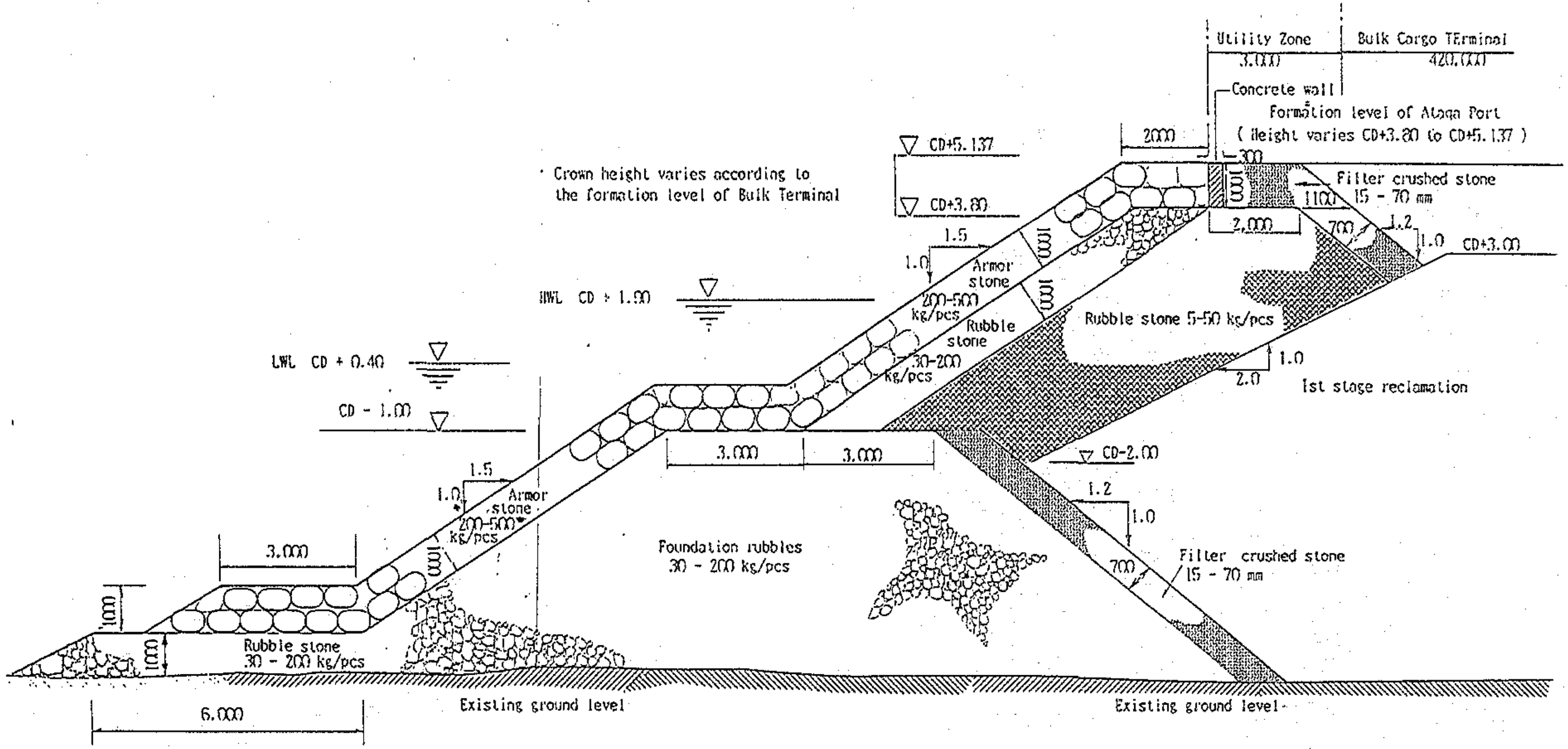


Figure 3.3-3-8 ***TYPICAL CROSS SECTION OF TEMPORARY REVETMENT***
SECTION D - D

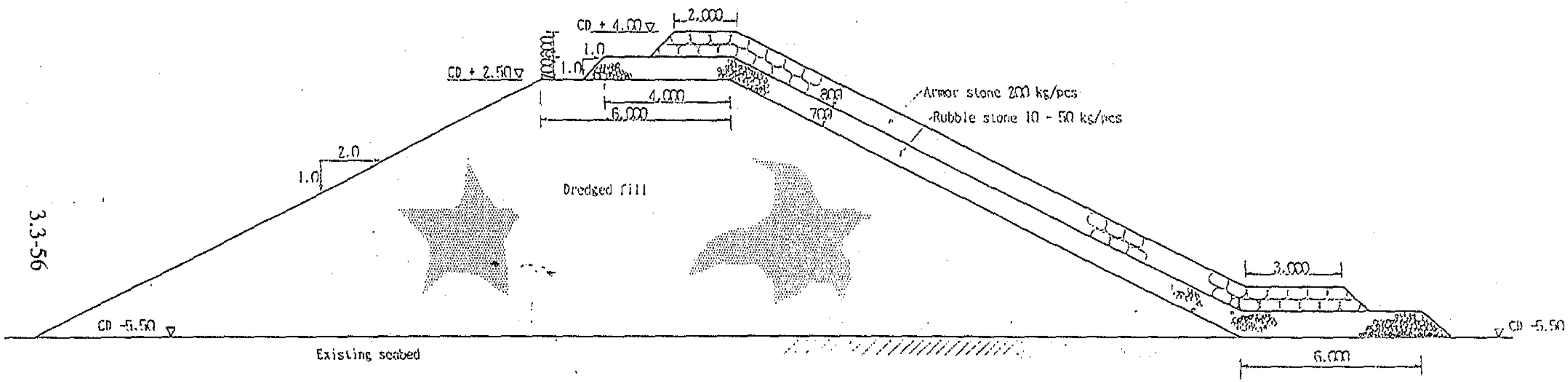


Figure 3.3-3-9 ***CROSS SECTION OF DYKE FOR DISPOSAL OF FINES - 1***

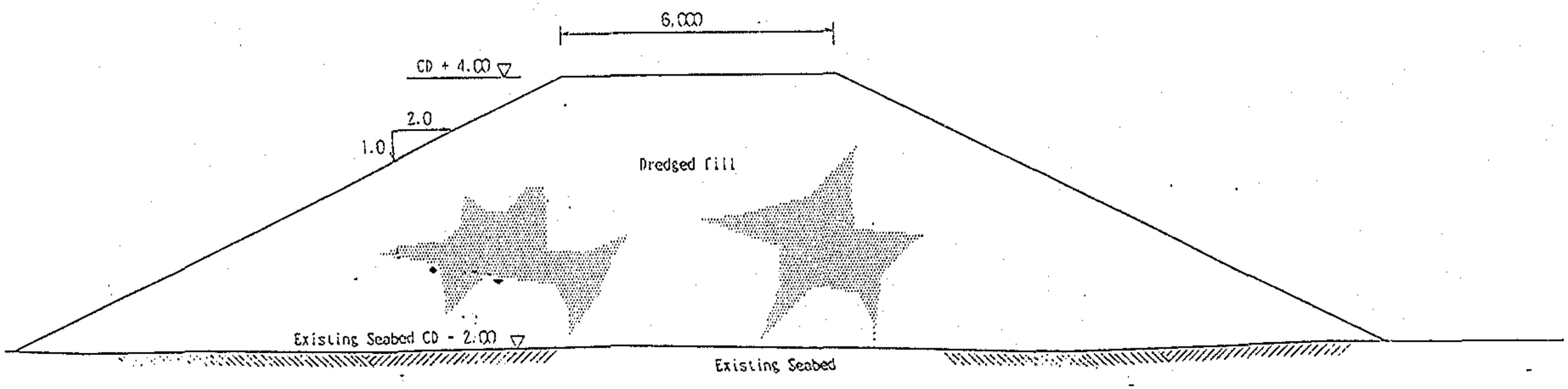


Figure 3.3-3-10 ***CROSS SECTION OF DYKE FOR DISPOSAL OF FINES - 2***

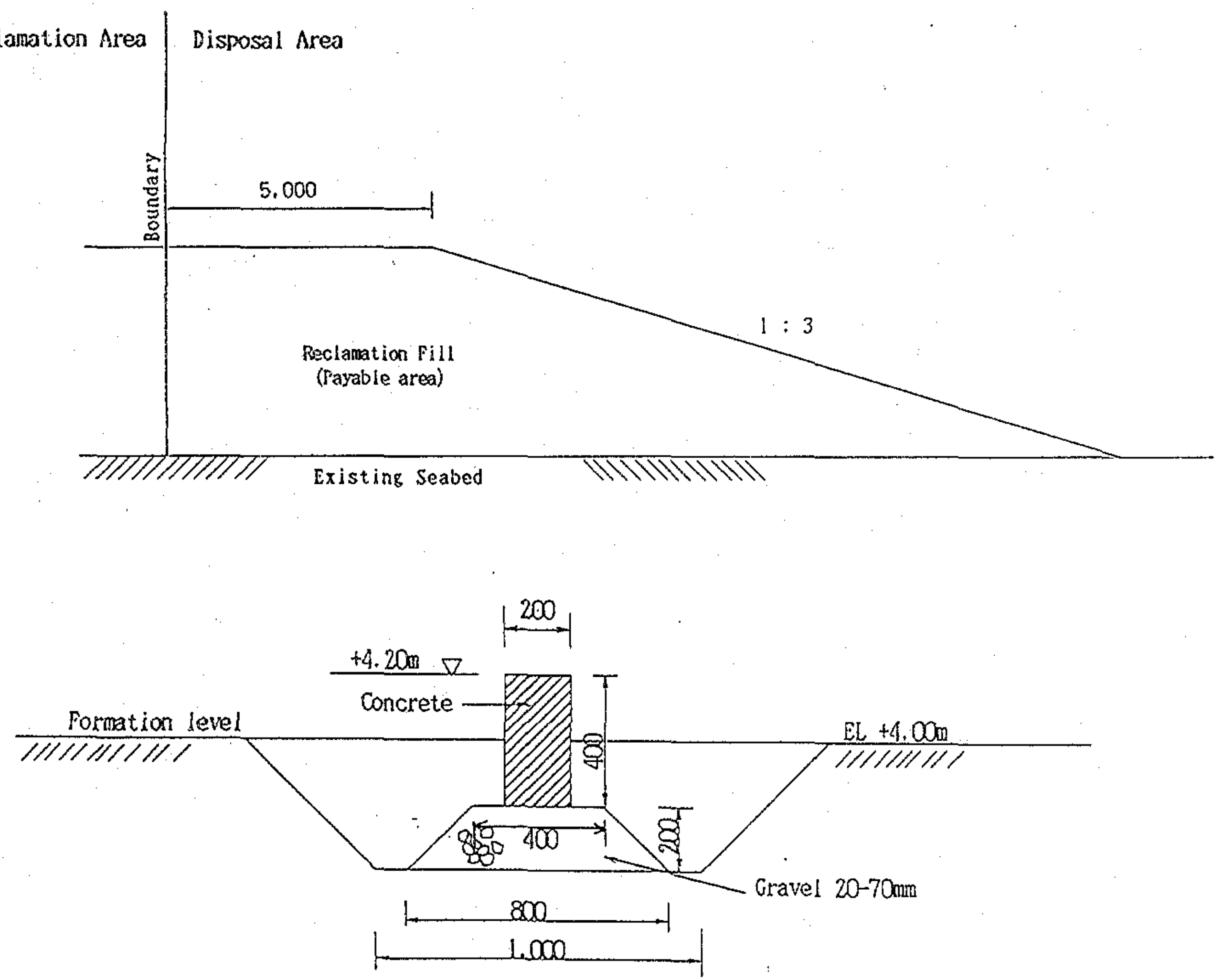


Figure 3.3-3-11 BOUNDARY CONCRETE BLOCK

(3) Access Channel and Turning Basin

(a) Channel and Tuming Basin

1) Actual Conditions

The existing access channel to Adabiya Port diverted from the main channel for Suez Canal and extends to the West between northern and southern waiting anchor areas. This access channel will be the access to the Ataqa Port.

The width of existing access channel between waiting anchor areas is about 500 m and is sufficient for the access of a 80,000 DWT class grain carrier. The channel length is about 6,000 m and present water depth is -16 m to -18 m below Chart Datum (C.D.) except 1,500 m on the land side part where the existing sea bed depth varies from -6 m to -15 m (C.D.).

About 500 m and 800 m offshore the quay of Ataqa Port, two shallow spots exist.

2) Design of Access Channel

The access channel and turning basin are designed for easy and safety ship maneuvering for maximum vessels of 80,000 DWT grain carrier.

Generally, berthing of large vessels to the quay will be assisted by tugboats, while small vessels less than 5,000 DWT may berth without tug assistance.

The width of channel is planned to be 375 m which is 1.5 times of over-all length of the maximum vessel (80,000 DWT grain carrier) since the channel is relatively short and vessels will pass by the channel each other.

The two spots in front of the quay will be removed to ensure easy and safe ship maneuvering.

The designed access channel and turning basin are shown in Figure 3.3.3-12.

(b) Navigation Aids

Lighted buoy No.1, No.2 and No.3 are to be installed on the edge line of he turning basin.

Two marker buoys, No.4 and No.5 are also placed at the distance of 130 m in the South and 80m in the North on the extension of the quay wall face line. Two lighted beacons, No.6 and No.7 are set at both ends of the quay. In addition to these navigation aids, a front leading light and a rear leading light are to be constructed on land on the extension of the center line of the channel. The height of the front leading light is 5m and the rear leading light is 15m, and each leading light is equipped with day mark and lighting lantern.

These navigation aids are to be provided in accordance with the system "A" of IALA. The characteristics of navigation aids are summarized in Table 3.3.3-1.

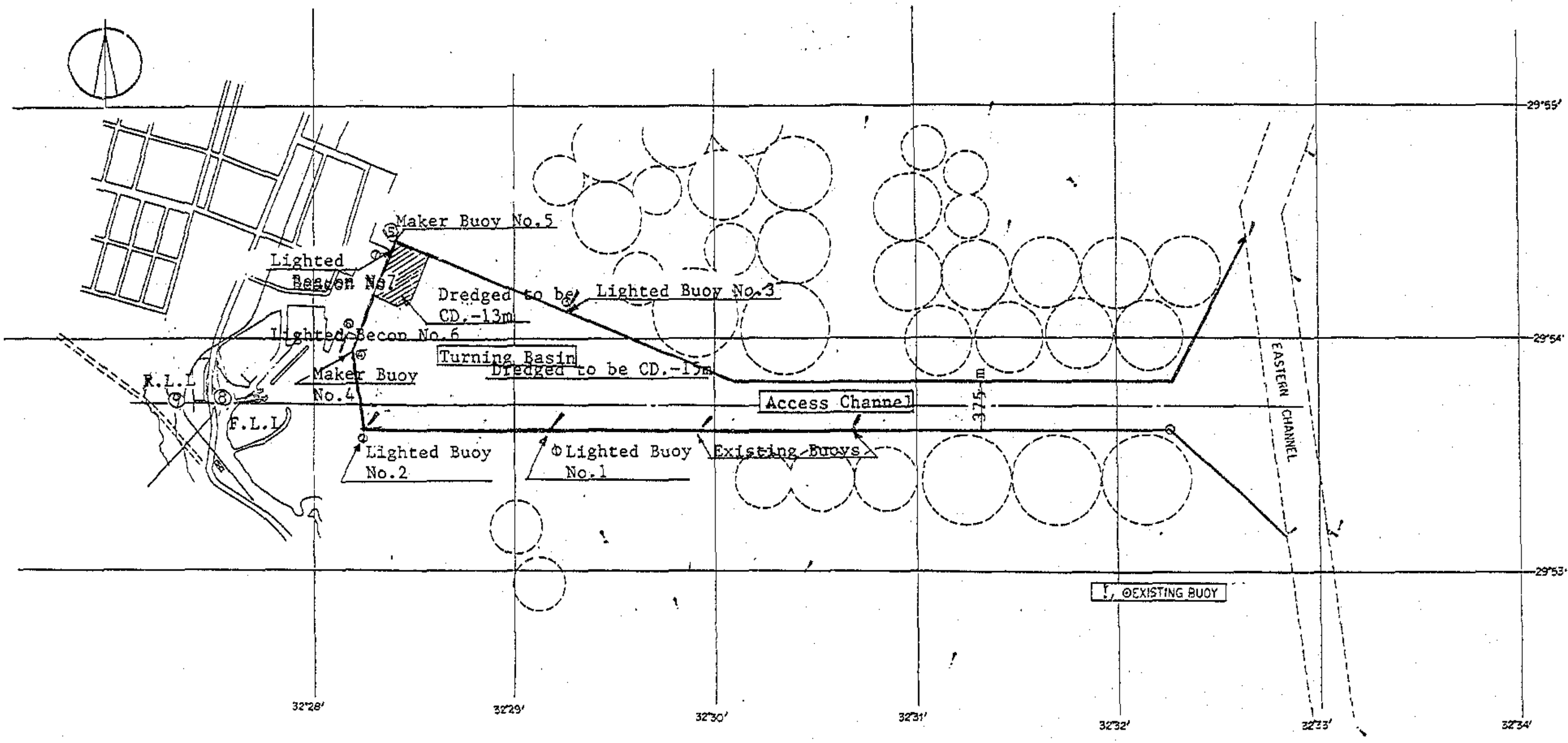


Figure 3.3-3-12 Access Channel and Turning Basin

Table 3.3-3-1 Characteristics of Navigation Aids

	Body			Light							POWER SOURCE	Accessories		
NO.	A i d	Focal plane height	Body color	Bulb	Character	Light color	Fixed intensity	Effective intensity	Luminus range T=0.85	Type	Battery No.	Top mark	Rader reflecter	SINKER
①	Lighted Buoy	4.5m	red	12V 0.25A	Fl r.5 sec.	red	15 cd	12 cd	3.2 n.m	solar	12V,65Ah x1 pce.	□	○	5.0ton x1 pce.
②	Lighted Buoy	4.5m	red	12V 0.25A	Fl r.5 sec.	red	15 cd	12 cd	3.2 n.m	solar	12V,65Ah x1 pce.	□	○	5.0ton x1 pce.
③	Lighted Buoy	4.5m	green	12V 0.25A	Fl g.5 sec.	green	15 cd	12 cd	3.2 n.m	solar	12V,65Ah x1 pce.	△	○	5.0ton x1 pce.
④	Marker Buoy (CAN type)	—	red	—	—	—	—	—	—	—	—	□	—	5.0ton x1 pce.
⑤	Marker Buoy (CONICAL type)	—	green	—	—	—	—	—	—	—	—	△	—	5.0ton x1 pce.
⑥	South Cardinal Lighted Beacon	5.5mm	UPPER YELLOW LOWER BLACK	12V 0.25A	Q(6)+long Fl every 15 sec.	white	50 cd	36 cd	5.4 n.m	solar	12V,65Ah x1 pce.	▽▽	—	—
⑦	North Cardinal Lighted Beacon	5.5m	black with a single broad horizontal yellowband	12V 0.25A	Q(3) every 10 sec.	white	50 cd	36 cd	5.4 n.m	solar	12V,65Ah x1 pce.	△▽	—	—
⑧	LeadingLight (Front)	5.0m	white	12V 0.25A	Fl 3 sec.	white	299 cd	245 cd	9.0 n.m	solar	12V,65Ah x2 pce.	⏢ (inverted)	—	—
⑨	LeadingLight (Rear)	15.0m	white	12V 0.25A	Iso 4 sec.	white	299 cd	245 cd	9.0 n.m	solar	12V,65Ah x2 pce.	⏢	—	—

(4) Grain Terminal

(a) Scale and Dimensions

1) Wharf

Number of berth	:	1 berth
Length of berth	:	310 m
Additional length of quaywall	:	20 m South extremity
Water depth of berth	:	C.D. -15.0 m
Crown height of berth (face line)	:	C.D. + 3.6 m
Width of apron	:	20 m
Gradient of apron	:	2.0 %
Structural type of quay wall	:	Reinforced concrete caisson

2) Area of grain terminal

Length of the area	:	310 m
Width of the area including wharf	:	200 m
Formation height at the wharf side	:	E.L.+2.863m (C.D.+4.0 m)
Ditto, but at the I.E side	:	E.L.+4.0 m
Width of railway right of way	:	20.0 m

(b) Facility Layout Plan

Figure 3.3.3-13 shows the General Layout of the grain terminal respectively.

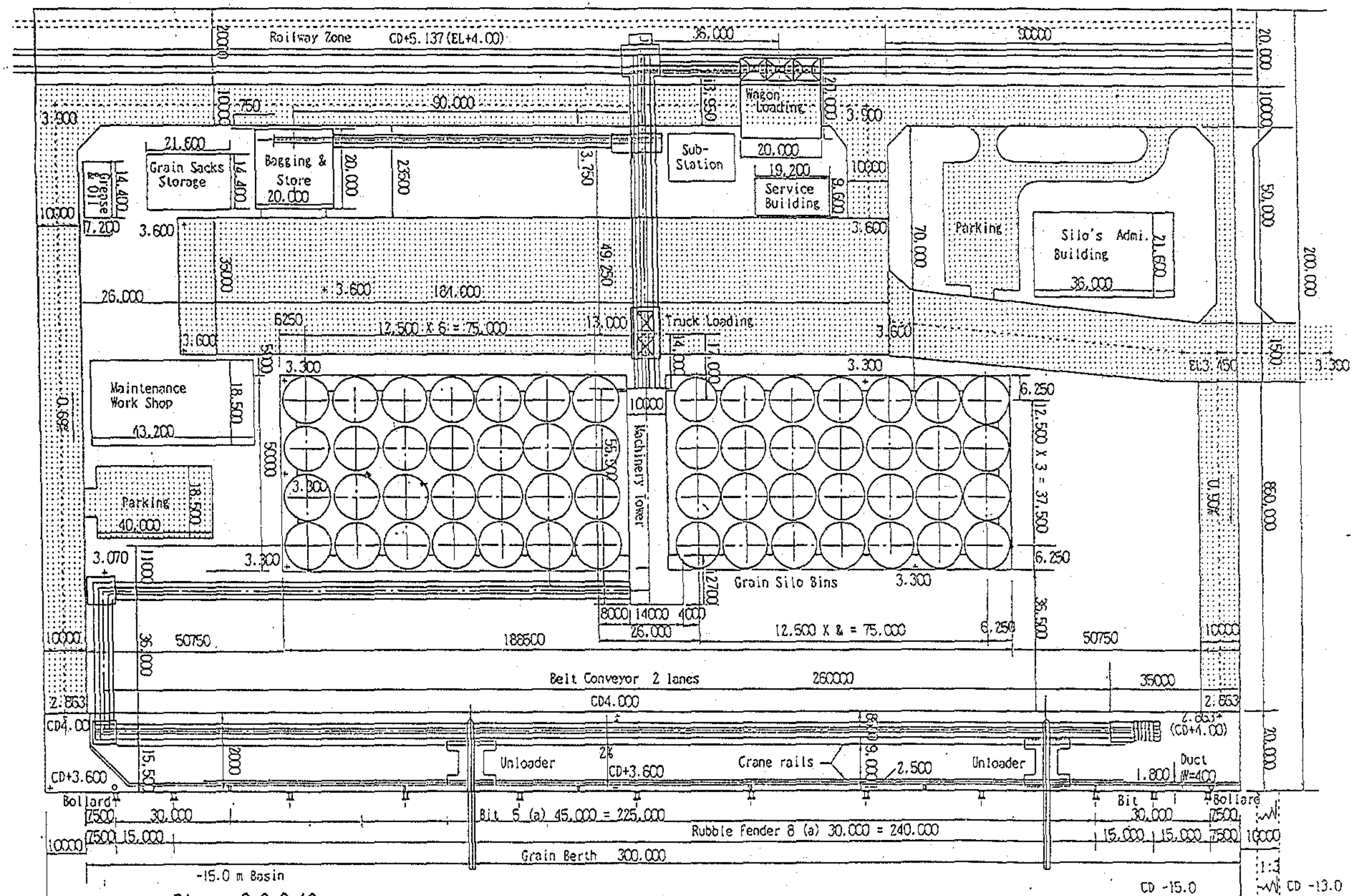


Figure 3.3-3-13 ***GENERAL LAYOUT OF GRAIN SILO TERMINAL***

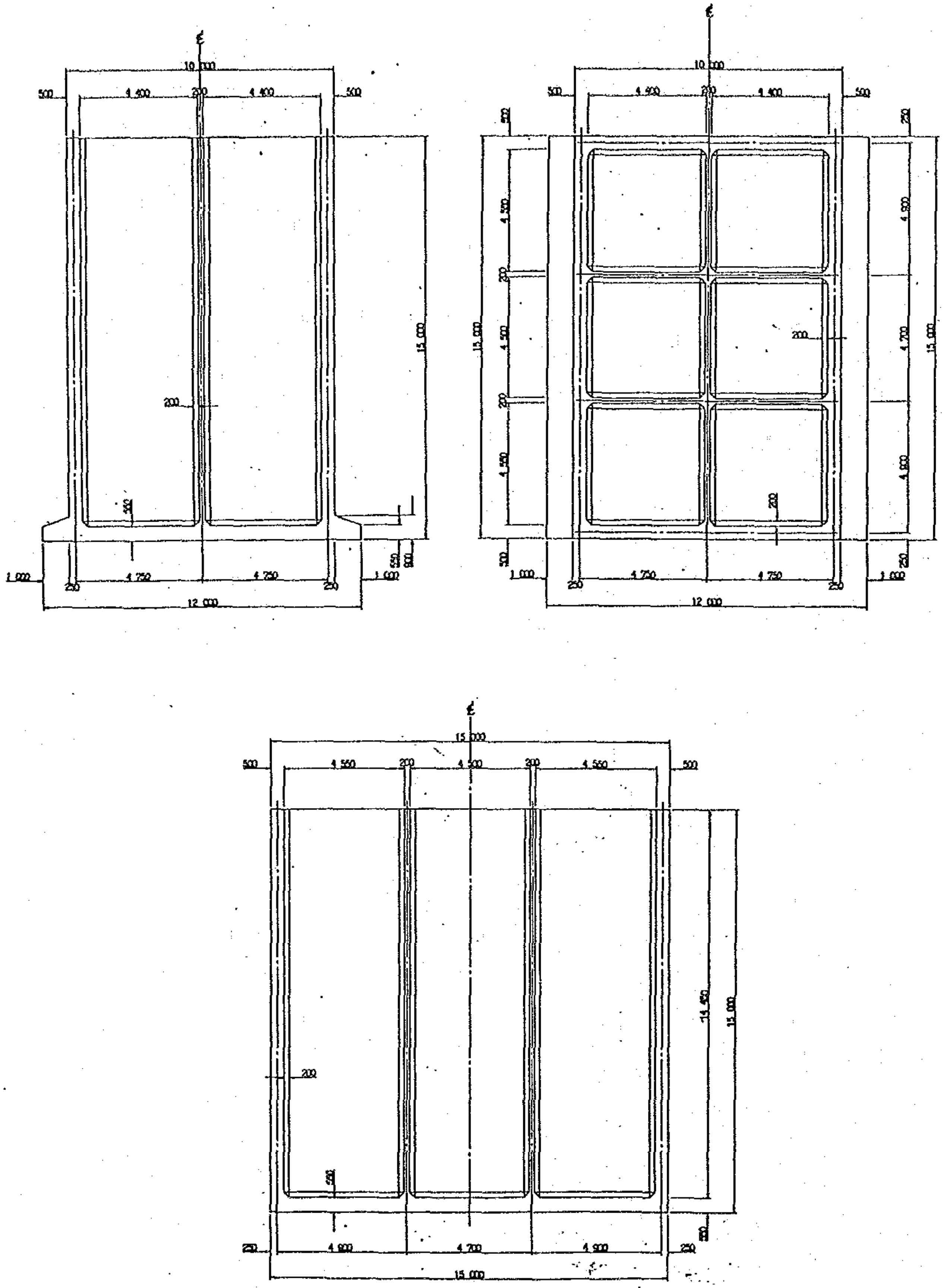


Figure 3.3-3-14 Elevation of Concrete Caisson

(5) Reinforced Concrete Box Caisson for Grain Quay Wall

(a) Dimensions of caisson

Size of box caisson

Height	17.0 m	Wall 16.1 m + Footing 0.9 m
Width Wall	11.9 m	
Footing	14.5 m	
Length	15.0 m	

Thickness

Side wall	50 cm
Partition wall	20 cm
Bottom slab	55 cm
Footing Edge	55 cm
Wall side	90 cm
Haunch	35 x 35 cm

(b) Calculation of stability while buoyant

1) For the completion conditions

Height of caisson1 17 m

Ballast	none	3 t/sq.m	4 t/sq.m
Draft (m)	9.74	12.13	12.93
GM (m)	-1.28	0.69	1.17
GM/Draft (%)	-	5.7	9.03

where GM : Metacenter = Center of buoyancy - Center of gravity

To ensure the safety of the caisson while buoyancy, it is necessary to make GM/Draft to be 5% or more.

2) For the completion of walls up to 11 m in height

Height of walls	11 m
Ballast	none
Draft	6.78 m
GM	0.64 m
GM/Draft	90.4%

(6) Detailed Design of Grain Berth

(a) Design of foundation

1) Dimensions of foundation

Foundation rubbles

Bottom level	C.D. -17.5 m
Top level	C.D. -15.5 m
Width of bottom	18.50 m
Both slopes	1:2
Thickness	2.0 m

Armor stone

Bottom level	C.D. -15.5 m
Top level	C.V. -15.0 m
Thickness	0.5 m

2) Material of stones

Foundation rubbles

Rubble stone 30-200 kg/pcs

Armor stone

Stone size	500 kg/pcs

(b) Design of backfill rubbles

Stone size	5-50 kg/pcs
Grading of backfill slope	1:1.2
Top level	C.D. -11.0 m
Width of top	3.00 m

(c) Filling material of caisson

Rubble stones or gravels of 5-50 kg/pcs will be used for the filling material of caisson.

(d) Cover concrete of caisson

Leveling concrete (lean concrete) with thickness of 30 cm is designed.

(e) Design of Apron

Apron:

- Width of apron 20.0 m
- Crown height at face line C.D. +3.60 m
- Crown Height at land side C.D. +4.00 m
- Gradient of apron 2%

Facilities of apron:

- Coping concrete
- Crane rail foundation
- Concrete pavement

1) Coping concrete

Type of cement	:	Sulfate Resistance Cement
Class of concrete	:	240 kg/sq.cm
Width	:	3,500 m
Interval of construction joint	:	15 m

2) Crane rail foundation

Type of cement	:	Sulfate Resistance Cement
Class of concrete	:	240 kg/sq.cm
Width	:	1,400 m
Interval of construction joint	:	15 m

3) Concrete pavement

Type of cement	:	Sulfate Resistance Cement
Class of concrete (Bearing strength)	:	45 kg/sq.cm

Width of pavement	:	15.100 m
Thickness of concrete	:	30 cm
wire net, slip & tie bars		
Thickness of base course	:	40 cm crusher run

(f) Rubber Fender

Conditions

Objective ship	80,000 DWT
Berthing velocity	0.10 m/sec
Berthing angle	6 degree

Result of calculation

Displacement	Ws = 95,797 ton
Vertical mass factor	Cb = 1.21
	Cm = 1.71
Eccentricity factor	Ce = 0.65
Ship's berthing energy	54.3 t-m
Installed interval	30 m

(g) Bollard, bitt

Tractive force on bollard 200 t

Two (2) bollards are arranged.

Tractive force on bitt 100 t

Bitts of 6 are installed.

Installed interval 45 meters

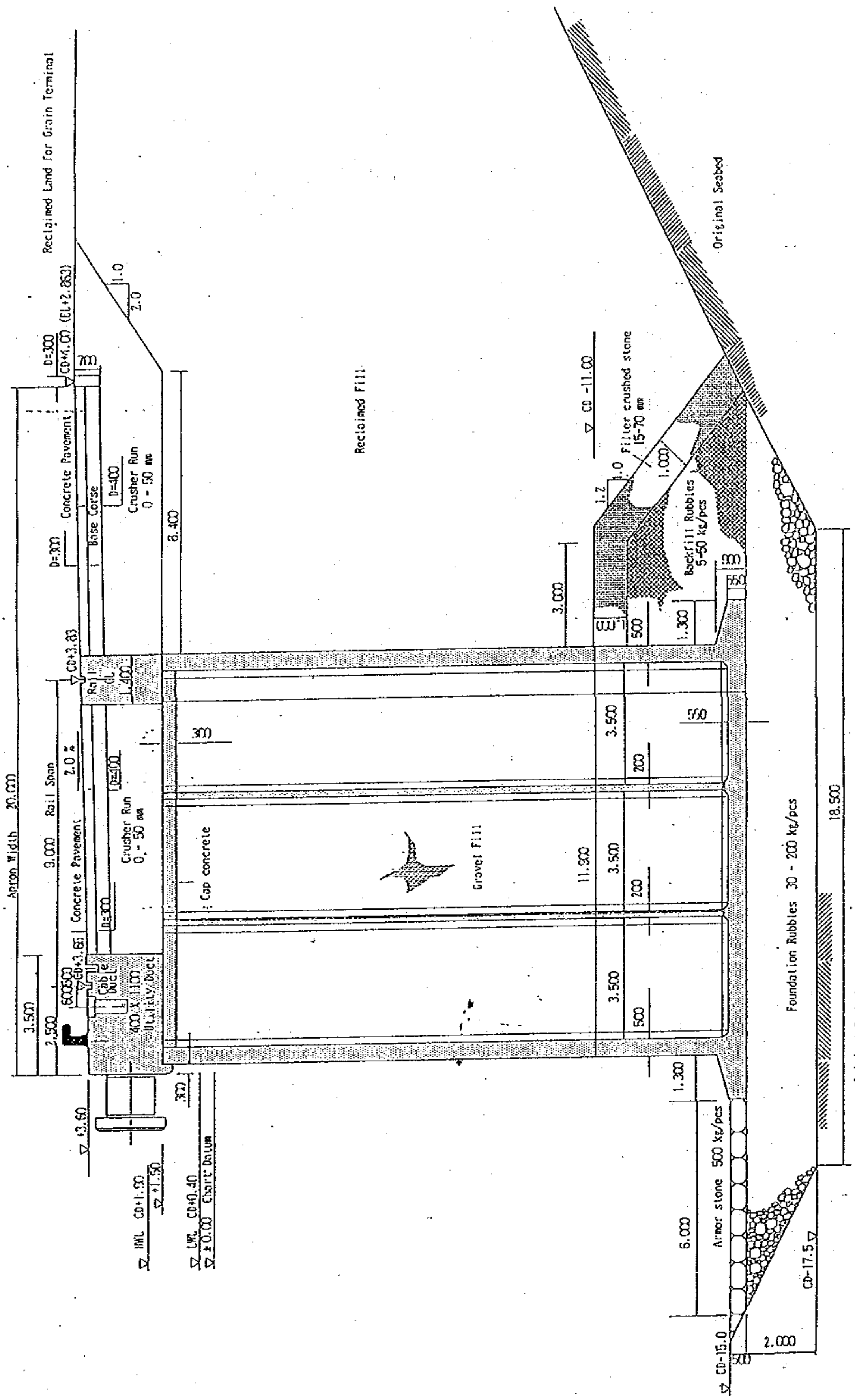


Figure 3.3-3-15 TYPICAL CROSS SECTION OF GRAIN WHARF

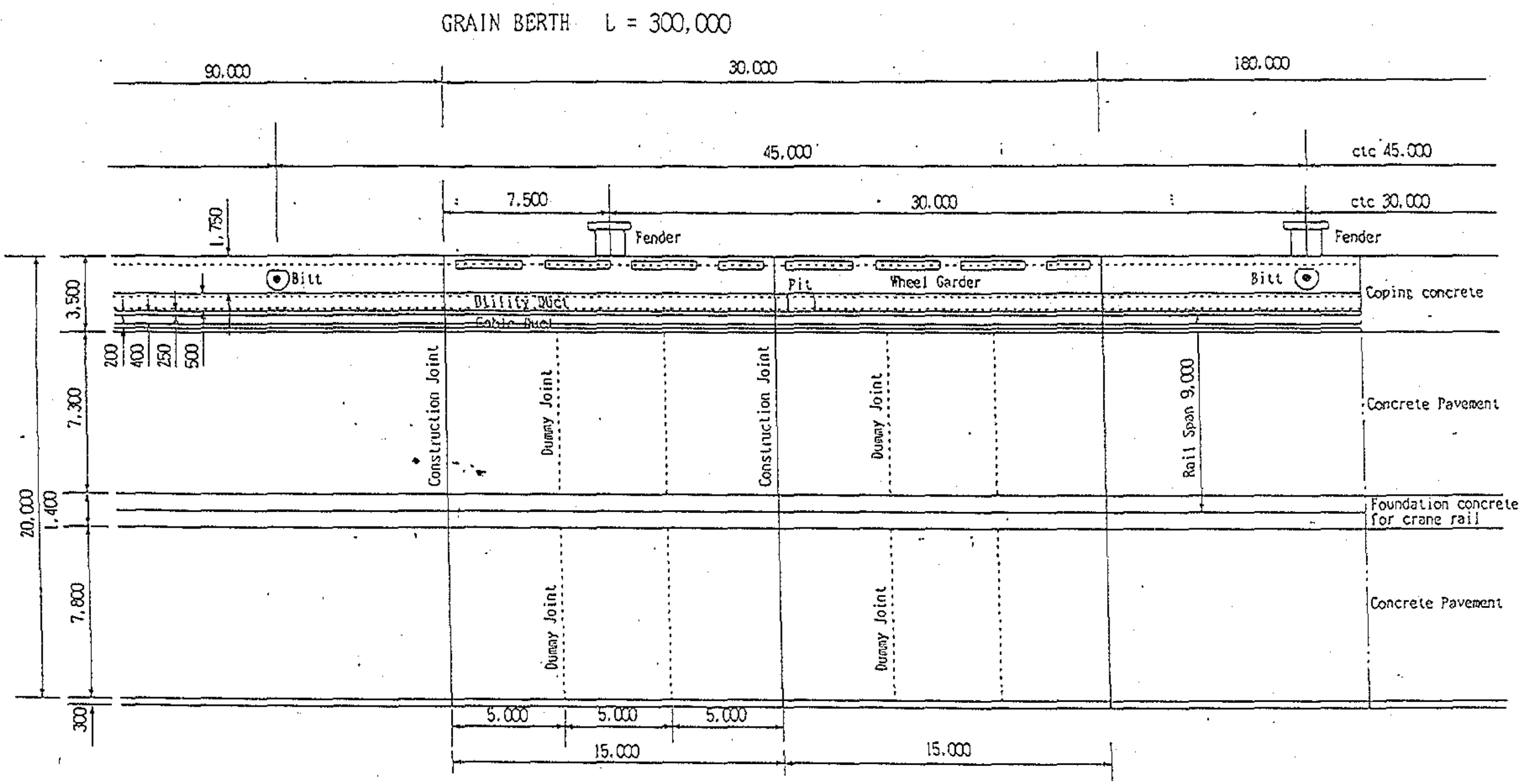


Figure 3.3-3-16 *DETAIL OF APRON AT GRAIN BERTH*

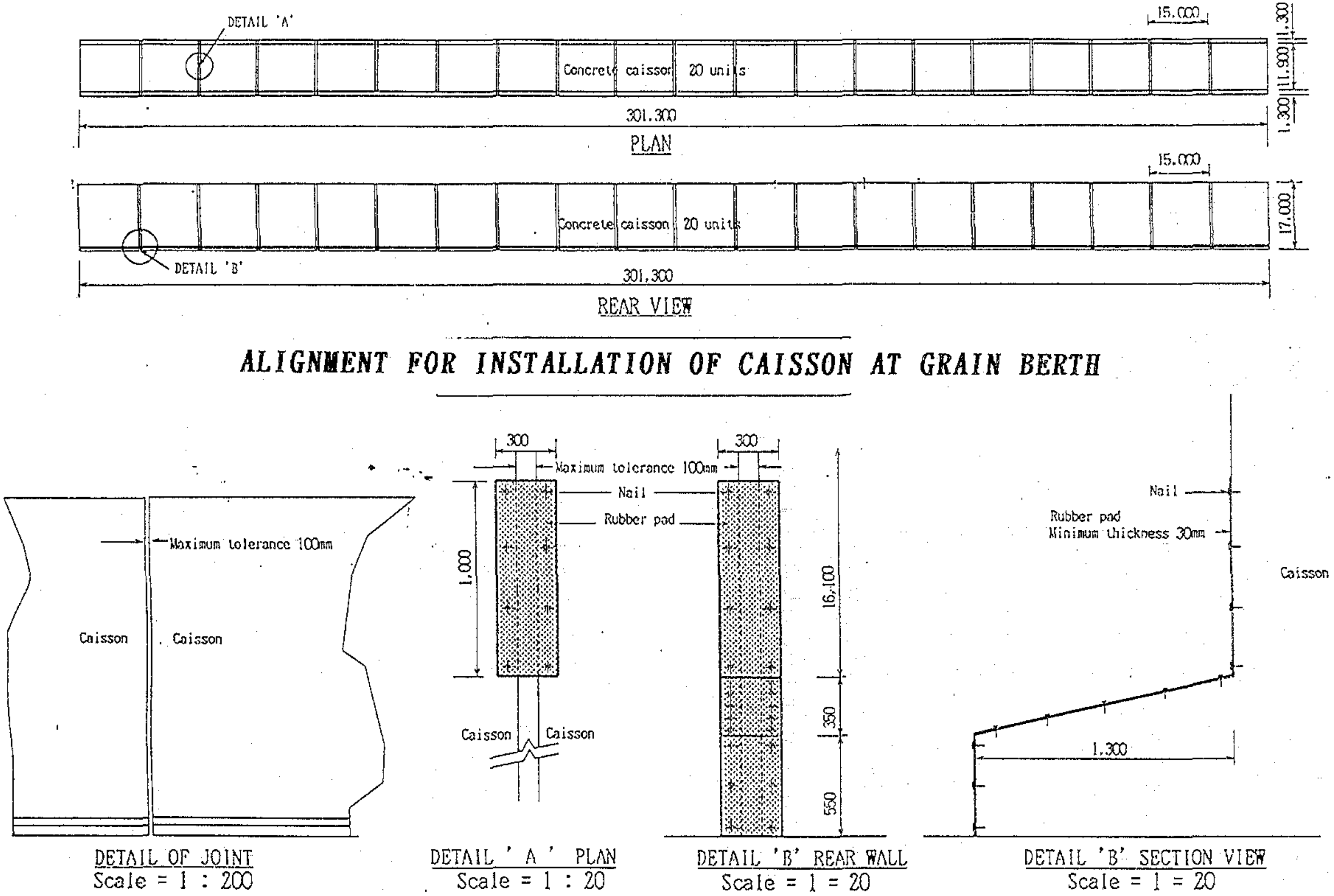


Figure 3.3-3-17 ALIGNMENT FOR INSTALLATION OF CAISSON AT GRAIN BERTH

(7) Bulk Cargo Terminal

(a) Scale and Dimensions

1) Wharf

Number of berths	2 berths
Length of berth	210 m
Additional length of quaywall	15 m
Water depth of berth	C.D.-13.0 m
Crown height of berth	C.D.+ 3.6 m
Width of apron	15 m
Gradient of apron	2.0 %
Structural type of quaywall	Reinforced concrete caisson

2) Area of bulk cargo terminal

Length of the area	420 m
Width of area including wharf	200 m
Formation height at the wharf side	E.L.+ 2.763 m (C.D.+3.90m)
Ditto,but at the I.E. side	E.L.+ 4.0 m
Area of open storage yards	75m X 80m X 4 units = 2.4 ha
Pavement of open storage yards	Asphalted concrete pavement
Open space	

3) Temporary revetments at the south boundary

The south boundary of the port area will be protected by the revetments of a stone mound type. In future, the revetment will be removed when a coal terminal is constructed.

(b) Facilities Layout Plan

Figure 3.3-3-18 shows the general plan of Bulk-Cargo Terminal.

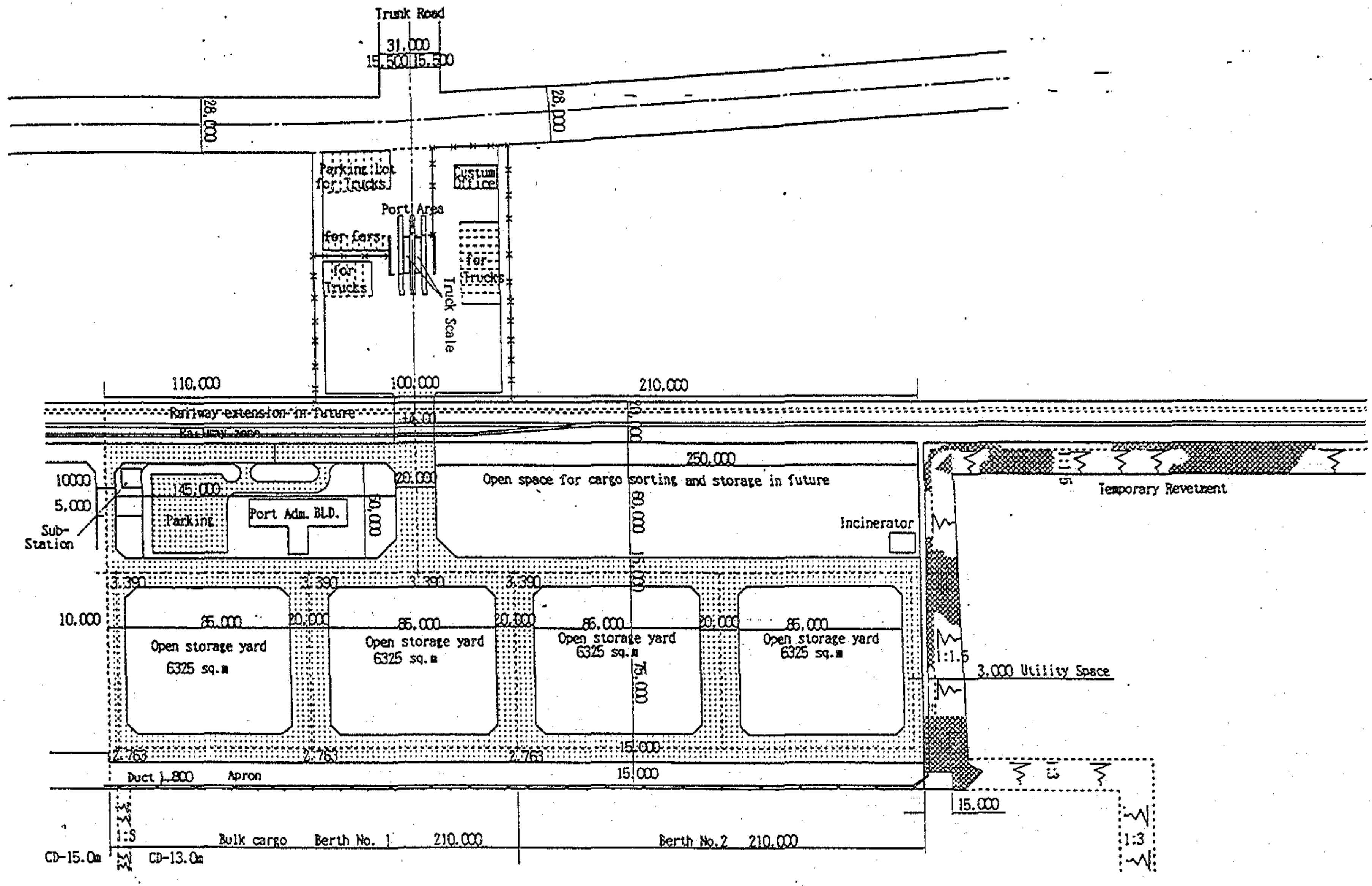


Figure 3.3-3-18 General Plan of Bulk Cargo Terminal

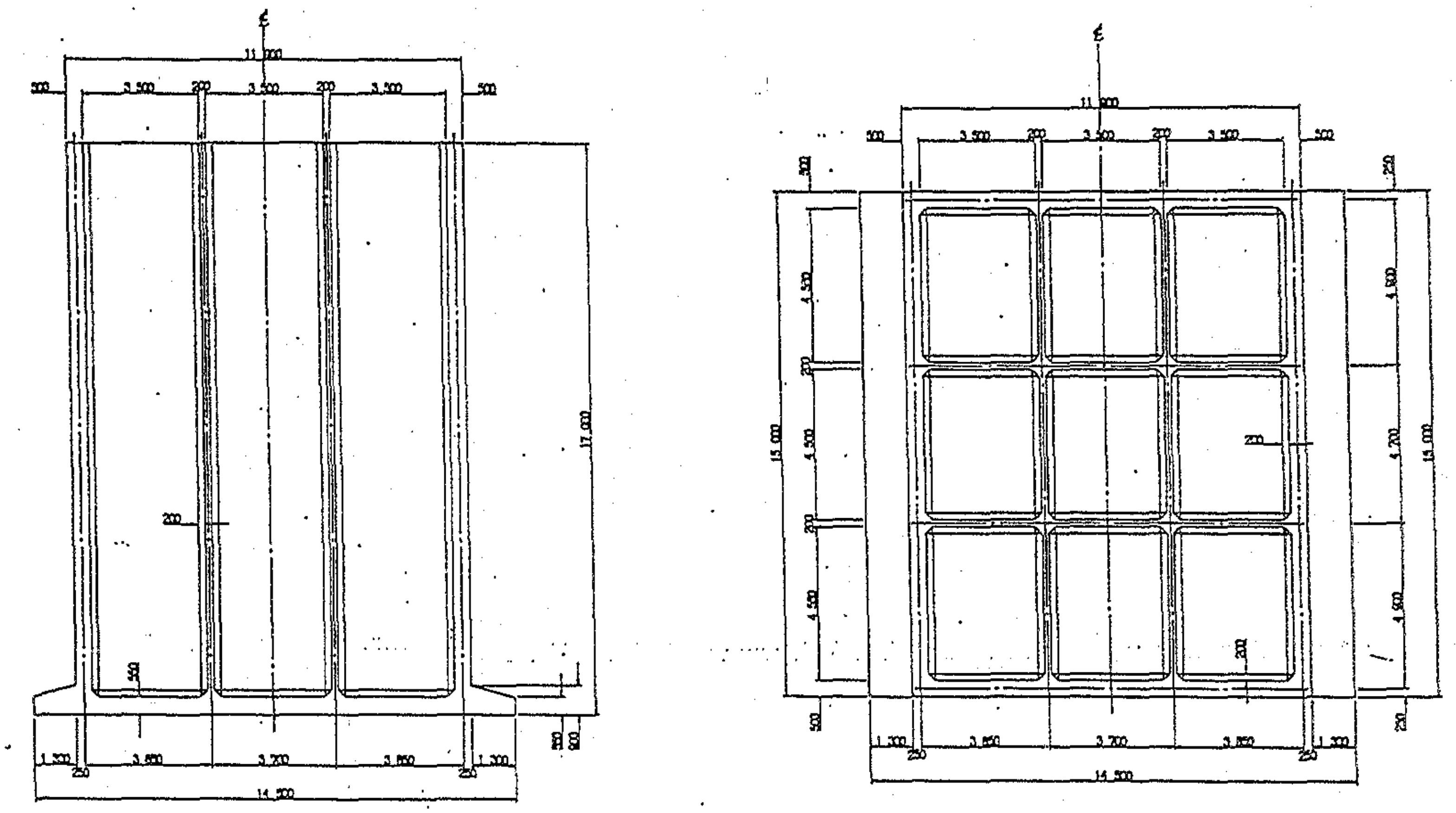


Figure 3.3-3-19 Elevation of Concrete Caisson

(8) Reinforced concrete box caisson for bulk cargo quay wall

(a) Determination of dimensions

Size of box caisson

Height	15.0 m
Width of wall	10.0 m
Width of Footing	12.0 m
Length	15.0 m
Thickness	
Side walls	500 mm
Bottom slab	550 mm
Side walls	D=500 mm
Bottom slab	D=550 mm
Partition walls	D =200 mm
Footings	
Length of footing	1,000 mm
Depth of toe	550 mm
Depth of edge	900 mm

(b) Calculation of stability while buoyant

1) For the completion conditions

Height of caisson	15 m		
Ballast	none	3 t/sq.m	4 t/sq.m
Draft (m)	7.72	10.19	11.02
GM (m)	-1.29	0.67	1.11
GM/Draft (%)	-	6.6	10.1

where GM : Metacenter = Center of buoyancy - Center of gravity

2) For the completion of walls up to 11 m in height

Height of walls	10 m
Ballast	none
Draft	5.59 m
GM	0.40 m
GM/Draft	7.2 %

(9) Detailed Design of Bulk Cargo Berth

(a) Design of foundation

Foundation rubbles

Bottom level	CD. -15.50 m
Top level	CD. -13.50 m
Width of bottom	16.00 m
Gradient of slopes	1:2
Thickness	2.0 m
Material	
Rubble stone	30-200 kg/pcs

Armor stone

Bottom level CD.	-13.50 m
Top level CD.	-13.00 m
Thickness	0.50 m
Material	
Armor stone	500 kg/pcs

(b) Design of backfill rubbles

Stone size	5-50 kg/pcs
Gradient of backfill slope	1 : 1.2
Top level	CD -9.00 m
Width of top	3.00 m

(c) Filling material of caisson

Rubble stones or gravels	5-50 mm

(d) Cap concrete of caisson

Leveling concrete with thickness of 30 cm is designed.

(e) Coping concrete

Overhang from front wall of caisson	300 mm
Crown height at the face line	C.D. +3.60 m
Width	2,400 mm(3,000 mm at Bollards and Bitts)

(f) Pavement of apron

Concrete pavement

Bending stress more than 45 kg/sq.cm

Thickness	300 mm
Expansion joint	
Lateral	5 m interval
Longi.	6.3 m

Base course

Well graded crushed stone 5-50 mm diameter

Thickness	400 mm

Sub-base course

Crusher run 0-50 mm above C.D.+1.50 m

Thickness	1.20 - 1.40 m

(g) Rubber fenders

Conditions

Objective ship	20,000 DWT
Berthing velocity	0.15 m/sec
Berthing angle	6 degree

Results of calculation

Displacement	Ws = 25,456 ton
Vertical mass factor	Cb = 1.19
	Cm = 1.71
Eccentricity factor	Ce = 0.64
Ship's berthing energy	32.0 m

(h) Bollard/bitt

Tractive force on bollard	100 t

Three (3) bollards are arranged of the berth.

Tractive force on bitt	70 t
Installed interval	30 meters

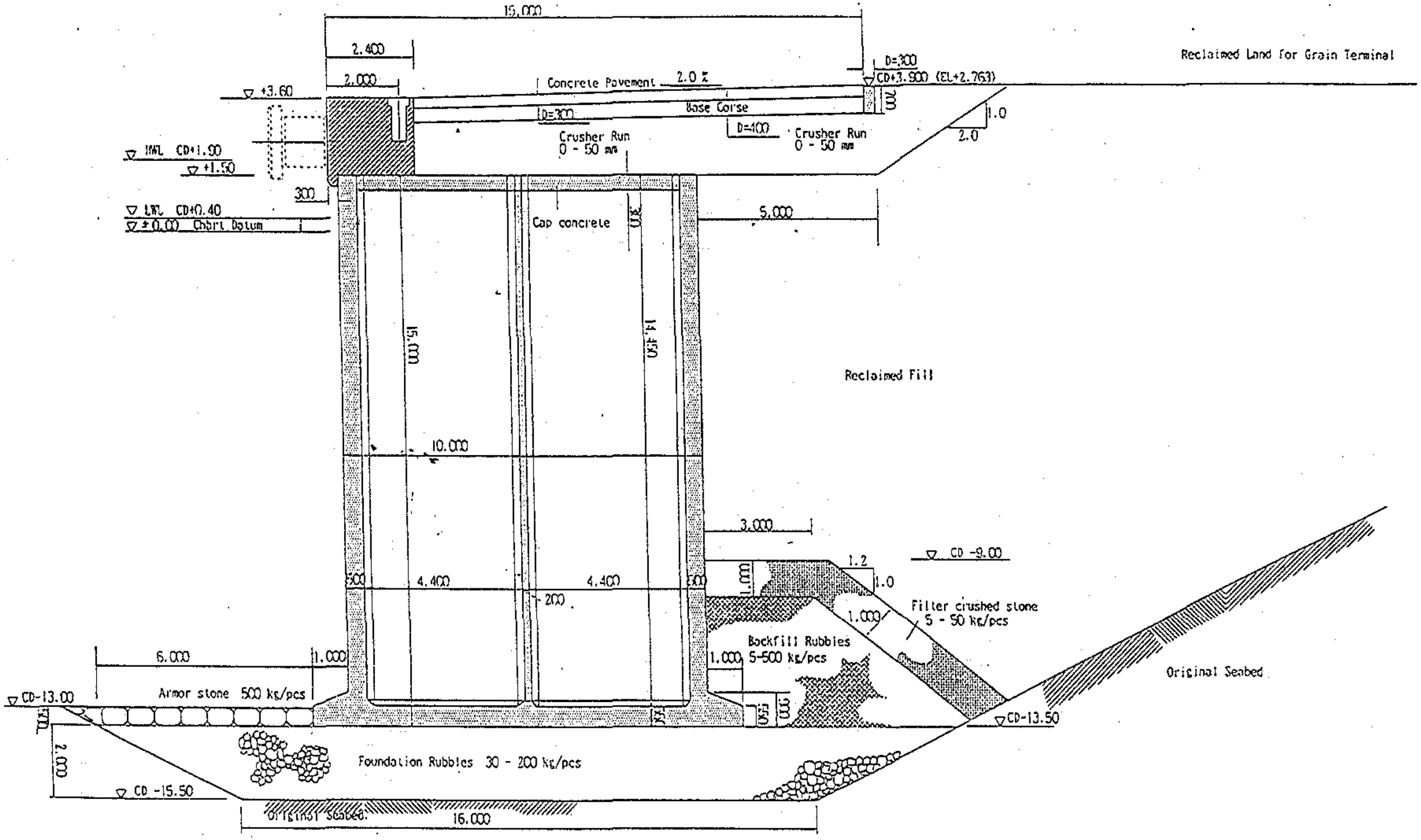


Figure 3.3-3-20 *TYPICAL SECTION OF BULK CARGO WHARF (1)*

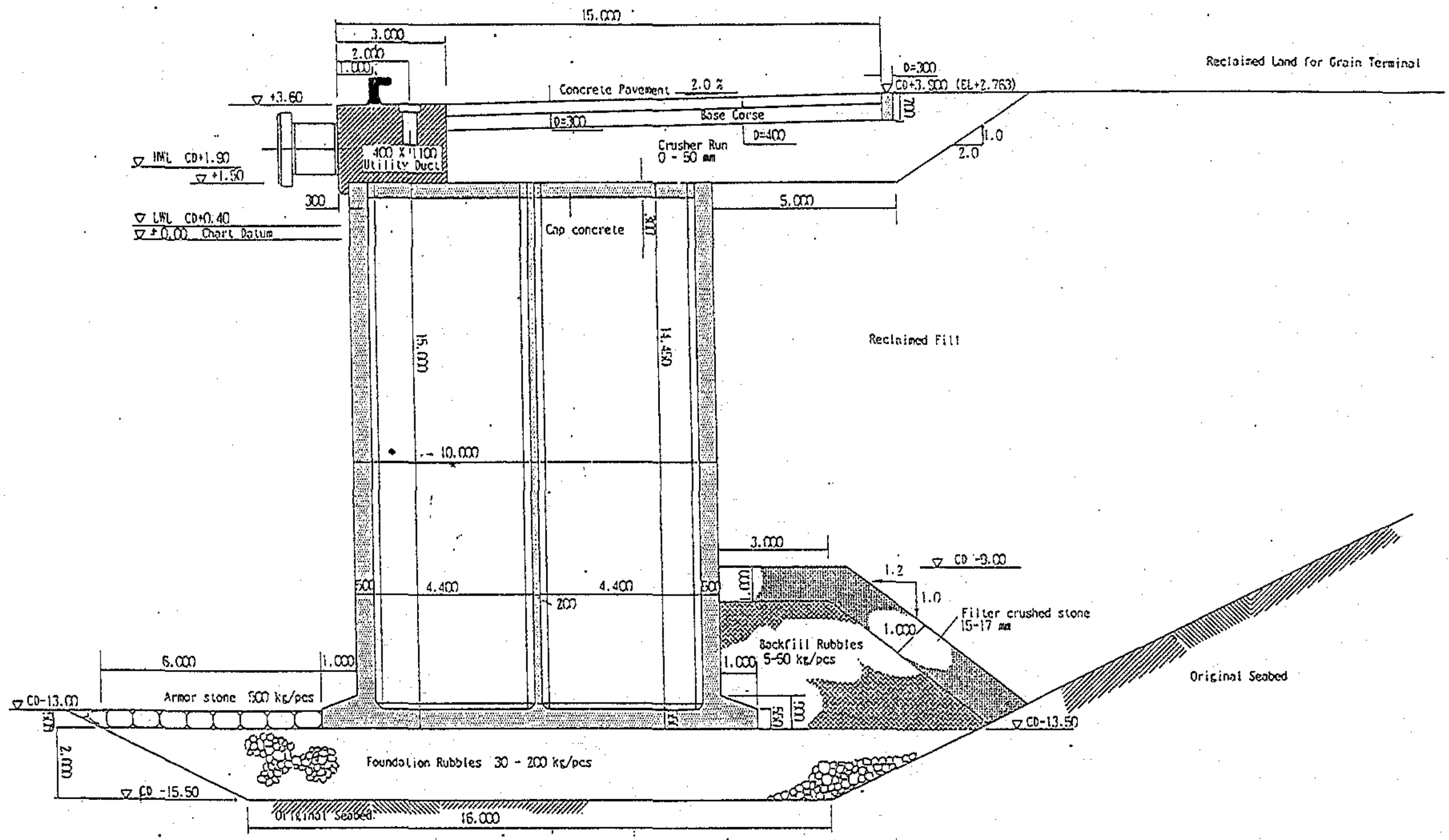


Figure 3.3-3-21 *TYPICAL SECTION OF BULK CARGO WHARF (2)*

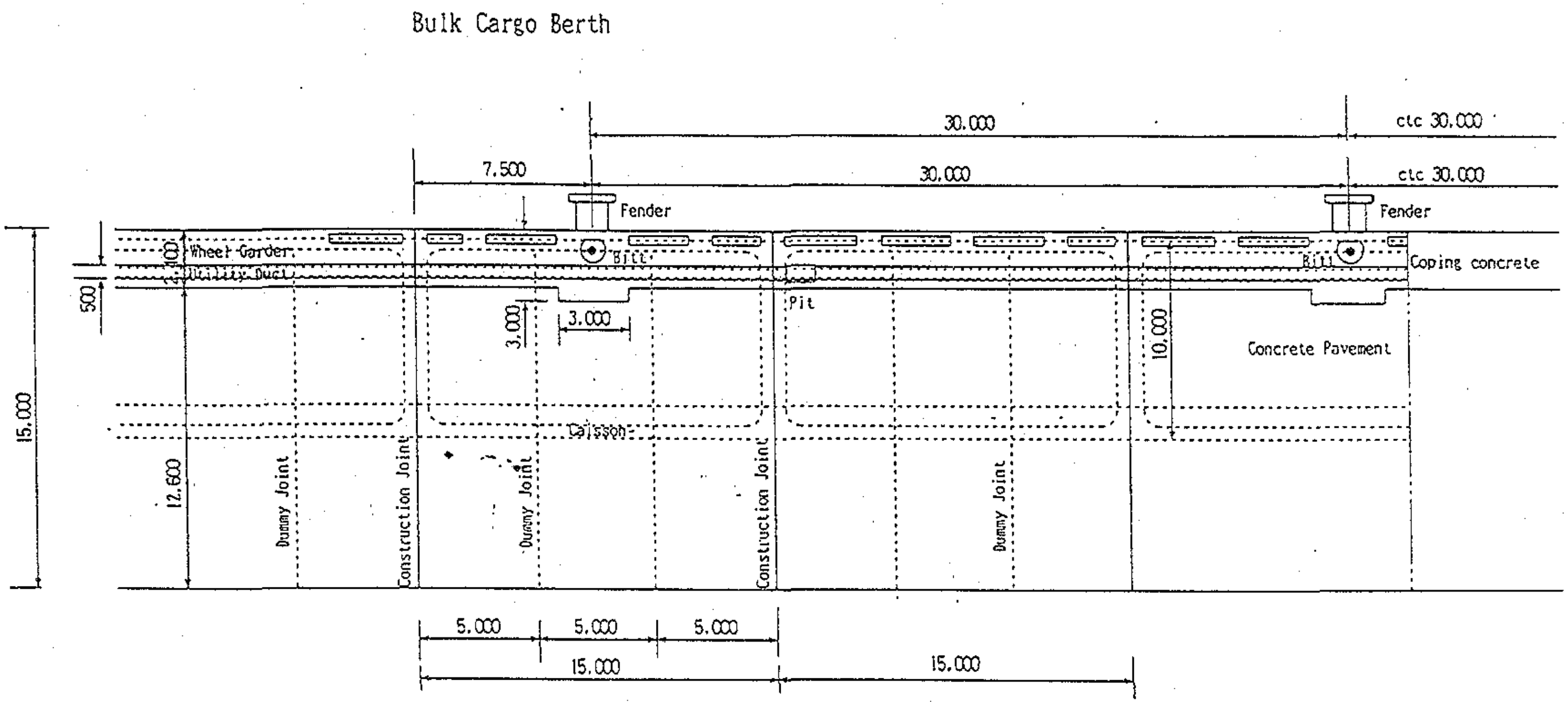


Figure 3.3-3-22 *DETAIL OF APRON AT BULK CARGO BERTH*

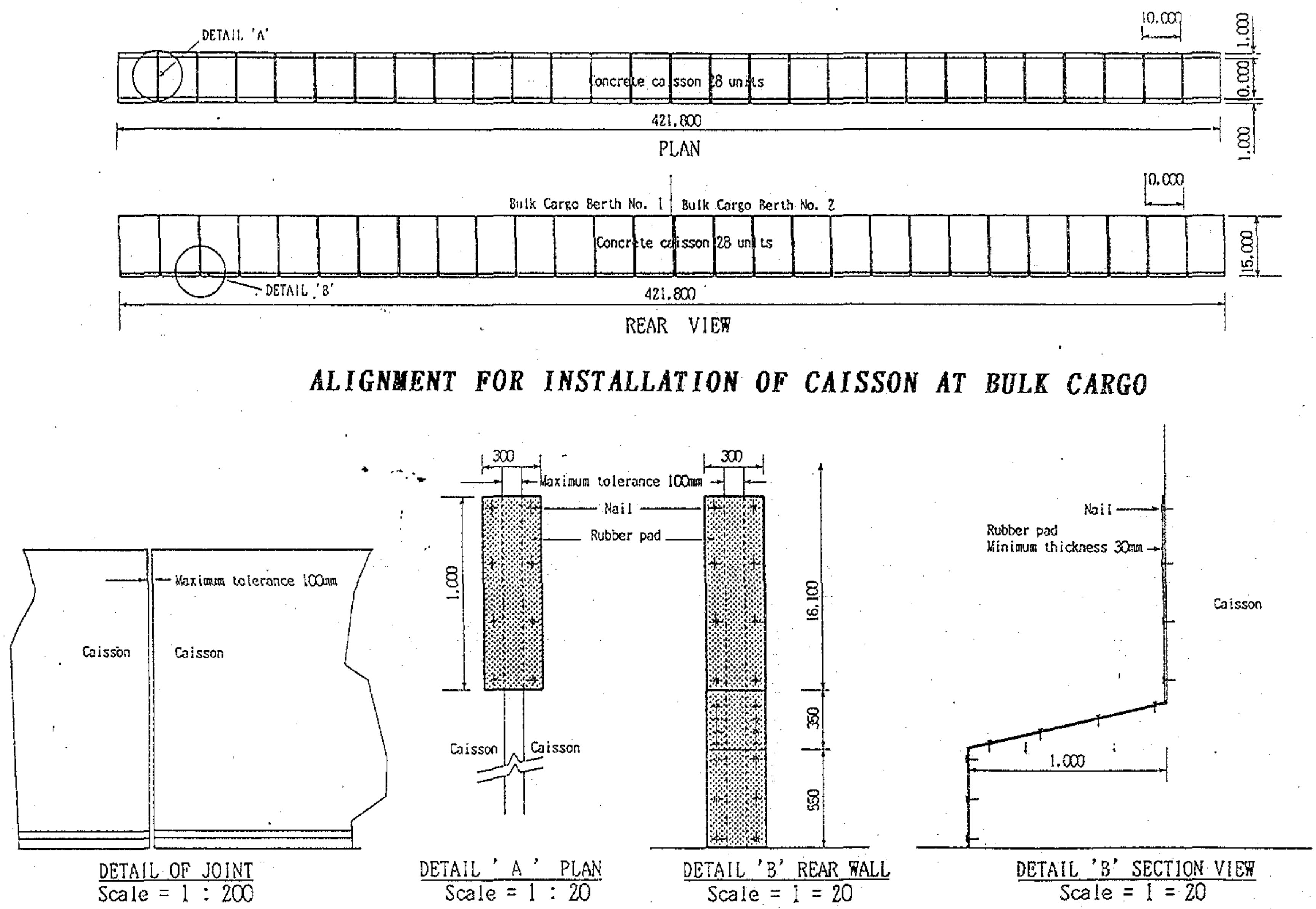


Figure 3.3-3-23 **ALIGNMENT FOR INSTALLATION OF CAISSON AT BULK CARGO**

(10) Quay Wall of Small Boat Basin

(a) General

Figure 3.3.3-27 and 3.3.3-28 show Typical Cross Section of North and West quaywalls. Figure 3.3.3-25 and 3.3.3-26 show the Front View of the quay walls. These quaywalls consist of foundation rubbles, concrete blocks (three blocks piled), coping concrete, apron and necessary accessories.

(b) Design of foundation

Width of bed for foundation rubbles	5 m + 2 X 2 X tan.45= 9.0 m
Gradient of side slopes	1 : 2
Thickness of foundation rubbles	2.0 - 3.0 m
Size of rubble stones	30 - 200 kg/pcs
Level of bed	C.D.-7.0 - -8.0 m
Level of top (formation of levelling)	C.D.-5.0 m

(c) Design of backfill rubbles

Size of backfill rubbles	5 - 50 kg/pcs
Design gradient of backward slope	1 : 1.2

(d) Design of concrete blocks

Precast concrete square block

Size of concrete blocks		Height	Width	Length	Volume	Weight
1st stage	(Type A)	2.0 m	4.5 m	3.0 m	24 cu.m	65 tons
	(Type A')	2.0 m	4.5 m	2.0 m	18 cu.m	44 tons
2nd stage	(Type B)	2.0 m	3.0 m	4.5 m	27 cu.m	64 tons
	(Type B')	2.0 m	3.0 m	2.0 m	12 cu.m	28 tons
3rd stage	(Type C)	2.5 m	2.0 m	6.0 m	29 cu.m	67 tons
	(Type C')	2.5 m	2.0 m	2.0 m	10 cu.m	23 tons

Figure 3.3.3-28 shows the Type of Concrete Blocks.

(e) Design of coping concrete

Height of coping wall	C.D.+ 3.0 m - C.D.+ 1.5 m = 1.5 m
Width of crown	1.00 m
Width of bottom	1.70 m
Length of overhang from front wall	0.20 m
Coping for bitt attaching portion : with reinforcement	1 m X 1 m X 1.5 m

(f) External forces and loads acting on wall

Surcharge on apron and road	1.00 t/sq.m
Tractive forth on bitt	15 tf
Seismic acceleration	Kn = 0.05 g

Calculation result

Active earth pressure -5.0 m		
Normal	2.55 t/sq.m	
Seismic	3.01 t/sq.m	
Overturning moment		
Normal	39.01 t-m/m	
Seismic	40.72 t-m/m	
Residual water pressure force	2.93 t/m	
Overturning moment	8.27 t-m/m	
Wall weight and resisting moment		
	Wall weight	Moment
Including surcharge(usual)	54.67 t/m	118.28 t-m/m
Including surcharge(seismic)	52.42 t/m	113.21 t-m/m
Excluding surcharge	50.17 t/m	108.15 t-m/m
Seismic force including surcharge		3.98 t/m
Overturning moment		15.86 t-m/m
Seismic force excluding surcharge		3.86 t/m
Overturning moment		14.96 t/m

(g) Stability computation

Normal	Elevation	Sliding Fs	Overturning Fs
	C.D. +1.50 m	2.56	6.44
	C.D. -1.00 m	1.48	2.10
	C.D. -3.00 m	1.50	2.05
	C.D. -5.00 m	2.08	2.61
Seismic	C.D. +1.50 m	2.29	5.80
	C.D. -1.00 m	1.26	1.78
	C.D. -3.00 m	1.21	1.64
	C.D. -5.00 m	1.57	1.95
Under tractive condition			
	C.D. +1.50 m	1.04	1.12
	C.D. -1.00 m	1.15	1.11
	C.D. -3.00 m	1.30	1.42
	C.D. -5.00 m	1.90	2.05

(h) Fender & bitt

Fender

Design conditions

Objective ship size	700 GT
Approach velocity	0.30 m/sec

Berthing energy

Displacement	Ws = 1,687 ton
Vertical mass factor	Cb = 1.0
	Cm = 1.54
Eccentricity factor	Ce = 0.59
Ship's berthing energy	Ef = 7.0 t-m

Bitt

Tractive forth on bitt	15 tf
Interval of bitts	8 m

(i) Pavement of apron

Concrete pavement	Bending stress more than 45 kg/sq.cm	
	Thickness	300 mm
	Expansion joint	Lateral 10 m interval
Base course	Crusher run	0 - 50 mm diameter
	Thickness	300 mm
Sub-base course	Selected sandy fill material shall be used.	

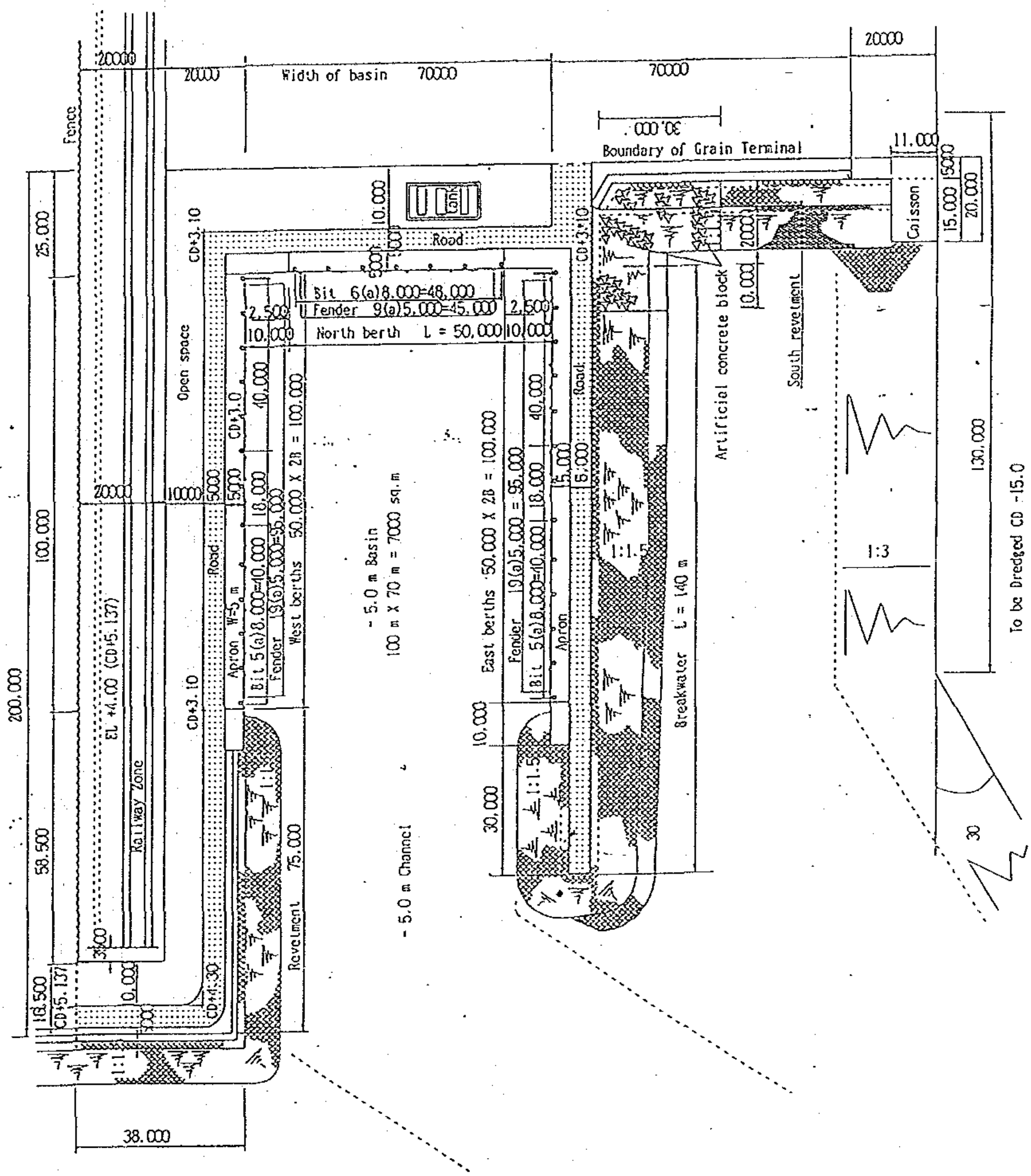
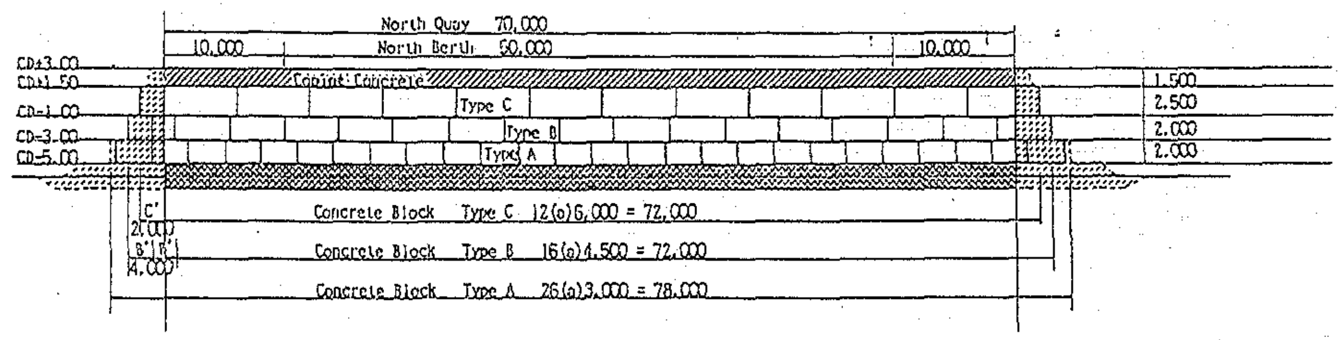


Figure 3.3-3-24 **SMALL BOAT BASIN GENERAL LAYOUT PLAN**



FRONT VIEW OF NORTH BERTH s=1:200

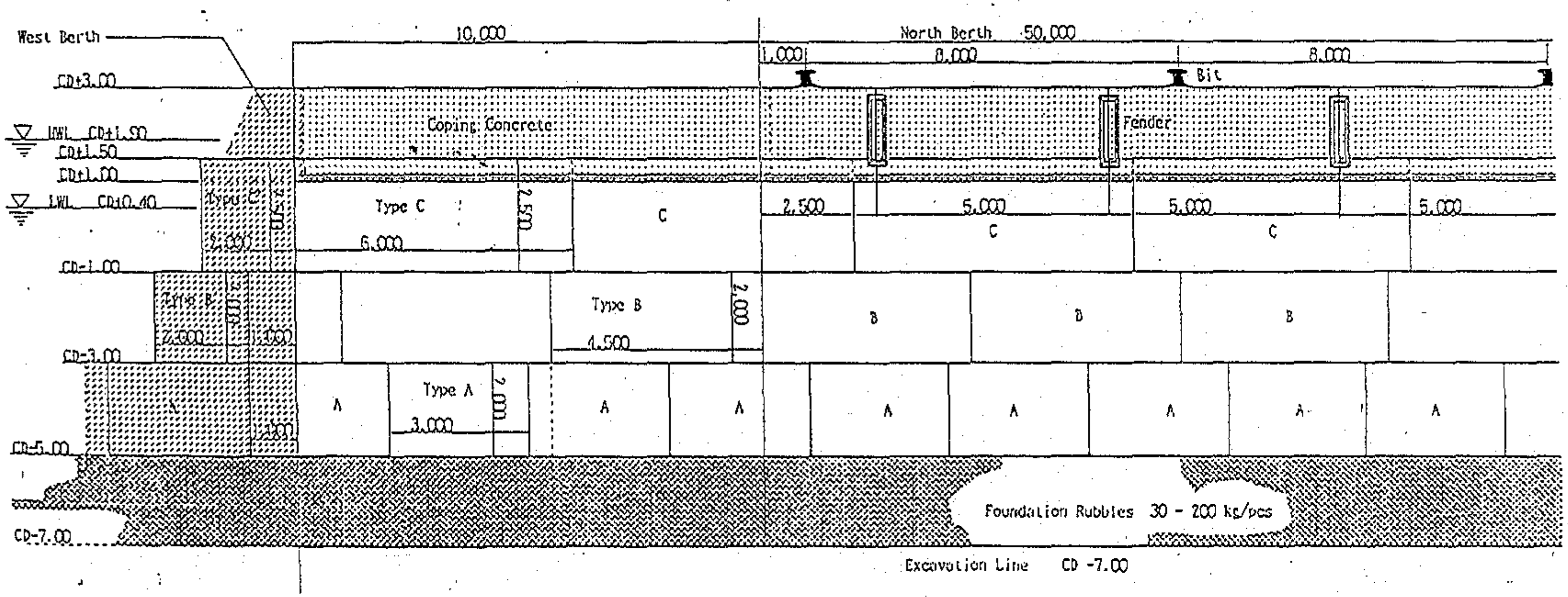
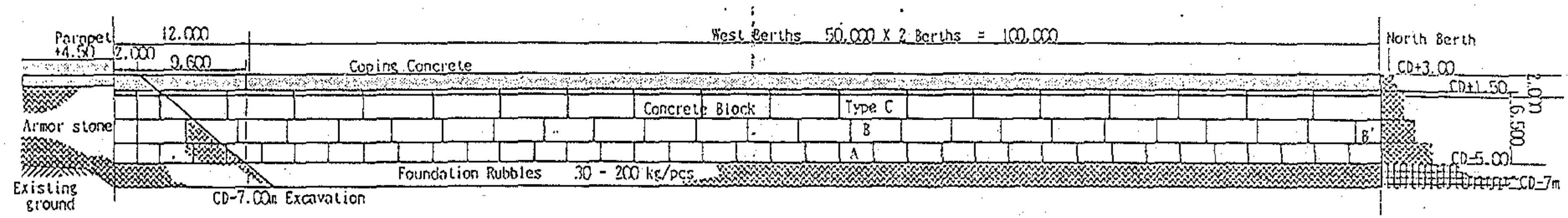
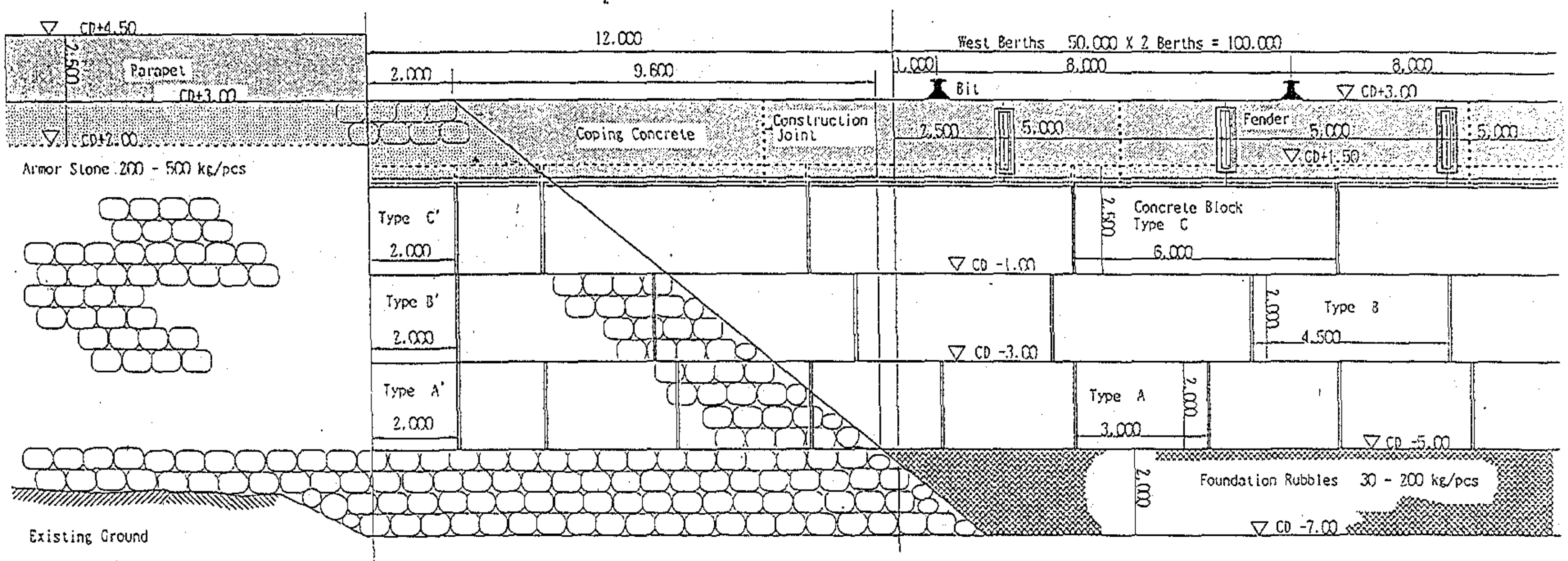


Figure 3.3-3-25 SMALL BOAT BASIN NORTH BERTH



FRONT VIEW OF WEST BERTHS



DETAIL OF WEST BERTHS

Figure 3.3-3-26 ***WEST BERTH***

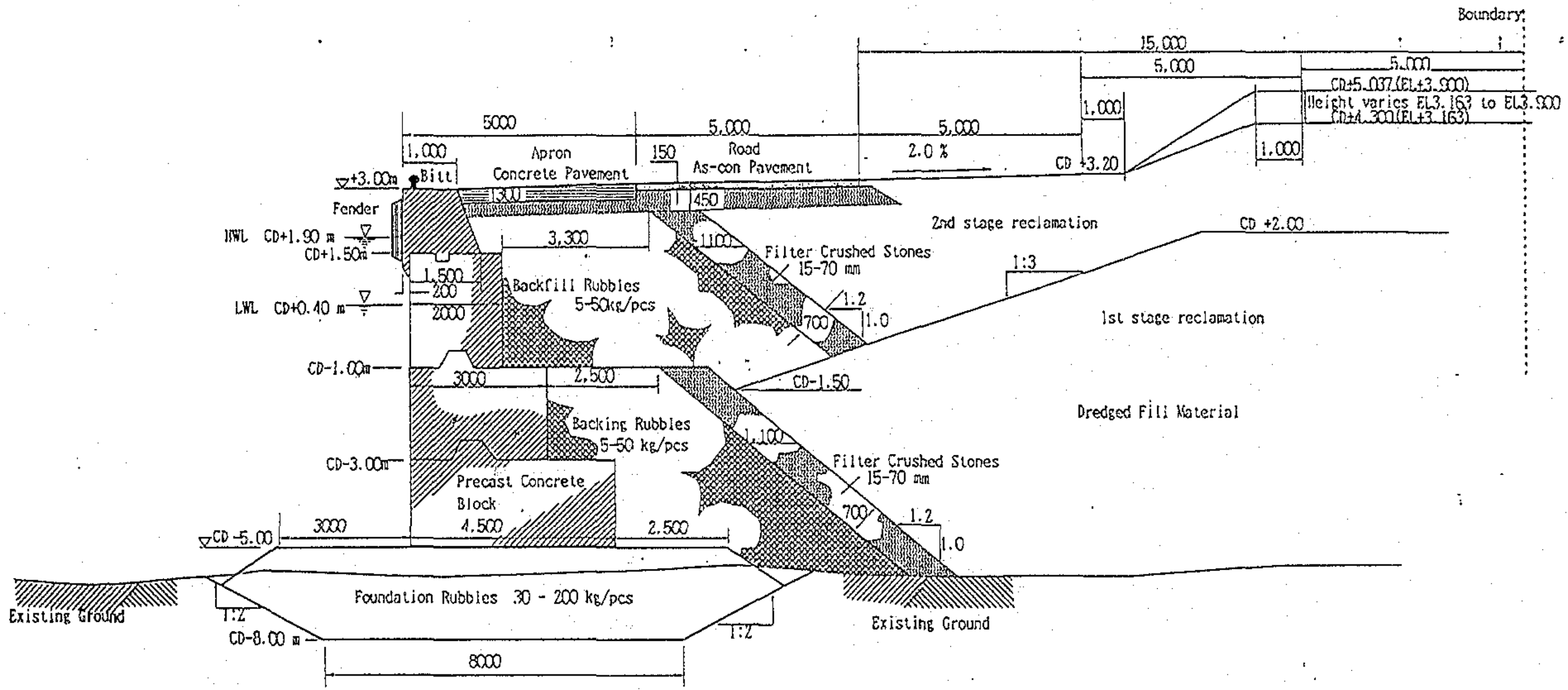


Figure 3.3-3-27 ***TYPICAL CROSS SECTION OF NORTH BERTH***

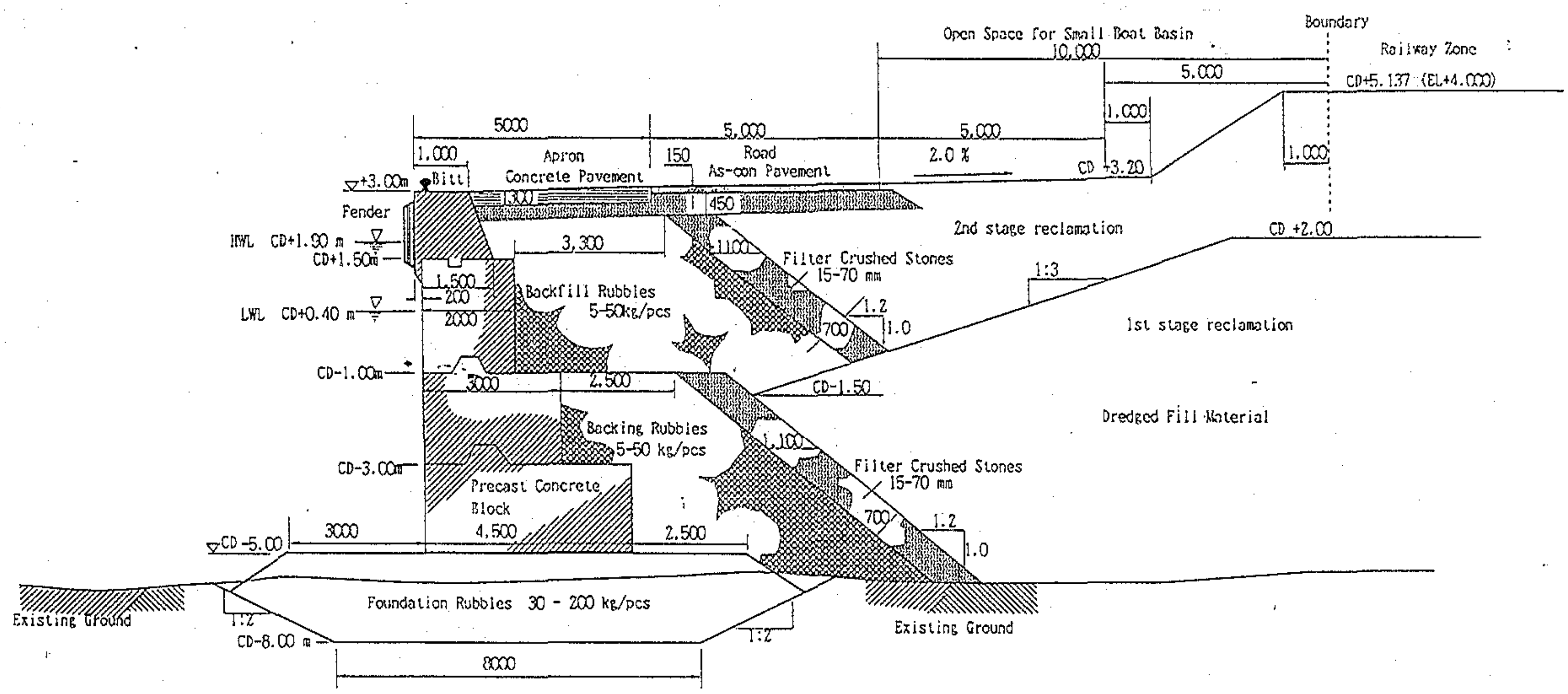
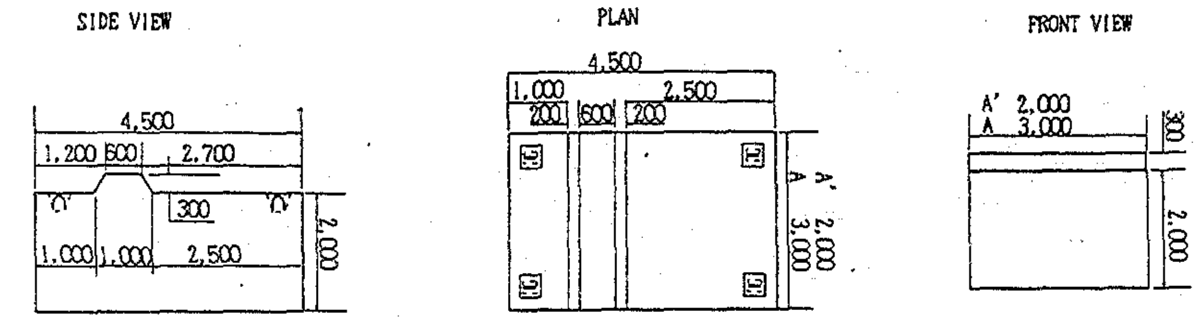
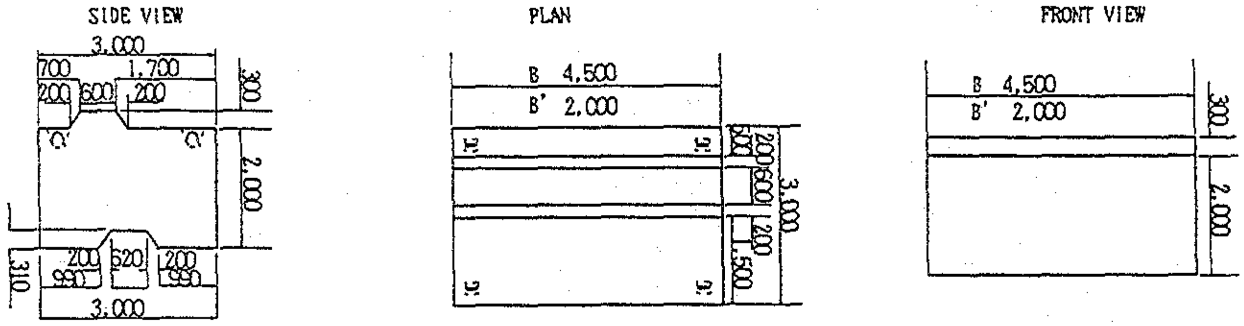


Figure 3.3-3-28 ***TYPICAL CROSS SECTION OF WEST BERTH***



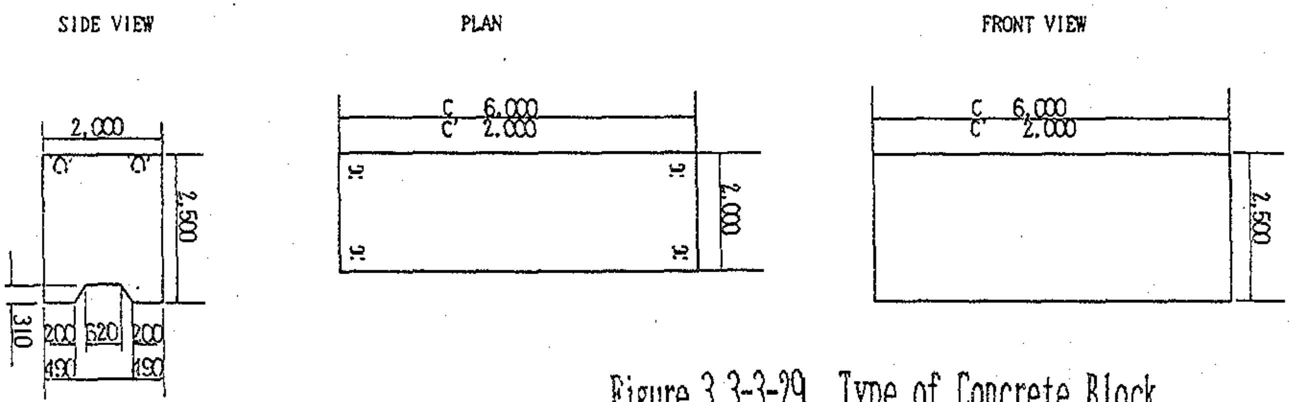
SPECIFICATION

TYPE	A	A'
HEIGHT	2,000	2,000
DEPTH	4,500	4,500
LENGTH	3,000	2,000
CONCRETE VOLUME	27.72	18.48
WEIGHT	65.2t	43.5t



SPECIFICATION

TYPE	B	B'
HEIGHT	2,000	2,000
DEPTH	3,000	3,000
LENGTH	4,500	2,000
CONCRETE VOLUME	27cu.m	12cu.m
WEIGHT	63.5t	28.2t



SPECIFICATION

TYPE	C	C'
HEIGHT	2,500	2,500
DEPTH	2,000	2,000
LENGTH	6,000	2,000
CONCRETE VOLUME	28.56	9.52
WEIGHT	67.2t	22.9 t

Figure 3.3-3-29 Type of Concrete Block

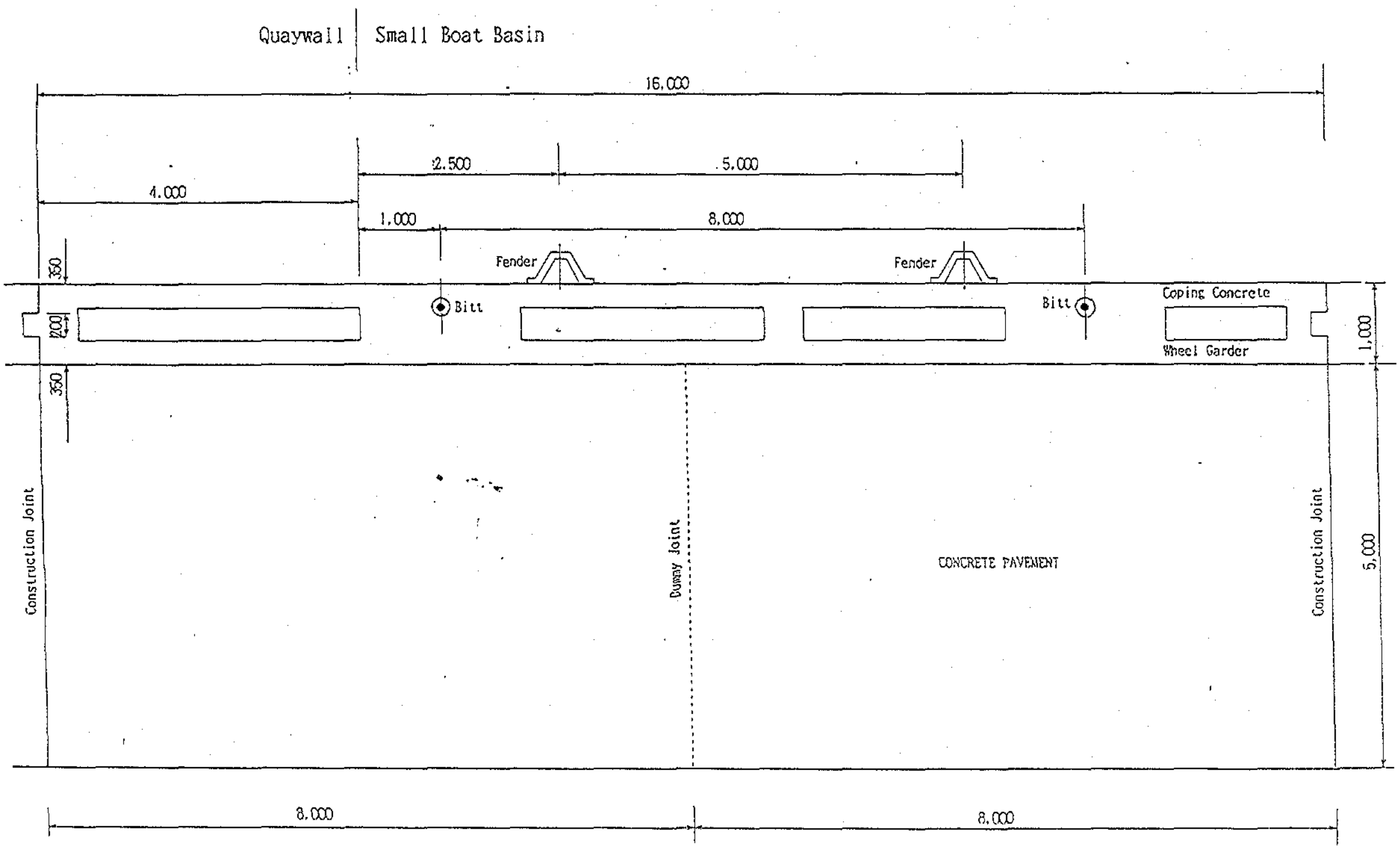


Figure 3.3-3-30 **DETAIL OF APRON AT SMALL BOAT BASIN**

(11) Breakwater

(a) Calmness of basin

The basin in front of the quaywall should secure the calmness to allow ship mooring for days corresponding to 95 % or more of the year. The allowable wave height for small craft to handle cargoes in the basin in front of berthing facilities should be at most 0.3 meters. In case of only mooring without any cargo handling, the significant wave height of 0.5 m in front of berth may be allowed.

In order to secure appropriate calmness in the mooring basin and to take small crafts refuse, the breakwater of 140 meters in length is designed with refraction, breaking and other transformation of waves were taken into consideration. Figure 3.7.2 shows the Significant Wave Height at the design wave height (50 years return period) using diffraction coefficient by the proposed breakwater. The figure shows a method of anchoring small crafts to take refuse at the time of huge storms generating higher waves than the design wave.

The prevailing wind direction is NWN to NEN as the occurrence of 70 % or more. It does not effective waves at Ataqa. Strong winds come from SSE to East, but the occurrence ratio is comparatively small ie. 9 % or less. Moreover, storm weather accompany strong winds from SSE direction is originated by Kamseen, which occurs once a year and lasts only for a few days.

It is said that, in winter only one percent of the swells originated by the wind from south to east direction reach the Suez Bay in the range of 0.3 m and 2.0m height (maximum wave height), with the majority of significant waves being less than 1.0 meter in height. During summer months the sea is usually calm. (Port of Suez - Master planning and feasibility study review - by Port of Suez Engineering Group).

As the conclusion, the basin in front of the berths is able to secure the calmness to 99 % or more of the year, and cargo handling activities for days corresponding to 98 % or more.

(b) Breakwater

1) Structural type of breakwater

Since it is extremely preferable to other types with regard to material availability, construction conditions and specially construction cost, rubble mound type breakwater is selected.

Figure 3.3.3-32 and 3.3.3-33 show the Typical Cross Section of Breakwater.
Figure 3.3.3-34 shows the Plan and Side View of Breakwater.

2) Crown height

In a port where the basin behind the breakwaters is small spacewise and it is used for small ships, considerable overtopping waves should be prevented. Hence the crown height of the breakwater is determined as 1.25 H1/3 above the mean spring high water level.

HWLS	+ 1.9 m
1.25H1/3 = 1.25X1.3	1.63 m
Crown height	C.D.+ 3.6 m

3) The gradient of slope

The gradient of slope should be determined from the results of the stability calculation. The slope of 1:1.5 is selected.

4) Crown width

The crown width of 3.0 meters may be sufficiently wide as well as the Ataqa Fishing Port Project. However, the crown width of 5.0 meters is determined in consideration of easiness in the execution of works so as to carry out as on-land work without any floating equipment.

5) Toe protection

According to the basic design report on "The project for rehabilitation and development of Ataqa fishing port" (JICA), current velocity is too small to take littoral drift. Therefore, sand in the seabed will not be moved by the current.

In order to protect the foundation of rubble mound breakwater from scouring, protection stones were laied. And the toe on the seaward side is made of big size of armor stones.

6) Material

All of stones will be supplied from Ataqa quarries.

Replacement	rubble stone	5 - 50 kg pcs
Core stone	rubble stone	30 - 200 kg pcs
Sloping surface	armor stone	300 - 500 kg pcs
Crown stone	armor stone	300 - 500 kg pcs
Toe protection	armor stone	500 kg pcs or more

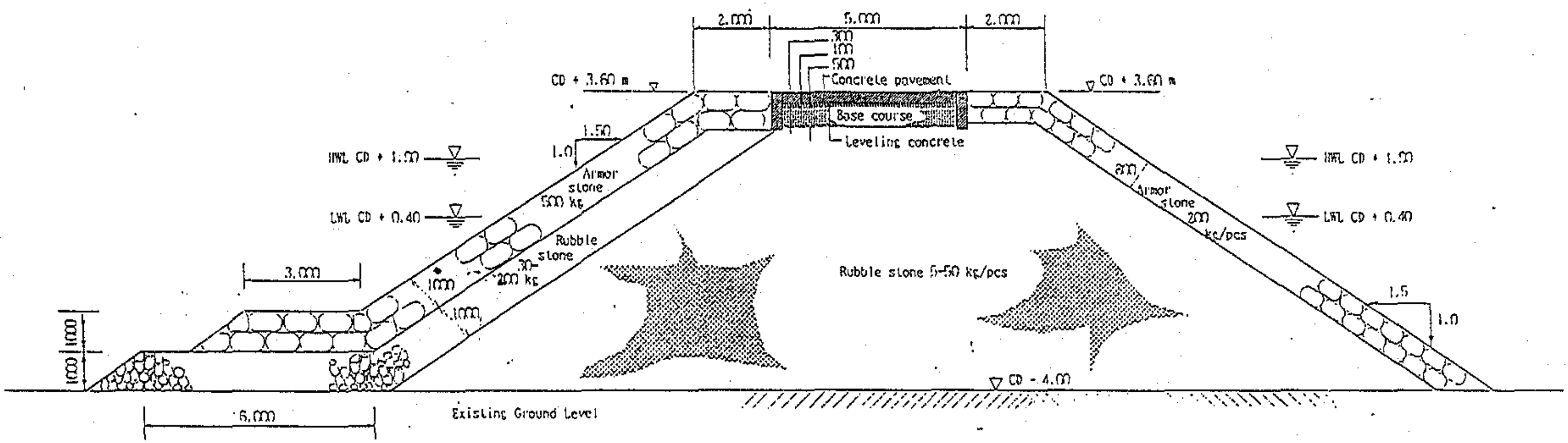


Figure 3.3-3-31 *TYPICAL CROSS SECTION OF BREAKWATER*

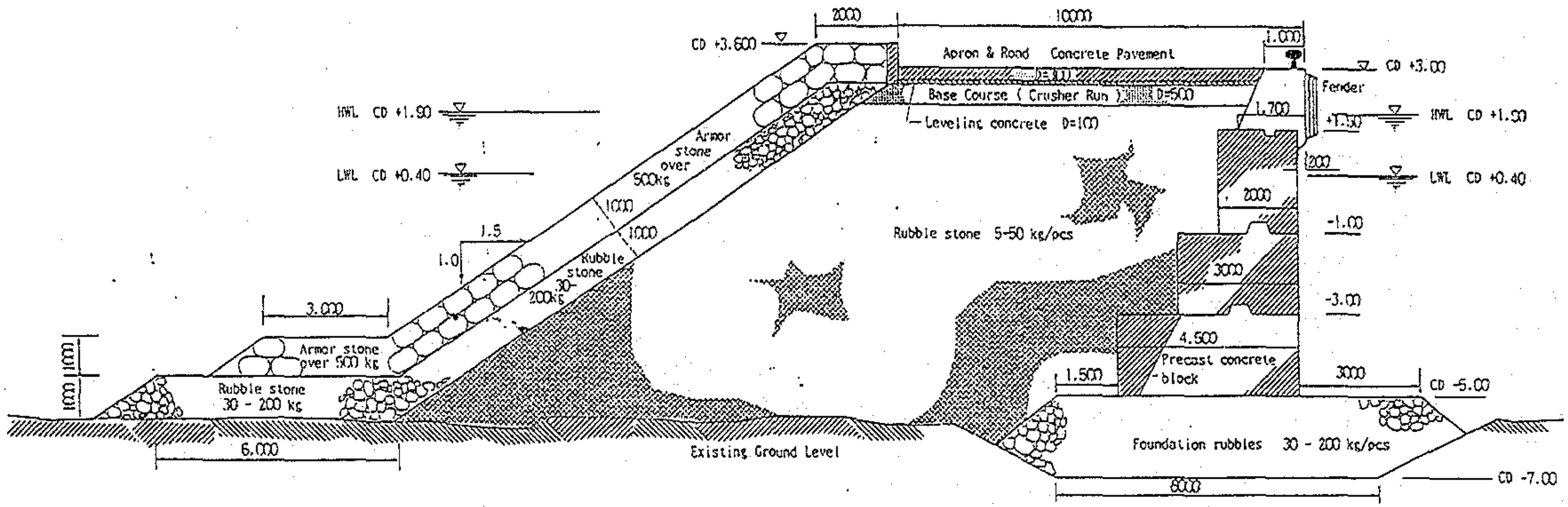
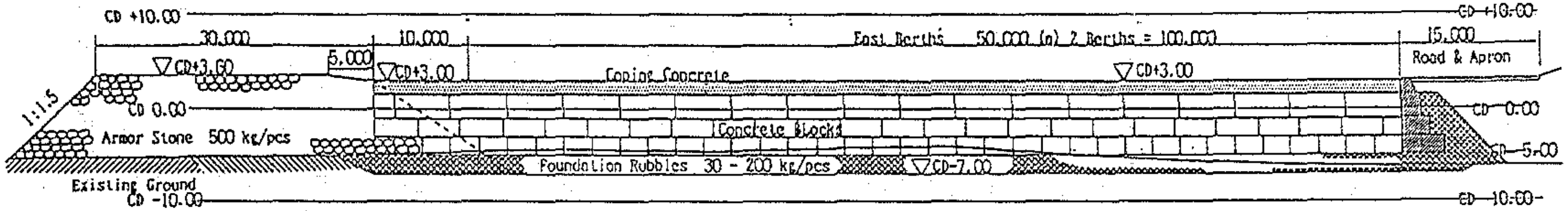
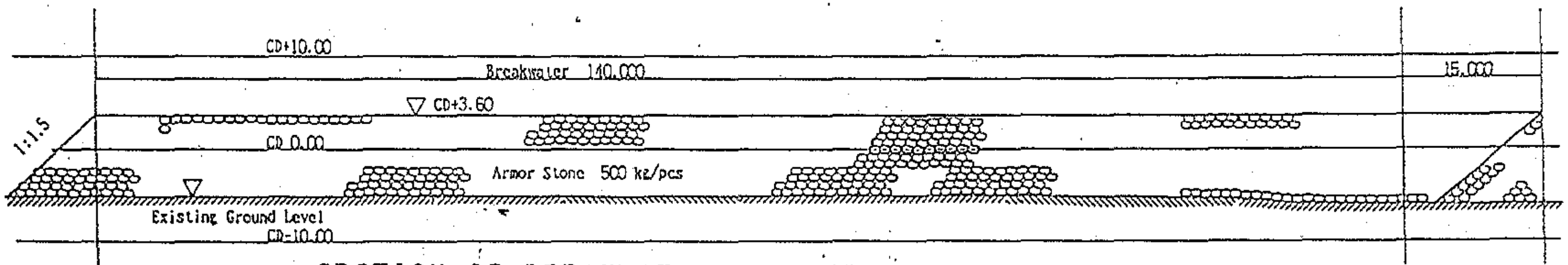


Figure 3.3-3-32 TYPICAL CROSS SECTION OF EAST BERTH WITH BREAKWATER



SECTION OF BREAKWATER BASIN SIDE S=250



SECTION OF BREAKWATER SEASIDE S=1:250

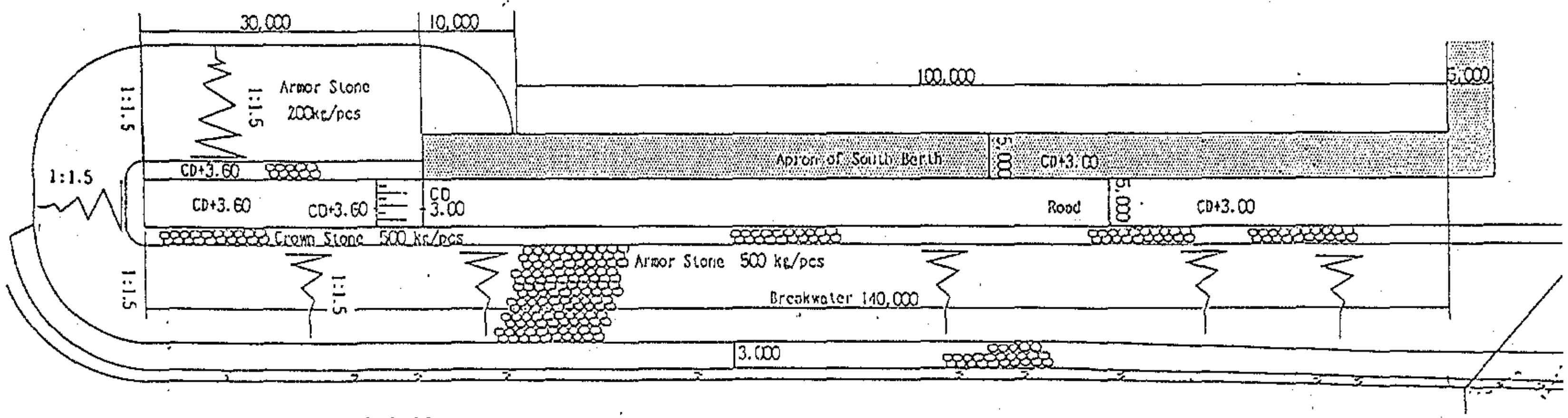


Figure 3.3-3-33 ***SMALL BOAT BASIN BREAKWATER***

(12) Port Entrance, Roads, Open Storage Yard and Fence

(a) Port Entrance

Port entrance area of 128 m in length and 100 m is allocated in the location as shown in Figure 3.3-3-34.

In the area, security gates, customs office, truck scale and parking lots are provided.

(b) Road and Open Storage Yard

Roads in the port area are paved with asphalt and open storage yards and aprons are paved with concrete.

At the bulk-cargo terminal, bulk-cargo will be handled by 30 ton cranes and containers will be handled with 30 ton fork-lifts. The thickness of concrete pavement is assumed as 35 cm, stresses of concrete by the crane load is calculated to be 44.1 kg/cm² and stress by the fork-lift is 38.6 kg/cm². Both stresses are less than the allowable stress of 45 kg/cm².

Following equation was used to calculate the concrete stress.

$$p = \frac{C \times P}{h^2} \times \{1 - \frac{(a/L)^{1/2}}{0.925 + 0.22 \times \frac{a}{L}}\}$$

where : p = Bending stress of concrete pavement (kg/cm²)

c= Coefficient (3.36)

P = Load (30,000 kg for 30 ton crane and 35,000 kg for 30 ton fork-lift)

h = Thickness of concrete pavement (35 cm)

a = Radius of contact area (23.6 cm for 30 ton crane and 41.8 cm for 30 ton fork-lift)

L = Radius of stiffness ratio (116.3 cm for 30 ton crane and 106.3 cm for 30 ton fork-lift)

(c) Fence

The fence made of bricks and supporting RC pillars is erected along the boundary of port area. The structure and locations of fence are shown in Figure 3.3-3-35.

A steel gate will be provided at the crossing of fence and railway. The structure of gate is shown in Figure 3.3-3-36.

(13) Utilities in the Port Area

(a) Power Supply and Lighting System

1) Power supply

Electrical power for the port area will be supplied from 66/22KV substation-B. Two units of substation will be installed in the port area, one substation with emergency generator in the grain terminal area and another substation without emergency generator in bulk-cargo terminal area.

2) Lightning

Electrical power for lighting will be supplied from the unite substation installed in bulk cargo terminal. Lighting in port area including port entrance area, grain terminal and bulk-cargo terminal area will be provided with the following lighting intensity.

Table 3.3-3-2 Lighting intensity

	Average Intensity
Port Entrance	20-50 lx
Apron in Grain Terminal	20 lx
Apron in Bulk Terminal	20 lx
Open Storage Yard	20 lx
Roads	10 lx
Small boat basin	15-20 lx
Fence	5-101 lx

3) Type of Lighting Fixture and Installation

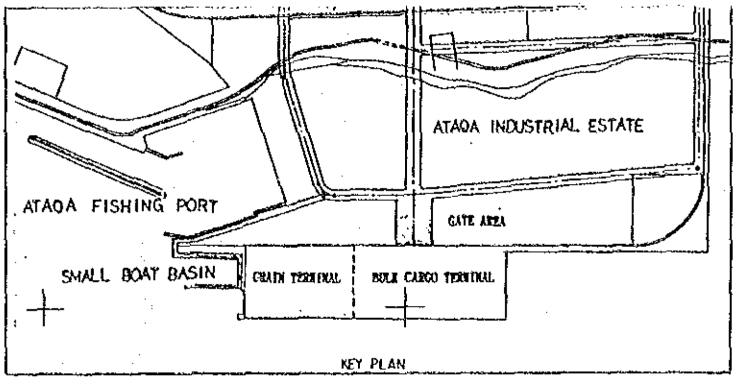
All lighting lamps will be set on poles except lighting along grain conveyor and fence. These lighting lamps will be fixed on the structures of conveyor and on the wall of fence.

(b) Water Supply, Hydrant System and Sewerage in Port Area

Water supply pipeline of 250 mm diameter is installed along the quay of both the grain berth and bulk-cargo berth. Outlets of water supply and hydrant are installed on the same pipe line at intervals of about 60 m.

In addition to the above, fire hydrants are also provided around the buildings of grain silo bins in the grain terminal and open storage yards in the bulk-cargo terminal.

The sewerage pipes in the port area are connected to the No.2 Sewerage Relay Pumping Station in the Ataqa I.E. Coastal.



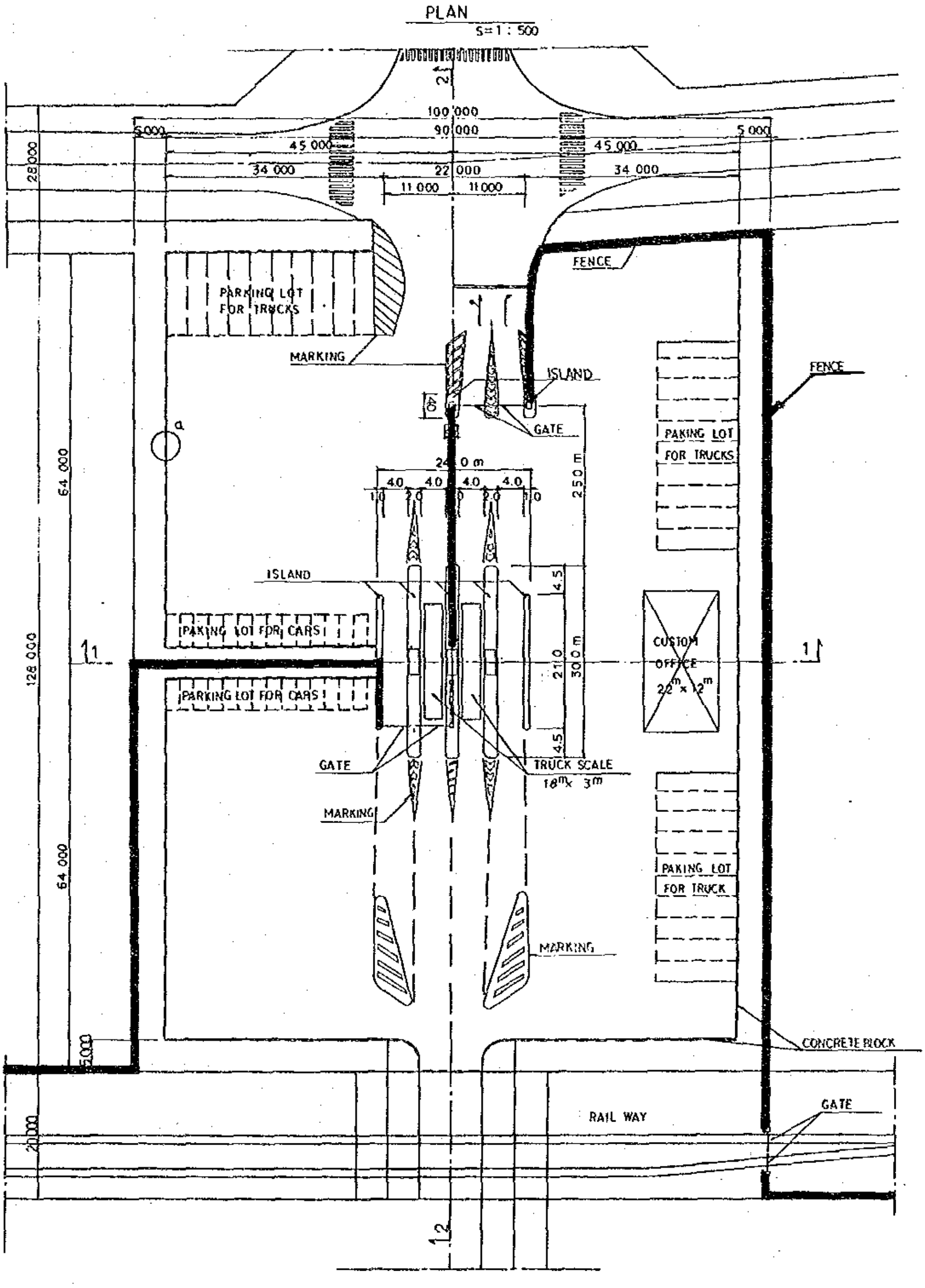


Figure 3.3-3-34 Plan of Port Entrance

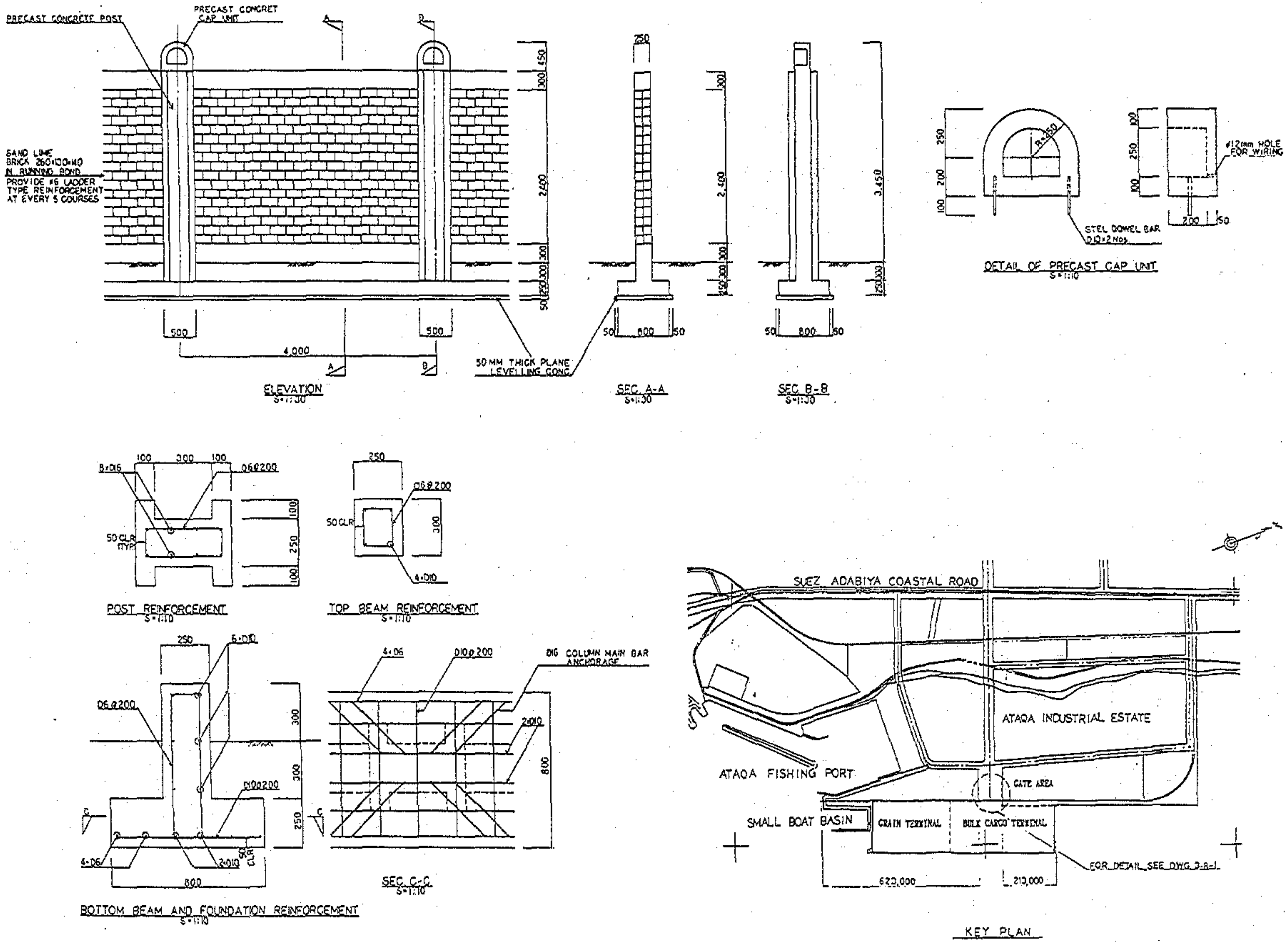
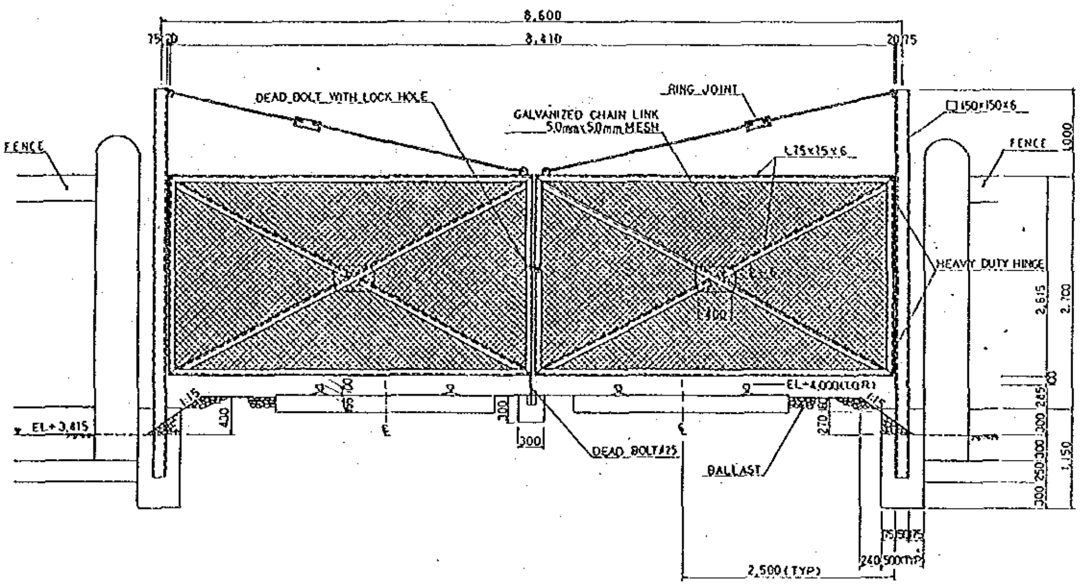
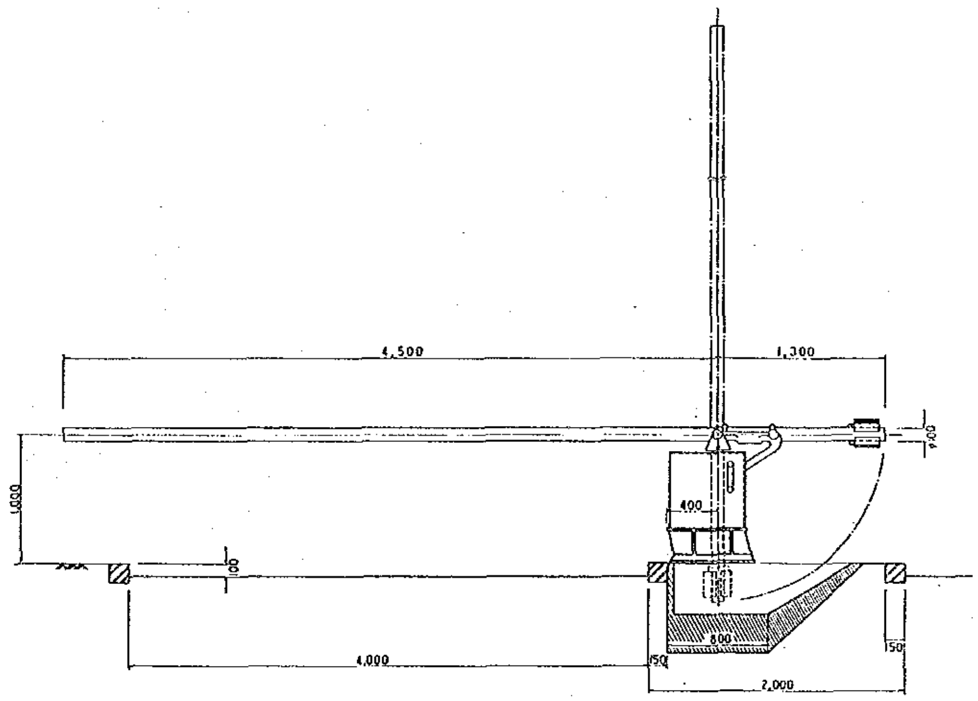


Figure 3.3-3-35 Fence for Port Area



ELEVATION OF RAILWAY GATE
S=1:30



ELEVATION OF PORT ENTRANCE GATE
S=1:20

Figure 3.3-3-36 Gates for Port Entrance and Railway