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REPORT OF THE JAPANESE SURVEY MISSION ON THE GRAVING DOCK CONSTRUCTION PROJECT IN SURABAJA, INDONESIA

December 1970

OVERSEAS TECHNICAL COOPERATION AGENCY
GOVERNMENT OF JAPAN

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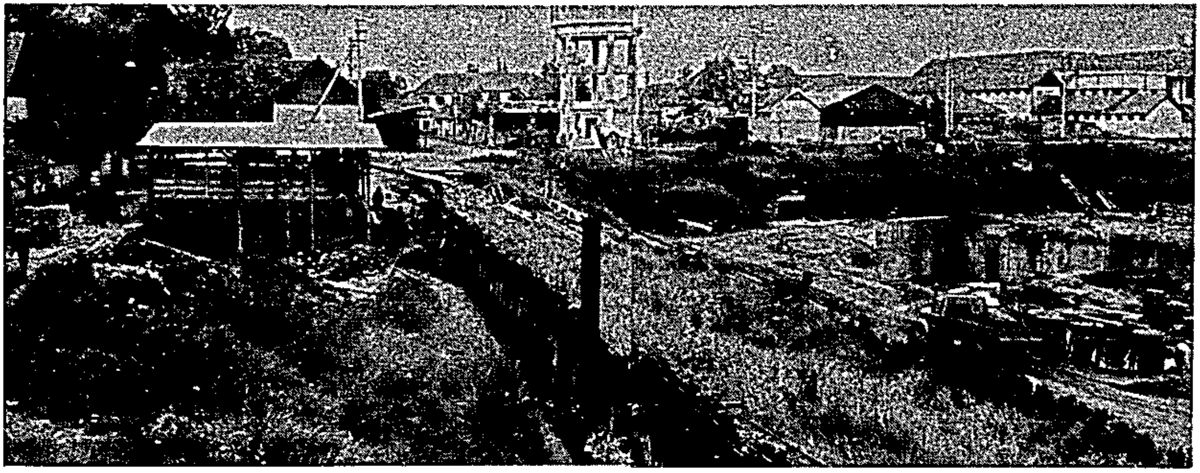
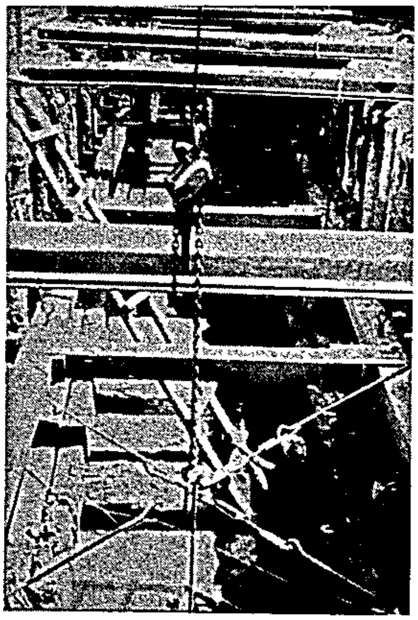
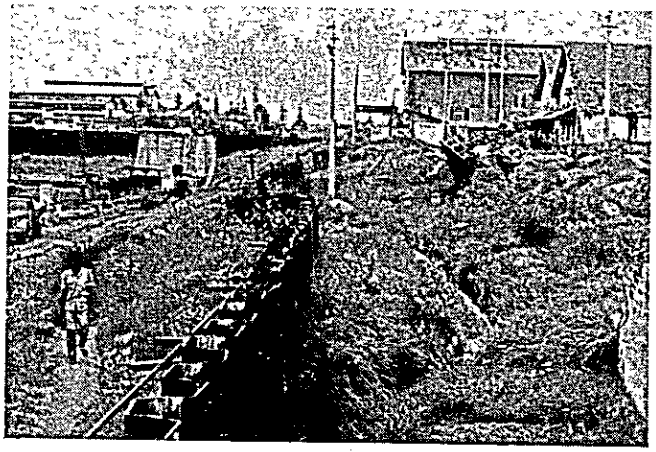


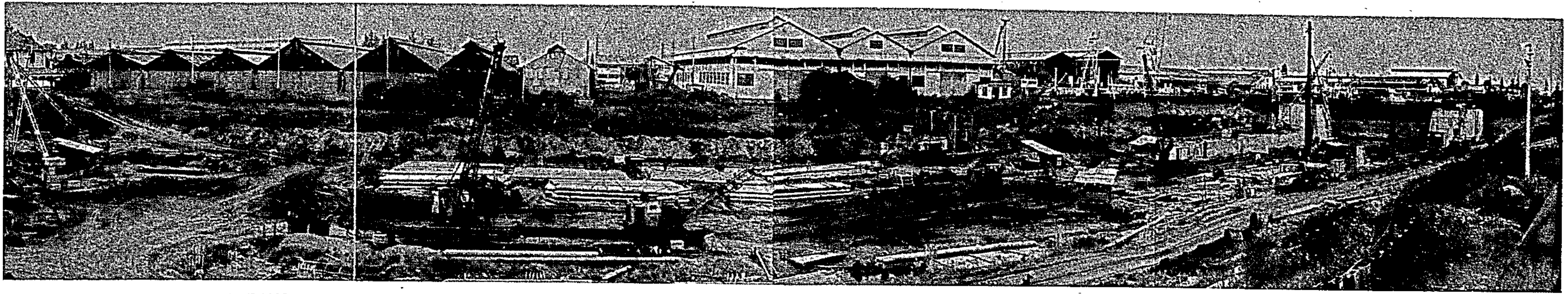
PIP WORK UNDER WAY



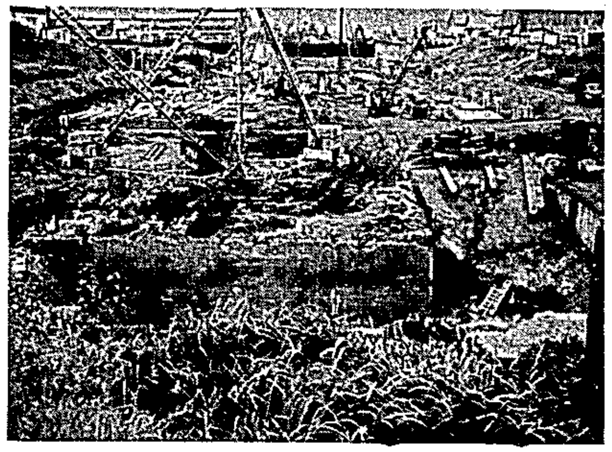
STRUT EXCAVATION



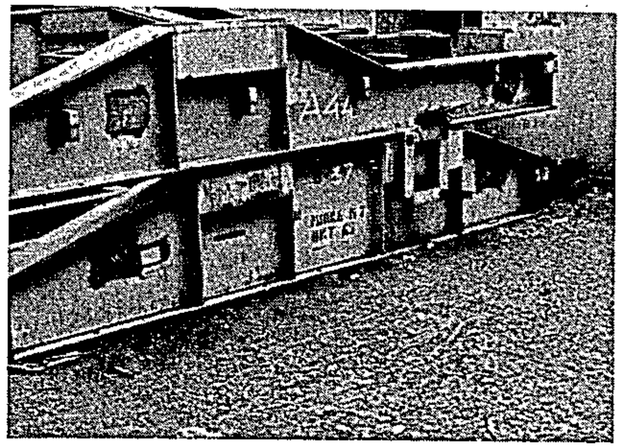
SCENE OF A SLOPE FAILURE ACCIDENT AT THE STEEL SHEET PILING OF THE GRAVING DOCK



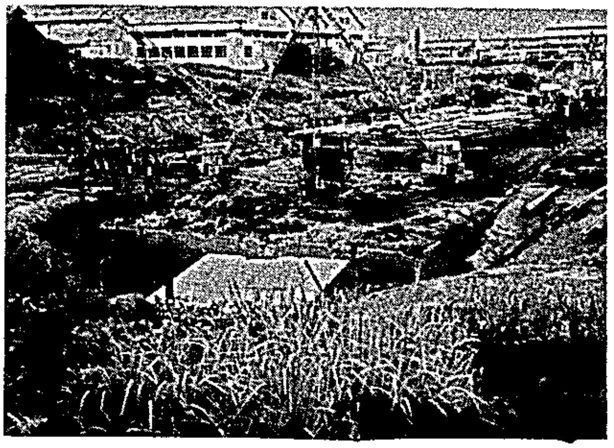
PANORAMIC VIEW OF THE GRAVING DOCK



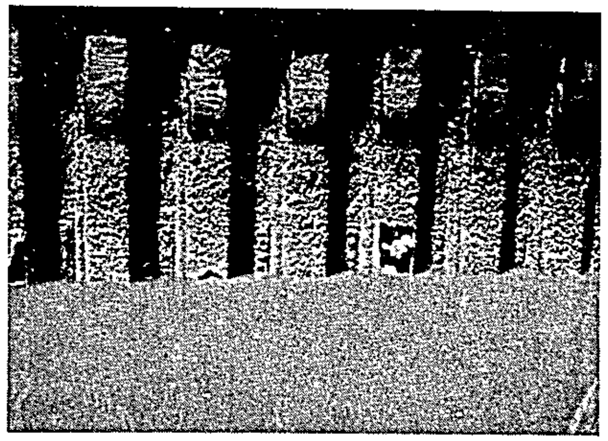
HAM DOCK



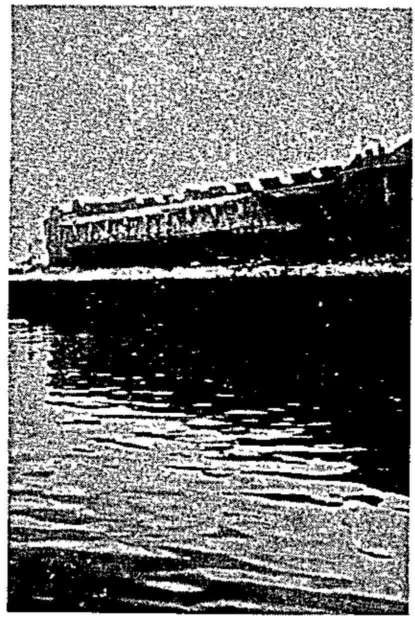
EQUIPMENT ASSEMBLIES LEFT IN THE OPEN



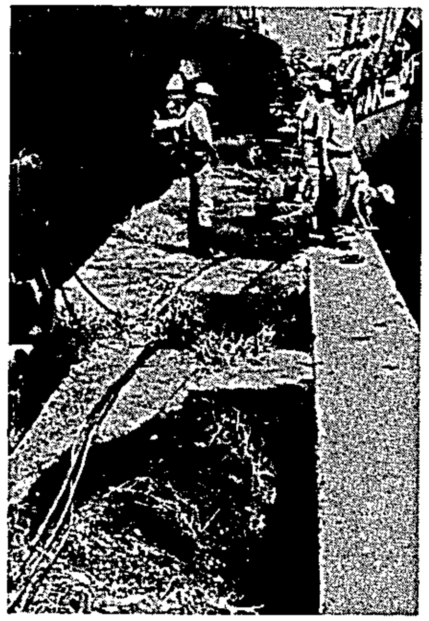
HAM DOCK



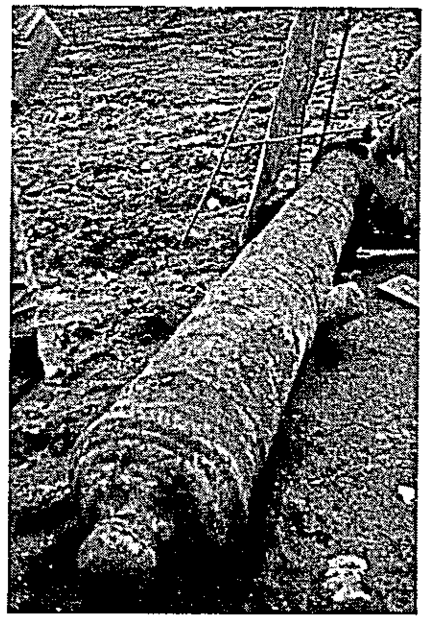
PART OF THE CORRODED STEEL SHEET PILE RIVETMENT



RIVETMENT A

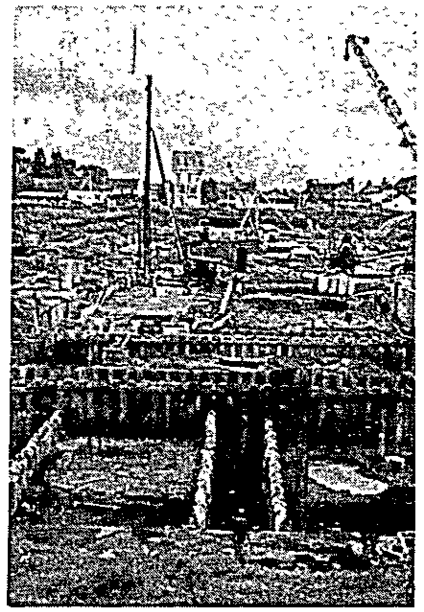


CAVED-IN STEEL SHEET PILE APRON



AN OLD CANNON DUG OUT AT THE DOCK WORK SITE

FRONT VIEW OF RIVETMENT D



DOCK VIEWED FROM THE DOCK ENTRANCE (CAISSON AND PARTIAL STRUT)

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REPORT OF THE JAPANESE SURVEY MISSION
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I FORWARD

1. Purpose of Survey

In June 1970, the Indonesian Government requested the Japanese Government to grant it a yen credit with which to complete the graving dock under construction in Surabaja, Indonesia. This survey team was organized to help the Japanese Government to consider the request for credit. Its purpose consisted in investigating into the particulars and present condition of the graving dock construction, the works to be completed and hydrographical conditions, clarifying the feasibility of the graving dock project from a technical point of view, estimating the time, materials and costs required for the completion and control of the construction works, and acquiring a fair knowledge of the present condition of the approaches to the graving dock.

2. Scope of Survey

A survey was made of the following concrete particulars to attain the purpose outlined above.

(1) Progress of the construction and the work and number of days required for the completion of the graving dock.

(2) Wear and tear of the machines and equipment in use and the number of replacements required (including parts) and their costs.

(3) Quantities and costs of additional materials required.

(4) Number of engineers required for the control and superintendence of the construction and the expenses for despatching them.

(5) Present condition of the approaches to the graving dock.

3. Premises of Survey

This present estimate has been prepared on the basis of the past data, taking into account the various conditions prevailing at the time of surveying. It is therefore based on the following premises:

(1) A war, political change or major economic change will not occur.

(2) Inflation of currency will not progress to excess.

(3) The Rupiah funds will be secured, and payments will be effected punctually.

(4) No greater change than that confirmed at present will occur in the soil surveyed.

4. Survey Team

Leader	Teiji Amimoto	Ship Bureau, Ministry of Transportation
Member	Yoshinori Makizawa	Ship Bureau, Ministry of Transportation
Member	Shogo Oba	Second Regional Harbour Construction Bureau, Ministry of Transportation
Member	Hiroshi Yoshimura	Kanto Regional Construction Bureau, Ministry of Construction
Member	Yoshio Yoshida	Overseas Enterprise Division. Overseas Technical Cooperation Agency

Mr. Noboru Hara, official of the Economic Cooperation Bereau of the Ministry of Foreign Affairs, accompanied the survey team.

5. Itinerary of Survey Team

(1) Period of Survey: From December 8, 1970 to December 25, 1970.

(2) Itinerary

From	To	Places Visited
December 8		Left Tokyo and arrived in Djakarta.
December 9	December 10	Djakarta
December 11		Left Djakarta and arrived in Surabaja.
December 12	December 19	Surabaja
December 20		Left Surabaja and arrived in Djakarta.
December 21	December 22	Djakarta
December 23		Left Djakarta and arrived in Singapore.
December 24		Left Singapore and arrived in Hongkong.
December 25		Left Hongkong and arrived in Tokyo.

(3) Principal Places Visited and Surveyed

The principal places that the survey team visited and surveyed during the period of survey are as follows:

PLACES VISITED AND SURVEYED	PERSONS CONTACTED	PURPOSES
Japanese Embassy (First Visit)	Ambassador Yagi Minister Arita Counselor Edamura Secretary Iwamoto Surveyer Nakaoka (Ministry of Construction) Specialist Koyama (Ministry of Transportation) Specialist Yokota (Ministry of Construction) OTCA Manager Sayama	Greeting and arrangement of detailed survey schedule
Indonesian Government (First Visit)	Col. Urip (Indonesian Naval Force) Maj. Soenarto (Indonesian Naval Force) Director General Sukaton (Maritime Production & Service)	Overall questions and request for facilities for conducting the survey. Secretary Iwamoto and Surveyer Nakaoka accompanied the survey team.

PLACES VISITED AND SURVEYED	PERSONS CONTACTED	PURPOSES
	Secretary Director Partana (Maritime Production & Service) Chief Director Wasono (Chief Directorate, Overall Management of Shipyards & Enterprises)	
Japanese Consulate at Surabaja	Consul Ariyoshi Vice-consul Yamazaki Commissioner Matsudz	Greeting
Headquarters of the Indonesian Naval Force Base at Surabaja	Col. Urip (Indonesian Naval Force) Col. Soedarsono (Headquarters of the Indonesian Naval Force Base at Surabaja) Maj. Soenarto (Indonesian Naval Force) Maj. Soetopo (Headquarters of the Indonesian Naval Force Base at Surabaja) All officers in charge	1. Discussion of the survey schedule and method 2. Detailed questions and request for data
Construction site of the graving dock	Maj. Soetopo (Headquarters of the Indonesian Naval Force Base at Surabaja) All officers in charge	1. Field surveys (Overall survey, survey of construction machines and equipment and survey of approaches) 2. Collection of data of the past and the future plan 3. Examination of the data collected

PLACES VISITED AND SURVEYED	PERSONS CONTACTED	PURPOSES
Headquarters of the Indonesian Naval Force Base at Surabaja	Same as at the time of the first visit	To convey the opinion of the survey team upon completion of surveys.
Indonesian Government (Second Visit) (Bappenas Meeting)	Dr. Soemalin (Bappenas) Col. Urip (Indonesian Naval Force) Maj. Soenarto (Indonesian Naval Force) Mr. Ali (Chief of Repairs Section of the General Shipbuilding Department)	1. To convey the opinion of the survey team regarding the survey. 2. Discussion between both parties, the Representatives of the Indonesian Government and the survey team.
Japanese Embassy (Second Visit)	Minister Arita Secretary Iwamoto Surveyer Nakaoka (Ministry of Construction) Surveyer Nochiide (Ministry of Transportation)	To make a brief report of the surveys.

II OUTLINE OF THE GRAVING DOCK PROJECT

1. Outline of Project

The plan states that this graving dock shall be constructed in the arsenal of the Indonesian Naval Force in Surabaja, Djawa Island. The construction site is located deep into Bandar Barat Bay on the west coast of Surabaja, a moorage including small docks which is commonly called "Ham Dock." According to the plan, the largest ships that are to be docked there will be cruisers having a displacement tonnage of 17,800. At ordinary times, however, the graving dock will be used for repairs of both commercial and naval vessels.

(1) Fundamental Specifications of the Graving Dock

a. Principal Dimensions of the Dock

Length of Flat Portion of Dock Bottom	230 M
Length from Upper Head to Outside of Dock Gate	241 M
Distance between Upper Dock-Walls	30 M
Distance between Lower Dock-Walls	23 M
Dock Depth from Bottom Centre to Ground Level	12 M
	28.8 x 5.6 M x 11.6 M
	Floating Caisson
Main Discharge Pumps	9,500 T/Hr x 350 kW 4
Discharge Time	3 hours
Maximum Docking Capacity: Displacement tonnage	17,800

b. Principal Supplementary Equipment

Level-luffing jib crane	30T x 18M/15T x 36M	2
Capstan	10T x 15M/min	1
	5T x 20M/min	2
Electric Supply Equipment	50 Hz 150 KVA 6,000-380V/220V	12
	60 Hz 300 KVA 6,000-440V	1
	D. C. 500 kW 250V/125V	1
Air Compressors	75 kW x 7 kg/cm^2	4
	75 kW x 4 kg/cm^2	4
Oxygen and Acetylene Generator		None
Supplementary Piping Work	Pipes for fresh and salt water, compressed air and steam	

Annexed House	Dock master house	1
	Power house	1
Tugboat	The owned tugboats shall be used.	

(2) Outline of the Soil

The boring and soil tests carried out prior to the construction work disclosed that the soil of the construction site consists of the following layers:

(From the surface)	Indication by the S. H. V. P.	
(1) Layer of mud	Sea bottom	About -5M
(2) Layer of soft sand		-8 M — -15M
(3) Layer of soft clay		-12M — -22M
(4) Layer of soft sand (at the entrance of the dock)		-18M — -23M
(5) Hard soil (supporting layer)		-21M — -23M

The layer (4) is thick at the entrance to the dock, showing a permeability factor of 10^{-2} cm/sec. Its water pressure is much the same as that at the outer water level. The layer (5) has N value of more than 20, and a permeability factor of 10^{-8} cm/sec. It is almost impermeable to water.

(3) Outline of the Graving Dock Structure

a. Dock Walls

The lower walls of the dock are to comprise concrete pneumatic caissons. The types and number of those caissons are given below. (See the attached table 2.)

TYPE		NUMBER
Caisson of I Type	(W_5 - W_9)	5
Caisson of II Type	(E_1 - E_{12}, W_1 - W_4)	16
Caisson near the pump room		3
Caisson on top of the dock		3

The standard dimensions of the caisson are H 9.0 M x B 8.0 M x L 15.0 M. For the caissons of I and II types, concrete piles 300 mm in diameter are to be driven into the soil to a depth of 24.0 M to secure supporting strength. The other caissons are to have their lower ends buried 24. 0 M deep into the soil so as to reach the supporting layer. The caissons are to have sand filled in them. The upper walls of the dock consist of concrete poured to a height of 1 M on top of the caissons. The walls are to be 8. 0 M in height, and a service tunnel is to be pierced through them. The walls are to form the foundation for 30-ton jib cranes. Concrete is to be poured at the work site.

b. Dock Bottom

The structure of the dock bottom is divisible into two sections.

(I) Since the water head is high 50 to 60 M inwards from the entrance to the dock to a point 50 - 60 M inwards from the entrance, struts are to be set up between the dock walls in order to secure safety in excavation and construction, and protect the caissons from the pressures of the surrounding soil. In the construction of struts the P. I. P. engineering method is to be employed using steel sheet piles. Plain concrete is to be placed on the bottom of the dock to a thickness of 4. 0 M.

(II) Since the water head is relatively low at the inner section of the dock, reinforced concrete is to be placed on the bottom of the dock, and the thickness of reinforced concrete is to be reduced to 1. 2 M by the use of the P. I. P. engineering method and concrete piles. The existing ham dock in this section of the dock site must be removed. The ham dock section will be a structure without struts after the excavations have finished, since the dock floor can be used as it is.

c. Dock Entrance

The gate-catch structure is to be built in the form of box caissons on either side as in the case of the dock walls.

Caisson on either side	(C_1, C_2)	2
Caisson at the centre	(D)	1

Since the bottom of the dock is to be made to reach the supporting layer of soil 24. 0 M deep, no supporting pile will be used.

d. Revetments

The survey has found that a caisson structure had been built between the dock walls on the east and west sides and the quay walls. However, the survey team is now condidering the possibility of constructing revetments of steel sheet piles, since the steel sheet piles to be used in the temporary locks can be reused for this purpose.

e. Pump Room and Pumping of Water

A pump room containing four discharge pumps is to be built in caissons B_1 and B_2 on the right side of the dock entrance. The bottoms of the caissons are to be made to reach the supporting layer of soil 24. 0 M deep.

Instead of providing a water inlet in the dock gate, a cylinder gate is to be installed in either wall of the dock. Water is to be discharge through the water inlet in the right-side wall of the dock by means of the four pumps mentioned above, which are to be installed by utilizing a dock side crane after its installation.

(4) Supplementary Equipment

a. Electric Supply Equipment

The electric power requirement for the discharge pumps, cranes, capstans, illumination, communication and the welding work, general use and temporary lighting in the docked vessel will be 1, 900 kW.

An A. C. power supply of 6, 000 volts received at the power house is not to be reduced in voltage in order to make an effective use of the voltage, and is to be fed to the transformer room set up in the dock wall on either side. At this point, the voltage is to be stepped down to the respective required voltages (380V - 220V) for various types of devices excluding the main discharge pumps.

The electric power is to be supplied to the docked vessel from the respective substations through the service tunnel in the dock wall and the power supply ducts installed at given places. The electrical work shall cover the wrIring and piping from the power house incoming panels to the terminal equipment.

b. Plumbing

The fresh and salt water pipes, compressed air pipes and steam pipes required for the repair and maintenance of a vessel in dock are to be branched off the respective installed pipes into the service tunnel running through the dock wall, and are to be led on to the service ducts laid down at given places. Water, air and steam are to be supplied through the service ducts running through the dock walls.

c. Docking Equipment

At either wing of the dock entrance, a capstan with a capacity of 5 tons x 20M/min is to be installed, and one capstan with a capacity of 10 tons x 15M/min is to be installed on the top of the dock. Along the walls on either side of the dock are to be installed two 50-ton bitts and twenty-two 20 ton bitts at intervals of 20 M.

d. Houses

The dock master's house and power house are planned to be built at a proper location somewhere around the graving dock. Their locations, areas and other particulars shall be determined by July 1971.

For other houses required, the existing buildings shall be put to good use.

(5) Organization of Staffs for the Construction Work

The construction of this graving dock has been under way under the direct control of the Indonesian Naval Force. According to the technical assistance agreement, the Engineering Team (Pacific Consultants International) is to furnish advice and guidance as staffs in charge of the construction of the Indonesian Naval Force. As in the case of the Indonesian Naval Force, the Engineering Team divides its duties into the respective fields of service such as civil engineering, construction, machinery, electricity and geology. Each occupational group consists of a chief engineers, engineers, field engineers and instructors of field workers. The number of these staffs has varied with the term of construction work: it reached its peak, 41, in May 1964, and after the incident of September 30, 1965 it began to decline sharply. It was as small as five as of December 1970.

2. Progress of Construction Works and Plan and Cost of Remaining Works

(1) Progress of Construction Works (See the attached table 1.)

The construction of this project was started in February 1964 with a plan to complete it in a period of about forty months from the commencement ceremony to the end of May 1967. As of the end of November 1970, that is, seven years after the commencement of the construction, the construction works had been completed to such an extent as shown below.

Temporary works	100%
Temporary cofferdam	100%
Driving of temporary steel sheet piles	100%
Laying the caissons at the dock entrance	100%
Laying the caissons at the foot of dock walls	100%

Pouring concrete on the floor of the dockhead

Caisson struts	About 80%
Partial struts	About 80%
Concrete piles	About 80%

And, the excavation of the dock bottom and demolition of the ham dock had been under way.

The wroks to be performed from now on are as follows:

Continuation of the dock bottom excavation and pouring concrete on the dock bottom
Pouring concrete in the upper part of dock walls
Construction of the gate-catch structure
Installation of pumps and mooring equipment
Installation of cranes
Supplementary works
Refilling of soil
Removal of steel sheet piles
Construction of revetments

It is extremely difficult to indicate the progress of the construction works in figures. If remotely indicated, it is estimated that approximately 60% of the works have been completed.

The equipment and materials required for the planned permanent and temporary works have been procured. As the works were placed under the direct control of the engineering unit of the Indonesian Naval Force in October 1966, 400 direct workers can be mobilized at ordinary times, and 600, at the peak times, in order to maintain these equipment and materials in good order.

The progress of works is shown in the attached table 1.

(2) Progress of Works in the Respective Fields and Remaining Works

a. Geological Survey

A geological survey was instituted prior to the commencement of the temporary works in June 1960. A land survey, survey of the soil and pumping test were carried out primarily around the location of the graving dock, and were completed in October 1964. At present, the necessity is hardly recognized for conducting further surveys and tests in carrying on the construction works.

For the purpose of conducting a geological survey, twenty boreholes were drilled, and a pumping test and an analytical test of soil grain size were carried out to determine the permeability factor and to obtain the data necessary for the designing and engineering of the graving dock construction.

b. Temporary Works

(I) Temporary Power Equipment

The power equipment already installed for the construction works comprises:

Temporary emergency diesel generator	100 kW
Power supply from the Naval Force arsenal	1,900 kW

The electric power is available at all times from these supply sources, and the estimated power requirement for the future construction works can sufficiently be met.

(II) Temporary Equipment of Water Supply and Draining

The existing facilities are sufficient to meet the requirements for the future construction works, there being no need to add to the existing equipment.

(III) Schedule of Use of Machines in Remaining Temporary Works

The construction machines are to be used according to the schedule outlined below from December 1970. The number of machines underlined in the table below is the additional machines asked as a result of the survey.

Kind of Machine	Total Number	Kind of Work	Note
7-ton excavator	4	Laying of partial struts Excavation of dock bottom Placement of concrete on dock bottom Driving of anchoring piles (P.I.P.)	Cranes with hanging crabs
$30M^3$ Batcher plant	1	Laying of partial struts Placement of concrete on dock bottom Construction of upper dock-walls (Driving of concrete piles)	
3-ton diesel-powered pile driver	2	Driving of piles into dock bottom P.I.P. work Driving of anchoring piles (P.I.P.)	
75 kW Horizontal-type air compressor Portal air compressor	4 2	P.I.P. work Placement of prepakt concrete Removal of ham dock Driving of anchoring piles (P.I.P.)	
7-ton dumpcart Dumpcart	25 <u>10</u>	Excavation of dock bottom Excavation for laying struts Excavation of dock bottom Transportation of frames Refilling of soil	41 dumpcarts are available, but 25 are now in operation.

Crushing plant	1	Laying of partial struts Placement of concrete on dock bottom Construction of upper dock-walls	Break 65 T/H Toggle 53 T/H
6-ton - 19-M stiff-leg crane	5	Excavation of dock bottom Placement of concrete on dock bottom Removal of ham dock	
9-ton bulldozer 16.5-ton bulldozer 13-ton bulldozer	1 1 1	Excavation of dock bottom Removal of ham dock Refilling of soil	Two of Soviet-made bulldozers are in use
9-ton crawler crane 25-ton crawler crane	4 1	Removal of ham dock Construction of upper dock-walls Installation of 30-ton cranes Driving of piles Transportation	
3-ton forklift	1	Installation of 30-ton cranes Transportation	
Diving pump 0.5 - 1.0 T/M Submerged pump 0.5 - 1.0 T/M Centrifugal pump 12 T/M - 25 M Centrifugal pump 12 T/M - 25 M	4 8 4 8	Excavation of dock bottom Placement of concrete on dock bottom	

(IV) Water Stop Work

The temporary cofferdam work was started in February 1964 and completed in September 1964 by driving V-shaped steel sheet piles to a depth of 24.0 M over a length of about

160 M on the north side of the dock construction site. In order to operate the excavation dry during this period, it was planned to drive V-shaped steel sheet piles along the whole 580-meter circumference of the dock. A floating pile driver was brought in with part of the cofferdam kept open. The pile driving was carried out using the floating pile driver and pile drivers for use on the land from March to September 1964. These steel sheet piles are expected to be removed by the time when the construction work of the graving dock is completed.

c. Construction of the Permanent Structures

(I) Caisson Laying Work

The laying work of 30 caisson blocks which constitute the lower section of the dock walls was completed in March 1970 together with the driving work of concrete piles supporting the caissons. The sinking work is for the most part satisfactory. However, the work is far behind the original schedule because of an increase in the number of caissons required resulting from modifications in the structural design of the dock, growing inflation in currency, occurrence of the incident of September 30, delayed payments in Rupiahs and so forth.

As mentioned in d, paragraph 3 of Chapter 1, it is now being considered that steel sheet piles are to be used in the revetment instead of caissons.

(II) Dock Bottom Laying Work

Part of the dock bottom laying work has been completed as follows:

Installation of caisson struts	5 out of 6
Installation of partial struts	5 out of 18
Excavation of dock bottom	920 M^3
Driving of concrete piles	7,590 out of 9,190
P.I.P.	80 out of 330

The main work to be carried out from now on comprises:

Excavation of soil and sand	About 45,000 M^3
Demolition of ham dock	About 9,000 M^3
Driving of foundation piles	About 1,900
Placement of dock bed concrete	About 12,000 M^3
Laying of caisson strut	1
Partial struts	13

(III) Placement of Concrete on the Top of Dock Wall Caissons

The placement of concrete on the top of dock wall caissons has not been under way, and is planned to be started from January 1971.

Concrete requirement	About 21,750 M^3

As these upper dock-walls will be of a complex structure with a service tunnel, metal fastenings and fittings and stairways provided in it, technical guidance must be furnished particularly to surveys and the construction of frames.

(IV) Dock Gate

The dock-gate structure comprises a caisson on both the laboard and starboard sides (C_1 and C_2) and another caisson (D) laid at the centre of the bottom. The laying work has been completed.

The dock-gate structure is of vital importance. It calls for elaborate work. There must not be unnecessary water leaks at the dock gate.

The dock-gate structure has been completed on the larboard side. What remains to be done with it is the installation of a caisson on the starboard side and a steel gate.

The gate has been completed, and is now moored off the dock entrance.

(V) Installation of Pumps and Mooring Equipment

The pump room and culverts consist of caissons B_1, B_2 and B_3. The installation has been completed.

The four pumps are to be installed by using the dock side

crane, when it is installed, and setting job of the pumps are to furnish technical guidance.
Three capstans and twenty-six bitts are to be installed after the installation of cranes.

(VI) Installation of Cranes

As the rail foundation is formed by the concrete slabs placed on the dock-wall caissons, it is completed as soon as the construction of dock walls in finished.
Since the dockside cranes play an important role in the transportation of dock pumps and mooring equipment, it is necessary to install cranes as soon as the dock walls are constructed to such an extent that rails for cranes may be laid down.

(VII) Supplementary Work

The work of laying power supply lines, compressed air pipes, and fresh water and steam pipes has not beem under way.
Among those power lines and pipes, those which are laid down directly in the dock may start being installed simultaneously with the placement of concrete in the dock walls.
Arrangements in the service tunnel are to be provided after the tunnel construction work has been completed.
On the other hand, connections to the respective power sources are to be carried out after refilling excavated soil.

(VIII) Refilling

As the placement of concrete in the dock walls is completed, excavated soil is to be filled back behind the dock walls.

(3) Schedule of Remaining Work

The survey team failed to find an official order concerning the day of commencement of this graving dock construction and working days for repair and maintenance work of vessels during the survey period.
However, the written decision dated April 25, 1970 and signed by President Soeharto states clearly that Rp 540,000,000 is to be disbursed to the

Indonesian Naval Force for three years from fiscal 1970. The fact that the Naval Force plans to complete this graving dock at the end of 1972 is therefore considered based on the written decision. The contractors and other people concerned there also plan to complete their remaining work by this time limit. Accordingly, the survey team conducted its surveys, considering the end of December of 1972 as a time limit by which the graving dock has to be completed.

The master schedule of remaining work by type of work is shown in the attached table 2.

a. Temporary Work

The temporary facilities, all installed, are now in operation serving their respective purposes. Their capacities are however not fully utilized for various reasons: Indonesian engineers are not yet accustomed to their operation; robberies occurred during and after the incident of September 30; replacement are delayed or are still unavailable and all these reasons combine to make it difficult to maintain the facilities properly. For these reasons, the construction work is delayed. Delays in the work in turn become the cause of an earlier wear and tear of equipment and facilities, calling for more replacements. They are again not readily available. The operation rate of the facilities is reduced, bringing about another delay in the work. And so the vicious circle goes on. To cope with these problems, they make shift with the parts available in Indonesia and temporary repairs. The immediate action which must now be taken is to replenish the parts and add the construction machines itemized in the attached table 5 which will be mentioned later in paragraph (3) of Chapter 3 so that the construction work may be carried on according to the schedule of use of machines in remaining temporary works presented in b in paragraph (2) of Chapter 2.

b. Schedule of Construction of Remaining Permanent Works

(I) Dock Bottom Work

The construction work of the dock bottom is to be completed by June 1972. The sea-side half of it is to be provided with struts according to the schedule below.

P.I.P. work for providing caisson struts	To be completed by September 1970
Work for providing the remaining two caisson struts	November 1970
P.I.P. work for providing substruts from the dock entrance	September - December 1970
Work for providing substruts from the dock entrance	September 1970 - July 1971

The excavation of the dock bottom is to be started from the sections where the struts or substruts are provided.

Excavation of the dock bottom	December 1970 - October 1971
Placement of prepakt concrete on the dock bottom	January 1971 - November 1971

In November 1971, therefore, the construction work of the sea-side half of the dock bottom is to be completed.

The commencement of the construction work of the shore-side half of the dock bottom calls for, among other things, the removal of the ham dock. The removal of the ham dock was started while this survey was under way.

Removal of the lower part of ham dock from the dock head	December 1970 - February 1972
Excavation of dock bottom	January 1971 - May 1972
Driving of concrete piles	January 1971 - February 1972
Placement of concrete on the dock bottom	January 1971 - May 1972

The placement of concrete on the dock bottom at the dock head has already been completed so that the ham dock might not disturb the work. The placement of finishing concrete is to be completed from April 1971 to June 1972.

The dock bottom is, in construction, divided into thirteen blocks each of which is about 15. 0 M long, corresponding to the length of the caisson. Every step of work, that is, driving of piles, laying of struts, removal of the ham dock, dock bottom excavation and placement of concrete, is to be carried out every fifteen days first from the larboard side and then from the starboard side for each block of the dock bottom.,

The point of engineering lies in the P.I.P. method, prepakt concrete method and method of removing springing water. Needless to mention, springing water opposes an obstacle to the work. In Southeast Asian countries, the construction work calls for powerful draining facilities to protect the works from squalls followed by copious rainfalls during the long rainy season. For this reason, a request for additional eight draining pumps has been added to the list.

(II) Placement of Concrete on the Upper Part of Dock Walls

The filling of soil behind the caissons in the lower dock walls and excavation from the top of caissons to the dock floor have been completed. Right at the foot of the caissos, side grooves are provided to drain springing water. Accordingly, concrete can easily be started being filled in the upper part of dock walls as soon as the dock bottom work is completed.

The placement of concrete in this work can be regarded as the same as that carried out in the construction of ordinary buildings on the land. It is not a special type of construction work.

Placement of concrete in the upper part of dock walls	January 1971 - June 1972
Work at the entrance to the pump room	July 1972 - October 1972
Refilling of soil	December 1971 - June 1972

(III) Gate-Catch Structure and Revetments

The dock gate now is in the form of an intended structure with caissons C_1, C_2 and D installed, and the stone piling work on the larboard side has also been completed. At present, the stone piling work on the starboard side is under way.

At the time of surveying, a caisson structure was to be used in the revetments, but the use of steel sheet piles is now under consideration.

Construction of banks	January 1972 - June 1972

(IV) Other Supplementary Work

The point of supplementary work is that supplementary 30-ton jib cranes should be installed as early as possible so that the installation of draining pumps, mooring equipment, pipes and doors, and the removal of temporary facilities may be facilitated. However, as the rail foundation for cranes also serves as the dock-wall structure, the installation of jib cranes depends on the circumstances.

The work schedule is shown in the attached table 2.

(4) Performance of Construction Work

a. Progress and Performance of the Construction Work

In 1962, geological and other surveys required to start the construction of the graving dock were instituted.

To begin with, the ham dock which had been built under Dutch rule began to be demolished. Then, the driving of steel sheet piles for installing the temporary locks of the dock followed. The attached table 1 shows how far the construction work has been carried out since its commencement. The construction works were undertaken by an Indonesian contractor, Biro Jasan Teknik P. T. The installation of temporary locks was the first thing to be performed. It appears, however, that a precarious supply of electricity required for the shaping and driving of steel sheet piles delayed the work to a great extent. There are also indications that they had much difficulty in performing the work because of the precarious supply of electric power coupled with a low level of engineering skill of engineers employed in the work. Steel sheet piling was carried out in parallel with the installation of temporary locks of the dock. Thin stone blocks, quarried and cut by hand at Kali Surabaja, are transported from there to the construction site. Coffer stones are transported from a place about 50 kM away from the construction site to a crushing plant built about 800 M away from the construction site to make stone blocks of desired size and shape, since suitable stone blocks are not available near by.

The installation of temporary locks was finished in September 1964, and in December they started drying up the dock.

The first step of work, that is, B. C. work and installation of caisson D (Refer to the attached table 2.), started in December 1964, and ended in November 1965. These caissons were installed as originally planned.

The original plan stated that a gravity wall should be adopted in other portions of the dock walls. In May 1965, however, normal-plane destruction occurred near the east-side stop water sheet piling about 100 M away from the dock entrance. As a result, the caisson method bakced by experience was adopted instead of the gravity wall method. (Mention will be made of this change later in b, paragraph 3.)

The installation of these twenty-four caissons continued, and ended in March 1970.

Old timbers and cannons were, it is supposed, an obstacle to the sinking of the caissons, and especially the sinking of caissons F and T seemed to have been extremely difficult because of the presence of a sunken vessel.

In 1965, the incident of September 30 occurred, expediting the years-old inflation and reducing the amount of rupiahs in circulation in its wake. As a result, the Indonesian Naval Force cancelled the contract with Biro Jasan Teknik P. T., and put the construction works under the direct control of its construction unit.

As a second step of dock bottom excavation, the work for setting struts to stabilize caissons E and W against the pressures of the surrounding soil was started in November 1967.

To begin with, steel sheet piles were driven in six rows (corresponding to three struts) in preparation for the placement of strut concrete, and excavation by hand was carried on.

Excavations were made at the layers of soil about 8.6 M thick from a depth of 7.0 M to that of 15.6 M. As excavations were still under way at the time of surveying, the survey team was afforded ample opportunities of observing the excavation work. The workers were observed facing many difficulties in the work. They were nonetheless carrying on the work with an efficiency in spite of the hot weather.

In May 1970, the P.I.P. method was adopted, instead of driving steel sheet piles, to support sand in the strut work, although steel sheet piles were used in excavations for strut work at the beginning. This is partly because the steel sheet piles at hand ran out and partly because it was feared that later removal of sheet piles might affect adversely the foundations. The workers gradually got accustomed to and skilled in the P.I.P. method, and the survey team observed that the work was being carried on without a hitch.

It is a common occurrence in developing countries that the construction work is disturbed by inconveniences in repairs of construction machines and replacing parts. The construction of this graving dock is not an exception. The daily work was disturbed by many inconveniences, and was devised in many ways unbelievable in Japan. Suffice it to cite an example. They put up with inconvenience in moving a big derrick on rails laid in a narrow place for driving foundation piles in the dock head.

A 30-ton crawler crane, which is asked for by Indonesia, will facilitate the piling work in great measure, and help to promote the construction work as a whole.

b. Causes of Delay in the Work Viewed from its Progress

Generally speaking, the activity of a consultant who has entered into a supervision contract consists in planning of a construction method, control of the construction work and furnishing technical advice. It is also the case with P.C.I. (Pacific Consultants International), a supervision contractor in this graving dock project. In the case of P.C.I., however, they are supposed to furnish field technical guidance on the work site when sheet piles are driven, concrete caissons are sunk and prepakt concrete is placed.

At the outset, this construction work was undertaken by a contractor. P.C.I. therefore furnished advice to the Indonesian Naval

Force concerning the planning of the construction and control of the work on one hand, and provided technical advice on problems about the execution of the work by the contractor on the other. It often occurred, however, that the advice furnished to the responsible staffs of the Indonesian Naval Force were not forwarded to the workers at the work site. For instance, bolts asked for did not reach the work site in time. A request for the preparation of a detailed schedule of work often failed to be met, although a weekly or monthly schedule of work had been explained beforehand. The advice about the arrangement of workers on the basis of the progress of work proved of no avail. It appears that troubles of this sort occurred from time to time. The survey team also learned that a similar condition had continued to exist even after the cancellation of the contract with Biro Jasan Teknik P. T. as an aftermath of the incident of September 30 put the construction work under the direct control of the construction unit of the Indonesian Naval Force.

It was also learned by the survey team that P. C. I., who feared that no substantial progress might be made in the work, if things were to go on like this, often went out of their way to do more than expected of them as a consultant: they had to give instructions directly to workers at the work site. P. C. I. were, so to speak, involved in performing the actual work at the work site. On other occasions, staffs of P. C. I. supposedly worked as foremen from time to time at the work site. This condition has always remained the same all through the years since the commencement of this construction work. It is believed that this condition is one of the major causes of the delayed work. Therefore, difficulties would persist, and a smooth performance of the work could not be hoped for, unless a normal condition were restored in which the consultant will not have to do more than to confirm the fundamental requirements for mapping out the schedule of the work, furnish advice to the responsible staffs of the Naval Force and inspect the progress and performance of the work, while the construction work itself will be carried out by the construction unit of the Naval Force.

Another reason for the delay in work is the normal-plane destruction which occurred in May 1965. Particular information is now not available as to the cause of this destruction, and there is now not a single means any more for investigating into its true cause.

As the result of this normal-plane destruction, the batcher plant tilted to one side, and the office of P. C. I. collapsed. And the work was temporarily brought to a stop.

Witnessing the destruction and the water stop piling which had tilted to one side in its wake, the Indonesian Naval Force conceived a misgiving about the construction method which had so far been employed, and strongly insisted that the foundations of a caisson structure should be laid. The proposed change of the construction method caused much discussion between the Indonesian authorities and P. C. I., and finally the place of discussion was moved to Tokyo, where the Indonesian Naval Force and P. C. I. reached an agreement as to the change from the former plan of construction to the present one employing a caisson structure in the foundations. About four to five months were spent before the agreement was reached. This change of plan is also one of the reasons for the delayed work.

These caissons were called respectively E, W, F and T, and were twenty-four in all. The sinking of these caissons required five years and four months.

Since four sets of caisson-sinking equipment are available, a year or a year and a half is a normal period of time required for sinking these caissons into this kind of soil in Japan. The investigation as to why such a long period of time was required in Indonesia disclosed that the delay of work is partly attributable to the incident of September 30 and that the following circumstances had a great effect on the performance of the work.

Because of an extreme shortage of rupiahs, a sufficient number of workers could not be employed (Wages being paid to workers on a daily basis in Indonesia), and, as a result, only one set of equipment was in operation. Moreover, the operation was only on two shifts for about sixteen hours a day with an insufficient number of workers employed, although a 24-hour three-shift operation is a normal method of operation in caisson work. It appears that in 1966 and 1967 a one-shift operation was not an uncommon occurrence in this construction work. During this period of time, compressed air continued to be supplied while the workers were off the work, blowing not a negligible amount of money to the winds. Mention should be made here of the fact that, although it is inevitable to some extent in the construction work under the direct control of any authorities, the Indonesian Naval Force must pay wages to the workers in regular employ by the construction unit of the Naval Force for the days when the work is not in operation. Lieut. Soetopo told the survey team that at least 4 to 5 million rupiahs was necessary every month for payments to the regular workers and maintenance of the power house, compressors and other facilities, and that the construction work would not progress, unless a rupiah fund in excess of 4 to 5 million rupiahs was available for the work. Such being the financial situation, the sinking of caissons E, W, F and T required such an enormous amount of time unconceivable by common sense.

As mentioned earlier, a sunken vessel (a steel vessel of about 200-tons with concrete filled in it) came out as the excavation proceeded. This sunken vessel first had to be removed before sinking caissons F and T. It appears that the caisson-sinking work was extremely difficult because of the presence of the sunken vessel. As a matter of fact, it took more than a month to sink caisson T by 5 M from a depth of 7 M to that of 12 M. (In usual cases, ten days is sufficient.)

Another reason for the delayed work is robbery of machines and materials. Particularly before and after the incident of September 30, the country was in total disorder, permitting frequent robberies of construction machines and materials.

Since replacements were not readily available for stolen machines and materials in Indonesia, robbery was a serious obstacle to the performance of the work.

c. Workmanship of the Construction Works

The portions of works completed comprised, for the most part, foundations, and could not be seen from the ground level. However, the workmanship of the works appeared normal, as far as the eye could see. The concrete surface was rather uneven, for the forms used were not good. Some portions presented a poor appearance of finish. At the time of surveying, the P.I.P. work was under way. The steel bars used were well-worked ones. The mortar proportions were controlled rather well, and the mortar mixture was of a good quality. The workers were probably skilled in the manufacture of concrete piles, which showed a normal workmanship. Clamps were used at the lower part of caissons E and W in driving down concrete piles.

It was reported that no disorderly arrangement of concrete piles (clamps being 8.5 M long) had been observed, when the sinking of caissons had been under way. It was further confirmed that the concrete piles had not inclined because of the use of clamps. It was also reported that only one case of a bodily injury had occurred during sinking the caissons, and no case of caisson disease was reported. Taken altogether, therefore, it can be said that the caisson work has been carried out without a hitch except for a delay in work and that appropriate advice was furnished by the consultants.

(5) Outlook for the Future Work

As has been mentioned upto this point, the caisson work had been completed, at the time of surveying, with the caisson strut work at the dock bottom nearing completion and the partial strut work under way. The part of the remaining work which is considered most difficult is 16-meter deep excavations at the dock entrance and concrete placement there. The caisson struts and partial struts have already been placed in this section, and what remains to be done is to fill concrete in the boxes between struts. Judging from the quantity of water which came out during the excavation to a depth of 16 M at this section, further excavations and concrete filling may be carried out in a dry state without encountering serious obstacles. However, in case of an emergency, necessary preparations should be made for a resort to the use of prepakt concrete while excavations are under way. In this case, highly technical judgement is required. If prepakt concrete is to be used, it will be the first experience of the Indonesian authorities, and perfect technical guidance should therefore be given as to the use of prepakt concrete. Hereunder are given the kinds of works which are considered rather difficult to perform.

a. Placement of concrete on the dock bottom and handling of joints

b. Preparation of forms and props
The finish of forms has not been satisfactory. Technical guidance is desirable.

c. Introduction of a network system
The dock walls, the construction of which occupies the major part of remaining works, are reinforced-concrete structures of complex shapes, and a great number of pipes of various types are planned to be built in them. Without the preparation of a highly accurate network, the work would get stalled, and a considerable delay would ensue.

d. Inspection of piping and reinforcement
As mentioned in (c) above, the upper dock-walls are to contain various types of pipes (fresh and salt water pipes, compressed air pipes, steam pipes and drain pipes) and electric wires. Their proper arrangement is of great importance but is hard to obtain. Technical guidance in these respects will be of no less importance.

e. Laying of the foundations for pumps and cranes
In order to install the pumps and cranes in accordance with the plan, their suppliers must be present on the job site, when the foundations are laid out. Of significance is the control of steps in the work in keeping up close communication between the people engaged in the foundation work and those working on the equipment installation.

f. Fitting of gate catches

g. Repairs and maintenance of construction machines
It is already years since the construction work got under way. Therefore, the repairs and maintenance of the mixing plant, crusher plant, belts and the like will be a difficult job.

The schedule of the future work is shown in the attached table 2. Although there are still unfinished works which demand considerable exertion, the whole construction works will be completed without much trouble, if appropriate technical guidance and necessary funds are provided.

(6) Budgets for the Future Construction Works in Indonesia

The Indonesian Government earmarked a total of 540 million rupiahs for the remaining works which were to be completed in three years from 1970. (Refer to the attached table 3.) The attached table shows the sole data of necessary funds by kind of work calculated in the national currency, Rupiah. To examine whether this calculation is reasonable or not requires the clarification of labour expenses, material costs and indirect expenses and the basis on which they were calculated. The survey team has failed to be provided with either a satisfactory answer or satisfactory data, except for a simple list of unit prices for fundamental types of work such as concrete work, earthwork, etc. According to this list, the percentage leaves a higher margin than the standard percentage commonly thought of in Japan. However, the state of affairs is totally different in Indonesia and Japan, and direct comparison of the unit prices in Indonesia with those in Japan will be meaningless. It is therefore impossible to judge whether or not the budget computed on the basis of these unit prices is sufficient for the completion of remaining works.

It must be pointed out that this budget has one miscalculation. (The amount of 3,500,000 rupiahs, No. 10 CONCRETE FILLING FOR DOCK BASE, is not correct. It should correctly be 35,000,000 rupiahs.) When this miscalculation is put to rights, the required funds will increase by 31,500,000 rupiahs. However, there is some margin in the estimate of construction costs as mentioned above, and an allowance of 15% (64,798,500 rupiahs) of the construction costs is made for contingency. Those things being considered, there probably will not be a considerable deficit in the budget.

It is however hoped that the Indonesian Government will take necessary measures for increasing the budget, if a deficit in the budget will be caused.

3. Wear of Machines for Permanent and Temporary Works and Requirement and Cost of Replacements

(1) Storage Location of Machines and Materials for Permanent and Temporary Works

All machines and materials for the permanent and temporary construction works originally planned have been supplied. Except for sand, coffer stones, pebbles and bricks which are to be supplied there, the parts for machines and materials which are frequently brought in and out for use in temporary works are stored around the dock, and the parts for machines and materials for use in permanent works sorted together in the premises of the Naval Force Base. The selection of those locations can be said to be appropriate from the viewpoints of storage control.

(2) Storage of Machines and Materials for Use in Permanent Works

Some machines are stored indoors, and others outdoors according to the types. Except for those packed machines carefully prevented from moisture and rust, machines simply coated with an anticorrosive were found left naked by twos and threes in the open or directly placed on the ground.

30-ton jib cranes may be left naked in the open, but they may have been corroded to a considerable extent by contact with the soil, unless sleepers or the like have been placed under them to prevent them from contacting the soil directly or sinking into it.

When cases containing assembly parts of pumps and other machines are piled on top of other cases which are about to give way, it is just possible that the cores of those parts of both upper and lower cases get warped or important parts get damaged, when the lower cases give way to the weight of those piled on top of them.

Electric wires are stored in a place with nothing but a roof. As they have been stored over a long period, it is feared that their insulation may have been worn out. Shortages in the lengths of electric wires for use in the permanent works have amounted to about 4,500 M for the following reasons:

(a) The delayed work caused a considerable wear of electric wires, necessitating the use of wires for the permanent works in the temporary works.

(b) The incident of September 30 put the country in disorder, permitting robberies at the work site.

The high-tension electric equipment and machines have never been unpacked for inspection since their arrival on the site, because of lack of time for repacking, fear of robberies and difficulty of perfect repacking due to lack of packing machines and materials. It is feared that the insulation may have been damaged by moisture and metallic contacts may have been corroded by harmful rusts in the case of those equipment and machines contained in the cases stored in a place with only a roof and decayed by rainwater at the bottom.

The dock gate was brought in to the work site in 1966. It is now moored off the shore near the work site. It was brought in the dock once, that is, in May 1970. Repairs are now being made to the partial corrosion at the welded part, and paint is being coated.

The parts and materials which have run short because of use in the temporary works and robberies are about 1,200 M of wire rope, various types of steel pipes totalling about 700 M in length, valves, elbows, piping parts such as T-shaped joints, steel materials, and so forth.

(3) Wear of Machines for Temporary Works

The machines for use in the temporary works have worn out to a greater extent than expected.

(a) Spare parts could not be purchased because of insufficient disbursement of the budget.

(b) The durable years of machines expired as the work had delayed.

(c) The machines were not handled properly for lack of skill.

Those are the principal causes of an excessive wear of machines for use in the temporary works. Besides, the insufficient after-sale service of Japanese manufacturers and underdevelopment of related Indonesian manufacturers are also responsible for such a wear of machines supplied, as is evidenced by the following facts:

(d) Shortage of measuring instruments

(e) Shortage of repair tools, especially special ones

(f) Poor maintenance of new machines.

As far as vehicles are concerned, the system of periodical checks and inspection has not been established. The people engaged in the work therefore lack the idea of maintenance necessity. They operate vehicles, ignoring minor troubles and damages. They do not make repairs to those vehicles in trouble which would recover their performance completely, if repaired at an early stage of trouble. They only start making repairs after the vehicles have broken down.

In such a case, the threds, for instance, of bolts, nuts and screws are deformed, and spare parts will not serve the purpose. The whole assemblies must be replaced. However, the assemblies are not readily available in the country, and they make shift with temporary repairs. It is therefore natural that those vehicles should not be able to operate at full capacity, and become as good as vehicles to be scrapped before time. Such being the situation, only 19 out of 41 dumpcarts available for the work are in operative condition.

It was reported that a Soviet-made electric motor had once been looked for in the arsenal of the Naval Force to temporarily replace a broken motor for conveyers. Although any temporary works in Indonesia naturally involve emergency repairs, the people in charge of the work at the site seem to have had great difficulties in emergency repairs and obtaining replacement parts, since this construction work has been disturbed by robberies as well as mechanical troubles.

Accordingly, a decline in the working efficiency of machines had an adverse effect on the productivity, thereby causing a delay in work.

There is no specific repairshop for vehicles and other machines except for one for dumpcarts, and the repairs of vehicles and machines has depended on the machining workshops in the arsenal of the Naval Force. It was learned that repairs were being improved to raise the efficiency of work as the amount of excavation work was on the increase in recent years.

(4) Additional Machines and Materials and Replacements and Their Cost

The particulars of additional machines and materials and replacements which are required for the permanent and temporary works under the circumstances described in (2) and (3) above are presented in the attached tables 4 and 5.

a. Orders to be Paid in Foreign Currency

Machines and Materials for Permanent Works

Mechanical work	Total	$ 9,035
Electrical work	Total	$50,648
Grand Total		$59,683

Machines and Materials for Temporary Works

25-ton crawler crane	1	$47,888
13-ton bulldozer	1	$22,031
3-ton forklift	1	$ 9,177
8-ton dumpcart	10	$61,770
Other machine parts		$154,788
Mechanical work	Total	$295,654
Electrical work	Total	$64,963
Grand Total		$360,617

Permanent and Temporary Works

Grand Total		$420,300

Those costs have been claculated on the basis of the following premises.

(I) Quantities

A survey was started by consultant team (P.C.I.) to make clear the quantities of machines and materials and their replacements for permanent works and the quantities of additional machines and materials and their replacements for temporary works at the beginning of 1970 when the outlook for the work performance began to take shape, and about six months later the survey, although rather rough, of almost the whole range of machines and materials was completed in Indonesia.

As the survey team could not possibly add and put in order the enormous amount of data concerning the estimated requirements of various types of machines and materials within the given time, the quantities in this report have been temporarily presented one mentioned above done by P. C. I. team.

(II) Prices

The attached tables mentioned above indicate the prices for the respective types of machines. It should be noted, however, that,

(a) modifications have been made on the prices of the machines the estimate of which has been made available,

(b) modifications have been made on the prices of the machines whose past data of purchase are available, although their estimate has not been prepared, and

(c) estimated prices have been adopted for the machines to which neither (a) nor (b) paragraph applies.

Those quantities indicated fluctuate, depending on the progress of the work, degree of maintenance skill, term and accuracy of an estimating forecast and purchase prices. Those quantities should therefore be considered based on an estimate as of the time of surveying.

As reparations for the year 1970, new machines and parts worth $150, 000 were furnished for use in temporary works. They were supplemented to promote the driving of piles and excavation work.

b. Rupiah Expenditure

The items of rupiah expenditure should be in principle repair and maintenance. However, as this project turned out to be in need of storage of machines and materials over a long period, expenditures for special repairs and maintenance must be added.

(I) Ordinary Repair and Maintenance Expediture

This item consists of general expenses for minor repairs and painting carried out in the assembly and installation of permanent and temporary works, and is included in the budget of 540,000,000 rupiahs.

(II) Special Repair and Maintenance Expenditure

The repairs necessitated by the condition of storage of machines for use in the permanent works, as mentioned above, are divisible into the minor ones which can be carried out in Indonesia and the ones which cannot be made there, unless brought over to Japan.

The latter in particular pose various problems. The expenses for the latter types of repairs are not included in the budget of 540,000,000 rupiahs mentioned above. In this case, the manufacturers of the machines must first make a survey of repairs to be made from a technical point of view, formulate definite plans of repair, and prepare the necessary estimates in order to have a budget earmarked for those expenses.

(5) Problems and Measures

a. Maintenance of Machines for Permanent Works

None of the machines intended for use in the permanent works will not have any effect on the performance of this graving dock. Judging from the past and present condition of storage, it cannot be said that appropriate control is maintained of the machines stored indoors according to the specific properties of the respective parts, not to speak of the machines stored outdoors, and that appropriate guidance is furnished to the method of control. According to P.C.I., for instance, seeing some naked machines and ones simply coated with an anticorrosive left in the open or placed directly on the ground, P.C.I. furnished in vain to the Naval Force advice as to the method of storage, since the advice was not followed out. However, the survey team pointed out the lack of proper attention to the storage of machines to the Naval Force, and saw next day the Naval Force piling them over again in a proper way. Consideration should be taken of a difference between the effect of the opinion of the survey team and that of the opinion of P. C. I. on the responsible staffs of the Indonesian Naval Force, but it is surmised that P. C. I. could have done more in the guidance of the Naval Force, and could have led them to the recognition that engineers would never admit of such an act as the leave machines placed directly on the ground over a long period. Measures for improvement must be taken immediately for the parts stored in an undesirable condition. Among the supplied which have had to be stored over a long period because of the delayed work, there may be some for which no such measures were taken in their manufacturing specifications in anticipation of a delay in use. Public peace and order now restored in Indonesia, and security is, it is said, also established in the premises of the construction works. It is now necessary to take action for proper maintenance of machines. The necessary measures will be to make each manufacturer inform the particulars as to its method of packing and prepare a check list, if necessary, for maintenance of the quality of supplied so that important parts of machines may be inspected at regular intervals, troubles or damages may be found early, and rust, corrosion, moisture and warping of alignment may be prevented. Judging from the present condition of storage, it is necessary that, at a suitable time prior to the planned assembly and installation of machines in the permanent works, an expert (s) of each manufacturer of supplied should be called from Japan to the work site to make a detailed survey of the present condition of storage.

It should be about six months, at least, before the commencement of assembly and installation in case of the worst circumstances where part of supplied must be brought back to Japan for repairs.

b. Machines for Temporary Works

What must be done about the machines intended for use in the temporary works is as follows:

(I) Immediate Supply of Additional Machines

If the work schedule is to be maintained by all means, it is absolutely necessary to have a supply of additional machines.

They must be supplied by the end of July 1971 at latest, if the graving dock is to be completed by the end of December 1972.

(II) Exhaustive Guidance to the Naval Force for Maintenance of Machines

For the purpose of furnishing exhaustive guidance to the Naval Force, it is necessary to send mechanical and electrical engineers to Indonesia from Japan, and make them attend to nothing but the maintenance of machines, irrespectively of the work at the job site. In developing countries, it is generally a common sight to see "patched-up repairs" and "machines and parts out of order left untouched." Underdevelopment of workshops and shortage of spare parts and replacements are the reasons. This phonomenon spreads widely among various types of machines, until the production capacity of construction projects gets reduced in great measure.

In order to avoid such a condition, the following technical fundamentals must be acquired by the workers working for the project.

(a) Maintenance of machines and parts is prerequisite to the performance of the project.

(b) Maintenance of machines and parts should be continuously carried out, and they should not be left uncared for.

(c) Maintenance of machines and parts must not be a makeshift.

It is an unconspicuous yet hard job to take these steps of education. However, this experience will bring about a favourable result to the construction work of the dock, and will lead to technical development in developing countries like Indonesia.

Although the lists of additional supplies in the attached tables 4 and 5, having been judged appropriate, were made to serve as a basis for the budget, it is hoped that those quantities will be properly controlled and that exhaustive guidance will be provided for keeping them within the limits.

4. Necessary Quantities of Additional Materials

The necessary quantities of cement and steel reinforcement should be estimated for the remaining work to be carried out from December 1970. For lack of data, however, they have been calculated on the basis of the work plans and data of the remaining work by kind of work prepared in July 1970. As indicated in the attached tables 6 and 7, the quantities of cement and steel reinforcement necessary for the remaining works as of the end of June 1970 are respectively 17,500 tons and 1,586 tons. As a result of study, those quantities are considered as reasonable.

On the other hand, the quantities of cement and steel reinforcement in stock as of the end of the same month are respectively 3,000 tons and 903 tons. The definite quantities of required cement and steel reinforcement and their costs are as follows:

	Requirement	Unit Price	Amount
Cement	14,500 tons	$20	$290,000
Steel Reinforcement	700 tons	$148	$103,600
		Total	$393,600

The quantity of cement required gives an impression that it is rather sizeable in view of the quantity planned at the beginning of the work and its fluctuation resulting from the change of design. It was explained to the survey team that the shortage of this size was attributable to the appropriation of part of the fund for cement to purchases of machines absolutely needed and the use of cement (partially having been supplemented, through) for other purposes in fear of its weathering because of a difference of time between its arrival and the work in need of cement. The survey team has however not been able to clarify the quantities in not a few respects in its analytical study. It is not possible that only force majeure is responsible for those shortages. There must be not a small number of problems about the control of the work and materials. Rigid control of the work and materials must precede a supply of additional materials.

The materials, especially steel reinforcement, must be supplied by the time around July 1971.

5. Number and Expenses of Engineers to be Despatched for Supervision of Works

The construction of this graving dock has been under the direct control of the Indonesian Naval Force, and has been carried on by its force stationed in Surabaja. The construction of a dry dock, especially this graving dock which is one of the biggest docks built in Indonesia, is the first experience of the country. The fact is therefore that neither the Government organizations nor the construction industry has any engineers with real experience in dock construction except for several short-term trainees.

The Indonesian engineers supervising this project do not know more than what they have so far learned in this work from Pacific Consultants International which has supervised it up to now. The survey team cannot help having a tinge of uneasiness toward those engineers without experience in carrying out even relatively simple types of works, not to speak of difficult ones such as "placement of prepakt concrete" and "handling of bottom concrete joints." The survey team is therefore of the opinion that it is absolutely necessary to continue to provide technical guidance at the work site till the completion of the construction project.

The remaining work, unlike the portions of work finished, consists of various types of work to be carried on in parallel, such as building of the dock bottom and walls, installation of dock pumps, assembling of cranes, placement of pipes, wires, machines and instruments, and so forth. Without a detailed and scrupulous network plan and control of the work, it would be quite difficult to carry out the work according to the schedule, even if materials are supplied early and sufficiently at that. Accordingly, it is necessary to send a minimum of engineers required for the supervision of the progress of work, construction work and materials and give guidance to the Indonesian field supervisors.

The number and expenses of engineers required to be sent to and stay in Indonesia from April 1971 till the completion of the work are respectively 17 and $442,700 as shown in detail in the attached table 8.

6 Payments of Construction Expenses and Expenses for Remaining Works

(1) Payments up to 1970

The dollar and rupiah payments which had been paid for the construction work since the realization of this project up to 1970 can be put in order as follows:

a. Survey and Design Expenses

In accordance with the Reparation Agreement (MISPRI 72 (60)), a total of about $228,000 was disbursed as expenses for the surveys which had been carried out from 1960 prior to the commencement of the work.

b. Dollar Payments for Machines and Materials for Permanent and Temporary Works

This item of expenses includes the purchases from Japan and expenses for the engineers dispatched by the Japanese suppliers, but excludes the expenses for sand, coffer stones, pebbles and bricks supplied from local sources.

Reparations and credit secured on them	About	$5,263,000
Payment of the same	About	$5,879,000

c. Dollar Payments for Construction Supervision, Etc.

This item of expenses covers indirect expenses such as ones for technical guidance, etc.

Reparations and credit secured on them	About	$1,810,000
Payment of the same	About	$1,735,000
Payment on a commercial basis	About	$643,000

d. Rupiah Payments for Labour and Other Expenses

This item of expenses covers payments for local labour, local supplies and direct expenses.

1962 - 1967 About Rp 204,801,000 (Source: P. C. I.)

It appears that the supply of funds was extremely precarious during the period from 1964 to 1969; particularly after the incident of September 30, 1965, the aggravating inflation not only brought out frequent adjustments of payment but also caused not a small number of delayed payments in its wake. The incident mentioned rendered the order of the country so precarious —— so much so that the work at the job site and quarries became too dangerous to continue to collect stone blocks and pebbles. In addition, delayed payments brought the work to a stop over and over again. This is one of the major reasons for the delayed work.

e. Total Amount of Expenditures

The expenses of items a, b, c and d paid up to 1970 can be presented in tabulated form as follows;

Expense Item	Foreign Currency Fund ($)		Indonesian Currency (RP)
	Reparation basis	Commercial basis	
a. Survey and design	About 228,000	-	-
b. Machines and materials	About 5,879,000	-	-
c. Supervision of construction	About 1,735,000	About 643,000	-
d. Labour, materials and miscellany	-	-	About 204,801,000
Total	About 7,842,000	About 643,000	About 204,801,000

(2) Expenses for Remaining Works

The expenses for the remaining works are explained in the respective chapters; rupiah expenses in paragraph 6 of Chapter 2, expenses for machines and parts in paragraph 4 of Chapter 3, expenses for materials in Chapter 4, and expenses for supervision in Chapter 5.

The can be added up and presented in tabulated form as follows;

Expense Item	Foreign Currency ($)	Indonesian Currency (RP)
Rupiah Expenses	-	540,000,000
Machines and Materials for Permanent and Temporary Works	420,300	
Additional Materials	393,600	
Supervision	442,700	
Total	1,252,600	540,000,000

The rupiah expenses of 540,000,000 is considered as a reasonable amount, as already discussed in paragraph 6 of chapter 2.

It cannot be affired, however, that this amount will be sufficient, unless powerful and adequate control will be held over the budget and all fields of the works from labour to purchase, storage, delivery, return and maintenance of machines and materials.

(3) Measures for Rupiah Budget

It will come to have a great effect on the promotion of the future work whether or not the appropriation and disbursement of a rupiah budget will be carried out smoothly. A survey in Indonesia has disclosed the following facts:

a. Budgetary Measures for Fiscal Years, 1967 - 1968

The Graving Dock Project of the Headquarters of the Surabaja Naval Force Base asked for a monthly construction fund of 20,000,000 rupiahs, that is, 240,000,000 rupiahs a year, for fiscal 1967 and 1968. The fund allocation was however no more than about 26% on the average.

	Budget Asked (monthly average)	Budget Allocated (monthly average)
Fiscal 1967	Rp 20,000,000	About Rp 3,988,900
Fiscal 1968	Rp 20,000,000	About Rp 4,666,700

It is said that, although some dollar fund cement was allocated, its use for other project was decided before its arrival at the Port of Surabaja in fear of its weathering which might result from a possible long period storage due to the delay in work caused by slow payments of labour wages.

b. Fiscal 1969

In fiscal 1969, a monthly budget of 7,500,000 rupiahs (90,000,000 rupiahs for fiscal 1969) was approved as part of the five-year plan of the National Defense and Peace Ministry, but its allocation fluctuated widely.

	Budget Asked (monthly average)	Budget Allocated (monthly average)
Fiscal 1969	Rp 7,500,000	Rp 6,875,000

c. Fiscal 1970 and After

According to the Decision of the National Defense and Peace Ministry, No. KEP/B/177/IV/1970, dated April 25, 1970, it was decided that this graving dock project should be incorporated into the five year plan of the Ministry, the said ministry bearing the expenses and the Naval Force being responsible for the construction work. And, it was also decided to disburse a total of 540,000,000 rupiahs (15,000,000 rupiahs a month on the average) for the period of three years starting from fiscal 1970/1971. From this time on, disbursements were smooth, and as of November 1970 the budget and allocation stood as follows;

	Budget Asked (monthly average)	Budget Allocated (monthly average)
April - November, 1970	Rp 15,000,000	About Rp 14,062,000

As a result, it appears, construction expenses have been paid punctually.

This budget of 540,000,000 rupiahs is solely for the construction of the graving dock entrusted to the Naval Force by the National Defense and Peace Ministry, and will not be used for any other project.

III APPROACH TO THE GRAVING DOCK

A vessel which is to enter the graving dock from Surabaja Road must pass through a narrow approach a little less than one kilometre long. The survey team was told, before departure from Japan, that the approach was not deep enough for the docking draught of the largest vessels that were to pass through it. As too many things were not clarified as to its depth, dredging plan and banks, it was feared that the graving dock might not be turned to best account on completion, if appropriate measures would not be taken.

Such being the situation, the survey team made a survey of the plan the Indonesian Naval Force had for the Improvement of the approach and its both banks. Mention will be made of the study and consideration of the survey team in this respect.

1. Approach

(1) Relation of the Approach and the Location of the Dock

The entrance to the graving dock is located about 850 M away from the entrance to Surabaja Road. At a half-way point, the approach is as narrow as 65 to 69 M in width along a length of about 250 M.

The approach is of a complex hydrographical shape as a whole, as can clearly be seen from the attached drawing 4, and a number of vessels are moored in AREA No. 1 and AREA No. 2 where there are permanent mooring facilities. The centre line of the dock and AREA No. 2 is 3.0 M off the centre line of the revetment for the following reason; at a distance of 6.0 M away from revetment D shown in the attached drawing 4, fender piles for a removed pre-war pier are left unremoved in the water over a distance of about 220 M in parallel with revetment D. The centre line of the graving dock was made to form a straight line with that of AREA No. 2 which was 58.874 M wide, taking no account of the distance of 6.0 M to those fender piles.

(2) Docking and Undocking of Vessels

The survey this time disclosed that this graving dock had been planned to be constructed in a terrain of a peculiar configuration quite different from ordinary sites of docks, and contained therefore various problems in taking a vessel into and out of it. Some consideration will be made here of these problems.

a. Vessels to be Docked

Although it cannot be made clear what types of vessels were conceived at the time of planning this project, the data furnished by the Indonesian Naval Force during surveying indicate the vessel described below as the largest size to be docked.

Vessel of Maximum Size to be Docked
(Length overall) 210.0 M x (Width) 22.0 M x (Depth 13.7 M x
(Maximum draught) 7.8 M
Docking Draught 6.3 M

The docking draught mentioned is not particularly designated as the aft draught. Generally speaking, however, the docking draught of a vessel, especially the trim, can be adjusted over a considerable range, and there will be no great mistake in taking this figure as representing the aft draught.

A commercial vessel of a dead-weight tonnage of 5,000 is presented here by way of example, since vessels of this type are supposed, from a vessel steering point of view, to be brought into the dock at frequent intervals.

Vessel of a Dead-Weight Tonnage of 5,000
(Length) 100.0 M x (Width) 16.0 M x (Depth) 9.0 M
Docking Draught (aft) 4.1 M

Since the water is 7.3 M deep (A.R.P.) at the dock threshold, the vessel 210 metres long with a docking draught of 6.3 M can enter the dock even when the tide is at its lowest level. The vessel of a dead-weight tonnage of 5,000 can naturally enter the dock at any tide level, and, moreover, it is possible in view of its length that two vessels of this type should be docked at one time and that repairs should be made on them.

b. Towing through the Approach and Piloting at the Dock Entrance

Special care is required, as illustrated in the attached drawing 1, in taking a vessel into and out of a dock located at the end of such a complicated approach. Mention is made below of such cautions.

(I) Towing of Vessel through Approach

Two methods may be employed in towing a vessel through the approach: one is to pilot the vessel by means of bitts installed on revetment B, E and F and the windlass and winches of the vessel, and the other is to use tugboats for piloting. The former method however requires a complicated operation, and, in any case, docking a vessel requires the use of tugboats. The latter method only should therefore be employed in this case. It is common practice that towing a vessel, whichever size it may be, through use of bitts is avoided.

(II) Arrangement of Tugboats

The arrangements of tugboats shown in the attached drawing 1 and 2 conform to a list of tugboats (attached chart 2) furnished by the Indonesian Government. Those tugboats generally lack thrust force, and the best plan of tugboat arrangement cannot therefore be obtained with those existing tugboats only. Mention will be made of the best plan later. Here suffice it to mention the condition for determining the permissible width and depth of the approach. When consideration is taken of the relation between the vessel to be docked and tugboats mentioned in paragraph b above, the approach must be about 55 M wide over the entire distance as indicated in the attached drawing. There is then room of only 7 M or so left on the side of either revetment When the deviation of a vessel from its course is considered, the existing approach must be utilizable to its full width and cleared of all obstacles at all times. The required depth of the approach and its bottom width are mentioned in paragraph d below.

c. Permissible Depth

If the docking draught of the 210-metre cruiser mentioned above is 6.3 M at the stern, a minimum depth of 6.8 M is necessary. In actuality, however, an allowance should be made for soil accumulated on the bottom.

The Beams of Naval vessels are narrow, compared with their length. Therefore, the docking draught of a commercial vessel naving her max. breadth being able to pass the dock entrance (28 metres wide at the upper section and 25 metres wide at the lower section) must be taken into consideration.

If the permissible width of a commercial vessel is 24 M, its dead-weight tonnage is about 20, 000 to 30, 000. As the docking draught of a vessel of this size is supposed to be about 5 M, the depth mentioned above can be said to be sufficient.

In docking a vessel, tugboats come close to the revetments to the utmost possible limit, the water depth at the normal line of the revetments must be maintained at 3. 0 M (A. R. P.) at least.

In the case of the best arrangement of tugboats, the water depth required is at least 1. 7 M, judging from the draught of the pusher boat.

Judging from the requirements mentioned in paragraphs c and d above, the cross section of the desired shape of the approach should be the one shown in the attached drawing 3.

(3) Survey of the Present Condition

The total length of the approach from Surabaja Road to the graving dock is about 850 M, its width being about 69 M at the portion surrounded by the both-side revetment near Surabaja Road and about 65 M near the graving dock. (Refer to the attached drawing 4.)

A glance at a sample of earth and sand collected by divers, condition of the earth and sand being dredged and earth sticking to steel bars observed during a survey of the interpenetration of them permitted it to be presumed that the bottom of the approach consists of blackish fine particles like ooze.

The approach being a blind channel, earth and sand cannot enter it at any portion of it other than its entrance. The condition of sand accumulation attests to it. A survey, for instance, which was made of the depths at various portions of the approach by the use of a echo-sounder in September 1970 indicated that the approach was - 1 to -3 metres deep at the entrance, getting deeper and deeper as the dock got near. In Area No. 2, its depth was -2 to -4 metres, while in front of the dock gate it was -4 to -5 metres.

As this region has little monsoon, there is no wave at the entrance to the approach. The English sea chart of 1970 edition states that there is a tidal current of 3.5 knots around the entrance to the approach, but people there told that they had never waited for a favourable tide to go to Madura Island across Surabaja Road even in a small boat. It is therefore thought that vessels entering the approach from Surabaja Road will affected by neither waves nor a tidal current.

Although it appears that the Indonesian Naval Force has been dredging the entrance to the approach including Bandar Timur to prevent the accumulation of drift sand, no particular information has been furnished.

The survey team asked the Naval Force for data showing the results of dredging by year, area and depth for the past five years, but failed to obtain the desired data except for some sea depth charts and verbal explanation mainly because the dredging and the dock construction were under the control of different divisions of the Naval Force.

According to the sea depth charts and explanation, Areas No. 1 and No. 2 were not dredged from 1964 to 1969, and dredging in these areas was started in December 1970 in accordance with the plan of 1970. It appears that Area No. 3 has been dredged to such an extent that there might not be hindrance to vessels having access to Bandar Timur.

Bucket dredgers have been in use.

Six bucket dredgers are now in port at the Port of Surabaja. The particulars of those dredgers are given in the table below. Three of them belong to the Indonesian Naval Force, and the remaining three belong to Port Administrator TANJUNG PERAK. The Naval Force has asked Port Administrator TANJUNG PERAK for help, as occasion demanded.

Dredger Name	Belonging to	Capacity (nominal)
MARGA-DJAJA	Naval Force	900 M^3/H
MARGA-TUNGGAL	Naval Force	450 M^3/H
MARGA-SAKTI	Naval Force	600 M^3/H
SINGGALANG	Port Administrator	900 M^3/H

Dredger Name	Belonging to	Capacity (nominal)
KALANDO	Port Administrator	600 M^3/H
BATANG-HARI	Port Administrator	900 M^3/H

The dredger which was dredging the approach at the time of surveying was "KALANDO" of Port Administrator TANJUNG PERAK.

The bucket dredgers of such a type as SINGGALANG can dredge to a depth of 12 M, and those of a KALANDO type, 7 M.

(4) Plan of Approach Improvement

Control has been maintained of the waterway and revetment on either side of it by the Indonesian Naval Force, indenpendently of the graving dock construction work. During this survey, the Naval Force was dredging the greater part of the approach, independently of the dock construction work. It has also been made clear that the Naval Force had mapped out a separate plan for dredging the approach by the time of completion of the graving dock to receive vessels to it and that the Indonesian Government would take the whole responsibility for the improvement and maintenance of the approach.

According to the dredging plan for vessels to be docked of the Naval Force, the dredging is to be carried out to a width of 40 M and a depth of 7 M (A. R. P.) on the enxtension of the centre line of the dock over the entire length of the approach, and 12, 000, 000 rupiahs are to be disbursed for the dredging (of 200, 000 M^3 of spoils) out of the budget earmarked for this graving dock project, 540, 000, 000 rupiahs. Repairs to the revetments have however not been considered in the plan.

It was told that the dredging work carried on by the Indonesian Naval Force also covered the portion of the approach near the temporary cofferdam of the dock and the entire approach excluding its either side 10 to 15 M away the revetments. The dredging depth was reported to be -6 M (A. R. P.)

Accordingly, the afore-mentioned dredging work has only to be a dredging of a depth of another metre, that is, from -6 M(A. R. P.) to -7 M, and a maintenance dredging.

(5) Consideration of the Present Dredging Plan

a. Depth and Width of the Fairway

The planned depth of the fairway is -7 M (A. R. P.), 30 cm shallower than the altitude of the dock threshold which is -7. 3 M (A. R. P.). The depth of the fairway does not therefore coincide with the capacity of the dock. As mentioned above, however, the largest vessel to be docked requires a depth of -6. 8 M (A. R. P.), and the range of tide can be turned to account in actual docking. For this reason, there is no necessity of making the fairway depth coincide with the height of the dock entrance.

The planned width of the fairway is 40 M compared with the required width of 55 M, but there will be no problem in taking a vessel into and out of the dock, since the fairway is already 4 M deep on either side 10 M wide. (Refer to the attached chart 3.)

b. Quantity of Earth and Sand to be Dredged

As the Indonesian Naval Force has been dredging the approach over almost its entire length to a depth of 6 M (A. R. P.), the earth and sand to be taken out will be those of a 1-metre depth and the sand which will have accumulated by the time of completion of the graving dock.

The quantities of earth and sand to be dredged are estimated as follows, dividing the dredging thickness into three areas, using the data on the sand accumulation from 1967 to 1970, results of the dredging in 1968 and sea depth charts of 1970.

Area	Dredging Thickness (M)	Cross Section (M^2)	Total Length (M)	Quantity of Sand (M^3)
Area No. 3	5	275	400	110, 000
Area No. 2	2. 5	120	250	20, 000
Area No. 1	1. 5	80	200	16, 000
Total				146, 000

In preparing the table above, it was assumed that no dredging would be carried out in Areas No. 1 and No. 2 independently of the dredging for bringing vessels into the dock by 1972 when the dock is expected to be completed. As for Area No. 3, no data of maintenance dredging were available, so the dredging thickness was estimated at 5 M, adding a dredging depth of 1 M to a difference in depth of about 4 M between February 1968 and September 1970 at the entrance of the approach which was considered as the thickness of sand accumulated over the entire Area No. 3.

The total dredging quantity of 146, 000 M^3 is smaller than the planned quantity of 200, 000 M^3 of the Indonesian Government, and will not, it is assumed, exceed 200, 000 M^3 to a great extent, even when consideration is taken of a possible error of estimation and extra dredging.

(6) Problems and Measures

a. Piloting of Vessels to be Docked

The current trend is generally toward the principal use of tugboats with highly-efficient Voith Schneider in conducting vessels to the dock. In conducting vessels through the narrow approach to the dock, an increase in the number of tugboats with Voith Schneider is particularly desirable in order to stabilize the course of a vessel and make most of the limited width and depth of the fairway.

A pusher boat is usually used as an auxiliary boat necessary for maintaining the course the vessel takes. However, no data concerning the pusher boat are available, there being no alternative but to use existing tugboats, as indicated in the attached drawings 1 and 2. Properly speaking, the use of small but powerful pusher boats is most desirable.

From this point of view, the best plan will be to use and arrange as indicated in (c) of the attached drawing 1;

Two tugboats with Voith Schneider	1,000 - 1,500 ps
Four pusher boats of the U.S. Force LCM type	2 x 165 ps

It is imperative that pusher boats should be provided.

The plan of the best arrangement of tugboats may also be used in conducting the largest types of commercial vessels to the dock.

The use of this dock has a number of fairway conditions which call for the highest steering skill required as in the case of a vessel's passage through the fairway, going astern of a large vessel out of the dock, turning round of a small vessel on the narrow fairway surface, etc. It is also an absolute condition that an excellent pilot should get on board a vessel, equipped with instructing devices such as a transceiver and the like to take quick action in careful conduct of the vessel. The plan of tugboat arrangement has been formed on the assumption that large vessels in particular are to be conducted under a favourable meteological and oceanic condition.

b. Plane Shape of Revetments

The current plan states that the distance from the dock entrance to Area No. 2 is to be about 200 M and that the distance from the inner face of the larboard dock-wall to the revetment is to be about 22 M. This area seems however too small for the movement of tugboats conducting large vessels, not to speak of 210-metre long vessels, to and out of the dock.

The maintenance of the course of the vessel is of vital importance in bringing it into and out of the dock. In this respect, the corner of the revetment A ⟷ B requires a modification over a length of 30 M as illustrated in the attached drawing 1 in order to secure the space for the movement of tugboat E (conducting the vessel into the dock) responsible for a fine adjustment of the vessel's course or tugboat H (conducting the vessel out of the dock). This modification is only required in the case of conducting a vessel more than 130 metres long, and smaller vessels do not require the modification of the revetment Moreover, to facilitate the towing or pushing work of tugboats or pusher boats finding their way between the vessel and revetment D is a factor of major importance for the maintenance of the vessel's course. The towing or pushing work at the dock entrance is worth particular consideration: it is desirable to move back eastward revetment D 5 to 10 M from the present normal line of the revetment.

c. Maintenance of the Required Water Depth

The required water depth of the approach cannot always be maintained, unless considerable dredging is carried out at frequent intervals every year, since sand accumulates incessantly on the bottom of the dredged approach.

The approach gets blocked up with drift sand coming in at the entrance to the approach, the source of drift sand being the earth and sand discharged by the nearby rivers.

The water of Indonesian rivers is mostly brown in colour, containing fine particles in colloidal suspension. Judging from the subsoil collected from the bottom of the approach, it seems that those fine particles of soil are drifted along the shore onto the entrance of the approach only to be accumulated on its bottom in the long run.

In order to reduce the tendency of sand to accumulate on the bottom of the approach and to maintain the same function of it, that is, to maintain a depth of -7 M (A.R.P.) at all times, the employment of either one of the following various means or combination of them is considered most effective.

(i) Construction of a Mole

Since, in the case of this port, the distance from the shore to a point -10 M deep off it is as short as 50 to 60 M, the construction of a mole connecting those points 10 M deep from the shore would mitigate the accumulation of sand in the approach, and result in considerable reduction of fairway-maintenance dredging expenses.

The cost of building such a mole is rather inexpensive: as there are no or little waves or tidal current at the entrance to the approach, these factors need not be taken into consideration in designing the mole. It has only to be of such a structure that would check the movement of fine particles of soil drifted by a tidal current. As the sea bottom base is considered consisting of accumulated soft fine particles of soil, a structure of steel sheet piling is believed to be more suitable than a gravity type, particularly when those factors such as waves and a tidal current are taken into consideration. The use of left-over water stop steel sheet piles around the temporary cofferdam and dock will make it possible to build the mole with a considerably reduced construction cost.

(ii) Measures are to be taken so that the accumulation of a given amount of sand may not affect adversely the function of the fairway: the fairway in Area No. 3 showing a marked tendency togather drift sand on its bottom is to be dredged to a depth of more than -7M (A. R. P.) beforehand, or a wider fairway is to be planned than is required for the steerage of a vessel. In Areas No. 1 and No. 2, however, the structure of the revetment poses problems to deeper dredging and fairway widening. Either of these measures had better be dropped. (Refer to paragraph 2 of Chapter 2.)

2. Revetments

(1) Survey of the Present Condition

The revetment on either side of the approach to the dock were built in the days of Dutch rule. The documents explaining them were burnt by the then Dutch authorities when the Japanese army made an inroad on the country during World War II. The reference data such as structural drawings, papers of architectural calculation, and so forth which would indicate how deep the dredging may go, if available, cannot be obtained any more.

In order to investigate the revetment structure and its wear, a visual inspection was made of the portion of the revetment above the water, the portion under water having been inspected by divers. At the same time, steel bars were penetrated into the base to find out the water depth at the time of revetment construction.

The plan arrangements of the structures are ichonographically represented in the attached drawing 4.

Sections A, B and E

Thise sections are of a steel sheet piling structure, and the steel sheet piles used are IV type equivalents. Sections B and E are excessively corroded at a height of A. R. P. + 1 M — so much so that the back filling crops out of the wall of steel sheet piles everywhere and that the apron has caved in. (See the attached drawing 6.) According to the Naval Force, the revetment made of steel sheet piles was built in about 1935.

Section C

This is an inclined revetment, the portion connecting to the steel sheet piling having been built of concrete.

Section D

Judging from its surface, it was built of concrete. The concrete used in the repairs to the wall near the structure built of steel sheet piles has sporadically scaled off. The examination of part of section D of the revetment exploded for providing the temporary cofferdam for the dock construction work disclosed that its upper structure had been built of bricks. People concerned with the work told that foundation piles had come out of the lower part of the section. As this section presented the same condition as that of sections G and H within the temporary cofferdam, the revetment construction is supposed to be something like the one illustrated in the attached drawing 7. Foundation piles (37 cm x 37 cm) called "wood of iron" (Kaju busi) were driven into the part below under water, five per 85-cm pitch along the length of 4 M, and upon this part upper structure made of something like concrete, probably set with stones and lime, was built using likewise "wood of iron" - timber sheet piles - about 20 cm thick as forms. Its top portion was built of bricks.

The Naval Force explained that, although the "wood of iron," both timber sheet piles and piles, was still good, the structure had probably been built about a hundred years before.

In front of section D there used to be a pier built of screw piles over a length of about 220 M along the revetment. After World War II, the pier was removed, leaving only the fender piles in front of the pier. The Naval Force remembered that the pier had been of such a structure as shown in the attached drawing 8.

Section F

The part of this section which can be seen is built of concrete. Drivers found that the portion up to its base (2 M deep - A. R. P.) was also of concrete, but could not make clear the structure beneath.

The result of manual penetration of steel bars (16 MM in diameter and 7 M in length) over a range 50 cm off the shore is shown in the attached drawing 9. (See the attached drawing 4 for points of survey.) At a point, No. 0 + 30 M, shown in the attached drawing 4, the steel bars went about 4 M deeper than the surface of the base, reaching a depth of 5. 6 M (A. R. P.) and showing a tendency to penetrate farther. However, the steel bars used were not long enough, deeper penetration could not be attained.

In Area No. 2, penetration up to a depth of 4 M (A. R. P.) was achieved on the west coast, and on the east coast the penetration reached a depth of -5. 5 M (A. R. P.). At a point about 1 M away from the revetment, however, a steel bar went deeper than -5. 6 M.

In front of section D, there were so many things thrown into the water that no penetration of steel bars was attempted.

(2) Relation between the Present Dredging Plan and Revetment Stability

Since the structural drawings of the revetments are not available as mentioned in (1) above, it is impossible to know how far dredging may go without endangering the stability of the revetments, unless large-scale test civil engineering such as excavation of the foundations of the revetments by installing temporary locks is carried out.

It is presumed, however, that the present plan of dredging for docking vessels will not endanger, though not absolutely, the foundations of the revetments for the following reasons.

a. The steel sheet piles used in the east-side sheet pile revetment are all IV-type equivalents. If the method of designing employed in the construction of this revetment is the same as that prevailing in Japan, the designed depth of this revetment will be about 6. 5 to 7.7 M (A. R. P.) in Surabaja where there is no earthquake.

It is presumed that since the revetment on the west coast has a total length of more than 450 M, there is little or no possibility of steel sheet piles originally intended for use in other works having been expediently used in the construction of this revetment and that steel sheet piles suiting the specifications of the revetment were employed. According to the Indonesian Naval Force, vessels of 5,000 tons were berthed to the west coast during World War II. Judging from the fact that berthing of vessels of 5,000 tons requires a berth depth of -7.0 to -7.5 M (A.R.P.) and that steel bars could be penetrated to a depth of more than 5.6 M (A.R.P.) at some points on either revetment, it can be presumed that the structures were originally designed to have a depth of about -7.0 M (A.R.P.). Although the steel sheet piles used in those revetments have been corroded to a great extent, the face line of the dredging for docking vessels runs 10 M away from the face line of the revetment on the west coast, and 16 M on the east coast, which fact means that the dredging of the approach for docking vessels runs little danger of immediately destroying the revetments.

b. Sections of Revetment without Steel Sheet Piles

Section C, being an inclined revetment, is presumed not to have its foundation buried deep into the soil. Its face line is however about 20 M backward, as compared with that of section B, that is, 30 M away from the dredging face line. Section C will therefore not pose any problem.

Section F is in contact with revetment E of sheet piles (which has a total length of about 57 M). Although it is impossible to infer from its structure how deep its foundation is buried, it is quite possible that section F should have an approximate depth of revetment E, since the revetment extension whose depth corresponds to that of the revetment built of IV-type steel sheet piles requires a length of about 130 M to berth a vessel of a dead-weight tonnage of 5,000, which fact means that the total length revetment E is not sufficient. This inference is backed by the fact that a test steel bar went more than -5.6 M deep at some points along revetment E.

If dredging is to be carried out at the foot of the revetment at a gradient of 1 : 3 as part of the plan of dredging for docking vessels, the water depth in front of the revetment will be about -2 M (A.R.P.), and if at a gradient of 1 : 5, the water depth will be about -4 M (A. R. P.). (See the attached drawing 3.) Judging from this calculation and the plans of survey of water depths of 1958, it is presumed that the dredging probably will not put the revetment in danger of destruction.

Section D used to have a pier in front of it. It is possible that the pier was built there to have section D deeper in water depth than sections E and F. But, it seems rather probable that the pier was built there, because section D had a less depth than sections E and F. (The plan of survey of water depths of 1958 shows that the water depth was not particularly deeper in front of the pier.)

If revetment D is supposed to be of such a structure as illustrated in the attached drawing 7, a little excavation at the front of revetment D will not lead to its immediate destruction, since the structure itself is supposed to be supported by piles.

(3) Problems

If revetment D is of such a structure as illustrated in the attached drawing over its entire length, the dredging of the fairway probably will not put any portion of the fairway revetment in danger of collapsing. There are however some problems as mentioned below.

a. The revetment built of steel sheet piles have been corroded to a considerable degree —— so much so that their durable years have already expired. It is high time that the revetments were reconstructed for their own stability, not because of the necessity of reconstruction brought about by the plan of dredging the fairway for docking vessels. (See footnote 1 .)

b. It cannot be said for certain that revetment D is of such a structure as illustrated in the attached drawing 7 over its entire length. It is possible that under some circumstances the dredging should make part of the revetment unstable. If revetment D is of such a structure as shown in the attached drawing 7, the sand behind the structure may have gradually flowed out over a long period, unless timber sheet piles were buried deep enough. (See footnote 2 .) Although it was made clear that section H had its timber sheet piles buried -2 M (A. R. P.) deep, the structure beneath is not known. If revetment D is not to be reconstructed, the employment of the best plan of boat arrangement (Refer a, paragraph 6 of Chapter 1.) is desirable, since the pusher boats the plan intends to use require a water depth of only -1. 7 M or so (A. R. P.).

Note 1

The steel sheet piles intended for use in temporary closing of the dock and water stop work will be left over in a large quantity. These sheet piles, being of the V-shaped type, are larger in cross section than those of the IV-type, and can well serve as reconstruction materials. If put to good use, they will help to reduce the reconstruction cost. Moreover, A coping, if placed from a height of A. R. P. + 0, would bring about a considerable increase in the durable years of the revetment built of steel sheet piles.

Note 2

Maximum safety will be provided, if the revetment is reconstructed using those left-over steel sheet piles. However, since it is not made sure that the revetment is in danger of collapsing, it may be reconstructed only when it is in trouble, if no budget has been appropriated.

IV CONCLUSION

The following five reasons can be brought forward as to why this project has not been completed, although an enormous amount of time as long as seven years and a tremendous amount of money have been spent since 1963.

(1) Internal disorder which reached its peak around the "incident of September 30," 1965.

(2) Ever-agravating inflation which has persisted since the commencement of the work till recently.

(3) Lack of Rupiah funds corresponding to foreign-currency funds and delayed payments.

(4) Lack of techniques and controlling ability required for the construction of a dock.

(5) Accident of slope failure which occurred to the rear section of the steel sheet piling on the east side of the dock.

The problems, (1) to (3), are not technical ones, but were the major causes of such a delay in work.

It can be said that those problems, except for (4), have been almost sloved for the following reasons.

(1) It is years since the Soeharto Administration took office, and the Administration is stable enough with the internal commotion having subsided.

(2) The monetary situation has cooled down since about a year ago as the result of the adoption of various restrictive monetary measures and a steady economic policy by the Administration.

(3) By the Written Decision signed by President Soeharto and issued in April 1970 for the promotion of this project it was decided that a budget of 540,000,000 rupiahs should be appropriated for no other purpose but the construction of this dock for three years, that is, till the completion of it. Rupiah disbursements have also been made punctually.

(5) The danger of another base collapse at the accident site has been completely removed.

Therefore, an early supply of machines, instruments and tools and their parts which cannot be obtained in Indonesia, a prompt supply of steel materials, cement and so forth, and the earliest possible despatching of engineers who are to furnish guidance as to the methods of work and supervise the construction works are essential prerequisites to the completion of the graving dock by the fixed time.

The staffs of the Indonesian Naval Force responsible for the construction of this graving dock informed by writing to the survey team that the dock would be operated and controlled by a civil commercial and industrial body upon completion and that the civil commercial and industrial body would cooperate with the Indonesian Naval Force and the Ministry of Transportation in making repairs to all types of vessels, although the survey team did not have it as a direct aim to collect this sort of information.

The information gathered, the collection of which was the purpose of this survey, can be summarized by items as follows:

1. Progress of Work and Amount of Work and Number of Days Required for the Completion of the Dock

The past progress of work has been rather slow for such an enormous amount of time as seven years spent for it. At the time of surveying, any structure, except for one at the dock entrance, which could have been seen from the ground, if its construction had been started, was hardly built. However, the caisson works which are the most difficult of all types of works in this project had been completed. As the installation of caissons was rather satisfactory, and the technically difficult installation of struts for dock bottom excavation was, for the most part, finished, it can safely be said that about 60% of the whole works have been finished.

The work which remains to be done from December 1970 till the whole works are completed is indicated in the attached table 2.

The Indonesian authorities now plan to complete the works by the end of December 1972. This construction period is by far longer than the time required for the construction of a dock in Japan. However, Indonesia is handicapped in many respects: the man-hour ratio of workers is about less than half that of Japanese workers; experience in dock construction is insufficient; slow repairs to construction machines due to the difficulty of obtaining their parts. Those factors being considered, the construction period mentioned above can be regarded as reasonable. If the necessary machines and materials are supplied by June

1971 at latest, and adequate technical guidance is furnished, it is, quite possible to complete the construction by the fixed time.

2. Wear of Machines for Temporary Works and Requirement and Cost of their Replacements

Although the machines and parts intended for use in the permanent and temporary works were all supplied by March 1970 on a reparation basis and on a contract secured on the reparations, part of the machines and materials for permanent works was used for temporary works because of the excessive inflation and robberies which followed an internal disorder attributable to the incident of September 30. For these reasons, there is a considerable shortage of machines and materials, and, moreover, the machines for use in temporary works have worn out to a by far greater extent than had been expected, because the durable years of most of them expired as the work delayed. To carry out the construction work requires the irreducible minimum of additional machines and parts listed in the attached tables 4 and 5. Their cost is estimated at $420, 300.

The maintenance and storage control of the machines and parts now in use are not adequate in many respects. Good control should be made of maintenance of them as soon as possible, and they should be inspected and repaired by the respective experts at least six months before their installation at the work site so that no trouble may occur at the time of later installation.

The expenses required for the maintenance and control of those machines and parts are included in the rupiah budget. However, the expenses which may be required for repair and maintenance and replacements necessitated by incomplete maintenance in excess of the budget have not been taken into account in estimating those maintenance and control expenses, since those excessive expenses should be met by the Indonesian authorities on their own responsibility.

3. Requirement and Cost of Additional Materials

The materials which require an additional supply are cement which was used for an unintended purpose in fear of its weathering because of the delay in work and concrete reinforcement which ran short because of a change in the dock wall design but could not be replenished by the reparations, MISPRI 354 (70), their requirements being respectively 14, 500 tons (cement) and 700 tons (concrete reinforcement). The cost is estimated at $393, 600.

4. Number of Engineers Necessary for Work Supervision and their Expenses

There are several kinds of works which can be performed by the Indonesian engineers, if they are simply to be carried out independently. Filling concrete in dock walls is an example.

However, many kinds of works overlap each other in a very complicated way while they are being carried out, and they therefore require the highest level of control techniques at all times. Some of the works which the Indonesian engineers have never experienced contain the piping and wiring work which cannot be restored, if damaged, to its original condition by simple repairs. Direct technical guidance at the work site is therefore of vital importance, if this project is to be completed by the fixed time in operative condition.

It follows that at least 17 engineers must visit the work site from Japan in accordance with the progress of the work during the period from April 1971 to the day of completion so that perfect advice and guidance may be furnished to the Indonesian engineers.

The expenses required for this purpose are estimated at $442, 700.

5. Present Condition of the Approach

This graving dock has only one narrow approach 850 M long and 65 M wide on the north of the port. As the water depth of this approach has a significant effect on the operation of the graving dock, it was included into the survey items. It is now 1 to 5 M deep (A. R. P.), being in need of an overall dredging prior to the completion of the graving dock.

Under these circumstances, the Indonesian Naval Force have two dredging plans: one formulated in 1970 is to dredge almost entire approach to a depth of 6 M (A. R. P.) irrespectively of the construction of the graving dock, and the other is to dredge the approach to a depth of 7 M (A. R. P.) as part of the dock construction project. With these two plans of dredging, the largest vessels that the Indonesian authorities have in mind may be brought in and out of the graving dock. However, this port shows a tendency to permit soil to accumulate on the bottom. In this respect, therefore, regular maintenance dredging is necessary to maintain the fairway in good condition.

As far the revetments, the Indonesian authorities have no plan of reconstruction. However, judging from the results of the past dredging and some data gathered during surveying, it can be said that dredging at this level will not lead to immediate destruction of any revetment.

Taken altogether, it is judged that the completion of this graving dock is quite possible from a technical point of view. The expected date of completion is December 1972, provided that the machines and materials are to be supplied by the stated time. The foreign-currency fund required for the completion of the dock is $1, 256, 600, all told.

Lastly, although it is evident that the work delayed considerably, requiring an additional supply of machines and materials more than needed for the reasons mentioned at the beginning of this section, it cannot necessarily be said that the supervision and control of the works by the supervisors have been adequate and appropriate in every respect, and, on the other hand, it appears that the Indonesians concerned have not always accepted and followed out all the technical advice and supervisory instructions given by the supervisors. This can also be considered one of the causes of the delayed work.

Those things being considered, it should be pointed out with emphasis that it is necessary to request the Indonesian Goverment to respect the advice and instructions of the supervisors and take measures to reflect the advice and instructions quickly and properly on the performance of the work, and on the other hand, the supervisors must exhibit the engineer's spirit to the fullest degree in furnishing advice and guidance to the Indonesians in charge of the construction works.

REFERENCES

DRAWING - 1

GUIDING A VESSEL IN AND OUT OF THE DOCK - 1 - (210-metre Vessel)

(A) Vessel Entering the Dock

(1) When the vessel comes near the dock entrance, tugboat H moves to the position indicated in the drawing.

(2) As the vessel is coming into the dock, tugboats A, D and H maintain the bow of the vessel going to good course.

(3) When the vessel is entering deeper into the dock, the tugboats move toward the stern of the vessel, and finally maintain the stern.

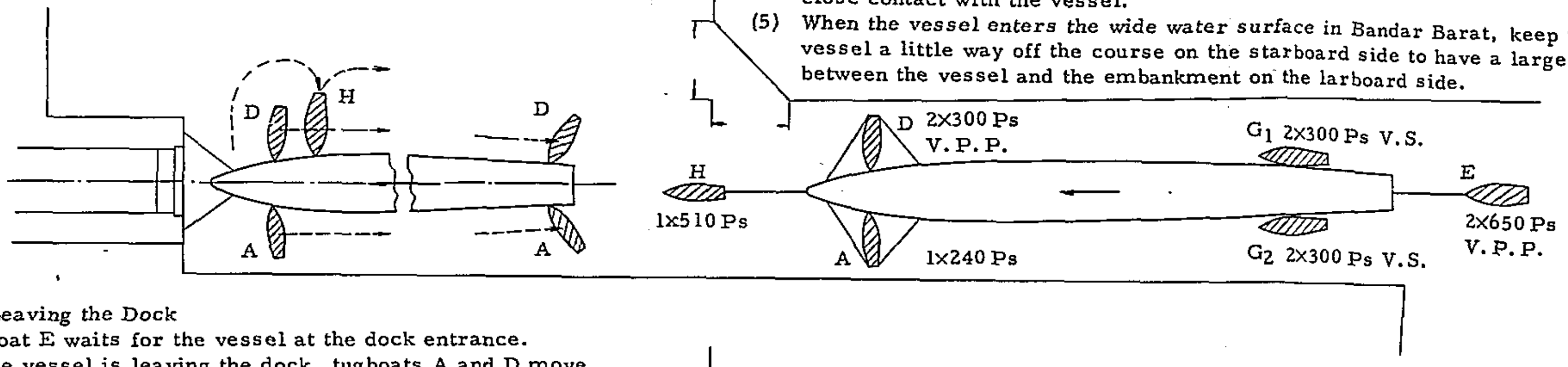
(1) The main engine and steering engine of the vessel are mainly used in propelling it into the dock, and the tugboats G_1 and G_2 with the highest steering performance are used as an auxiliary boat.

(2) Tugboat H conducts the vessel into its advancing course, and tugboats D and A adjust the course. Tugboat E is used as a steering boat, as occasion calls for.

(3) Tugboat E is used in slowing down the vessel.

(4) Wire stays are stretched as indicated in the drawing so that tugboats A and D keep close contact with the vessel.

(5) When the vessel enters the wide water surface in Bandar Barat, keep the stern of the vessel a little way off the course on the starboard side to have a larger clearance between the vessel and the embankment on the larboard side.



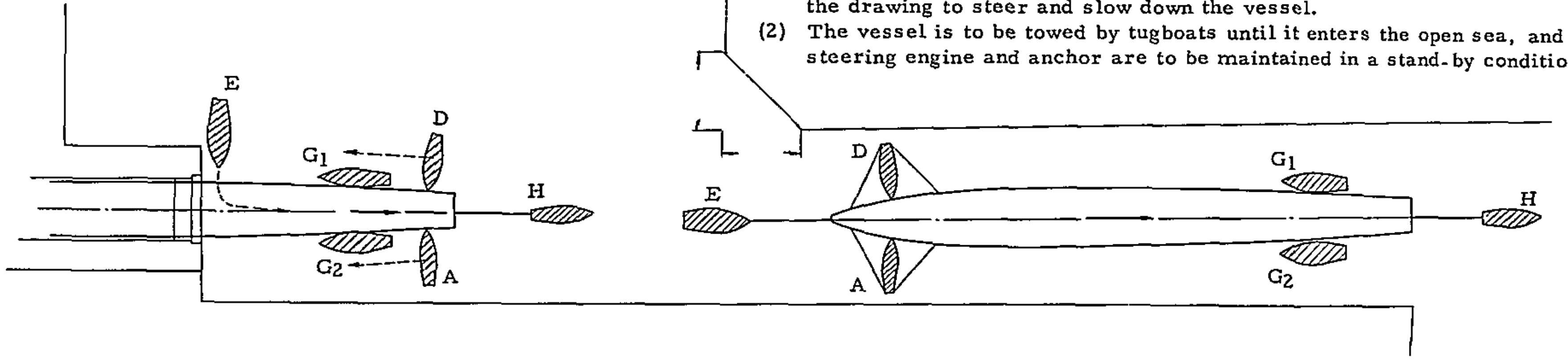
(B) Vessel Leaving the Dock

(1) Tugboat E waits for the vessel at the dock entrance.

(2) As the vessel is leaving the dock, tugboats A and D move toward its bow.

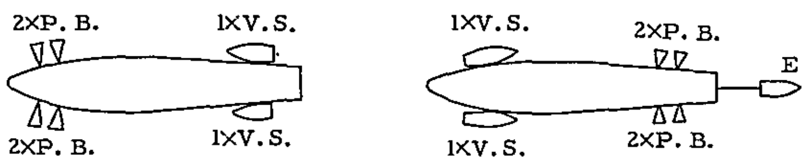
(1) As soon as the vessel is out of the dock, tugboat E moves to the position indicated in the drawing to steer and slow down the vessel.

(2) The vessel is to be towed by tugboats until it enters the open sea, and its main engine, steering engine and anchor are to be maintained in a stand-by condition in case of emergency



(C) Improved Plan of Tugboat Arrangement

(1) Entering the Dock (2) Leaving the Dock



As it seems that the existing tugboats generally lack thrust force, it is desirable to arrange two tugboats with V.S. propulsion machinery (1,000 to 1,500 ps) and four Gray Marines of the U.S. Army LCM type (165 ps x 2) as illustrated in the drawing above.

(D) General Notes

(1) The towing speed is less than 2.0 knots, and max. 2.5 knots.

(2) The main engine, steering engine and anchor are to be maintained in a stand-by condition.

(3) The pilot must be the highest engineer, and transceivers are to be used for communication between him and the watches and tugboats.

(4) The wind velocity must be below 6 M/sec.

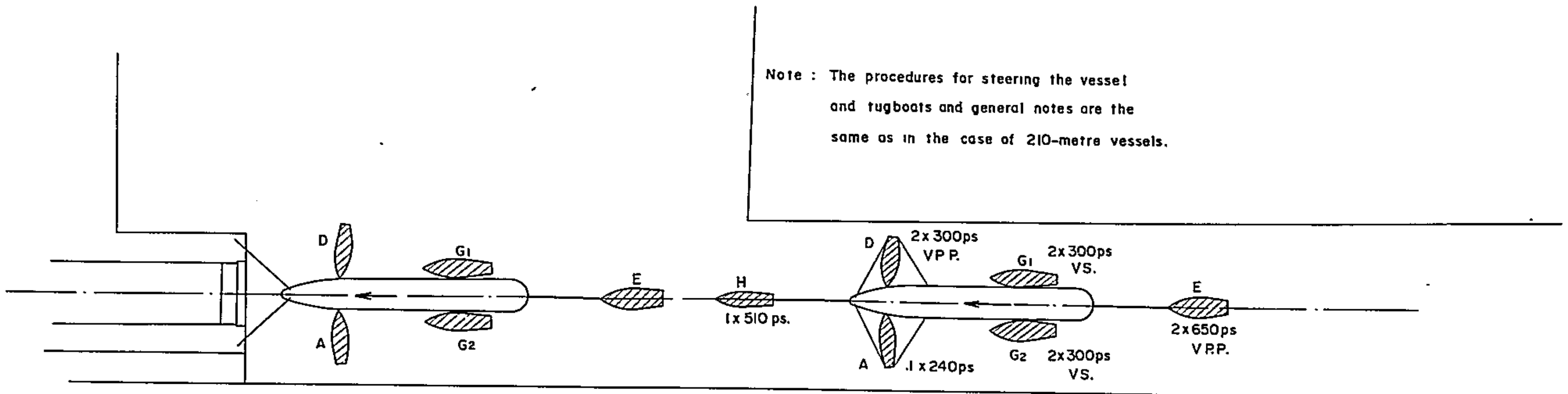
(5) The yawing motion of the vessel must be below 4 M on one side.

DRAWING – 2

GUIDING A VESSEL IN AND OUT OF THE DOCK – 2 –

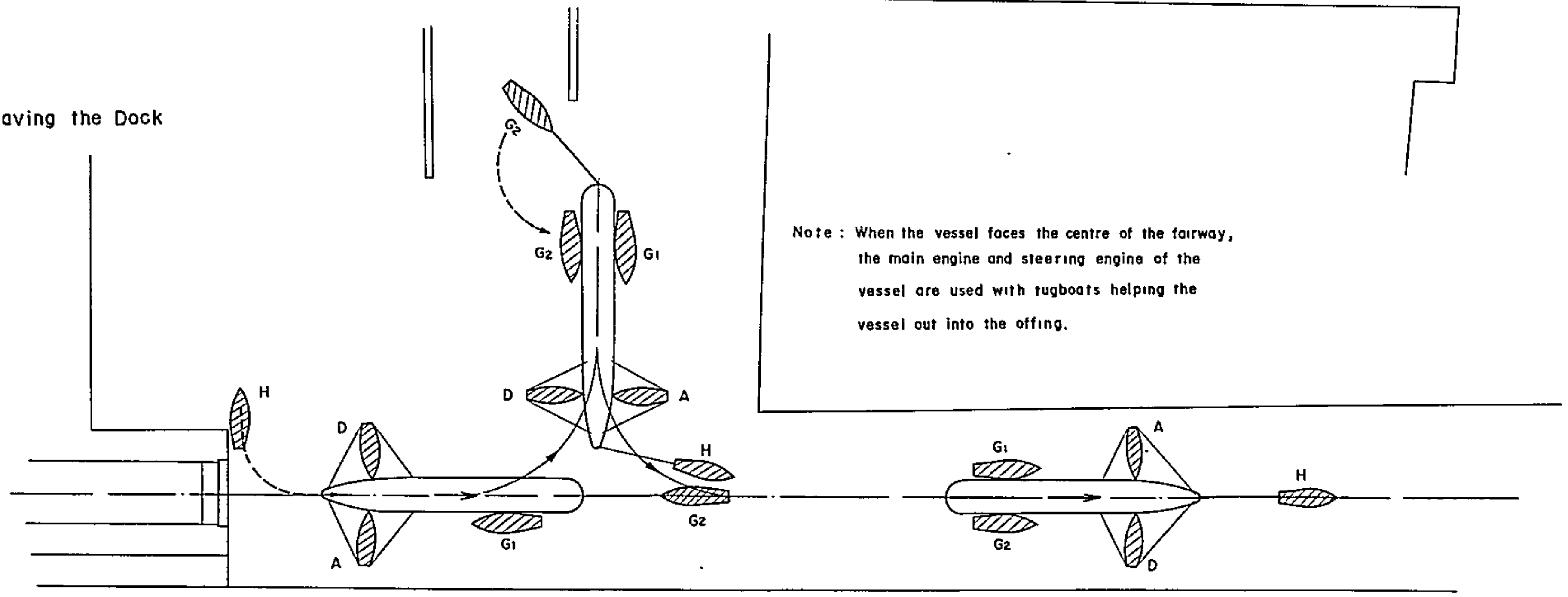
(5,000-DW Veseel)

(E) Entering the Dock



Note : The procedures for steering the vessel and tugboats and general notes are the same as in the case of 210-metre vessels.

(F) Leaving the Dock



Note : When the vessel faces the centre of the fairway, the main engine and steering engine of the vessel are used with tugboats helping the vessel out into the offing.

(G) Tugboats to be Used (in conducting both a 210-m vessel and 5,000-DW vessel)

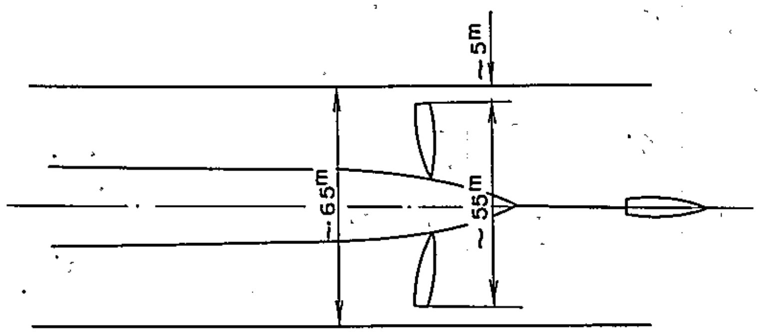
	A	B	C	D	E	F	G	H
POWER	I x 240 PS DIESEL	I x 150 PS DIESEL	I x 650 PS DIESEL	2 x 300 PS DIESEL	2 x 650 PS DIESEL	I x 500 PS STEAM REC	2 x 300 PS DIESEL	I x 510 PS DIESEL
DIMENSION	22.0x55x2	130x36x 1.5	28.0x7.3x34	22.0x7.0x 2.5	25.0x76x2.7	300x80x35	243x7.2x 3.1	244x5.7x25
PROPELLER	℄ AFT	℄ AFT	℄ AFT	2x℄ AFT. V.P.P.	2x℄ AFT V.P.P.	℄ AFT	2 x V S.	℄ AFT

WHERE V.P.P. = VARIABLE PITCH PROPELLER.
V.S. = VOITH SCHNEIDER PROPELLER.

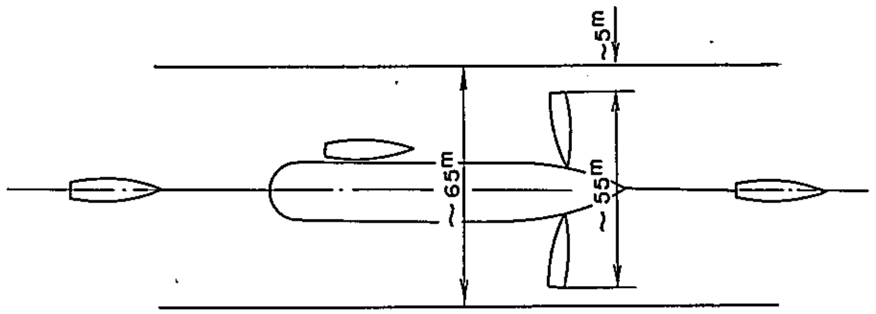
DRAWING-3

RELATION BETWEEN THE FAIRWAY AND THE REVETMENTS

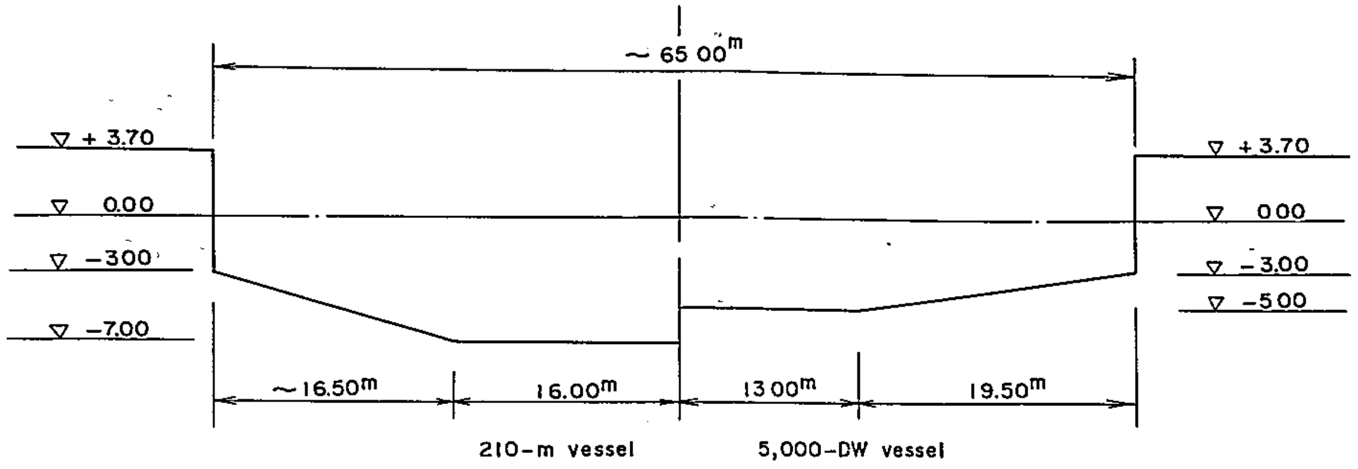
Towing a 210-m vessel through the fairway



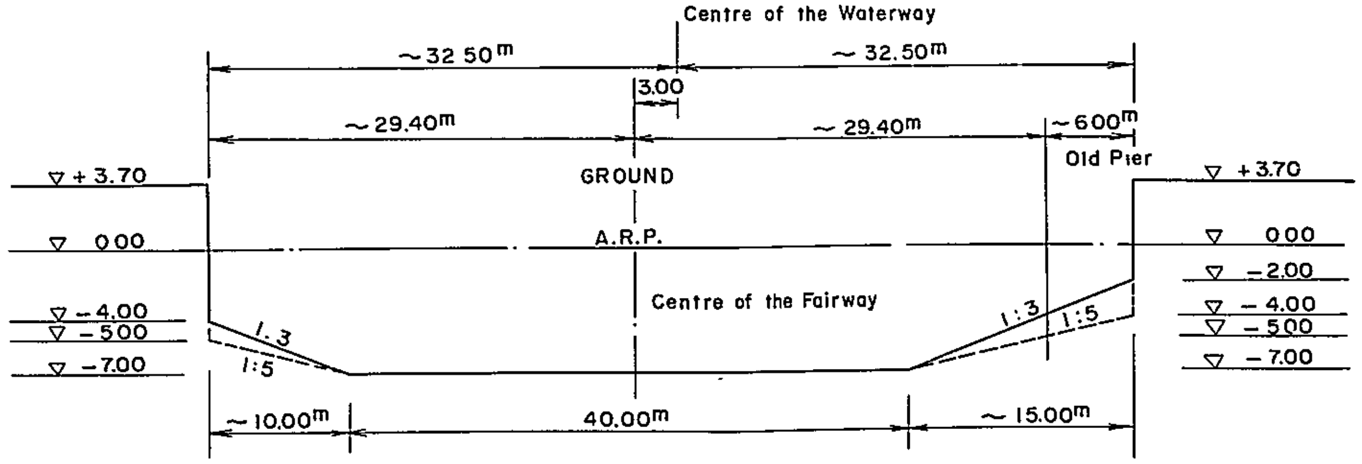
Towing a 5,000-DW vessel through the fairway



Permissible Fairway Water Depth



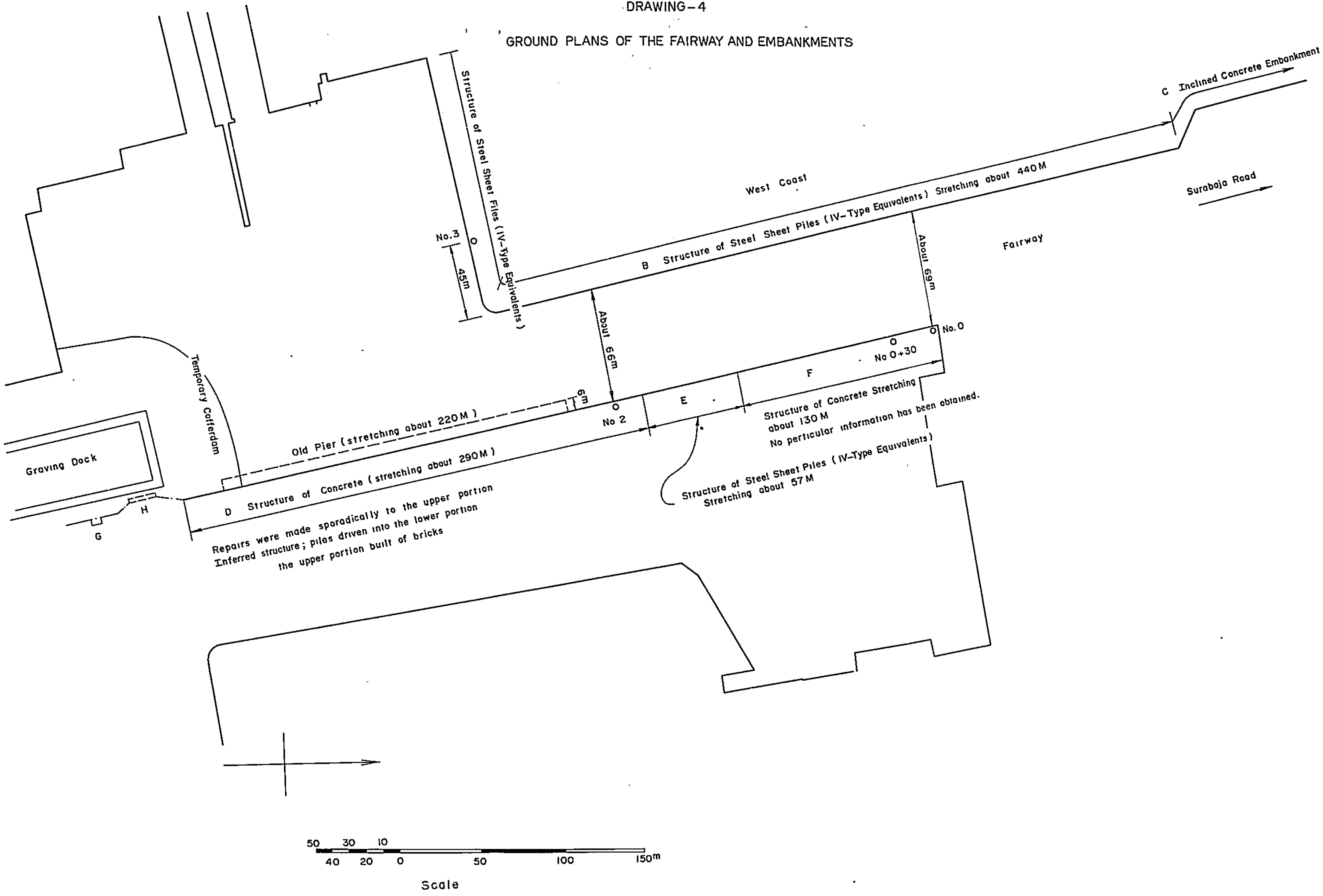
SCALE : DEPTH 1/400 BREADTH 1/500



SCALE : DEPTH 1/400 BREADTH 1/500

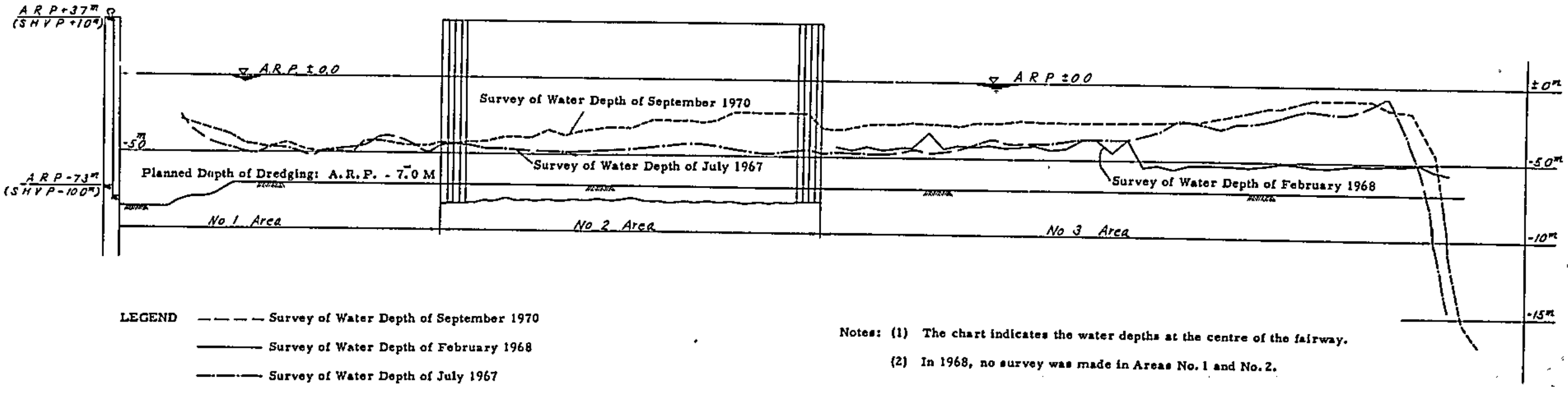
DRAWING-4

GROUND PLANS OF THE FAIRWAY AND EMBANKMENTS



DRAWING-5

ACCUMULATION OF SAND FROM 1967 to 1970,

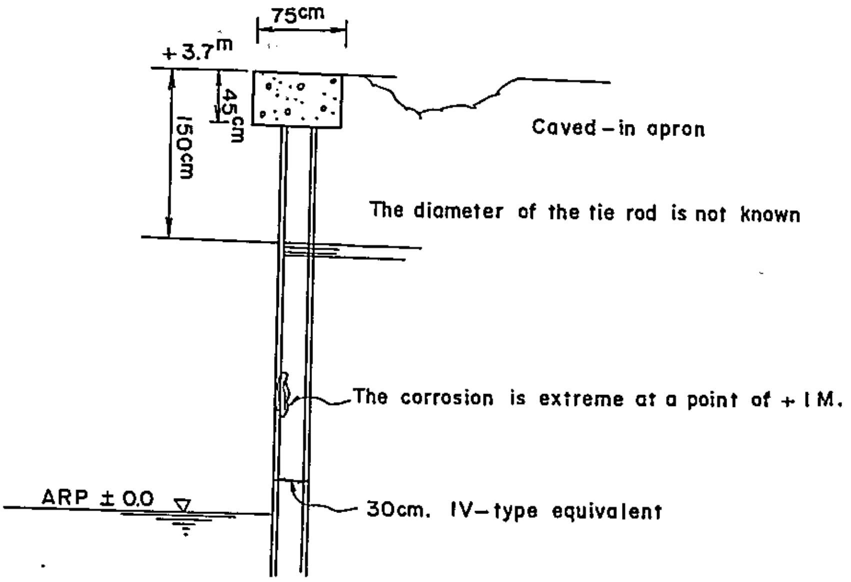


Notes: (1) The chart indicates the water depths at the centre of the fairway.

(2) In 1968, no survey was made in Areas No. 1 and No. 2.

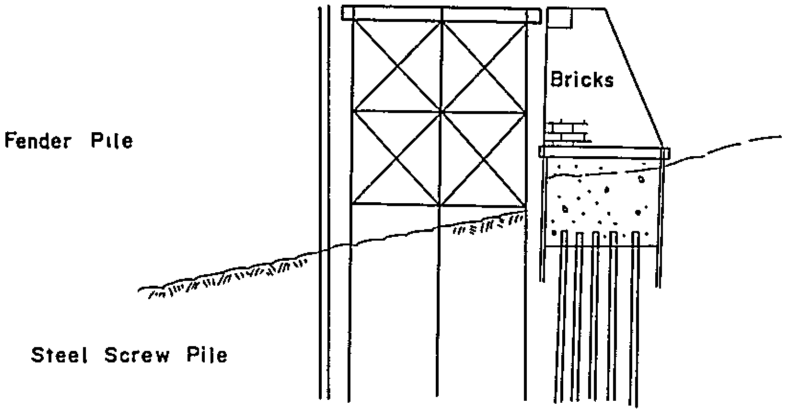
DRAWING- 6

SKETCH OF STEEL SHEET PILING



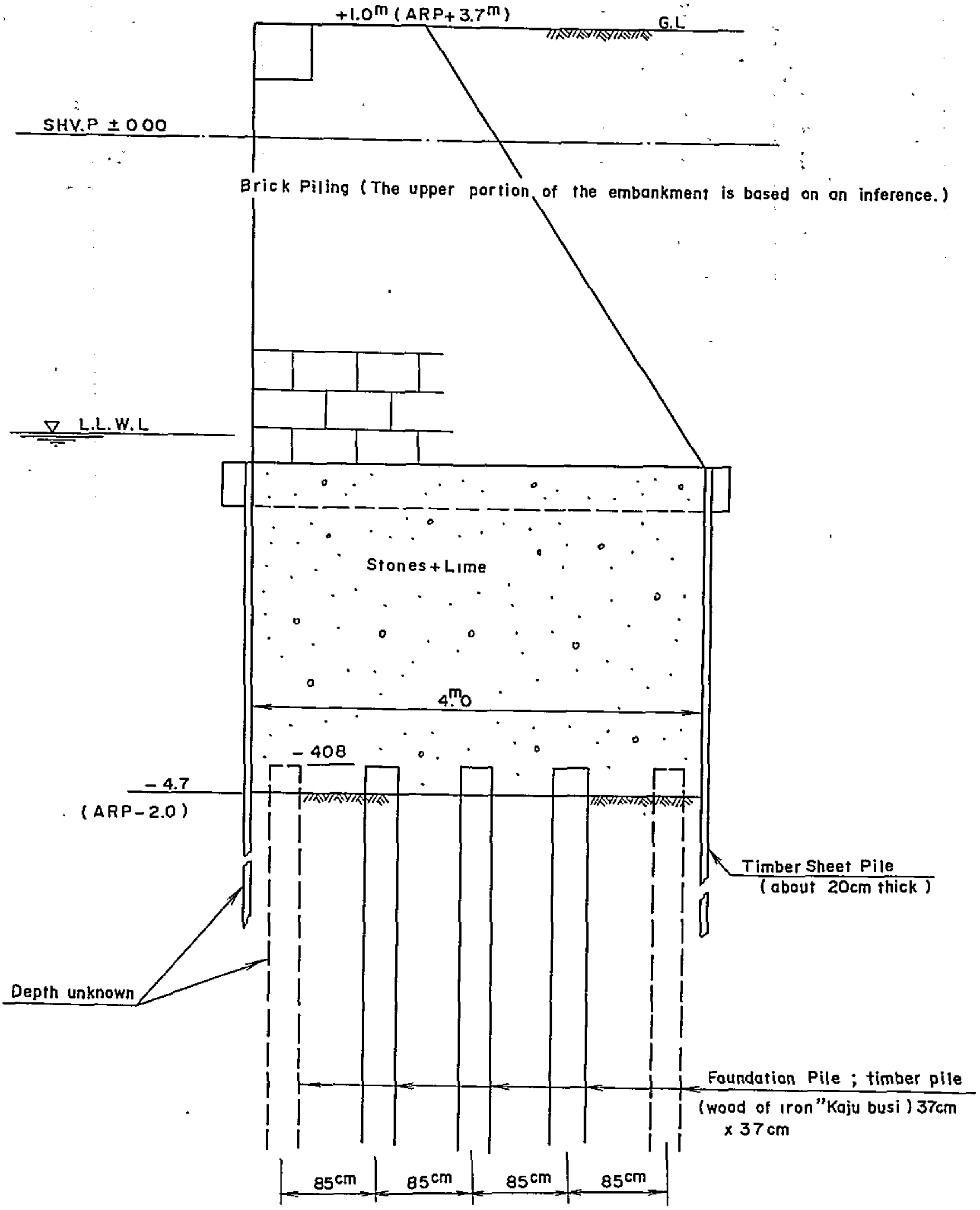
DRAWING - 8

INFERRED STRUCTURE OF THE PIER IN FRONT OF SECTION D



DRAWING - 7

INFERRED STRUCTURE OF REVETMENT



DRAWING-9
SURVEY OF THE DEPTH OF THE APPROACH AND PENETRATION OF STEEL RARS

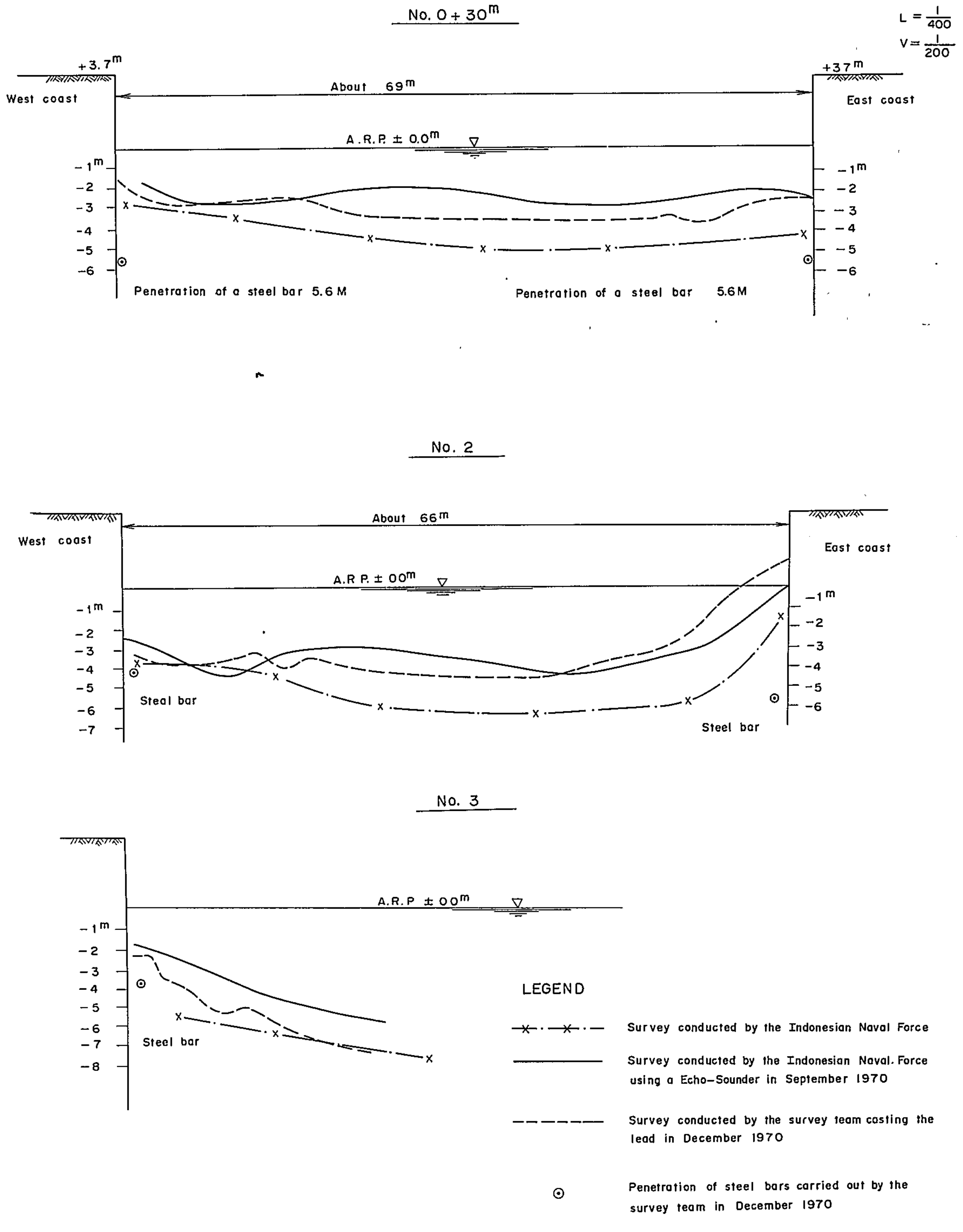
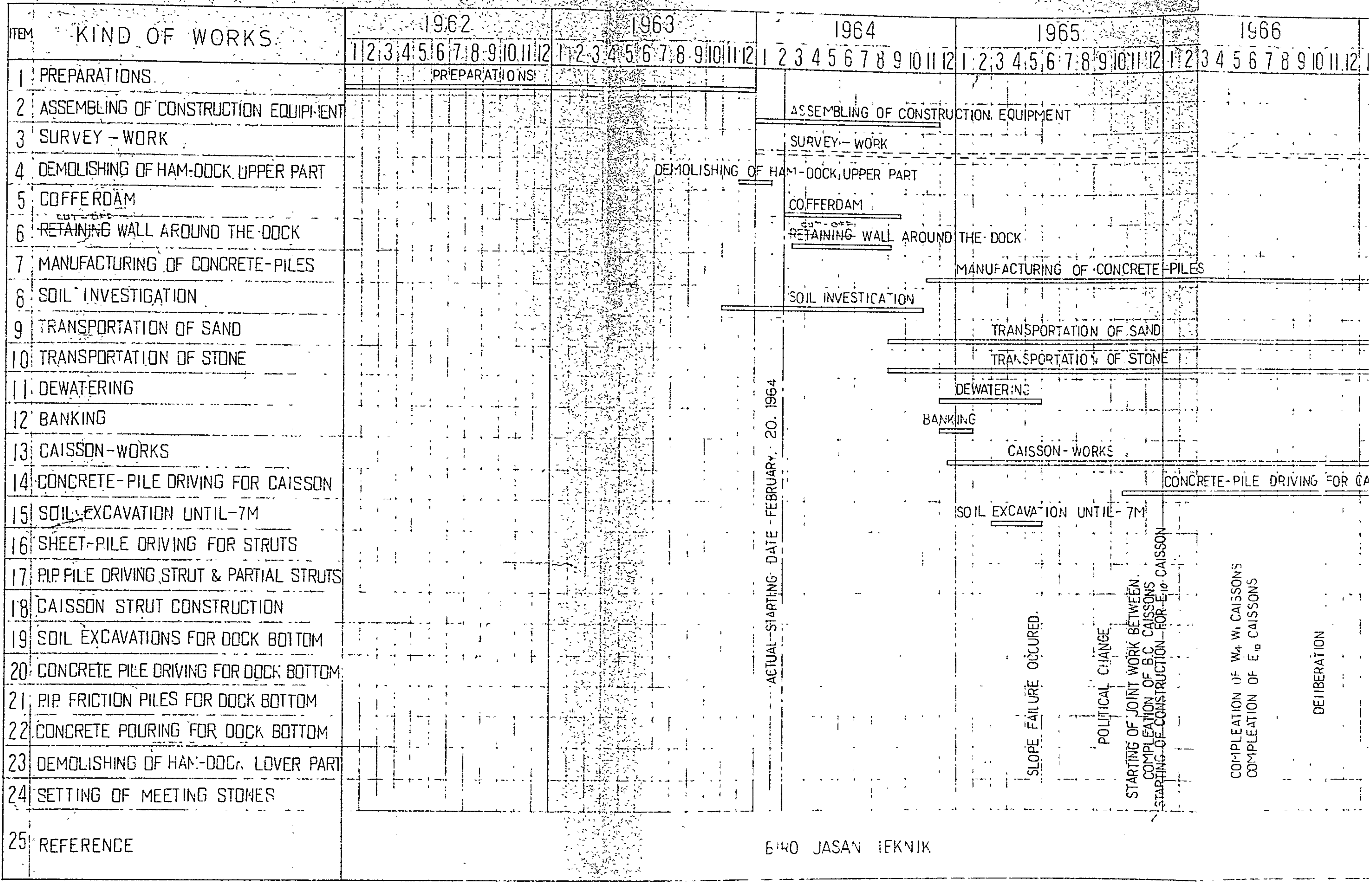


TABLE 1 PROGRESS REPORT OF THE GRAVING DOCK PR



OF THE GRAVING DOCK PROJECT

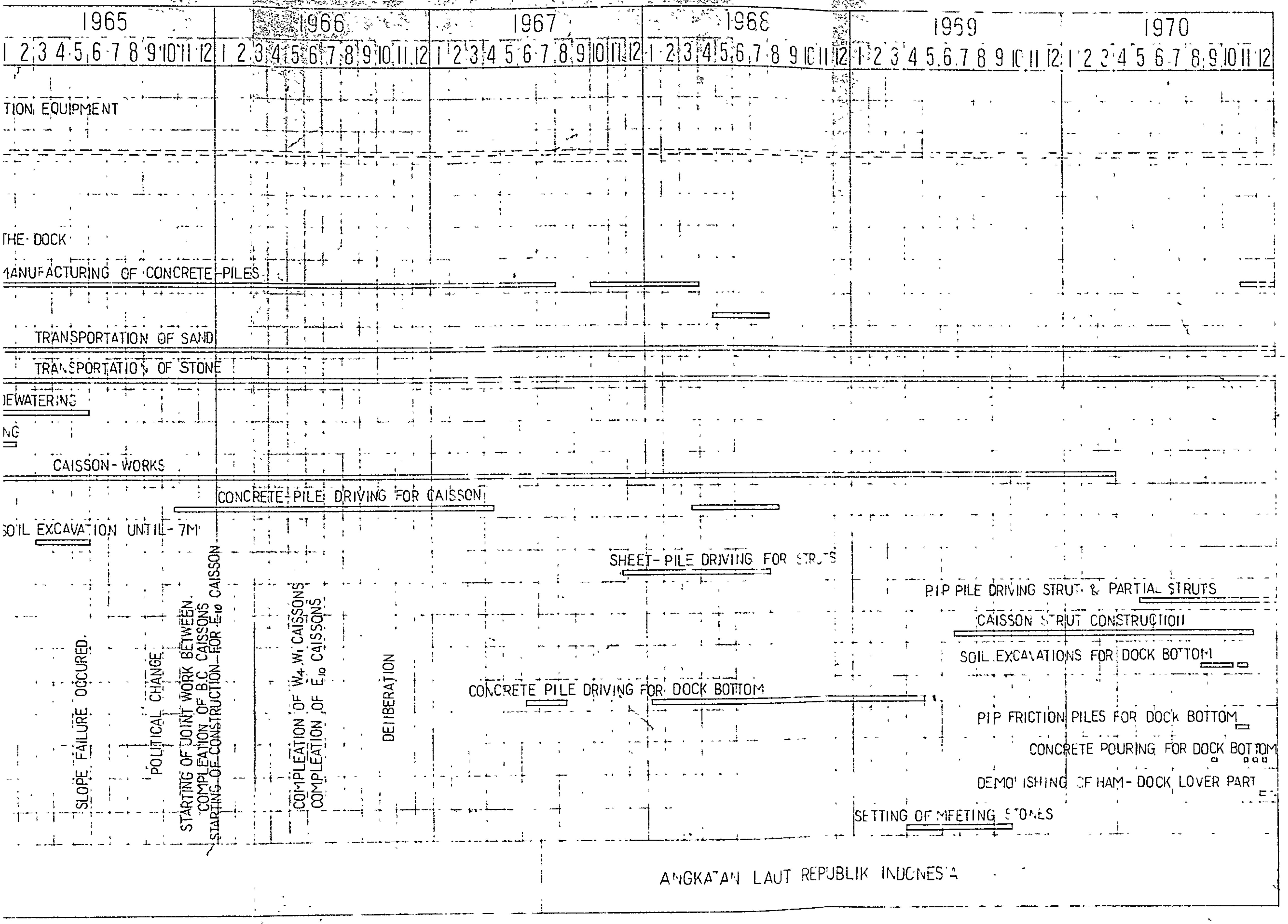
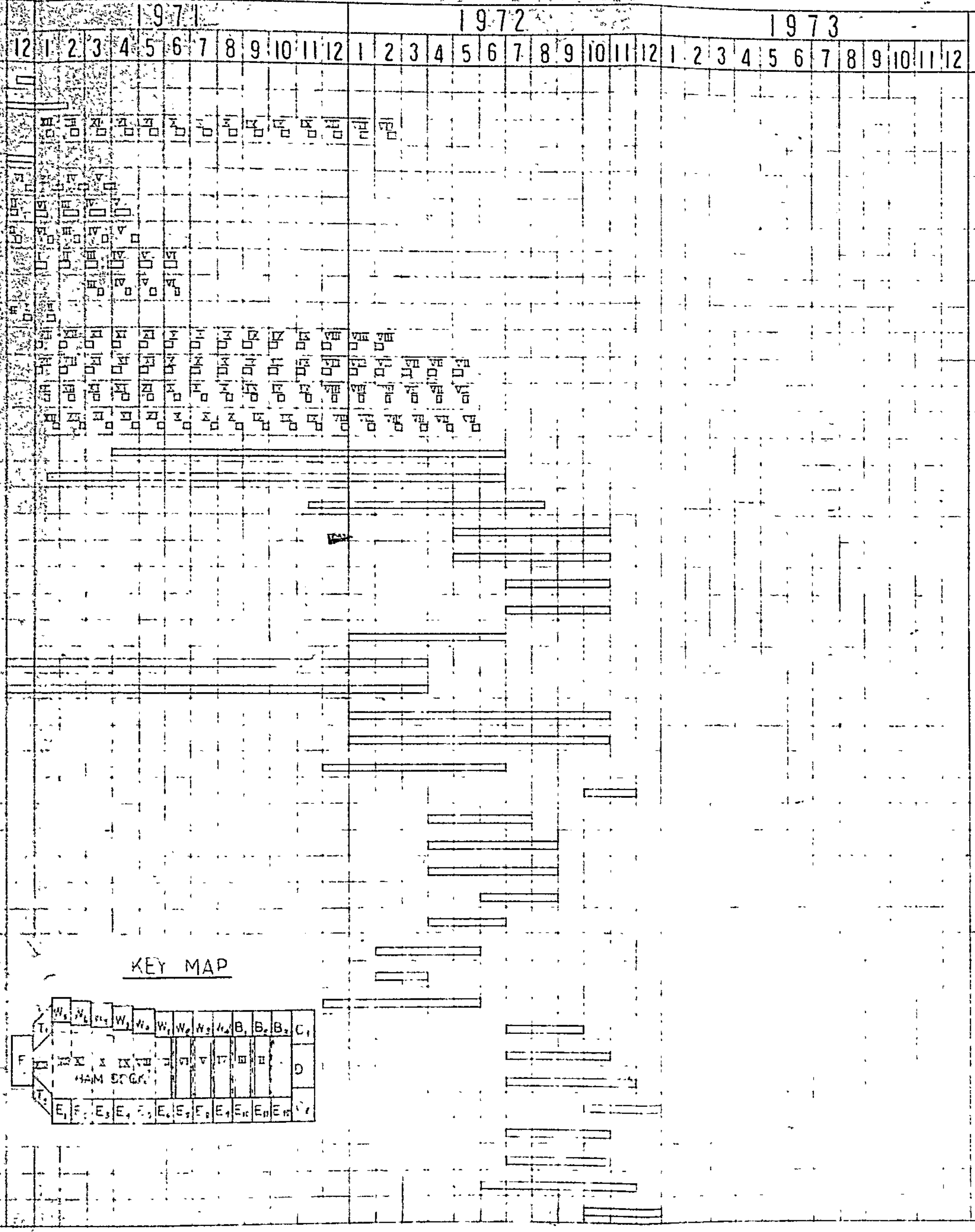


TABLE-2 WORK SCHEDULE OF THE GRAVING DOCK PROJECT

NO	KIND OF WORKS	QUANTITY		REMARKS
1	STRUT CONSTRUCTION EXCAVATION AND CONCRETE FILLING	126	M³/UNIT	
2	MANUFACTURE OF CONCRETE PILE	740	PILES	
3	CONCRETE PILE DRIVING FOR DOCK BOTTOM	1.590	PILES	
4	P.I.P. WORK FOR PARTIAL STRUTS	220	PILES	
5	EXCAVATION UNTILL -10^m	3.680	M³/UNIT	
6	EXCAVATION FOR PARTIAL STRUTS	3.650	M³/UNIT	
7	CONCRETE PLACING FOR PARTIAL STRUTS	1,215	M³/UNIT	
8	EXCAVATION FOR DOCK BOTTOM (PART I - VI)	21,600 ~~1,600~~	M³/UNIT	
9	CONCRETE PLACING FOR DOCK BOTTOM (PART III-VI)	6,200 ~~600~~	M³/UNIT	
10	PREPACKT CONCRETE FOR DOCK BOTTOM (PART I - II)	1,200 ~~600~~	M³/UNIT	
11	DEMOLISHMENT FOR HAM DOCK	9.000	M³/UNIT	
12	EXCAVATION FOR DOCK BOTTOM (PART VII - XII ~~VIII~~)	16.000	M³/UNIT	
13	ANCHOR PILE WORK (P.I.P. METHOD)	252	PILES	
14	FILLING CONCRETE FOR DOCK BOTTOM (PART VII - XII ~~I — XIII~~)	3.100	M³	
15	FINISHED CONCRETE FOR DOCK BOTTOM	1.440	M³	
16	UPPER STRUCTURE ON CAISSON (INCLUDING STAIRS)	21,750 ~~15,750~~	M³	
17	UTILITY DUCT BETWEEN DOCK AND POWER HOUSE	50	M³	
18	CONSTRUCTION OF DOCK MASTER HOUSE			
19	CONSTRUCTION OF POWER HOUSE			
20	ENTRANCE OF DOCK (FOR DOCK MASTER HOUSE)	1	UNIT	
21	ENTRANCE OF DOCK (FOR PUMP ROOM)	1	UNIT	
22	QUAY WALL WORK	170	M	
23	TRANSPORTATION OF STONE	33.000	M³	
24	TRANSPORTATION OF SAND	22.500	M³	
25	PIPING WORK FOR DOCK	1	UNIT	
26	ELECTRIC WIRING WORK FOR DOCK	1	UNIT	
27	SAND FILLING AROUND DOCK	50.000	M³	
28	SETTING OF DOCK GATE	1	SET	
29	INTAKE WORK	1	UNIT	
30	SETTING OF CRANE	2	SET	
31	SETTING OF PUMP (WITH ATTACHMENT)	1	UNIT	
32	SETTING OF PUMP SEA WATEA WATER	1	UNIT	
33	SETTING OF FENDER	1	UNIT	
34	SETTING OF BOLLAROS	24	SET	
35	SETTING OF CAPSTANS	3	SET	
36	SETTING OF BOTTOM RING AND KEEL BLOCK	260	EACH	
37	SETTING OF DRAINAGE PUMP	1	UNIT	
38	PIPING FOR COMPRESSED AIR BETWEEN DOCK AND COMPRESSED P.M.	1	UNIT	
39	DRAINAGE AROUND DOCK	1	UNIT	
40	TEST OPERATION	1	UNIT	
41	REMOVAL OF COFFER - DAM	150	M	
42	OTHER MISCELLANEOUS WORKS	1	UNIT	
43	DREDGING FOR CANAL	2 .000	M³	
44	CLEANING WORKS	70.0	M²	



~~TABLE-6~~

附表-6 [illegible]

TABLE-3 ESTIMATE OF COSTS
FOR THE COMPLETION OF THE GRAVING DOCK PROJECT

NO.	KIND OF WORK	UNIT	QUANTITE	UNIT COST	AMOUNT	REMARKS
1.	Caisson strut work (excavation & pouring concrete).	ea	3	Rp. 1,000,000.-	Rp. 3,000,000.-	
2.	Concrete piles manufacturing.	ea	2,000	" 5,000.-	" 10,000,000.-	
3.	Concrete piles driving.	ea	2,250	" 2,000.-	" 4,500,000.-	
4.	Soil exploration (borings).	ea	12	" 7,500.-	" 90,000.-	
5.	Demolishment of the Ham-dock.	m^3	9,000	" 400.-	" 3,600,000.-	Concrete walls and sand.
6.	PIP work for partial struts.	ea	990	" 4,000.-	" 3,960,000.-	
7.	Excavation of the dock base.	m^3	28,000	" 500.-	" 14,000,000.-	
8.	Assembling of prepakt concrete mining plant.	ea	1	" –	" 10,000,000.-	
9.	Prepakt concrete pouring for dock-bottom.	m^3	11,100	" 3,500.-	" 38,850,000.-	
10.	Concrete filling for dock base.	m^3	3,500	" 10,000.-	" 3,500,000.-	
11.	Finishing concrete for dock-bottom.	m^3	1,440	" 10,000.-	" 14,400,000.-	
12.	Upper structure on caisson.	m^3	15,750	" 10,000.-	" 157,500,000.-	
13.	Cutting of slope.	m^3	9,000	" 300.-	" 2,700,000.-	
14.	Utility duct between dock and power houses	m'	50	" 80,000.-	" 4,000,000.-	
15.	Construction of dock-masters house	ea	1	" 10,800,000.-	" 10,800,000.-	
16.	Construction of power house	ea	1	" 13,500,000.-	" 13,500,000.-	
17.	Entrance of dock (for dock-masters house)	ea	1	" –	" 1,500,000.-	
18.	Entrance of dock(for pump-room)	ea	1	" –	" 1,500,000.-	
19.	Setting of meeting stone	ea	6	" 100,000.-	" 600,000.-	
20.	Quay wall work	m'	50	" 500,000.-	" 25,000,000.-	
21.	Piping work for dock	Unit	1	" –	" 2,500,000.-	
22.	Electric wiring work for dock	Unit	1	" –	" 4,000,000.-	
23.	Sand filling around the dock	m^3	50,000	" 400.-	" 20,000,000.-	
24.	Setting of dock gate	ea	1	" –	" 2,000,000.-	
25.	Intake work	Unit	1	" –	" 2,000,000.-	
26.	Setting of crane	ea	2	" 6,600,000.-	" 13,200,000.-	
27.	Setting of pumps (with attachments)	ea	4	" 1,000,000.-	" 4,000,000.-	
28.	Setting of bollards	ea	24	" 10,000.-	" 240,000.-	
29.	Setting of capstans	ea	3	" 50,000.-	" 150,000.-	
30.	Partial strut work	ea	18	" 600,000.-	" 10,800,000.-	
31.	Bottom-ring-and keelblocks	ea	260	" 45,000.-	" 11,700,000.-	
32.	Removal of cofferdam.	m'	160	" 40,000.-	" 6,400,000.-	
33.	Drainage around the dock	Unit	1	" –	" 1,000,000.-	
34.	Test operation	Unit	1	" –	" 2,500,000.-	
35.	Other miscellanieous work	–	–	" –	" 2,500,000.-	
36.	Dredging.	m^3	200,000	" 60.-	" 12,000,000.-	
37.	Asphalt pavement and cleaving works.	m^2	7,000	" 2,000.-	" 14,000,000.-	

SUB TOTAL (A)	Rp.431,990,000.-
CONTINGENCY 15% x (A)	Rp. 64,798,500.-
OFFICE AND ADMINISTRATION EXPENSES 10% x (A)	Rp. 43,199,000.-
GRAND TOTAL	Rp.539,987,500.-
ROUNDED	Rp.540,000,000.-

(FIVE HUNDRED AND FORTY MILLION RUPIAHS ONLY).

TABLE– 4

LIST OF SHORT QUANTITIES OF PARTS FOR MACHINES FOR USE IN PERMNENT WORKS

(Machines and Equipment for Permanent Works)

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Shortage	Unit Price	Remarks
1	501	CRANE B-36	LADDER FOR SLEWING FRAME	1	1	(US$) 306	
2	503	PUMP					
		CASE 5/36 (1100 SP P)	STEEL TUBE 1-1/4 B x 150		1		
		" 6/36 (")	" "		1		
		" 7/36 (")	" "		1		
		" 8/36 (")	STEEL TUBE 1-1/4 B x 150		1	5	
3	557	WIRE ROPE	3/8" ∅ FOR HAND RAIL	0	120m	275	
4	558	BOLT FOR FITTING OF FENDER	32 ∅ x 720mm, SS41	0	220	834	
5	559	WASHER FOR FITTING FENDER	OUTSIDE 120 ∅ FOR 40mm BOLT	0	8	1	
6	560	NOT FOR FITTING FENDER	40 ∅ SS41	0	8	5	
7	563	SCREEN C TYPE	1,200 x 680 STEEL PLATE PERFORATED	0	2	221	
8	568	I BEAM FOR PIT	125 x 75 x 5.5mm L = 1,500 mm		31	272	
9	569	PIPE (E) AIR LINE (BLACK)	125 ∅ S.G.P. (200m)	170m	30m		
		(F) STEAM LINE (BLACK)	100 ∅ S.G.P. (450m)	0	450m		
		(H) DRAIN LINE (BLACK)	65 ∅ S.G.P. (10m)	0	10m		
		(I) AUXIRIARY DRAIN PUMP (BLACK)	50 ∅ S.G.P. (20m)	0	20m		
		" STEAM LINE (BLACK)	50 ∅ S.G.P. (25m)	0	25m		

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Shortage	Unit Price	Remarks
		(J) STEAM LINE (BLACK)	20 ø S.G.P. (400m)	341m	60m	(US$)	
		(K) SALT WATER LINE (BLACK)	150 ø S.T.P. 35 (30m)	0	30m		
		(L) SALT WATER LINE (BLACK)	100 ø S.T.P. 35 (420m)	400m	20m		
		(M) FRESH WATER LINE (GALVA)	65 ø S.G.P. (30m)	0			
		(N) STEAM LINE (BLACK)	50 ø S.T.P. 35 (30m)	165m	15m		
		" AIR LINE (BLACK)	50 ø S.T.P. 35 (30m)	0	30m	3,529	
10	571	ANGLE VALVE (A) COMPRESSED AIR LINE	BRONZE, SCREWED 50 ø 10kg/cm^2	0	11		
		STEAM LINE	"	0	11		
		(B) FRESH WATER LINE	BRONZE, SCREWED 65 ø 10kg/cm^2	0	17	1,803	
11	573	DRAIN VALVE (FOR MAIN PIPING, FRESH WATER, SALT WATER AND AIR)	50 ø , BRONZE, SCREWED, GATE VALVE, JIS, B2013 5kg/cm^2	0	12	447	
12	574	ELBOW (SCREWED) (A) STEAM DRAIN, PUMP LINE	50 ø - 90° FCM 28 (8)	7	1		
		(B) SALT WATER LINE	65 ø - 90° S.G.P. (8)	5	3		
		FRESH WATER LINE	65 ø - 90° S.G.P. (17)	16	1		
		(C) FRESH WATER LINE	65 ø - 45° (2)	0	2	16	
13	576	TEE (SHORT) (E) STEAM LINE (BLACK)	100 x 100 x 100mm S.G.P. 10kg/cm^2	0	1		
		(F) STEAM LINE (BLACK)	100 x 100 x 50mm S.G.P. 10kg/cm^2	10	1	13	

Number	Reference Number	Name of Part and Assembly	Specifications	Reqired Quantity	Shortage	Unit Price.	Remarks
14	577	TEE (SCREWED)				(US$)	
		(A) STEAM LINE	20 x 20 x 20mm FCM 28 (30)	0	30		
		VERTICAL PUMP COOLING LINE	" (10)	4	6		
		VACUUM PUMP SECTION LINE	" (2)	0	2		
		(B) AUXILIARY PUMP COOLING LINE	25 x 25 x 25 " (5)	3	2	16	
15	579	NIPPLE STEAM LINE (BLACK)	20 ø FCM 28 (85)	79	6	1	
16	580	UNION					
		STEAM LINE (BLACK)	50 ø FCM 28 (11)	0	11		
		AIR LINE (")	" (11)	0	11		
		UNION (SCREWED)	20 ø (4)	2	2		
		"	25 ø (1)	0	1		
		"	65 ø (1)	0	1	60	
17	582	TEE					
		(A) FRESH WATER (BLACK)	100 x 100 x 50mm S.G.P. (4)		4		
		(B) " (GALVA)	" (1)		1		
		(C) AIR & DRAIN	150 x 150 x 50 (2)		2	61	
18	583	UNION STEAM LINE (BLACK)	20 ø FCM 28 (20		20	17	
19	585	FLANGE BOLTS					
		(A) FRESH WATER LINE (GALVA)	16 ø x 55mm SS41 (200)		200		
		AIR LINE (BLACK)	" (200)		200		
		SALT WATER LINE (")	" (120)		120		
		(B) STEAM LINE (BLACK)	16 ø x 55mm SS41 (28)		280		
		FRESH WATER LINE (GALVA)	13 ø x 45mm SS41 (45)		45		
		SALT WATER LINE (BLACK)	" (25)		25		
		DRAIN PUMP (")	" (18)		10		

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Shortage	Unit Price	Remarks
		AIR LINE (BLACK) STEAM LINE (") AUXILIARY PUMP, DRAIN PUMP	13 ø x 45mm SS41 (45) " (45) " (10)		45 45 10	(US$)	
19	585	FLANGE BOLTS FRESH WATER LINE (GALVA) SALT WATER LINE (BLACK) AIR LINE (")	19 ø x 60mm SS41 (10) " (10) " (10)		10 10 10		
20	586	DIVIDE (Y) SOCKET SALT WATER OUTLET	65 ø BC (6)	0	6	211	
21	587	MACHINED COUPLING FRESH WATER OUTLET	65 ø BC (11)		11	118	
22	594	BAND	COPPER WIRE #16	0	1,880m	53	
23	598	CYLINDER GATE FISH PLATE RAIL BOLT, NUT, RING ROLLER	(16) 1/2" ø x 30 (64) (8)	0 32 0	16 32 8	60	
24	600	STEEL FLAME ANGLE (B) AIR WATER OUTLET COVER ELECTRIC SERVICE PIT COVER	L - 60 x 60 x 7mm SS34 "	0 0	6m 120m	113	
25	602	ANGLE (A) AIR DUCT FLANGE AIR DUCT BRACKET (B) VOLUTE PUMP BASE	L - 40 x 40 x 5mm SS34 (145m) " (20m) L - 200 x 80 x 75mm SS34 (10m)		145m 20m 10m	92	
26	606	STEEL PLATE (A) BASE PLATE OF PIPING ROCK	SS34 200 x 200 x 10mm (70)	60	10ea		

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Shortage	Unit Price	Remarks
		BASE PLATE OF PIPING ROCK (B) STEAM MAIN LINE COVER	SS34 150 x 150 x 10 (30) SS34 5,000 x 700 x 12 (1)	29 0	1 1	(US$) 113	
27	608	FLAT BAR (A) PIPE HANGER (B) AIR DUCT BRACKET OF PUMP ROOM	FB 30 x 6mm SS34 (80m) FB 50 x 6mm " (35m)		80m 35m	25	
28	609	BOLT NUT (ANCHOR BOLT) PIPE HANGER (B) 65 FRESH LINE BOLTS & NUT (D) AIR DUCT FLANGE	13ø x 700mm (40) 9 ø x 25mm (750)		40 sets 750	98	
29	613	PRESSURE GAUGE	15ø x 125 0 - 15kg/cm^2 15ø x 125 0 - 10 "	1 0	7 2	32	
30	654	CHANNEL	150 x 75 x 65mm, L = 1,800 mm WITH ANCHOR BOLT 5/8"ø x 200 (2) (2)		2ea	8	
31	655	HOSE VALVE	20ø BRONZE (2)		2ea	5 US$9,035	

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Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Shortage	Unit Price	{Remarks
32	614	CABLE	(A-1) BN 6KV 150^{o}-3C JEC-139	1,600m	500m	(US$)	
			(B-1) " 100^{o}-3C "	40m	100m		
			(C-1) " 50^{o}-3C "	180m	200m		
			(D-1) " 38^{o}-3C "	80m	100m		
			(F-1) BN 3KV 250^{o}-3C "	150m	100m		
			(H) RV 600V 500^{o}-1C JCS-248	2,300m	200m		
			(M) " 80^{o}-3C "	50m	100m		
			(N) " 80^{o}-2C "	170m	100m		
			(O) " 38^{o}-3C "	160m	100m		
			(P) " 38^{o}-2C "	430m	200m		
			(Q) " 22^{o}-3C "	240m	100m		
			(R) " 14^{o}-3C "	200m	100m		
			(T) " 55^{o}-3C "	60m	100m		
			(U) " 55^{o}-2C "	440m	200m		
			(V) " 35^{o}-3C "	200m	100m		
			(W) VVC 600V 8^{o}-2C JIS C3401	60m	100m		
			(X) " 35^{o}-7C "	60m	100m		
			(B-11) " 35^{o}-2C "	200m	200m		
			(C-11) " 20^{o}-8C "	100m	100m		
			(D-11) " 20^{o}-6C "	230m	200m		
			(E-11) " 20^{o}-5C "	400m	200m		
			(F-11) 0.65mm x 100 PVC INSULATED PVC SHEATHED COMMUNICATION CABLE	600m	600m	36,052	
33	615	CONNECTOR	(A) FOR $600mm^2$ T. BRANCH	20	50	2,634	
34	616	600V CABLE PVC INSULATED WIRE	(A) $50mm^2$ JIS C3307	0	700m	1,340	
35	623	CONSENT	(B) WITH PLATE, 2P 10A 250V FLASH TYPE	0	50	42	

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Shortage	Unit Price	Remarks
36	624	TUMBLER SWITCH	(A) 2P 10A 250V WITH PLATE FLASH TYPE	0	35	(US$)	
			(B) WITH PLATE 3 WAYS 10A FLASH TYPE	0	25	73	
37	627	WIRE MESH FOR PROTECTION (DWG E-16)	(B) 900 x 1,500mm	7 sheets	1 sheet		
			(G) 900 x 900mm	10	2		
			(H) 900 x 300mm	6	2	58	
38	632	SEPARATOR	(A) L-50 x 50 x 4mm PL480mm x 4mm	0	40m		
			(B) " PL280mm x 4mm	0	40m		
			(C) " PL180mm x 4mm	0	50m	606	
39	637	COPPER BUSBAR	75 mm x 6mm JES No. 294	200m	60m	995	
40	638	COPPER ROD	(A) 9mm ϕ JIS C3101	65m	50m		
			(B) 6mm ϕ "	55m	40m	157	
41	641	SLEEVE MADE OF CAST IRON PIPE	(A) 22 ϕ x 250mm WITH WATER-PROOF CAP		42 sets		
			(B) 100 ϕ x 250mm WITH WATER-PROOF CAP		12		
			(C) 150 ϕ x 250mm WITH WATER-PROOF		18		
42	536	INTERPHONE	FOR 10 STATION, WITH POWER SUPPLY UNIT FOR SINGLE PHASE, 220V	3 sets	10 sets	3,732	

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Shortage	Unit Price	Remarks
						(US$)	
43	356	PORTABLE VOLTMETER	05 CLASS A.C. 0-500V	0	1 set	50	
44	357	PORTABLE AMMETER	(C) 25 CLASS A.C. 0-200A C.T. TYPE	0	1 set	174	
45	359	PORTABLE MEGGER	(A) 1,000V, YEW TYPE 3213	1	1 set		
			(B) 500V, " "	0	2 sets	279	
46	305	PORTABLE EARTH TESTER	YEW TYPE 3235 0-1,000 OHM DIAL INDICATE TYPE	0	1 set	139	
47	304	PORTABLE CIRCUIT TESTER	FOR A.C.D.C. 0-500V	0	2 sets	145	
48		SAFETY BELT	FOR ELECTICIAN TYPE T-530 FUJI	0	6 sets	105	
49	316	KNIFE	FOR ELECTICIAN 100mm LONG	0	20 sets	44	
50	317	TOOL BAND	FOR ELECTICIAN	0	16 sets	54	
51	76	WIRE	FOR TELEPHONE VFF 12mm x 2	0	1,000m	105	
52	360	DETECTOR	(A) FOR 1,000 11,000V	1	1 set	28	
53	363	PORTABLE ELECTRIC DRILL	(A) 3/4 HP, 220V/380V	1	2 sets		
			(B) 1/2·HP, 220V	1	2		
			(C) 1/4 HP, 220V PISTOL TYPE	0	2	517	

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Shortage	Unit Price	Remarks
54	62	ELECTRIC GRINDER	(A) STATIONERE TYPE E.B.C.-2, 220V/380V	0	2 sets	(US$)	
			(B) PORTABLE TYPE P.G.-180T, 220V/380V	0	4	891	
55	386	BN CABLE TERMINATING MATERIALS	(A) FOR 6KV 3C-150mm^2 CABLE	13 sets	25 sets		
			(B) " 3C-100mm^2 "	5	10		
			(C) " 3C-50mm^2 "	8	10		
			(D) " 3C-38mm^2 "	15	15		
			(E) FOR BN 6KV 3C-14mm^2 CABLE	4	5		
			(F) " BN 3KV 3C-250mm^2 "	8	10	2,239	
		Sub-Total of Electrical Parts for Permanent Works				US$50,648	
		Sub-Total of Mechanical and Electrical Parts for Permanent Works				US$59,683	

TABLE– 5

LIST OF PARTS FOR ADDITIONAL MACHINES FOR USE IN TEMPORARY WORKS

(Machines and Equipment for Temporary Works)

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
1		CRAWLER CRANE 330 (with spare)	ISHIKAWAJIMA KOEHRING TYPE 330	1	(US$) 47,888	One 9-T carwler crane is now in operation
2		FORKLIFT F 33 (with spare)	KOMATSU F 33	1	9,177	Forklifts (1-1.5T) borrowed from the Naval Force are now in operation.
3		BULLDOZER D-60 A-3 (with spare)	KOMATSU D-60 A-3	1	22,031	A 9-T bulldozer and two Soviet-made ones (without spare parts) are now in use.
4		DUMP TRUCK (with spare)	HINO TE-11	10	61,770	Fourty-one dump trucks were acquired at the beginning. Out of 35 on hand only 19 units can be operated.
5		SUBMERGED ELECTRIC PUMP	MODEL U-484 SAKURAGAWA PUMP	4	2,529	Four pumps (0.5 - 1 T/H) are now available.
6		SUBMERGED ELECTRIC PUMP	MODEL U-4104 SAKURAGAWA PUMP	4	3,115	Four pumps (12 T/H) are now available.
7		LATHE (with spare)	Center length: MIN. 1.2m Center height: MIN. 0.275m	1	7,309	
8		PORTABLE AIR COMPRESSOR	MITSUI SEIKI MODEL RA-150			Two compressores are now in operation. But those parts are necessary to obtain their perfect performance.
		A. L.P. Cylinder Parts				
		a. Blade, L.P. rotor	12R - 210A	12		
		b. O-ring, bearing housing to cylinder	10R - 113	10		
		c. Roller bearing	10R - 204	5		
		d. Blade, H.P. rotor	12R - 211	12		
		e. Roller bearing	10R - 232	5		

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantiy	Unit Price	Remarks
		B. Oil Pump Parts			(US$)	
		a. Drive gear, main oil pump	10R - 303	2		
		b. Drive gear, main oil pump	10R - 304	2		
		c. Bearing B, main oil pump driven gear	10R - 306	5		
		d. Driven gear, scavenging oil pump	1R - 306	3		
		e. Driven gear, scavenging oil pump	1R - 307	3		
		f. Bearing B, main oil pump driven gear	1R - 311	5		
		g. Bearing A, main oil pump driven gear	10R - 305	5		
		h. O-ring, scavenging oil pump to main oil pump	10R - 114	10		
		i. O-ring, scavenging oil pump cover	10R - 113	10		
		j. Spring, main oil pump relief valve	1R - 316	5		
		C. Speed Regulator Parts				
		a. Spring, speed regulator valve	1R - 453	5		
		b. Spring, speed regulator needle valve	1R - 452	5		
		c. Needle valve, speed regulator	1R - 446	5		
		d. Needle valve seat speed regulator	1R - M443	5		
		e. Diaphragm, speed regulator valve	1R - 455	10		
		f. Diaphragm, speed regulator lever	1R - 454	10		
		g. Spring, speed regulator lever	1R - 442	5		

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
		D. Reducing Valve Parts			(US$)	
		a. Diaphragm, reducing valve	1R - 469	10		
		b. Spring A, reducing valve	1R - 476	5		
		c. Spring B, reducing valve	1R - 477	5		
		d. Valve, reducing valve	1 - 471, 472	6		
		E. Volumetric Regulator Parts				
		a. Diaphragm, Vol. Reg.	10R - 415	10		
		F. Check Valve Parts				
		a. Gasket, check valve elbow	10R - 503	10		
		b. Gasket, check valve body	10R - 506	10		
		c. Check valve	10R - M509, M510	6		
		d. Spring, check valve	10R - 511	5		
		e. O-ring, discharge pipe	10R - 614	10		
		G. Hand Pump Parts				
		a. Piston ass'y	40R - 863	3		
		b. O-ring, hand pump	40R - 867	10		
		c. Spring	40R - 871	5		
		H. Safety Valve Ass'y	10R - 0605	4		
		I. Oil Filter Parts				
		a. Filter plate, oil filter	20R - 741 - 1	400		
		b. Spacer plate, oil filter	20R - 741 - 2	400		
		c. Scraper plate oil filter	20R - 741 - 3	400	3,858	

Number	Reference. Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
9		PILE DRIVER ON LAND	HAMMER K-13 KOBE DRIVING TOWER KS-2357		(US$)	Two pile drivers are now in operation. One is for exclusive use in PIP works. The spare parts are required for both.
		a. Grease nipple	1117 000 000	20		
		b. Guide ring hammer (Bronze)	1205 000 000	12		
		c. Traction roller chain	Type P 1-1/2" x ø 7/8" 186 links/set	6sets	1,295	
10		EXCAVATOR	MODEL 205 - 2B ISHIKAWAJIMA KOEHRING			Four excavators are now available, all requiring thse spare parts.
		A. Cramler Parts				
		a. Bushing, drive tumbler shaft	200A 1495	12		
		b. ditto	200A 1494A	12		
		c. Thrust plate	247A 736	24		
		d. Snap ring	299A 311A	24		
		e. A lemite fitting	1610B	100		
		f. A lemite fitting	1613	60		
		g. Drive chain	RO 1613 AK	4sets		
		h. Oil seal	10100 L.P.D.	12		
		i. Thrust washer	247A 575	20		
		B. Traction Brake Parts				
		a. Brake lining (L;274)	274B 4598	6		
		b. Brake lining (L;239,5)	247B 4599	6		
		c. Rivet (Brass)	299B 3184-1	200		
		C. Lower Steering Linkage				
		a. Air chamber diaphragm	ME 13214	50		
		b. Oilite bushing (L;12,7)	A 618 - 1	8		
		c. Oilite bushing (L;25,4)	A 1204 - 7	8		
		D. Hook & Turn Table Roller				
		a. Turn table roller	234 UA 10A	8		

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
					(US$)	
		b. Bushing	247A 337A	12		
		c. Thrust washer	201A 545	16		
		d. Bushing	234A 1570	12		
		E. Swing & Traction Clutch				
		a. Lining	247D 1731	4		
		b. Tubular, rivet	299B 3184-5	200		
		c. Extension spring	200A 990	12		
		d. Extension spring	201A 1016	4		
		F. Boom Hoist & Retact Clutch				
		a. Compensator spring	247A 1638A	4		
		G. Boom Hoist Drum Shaft				
		a. Tension spring	200A 831	8		
		b. Lever	247A 210	4		
		c. Link	247A 206	4		
		d. Link	247A 207	4		
		e. Link Pin	247A 208	20		
		f. Lever	247A 831	4		
		g. Oilite bearing	A2203-6	4		
		h. Nipple tee	1/8" x 64	4		
		i. E elbow	1/8" x 45	4		
		j. Wing pin	247UA 825	8		
		k. Clutch lining	247D 216	4		
		l. Rivet (Brass)	299B 3184-9	30		
		H. Main Drum Shaft Parts				
		a. Spring	247A 741	4		
		b. Lining (564 L)	247D 2813-1	4		
		c. Lining (726 L)	247D 2813-2	4		
		d. Rivet	299B 3184-5	100		
		I. Engine Parts	NISSAN UD-3			
		a. Pump ass'y feed	4U-311-1400	4		
		b. Fuel hose	4U-321-258	8		

Number	Reference Number	Name of Part and Assembly	Specifications	Repuired Quantity	Unit Price	Remarks
					(US$)	
		c. Fuel hose	4U-402-258	8		
		d. Fuel hose over flow	4U-412-259	20		
		e. Bushing, oil seal		20		
		f. Ring seal and plate	7U401-20	20		
		g. Cylinder liner	IU401-41	12		
		h. Gasket cylinder liner upper	IU401-48	24		
		J. Air Compressor Parts				
		a. Cylinder liner	9U-401-406	4		
		b. Cylinder gasket	9U-401-407	20		
		c. Flexible pipe with coupling	10U-404-76	4		
		d. Ditto	10U-404-77	4		
		e. Spring holder outlet valve	9U-401-423	6		
		f. Holder outlet valve	9U-401-422	4		
		g. Valve flat	9U-401-424	4		
		h. Seat valve outlet	9U-401-425	4		
		i. Holder, inlet valve	9U-401-437	4		
		j. Spring, inlet valve	9U-401-439	6		
		k. Stud B holder valve	9U-401-440	4		
		l. Spring, release valve	9U-401-432	6		
		m. Unloader	9U-401-435	4		
		n. Cylinder head	9U-402-421	4		
		o. Holder, release valve	9U-401-431	4		
		p. Connector pipe, inlet valve	9U-401-426	12		
		q. Gasket, valve seat	9U-401-426	12		
		r. Piston	9U-481-411	4		
		s. Piston ring	9U-401-420	4		
		t. Oil ring	9U-401-413	4		
		u. Piston pin	9U-401-415	4		
		v. Clip piston pin	9U-401-416	4		
		w. Connecting rod	9U-401-417	4		
		x. Bushing, connecting rod	9U-401-418	4		

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
					(US$)	
		y. Shim, connecting rod	9U-401-409-1	8		
		z. Ditto	9U-401-409-2	8		
		Ditto	9U-401-409-3	8		
		K. Injection Pump Parts				
		a. Check valve spring	4U-401-867	4		
		b. Nylon packing	4U-401-672	12		
		c. Nozzle ass'y	4U-411-4000	12		
		d. Priming pump	4U-301-870	4		
		L. Engine Clutch Lever Parts				
		a. Extension spring	4230A 186A	4		
		b. Band and pin	200A 1223A	4		
		c. Brake band retainer	299A 690	4		
		d. Lining	247B 0299-1	4		
		e. Ditto	247B 0299-2	4		
		f. Ditto	247B 0299-3	4		
		g. Ditto	247D 259A-1	4		
		h. Ditto	247D 259A-2	4		
		i. Spring	200A 947	8		
		j. End rod	247A 364	4		
		k. Guide pin	247A 365A	4		
		l. Spring	200A 799	4		
		M. Swing Brake Parts				
		a. Lining	247B 135A	4		
		b. Spring	4206A 668	4		
		N. Regulator Ass'y	9U-104-4400	1set		
		O. Rubber Ring	IU-411-85	50		
		P. Ditto	IU-411-86	30		
		Q. Clamshell Bucket Parts				
		a. Closing sheave (12 UD)	B-12561-13	5		
		b. Needle bearing	B-2420 7275	12		

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantiy	Unit Price	Remarks
					(US$)	
		c. Grease seal	299A 528	12		
		d. Tooth bolt & nut (long)	IK-C-12596-1 (2)	48		
		e. Ditto (short)	IK-C-12596-1 (1)	24		
		f. Guide roller	C-10298-10-23	4		
		g. Guide roller shaft	C-10298-10-22	4		
		h. Bushing (Bronze)	A-12515-24	4		
		R. Standard & Special Tools		2sets	27,427	
11		BULLDOZER	KOMATSU D-50-11			One bulldozer is now in operation. The spare parts listed are for this machine.
		A. Injection Pump Parts				
		a. Pump housing complete	90110 005-0	2sets		
		B. Dozer Parts				
		a. O-ring	620-S0-5150	9		
		b. Seal	D-50 T117	9		
		c. Packing	D-50 T103 B	12		
		C. Main Clutch Parts				
		a. Plate	D-50 S FE 101	6		
		b. Plate	D-50 S FE 116	12		
		c. U-belt	4D 120A-1242	10	2,847	
12		PNEUMATIC CONCERT BRAKER (with spare)	Type C B-30	6sets	1,332	Ten concrete brakes were acqured at the beginning. At present four units including ones being reparied are available for the works.
13		PNEUMATIC COOL PICK (with spare)	Type C A-7A	10sets		Five picks were acquired at the beginning. At present twenty-three units including ones being repaired are available for the works.
		a. Pick steel		30	1,145	
14		CONCRETE VIBRATOR	YF-A-6 3/4 HP 380/220			Ten vibrators are now available. The flexible tube gets easily damaged.
		a. Tube & shaft ass'y vibrator	34mm x 13mm x 6m ø 60mm x 495mm	25pcs	4,831	

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
15		SOIL HOPPER			(US$)	
		a. Magnet contacter	for 1.5KW Motor 30A-3P	5		
		b. Limit switch		4	51	
16		BELT CONVEYOR	SANKI S-CON			
		a. Motor (350mm belt)	1KW 380V 50C	10	366	
17		HORIZONTAL AIR COMPRESSOR	MIKUNI KIKAI Type FH-4 SUP 4			Eight compressors are now available, requiring those listed parts.
		A.				
		a. Valve spring		60		
		b. Valve cover, gasket packing asbestos cup (small)		100		
		c. Valve seat, gasket packing asbestos cup (large)		100		
		B.	Type FH4-2 SUP 4			
		a. Valve spring		60		
		b. Valve cover, gasket packing asbestos cup (small)		100		
		C. Controller (75KW) Parts				
		a. Solenoide	Type AS 50210 M/110V 50/60 C/S MATSUSHITA	4sets		
		D. Magnet Contactor	200A	1	772	
18.		COOLING PLANT (HITACHI)	Type PV V-4			The listed parts are for one unit.
		a. Piston ring, compressor		4sets		
		b. Automatic expansion valve		4sets		

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
					(US$)	
		c. V-belt B-84		12		
		d. Magnet contactor	7KW 3 Pole Type SK 6	2		
		e. Magnet contactor	1.5KW 3 Pole Type SK	3		
		f. Automatic heat regulator	30 form DP 2	3	232	
19		CRUSHING PLANT	KURIMOTO TEKKO			
		a. V-belt	D-260	20		
		b. V-belt	B-96	12		
		c. Support spring (Ripple flow screen)	For Brake Jaw Crusher	12	676	
20		BATCHER PLANT	ISHIKAWAJIMA KOEHRING			
		a. Taper roller bearing	30207	4		
		b. "OU" packer 1/2"	IK-A-10219-9-11	30		
		c. "OU" packer 1/4"	IK-A-10219-8-15	72		
		d. Cup packer 1/2"	IK-A-10219-8-11	12		
		e. Cup packing 1/4"	IK-A-10219-9-11	12		
		f. Air hose ø 1/4"		40m		
		g. Angular contact ball bearing	NSK 7208A	4		
		h. Air vibrator	IK-I-18081-12	2		
		i. Cup leather	A-2935-K	4		
		j. Beam box		2		
		k. Micro switch (YAMATAKE HONEYWELL)	15A-125/250V AC BZI-MZ RM	5		
		l. Micro switch (YAMATAKE HONEYWELL)	15A-125/250V AC BZE-6-2RN	7		
		m. Micro switch (Black little)				
		n. Mercuty switch		12		
		o. HHH Conveyor oval	IK-B-12517-58	1,200		
		p. Ditto	IK-B-12517-59	300		
		q. Tange washer	IK-A-12567-21-J	700		
		r. Ditto	IK-A-12567-21-H	200	5,141	

Number	Reference, Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
					(US$)	
21		CHAIN BLOCK				
		A. Standard Lift: 3m	Type 3 stage, cap 2 ton	5		
		B. Ditto	Cap 3 ton	5	1,026	
22		GREASE PUMP (High Pressure)	ø 40mm x 200mm	5	40	
23		TAP (with holder)	5/32" to 5/8"	4sets	50	
24		DIES (with handle)	1/4" to 5/8"	4sets	100	
25		CENTRIFUGAL PUMP (with spare parts)	ø 2-1/2"	4sets		
		Ditto	ø 4"	4sets	8,251	
26		STOP VALVE	For water			
		a.	ø 2"	10		
		b.	ø 3"	10		
		c.	ø 4"	5		
		d.	ø 6"	5		
		e.	ø 8"	2	1,470	
27		SLUICE VALVE	For air			
		a.	ø 2"	10		
		b.	ø 3"	10		
		c.	ø 6"	5	2,958	
28		WIRE ROSE				CRAWLER CRANE, DERRICK CRANE, BACKET TOWER and other purpose of use.
		a.	ø 1" 37 x 6	500m		
		b.	ø 3/4" 37 x 6	1,000m		
		c.	ø 5/8" 37 x 6	1,500m		
		d.	ø 1/2" 37 x 6	1,000m		
		e.	ø 3/8" 37 x 6	1,000m	3,823	

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
29		ELECTRODE			(US$)	
		a.	∅ 3.2mm	1,000kg		
		b.	∅ 4mm	1,500kg	689	
30		DUMP & CARGO TRUCK	HINO			1. Nineteen dump trucks are now available for the works. 2. Seven cargo trucks are now available for the works. 3. The three-year accessory parts suppljed with the new trucks have been used up.
		a. Nozzle	6011441100	150		
		b. Plunger, injection pump	6053121450	150		
		c. Oil seal hydrolis	TC2858411895	20		
		d. Brush carbon dynamo	NA40-30622	80		
		e. Brush carbon starter	NA40-31355	80		
		f. Bearing, thrust clutch release sleeve	TE10-3013	15		
		g. Bearing, thrust king pin	TE10-6610	15		
		h. Bearing taper roller front wheel hub inner	TE10-6620	15		
		i. Bearing taper roller wheel hub outer	TE10-6619	15		
		j. Bearing taper roller rear wheel hub inner	AEQ 32216	15		
		k. Bearing taper roller rear wheel hub outer	AEQ 32215	15		
		l. Bearing set main crankshaft inner intermediate (STD)	165-10620	80		
		m. Ditto	US 0.25	100		
		n. Bearing set main crankshaft front & rear (STD)	165-10615	60		
		o. Ditto	US 0.25	60		
		p. Bearing set main crankshaft center (STD)	165-10610	40		
		q. Ditto	US 0.25	40		
		r. Bearing, connecting rod (STD)	DS-30 1915A	100		

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
					(US$)	
		s. Ditto	US 0.25	100		
		t. Rubber hose (cylinder head to radiator)	2874-163301	30		
		u. Rubber hose (radiator to crank case)	2391223700	30		
		v. Piston ring	NA-40-40122	25sets		
		w. Piston ring, air compressor	6033401930	25sets		
		x. Ring, oil controle	NA-40-40123	20sets		
		y. Diaphragm rear brake chamber (dump truck)	NA-40-41767	100		
		z. Diaphragm rear brake chamber (cargo truck)	NA-40-41827	100		
		A. Valve air brake ass'y	NA-40-4317	15		
		B. Nut locking rear wheel left inner	TH-12-6826-C	200		
		C. Nut locking rear wheel left outer	TH-12-6830-A	200		
		D. Nut locking rear wheel right inner	TH-12-6827-C	200		
		E. Nut locking rear wheel right outer	TE-12-6829-A	200		
		F. Bearing, water pump	6204	25		
		G. Relay dynamo	NA-32401 24V 350W	20		
		H. Dynamo (generator)	60313802	15		
		I. Lens head light	NA-40-55096	40		
		J. Plate disclutch driven ass'y	TH-14-30K-021	15		
		K. Spider front universal joint	TH-12-3401-C	60		
		L. Cage universal joint spider	TH-15-34K-0501	150		
		M. Seal water ass'y	3305160602	30		

Number	Reference. Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
					(US$)	
		N. Bearing roller spiral bevel pinion	NU-406	20		
		O. Ring set piston (STD)	DS-50-12K-0001	25sets		
		P. Compressor air ass'y	6031333000	10		
		Q. Pump water ass'y	3303160-203	10		
		R. Plate disk clutch driven ass'y	TE-10-30K-0201	15		
		S. Facing, clutch driven plate	TH-13-3010	60		
		T. Rivet clutch driven plate facing	HRB-0410-H	300		
		U. Packing nozzle (Bronze)	DS-70-DC21-1020	100		
		V. Air hose for brake		25	17,506	
31		GROUT PUMP (FG)	SHIMIZU CONSTRUCTION (SANWA KIZAI)			Although this grout pump was originally intended for use in the preparation of prepack concrete, it is now used in PIP works too.
		A. Motor pressure gauge	0 - 25kg/cm^2 OKAKURA	15ea		
		B. Gland packing	Drawing No. 2001 No. 55	30		
		C. Packing for liner holder	" No. 48	80		
		D. Piston liner	" No. 46	30		
		E. Valve seat	" No. 44	70		
		F. Wing valve	" No. 43	170		
		G. Insert	" No. 42	200		
		H. Compressive spring	" No. 39	50		
		I. Piston rod	" No. 37	15		
		J. Gland packing	" No. 26	30		
		K. Piston	"	200	8,949	
32		METAL FORM		94T	47,000	
		Machines for Temporary Works sub-Total			US$295,654	

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
					(US$)	
32		SUB STATION				
		A. MAGNET CONTACTOR	75KW/200A	3sets	1,265	
		B. SIGNAL LAMP	5W/220V	200ea	84	
		C. CHANGE OVER OIL SWITCH WITH	A.C. MAGNET DRIVE 6.9KV/300A/3P	1set	1,211	
33		SWITCH BOX (WITH FUSE) KNIFE SWITCH, OUTSIDE OPERATER	a. 200 A – 3P	10sets		
			b. 100 A – 3P	10		
			c. 80 A – 3P	10		
			d. 60 A – 3P	10		
			e. 30 A – 3P	10		
			f. 60 A.– 2P	6		
			g. 30 A – 2P	6	1,201	
34		LOW TENSION CABLE (600V)	A. CABTYRE CABLE			
			a. 3C x 100^{o}	500m		
			b. 3C x 60^{o}	500m		
			c. 3C x 50^{o}	1,500m		
			d. 3C x 38^{o}	1,000m		
			e. 3C x 22^{o}	1,000m		
			f. 3C x 14^{o}	1,000m		
			g. 3C x 5.5^{o}	1,000m		
			h. 3C x 35^{o}	1,500m		
			B. P.V.C. CABLE			
			a. 1C – 100^{o}	500m		
			b. 1C – 80^{o}	500m		
			c. 1C – 50^{o}	1,500m		
			d. 1C – 38^{o}	1,000m		
			e. 1C – 14^{o}	1,000m		
			f. 1C – 8^{o}	1,000m		
			g. 1C – 5.5^{o}	1,000m		
			h. 1C – 35^{o}	1,500m	47,236	

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
35		SAFETY SWITCH (WITH NILFUSE)	a. NE 3P - 200 A b. " 3P - 100 A c. " 3P - 60 A d. " 3P - 30 A e. " 3P - 15 A	4sets 5 " 10 " 10 " 10 "	(US$)	
36		ENCLOSED FUSE	a. 200 A b. 100 A c. 60 A d. 30 A	30ea 30 " 50 " 70 "	608	
37		FOR P.I.P. EG	MOTOR 30KW/220V WITH SWITCH BOX CUBICLE AND FEEDER CABTYRE CABLE 3P - 60° 100m	1set	6,600	
38		TRANSFORMER	50KVA PRIMERY 380V/220V SECONDARY 220V/110V 3 PHASS 4 WIYE	1set	880	
39		RESISTOR	75KW/3P (FOR 75KW MOTOR) 55KW/3P (FOR 75KW MOTOR) 30KW/3P (FOR 30KW MOTOR) 20KW/3P (FOR 20KW MOTOR)	1ea 2ea 3ea 3ea	654 1,308 892 892	
40		MERCURY LAMP	200W 220V BODY AND BALLAST FOR MERCURY LAMP TYPE BALLAST HZ-CA	25ea 25ea	2,081	

Number	Reference Number	Name of Part and Assembly	Specifications	Required Quantity	Unit Price	Remarks
		Electric for Temporary Works sub–Total			(US$) US$64,963	
		Machines and Equipment and Electric for Temporary Works|Total			US$360,617	
		Machines and Equipment and Electric for Permanent and Temporary Works Grand Total			US$420,300	

TABLE-6 BREAK DOWN CALCULATION OF SHORTAGE CEMENT VOLUME

	ITEM	BASE FIGURE	UNIT	CEMENT VOLUME
1	PIP Work for caisson strut			
	Quantity	360	ea	594 ton
	Mortar volume	2.36	m3/ea	
	Proportion	700	kg/m3	
	Cement volume	1.65	t/ea	
2	Manufacture of concrete pile			
	Quantity	1.656	ea	507 ton
	Concrete volume	0.85	m3/ea	
	Proportion	360	kg/m3	
	Cement volume	306	kg/ea	
3	Partial strut			
	Quantity	18	place	522 ton
	Concrete volume	90	m3/place	
	Proportion	320	kg/m3	
	Cement volume	29	ton/place	
4	Caisson strut			
	Quantity	3	place	120 ton
	Concrete volume	126	m3/place	
	Proportion	320	kg/m3	
	Cement volume	40	ton/place	
5	PIP Work for partial strut			
	Quantity	620	ea	1,025 ton
	Concrete volume	2.36	m3/ea	
	Proportion	700	kg/m3	
	Cement volume	1.65	ton/ea	
6	Concrete Placing for Dock Bottom			
	Quantity	4	place	68 ton
	Concrete volume	600	m3/place	
	Proportion	320	kg/m3	
	Cement volume	192	ton/place	
7	Prepackt concrete for Dock Bottom			
	Quantity	2	place	384 ton
	Concrete volume	600	m3/place	
	Proportion	320	kg/m3	
	Cement volume	192	ton/place	
8	Anchor Pile (PIP Method)			
	Quantity	252	ea	670 ton
	Mortar volume	3.80	k3/ea	
	Proportion	700	kg/m3	
	Cement volume	2.66	ton/ea	

9	Filling Concrete for Dock Botton			
	Quantity	13,400	m3	4,288 ton
	Proportion	320	kg/m3	
10	Finished Concrete			
	Quantity	1,440	m3	461 ton
	Proportion	320	kg/m3	
11	Upper structure			
	Quantity	15,750	m3	5,040 ton
	Proportion	320	kg/m3	
12	Utility Duct			
	Quantity	50	m3	16 ton
	Proportion	320	kg/m3	
13	Dock master house			
	Quantity	156	m3	50 ton
	Proportion	320	kg/m3	
14	Power house			
	Quantity	125	m3	
	Proportion	320	kg/m3	
15	Quay wall			
	Quantity	1,100	m3	300 ton
	Proportion	320	kg/m3	
16	Miscellaneous			
	Quantity	3,000	m3	960 ton
	Proportion	320	kg/m3	
17		Total		15,893 ton

Percentage against total above volume 10%	1,589 ton
Grand total	17,482 ton
Stock volume (July - 1970)	3,000 ton
Shortage volume	14,482 ton
Rounded	14,500 ton

TABLE-7

VOLUME OF REINFORCEMENT SHORTAGE

July 28, 1970

		Reinforcement									
		ø32	ø28	ø25	ø22	ø19	ø16	ø13	ø 9	Total ton	Average /kg.m3
1	PIP. Work	ton	ton	ton	ton	ton 104	ton 140	ton	ton 31	(275)	(83)*
2	Dock bottom I - VI (Prepakt concrete)										
3	Dock bottom VII - XIII (Reinforced concrete)						177		22	(199)	(52)*
4	Dock bottom (Adjustment concrete)										
5	Upper structure	110					389	1		(508)	(32)
6	Adjustment concrete for inside and stairs							30		(30)	
7	Concrete pile						247		13	(260)	(241)*
8	Quay - Wall					50		27		(77)	(70)
9	Miscellaneous		4		12			45	29	(90)	(30)
	Sub Total	110	4	8	12	154	953	103	95	1439	
	Percentage against total of above volume	(15%) 16	-	(15%) 1	-	(10%) 15	(10%) 95	(10%) 10	(10%) 10	(147)	
	Grand Total	126	4	9	12	169	1.048	113	105	(1.586)	
	Stock volume	100	4	7	12	0	592	83	105	(903)	
	Shortage volume	26	0	2		169	456	30		(683)	

* Be calculated with allowance. Rounded 700

TABLE-8 NUMBER OF JAPANESE ENGINEERS REQUIRED IN INDONESIA

(April 1971 - December 1972)

POSITION	NUMBER	DUTY	REASON OF NECESSITY	PERIOD OF STAY 1971 (6, 9, 12) 1972 (3, 6, 9, 12)	TOTAL MONTHS	SALARY PER MONTH ($)	TOTAL SALARY ($)	REMARKS
Superintendent	1	Overall supervision of the project		As required (3 times)	3	1,490	4,470	
Special Consultant	1	Special engineering		As required (6 times)	3	1,930	5,790	
Project Engineer	1	Overall supervision in Indonesia	Supervision of the whole works		21	1,040	21,840	
Senior Engineer	1	Engineering works	Assistance to Project Engineer and supervision of engineering works		21	840	17,640	
Assistant Engineer	1	Engineering works and machines	Control of engineering works, machines and electric work		21	500	10,500	
Assistant Engineer	1	-do.-	Control of concrete work, machine installation and gate installation		19	500	9,500	
Assistant Engineer	1	-do.-	Desings in Indonesia		16	500	8,000	
Senior Engineer	1	Engineering works	Guidance in PIP and Prepakt concrete work		13	1,040	13,520	
Technician	1	- do. -	-do.-		7	840	5,880	
Mechanician	1	Installation and maintenance of machines	Pump boats and piping		16	840	13,440	
Mechanician	1	- do. -	Installation of cranes		12	840	10,080	
Mechanician	1	- do. -	Maintenance of machines for temporary works and assistance to machine installation		21	500	10,500	
Electrician	1	Electric work	Control and maintenance of electric machines and equipment and wiring work		18	840	15,120	
Electrician	1	-do.-	-do.-		21	500	10,500	
Archetecture	1	Building work	Dock master house, substation, pump room		8	840	6,720	
Business Manager	1		Negotiations and office work	As required (7 times)	7	840	5,880	
Clerk	1		Personnel affairs, ration, welfare, accounting		21	500	10,500	
Total	17						179,880	

Salary		US$	179,880
Local allowance	20%		35,976
Air ticket	$750/Time (30 times)		22,500
Living cost			18,200
Furniture			2,800
Stationery			3,500
Miscellaneous expenses	80%	143,904 -	143,868
Engineering fees	20%		35,976
Total		442,736 -	442,700