4. Management and operation

4.1 Concept of management and operation

In order to implement the proposed projects in the Short-term plan (including Urgent measures), not only adequate port planning but also the establishment of an effective port management and operation system is required. In principle, the very important matters for port management and operation are ensuring efficient utilization of the port facilities and providing reliable services at reasonable charges. In this chapter, problems in the present system of port management and operation have been examined, and management and operation system for the Short-term plan has been drafted.

The following items are very important for adequate port management and operation in the stage of the Short-term plan.

1) Selection of management and operation body for new container terminal
2) Strengthening of port management body
   (Introduction and reinforcement of new or existing section)
3) Finance system (for sound finance of port management body)
4) Establishment of effective maintenance system
5) Training system and reinforcement of personnel policy
6) Improvement of statistic system and introduction of port promotion

4.1.1 Management and operation body of new container terminal

Two methods are considered for the construction and management system of the container terminal. One method is for the terminal to be developed and operated by Sihanoukville Port. The other is for the terminal to be developed by Sihanoukville Port and operated by private sectors (Lease a quay or grant license to use the port).

At present, containerization in Cambodia is in the early stages. Semi container ships or small full container ships operated by various shipping companies call on Sihanoukville Port. This kind of container terminal should be open for public use. Also private companies with sufficiently skilled personnel and know-how of operation have been not well reared in Cambodia.

From such points of view, it is recommended that the new container terminal should be constructed, managed and operated by Sihanoukville Port in the stage of the Short-term plan. Therefore Sihanoukville Port should obtain know-how of container terminal operation and should newly introduce container terminal division to operate container terminal efficiently and effectively.

4.1.2 Strengthening of port management body
(Introduction and reinforcement of new or existing section)

As mentioned in the Long-term improvement plan, following sections should be introduced or reinforced in the stage of the Short-term plan.

1) Container terminal operating division
2) Port planning section
3) Port management and operation strategy section
4) Port promoting section
5) Port statistic section

These division or sections are mentioned in chapter 4.3.

4.1.3 Finance system

A port administrative body's finance should be sound in order to maintain and upgrade port facilities. And a suitable form and structure for port management is autonomy. This means the finance of the port has to be separated from that of the nation. The port's finance has to balance costs and revenues and this balance should be retained while renewing port facilities, and paying back loans with interest. To attain this, adequate administrative scheme must be carefully considered to get sufficient funds for managing, operating and maintenance.

Sihanoukville Port is financially independent from the Central Government. However it is important that Sihanoukville Port should make Ministry of Public Works and Transport and other related organs recognize the necessity of not only the project but also continuous budget and internal finance resources (contribution cutbacks) showing the port development plan and estimated financial statements in order to ensure a sufficient budget for the project.

At Sihanoukville Port, the present salary/wage system is based on cargo handling volume (A commission of 20 per sent is given on handling revenue.). This is an effective means to raise the efficiency of port activities and to raise the low base salary. Hereafter according to changes in handling system (gantry crane), productivity of cargo handling will be rapidly raised and cargo handling revenue will be also increased. However if Sihanoukville Port continues to adopt this system, the financial situation of the port management body will worsen. This is because the increased revenues are a result of mechanical measures and should be allotted for renewal investment costs and maintenance cost of new facilities. Thus Sihanoukville Port needs to reexamine the salary/wage system (for example: fixing wages at a standard level, etc.).

4.1.4 Establishment of effective maintenance system

Maintenance work is required for not only ensuring safety to port users but also for extending the service life of facilities. In particular, as the container terminal is highly mechanized, problems with cargo equipment have a direct influence on the terminal operation. For example, problems with gantry crane can stop the flow of container operation and make the docking time of container ships longer. Container terminal operation is brought to a half.

Maintenance work on the structures can be divided into two categories, namely the routine maintenance and the urgent rehabilitation. While the former consists of preventive measures in which required cost is minor, the latter consists of corrective measures against large scale damage in which required cost is large. In general, if preventive maintenance is appropriately performed, the required cost for corrective maintenance works will be minimized.

In order to perform effective maintenance, the following measures are considered.

1) To prepare a list of facilities together with possible damage.
2) To carry out monitoring of the present usage and damage inspection periodically.
3) Maintaining a sufficient supply of all spare parts.

4.1.5 Training system and reinforcement of personnel policy

(1) Training for operation of the new container terminal

Gantry cranes (2 sets) and transfer cranes (6sets) are proposed in the Short-term plan. The new container terminal will be really operated by Sihanoukville Port. In order to correspond to drastic change of cargo handling system (from ship's gear or mobile crane to gantry crane and transfer crane), Sihanoukville Port should post capable operation staffs and operators in the operation department until 2003.

The following training courses are necessary to foster capable operation staffs and operators.

1) Training for container terminal operation staffs
2) Training for gantry crane and transfer crane operators

Several staffs and operators could be sent to foreign ports to acquire knowledge or skill based on the latest management and operation or cargo handling techniques. They should pass on their knowledge or skill to other staffs or operators. On the other hand, specialists could be invited from abroad. Because field training is very useful for skill acquisition, the invitation of technical supporting specialists or engineers makes it possible to accelerate technology transfer.

(2) Training for executing the projects

In the Short-term plan (including Urgent measures), projects include land reclamation, expansion or improvement berth, pavement of container yard, manufacturing and setting of gantry cranes and so on. These projects are planned to start from 1998. In order to control design and construction work of the projects, Sihanoukville Port should have a section in charge of these works. However, Sihanoukville Port does not have enough capable technical staffs.

In this connection, Sihanoukville Port should rear capable technical staffs by the beginning of the project, 1998. The following training courses are recommended.

1) Training for port planning

The purpose of this training is to rear capable technical staffs who understand how to plan the port facilities and are able to alter the port planning when unexpected problems arise.

Not many staffs are required for port planning, so the following training should be considered.

- Send selected staffs to domestic or foreign technical school or related organ.
- Invite specialists for a long term (specialists should be assigned to port planning section which is recommended in this study to assist in on-the job training.

2) Training for design, construction and maintenance work

The purpose of this training is to rear capable technical staffs who have knowledge of design, construction and maintenance work in order to supervise the design and construction of the projects and maintenance of existing and new port facilities.

Sihanoukville Port will have many port facilities and equipment and many staffs for civil, mechanical and electrical work will be required. The following training is considered.

- Invite part-time instructor from domestic technical school or foreign experts for long term instructor.

(3) Human resources development

For human resource development, it is recommended to dispatch high level administration staff to advanced foreign ports whose administrative work is very efficient. After returning home, they can share their knowledge with other members of the administration section. The important thing is that visiting foreign ports would be the motivation to increase work efficiency.

Furthermore, in order to make personnel conscious of rational and efficient management,

it is recommended that Sihanoukville Port should introduce measures for activation of the organization such as Quality Control (QC) circle and proposal activities system in the Short-term plan.

(4) Training of computer operation

Computers can be used efficiently to perform work that is currently done manually in the administration section. Therefore it is desirable that all the staff members of administrative section are able to operate computers. As several personal computers have been recently introduced, practical training on personal computers using application software such as word processor, calculation format and drawing processor should be strengthened.

4.2 Cargo handling system

4.2.1 Improvement plan in 2005

(1) Cargo handling system

At present, in Sihanoukville Port, almost all of the unloaded cargoes are directly delivered to consignee and only valuable and perishable cargoes are stored in the transit sheds in the port, therefore, the overall cargo handling rate is rather low. In order to increase the cargo handling rate for the target year of 2005, it is necessary to consider the present cargo handling system including the effective use of the transit sheds and open yards and to examine the storage of cargoes in the transit sheds depending on the nature and kind of cargo, and also to designate the utilization of the transit sheds and the open yards per kind of cargo. Also, in order to ensure the effective use of the transit sheds and the open yards, the cargo should be stacked in tiers when possible with proper and sufficient wooden dunnage, and the stacking of cargo should be done in a block per kind and lot of cargo with proper clearance between piles thereby facilitating cargo handling at the time of delivery.

Generally, there is a traditional cargo handling system at every port. Cargo handling systems are also diversified, according to packing style, handling volume and nature of cargo, and type, kind and size of carrying vessel and method of storage in port and the type, size and capacity of the cargo handling equipment and facilities such as cranes, forklifts, etc. According to the demand forecast for the target year of 2005, the future cargo handling system in Sihanoukville Port is proposed with regard to the following vessel types, considering the present cargo handling system and cargo flow within the port.

General cargo vessel	- Laden with various kinds of cargoes
	- Laden with one kind of commodity
	- Rice , Sugar, Cement, and Fertilizer (bagged)
	- Wood products
	- Steel products
Tanker	- Bitumen
Container vessel	

a. General cargo vessel

The unloading and loading of cargoes from/to vessels in the port are generally carried out using ship's crane/gear and mobile crane. The packaging of general cargoes is tending conspicuously towards unitization, such as palletization and containerization, enlargement, and the

unit weight per package is becoming heavier. Nevertheless it is difficult to select the most advisable equipment for general cargo vessels because besides the unitized cargoes, various kinds, types and sizes of general cargoes are co-stowed in the vessel's hold. Following these trends, the lifting capacity of ship's cranes/gear has become larger and the number of vessels having cranes with lifting capacities between 10-15 tons is increasing in the world's maritime fleets. Heavy cargoes exceeding this range are generally handled by means of mobile cranes.

1) General cargo vessel laden with various kinds of cargoes

In order to achieve smooth unloading and loading from/into vessels, the proper type and capacity of handling tools, such as sling, spreader, etc., and forklifts should be chosen and separately used per kind, type and weight of cargoes, especially, top-loader should be prepared for unloading container onto chassis.

2) General cargo vessel laden with one kind of commodity

- Rice, sugar, cement, and fertilizer (bagged)

At present, almost all bagged cargoes such as rice, sugar and etc. are directly delivered from the port by trucks as they are. Given the nature of such cargo, this handling system is considered to be unavoidable. In order to raise the cargo handling rate, the handling system for bagged cargoes needs some reformation throughout the port, e.g. introduction of palletization and/or provision of storage facilities within the port.

- Wood products

Wood products are usually bundled in cubes fit for forklift handling as the handling throughout the port is mainly carried out by forklifts. This cargo is kept in the transit sheds and open yards of the port in accordance with the nature and packing of the cargo, and requires the transit shed and open yards for smooth handling and storage.

- Steel products

There are many kinds of steel products and many types of packaging for international trade. These cargoes, except for high quality goods, are kept in transit shed and open yards in the port, and require a wide apron and wide open yards for smooth handling and storage given the type of cargo packaging. In addition, the handling of these goods is very difficult because they are lengthy and/or heavy and in order to ensure quick handling and prevent damage at all stages of port traffic, it is necessary that the equipment and handling tools are properly chosen and used.

The handling equipment such as forklifts, mobile cranes, etc., will be arranged step-by-step along with increase in the cargo handling volume in the future.

b. Tanker (Bitumen)

Unloading bitumen is handled at berth Nos. 5 and 6 with the existing shore pipe lines running to storage tanks in the port area by private companies (the same as at present) for the target year 2005.

c. Container vessel

Container is handled at the new container berth for the target year 2005, which is equipped with gantry cranes and planned with the transfer crane system for the container terminal. Regarding the commencement of a full-scaled container handling system, it is recommended by the study team that a new container terminal should be established in order to conduct effective operation for future container traffic.

The following points would be advisable from the viewpoint of the container handling system so as to realize this recommendation;

- establishing communications between related offices
- establishing the terminal operation

1) Establishing communications

Regarding the general concept of the container terminal, it is basically designed on the assumption that various functions of the terminal such as the gate, the yard operation and the loading/unloading operations would function systematically as a whole. In order to implement the functions above, it is necessary to stress the importance of the smooth information-exchange among the functions concerned. Reliable communications will enable confirmation of the fulfillment of each office's responsibility during container handling operation and to compensate for each other's weak point.

2) Establishing the terminal operation

Establishing the terminal operation would be advisable in order to realize the following points;

- employing experienced staff and youthful terminal operators, and
- introducing container terminal computer systems.

At Sihanoukville Port, the container handling operation is managed by inventory card and computer-based container terminal operation has not yet started. Therefore, the port should introduce a computerized container operation system, and experienced staff and youthful terminal operators should be employed to establish the unification and flexibility of planning. Since it will be difficult to quickly introduce a full scale computer system, it will thus be necessary to start with a small scale computer system for the target year of 2005, which has the following functions:

- Promoting the stacking plan.
- Determining container storage positions.
- Determining re-handling when unloading containers.
- Promoting the shift plan in the yard.
- Promoting the sequence plan of ship loading/discharging.
- Controlling the yard map.

However, the development of a small scale computer system should take into consideration the possibility of extending components of the system for further development.

(2) Cargo handling capacity

According to the proposed cargo handling system, it is necessary to estimate the cargo handling productivity by commodities. Therefore, the cargo handling productivity by commodities per hour per gang is calculated as shown in Table - 4.2.1-1.

Table - 4.2.1-1 Estimation of cargo handling productivity

Cargo	Equipment	Precondition			Productivity
		ton/unit	efficiency	cycles/hr	ton/hr/gan
General Cargo	Ship's gear	1.5	0.70	13.3	14.0
Bagged Cargo Fertilizer Cement Rice Sugar	Ship's gear	1.5	0.75	13.8	15.5
Machinery	Ship's gear /Crane	1.5	0.70	20.0	20.3
Steel product	Ship's gear /Crane	2.0	0.80	15.3	24.5
Wood product	Ship's gear	2.0	0.75	14.5	21.8
Bitumen	Ship's pump	100.0	0.90	1.0	90.0
Container (TEU)	Gantry crane	1.0	0.80	24.0	19.2
Container (TEU)	Ship's gear /Crane	1.0	0.70	10.0	7.0

4.2.2 Cargo handling and storage facilities

(1) General cargo handling

According to the demand forecast for the target year of 2005, the volumes of general cargoes through the transit shed and open storage yard area are estimated as shown in Table - 4.2.2-1.

Table - 4.2.2-1   Volume of cargoes passing through transit shed and open storage yard in 2005

Commodities	Volume of Cargo (tons)	Direct Cargo (tons)	(tons)		
			Open Storage	Transit Shed	Sub-total
General Cargoes	92,817	46,409	13,923	32,486	46,409
Rice	63,700	31,850		31,850	31,850
Sugar	92,800	46,400		46,400	46,400
Cement	207,700	103,850		103,850	103,850
Fertilizer	95,000	47,500		47,500	47,500
Machinery	46,400	23,200	23,200		23,200
Steel Products	72,200	36,100	36,100		36,100
Wood Products	32,800	16,400	3,280	13,120	16,400
Total	703,417	351,709	76,503	275,206	351,709

a. Transit shed and open storage yard

The result of calculation for the required size of the transit shed and open storage yard is shown in the following table.

Table - 4.2.2-2   Required size of the transit shed and open storage yard

Volume of Cargo Handled (N) (tons)		Annual Storage Volume R x a x W (tons/m²)			Required Area (N x P / R x a x W) /B (m²)
(Transit Shed)					
General Cargoes	32,486	122	0.5	2.5	369
Rice	31,850	122	0.5	2.5	362
Sugar	46,400	122	0.5	2.5	527
Cement	103,850	122	0.5	2.5	1,180
Fertilizer	47,500	122	0.5	2.5	540
Wood Products	13120	37	0.5	1.2	1,024
Total	275,206				4,003
(Open Storage)					
General Cargoes	13,923	122	0.5	2.5	158
Machinery	23,200	24	0.5	2.0	1,676
Steel Products	36,100	24	0.5	2.0	2,607
Wood Products	3,280	37	0.5	1.2	256
Total	76,503				4,697

b. Port traffic facilities

An access road and inner port road connecting to the national road are proposed for the smooth distribution of port traffic generated at the wharves.

1) Traffic volume forecast

Table - 4.2.2-3 shows the result of calculation of generated traffic volume by wharf. Daily port generated traffic volume is 1,500 cars.

Table - 4.2.2-3 Generated traffic volume in 2015

Type	Cargo Volume (ton)	Cargo weight of loaded (ton/car)	Hourly generated traffic volume (car/hour)
Genral Cargo	92,817	8.0	15
Rice	63,700	8.0	10
Sugar	92,800	8.0	15
Steel products	72,200	8.0	11
Wood product	32,800	8.0	5
Machinery	46,400	1.45	40
Fertilizer	95,000	8.0	15
Cement	207,700	8.0	32
Bitumen	59,000	8.0	9
Total	762,417		152

2) Size of parking lot

The maximum number of vehicles is mentioned below, and the area of the parking lot is calculated as follows:

$$A: 30 \times 152 \times 0.8 \times 1.0 = 3,700 \text{ m}^2$$

(2) Container handling

a. Container yard

The required storage number of container is calculated by the same formula as mentioned in the master plan and premises for calculation are as follows:

- Dwelling time in container yard (CY) and container freight station (CFS)

At present, in spite of the free storage periods (7 days) and a lot of valuable cargoes, the average dwelling time of imported container is 6.2 days.   As this is rather longer compared with other ports (Lazier Cardenas, Mexico: 5 days, Colombo, Sri Lanka: 6 days), many of the shipping agents are sometimes dissatisfied with the port, therefore, this figure is assumed to be reduced to 6 days for 2005.

Exported container is assumed to stay for 3 days.   The present average dwelling time of empty containers is 8.4 days, and will be assumed to be reduced to 7 days.   Reefer containers (or refrigerated containers) are assumed to be 5 days.   The dwelling time in the CFS is set at 5.6 days.

- Stacking height of containers

Import/export containers, excluding loaded reefers, could be stacked at three layers height in the container yard.   However, operationally, it is desirable to stack 2.5 high on an average basis.   Therefore import container is set at 2.5, however, export container is set at 3.0.   The stacking height of reefers is set at 2.0, while that of empty containers is set at 4.0.

The results of the calculation are shown in Table - 4.2.2-4.

Table - 4.2.2-4   Required storage capacity in container yard

| Target Year 2015 | Unit | Laden Container | | | Empty | |
		Import	Export	Reefer	Container	Total
Annual Container Throughput (My)	TEUs	76,500	28,100	1,500	49,200	155,300
Average Dwelling Days	Days	6.0	3.0	5.0	7.0	
Required Storage Number (MI)	TEUs	1,808	332	30	1,357	3,527
Average Stacking Height	Layers	2.5	3.0	2.0	4.0	
Required Ground Slots	Slots	723	111	15	339	1,188

b. Container freight station (CFS)

The required area for the CFS is calculated as follows:

$$CFS: (32,800 \times 5.6 \times 1.3)/ (1.3 \times 0.5 \times 330) = 1,100 \text{ m}^2$$

The required capacity of CFS is 1,100 m^2, the total warehouse area still has enough capacity in the port, thus warehouse No.I is used as CFS for the target year of 2005.

c. Other facilities

1) Gate

The required number of truck lanes is 2 lanes for the target year of 2005.   As necessary equipment, one truck scale should be equipped at the gate.

2) Terminal Office

An area of around 3,000 m^2 will be planned in the target year of 2005 for the terminal office.

3) Others

- Repair of damaged containers

A container repair yard of around 1,000 m^2 is planned in the target year of 2005.

- Fumigation of containers

Loaded import container has to be transferred to an exclusive yard for fumigation.   A fumigation yard of around 1,000 m^2 is planned for the target year of 2005.

- Washing and Cleaning Containers

For washing and cleaning of empty containers at the container terminal for the target year of 2005, an area of 500 m^2 is planned.

- Customs Inspection

Custom inspection yard of about 500 m^2 is planned for the target year of 2005.

- Others

Necessary facilities such as an electric station, an oil station, parking areas for yard tractor-chassis, etc. are included in the facility layout in the target year of 2005.

Figure - 4.2.2-1 shows the layout image of container yard of high case in the target year of 2005.
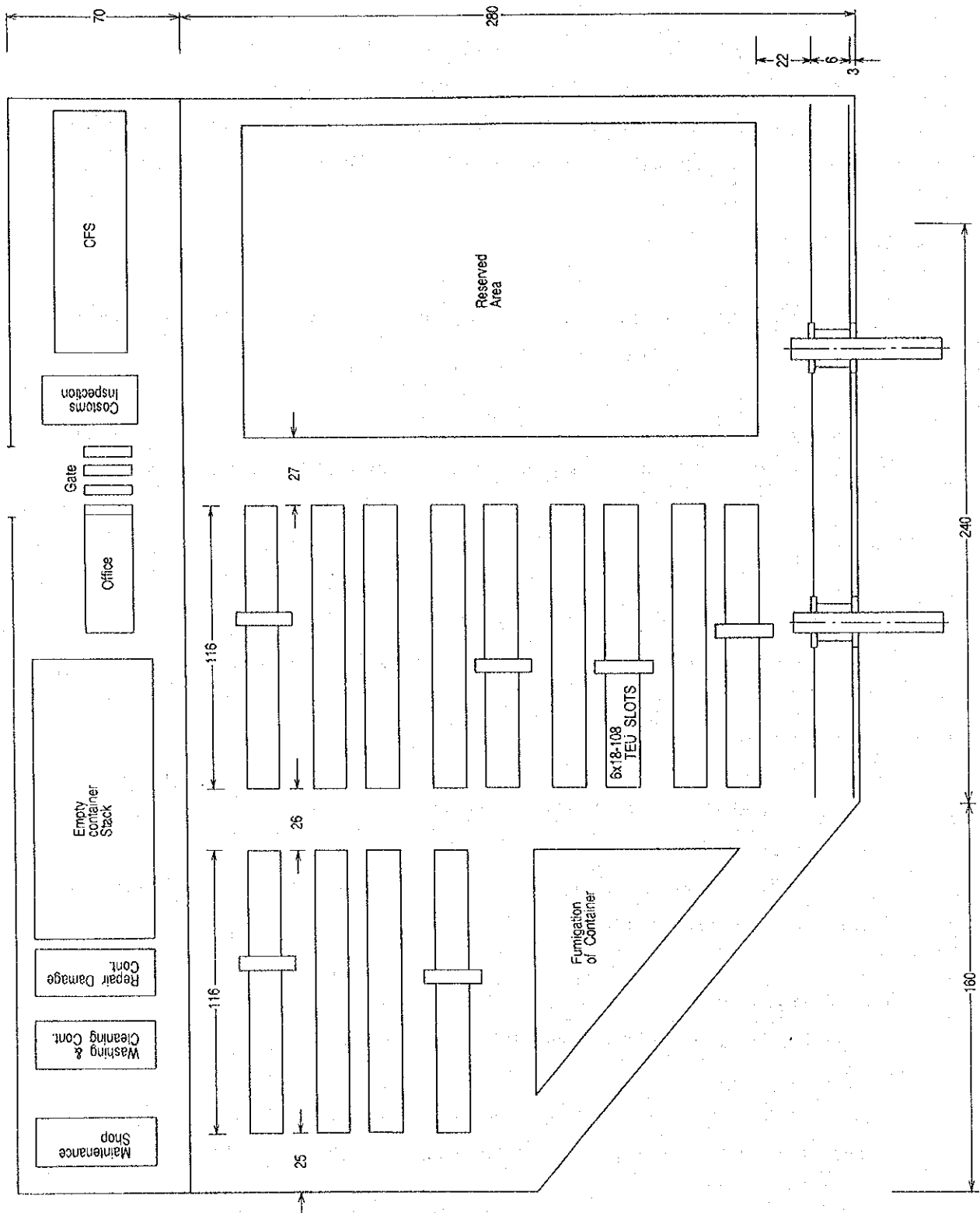
Fig. - 4.2.2-1   Layout of container yard in the target year of 2005

The figure includes the following labels:

- CFS
- Customs Inspection
- Gate
- Office
- Empty container Stack
- Repair Damage Cont.
- Washing & Cleaning Cont.
- Maintenance Shop
- Reserved Area
- 6x18=108 TEU SLOTS
- Fumigation of Container

Dimensions: 70, 280, 22, 6, 3, 240, 160, 27, 116, 26, 116, 25

4.2.3 Required scale of cargo handling equipment

(1) General cargo handling equipment

According to the proposed future cargo handling system mentioned above, it is necessary to ensure the cargo handling productivity. Therefore, the introduction of cargo handling equipment from the economic point of view should be carried out to increase the loading/unloading efficiency and in so doing the overall functions of port will be enhanced.

a. Forklift

The required number of forklifts for general cargoes is calculated by the same formula given in the master plan. The required number of forklifts is 42 units for the target year of 2005.

b. Tractor

The required number of tractors for general cargoes is calculated by the same formula used in the master plan. The required number of tractors is 7 units for the target year of 2005.

c. Trailer

The required trailers for the target year 2005 is equal to the number of tractors.

Required general cargo handling equipment of each case for the target year of 2005 is proposed as shown in Table - 4.2.3-1.

Table - 4.2.3-1   Required general cargo handling equipment

Equipment	Capacity	Unit	Quantity
Tractor	for transport	No.	7
Trailer	for transport	No.	7
Forklift	3 tons	No.	28
	5 tons	No.	14
Mobile Crane	100 tons	No.	1
	200 tons	No.	1
Beltconveyor	for Bagged cargo handling	No.	14
Total			72

(2) Container handling equipment

The container volume to be handled at the target year of 2005 is as follows:

	Import (loaded)	Export (loaded)	Export (empty)	Reefer	Total
TEU:	76,500	28,100	49,200	1,5000	155,300

a. Gantry crane

The required number of gantry cranes in the target year of 2005 is calculated by the same formula mentioned in the master plan.

$$Nc: \quad 155,300 / 19.2 \times 0.7 \times 20 \times 320 \times (1+0.3) = 2 \text{ cranes}$$

b. Transfer crane

The required number of transfer crane is calculated from the total handling volume of containers and the results of the calculation are shown in Table - 4.2.3-2.

Table - 4.2.3-2   Required number of transfer crane

		Unit	Target Year
			2005
Handling Volume at Berth	Gantry Crane Ship gear	TEU/hour	40 14
Handling Volume at Yard	Transfer Crane	TEU/hour	31
Total Handling Volume	Transfer Crane	TEU/hour	85
Required Number	Transfer Crane	Units	6

The required number of transfer crane is 6 units for the target year of 2005.

c. Top loader

The required number of top loaders for reefer containers and others at the berths and container yard is calculated by the same formula mentioned in the master plan.

Mc: 3,400 TEU, Dy: 330 days h: 18 hours

The required number of top loaders is 3 units for the target year of 2005.

d. Chassis

The required number of chassis for shipping is calculated by the same formula mentioned in the master plan. According to the result of the calculation, 15 units of chassis are required for the target year of 2005 (see Table - 4.2.3-3).

Table - 4.2.3-3   Required number of chassis

Target Year 2015	Tl	Tu	S	V	Tc	Tm	n	N (Unit)
Berth (G. crane)	20	30	1	10	410	100	2	8
Berth (Ship's gear)	20	30	1	10	410	360	2	2
CFS								3
Sub-total								13
Total (includ. 15% spare)								15

e. Tractor

The required number of tractors for target year is the same as the number of chassis (excluding number of spare chassis), thus 13 units are required in the target year 2005.

f. Forklift

The required number of forklift for CFS is calculated by the same formula mentioned in the master plan. The required number of forklifts is 2 units for the target year of 2005.

g. Required quantity of container handling equipment

The container handling equipment required for the target year of 2005 is shown in Table - 4.2.3-4.

Table - 4.2.3-4　Required quantity of container handling equipment

Equipment	Capacity	Unit	Quantity
Gantry Crane	30.5 ton	No.	2
Tranfer Crane	Tire-mount type, 30.5 ton Lift: 1 over 4, Span: 6 + 1	No.	6
Top-Loader	45 tons	No.	3
Tractor	for yard	No.	13
Chassis	for yard (20'-40')	No.	15
Forklift	2-4 tons	No.	2
Total			41

(3)　Required number of workers

Required number of workers per gang by commodity each area is proposed considering the grade of handling efficiency as shown in Table - 4.2.3-5.

Table - 4.2.3-5　Required number of workers per gang by commodity

Field	Role	Unitized cargo	General cargo	Bagged cargo	Field	Role	Container
On board	Supervisor	0.5	0.5	0.5	Control tower	Planner	0.5
	Foreman	1.0	1.0	1.0		Supervisor	0.5
	Deck man	1.0	1.0	1.0	On board	Lasher	6.0
	Crane driver	1.0	1.0	1.0		Signal man	1.0
	Machine driver	1.0	1.0	1.0	On dock	Crane driver	1.0
	Hold man	6.0	10.0	14.0		Cranker	2.0
	Sling man	2.0	2.0	2.0	Container yard	Transtainer driver	3.0
On dock	Foreman	0.5	0.5	0.5		Signal man	3.0
	Worker	2.0	6.0	8.0		Tallying	1.0
	Machine driver	2.0	2.0	2.0		Tractor driver	8.0
	Crane driver	(1)	(1)	(1)	Total		26
Warehousing	Foreman	0.5	0.5	0.5	CFS	Worker	2.0
	Worker	2.0	4.0	6.0		Forklift driver	1.0
	Machine driver	1.0	1.0	1.0		Measuring staff	1.0
Tallying	Tally man	1.0	1.0	1.0		Tractor driver	0.2
Total		22	32	40		Tally man	1.0
					Total		5

4.3 Organization

4.3.1 Container terminal division

Management of a container terminal is best performed by a single organization which has enough skillful officers and workers to be able to supply full service to customers (shipping companies, shipper/consignees), from receiving containers to leading them onboard ship, or from discharging container to delivery to the consignees. As mentioned in chapter 4.1, it is best that Sihanoukville Port, the present port administrator, should directly manage the container terminal. Necessary preparations for this matter are as follows:

1) Sihanoukville Port will set up an exclusive terminal operating division to manage the container terminal in Sihanoukville port.

2) This division should be separated from division of conventional cargo handling.

3) This department should take charge of not only the physical cargo handling but also overall control of the container terminal including yard planning and inventory control of containers which are essential for a modernized container terminal.

4) Establishment of a mechanical maintenance and repair system for cargo handling equipment is necessary to keep cargo handling equipment always in good operating condition. For this purpose it is necessary to maintain a sufficient mechanical staff, to establish a mechanics training program, to ensure proper supplies and to arrange facilities for the orderly storage of mechanical parts.

In the Short-term plan, an example of proposed organization chart of container terminal is the same as that in Long-term plan and is shown in Fig. - 4.3.1-1. Number of employees in the Short-term plan was estimated based on the case of a typical container terminal. Table - 4.3.1-1 shows the number of employees at container terminal in Sihanoukvill port in the Short-term plan. The function of each section is mentioned in Long-term plan (Volume (2) chapter 5.2.2).

Table - 4.3.1-1   Required number of employees at container terminal in Short-term plan

Section	Number of employees
Manager of Container Terminal Division	1
Administration Department	10
Operation Department	159
Maintenance Department	50
C.F.S. Department	30
Total	250
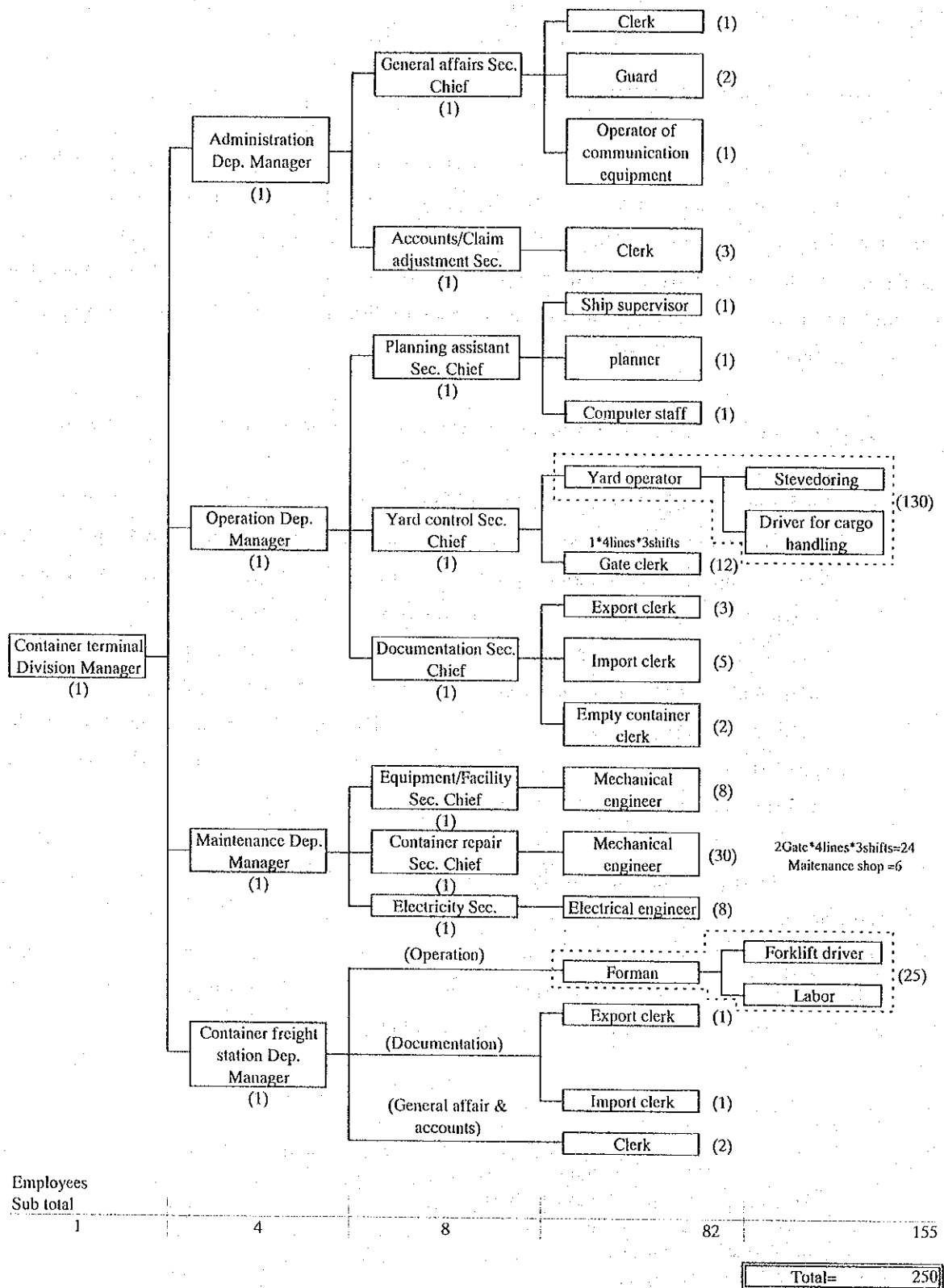
Fig. - 4.3.1-1 Organization chart of the container terminal at Sihanoukville Port for the Short-term plan

4.3.2 Conventional general cargo berth

Conventional general cargo berth for bagged fertilizer, cement, rice sugar, wood product, steel product and etc. should be open for public use and should be operated by Sihanoukville Port as it is at present. The current organization structure for conventional general cargo berth should also be maintained. According to the increase in the conventional cargo handling volume, required number of cargo handling workers including drivers of cargo handling equipment is shown in Table - 4.3.2-1.

Table - 4.3.2-1   Required number of cargo handling workers for conventional cargo
in Short-term plan

Commodity	Number of worker	
Bagged cargo (Fertilizer, Cement, Rice, etc.)	about	540
Unitized cargo (Machinery, Steel, Wood, etc.)	about	70
General cargo	about	80
Total	about	690

(note) including machine driver, crane driver, worker of warehouse and tally man

4.3.3 Introduction and reinforcement of new or existing section

(1) Port planning section

In order to realize the Short-term plan, the following items are essential.

1) Promoting full understanding on the project and securing adequate financial support with proper budgetary arrangements

2) Control of design and construction work of the projects

3) Reviewing periodically the projects according to the actual situation of the country and region.

In order to cope with above mentioned items, Sihanoukville Port should improve port planning section and rear capable technical staffs through training.

(2) Port management and operation strategy section

This section is in charge of preparing the strategies for port promotion and personnel affairs in order to ensure financial resources and capable human resources and activate the organization for promoting the Short-term plan.   Sihanoukville Port should introduce this section.

(3) Improvement of statistic system and introduction of port promotion

In Sihanoukville Port, the present port statistics are insufficient. Port statistics are important information for port planning and management. Sihanoukville Port should improve port statistic system and should prepare timely and accurate port statistics.

To ensure the success of the project, in addition to the above mentioned section, Sihanoukville Port is required to introduce port promoting section. Because without a positive approach, the port users may not be attracted to the port. Under a systematic action program, the representatives should call for sales at shipping companies or shippers and point out the real merits of utilizing Sihanoukville Port.

4.4 Tariff

The present tariff was established in 1987, and charge of container was added in 1993. In the current procedure of tariff decision and its revision, central government has the authority. It is understandable that tariff revision falls under government control because port tariff is an important part of the transportation cost which directly affects consumer's prices. However, from the port management body's view, the level of port dues and charges should be sufficient to ensure funds to maintain port facilities and allow for depreciation, and must be rationally set in proportion to the value and usefulness of each port. If port dues and charges are too low, the port management body can not get sufficient funds to improve the port and port facilities. Consequently, the quality of services for port users will not correspond to their payment for port dues and charges. The port management body best understands the daily port activities and demands, many of which often have to be dealt with timely. Thus, to ensure smooth and efficient operation, it is better for the port management body to have the right to revise its tariff.

In the Short-term plan, the container terminal will be opened and the cargo handling system will be changed from ship gear or mobile crane to gantry crane and transfer crane. But, it seems that the cargo handling charge of gantry crane, which requires a large amount of costs (initial and maintenance cost) has not yet been decided. Sihanoukville Port should request to the government to establish a new tariff to be applied to this facility.

5. Economic analysis

5.1 Objectives and methodology of the economic analysis

5.1.1 Objective

The objective of the economic analysis is to appraise the economic feasibility of the short-term plan (including urgent-measures) for Sihanoukville Port in the target year (2005) from the viewpoint of the national economy. Therefore, the objectives of this section are to investigate the economic benefits as well as the economic costs that will arise from this project, and to evaluate whether the net benefits of the project exceed those that could be obtained from other investment opportunities in Cambodia.

5.1.2 Methodology

Economic analysis will be carried out according to the following method. Short-term plan will be defined and it will be compared to the "Without" case. All benefits and costs of it in market price for the difference from "With" case will be calculated and it will be converted to economic price. All benefits and costs are evaluated using economic prices in the economic analysis based on the border price concept.

There are various methods to evaluate the feasibility of this type of development project. Here, the economic internal rate of return (EIRR) based on a cost-benefit analysis is used to appraise the feasibility of the project. The EIRR is a discount rate which makes the costs and the benefits of the project during the project life equal. The procedure used for this economic analysis is shown in Fig. - 5.1-1.

5.2 Economic analysis

5.2.1 "With" case and "Without" case

In the cost-benefit analysis, the benefits and the costs of the project are defined as the difference between the "Without" case and "With" case of the project. Therefore, it is very important to define the difference between "Without" case and "With" case in the economic analysis in order to evaluate the feasibility of the development project. The following conditions are assumed for this study.
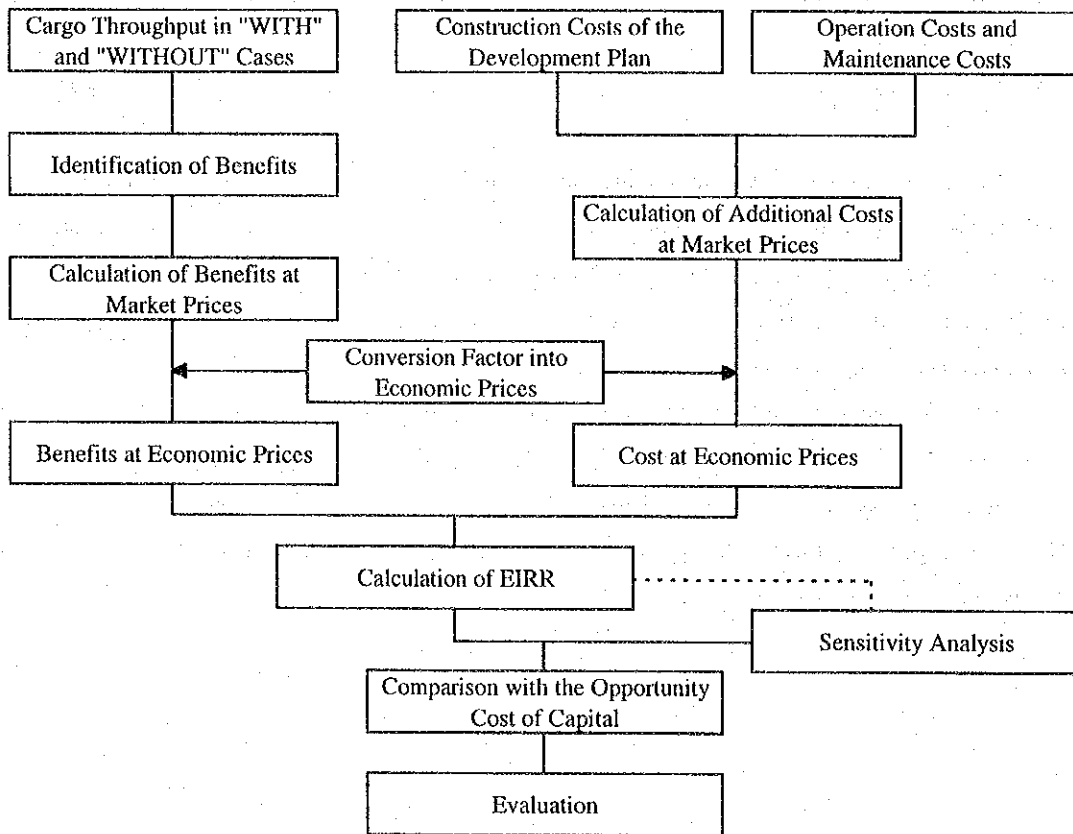
Fig. - 5.1-1   Procedure of the economic analysis

(1) "With" case

In an economic analysis, benefits are mainly brought about by improvements and expansions in handling capacity. Therefore, the "With" case scenario includes all improvements

in productivity and all expansions of port facilities for the short-term plan. In this study, the following conditions are assumed for the capacity of cargo handling and the ship size.

i) When handling volume reaches the maximum volume of handling capacity of the port planned in the short-term plan, the cargoes which cannot be handled in the port are assumed to be handled in foreign ports and then transported to Cambodian provinces through Phnom Penh by truck.

ii) Ship size for the container and conventional cargoes will be enlarged.

(2) "Without" case

In this study, the following conditions are adopted as the "Without" case.

i) No investment is made for the port

ii) When handling volume reaches the maximum volume of handling capacity of the port, the excess cargoes are assumed to be handled in the following way;

- Cargoes carried by ships smaller than 3,000 DWT are handled in Phnom Penh Port till the handled cargo volume at Phnom Penh Port reaches the capacity. In this case, original cargoes at Phnom Penh have priority.

- Cargoes carried by ships larger than 3,000 DWT, and which cannot be handled in Phnom Penh Port, are assumed to be handled in foreign ports and then transported to Cambodian provinces through Phnom Penh by trucks.

iii) The size of vessels and the working efficiency of cargo handling are not the same as "With" case.

(3) Ships size and cargo handling efficiency

The size of ships and the working efficiency of cargo handling in the "With" and "Without" cases are shown in Table - 5.2-1

Table - 5.2-1　Size of ship and working efficiency of cargo handling in both cases

Commodity	WITHOUT			WITH		
	Ship Type	DWT	Efficiency (/ day)	Ship Type	DWT	Efficiency (/ day)
Fertilizer	General	5000	434 ton	General	7000	651 ton
Cement	General	7000	434 ton	General	10,000	651 ton
Rice	General	7000	651 ton	General	5000	434 ton
Sugar	General	5000	434 ton	General	5000	434 ton
Bitumen	Tanker	3000	1,056 ton	Tanker	5000	1,620 ton
Machinery	General	3000	700 ton	Ro-Ro	7000	1,029 ton
Steel Product	General	5000	480 ton	General	5000	686 ton
Wood Product	General	5000	348 ton	General	5000	609 ton
General Cargo	General	3000	364 ton	General	5000	504 ton
Container	Container	4000	280 TEU	Container	5000	800 TEU

5.2.2　Prerequisites of the economic analysis

In order to estimate the costs and benefits, the following requisites are assumed for the analysis.

(1)　Base Year

The "Base Year" here means the standard year in the estimation of costs and benefits. Taking into consideration the base year in cost estimation of construction, 1995 is set as the "Base Year" for this study.

(2)　Project Life

Taking into consideration the depreciation period of the main facilities of 30 years and the construction period of 7 years, the period of calculation (project life) in the economic analysis is assumed to be 37 years from the beginning of construction.

(3)　Foreign Exchange Rate

The exchange rate adopted for this analysis is US$ 1.00 = 2,678 Riels, the same rate as used in the cost estimation.

5.2.3 Economic prices

(1)　Method for converting to economic prices from market prices

For the economic analysis, prices are expressed in economic prices rather than prices based on the border price concept.　There are various methods to convert the market prices into

border prices. Here, the border prices (economic prices) are calculated by eliminating transfer items, such as taxes, subsidies, etc.

In general, all the costs and benefits are divided into three categories : labor, tradable goods and non-tradable goods. And labor is further classified into skilled labor and unskilled labor. As for skilled labor, the economic price is determined by multiplying the market wage by the conversion factor for consumption. On the other hand, the economic price of unskilled labor is determined by multiplying the nominal wage by the shadow wage rate and the conversion factor for consumption. The prices of tradable goods are expressed in CIF and FOB value for import goods and export goods respectively.

These values show the actual border prices. However, as the border price of non-tradeable goods cannot be converted directly, the border price of the inputs needed to produce the non-tradable goods is considered. After some classification of the non-tradable goods, the economic price of a small amount of the non-tradable goods is calculated by multiplying the market prices by the standard conversion factor directly.

(2) Transfer items

Import / export duties, other taxes and subsidies are merely transfer items which do not actually reflect any consumption of national resources. Therefore, these transfer items should be excluded in the calculation of the costs and benefits of the project for the economic analysis.

(3) Conversion factors

Conversion factors for goods and labor are determined as follows:

a. Standard Conversion Factor (SCF)

The standard conversion factor is used to determine the economic prices of certain goods which cannot be directly revalued at border prices. These goods include most non-tradable goods and services. The standard conversion factor is expressed by the following equation:

$$SCF = \frac{(X + M)}{\{(X - Tx) + (M + Tm)\}}$$

where, X : Value of exports

M : Value of imports

Tx : Value of taxes on export

Tm : Value of taxes on import

b. Conversion Factor for Consumption (CFC)

This conversion factor is used to convert the market prices of consumption goods into the border prices. The conversion factor for consumption is usually calculated in the same manner as

the SCF, replacing total imports and exports by those of consumption goods only.

c. Result of SCF and CFC

The calculated result of SCF and CFC are as shown in Table - 5.2-2. The SCF of 0.918 and CFC of 0.829 in 1995 is adopted according to the past records of trade and customs.

Table - 5.2-2 Estimation of Conversion Factor in 1995

Items	Unit	SCF	CFC
Value of Import (CIF)	million Riels	1,478,893	584,125
Value of Export (FOB)	million Riels	141,016	3,212
Taxes on Import	million Riels	158,546	121,928
Taxes on Export	million Riels	14,100	321
Conversion Factor		0.918	0.829

c. Conversion factor for skilled labor

The cost of skilled labor is calculated based on actual market wages, assuming that the market mechanism is functioning properly. However, as these are domestic costs or market costs, they are converted into border prices by multiplying the market wages by the CFC.

The Conversion Factor for Skilled Labor = (Market wage rate) $\times$ **(CFC)**
$$= 1 \times 0.918 = 0.918$$

d. Conversion Factor for Unskilled Labor

As the wages paid to unskilled labors by a project are usually far the above opportunity cost, these market wages should not be used for calculation of the economic value of the unskilled labors. Considering the labor market, the labor is usually provided from the agriculture sector. Therefore, in this study, the economic cost of unskilled labor is estimated based on a simplified measure of the opportunity cost considering the productivity of the agriculture sector.

The conversion factor for unskilled labor is calculated by the following formula.

$$\textbf{Conversion Factor for Unskilled Labor} = \frac{\textbf{Opportunity cost}}{\textbf{Worker's Cost of Construction}} \times \textbf{CFC}$$

$$= (71.7 / 120.0) \times 0.829 = 0.495$$

5.2.4 Costs of the projects

The items that should be considered as costs of the projects (difference between "With" case and "Without" case) are construction costs, re-investment costs and operation costs. The project costs must be converted from market prices into economic prices for the economic analysis.

(1) Construction costs

Construction costs are divided into such categories as foreign currency portion, local currency portion, skilled labor, unskilled labor and others.

The costs of local currency portion and others at market prices are converted to economic prices by multiplying by the SCF.

The costs of skilled labor and unskilled labor at market prices are converted to economic prices by multiplying by the CFC for skilled labor and the conversion factor for unskilled labor respectively.

(2) Re-investment costs

The re-investment costs for facilities and equipment after their useful lifetimes are considered.

(3) Operation costs

a. Maintenance costs

The costs of maintaining the port facilities are estimated as a fixed proportion (1 % for structures, 4 % for handling equipment) of the original construction costs excluding the costs of dredging and reclamation costs.

b. Personnel costs

Personnel costs are based on the estimation in the following section "Financial analysis", and the costs are converted to economic prices by multiplying by the CFC for skilled labor.

c. Others

Other costs are based on the estimation in the following section "Financial analysis". Other costs are estimated as 80 % of the personnel costs.

(4) Summary of costs

Table - 5.2-3 shows the economic prices of the construction costs, re-investment costs and operation costs by years.

Table - 5.2-3 Cost in economic prices by year

(Unit: thousand US$)

Calendar year	Construction	Re-investment	Operation			Total
			Maintenance	Personnel	Others	
1998	6,854	0	0	0	0	6,854
1999	17,150	0	69	0	0	17,218
2000	13,157	0	271	0	0	13,428
2001	17,969	0	565	330	264	19,128
2002	19,479	0	751	635	508	21,373
2003	35,102	0	955	941	753	37,751
2004	368	0	2,157	1,011	809	4,345
2005	0	0	2,172	1,044	835	4,050
2006	0	0	2,172	1,084	867	4,124
2007	0	0	2,172	1,084	867	4,124
2008	0	0	2,172	1,084	867	4,124
2009	0	1,653	2,172	1,084	867	5,777
2010	0	1,706	2,172	1,084	867	5,830
2011	0	0	2,172	1,084	867	4,124
2012	0	1,024	2,172	1,084	867	5,148
2013	0	3,024	2,172	1,084	867	7,148
2014	0	379	2,172	1,084	867	4,503
2015	0	0	2,172	1,084	867	4,124
2016	0	0	2,172	1,084	867	4,124
2017	0	4,968	2,172	1,084	867	9,092
2018	0	27,066	2,172	1,084	867	31,189
2019	0	1,653	2,172	1,084	867	5,777
2020	0	1,757	2,172	1,084	867	5,881
2021	0	0	2,172	1,084	867	4,124
2022	0	1,024	2,172	1,084	867	5,148
2023	0	3,024	2,172	1,084	867	7,148
2024	0	379	2,172	1,084	867	4,503
2025	0	0	2,172	1,084	867	4,124
2026	0	0	2,172	1,084	867	4,124
2027	0	1,616	2,172	1,084	867	5,739
2028	0	1,672	2,172	1,084	867	5,795
2029	0	2,450	2,172	1,084	867	6,573
2030	0	1,706	2,172	1,084	867	5,830
2031	0	3,193	2,172	1,084	867	7,316
2032	0	4,290	2,172	1,084	867	8,414
2033	0	31,724	2,172	1,084	867	35,847
2034	0	5,348	2,172	1,084	867	9,471
Total	110,079	99,658	69,922	35,407	28,325	343,391

5.2.5 Benefits of the projects

(1) Benefit Items

As benefits brought about by the short-term plan of the study port, the following items are identified.

    i)   Savings in waiting costs of ships

    ii)   Savings in water transportation cost by enlargement of ship size

    iii) Savings in land transportation costs

    iv)   Savings of cost in cargo handling

    v)   Savings in interest of cargo costs

    vi)   Reduction of cargo damage and accidents at the port

    vii) Promotion of regional economic development

    viii) Increase in employment opportunities and incomes

Items i), ii), iii), iv) and v) are considered countable and in this study the monetary benefits of item i), ii) and iii) are calculated.

(2) Calculation of benefits

a. Savings in waiting costs of ships

In accordance with the implementation of the projects, the total ship staying time, namely ship waiting time for berthing and ship mooring time for unloading / loading in the port, will be greatly decreased. The reduction of the ship staying time under the "With" case is one of the major benefits of the project. The benefits that will accrue to Cambodia from the projects can be calculated by the following formula.

Savings in ships' waiting costs

= Difference in waiting time between "With" and "Without" cases

$\times$ Ship's staying cost (unit cost) $\times$ Share of benefits accruing to Cambodia (= 0.5)

b. Savings in water transportation cost by enlargement of ship size

When the size of calling ships becomes larger to capitalize on mass transportation, large ships can call at deep berths but can not call at existing shallow and short berths. The water transportation cost per ton of cargo will become cheaper by enlargement of ship size. The benefit that will accrue to Cambodia from the project can be calculated by the following formula.

Savings in water transportation cost by enlargement of ship size

= Difference in water transportation cost between "With" and "Without" cases (unit cost)

$\times$ Handling cargo volume $\times$ Share of benefits accruing to Cambodia (= 0.5)

c. Savings in land transportation costs

When that handling volume exceeds the handling capacity of the port, the excess cargoes which can not be handled in the port will be handled in other ports and then be transported to the destination by trucks. The benefit that will accrue to Cambodia from the project can be calculated by the following formula.

Savings in land transportation costs
= Difference in handling cargo volume between "With" and "Without" cases
× Difference in land transportation cost (unit cost)

d. Summary of benefit

Table - 5.2-4 shows the results of the benefits by above method.

Table - 5.2-4   Benefits of the projects

(Unit: million US$)

Year	Waiting Cost	Water Transportation Cost	Land Transportation Cost	Total
1998	0	0	0	0
1999	0	0	0	0
2000	7,383	77	0	7,460
2001	7,292	612	-1,448	6,456
2002	12,813	1,068	-1,452	12,429
2003	12,862	2,490	-256	15,096
2004	13,395	2,908	485	16,789
2005	13,754	3,346	1,308	18,407
2006	14,827	3,604	2,070	20,501
2015-	14,827	3,604	5,179	23,610

5.2.6 Economic internal rate of return (EIRR)

(1) Calculation of the EIRR

The economic internal rate of return (EIRR) based on a cost-benefit analysis is used to appraise the economic feasibility of the project. The EIRR is the discount rate which makes the costs and benefits of a project during the project life equal. It is calculated by using the following formula.

$$\sum_{i=1}^{n} = \frac{B_i - C_i}{(1+r)^{i-1}} = 0$$

where,   n   : Period of economic calculation (project life)

           B_i : Benefits in i-th year

           C_i : Costs in i-th year

           r   : Discount rate

(2) Sensitivity Analysis

In order to determine whether the project is feasible when certain conditions change, a sensitivity analysis is made for the following three alternatives.

         Case A: The costs increase by 10%

         Case B: The benefits decrease by 10%

         Case C: The costs increase by 10% and the Benefits decrease by 10%

The sensitivity analysis for the three alternatives is calculated by using above formula as the base case and the results are shown in Table - 5.2-5 (refer to Table - 5.2-6).

Table - 5.2-5   Results of sensitivity analysis

Case	EIRR (%)
Base Case	15.0 %
Case A	13.0 %
Case B	12.8 %
Case C	11.0 %

5.3 Evaluation

There are various views concerning the critical percentage of EIRR to judge whether a project is feasible or not. The leading view is that the project is feasible if the EIRR exceeds the opportunity cost of capital (OCC). In general, the opportunity cost of capital is considered to range from 8 % to 10 % according to the degree of development in each country. It is generally considered that a project with an EIRR of more than 10 % is economically feasible for infrastructure or social service projects.

As for this project, even though the economic calculation only takes into account the items which are easily quantified, the EIRR (15.0 %) exceeds 10 %. Therefore, this short-term plan development project is feasible from the viewpoint of the national economy. Moreover, concerning the benefit of land transportation cost, the foreign port which should logically handle cargoes in excess of Cambodian ports' capacity is in Vietnam. But as the cargo volume is so large, there are no ports in Vietnam at present which have the capacity to handle all of the cargoes. Therefore, some / all of the cargoes will be handled at a port in Thailand and carried by truck to Cambodia. In case that 30 % of this cargo (import / export volume from / to Thailand to / from Cambodia in 1995) is carried from a Thailand port by truck to Cambodia, EIRR is about 21.9 %.

Table-5.2-6 (a) Cost / benefit analysis of Short-term plan (Base Case)

EIRR= 15.0%

(Unit: thousand US$)

	Calendar year	Cost total	Benefit total	Benefit - Cost	Net Present Value (NPV)		
					Benefit	Cost	Benefit - Cost
	1998	6,853.98	0.00	-6,853.98	0.00	6,853.98	-6,853.98
	1999	17,218.46	0.00	-17,218.46	0.00	14,976.92	-14,976.92
	2000	13,428.46	7,460.50	-5,967.96	5,644.49	10,159.75	-4,515.26
	2001	19,128.31	6,455.51	-12,672.80	4,248.30	12,588.15	-8,339.84
	2002	21,372.55	12,428.85	-8,943.69	7,114.51	12,234.04	-5,119.53
	2003	37,751.11	15,095.89	-22,655.22	7,516.24	18,796.28	-11,280.03
	2004	4,344.63	16,788.76	12,444.13	7,270.92	1,881.58	5,389.33
1	2005	4,050.50	18,407.43	14,356.93	6,934.13	1,525.83	5,408.30
2	2006	4,123.62	20,500.88	16,377.26	6,717.38	1,351.16	5,366.22
3	2007	4,123.62	20,767.51	16,643.90	5,918.89	1,175.26	4,743.63
4	2008	4,123.62	21,037.44	16,913.82	5,215.27	1,022.26	4,193.01
5	2009	5,777.03	21,318.22	15,541.19	4,596.88	1,245.71	3,351.17
6	2010	5,830.11	21,645.79	15,815.68	4,059.89	1,093.50	2,966.39
7	2011	4,123.62	22,007.65	17,884.03	3,590.40	672.74	2,917.66
8	2012	5,147.94	22,402.22	17,254.28	3,178.99	730.52	2,448.47
9	2013	7,147.69	22,839.88	15,692.19	2,819.16	882.25	1,936.91
10	2014	4,502.99	23,314.15	18,811.16	2,503.08	483.45	2,019.62
11	2015	4,123.62	23,609.65	19,486.04	2,204.82	385.09	1,819.73
12	2016	4,123.62	23,609.65	19,486.04	1,917.79	334.96	1,582.83
13	2017	9,091.87	23,609.65	14,517.78	1,668.13	642.38	1,025.75
14	2018	31,189.38	23,609.65	-7,579.73	1,450.97	1,916.79	-465.82
15	2019	5,777.03	23,609.65	17,832.63	1,262.08	308.82	953.26
16	2020	5,881.08	23,609.65	17,728.58	1,097.78	273.45	824.33
17	2021	4,123.62	23,609.65	19,486.04	954.87	166.78	788.09
18	2022	5,147.94	23,609.65	18,461.71	830.56	181.10	649.46
19	2023	7,147.69	23,609.65	16,461.96	722.44	218.71	503.72
20	2024	4,502.99	23,609.65	19,106.66	628.39	119.85	508.54
21	2025	4,123.62	23,609.65	19,486.04	546.58	95.47	451.12
22	2026	4,123.62	23,609.65	19,486.04	475.43	83.04	392.39
23	2027	5,739.27	23,609.65	17,870.38	413.54	100.53	313.01
24	2028	5,795.37	23,609.65	17,814.28	359.70	88.29	271.41
25	2029	6,573.44	23,609.65	17,036.21	312.87	87.11	225.76
26	2030	5,830.11	23,609.65	17,779.54	272.14	67.20	204.94
27	2031	7,316.23	23,609.65	16,293.42	236.72	73.35	163.36
28	2032	8,413.73	23,609.65	15,195.92	205.90	73.38	132.52
29	2033	35,847.46	23,609.65	-12,237.81	179.10	271.93	-92.83
30	2034	9,471.25	23,609.65	14,138.41	155.78	62.49	93.29
	Total	343,391.14	744,663.73	401,272.58	93,224.09	93,224.09	0.00

Table-5.2-6 (b)　Cost / benefit analysis of Short-term plan (Case A)

EIRR= 13.0%

(Unit: thousand US$)

	Calendar year	Cost total	Benefit total	Benefit - Cost	Net Present Value (NPV)		
					Benefit	Cost	Benefit - Cost
	1998	7,539.37	0.00	-7,539.37	0.00	7,539.37	-7,539.37
	1999	18,940.30	0.00	-18,940.30	0.00	16,757.77	-16,757.77
	2000	14,771.30	7,460.50	-7,310.80	5,840.19	11,563.19	-5,723.00
	2001	21,041.14	6,455.51	-14,585.64	4,471.14	14,573.29	-10,102.14
	2002	23,509.80	12,428.85	-11,080.95	7,616.38	14,406.77	-6,790.39
	2003	41,526.22	15,095.89	-26,430.33	8,184.76	22,514.87	-14,330.11
	2004	4,779.10	16,788.76	12,009.66	8,053.69	2,292.57	5,761.12
1	2005	4,455.55	18,407.43	13,951.88	7,812.66	1,891.07	5,921.59
2	2006	4,535.98	20,500.88	15,964.90	7,698.53	1,703.36	5,995.17
3	2007	4,535.98	20,767.51	16,231.54	6,900.00	1,507.08	5,392.92
4	2008	4,535.98	21,037.44	16,501.46	6,184.25	1,333.41	4,850.83
5	2009	6,354.73	21,318.22	14,963.49	5,544.65	1,652.80	3,891.85
6	2010	6,413.13	21,645.79	15,232.67	4,981.11	1,475.78	3,505.33
7	2011	4,535.98	22,007.65	17,471.67	4,480.80	923.53	3,557.27
8	2012	5,662.74	22,402.22	16,739.48	4,035.55	1,020.09	3,015.46
9	2013	7,862.46	22,839.88	14,977.42	3,640.28	1,253.14	2,387.14
10	2014	4,953.29	23,314.15	18,360.86	3,287.68	698.50	2,589.19
11	2015	4,535.98	23,609.65	19,073.68	2,945.70	565.94	2,379.76
12	2016	4,535.98	23,609.65	19,073.68	2,606.27	500.73	2,105.54
13	2017	10,001.06	23,609.65	13,608.59	2,305.94	976.80	1,329.14
14	2018	34,308.32	23,609.65	-10,698.67	2,040.22	2,964.74	-924.52
15	2019	6,354.73	23,609.65	17,254.92	1,805.12	485.86	1,319.26
16	2020	6,469.18	23,609.65	17,140.47	1,597.12	437.62	1,159.50
17	2021	4,535.98	23,609.65	19,073.68	1,413.08	271.49	1,141.59
18	2022	5,662.74	23,609.65	17,946.91	1,250.24	299.87	950.38
19	2023	7,862.46	23,609.65	15,747.19	1,106.18	368.38	737.80
20	2024	4,953.29	23,609.65	18,656.36	978.71	205.33	773.38
21	2025	4,535.98	23,609.65	19,073.68	865.93	166.37	699.56
22	2026	4,535.98	23,609.65	19,073.68	766.15	147.20	618.95
23	2027	6,313.20	23,609.65	17,296.45	677.86	181.26	496.60
24	2028	6,374.91	23,609.65	17,234.74	599.75	161.94	437.81
25	2029	7,230.78	23,609.65	16,378.87	530.64	162.52	368.12
26	2030	6,413.13	23,609.65	17,196.53	469.49	127.53	341.96
27	2031	8,047.85	23,609.65	15,561.80	415.39	141.60	273.80
28	2032	9,255.11	23,609.65	14,354.55	367.53	144.07	223.45
29	2033	39,432.20	23,609.65	-15,822.55	325.18	543.10	-217.92
30	2034	10,418.37	23,609.65	13,191.28	287.71	126.96	160.75
	Total	377,730.26	744,663.73	366,933.47	112,085.86	112,085.86	0.00

Table-5.2-6 (c) Cost / benefit analysis of Short-term plan (Case B)

EIRR= 12.8%

(Unit: thousand US$)

	Calendar year	Cost total	Benefit total	Benefit - Cost	Net Present Value (NPV)		
					Benefit	Cost	Benefit - Cost
	1998	6,853.98	0.00	-6,853.98	0.00	6,853.98	-6,853.98
	1999	17,218.46	0.00	-17,218.46	0.00	15,261.07	-15,261.07
	2000	13,428.46	6,714.45	-6,714.01	5,274.63	10,548.91	-5,274.28
	2001	19,128.31	5,809.96	-13,318.36	4,045.25	13,318.31	-9,273.06
	2002	21,372.55	11,185.97	-10,186.58	6,902.98	13,189.23	-6,286.25
	2003	37,751.11	13,586.30	-24,164.81	7,431.14	20,648.28	-13,217.14
	2004	4,344.63	15,109.89	10,765.25	7,324.97	2,106.19	5,218.78
1	2005	4,050.50	16,566.68	12,516.19	7,118.22	1,740.38	5,377.84
2	2006	4,123.62	18,450.79	14,327.17	7,026.54	1,570.38	5,456.16
3	2007	4,123.62	18,690.76	14,567.15	6,308.77	1,391.86	4,916.91
4	2008	4,123.62	18,933.69	14,810.08	5,664.27	1,233.63	4,430.63
5	2009	5,777.03	19,186.40	13,409.37	5,087.36	1,531.80	3,555.56
6	2010	5,830.11	19,481.21	13,651.10	4,578.32	1,370.15	3,208.17
7	2011	4,123.62	19,806.88	15,683.27	4,125.69	858.93	3,266.76
8	2012	5,147.94	20,162.00	15,014.06	3,722.25	950.40	2,771.85
9	2013	7,147.69	20,555.89	13,408.20	3,363.56	1,169.58	2,193.98
10	2014	4,502.99	20,982.73	16,479.74	3,043.09	653.06	2,390.03
11	2015	4,123.62	21,248.69	17,125.07	2,731.34	530.06	2,201.29
12	2016	4,123.62	21,248.69	17,125.07	2,420.85	469.80	1,951.05
13	2017	9,091.87	21,248.69	12,156.81	2,145.64	918.08	1,227.57
14	2018	31,189.38	21,248.69	-9,940.69	1,901.73	2,791.41	-889.68
15	2019	5,777.03	21,248.69	15,471.66	1,685.54	458.26	1,227.28
16	2020	5,881.08	21,248.69	15,367.61	1,493.93	413.48	1,080.45
17	2021	4,123.62	21,248.69	17,125.07	1,324.10	256.96	1,067.14
18	2022	5,147.94	21,248.69	16,100.74	1,173.58	284.32	889.25
19	2023	7,147.69	21,248.69	14,100.99	1,040.17	349.89	690.27
20	2024	4,502.99	21,248.69	16,745.70	921.92	195.37	726.55
21	2025	4,123.62	21,248.69	17,125.07	817.12	158.57	658.54
22	2026	4,123.62	21,248.69	17,125.07	724.23	140.55	583.68
23	2027	5,739.27	21,248.69	15,509.41	641.90	173.38	468.52
24	2028	5,795.37	21,248.69	15,453.31	568.93	155.17	413.76
25	2029	6,573.44	21,248.69	14,675.25	504.25	155.99	348.26
26	2030	5,830.11	21,248.69	15,418.57	446.93	122.63	324.30
27	2031	7,316.23	21,248.69	13,932.46	396.12	136.39	259.73
28	2032	8,413.73	21,248.69	12,834.95	351.09	139.02	212.07
29	2033	35,847.46	21,248.69	-14,598.77	311.18	524.97	-213.79
30	2034	9,471.25	21,248.69	11,777.44	275.80	122.94	152.87
	Total	343,391.14	670,197.35	326,806.21	102,893.39	102,893.39	0.00

Table-5.2-6 (d) Cost / benefit analysis of Short-term plan (Case C)

EIRR= 11.0%

(Unit: thousand US$)

	Calendar year	Cost total	Benefit total	Benefit - Cost	Net Present Value (NPV)		
					Benefit	Cost	Benefit - Cost
	1998	7,539.37	0.00	-7,539.37	0.00	7,539.37	-7,539.37
	1999	18,940.30	0.00	-18,940.30	0.00	17,062.92	-17,062.92
	2000	14,771.30	6,714.45	-8,056.85	5,449.33	11,988.14	-6,538.81
	2001	21,041.14	5,809.96	-15,231.19	4,247.88	15,383.98	-11,136.10
	2002	23,509.80	11,185.97	-12,323.83	7,367.83	15,485.13	-8,117.30
	2003	41,526.22	13,586.30	-27,939.92	8,061.83	24,640.81	-16,578.98
	2004	4,779.10	15,109.89	10,330.79	8,077.19	2,554.73	5,522.46
1	2005	4,455.55	16,566.68	12,111.14	7,978.13	2,145.69	5,832.44
2	2006	4,535.98	18,450.79	13,914.81	8,004.74	1,967.90	6,036.84
3	2007	4,535.98	18,690.76	14,154.78	7,305.09	1,772.84	5,532.25
4	2008	4,535.98	18,933.69	14,397.72	6,666.54	1,597.11	5,069.43
5	2009	6,354.73	19,186.40	12,831.67	6,085.90	2,015.71	4,070.19
6	2010	6,413.13	19,481.21	13,068.09	5,566.91	1,832.60	3,734.31
7	2011	4,535.98	19,806.88	15,270.91	5,098.95	1,167.71	3,931.24
8	2012	5,662.74	20,162.00	14,499.26	4,675.90	1,313.28	3,362.61
9	2013	7,862.46	20,555.89	12,693.43	4,294.71	1,642.69	2,652.02
10	2014	4,953.29	20,982.73	16,029.44	3,949.35	932.30	3,017.05
11	2015	4,535.98	21,248.69	16,712.71	3,602.99	769.13	2,833.85
12	2016	4,535.98	21,248.69	16,712.71	3,245.86	692.90	2,552.96
13	2017	10,001.06	21,248.69	11,247.63	2,924.12	1,376.29	1,547.83
14	2018	34,308.32	21,248.69	-13,059.63	2,634.28	4,253.34	-1,619.05
15	2019	6,354.73	21,248.69	14,893.96	2,373.17	709.73	1,663.44
16	2020	6,469.18	21,248.69	14,779.50	2,137.94	650.90	1,487.04
17	2021	4,535.98	21,248.69	16,712.71	1,926.02	411.15	1,514.87
18	2022	5,662.74	21,248.69	15,585.95	1,735.12	462.41	1,272.71
19	2023	7,862.46	21,248.69	13,386.22	1,563.13	578.39	984.74
20	2024	4,953.29	21,248.69	16,295.40	1,408.19	328.26	1,079.93
21	2025	4,535.98	21,248.69	16,712.71	1,268.61	270.81	997.80
22	2026	4,535.98	21,248.69	16,712.71	1,142.86	243.97	898.90
23	2027	6,313.20	21,248.69	14,935.49	1,029.58	305.90	723.68
24	2028	6,374.91	21,248.69	14,873.78	927.53	278.27	649.26
25	2029	7,230.78	21,248.69	14,017.91	835.59	284.35	551.25
26	2030	6,413.13	21,248.69	14,835.56	752.77	227.19	525.57
27	2031	8,047.85	21,248.69	13,200.84	678.15	256.85	421.30
28	2032	9,255.11	21,248.69	11,993.58	610.93	266.10	344.83
29	2033	39,432.20	21,248.69	-18,183.52	550.38	1,021.36	-470.98
30	2034	10,418.37	21,248.69	10,830.32	495.82	243.11	252.72
	Total	377,730.26	670,197.35	292,467.10	124,673.33	124,673.33	0.00

6. Financial analysis

6.1 Objective and methodology of the financial analysis

6.1.1 Objective

The purpose of the financial analysis is to appraise the financial feasibility of the Short-term development plan. The analysis focuses on the viability of the project itself and the financial soundness of the port management body (Sihanoukville Port) during the project life.

6.1.2 Methodology

(1) Viability of the project

The viability of the project is analyzed using the Discount Cash Flow Method and appraised by the Financial Internal Rate of Return (FIRR). The FIRR is a discount rate that makes the costs and the revenue during the project life equal, and it is calculated using the following formula:

$$\sum_{i=1}^{n} = \frac{B_i - C_i}{(1+r)^{i-1}} = 0$$

where, n : Project life

Bi : Revenue in the i-th year

Ci : Cost in the i-th year

r : Discount rate

The revenues and costs which are taken into account for the FIRR calculation are summarized in Table - 6.1.2-1.

Table - 6.1.2-1   The revenues and costs taken into account for the FIRR calculation

Revenues	Costs
1) Port operating revenues 2) Residual value of the fixed assets at end of the project life	1) Investments for the project (initial investments for the project and its renewal investments) 2) Operating expenses such as maintenance, repair, personnel and other costs

The revenues and costs exempted from the FIRR calculation are summarized in Table - 6.1.2-2.

Table - 6.1.2-2   The revenues and costs exempted from the FIRR calculation

Revenues	Costs
1) Fund management income	1) Depreciation cost 2) Repayment of the loan principal 3) Interest on loans

When the calculated FIRR exceeds the weighted average interest rate of the total funds for
the investments of the project, the project is regarded as financially feasible.

(2) Financial soundness of the port management body

The financial soundness of the project is appraised based on its projected financial statements (Profit and Loss Statement, Cash Flow Statement and Balance Sheet).   The appraisal is generally made from the viewpoint of profitability, loan repayment capacity and operational efficiency, using the following ratios:

a. Profitability

Rate of Return on Net Fixed Assets:

$$\frac{\text{Net Operating Income}}{\text{Total Fixed Assets}} \times 100\%$$

This indicator shows the profitability of the investments, which are presented as net total fixed assets.   It is necessary to keep the rate higher than the average interest rate of the funds for investments.

b. Loan repayment capacity

Debt Service Coverage Ratio :

$$\frac{\text{Net Operating Income + Depreciation Cost}}{\text{Repayment of and Interest on long-term loans}}$$

This indicator shows whether the operating income can cover the repayment and the interest on long-term loans.   The ratio must be higher than 1.0 and it is preferable that it be over 1.75.

c. Operational efficiency

Operating Ratio:

$$\frac{\text{Operating Expenses}}{\text{Operating Revenues}} \times 100 \%$$

Working Ratio:

$$\frac{\text{Operating Expenses - Depreciation Expenses}}{\text{Operating Revenues}} \times 100 \%$$

The operating ratio shows the operational efficiency of the organization as an enterprise, and the working ratio shows the efficiency of the routine operations of the port. When the calculated operating ratios are less than 70~75%, and the working ratios are less than 50~60%, the operation of the port is efficient.

6.2 General prerequisites of financial analysis

6.2.1 Scope of the analysis

At present, construction and management of port facilities such as breakwater, jetty, quay, seawall, reclamation, warehouse, open yard, cargo handling equipment, navigation assistance and so on are the responsibility of Sihanoukville Port. Also, cargo handling/storage and navigation service are provided for port users by Sihanoukville Port.

In the proposed Short-term plan (including Urgent measures), we assume that general cargo berth, container berth and container yard will be constructed and operated by Sihanoukville Port as it is at present.

The financial analysis considers the port management body (Sihanoukville Port) as an implementation body. Therefore, the focus of the financial analysis is all projects of Short-term plan.

The viability of the project (FIRR) is analyzed using the difference of revenues and expenses between "With Case" and "Without Case".

With Case : Short-term plan

Without Case : Existing situation

(But we assume Old Jetty will be out of use in 2003.)

The influence on the financial soundness of the port management body is analyzed using With Case.

6.2.2 Project life and base year

(1) Project life

Taking account of the conditions of the long-term loans and the service lives of the port facilities, the project life for the financial analysis is determined as 30 years after construction.

(2) Base year

In principal, all costs and revenues are indicated in prices as of May 1996 (US$1.00 = 2,594Riels). Neither price inflation nor increases in nominal wage are considered during the project life.

6.2.3 Revenue and expenditure

(1) Cargo handling volume and calling vessels

The cargo handling volume and calling vessels are estimated based on the demand forecast. The volume and number of vessels are shown in Table - 6.1.3-1 (With Case) and Table - 6.1.3-2 (Without Case). The handling capacity at the container and general cargo berths will reach its limit in 2006.

(2) Revenues

The revenues from the port activities are calculated based on the present port charges and dues. Sihanoukville Port gains the following revenues.

1) Navigation revenue : tonnage charges, berthage charges, pilotage charges, tug assistance charges, mooring/unmooring charges, clearance fee, etc.
2) Cargo handling charges
3) Storage charges

The revenues/year during the project life are shown in Table - 6.2.3-1 (With Case) and Table - 6.2.3-2 (Without Case). The viability of the project (FIRR) is analyzed using the difference of revenues between both cases (see Table - 6.2.3-3).

Table - 6.2.3-1 Revenue in With Case

Unit Revenue		(Gantry crane) 2003 -	
Navigation Revenues (Container & Conventional)	U1= 1.51		(US$/GT)
Handling & Storage Revenues (Container Cargo)	U2= 0.0517	U2'= 0.0657	(1,000US$/TEU)
Handling & Storage Revenues (Conventional Cargo)	U3= 10.2		(US$/tons)

Unit: 1,000US$

Year	Cargo Volume		Calling Vessels				Revenue						Grand Total
	Container	Conventional Cargo Total	Container		Conventional		Container Cargo			Conventional Cargo			
			Number of calling Vessels	Av. GT of Vessels	Number of calling Vessels	Av. GT of Vessels	Handling & Storage	Navigation	Sub Total	Handling & Storage	Navigation	Sub Total	
	(1) (TEU)	(2) (1,000ton)	(3)	(4) (1,000GT)	(5)	(6) (1,000GT)	(1)× U2,U2'	(3)×(4) ×U1		(2)×U3	(5)×(6) ×U1		
1997	61,226	490	408	2.4	201	2.9	3,165	1,489	4,654	4,994	873	5,867	10,521
1998	70,947	527	473	2.4	206	3.0	3,668	1,725	5,393	5,372	941	6,314	11,707
1999	79,888	573	533	3.1	217	3.1	4,130	2,530	6,661	5,848	1,026	6,874	13,534
2000	90,788	585	454	3.1	191	3.7	4,694	2,157	6,851	5,968	1,056	7,024	13,875
2001	102,137	607	511	3.1	214	3.4	5,280	2,426	7,707	6,193	1,091	7,285	14,991
2002	114,145	637	571	3.1	214	3.6	5,901	2,712	8,613	6,495	1,148	7,643	16,256
2003	126,947	673	317	3.9	214	3.8	8,340	1,851	10,192	6,868	1,217	8,086	18,277
2004	140,649	715	352	3.9	216	4.0	9,241	2,051	11,292	7,290	1,296	8,585	19,877
2005	155,342	762	388	3.9	206	4.5	10,206	2,265	12,471	7,777	1,391	9,167	21,639
2006	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2007	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2008	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2009	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2010	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2011	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2012	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2013	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2014	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2015	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2016	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2017	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2018	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2019	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2020	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2021	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2022	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2023	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2024	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2025	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2026	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2027	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2028	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2029	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2030	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2031	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2032	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2033	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875
2034	171,112	790	428	3.9	160	4.5	11,242	2,495	13,737	8,056	1,081	9,137	22,875

Table - 6.2.3-2   Revenue in Without Case

Unit: 1,000US$

	Cargo Volume		Calling Vessels				Revenue						
			Container		Conventional		Container Cargo			Conventional Cargo			
	Container	Conventional Cargo Total	Number of calling Vessels	Av. GT of Vessels	Number of calling Vessels	Av. GT of Vessels	Handling & Storage	Navigation	Sub Total	Handling & Storage	Navigation	Sub Total	Grand Total
Year	(1) (TEU)	(2) (1,000ton)	(3)	(4) (1,000GT)	(5)	(6) (1,000GT)	(1)×U2	(3)×(4) ×U1		(2)×U3	(5)×(6) ×U1		
1997	61,226	490	408	2.4	201	2.9	3,165	1,489	4,654	4,994	873	5,867	10,521
1998	70,947	527	473	2.4	206	3.0	3,668	1,725	5,393	5,372	941	6,314	11,707
1999	79,888	573	533	3.1	217	3.1	4,130	2,530	6,661	5,848	1,026	6,874	13,534
2000	90,788	585	454	3.1	225	3.1	4,694	2,157	6,851	5,968	1,047	7,015	13,865
2001	96,766	421	484	3.1	140	3.6	5,003	2,299	7,302	4,293	759	5,052	12,354
2002	92,764	326	464	3.1	100	3.9	4,796	2,204	7,000	3,327	591	3,918	10,917
2003	71,269	231	356	3.1	72	3.8	3,685	1,693	5,378	2,358	418	2,777	8,154
2004	73,955	223	370	3.1	70	3.8	3,823	1,757	5,580	2,272	403	2,675	8,255
2005	76,301	215	382	3.1	69	3.7	3,945	1,813	5,757	2,197	389	2,587	8,344
2006	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2007	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2008	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2009	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2010	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2011	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2012	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2013	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2014	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2015	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2016	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2017	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2018	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2019	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2020	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2021	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2022	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2023	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2024	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2025	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2026	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2027	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2028	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2029	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2030	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2031	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2032	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2033	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352
2034	78,617	209	393	3.1	51	3.7	4,065	1,868	5,932	2,136	284	2,420	8,352

Table - 6.2.3-3   Difference between With Case and Without Case

Unit : 1,000US$

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 -
With Case	10,521	11,707	13,534	13,875	14,991	16,256	18,277	19,877	21,639	22,875
Without Case	10,521	11,707	13,534	13,865	12,354	10,917	8,154	8,255	8,344	8,352
	0	0	0	10	2,637	5,339	10,123	11,622	13,295	14,523

(3) Investment costs

a. Initial Investment costs

Initial investment cost is shown in Chapter 3.3.5 and are summarized in Table - 6.2.3-4.

b. Renewal investment costs

The depreciable facilities and equipment will be renewed based on their service lives which are shown in Table - 6.2.3-5. The service lives of the facilities and equipment are decided based on the standard of Sihanoukville Port, Japan and UNITED NATIONS (port development).

The fund for renewal investment costs will be financed by internal resources of Sihanoukville Port.

Two expenditures mentioned above are equal to the difference of expenditures between the With Case and Without Case. Therefore, the viability of the project and the influence on the financial soundness is analyzed using these expenditures.

Table - 6.2.3-5   Service lives for port facilities and equipment

Unit: years

Item	Service lives
Berth	50
Yard and road	30
Building	25
Floating equipment	17
Gantry crane	15
Other cargo handling equipment	10
Transport equipment	10
Utilities	10

(4) Operation expenses

The annual operation expenses are assumed as follows:

a. Personnel cost

The annual personnel costs are estimated based on the required number of employees to manage and operate the future cargo handling volume and port facilities. Unit personnel cost is estimated according to present paying system of wage/salary which increases according to increased handling revenue. But its upper limit is assumed as 180 US$/month per one employee based on current labor wages in Cambodia.

b. Administration and other cost

Administration and other cost is assumed as 80% of total personnel cost. This ratio is based on the actual one of Sihanoukville Port in recent years.

Table - 6.2.3-4 Project cost of Sihanoukville Port

Unit:1,000US$

	Initial Investment Costs by Facilities				Maintenance	Depreciation	Depreciation
	Direct Cost	Engineering	P.Contingency	Total	Cost	Period	per Year
Urgent Measures	**23,818**	**1,798**	**2,562**	**28,178**	**355**		**675**
Civil Work, Main Port Facilities	*20,873*	*1,670*	*2,254*	*24,797*	*248*		*337*
Accessories of New Quay	735	59	79	873	9	50	17
General Cargo Berth	12,261	981	1,324	14,566	146	50	291
Yard	290	23	31	345	3	30	11
Roads	431	34	47	512	5	30	17
Dredging	7,156	572	773	8,501	85		
Utilities	*800*	*64*	*86*	*950*	*10*		*95*
Lighting System etc.	800	64	86	950	10	10	95
Cargo Handling Equipment	*2,145*	*64*	*221*	*2,430*	*97*		*243*
Top-loader	1,100	33	113	1,246	50	10	125
Tractor	540	16	56	612	24	10	61
Chassis	300	9	31	340	14	10	34
Forklift Truck	160	5	16	181	7	10	18
Belt Conveyor	45	1	5	51	2	10	5
Short-term Plan	**73,172**	**4,385**	**7,756**	**85,312**	**1,852**		**3,461**
Civil Work, Main Port Facilities	*38,165*	*3,053*	*4,122*	*45,340*	*453*		*776*
Container Berth	11,260	901	1,216	13,377	134	50	268
Reclamation	8,888	711	960	10,559	106	50	211
Revetment	1,418	113	153	1,685	17	30	56
Yard	5,167	413	558	6,138	61	30	205
Roads	771	62	83	916	9	30	31
Dredging	10,614	849	1,146	12,609	126		
Reefer Container Facilities	47	4	5	56	1	10	6
Building	*2,874*	*230*	*310*	*3,414*	*34*		*137*
Administration Office	750	60	81	891	9	25	36
Maintenance Workshop	506	40	55	601	6	25	24
Container Repair Facility etc.	996	80	108	1,183	12	25	47
Customs Office	20	2	2	24	0	25	1
Gate House	60	5	6	71	1	25	3
CFS	50	4	5	59	1	25	2
Other House	492	39	53	584	6	25	23
Utilities	*2,573*	*206*	*278*	*3,057*	*31*		*306*
Power Supply etc.	2,573	206	278	3,057	31	10	306
Cargo Handling Equipment	*25,180*	*755*	*2,594*	*28,529*	*1,141*		*1,950*
Gantry Crane	14,000	420	1,442	15,862	634	15	1,057
Transfer Crane	9,900	297	1,020	11,217	449	15	748
Tractor	720	22	74	816	33	10	82
Chassis	180	5	19	204	8	10	20
Forklift Truck	335	10	35	380	15	10	38
Trailer	45	1	5	51	2	10	5
Navigation Assistance	*4,380*	*140*	*452*	*4,972*	*192*		*292*
Navigation Aids	180	14	19	214	2	17	13
Tug Boat	4,200	126	433	4,759	190	17	280
Sub total							
Direct Cost	96,990						
Engineering Service		6,183					
Physical Contingency			10,317				
Total				**113,490**	**2,206**		**4,136**

Unit:1,000US$

	1998	1999	2000	2001	2002	2003	2004	Total
Urgent Measures	7,095	15,625	5,459					28,178
Short-term Plan		2,010	8,055	19,265	20,167	35,447	369	85,312
Total	**7,095**	**17,635**	**13,514**	**19,265**	**20,167**	**35,447**	**369**	**113,490**

c. Maintenance and repair cost

The annual maintenance and repair costs for port facilities are calculated as follows:

Infrastructure : 1.0% of the original construction cost
Cargo handling equipment : 4.0% of the original procurement cost
Tugboat : 4.0% of the original procurement cost

In the With Case maintenance and repair cost is calculated for the existing facilities which belong to Sihanoukville Port and the facilities which are planned in the Short-term plan. In the Without Case maintenance and repair cost is calculated for the existing facilities only.

Therefore the viability of the project is analyzed using the maintenance and repair cost for the planning facilities which means the difference between the With Case and Without Case. The influence on the financial soundness of the port management body is analyzed using the maintenance and repair cost in the With Case. Maintenance and repair cost for existing facilities is calculated based on the actual one of Sihanoukville Port in recent years.

d. Depreciation cost

The annual depreciation costs for port facilities and equipment are calculated by the straight line method, based on their service lives. Residual values after all depreciations are estimated as zero. At end of the project life, fixed assets are assumed to be sold at their residual values.

Depreciation cost is exempted from calculation of the analysis of the viability of the project. In the analysis of the influence on the financial soundness, depreciation cost is calculated on the existing and planned facilities. Depreciation cost for existing facilities is calculated based on the actual one of Sihanoukville Port in recent years and the investment cost of Sihanoukville port until 1995 (See Table - 6.2.3-6).

(5) Taxes

The port of Sihanukville pays the following taxes according to the current tax structure.

1) Turnover tax:
   This is a tax charged on all operating revenue and the rate is 4%.
2) Profit tax:
   This is charged on profit at a rate of 20%.
3) Tax on the capital:
   This is charged on government owned capital and the rate is 4%.

Table - 6.2.3-6　Investment and accumulated depreciation cost of existing facilities until 1995

Unit: 1,000 Riels

Items		Construction or procurement cost	Accumulated depreciation cost	Residual value
Land and yard		449,714	0	449,714
Jetty and quay		1,760,832	874,310	886,522
Breakwater		173,664	102,073	71,591
Building		697,506	315,197	382,308
Sub total		3,081,716	1,291,581	1790,135
Machinery and equipment		5,974,016	807,173	5,166,843
Office equipment		112,962	10,705	102,257
Furniture		89,370	6,056	83,312
other		129,653	12,648	117,205
Sub total		6,306,201	836,584	5,469,617
Total	Unit : 1,000 Riels	9,387,917	2,140,202	7,259,751
	(Unit : 1,000 US$)	(3,619)	(820)	(2,799)

Source : Sihanoukville Port

(Note) : Excluding facilities of Oil port

6.2.4 Fund raising

Eighty-five percent of initial investment costs is assumed to be raised by foreign fund. The remain initial investment costs(15%) and all of renewal investment costs are assumed to be raised by the internal resources of the port management body (Sihanoukville Port).

The following conditions apply to the above foreign fund.

[Foreign fund]

Loan period　　　　: 30 years

Grace period　　　 : 10 years

Interest rate　　　 : 1.0% per annum

Repayment　　　　 : Fixed amount repayment of principal

Ratio of investment : Less than 85% of the project cost

　(Note)　These conditions are quoted from those of the OECF(Japan)

The weighted average interest rate of the funds for investments is 0.85% when above funds are applied.

Any cash shortage should be covered by short-term loans with an annual interest rate of 18.8%/year. Cash excess will be deposited to a bank with an annual deposit interest rate of 3.7%/year.

6.3 Financial analysis

6.3.1 Analyzed pattern

The calculation of the FIRR is examined on the project of the Short-term plan (including Urgent measures) to clarify the viability of the project.

We consider the following two scenarios concerning the fund raising plan to cover the investment cost of the Short-term plan (See Fig. - 6.3.1-1).

Scenario A :   - Investment cost of Short-term plan (including Urgent measures)

               Foreign loan (1%)   : Ratio of investment is 85%.

               Internal resources   : Ratio of investment is 15%.

Scenario B :   - Investment cost of Short-term plan (excluding Urgent measures)

               Foreign loan (1%)   : Ratio of investment is 85%.

               Internal resources   : Ratio of investment is 15%.

         - Investment cost of Urgent measures

               Grant from foreign country : Ratio of investment is 100%.

The revenues and costs which are taken into account for the FIRR calculation are summarized in Fig. - 6.3.1-2.
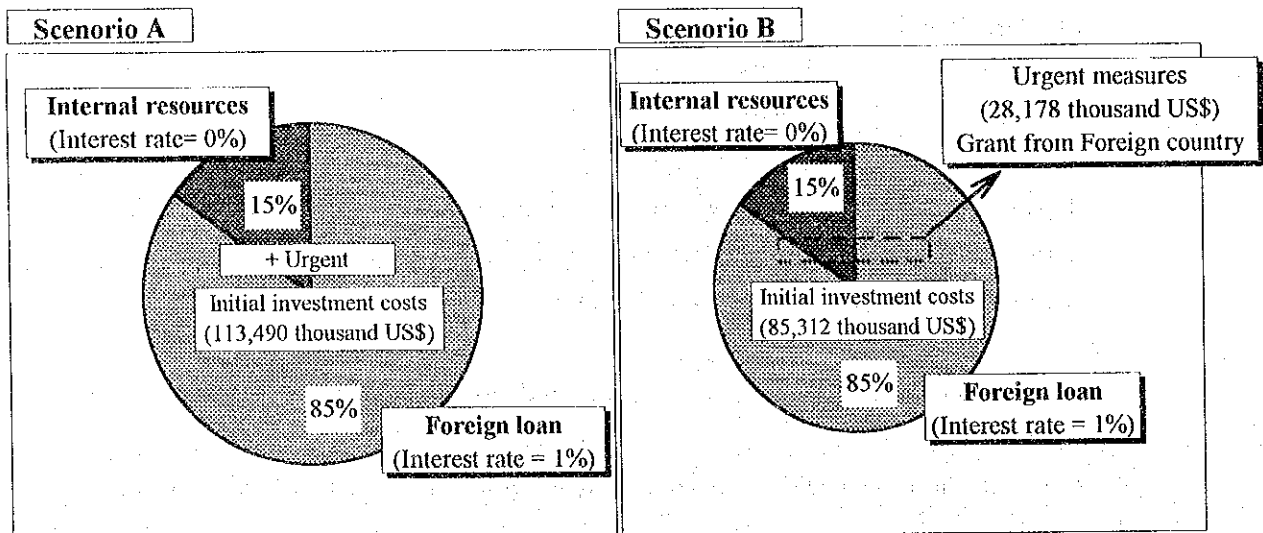
Fig. - 6.3.1-1   Fund raising plan
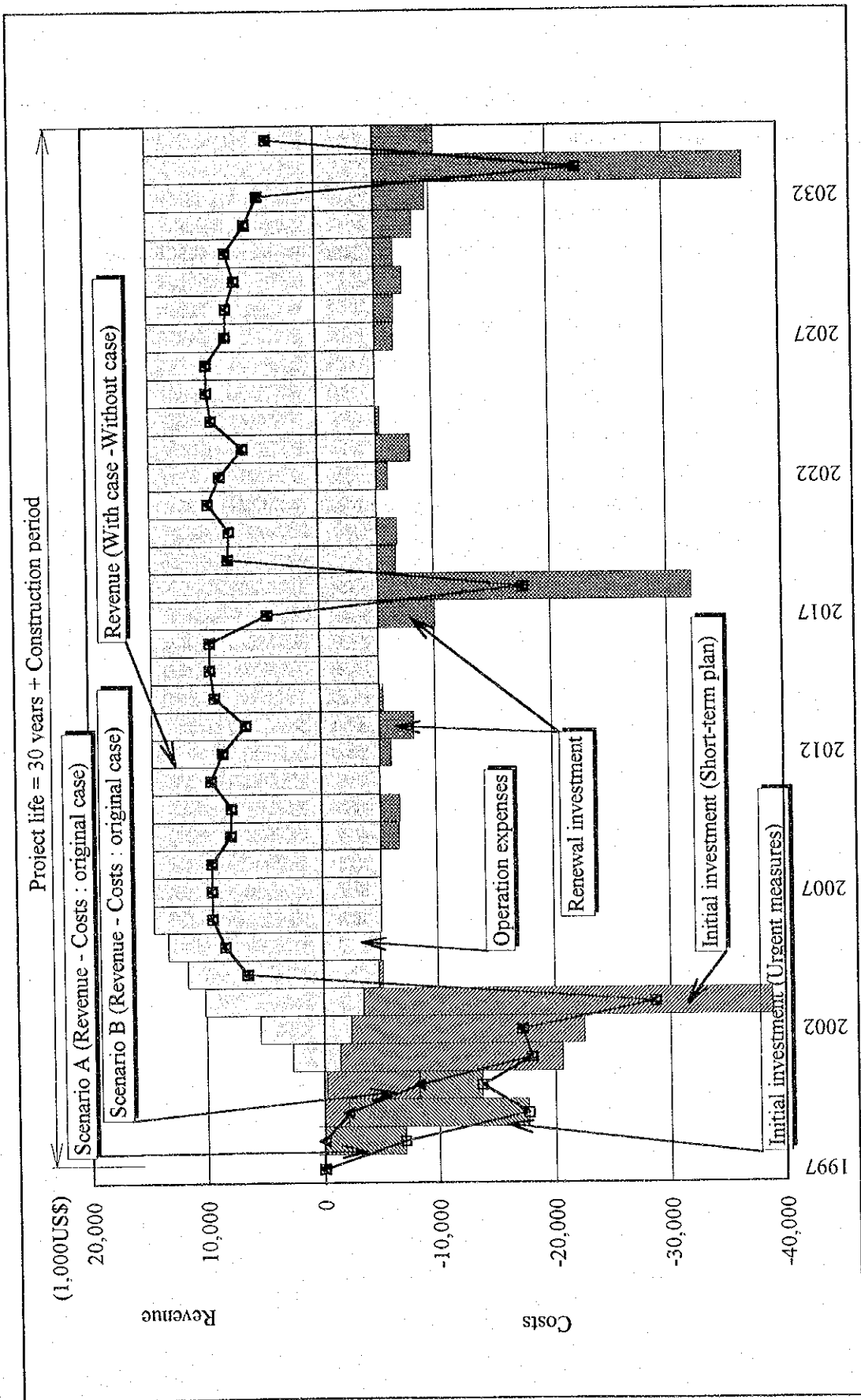
Fig. - 6.3.1-2 Revenues and costs (for the FIRR calcuulation)

6.3.2 Sensitivity analysis

Sensitivity analysis is conducted to examine the impact of unexpected future changes. The following three cases are envisioned:

Case 1 : The revenue decreases by 10%

Case 2 : The project cost increases by 10%

Case 3 : The revenue decreases by 10% and the project cost increases by 10%.

Unexpected future changes could be as follows:

1) Decrease of the revenue

- Decrease of the estimated cargo volume

- Decrease of the tariff level

2) Increase of the project cost

- Increase of the facilities construction cost by soil condition

- Sudden rise in building materials prices

6.4 Appraisal of the project

6.4.1 Viability of the project

(1) Results of the FIRR calculation

The results of the FIRR calculation are shown in Table - 6.4.1-1 and the FIRR calculation and its details are shown in Table - 6.4.1-2 (Scenario A) and Table - 6.4.1-3 (Senario B).

Weighted average interest rate of the funds is 0.85% in this study. In all cases of ScenarioB, FIRR exceeds this rate. However in Case 3 of Scenario A, the result of the FIRR calculation is -0.1%, as shown in Table - 6.4.1-1. In case of Scenario A, judging from this analysis, it is difficult to ensure financial feasibility. In case of Scenario B, this project can be judged to be financially feasible.

Table - 6.4.1-1   Results of the FIRR calculation

		Fund raising plan	
		Scenario A	Scenario B
Original Case		4.4%	7.9%
Sensitivity analysis			
Case 1	revenue decreases by 10%	2.3%	5.3%
Case 2	project cost increases by 10%	2.5%	5.6%
Case 3	revenue decreases by 10% project cost increases by 10%	-0.1%	2.7%

6.4.2 Financial soundness of the port management body

Scenario B is appraised from the viewpoint of financial soundness of the port management body. The projected financial statements for the Short-term improvement and financial indicators, the rate of return of net fixed assets, debt service coverage ratio, operating ratio and working ratio of the project are shown in Table - 6.4.2-1 and Fig. - 6.4.2-1.

(1) Profitability

The rate of return on net fixed assets remains higher than the weighted average interest rate of funds for the investments during the project life.

(2) Loan repayment capacity

The debt service coverage ratio exceeds over 1.0 during the project life. There will be no problem with the repayment of the long-term loans using the annual operating revenues.

(3) Operational efficiency

The operating ratios keeps below 70% and the working rations keeps below 50% during the project life.   This shows that the operation will be efficient.

(4) Appraisal

Based on the above indicators, it can be judged that financial soundness of the port management body can be easily secured.

6.4.3 Conclusion

In case of Scenario B, judging from the above analysis, this project can be regarded as financially feasible.   Furthermore, it is recommended that Sihanoukville Port should make efforts to heighten the quality of the service, to improve cargo handling efficiency, to secure forecast cargo volume, to reduce operating expenses and to ensure the internal resources for these projects.

Table - 6.4.1-2　Results of the FIRR calculation　(Scenario A)

Result of Calculation

Original Case	4.4%	
Sensitivity Analysis 1	2.3%	Revenue 10%Down
Sensitivity Analysis 2	2.5%	Cost 10%Up
Sensitivity Analysis 3	-0.1%	Revenue 10%Down, Cost 10%Up

Unit: 1,000US$

Year	Revenues			Cost			Revenue-Cost	Net Present Value		
	Operating Revenues	Grant	Total	Investment	Expense	Total		Revenues	Cost	Difference
1997	0		0	0	0	0	0	0	0	0
1998	0		0	7,095	0	7,095	-7,095	0	7,095	-7,095
1999	0		0	17,635	71	17,706	-17,706	0	16,957	-16,957
2000	10		10	13,514	279	13,792	-13,783	9	12,650	-12,641
2001	2,637		2,637	19,265	1,397	20,662	-18,024	2,317	18,148	-15,832
2002	5,339		5,339	20,167	2,368	22,535	-17,197	4,491	18,956	-14,466
2003	10,123		10,123	35,447	3,434	38,880	-28,758	8,155	31,322	-23,167
2004	11,622		11,622	369	4,852	5,221	6,401	8,967	4,028	4,938
2005	13,295		13,295	0	5,004	5,004	8,290	9,823	3,697	6,126
2006	14,523		14,523	0	5,143	5,143	9,380	10,276	3,639	6,638
2007	14,523		14,523	0	5,143	5,143	9,380	9,842	3,485	6,357
2008	14,523		14,523	0	5,143	5,143	9,380	9,425	3,338	6,088
2009	14,523		14,523	1,654	5,143	6,797	7,726	9,026	4,224	4,802
2010	14,523		14,523	1,744	5,143	6,886	7,637	8,645	4,099	4,546
2011	14,523		14,523	0	5,143	5,143	9,380	8,279	2,932	5,347
2012	14,523		14,523	1,050	5,143	6,192	8,331	7,929	3,381	4,548
2013	14,523		14,523	3,066	5,143	8,208	6,315	7,593	4,292	3,301
2014	14,523		14,523	380	5,143	5,522	9,001	7,272	2,765	4,507
2015	14,523		14,523	0	5,143	5,143	9,380	6,964	2,466	4,498
2016	14,523		14,523	0	5,143	5,143	9,380	6,669	2,362	4,308
2017	14,523		14,523	4,972	5,143	10,115	4,408	6,387	4,449	1,939
2018	14,523		14,523	27,079	5,143	32,221	-17,699	6,117	13,572	-7,455
2019	14,523		14,523	1,654	5,143	6,797	7,726	5,858	2,742	3,117
2020	14,523		14,523	1,794	5,143	6,937	7,586	5,610	2,680	2,930
2021	14,523		14,523	0	5,143	5,143	9,380	5,373	1,903	3,470
2022	14,523		14,523	1,050	5,143	6,192	8,331	5,146	2,194	2,952
2023	14,523		14,523	3,066	5,143	8,208	6,315	4,928	2,785	2,143
2024	14,523		14,523	380	5,143	5,522	9,001	4,719	1,794	2,925
2025	14,523		14,523	0	5,143	5,143	9,380	4,520	1,600	2,919
2026	14,523		14,523	0	5,143	5,143	9,380	4,328	1,533	2,796
2027	14,523		14,523	1,677	5,143	6,820	7,703	4,145	1,947	2,199
2028	14,523		14,523	1,737	5,143	6,879	7,643	3,970	1,881	2,089
2029	14,523		14,523	2,511	5,143	7,653	6,869	3,802	2,004	1,798
2030	14,523		14,523	1,744	5,143	6,886	7,637	3,641	1,726	1,915
2031	14,523		14,523	3,449	5,143	8,591	5,931	3,487	2,063	1,424
2032	14,523		14,523	4,576	5,143	9,718	4,805	3,340	2,235	1,105
2033	14,523		14,523	31,909	5,143	37,051	-22,528	3,198	8,159	-4,961
2034	14,523		14,523	5,352	5,143	10,495	4,028	3,063	2,213	850
Total	464,185	0	464,185	214,331	166,539	380,870	83,315	207,314	207,314	0

FIRR=　4.4%

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Table - 6.4.1-3   Results of the FIRR calculation   (Scenario B)

Result of Calculation

Original Case	7.9%	
Sensitivity Analysis 1	5.3%	Revenue 10%Down
Sensitivity Analysis 2	5.6%	Cost 10%Up
Sensitivity Analysis 3	2.7%	Revenue 10%Down, Cost 10%Up

Unit: 1,000US$

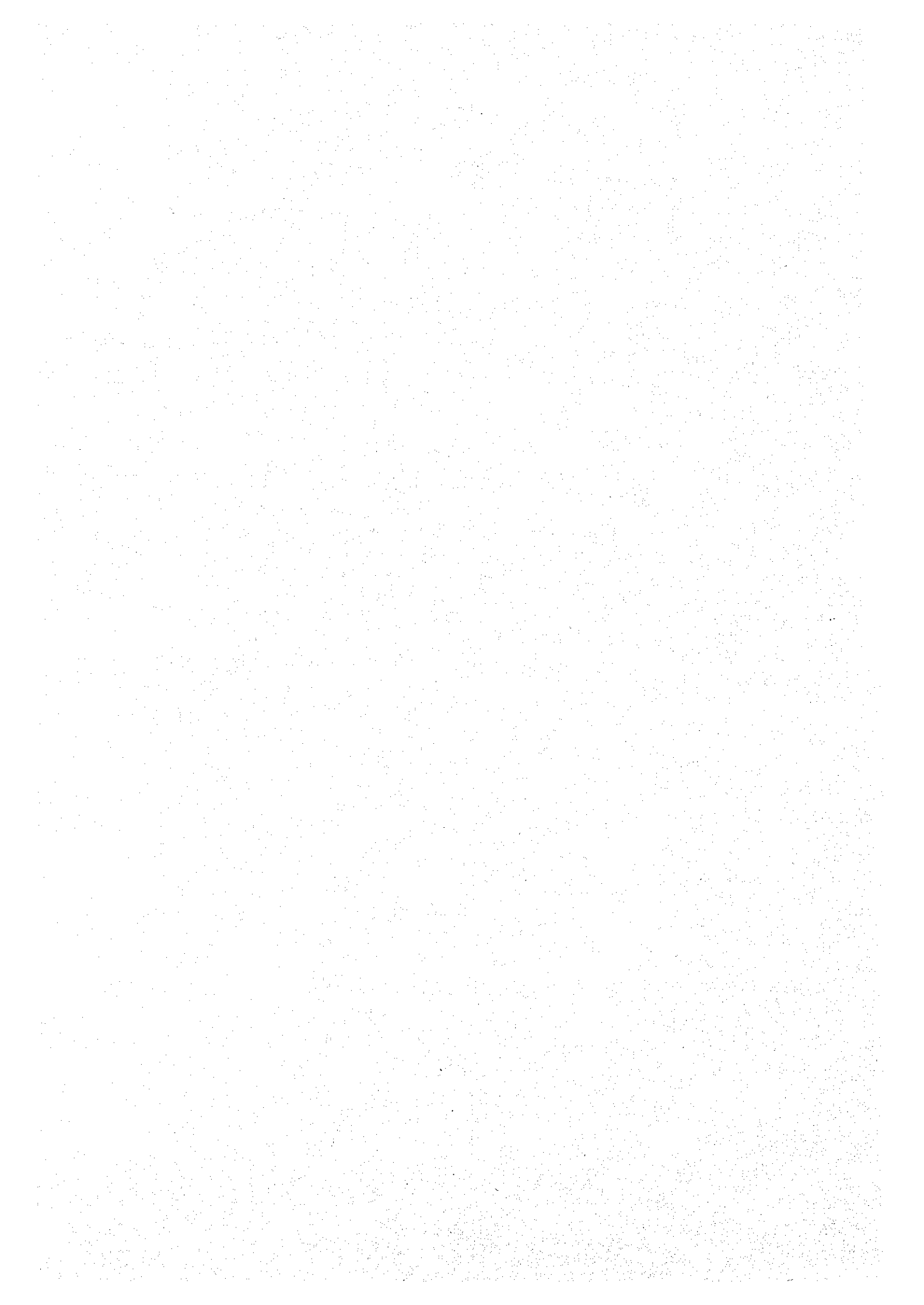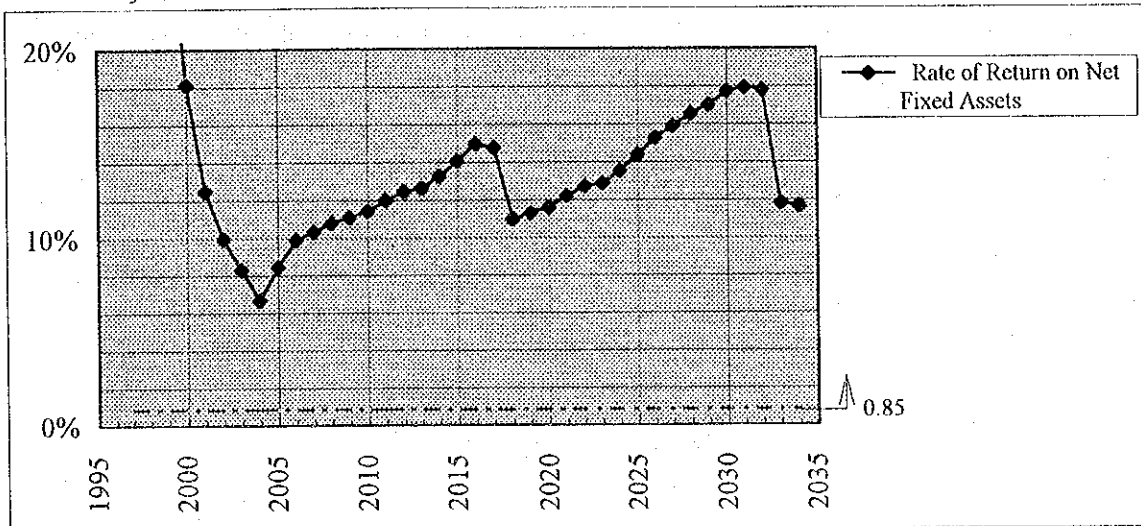| Year	Revenues			Cost			Revenue-Cost	Net Present Value		
	Operating Revenues	Grant	Total	Investment	Expense	Total		Revenues	Cost	Difference
1997	0	0	0	0	0	0	0	0	0	0
1998	0	7,095	7,095	7,095	0	7,095	0	7,095	7,095	0
1999	0	15,625	15,625	17,635	71	17,706	-2,081	14,482	16,412	-1,929
2000	10	5,459	5,468	13,514	279	13,792	-8,324	4,698	11,850	-7,152
2001	2,637	0	2,637	19,265	1,397	20,662	-18,024	2,100	16,454	-14,354
2002	5,339	0	5,339	20,167	2,368	22,535	-17,197	3,941	16,634	-12,694
2003	10,123	0	10,123	35,447	3,434	38,880	-28,758	6,926	26,602	-19,676
2004	11,622	0	11,622	369	4,852	5,221	6,401	7,370	3,311	4,059
2005	13,295	0	13,295	0	5,004	5,004	8,290	7,815	2,942	4,873
2006	14,523	0	14,523	0	5,143	5,143	9,380	7,913	2,802	5,111
2007	14,523	0	14,523	0	5,143	5,143	9,380	7,335	2,597	4,737
2008	14,523	0	14,523	0	5,143	5,143	9,380	6,799	2,407	4,391
2009	14,523	0	14,523	1,654	5,143	6,797	7,726	6,302	2,949	3,352
2010	14,523	0	14,523	1,744	5,143	6,886	7,637	5,841	2,770	3,071
2011	14,523	0	14,523	0	5,143	5,143	9,380	5,414	1,917	3,497
2012	14,523	0	14,523	1,050	5,143	6,192	8,331	5,018	2,140	2,879
2013	14,523	0	14,523	3,066	5,143	8,208	6,315	4,652	2,629	2,023
2014	14,523	0	14,523	380	5,143	5,522	9,001	4,312	1,639	2,672
2015	14,523	0	14,523	0	5,143	5,143	9,380	3,996	1,415	2,581
2016	14,523	0	14,523	0	5,143	5,143	9,380	3,704	1,312	2,393
2017	14,523	0	14,523	4,972	5,143	10,115	4,408	3,434	2,391	1,042
2018	14,523	0	14,523	27,079	5,143	32,221	-17,699	3,183	7,061	-3,879
2019	14,523	0	14,523	1,654	5,143	6,797	7,726	2,950	1,381	1,569
2020	14,523	0	14,523	1,794	5,143	6,937	7,586	2,734	1,306	1,428
2021	14,523	0	14,523	0	5,143	5,143	9,380	2,534	897	1,637
2022	14,523	0	14,523	1,050	5,143	6,192	8,331	2,349	1,002	1,348
2023	14,523	0	14,523	3,066	5,143	8,208	6,315	2,178	1,231	947
2024	14,523	0	14,523	380	5,143	5,522	9,001	2,018	767	1,251
2025	14,523	0	14,523	0	5,143	5,143	9,380	1,871	662	1,208
2026	14,523	0	14,523	0	5,143	5,143	9,380	1,734	614	1,120
2027	14,523	0	14,523	1,677	5,143	6,820	7,703	1,607	755	853
2028	14,523	0	14,523	1,737	5,143	6,879	7,643	1,490	706	784
2029	14,523	0	14,523	2,511	5,143	7,653	6,869	1,381	728	653
2030	14,523	0	14,523	1,744	5,143	6,886	7,637	1,280	607	673
2031	14,523	0	14,523	3,449	5,143	8,591	5,931	1,186	702	485
2032	14,523	0	14,523	4,576	5,143	9,718	4,805	1,100	736	364
2033	14,523	0	14,523	31,909	5,143	37,051	-22,528	1,019	2,601	-1,581
2034	14,523	0	14,523	5,352	5,143	10,495	4,028	945	683	262
Total	464,185	28,178	492,362	214,331	166,539	380,870	111,493	150,706	150,706	0

FIRR=	7.9%
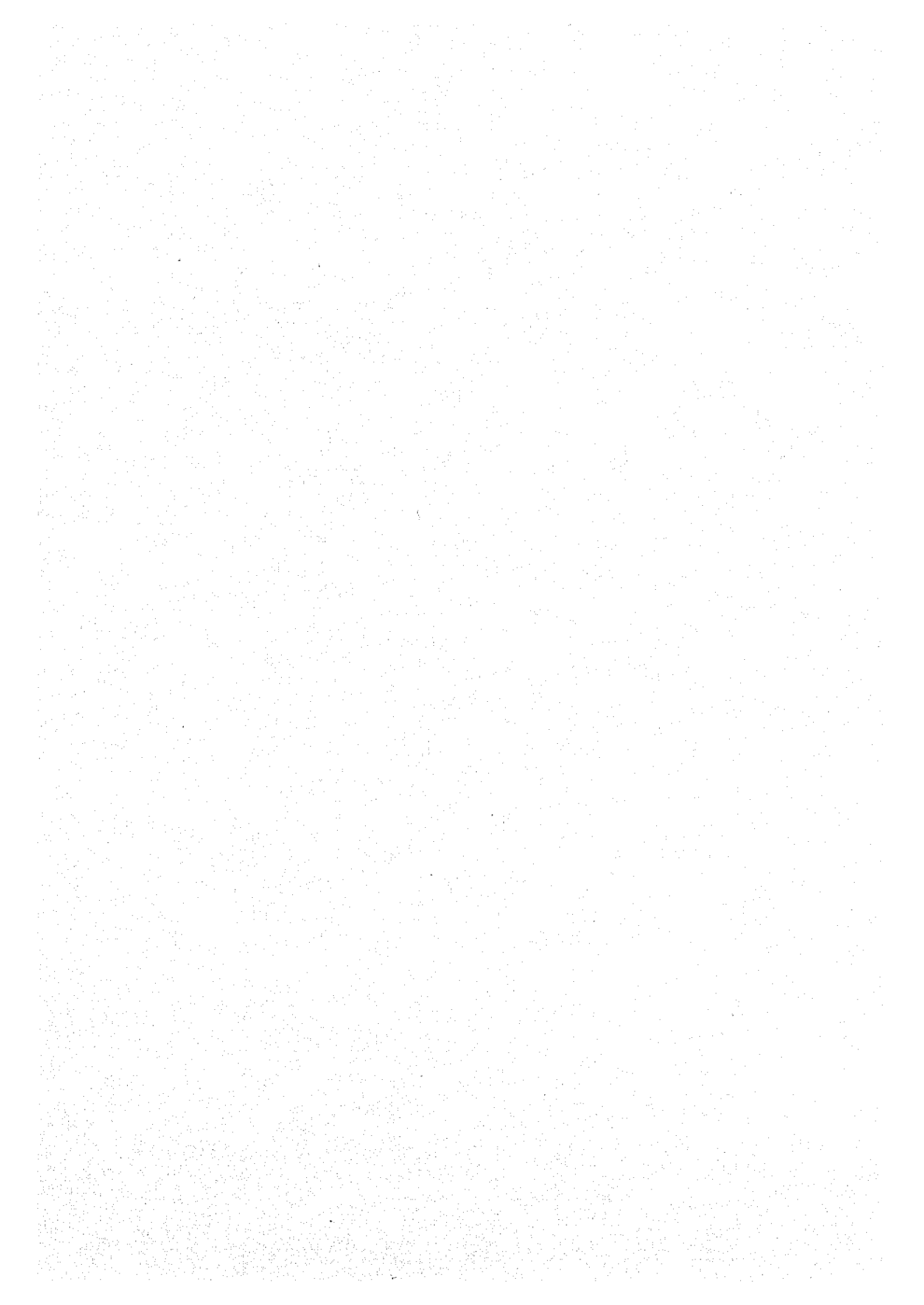
Table 6.4.2-1 Financial statements for Short-term plan (Scenario B)

PROFIT AND LOSS STATEMENT (Unit: 1,000 US$)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Operating Revenue	10,521	11,707	13,534	13,875	14,991	16,256	18,277	19,877	21,639	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875	22,875
Operating Cost	4,764	5,155	5,761	6,531	7,655	8,538	9,055	12,728	12,930	13,082	13,081	13,079	13,078	13,077	13,076	13,076	13,075	13,075	13,074	13,074	13,073	13,072	13,072	13,071	13,071	13,071	13,071	13,071	13,071	13,071	13,071	13,071	13,071	13,071	13,071	13,071	13,071	13,071
Personnel	2,037	2,231	2,438	2,560	2,668	2,776	2,687	2,780	2,825	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884	2,884
Operations, maintenance & repair	380	380	451	658	956	1,155	1,367	2,571	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587
Administrations	1,630	1,785	1,951	2,048	2,134	2,220	2,150	2,224	2,260	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307	2,307
Turnover tax & Tax on Capital	474	515	583	590	629	674	751	812	879	926	924	923	921	921	920	920	919	919	918	917	917	916	916	915	915	915	915	915	915	915	915	915	915	915	915	915	915	915
Depreciation costs	243	243	338	674	1,269	1,714	2,101	4,341	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379
Net Operating Income	5,757	6,551	7,773	7,344	7,336	7,718	9,222	7,149	8,709	9,792	9,794	9,795	9,797	9,798	9,798	9,799	9,799	9,800	9,800	9,801	9,802	9,802	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803
Non-operating Revenues	0	170	369	603	809	978	1,171	1,338	1,717	2,158	2,643	3,143	3,657	4,126	4,602	5,144	5,633	6,030	6,484	6,966	7,463	7,792	7,313	7,763	8,221	8,761	9,279	9,738	10,312	10,918	11,542	12,125	12,723	13,312	13,950	14,558	15,174	14,829
Interest on deposit	0	170	369	603	809	978	1,171	1,338	1,717	2,158	2,643	3,143	3,657	4,126	4,602	5,144	5,633	6,030	6,484	6,966	7,463	7,792	7,313	7,763	8,221	8,761	9,279	9,738	10,312	10,918	11,542	12,125	12,723	13,312	13,950	14,558	15,174	14,829
Non-operating Expenses	0	0	0	17	86	249	421	722	725	725	725	725	725	724	720	708	687	650	614	578	542	505	469	433	397	360	324	288	252	215	179	143	107	71	39	15	0
Interest on long-term loans	0	0	0	17	86	249	421	722	725	725	725	725	725	724	720	708	687	650	614	578	542	505	469	433	397	360	324	288	252	215	179	143	107	71	39	15	0
Interest on short-term loans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Income Before Tax	5,757	6,722	8,143	7,930	8,059	8,447	9,972	7,765	9,701	11,225	11,712	12,213	12,729	13,198	13,676	14,222	14,725	15,144	15,634	16,153	16,686	17,052	16,611	17,097	17,592	18,168	18,722	19,217	19,827	20,469	21,130	21,749	22,384	23,008	23,682	24,323	24,962	24,632
Income Tax	1,151	1,344	1,629	1,586	1,612	1,689	1,994	1,553	1,940	2,245	2,342	2,443	2,546	2,640	2,735	2,844	2,945	3,029	3,127	3,231	3,337	3,410	3,322	3,419	3,518	3,634	3,744	3,843	3,965	4,094	4,226	4,350	4,477	4,602	4,736	4,865	4,992	4,926
Net Income After Tax	4,605	5,377	6,514	6,344	6,448	6,757	7,978	6,212	7,761	8,980	9,369	9,770	10,183	10,558	10,940	11,378	11,780	12,115	12,507	12,922	13,349	13,642	13,288	13,677	14,073	14,534	14,977	15,374	15,862	16,376	16,904	17,399	17,907	18,407	18,946	19,458	19,970	19,706
Retained Earnings	4,605	9,740	15,709	20,602	23,916	27,405	29,823	35,737	43,254	51,991	61,117	70,644	78,930	87,502	98,199	108,284	116,755	128,248	140,512	153,191	161,324	147,644	159,035	170,675	184,505	197,746	209,415	224,166	239,785	255,917	270,901	286,320	301,474	317,894	333,148	347,787	335,605	349,715

CASH FLOW STATEMENT (Unit: 1,000US$)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Cash Beginning	0	4,605	9,983	16,291	21,857	26,440	31,643	36,162	46,417	58,313	71,429	84,934	98,841	111,506	124,371	139,020	152,238	162,984	175,245	188,263	201,695	210,582	197,656	209,800	222,193	236,777	250,771	263,193	278,698	295,070	311,956	327,693	343,866	359,772	377,031	393,466	410,105	400,780
Cash Inflow (excluding G. Funds)	6,000	14,059	25,814	20,927	25,789	27,552	42,624	13,142	14,805	16,329	16,816	17,317	17,833	18,302	18,779	19,322	19,811	20,209	20,664	21,146	21,644	21,973	21,495	21,945	22,404	22,943	23,461	23,921	24,494	25,100	25,725	26,307	26,906	27,494	28,133	28,741	29,356	29,011
Net operating income	5,757	6,551	7,773	7,344	7,336	7,718	9,222	7,149	8,709	9,792	9,794	9,795	9,797	9,798	9,798	9,799	9,799	9,800	9,800	9,801	9,802	9,802	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803	9,803
Depreciation costs	243	243	338	674	1,269	1,714	2,101	4,341	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379	4,379
Capital Grant	0	7,095	15,625	5,459	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Long-term loans	0	0	1,709	6,847	16,375	17,142	30,130	313	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest on deposits	0	170	369	603	809	978	1,171	1,338	1,717	2,158	2,643	3,143	3,657	4,126	4,602	5,144	5,633	6,030	6,484	6,966	7,463	7,792	7,313	7,763	8,221	8,761	9,279	9,738	10,312	10,918	11,542	12,125	12,723	13,312	13,950	14,558	15,174	14,829
Cash Outflow (excluding G. Funds)	1,394	8,682	19,506	15,360	21,206	22,349	38,105	2,887	2,909	3,213	3,311	3,411	5,168	5,437	4,130	6,104	9,065	7,948	7,646	7,714	12,757	34,900	9,351	9,552	7,820	8,949	11,039	8,416	8,122	8,214	9,988	10,135	10,999	10,235	11,698	12,102	38,682	10,537
Investment	243	7,338	17,877	13,757	19,509	20,411	35,690	612	243	243	243	243	1,897	1,980	243	1,293	3,309	623	243	243	5,216	27,322	1,897	2,038	243	1,293	3,309	243	243	1,921	1,980	2,754	1,987	3,692	4,819	32,152	5,595
Repayment for long-term loans	0	0	0	0	0	0	0	0	0	0	0	0	0	85	428	1,247	2,104	3,610	3,626	3,626	3,626	3,626	3,626	3,626	3,626	3,626	3,626	3,626	3,626	3,626	3,626	3,626	3,626	3,540	3,198	2,379	1,522	16
Interest on long-term loans	0	0	0	17	86	249	421	722	725	725	725	725	725	724	720	708	687	650	614	578	542	505	469	433	397	360	324	288	252	215	179	143	107	71	39	15	0
Income Tax	1,151	1,344	1,629	1,586	1,612	1,689	1,994	1,553	1,940	2,245	2,342	2,443	2,546	2,640	2,735	2,844	2,945	3,029	3,127	3,231	3,337	3,410	3,322	3,419	3,518	3,634	3,744	3,843	3,965	4,094	4,226	4,350	4,477	4,602	4,736	4,865	4,992	4,926
Interest on short-term loans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Inflow - Cash Outflow	4,605	5,377	6,308	5,566	4,583	5,202	4,519	10,255	11,897	13,116	13,505	13,906	12,665	12,866	14,649	13,218	10,746	12,261	13,018	13,432	8,887	-12,927	12,145	12,393	14,584	13,995	12,422	15,505	16,372	16,886	15,737	16,173	15,906	17,259	16,435	16,639	-9,325	18,474
Cash Ending	4,605	9,983	16,291	21,857	26,440	31,643	36,162	46,417	58,313	71,429	84,934	98,841	111,506	124,371	139,020	152,238	162,984	175,245	188,263	201,695	210,582	197,656	209,800	222,193	236,777	250,771	263,193	278,698	295,070	311,956	327,693	343,866	359,772	377,031	393,466	410,105	400,780	419,254
Cash excess	4,605	9,983	16,291	21,857	26,440	31,643	36,162	46,417	58,313	71,429	84,934	98,841	111,506	124,371	139,020	152,238	162,984	175,245	188,263	201,695	210,582	197,656	209,800	222,193	236,777	250,771	263,193	278,698	295,070	311,956	327,693	343,866	359,772	377,031	393,466	410,105	400,780	419,254
Cash shortage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

BALANCE SHEET (Unit: 1,000US$)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
(Assets)																																						
Current Assets	4,605	9,983	16,291	21,857	26,440	31,643	36,162	46,417	58,313	71,429	84,934	98,841	111,506	124,371	139,020	152,238	162,984	175,245	188,263	201,695	210,582	197,656	209,800	222,193	236,777	250,771	263,193	278,698	295,070	311,956	327,693	343,866	359,772	377,031	393,466	410,105	400,780	419,254
Cash & Deposit	4,605	9,983	16,291	21,857	26,440	31,643	36,162	46,417	58,313	71,429	84,934	98,841	111,506	124,371	139,020	152,238	162,984	175,245	188,263	201,695	210,582	197,656	209,800	222,193	236,777	250,771	263,193	278,698	295,070	311,956	327,693	343,866	359,772	377,031	393,466	410,105	400,780	419,254
Fixed Assets	2,799	9,893	27,432	40,516	58,755	77,452	111,041	107,311	103,175	99,039	94,903	90,767	88,285	85,893	81,757	78,600	77,600	73,843	69,707	65,571	66,408	89,350	80,391	77,305	76,234	72,478	68,342	64,206	61,747	59,348	55,330	54,643	55,083	82,857	84,071	117,071	208,979	214,331
Construction costs	0	7,095	24,729	38,243	57,508	77,676	113,122	113,491	113,491	113,491	113,491	113,491	115,145	116,888	116,888	117,938	121,004	121,383	121,383	121,383	126,356	153,434	155,088	156,883	156,883	157,933	160,998	161,378	161,378	163,055	164,792	167,303	169,046	172,495	177,071	208,979	214,331	
Existing Fixed Assets	4,105	4,349	4,592	4,835	5,078	5,321	5,564	5,807	6,050	6,294	6,537	6,780	7,266	7,509	7,752	7,996	8,239	8,482	8,725	8,968	9,211	9,454	9,698	9,941	10,427	10,670	10,913	11,156	11,400	11,643	11,886	12,129	12,372	12,615	12,858	13,101		
Accumulated depreciation	1,307	1,550	1,888	2,562	3,831	5,545	7,646	11,987	16,366	20,745	25,124	29,504	33,883	38,262	42,641	47,020	51,399	55,778	60,158	64,537	68,916	73,295	77,674	82,053	86,433	90,812	95,191	99,570	103,949	108,328	112,707	117,087	121,466	125,845	130,224	134,603	138,982	143,362
Net fixed assets	2,799	9,893	27,432	40,516	58,755	77,452	111,041	107,311	103,175	99,039	94,903	90,767	88,285	85,893	81,757	78,670	77,600	73,843	69,707	65,571	66,408	89,350	80,391	77,305	76,234	72,478	68,342	64,206	61,747	59,348	55,330	54,643	55,083	82,857	84,071			
Total Assets	7,404	19,876	43,723	62,373	85,196	109,095	147,202	153,728	161,488	170,468	179,837	189,608	199,791	210,264	220,777	230,908	240,584	249,089	257,970	267,267	276,990	287,006	296,669	306,720	317,168	328,076	339,428	351,176	363,412	376,162	389,440	403,214	417,495	432,361	448,109	465,188	483,635	503,325
(Liabilities and capital)																																						
Liabilities	0	0	1,709	8,555	24,931	42,073	72,202	72,516	72,516	72,516	72,516	72,516	72,430	72,002	70,756	68,652	65,042	61,416	57,791	54,165	50,539	46,913	43,287	39,662	36,036	32,410	28,784	25,159	21,533	17,907	14,281	10,655	7,115	3,917	1,538	16	-0	
Current Liabilities (cross subsidy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fixed Liabilities (Long-term loan)	0	0	1,709	8,555	24,931	42,073	72,202	72,516	72,516	72,516	72,516	72,516	72,430	72,002	70,756	68,652	65,042	61,416	57,791	54,165	50,539	46,913	43,287	39,662	36,036	32,410	28,784	25,159	21,533	17,907	14,281	10,655	7,115	3,917	1,538	16	-0	
Capital	7,404	19,876	42,015	53,817	60,265	67,022	75,000	81,212	88,973	97,952	107,322	117,092	127,275	137,834	148,774	160,152	171,932	184,047	196,554	209,476	222,825	236,467	249,755	263,433	277,506	292,040	307,017	322,391	338,253	354,629	371,533	388,933	406,839	425,246	444,192	463,650	483,620	503,325
Capital Grant	0	7,095	22,719	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178	28,178
Owned Capital	2,799	3,042	3,586	5,038	8,171	11,439	16,999	17,298	17,541	17,784	18,027	18,270	20,167	22,154	22,397	23,690	26,999	27,621	27,865	28,108	33,323	60,645	62,542	64,580	64,823	66,116	69,425	70,047	70,291	70,534	72,454	74,434	77,188	79,175	82,867	87,685	119,837	125,432
Retained Earnings	4,605	9,740	15,709	20,602	23,916	27,405	29,823	35,737	43,254	51,991	61,117	70,644	78,930	87,502	98,199	108,284	116,755	128,248	140,512	153,191	161,324	147,644	159,035	170,675	184,505	197,746	209,415	224,166	239,785	255,917	270,901	286,320	301,474	317,894	333,148	347,787	335,605	349,715
Total Liabilities and capital	7,404	19,876	43,723	62,373	85,196	109,095	147,202	153,728	161,488	170,468	179,837	189,608	199,791	210,264	220,777	230,908	240,584	249,089	257,970	267,267	276,990	287,006	296,669	306,720	317,168	328,076	339,428	351,176	363,412	376,162	389,440	403,214	417,495	432,361	448,109	465,188	483,635	503,325

FINANCIAL INDICATORS

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Working Ratio (%)	43.0%	42.0%	40.1%	42.2%	42.6%	42.0%	38.0%	42.2%	39.5%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%	38.0%
Operating Ratio (%)	45.3%	44.0%	42.6%	47.1%	51.1%	52.5%	49.5%	64.0%	59.8%	57.2%	57.2%	57.2%	57.2%	57.2%	57.2%	57.2%	57.2%	57.2%	57.2%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%
Rate of Return on Net Fixed Assets	205.7%	66.2%	28.3%	18.1%	12.5%	10.0%	8.3%	6.7%	9.9%	10.3%	10.8%	11.1%	11.4%	12.0%	12.5%	12.6%	13.3%	14.1%	14.9%	14.8%	11.0%	11.3%	11.6%	12.2%	12.7%	12.9%	13.5%	14.3%	15.3%	15.9%	16.5%	17.0%	17.7%	17.9%	17.8%	11.8%	11.7%	
Debt Service Coverage Ratio				469.30	100.58	37.83	26.91	15.91	18.05	19.54	19.54	19.55	19.55	17.49	12.31	7.21	5.04	3.30	3.32	3.34	3.37	3.40	3.43	3.46	3.49	3.53	3.56	3.59	3.62	3.66	3.69	3.73	3.76	3.89	4.34	5.86	9.22	896.62

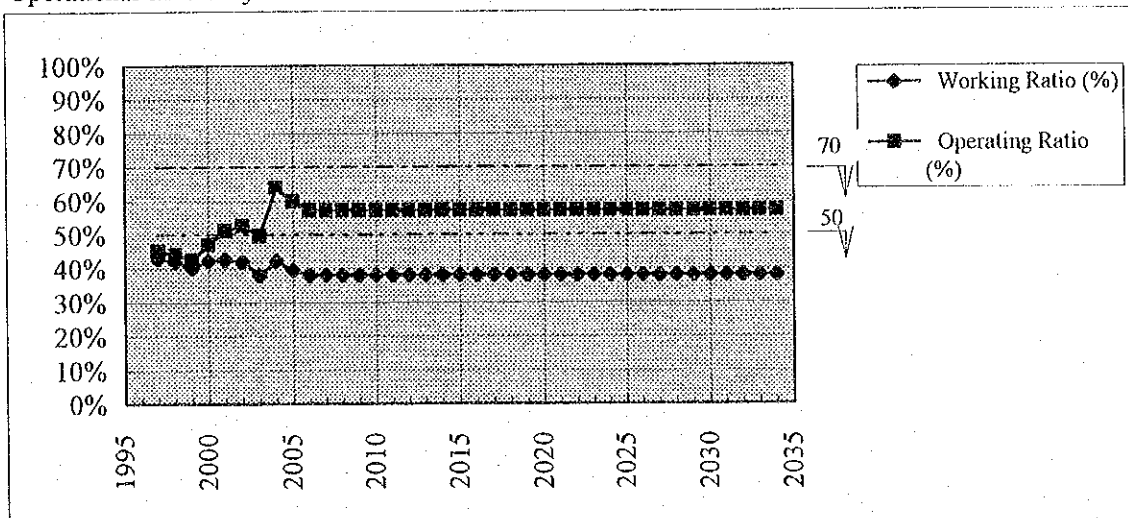Profitability

Loan repayment capacity

Operational efficiency

Fig. - 6.4.2-1   Financial indicators for Short-term plan (Scenario B)