# CHAPTER VI

# DESIGN AND COST ESTIMATE OF THE PROJECT PORT

## 6.1 GENERAL

In this chapter are described the preliminary designing and cost estimate of the project port (Alt. III) whose lay-out has been already determined in the previous chapter.

## 6.2 DESINING

### 6.2.1 Design Criteria

The design criteria that has been studied in the chapter IV, is summarized as below.

(1) Natural condition

| | |
|---|---|
| Tides: | H.W.L. = M.L.L.W. + 1.0 m |
| | L.W.L. = M.L.L.W. $\pm$ 0 m |
| Currents: | a maximum of 0.44 knots (Southward) |
| Waves: | H 1/3 = 2.60 m |
| | Hmax = 2.60 x 1.3 = 4.2 m |
| Subsoil: | Clay, C = 2.2 t/m$^2$ |
| Seismic coefficient: | $k_H$ = 0.12, $K_V$ = 0 |

(2) Surcharge

| | |
|---|---|
| dead load: | 3 t/m$^3$ |
| live load: | Hopper 50 t (total weight) |
| | Truck 25 t (total weight) |

(3) Approach velocity of docking ship: 0.18 m/sec

The major dimensions required for the Project Port is tabulated as shown on

Table 32 MAJOR DIMENSIONS OF THE PROJECT PORT

| | Vessel to be accom-modated | Length/ area | Eleva-tion | Water depth | Apron width | Remark |
|---|---|---|---|---|---|---|
| Pier No.1 | 1500 DWT 1000 DWT | 53 m & 56 m | +3.0 m | -4.0 m & -4.5 m | 12 m | domestic |
| Pier No.2 | 7000 DWT | 75 m | +3.0 m | -8.5 m | 12 m | foreign |
| Approach bridge | (10~20GT fishing boat) | 24 m | +3.0 m | -2 m | 9 m | fishing |
| Revetment | - | ≒100 m | +3.0 m | ±0~-2 m | - | |
| Stockyard | - | 2900 $m^2$ | ≒+3.0 m | - | - | |
| Warehouse | - | 1500 $m^2$ | ≒+3.0 m | - | - | |
| Accses road | - | 2400 $m^2$ | - | - | - | |

6.2.2 Pier

The noteworthy points in designing the piers of barge berth and ocean-going vessel berth are summarized as below:

(1) The piles of the pier has been designed using economical concrete piles locally obtained in Mindanao, instead of steel piles.
(2) The structural dimensions of the concrete pile has been determined by seismic force rather than docking force of ships.
(3) In fendering system, the barge berth uses Apitong cluster piles, while the ocean-going vessel berth uses the separate dolphin equipped with the rubber tender.
(4) The structural dimensions of concrete slab and beam has been determined by hopper load (50 t) and truck load (25 t) respectively.

### 6.2.3 Revetment and Causeway

The water depth where the revetment is to be constructed is an average of -1.0 m. Considering the shallow water depth and subsoil condition, such structures as sheet-piled foundation, concrete block and riprap foundation can be applied to the revetment of the project port.

Taking into account the locality and cost factor, the most simple way of riprap foundation has been employed. The size of armor stone has been determined as 1 ton to cope with the design wave of 2.6 m.

The elevation of the coping has been set at +3.0 m with giving due consideration over the condition of pavement and quantity of overtopping waves.

The causeway has been designed in the form of permeable structure so as not to cause accretion or erosion in the nearby share.

### 6.2.4 Land Reclamation

The landfill materials for warehouse area is taken from on-site-born material obtained in the couse of levelling off the stockyard. A total volume of earth work is estimated at 10,000 $m^3$.

## 6.3 CONSTRUCTION PLAN

### 6.3.1 Major Construction Materials

The preliminary designing has been carried out and the major construction materials are tabulated below.

| Quantity of Construction Work | [Phase I] | [Phase II] |
|---|---|---|
| Concrete pile 45 cm x 45 cm | 125 nos (V-99, B-26) | 116 nos (V-91, B-25) |
| Cast-in situ concrete | 240 $m^3$ | 270 $m^3$ |
| Dredging | 2,100 $m^3$ | 200 $m^3$ |
| Rip-rap rock | 1,600 $m^3$ | - |
| Landcut | 5,500 $m^3$ | - |
| Landfill | 4,800 $m^3$ | - |

### 6.3.2 Construction Method

The major construction methods of the project port are summarized below.

(1) Preparatory work

Prior to the actual construction, such preparatory work as the installation of power, water, communication system and housing facilities shall be initiated.

The site office is to be located in the open space 50 m east of the stockyard. The communication system will be installed between EAC factory and site.

(2) Landreclamation and revetment

The landreclamation work is preceded by rip-rap work of revetment. The rip-rap rock can be obtained from the upper stream of the Iligan River which flows east of the

Iligan city. According to the Public Works information, the quantity can be assured for revetment of the project port.

In rip-rap work, the rubble stone is first placed in the mound portion and later covered by 1 ton class armor stone by use of onshore heavy crane. On completion of the revetment, the landfill material will be filled.

(3) Piling work

Cement and steel reinforcing bar can be procured from the nearby factory in Iligan city. Using these materials, the concrete pile will be fabricated in the workshop near the site. The concrete pile will be transported by trailler-truck up to the tip of the existing old pier at Punta Silum, and loaded onto the barge. The piling work will be carried out with a pile-driving barge equipped with DELMAG D22 class hammer.

The number of piles to be driven is 125 in phase I and 116 in phase II. Assuming that the pile is driven 2.5 nos a day, it will take 50 or 46 days for phase I or II.

(4) Slab work

On completion of piling work, such works will be followed, setting supports, placing forms and fabricating reinforcement bars. The concrete casting work will be carried out one block by one block using the carts. A series of slab work mentioned above can be performed approximately by 1 month a block, requiring a total of 4 months for phase I or for phase II.

(5) Access road

Between the proposed port and the existing National Highway, there is 5 to 10 m wide unmaintenanced earth road. This road will be replaced by straight short cut perpendicular to the National Highway. The subbase material can be obtained from Iligan River and surface will be concrete paved.

(6) Ancillary works

The ancillary works consist of installing mooring facilities, navigation aids and lighting facilities.

## 6.4 CONSTRUCTION TIME SCHEDULE

The construction time schedule can be developed as shown in Fig 22, 23.

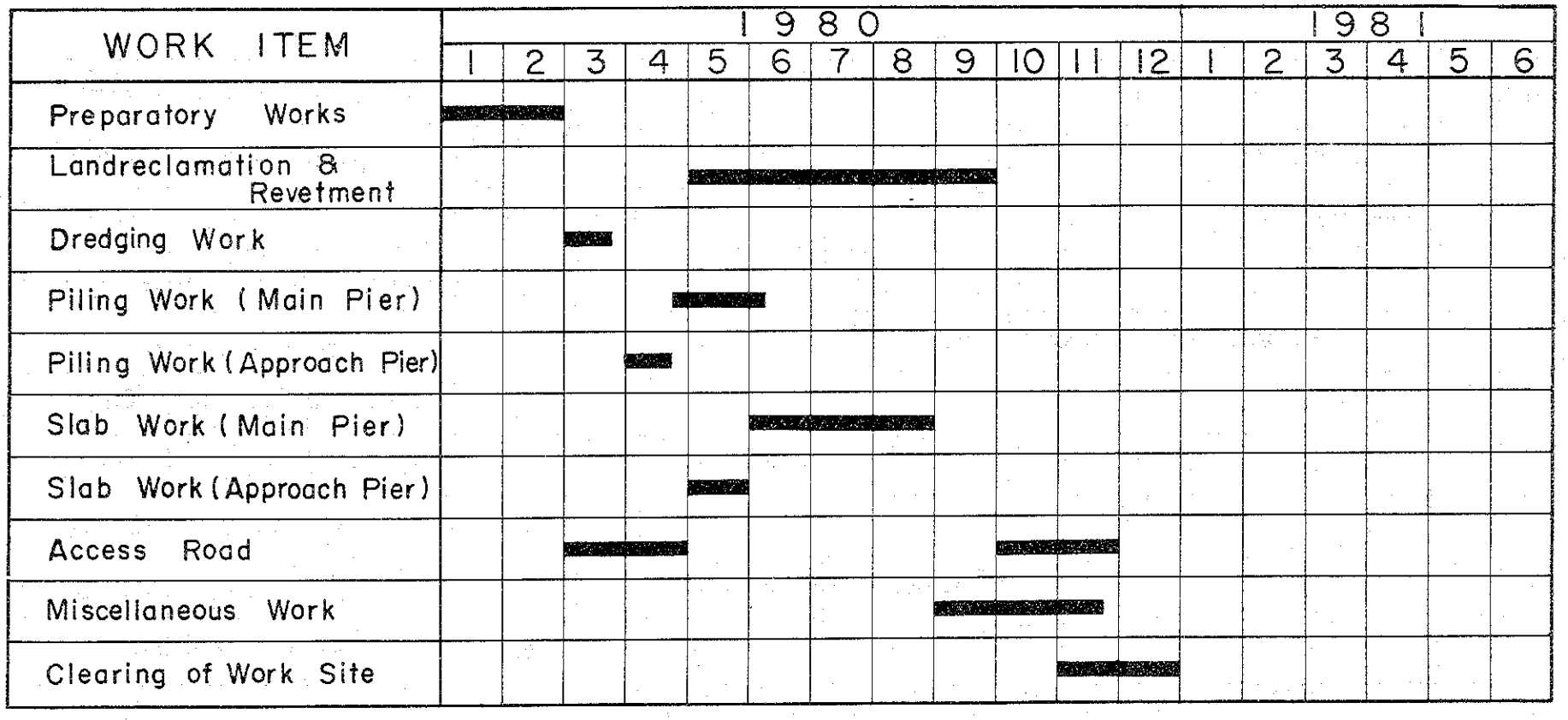


Fig. 22 Construction Schedule (Phase I)

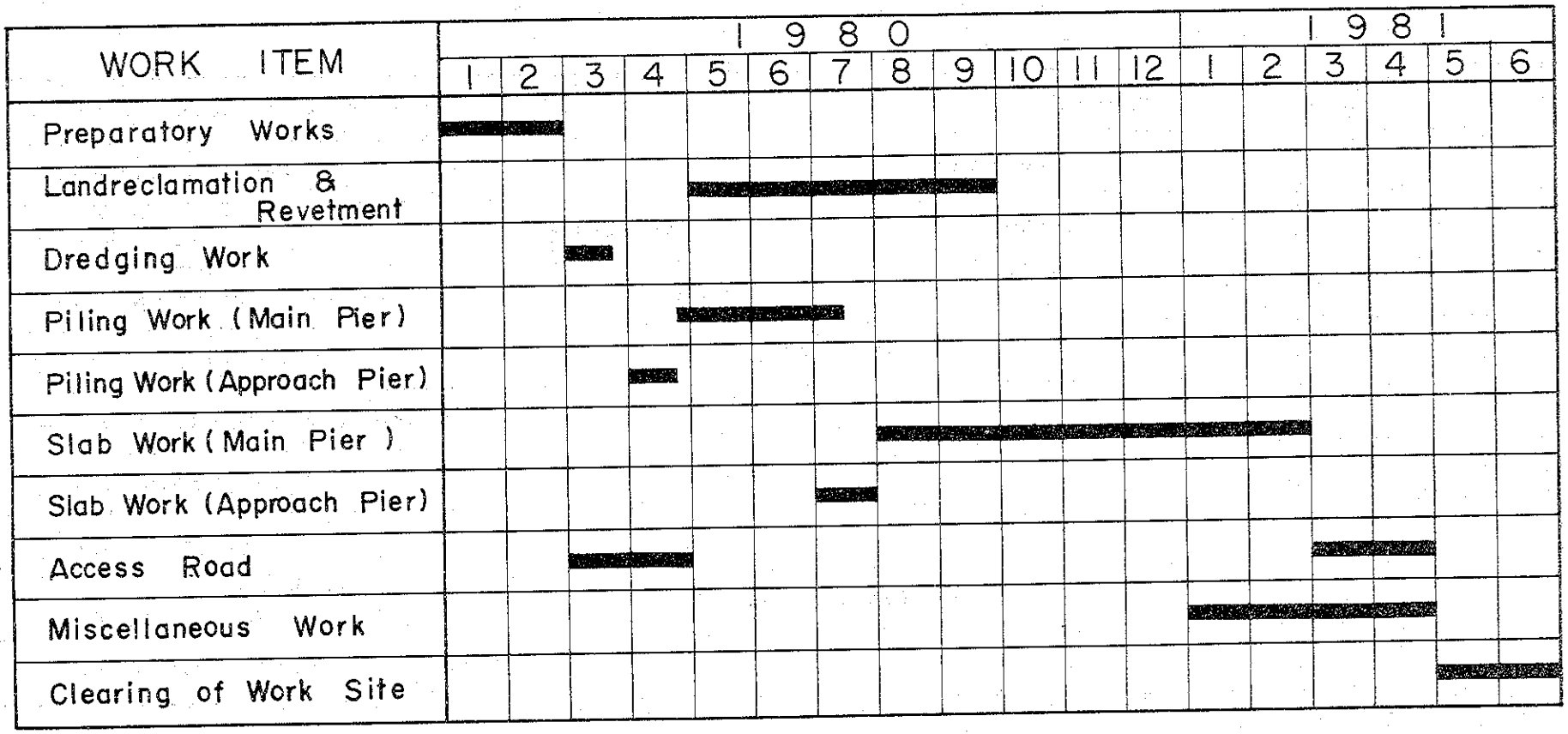


Fig. 23 Construction Schedule (Phase I + II)

## 6.5 CONSTRUCTION COST AND OPERATION & MAINTENANCE COST

### 6.5.1 Construction Cost

Most of the construction cost has been estimated on the basis of the pricing information obtained from the Public Works of Iligan city that is supervising construction work in the project area. Supplementary cost data has been obtained from the staff working in the EAC factory. Major construction crafts such as pile driving barge and dredging barge will be mobilized from Cebu Port. The concrete pile will be fabricated near the proposed port site. In addition to the direct construction cost, administration fee, consulting fee and contingency has been considered for project cost.

Table 33 CONSTRUCTION COST

(unit:x1000 pesos)

| | Phase I | Phase II |
|---|---|---|
| i) Main Pier | 2,410 | 3,531 |
| Piling work | 1,304 | 1,661 |
| Slab & beam work | 783 | 945 |
| Dredging work | 28 | 3 |
| Ancillary work | 51 | 730 |
| Mooring piles | 244 | 192 |
| ii) Access Pier | 436 | |
| Piling work | 369 | |
| Slab & beam work | 39 | |
| Ancillary work | 4 | |
| Mooring piles | 24 | |
| iii) Landreclamation with revetment | 309 | - |
| iv) Landcut | 503 | - |
| v) Others | 400 | 190 |
| Subtotal | 4,058 | 3,721 |
| Administration fee | 1,014 | 930 |
| Consulting fee | 761 | 698 |
| Contingency | 875 | 802 |
| Total | 6,708 | 6,151 |

### 6.5.2 Operation and Maintenance Cost

The project cost consists of the construction cost and operation & maintenance cost.

Assuming that annual operation & maintenance cost (OM cost) is a total of 2% of the direct construction cost, the OM cost can be calculated as follows:

| | |
|---|---|
| Phase I | ..... 134,000 pesos. |
| Phase I + II | ..... 257,000 pesos. |

# CHAPTER VII

# ECONOMIC EVALUATION

## 7.1 GENERAL

The economic evaluation on the project has been carried out to examine the economic feasibility of the investment to the project port construction. This evaluation results from the comparison between project cost and project benefit. In practice, the evaluation can be done through checking the factor of internal rate of return (I.R.R.). Here in this report the benefit-cost ratio of the project has been also calculated at the most commonly used discount rate of 8%. The benefit accruing from the project are classified into public benefit and EAC-oriented benefit.

(A) EAC-oriented-benefit

i) transportation cost saving of EAC-related-goods.

(B) Public-oriented-benefit

i) transportation cost saving of the goods related to the factories surrounding EAC factory. (EAC SURROUNDING FACTORY)

ii) benefit generated when local consumer goods and agricultural products are handled through the pier.

iii) benefit derived through usage of the pier by fishing boats.

iv) port income to Manticao municipal.

v) other indirect benefit.

The factories surrounding EAC factory are run by Philippine's capital, so that the benefit for these factories are considered as public-oriented-one. Of the above benefits, the transportation cost saving of A (i) and B (i) can be tangible benefits. Other benefits B (ii - v) are small in volume and difficult to be measured monetarily. Here in this report, these intangible benefit though roughly described, has not been included in the calculation of net benefit, B/C or I.R.R.

The amount of cargoes to be handled through the project port has been assumed as follows on each factory.

Ferro Chemical Corp.

All the raw materials and products which are being loaded/unloaded through the Iligan port.

Mindanao Steel Corp.

All the products which are being loaded/unloaded through the Iligan port.

Refractory Corporation of Philippines

Major raw materials and all the products which are being loaded/unloaded through the Iligan port.

Note: in phase I, the above amount is restricted to the capacity of the pier and barges.

The benefit of EAC-SURROUNDING-FACTORY can be calculated in the same procedure as applied in the EAC factory.

Meanwhile, the port income to Manticao municipal, which has not to be considered in the economic study, has been tentatively figured out to grasp a total amount of income. In calculation of I.R.R. the construction period has been assumed as 1 year for pahse I and 1.5 years for phase II. The project life has been set at 20 years, same as the durable years of project port facilities. The annual benefit and cost has been capitalized to the year of 1980 and summed up to obtain total present values of benefit and cost at the year of 1980. In the calculation, discount rate is assumed at 8%.

## 7.2 PROJECT BENEFIT

### 7.2.1 EAC-oriented-benefit

The EAC factory-related-goods are offloaded/loaded in the Iligan port and transported by truck through the distance of 22.5 km. In case that the project port is established at Punta Silum, the EAC-related-commodities will be loaded/unloaded at the project pier, and the existing transportation distance of 22.5 km between the Iligan port and the EAC factory will be shorted to 2.5 km. This reduction in transportation distnace leads to the saving of the transportation cost. The unit transportation cost by ton-km is, in the project area, 1.7 pesos/ton/km. By use of this unit cost, shortened distance and amount of commodities to be transported, the benefit can be calculated out as follows.

| | |
|---|---|
| Phase I ..... | 1,018,000 pesos/year |
| Phase II ..... | 1,878,000 pesos/year |

### 7.2.2 Public-oriented-benefit

(1) Transportation cost saving of EAC-SURROUNDING-FACTORY

The EAC-SURROUNDING-FACTORY can be benefited in the same manner as applied in EAC factory. The EAC-SURROUNDING-FACTORY has been restricted to the three factory that are located near the project port and are not provided with their private piers. They are Refractory Corporation of Philippines factory (9.5 km away from EAC), Mindanao Steel Corp. (6.0 km away) and Ferro-chemical Corp. (3 km away)

Table 34 TRANSPORT BENEFIT OF EAC-SURROUNDING-FACTORY

(Unit: pesos/year)

| Phase | I | I + II |
|---|---|---|
| Ferro chemical | - | 752,760 |
| Mindanao steel | 344,760 | 367,200 |
| R.C.P. | 152,405 | 215,050 |
| Total | 497,165 | 1,335,010 |

(2) Benefit derived through the use of the pier when handling agricultural and local consumer goods

The coconut plantation is extending along the national highway between the Iligan port and Cagayan de Oro port.

Most of the copra are processed in the nearby processing plant like GRANEX, ILICOCO and shipped through their private piers. Into these two coconut oil plant huge amount of copra are being gathered from the northern Mindanao and Visayas area. Some part of them are shipped in the form of non-processed condition due to low capacity of the coconut plant.

The Philippine Coconut Authority envisages to put up a new plant in Gitagum between Manticao and Cagayan de Ore city. If this factory were put up near the project port site, this factory can make use of the project pier.

In the area between Cagayan de Oro and Iligan city the agricultural production of corn and rice are relatively low, so that the project port will not be used so frequently to ship such crops. At present, the provincial staff envisages to promote irrigation project. On completion of this project transportation of the agricultural products is expected to increase, justifying the project port.

Among the rich forest in the project area the southern east zone is logged in small volume by only one company.

For handling logs and timber is required spacious area larger than required for the project port. If desired by the logging company, the space east of the old demolished pier can be allocated for that purpose.

As stated above, the project port will be used effectively for handling agricultural and consumer goods.

Due to difficulty of quantification, agricultural benefit has been omitted in calculation of economic evaluation.

(3) Benefit derived through usage of the pier by fishing boats

According to the statistics of the Misamis Oriental province, the fish production in the area of Manticao was 11,620 ton in 1976. Most of the fish are directly transported by sea to the Cagayan de Oro city, and partly delivered back to the project site in the form of the processed products. Speaking the occupation in the project site, 27 - 57% of the workers are engaged in the fishing sector.

Most of the fishing boats called "Banca" are small canoes with outriggers on both sides.

Most of the fish has been captured by comparatively large vessels of 10 - 20 ton class rather than by the above small boats. However in Manticao, there is no piers available for these large fishing boat.

The plan of the project port includes the piers exclusively to be used for fishing boats, so that 20 tons class boats can be berthed. If some cold storage and berth are provided near the pier, this port will be upgraded to a fishing port.

The plan of the vocational school for operating cold storage has been envisioned in Libertad municipal and Naawan municipal.

These fishing-related benefit has also been omitted in calculation of the project benefit on account of poor quantifiability.

(4) Port income to Manticao municipal

It is expected that on completion of the project port, the ownership will be handed over to Manticao municipal, though the port is administered by the Port Authority.

In this case, Manticao municipal can impose tariff on the goods to be handled through the project pier. In Philippine, the tariff in the private pier is an average of 0.25 pesos/ton. This tariff has been applied for figuring out the annual port income of Manticao town.

Table 35 PORT INCOME

(unit: pesos/year)

| | Phase I | Phase I+II |
|---|---|---|
| EAC | 7,300 | 13,475 |
| Ferro Chemical | - | 5,400 |
| Mindanao Steel | 4,225 | 4,500 |
| R.C.P | 4,075 | 5,750 |
| Total | 15,600 | 29,125 |

(5) Other indirect benefits

At present, the materials and products of EAC factory are handled through the public pier in the Iligan port. The raw materials, piled temporarily in the platform causes dust pollusion and traffic obstruction. If these EAC-related vessels are shifted to the project port, above problems will be removed and yield some additional berthing space.

Besides, the project port development will bring about the following indirect tangible and intangible benefits.

- increase the work opportunity of the regional people
- increase the income of regional people
- generate undulating effect on capital flow

These indirect benefits has also been deleted in calculation of the project benefit.

## 7.3 PROJECT COST

In the chapter VI, the project cost has been estimated in the form of construction capital cost and OM cost.

(unit: 1000 pesos)

| | Phase I | Phase I+II |
|---|---|---|
| Construction cost | 6,710 | 12,860 |
| Maintenance and operation cost | 134 | 257 |

The destribution of the construction cost has been assumed as below.

(unit: 1000 pesos)

| Phase | Phase I | Phase I+II |
|---|---|---|
| 1980 | 6,710 | 8,570 |
| 1981 | - | 4,290 |

## 7.4 BENEFIT COST RATIO (B/C) AND INTERNAL RATE OF RETURN (I.R.R.)

The project benefit and cost has been described in 7.2 & 7.3. The annual cost and benefit can be assumed as follows on the premise that project life is 20 years and the begining year of the project is 1980.

Table 36 ANNUAL DISTRIBUTION OF BENEFIT AND COST

(unit: pesos)

| | | Construction cost | | Operation & Maintenance | | Benefit | |
|---|---|---|---|---|---|---|---|
| | | Phase I | Phase I+II | Phase I | Phase I+II | Phase I | Phase I+II |
| 0 | 1980 | 6,710,000 | 8,570,000 | | | | |
| 1 | 81 | | 4,290,000 | | | | |
| 2 | 82 | | | 134,000 | 257,000 | 1,514,785 | 3,213,425 |
| 3 | 83 | | | " | " | " | " |
| 4 | 84 | | | " | " | " | " |
| 5 | 85 | | | " | " | " | " |
| 6 | 86 | | | " | " | " | " |
| 7 | 87 | | | " | " | " | " |
| 8 | 88 | | | " | " | " | " |
| 9 | 89 | | | " | " | " | " |
| 10 | 90 | | | " | " | " | " |
| 11 | 91 | | | " | " | " | " |
| 12 | 92 | | | " | " | " | " |
| 13 | 93 | | | " | " | " | " |
| 14 | 94 | | | " | " | " | " |
| 15 | 95 | | | " | " | " | " |
| 16 | 96 | | | " | " | " | " |
| 17 | 97 | | | " | " | " | " |
| 18 | 98 | | | " | " | " | " |
| 19 | 99 | | | " | " | " | " |
| 20 | 2000 | | | " | " | " | " |
| 21 | 2001 | | | " | " | " | " |

Table 37 BENEFIT COST RATIO

| | (C) Total cost ($x10^3$) | | (B) Total Benefit ($x10^3$) | | B/C | |
|---|---|---|---|---|---|---|
| | Phase I | Phase I+II | Phase I | Phase I+II | Phase I | Phase I+II |
| 5% | 8,220 | 15,620 | 17,120 | 36,320 | 2.08 | 2.33 |
| 8% | 7,840 | 14,780 | 12,750 | 27,047 | 1.63 | 1.83 |
| 10% | 7,650 | 14,380 | 10,660 | 22,610 | 1.39 | 1.57 |
| 15% | 7,340 | 13,660 | 7,170 | 15,210 | 0.98 | 1.11 |

As shown on table 37, the figure of I.R.R. that has been calculated using only EAC-related-benefit (without-public-benefit) shows 9.2% in phase I and 8.9% in phase I + II. On the other hand, in case of using both public benefit and private benefit (with-public-benefit), I.R.R. has been increased to 12.6% and 15.2% for phase I and phase I + II.

Meanwhile, the benefit cost ratio has been calculated. In case of without-public-benefit, E/C is 1.09 and 1.07, while in case of with-public-benefit, B/C is upgraded to 1.37 and 1.67 in phase I and Phase II respectively.

Therefore, it can be said that this project is marginally feasible even in case that the project port is used exclusively for EAC factory, but in case that the project port is used as both private and public piers, this project is more feasible.

# CHAPTER VIII

# CONCLUSION AND RECOMMENDATION

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# CONCLUSION AND RECOMMENDATION

As stated in the previous chapter, Punta Silum site has been selected for the project port. This project port will be used by EAC factory, neighboring other three factories and regional community. The cargo of EAC factory and other three factories are in volume 50,000 tons and 47,000 tons per year respectively. To cater for these cargoes, a barge berth for 1,000 DWT calss and an ocean-going vessel berth for 5,000 DWT class will be constructed.

The economic evaluation has been made on the basis of benefit of transportation cost saving and construction plus OM cost. As a result, I.R.R. of 8.9% has been calculated in case of taking care of only EAC-related cargo flow, while 15.2% has been calculated in case of taking care of EAC and other public-oriented-cargo flows as well.

Besides transportation benefits, a variety of direct & indirect or tangible & intangible public benefits will come about in the field of agriculture, fishing, forest and overall regional development.

Therefore this port project is worthy of proceeding at the earliest convenient time.

Lastly, as understood by the results of B/C ratio, it is recommended that this project is completed in one pack without being split into phase I and II.

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