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THE PEOPLE'S REPUBLIC OF BANGLADESH

FEASIBILITY STUDY
ON
THE OPTIMIZATION OF CAPACITY UTILIZATION AND IMPROVEMENT OF PERFORMANCE
OF
CHITTAGONG DRY DOCK LIMITED

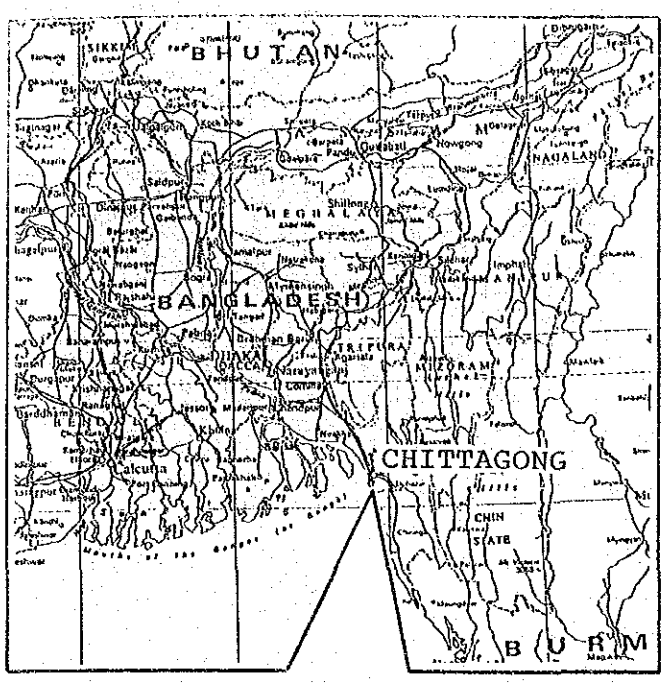
FINAL REPORT

SUMMARY

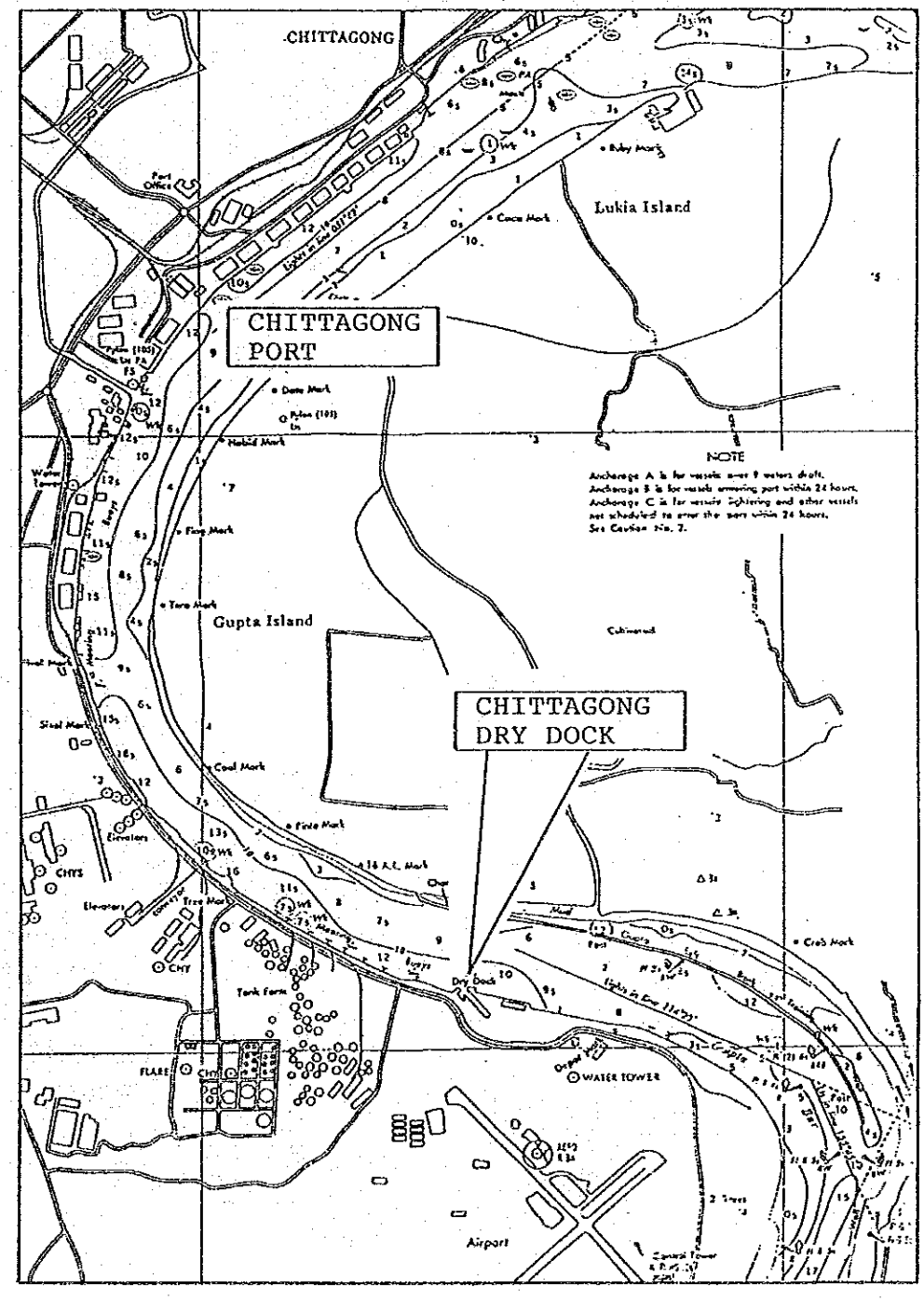
FEBRUARY 1990

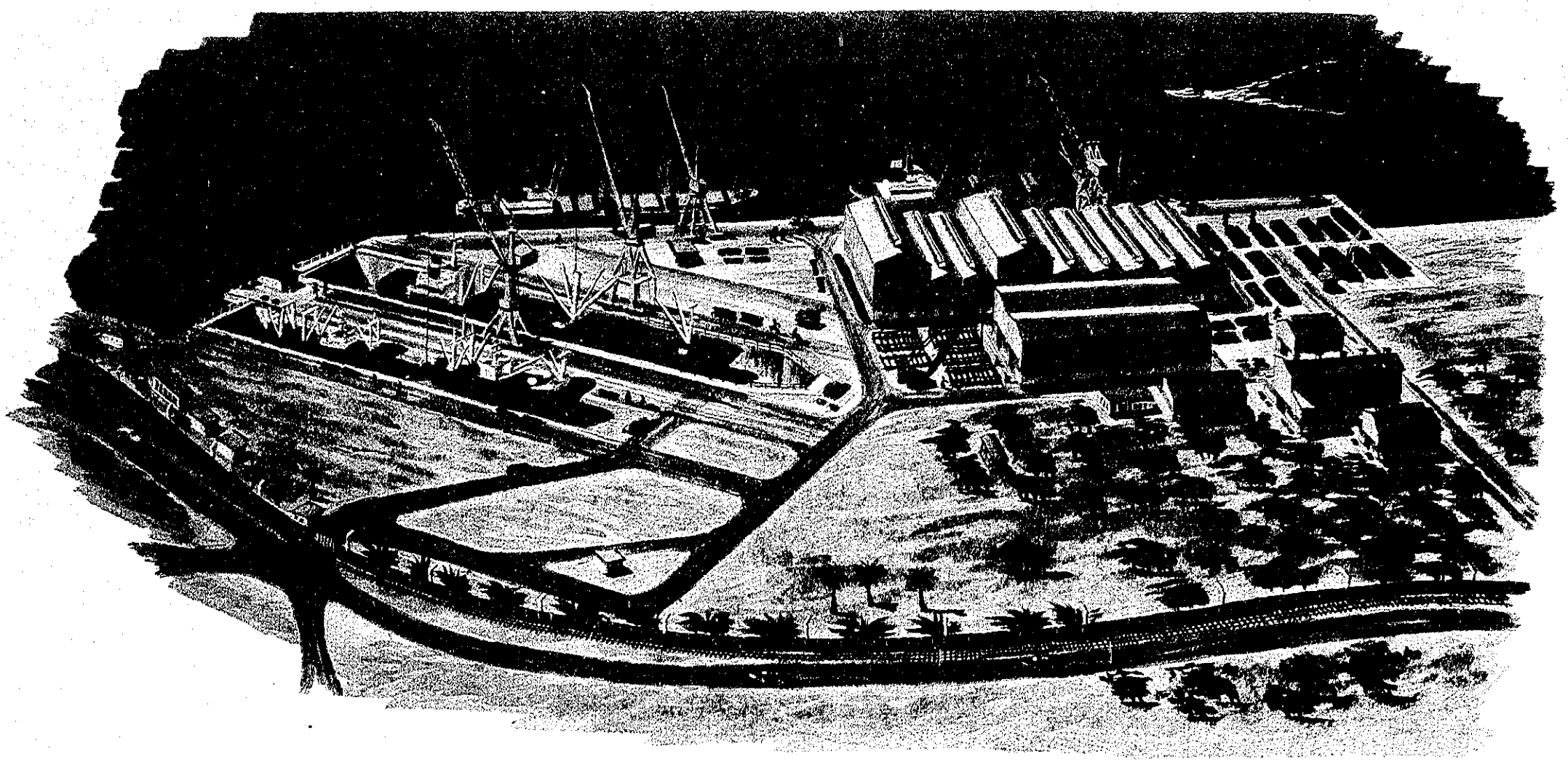
JAPAN INTERNATIONAL COOPERATION AGENCY

国際協力事業団
21232



CHITTAGONG DRY DOCK





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1 SUMMARY

1 SUMMARY

1-1 BACKGROUND OF THE STUDY

The Dry Dock & Heavy Steel Structure Works was originally conceived in 1963 to carry out repair of the seagoing vessels which touch at the port of Chittagong and Khulna.

The physical work started at the site in 1967, however, the implementation work was frozen in 1971 by the Government due to the Liberation war. In 1978, a conceptual change had been made in the original scheme by incorporating a new dock for the construction of seagoing vessels in place of a slipway.

Later on, due to financial constraint the idea of constructing the shipbuilding dock was kept in abeyance and the plant initially started operations as soon as the graving dock was commissioned in 1981. The berth and workshop buildings were completed in 1983.

However, for various reasons Chittagong Dry Dock Limited(CDD), an enterprise of Bangladesh Steel & Engineering Corporation(BSEC), is not being able to utilize its built in capacity to a desirable level.

Under the circumstances, BSEC is thinking seriously as to how the capacity of CDD can be optimally utilized and to explore the possibility of constructing ship with minimum further investment and with maximum utilization of the existing facilities.

With this objective in view, BSEC requested the Japanese Government through the Government of Bangladesh to conduct a study in order to find out ways and means for optimization of capacity utilization and improvement of performances of CDD.

In response to this request, the Japanese Government sent a study team to make studies on present condition of CDD, market study and demand forecast, improvement factor, financial and economic analyses, etc., which resulted in a consolidated feasibility study on the optimization of capacity utilization and improvement of performance of CDD.

Through a series of studies and analyses, the optimum plan was selected among several alternatives, and it was concluded that this project would be "feasible" on condition that government policies are properly carried out and efforts of the executing agency are enthusiastically made as recommended.

1-2 PRESENT CONDITION OF CHITTAGONG DRY DOCK (CDD)

(1) Location of CDD: Chittagong Dry Dock is located on the right bank of the Karnaphuli River with the distance of about 10 km from the river mouth and just downstream of the port of Chittagong. (Fig. 1-2-1)

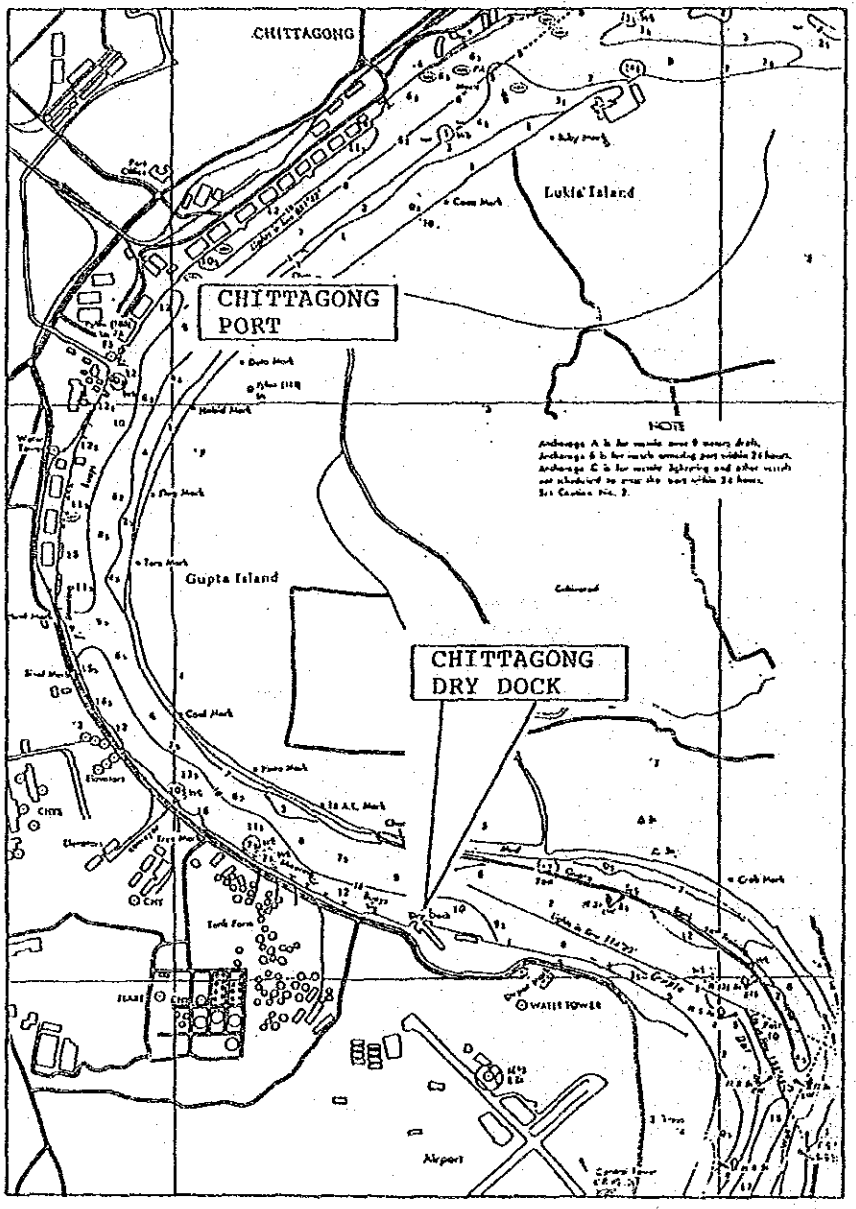


Fig. 1-2-1 Location of Chittagong Dry Dock

(2) Yard Layout : General layout of CDD is shown in Fig. 1-2-2. The total area of land is 210,800 sq. meters.

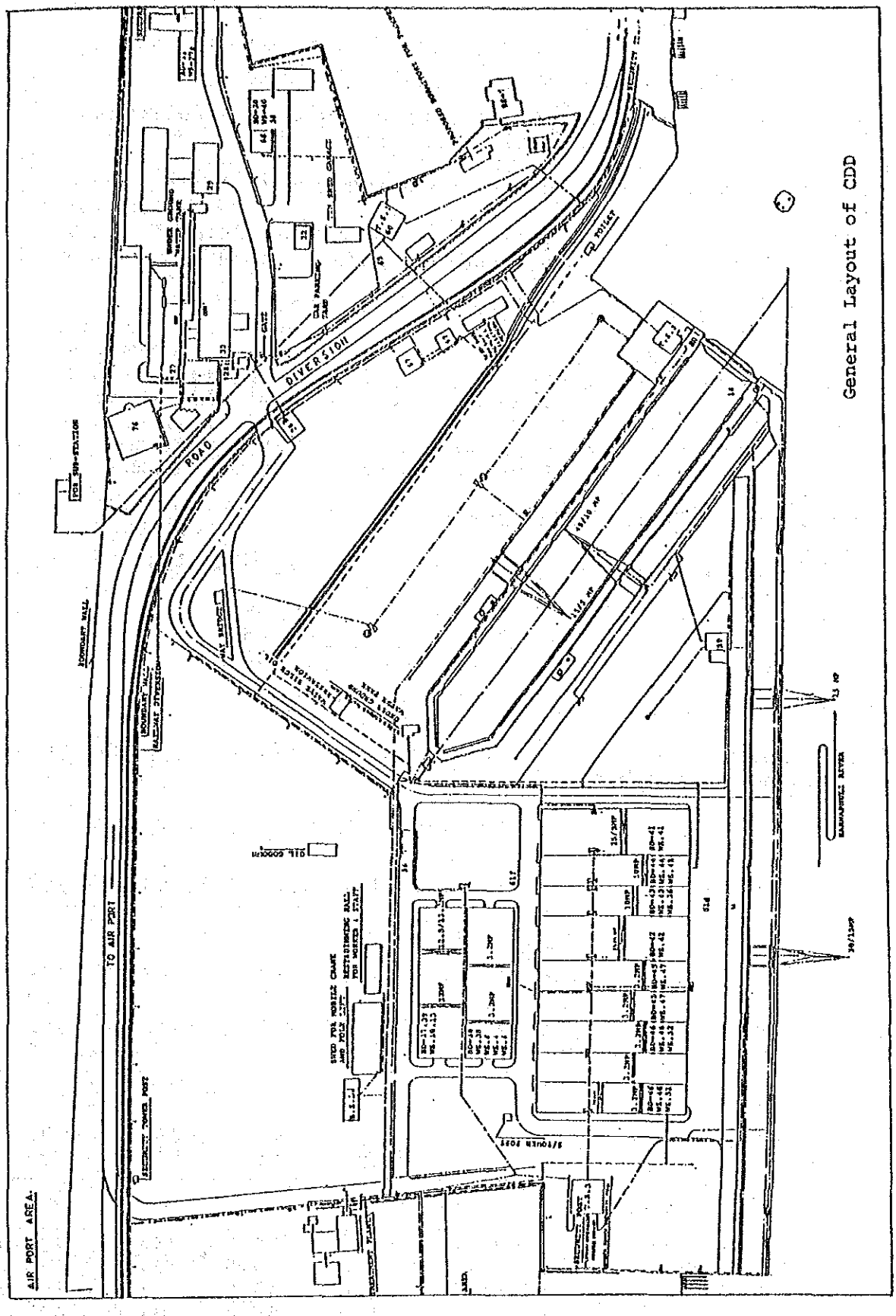


Fig. 1-2-2 General Layout of CDD

(3) Capital Investment : 16,781 Lac. taka as on date of operation, 1-7-1985

(4) Main Facilities : CDD is equipped with the following facilities.

1) Dry dock : L x B x D = 183 m x 27.4 m x 13.1 m

2) Dockside cranes : Port 40/10T at 24.3/37.2 m x 1
Starboard 15/5 T at 30.5/37.5 m x 1

3) Fitting out quay : Length = 342 m

4) Quay cranes : 50/15T at 24.3/37.2 m x 1
15/5 T at 30.5/37.5 m x 1

5) Workshop : Machine shop etc. 120 m x 60 m
Fabrication shop 60 m x 36 m

(5) Current Strength of Manpower

Current strength of manpower as of April, 1989 is as follows:

Officer and staff	305
Worker	257
Total	562

(6) Business Performance

The past production and financial performances of CDD are as shown in Table 1-2-1 and 1-2-2.

Table 1-2-1 Past Production Performence of CDD

	1983/84	1984/85	1985/86	1986/87	1987/88
Dry Dock/Repair					
Number of vessels -Local	18	15	27	50	40
-Foreign			4		3
Days occupied -Local	251	237	259	313	302
-Foreign			30		15
Afloat Repair					
Number	72	85	101	160	171
Days	653	617	668	514	732
Sales (Lac. taka)					
Dry Dock/Repair	309.9	356.7	394.5	393.9	482.5
Afloat Repair	23.6	31.5	40.8	35.6	48.9
Allied Products	1.7	31.6	53.9	159.9	159.7
Total	335.2	419.8	489.2	589.4	691.1

Source: CDD

Table 1-2-2 Financial Performance

(1,000 taka)

	1985/86	1986/87	1987/88
Sales Revenue			
Sales from Production	48,918	58,946	69,045
Sales of Steel	0	109	238
Total	48,918	59,054	69,282
Cost of Production			
Raw Material	13,630	22,767	23,960
Indirect Material	708	997	704
Work by Outsider	1,532	586	1,394
Contractors Workers	2,882	3,512	2,450
Wages	1,709	1,697	2,467
Overtime for Job	937	0	0
Overtime for General	526	557	0
Salary for Staff	2,694	2,817	3,188
Salary of Officer	2,943	3,242	3,540
Other Pay	4,587	4,818	5,859
Repair & Maintenance	2,606	2,737	4,315
Rent	535	0	0
Power	3,326	2,955	4,260
Other Direct Expenses	391	99	194
Contribution to Head Office	470	513	527
Insurance	0	0	1,533
Depreciation	9,363	9,352	15,895
Total	48,841	56,650	70,286
Gross Operating Income	77	2,405	-1,003
Administration & Selling Expenses			
Salary of Officer	736	811	885
Salary of Staff	673	704	797
Other Pay	283	895	1,261
Overtime	0	139	20
Rent	0	111	86
Depreciation	1,040	1,039	1,766
Insurance	1,339	1,418	170
Interest	9,614	9,614	28,449
Power	370	328	473
Other Administration Cost	2,611	2,967	3,533
Contribution to Head Office	118	101	104
Tax	731	836	989
Total	17,515	18,963	38,535
Other Revenue	3,166	2,497	5,149
Net Operating Income	-14,271	-14,061	-34,389

Source: CDD Profit & Loss Statement

(7) Present Difficulties

The current difficulties with management that CDD was confronted is pointed out as follows;

1) Small sales amount compared with the scale of the facilities

2) Large amount of depreciation and interest

3) Longer docking period than foreign dockyards in Singapore, Malaysia, etc.

4) Difficulty in proper procurement of materials

5) Insufficiency of technic and skill

6) Lack of general service in commercial base management

7) Many competitors, except seagoing ship repair

8) Inefficient utilization of machinery due to the shortage of spare parts and adequate attachment

1-3 MARKET STUDY AND DEMAND FORECAST

(1) Future Cargo Handling Volume

1) Basic concept

The volume of cargo handled at a port is closely connected with the social and economic activities in the port's hinterland.

Thus, the port's future cargo handling volume is generally forecast based on the past correlation between cargo handling volume major socioeconomic indices and future forecast of these indices.

Basic cargo data and socioeconomic indices are utilized from statistical Yearbook 1987 and 1989, Bureau of Statistics.

The Third Five Year Plan (TFYP) starting from 1985/86 states various target values for the year 1989/90.

The four years of 1989/90, 1994/95, 1999/00, and 2004/05 are chosen since these are the final years of each five year plan period.

The study team forecasts national cargo volume by commodity based on the past economic indices and the past cargo volume of imports and exports.

2) Summary of future cargo volume

A summary of the cargo forecast is presented in Table 1-3-1.

The average annual growth rate of the total cargo handling volume is 4.3% during 1989/90-1994/95, 4.7% during 1994/95-1999/00, and 5.8% during 1999/00-2004/05. The overall average annual growth rate during the entire period is 4.9% per year.

The average growth rate of international cargo handled at the ports of Chittagong and Mongla were 2% for export and 5.3% for import during 1975/76 and 1987/88. In the same period, GDP at constant 1984/85 price increased at 4.7% per year. Therefore, GDP elasticity coefficient of the cargo volume growth rate can be calculated at 0.43 for export and 1.13 for import. Based on this elasticity coefficient, the growth rate of cargo volume is forecast at 2.4% in 1989/90-1994/95 and 2.3% in 1994/95-2004/05 for export and 6.1%, 6.2% in the same period for import.

The results of the micro forecast is slightly lower than that of the GDP elasticity forecast. The study team adopts the results of the micro forecast by commodity.

		1989/90 - 1994/95	1994/95 - 1999/00	1999/00 - 2004/05
Micro forecast method	Export	3.3 (%)	1.5 (%)	2.0 (%)
	Import	4.4	4.9	6.1
GDP elasticity method	Export	2.4	2.3	2.3
	Import	6.1	6.2	6.2

Table 1-3-1 Summary of Future Cargo Handling Volume

(1,000 ton)

	1984/85	1989/90	1994/95	1999/00	2004/05
Imports	6,172	9,624	11,945	15,179	20,436
(Bulk)	4,783	7,837	9,234	11,278	14,976
Food Grains	1,032	1,090	652	0	0
Fertilizer	668	1,044	827	884	959
Cement	1,202	1,812	2,564	3,536	5,021
Iron & Steel	326	277	389	564	796
Petroleum	1,555	1,828	2,092	2,394	2,740
(Non-bulk)	1,389	1,787	2,711	3,900	5,459
Others					
Exports	854	952	1,120	1,209	1,334
(Bulk)	711	792	896	896	896
Jute	266	285	306	306	306
Jute Goods	445	507	590	590	590
(Non-bulk)	143	160	224	313	438
Others					
Total	7,026	10,576	13,065	16,388	21,769

(2) Required Number of Vessels

1) Basic concept

In this section , the required number of vessels in Bangladesh until the year 2004/05 has been estimated in view of the latest economic situation, cargo volume and the present fleet expansion plan up to the year 1990 (End of Third Five Year Plan) which was prepared by Bangladesh Shipping Corporation (BSC).

As a basic concept for the estimation adopted in this procedure, the following is considered.

- Forecasting period

  Four years of 1989/90, 1994/95, 1999/2000, and 2004/05 are chosen since these years are the last years of each five-year plan period.

- Forecasting ships

  The following types of ships are considered to be forecast from the past performance.

  Seagoing ship --- BSC own ship
  --- BSC chartered ship
  --- Private ship
  --- Foreign flag ship

  Fishing trawler

The number of other ships are almost the same as that of the fishing trawlers from the past performance, and shall be continued throughout the planning period.

2) Summary of future number of vessels

A summary of the future number of vessels is presented in Table 1-3-2 for the case of 30% lifting shares and Table 1-3-3 for 40% lifting shares.

Table 1-3-2 Summary of Required Vessels (30%)

	BSC Owned	BSC Chartered	Private	Foreign	Trawler
1989/90	22	25	25	195	39
1990/91	22	25	25	202	40
1991/92	23	25	26	212	42
1992/93	25	26	28	217	44
1993/94	25	26	29	225	45
1994/95	26	26	29	234	47
1995/96	27	26	29	243	48
1996/97	27	27	30	252	50
1997/98	30	28	33	261	51
1998/99	30	29	34	271	53
1999/00	31	29	34	280	54
2000/01	31	29	35	299	55
2001/02	31	30	36	321	56
2002/03	35	33	39	343	58
2003/04	35	34	40	367	59
2004/05	35	33	41	366	60

Table 1-3-3 Summary of Required Vessels (40%)

	BSC Owned	BSC Chartered	Private	Foreign	Trawler
1989/90	22	25	25	195	39
1990/91	23	25	26	202	40
1991/92	24	25	27	205	42
1992/93	26	28	31	212	44
1993/94	28	28	32	217	45
1994/95	29	28	33	224	47
1995/96	30	28	33	231	48
1996/97	32	28	34	240	50
1997/98	34	32	36	248	51
1998/99	37	32	37	255	53
1999/00	38	32	37	264	54
2000/01	38	33	40	275	55
2001/02	38	35	45	290	56
2002/03	40	38	49	303	58
2003/04	40	41	53	319	59
2004/05	40	42	59	313	60

(3) Steel Structure

1) Electricity transmission tower

The Bangladesh Power Development Board (BPDP) is the only state corporation requiring an electricity transmission tower for power distribution.

The total procurement volume of steel towers can be estimated by multiplying the total length of the transmission (1,468 km) with the average tonnage per km (about 30 ton/km), that is 44,040 tons for the Fourth Five Year Plan period (1990-95).

2) Chemical plants

Top officials of BCIC expect that chemical plants will consume an estimate of about 1,200 tons of steel per year and require less time in procurement, lower price, and better quality.

3) Bridge

The government has decided to urgently install steel bridges in every Upazila (sub-district) due to the bad experience of flood disaster. The government prefers concrete or steel bridges feeder roads depending on specific site conditions and accessibility and prefers steel bridges for rural roads.

There is a possibility of utilizing 2,000 meters of bridges under foreign aided projects, 3,000 meters under local resources and 6,000 meters under local government sources every year.

1-4 BASIC IDEA OF IMPROVEMENT

Based on the study of present condition of CDD and demand forecast, the following future improvement plans are studied.

1-4-1 Ship Repair

(1) Supply and Demand Forecast of Docking

The supply and demand gap of the docking is estimated as shown in Table 1-4-1. The docking demand of small vessels is shown in the figure of the number of dockings. It shows that the ship repair demand exceeds the docking capacity of CDD.

Table 1-4-1 Supply and Demand Forecast of Docking

1. Lifting Share 30%

Year	Docking Capacity	Docking Demand	
		Seagoing	Small
1989/90	21	13	15
1992/93	23	19	17
1997/98	25	28	20
2002/03	27	36	23
2007/08	28	38	24
2012/13	28	38	24

2. Lifting Share 40%

Year	Docking Capacity	Docking Demand	
		Seagoing	Small
1989/90	21	13	15
1992/93	23	20	17
1997/98	25	31	20
2002/03	27	41	23
2007/08	28	43	24
2012/13	28	43	24

In this table, docking demand of small vessels is given in the figure of number of dockings.

(2) Outline of future plan for improvement

The two alternatives are considered for the future improvement of CDD, namely, Plan "A" and Plan "B".
The outline of each plan is summarized in Table 1-4-2.

Table 1-4-2 Outline of Future Plan for Improvement (Ship Repair)

Item	Plan "A"	Plan "B"
1. Basic concept	Ship repair business both for sea-going vessels and for other small vessels shall be carried out at existing dry dock with technical assistance from technically advanced country and provisions for additional facility.	This plan is to construct a new docking facility for small sized ship repair, in addition to the implementation of Plan "A"
2. Training programme	(1) Training in overseas shipyards 7 trainees, total 48 man-months (2) Technical assistance from overseas shipyards 5 experts, total 54 man-months	
3. Additional facility	(1) Service utility piping (Compressed air, acetylene and oxygen, and water supply line) (2) Workshop machinery (Lathe machine, dynamic balancing machine, etc.) (3) Painting equipment (4) Foundry shop (Building and equipment) (5) Tools	In addition to the Plan "A", a docking facility for small vessels is planned. It is recommended the facility should have the capacity of two small size vessels docking at a time. (A semi-dry dock type slipway of 100m length is recommended.)
4. Additional investment amount (Lac. taka)	Training 391.2 Facility 925.2 Total 1,316.4	Training 391.2 Facility 1,670.6 Total 2,061.8

Item	Plan "A"		Plan "B"		
5. Increased docking capacity according to the improvement of productivity	Year	Docking Capacity (Dry Dock)	Year	Docking Capacity Dry Dock	Slipway
	1989/90	21	1989/90	21	-
	1992/93	23	1992/93	23	-
	1997/98	33	1997/98	33	65
	2002/03	39	2002/03	39	77
	2007/08	41	2007/08	41	81
	2012/13	41	2012/13	41	81
6. Prospective number of docked vessels	In case of lifting share 30%				
	Year	No. of Vessels Seagoing / Small vessel	Year	No. of Vessels Seagoing / Small vessel	
	1989/90	13 / 24	1989/90	13	24
	1992/93	19 / 12	1992/93	19	12
	1997/98	28 / 15	1997/98	28	61
	2002/03	36 / 9	2002/03	36	69
	2007/08	38 / 9	2007/08	38	73
	2012/13	38 / 9	2012/13	38	73
	In case of lifting share 40%				
	Year	No. of Vessels Seagoing / Small vessel	Year	No. of Vessels Seagoing / Small vessel	
	1989/90	13 / 24	1989/90	13	24
	1992/93	20 / 9	1992/93	20	12
	1997/98	31 / 6	1997/98	31	61
	2002/03	39 / -	2002/03	39	69
	2007/08	41 / -	2007/08	41	73
	2012/13	41 / -	2012/13	41	73

1-4-2 STEEL STRUCTURE

(1) Study Results on Present Condition

The past records of CDD provides us with the following factors on steel structural work.

- Average annual sales for latest 2 years: 127.85 Lac. TK
- Average annual production for latest 2 years : 290 ton
- Estimated production capacity : 0.13 ton/m2 (290 ton/2,160 m2)
- Estimated working hours per production tons: 333 hr/ton

(2) Expected Future Work

In planning for improvement of CDD's steel structural engineering, the expected future work items of CDD are considered as follows, based on the market study.

- Conventional products, like pontoons, tanks, steel racks, etc.
- Electricity transmission towers and telescopic poles
- Bridges
- Steel structures for chemical plants, like steel buildings, tanks, etc.
- Other products, like basket for centrifugal machine, etc.

(3) Outline of Future Plan for Improvement

Based on the review of present conditions and market study, the three alternative improvement plans, i.e., Plan "a", Plan "b" and Plan "c" are studied.

The outline of each plan is shown in Table 1-4-3, and Fig. 1-4-1.

Table 1-4-3 Outline of Future Plan for Improvement (Steel Structure)

Item	Plan "a"	Plan "b"	Plan "c"
1. Basic concept	Upgrading of productivity using the existing fabrication shop by way of technical training and additional facility	Conversion of one engine shop and one machine shop into steel fabrication shop, in addition to the implementation of Plan "a"	Construction of new fabrication shop, in addition to the implementation of Plan "b"
2. Fabrication shop area (m2)	2,160	3,780	5,940
3. Prospective product volume (Target tons per year), in accordance with the improvement of productivity and the increase of production area	1989/90 320 1992/93 370 1993/94 430 1997/98 500 2002/03 550 2007/08 650 2012/13 700	320 370 560 930 1,300 1,460 1,520	320 370 900 1,500 2,000 2,200 2,400

Item	Plan "a"	Plan "b"	Plan "c"
4. Training	Despatch of an engineer to CDD for one year	(1) Training in overseas yards Total 84 man-months (2) Technical assistance from overseas yards 2 experts, total 18 man-months	
5. Additional Facilities	(1) Punching, shearing and angle cutting machines (2) Bending roller (3) Semiautomatic gas cutting machines (4) Automatic welding machines (5) Air tools, etc.	In addition to Plan "a", (1) Partition wall (2) Electric distribution boxes and pipings (3) Turning roller (4) Traversers (5) Radial hoist cranes	In addition to Plan "b", (1) Construction of new fabrication shops (36m x 60m) (2) Overhead travelling cranes
6. Additional investment amount (Lac. taka)	Training 64.4 Facility 68.8 Total 133.2	Training 235.4 Facility 159.1 Total 394.5	Training 235.4 Facility 594.1 Total 829.5

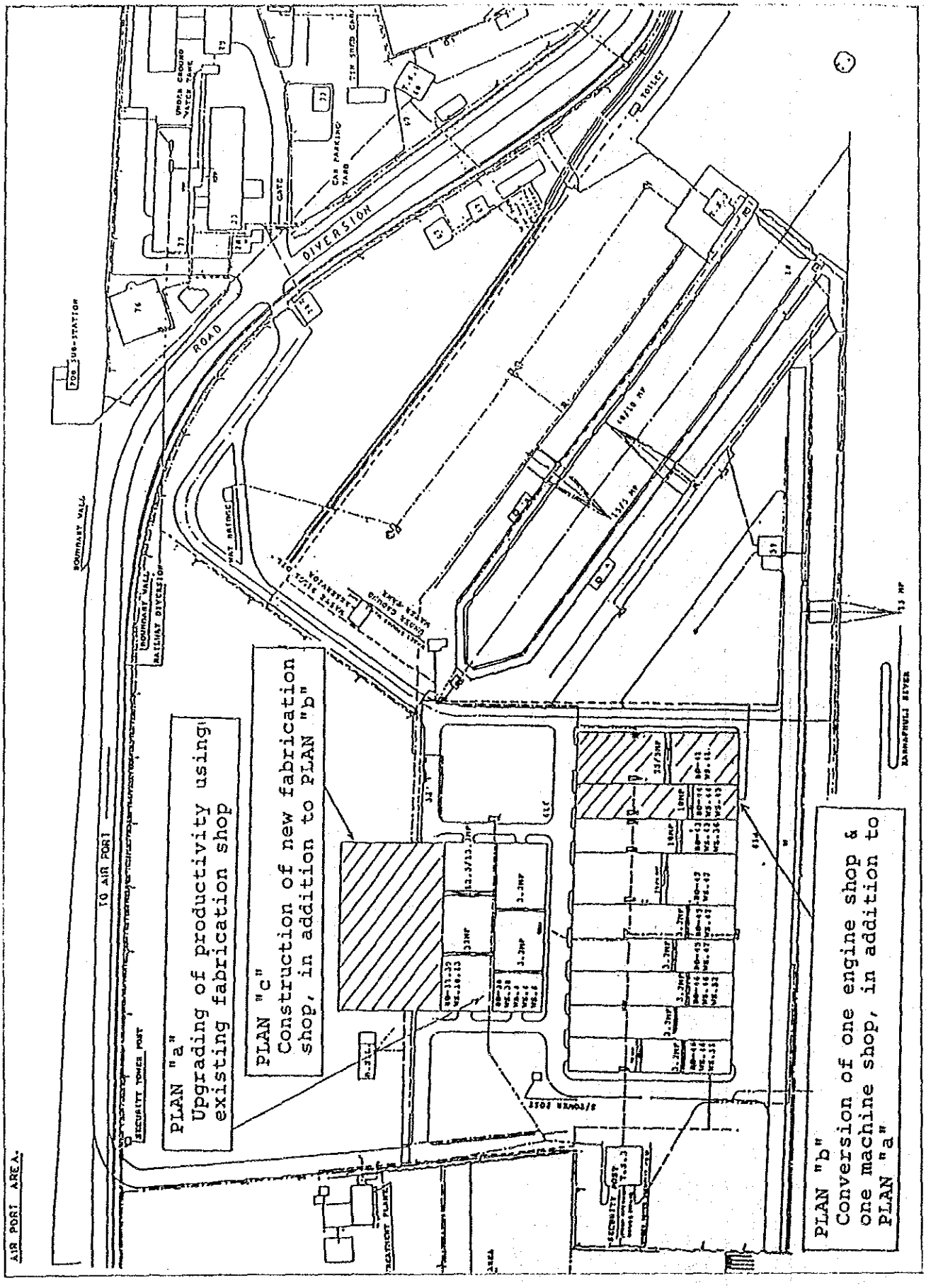


Fig. 1-4-1 Proposed Idea Plan on Steel Structure Fabrication Shop

1-5 SELECTION OF OPTIMUM PLAN

In order to sound preliminary feasibility of proposed each plan and find an optimum plan for improving CDD, the following four cases are selected by combining each plan.

Steel / Ship Repair / Struct.	Plan "a"	Plan "b"	Plan "c"
Plan "A"	Case "1"	Case "2"	
Plan "B"		Case "3"	Case "4"

The financial profitability of each plan is calculated as shown in Table 1-5-1, in terms of Financial Internal Rate of Return (FIRR).

Since the purpose of pre-checking is to select an optimum plan for further study in detail, the data applied for calculation is estimated at the preliminary level.

Table 1-5-1 FIRR of Each Case

	Lifting Share	Repair	Steel	Total
Case 1	30% 40%	1.4 0.9	0.02 0.02	1.3 0.8
Case 2	30% 40%	1.4 0.9	6.8 6.8	2.8 2.4
Case 3	30% 40%	4.4 5.1	6.8 6.8	4.8 5.4
Case 4	30% 40%	4.4 5.1	5.5 5.5	4.7 5.2

Case 3 with 30% case of lifting shares shall be selected to study further since it obtained the highest FIRR and the difference in FIRR between 30% and 40% could not appreciate much.

1-6 OUTLINE OF OPTIMUM PLAN

(1) Management and Operation Plan

1) Production plan

The future production plan is the same as Plan "B" for ship repair and Plan "b" for steel structure in Table 1-4-2 and 1-4-3 respectively.

2) Manpower plan

The necessary manpower (number of direct workers) for the future production is planned as shown in Table 1-6-1.

Table 1-6-1 Manpower Plan

Year	Ship Repair	Steel Structure	Galva-nizing	Total
1989/90	133	52	0	185
1992/93	152	55	0	207
1993/94	193	84	10	287
1997/98	250	106	14	370
2002/03	347	124	17	488
2007/08	379	128	19	546
2012/13	379	128	20	547

3) Organization

The organization chart shown in Fig. 1-6-1 is recommended. This organization is mainly drafted in consideration of the following points:

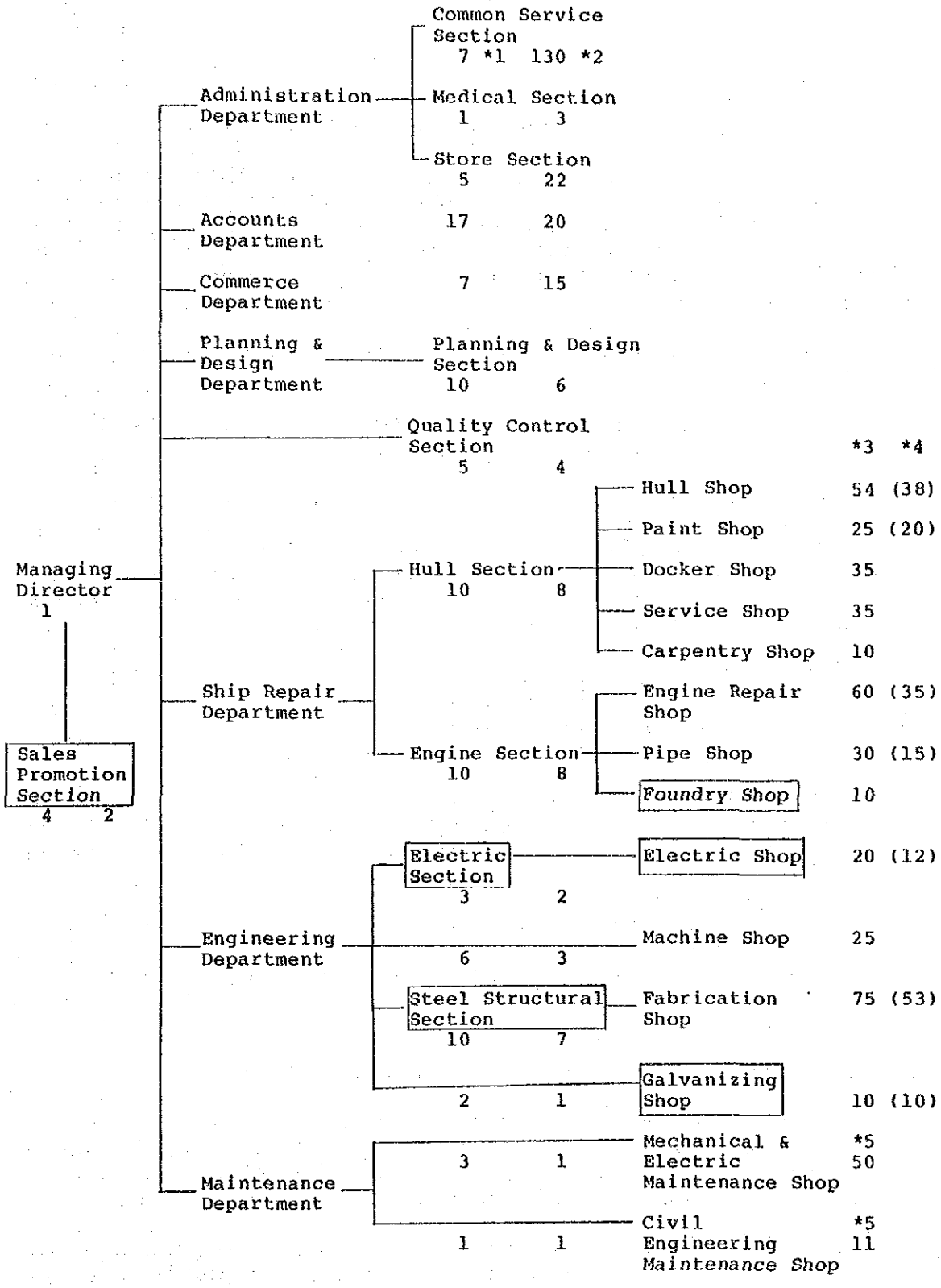
a) The Sales Promotion Section shall be newly organized and operated under the control of the Managing Director.

b) A newly planned Foundry Shop shall be put under the control of the Engine Section.

c) The Electric Section shall be newly organized.

d) The Steel Structure Section shall be newly established. The existing fabrication shop shall be operated under this section.

e) A newly built galvanizing shop shall be organized in the Engineering Department.



Remark: *1 Officer
*2 Staff
*3 Direct Worker
*4 Subcontracted Worker
*5 Indirect Worker

* The figures show the number of personnels in 2012/13.
* The newly established sections and shops are shown in rectangulars.

Fig. 1-6-1 Recommended Organization Chart

(2) New Facilities

1) Drydocking system for the small sized vessels

There are several kinds of systems for this purpose in which there are advantages and disadvantages. After the comparison of their features, a semi-dock type slipway system is recommended from the view of minimum investment, simple operation, easy expansion and present site conditions.

The slipway is being placed in parallel with the existing dry dock.

Fig. 1-6-2 shows the arrangement of the docking on slipway for 350 GT fishing trawlers.

2) Galvanizing shop

This shop is planned to have a hot-dip galvanizing capacity of the following products, considering the dimensions of steel materials, the size of pannel block of portable bridges, etc.

Length	:	6,000 mm max.
Width	:	600 mm max.
Depth	:	1,000 mm max.
Weight	:	1,000 kgs/piece max.

This plant has the waste water and acid neutralizing equipment for the environmental protection. Fig. 1-6-3 shows the arrangement and workflow of the galvanizing shop.

3) Machinery and equipment

The outline of the additional machinery and equipment is as shown in Table 1-4-2 and 1-4-3.

(3) Implementation Schedule and Investment Amount

An implementation schedule and the estimated total investment amount of the selected optimum plan is shown in Fig. 1-6-4 and Table 1-6-2, expecting the construction work and technical training commence on July, 1992.

However, in case early line up of finance is possible for train up of personnel for improvement of CDD's present activities, some components of training not related to the creation of new facilities proposed may be implemented at the earliest before the implementation of the investment plan.

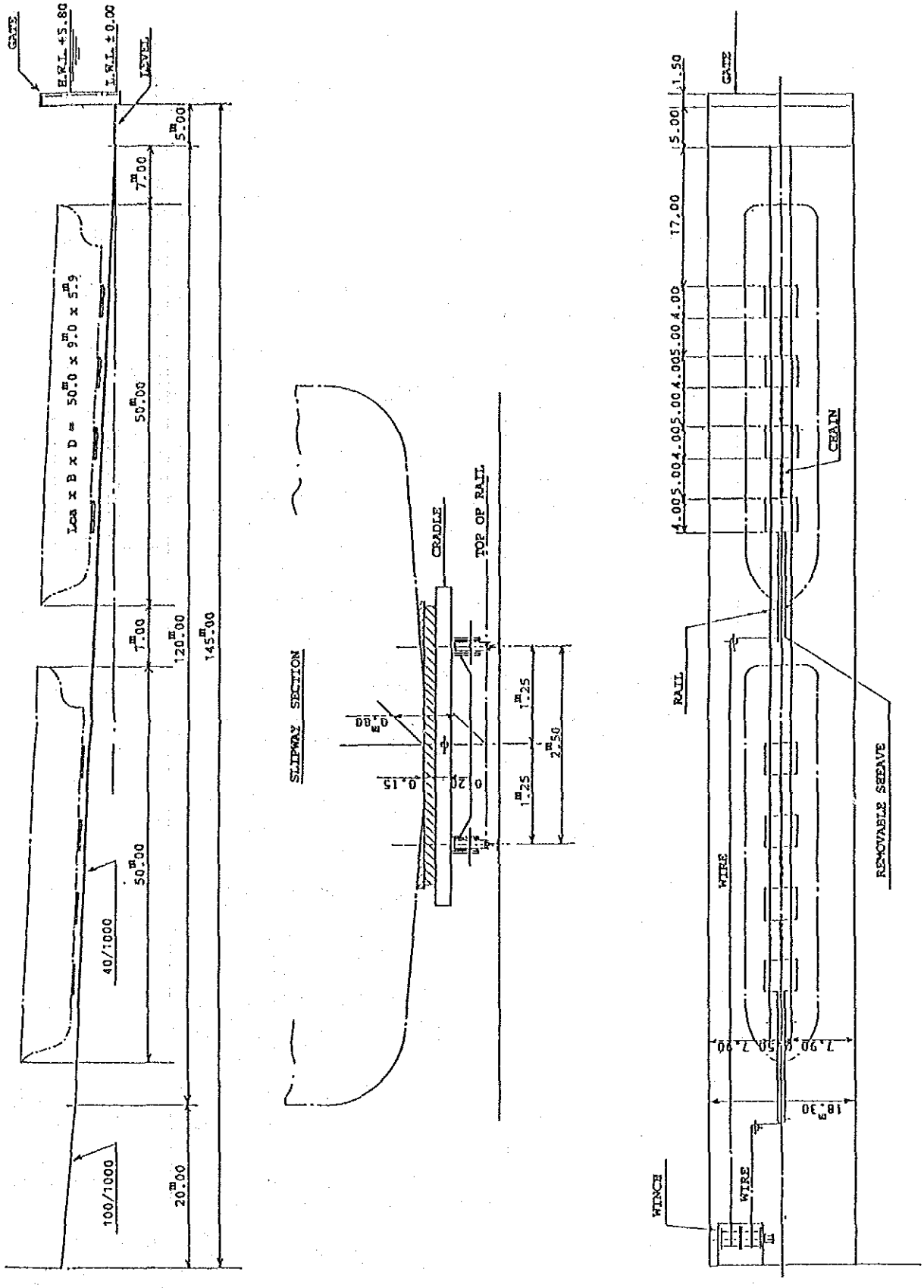


Fig. 1-6-2 Arrangement of Docking on Slipway

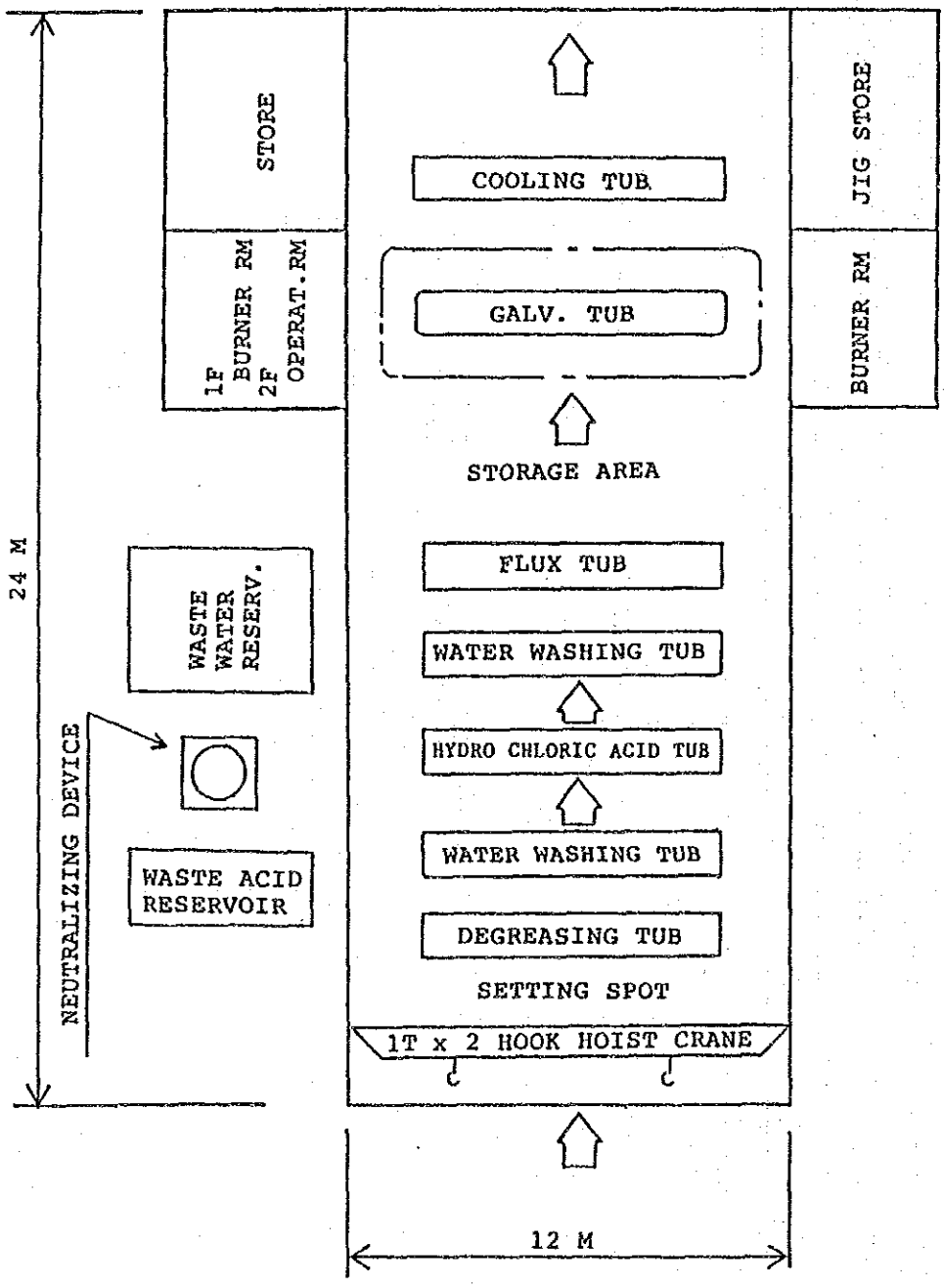


Fig. 1-6-3 General Arrangement of Galvanizing Shop

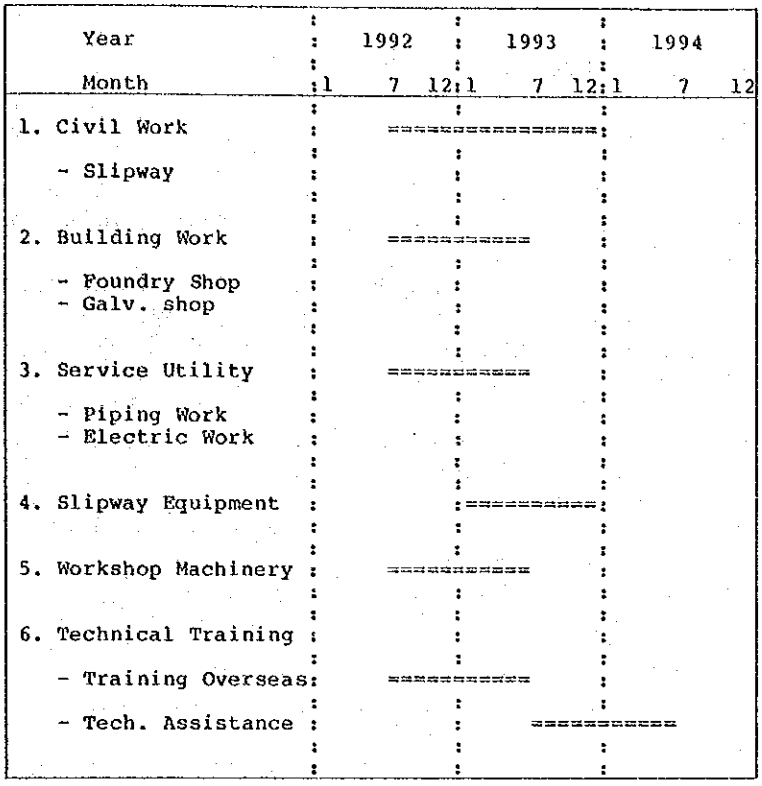


Fig. 1-6-4 Implementation Schedule

Table 1-6-2 Estimated Total Investment Amount

(Unit : 1,000 taka)

Item	Ship Repair		Steel Structure	
	Local Currency Portion	Foreign Currency Portion	Local Currency Portion	Foreign Currency Portion
Civil&Build.	30,230	330	7,100	0
Equipment	27,220	70,700	10,190	20,030
Tech. Assist.	0	10,100	0	17,100
Consultant Fee	0	12,000	0	4,500
Civil&Build.	28,120	330	0	0
Equipment	3,950	6,180	0	0
Tech. Assist.	0	29,020	0	9,700
Consultant Fee	0	3,000	0	0
Total	89,520	131,660	17,290	51,330
	221,180		68,620	
	289,800			

These figures are based on values as of September, 1989.
(Exchange rate : 1 taka = 4.35 Yen)

1-7 FINANCIAL EVALUATION

(1) Cash Flow Analysis

Here, financial internal rate of return (FIRR) is reviewed on the basis of the revenue estimation and the cost estimation.
The internal rate of return is calculated to review the financial viability of projects by the incremental analysis method. Tables 1-7-1 through 1-7-6 show the cash flow statement. The internal rate of return for the projects are shown below, which is nearly same as the currently prevailing market interest rate for long term lending in Bangladesh. This project itself (FIRR with Tax) is therefore found very viable in Bangladesh. The FIRR of CDD on total project basis including the past investment cost are calculated as under in accordance with data supplied by Project Proforma 1989.

Department	Project	FIRR
Ship Repair	Slipway Project	13.7 %
Steel Work	Expansion Project	7.7 %
Total Project		12.4 %
CDD Total	Without Optimum Plan	-191.0 % (Note 1)
CDD Total	With Optimum Plan	1.1 % (Note 2)

(2) Analysis of Income Statement

Based on the review of the cash flow statement, the income statement will be prepared only for CDD with optimum plan and without project. It is seen that the profit turns into black as early as 8 years from the commencement of the services in "With Optimum Plan" while the profit will never be generated till the year 2012/13 in "Without Project".

Note 1: Net Present Value at 15% of discount rate = Benefit - Cost = 217,515,000 taka - 1,005,292,000 taka
Benefit-Cost Ratio = 0.22

Note 2: Net Present Value at 15% of discount rate
323,217,000 taka - 1,097,081,000 taka,
Benefit-Cost Ratio = 0.3

(3) Analysis of Fund Flow Statement

Assumptions imposed on the analysis of the fund flow statement for CDD are as follows:

(1,000 taka)

	1992/93	1993/94	Total
Foreign	130,410	47,910	178,320
Local	69,580	29,330	98,910
Total	199,990	77,240	277,230

The total investment amounts 277,230,000 taka excluding contingencies of which the foreign currency portion(178,320,000 taka) will be financed by soft loan from the Bangladesh Government (30 years repayment with 2% p.a. interest with grace period of 10 years). The local currency portion is to be financed with Commercial Bank, that is, about 40% of the total investment of 98,910,000 taka will be raised. The terms imposed on domestic loan is a 15% p.a. interest without grace period.

Repayment of loans reaches its peak in 2002/03 and amounts three times larger than the investment cost, it is difficult to repay loans without liquidating internal reserves(retained earnings). The debt service ratio (net income + depreciation/principal repayment) ranges between - 0.17 and 7.14 during 1992/93 to 2012/13 period and will exceed 1.3 only from the year 3007/08. But, repayment of all loans will not be completed by the year 2012/13. Thus, this plan provides a quite sound investment opportunity though the larger amount of loans make weaken its repayment capability.

It is noted that the fund flow statement with Optimum Plan has not solved the problem of deficit amount every year. CDD should procure a short-term loan for the deficit amount every year generating throughout the planned period.

Table 1-7-1 Cash Flow Statement for Ship Repair (Without Project)

(1000 taka)

			1989/90	1992/93	1993/94	1997/98	2002/03	2007/08	2012/13
Production (1000 ton)	Vessels	Seagoing	13	19	20	25	27	28	28
		Coastal	24	12	9	0	0	0	0
	DWT	Seagoing	142,612	210,197	223,132	274,211	302,964	311,367	311,367
		Coastal	18,240	9,120	6,840	0	0	0	0
Sales		Seagoing	22,148	34,726	37,997	50,778	63,938	70,064	70,064
		Coastal	18,723	9,902	7,629	0	0	0	0
		Total	40,871	44,628	45,626	50,778	63,938	70,064	70,064
Operating Expenses	Material	Import	3,270	3,570	3,650	4,062	5,115	5,605	5,605
		Local	6,315	6,895	7,049	7,845	9,878	10,825	10,825
		Total	9,585	10,465	10,699	11,907	14,993	16,430	16,430
	Fuel & Power		3,291	3,830	3,933	4,409	5,075	5,406	5,406
	Salary	Direct	4,847	5,667	6,499	8,860	12,535	16,950	21,633
		Indirect	7,840	9,122	9,847	12,631	16,631	21,864	27,905
		Total	12,687	14,789	16,346	21,492	29,166	38,814	49,538
	Subcontracting		0	0	0	0	0	0	0
	Maintenance		2,304	2,681	2,753	3,086	3,553	3,784	3,784
	Other		2,787	3,176	3,373	4,089	5,279	6,443	7,516
	Total Cost		30,654	34,941	37,105	44,983	58,065	70,877	82,673
Gross Profit			10,217	9,687	8,521	5,795	5,873	-813	-12,609
Profit After Tax			5,620	5,328	4,687	3,187	3,230	-813	-12,609

Source : Study Team

Table 1-7-2 Cash Flow Statement for Ship Repair (Optimum Plan)

(1000 taka)

			1989/90	1992/93	1993/94	1997/98	2002/03	2007/08	2012/13
Production (1000 ton)	Vessels	Seagoing	13	19	20	28	36	38	38
		Coastal	24	12	35	61	69	73	73
	DWT	Seagoing	142,612	210,197	223,132	296,537	369,942	385,787	385,787
		Coastal	18,240	9,120	26,600	46,360	52,440	55,480	55,480
Sales		Seagoing	22,157	34,854	38,239	61,221	101,067	121,536	121,536
		Coastal	18,730	9,902	29,856	63,846	96,645	118,478	118,478
		Total	40,887	44,756	68,095	125,067	197,712	240,014	240,014
Operating Expenses	Material	Import	3,271	3,580	5,448	10,005	15,817	19,201	19,201
		Local	6,317	6,915	10,521	19,323	30,547	37,082	37,082
		Total	9,588	10,495	15,969	29,328	46,364	56,283	56,283
	Fuel & Power		3,291	3,756	4,773	6,208	8,596	9,892	9,892
	Salary	Direct	4,847	6,076	7,230	9,903	15,278	22,134	28,249
		Indirect	7,840	9,296	9,725	12,086	16,340	21,669	27,655
		Total	12,687	15,372	16,955	21,990	31,617	43,802	55,904
	Subcontracting		0	0	524	1,490	3,634	4,880	5,657
	Maintenance		2,304	2,629	3,341	4,346	6,017	6,924	6,924
	Other		2,787	3,225	4,156	6,336	9,623	12,178	13,466
	Total Cost		30,657	35,478	45,718	69,698	105,851	133,959	148,126
Gross Profit			10,230	9,278	22,377	55,369	91,861	106,055	91,888
Profit After Tax			5,627	5,103	12,307	30,453	50,524	58,330	50,538

Source : Study Team

Table 1-7-3 Cash Flow Statement for Ship Repair (Slipway Project)

(1000 taka)

			1989/90	1992/93	1993/94	1997/98	2002/03	2007/08	2012/13
Production (1000 ton)	Vessels	Seagoing	0	0	0	3	9	10	10
		Coastal	0	0	26	61	69	73	73
	DWT	Seagoing	0	0	0	22,326	66,978	74,420	74,420
		Coastal	0	0	19,760	46,360	52,440	55,480	55,480
Sales		Seagoing	9	128	242	10,443	37,129	51,472	51,472
		Coastal	7	0	22,227	63,846	96,645	118,478	118,478
		Total	16	128	22,469	74,289	133,774	169,950	169,950
Operating Expenses	Material	Import	1	10	1,798	5,943	10,702	13,596	13,596
		Local	2	20	3,472	11,478	20,669	26,257	26,257
		Total	3	30	5,270	17,421	31,371	39,853	39,853
	Fuel & Power		0	-74	840	1,800	3,521	4,486	4,486
	Salary	Direct	0	409	731	1,043	2,743	5,184	6,616
		Indirect	0	174	-122	-545	-291	-195	-249
		Total	0	583	609	498	2,451	4,988	6,367
	Subcontracting		0	0	524	1,490	3,634	4,880	5,657
	Maintenance		0	-51	588	1,260	2,464	3,140	3,140
	Other		0	49	783	2,247	4,344	5,735	5,950
	Total Cost		3	537	8,614	24,715	47,785	63,082	65,453
Gross Profit			13	-409	13,855	49,574	85,989	106,868	104,497
Profit After Tax			7	-225	7,620	27,266	47,294	59,143	63,148

Source : Study Team

Table 1-7-4 Cash Flow Statement for Steel Work (Without Project)

(1000 taka)

			1989/90	1992/93	1993/94	1997/98	2002/03	2007/08	2012/13
Production		(1000 ton)	320	370	400	430	430	430	430
Sales			14,060	16,200	17,490	18,900	18,900	18,900	18,900
Operation Expenses	Material	Import	192	160	384	480	480	480	480
		Local	9,880	11,350	12,512	13,526	13,526	13,526	13,526
		Total	10,072	11,510	12,896	14,006	14,006	14,006	14,006
	Fuel & Power		986	973	973	973	973	973	973
	Salary	Direct	1,974	2,285	2,399	2,916	3,722	4,751	6,063
		Indirect	3,065	3,514	3,437	3,864	4,528	5,519	7,044
		Total	5,039	5,799	5,836	6,780	8,250	10,270	13,107
	Subcontracting		0	0	0	0	0	0	0
	Maintenance		690	681	681	681	681	681	681
	Other		1,679	1,896	2,039	2,244	2,391	2,593	2,877
	Total Cost		18,466	20,859	22,425	24,684	26,301	28,523	31,644
Gross Profit			-4,406	-4,659	-4,935	-5,784	-7,401	-9,623	-12,744
Profit After Tax			-4,406	-4,659	-4,935	-5,784	-7,401	-9,623	-12,744

Source : Study Team

Table 1-7-5 Cash Flow Statement for Steel Work (Optimum Plan)

(1000 taka)

			1989/90	1992/93	1993/94	1997/98	2002/03	2007/08	2012/13
Production		(1000 ton)	320	370	560	930	1,300	1,400	1,520
Sales			14,060	16,150	31,670	59,310	86,990	99,350	104,740
Operation Expenses	Material	Import	192	160	3,690	8,880	14,320	16,870	18,224
		Local	9,880	11,350	17,960	30,880	43,840	49,430	51,566
		Total	10,072	11,510	21,650	39,760	58,160	66,300	69,790
	Fuel & Power		986	1,030	1,804	2,324	2,721	2,850	2,863
	Salary	Direct	1,974	2,285	2,977	4,104	5,759	7,409	9,456
		Indirect	3,065	3,334	3,879	4,835	5,816	6,722	8,579
		Total	5,039	5,619	6,856	8,939	11,575	14,131	18,035
	Subcontracting		0	80	745	1,366	2,051	2,586	3,046
	Maintenance		690	721	1,263	1,627	1,905	1,995	2,004
	Other		1,679	1,896	3,232	5,402	7,641	8,786	9,574
	Total Cost		18,466	20,856	35,549	59,417	84,052	96,648	105,312
Gross Profit			-4,406	-4,706	-3,879	-107	2,938	2,702	-572
Profit After Tax			-4,406	-4,706	-3,879	-107	1,616	1,486	-572

Source : Study Team

Table 1-7-6 Cash Flow Statement for Steel Work (Expansion Project)

(1000 taka)

			1989/90	1992/93	1993/94	1997/98	2002/03	2007/08	2012/13
Production		(1000 ton)	0	0	160	500	870	970	1,090
Sales			0	-50	14,180	40,410	68,090	80,450	85,840
Operation Expenses	Material	Import	0	0	3,306	8,400	13,840	16,390	17,744
		Local	0	0	5,448	17,354	30,314	35,904	38,040
		Total	0	0	8,754	25,754	44,154	52,294	55,784
	Fuel & Power		0	57	831	1,351	1,748	1,877	1,890
	Salary	Direct	0	0	578	1,188	2,037	2,658	3,392
		Indirect	0	-180	442	971	1,288	1,203	1,535
		Total	0	-180	1,020	2,159	3,324	3,861	4,928
	Subcontracting		0	80	745	1,366	2,051	2,586	3,046
	Maintenance		0	40	582	946	1,224	1,314	1,323
	Other		0	-0	1,193	3,158	5,250	6,193	6,697
	Total Cost		0	-3	13,124	34,733	57,751	68,125	73,668
Gross Profit			0	-47	1,056	5,677	10,339	12,325	12,172
Profit After Tax			0	-47	1,056	5,677	9,017	11,109	12,172

Source : Study Team

1-8 ECONOMIC EVALUATION

(1) Objective

The purpose of economic evaluation is to grasp how effective projects lead to the Bangladesh economy. In other words, irrespective of the composition of investors of input goods (expenses) for projects or the composition of beneficiaries of outputs (benefit), it estimates how the utilization of various resources through projects will contribute to the national economy.

(2) Economic Internal Rate of Return (EIRR)

1) Consumer surplus

Since shipowner should bear two kinds of payment for ship repair. One is ship repair payment made by shipowner to CDD and the other is fleet operation cost expected to incur during dock repairing period. If docking period become shorten, the less fleet operating cost will incured. Both seagoing and trawler owners claimed CDD for its inefficiency of dock operation which caused excess time and exorbitant charges due to an absence of proper planning. With execution of this plan , it is expected that CDD can achieve a less time for more work volume.

Thus, economic benefit generating from time reduction can be calculated by multiplying reduced days with fixed operating cost per day.

2) Results

In consideration of the foregoing reviews, EIRR for the slipway project and the steel expansion project are calculated as 31% and 13% respectively, thereby, total EIRR is 27%.

The International Bank for Reconstruction and Development (IBRD) assumes that the opportunity cost of capital in each developing country lies between 8 to 15%. Accordingly, the project is evaluated in the light of the upper limit of 15%.

The EIRR for the plan greatly exceeds these interest rate and proves that the said plan will greatly contribute to the Bangladesh economy.

It has been made clear that the said plan presents strong financial/economic benefits earning capacity through the projection and analyses in the previous sections. The financial rate of return of 12.4% and the economic rate of return of 27% strongly recommend the implementation of the said project.

(3) Impacts on foreign currency balance

1) Method

The degree of impact on foreign currency balance can be estimated firstly by preparing cash flow of foreign portion for each project and compare their FIRR and original FIRR.

Secondly, the Modified Buruno Ratio (MBR), well known to measure the degree of impact, will be obtained by the following formula:

$$MBR = \frac{\text{Present Value of Local Currency Expenses}}{\text{Present Value of Foreign Currency Revenue}}$$

The ratio can measure the degree of consuming one unit local currency to earn one unit foreign currency for the project. When this ratio fall below the shadow Exchange Rate, the project is proved to contribute national foreign currency balance.

2) Results

The results of calculation are presented as under:

	Slipway	Steel Expansion	Total
FIRR (%)	13.7	7.7	12.4
FIRR for foreign portion (%)	4.7	19.5	10.0
MBR	1.78	1.04	1.34

It is obvious that since the slipway project is aimed to provide facilities for trawlers and coastals with technical assistance for both seagoing and trawlers/coastals, a lower FIRR for foreign portion and Buruno ratio exceeds shadow exchange rate(SER, 1.22). On the other hand, the steel expansion project with technical assistance obtained higher FIRR for foreign portion and fall below SER and concluded to contribute national foreign currency balance.

(4) Other Benefits

1) Expansion of employment

About 780 personnels and 180 subcontracted workers are scheduled to be hired for the operation of CDD, which means that these projects will newly create about 130 personnels and 180 subcontracted workers of job opportunities. Furthermore, taking the multiplier effect into consideration, it is estimated that the implementation of projects will produce the employment creation effect which offers several times as many job opportunities as the above-mentioned number, including the related industries sectors and the service sectors.

2) Development of the related industries

It is expected that the implementation of projects will contribute to a development and progress of the domestic related industries dealing with various materials and equipment goods required for CDD to a great extent.

1-9 PROJECT IMPLEMENTATION BY STAGE (PHASE ARRANGEMENT)

In the light of realistic implementation of this project, the Optimum Plan proposed in the Study was diagnosed. It was divided into a two-phasing-plan from the view point of priority and viability.

(1) Maximum Utilization of Present Facilities (First Phase Improvement)

This stage is defined as follows:

"Maximum utilization of the existing facilities by providing required additional investment and training to make CDD financially viable."

Accordingly, the implementation of Plan "A" for ship repair and Plan "a" for steel structure shown in Section 1-4 corresponds to the first phase improvement.

The calculation results of the financial internal rate of return (FIRR) for this phase are obtained as follows: (applying the same method of the calculation as done for the Optimum Plan)

	FIRR
Ship repair	7.4 %
Steel structure	4.7 %
Total	7.2 %

(2) Optimum BMR (Second Phase Improvement)

The suggestion of the second phase is as follows:

"Optimum Balancing, Modernization and Rehabilitation (BMR) project including diversification of product lines with necessary additional investment keeping in view the financial viability and the incremental benefit of production & revenue earnings, to be undertaken in the second phase based on the evaluation of the operation and financial results of the first phase."

The implementation of the Optimum Plan shown in Section 1-6 corresponds to this stage.

2 RECOMMENDATION

2 RECOMMENDATION

For the smooth implementation and sound operation of the CDD Project, the requisite several supporting measures to be taken are recommended as follows:

(1) Capital Restructuring

The Annual Development Programme (ADP) Loan is to be converted into share capital. The debenture issued in lieu of ADP Fund can be raised by the Government by contributing share capital to the extent that the past investment amount increased due to the exchange rate fluctuation. This will reduce the interest expense and principle repayment to relief from the present financial burden.

(2) Promotion of Sales Activities

The business activities of a shipyard should be done on a scale that can secure a workload matching the capacity of its production. It is desired above all that every efforts to materialize a potential demand shall be made through direct contacts with clients. This is because these efforts make it possible for the shipyard to succeed in receiving job contracts from foreign as well as domestic customers, thus assuring the lasting patronage of the customers.

It is necessary for CDD to improve the sales activities more than ever, by not only depending on the Government's policies and waiting orders but also by contacting positively with shipowners and other customers.

(3) Introduction of Necessary Incentives

Ship repair is an industry involving vast technology of a diversified nature which is to be performed at a high quality and within the shortest possible time. Ship repair services, being of international standard, demand a high degree of skill, know-how and dedication on the part of its workforce. However, the venture of ship repair of seagoing vessels being the first of its kind in Bangladesh, there is an acute shortage of skilled manpower in this sector.

Therefore, it should be considered for the employee of CDD to give special consideration to the salary structure, benefits, incentives, etc. in order to settle skilled manpower in CDD.

(4) Easy Procedural Formalities for Procuring Materials

Due to taking much time for procurement of materials, CDD is confronted with many difficulties in controlling production schedule. Especially, as to the imported materials, much time is consumed for clearing official procedures like budgeting, bidding, customs clearing, etc. This causes CDD a great deal of disadvantages in keeping their production schedule and in responding to urgent demands of customers.

In view of this situation, it should be considered to reduce lead time for material procurement by simplifing procedural formalities.

(5) Education and Training of Engineers and Workers

With the augmentation of work volume, it becomes necessary to conduct education and training to raise the level of engineers and to improve the skill of workers, as well as to improve the yard facilities.

To meet the above, the following measures should be taken through technical cooperation with advanced shipbuilding country.

1) Dispatch of engineers and workers to advanced shipbuilding country

2) Engagement of experts from the said country

The training subject should especially include design, total management technic, mechanical and electrical work skill, etc.

Furthermore, it is worth while considering to establish an advanced technical training center for the development of ship repair, shipbuilding, and steel structural engineering, as a national policy in the long run.

(6) Employment of Subcontractors

Ship repair is called a labour intensive industry, and needs many skilled workers of various fields by trade. In addition, an enterprise exclusively for ship repair is especially liable to suffer from fluctuations in workload which are natural to the industry.

Therefore, shipyards have to take measures to meet the situation. One of the countermeasures suggested to CDD is to foster cooperative companies and to make good use of them as subcontractors.

(7) Maintenance and Repair of Facilities under Good Equipped Condition

Some of the machinery is not utilized efficiently due to a shortage of spare parts, etc. The facilities of CDD, as being worn and superannuated with years, should be maintained and repaired periodically so as to be always in good condition.

(8) Provision of General Services for Customers

It seems that general services for customers are insufficient in commercial base management at CDD. For example, provision of advertisement of CDD by brochure, something good for a souvenir, conveniences to crew during their stay in the yards like telephone service, etc. should be considered, as the foreign shipyards usually do.

(9) Policy for Ship Repair and Shipbuilding, to be Enforced by the Government

With the implementation of the proposed plan in the Study, it is recommended that the rules and regulations for ship repair and shipbuilding, which are now in process, should be revised and strengthened in the following manner.

- Import ban up to 4,000 DWT vessel
- Continuation of Duty Draw Back system
- Obligatory docking of Bangladeshi flag vessels in CDD

(10) Project Implementation

Through a series of studies and analyses, several improvement plans were proposed and the Optimum plan was selected for the future improvement of CDD. And the financial and economic evaluation on the plan were conducted. Furthermore, to achieve easy implementation of the entire project, an idea of two phases implementation by stages was studied and reported.

With the view of materializing this project at the earliest, it is considered that the project implementation by stages would be the most appropriate, considering the investment amount, the fund allocation, priority, financial viability, etc., within the framework of the national development programme.

ADDITIONAL STUDY FOR NEW SHIPBUILDING

ADDITIONAL STUDY FOR NEW SHIPBUILDING

(1) Possibility for New Shipbuilding by Utilizing Existing Drydocking Facility

The existing drydocking facility is occupied by repair ships almost in full condition as shown in Table 1-1-1. Therefore, it is quite obvious that the construction of new ships by utilizing exsisting drydocking facility will hamper the drydocking jobs for ship repair for a period of new shipbuilding.

As for ship repair and fabrication of steel structures like pontoons, some technics and experience have accumulated by work done at CDD in the past eight years. However, considering that CDD has no experience and technics in the field of new shipbuilding, it may take ten or more months to construct a hull structure of 4,000 DWT class cargo ship.

Therefore, it is actually not possible to build ships in the existing drydocking facility (Graving dock) without hampering drydockings for ship repair which are now done at the said dry dock.

Taking the fact into consideration that CDD was established to give drydocking and repairing facilities not only to the BSC fleet but also to all ships that touch Chittagong and Mongla port, it is concluded that new shipbuilding facility(another graving dock or shipbuilding berth) is indispensable to prepare a development plan for new shipbuilding at CDD.

(2) Type of Ships to be Constructed

From a view of minimum initial investment and capability of CDD, it is recommended that the construction of small sized vessels like inland water vessels and coastal vessels should be constructed at a first stage, then, gradual scale up of vessel's size should be considered in a long term plan.

However, there exists management policy of BSEC that small sized ships should not be taken by CDD because facilities for construction of this kind of ships already exist in KSY and DEW. From this point of view, CDD should start shipbuilding work with medium sized ships market where no facilities exist for this type of shipbuilding in the country.

Therefore, keeping these points in mind, the preferable type of ships to be constructed in CDD are studied as follows:

1) Classification of Ships

Based on the present fleet position and future extension programme of BSC, BIWTC and private sector, etc., kinds and types of ships to be constructed at CDD can be classified as shown in Table 1.

Table 1 Classification of Ships

Class	Kinds of Ships	Type/Size of Ships
1	Small sized ships Inland passenger ship Inland cargo vessel Inland barge Inland workboats Fishing trawler	350GT Fishing trawler Loa = 50.0 m Lpp = 45.0 m B = 8.0 m D = 5.9 m
2	Medium sized ships Coastal cargo vessel Coastal tanker Inland container vssl.	4,000DWT Cargo vessel Loa = 100.0 m Lpp = 90.0 m B = 14.3 m D = 7.7 m
3	Large sized ships Ocean going vessel	16,500DWT Cargo vessel Loa = 170 m Lpp = 160 m B = 21.6 m D = 13.0 m

2) Demand for new shipbuilding

a) Small sized ships (Class "1")

According to the fleet expansion programme of BIWTC, BIWTA, and results of forecast of required number of fishing trawlers, the expected work volume on new shipbuilding of small sized ships can be summarized as shown in Table 2.

Table 2 Demand for Small Sized Ships

Ship operator	Annual Required Number of Vessels
BIWTC	138 vsls/ 5 years = 28 vsls/year
BIWTA	23 vsls/ 5 years = 5 vsls/year
BFDC, Private	12 vsls/10 years = 1 vsl./year
Total	34 vsls/year

b) Medium sized ships(Class"2") and large sized ships(Class"3")

New shipbuilding demand for these classes can be obtained by adding the number of replaced vessels to the increase in number of fleet. Based on the present fleet position and the result of demand forecast on the vessels owned by BSC and private sectors, the new shipbuilding demand is estimated as shown in Table 3.

Table 3 Number of Required Vessels by Class

Class	Lifting share	
	30 %	40 %
2	4.9 vsls/year x 0.2 = 1.0 vsl/year	6.0 vsls/year x 0.2 = 1.2 vsls/year
3	4.9 vsls/year x 0.8 = 3.9 vsls/year	6.0 vsls/year x 0.8 = 4.8 vsls/year

As for class "2" vessels, it can be said that about one vessel per year of shipbuilding work is expected from BSC and private shipowners. In addition to this, there is expectancy of business opportunity for CDD to build such ships as various workboats, inland container vessels, etc. from the other marine authorities in the country.

(3) Shipbuilding Programme

Considering the present capability of CDD, the demand for new shipbuilding and the management policy of BSEC, the following two cases of shipbuilding programme is prepared.

Case "A" : To build class "1" and class "2" vessels alternately

Case "B" : To build class "2" vessels continuously

Fig. 1 shows the shipbuilding programme of both cases.

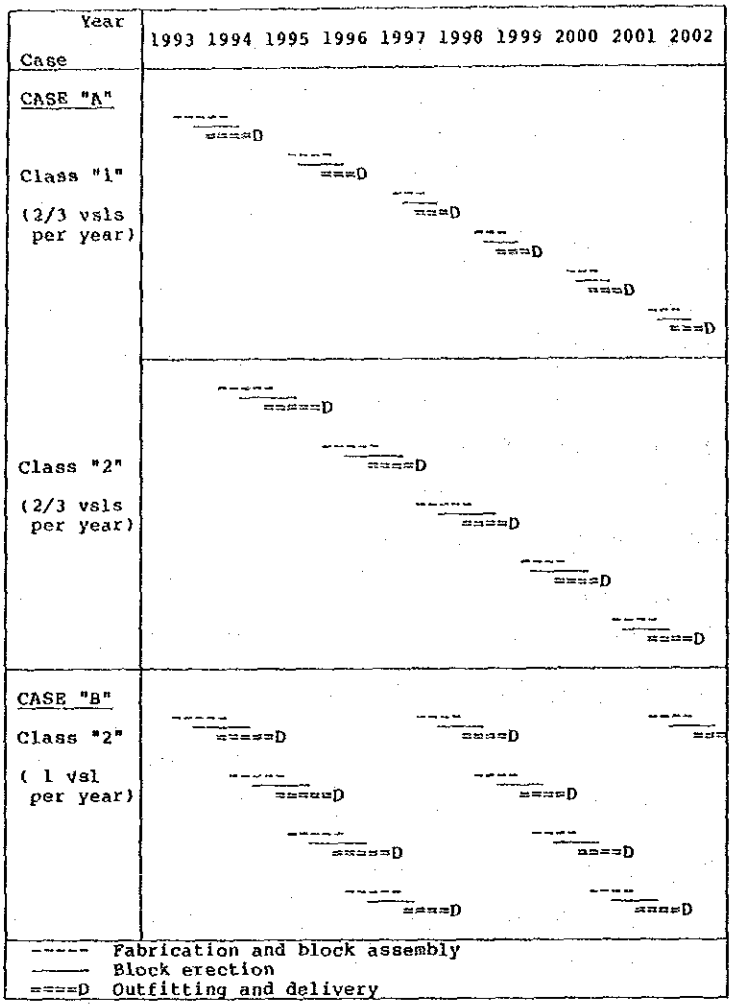


Fig. 1 Shipbuilding Programme

(4) Facility Plan for New Shipbuilding

In addition to the available existing facilities, the following are newly planned for shipbuilding work. (A slipway, which is planned as a facility for small sized ship repair, is used for a shipbuilding berth.)

- Mold loft shop
- Sand blast and paint shop
- Fabrication equipment
- Shipbuilding berth equipment
- Transport equipment
- Welding machine
- Painting machine
- Pipe fabrication machine
- Generator testing equipment
- Shafting machine
- Service utilities
- Tools and jigs
- General service facility

(5) Manpower and Training Plan

The annual working hours and manpower necessary for shipbuilding work are estimated as shown in Table 4. According to the estimation, about 350 of workers are required for the first vessel.

Table 4 Estimated Annual Working Hours and Manpower

Year	Expected improvement of productivity	Shipbuilding programme			
		Case "A"		Case "B"	
		Working hours	No. of worker	Working hours	No. of worker
1993/94	1.00	106,600	40	220,000	90
1994/95	1.00	800,000	325	880,000	355
1997/98	1.50	533,300	215	586,600	240
2002/03	2.20	363,600	150	400,000	165
2007/08	2.80	285,700	115	314,200	130
2012/13	3.00	266,000	110	293,300	120
No. of workers = Annual working hours / 2,480 hours/person					

The education and training for engineers and workers is planned as follows:

- dispatch of engineers and workers to the advanced shipbuilding country:

  22 persons x 6 months = 132 man-months

- technical assistance from the technically advanced country:

  10 experts, total 68 man-months

- cultivation of skilled workers at the domestic training center

(6) Investment Amount

The estimated investment amount for the development plan on new shipbuilding is given in Table 5.
These figures are based on values as of September, 1989.

Table 5 Estimated Investment Amount

(Unit: 1,000 taka)

Item	Local Currency Portion	Foreign Currency Portion	Total
1. Building	2,210	450	2,660
2. Service utilities	590	950	1,540
3. Machinery & equipment	18,040	32,020	50,060
4. General service facility	4,090	1,100	5,190
5. Contingencies	13500	1,740	3,090
6. Technical training	0	64,500	64,500
7. Consutant fee	0	10,500	10,500
Grand total	26,280	111,260	137,540

(7) Financial Evaluation

The results of FIRR for Case "A" and "B" are obtained as follows, applying the operating condition of CDD after the implementation of Optimum Plan and the same calculation method as for Optimum Plan.

	New Ship Building	Ship Repair	Steel Struct.	Total
Case "A"	0.5 %	8.4 %	6.0 %	5.7 %
Case "B"	5.4 %	8.4 %	6.0 %	6.8 %

(8) Suggestion for New Shipbuilding Business

To promote the development plan for new shipbuilding of CDD smoothly, various policies and measures should be taken and enforced. The desirable measures to be taken are suggested as follows:

1) Requisition on KSY and DEW for skilled shipbuilding personnel

As for ship repair and fabrication of steel structures, some technic and experience have accumulated by work done at CDD in the past. However, considering that CDD has no experience and technic in the field of new shipbuilding, it should be considered that requisite technically skilled shipbuilding personnel of KSY and DEW, operated in this field under the administration of BSEC, should be placed in CDD for shipbuilding work, when required.

2) Standardization of ships to be built in CDD

Standardization of ships makes it possible for shipbuilders to simplify their production process, due to a similar type ship effect (experience effect). This produces a good effect on shipowners by offering ships of economical price, good quality, stable performance, shorter delivery, etc.

In view of the fact, it is desirable for CDD to develop their standard type ships, in compliance with the demand of shipowners.

3) Adoption of package deal supply for shipbuilding work

As CDD is insufficient in technology and experience of shipbuilding, it is recommended that a package deal supply system should be adopted at the first stage of embarkation on a new shipbuilding business, wherein the design drawings, component parts and materials, training abroad, experts services, etc. can be supplied to CDD by a foreign supplier.