VII. SPECIFICATIONS OF THE GRAIN TERMINAL FACILITIES IN CEBU

7.1 Outline

7.1.1 Foreword

The proposed grain terminal will be designed on the basis of the most advanced technology in respective branches of engineering with due consideration given to the geographical conditions of the site and the operational performance, safety, reliability and economy of the system.

7.1.2 Location

The terminal will be constructed on the land of about two hectares in area facing the wharf at the northeastern end of the Port of Cebu.

7.1.3 Outline

Bulk grain will be unloaded from the interisland vessel alongside the wharf by a pneumatic unloader with a capacity of 150 tons per hour and fixed on the wharf. Then the grain will be carried on a chain conveyer to the silo tower. After rough cleaning and weighing in the silo tower, the grain will be transported by the bucket elevator and the chain conveyer to the silo bins (12,276 tons in capacity) for storage. While stored in the silo bins, the grain will have its temperature adjusted and cooled, aerated, and fumigated, if necessary.

The stored grain will be discharged from the silo bins by two lines of chain conveyers (capacity: 60 tons/hour each) and bucket elevators, and after weighing, part of the grain will be loaded onto trucks and the rest packed in 50 kg bags for storage in the warehouse. Still another portion of the grain will be sent to the storage bins of the corn mill. In the corn mill, the corn will be taken out of the two bins (each having a capacity of 100 tons) and by going through cleaning, milling, separation and other processes, it will be transformed into grits (processing capacity of 4 tons/hour per unit of corn).

Corn grits and bran will be bagged and stored in the warehouse. Delivery of these corn products will be made by hand.

The terminal will include silo bins, a silo tower, a corn mill, a warehouse, an administration building, other buildings, foundations of the structures, an unloading equipment, intake equipment, discharging equipment, a corn mill, dust collecting equipment, automatic sampling equipment, electrical equipment, grain temperature measuring instruments, test equipment and accessory facilities.

7.2 Capacity

7.2.1 Basis of capacity

The principal grain to be handled by the grain terminal is corn. Each capacity of the equipment is measured in terms of corn.

7.2.2 Storage capacity of the silo

The silo will consist of 10 round bins, each with a storage capacity of 1,138 tons, and four interstice bins, each with a capacity of 224 tons, for a total of 12,276 tons (practical capacity of 10,000 tons).

7.2.3 Unloading capacity

An unloader with a capacity of 150 tons/hour (max. 165 tons/hour) will be installed. The maximum size of vessels considered for the design purposes is 5,000 DWT. (The vessels must have a moulded depth smaller than the depth of water of about 7.4 M alongside the wharf.)

7.2.4 Intake capacity

A chain conveyer with a capacity of 150 tons/hour (max. 165 tons/hour) will be used for transporting bulk corn from the wharf to the silo.

7.2.5 Discharging capacity

Two lines of chain conveyers, each with a capacity of 60 tons/hour (max. 66 tons/hour), will be used for discharging bulk corn from the silo bins. It is assumed that the corn can be loaded in bulk onto trucks.

7.2.6 Bagging capacity

Some portion of the bulk corn will be bagged in 50 kg bags and the bagging capacity is assumed to be 40 tons/hour.

7.2.7 Corn processing capacity

For two storage bins, each with a capacity of 100 tons of corn grain, the milling capacity is assumed to be 4 tons/hour. All corn grits and bran will be bagged.

7.2.8 Storage capacity of the warehouse (corn and its products in bags)

The warehouse excluding the passages will have a maximum capacity of 1,550 tons, which is broken down into 500 tons of corn, 830 tons of grits and 220 tons of bran. The practical storage capacity is 930 tons at a stacking efficiency of 60%.

7.3 Specifications of the Structures

7.3.1 Geological conditions

The proposed site is well prepared for the construction by land fill. A strip of Recent Alluvial soil runs along the shoreline and sedimentary to terraqeous formations of the Diluvial to the Tertiary Poliocene form terraces and hills extending to the mountain district. Deposits of the periods preceding the Tertiary Miocene to the Cretaceous are exposed conspicuously in the central mountainous area. (See Drawing Plate No. 3.)

Two penetration tests carried out at the site revealed the following geological features of the site: Very soft clay to clayey silt with N values of 0 to 2 according to standard penetration test reach down to about 9 M below the ground level. The first 4 to 5 meters of the upper part of the layers consist of silty clay to sandy soil-presumably filled-up layers - under which lies alluvial clayey soil. Below the depth of 9 M lie Diluvial to Tertiary formations consisting primarily of alternate layers of hard yellowish brown half-consolidated and highly plastic clay and silt.

As can be seen from the results of the geological investigation, the stratification of Boreholes No. 1 and No. 2 are greatly varied, but evidently the layers are a series of deposits formed in substantially the same geological era. The Diluvial to the Tertiary foundations show N values ranging from 15 to 100. Normally, N values grow with increasing depth. However, the layers at Borehole No. 1 show rather smaller N values in general than those at Borehole No. 2.

The lower stratum which will bear the proposed structures shows a constant N value of 30. Usually, the Diluvial to the Tertiary formations provide a good foundation ground for medium and higher buildings. Therefore the piles should reach a depth of 17 M.

7.3.2 Silo bins

The silo bin is a permanent structure of reinforced concrete having earthquake-proof, fire-proof, watertight, heat-insulated and damp-proof characteristics. The silo bins will consist of 10 round bins with an inside diameter of 8.3 M, wall thickness of 0.25 M and height of 37 M arranged in two rows of 5 bins, and 4 interstice bins between them. A space is provided for additional construction of two rows of round bins. The silo bins will be supported on 250 steel pipe piles (with a diameter of 508.15 mm and length of 17 M) driven into the bearing stratum.

7.3.3 Shed on silo bins

A shed will be built as an extension of the upper part of the silo bins. It is to be designed as a rigid frame structure of reinforced concrete with a width of 10.5 M, length of 43.9 M and floor area of 460.95 M^2.

7.3.4 Silo tower

The silo tower to be constructed at the front of the silo bins will also be a rigid frame structure of reinforced concrete with 10 floors having a total floor area of 1,680.48 M^2. It will be equipped with an elevator with a capacity of 6 persons and will also have a central control room, a power room, a control center room, a laboratory, an unloader machine room, etc.

7.3.5 Storage bin for the corn mill

Two steel-shelled storage bins, each with a capacity of 100 tons, will be built. Each bin will be 3.4 M in inside diameter and 20 M in height. No shed will be provided for the storage bins.

7.3.6 Corn mill

The corn mill to be built adjacent to the warehouse will be of reinforced concrete construction partly with four floor and partly with two floors.

The mill will be 8 M in width, and 25 M in length. Its height will be 15.5 M for the four-story section and 11.5 M for the two-story section.

7.3.7 Warehouse

The warehouse will be a one-story lightweight steel frame structure with a floor area of 720 M^2. It will have a roof of large-corrugated slates, walls of small-corrugated slates and a 20 cm-thick reinforced concrete floor.

The entrance will be covered with a pent roof jutting out 10 M to permit cargo handling in all kinds of weather. The warehouse will have a resting room for workers and be equipped with a ventilation system.

7.3.8 Administration building

The administration building will be a one-story reinforced concrete structure with a floor area of 375 M^2 and consist of an office, a drawing room, a conference room, a locker room, a hot-water service room, lavatories, shower rooms, a dining room and a kitchen.

7.3.9 Work shop

The work shop will be a one-story steel-frame structure with a floor area of 50 M^2. The roof will be of large-corrugated slates, the walls of small-corrugated slates and the floor of concrete 10 cm in thickness.

7.3.10 Guard house

The guard house will be a one-story reinforced concrete structure with a floor space of 16 M^2 and will consist of a checkup room, a resting room and lavatories.

7.3.11 Exterior works and accessory facilities

The premises will be enclosed with steel net fences. The entrance and exit gates will be provided with steel sliding gates, the access roads paved with concrete, and the areas adjoining the buildings and sturctures rodded and planted with trees, water pipes and drain pipes will be embedded in the ground of the premises.

Other necessary facilities of the grain terminal will include parking, outdoor fire hydrant, outdoor lighting and lightning rods.

7.4 Specifications of Mechanical Equipment

7.4.1 Unloading equipment

(1) Reasons for selection of pneumatic unloader

As can be seen from the table of comparison in 4.4.1(1) (Table 4-1), the pneumatic unloader has advantages over the mechanical unloader in terms of operational performance, emptying efficiency, size and type of interisland vessels (max. 5,000 DWT) and other relevant factors.

This is the primary reason for the adoption of pneumatic unloaders for the project.

(2) Specifications

The size of vessels considered in designing the pneumatic unloader is max. 5,000 DWT. Since the vessels are free to move alongside the wharf, the pneumatic unloaders will be of fixed type, and a 2-nozzle system will be introduced to improve the operational efficiency. The horizontal and vertical pipes will be telescopic.

The unloader will suck up bulk grain from the vessel and discharge it onto the intake chain conveyor.

The number to be installed is one and the unloader capacity will be 150 tons/hour (max. 165 tons/hour).

7.4.2 Intake equipment

Bulk grain, when discharged from the unloader, will be carried on the chain conveyor to the silo tower.

After being carried up by bucket elevators in the silo tower, the grain will be roughly cleaned by the rubble separator and, after passing the surge bin, will be weighed by an intake hopper scale with a capacity of 2 tons per batch. The hopper scale enables the intake volume to be weighed.

After weighing, the grain will be transported by the bucket elevator and chain conveyor, and discharged into the silo bins by way of the remote-controlled slide gate and 2-way chute valve.

The capacity of the intake equipment is 150 tons/hour (max. 165 tons/hour).

7.4.3 Discharging equipment

Bulk grain stored in the silo bins will be discharged through the slide gate under the bins and carried on the chain conveyors under the silo bins then by bucket elevators through the surge bin to the discharge hopper scale (capacity of 500 kg/batch) for weighing. The hopper scale will enable the discharge quantity for each line to be weighed.

After weighing, the grain will be channeled into one of four flows by the four-way distributors.

One flow will be loaded onto trucks by 2 lines, one a direct chute to the truck, the other through chain conveyor.

A second flow will be transported to the surge bins for bagging (capacity: two units of 20 tons each).

A third flow will be carried by chain conveyor and bucket elevator to the two storage bins for the corn mill (capacity: 2 units of 100 tons each).

A fourth flow will be discharged into the intake bucket elevator to return to the silo bins.

The capacity of the discharging equipment (2 lines) is 60 tons/hour (max. 66 tons/hour).

7.4.4 Silo bin rotation equipment

This equipment is used to empty the grain out of a silo bin into another.

When discharged from a silo bin by the discharging equipment, the grain will be channeled into rotation flow by the 4-way distributor under the hopper scale and will then be carried by the intake bucket elevator and chain conveyor to another silo bin.

The silo bin rotation equipment will have a capacity of 60 tons/hour (max. 66 tons/hour), and will depend on the discharge capacity of the silo. A part of the intake equipment is used for silo bin rotation, since the rotation equipment will have a low frequency of use. The rotation equipment will be used only when grain is not being received into the silo bins. It is also employed to return the grain in the surge bins above the discharge hopper scale to the silo bins.

7.4.5 Bagging equipment

Bulk grain will be packed in bags by four bagging machines under the two bagging surge bins, each with a 20-ton capacity. The bags will then be sewed up by a sewing machine while travelling on a special conveyor. After that they will be carried on a belt conveyor to the warehouse for stacking.

The combined capacity of the four bagging machines is 40 tons/hour.

7.4.6 Dust collecting equipment

The dust collecting equipment is provided to prevent accumulation of dust and to maintain sanitary environment. Prevention of dust explosion is another purpose of providing this equipment.

This equipment draws in dust with a turbo fan, and after filtering off the dust from the air, the dust is collected, while the air is discharged outdoor.

Dust collecting equipment consists of one unit for the intake equipment, two for the discharging equipmnet and one for the bagging equipment.

7.4.7 Fumigation

Phostoxin tablets will be used for fumigation of the silo bins. The tablets will be injected among the grain in the bin by means of an injector and after sealing the bin tightly, they are fumigated.

The manholes, chutes and gates attached to the top and bottom of the silo bins, and other necessary parts will be of such construction as can be made airtight.

7.4.8 Automatic sampling equipment

This equipment is capable of automatic sampling of the grain for laboratory analysis of its quality.

It extracts automatically samples from the grain on the rubble separator of the intake equipment at given time intervals and sends a small amount of the samples divided by the sample divider to the laboratory. The remaining portion of the divided samples will be sent back to the intake bucket elevator.

7.4.9 Test equipment

The test equipment measures and tests the quality, foreign matter, water content, etc. of the grain taken into the terminal.

This equipment includes an automatic moisture tester, laboratory grain scale, trip balance scale, grain sampler and dockage tester, etc.

7.4.10 Grain temperature measuring instruments

The grain temperature measuring instruments consists of temperature measuring resistors provided in all the silo bins, and a recorder mounted on the instrument panel in the central control room which gives direct reading and typing out of the temperature record of the grain.

Three temperature measuring resistors will be installed at the upper, middle and lower parts of each bin. High temperature of the grain is an indication that it is damaged by high moisture content, insects, etc. If the grain temperature is high, the grain must be discharged from the bin or moved to other bins, or cooled and aerated.

7.4.11 Cooling and aerating equipment

In case of a temperature rise of the grain stored in the silo bin, the cooling and aerating equipment blows cold air into the bins to prevent damage to the grain.

This equipment comprises a refrigerator, heat exchanger, fan and piping. The equipment will be provided for the round bins only. It is not needed for the interstice bins, since their smaller capacity makes it easy to move contents to other bins or discharge them.

7.4.12 Corn mill equipment

After discharge from the silo bin, bulk corn will be stored in two storage bins, each having a 100-ton capacity which corresponds to two days' stock. When the corn has been discharged from the storage bins it will be weighed by a hopper scale with a capacity of 50 kg/batch. The total amount weighed is the quantity to be received by the corn mill.

After weighing, the corn is separated from foreign matter through the grain separator and then humidified and sent to the tempering bin. After tempering, the corn is steamed, cleaned of its iron contents by a magnetic separator and then treated by the degerminator.

After being dried on a conveyor fitted with a steam jacket, the corn is classified by the sifter.

When each stock has been classified by the sifter, it is reclassified by the aspirator or table gravity separator and then rough-milled by the brake roll. The rough-milled stock will be classified once again by the sifter and then refined by the aspirator according to the stock size.

Finally, the reduction roll and the sifter work together to produce grits of required sizes.

The finished grits are classified into grits #8, #10, #12, #14, #16 and corn flour according to the size. The products will then be sent to their respective surge bins for bagging.

All grain, stocks and finished products in the mill, except for a portion of them, are carried by the pneumatic conveyor system.

The hulls, germs, bran, etc. separated during the cleaning and milling processes will be dried on a conveyor fitted with a steam jacket, crushed by the hammer mill and then sent to the surge bin for corn meal bagging. Germs can be extracted separately.

All products and by products will be packed in bags, weighed and then sewed up. After that they will be transported by the belt conveyor to the warehouse for stacking.

A steam boiler with an evaporative capacity of 2 tons/hour and an oil storage tank with a capacity of 8 kℓ will be installed as accessory equipment of the corn mill.

The milling capacity of the corn mill is 4 tons/hour. Assuming 24-hour operation per day, the daily production amounts to 96 tons and the monthly output about 2,000 tons.

7.5 Specifications of Electrical Equipment

7.5.1 Power supply

For the grain terminal facilities, it is planned to supply power from the power cable of the Visayan Electric Company (VECO). During September, 1977, however, the National Power Corporation (NPC) will built up a diesel power station (capacity: 65 MW) in a reclaimed land in Naga. When this new power station is completed by the time, power to the grain terminal facilities will be supplied from this Naga Power Station.

The power cable will be branched at Point "A" in the South of San Jose Dela Montana Street (see Annex 7-5), and thus, power will be supplied to the grain terminal facilities.

This power supply will be 13.8 kV, 3-phase, 3-wire, 60 Hz. At present, power failure occurs for a couple hours almost every day. When power is supplied from the above mentioned NPC, it will not be necessary to take power failure problem into consideration.

7.5.2 Power receiving/transforming method

The 13.8 kV, 3-phase, 3-wire 60 Hz power supplied by VECO in a single channel will be received at a pole within the premises of the grain terminal. Thereafter, the received 13.8 kV will be transformed to 440 V for motors, and for lighting, this 440 V will be further transformed to 220 V as shown in the skeleton diagram (see Drawing Plate No. 52).

Further, for power-factor improvement, a power condenser will be installed so that power-factor can be regulated in response to load conditions.

The power required for the plant will be as indicated below:

Equipment	Power Demand	
	Phase I	Phase II
(1) Pneumatic unloader	260 kW	
(2) Power equipment for silo	230 kW	50 kW

Equipment	Power Demand	
	Phase I	Phase II
(3) Corn mill	430 kW	
(4) Miscellaneous power facilities (Maintenance equipment, etc.)	100 kW	
(5) Lighting and outlet	50 kW	10 kW
Total	1,070 kW	60 kW

As for the equipment for this power receiving/transforming equipment, the power transforming equipment and control equipment will be installed respectively on the first and second floors. As for an emergency power supply, a diesel engine power generator will be installed so that the minimum lighting and various important loads required in securing the facilities can be operated.

7.5.3 Silo control system

It is suitable to employ a computer system for the silo control generally when (1) Capacity of the silo is more than about 100,000 tons, (2) Quantities handled are extremely large and stock control is very difficult, and (3) Number of types of items handled is very large. For the grain terminal, the cost of a computer system is too high, and there is no reason for employment of such an expensive system. Thus, a central remote control system will be employed.

The overall silo operations will be controlled from the control room on the first floor of the silo tower, and it will be so constructed that all the necessary controls can be done with the central operation panel installed in this control room.

To be a little more specific, operations such as an intake from a interisland vessel to the silo, various deliveries and rotations will be remotely controlled.

Moreover, the central operation panel will be equipped with a graphic panel on its face so that operating conditions, status of the system, occurrence of a trouble, etc. can be monitored and interlocking operations can be controlled on the table. (See Drawing Plate No. 54 and 55.)

As for the operating system, both individual and interlocking devices can be performed. The term "individual operation" refers to the operation of a machine controlled by the switches installed beside the machine at the time of test running or restoring from a trouble.

The term "interlocking operation" refers a totally sequential operation including various block operations such as intake, discharge, delivery and each rotation by the individual processes controlled at the central operation panel.

7.5.4 Corn mill control system

The overall corn mill operations will be controlled from the control room on the second floor of the corn mill, and it will be so constructed that all the necessary controls can be done at the central operation panel installed in this control room. To be specific, when raw corn is sent into the corn mill, the sequential operations started from the conveying equipment in the corn mill to the bagging process through cleaning, selecting and milling processes will be remotely controlled from the control room. The central operation panel will be equipped with a graphic panel of its face so that the overall operating conditions of the corn mill, status of the system, occurrence of trouble, etc. can be monitored.

As for the operating system, both individual and interlocking can be performed in the same manner as silo.

The term "individual operation" denotes the operation of a machine controlled by the switches installed beside the machine at the time of test running or restoring from a trouble. The term "interlocking operation" denotes a totally sequential operation including various block operations by the individual processes controlled at the central operation panel.

7.5.5 Wiring work

Wiring will consist of cable pit, conduit pipe, cable rack and duct, and it will be so executed that the equipment in the grain terminal will fully display their performances and functions.

7.5.6 Lighting equipment

Lighting equipment will be of a illuminance required in performing work and operations at the electric room, control room, machine room, administration building and road. For the lighting, fluorescent lamps, mercury arc lamps and incandescent lamps will be used, and necessary places will be equipped with outlet. (See Annex 7-4.)

7.5.7 Internal communication equipment

The communication equipment will be of such a type that mutual inter/intra premises communications can be accomplished simply for the terminal operations. It will also be provided with functions for general calling, mutual communication and generation of emergency signals.

The communication equipment will include a loudspeaker unit to be used for the announcement of time, calling a truck driver, overall premises calling or announcement, etc.

7.5.8 Air conditioning equipment

The air conditioning equipment will be suited for the electric room, control room and administration building so that the plant operations and the office work can be smoothly accomplished.

7.6 Layout of the Propsoed Site (See Drawing Plate No. 41.)

The proposed site covers an area of approximately 2 hectares facing the wharf at the northeastern end of the port of Cebu.

The pneumatic unloader will be installed on the southeastern part of the wharf, outside of the premises. A road will be constructed on the southeastern side of the premises to permit the passage of delivery trucks. The silo tower and the silo bins will be built along the northeastern part of the wharf. To the southwest of the silo will be located the corn mill and beyond that the warehouse. A pent roof will be provided for three entrance of the warehouse to permit cargo handling in all kinds of weather. A roadway will be built around the silo and the warehouse for passage of delivery trucks. The main gate of the grain terminal will be provided almost in the middle of the northwestern side of the premises, and the administration building will be located nearby, just southwest of the main gate.

7.7 Extension Plan (Operational at the beginning of 1990)

7.7.1 Silo bins

Additional four round bins and two interstice bins with a storage capacity of 5,000 tons will be constructed. The total storage capacity of the silo bins will be 17,276 tons. The shed on the silo bins will also be extended.

7.7.2 Others

To cope with the proposed extension of the bins, the intake chain conveyor above the silo bins and the discharge chain conveyor under the silo bins will be extended. Additional grain temperature measuring instruments will be provided and the pipes of the cooling and aerating equipment will be extended to permit ventilation of the additional round bins.

No other additions are planned.

7.8 Cost Estimate for Construction

7.8.1 Cost estimate

Based on the available data on the site conditions, a tentative cost estimate of the proposed grain terminal including the corn mill has been prepared.

The total cost of the Step I construction with a capacity of 12,276 tons is estimated at ₱44,045,000, which includes engineering consulting fee. Of this amount, ₱20,156,000, or 45.8% of the total, represents the foreign currency portion and the remaining P23,889,000 or 54.2%, local currency portion. The cost of the additional consturction with a capacity of 5,000 tons planned for periods before 1990 is estimated at P5,044,000, of which the foreign currency accounts for 11.2% and the local currency 88.8%.

Breakdown of the cost estimate is shown on the Table 7-1.

7.8.2 Estimate conditions

The basic preconditions of the cost estimate are enumerated as follows.

(1) All prices are based on the prices as of the end of 1976. Contingency is equal to 10% of the total cost for both the foreign and local currency portions.

(2) It is assumed that all imported equipment and materials are to be supplied from Japan, and that they will be exempted from import duties.

(3) Cost of roadways, water supply and drainage outside of the premises are not included in the cost estimate.

(4) Engineering consulting fee varies with the scope and the types of services involved. However, under this project, it has been calculated as follows.

i) As for the civil engineering, 5.0% of the cost for the local currency of the construction cost in the following table, items (A) to (G) and (L) is accounted for the engineering consulting fee, divided into costs for the local currency, items (N) and (P).

ii) As for the mechanical and electrical equipment, 5.4% of the total of the cost for foreign currency of the construction cost in the following table, items (A) to (N) and the cost for local currency items (H) to (K) is accounted for the engineering consulting fee.

(5) As for the classification of estimate in foreign or local currencies for the cost of equipment of the project, they are, as a rule, estimated in local currency for the civil part and in foreign currency for the electrical and mechanical equipment, further taking the contraband items etc. into consideration.

7.9 Implementation of the Project (See Drawing Plate No. 70.)

An engineering consultant and a contractor must be selected for the construction of the project.

(1) The first step is to select a general engineering consultant of foreign nationality (local consultant will be engaged for the civil engineering work) to provide a set of services, including detail design, preparation of the construction plan, selection of the contractor, construction supervision and technical guidance on test running of the completed terminal facilities.

The consultant must, therefore, be well qualified and experienced in the relevant branch of engineering.

(2) With the assistance of the consultant, well experienced and competent foreign contractors will be invited to bid for the construction works and the selection of the contractor must be made after a careful analysis of the technical level and experience of the bidders and their bid prices.

The construction of the project requires a minimum period of 27 months as shown below.

(1) From initiation of engineering consulting services to completion of tender documents .... 6 months

(2) From opening of bids to selection of contractor and conclusion of a contract .... 4 months

(3) From start of construction to its completion ......15 months

(4) Test running .... 2 months

Table 7-1 Cost Estimate of Cebu Grain Terminal Project

Cost Item	Step I Construction		Step II Construction	
	Local Currency (₱)	Foreign Currency (₱)	Local Currency (₱)	Foreign Currency (₱)
A Silo	11,955,000	250,000	3,673,000	
B Corn mill	1,116,000	47,000		
C Warehouse	1,084,000			
D Administration building	1,007,000			
E Guard house	34,000			
F Work shop	83,000			
G Boiler room	45,000	6,000		
H Mechanical equipment of silo	1,467,000	8,019,000	93,000	250,000
I Electrical equipment of silo	923,000	1,929,000	125,000	167,000
J Mechanical equipment of corn mill	730,000	3,566,000		
K Electrical equipment of corn mill	653,000	1,507,000		
L Accessory facilities	1,833,000	108,000	15,000	

Cost Item	Step I Construction		Step II Construction	
	Local Currency (₱)	Foreign Currency (₱)	Local Currency (₱)	Foreign Currency (₱)
M Spare parts		400,000		
N Design and supervision services	80,000	1,458,000		63,000
Sub total	21,010,000	17,290,000	3,906,000	480,000
O Contingency	2,101,000	1,729,000	391,000	48,000
P Engineering consulting fee	778,000	1,137,000	184,000	35,000
Total of Items A to O	23,111,000	19,019,000	4,297,000	528,000
Total of Items A to P	23,889,000	20,156,000	4,481,000	563,000
Grand total	44,045,000		5,044,000	

VIII. FINANCIAL AND ECONOMIC ANALYSES OF THE GRAIN TERMINAL IN CEBU

8.1 Introduction

This analysis covers the period of thirty years from 1978 based on the durable years for tax purposes of the comparable facilities in the Philippines and Japan and also its economic life estimated by the technical study.

The durable years are assumed to be 50 and 20 years for the building and the machinery respectively.

The aspect of loan, which is to be provided for the total amount of the construction cost of grain terminal, has been excluded from the report as there still exist number of uncertain or flexible factors.

All the price quotation in this report has been made for the project based on the price as of December, 1976.

8.2 Financial Analysis

8.2.1 Revenues

Total revenues for the period of thirty years:

Handling charge	₱ 32 million
Storage charge	₱ 93 million
Grits processing charge	₱ 74 million
Total	₱199 million

The basis of calculation is shown in the Annex 6-10 and 6-15.

8.2.2 Expenditures

Total expenditures for the period of thirty years.

	Local currency	Foreign currency	Total
Construction cost	₱ 28 million	₱ 21 million	₱ 49 million
Personnel expense	11 million	-	11 million
Maintenance and replacement	12 million	9 million	21 million
Electricity	29 million	-	29 million
Fuel	8 million	-	8 million
Insurance	8 million	-	8 million
Miscellaneous	4 million	-	4 million
Total	₱100 million	₱ 30 million	₱130 million

8.2.3 Net cash flow

The cash flow is shown in the Annex 8-1, which indicates the net cash flow of ₱68 million and it gives surpluses from 1992 onward.

8.2.4 Internal rate of return

Internal rate of return is 6.8 percent. (cf. Annex 8-2)

8.2.5 Sensitivity analysis

Sensitivity analysis has been made on the grits processing charge, unloaded volume of commercial corn and construction cost which may substantially influence the evaluation, and the result htereof shows the internal rate of returns as below:

(1) In case of an incerase of grits processing charge by 10 percent to become 121 per metric ton, with other conditions kept unchanged. 7.4%

(2) In case of an increase of grits processing charge by 20 percent to become 132 per metric ton, with other conditions kept unchanged.	7.9%
(3) In case of a two-fold increase of unloaded volume of commercial corn (24,000 T in the first year (1982) with an annual increase of 5%), with other conditions kept unchanged.	7.3%
(4) In case of a five-fold increase of unloaded volume of commercial corn (60,000 T in the first year (1982) with an annual increase of 5%), with other conditions kept unchanged.	8.7%
(5) In case of an increase of construction cost by 10 percent, with other conditions kept unchanged.	6.1%

8.3 Economic Evaluation

8.3.1 Economic benefits

With its national aim to ensure a stable supply of grain and steady price maintenance, this project can be given quantitative economic benefits as follows. (cf. Annex 8-5)

Total amount to be attained over the whole period.

Reduction in spillage	₱ 13 million
Saving of cargo handling at port	₱ 23 million
Reduction in spoilage	₱ 30 million
Saving of warehouse operation	₱ 5 million
Saving of inland transportation	₱ 12 million
Saving of transportation by direct connection with mills	₱ 4 million
Increase of added value by milling	₱134 million
Enforcement of storing capacities	₱ 16 million
Total	₱237 million

8.3.2 Economic costs

The following items of costs can be taken into account. (cf. Annex 8-4)

Construction cost	₱ 49 million
Personnel expense	₱ 11 million
Maintenance and replacement	₱ 21 million
Electricity	₱ 20 million
Fuel	₱ 8 million
Insurance	₱ 9 million
Land-rent	₱ 2 million
Miscellaneous	₱ 4 million
Total	₱124 million

8.3.3 Net cash flow

The net cash flow is to be ₱113 million as shown in the Annex 8-2.

8.3.4 Internal rate of return

As is shown in the Annex 8-3, IRR is estimated to stand at 11.1 percent. It will obviously contribute to an enhancement of social welfare by attaining stable grain supply and price maintenance to provide one of the latest facilities of terminal silo in this port area and to procure and maintain large volume of buffer sotck therein. Further, this terminal will leads to streamlining of grain distribution in the domestic market. With these intangible benefits then into consideration, the project can prove itself feasible from the economic point of view.