4.3 Design Conditions

Tidal Level: At Suez Bay, the chart datum is approximately the level of the Lowest Astronomical Tide (L.A.T.). With reference to the L.A.T., tidal levels based on data obtained from soundings at the locations below are as follows.

Place	Suez Bay Eastern Channel of Suez Canal	EL Tor Eastern Coast of Gulf of Suez	Ras Gharib Western Coast of Gulf of Suez
Lat	N 29°56'	N 28°14'	N 28°21'
Long	E 32°33'	E 33°37'	E 33°07'
MHHW		+0.3 m	
MHWS	+1.9 m	-	+0.5 m
MLWS	+0.4 m	-	+0.1 m
MLLW		+0.1 m	

Tidal levels at Ras Sudr and Ain Sukhna are estimated based on the above data.

Design Tidal Levels

	Ras Sudr Ain Sukhana	Ataka Adabiya
MHWS	+1.6 m	+1.9 m
MHWN	-	+1.6 m
MLWN	-	+0.7 m
MLWS	+0.3 m	+0.4 m

Earthquakes: Method of Analysis – Seismic Coefficient Method

Acceleration – 0.05 g

Design Seismic Coefficient – 0.05

Seismic Force

– Deadweight x Design Seismic Coefficient (b)

– (Deadweight + Surchage) x Design Seismic Coefficient (b)

Either of the seismic forces given above, whichever is critical to the design structure, acts on the center of gravity of the structures.

Tidal Current: The maximum current velocity in mid-channel of the Suez Bay is 0.75 m/sec at spring and 0.25 m/sec at neap tide. According to the report "Safety Improvement of the Suez Canal", the maximum current velocity can be estimated as follows;

Maximum Current Velocity	
Adabiya	0.5 m/sec
Ataqa	0.5 m/sec
Ain Sukhna	1.0 m/sec
Ras Sudr	1.0 m/sec

Waves: Estimated waves are as follows:

		Entrance of Suez Bay	Ain Sukhna	Ras Sudr
Wind	W = m/sec	12.25	9.5	13.5
	Direction	S	SE	NNW
	Duration (hrs)	8	8	8
Fetch	km	60	70	45
Wave	Height H1/3 (m)	1.65	1.24	1.68
	Period T1/3 (m)	4.8	4.3	4.7

Fig. 4.3.1 Wind Direction and Fetch

DEEP WATER WAVES

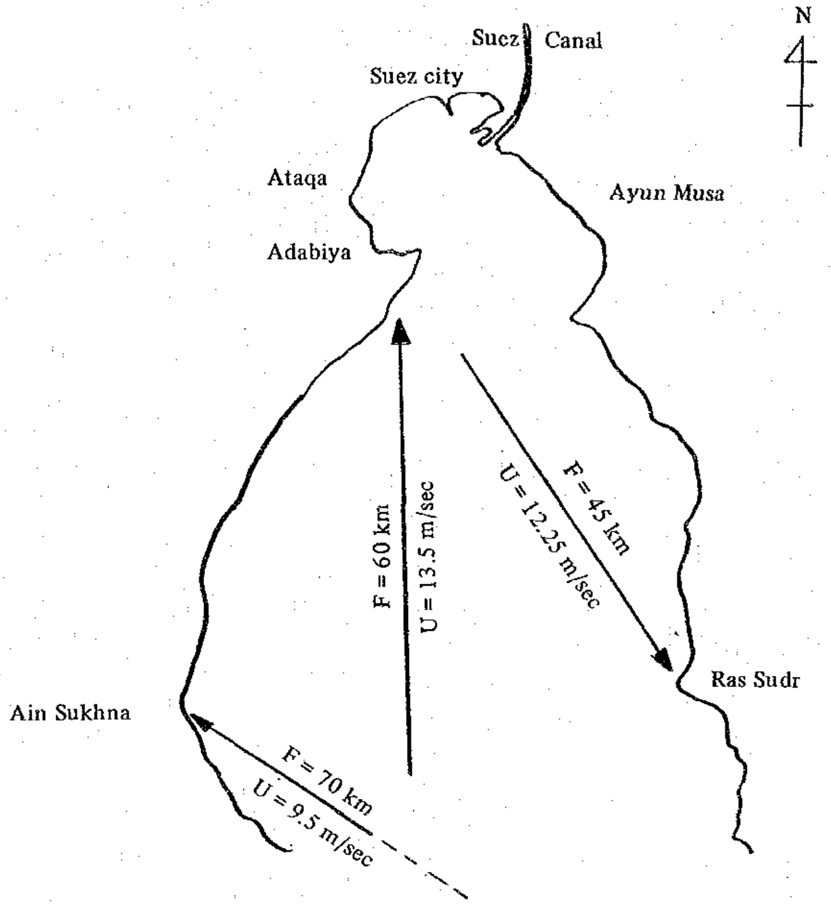
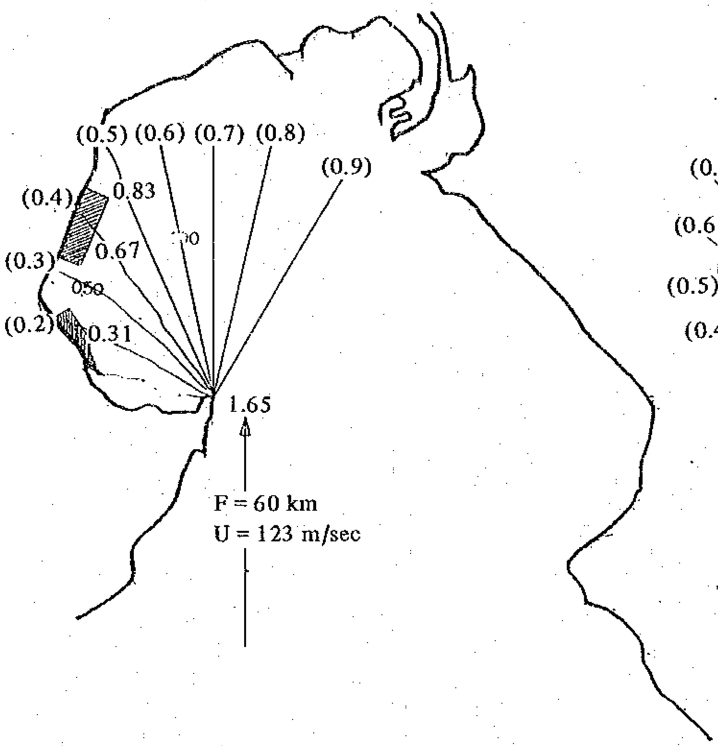
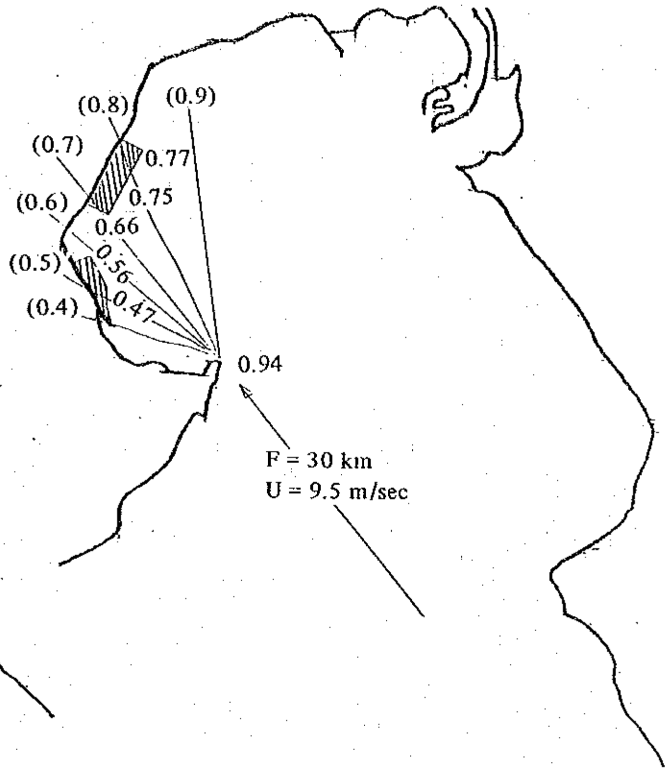
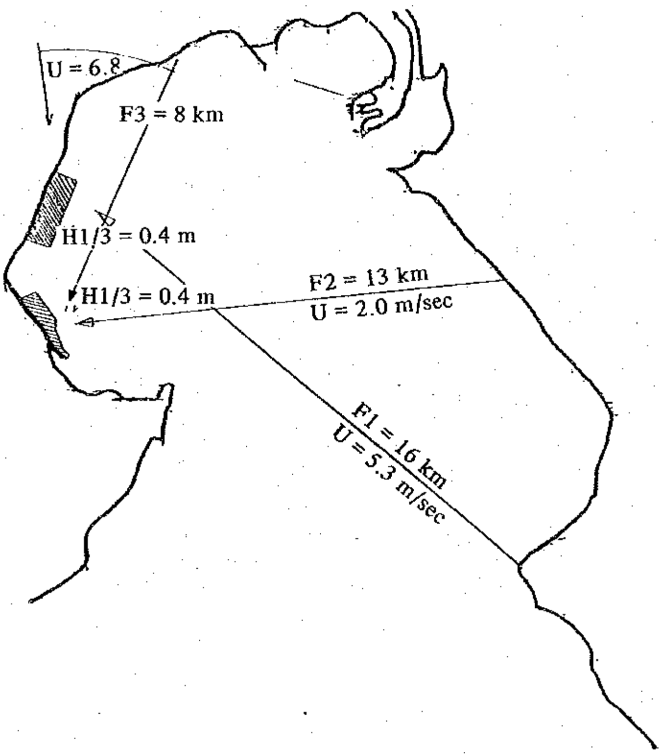


Fig. 4.3.2 Diffraction of Waves at Ataqa-Adabiya







( ): Wave Height Ratio

Fig. 4.3.3 Diffraction of Waves at Ain Sukhna

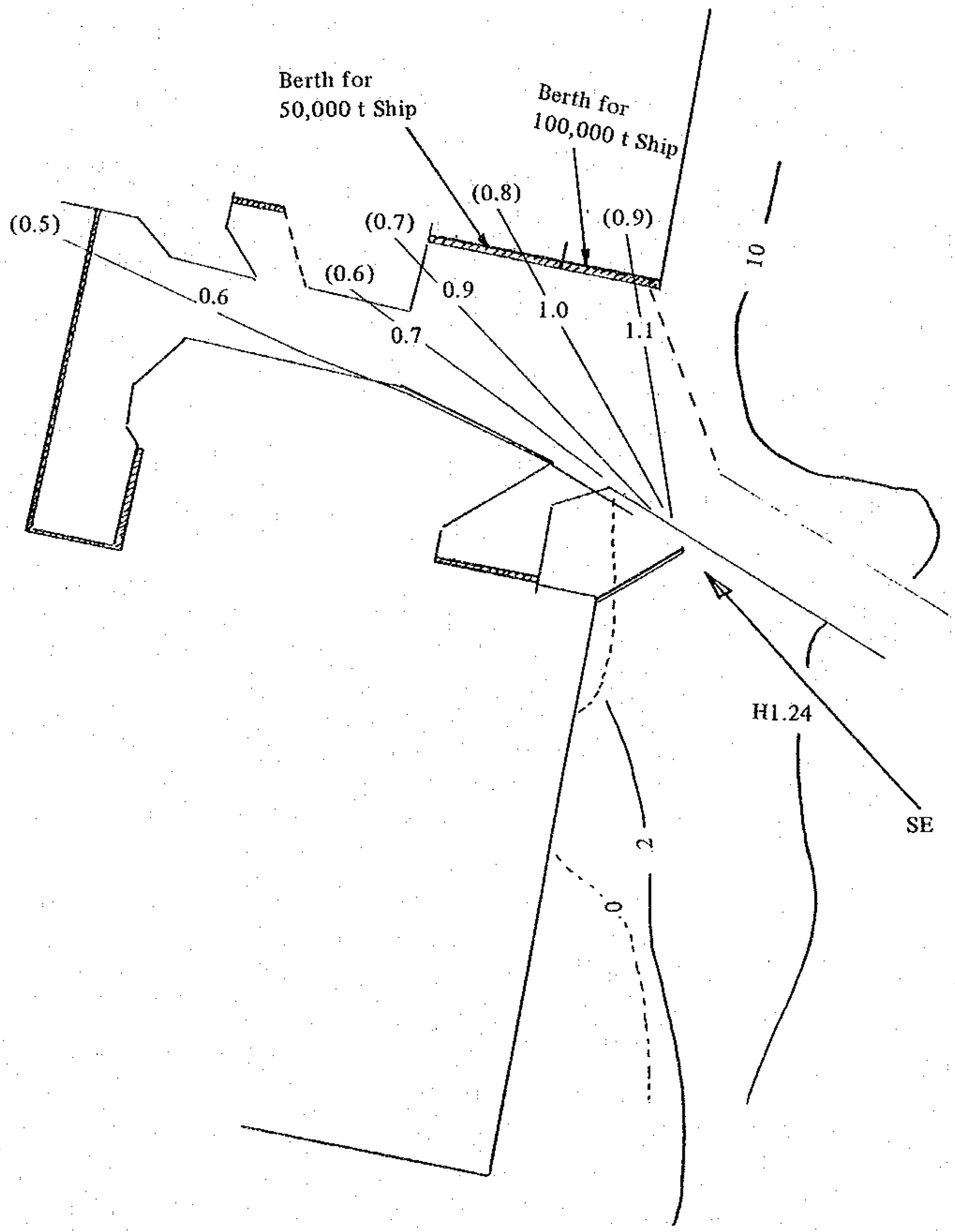
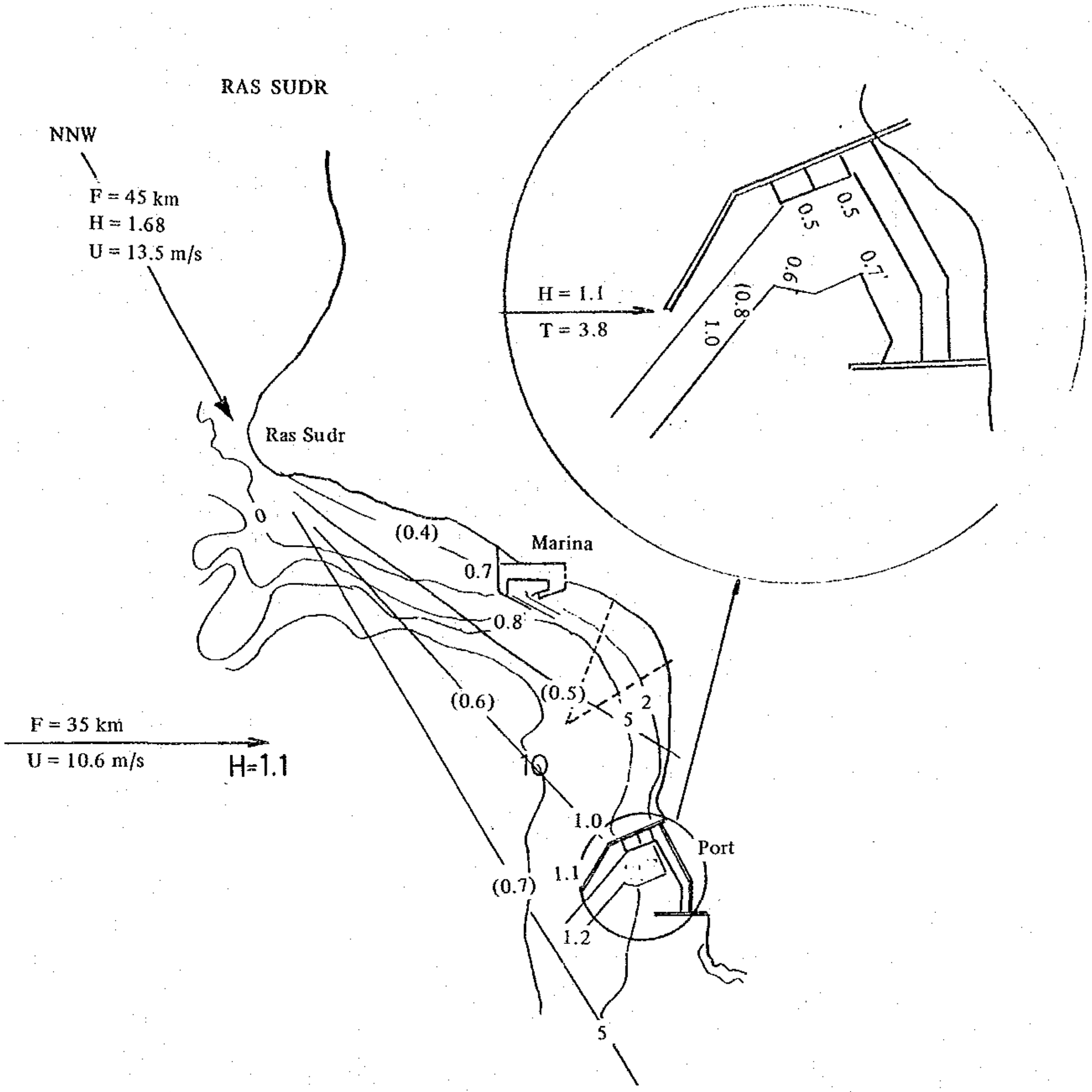


Fig. 4.3.4 Diffraction of Waves at Ras Sudr



Crown Height of the Port Facilities:

1) *Mooring Facilities*

Place	Ataqa Adabiya	Ain Sukhna Ras Sudr
H.W.L.	DL + 1.9 m	DL + 1.6 m
Allowance	1.7 m	2.0 m
Crown Height	DL + 3.6 m	DL + 3.6 m
Crown Height of the Marina		+ 2.5 m

The mooring jetty should be a floating structure.

2) Breakwaters

	Ain Sukhna	Ras Sudr
M.H.W.S.	DL + 1.60 m	DL + 1.60 m
0.6 x H1/3	0.75 m	0.70 m
Allowance	0.65 m	0.70 m
Top Level	DL + 3.00 m	DL + 3.00 m
Parapet Height	1.50 m	1.50 m
Crown Height of Papapet	DL + 4.50 m	DL + 4.50 m

3) Shore Revetment

Ataqa, Adabiya

As a permanent revetment: DL + 3.60 m

As a temporary stone revetment DL + 3.00 m

Ain Sukhna, Ras Sudr

Apron DL + 2.50 m

Parapet DL + 4.00 m

Design Conditions for Mooring Facilities:

1) Berthing Speed of Vessels (m/sec)

for 3,000 DWT ships: 0.20 m/sec

for over 10,000 DWT ships: 0.15 m/sec

for over 80,000 DWT ships: 0.10 m/sec

2) Surcharge Refer to the table

3) Handling Facilities Refer to the table

Design Conditions for Mooring Facilities

Place	Grain Ataqa	Coal Ataqa	Bulk Cargo Ataqa	Container Adabiya	Special Cargo Adabiya
Design conditions					
Surcharge (t/m^2)	1.0	1.0	1.0	2.5	3.0
Design Depth (m)	DL-15.0	DL-13.0	DL-11.5	DL-13.0	DL-11.5
Design Length (m)	300	270	210	300	210
Size of Vesseles (DWT)	80,000	50,000	20,000	30,000	20,000
Berthing Speed of Vessels (m/sec)	0.10	0.15	0.15	0.15	0.15
Handling Facilities					
Type	Pneamatic Unloader	Unloader	Ship Loader	Gantry Cargo	Ship Loader
Capacity (t/h)	1,200	1,000	120	20 TEU/h	230

Place	General Cargo Adabiya	General Cargo Ain Sukhna	Bulk Cargo Ain Sukhna	General Cargo Ain Sukhna	Iron Ore Ain Sukhna
Design Conditions					
Surcharge (t/m^2)	1.0	1.0	1.0	1.0	1.0
Design Depth (m)	DL-11.5	DL-11.5	DL-6.5	DL-6.5	DL-18.0
Design Length (m)	210	210	105	105	330
Size of Vessels (DWT)	20,000	20,000	3,000	3,000	100,000
Berthing Speed of Vessels (m/sec)	0.15	0.15	0.20	0.20	0.10
Handling Facilities					
Type	Ship Loader	Ship Loader	Ship Loader	Ship loader	Unloader
Capacity (t/h)	50	56	100	100	2,500

Place	Coal Ain Sukhna	Oil Ain Sukhna	Iron & Steel Ain Sukhna	Bulk Cargo Rad Sudr
Design Conditions				
Surchage (t/m^2)	1.0	1.0	3.0	1.0
Design Depth (m)	DL-13.0	DL-11.5	DL-11.5	DL-6.5
Design Length (m)	270	105	105	105
Size of Vessels (DWT)	50,000	3,000	3,000	3,000
Berthing Speed of Vessels (m/sec)	0.15	0.20	0.20	0.20
Handling Facilities				
Type	Unloader	Landing Arm	Mobil Crane	Ship Loader
Capacity (t/h)	100	100	100	100

Soil Conditions:

1) Ataqa, Adabiya

Seven borings (4 points at the Adabiya New Quays, 3 points at the Halkis Cement Jetty) for the soil investigations were carried out at the request of the Red Sea Port Authority in 1982.

Six borings carried out for the study of the Suez Bay Coastal Area Development Plan in 1985 together with the seven borings mentioned above provide sufficient data for the feasibility study of the development plan.

The locations of the boring points are shown in Fig. 4.3.5.

2) Ain Sukhna

No borings for soil (geotechnical) investigation have been carried out in this area. Only some drillings for ground water resource investigation show the soil features of the area.

Depth from the surface

0 ~ 18 m	Gravel, some limestone
18 ~ 54 m	Gravelly sand
54 ~ 60 m	Gravel

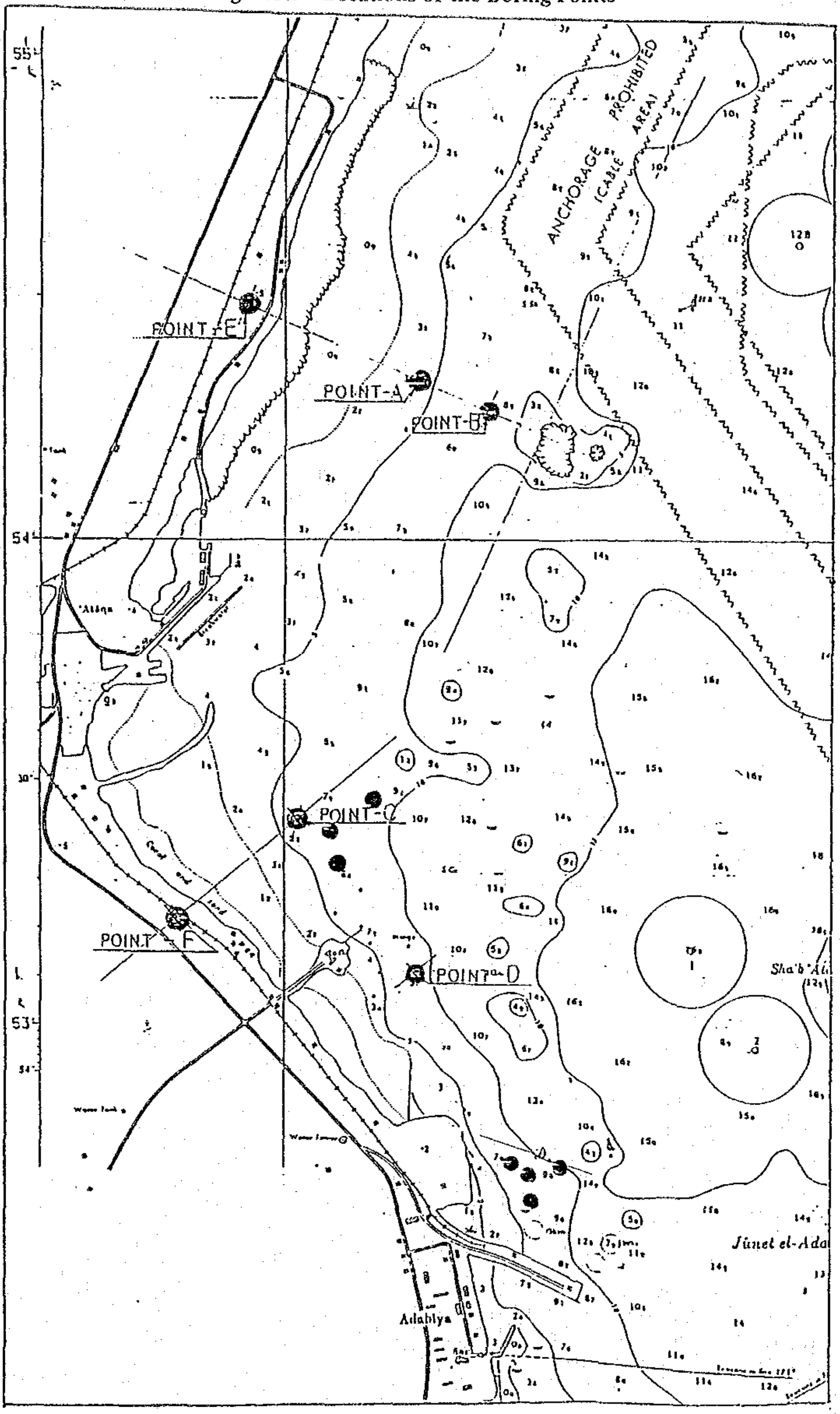
The terrain of the coastal zone is basically flat and slightly undulating with occasional sand dunes.

3) Ras Sudr

The beach of Ras Sudr is covered with several coral patches above the sandy soil. No soil investigations have been carried out for the study.

The structures proposed for the area under the development plan all have shallow foundations, so it is possible to design and estimate the construction cost of the structures based on assumed soil conditions.

Fig. 4.3.5 Locations of the Boring Points



4.4 Preliminary Design of the Grain Terminal

(1) General

Construction: This terminal is designed for grain handling consisting of silo facilities to store bulk grain, unloading facilities and conveying facilities. The construction plan consists of Phase 1 and Phase 2 works. A 70,000 ton storage silo and an unloading and transfer conveying system with related facilities will be constructed in the Phase 1 work, and an additional 30,000 ton storage silo with related facilities will be constructed in the Phase 2 work.

When completed, the grain terminal will be a state of the art facility with silos having a total storage capacity of 100,000 tons, an unloading capacity of 1200 tons/hour and an annual handling capacity of 2.096 million tons.

General Arrangement: Centering around the grain storage silos, a machinery tower, an office building, a bagging house and miscellaneous buildings are effectively arranged in the Terminal.

Ship unloaders are installed on rails on the berth for ocean vessels and connected to silo facilities by a transfer conveying system installed on the wharf.

Description of Arrangement:

o Take-in

Grains are unloaded using 2 newly installed ship unloaders (each 600 tons/hour) and then transferred by the transfer conveying system to silos after the completion of separating, sampling and weighing of the grains.

o Take-out

Bulk and bagged grain are carried out by wagons and trucks.

Grain Testing: Quality inspection is made on the grains to be transferred to silos collecting samples by auto-samplers installed at the Machinery Tower. The temperature of grains stored in the silos is measured by temperature detectors installed in silo bins, so the storage conditions of the grains can be carefully monitored.

Fumigation System: When harmful insects are observed in grains to be transferred to silos, the grains are fumigated in the silo bins to kill the insects.

Safety and Maintenace Control: Dust collecting, cleaning, fire alarm and fire fighting facilities are installed to maintain a good working environment, and for the safety and maintenance control of the terminal.

Dust collecting facilities absorb grain dust generated during transfer conveyance of grains to improve the work environment and to eliminate the dust pollution.

Cleaning can be executed by a central vacuum cleaning facility. Piping of the cleaning facilities is provided so that the top and bottom of the silos and the inside of the buildings can be cleaned easily.

Electrical Work: Electric power is received at high voltage (6.0 KV) from Egypt Electric Power, and distributed to all electrical equipment used in the terminal after being transformed. All the equipment is driven by electric power except for the weighing scale and the dust collectors driven by air. Complete lighting and communication facilities required for the operation of the terminal will be installed during the construction.

Control System: All operations are supervised from the central monitor system in the control room.

The system allows manual operation of equipment and units for local tests and maintenance.

Operation control is carried out by programs incorporated into the controller and at the same time monitoring is made via a display panel.

Areation System: When abnormal temperature rise is observed in grains stored in silos, the temperature can be cooled down by aeration in the silo bins through the piping using blower and cooling dryer.

Generally, aeration in the grain silo located at the consumed area will be seldom used because of quick rotation. Therefore aeration system is designed to use fumigation facilities.

When the different facilities are used for aeration system itself, additional cost of about 500,000 LE will be necessary.

(2) Description of General Conditions

Site: The site of the Ataqa Grain Handling and Storage Terminal will be located at Adabiya Port of the Arab Republic of Egypt on the East Coast of the Suez Bay approximately 130 km east of Cairo. Access to the site is available via road, rail and barge.

Handling Material:

• Material:	Whaet
• Apparent specific:	0.75 metric tons per cubic meter gravity
• Angle of repose:	28°
• Moisture content:	$12 \sim 14\%$ wb
• Storage period:	Max. 60 days

Handing Capacity:

o Unloading Capacity

• Phase 1:	1,462,000 metric tons per annum
• Phase 1 + Phase 2:	2,096,000 metric tons per annum

o Outloading Capacity

• Wagon loading:	57% of total handling capacity
• Bagging:	24% of total handling capacity
• Conveying to mill-plant:	19% of total handling capacity

Working Time:

o Working Days

• For unloading:	330 days per annum
• For outloading:	330 days per annum

o Working Time:

• For unloading:	18 hours per day
• For outloading:	8 hours per day

Note: "Unloading" means "vessel to the silos"
"Outloading" means "silo to the wagons, trucks and mill-plant".

Size of Vessels and Wagons:

o Ocean Vessels:	Maximum 80,000 D.W.T.
• Length over all:	250 meters
• Breadth molded:	38.5 meters
• Depth:	Full draft −14.5 meters
• Length of hatch:	180 meters
o Wagons:	45.0 tons
• Length:	15.8 meters

Meteorological Data:

o Local Climate

• Temperature:	Maximum 35.4°C
	Minimum 10.4°C
• Relative humidity:	Maximum 94.7%
	Minimum 0.3%
• Rainfall:	Maximum 4.7 milimeters per hour

o Local Force Effect

• Wind velocity:	Maximum 11.3 knots
• Earthquake load:	Seismic acceleration 0.05 g

o Tidal Range

• High water level:	DL +1.9 meters
• Low water level:	DL +0.4 meters

(3) Structures

Codes and Standards: The design of civil structures, silo facilities and outer ditches shall conform to the following Japanese Standards.

	Japanese Standards
General	JIS
Material	JIS
Concrete Structure	AIJ Standard for Structural Calculation of Reinforced Concrete Structures
R.C Silo	ACI
Building	Building Standard Act, UBC
Steel Structure	AIJ Design Standard for Steel Structures
Fumigation	Plant Protection Law
Painting	JIS, SSPC

JIS : Japanese Industrial Standards
AIJ : Architectural Institute of Japan
UBC : Uniform Building Code
SSPC : Steel Structures Painting Council
ACI : American Concrete Institute

Storage Structures:

1) Silo Bins

- Shape: Independently self-standing cylindrical shape
- Type: Reinforced concrete
- Effective Capacity: Alternative–Flat steel welded silo 1,870 metric tons/bin
- Number of Silo Bins: Phase 1 40 bins
  Phase 2 16 bins
- Total Effective Capacity: Phase 1 74,800 metric tons
  Phase 2 29,920 metric tons
  (Total 104,720 metric tons)
- Structucture

  RC type

  The roofs of bins shall be of T-shaped slab precasted R.C blocks (standard size of 4 m x 12.5 m) which are supported by the transberth beams of reinforced in-situ concrete.

  Alternative-Flat steel welded type:
  The roofs of bins shall be of flat plate-shaped self-supporting structure, the shell part made of cylindrical steel plate and the lower part composed of conical steel plate, and the hopper angle shall be 45°

The skirts of the bins shall be of sufficiently strengthened flat steel with a welded skirt structure fixed to the civil part through the base plate by the use of anchor bolts. The tops of the silos shall be fitted with steel plates between the bins and with roofs to provide flushing for a group of bins. Thermal insulation and waterproofing mortar with dip gradient shall be applied. The shell part shall be covered using PVC coated steel sheets at the outer part of the silos.

2) Accessories of Silos

○ Grain inlet nozzle on the bin roof:	1 or 2 sets per bin
○ Manhole on the bin roof:	1 set per bin
○ Safety valve and fitting nozzle on the bin roof:	1 set per bin
○ Temperature detector fitting hook on the bin roof:	1 set per bin
○ Grain level switch fitting nozzle (for the upper limit of grain) on the bin roof:	1 set per bin
○ Manhole to the bin hopper:	1 set per bin
○ Stage for manhole to the bin hopper:	1 set per bin
○ Outlet nozzle to the bin hopper:	1 set per bin
○ Inlet equipment for fumigation to the bin hopper:	1 set per bin
○ Gas inlet nozzle for fumigation to the bin hopper:	1 set per bin
○ Gas outlet nozzle for fumigation on the bin roof:	1 set per bin
○ Silo bin earth to the bin shell:	4 sets . . . Phase 1 2 sets . . . Phase 2
○ Hand rail on the bin roof:	1 set
○ Doors (steel sash) to the silo skirt:	1 set
○ Windows (steel sash) to the silo skirt:	1 set
○ Drain pipe:	1 set
○ Fire distinguish and fire detection system:	1 set
○ Explosion detector fitting:	1 lump sum

3) Mortar to Silo Roof (alternative only)

Asphalt waterproofing is used over the entire area on the outside of the silo roofs, and mortar with a dip gradient of 1/100 is applied from the central part to the outside.

The average thickness of this mortar shall be approx. 100 mm.

4) Dual Wall (alternative only)

In order to prolong the capability to store grain in a hot region and to protect the silo from the adverse effects of sea breezes and from strong ultra-violet rays and also to ensure its resistance to weather, the outer part of the bins shall be a dual structure consisting of shaped PVC-coated steel sheets.

Machinery Tower: A machinery tower shall be installed between the silo-group.

A dust cleaning equipment room shall be housed on the 1st floor of the tower; a control room, an electric room and an instrument repair room shall be housed on the 2nd floor, and transportation equipment, separators, auto-samplers, automatic hopper scales, dust collecting equipment and compressed air equipment shall be housed on the 3rd floor and aobve.

The tower shall also include an elevator for men and instruments and a stair way and machine hatch equipped with a hoist.

- Building area 600 m^2
- Linear floor area 3,600 m^2
- Structure
  - 1st to 3rd floors .... Reinforced concrete
  - 4th floor and above .... Steel structure
- Finishes
  - Outer wall
    - Reinforced concrete .... Concrete placing
    - Steel structure .... Corrugated pvc coated steel plate
  - Roof .... Ribbed seam roofing with long-scale pvc coated steel plate
  - Fittings ... Window ...... Aluminium sash
    - Doors .... Steel sash
- Building Facilities
  - Elevator for men and instruments .... 6 persons (500 kg), speed 45 m/min
  - Lighting fixtures
  - Fire alarm and fire fighting equipment
  - Communication and telephone facilitise
  - Water supply and drainage .... on the 2nd floor
  - Air conditioning equipment .... control room

Office Building: An office building shall be installed besides the silos. An office and reception room shall be provided on the 1st floor of the building, and rooms provided on the 2nd floor shall include the director's room, conference rooms, a laboratory, etc.

- Building area 175 m^2
- Linear floor area 350 m^2
- Structure Reinforced concrete
- Finishes
  - Outer wall Reinforced concreted
  - Roof Reinforced concrete
  - Fittings Aluminium sash

o Building facilities

- Lighting fixtures
- Fire alarm and fire fighting equipment
- Communication and telephone facilities
- Toilets .... on the 1st and 2nd floors
- Water supply and drainage .... on the 1st and 2nd floors
  (hot water supply)
- Air conditioning equipment .... on the 1st and 2nd floors

Wagon Loading House: The wagon loading house shall be installed beside the silos. It shall include transfer equipment, dust collecting equipment and wagon loading tanks and chutes.

o Building area 1,180 m^2

o Linear floor area 1,180 m^2

o Structure .... Steel structure

o Finishes

- Outer wall .... Corrugated PVC coated steel plate
- Roof .... Ribbed seam roofing with long-scale PVC coated steel plate
- Fittings .... Alumium sash

o Building facilities

- Lighting fixtures
- Fire alarm and fire fighting equipment
- Communications and telephone facilities

Bagging House: A bagging house shall be installed adjacent to the machinery tower beside each silo. A paletizing area and a truck-loading area shall be available on the 1st floor of the house, and the bagging facility (including the sewing machine packer-scale), a place for hemp-bags, workers' accommodations, etc. shall be housed on the 2nd floor. Items housed on the 3rd floor shall include transfer equipment and dust collecting equipment. In addition, the house shall be provided with a hoist for loading of hemp-bags, etc. and spouts for loading bagged materials onto pallets or trucks.

o Building area 1,890 m^2/1st phase
945 m^2/2nd phase

o Linear floor area 3,780 m^2/1st phase
1,890 m^2/2nd phase

o Structure .... Steel structure

o Finishes

- Outer wall .... Corrugated PVC coated steel plate
- Roof .... Ribbed seam roofing with long-scale PVC coated steel plate

- Fittings Door .... Steel sash
  Window ...... Aluminium sash

- ○ Building facilities
  - Lighting fixtures
  - Fire alarm and fire fighting equipment
  - Toilet .... on the 2nd floor
  - Water supply and drainage .... on the 2nd floor
  - Air conditioning equipment .... Workers' accommodation on the 2nd floor

Workers' Stations: Two rest rooms for workers shall be installed: one at the truck parking area and another near the office building. A workers' accommodation room, a drivers' rest room, a shower room, etc. shall also be provided.

- ○ Building area 150 m²
- ○ Linear floor area 150 m²
- ○ Number of buildings 2
- ○ Structure Concrete
- ○ Building facilities
  - Lighting fixtures
  - Fire alarm and fire fighting equipment
  - Communication and telephone facilities
  - Toilets
  - Water supply and drainage (hot water supply)
  - Air conditioning equipment

Power Receiving: A power receiving house shall be installed at the southern corner of the terminal.

The power receiving equipment such as the transfer, the incoming panel, the high voltage switch-gear panel, etc. shall be housed here.

- ○ Building area 210 m²
- ○ Linear floor area 210 m²
- ○ Structure .... Steel structure
- ○ Finishes
  - Outer wall .... Corrugated PVC coated steel plate
  - Roof .... Ribbed seam roofing with long-scale PVC coated steel plate
  - Fittings .... Door .... Steel sash
    Window ..... Aluminium sash

Maintenance Shop: A maintenance shop shall be provided besides the silos.
The workshop, machine tools, material storage area and spare parts storage area shall be on the 1st floor of the shop, and a drawing room and workers' accommodation facilities will be located on the mezzanine.
The workshop ceiling shall be equipped with a hoist rail to permit heavy materials to be loaded or relocated by means of a hoist.

o Building area		300 m^2
o Linear floor area	1st floor	300 m^2
	Mexxanine	75 m^2
o Structure	Concrete	

o Building facilities
- Lighting fixtures
- Fire alarm facilities
- Communication and telephone facilities

Miscellaneous Buildings: The miscellaneous buildings shall include fumigation equipment rooms, a dust fumigation room, a fumigation gas cylinder room and a guard house.

Buildings related to fumigation shall be provided underneath the silo bin hopper (inside of the silo skirt), and a guard house shall be installed alongside the road.)

o The fumigation equipment rooms shall be of steel structure and shall be fitted with entrance and exit steel doors and fans. Items housed in the rooms shall include a blower, a gas vaporizer, a cyclone and an operation panel.

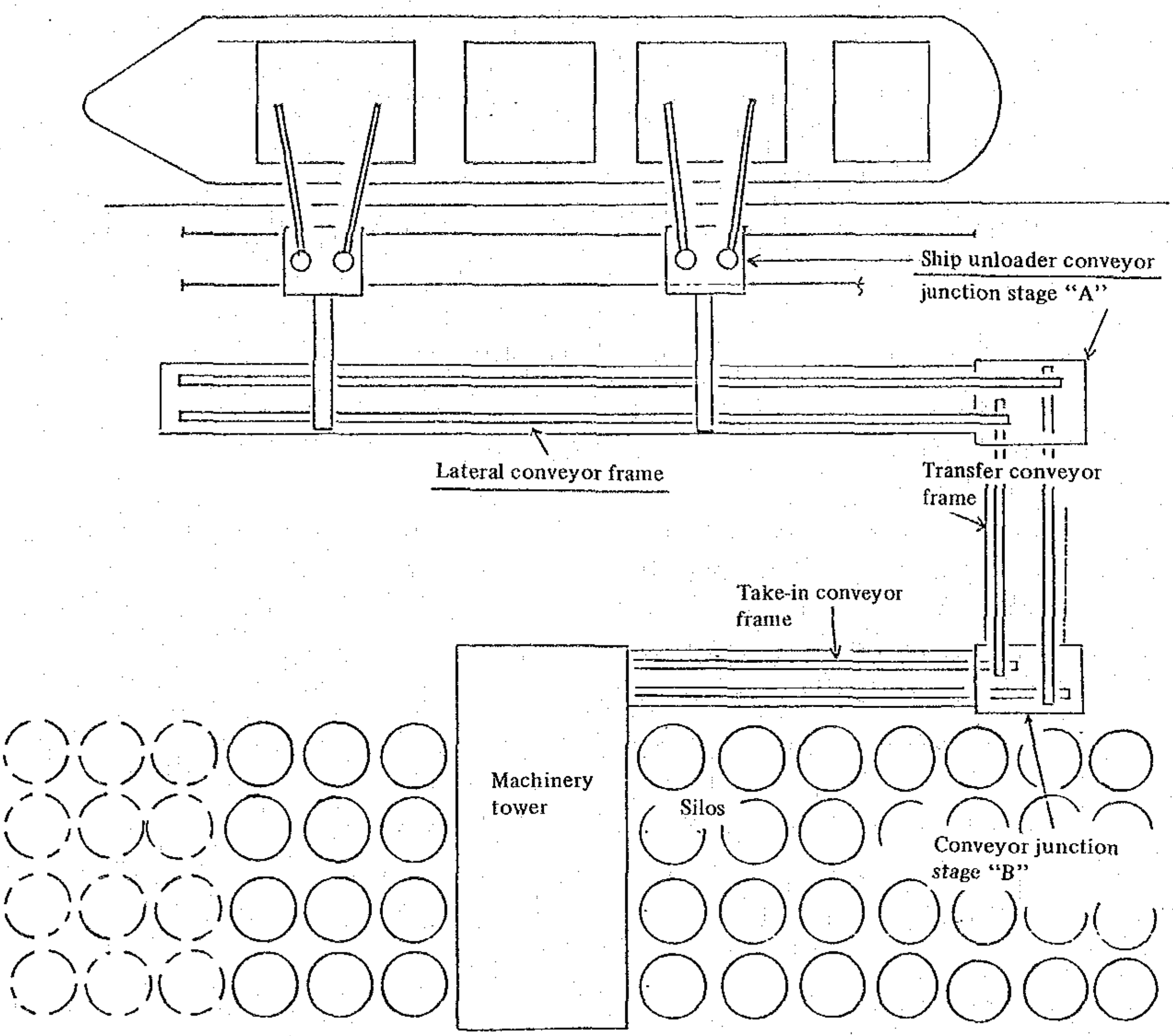
o The dust fumigation room shall of airtight steel plate structure, and shall be equipped with an airtight type entrance and exit steel door, a gas intake port and a gas density measurement port.

o The fumigation gas cylinder room shall be of steel structure and shall be equipped with entrance and exit steel doors and fans.

o The guard house shall be a 1-story reinforced concrete structure equipped with lighting fixtures, communication and telephone facilities and air conditioning equipment.

Structure of Transfer Conveyors: The transfer conveyors shall be equipped with a lateral conveyor frame along the quay, conveyor junction stage "A", a transfer conveyor frame, conveyor junction stage "B" and a take-in conveyor frame as shown in Fig. 4.4.1.

Fig. 4.4.1 Structure of Transfer Conveyors



The lateral conveyor stage along the quay shall be of steel with a total length of 295 m, and the height of the stage shall be 5 m (min.) and it shall be fixed on the bases of columns installed at intervals of 10 ~ 15 m. The frame shall be equipped with a grating walkway and a stage so as to allow the maintenance and inspection of conveyors and connection to unloaders.

The conveyor junction stage "A" is intended to make the transfer point from the lateral conveyors along the quay to the transfer conveyors. The driving devices for the lateral conveyors along the quay and the dust collecting equipment shall be housed therein.

Dimensions of stage:	7 m x 8 m x height 5 m
Structure:	Steel structure

The transfer conveyor frame shall be of steel structure with a total length of approx. 44 m, and it shall be fixed on the bases of columns installed at intervals of 10 ~ 15 m. The frame shall be equipped with a grating walkway so as to allow the checking and maintenance of the conveyor.

The conveyor junction stage "B" is intended to make the transfer point from the transfer conveyors to the take-in conveyors.

The driving devices for the transfer conveyors, spouts for loading grain onto the take-in conveyors, dust collecting equipment, etc. are housed therein.

Dimensions of stage:	10 m x 7 m x height 10 m
Structure:	Steel structure

The take-in conveyor frame shall be of steel structure with a total length of approx. 140 m, and it shall be fixed on the bases of columns installed at intervals of 10 ~ 15 m.

The frame shall be equipped with a grating walkway so as to allow the checking and maintenance of the conveyors.

(4) Mechanical Equipment

Codes and Standards: All mechanical and electrical equipment shall conform to the following Japanese codes and standards.

Japanese Standards	
General	JIS
Material	JIS
Steel Structure	AIJ Design Standard for Steel Structures
Fumigation	The Plant Protection Law
Plainting	JIS
Electrical Equipment	JEC, JEM

JEC : Japan Electro-technicla Committee
JEM : Japan Electric Machine Industry Association

Unloaders: The equipment is a package type and shall be installed on the rails and unload grain from ocean vessels to feed to lateral conveyors.

o Capacity:	Unloader Max. 600 t/h
o Quantity:	2 sets
o Type:	Penumatic type
o Operation of boom:	Forward and backward, up and down and slewing movement are possible, allowing vessels to unload all grain in the hold without shifting
o Travelling:	Motor driven, self travelling
o Track rail gauge:	9 m
o Length of travelling rail:	Approx. 275 m
o 10 ton jib-crane:	1 set/unloader
• Hoisting speed:	6 m/min.
• Derrick speed:	6 m/min.
• Slewing speed:	0.2 r.p.m.
o Feeding chain conveyor to lateral conveyor:	1 set/unloader
• Capacity:	Max. 600 t/h
o Power supply method:	Cable reel
o Accessories:	Dust collector, Compressor, Interphone, Lighting fixture

Transfer Conveyors: The transfer conveyros shall consist of lateral conveyors, transfer conveyors and take-in conveyors.

o Lateral Conveyors

• Capacity:	: Max. 660 t/h
• Quantity:	: 2 sets
• Type:	: Belt conveyor (outdoor)
• Conveyor length:	: Approx. 295 m
• Operation control device:	: Slip detector, weaving detector, Chute detector, Head pulley bearing temperature detector
• Accessories:	: Take-up chamber

o Transfer Conveyors

• Capacity:	: Max. 660 t/h
• Quantity:	: 2 sets
• Type:	: Belt conveyor (outdoor)
• Conveyor length:	: Approx. 44 m
• Operation control:	: Slip detector, Weaving detector, Chute detector, Head pully bearing temperature detector
• Accessories:	: Take-up chamber, Dust collector

○ Take-in Conveyors

- Capacity: : Max. 660 t/h
- Quantity: : 2 sets
- Type: : Belt conveyor (outdoor)
- Conveyor length: : Approx. 140 m
- Operation control: : Slip detector, Weaving detector, Chute detector, Head pulley bearing temperature detector
- Accessories: : Take-up chamber, Dust collector

Take-in Conveying Equipment: The take-in conveying equipment shall be composed of bucket elevators, tanks, magnetic separators, net screen separators, automatic hopper scales, through chain conveyors, auto-samplers, spouts, slide gates and two-way cut-gates.

○ Bucket Elevators

- Capacity: Max. 660 t/h
- Quantity: 2 sets
- Operation control:device: Speed detector, Weaving detector, Head pulley bearing temperature detector
- Accessories: Vent for dust-explosion prevention, Inspection-drive equipment, Spout

○ Magnetic Separators

- Capacity: Max. 660 t/h
- Qantity: 2 sets
- Type: Rotary drum, permanent magnet type
- Accessories: Grain flow control equipment, Iron piece discharge discharge chute, Iron piece receiving box

○ Net Screen Separators

- Capacity : Max. 660 t/h
- Quantity : 2 sets
- Type : Net screen rotation type
- Accessories : Impurities discharge chute, Impurities tank

○ Auto-samples

- Quantity : 2 sets
- Type : Continuous type
- Accessories : Divider, Chute, Sample receiving box

○ Tanks

- Quantity : 2 sets on scale
  : 2 sets under scale
- Structure : Steel plate structure
- Operation control device : Level switch

o Automatic Hopper Scales

- Capacity : Max. 660 t/h
- Quantity : 2 sets
- Type : Load cell type automatic hopper scale with fixed quantity
- Accuracy : ±0.1%
- Operation : Automatic and manual operation
- Printer : To be installed in control room

o Trough Chain Conveyors

- Capacity : Max. 660 t/h
- Quantity : Phase 1 8 sets, Phase 2 3 sets (Additional)
- Operation control device : Chute detector
- Accessories : Vent for dust-explosion prevention, Slide gate, Spout

Take-out Conveying Equipment: The take-out conveying equipment is composed of trough chain conveyors, bucket elevators, tanks, automatic hopper scales, spouts, slide gates and two-way cut-gates.

o Trough Chain Conveyors

- Capacity : Max. 240 t/h, 25 t/h (for bagging)
- Quantity

	Phase 1	Phase 2
Take-out	8	4 (Additional)
Wagon loading	6	–
Bagging	5	3
Mill-plant	2	–
Recycler	1	–

Operation control device : Chute detector
- Accessories : Same as those of "Take-in"

o Bucket Elevators

- Capacity : Max. 240 t/h, 25 t/h (for bagging)
- Quantity

	Phase 1	Phase 2
Take-out	4	–
Bagging	5	3

- Operation control device: : Same as those of "Take-in"
- Accessories : Vent for dust-explosion prevention

o Tanks

- Quantity : Phase 1 ┬ 4 sets on scale
  ├ 4 sets under scale
  └ Wagon Loading – 9 sets
- Structure: : Steel structure
- Operation control device : Same as those of "Take-in"

○ Automatic Hopper Scales

• Capacity	:	Max. 24 t/h
• Quantity	:	Phase 1 4 sets
• Type	:	Same as those of "Take-in"
• Accuracy	:	
• Operation	:	
• Printer	:	

Gates:

○ Airtight Valves on Grain Inlet Nozzles of Bins

• Quantity	:	Phase 1 40 sets
	:	Phase 2 16 sets
• Type	:	Manually operated valve

○ Slide Gates

• Quantity :

Phase 1	Take-in	27 sets
	Take-out	20 sets
	Wagon Loading	27 sets
Phase 2	Take-in	8 sets

• Type : Motor driven

○ Two-way Cut-gates

• Quantity :

Phase 1	Take-in Take-out	20 sets 27 sets
Phase 2	Take-in Take-out	9 sets 8 sets

• Type : Motor driven

○ Silo Discharging Gates

• Quantity	:	Phase 1 50 sets
		Phase 2 16 sets
• Type	:	Motor driven slide gates
• Accessories	:	Manually operated airtight equipment, air-lock indicators

Spouts

○ Spouts shall be of either round or square type and they shall be of steel plate welded structure or made of commercially available pipes.

○ Each spout shall be of the same size as much as possible so that repair and replacement can be done safely and quickly.

○ If necessary, some spouts shall be provided with inspection windows.

Truck Loading Chutes:

○ The truck loading chutes shall be composed of expansion device a dust collecting hood, a bellows and a flow regulating nozzle, and expansion shall be carried out by remote operation.

- Capacity : Max. 240 t/h
- Quantity : Phase 1 4 sets
- Type : Motor-driven expansion chute

Stage, Walkways, Stairs, Steps:

○ Stages

Spacious stages strengthened with either checkered steel plates or expanded metal shall be provided at the bucket elevator head, the chain conveyor driving section, the tail section and also at such portions as necessary for operation and maintenance. In addition, hand rails shall be provided.

○ Walkways

High level walkways shall be made of checkered steel plates, whereas other walkways shall use expanded metal.

○ Stairs

Safe stairs shall be provided at convenient locations.

○ Steps

Steps (over GL, FL +2,300 mm) shall be provided in principle with protective frames.

Begging Equipment: The bagging equipment shall deliver grain from the silos to the storage tanks and permit continuous bagging operation irrespective of other take-out loading. Bagged grain shall be directly loaded onto a truck by means of a bag-chute.

The bagging equipment shall be composed of storage bins, automatic packer scales, sewing machines, bag conveyors, dust collecting equipment and bag chutes.

○ Storage Tanks

- Capacity : 25 tons
- Quantity : Phase 1 6 sets
  : Phase 2 3 sets
- Structure : Steel plate structure
- Operation control device : Level switch
- Accessories : Manholes on the roofs

○ Automatic Packer-scales

- Capacity : 25 t/h (50 ~ 80 kg/bag)
- Quantity : Phase 1 6 sets
  Phase 2 3 sets
- Type : Lever type high-speed packer-scales with fixed quantity
- Accuracy : ±0.2%

○ Sewing Machines

- Capacity : 500 bags/h
- Quantity : Phase 1 6 sets
  Phase 2 3 sets

- Conveyor feeding speed : 10 m/min.
- Seam width : 7 ~ 11 mm

o Bag Conveyors
- Capacity : Max. 30 t/h
- Quantity : Phase 1 6 sets
  Phase 2 3 sets
- Type : Portable belt conveyor type

Dust Colecting Equipment: The dust collecting equipment shall be provided with a self-sashing bag-filter having a good efficiency of collection, easier maintenance and low operation cost. Necessary heat treatment shall be provided for specified parts.

The dust collecting equipment shall be composed of fans, dust collectors, ducts, dampers and spouts.

1) Lines of Dust Collector

The dust collector is provided for the following 27 lines in Phase 1 and 3 lines in Phase 2.

Line	Installation Location	Number of Lines	
		Phase 1	Phase 2
Lateral Conveyors	Junction Stage "A"	2	–
Transfer Conveyors	Junction Stage "B"	2	–
Magnetic Separator, Net Screen Separator and Take-in Hopper Scale	Machinery Tower	2	–
Silo Feeding Conveyor		4	
Take-out Bucket Elevator and Hopper Scale	Machinery Tower	4	–
Truck-loading Chute	Wagon Loading House	4	–
Wagon Loading Conveyor		3	–
Bagging Hopper Scale	Bagging House	6	3

2) Main Equipment

o Dust Collectors
- Type : Bag filter type
- Dust removing : Automatic reverse air cleaning system
- Accessories : Rotary valve

o Fans
- Type : Turbo fan
- Volume : 250 ~ 350 mm Aq
- Accessories : Damper, vibration-proof duct

3) Disposal of Collected Dust

Dust collected shall be returned to a transfer system to eliminate the need for collection by 6 bag.

Compressed Air Equipment: This equipment is intended to supply air for the hopper scale air cylinders and auto-sampler air cylinders driving device and for removing dust from bag-filters, and drain pipes shall be provided at necessary locations.

The system is composed of an air compressor, dehumidifier, pressure switch, piping, valves, etc.

1) Installation Location

• Conveyor junction stage "B"	1 set
• Machinery tower	1 set
• Bagging house	2 sets

2) Air Compressor

• Type	: Reciprocating or screw type
• Suction pressure	: Atmospheric pressure
• Delivery pressure	: Max. 7 kg/cm^2
• Cooling method	: Air-cooled

Dust Cleaning Equipment: This equipment is intended to return such dust as collected by the dust collecting equipment to the dust tank.

1) Blowers

• Type	: Roots blower
• Pressure	: +150 mm Aq x –5,000 mm Aq
• Air volume	: 5 m^3/min
• Accessories	: Delivery silencer, Pressure gauge, Safety valve
• Quantity	: 2 sets

2) Dust Collector

• Type	: Self-washing bag filter, with rotary valve and power power control board
• Air volume to be treated	: 5 m^3/min
• Pressure resistance	: –5,500 mm Aq
• Quantity	: 2 sets

3) Auxiliary Equipment

o Hoses, etc.	: Nozzle hose, extension hose, suction pipe, floor brush and others
o Piping	: Diameter 65A, zinc coated steel pipes for general water supply purpose, couplings, others

Fumigation and Aeration Equipment: The fumigation equipment is of the gas fumigation type using a methyl bromide (CH_3Br) agent and shall conform to the Japanese Plant Quarantine Law.

With this equipment, methyl bromide in the cylinder is guided to a gas-vaporizer for evaporation after grain has been stored inside the silo. The vapor thus produced is then mixed with the blowing air and the specified amount of compressed vapor is fed into each silo for fumigation, uniformly dispersing the vapor in the grain layer.

Further, this equipment permits 4-unit simultaneous fumigation to be carried out using 4 blowers with regard to Phase 1 silo groups. Likewise, for the Phase 2 silo group is also possible of effect (2-unit simultaneous fumigation).

After completion of the foregoing fumigation, fresh air is fed in a compressed manner so that gases are quickly discharged into the atmosphere to eliminate any danger. In addition, a dust fumigation room shall be provided for the fumigation of hemp bags, dust, etc.

1) Main Equipment

The fumigation equipment shall be composed of the blowers, gas vaporizers, cyclones, valves, gas cocks, piping, etc.

o Blowers

• Capacity	:	80 m^3/min. x 2,200 mm Aq
• Quantity	:	Phase 1 4 sets Phase 2 2 sets
• Type	:	Turbo blower type
• Accessories	:	Bearing thermometer, Vibration-proof joints, Pressure measurement manometer

o Gas-vaporizers

• Capacity	:	120 liters (amount of water)
• Quantity	:	Phase 1 4 sets Phase 2 2 sets
• Type	:	Warm water type vaporizer
• Accessories	:	Heater, Thermostat, Water level gauge, Thermometer

2) Miscellaneous Equipment

The miscellaneous equipment includes such measuring instruments as necessary for fumigation operations; they include a gas detector, gas density measuring instruments, platform scales, insect detection devices, gas masks and gas absorption cans, emergency medicine, fumigation markings.

Miscellaneous Equipment: Miscellaneous equipment includes such apparatuses and tools necessary for the maintenance or repair of this terminal such as hoists, grain testing equipment, repairing tools, bulldozers for ship holds, sump pumps, etc.

o Hoists

• Installation location:	:	Machinery tower, Bagging House, Maintenance shop
• Capacity	:	1 ton or 3 ton
• Type	:	Powered hoist (Chain or wire type)
• Accessories	:	Pendant switch

- o Grain Testing Equipment
  - Installation location : Machinery tower
  - Equipment : Automatic moisture testers, thermometers, Laboratory grain scales, etc.
  - Quantity : 2 sets
- o Repairing Tools
  - Installation location : Maintenance shop or Instrument repair shop
  - Tools : Lathe, Welding equipment, Gas welding equipment equipment, Drilling machines, Grinders, Milling machine and others.

Bulldozers for Ship Holds

- Quantity : 4 sets (2 sets/unloader)
- Type : Komatsu D21 trimming dozer or equivalent

Sump Pumps

- Installation Location : Machinery tower
- Quantity : Phase 1 2 sets

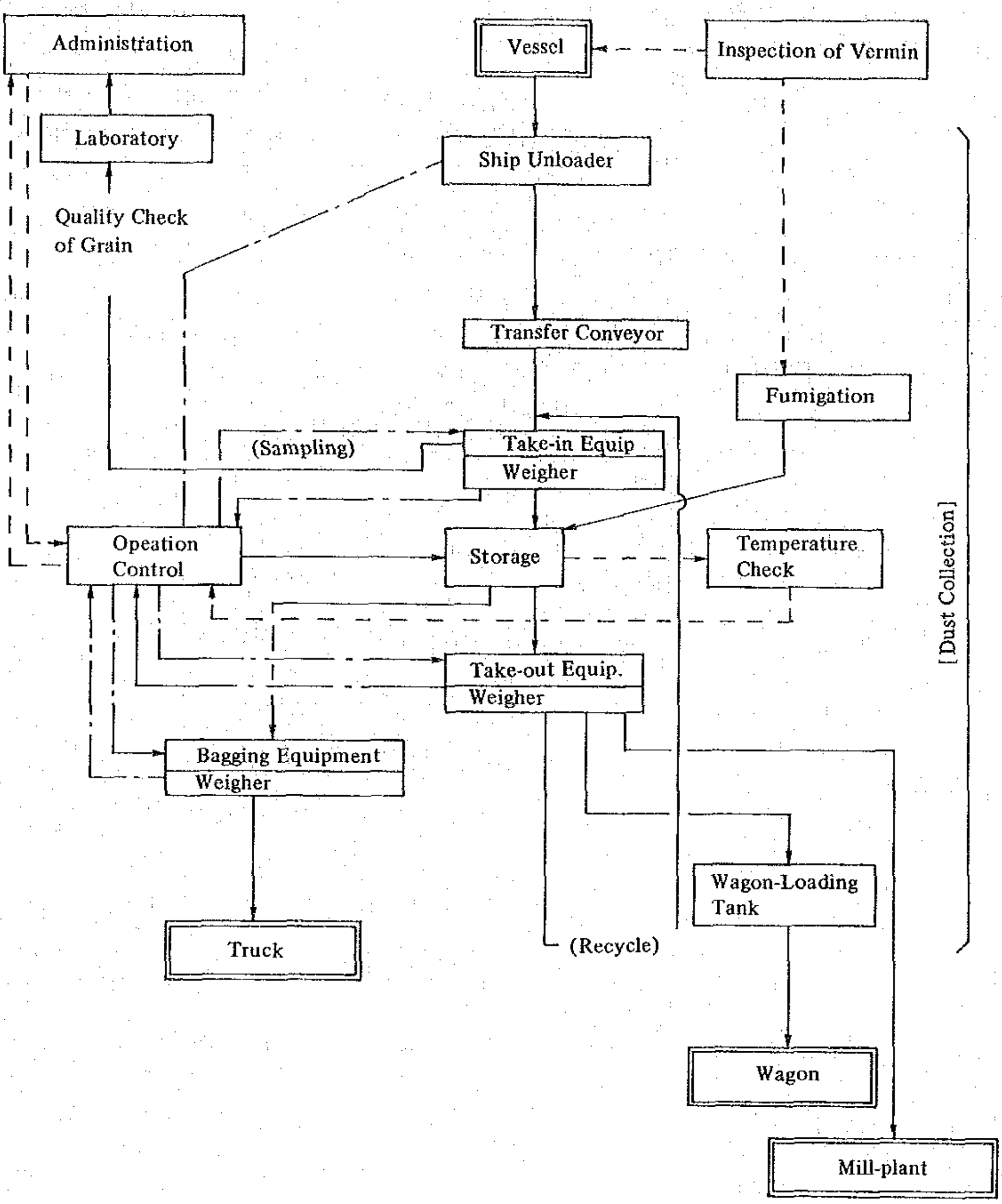
Water Piping

Water piping shall be linked to the fumigation machinery room, cooling tower, office, machinery tower, bagging house, workers' station and other areas as necessary.

(5) Operation

General: As is shown in Fig. 4.4.2, Flow Diagram: General, operations of this terminal will consist of operations at the main operation center in the control room and of the operations of unloading, fumigation, truck loading, and bagging in the sub-operation stations. Integrated operation control will be made in the control room.

Fig. 4.4.2 Flow Diagram: General

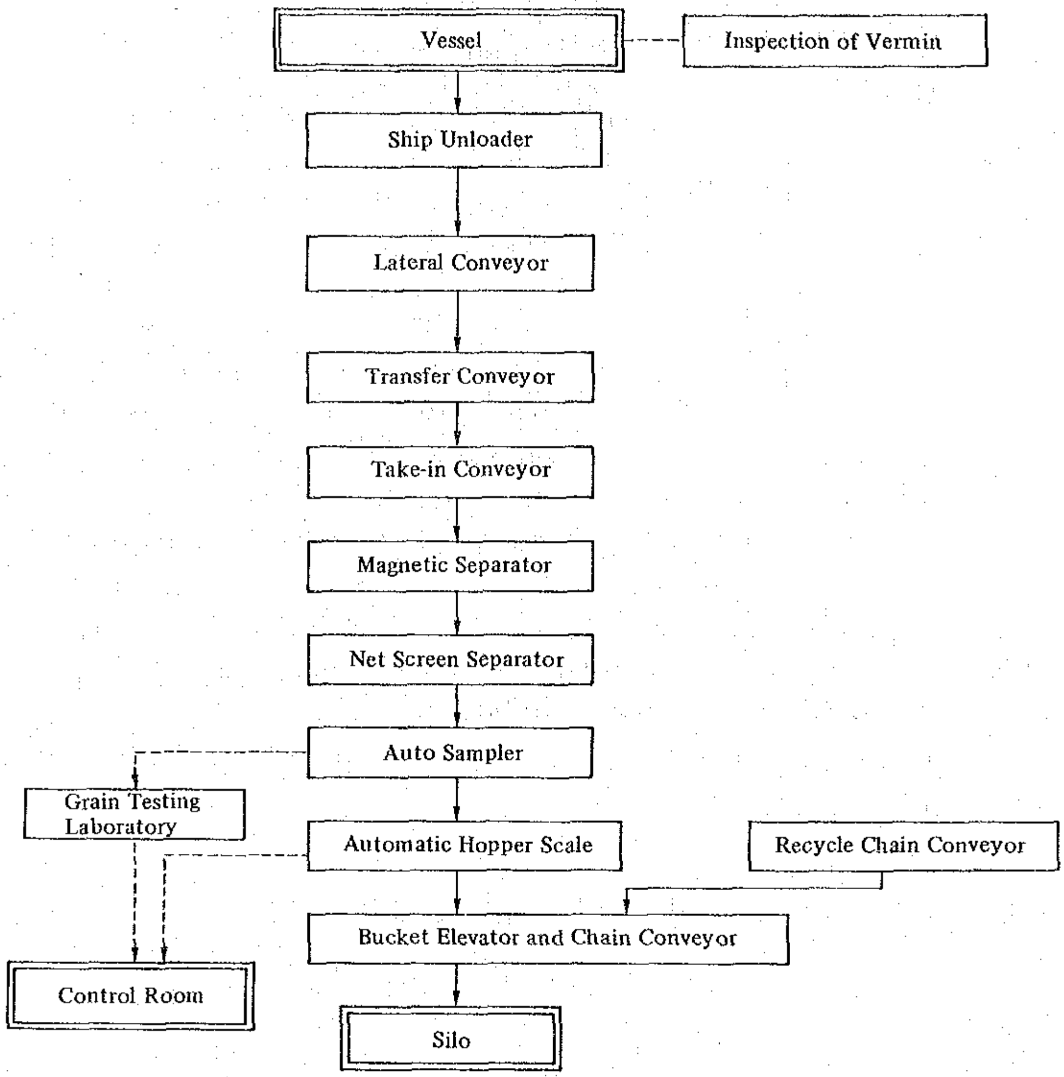


Taking-in Grain: As is shown in Fig. 4.4.3, Flow Diagram: Take-in, take-in work begins with the inspection of vermin by the Plant Quarantine Office immediately after an ocean vessel has come alongside the pier. If vermin are found in the grain, an order is issued to subject the grain to fumigation after it is brought into silos.

Grain, after being carried by the transfer conveyors, is weighed and separated magnetically. It is separated, sampled, and weighed in the machinery tower, and then stored in silos. The portion of grain sampled by the auto-samples is brought to the grain testing laboratory, where it is subjected to quality tests.

The unloaders are operated from the sub-operation room in the unloaders, but all the other equipment is operated from the control room. All measurement data taken by the weigher are transmitted electriclly to the control room, where they are output by printers for arrival and delivery control.

Fig. 4.4.3 Flow Diagram: Take-in



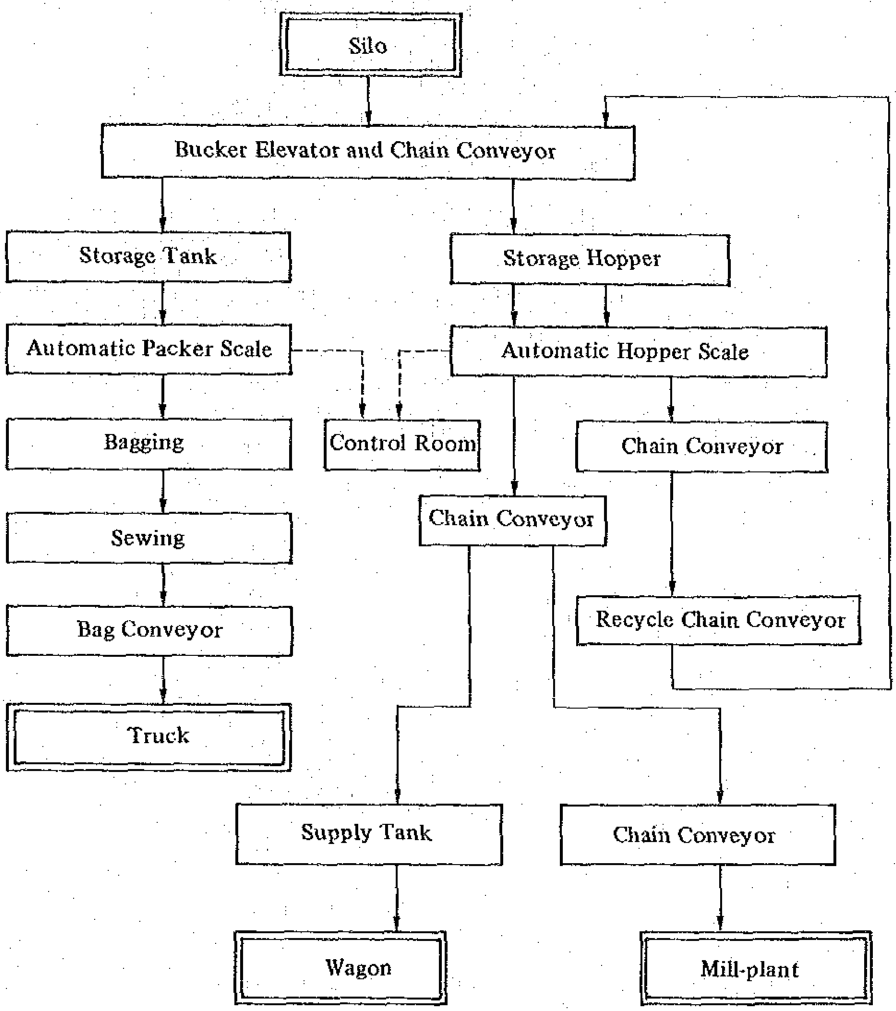
Taking-out Grain and Bagging: As is shown in Fig. 4.4.4, Flow Diagram: Take-out, two routes are available for taking out grain. One comprises discharging onto wagons in bulk form and the other comprises bagging and discharging onto trucks.

In the former case (delivery in bulk form), grain is thrown into the storage hopper on the take-out hopper scale by means of a silo reclaiming conveyor and bucket elevator (capacity max. 240 t/hr), weighed, and then loaded on to wagons. Since two storage hoppers are installed for each hopper scale, a maximum of two kinds of grain in each take-out line can be taken out without recycling to the silo. Recycling requires connection to the take-in conveyor by means of the recycling conveyor and throwing into the same or another silo.

In the second case (delivery in bags), grain is stored temporarily in a storage tank from the take-out system (capacity, max. 25 t/hr) by means of a chain conveyor, followed by continuous bagging by bagging equipment. The storage tank has a capacity of 25 tons which permits about one hour of storage. Grain is bagged in 50 – 80 kg-capacity hemp bags by six lines (Phase 1) and three lines (Phase 2) of bagging equipment (each line has a capacity of 25 t/hr) and then loaded directly onto trucks via a chute.

The bagging equipment is operated from the sub-operation panel in the bagging yard, but all the other equipment is operated from the control room. Bagging data are printed-out for arrival and delivery control.

Fig. 4.4.4 Flow Diagram: Take-out



Grain Storage in Silos: Grain stored in silos is subjected to two treatments: fumigation and aeration. Fumigation is made only in storage bins having grain for which a fumigation order is issued by the Plant Quarantine Office, Four lines of fumigation equipment are used for phase 1 and two lines for phase 2. Methyl-bromide gas is introduced uniformly into the silos kept in airtight conditions using gates, valves, and other devices, followed by sealing for 48 hours. After the fumigation effects are confirmed, the gas is purged with fresh air.

Aeration is carried out when the grain temperature becomes high. Fresh air is pressed into the bin from its bottom by using the fumigation equipment. When the grain temperature becomes abnormally high, grain is shifted to another silo bin for cooling using the recycling equipment.

Fumigation and aeration works are operated from the sub-operation panel.

(6) Electrical Equipment

Electrical Work:

1) Power Source

• Receiving circuit	AC 6.0 KV 50 Hz 3ϕ 4W
• Motor circuit (high voltage)	AC 3.0 KV 50 Hz 3ϕ 3W
• Motor circuit (low voltage)	AC 380 V 50 Hz 3ϕ 3W
• Motor circuit (gate)	AC 200V 50 Hz 3ϕ 3W
• Control circuit	AC 200 V 50 Hz 3ϕ 2W
	DC 24 V or necessary
• Lighting circuit	AC 380/200 V 50 Hz 3ϕ 4W

2) Substation

o General

- Electric power will be supplied by the use of a service system with one line.
- Power will be led in by means of aerial wire cables placed on a lead-in pole provided in the site. An interrupt switch (I.S.: load breaker type) will be installed on the lead-in pole so that it may serve as a service entrance switching station.
- The primary side of this I.S. will be considered as a receiving point.
- The substation will consist of the following systems.

1 Service entrance switching station
2 Incoming panel
3 High voltage switchgear panel
4 Static condenser panel
5 Transformer
6 Power display panel

o Service Entrace Switching Station

- Component Equipment
  1 Lead-in pole
  2 Interrupt Switch : Triple pole double throw, load breaker type

o Incoming Panel

- Panel type : Indoor, Metal clad, Dust-proof & Free standing type
- Main Equipment
  1 D.S. (main) : Triple pole single throw
  2 D.S. (for L.A.) : Triple pole single throw
  3 C.B. : V.C.B. (vacuum circuit breaker)
  4 L.A.
  5 M.O.F. : Furnished by electric power company
  6 Instrumentation
     V meter
     A meter
     F meter
  7 Protective Relay
     51 (JEC) (Overcurrent Relay)
     67 (Directional Ground Relay)
     27 (Under Voltage Relay)
     64 (Over Voltage Ground Relay)
     87 (Differential Relay)
  8 Meter Transformer
     CT
     GPT

o High Voltage Switchgear Panel

Main Switch Panel : 1 set 1 set

- Panel type : Indoor, metal clad, dust-proof & free standing type
- Main Equipment
  1 C.B. : VCB
  2 Protective Relay
     51
     27
     59
     64
  3 Instrumentation
     V meter
     A meter
     Vo meter

4 Meter Transformer
   PT
   CT
   GPT

o Distribution Panel : 1 set 1 set

- Panel type : Indoor, metal clad, dust-proof & free standing type

- Main equipment for each unit
  1 CB : VCB
  2 Protective relay
     51
     67
  3 Instrumentation
     A meter
  4 Meter Transformer
     CT
     ZCT

o Static Condenser Panel (for Power Factor Improvement) 1 set

- Panel type : Indoor, metal-clad, dust-proof free standing type

- Main equipment for each unit
  1 Combination unit : H.M.C. + PF
  2 S.C. : 3ϕ 600 KVA
     3ϕ 400 KVA
     3ϕ 200 KVA
  3 S.R. : 36 KVA
     24 KVA
     12 KVA
     6 KVA

o Transformer

- Main Transformer 1
  1 Type : Epoxy resin molded forced air cooled type
  2 Ratio : KV/3. KV
  3 Protective Relay
     26 (Temperature relay)
     96 (Fault localization relay)

- Power Transformer 1
  1 Type : Epoxy resin molded self cooled type
  2 Ratio : 3. KV/ V

- Lighting Power Transformer 1
  1 Type : Epoxy resin molded self cooled type
  2 Ratio : 3.0 KV/380 – 200V
- Miscellaneous Power Transformer 1
  1 Type : Epoxy resin molded self cooled type
  2 Ratio : 3.0 KV/200 V

o Power Supervisory Panel 1 set

- Panel type : Indoor, metal-clad, dust-proof free standing type
- Main Equipment

For Supervision
  1 Single line graphic
  2 Instrumentation
     V, A, W, WH, PF, Vo

For Operation
  1 Control switch (on-off of C.B.)

3) Medium Voltage Station Service

o General

- The medium voltage station service will consist of the following equipment:
  1 Combination starter panel
- All motor protection will be based on 3E relay
- Motors will be started by the direct on-line method

o Combination Starter Panel

- Panel type : Indoor, metal clad, dust-proof free standing type
- Unit type : Draw-out type
- Main equipment for each unit
  1 P.F.
  2 HMC
  3 C.T.
  4 A meter
  5 3E relay

4) Low Voltage Station Services

o General

- All motors will be protected by thermal overload relays.
- MCBs with auxiliary contacts will be used for the branch circuits for interlocking. Their interrupting capacities will be large enough to enable cascade scheme applications.
- The low voltage station service will consist of the following panel:
  1 Load center

2 Motor control center

3 Gate control panel

○ Load Center

Motor load 1 set

- Panel type : Indoor, metal clad, dust-proof free standing type
- Main equipment

1 ELB

Lighting Load 1 set

- Panel type : Indoor, metal clad, dust-proof free standing type
- Main equipment

1 ELB

2 Instrumentation

V meter

A meter

Miscellaneous Load

- Panel type : Indoor, metal clad, dust-proof free standing type
- Main equipment

1 Instrumentation

V meter

A meter

○ Motor Control Center 1 set

- Panel type : Multi-tier type
- Each unit will consist of the following equipment :

1 M.C.B.

2 M.C.

3 TH RY

4 Aux. control relay

- Secondary Connection will be used for connector form
- Each unit will be draw-out type

○ Gate Control Panel 1 set

For Silo Upper

- Panel type : Indoor, metal-clad, dust-proof free standing type
- Main equipment

Face

1 PB (Push button switch)

2 COS (Changeover switch)

Inside

1 MCB
2 MC (Reversible type)
3 TH RY
4 Aux. control relay

For Silo Bottom

- Panel type : Indoor, metal-clad, dust-proof free standing type
- Main equipment

Face

1 PB
2 COS

Inside

1 MCB
2 MC (Reversible type)
3 TH RY
4 Aux. control relay

For Machinery Tower

- Panel type : Indoor, metal-clad, dust-proof free standing type
- Main equipment

Face

1 PB
2 COS

Inside

1 MCB
2 MC (Reversible type)
3 TH RY
4 Aux. control relay

5) Motors

Motors are equipped for various equipment such as ship unloaders, conveyors, bucket elevators, blowers, fans, etc.

o The motors are totally enclosed with cooling fans and are of the three (3) phase induction motor squirrel cage rotor type.

o The insulation is of class B for low voltage and class for high voltage.

o The applied voltage of motors is as follows:

90 KW and larger : 3,000 volts
Smaller than 90 KW : 380 volts

6) Communication System

o Private Telephone Equipment

This equipment consists of the following items.

- 30 handsets (the ones installed in places subjected to dust will be placed in dustproof boxes.)

Locations:	:	Silo top	3 positions
		Silo bottom	6 positions
		Wagon loading house	2 positions
		Bagging house	4 positions
		Control room	1 position
		Office	3 positions
		Power receiving house	1 position
		Machinery tower	3 positions
		By the side of lateral conveyor	1 position
		Maintenance shop	1 position
		Guard house	1 position
		Workers' station	1 position/each
		Transfer conveyor	2 positions

- Private automatic branch-exchange (32 lines) — 1 set

o Interphone Equipment

- Intercommunication system — 3 handsets

Location	:	Ship unloader	2 positions
		Operator room	1 position

o Speaker Equipment

This equipment consists of the following.

- 12 speakers (5W)

Location	:	Silo top	3 positions
		Silo bottom	2 positions
		Wagon loading house	2 positions
		Bagging house	2 positions
		Machinery tower	1 position
		By the side of lateral conveyor	1 position
		Workers' station	1 position/each

- 1 Amplifier Unit

  Type : 120W, 12 lines

- 1 Microphone

7) Lighting Equipment

The lighting equipment listed below will be installed.

o Common Lighting

Location	Type	Illumination or number
Office	Fluorescent lamp	500 LX
Control room	〃	300 〃
Power receiving house	〃	150 〃
Guard house	〃	150 〃
Ship unloader	Dust proof fluorescent lamp	75 〃
Maintenance shop	〃	75 〃
Bagging house	〃	75 〃
Machinery tower	〃	75 〃
Workers' station	〃	75 〃
Silo bottom	〃	400W-2/2/BIN
Silo top	Mercury-vapor lamp & Dust proof fluorescent lamp	75 LX
Wagon loading house	〃	75 〃
By the side of guard house	Mercur-vapor lamp	300W x 1
Transfer conveyor		200W x 1/5 m

o Emergency lighting 1 set

Equipment to meet the Buildings Standards Act will be supplied.

o Training lighting

Equipment to meet the Fire Services Act will be supplied.

8) Wiring

o General

- Underground wiring using 6.0 KV CV cables will be provided from the receiving point to the incoming panel.
- Cable racks will be used for the main route, and rigid metallic conduits for the branch routes.
- Connections to the electric machinery and apparatus will be made using flexible tubes.
- The following cables will be used:

High voltage power circuit;			
	3 KV CV cable	:	14 sq or more
Low voltage power circuit;			
	600 V CV cable	:	2 sq or more
Control circuit;	600 V CVV cable	:	1.25 sq or more
or	600 V CVVS cable	:	1.25 sq or more

9) Miscellaneous Equipment

o Receptacles

Location :	Silo top	2 positions
	Silo tottom	2
	Bagging house	2
	Machinery tower	2
	Wagon loading house	1 position
	Maintenance shop	2 positions

o Covered receptacles will be used in places subjected to dust

Covered receptacles will be used in places subjected to dust.

o Lighting protection

A system conforming to JIS will be supplied. Down conductors will be bonded to the steel frame of the silo building or silo body and the silo body will function as a down conductor.

- Lightning rod: 1 set
- The protection angle will be within 60°
- 16 testing terminal boxes
- 16 earth rods

Earth resistance per position will not be more than 10Ω.

(7) Instrumentation

The control systems for this project will consist of supervisory panels, temperature measuring systems, scale systems, ITV systems, etc. The control desk, graphic panel with ITV monitor, scale panel, etc. will be installed at the central control room.

Control Desk and Supervisory Panel: Modular, solid state/digital design will be used in the construction of freestanding, self-supporting control and supervisory panels. Panels will be one hundred percent (100%) electrical/electronic in design with a graphic panel. Front face supervisory devices will be flush-mounted where practical.

Supervisory panel organization will be such that the graphic panel with ITV monitor, scale panel, panel for extrahigh voltage, etc. will have separate, isolated packages so that malfunctions of one do not affect the others.

o Design Basis

- Control desk

  The following equipment will be installed at the desk area.

  – Control switches and indicating lamps

- Graphic panel

  The following devices will be mounted on the panel.

- Acryl mosaic graphic
- Ammeters
- Annunciator lamps
- Indicating lamps
- ITV monitors
- Grain temperature monitors

• Scale panel

The following devices will be included in the panel.

LED indicators

- Counters
- Control switches
- Indicating lamps
- Printers

• Supervisory panel for extrahigh voltage

The following devices will be mounted on the panel.

- Ammeter
- Voltmeter
- Watt meter
- Powerfactor meter
- Frequency meter
- Control SW
- Graphic drawing

Temperature Supervisory System: The temperature measuring system will be divided into two (2) areas. The main area will be grain temperature and the secondary area will be conveyor bearings. These measurements will be taken in order to store high quality grains and to protect the facilities from explosions which would otherwise occur unexpectedly.

o Design Basis

• Grain temperature

The measurement of grain temperature will be executed by resistance temperature detectors (RTD). Three (3) points per silo bin will be measured. The system will consist of remote scanner units, temperature monitor controllers, etc.

• Bearing temperature

Conveyor bearing temperature will be measured. The detectors will be resistance temperature detectors (RTD) and the temperature signals will be interlocked to protect facilities from overheating and explosion. The temperatures will be measured on the following facilities:

- Belt conveyors
- Bucket elevators

ITV System: A closed circuit television system (CCTV) will be provided to supervise the plant more safely and effectively.

o Design Basis

The ITV system will be installed at the unloader area and the wagon loading house.

The system will consist of cameras with zoom lenses, monitors, an operator console, accessories for mounting, etc.

Scale System: High accuracy hopper scales will be used for the grain loading and unloading. Four (4) load cells per service tank will be installed.

o Design Basis

The following equipment will be installed on the scale monitoring panel.

- Control units with LED indicators
- Counters
- Switches
- Lamps
- Printers

o Equipment

- Automatic hopper scales

Charging gate	:	Automatic cut gate
Weighing hopper	:	Steel made hopper
Discharging gate	:	Automatic cut gate
Weighing type	:	Load cell type
Accessories	:	Automatic self control panel, Testing weight

- Automatic packer scales

Charging gate	:	Automatic cut gate
Weighing hopper	:	Steel made hopper
Discharge	:	Automatic cut gate
Weighing type	:	Lever or load cell type
Accessories	:	Automatic self control panel, Bagging counter

Local Instruments: Local instrumentation for safe operations and supervision will be provided.

Protective devices such as slip detectors, weaving detectors, chute detectors, speed detectors, etc. will be mounted at the following facilities.

- Belt conveyors
- Chain conveyors
- Bucket elevators

Pressure switches, pressure gauges, temperature gauges, level indicators, etc. will be included.

(8) Control System

Take-in Wagon and Truck Loading Operation System:

1) Take-in Operation

- o The take-in route and silo bins are set by the control desk and displayed on the graphic panel for unloading and loading. Programming for up to 5 silos is possible. Displays of empty bin Nos. and bin Nos. grouped by kind of grain are made to assist the programming.
- o Pushing the starting pushbutton on the desk causes operation of the equipment in the following order. Timing for start-up in this order is taken by a timer. (It is assumed that the main air compressor has already been started manually.)
  - • Operation of the gate above the silo and of the gate on the line.
  - • Start-up of the conveyor and bucket elevator in set order and timing from the silo feeding conveyor. Start-up of the dust collector interlocked with suitable conveyors.
- o After the tack-in amount is set, the hopper scale stops immediately when the take-in amount reaches the set value or when the silo's level switch operates. After a certain period of time has passed operation is resumed with switchover to the next reserved bin. If there is no next reservation, the conveyor continues with the operation while the hopper scale is stopped. Thereafter, the conveyor stops when the level switch of the tank above the hopper scale actuates.

2) Wagon and Truck Loading Operation

- o Orders for shipment are made by telephone in advance, or hand carried by truck driver. Details of reservation and the number of wagons or truck loading storage tanks to be unloaded are keyed in via the control desk and displayed on the graphic panel.
- o The operator turns on the switch over the delivery port and starts the equipment in the following order. (It is assumed that the main air compressor has already been started manually.)
  - • Start-up of the conveyor in set order and timing from the delivery port side (downstream side). Start-up of the dust collector interlocked with suitable conveyors.
  - • Hopper scale is the operated.
- o When the take-out amount reaches a set value, the hopper scale stops and the conveyor stops after a certain period of time.

Bagging Control System:

- o As preparatory work for bagging, the amount of grain to be bagged stored in the storage tank is checked by the level indication lamp on the graphic panel. After that the bagging equipment is started.
- o After completion of weighing with a packer scale, a fixed amount of grain is put automatically into a hemp bag when it is completely clamped at the mouth and an interlock release signal is issued.
- o The bag is unclamped and rides on the bag conveyor after a scale signal to notify completion of the packing of grain into the bag is issued.
- o Bags are carried by the bag conveyor to the sewing machine. Their mouths are set to the sewing machine manually, sewn at the same speed as the conveyor, and then the threads are cut automatically.
- o Full bags are tilted down by an arm and carried to the truck loading chute.

Fumigation Control System:

- o The fumigation control system is simple and independent of the other systems.
- o As preparatory work for fumigation, the gates, manholes, and other openings on the top and bottom of the silo bin are sealed, the valves of the bin piping to be fumigated are opened, and thus a circulation loop is formed. This work is carried out by manual operation.
- o The vaporizer has a thermostat. The temperature of the vaporizer is checked with the fumigation control panel having a display lamp connected to the thermostat.
- o The blower is started after signals to show closed conditions of the airtight gates and valves on the top and bottom of the silo are confirmed.
- o After the introduction of gas into the cin is completed, the valves in the top and bottom of the bin are closed and 48 hours later the gas remaining in the silo is purged with fresh air to complete fumigation.

Grain Temperature Supervisory System:

- o A cable-type sensor having three detection points at the top, middle, and bottom is hung from the top of each silo to detect the grain temperature.
- o Signals of the sensor are input to a remote scanner panel installed on the top of silo and then transmitted from it to the central control and display unit by scanning.
- o Digital display of the grain temperature is made on the central control and display unit by setting the tag no. of the sensor in question through the key switch.

Fig. 4.4.5 Flow Chart of Grain

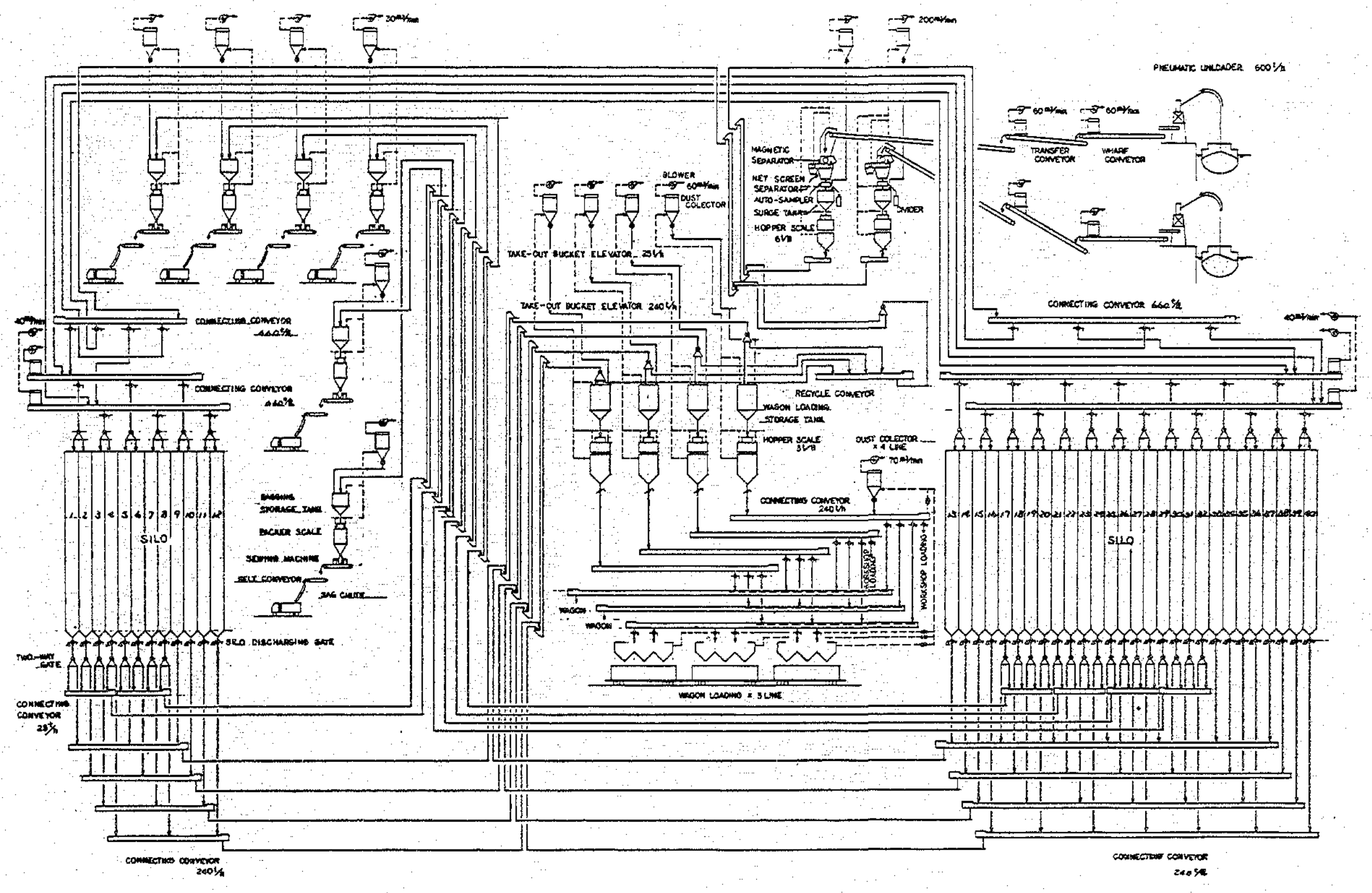
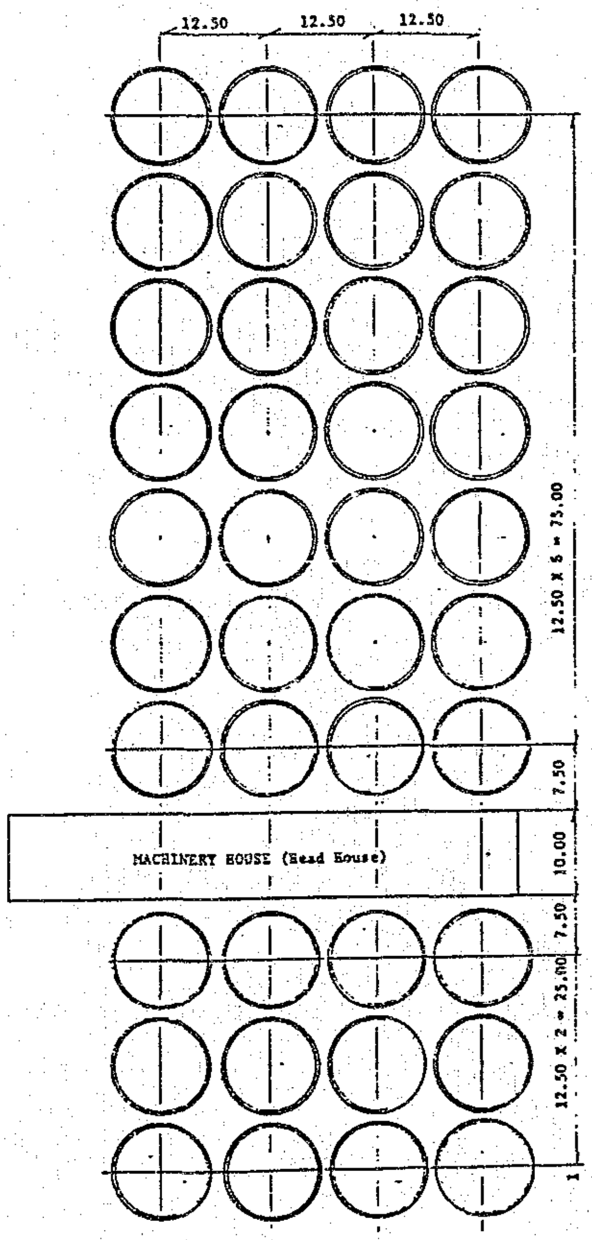


Fig. 4.4.6 Layout of R.C Grain Silo



Chain Conveyor on Ceiling

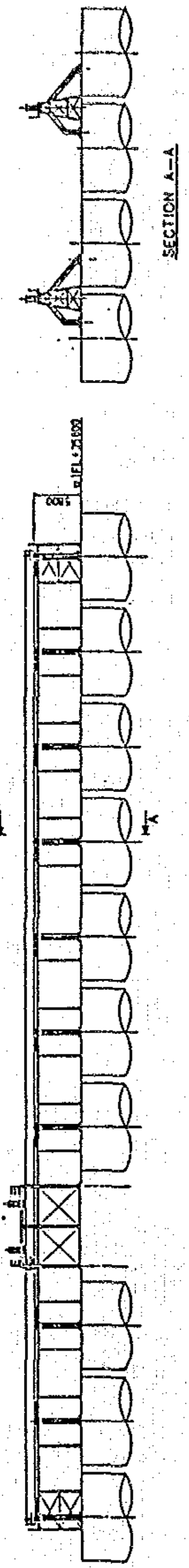
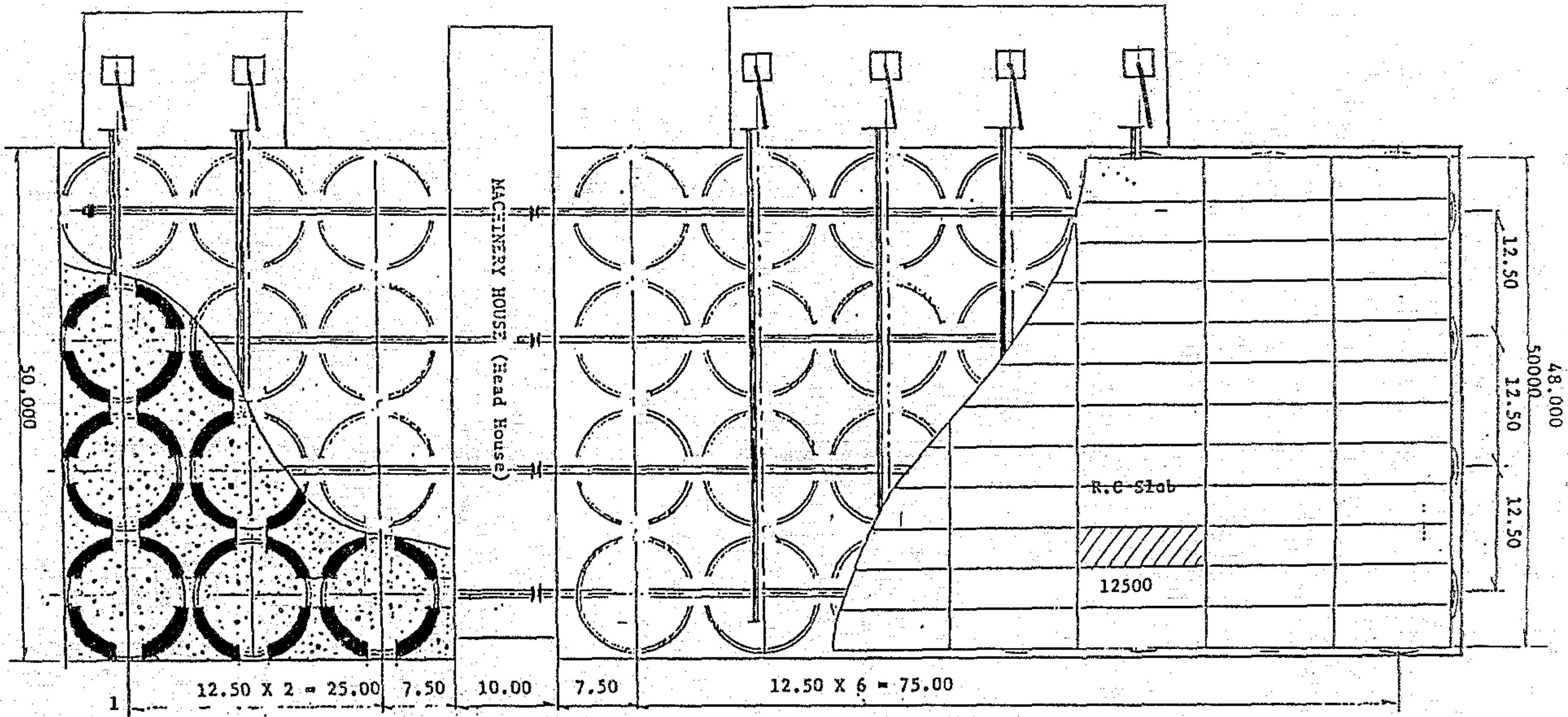


Fig. 4.4.7 Structure Plan of R.C. Grain Silo

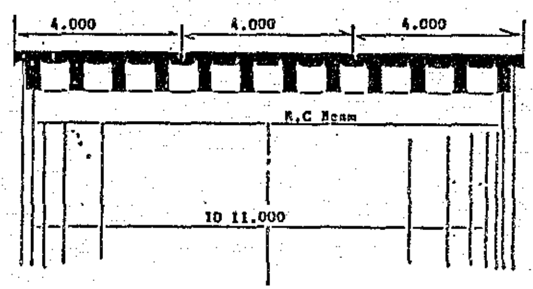


Structure Plan of R.C Grain Silo

View of Floor

Take out Chain conveyor

Ceiling



Concreted Pavement

Pile Foundation

Fig. 4.4.8 R.C Grain Silo Bin

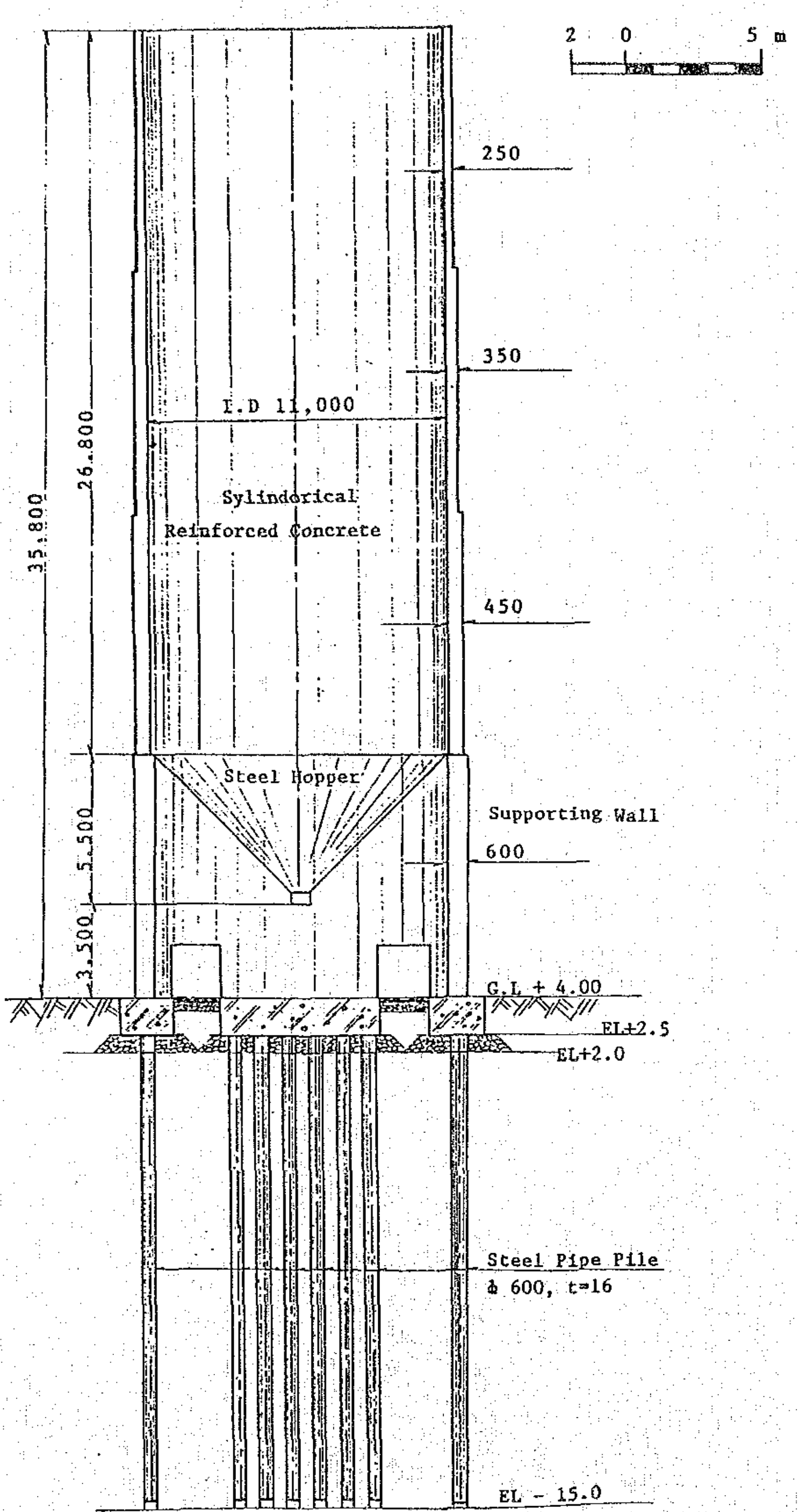
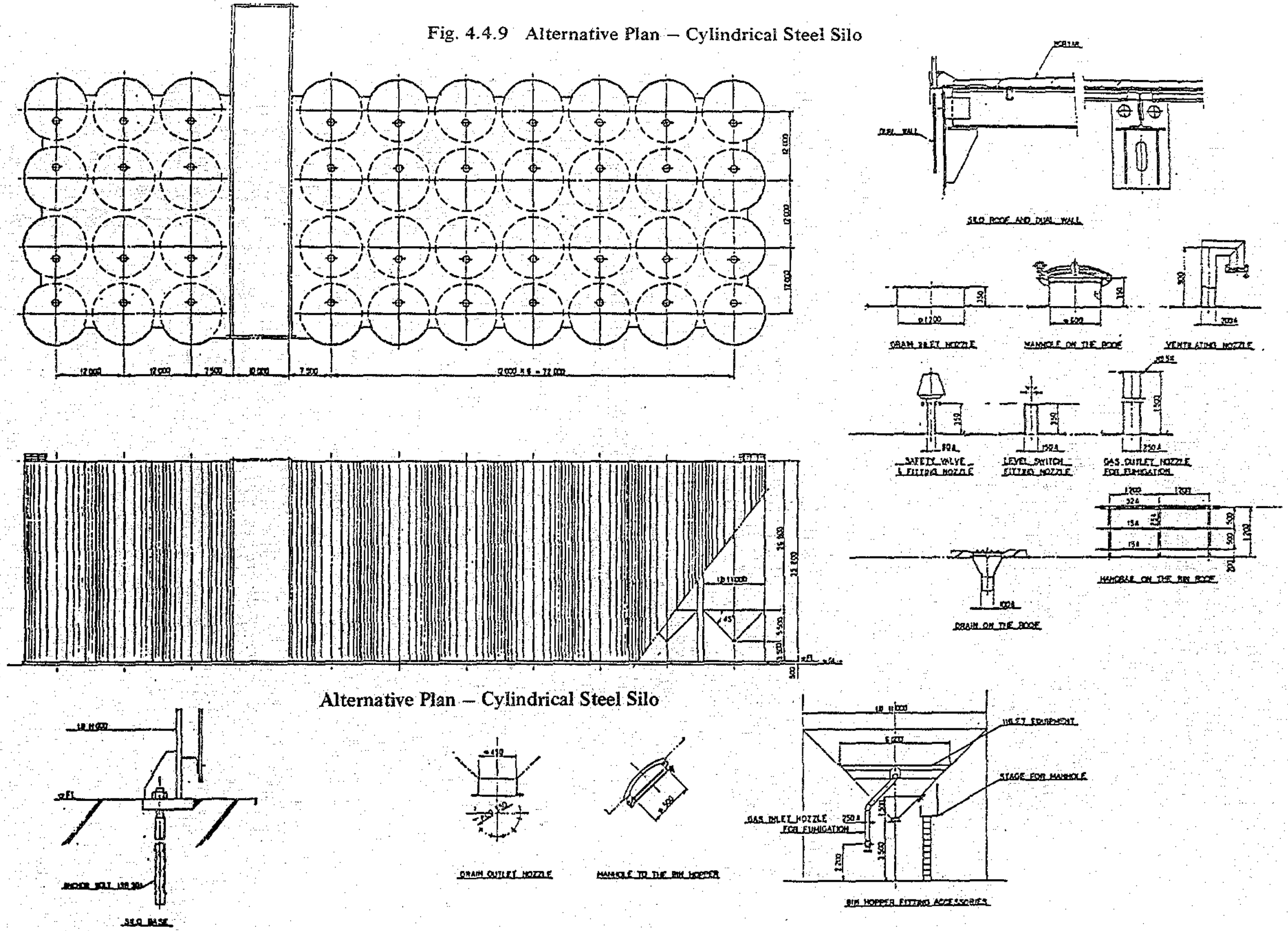


Fig. 4.4.9 Alternative Plan – Cylindrical Steel Silo



Alternative Plan – Cylindrical Steel Silo

Fig. 4.4.10 Machinery Tower View of Each Floor

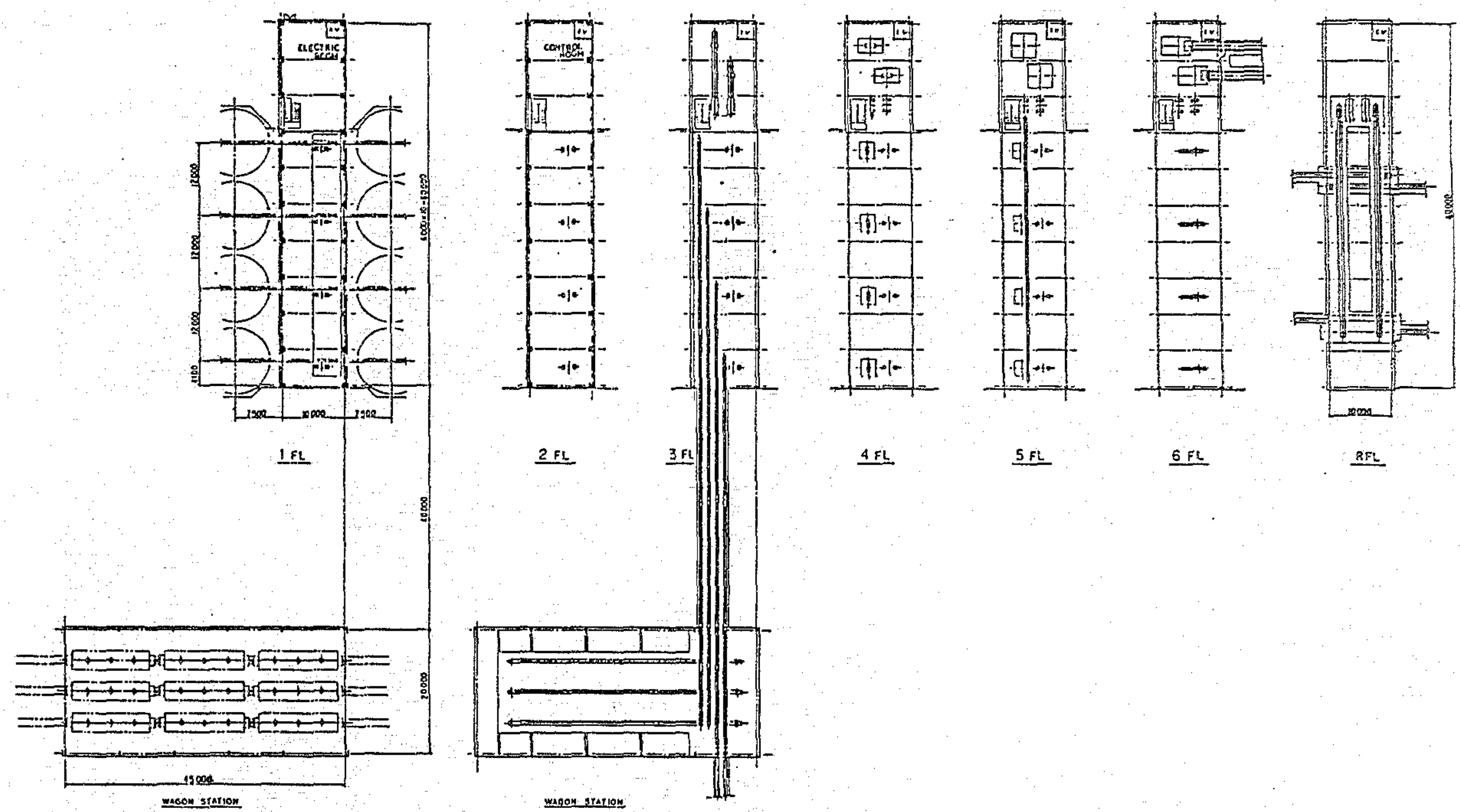


Fig. 4.4.11 Fumigation System

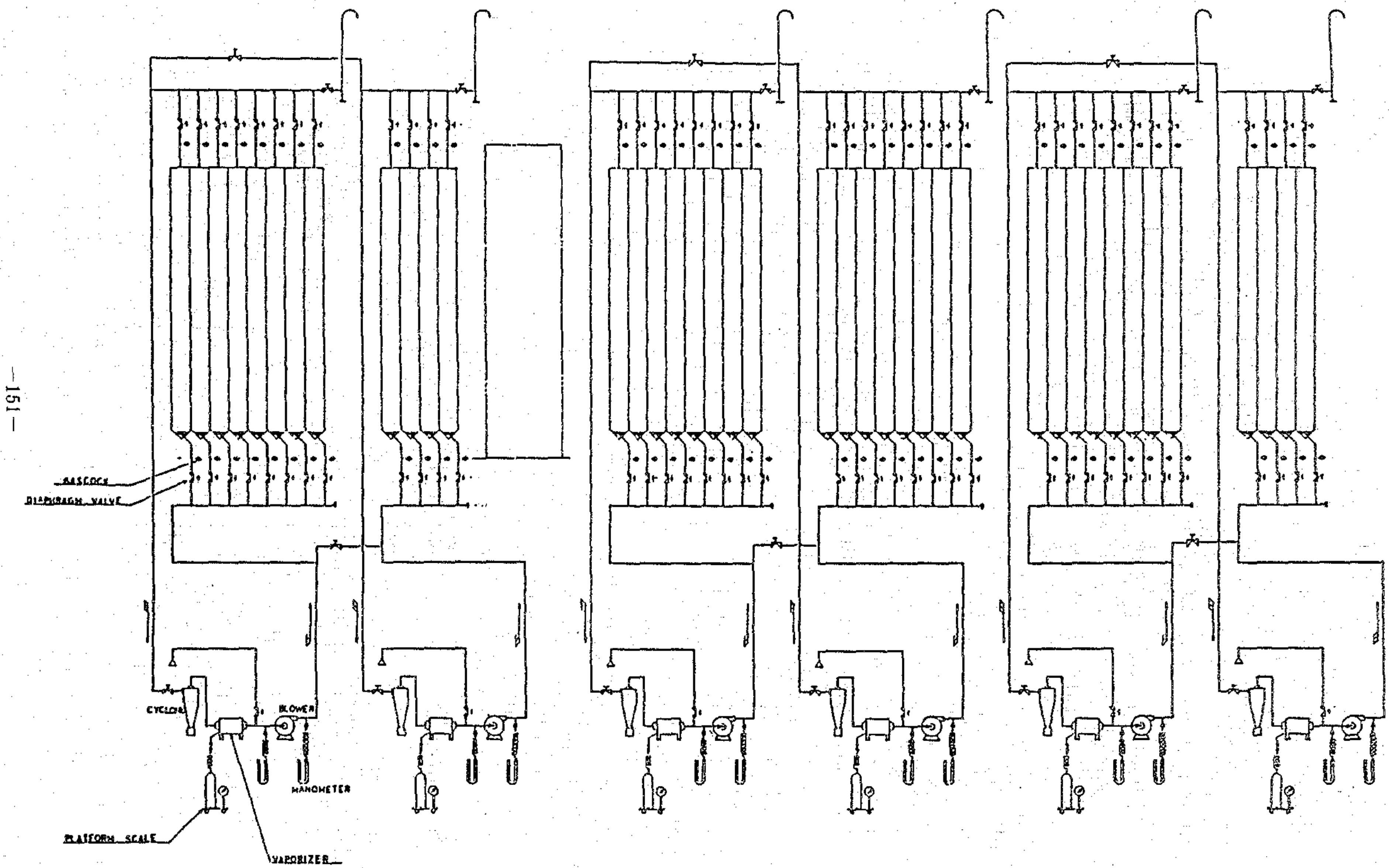


Fig. 4.4.12 Sketch of Dust Collection System

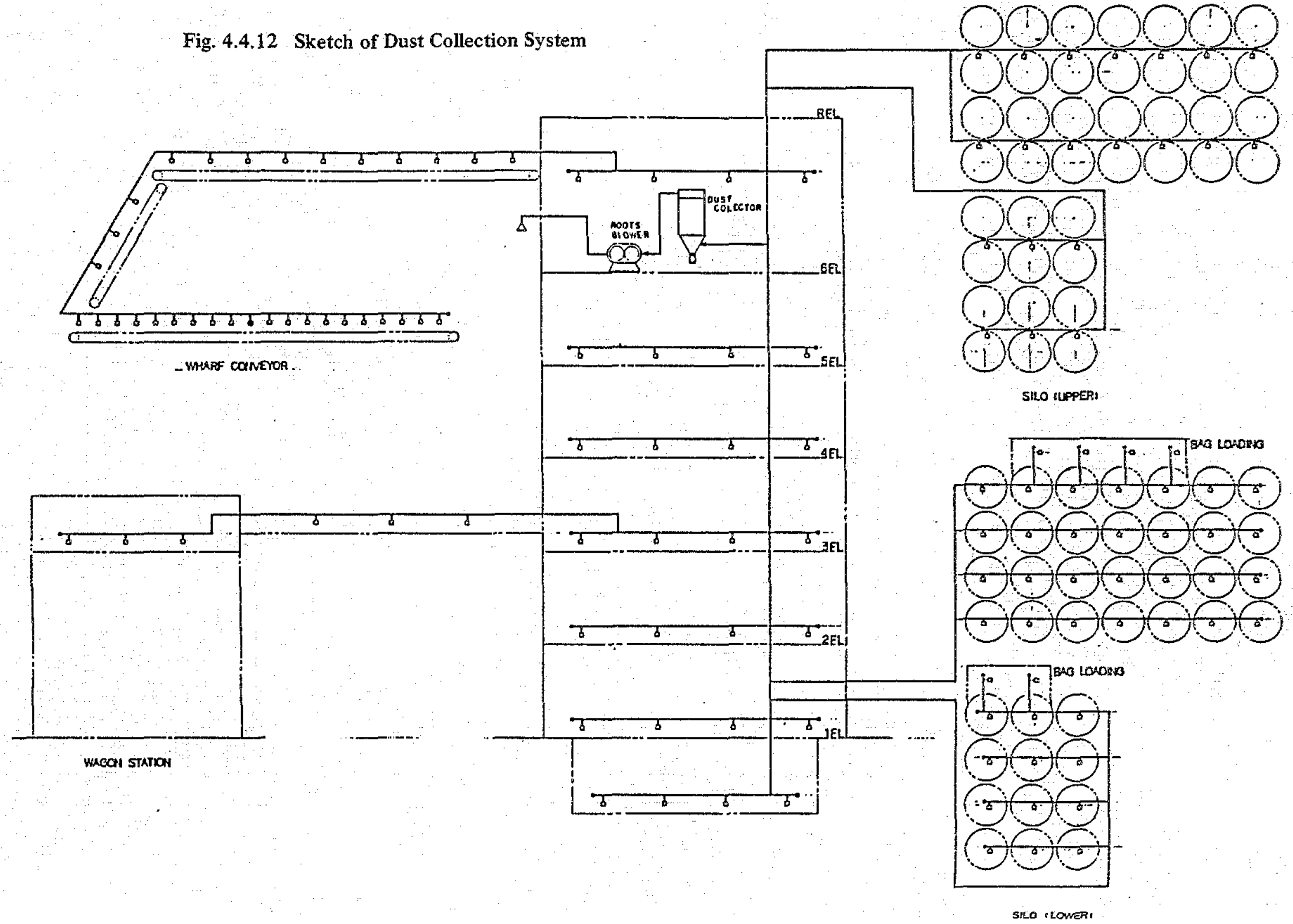


Fig. 4.4.13 Dust Collection System

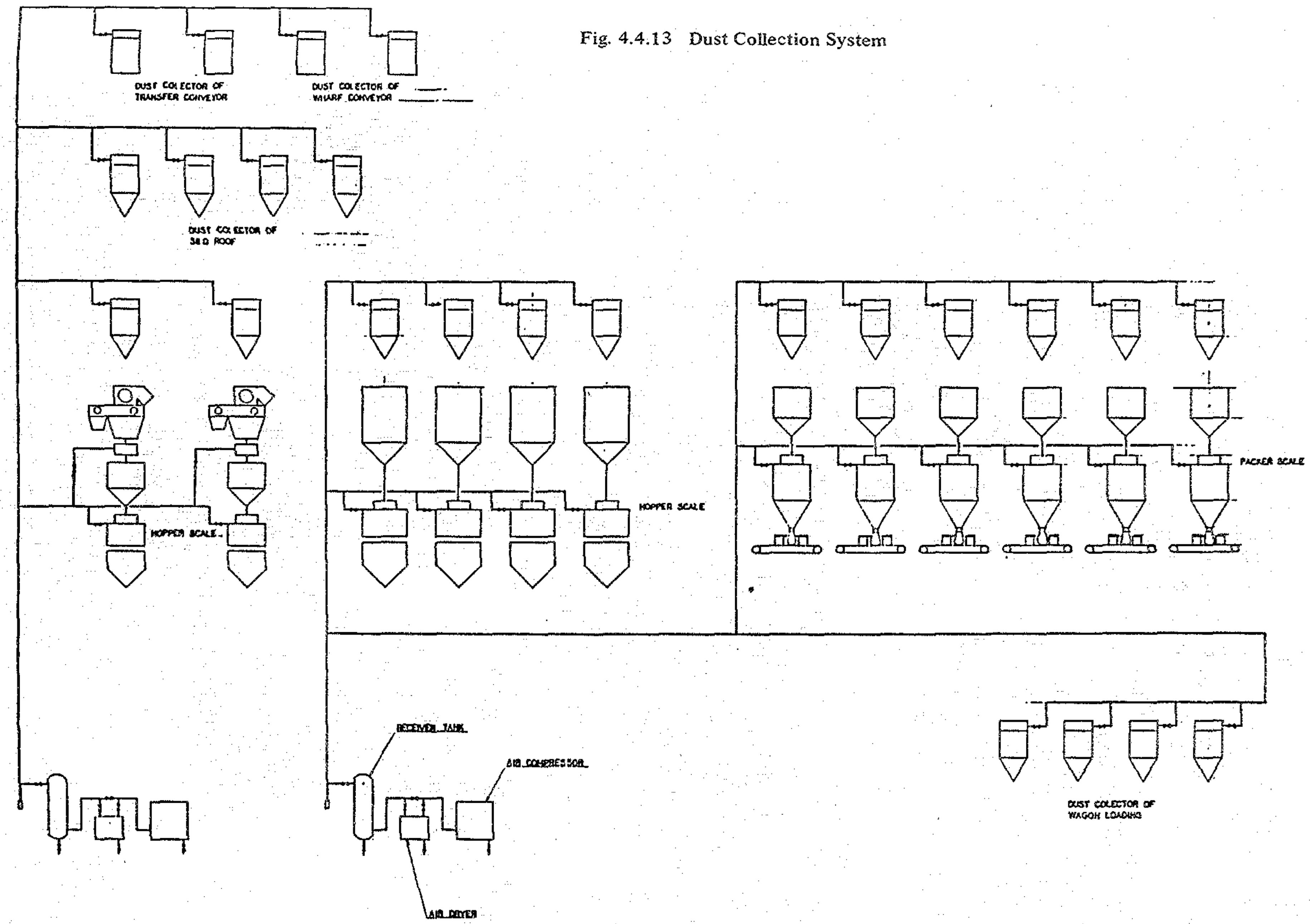


Fig. 4.4.14 Sketch of Pneumatic Unloader

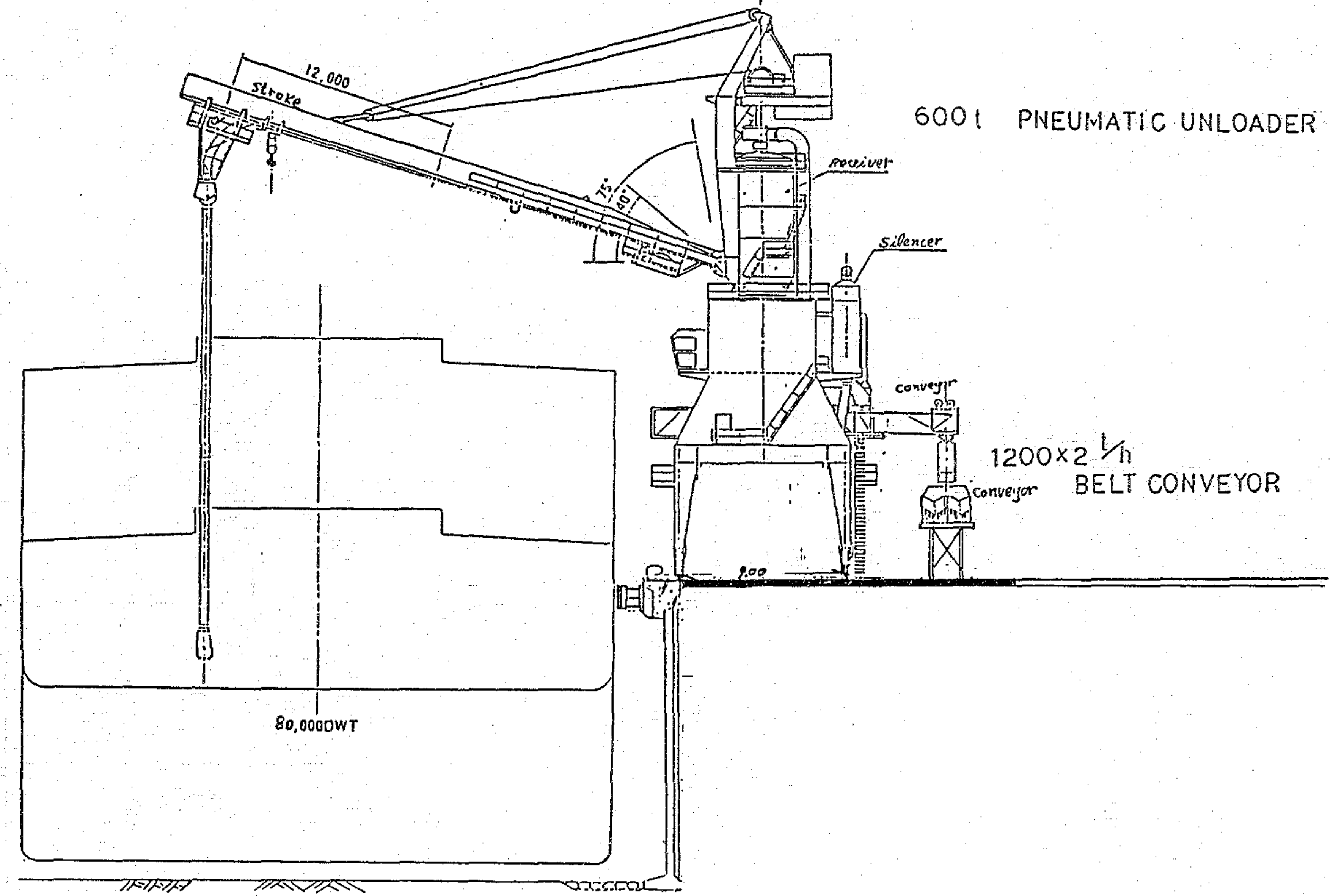


Fig. 4.4.15 Belt Conveyor from Berth to Machinery Tower

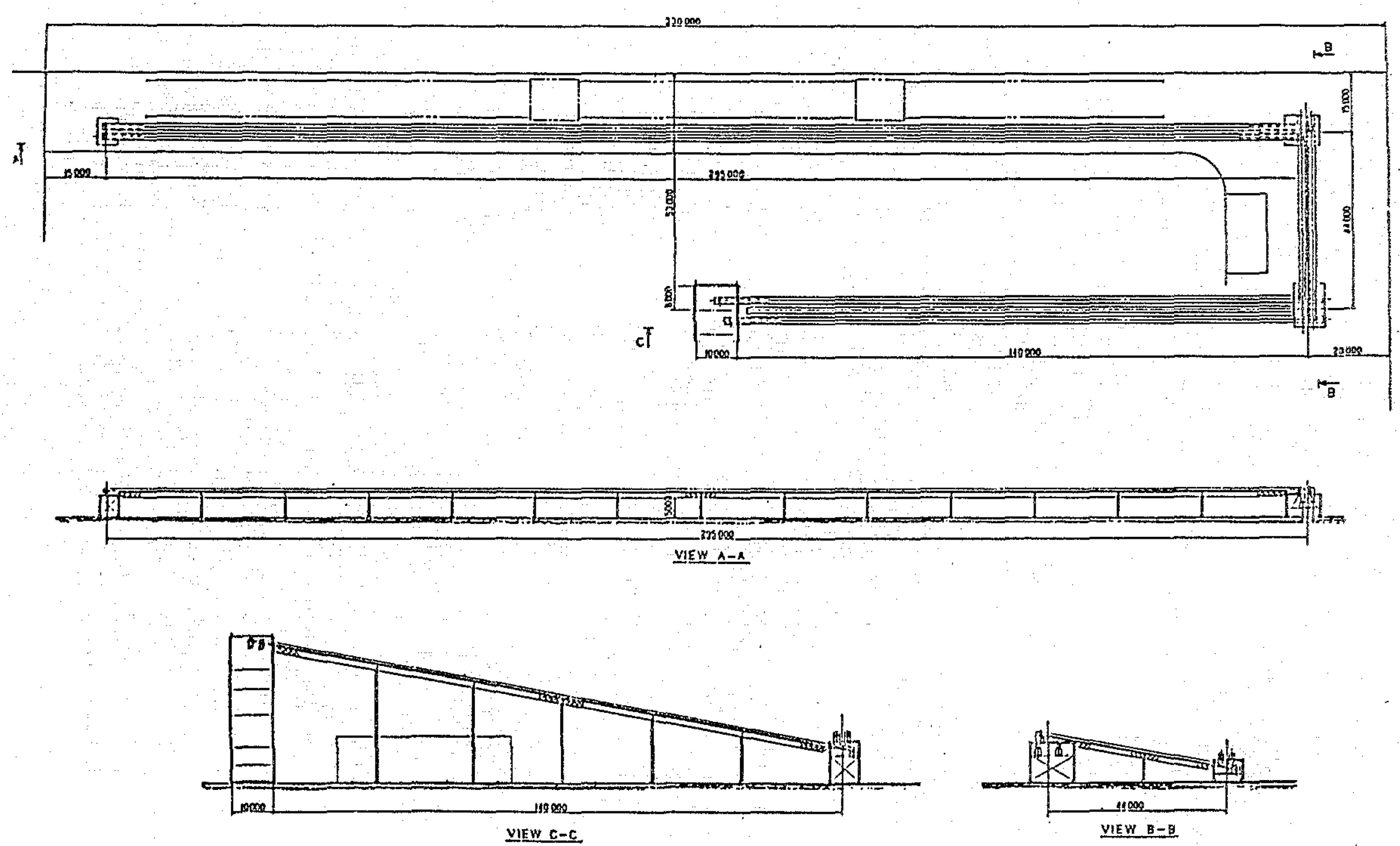


Fig. 4.4.16 Take-out Chain Conveyor on Floor

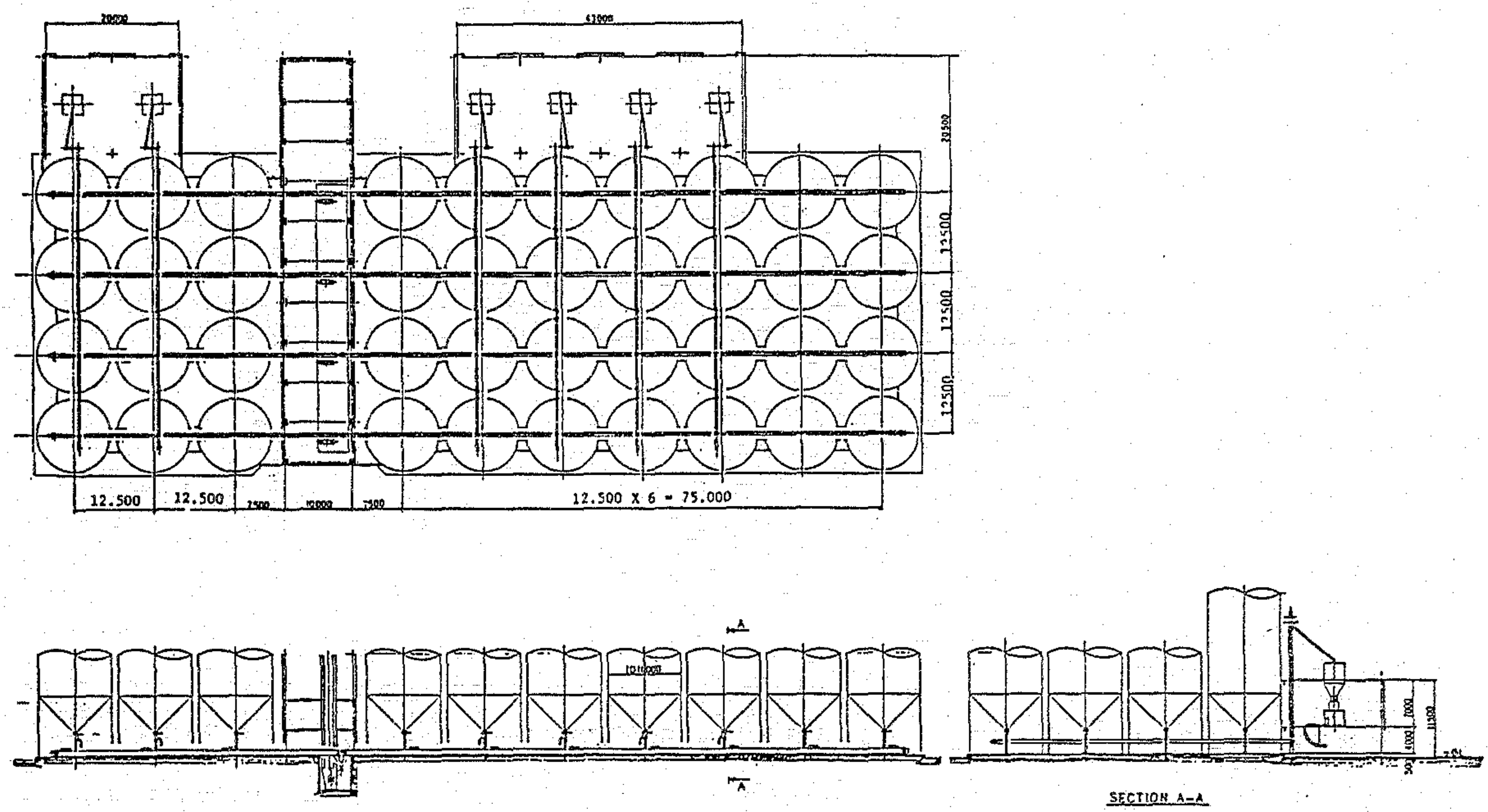
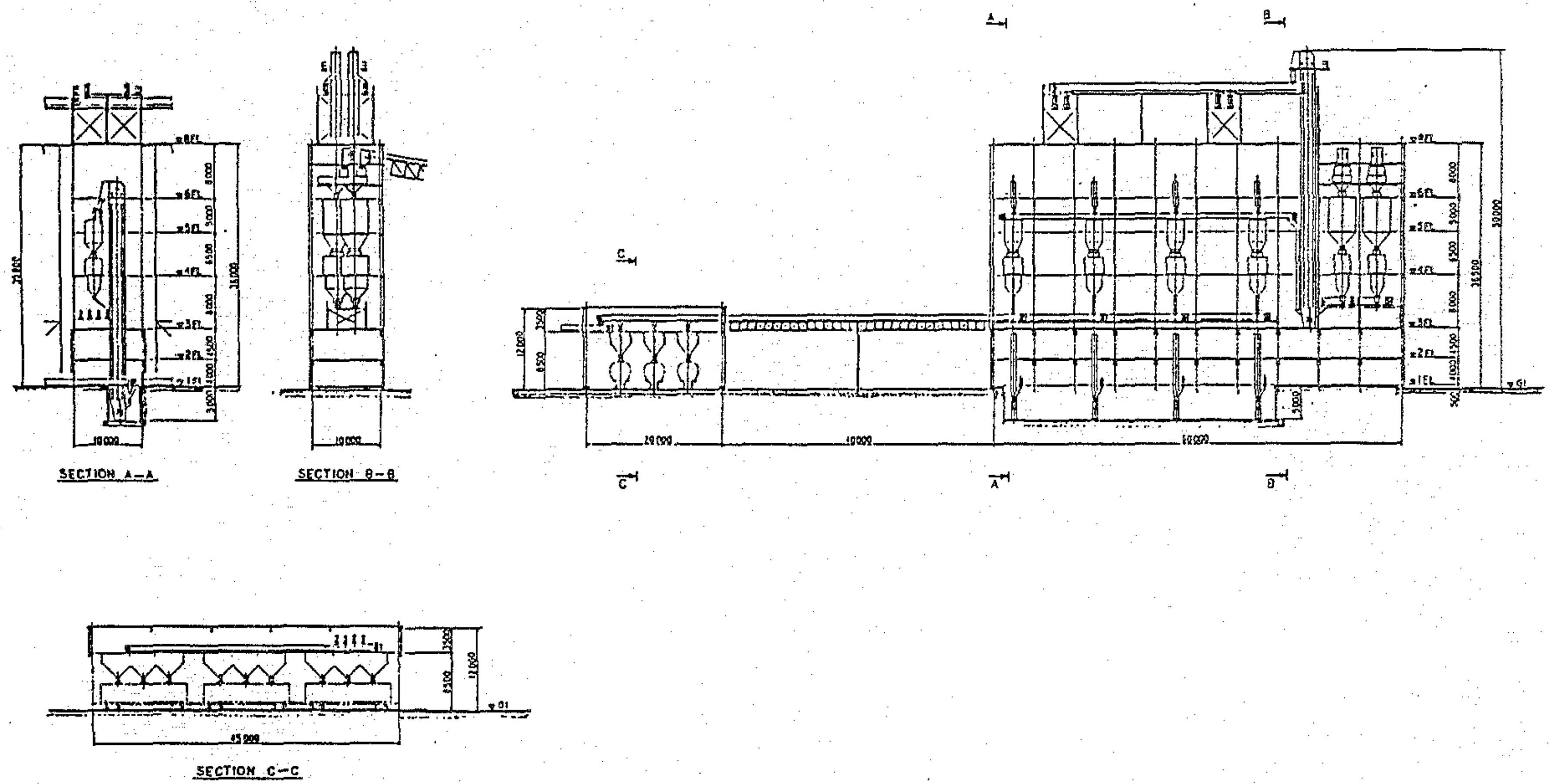


Fig. 4.4.17 Wagon Loading System



4.5 Preliminary Design of Container Terminal

Design features of container terminal is shown in the following figures.

Fig. 4.5.1 Layout

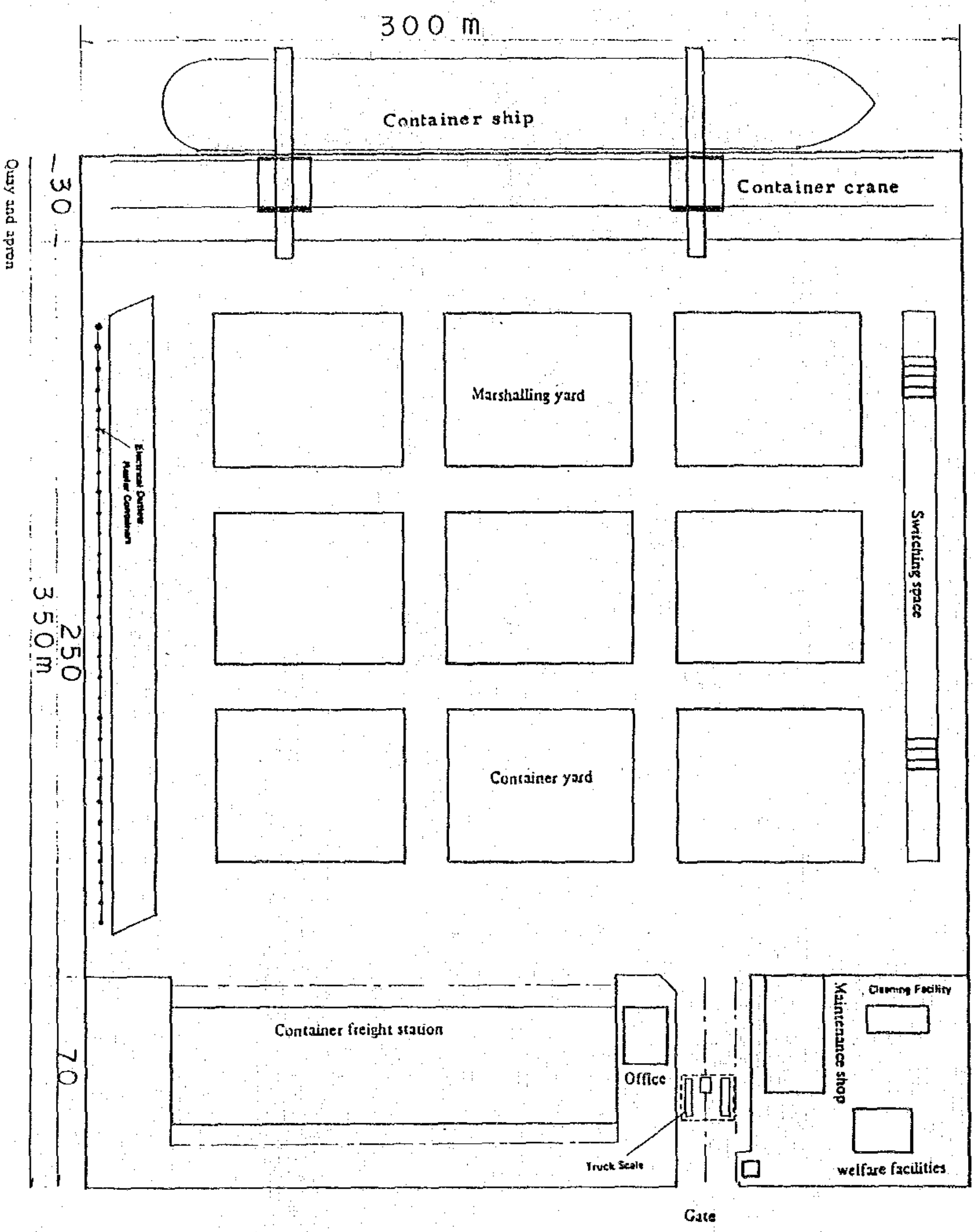


Fig. 4.5.2 Cross Section

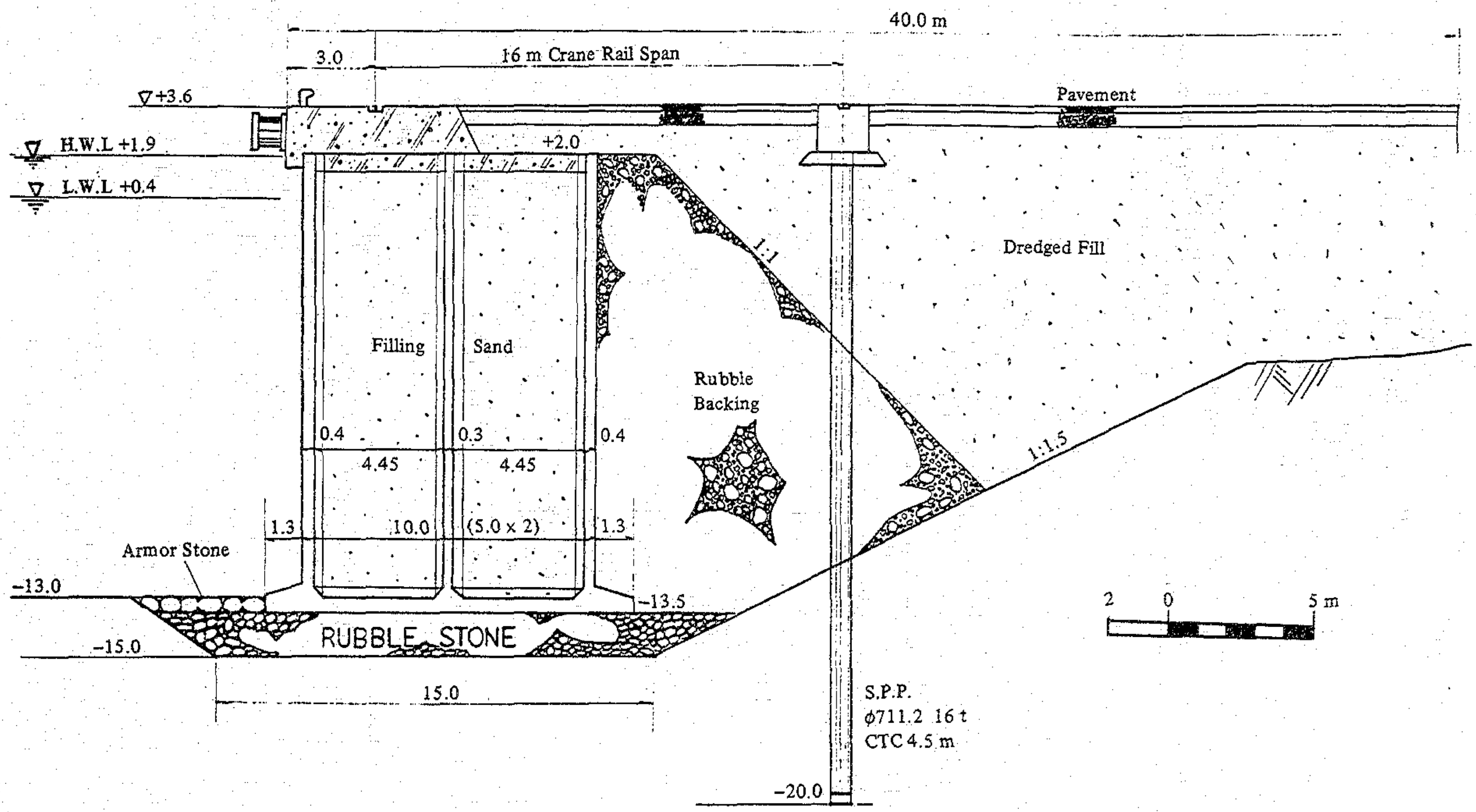


Fig. 4.5.3 Section of Concrete Caisson for Quaywall

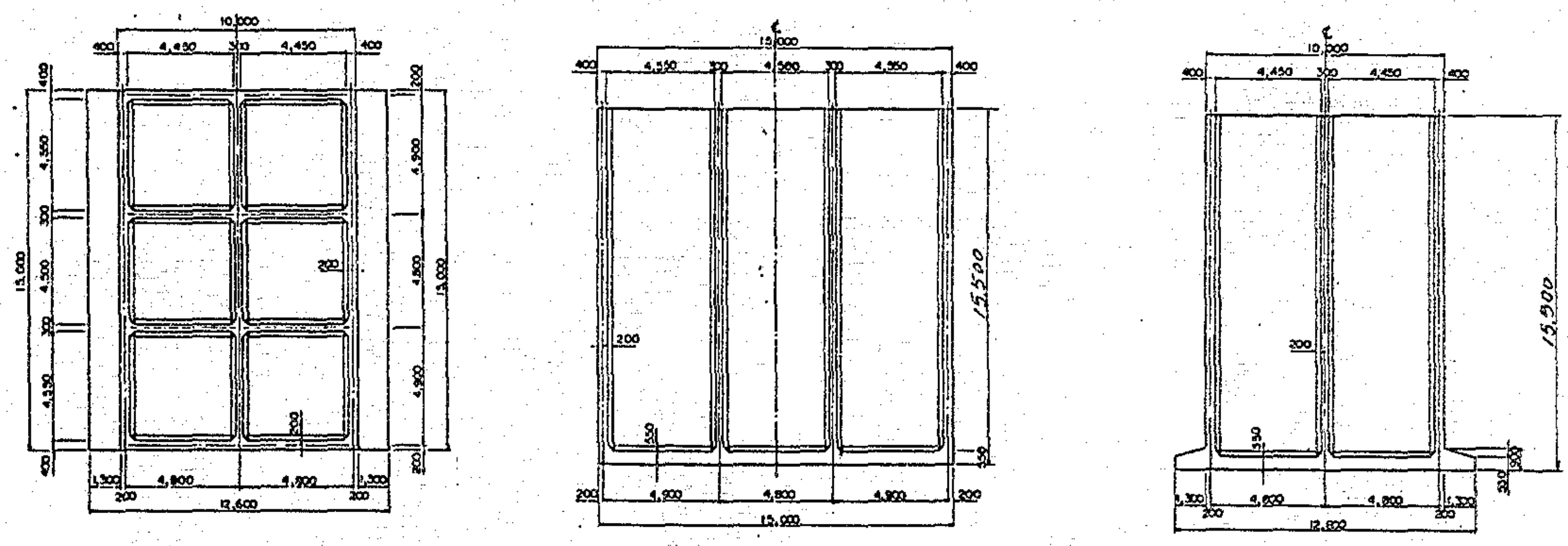
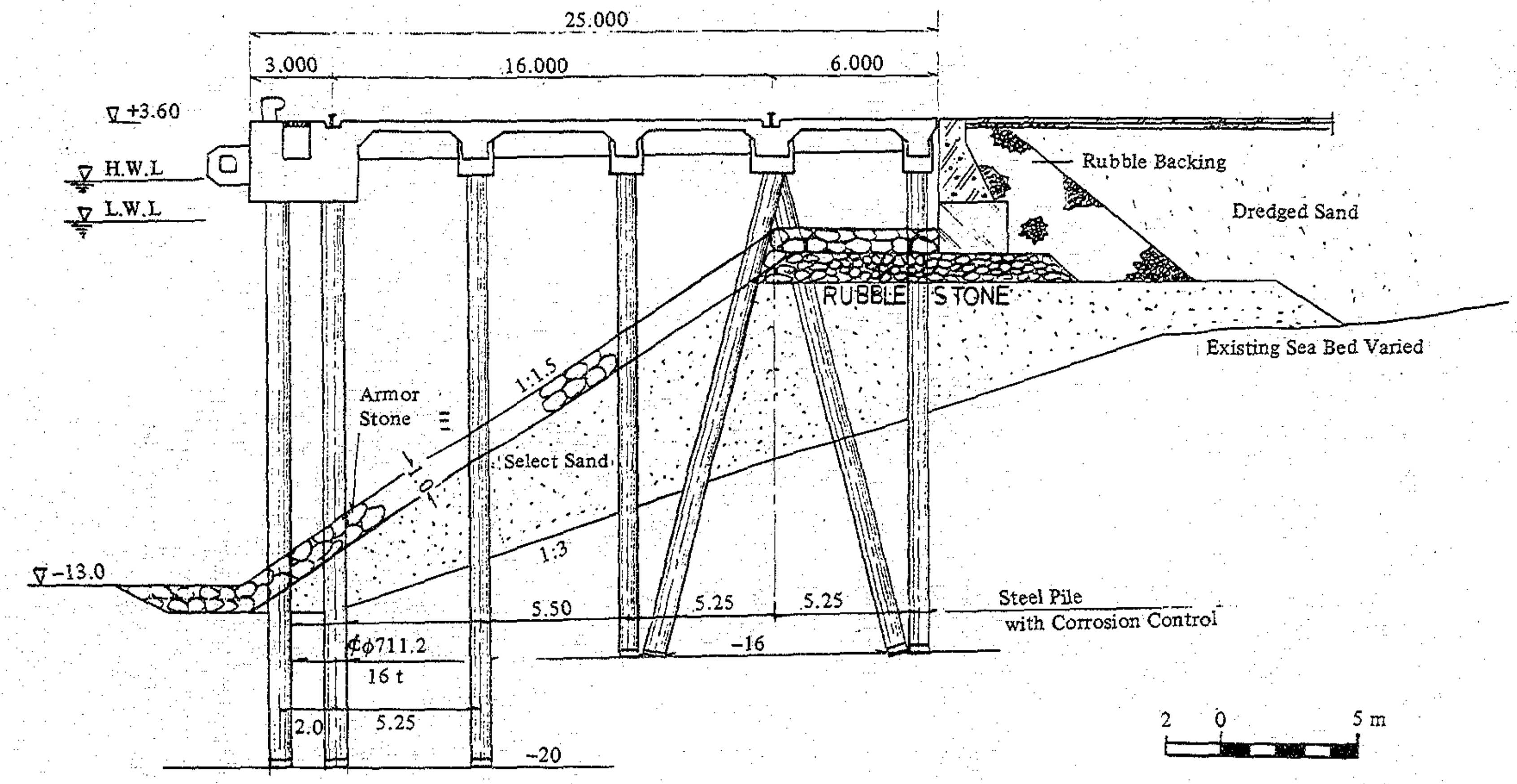
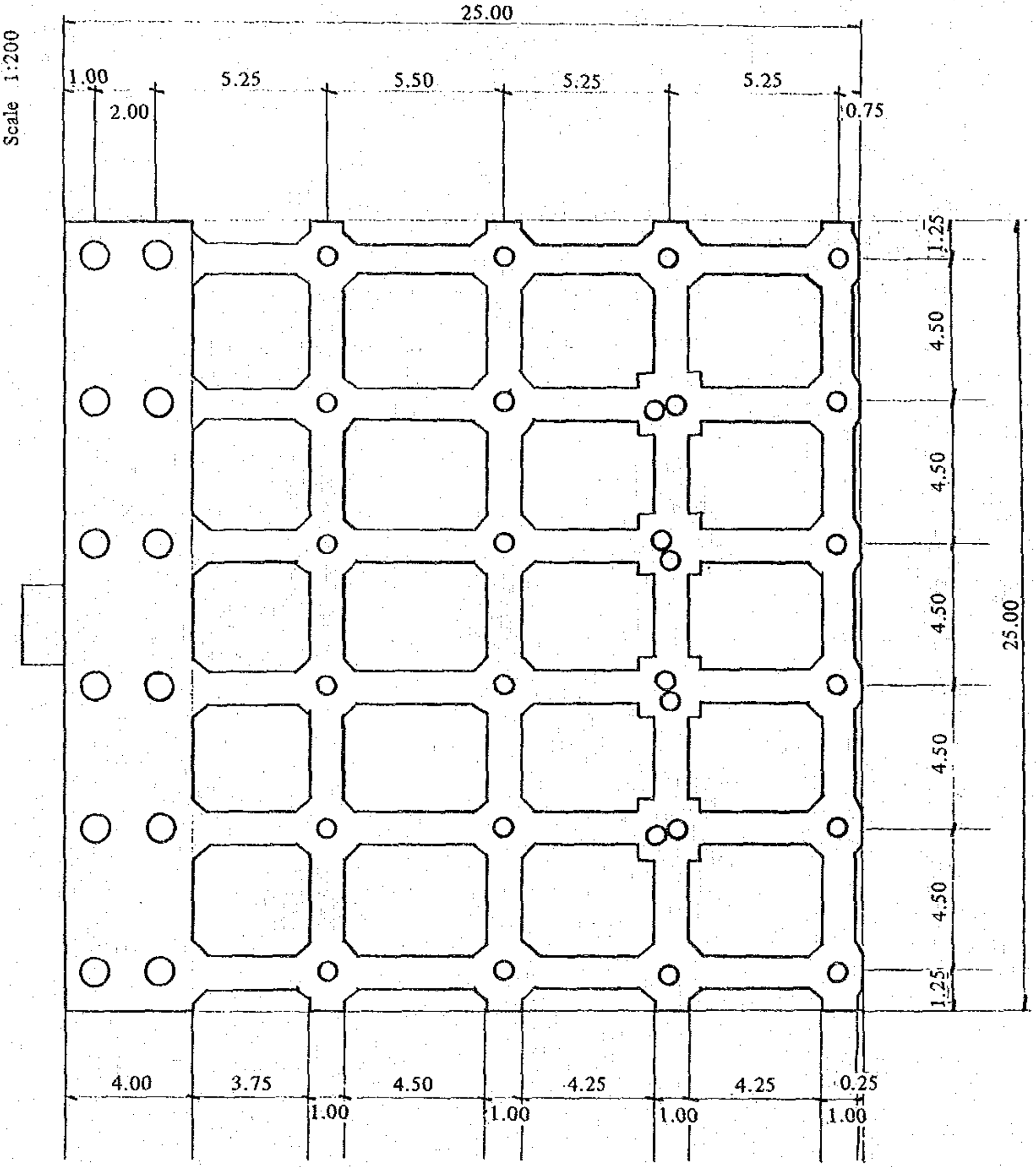


Fig. 4.5.4 Cross Section (An Alternative)





Scale 1:200

Fig. 4.5.5 Plan – Girder for Platform

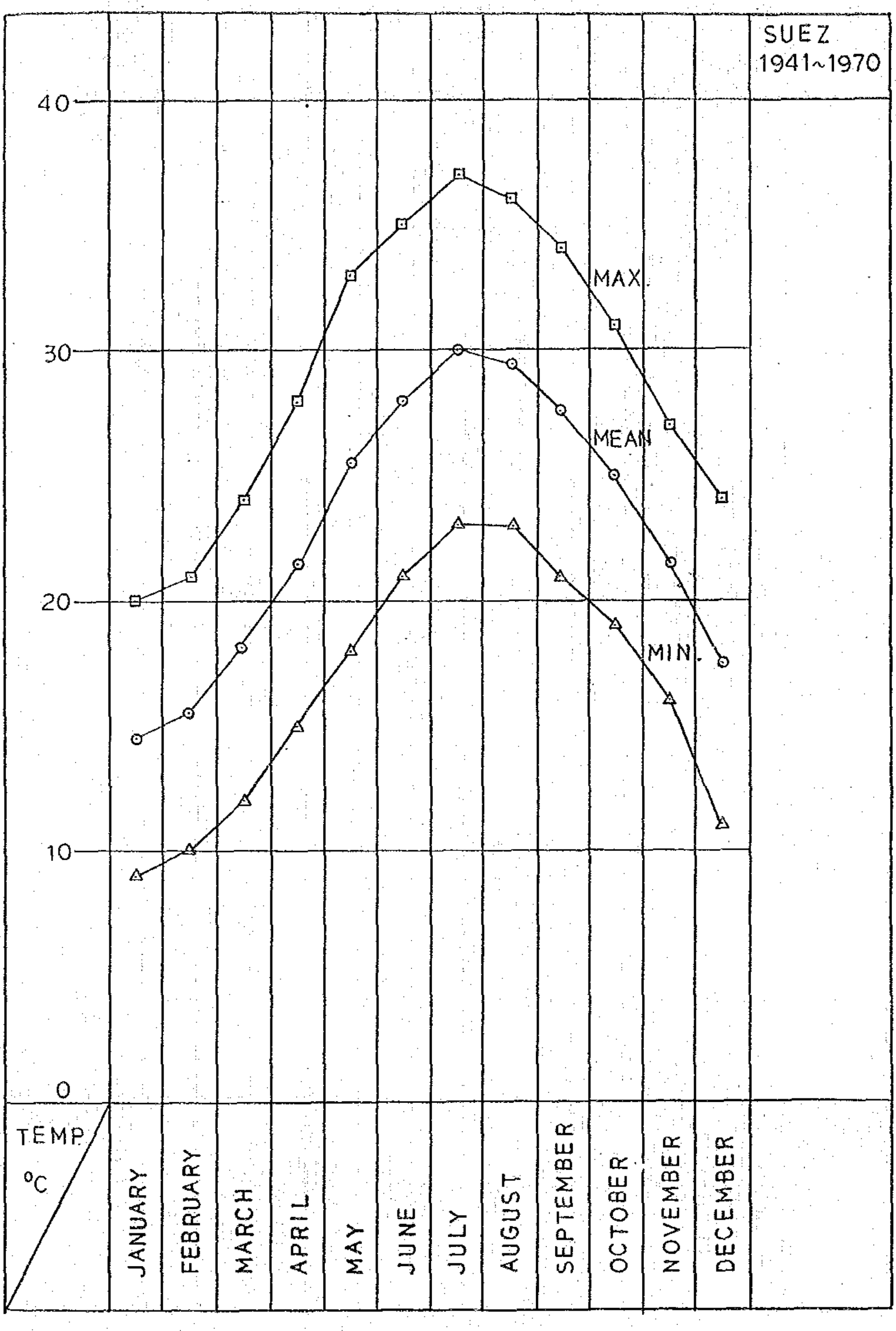
APPENDIX V

– NATURAL CONDITIONS –

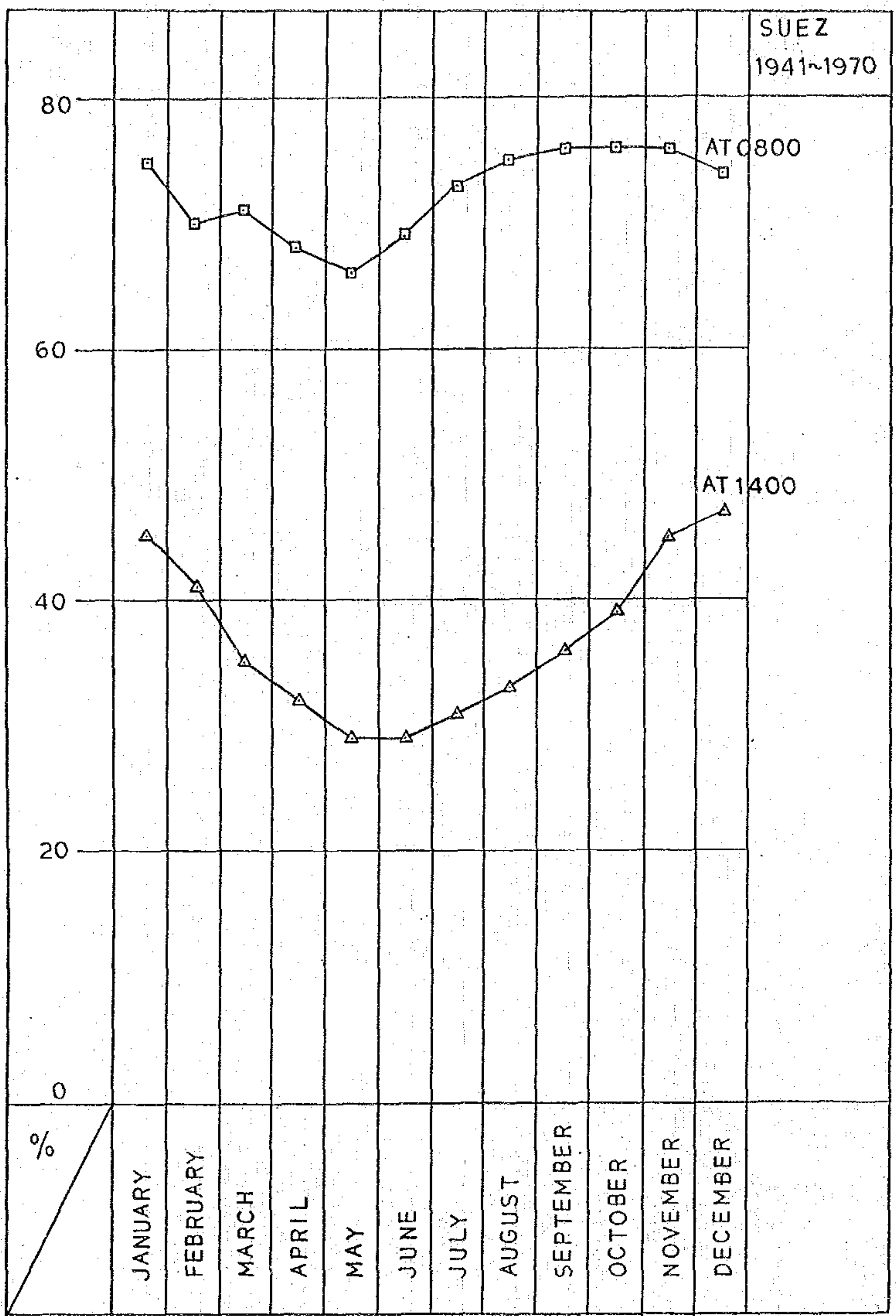
1. Meteorological Information   Suez 1941 to 1970
2. Meteorological Information   Adabiya 1964 to 1973
3. S.M.B. Method
4. Estimation of Waves
5. Soil Investigation
6. Analysis of Bottom Sediment and Sea Water Quality

5.1 Meteorological Information Suez 1941 to 1970

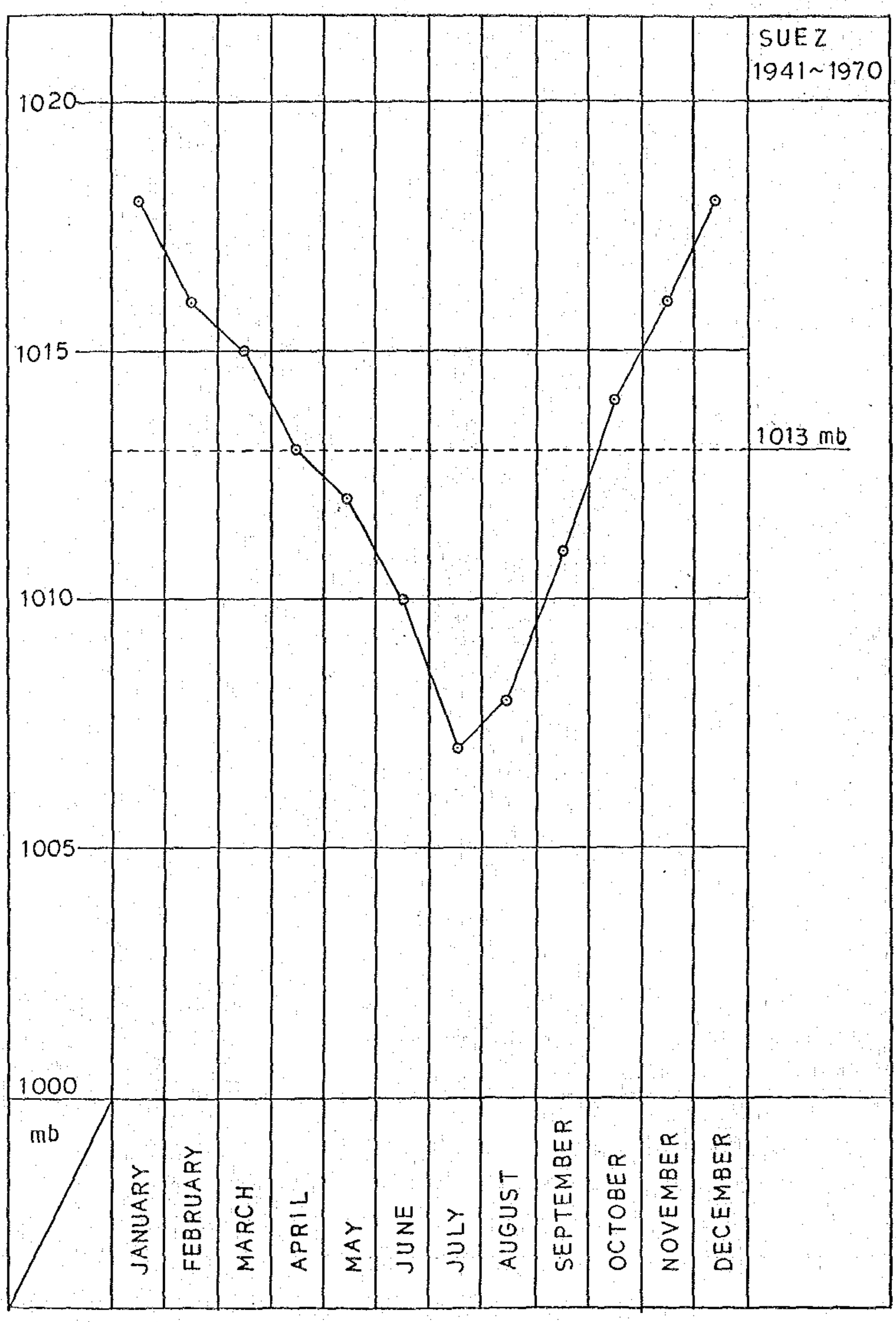
(1) Temperature



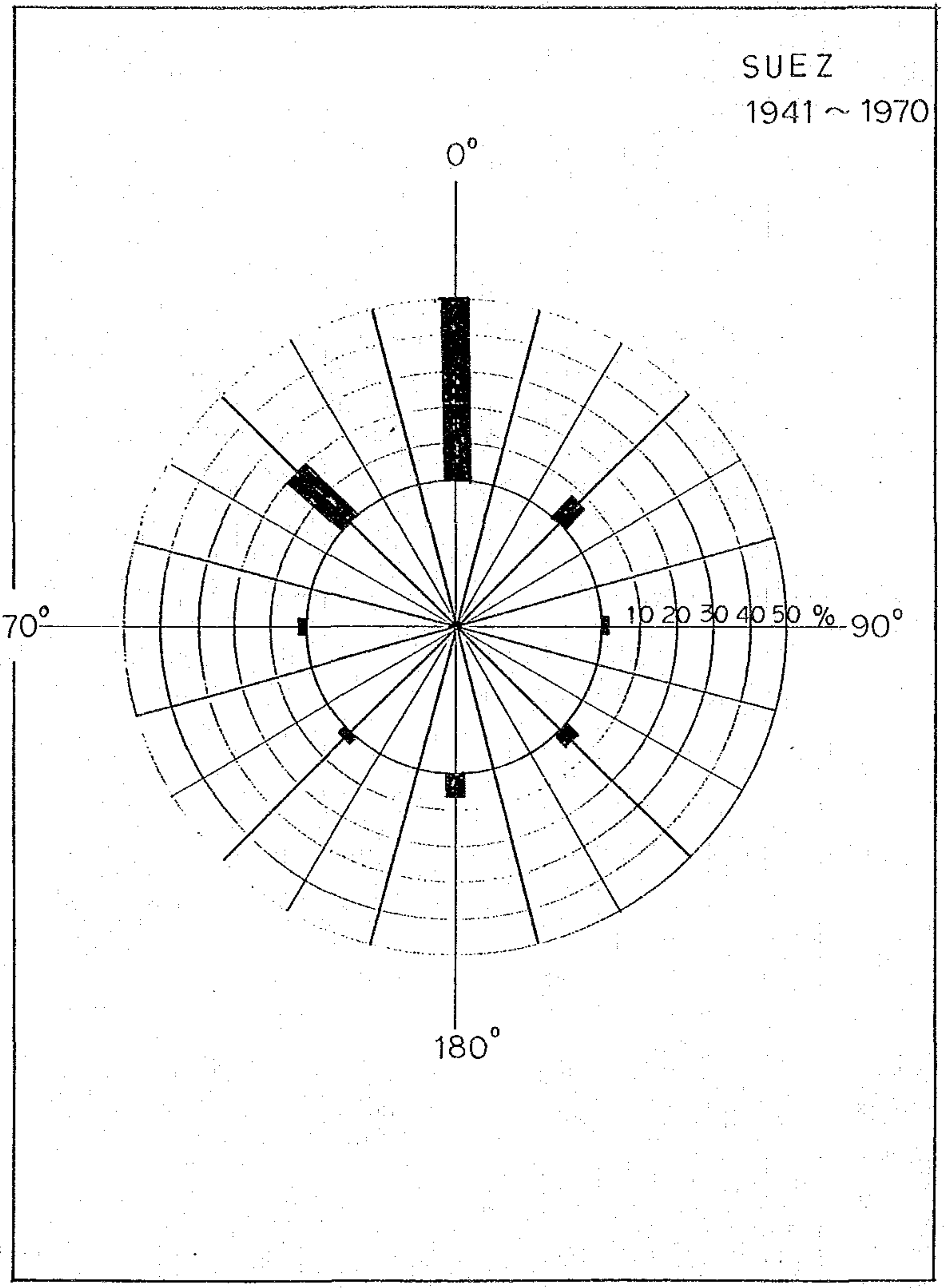
(2) **Relative Humidty**



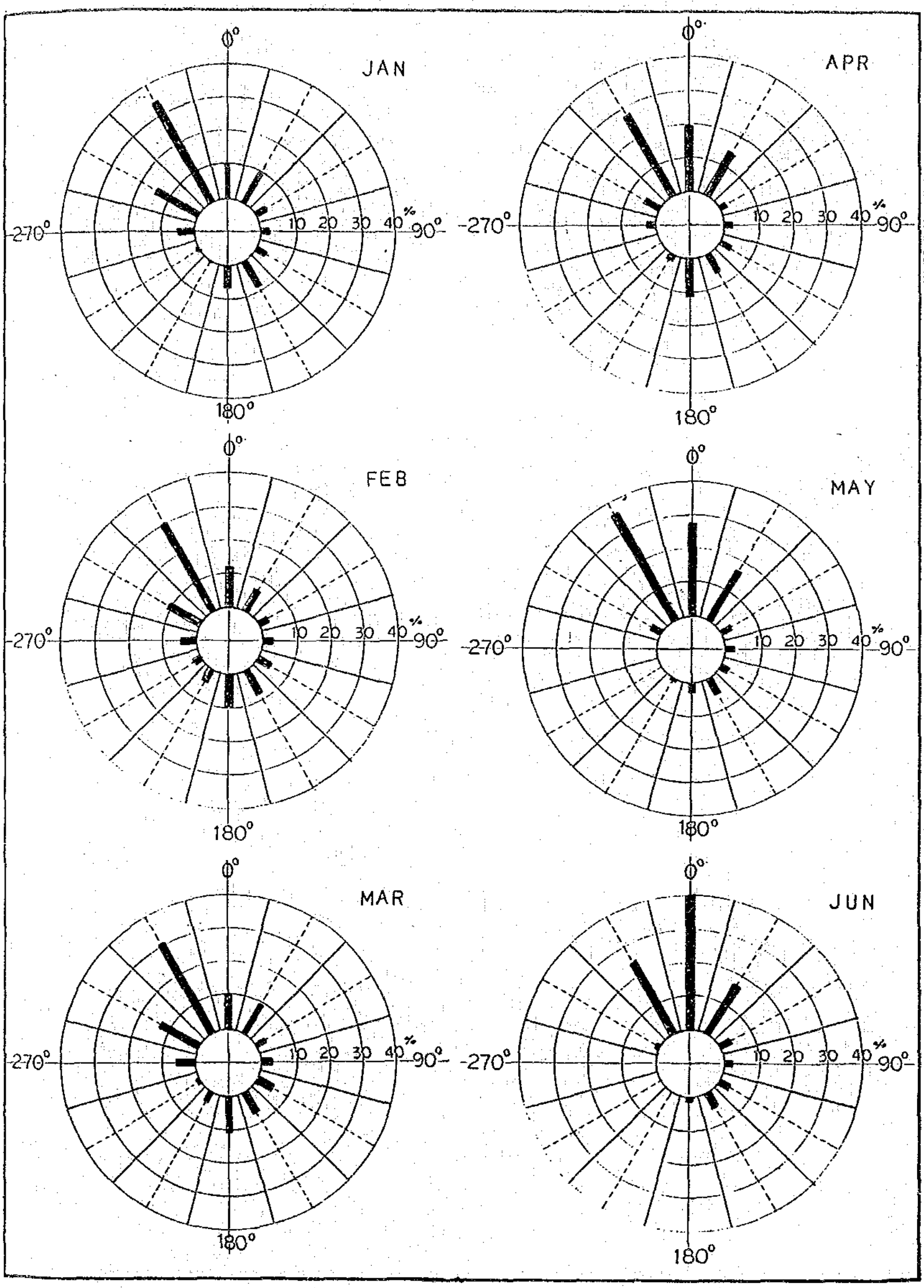
(3) **Atmospheric Pressure**



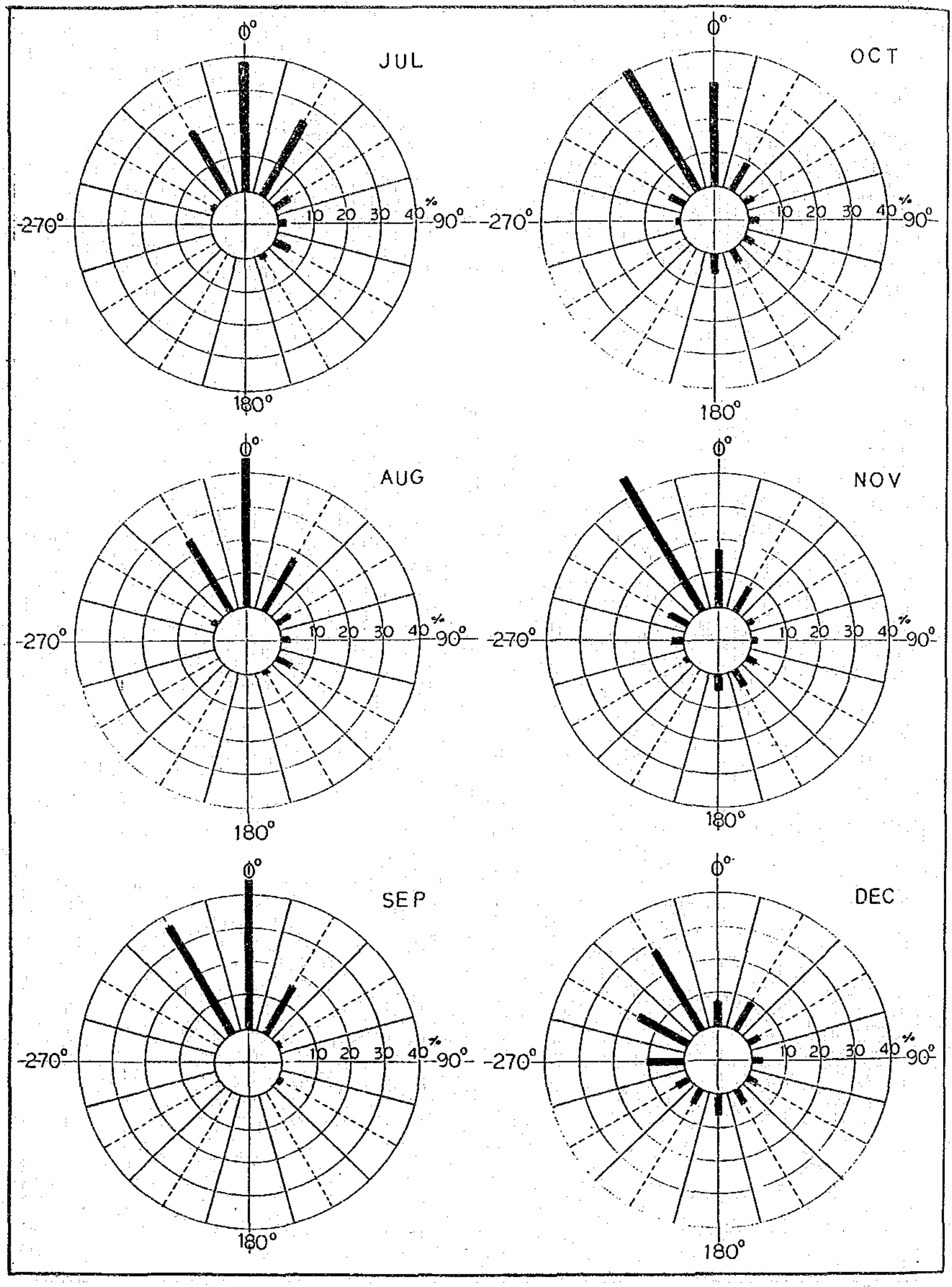
(4) Wind Distribution



(5) **Wind Rose Suez, 1979 to 1981**



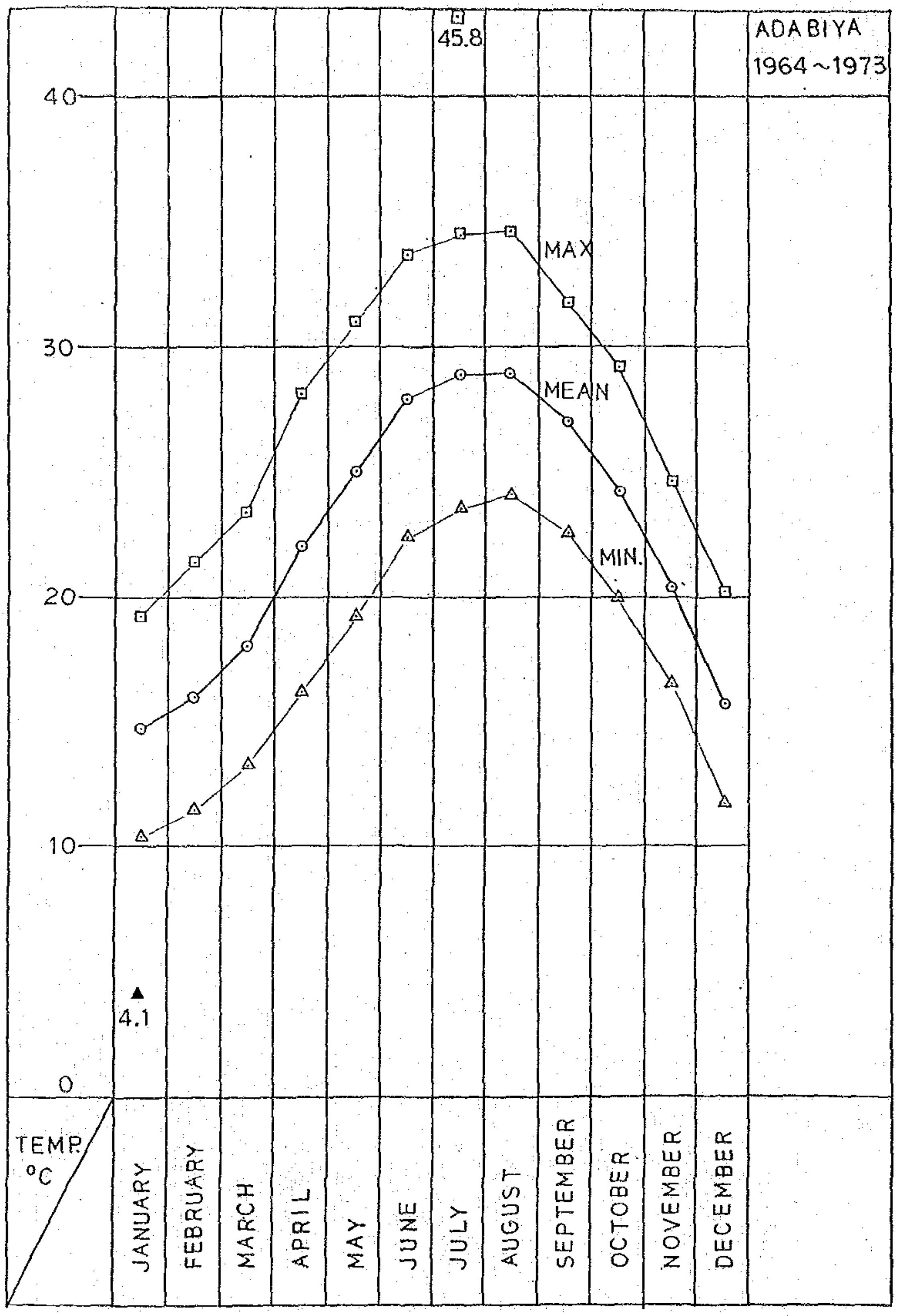
(5) (Continued)



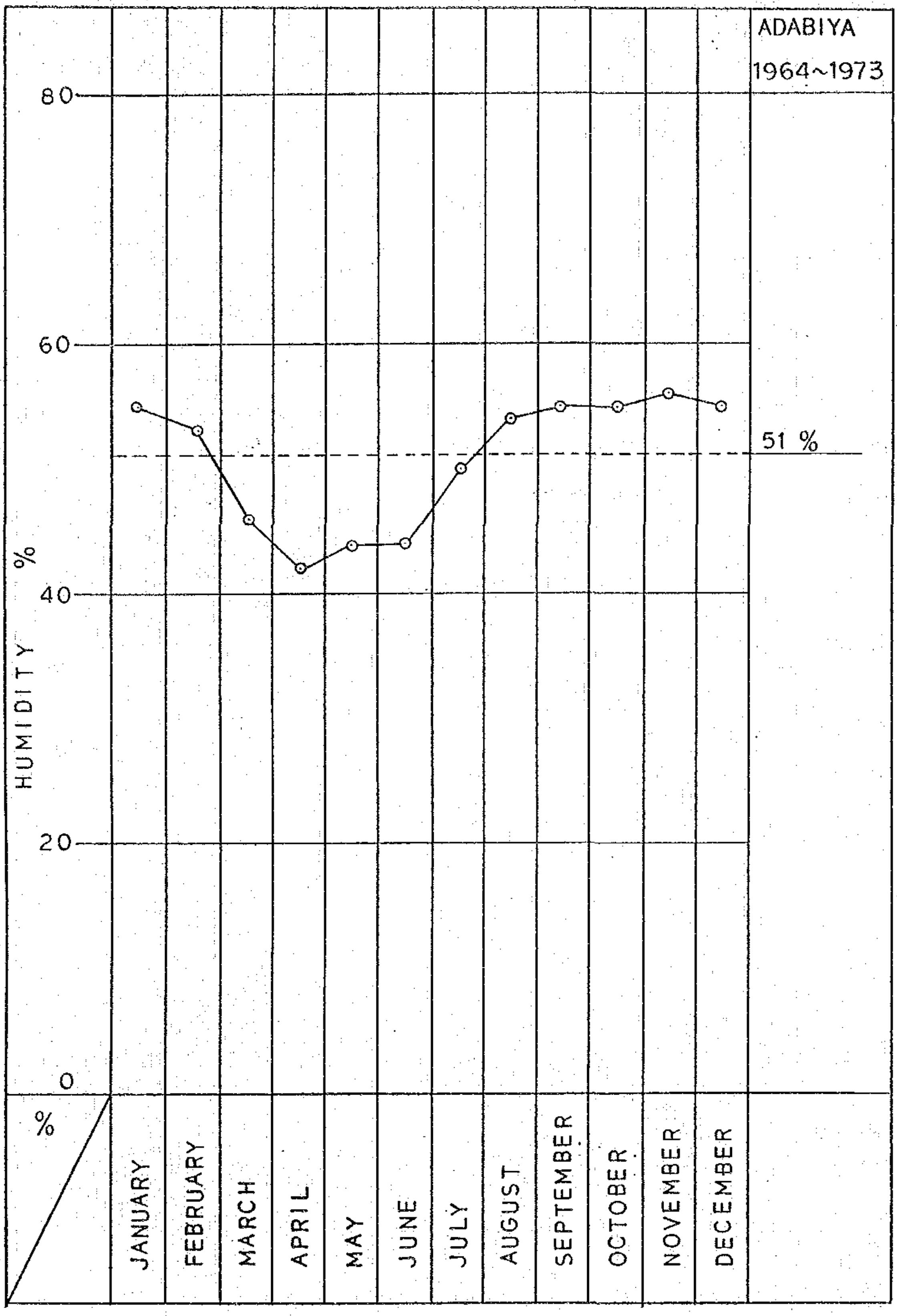
JUL
0°
90°
180°
270°
10 20 30 40 %
OCT
0°
90°
180°
270°
10 20 30 40 %
AUG
0°
90°
180°
270°
10 20 30 40 %
NOV
0°
90°
180°
270°
10 20 30 40 %
SEP
0°
90°
180°
270°
10 20 30 40 %
DEC
0°
90°
180°
270°
10 20 30 40 %

5.2 Meteorological Information Adabiya 1964 to 1973

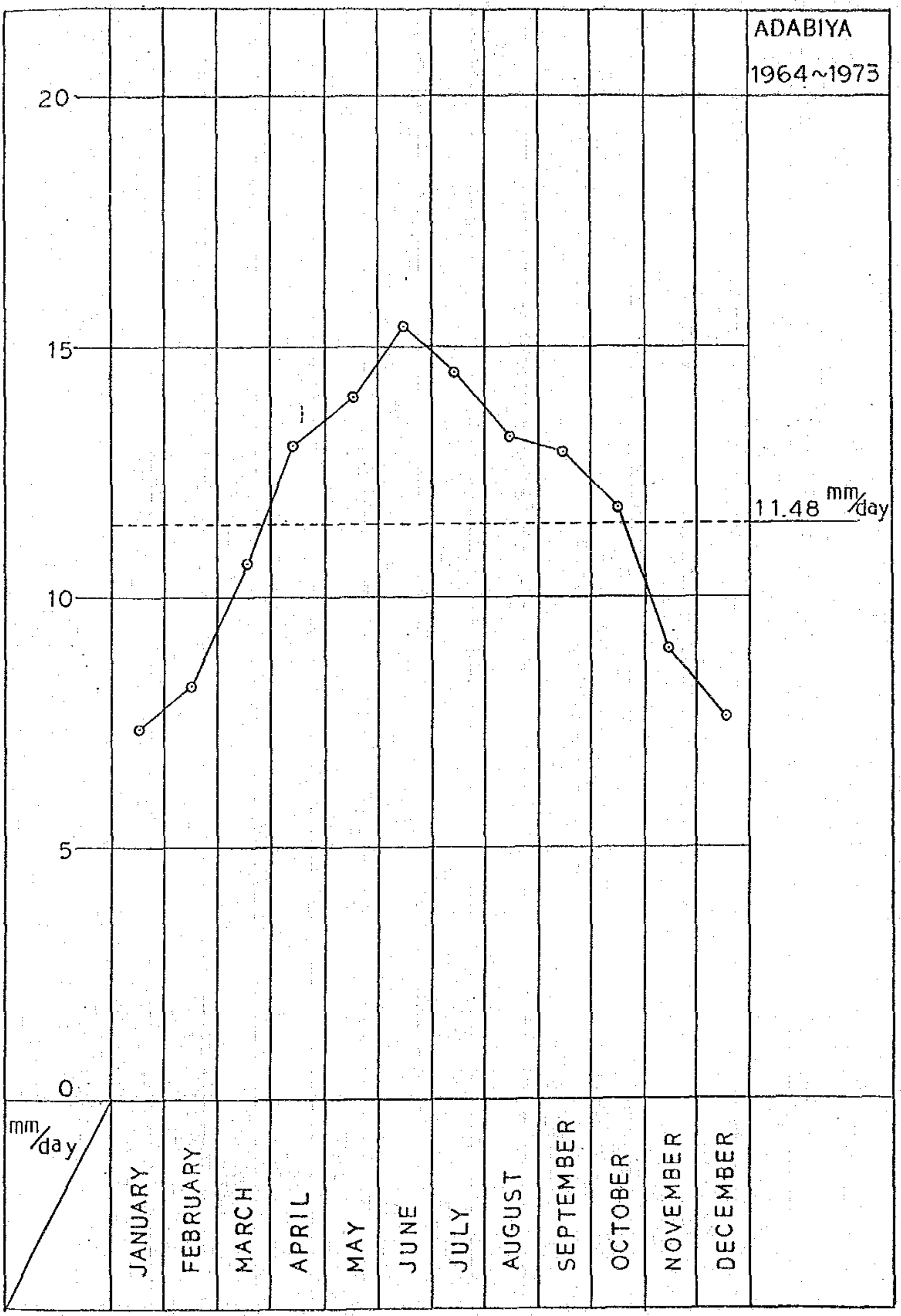
(1) Temperature



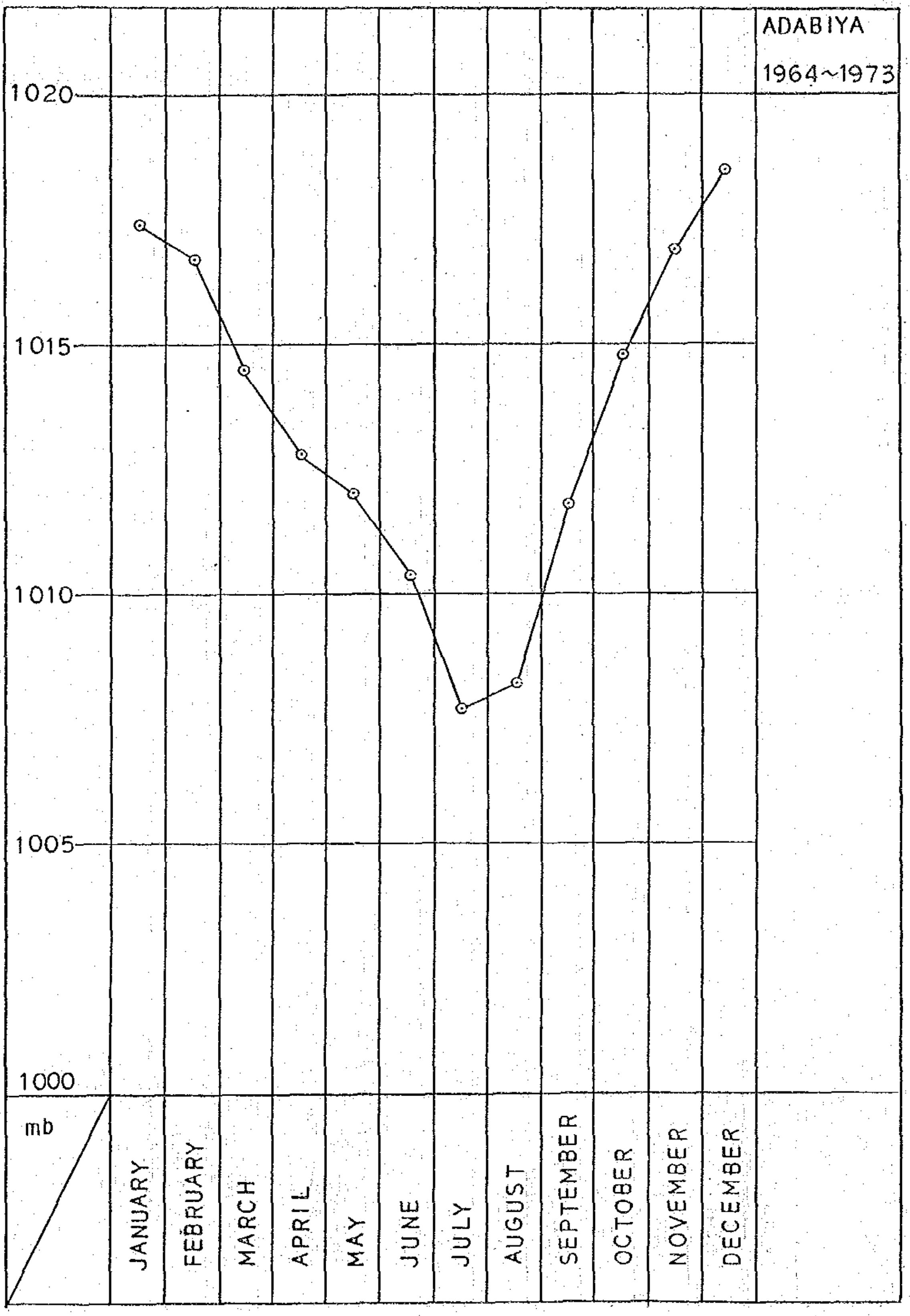
(2) Relative Humidity



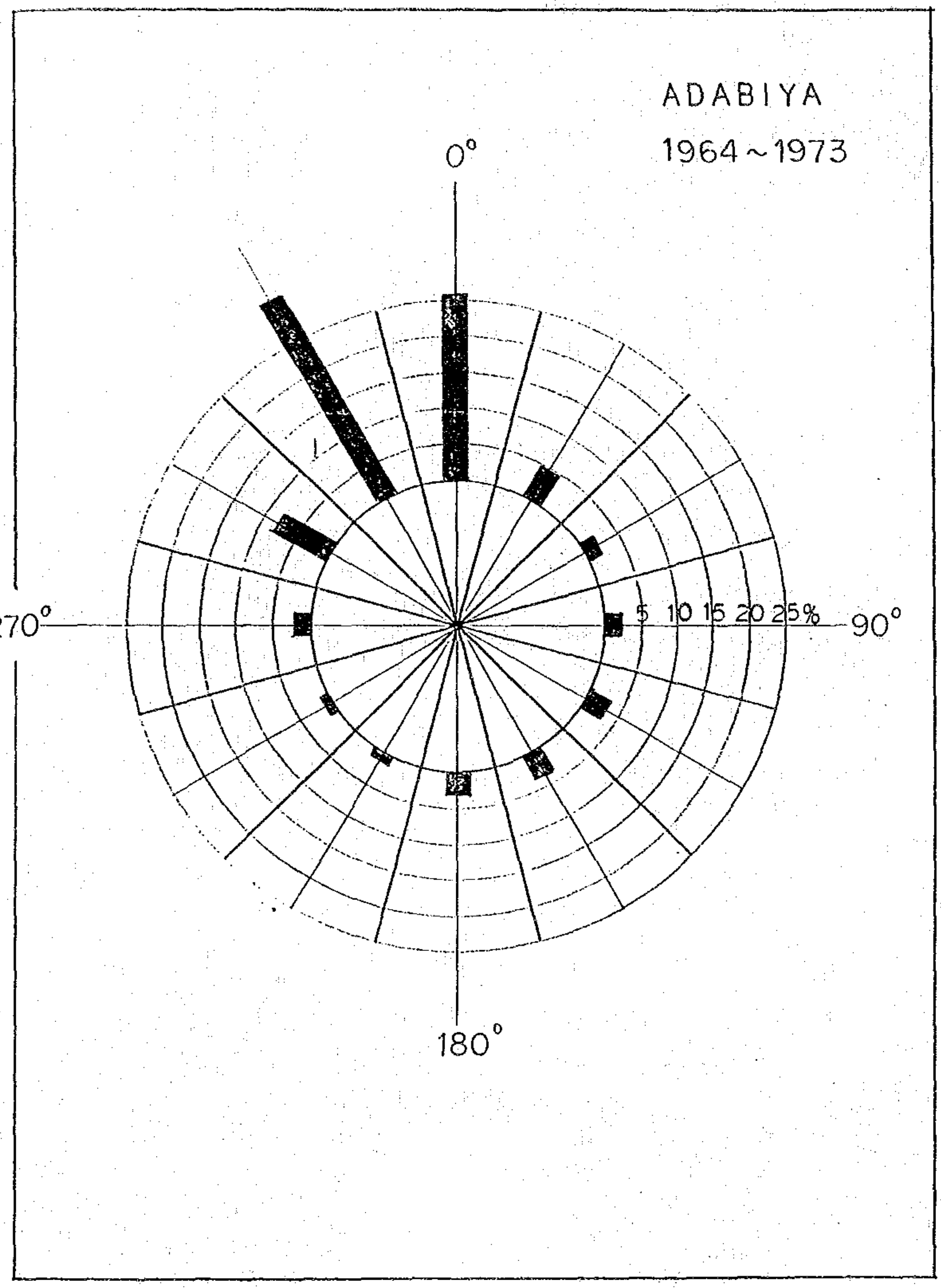
(3) **Evaporation**



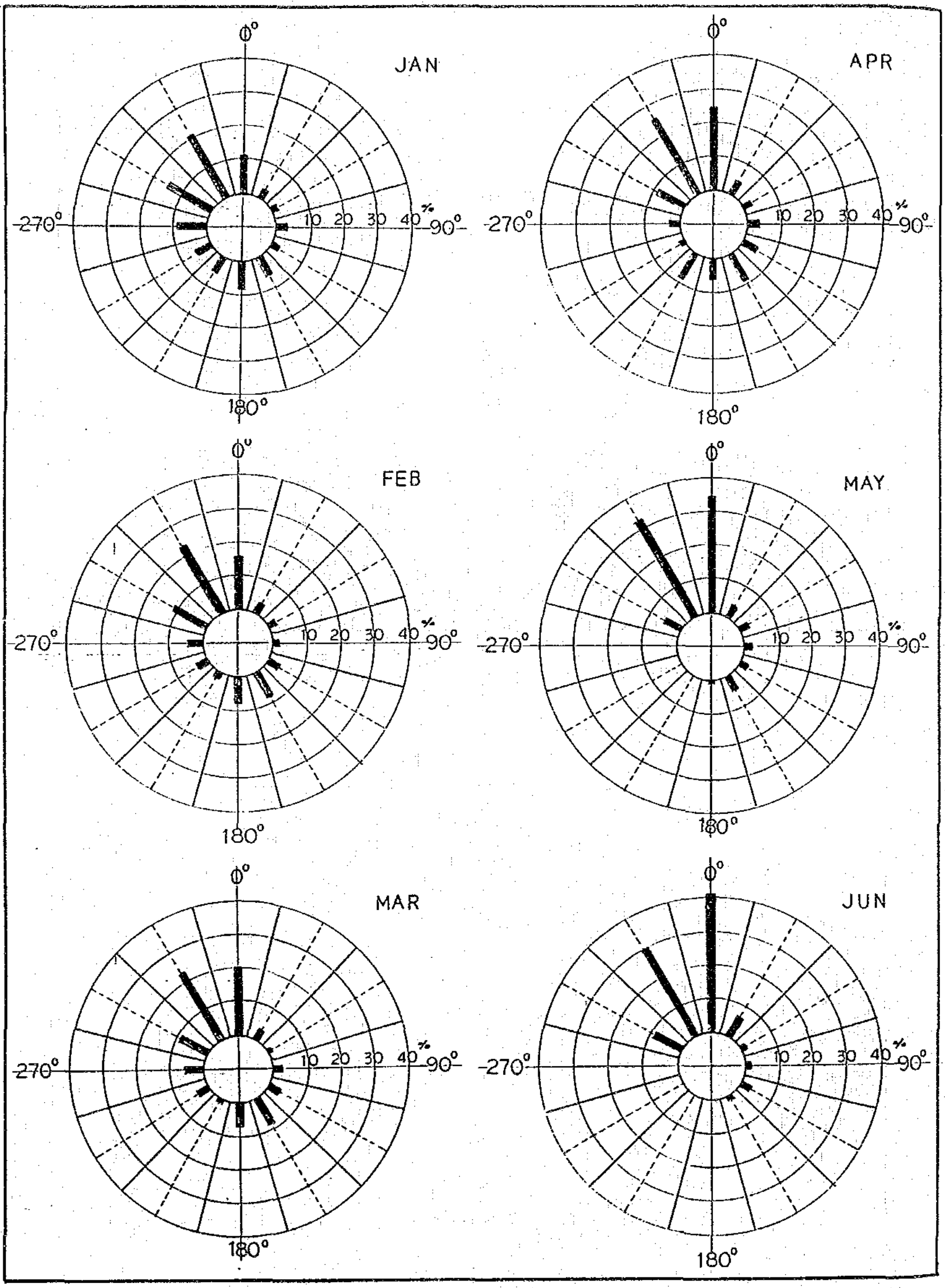
(4) Atmospheric Pressure



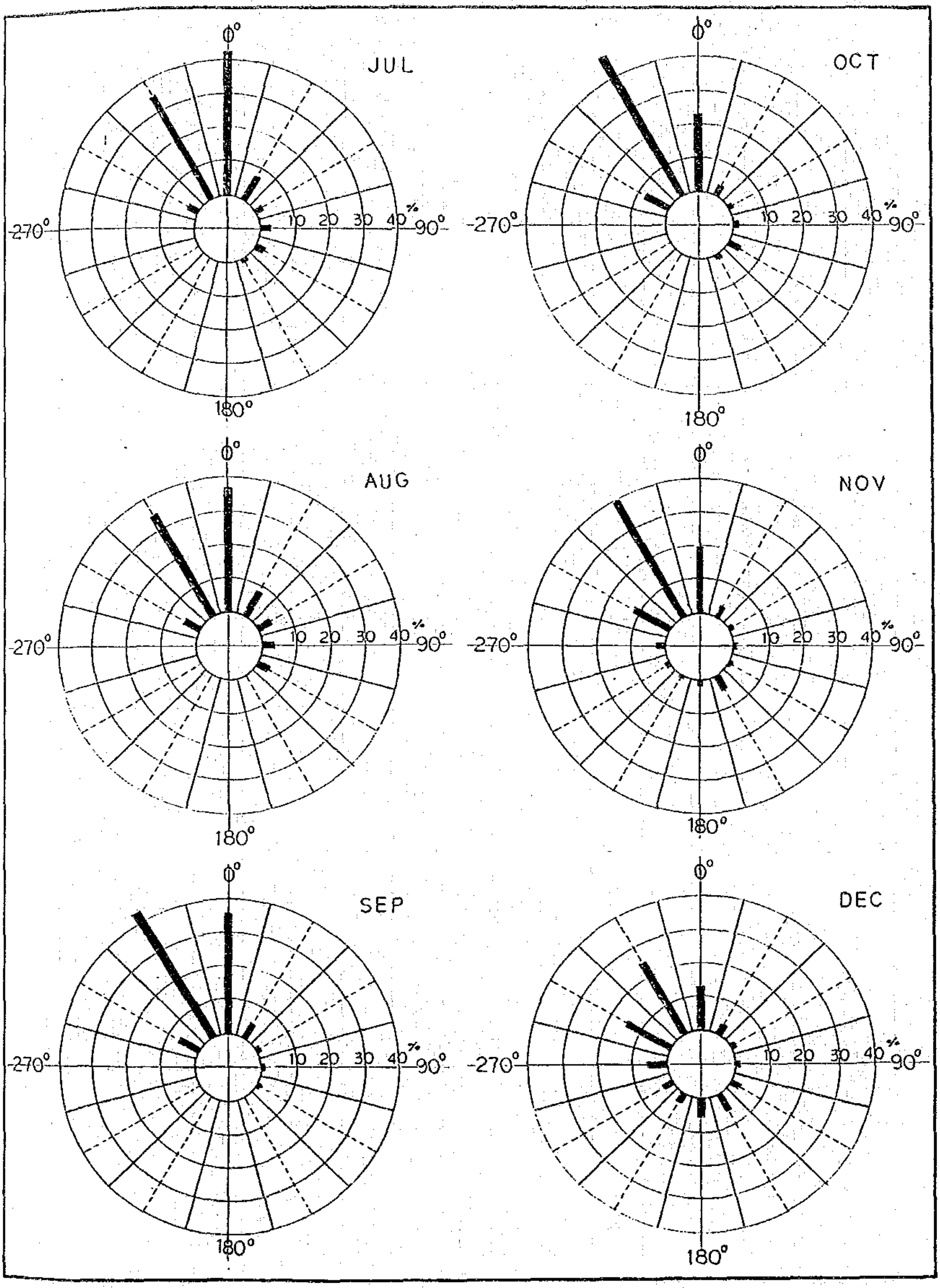
(5) **Wind Distribution**



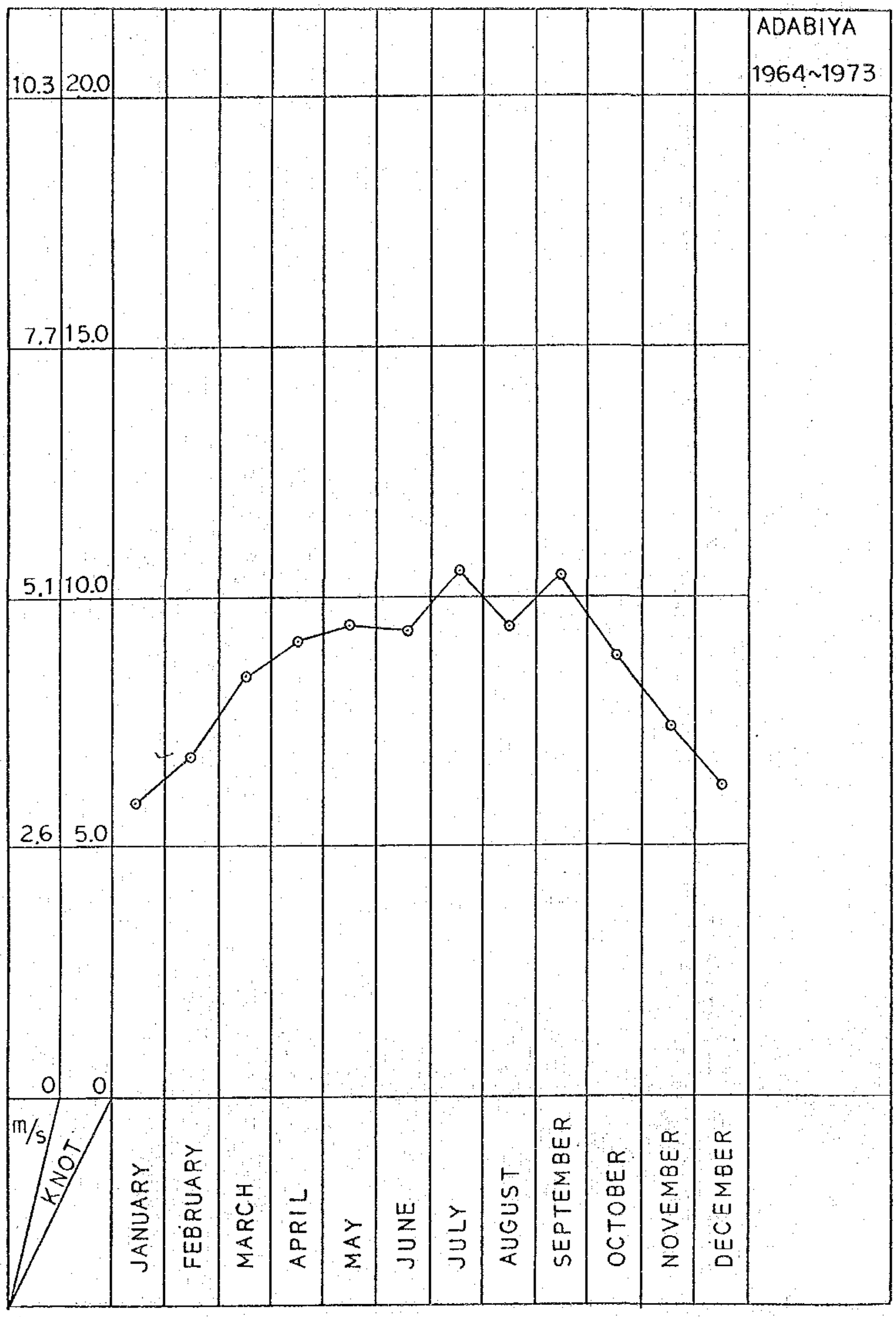
(6) Wind Rose Adabiya, 1965 to 1972



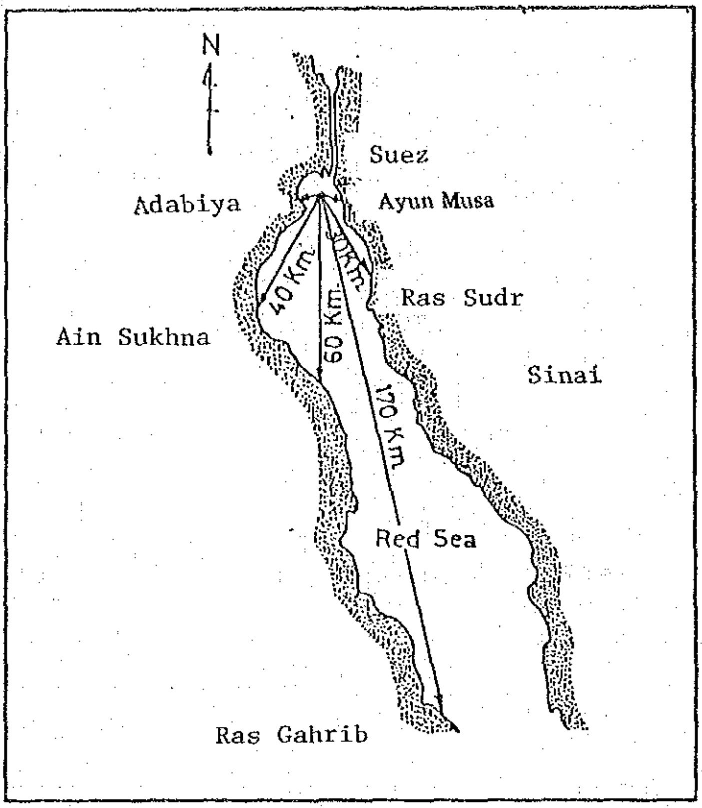
(6) (Continued)



(7) Wind Velocity



5.3 S.M.B. Method



S.M.B. FORMULA

$$\frac{gH_{\frac{1}{3}}}{U^2} = 0.30 \left[1 - \frac{1}{\{1+0.004(\frac{gF}{U^2})^{1/2}\}^2} \right]$$

$$\frac{gT_{\frac{1}{3}}}{2\pi U} = 1.37 \left[1 - \frac{1}{\{1+0.008(\frac{gH}{U^2})_{\frac{1}{3}}\}^5} \right]$$

Where $H_{\frac{1}{3}}$: Significant wave height (meters)

$T_{\frac{1}{3}}$: Significant wave period (sec.)

U : Wind velocity at 10m above sea surface (m/s)

F : Fetch length (meters)

g : Acceleration of gravity (9.8 m/s^2)

5.4 Estimation of Waves

(1) Wave Height and Period

ESTIMATION OF WAVE HEIGHT (meters)

FETCH (km)	10	40	60	30	10
DIRECTION	ESE	SSE	S	SSW	WSW
WIND VELOCITY (m/s) 2.50	0.11	0.14	0.15	0.14	0.11
4.25	0.22	0.35	0.37	0.31	0.22
6.75	0.40	0.65	0.73	0.60	0.40
9.50	0.61	1.03	1.18	0.93	0.61
12.25	0.81	1.43	1.65	1.28	0.81
15.25	1.04	1.87	2.18	1.66	1.04
20.00	1.40	2.57	3.04	2.28	1.40

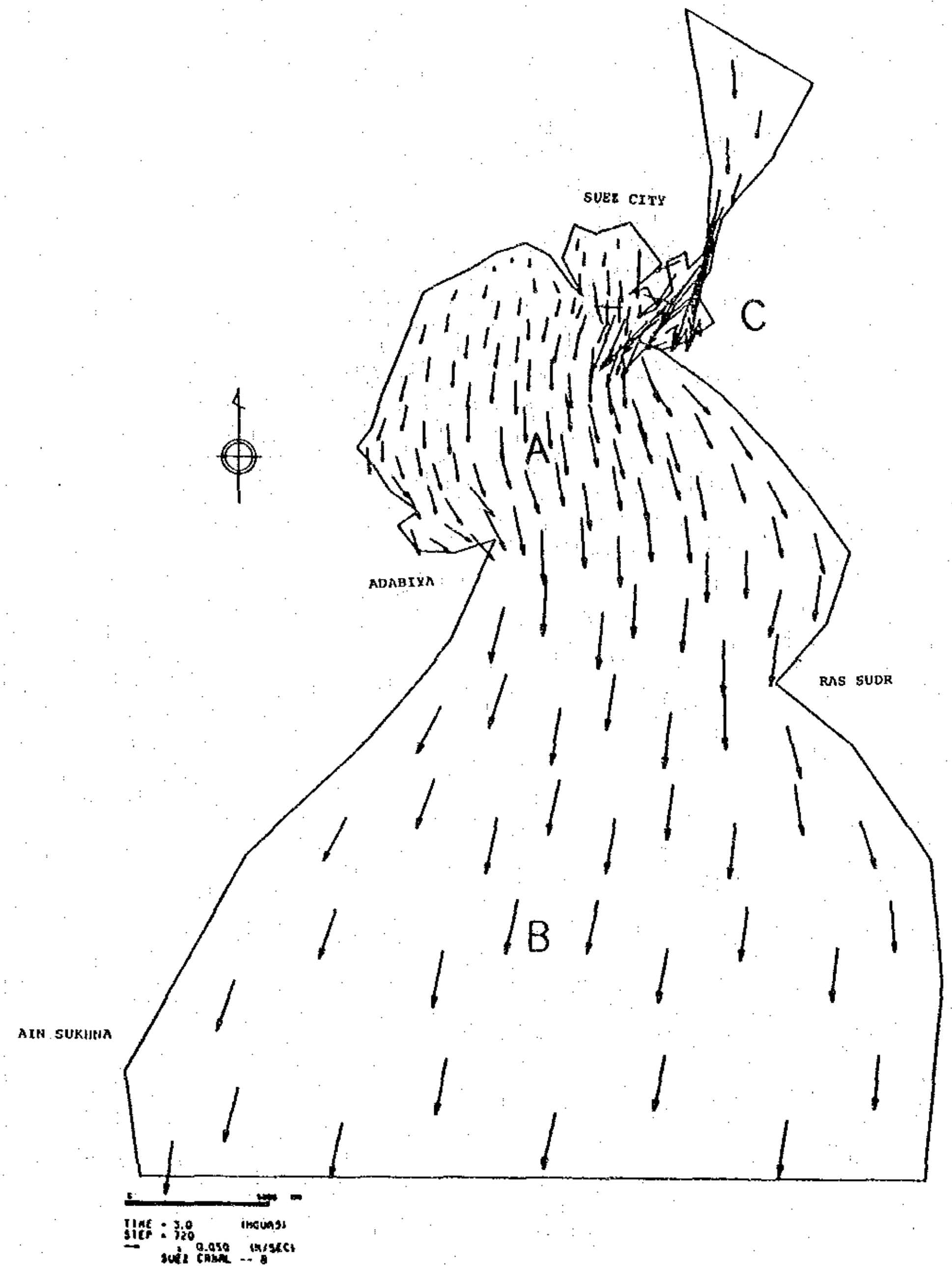
ESTIMATION OF WAVE PEIOD (sec.)

FETCH (km)	10	40	60	30	10
DIRECTION	ESE	SSE	S	SSW	WSW
WIND VELOCITY (m/s) 2.50	1.31	1.64	1.73	1.57	1.31
4.25	1.79	2.36	2.53	2.24	1.79
6.75	2.30	3.14	3.41	2.96	2.30
9.50	2.72	3.82	4.17	3.57	2.72
12.25	3.06	4.37	4.81	4.07	3.06
15.25	3.38	4.88	5.39	4.54	3.38
20.00	3.80	5.57	6.18	5.16	3.80

ESTIMATION OF WIND DURATION (hours)

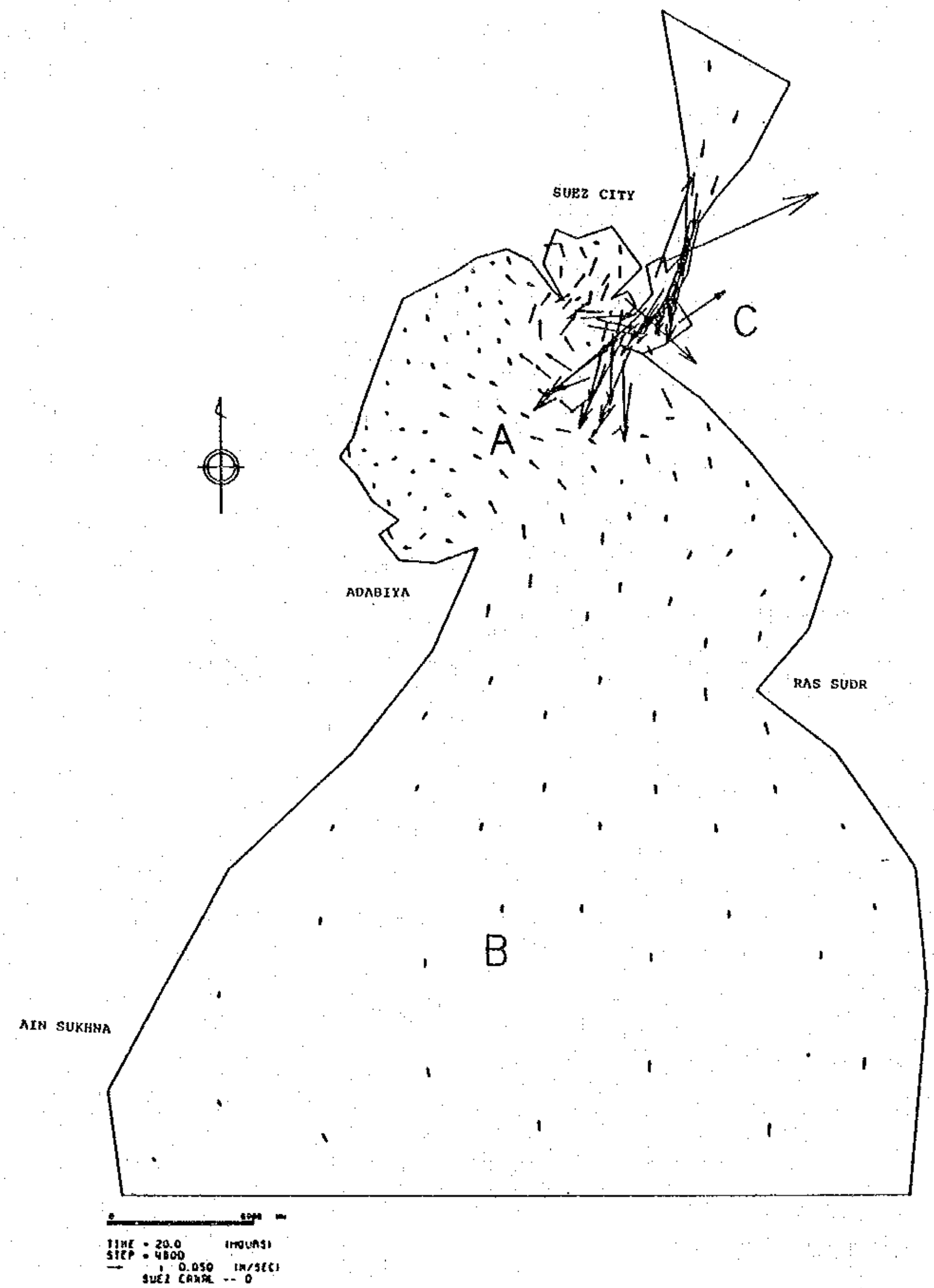
FETCH (km)	10	40	60	30	10
DIRECTION	ESE	SSE	S	SSW	WSW
WIND VELOCITY (m/s) 2.50	57	160	215	129	57
4.25	44	124	167	100	44
6.75	35	99	134	80	35
9.50	29	84	113	67	29
12.25	26	74	100	59	26
15.25	23	66	90	53	23
20.00	20	58	79	47	20

(2) Drift Current



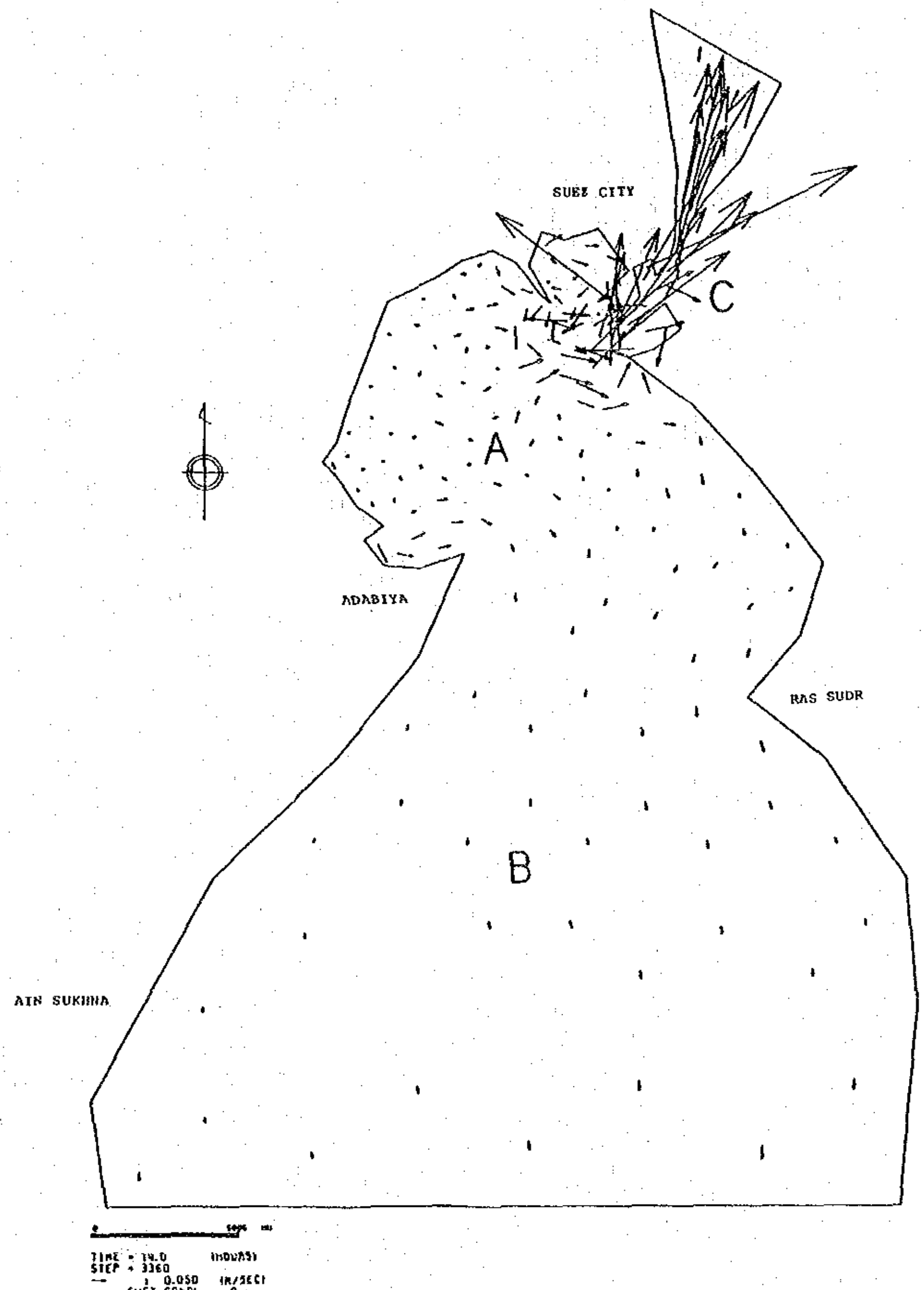
AREA A	AREA B	AREA C (CANAL)
5 - 15 cm/sec Southward	15 - 20 cm/sec Southward	15 - 25 cm/sec Southward

(3) Tidal Current, 2 Hours after High Water



AREA A	AREA B	AREA C (CANAL)
about 5 cm/sec Northward	less than 5 cm/sec ------	50 - 70 cm/sec Northward Southward

(4) Tidal Current, 2 Hours after Low Water

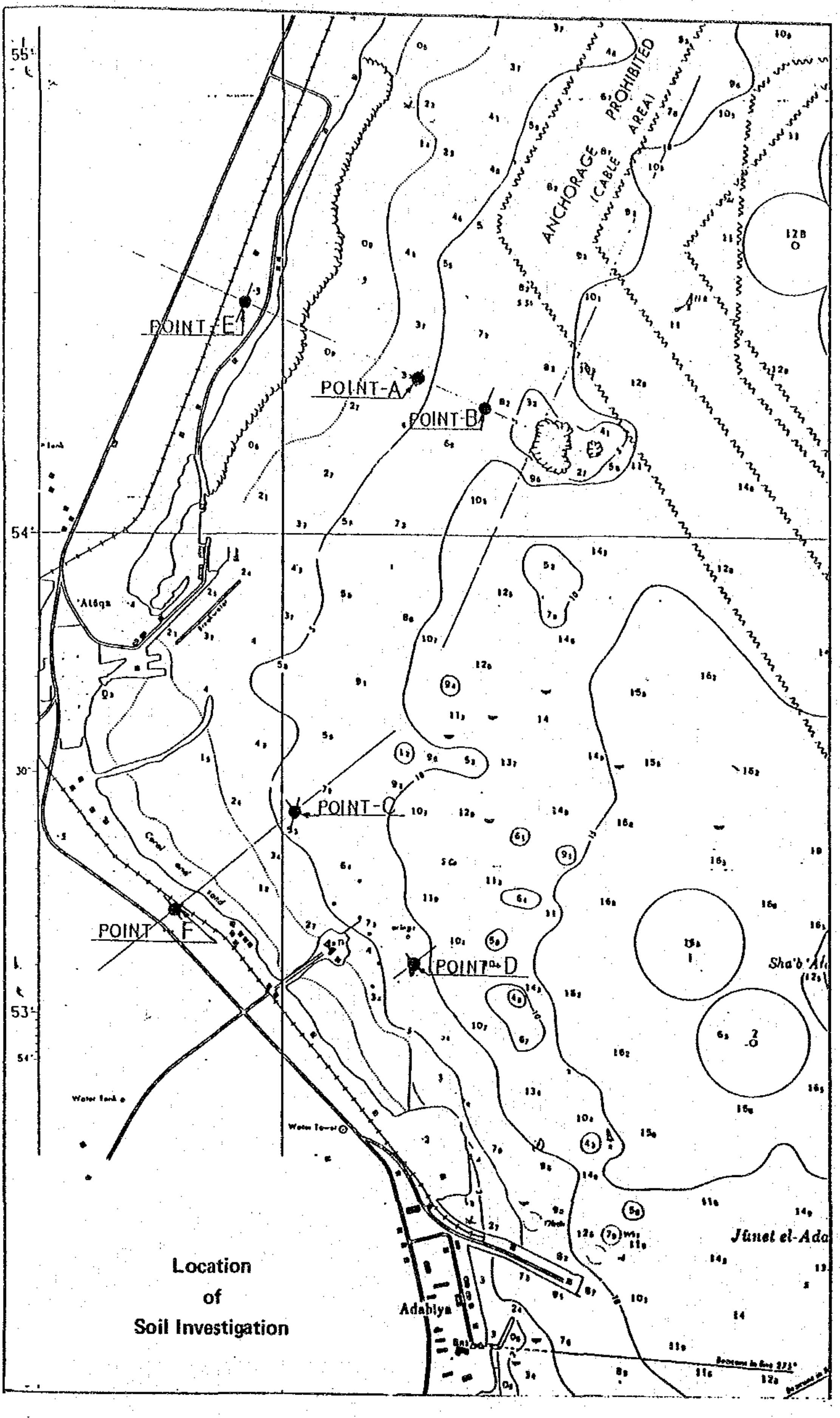


AREA A	AREA B	AREA C (CANAL)
less than 5 cm/sec	less than 5 cm/sec	50 - 70 cm/sec Northward

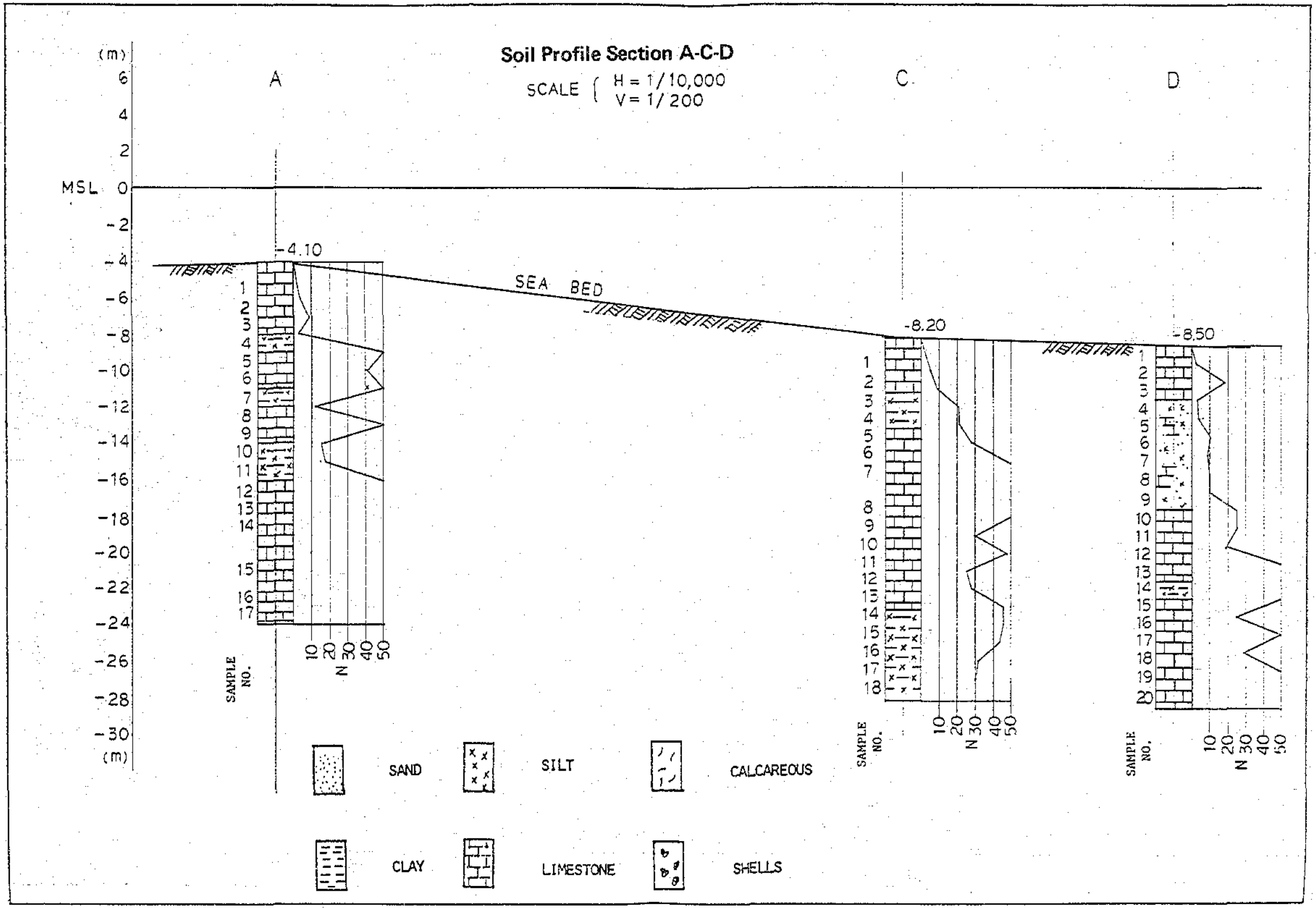
5.5 Soil Investigation

(1) Investigation Points

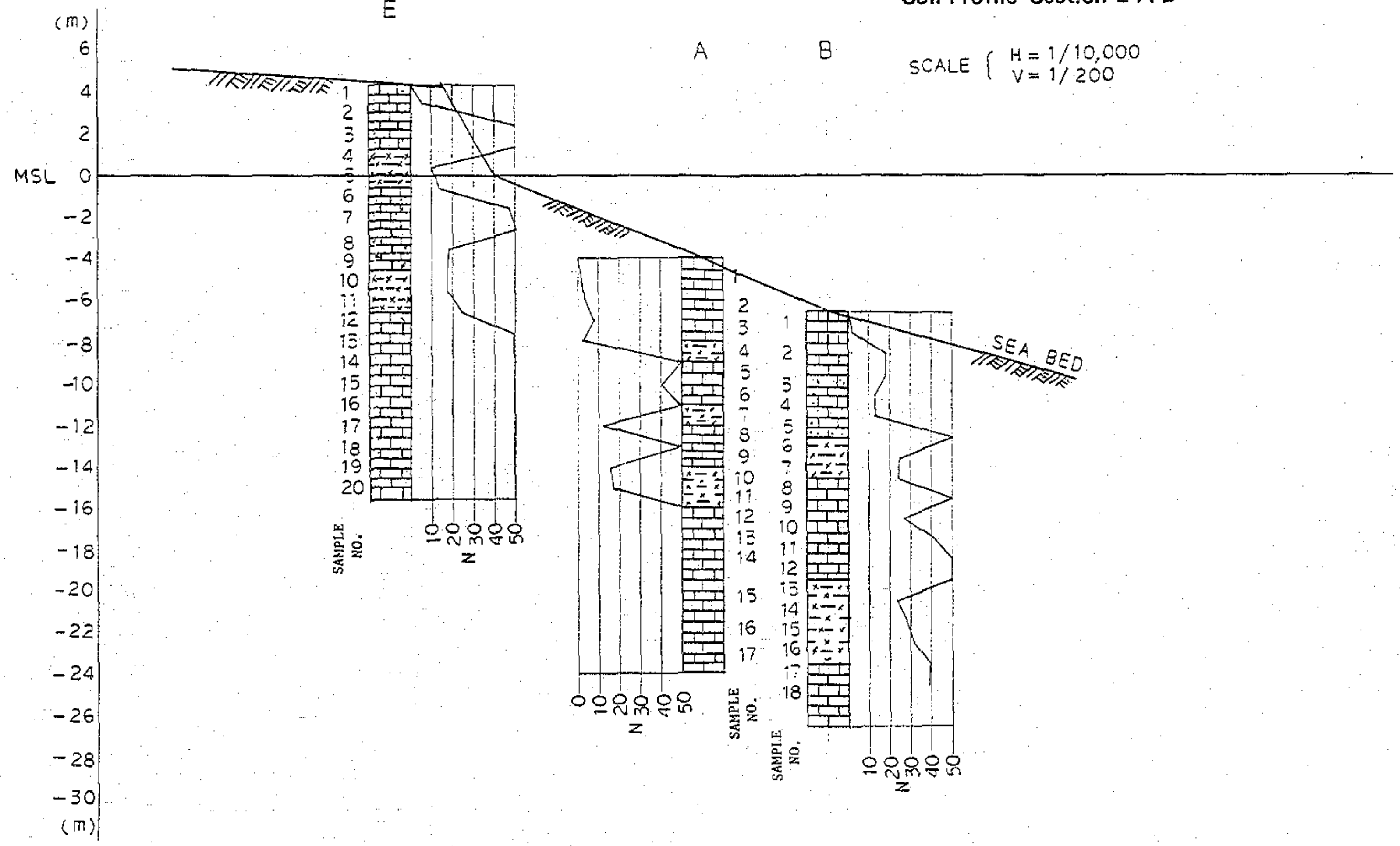
POINT NO.	COORDINATE NORTH	EAST	ELEVATION
A	29°-54'-20"	32°-28'-19"	MSL-4.10^{m}
B	29 -54 -16	32 -28 -29	MSL-6.70
C	29 -53 -25	32 -28 -02	MSL-8.20
D	29 -53 -06	32 -28 -19	MSL-8.50
E	29 -54 -29	32 -27 -54	+4.33
F	29 -53 -12	32 -27 -44	+5.45


POINT-E
POINT-A
POINT-B
POINT-C
POINT F
POINT-D
ANCHORAGE
PROHIBITED
(CABLE AREA)
Adabiya
Sha'b 'Al
Jûnet el-Ada
Location
of
Soil Investigation

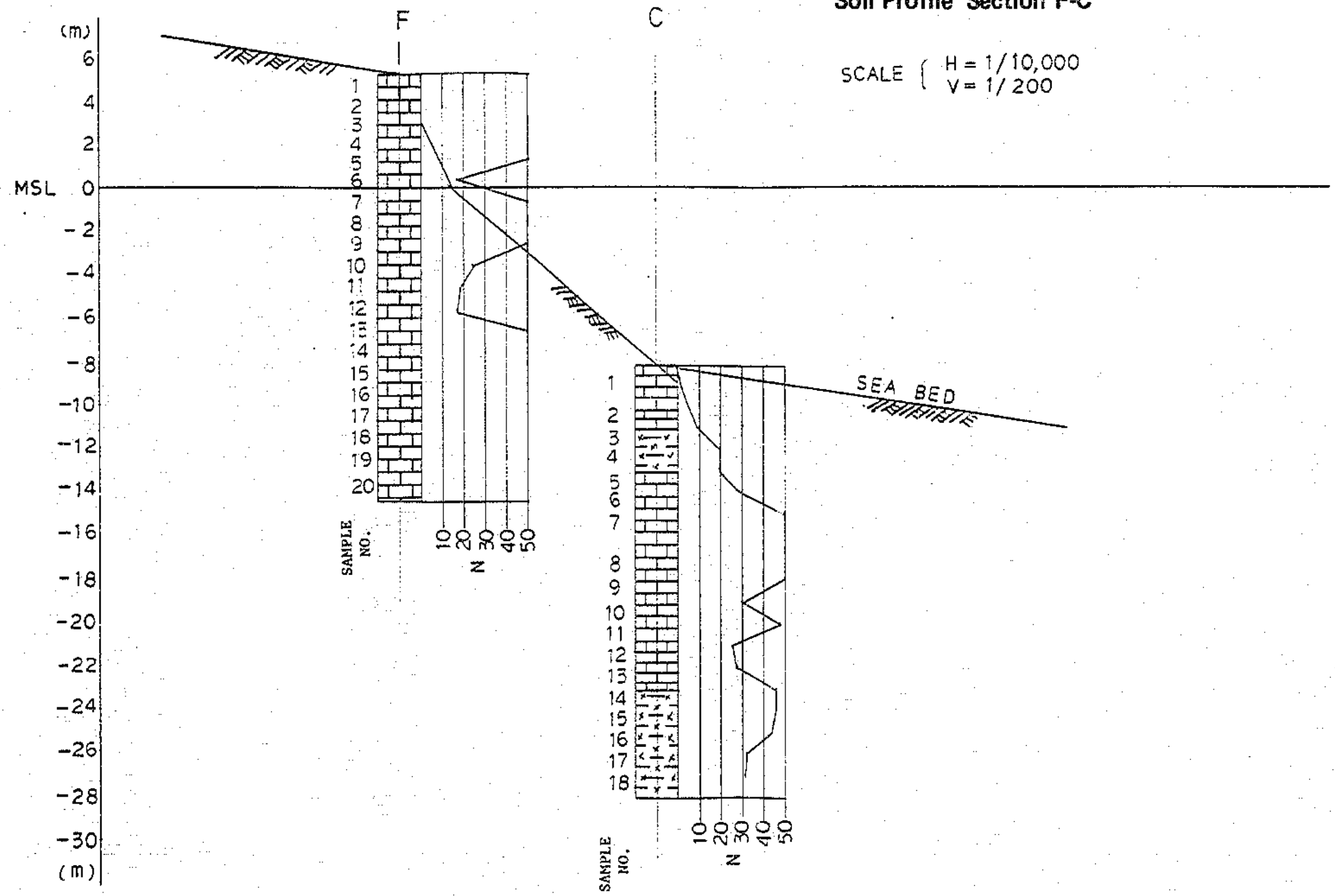
(2) Soil Profile



Soil Profile Section E-A-B



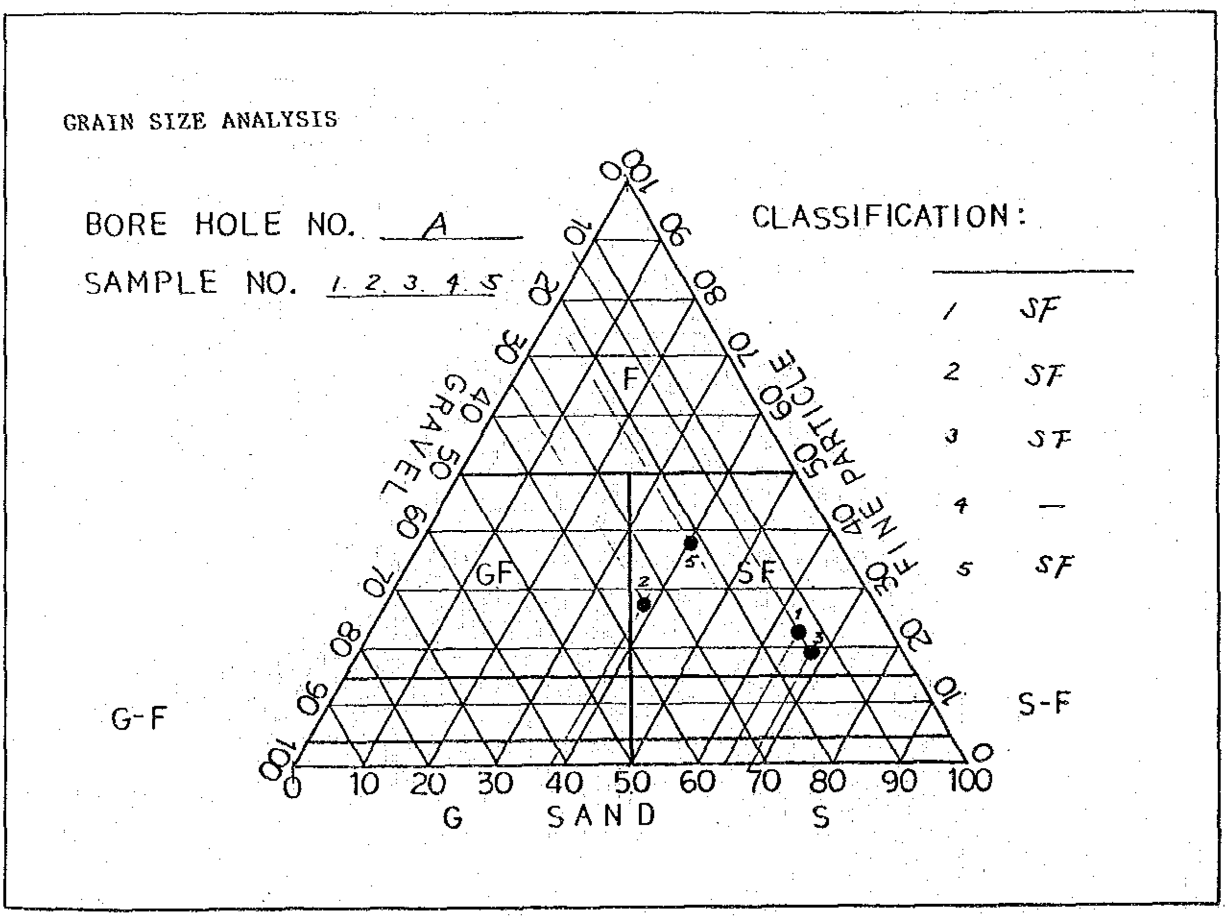
Soil Profile Section F-C



(3) **Grain Size Analysis**

LEGEND FOR GROUP SYMBOLS

SYMBOL	DESCRIPTION
F	Fine grained soil (Silt, Clay)
GF	Gravelly soil with fine grained soil.
SF	Sandy soil with fine grained soil
G-F	Gravel with fine grained soil
S-F	Sand with fine grained soil
G	Gravel
S	Sand



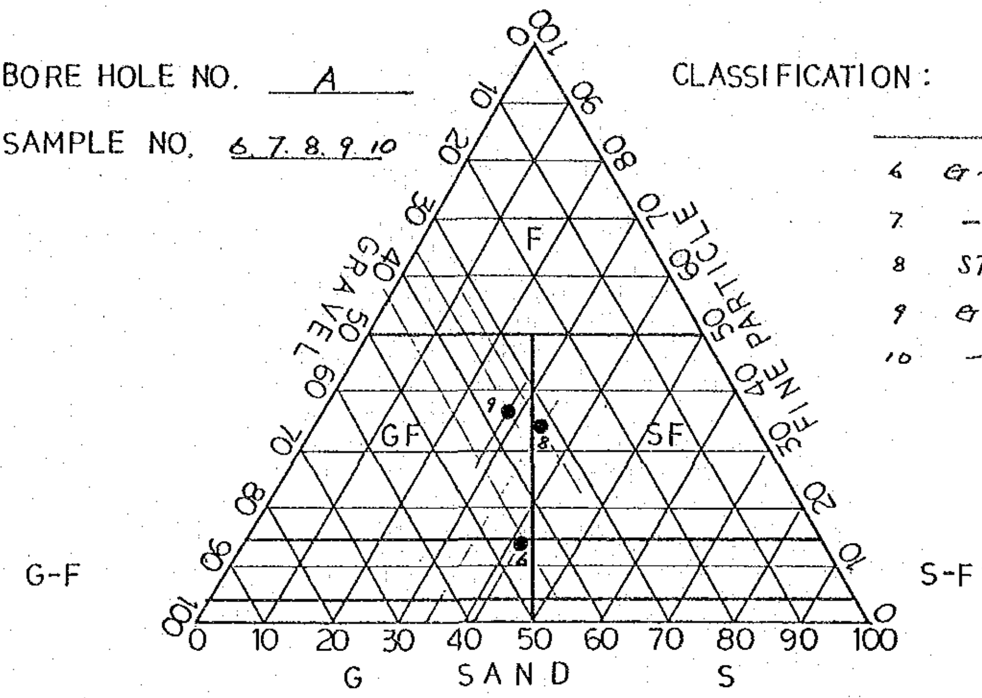
GRAIN SIZE ANALYSIS

BORE HOLE NO. A

SAMPLE NO. 6. 7. 8. 9. 10

CLASSIFICATION :

6	G-F
7	–
8	SF
9	GF
10	–



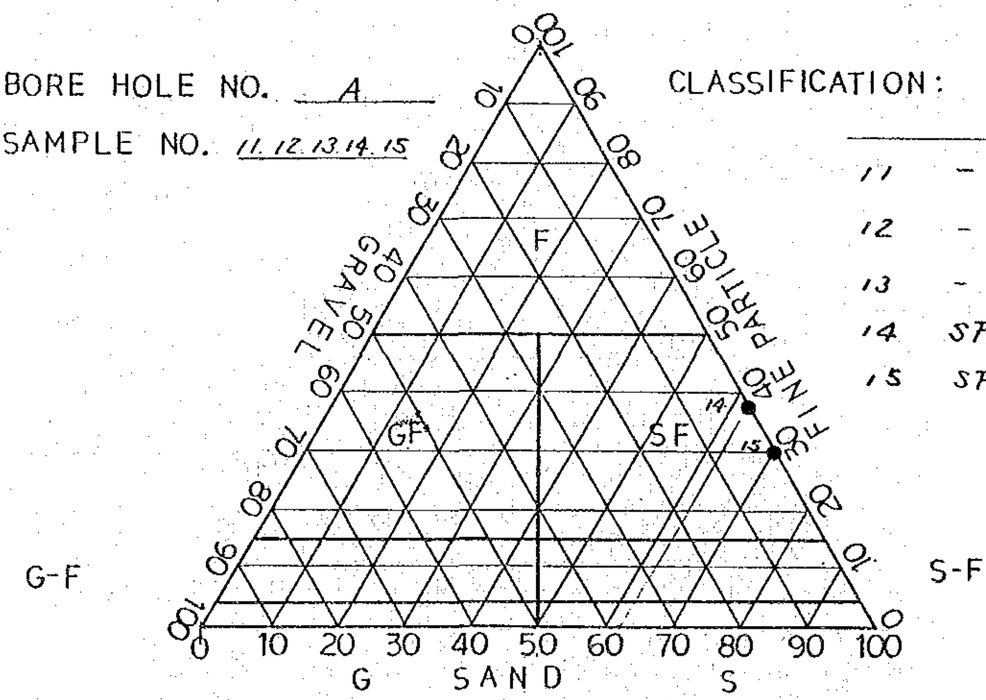
GRAIN SIZE ANALYSIS

BORE HOLE NO. A

SAMPLE NO. 11. 12. 13. 14. 15

CLASSIFICATION:

11	–
12	–
13	–
14	SF
15	SF



GRAIN SIZE ANALYSIS

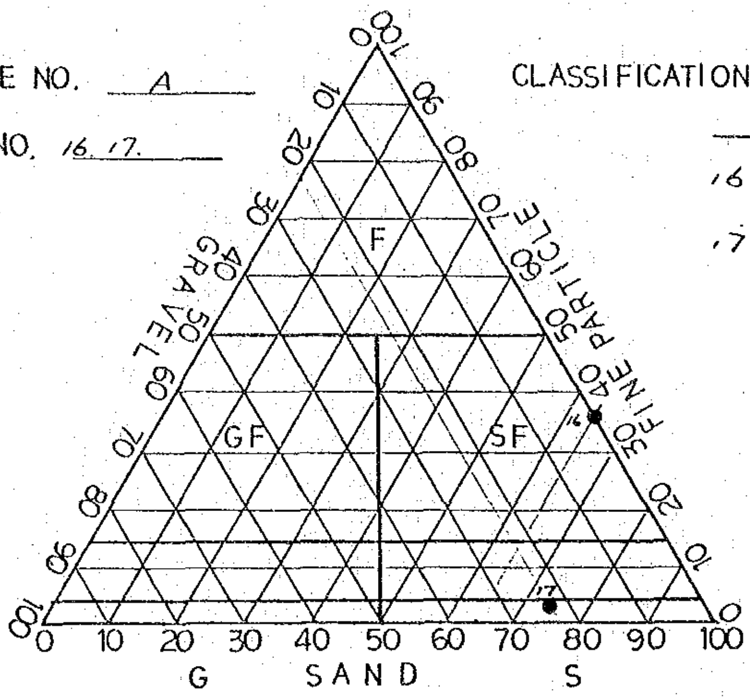
BORE HOLE NO. A

SAMPLE NO. 16, 17.

CLASSIFICATION :

16 SF

17 S



G-F

S-F

GRAIN SIZE ANALYSIS

BORE HOLE NO. B

SAMPLE NO. 1, 2, 3, 4, 5

CLASSIFICATION:

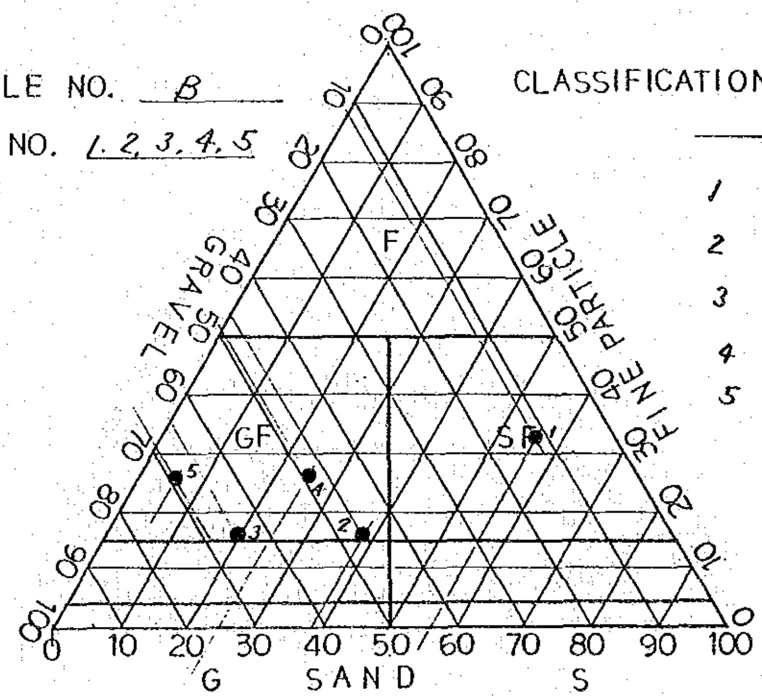
1 SF

2 GF

3 GF

4 GF

5 GF



G-F

S-F

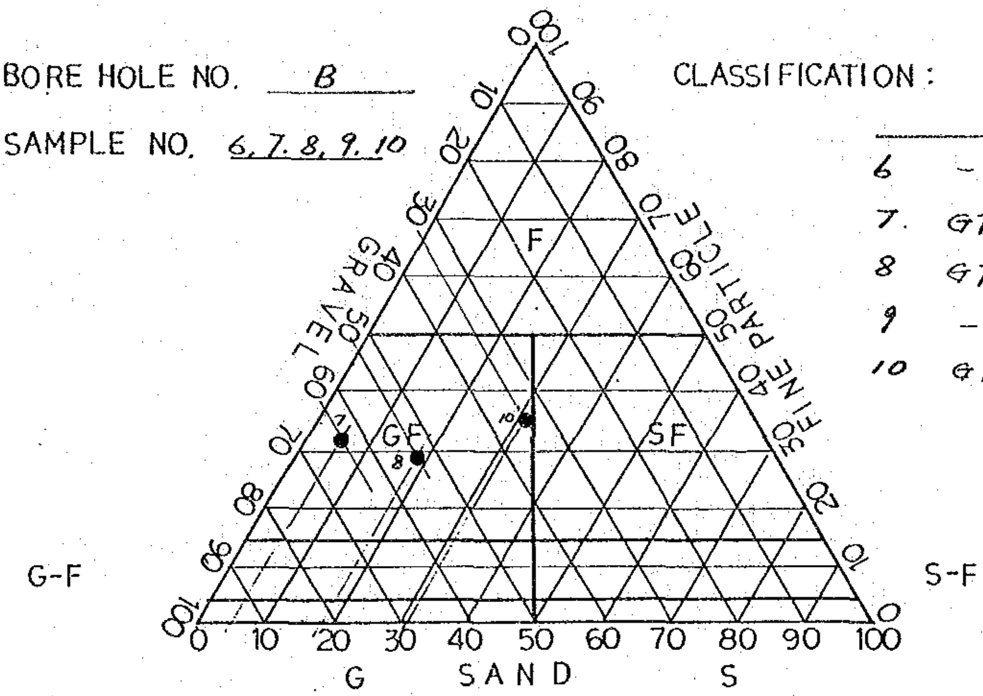
GRAIN SIZE ANALYSIS

BORE HOLE NO. B

SAMPLE NO. 6, 7, 8, 9, 10

CLASSIFICATION :

6	–
7.	GF
8	GF
9	–
10	GF



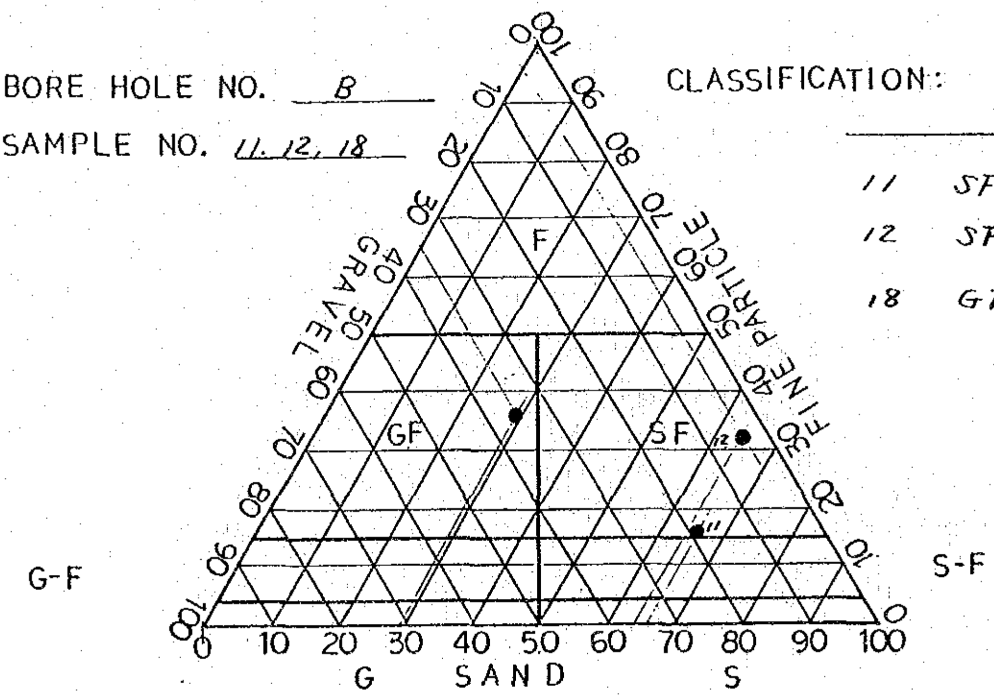
GRAIN SIZE ANALYSIS

BORE HOLE NO. B

SAMPLE NO. 11, 12, 18

CLASSIFICATION:

11	SF
12	SF
18	GF



GRAIN SIZE ANALYSIS

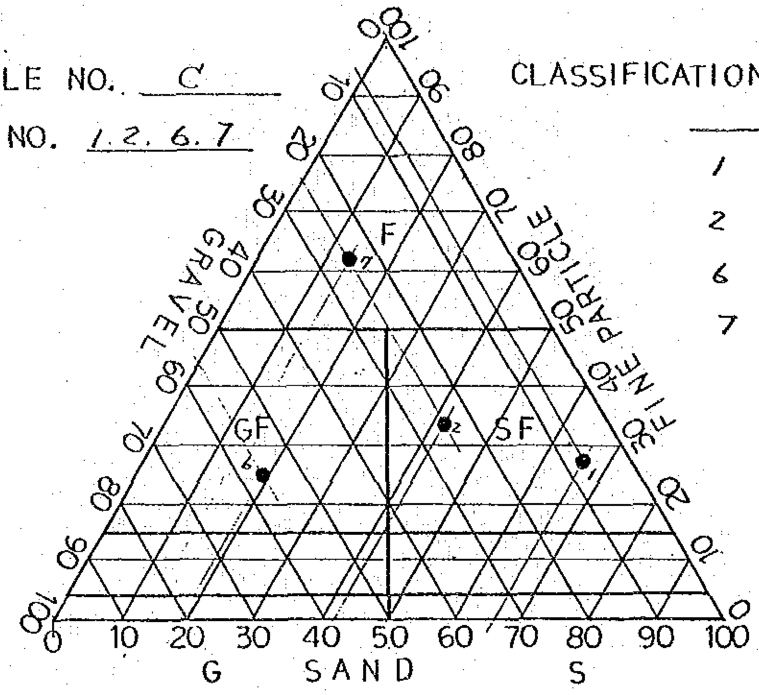
BORE HOLE NO. C

SAMPLE NO. 1. 2. 6. 7

CLASSIFICATION :

1	SF
2	SF
6	GF
7	F

G-F



S-F

GRAIN SIZE ANALYSIS

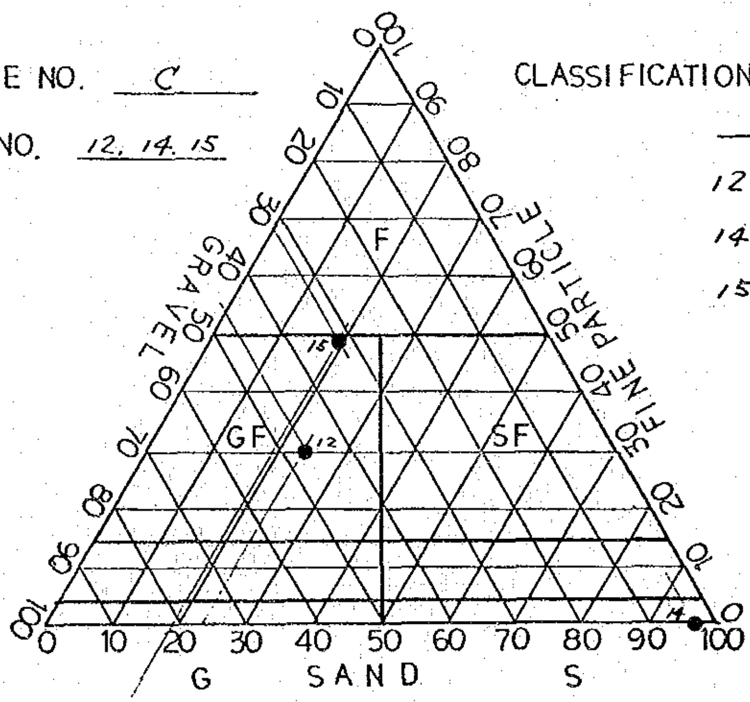
BORE HOLE NO. C

SAMPLE NO. 12, 14. 15

CLASSIFICATION :

12	GF
14	S
15	GF

G-F



S-F

GRAIN SIZE ANALYSIS

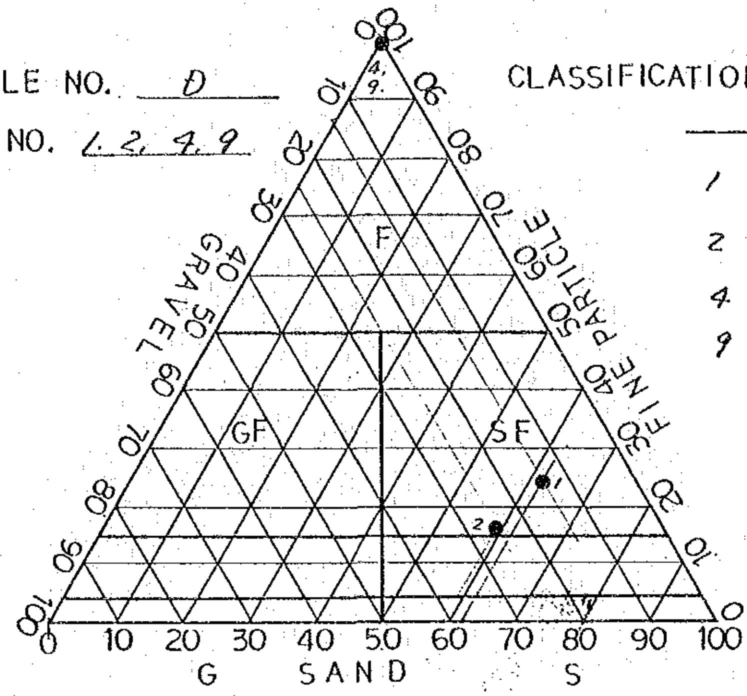
BORE HOLE NO. D

SAMPLE NO. 1, 2, 4, 9

CLASSIFICATION :

1	SF
2	SF
4	F
9	F

G-F



S-F

GRAIN SIZE ANALYSIS

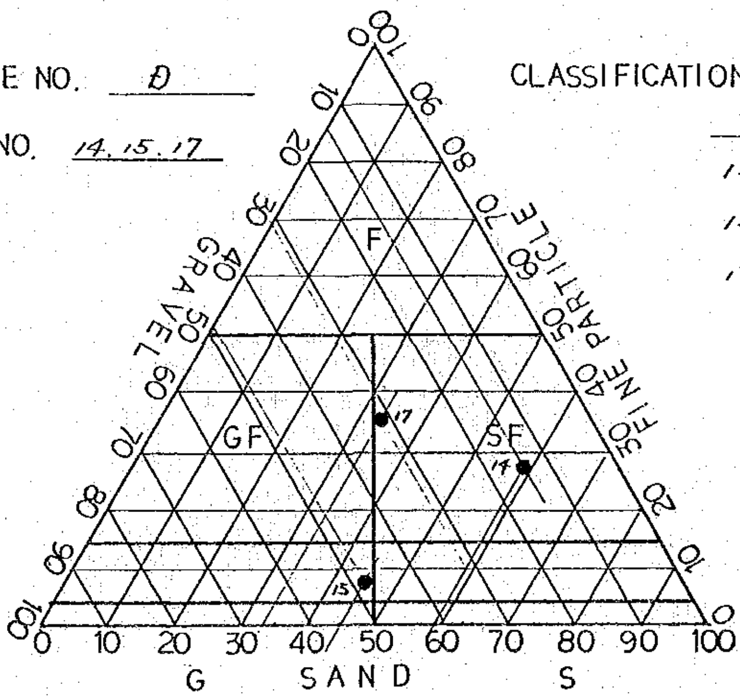
BORE HOLE NO. D

SAMPLE NO. 14, 15, 17

CLASSIFICATION :

14	SF
15	G-F
17	SF

G-F



S-F

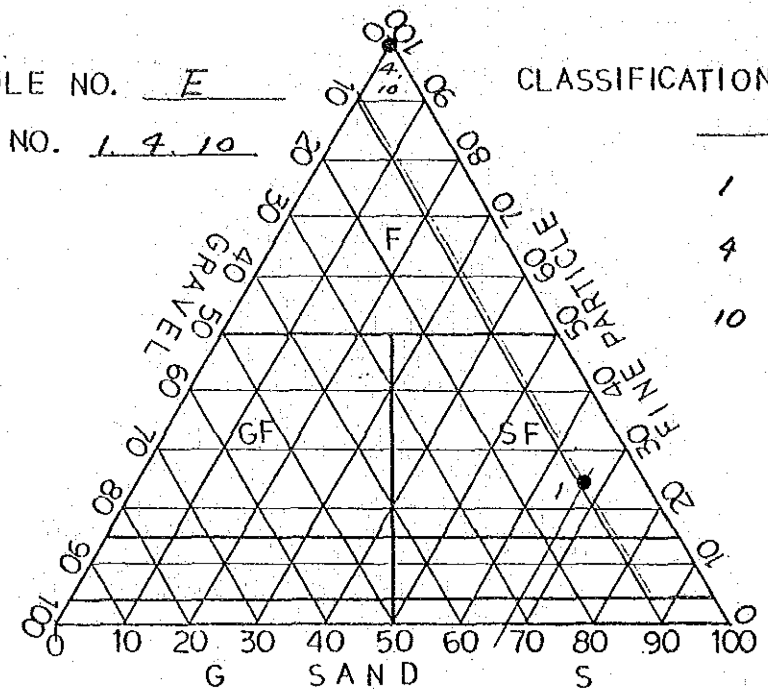
GRAIN SIZE ANALYSIS

BORE HOLE NO. E

SAMPLE NO. 1, 4, 10

CLASSIFICATION:

1	SF
4	F
10	F



G-F

S-F

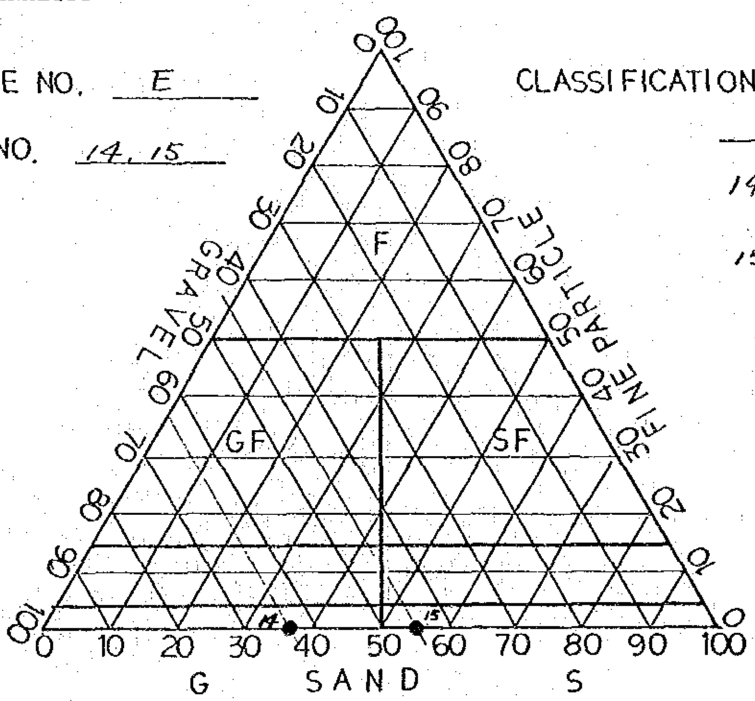
GRAIN SIZE ANALYSIS

BORE HOLE NO. E

SAMPLE NO. 14, 15

CLASSIFICATION:

14	G
15	S



G-F

S-F

GRAIN SIZE ANALYSIS

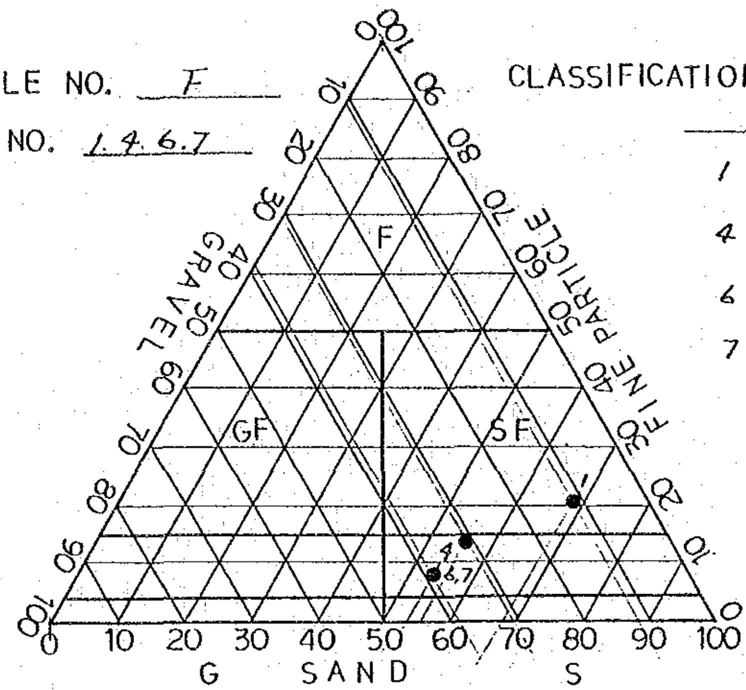
BORE HOLE NO. F

SAMPLE NO. 1.4.6.7

CLASSIFICATION:

1	SF
4	S-F
6	S-F
7	S-F

G-F



S-F

GRAIN SIZE ANALYSIS

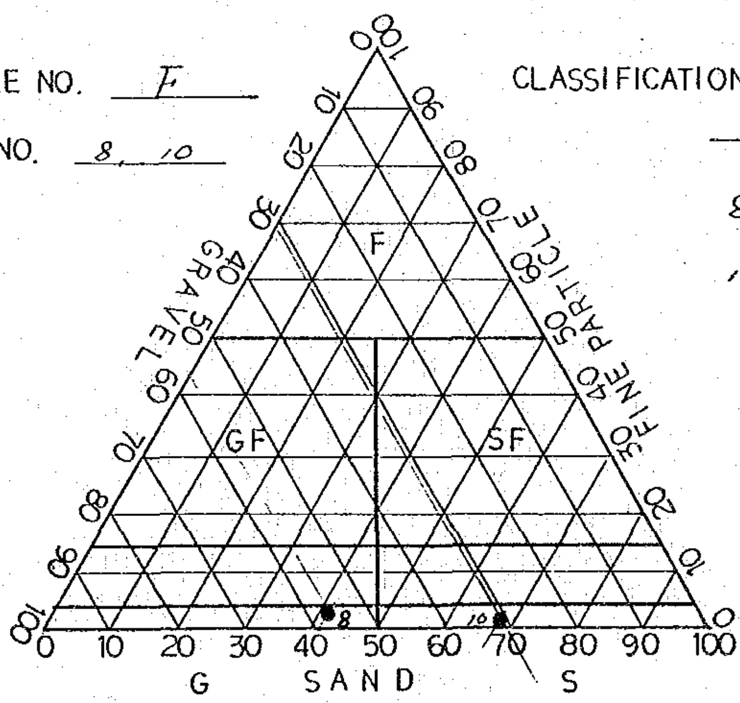
BORE HOLE NO. F

SAMPLE NO. 8, 10

CLASSIFICATION:

8	G
10	S

G-F



S-F

GRAIN SIZE ANALYSIS

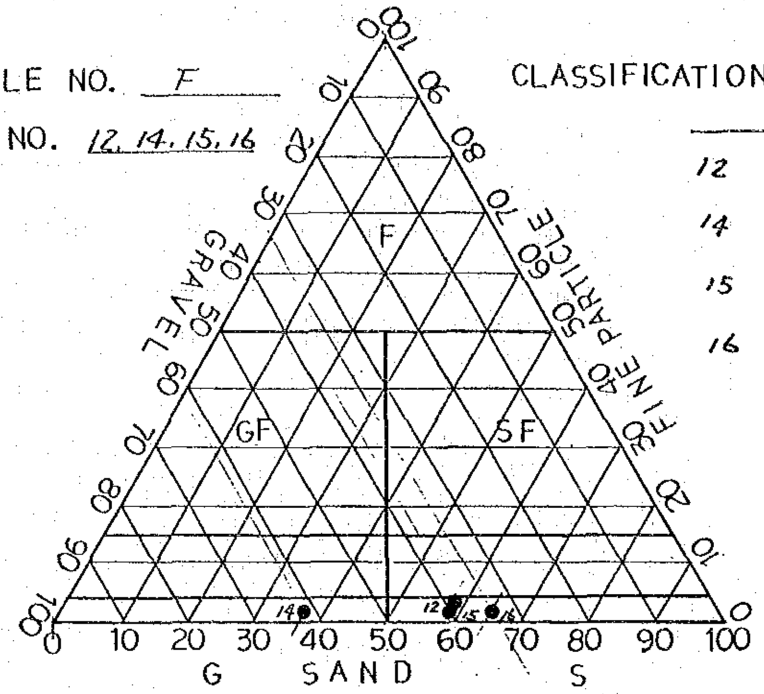
BORE HOLE NO. F

SAMPLE NO. 12, 14, 15, 16

CLASSIFICATION :

12	S
14	G
15	S
16	S

G-F



S-F

GRAIN SIZE ANALYSIS

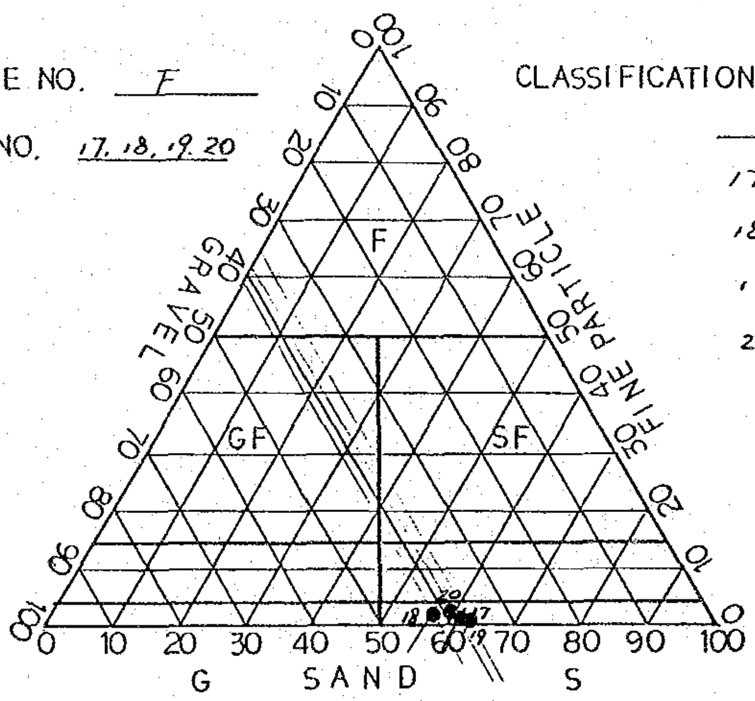
BORE HOLE NO. F

SAMPLE NO. 17, 18, 19, 20

CLASSIFICATION :

17	S
18	S
19	S
20	S

G-F

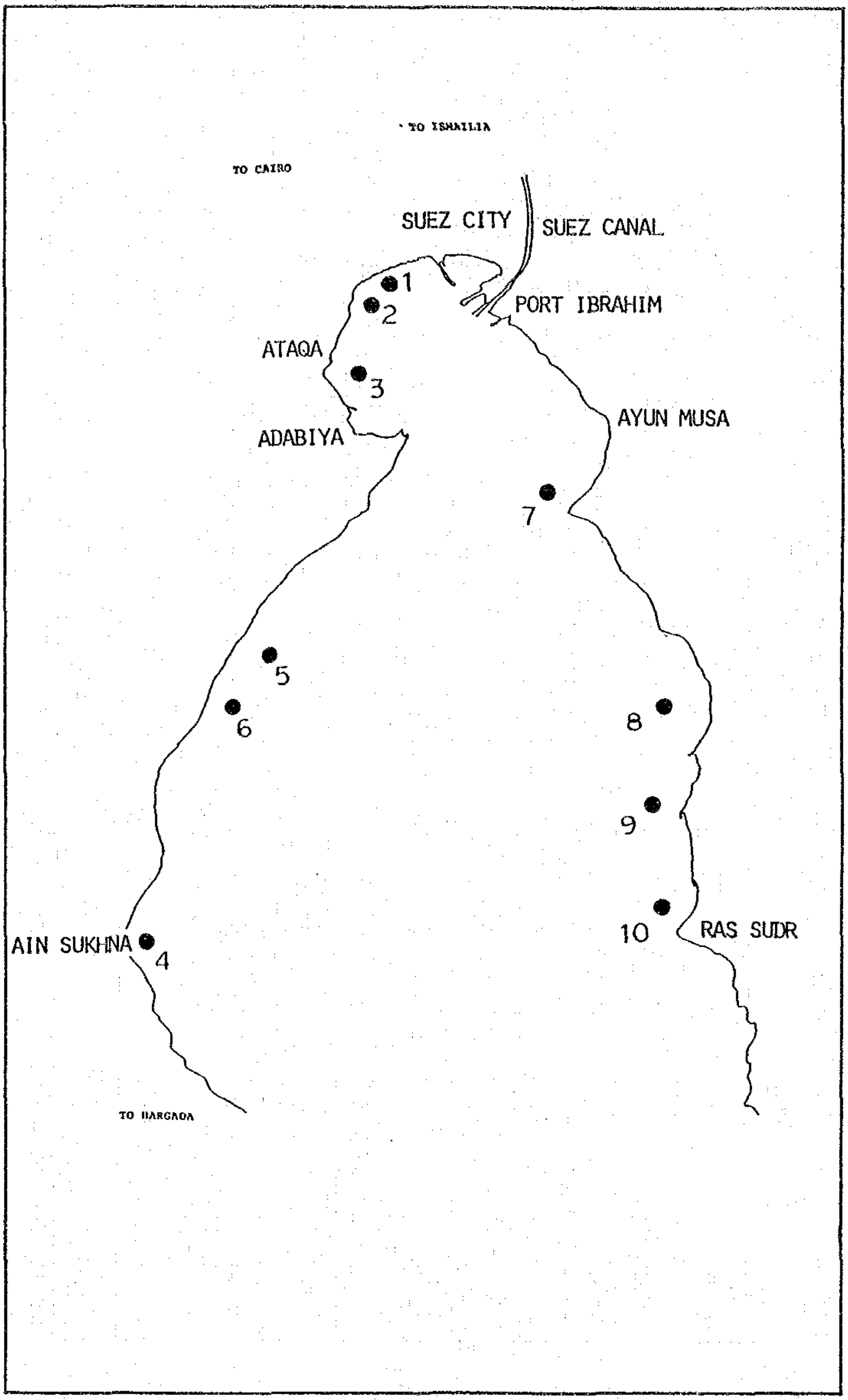


S-F

5.6 Analysis of Bottom Sediment and Sea Water Quality

(1) Location of Sampling for Bottom Sediment and Sea Water Quality

POINT NO.	COORDINATE		ELEVATION
	NORTH	EAST	
1	29 -55 -51	32 -29 -00	MSL-4.45
2	29 -55 -19	32 -28 -53	MSL-5.95
3	29 -53 -47	32 -27 -58	MSL-4.85
4	29 -33 -50	32 -21 -45	MSL-0.85
5	29 -43 -12	32 -24 -54	MSL-15.25
6	29 -42 -06	32 -24 -52	MSL-20.35
7	29 -51 -00	32 -35 -40	MSL-16.45
8	29 -42 -57	32 -40 -10	MSL-17.65
9	29 -40 -00	32 -39 -31	MSL-17.85
10	29 -37 -29	32 -40 -06	MSL-12.55


TO ISMAILIA
TO CAIRO
SUEZ CITY
SUEZ CANAL
1
2
PORT IBRAHIM
ATAQA
3
ADABIYA
AYUN MUSA
7
5
6
8
9
10
RAS SUDR
AIN SUKHNA
4

(2) **Analysis of the Bottom Sediment**

SAMPLE NO.	DEPTH OF SAMPLING (m)	TEMP. (c)	SPECIFIC GRAVITY	GRAIN SIZE ANALYSIS (D50) %	N-HEXANE EXTRACT (mg/l)	CLASSIFICATION
1	- 4.2	27.6	2.70	0.138	20.0	A
2	- 5.6	26.4	2.67	0.173	15.0	A
3	- 4.6	25.0	2.66	0.210	21.6	A
4	- 2.0	28.8	2.68	0.230	15.7	B
5	-15.0	27.2	2.63	0.024	3.7	C
6.	-20.0	27.4	2.64	0.165	5.8	B
7.	-17.2	25.4	2.65	0.081	5.8	B
8.	-18.0	26.6	2.67	0.420	11.8	B
9.	-18.0	26.7	2.70	0.33	1.9	B
10	-12.6	26.5	2.68	0.270	2.0	B

NOTE: Classification A - Organic highly weathered limestone, shell fragments and a little sand
B - Highly weathered limestone, shell fragments and sand
C - Calcreous clayey silt with a little fine sand and shell fragments

(3) Water Quality Analysis

SAMPLE NO.	DEPTH OF SAMPLING	TEMP. (°C)	VISBILITY (m)	SPECIFIC GRAVITY	C.O.D. (ppm)	Cl *1 (°/°°)	PH	S.S. *2 (mg/l)	D.O. (ml/l)	N.H.E. *3 (mg/l)
1	-2.1 m	27.6	2.9	1.0284	7.21	23.6	8.2	4.6	8.8	17.5
2	-2.6	26.8	3.0	1.0284	4.79	24.6	8.2	4.4	5.2	13.2
3	-2.3	27.8	3.0	1.0288	8.84	23.5	8.2	6.1	7.2	18.3
4	-2.0	29.1	3.0	1.0276	4.80	23.7	8.3	5.0	13.2	13.3
5	-7.5	28.2	6.5	1.0288	0.30	24.5	8.2	4.5	6.8	2.5
6	-10.0	27.9	7.0	1.0289	0.50	24.4	8.3	4.0	12.4	4.9
7	-8.6	25.4	4.5	1.0290	0.61	24.7	8.3	8.6	13.4	6.8
8	-9.0	26.8	5.0	1.0290	0.06	24.6	8.3	16.0	14.2	1.0
9	-9.0	26.6	5.5	1.0289	0.03	23.6	8.2	4.0	14.4	0.8
10	-6.3	26.3	6.0	1.0290	0.03	24.6	8.2	7.7	14.4	0.9

Note: *1 Chloride density
*2 Suspended Solid
*3 N-hexan extract