PART 2.2 PRELIMINARY STUDY ON MAJOR PROJECTS IN THI VAI-VUNG TAU AREA

In order to examine the comparison between Thi Vai- Cai Mep site and Ben Dinh-Sao Mai site, an under-mentioned study is conducted based on the assumed components shown in the Table 18.1, in which 30,000 DWT general cargo berths are included.

Table 18.1 Major Projects Components in Thi Vai- Vung Tau Area

(1) Ben Dinh-Sao Mai Site

Site and facility	Vessel Size	Number
Container Berth	80,0000 DWT	2
Container Berth	50,0000 DWT	3
Breakwater		100 m
Channel (GRB-BDSM)	80,000 DWT	Two-way
Access Road		4 lanes 3 km

(2)Cai Mep Site

Site and facility	Vessel Size	Number
Container Berth	80,000 DWT	2
Container Berth	50,000 DWT	3
Channel (GRB-CM)	80,000 DWT	Two-way
Access Road		4 lanes 3 km

(3) Thi Vai Site

Site and facility	Vessel Size	Number
General Cargo Berth	50,000 DWT	2
General Cargo Berth	30,000 DWT	2
Channel (CM-TV)	50,000 DWT	One-way
Access Road		4 lanes 2 km

GRB: channel section in the entrance of Ganh Rai Bay
BDSM: channel section in the offshore of Ben Dinh -Sao Mai site
CM: channel section in the riverfront of Cai Mep site
TV: channel section in the riverfront of Thi Vai site

Chapter 18 Preliminary Structural Design for Major Projects

18.1 General

The projects to be developed in southern part of Vietnam by the year 2020 are container terminals, general cargo terminals and passenger terminals in Saigon area, container and general cargo terminals of Thi Vai port and container terminals of Cai Mep port in Thi Vai area or container terminals of Ben Dinh - Sao Mai port in Vung Tau area as proposed in Chapter 17.

Out of these projects, the projects of Thi Vai port, Cai Mep port and Ben Dinh - Sao Mai port are studied in this Chapter as major projects.

The structural design on the facilities is conducted based on the technical standards prevailing in Vietnam as much as possible. However, if there are no suitable technical standards in Vietnam, the "Technical Standards for Port and Harbour Facilities in Japan" is applied.

Since this preliminary structural design is conducted for preparing the "Master Plan", the structural of facilities is selected based not on the comparative study of all alternatives but on experimental judgement. A detailed comparative study to pursue the economically optimal type of structure will be conducted in the stage of " Feasibility Study".

18.2 Design Criteria

18.2.1 Facilities of Major Projects

The designative facilities of major projects for preliminary structural design are as follows:

Table 18.2.1 Facilities for Preliminary Design

Location of Port	Type of Facility	Design Vessel	Number of Berths
Thi Vai	Container Terminal	50,000 DWT	2
	General cargo Terminal	30,000 DWT	2
Cai Mep	Container Terminal	80,000 DWT	2
	Container Terminal	50,000 DWT	3
Vung Tau	Container Terminal	80,000 DWT	2
	Container Terminal	50,000 DWT	3

18.2.2 Design Vessels

The dimensions of design vessels are summarized in table below:

Table 18.2.2 Dimensions of Design Vessels

DWT (ton)	Cargo Type	LOA (m)	LPP (m)	Beam (m)	Draft (m)
80,000	Container	300	284	42.8	14.0
50,000	Container	267	253	32.3	12.5
30,000	General cargo	210	200	30.0	10.7

18.2.3 Load Condition

1) Dead Weight

The values of unit weight of materials shown in table below are applied for obtaining the deadweight of structure:

Table 18.2.3 Unit Weight of Main Materials

Material	Unit Weight (kN/m3)	Material	Unit Weight (kN/m3)
Steel	77.0	Reinforced Concrete	24.0
Asphalt Concrete	22.6	Plain Concrete	22.6
Stone	26.0	Sand (wet condition)	18.0

2) Surcharge

The surcharge on an apron of quay and on a terminal storage yard are applied as follows:

Table 18.2.4 Surcharge

Loading Location	Ordinary Condition	Earthquake Condition
Apron of Quay	40 kN/m2	20 kN/m2
Storage Yard	20 kN/m2	20 kN/m2

3) Cargo Handling Equipment

The loads and dimensions of main container handling equipment applied for the preliminary design are as follows:

Table 18.2.5 Loads and Dimensions of Quay Container Gantry Crane

Vessel Size	Container Size	Lifting Capacity	Total Weight	Out Reach	Rail Span	Axial Distance	Number of Wheels	Sea Side kN/ Wheel	Land Side kN/ Wheel
80000DWT	20',40',45'	40.6 t	900 t	47.8m	30m	18m	32	458	324
50000DWT	20',40',45'	30.5 t	650 t	36.0m	16m	18m	32	341	275
30000DWT	20',40',45'	30.5 t	650 t	36.0m	16m	18m	32	341	275

Table 18.2.6 Load and Dimensions of Rubber Tire Mounted Gantry Crane

RTG Size	Container Size	Lifting Capacity	Total Weight	Span	Axial Distance	Number of Wheels	kN/ Wheel
6+1 row, 4+1 high	20',40',45'	40.6 t	136 t	23.47 m	2.5 m	8	290

4) Vehicle Load

The vehicle load of "H30" of Vietnam Road Standard is applied for the road design.

5) Berthing Force

The ship's berthing energy is calculated by kinetic method by using the following equation:

$$Ef=(Ws*V^2/2g)*Ce*Cm*Cs*Cc$$

Where Ef : Ship's berthing energy (tf-m)
g : Accceleration gravity (m/s^2)
Ws : Water displacement of berthing ship (tf)
V : Approach velocity of ship against the fender (m/s)
Ce : Eccentricity factor
Cm : Virtual mass factor
Cs : Softness factor
Cc : Shape factor of berth

Based on the above formula, the berthing energies of design vessels are obtained as follows by applying V=0.1 m/s of approach velocity for all design vessels:

Design Vessel	Berthing Energy
80,000 DWT	50.7 tf-m
50,000 DWT	35.4 tf-m
30,000 DWT	21.4 tf-m

Above berthing energies shall be absorbed by the suitable fender system. When cell-type rubber fenders are adopted, the reaction forces against the quay structures would be as follows:

Design Vessel	Size & Number of Fender	Reaction Force of Fender
80,000 DWT	SUC1000RH x 2 units	115.8 tf
50,000 DWT	SUC1000R0 x 2 units	89.0tf
30,000 DWT	SUC800RH x 2 units	72.4 tf

6) Mooring Force

A ship is subject to the action of waves, winds, and currents during its moored to a quay and the external forces generated by the oscillation of the moored ship should be taken into account. As will be presented in Section 18.2.5, waves, winds and currents are not so strong in these project sites. Therefore, in this preliminary design, the mooring force acting on the mooring posts is determined by the value of tractive force recommended in the Japanese standard (Technical Standards for Port and Harbour Facilities).

Design Vessel	Mooring (Tractive) Force
30,000~80,000DWT (26,400~70,400GT)	1000 kN

7) Earthquake Force

Based on the Vietnam technical standard for port construction promulgated by Ministry of Transport in 1985, the project sites are situated in the Zones 6 to 7 in the zoning map of seismic intensity levels in Vietnamese territory, which corresponds to seismic coefficient of 0.05.

18.2.4 Materials

1) Steel

a. Structural Steel

The allowable axial compressive stress of slender member like a pile and a column should be reduced against the effect of buckling.

Table 18.2.7 Allowable Stress of Structural Steel

Kind of Stress \ Kind of Steel	SS400	SM490
Axial tensile stress (per net sectional area)	140	185
Axial compressive stress (per gross sectional area)	140	185
Bending tensile stress (per net sectional area)	140	185
Bending compressive stress (per gross sectional area)	140	185
Shearing stress (per gross sectional area)	80	105
Bearing stress (between steel plates)	210	280

(N/mm^2)

b. Steel Sheet Pile

Table 18.2.8 Allowable Stress of Steel Sheet Pile

Kind of Stress \ Kind of Sheet Pile	SY295
Bending tensile stress (per net sectional area)	180
Bending compressive stress (per gross sectional area)	180
Shearing stress (per gross sectional area)	100

c. Increase of Allowable Stress

When the influence of earthquake is considered, the allowable stresses presented in the above tables can be increased by 50%.

d. Corrosion Rate of Steel

The typical value of corrosion rates of steel design are shown in table below:

Table 18.2.9 Corrosion Rates of Steel

Corrosive environment		Corrosion rate (mm/year)
Sea Side	Above H.W.L.	0.3
	H.W.L.~L.W.L-1.0m	0.1 ~ 0.3
	L.W.L.-1.0m ~ the sea bottom	0.1 ~ 0.2
	Below the sea bottom	0.03
Land Side	In marine atmosphere	0.1
	In soil (above the residual water level)	0.03
	In soil (below the residual water level)	0.02

2) Concrete

a. Quality of Concrete

The quality of concrete for marine reinforced concrete structures shall be f'ck = 24 N/mm^2.

b. Allowable Stress of Reinforcing Bar

The allowable tensile stresses of reinforcing bar are as shown in the table below:

Table 18.2.10 Allowable Tensile Stress of Reinforcing Bar

Kind of Re-bar	SR295	SD345
(a) Allowable tensile stress in general case	157	196
(b) Allowable tensile stress for Fatigue strength	157	176
(c) Allowable tensile stress for Yield strength	176	196

(N/mm^2)

c. Increase of Allowable Stress

When the influence of earthquake is considered, the allowable stresses presented above tables can be increased by 50%.

18.2.5 Natural Conditions

1) Climatic Conditions

a. Temperature

The monthly average air temperature at HCM City varies from 26.0℃ in December to 29.1℃ in April and the maximum and minimum air temperatures were 39.3℃ and 14.1℃ recorded in 1998 and 1976 respectively.

b. Wind

The monthly average wind velocity through a year is 4.1 m/sec at Vung Tau area and 2.5 m/sec at HCM City. The wind direction prevails in E to SE during November to April and in SW to W during May to October. The maximum wind velocity at Vung Tau was 30 m/sec during the past 40 years and at HCM City it was 36 m/sec during the past 30 years.

c. Precipitation

The monthly average rainfalls at HCM City during 1952 to 1987 were 206 to 298 mm/month in rainy season from May to October and 4 to 118 mm/month in dry season from November to April. Based on statistical analysis of rainfall data at HCM City, the rainfall by probability of occurrence are obtained as follows:

Table 18.2.11 Rainfall by Probability of Occurrence at HCM City

Case	Probability of Occurrence (%)				
	1	2	3	5	10
Hourly maximum rainfall (mm)	126	116	111	103	93

2) Maritime and Fluvial Conditions

a. Tide

(1) Chart Datum and National Datum

The Chart Datum Line (CDL) is defined in relation to the National Datum Line at Hon Dau (NDL) by the following equations:

At Vung Tau: CDL= NDL-2.887 m

At Phu An: CDL= NDL-2.757 m

(2) Tide Level at Vung Tau and Thi Vai

The tide in this area is predominantly "semi-diurnal" and the representative tidal levels at Vung Tau area and Phu An (Sai Gon) area are shown in the table below:

Table 18.2.12 Tidal Levels

Tide Levels	Abbreviation	Location	
		Vung Tau	Phu An
Highest High Water Level	HHWL	+4.43m	+4.19m
High Water Level	HWL	+3.97m	+3.92m
Mean Sea Level	MSL	+2.67m	+2.86m
Low Water Level	LWL	+0.58m	+1.04m
Lowest Low Water Level	LLWL	-0.47m	+0.12m
Chart Datum Level	CDL	0.00m	0.00m

b. Wave

(1) Observed Wave Height

The maximum observed wave height and the statistically estimated wave height by the Marine Hydro-meteorological Center are given in table below:

Table 18.2.13 Observed and Estimated Extreme Wave Heights

Station	Observed Period	Direction	Max. Wave Height (m)	Recurrence Period (year)			
				10	50	75	100
Vung Tau	1979-1993	SW	3.0	3.2	3.7	4.1	4.6
Can Dao Island	1979-1993	NE	3.5	3.4	4.3	5.0	5.5
Offshore of Vung Tau - Can Dao	1960-1982	NW	8.5	10.0	11.5	12.7	13.5
Bach Ho Oil Rig	1985-1988	-	10.5	13.5	15.0	16.5	17.5

(2) Wave Height in Ganh Rai Bay

According to the data observed at Sao Mai and Nghinh Phong during 1986 to 1987, the maximum wave heights are as follows:

At Sao Mai: H=1.20 m, T=3.8 sec., L=45 m

At Nghinh Phong: H=1.97 m, T=5.9 sec., L=57 m

(3) Design Waves for Protective Facilities at Ben Dinh - Sao Mai Port

The design waves for protective facilities required for Ben Dinh - Sao Mai port are the waves generated by typhoons. The analysis of the design wave is not obtained yet. Therefore, in this preliminary design, it is assumed that the design wave height is the breaking wave height at the place of interest.

c. Current

The maximum currents in each project site are as follows:

Table 18.2.14 Maximum Current at Thi Vai River and Vung Tau

	Thi Vai	Cai Mep	Ben Dinh – Sao Mai
Max. Current	1.33 m/sec	2.50 m/sec	1.22 m/sec

3) Sub-soil Conditions

a. Thi Vai Area

The sub-soil conditions at the land reclamation site of Thi Vai container and general cargo terminal is modeled for this preliminary design purpose as follows:

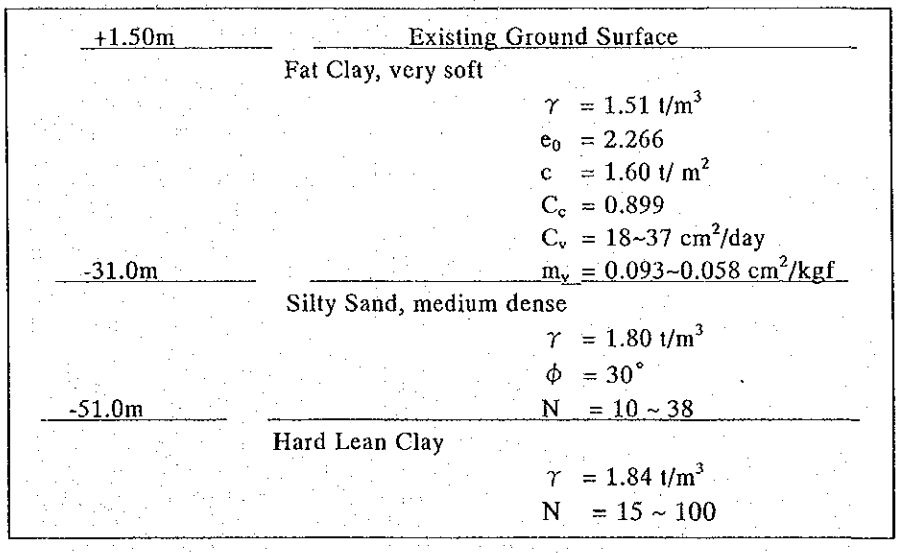


Figure 18.2.1 Sub-soil Condition of Thi Vai Port

b. Cai Mep Area

The sub-soil conditions at the land reclamation site of Cai Mep container terminal is modeled for this preliminary design purpose as follows:

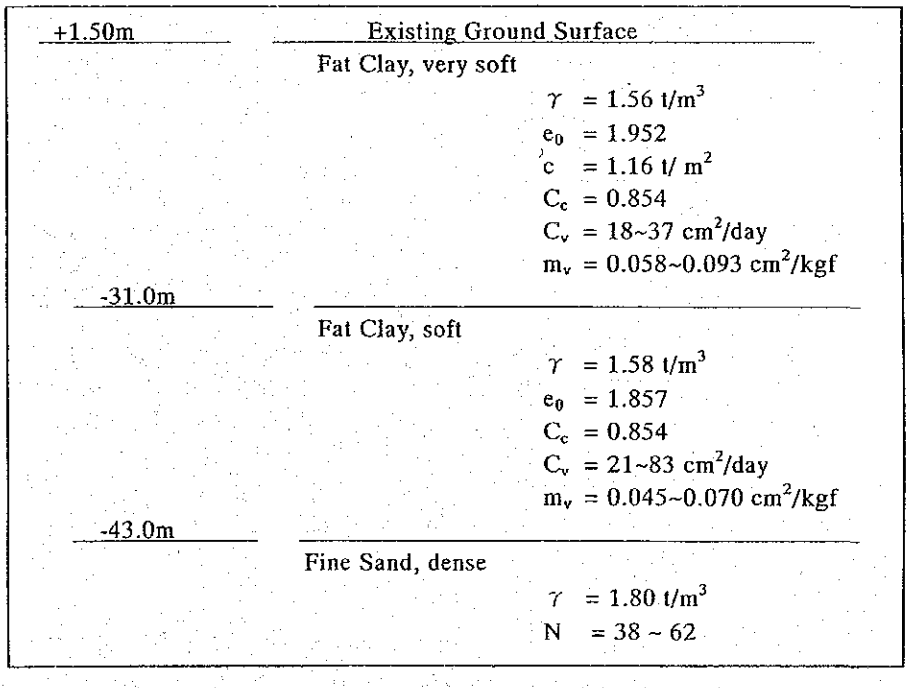


Figure 18.2.2 Sub-soil Condition of Cai Mep Port

c. Vung Tau Area

The sub-soil conditions at the land reclamation site of Ben Dinh - Sao Mai container terminal in Vung Tau is modeled for this preliminary design purpose as follows:

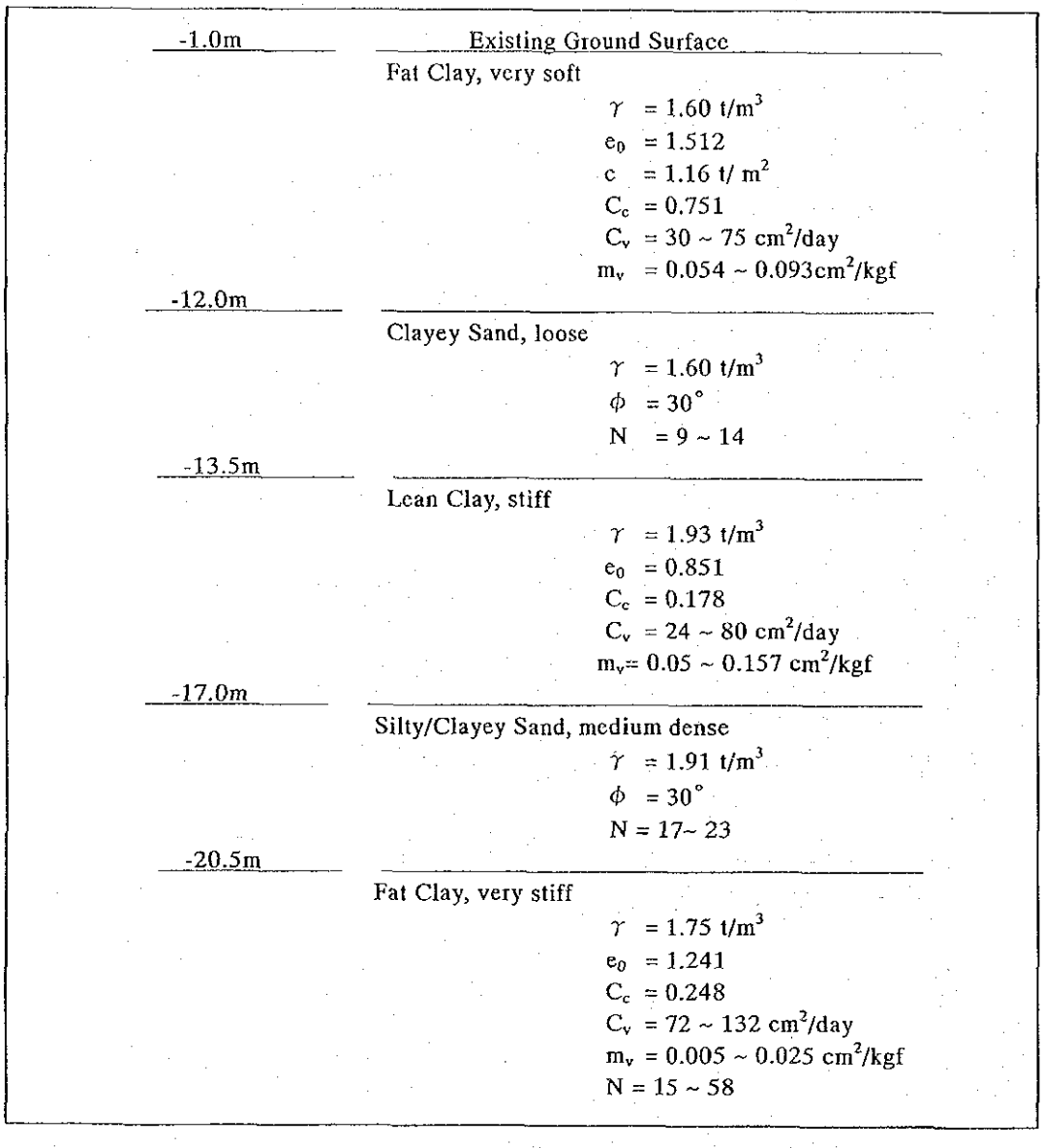


Figure 18.2.3 Sub-soil Condition of Ben Dinh - Sao Mai Port

18.3 Preliminary Design of Port Facilities

18.3.1 Mooring Facility

1) *Berth Length and Water Depth*

The berth lengths are decided as the LOA plus required lengths for bow and stern lines based on the dimensions of design vessels shown in Table 18.2.2. The water depths in front of quay walls are determined by adding about 10% of maximum draft as a depth allowance to the full load draft. The adopted berth lengths and water depths are summarized in the table below:

Table 18.3.1 Berth Lengths and Water Depths for the Design Vessels

Design Vessel	Berth Length (m)	Water Depth (m)
80,000 DWT Container Ship	350	16
50,000DWT Container Ship	300	14
30,000DWT General Cargo Ship	250	12

2) Crown Height

The crown heights of quaywalls are determined by employing 1.0m above HWL in Vietnam. While, Japanese technical standard for port and harbour recommends that where tidal range is more than 3.0 m, the crown height should be 0.5 ~ 1.5 m above HWL for the quaywalls with a water depth of 4.5 m or more. Basic procedure for determining the crown height is the same between both countries. Therefore, applying the Japanese standard of HWL +3.97 m at Thi Vai / Vung Tau area, the crown heights of quaywalls of these major projects are determined as CDL +5.00 m.

3) Apron Width

Between the face line of the wharf and the open storage in the back or the back line of deck slab of detached pier, an "apron" space should be provided for the purpose of temporary stock of containers and hatch covers of container ship, and safe and smooth traffic flow for tractor - trailers or cargo handling equipment. In general, the apron width of container terminals in the world is between 40 m and 70 m.

The quay container gantry crane for the container ship of 80,000 DWT has an out reach length of 45 m, crane rail span of 30 m and back reach length of 15 m and for the container ships of 50,000 DWT to 30,000 DWT has an out reach length of 36 m, crane rail span of 16 m and back reach length of 12 m approximately.

Considering the above figures and the smooth traffic flow, the apron widths of this project are determined as follows:

Design Vessel	Apron Width
80,000 DWT	60 m
50,000 ~ 30,000 DWT	40 m

4) Loading Conditions

In the structural design of quay, following loading conditions are considered to secure the stability of structures:

a. Dead Weight of Quay + Dead Weight of Crane + Live Load (4 t/m^2) + Berthing Force

b. Dead Weight of Quay + Crane Load in Operation + Live Load (4 t/m^2)

c. Dead Weight of Quay + Crane Load in Operation + Live Load (4 t/m^2) + Mooring Force

d. Dead Weight of Quay + Crane Load in Operation + Live Load (2 t/m^2) + Earthquake Force

5) Structure of Quay

The mooring facilities of Thi Vai port and Cai Mep port will be constructed along the bank of Thi Vai River. Therefore, the open-type quay structure is recommended not to disturb the flow of river as already adopted for all mooring facilities constructed along the Thi Vai River.

The existing mooring facilities are mostly constructed by using rectangular concrete piles. The mooring facilities that are supported by steel pipe piles are few. However, the steel pipe pile structure was adopted in this project because the water depths of berths are deeper than the existing facilities and the bearing layer for the piles is also deeper than the existing facilities.

Also in this design, all foundation piles were designed to be vertical piles in order to eliminate the negative influence of settlement of sub-soil as much as possible. However, a possibility remains to adopt a structure consisting of vertical piles and coupled batter piles because they are more economical. Therefore, detailed comparative study will be conducted in the stage of feasibility study.

The mooring facility of Ben Dinh - Sao Mai port is situated in the Ganh Rai Bay. The sub-soil condition around the port is better than that of Thi Vai port or Cai Mep port but it is still insufficient to adopt a gravity-type mooring facility. Unlike Thi Vai and Cai Mep ports this port is attacked by wave action. To cope with the wave influence to ships at berth as much as possible, the open-type structure was also adopted in this design. However, the possibility to adopt another type of structure like a steel-sheet pipe-pile type structure remains for this port. Therefore, if this port is selected for the project for feasibility study, the detailed comparative study will be conducted.

The typical sections and plans of the preliminary design of mooring facilities of Thi Vai port, Cai Mep port and Ben Dinh - Sao Mai port are presented in Figures 18.3.1 to 18.3.3.

6) Trestle

The width of Thi Vai River is very wide around Cai Mep port but the slope of riverbed is very gentle. Therefore, if the face line of wharf is allocated in a deepwater area, a large amount of land reclamation and strong revetment structure are required and it will disturb the smooth flow of the river. On the contrary, if the face line of wharf is arranged in a shallow water area, a large amount of initial and maintenance dredging are required.

Therefore, the middle of above two ideas was adopted for the Cai Mep port, i.e., the wharf and terminal yard are constructed separately and trestles are provided between them. Considering the topographic and bathymetric conditions, the length of a trestle was determined to be 90 m, which consists of 5 bridges of 18m spans. And from the viewpoint of smooth traffic flow between the detached pier and backup yard, the width of trestle was determined to be 20 m.

7) Breakwater for Ban Dinh - Sao Mai Port

As explained in Chapter 13.3.3, the calmness of basin at the proposed layout plan of Ben Dinh - Sao Mai port dose not satisfy the required norm of more than 97.5% of time to be less than 0.5 m of significant wave height.

Therefore, the breakwater of 100 m long is planned to be constructed at the tip of quaywall.

The existing sea bottom elevations around the proposed breakwater are around CDL 0.0 m to –2.0 m. At the high tide, the water depth will be 4.0 m to 6.0 m and the breaking wave height is estimated at 4.0 m.

Based on the technical standards for port and harbour facilities in Japan, the crown height of this breakwater shall be CDL +6.5 m, which corresponds to HWL +3.97 m plus 0.6 times of breaking wave height of 4.0 m.

The structural type of this breakwater was proposed to be rubble-mound type from the viewpoint of availability of local material, construction cost and flexibility for future rearrangement or modifications. The offshore side of the breakwater was sloped at 1:2 and the armor stone of around 2.0 tons per piece cover its surface and the basin side was sloped at 1:1.5.

As known from the figure 18.2.3, the sub-soil conditions in the Ben Dinh - Sao Mai port area is very soft from surface up to around -12.0 m. If the breakwater is constructed on this soil layer, the rubble-mound structure can not stand stable, therefore, this soft soil layer shall be dredged before construction of the breakwater and the rubble stone placed from -12.0 m.

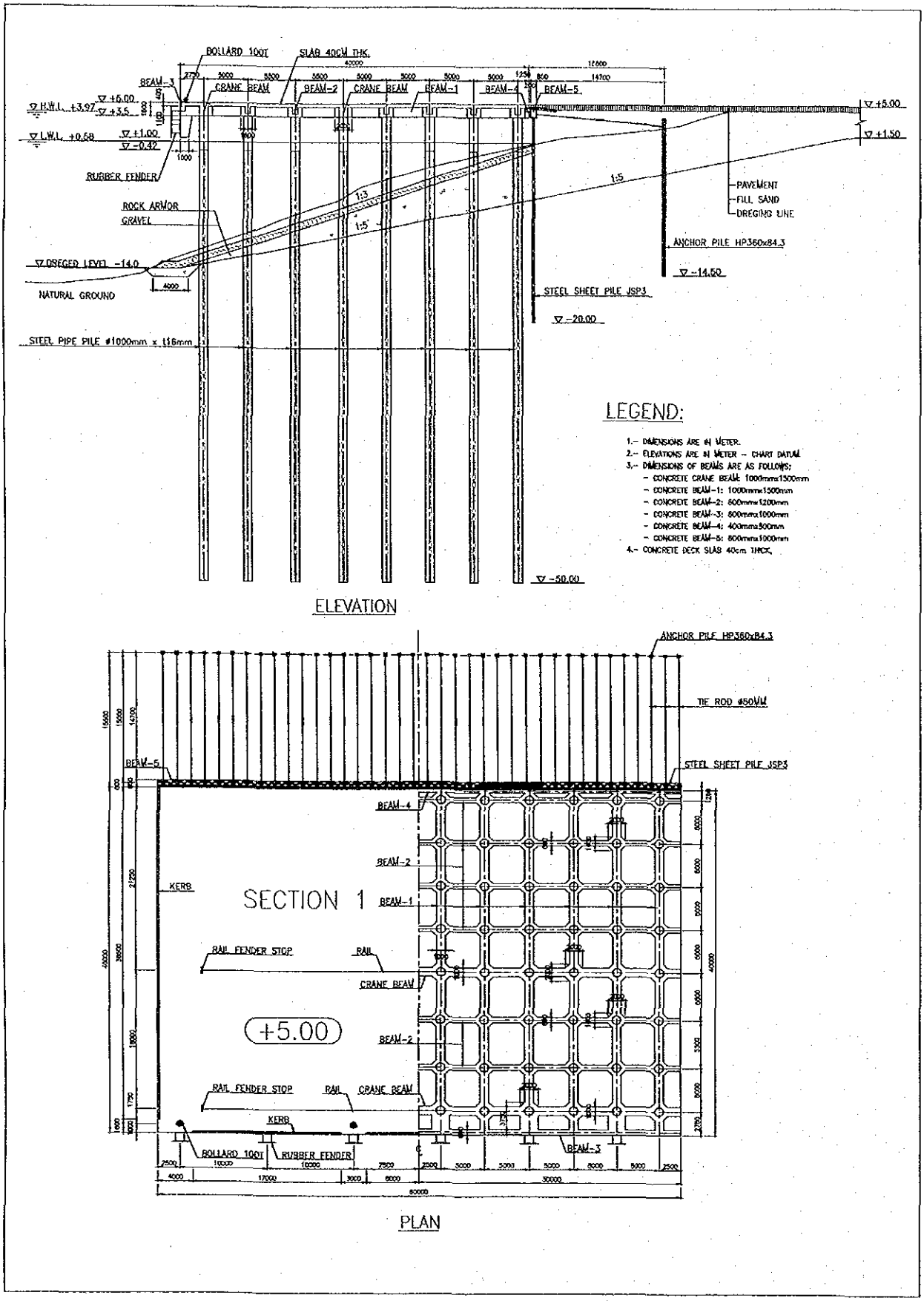


Figure 18.3.1 Mooring Facility of 50,000DWT Container Terminal at Thi Vai Port

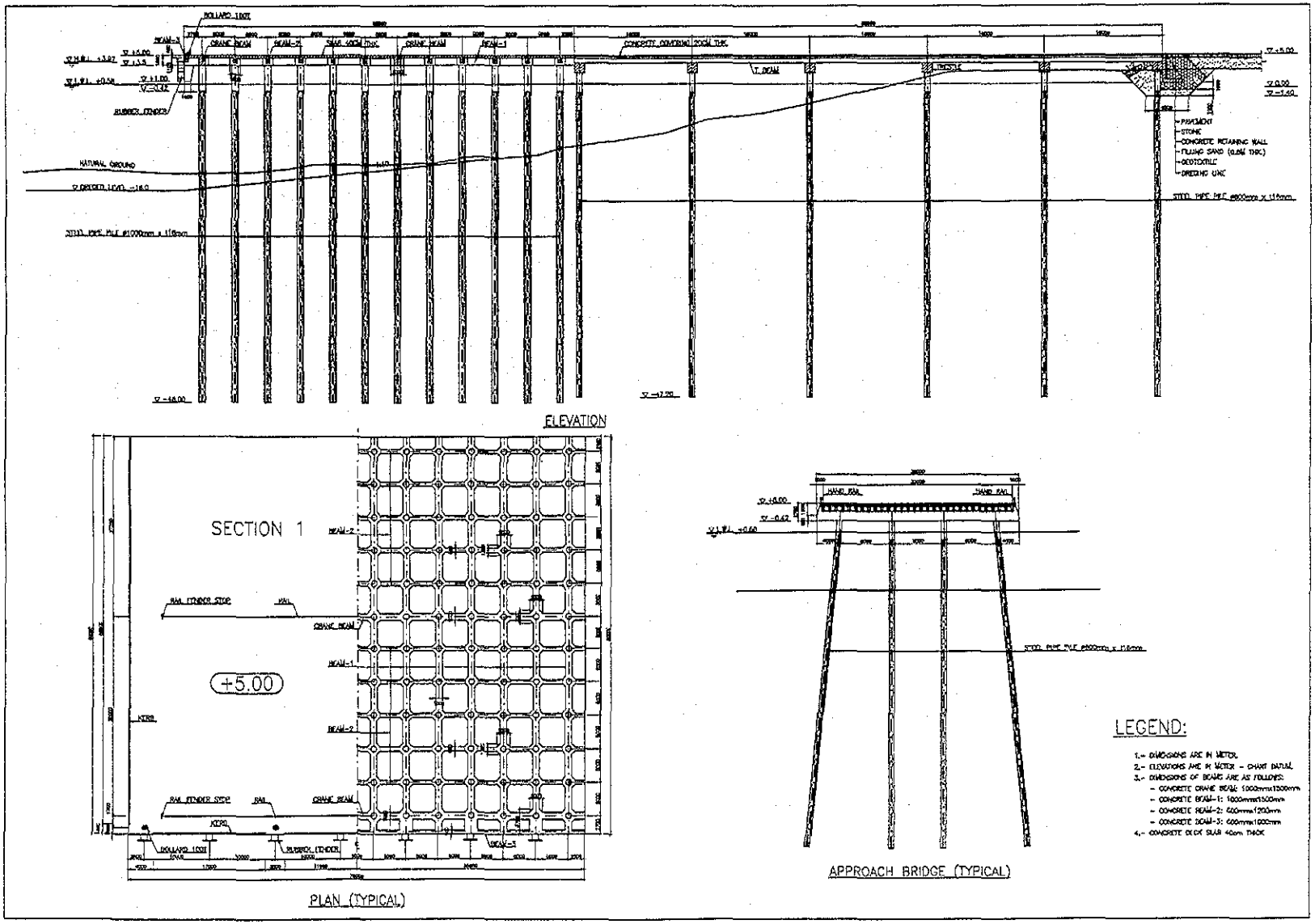


Figure 18.3.2 Mooring Facility for 80,000DWT Container Terminal at Cai Mep Port

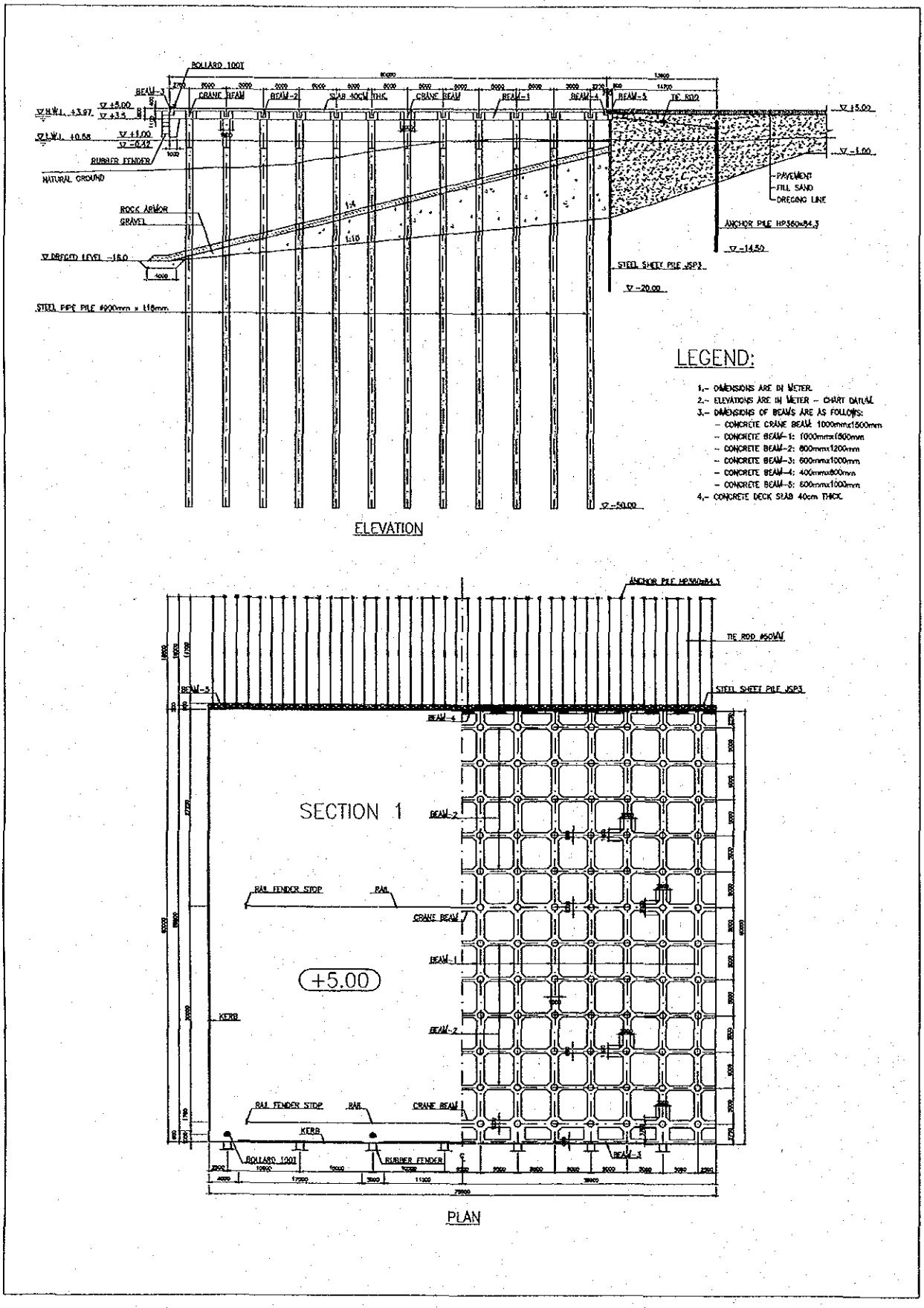


Figure 18.3.3 Mooring Facility for 80,000DWT Container Terminal at Ben Dinh – Sao Mai Port

18.3.2 Terminal Yard

1) Land Reclamation

a. Surface Elevation

The surface elevation of reclaimed land is determined as CDL +5.00 m by the same standard explained in the previous section 18.3.1.2) Crown Height.

b. Surcharge

The reclaimed land is mainly used for the container stacking and marshalling yard where full loaded containers are stacked in 4 layers. Therefore, the surcharge for determining the bearing capacity of reclaimed land was decided to be 5.0 ton/m^2.

c. Settlement and Soil Improvement

As known from the sub-soil conditions shown in Figures 18.2.1 to 18.2.3, the very soft clay layers of sub-soil exist in all project sites and the fill material for land reclamation and surcharge will be used to consolidate these layers.

Based on the consolidation analysis, the total settlements of Thi Vai port, Cai Mep port and Ben Dinh - Sao Mai port were estimated at 2.81 m, 3.33 m and 1.86 m respectively as shown in Figures 18.3.2 to 18.3.4. These settlement will occur gradually and continue for many years and will damage the structures and facilities on the reclaimed land.

To cope with the negative influence of this settlement, soil improvement that using vertical plastic board drains to accelerate the consolidation of soft soil layer should be executed. The relation between the time and degree of consolidation by the vertical plastic board drains provided at an interval of 1.5 m in triangular arrangement were calculated and presented in the Figures 18.3.4' to 18.3.6' for Thi Vai port, Cai Mep port and Ben Dinh - Sao Mai port respectively.

These tables shows that the soil improvement works require about 2 years period to obtain 70 to 80% of consolidation of sub-soil which allows removal of surcharged soil and commencement of construction works on the reclaimed land.

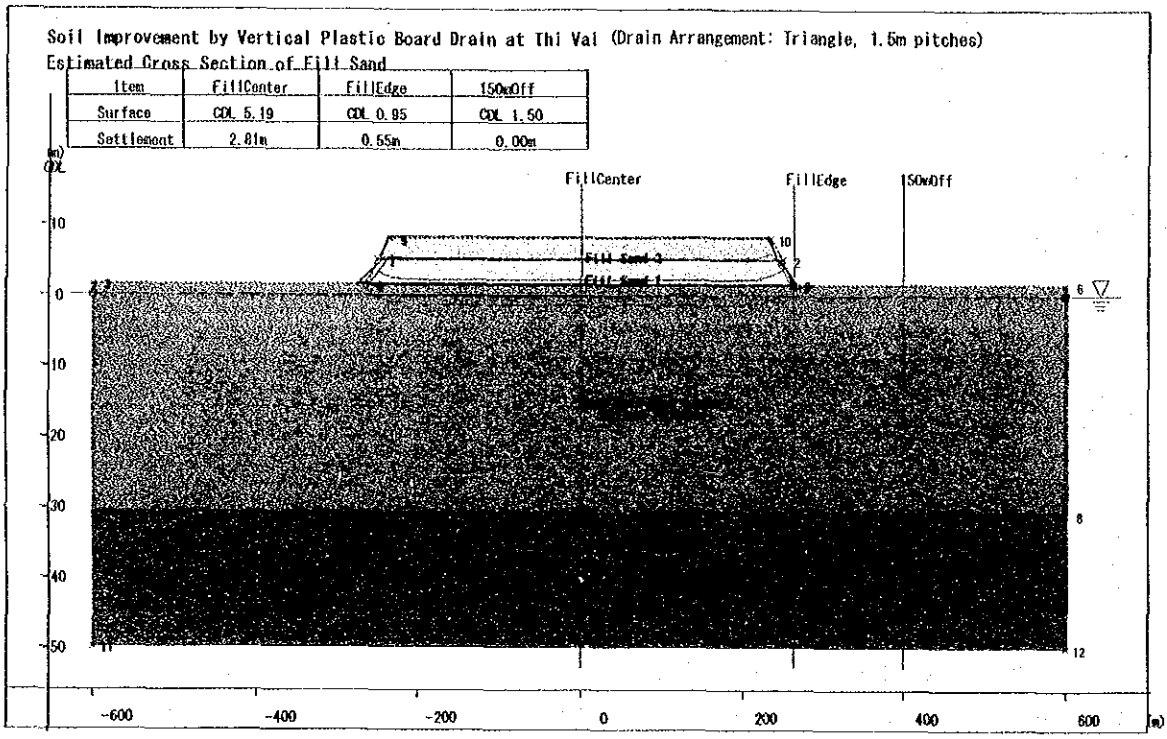


Figure 18.3.4 Cross Section of Fill Sand and Settlement at Thi Vai Port

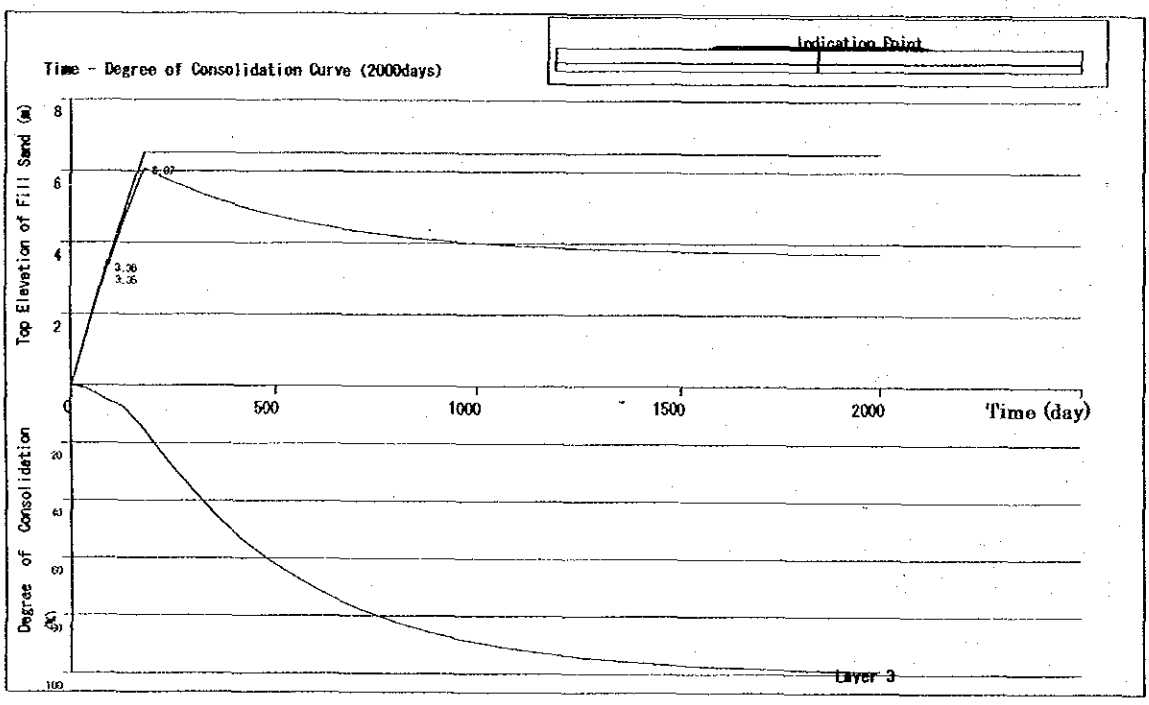


Figure 18.3.4' Time – Degree of Consolidation Curve (Thi Vai Port)

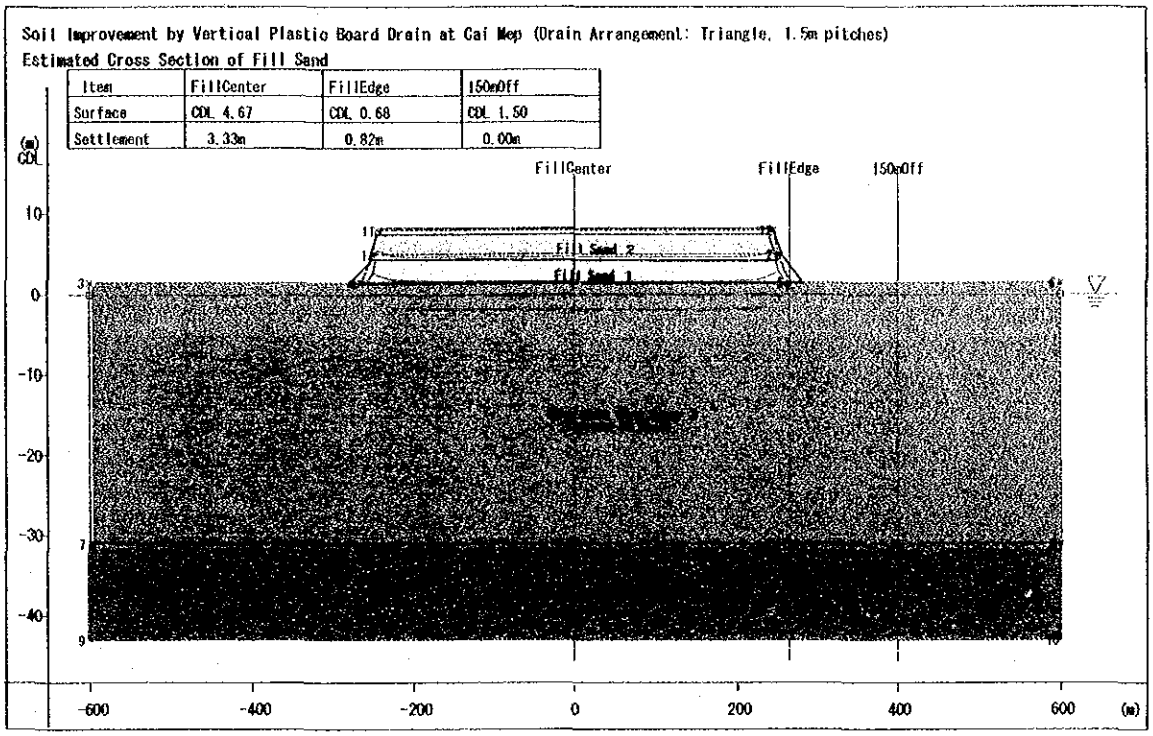


Figure 18.3.5 Cross Section of Fill Sand and Settlement at Cai Mep Port

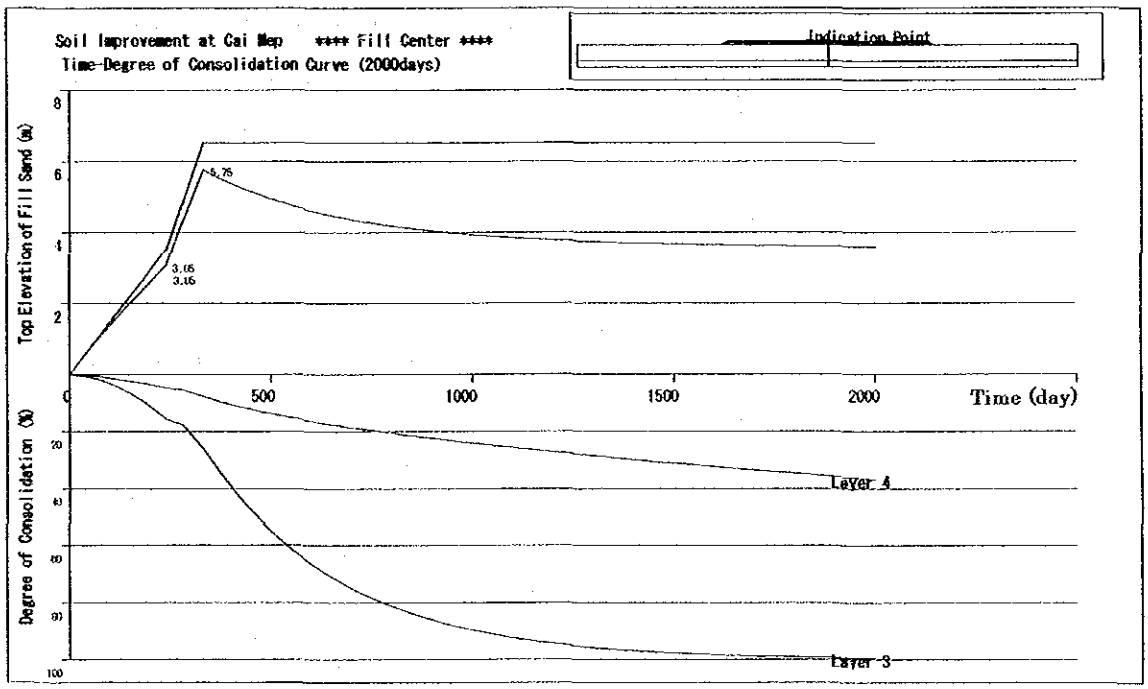


Figure 18.3.5' Time – Degree of Consolidation Curve (Cai Mep Port)

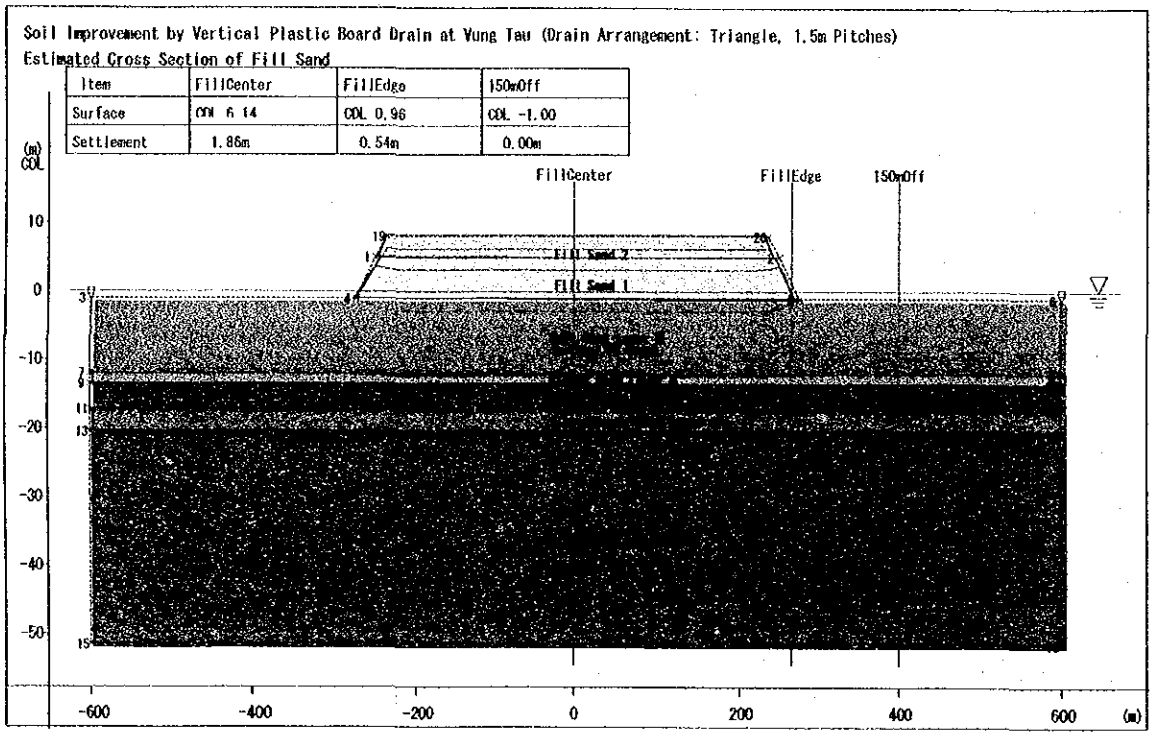


Figure 18.3.6 Cross Section of Fill Sand and Settlement at Ben Dinh – Sao Mai Port

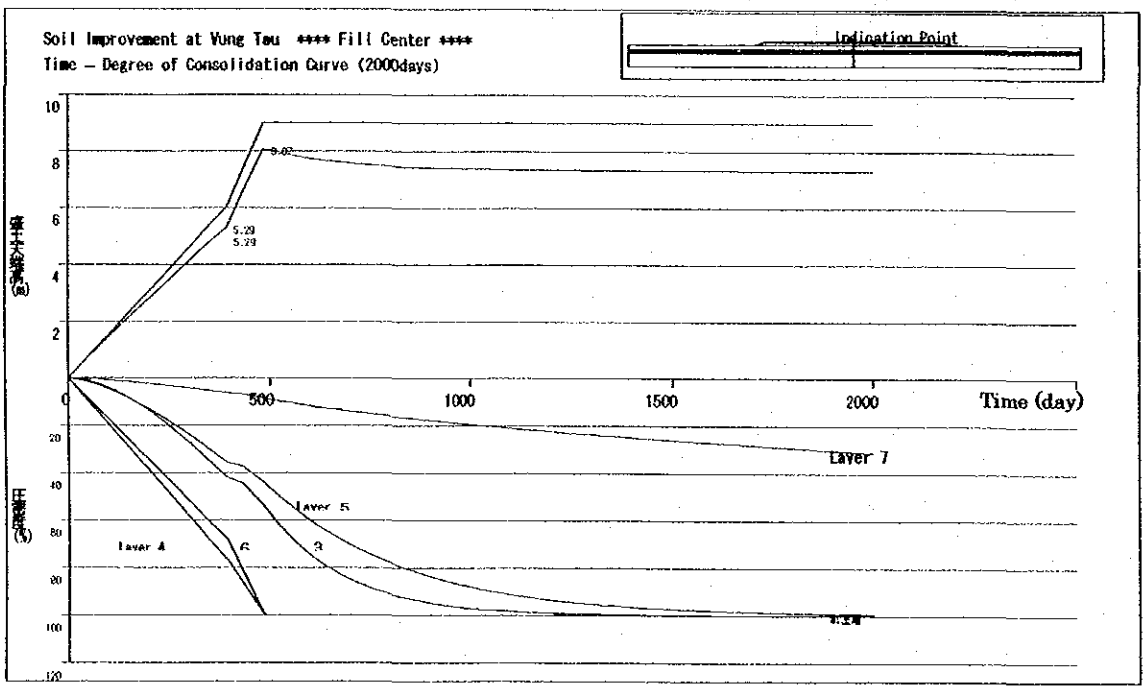


Figure 18.3.6' Time – Degree of Consolidation Curve (Ben Dinh – Sao Mai Port)

Chapter 19 Preliminary Construction Plan and Cost Estimate

19.1 Preconditions on Construction Plan

19.1.1 Construction Activity of Viet Nam in General

Construction works every field in Viet Nam is very vigorous reflecting economic development particularly the shortage of infrastructure. According to the statistics the total investment outlays of society (deeply related with construction activity) in 1995-2000 at current price becomes more than 1.7 times from 1995 to 2000 with average annual increase rate of 12.4% and at constant price in 1994 becomes 1.5 times with annual increase rate of 8.9%. The share of investment outlays in Gross Domestic Product stands out constantly around 30% every year. (cf. Table 19.1.1)

Table 19.1.1 Construction Investment Outlays and GDP in 1995-2000

	Investment Outlays *Constant Price in 1994*		Investment Outlays *Current Price*		GDP at Constant *Price in 1994.*		GDP at Current Price	
Year	Amount (Bill. Dongs)	Increase Rate	Amount (Bill. Dongs)	Increase Rate	Amount (Bill. Dongs)	Growth Rate	Amount (Bill. Dongs)	Growth Rate
1995	60,757.0	—	68,047.8	—	195,567	—	228,892	—
1996	67,489.3	1.111	79,367.4	1.165	213,833	1.095	272,036	1.282
1997	79,204.6	1.174	96,870.4	1.220	231,264	1.081	313,623	1.153
1998	75,579.7	0.954	97,336.1	1.005	244,596	1.058	361,016	1.151
1999	78,997.0	1.047	103,771.9	1.067	256,272	1.048	399,942	1.108
2000	91,807.3	1.162	120,600.0	1.162	273,582	1.068	444,139	1.111
—	—	Av. 1.089	—	Av.1.124	—	Av.1.070	—	Av.1.142

Source: Statistical Year Book in 1999&2000 General Statistical Office Vie Nam Government

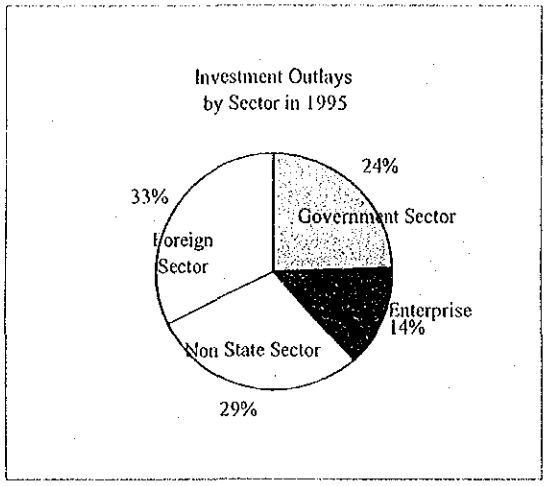
Table 19.1.2 and Figure19.1.1 show the source of investment by year. Investment for construction works comes from the four major sources namely Government sector both central and local, state enterprises, private sectors and foreign investors including ODA.

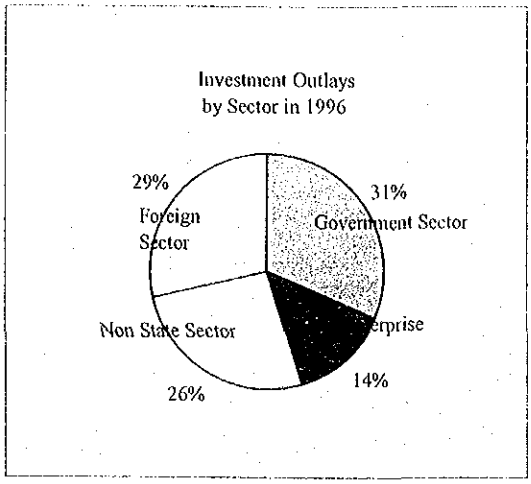
Out of those sources, foreign sectors amounted more than 25% except in 1999&2000. It means how the investment from abroad is important and affects not only construction activities but also employment aspect and economic development in Viet Nam.

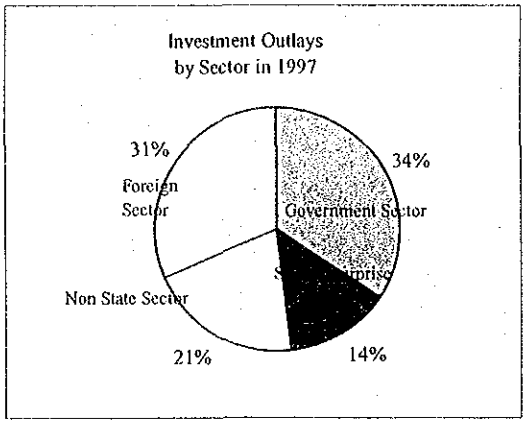
Table 19.1.2 Investment Outlays by Sector in 1995-2000 (Constant Price in 1994)

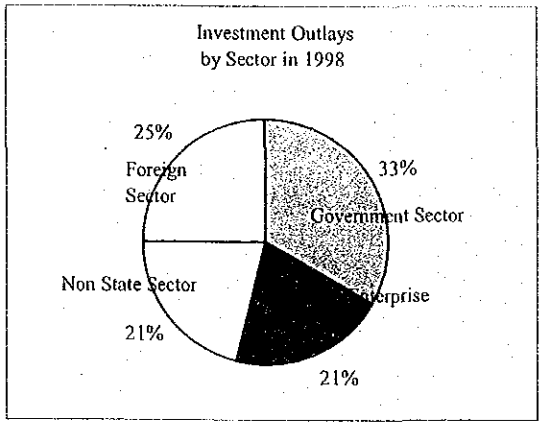
Year	Government Investment	State Enterprise	Non State Sector	Foreign Investment	Total Investment
1995	14,856.2	8,400.8	17,857.1	19,642.9	60,757.0
1996	21,109.2	9,413.3	17,664.1	19,302.7	67,489.3
1997	27,203.1	10,874.5	16,352.7	24,774.3	79,204.6
1998	25,176.4	15,616.9	15,917.9	18,868.5	75,579.7
1999	31,195.8	17,427.1	15,986.4	14,387.7	78,997.0
2000	40,118.1	16,747.6.	17,889.5	17,052.1	91,807.3

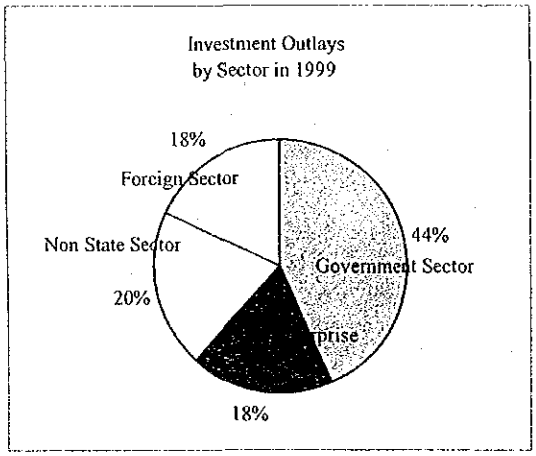
Source: Statistical Year Book in 2000, General Statistical Office VNG (Unit: Billion Dongs)











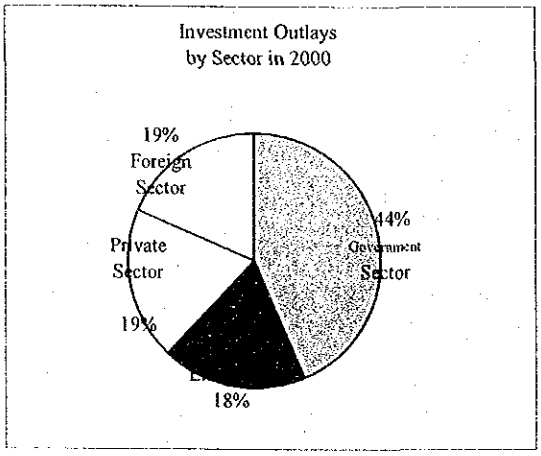


Figure 19.1.1 Investment Outlays by Sector in 1995-2000

No data available for total workers of construction activity field in whole country so far. However the workers who are engaged in construction field as in state sectors both central and local Government in 1999 number 360 thousand among 3,370 thousand persons in total according to the statistical year book in 1999 by General Statistical Office. These workers slightly increase year by year with the share of over 10% of total workers. This fact also indicates that construction activities in Viet Nam are significant for employment situation under the circumstance of unemployment rate of labor force of working ages in urban area exceeding 7 % at present.

State enterprises in Viet Nam generally lead most economic activities in various fields and construction state enterprises as well. State enterprises related construction field under Ministry of Transport and Communication can be counted nearly 150 including construction labor force supplier, companies related to construction equipment and material except consultant companies. Table 19.1.3 and Table 19.1.4 (1)~19.1.4 (3) show the company list of related to construction equipment and construction under MOT respectively. They are to be counted 22 and 92 companies.

Table 19.1.3 The List of Equipment Company Name of Contractor under MOT

No	Company Name Specified Construction Equipment (Vietnamese)	Abbreviation (English)	Location
1	Tong Cong Ty Co Khi Giao Thong Van Tai		Ha Noi
2	Cong Ty Co Khi Ngo Gia Tu		Ha Noi
3	Cong Ty Co Khi 120		Ha Noi
4	Cong Ty Co Khi 19-8		Ha Noi
5	Cong Ty Xay Dung Cong Trinh		Ha Noi
6	Cong Ty Co Khi 19-8		Ha Noi
7	Cong Ty Xay Dung Cong Trinh		Ha Noi
8	Cong Ty Co Khi Van Tai Va Xay Dung		Hai Phong
9	Cong Ty Co Khi Giao Thong 2		Ho Chi Minh
10	Tong Cong Ty Duong Song Mien Nam	SOWATCO	Ho Chi Minh
11	Cong Ty Co Khi Cong Trinh 2		Ho Chi Minh
12	Cong Ty Xay Lap Cong Trinh		Ho Chi Minh
13	Tong Cong Ty Duong Song Mien Bac	NOWATRANCO	Ha Noi
14	Cong Ty VTTB Va XD Duong Thuy		Ha Noi
15	Nha May Co Khi 75		Ha Noi
16	Cong Ty Van Tai Va Co Khi Duong Thuy		Ha Noi
17	Tong Cong Ty Xay Dung Cong Trinh Giao Thong 1	CIENCO 1	Ha Noi
18	Cong Ty Co Khi Xay Dung Cong Trinh 121		Ha Noi
19	Tong Cong Ty Xay Dung Cong Trinh Giao Thong 4	CIENCO 4	Nghe An
20	Cong Ty Co Khi Cong Trinh Giao Thong		Nghe An
21	Tong Cong Ty Xay Dung Cong Trinh Giao Thong 6	CIENCO 6	Ho Chi Minh
22	Cong Ty Co Khi Xay Dung Cong Trinh 623		Ho Chi Minh

Source: Compiled from Telephone Book of MOT in 2000

Table 19.1.4 (1) The List of Construction Company Name of Contractor under MOT

No	Company Name Specified Construction in Vietnamese (Vietnamese)	Abbreviation (English)	Location
1	Tong Cong Ty Xay Dung Thang Long		Ha Noi
2	Cong Ty Cau 1 Thang Long		Ha Noi
3	Cong Ty Cau 3 Thang Long		Ha Noi
4	Cong Ty Cau 5 Thang Long		Ha Noi
5	Cong Ty Cau 7 Thang Long		Ha Noi
6	Cong Ty Cau 11 Thang Long		Ha Noi
7	Cong Ty Xay Dung So 9		Ha Noi
8	Cong Ty Xay Dung Cong Trinh Thang Long		Ha Noi
9	Cong Ty Xay Dung Thang Long		Ha Noi
10	Tong Cong Ty Xay Dung Cong Trinh Giao Thong 1	CIENCO 1	Ha Noi
11	Cong Ty Cau Duong 10		Hai Phong
12	Cong Ty Cau 12		Ha Noi
13	Cong Ty Cau 14		Ha Noi
14	Cong Ty Cong Trinh Giao Thong 116		Ha Noi
15	Cong Ty Xay Dung Cong Trinh GiaoThong 118	CIENCO118	Ha Noi
16	Cong Ty Cong Trinh GiaoThong 124		Ha Noi
17	Cong Ty Cong Trinh GiaoThong 128		Ha Tay
18	Cong Ty Cong Trinh GiaoThong 134		Ha Noi
19	Cong Ty Xay Dung Cong Trinh 136		Ha Noi
20	Cong Ty Duong 126		Ha Noi
21	Cong Ty Duong 122		Ha Noi
22	Cong Ty Xay Dung Cong Trinh Thuy		Hai Phong
23	Cong Ty Xay Dung Cong Trinh 120		Ha Noi
24	Tong Cong Ty Xay Dung Cong Trinh Giao Thong 4	CIENCO 4	Nghe An
25	Cong Ty Cong Trinh Giao Thong B19		Nghe An
26	Cong Ty Cong Trinh Giao Thong 208		Ha Noi
27	Cong Ty Cong Trinh Giao Thong 228		Ha Noi
28	Cong Ty Cong Trinh Giao Thong 246		Ha Noi
29	Cong Ty Cong Trinh GiaoThong 423		Nghe An
30	Cong Ty Cong Trinh Duong Bo 471		Nghe An
31	Cong Ty Cong Trinh Duong Bo 473		Ha Tihn
32	Cong Ty Cong Trinh GiaoThong 475		Ha Tihn
33	Cong Ty Cong Trinh Giao Thong 479		Nge An
34	Cong Ty Cong Trinh Giao Thong 480		Thanh Hoa
35	Cong Ty Cong Trinh Giao Thong 482		Nghe An
36	Cong Ty Cong Trinh Giao Thong 484		Nghe An
37	Cong Ty Cong Trinh Giao Thong 492		Nghe An

Source: Compiled from Telephone Book of MOT in 2000

Table 19.1.4 (2) The List of Construction Company Name of Contractor under MOT

No	Company Name Specified Construction in Vietnamese (Vietnamese)	Abbreviation (English)	Location
38	Tong Cong Ty Xay Dung Cong Trinh Giao Thong 5	CIENCO 5	Da Nang
39	Cong Ty Xay Dung Cong Trinh GiaoThong 501	CIENCO 501	Hue
40	Cong Ty Xay Dung Va XNK Cong Trinh GiaoThong 502		Quang Nam
41	Cong Ty Xay Dung Cong Trinh GiaoThong 503	CIENCO 503	Da Nang
42	Cong Ty Xay Dung Cong Trinh GiaoThong 504	CIENCO 504	Binh Dinh
43	Cong Ty Xay Dung Cong Trinh GiaoThong 505	CIENCO 505	Khan Hoa
44	Cong Ty Xay Dung Cong Trinh GiaoThong 506	CIENCO 506	Gia Lai
45	Cong Ty Xay Dung Cong Trinh GiaoThong 507	CIENCO 507	Dac Lac
46	Cong Ty 508		Binh Dinh
47	Cong Ty Xay Dung Cong Trinh GiaoThong 510	CIENCO 510	Khan Hoa
48	Cong Ty Xay Dung Cong Trinh GiaoThong 511	CIENCO 511	Binh Duong
49	Cong Ty Xay Dung Cong Trinh 512		Da Nang
50	Xi Nghiep Xay Dung Cong Trinh 515		Quang Ngai
51	Cong Ty Xay Dung Cong Trinh GiaoThong 519	CIENCO 519	Vinh Long
52	Cong Ty Xay Dung Cong Trinh GiaoThong 520	CIENCO 520	Ho Chi Minh
53	Xi Nghiep Xay Dung Cong Trinh 522		Dong Nai
54	Cong Ty Cong Trinh Giao Thong 525		Da Nang
55	Xi Nghiep Xay Dung Cong Trinh 539		—
56	Xi Nghiep Xay Dung Cong Trinh 557		Lam Dong
57	Cong Ty Xay Dung Cong Trinh GiaoThong 585	CIENCO 585	Khanh Hoa
58	Cong Ty Xay Dung Cong Trinh GiaoThong 586	CIENCO 586	Ho Chi Minh
59	Tong Cong Ty Xay Dung Cong Trinh Giao Thong 6	CIENCO 6	Ho Chi Minh
60	Cong Ty Cong Trinh GiaoThong 60		Ho Chi Minh
61	Cong Ty Cong Trinh GiaoThong 61		Ho Chi Minh
62	Cong Ty Cong Trinh GiaoThong 68		Ho Chi Minh
63	Cong Ty Cong Trinh GiaoThong 610		Ho Chi Minh
64	Cong Ty Thi Cong Co Gioi 6		Ho Chi Minh
65	Cong Ty Cong Trinh GiaoThong 674		Long An
66	Cong Ty Cong Trinh GiaoThong 675		Can Tho
67	Cong Ty Cong Trinh GiaoThong 676		Ho Chi Minh
68	Cong Ty Cong Trinh GiaoThong 677		Binh Thuan

Source: Compiled from Telephone Book of MOT in 2000

Table 19.1.4 (3) The List of Construction Company Name of Contractor under MOT

No	Company Name Specified Construction in Vietnamese (Vietnamese)	Abbreviation (English)	Location
69	Tong Cong Ty Xay Dung Cong Trinh Giao Thong 8	CIENCO 8	Ha Noi
70	Cong Ty Xay Dung Cong Trinh GiaoThong Cau 75		Nghe An
71	Cong Ty Xay Dung Cong Trinh GiaoThong 810	CIENCO 810	Ha Noi
72	Cong Ty Xay Dung Cong Trinh GiaoThong 820	CIENCO 820	Ha Nam
73	Cong Ty Xay Dung Cong Trinh GiaoThong 829	CIENCO 829	Ha Noi
74	Cong Ty Xay Dung Cong Trinh GiaoThong 838	CIENCO 838	Thanh Hoa
75	Cong Ty Xay Dung Cong Trinh GiaoThong 842	CIENCO 842	Ha Noi
76	Cong Ty Xay Dung Cong Trinh GiaoThong 872	CIENCO 872	Ha Noi
77	Cong Ty Xay Dung Cong Trinh GiaoThong 873	CIENCO 873	Ha Noi
78	Cong Ty Xay Dung Cong Trinh GiaoThong 874	CIENCO 874	Ha Noi
79	Cong Ty Xay Dung Cong Trinh GiaoThong 875	CIENCO 875	Ha Noi
80	Cong Ty Xay Dung Cong Trinh GiaoThong 889	CIENCO 889	Ha Noi
81	Cong Ty Xay Dung Cong Trinh GiaoThong 892	CIENCO 892	Ha Noi
82	Cong Ty Xay Dung Cong Trinh GiaoThong Viet -Lao		Ha Noi
83	Cong Ty Xay Dung Cong Trinh GiaoThong Mien Tay		Ha Noi
84	Tong Cong Ty Xay Dung Duong Thuy	VINAWACO	Ha Noi
85	Cong Ty Nao Vet Duong Thuy 1		Hai Phong
86	Cong Ty Nao Vet Duong Thuy 2		Ho Chi Minh
87	Cong Ty Nao Vet Duong Bien 1		Hai Phong
88	Cong Ty Nao Vet Duong Bien 2		Ho Chi Minh
89	Cong Ty Cong Trinh 86		Ho Chi Minh
90	Cong Ty Cong Trinh Duong Thuy Mien Nam	SWACO	Ho Chi Minh
91	Cong Ty Cong Trinh Duong Thuy		Ha Noi
92	Cong Ty Xay Dung Cong Trinh Duong Thuy 2		Hai Phong

Source: Compiled from Telephone Book of MOT in 2000

Tong Cong Ty in Vietnamese means that representative company of the group. Then he can organize his own group companies and joins biddings, then allocates construction works among his group companies. Sometimes representative companies supply loans to their own group companies.

They are located from northern to southern regions and cover all over the country. They have usually work experiences more than 20 years and have the enough capacity to execute various kinds of works mostly related with transport infrastructures such as road, bridge, railway, port, fishing port, airport, navigation channel, building and others in each region.

Out of total nearly 150 companies, the above listed companies are 114 and the remains are construction material producing or selling companies except 4 labor force supply companies.

It should be noticed that beside the above listed companies there are many state enterprises related to construction activities under Ministry of Construction or other ministries concerned.

19.1.2 Construction Activity of Ho Chi Minh City Area in General

Ho Chi Minh City Area is the biggest center as commercial and industrial activities in Viet Nam and the investment for infrastructures or industrial development had been started early stage since Doi Moi policy introduced in 1986. Extraordinary early 90' EPZ or IZ development needed large scale construction works and not only state investment outlays but also foreign investors outlays such as Taiwan, Singapore, South Korea and Hong Kong increased a great deal. As a result, for example, Tan Thuan or Linh Trung EPZ development plan have been almost completed and take a reputation the most successful EPZs in Viet Nam.

Large scale of industrial or commercial development are still going on in Hiep Phuoc IZ or Southern Sai Gon and GDP of Ho Chi Minh City is increasing with average increasing rate of 8.1% as seen in Table 19.1.5. However, Investment outlays become decrease since 1998. It means construction activities in Ho Chi Minh City Area slow downed and we have much capacity to execute construction works to the present amount of works.

Table 19.1.5 Construction Investment Outlays and GDP in 1997-2000 in Ho Chi Minh City

	Investment Outlays Current Price		GDP at Constant Price in 1994.		GDP at Current Price	
Year	Amount (Bill. Dongs)	Increase Rate	Amount (Bill. Dongs)	Growth Rate	Amount (Bill. Dongs)	Growth Rate
1997	22,960	--	41,900	--	52,767	--
1998	23,984	1.045	45,683	1.090	61,226	1.160
1999	18,920	0.789	48,499	1.062	69,002	1.127
2000	19,701	0.821	52,860	1.090	76,660	1.111
	--	Av.0.970	--	Av.1.081	--	Av.1.133

Source: Compiled from Statistical Year Book in 2000, Statistical Bureau of Ho Chi Minh City

Table 19.1.6 shows the investment outlays deeply related construction works by sector in recent 4 years. Total investment outlays decrease with the average annual rate of 0.97% despite of Government investment outlays not so much changed. Foreign sectors investment slow downing makes an influence to the total decrease. Figure19.1.2 shows composition of investment outlays by sector in Ho Chi Minh City.

Table 19.1.6 Construction Investment Outlays in 1997-2000 by Sector in Ho Chi Minh City

Year	Government	State Enterprise	Non State Enterprise	Foreign Sector	Total
1997	2,349,504	6,328,571	5,533,191	8,748,594	22,959,860
1998	2,414,902	6,518,728	6,832,761	8,217,174	23,983,565
1999	2,122,640	5,179,060	5,299,187	6,318,781	18,919,668
2000	3,183,530	5,645,934	5,829,239	5,042,355	19,701,058

(At Current Price Million Dongs)
Source: Statistical Year Book in 2000, Statistical Bureau of Ho Chi Minh City

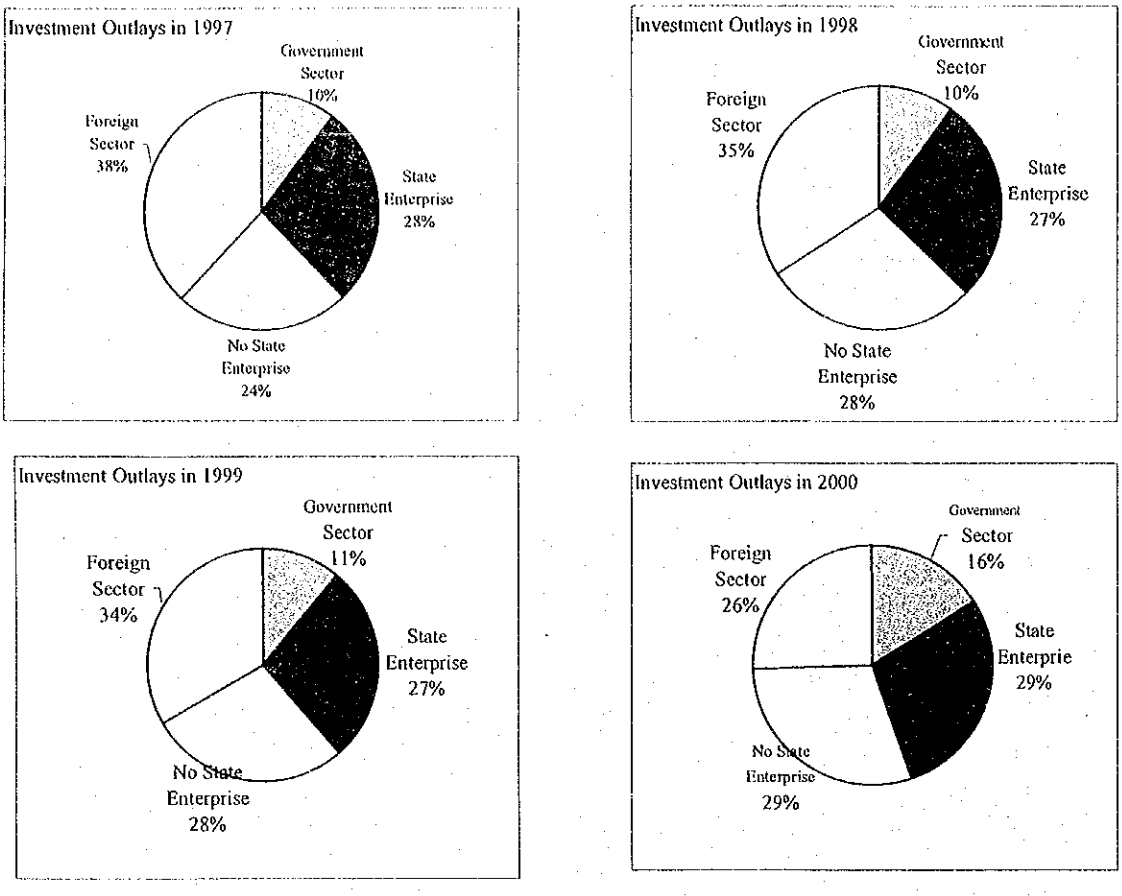


Figure19.1.2 Annual Investment Outlays in Ho Chi Minh City

Table 19.1.7 Tan Thuan and Linh Trung EPZ Investment Result(1993～2000)

Item	Total	Tan Thuan	Linh Trung
Investment license Issued	144	117	27
Applied Investment license	177	157	20
Land Area (ha)	122.1	98.9	23.2
Invested Capital (Million USD)	632.2	522.2	110.0
Labor Recruited (Person)	44,138	24,672	19,466

Source: Statistical Year Book in 2000, Statistical Bureau of Ho Chi Minh City

Table19.1.8 shows the investment to new houses construction including buildings by sector. It can be seen that the peak of investment occurred in 1998 and extraordinarily state enterprises portion amounted large in 1998. It can be easily imagined that the contractors could cope with mobilizing the laborers, materials and equipments and executed housing construction works about four times volume as present demand. Therefore even if such kind of works increase in the future there seems to be no problem in the executing capacity in this area.

Table 19.1.8 New Housing Construction Investment

	Government Outlays Current Price		State Enterprise Outlays Current Price		Non State Enterprise & Others Outlays Current Price		Foreign Enterprise Outlays Current Price	
Year	Amount (Mill. Dongs)	Ratio to Prev. Year	Amount (Mill. Dongs)	Ratio to Prev. Year	Amount (Mill. Dongs)	Ratio to Prev. Year	Amount (Mill. Dongs)	Ratio to Prev. Year
1997	546,275	--	275,020	--	1,131,538	--	--	--
1998	618,034	1.131	1,239,592	4.507	3,731,185	3.297	--	--
1999	253,853	0.411	244,025	0.197	2,312,930	0.620	417,000	--
2000	179,625	0.708	366,796	1.503	2,618,903	1.132	--	--

Source: Statistical Year Book in 2000, Statistical Bureau of Ho Chi Minh City

According to the new telephone book in Ho Chi Minh City, companies related construction field can be counted more than 650 except consultant companies. They are companies whose activities are mostly construction works, construction material supply or producing, equipment leasing and housing or developers.

Table 19.1.9(1)~(3) are the lists of the construction companies which are members of Viet Nam Chamber of Commerce and Industry (VCCI) in Ho Chi Minh City. It can be numbered 88 companies of which 47 companies are mostly specialized construction activities, 31 companies, construction material producing or supplying, 7 companies, so-called developers and 4 companies are specialized house building. Beside them now in Ho Chi Minh City there are thirteen Japanese Companies have their offices and extending activities.

Table 19.1.9 (1) The List of Company Name of Contractor, Member of VCCI (Viet Nam Chamber of Commerce and Industry in HCMC)

No	Company Name in Vietnamese	Abbreviation (English)	Remarks
1	Cong Ty LD POSTVINA	PSTIVINA	A
2	Cong Ty Co Phan May Xay Dung Huy Hoan		A
3	Cong Ty Tnhh Xay Dung Tanh Binh	THABICO	A
4	Cong Ty Tnhh Xay Dung Va Thuong Mai Hung Thinh		A
5	Cong Ty Tnhh Tanh Binh(TNHH)	Thai Binh Co.LTD	A
6	Cong Ty Tnhh Xay Dung Cong Nghiep Thuong Mai Tan Tien		A
7	Cong Ty Tnhh Nong San Xay Dung Thuong Mai Vien Thang		A
8	Cong Ty Tin Nghia	TIMEX	A
9	Cong Ty Xay Dung Va Thiet Ke So 1	DECOFI	A
No	Company Name in Vietnamese	Abbreviation(English)	Remarks
10	Cong Ty Co Phan Dau Tu Xay Dung Tan Binh		A
11	Cong Ty Sai Gon Xay Dung	COSACO	A
12	Cong Ty Xay Dung Va Phat Trien Kinh Te Quan 6	SICEDCO	A
13	Cong Ty Co Phan Hoang Gia	HOANG GIA (royal)	A
14	Cong Ty Tnhh Xay Dung Nuoc Ngam	WACO	A
15	Cong Ty Tnhh Xay Dung Van Tai Thuong Mai Phuoc Tinh		A
16	Cong Ty Xay Dung Thuy Loi 40		A

Table 19.1.9 (2) The list of Company Name of Contractor, Members of VCCI

No	Company Name in Vietnamese	Abbreviation (English)	Remarks
17	Cong Ty Tnhh Xay Dung Phu Tho		A
18	Cong Ty Tnhh Xay Dung Viet Chau		A
19	Cong Ty Tnhh Xay Dung Van Thuong Mai Ca-Kieu	K.K.MIGTEL.S	A
20	Cong Ty Tnhh Xay Dung Sai Gon	SACOCO	A
21	Cong Ty Tnhh Xay Dung -Thuong May Ty Phuoc		A
22	Cong Ty Tnhh Xay Dung Hoan Thien		A
23	Cong Ty Tnhh Tm Va Xay Dung Dong Au		A
24	Cong Ty Co Phan Phuc Long		A
25	Cong Ty 56-Bo Quoc Phong	CC56	A
26	Cong Ty Lap May Va Xay Dung 45-1	ECC45	A
27	Cong Ty Co Phan Dau Tu Xay Dung Nha Be	NIC	A
28	Cong Ty Tnhh Xay Dung Va Thuong Mai Bao Huy		A
29	Cong Ty Xay Dung Tan Binh Dong		A
30	Cong Ty Tu Doanh Luong Bang		A
31	Cong Ty Tnhh Hong Long		A
32	Cong Ty Tnhh Xay Dung Va Thuong Mai Kien Tao	KITACO	A
33	Cong Ty Tnhh Xay Dung Thuong Mai Toan Vinh	TOVICO	A
34	Cong Ty Xay Dung Trang Tri Kien Truc ADC		A
35	Cong Ty Xay Dung Thuong Mai Bach Khoa	TIMEX	A
36	Cong Ty Tnhh Tm Va XD Trung Viet		A
37	Cong Ty Xay Dung Cong Nghiep Nhe So2	DESCON	A
38	Cong Ty Tnhh Xay Dung Van Giao Thong Duc Hanh		A
39	Cong Ty Tnhh Xay Dung Thuong Mai Trog Rung VBB		A
40	Cong Ty Tnhh Giao Thong Thuy Loi The Ki		A
41	Cong Ty Tau Cuoc 2	DRECONT	A
42	Cong Ty Tnhh Xay Dung Giao Thong Nhi Hiep		A
43	Cong Ty Tnhh San Xuat Giay -Xay Dung An Thinh		A
44	DNTN Cong Nghe Moi T&S		A
45	Cong Tnhh Xay Dung Va Thuong Mai Quoc Hoa	GESECO	A
46	Cong Ty Tnhh Xay Dung Thuong May Ngoc Oanh		A
47	Cong Ty Tnhh Thanh Danh		A
Total			**47**
48	Cong Ty XNK Va Tu Va Ky Thuat	REXCO	B
49	Cong Ty Theip Mien Nam	SSC	B
50	Cong Ty XNK Tong Hop Va Dich Vu TP HCMC	GESECO	B
51	Lien Hiep HTX Mua Ban TP HCMC	SAIGON COOP	B
No	Company Name in Vietnamese	Abbreviation(English)	Remarks
52	Cong Ty Dau Tu Va Dich Vu TP HCMC	INVESCO	B
53	Cong Ty Gach Bong Va Da Op Lat So 1	FLOTISCO	B
54	Cong Ty Vat Tu Xay Dung TP HCMC		B
55	Cong Ty XNK Dau Tu Va Xay Dung Go Vap	GOVIMEX	B

Table 19.1.9 (3) The list of Company Name of Contractor, Members of VCCI

No	Company Name in Vietnamese	Abbreviation (English)	Remarks
56	Cong Ty Kinh Doanh Vat Tu Va XNK Vat Lieu Xay Dung	BMT	B
57	Cong Ty Gach Men Thanh Thanh		B
58	Cong Ty Vat Lieu Xay Dung 2	CMC	B
59	Cong Ty Gach Trang Tri Thanh Danh		B
60	Cong Ty Hop Tac Kinh Te Va Xuat Nhap Khau	SAVIMEX	B
61	Cong Ty Tnhh Tinh Che Go Va My Nghe XK SG	SF	B
62	Cong Ty Che Bien Go Viet Duc- Khanh Hoa	KHAVOWOOD	B
63	Cong Ty Su Thien Thanh	SSC	B
64	Cong Ty Tnhh May Theu Thoi Trang Son Kim		B
65	Cong Ty Kd Xnk Tong Hop 30/4 Tay Ninh	TAGIMEXCO	B
66	Cong Ty Cong Nghiep Da Xuat Khau Lam Dong	LESICO	B
67	Cong Ty Tnhh Thuong Mai Kien Giang		B
68	Chi Nhanh Cong Ty Vat Lieu Xay Dung Va Lam San Tai TP.HCM	BMFP	B
69	Cong Ty Tnhh Thuong Mai Trung Son		B
70	Cong Ty Tnhh May Theu Thuong Mai Lan Anh		B
71	Cong Ty Tnhh Thuong Mai Minh Hai		B
72	Cong Ty Xay Lap Thuon Mai 2	ACSC	B
73	Cong Ty Tnhh XD TM & DV Nam Viet		B
74	Cong Ty Gach Ngoi Dong Nai	TUILDONAI	B
75	Cong Ty Xay Dung Va San Xuat Vat Lieu Xxay Dung Bien Hoa	BBCC	B
76	Cong Ty Tnhh SX TM DV Tri Tin		B
77	Cong Ty Tnhh Giao Nhan Thuong Mai Thien Kim		B
78	Cong Ty CP Thuong Mai-SX- Xay Dung Hung Thinh		B
Total			**31**
79	Cong Ty Phat Trien Do Thi Va Khu Cong Nghiep-Bo Xay Dung	URBIZ	C
80	Cong Ty Xay Dung Va Phat Trien Nha Hoc Mon		C
81	Cong Ty Dau Tu Va Phat Trien Do Thi		C
82	Cong Ty Dich Vu Phat Trien Do Thi	UDESCO	C
83	Cong Ty Dau Tu Va Phat Trien Xay Dung	INVESCO	C
84	Cong Ty Phat Trien Cong Nghip Tan Tuan	IPC	C
85	Cong Ty Dau Tu Va Phat Trien Ha Tang	IDI	C
Total			**7**
86	Cong Ty Tnhh Xay Dung Kinh Doanh Nha Nam Long	NALCO PTE.LTD	D
87	CTY Phat Trien Nha Va Dich Vu Khu Cong Nghiep Q. Thu Duc	THU DUC HOUSE CO	D
88	Cong Ty Kinh Doanh Va Phat Trien Nha Quan Tan Binh		D
Total			**3**

Source: Compiled from List of Members 1999~2000 of VCCI

Note: **A**: Construction, **B**: Material, **C**: Developer, **D**: Housing

19.1.3 Construction Company Capable of Marine Works in the Project Area

Marine works usually need large-scale equipments such as large floating cranes, pile driving vessels, platforms in the water and dredgers. So that construction companies capable of marine works are not so many in number. According to an official MPMU (Vinamarine Project Management Unit) construction companies, which have some experiences and are capable of marine works in our Study Area can be listed as in the Table 19.1.10 in which some companies are added by our investigation as well.

Table 19.1.10 Construction Company Capable of Marine Works in the Project Area

Company Name in Vietnamese	Abbreviation;	Company Name in English
Tong Cong Ty Xay Dung Cong Trinh Duong Thuy	VINAWACO	Vietnam Waterway Construction Corporation
Cong Ty Xay Dung Cong Tinh Duong Thuy Mien Nam	SOWACO	Southern Waterway Construction Company
Cong Ty Cong Trinh 86		Construction Company No.86
Chi Nhanh Cong Ty Thi Cong Co Gioi		Labor Force Mechanized Construction Company
(Cong Ty Nao Vet Duong Thuy No.1)	WDCO No.1	Waterway Dredging Company No.1
(Cong Ty Nao Vet Duong Thuy No.2)	WDCO No.2	Waterway Dredging Company No.2
(Cong Ty Nao Vet Duong Bien No.1)	MADRECO NO.1	Maritime Dredging Company No.1
(Cong Ty Nao Vet Duong Bien No.2)	MADRECO No.2	Maritime Dredging Company No.2
Tong Cong Ty Xay Dung Cong Trinh Giao Thong No.6	CIENCO No.6	Civil Engineering Corporation No.6
Cong Ty Xay Dung Cong Trinh Giao Thong No.60	CIENCO No.60	Civil Engineering Corporation No.60
Cong Ty Xay Dung Cong Trinh Giao Thong No.61	CIENCO No.61	Civil Engineering Corporation No.61
Cong Ty Xay Dung Cong Trinh Giao Thong No.68	CIENCO No.68	Civil Engineering Corporation No.68
Cong Ty Xay Dung Cong Trinh Giao Thong No.610	CIENCO No.610	Civil Engineering Corporation No.610
Cong Ty Thi Cong Co Gioi No.6		
Cong Ty 59-b3 Quoc Phong		
Tong Cong Ty Xay Dung Cong Trinh Giao Thong No.1	CIENCO No.6	Civil Engineering Corporation No.1
(Cong Ty Xay Dung Cong Tinh Thuy) Hai Phong	VIWECO	
(Cong Ty Thiet Ke Va Xay Dung Dau Khi)*	PVECC	Petrovietnam Engineering & Construction
*Design & Construction Company of Soil Improvement Works in Cai Mep		Company

Source: Vinamarine MPMU and ( ) :Others

Out of these companies VINAWACO mostly executes dredging works all over the country and He has four companies named with Maritime Dredging Company No.1 & Maritime Dredging Company No.2 then Waterway Dredging Company No1 & Waterway Dredging Company No2. Maritime Dredging Companies specialized the dredging works using hopper dredgers and Maritime Dredging Company No.1 and No.2 mostly covers the dredging work in North and South respectively. Waterway Dredging Companies can carry out dredging works mostly by cutter suction pump dredgers and No.1 usually covers the North and No.2 covers the South.

CIENCO No.6 is the major company in the South Viet Nam. He can cope with various kinds of works such as airport, bridge, road and port facilities as well. He has also butchers plants making concrete or asphalt and quarries to supply stones.

Petrovietnam Engineering & Construction (PVECC) Company is rather unique company which specializes in constructing and assembling oil and gas works located in Vung Tau. He has nearly 20 years experiences in fabricating or installing platform jackets or other structures for exploiting crude oil and roads or jetties construction works as well. Furthermore earth works for leveling or soil improvement works in the construction site of Gas Distribution Station in Phu My and now they are executing the construction works for Cai Meip LPG base. In case of soil improvement works in Cai Miep LPG base they conducted paper drain works for11ha with total 6 number of soil improvement equipments, they are, the drivers for paper drain works. In our Project it might be needed to drive large diameter of steel pipe piles or paper drain works. When we need more large-scale equipments we can easily procure them from other countries by the interviews from several construction companies.

19.1.4 Equipment Available for the Project

Through the interviews or documents supplied by the above-mentioned construction companies, typical equipments available in case of implementation of our projects can be summarized in Table 19.1.11.

Table 19.1.11 Typical Equipment Available for the Project

Kind of Equipment	Capacity	Owner	Remarks
Truck Crane	Lifting Capacity 70t	PVECC	Japan
Bulldozer	130t	〃	Russia
Steel Sawing Machine	ϕ =870mm	〃	
Road Roller	12t	〃	China
Pile Driver	Paper drain works	〃	4 sets
Concrete Plant	60m^3/ h	SIENCO6	Germany
Truck Crane	Lifting Capacity 80t	〃	Japan
Concrete Pump Vehicle	Pumping Capacity 95 m^3/ h	〃	Germany
Concrete Pump Vehicle	Pumping Capacity 60 m^3/ h	〃	Korea
Diesel Pile Hammer	Hammer Weight 7.5t(D75)	〃	Germany
Flat Barge	600t~2000t	〃	Viet Nam
Pile Driving Vessel	100t Fat Barge+D75 P&H	〃	America
Hopper Dredger	3500 m^3 -25m	MADRECONo.2	Germany
Bucket Dredger	TC-81 800 m^3/ h	〃	France
Cutter Suction Dredger	4070HP -2.4~17m	WDCO No.2	America
〃	2000HP -2.5~12m	〃	Japan
〃	1200HP	〃	Holland
Pile Driving Vessel	Hammer Weight 4.5t(D45)	SWACO	China
Pile Driving Vessel	Hammer Weight 4.6t(D46)	〃	Russia
Vibratory Pile Hammer	Vibrator CM2- 80	〃	Japan
Flat Barge	100t~1200t	〃	Viet Nam, USA
Road Roller	12t	〃	Russia
Asphalt Finisher		〃	Japan
Crane Transport Vessel	3,343DWT lifting Power 600t	VIETSOVPETRO	Finland
Ocean Tug Boat	1379.2DWT 2,650HP	〃	Poland

Scales and structures for quay walls or other port facilities of our project have not yet been decided. However we can use rather large scale of equipment or work vessels above described. However, it can be supposed that dredging volume or excavating volume become so large that there might happen shortage of dredgers or work vessels for implementation. When we need large-scale hopper dredgers or cutter suction dredgers we have to procure them from neighboring countries.

19.1.4 Material Supply Capacity

As for construction material supply, we have several ready-mixed concrete plans near the Project site and a factory which producing iron bars or other steel members in Phu My. We have also several quarries supplying stones or aggregate for concrete mixing in Vung Tau or Dong Nai area and brick factories as well. Fine sand for filling material in land or concrete mixing fine aggregate we can obtain in the area upstream of Dong Nai River. Rubble stones can be obtainable from quarries located in the east Mountain side of Baria City about 20km far from the Project site. According to the site survey done in November in 2001, near Cai Mep LPG Base there already located a large- scale supply base for rubble stones, sand or aggregate. We can easily transport these materials by barges from that base.

However, we don not have factories producing steel pipe piles or pre-stressed circular concrete piles in Viet Nam. In case of steel pipe piles we have to import from Japan and as for pre-stressed circular concrete piles from Malaysia or Singapore.

Photo 19.1.1 and Photo 19.1.2 show a ready mixed concrete plant near Cat Lo fishing port in Vung Tau City. The capacity of the butchers-plant is not clear but it seems rather large scale and can supply 100~150m^3 ready mixed concrete per hour. As a conclusion there might no problem to supply every construction materials except special material in the future construction works for our Project.

Photo 19.1.1 Mekong Ready Mixed Concrete Plant near Cat Lo Fishing Port

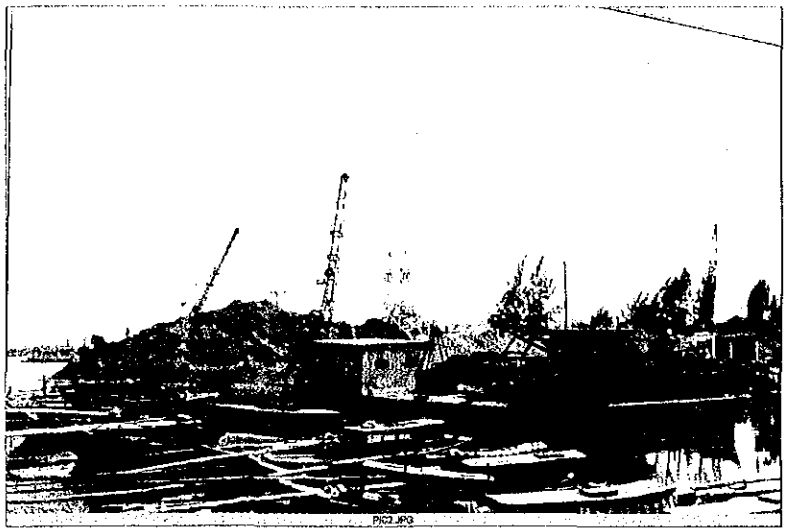


Photo 19.1.2 Mekong Ready Mixed Concrete Plant near Cat Lo Fishing Port

19.2 Cost Estimate

19.2.1 Method of Cost Estimate in General

The method of cost estimate is different to project to project and projects stage to stage in general. Most precise one is for tendering cost estimate based on a detail design. Recently Ministry of Construction issued the circular regarding cost estimate in Viet Nam. The circular's name is "Instruction on Issuing and Managing Engineering Cost for Investment Projects". This circular aims at carrying out cost estimate work reasonably for many organization particularly related with the Government body on detail design works. Here only some brief points are to be introduced.

The circular's headlines are like bellow.

CIRCULAR NUMBER 09/2000/TT-BXD DATED 17TH JULY 2000
MINISTRY OF CONSTRUCTION
Instruction on issuing and managing engineering cost for investment projects

- Pursuant to the Decree number 52/1999/ND-CP dated 08 July 1999 on Regulation of Construction and Investment Management of the Government.
- Pursuant to the Decree number 12/2000/ND-CP dated 05 May 2000 on amending and supplementing some provisions of Construction and Investment Management Regulation issued hereto the Decree No. 52/1999/ND-CP dated 8 July 1999 of the Government,
- In order to implement the construction management of construction and investment projects using Stage budget, credit fund of State...regulated in the provisions 10, 11, 12 of the Decree No.52/1999/ND-CP and items 4,5,6 of the provision 1 – the Decree No.12/2000/ND-CP.

Remarks: The Circular is replacing to the Circular number 08/1999/TT-BXD of Ministry of Construction instructing on establishing and managing engineering costs of construction and investment projects.

Main points of content in the circular can be summarized below.

1. Cost Estimate Norm
Construction cost estimate norms were studied and issued by Ministry of Construction. Construction unit cost issued by Provincial People's Committee or others (for special constructions) should be established based on the cost estimate norm here mentioned.
Ministries relating construction shall cooperate with Ministry of Construction to check modify and supplement specific cost estimate norms.

2. Unit cost
Unit cost is issued by Chairman of People Committee in provinces, cities (called local unit cost) and only used for constructions in the province not others.

As regard to important and special constructions, it is requested to have a special unit cost based on unit cost establishing method of Ministry of Construction.

3. Total cost estimate

Total cost estimate should be made in accordance with concepts, principles mentioned in this Circular for all constructions not except special ones.

4. Cost Modification

Prices vary according to economic situation so that prices of salary and electricity or oil etc. should be modified time-by-time when needed.

19.2.2 Item for Cost Estimate

The above-mentioned circular shows the standard cost calculation items and standard cost estimate table shown as an appendix under mentioned. These items are not so much different from Japanese one except tax or contingency and it is usable in case of our feasibility study. We will calculate cost estimate as same rules as bellow written.

APPENDIX NO. 1

Calculating method of Engineering Cost Estimate

(Attached with the Circular No. 09/2000/TT-BXD dated 17th July 2000)

Total cost estimate is summing up necessary costs for constructing and will be calculated specifically in the detail design stage (for construction having two design stages) or technical engineering design (for construction with one design stage). Total cost (G_{TDT}) is including: construction cost (G_{XL}), equipment cost (G_{TB}), other cost (G_K) and contingency (G_{DP}).
Total cost estimate shall calculated as the following formula:

$$G_{TDT} = G_{XL} + G_{TB} + G_K + G_{DP}$$

1. Calculating method of construction cost

Construction cost is all expenses for implementing construction or assembling works of each engineering item. Construction cost shall be calculated as follows:

$$G_{XL} = \Sigma g^i_{xl} \ (1 + T^{XL}_{GTGT})$$

Where:

g^i_{xl}: construction cost estimate before tax of the item No. i.

T^{XL}_{GTGT}: VAT value for construction and assembling works.

- For special designed construction items, cost estimate value before tax have been determined the following appendix No. 2.
- For ordinary construction items (buildings, administration house, store, road, yard...), cost estimate value before tax shall be calculated as follows:

$$g^i_{xl} = P_i \times S_i$$

Where:

P_i: price level for area or using capacity units of the item No. i.

S_i: Area or using capacity of the item No. i.

2. Calculating method for equipment cost

Equipment cost have been determined as follows:

$$G_{TB} = \Sigma Q_i M_i \ (1 + T^{XL}_{GTGT})$$

Where:

Q_i: Weight (ton) or number (unit) equipment (equipment group) No. i.

M_i: price for one ton or one unit (one group) of equipment No. i

$$M_i = m_i + n_i + k_i + v_i + h_i$$

m_i: price of equipment No. i at manufacture (manufacture, technology supplier in Vietnam) or price at Viet Nam port (for import equipment) .

n_i: transportation cost for one ton or one unit (one group) of equipment No.i from manufacture or Viet Nam port to construction site.

k_i: yard, store, container costs for one ton or one unit (one group) of equipment No.i (if available) at Viet Nam port (for import equipment).

v_i: maintenance cost for one ton, one unit (one group) of equipment No.i at site.

h_i: tax and insurance cost for equipment No.i.

T^{XL}_{GTGT}: VAT level regulated for each equipment.

As regard to irregular equipment to be produced, its cost shall be calculated based on principal, method in item 1.2, point 1 of IV of the circular and consists all contents as mentioned above.

3. Calculating method for other costs

Other cost shall be calculated as follows:

$$G_K = (\Sigma B_i + \Sigma C_j) \times (1 + T^{XL}_{GTGT})$$

Where

B_i: Value of other cost item No.i belongs to expenditure group the following percentage.

C_j: Value of other cost item No.j belong to other cost group calculated by cost estimate.

T^{XL}_{GTGT}: VAT level according to regulation for other cost which is subject to be paid VAT.

4. Contingency

Contingency (due to increased volume and escalation) shall be calculated by **10%** total construction, equipment, other costs and determined as follows:

Standard form (as a sample) for the table of cost estimate is show as followings. Beside of this table, summary table of total cost estimate, summary table of cost items as construction, equipment, other costs and calculating table of construction volume are to be made.

We will use these methods when we calculate the construction cost for short-term plan chosen as the optimum plan. As for Master Plan we will figure out more simple and rough way considering various unit prices issued by local government, available prices in new similar pre-feasibility studies, actual contract prices or cost estimate by manufacturers' etc.

5. Standard Table of total cost estimate

Date.....month.....year

Name of construction:

No.	Expenditure item	Value before tax	Output VAT	Value after tax
1	2	3	4	5
1	Construction cost			G_{XL}
2	Equipment cost			G_{TB}
3	Other costs			G_K
	- Investment preparing stage.			
	-Investment implementing stage			
	-Completing stage			
4	Contingency			G_{DP}
	Total (1+2+3+4)			G_{TDT}

Calculating person Checking person Name of company

19.2.3 Unit Price issued by Local Governmental Organization and Others

According to the "CIRCULAR NUMBER 09/2000/TT-BXD DATED 17TH JULY 2000 by MINISTRY OF CONSTRUCTION" in the previous section, construction unit cost issued by Provincial People's Committee or others (for special constructions) should be established based on the cost estimate norm.

Table 19.2.1 shows unit price document issued by the organization related with the Project.

Table 19.2.1 Unit Price or officially published by related organization

As of 2001.11.2

No	Title	Source	Page	Content
1	Announcement (Thong Bao) of Ministry of Construction, March 2001	MOC	9	Unit Price of Construction Material
2	Announcement (Thong Bao) of T.P HCMC, January 2001	HCMC	11	Unit Price of Construction Material
3	Thong Bao Don Gia Xay Dung Co Ban Tinh Ba Ria Vung Tau 1999	BaRiaVungTau UBND	477	Price of Construction Works
4	Bang Gia Du Toan Ca May Va Thiet Bi Xay Dung 2000	MOC	389	Unit Price of Construction Machine and Equipment

Beside the above document TEDI-South provided useful average and prevailing unit prices in the Project area as Table 19.2.2.

These Prices vary under condition to condition. However, when we will calculate rough cost estimate quickly, they are useful to grasp amount of a project cost.

The Project Cost next section mentioned has been calculated using such data.

Table 19.2.2 Prevailing Unit Price in the Project Area

No	Item		Unit	U. Price (VND)
I	Information on prevailing Unite Prices			
	Excavation		m^3	12,000
	Dredging		m^3	28,000
	Filling Work		m^3	60,000
	Soil Improvement		m^2	600,000
	Embankment		m^2	5,500,000
	Riprap		m^2	140,000
	Pile Foundation	- PC pile (þ600)	m	850,000
		-RC pile (40x40cm)	m	450,000
		- Steel Pipe pile (þ600)	m	1,750,000
		- Steel Sheet pile	T	5,800,000
	Pavement	- Sub-grade placement	m^3	65,000
		- Sub-base Course placement	m^3	175,000
		- Base Course placement	m^3	210,000
		- Asphalt Surfacing	m^3	560,000
		- Concrete Surfacing	m^3	850,000
	Concrete Works	- Foundation Concrete	m^3	850,000
		- Ground Floor Slab	m^3	1,080,000
		- Ground Beam and Wall	m^3	1,150,000
		- Elevated Floor Slab	m^3	1,100,000
		- Elevated Beam and Wall	m^3	1,170,000
	Steel Works		T	6,500,000
	Office		m^2	3,000,000
	Warehouse		m^2	4,200,000
II	Leasing Rates of Construction Equipment			
	Bulldozer 110CV		Shift	800,000
	Back hoe 1,25m^3		Shift	1,460,000
	Loader 5T		Shift	310,000
	Dump Truck 10T		Shift	630,000
	Pile Driver	- Diesel 3,5 T	Shift	1,880,000
		- Vibrating 60 Kw	Shift	1,210,000
	Crane 50T		Shift	1,970,000
	Truck 10T		Shift	510,000
	Trailer 20T		Shift	130,000
	Roller - Tire (18T)		Shift	550,000
	Roller - Tamping (9T)		Shift	540,000
	Roller - Vibrating (18T)		Shift	1,120,000
	Asphalt Finisher (60T/h)		Shift	11,850,000
	Concrete Agitator Truck (60m^3/h)		Shift	1,940,000
	Concrete Pump (60m^3/h)		Shift	2,200,000
	Crane Barge 40T		Shift	2,280,000
	Flat Barge 800T		Shift	1,330,000
	Tug Boat 150CV		Shift	930,000
	Small Working Boat		Shift	200,000
III	Wage of Manpower			
	Worker (3,5/7)		Shift	36,000
	Foreman		Shift	450,000
	Secretary		Shift	255,000
	Typist		Shift	130,000
	Clerk		Shift	255,000
	Draftsman		Shift	360,000
	Guard man, Watchman		Shift	50,000
	Labor		Shift	32,000

Source: TEDI-South

19.2.4 Actual Dredging Cost Analysis for Navigation Channel on Project Area

Base on the data provided by MPMU navigation channel maintenance dredging cost has been analyzed as the Table 19.2.3. It can be usable for calculating dredging works on the Project. However, it should be noticed that all these dumping sites are located in Ganh Rai Bay or upstream basins.

Table 19.2. 3 Maintenance Dredging in Lon Tau Channel

(in the year 2000)

	1.GANH RAI	2.KERVELLA	3.PROPONTIS	4.DA HAN	5.P77--P79	2+3+4+5	6.Mui L'est	7.Dan Xay	6+7
Volume 1 (section) (m^3)	10,004	40,130	31,832	11,858	18,611	102,431	90,015	25,243	115,258
Volume 2 (allowance) (m^3)	12,127	15,781	10,342	3,211	6,022	35,356	45,014	20,615	65,629
Total (m^3)	22,131	55,911	42,174	15,069	24,633	159,918	135,029	45,858	180,887
Discharge Distance (km)	15.8	11.8	4.3	3.8	21.8	10.4	9.75	16.8	13.3
Work Vessel	Drag Suction	Bucket Dredger	Bucket Dredger	Bucket Dredger	Bucket Dredger	Bucket Dredger	Bucket Dredger	Bucket Dredger	Bucket Dredger
Cost (Dong)									
Dredging	344,402,623	2,253,196,527	1,227,039,878	427,171,491	1,360,719,531	5,612,530,050	5,028,074,873	2,190,584,687	7,218,659,560
Excavation	208,308,038	721,168,034	543,981,339	194,367,497	317,728,751	1,777,245,621	1,741,671,557	591,289,094	2,332,960,651
Transportation	136,094,585	985,666,201	270,934,211	85,549,726	802,277,104	2,144,427,242	1,966,899,928	1,150,979,034	3,117,878,962
Reclamation	0	546,362,292	412,124,328	147,254,268	240,713,676	1,346,454,564	1,319,503,388	448,116,559	1,767,619,947
Others (Dong)	129,576,344	36,225,909	21,236,862	23,970,249	33,353,208	114,786,228	87,607,485	38,168,010	125,775,495
Supervision	2,906,102	N.A	N.A	N.A	N.A	36,139,354	N.A	N.A	56,883,037
Design	582,410	N.A	N.A	N.A	N.A	11,301,228	N.A	N.A	10,235,524
Survey	28,167,832	N.A	N.A	N.A	N.A	67,345,646	N.A	N.A	58,656,934
Mobilization	2,920,000	N.A	N.A	N.A	N.A	0	N.A	N.A	N.A
Contingency (Dong)	35,000,000	228,942,243	124,827,674	45,114,174	139,407,274	538,291,365	511,568,236	222,875,269	734,443,505
Total (Dong)	473,978,967	2,518,364,679	1,373,104,414	496,255,914	1,533,480,013	5,921,205,020	5,627,250,593	2,451,627,967	8,078,878,560
Unit Price (Dong/m^3)	21,417	45,042	32,558	32,932	62,253	37,027	41,674	53,461	44,663
Dredging	15,562	40,300	29,095	28,348	55,240	35,096	37,237	47,769	39,907
Excavation	9,413	12,899	12,899	12,899	12,899	11,113	12,899	12,894	12,897
Transportation	6,150	17,629	6,424	5,677	32,569	13,410	14,566	25,099	17,237
Reclamation	0	9,772	9,772	9,772	9,772	8,420	9,772	9,772	9,772
Others	5,855	648	504	1,591	1,354	718	649	832	695
Contingency	1,581	4,095	2,960	2,994	5,659	3,366	3,789	4,860	4,060
Transportation/km/ m^3	389	1,494	1,494	1,494	1,494	1,289	1,494	1,494	1,296

19.2.5 Rough Cost Estimate for Master Plan

Based on the layout plans for the major port projects discussed in the Chapter 17 and the preliminary structural designs prepared in the Chapter 18, a rough cost estimate is carried out. The detailed quantities shown in the cost estimate Table A.19.2.1 ~A19.2.6 have been calculated according to the preliminary designed sections and the layout plans. These quantities do not contain allowances necessary in actual works. The amount of the cost has been figured out using these quantities and unit costs. Unit costs are fixed by referring with the average and prevailing costs shown in the Table 19.2.2, data from Japanese trading companies that have the experiences of foreign trade, and cost estimate documents in the similar projects of South Viet Nam.

Usually we need 5 % value added tax, survey or consultant fee and 10% contingency for cost estimate. In this case, considering the quantity allowances necessary in actual works and the above-mentioned costs, the adopted unit costs are increased by about 20%. Then, land and compensation fees are also considered.

The result of the cost estimate is summarized in the Table 19.2.4

Table 19.2.4 Rough Construction Cost Estimate for Master Plan in Thi Vai and Vung Tau

Port	Ship Size etc.	No.	Cargo	Length (m)	Depth(m)	Billion VND	Million USD	Million Yen
Ben Dinh Sao Mai								
Container (incl. Breakwater)	80,000DWT	2	Container	350×2=700m	-16.0	2,797	186.4	22,370
Container	50,000DWT	3	Container	300×3=900m	-14.0	2,949	196.6	23,590
Access Road				3,000m		105	7.0	840
Channel	52.0 Mill. m^3					1,532	102.1	12,260
BDSM Channel	46.7 Mill. m^3			5,838m	-16.0	1,400	93.4	11,200
G.R.B. Channel	5.3 Mill. m^3			10,510m	-16.0	131	8.8	1,050
Total						**7,382**	**492.1**	**59,060**
Cai Mep								
Container	80,000DWT	2	Container	350×2=700m	-16.0	2,578	171.9	20,630
Container	50,000DWT	3	Container	300×3=900m	-14.0	2,796	186.4	22,360
Access Road				3,000m		101	6.7	810
Channel	31.3 Mill. m^3			26,160m		1,529	102.0	12,240
C.M. Channel	28.0 Mill. m^3			13,270m	-16.0	1,398	93.2	11,180
G.R.B. Channel	5.3 Mill. m^3			10,510m	-16.0	131	8.8	1,050
Total						**7,004**	**466.9**	**56,030**
Thi Vai								
General	50,000DWT	2	General	300×2=600m	-14.0	1,206	80.4	9,650
General	30,000DWT	2	General	250×2=500m	-12.0	867	57.8	6,940
Access Road				2,000m		61	4.0	490
P.M. Channel	13.4 Mill. m^3			12,000m	-14.0	670	44.7	5,360
Total						**2,804**	**186.9**	**22,430**

Note: Exchange Rate VND15,000 = USD 1 = JY 120.

Total cost between Ben Dinh Sao Mai and Cai Mep differs about 3 billion yen in spite of the same scale development. However, the difference compared with the total cost becomes nearly 5%. It means that, from the viewpoint of the cost estimate, there is not a significant difference between the two projects.

As for the dredging volume, the difference between Ben Dinh Sao Mai and Cai Mep is more than 20 million m^3 approximately. However, the fact that dumping site should be selected offshore about 5km from Vung Tau Peninsula to prevent return of soils to the channels makes transport distance of dredging soil shorter from Ben Dinh Sao Mai than that from Cai Mep, which results in the dredging cost nearly same.

Thi Vai project comprises two general berths for 50,000 DWT and two general berths for 30,000DWT. The total berth length is 1,100m, which is about 73% of Ben Dinh Sao Mai or Cai Mep that has 1,500m berth length, respectively. While the total cost becomes less than 40% comparing Ben Dinh Sao Mai Project with Cai Mep Project. It is derived from the difference of the equipment costs for container berths and general berths.

Table 19.2.5 to Table 19.2.7 show each project cost by item such as civil works, building, utilities (for water and electric power supplies, etc.), and equipment. Comparing with general 50,000DWT berth in Thi Vai and container 50,000DWT berth in Ben Dinh Sao Mai or Cai Mep, there is no significant difference between the both item costs except that of equipment. The equipment cost for one 50,000DWT general berth is about 1.5 billion yen. While that for one 50,000DWT container berth becomes 4.1 billion yen, which is nearly triple as of general berth equipment.

The portion of the equipment cost for container berth is very high, showing 46% to 55% of the total cost. As for the general berth, the portion of the equipment cost is rather high, indicating 35% and 44%.

The each cost breaking down in detail is shown in Table A19.2.1 to Table A19.2.6.

Table 19.2.5 Rough Cost Estimate on Ben Dinh Sao Mai Master Plan

A. Ben Dinh Sao Mai Container Berth for 80,000DWT 2 Berths VND15,000=USD 1=JY 120

No.	Item	Description	Unit	Quantity	Amount of Construction Cost		
					Mill. VND	Thou. USD	Mill. Yen
1	Land Reclamation	700 × 550m	m^2	385,000	377,596	25,173	3,021
2	Dredging	-16.0m	m^3	752,600	37,630	2,509	301
3	Pier	L=700m, B=60m	m	700	637,337	42,489	5,099
4	Sheet Pile Revetment	L=700m	m	700	87,943	5,863	704
5	Rubble Stone Revetment	L=1,800m	m	1800	7,781	519	62
6	Yard Construction	for 2 Berth	m^2	369,200	190,330	12,689	1,523
7	Buildings	for 2 Berth	m^2	18,700	29,340	1,956	235
8	Utilities	for 2 Berth	set	1	43,158	2,877	345
9	Equipment	for 2 Berth	unit	88	1,289,000	85,933	10,312
10	Basin	700 × 50m	m^2	35,000	59,480	3,965	476
11	Breakwater	Rubble Sloping	m	100	37,000	2,467	296
	Total				2,796,595	186,440	22,373

B. Ben Dinh Sao Mai Container Berth for 50,000DWT 3 Berths

No.	Item	Description	Unit	Quantity	Amount of Construction Cost		
					Mill. VND	Thou. USD	Mill. Yen
1	Land Reclamation	990 × 480m	m^2	475,200	408,078	27,205	3,265
2	Dredging	-14.0m	m^3	949,950	47,498	3,167	380
3	Pier	L=900m, B=40m	m	900	463,574	30,905	3,709
4	Sheet Pile Revetment	L=900m	m	900	118,564	7,904	949
5	Rubble Stone Revetment	L=2,250m	m	2,250	9,726	648	78
6	Yard Construction	for 3 Berth	m^2	394,250	198,520	13,235	1,588
7	Buildings	for 3 Berth	m^2	14,850	30,100	2,007	241
8	Utilities	for 3 Berth	set	1	51,082	3,405	409
9	Equipment	for 3 Berth	unit	110	1,527,600	101,840	12,221
10	Basin	900 × 50m	m^2	45,000	93,821	6,255	751
	Total				2,948.562	196,571	23,589

C. Access Road for Ben Dinh Sao Mai L=3,000m W= 20m

No.	Item	Description	Unit	Quantity	Amount of Construction Cost		
					Mill. VND	Thou. USD	Mill. Yen
1	Access Road	L=3,000m W=20	m	3,000	104,781	6,985	838

D. Channel for Ben Dinh Sao Mai

No.	Item	Description	Unit	Quantity	Amount of Construction Cost		
					Mill. VND	Thou. USD	Mill. Yen
1	Channel (BDSM-Ganh Rai)	L=5,840m B=350m -16.0m	Thou m^3	46,682	1,400,470	93,365	11,204
2	Channel (S50-Ganh Rai)	L=10,510m B=350m-16.0m	Thou m^3	3,679	131,470	8,765	1,052
	Total			50,361	1,531,940	102,129	12,256

E. Master Plan for Ben Dinh Sao Mai

	Grand Total				**7,381,878**	**492,125**	**59,055**

Table 19.2.6 Rough Cost Estimate on Cai Mep Master Plan

A. Cai Mep Container Berth for 80,000DWT 2 Berths VND15,000=USD 1=JY 120

No.	Item	Description	Unit	Quantity	Amount of Construction Cost		
					Mill. VND	Thou. USD	Mill. Yen
1	Land Reclamation	740 × 570m	m^2	421,800	351,383	23,426	2,811
2	Dredging	-16.0m	m^3	564,600	36,699	2,447	294
3	Pier	L=700m, B=60m	m	700	580,212	38,681	4,642
4	Trestle	30m x 90m x 4	m	360	44,316	2,954	355
5	Retaining Wall Revetment	L=700m	m	700	5,853	390	47
6	Rubble Stone Revetment	L=1800m	m	1,800	7,781	519	62
7	Yard Construction	for 2 Berth	m^2	369,200	190,330	12,689	1,523
8	Buildings	for 2 Berth	m^2	18,700	29,340	1,956	235
9	Utilities	for 2 Berth	set	1	43,158	2,877	345
10	Equipment	for 2 Berth	unit	88	1,289,000	85,933	10,312
11	Basin	0	m^2	0	0	0	0
	Total				2,578,071	171,871	20,625

B. Cai Mep Container Berth for 50,000DWT 3 Berths

No.	Item	Description	Unit	Quantity	Amount of Construction Cost		
					Mill. VND	Thou. USD	Mill. Yen
1	Land Reclamation	960 × 470m	m^2	451,200	372,591	24,839	2,981
2	Dredging	-14.0m	m^3	456,500	29,673	1,978	237
3	Pier	L=900m, B=40m	m	900	512,367	34,158	4,099
4	Trestle	20m x 90m x 6	m	360	48,026	3,202	384
5	Retaining Wall Revetment	L=900m	m	900	7,526	502	60
6	Rubble Stone Revetment	L=2,250m	m	2,250	9,726	648	78
7	Yard Construction	For 3 Berth	m^2	394,250	198,520	13,235	1,588
8	Buildings	For 3 Berth	m^2	14,850	30,100	2,007	241
9	Utilities	For 3 Berth	set	1	51,082	3,405	409
10	Equipment	For 3 Berth	unit	110	1,527,600	101,840	12,221
11	Basin	L=900m, B=50m	m^2	45,000	8,314	554	67
	Total				2,795,524	186,368	22,364

C. Access Road for Cai Mep L=3,000m W= 20m

No.	Item	Description	Unit	Quantity	Amount of Construction Cost		
					Mill. VND	Thou. USD	Mill. Yen
1	Access Road	L=3,000m W=20	m	3,000	100,931	6,729	807

D. Channel for Cai Mep

No.	Item	Description	Unit	Quantity	Amount of Construction Cost		
					Mill. VND	Thou. USD	Mill. Yen
1	Channel (Cai Mep-S43)	L=13,270m B=350m-16.0m	Thou m^3	27,960	1,398,010	93,201	11,184
2	Channel (S43-Ganh Rai)	L=10,510m B=350m-16.0m	Thou m^3	5,259	131,470	8,765	1,052
	Total			33,219	1,529,480	101,965	12,236

E. Master Plan for Cai Mep

	Grand Total				**7,004,006**	**466,934**	**56,032**

Table 19.2.7 Rough Cost Estimate on Thi Vai Master Plan for 50,000DWT

A.Thi Vai General Berth for 50,000DWT 2 Berths VND 15,000=USD 1=JY 120

No.	Item	Description	Unit	Quantity	Amount of Construction Cost		
					Mill. VND	Thou. USD	Mill. Yen
1	Land Reclamation	640 × 430m	m^2	275,200	242,695	16,180	1,942
2	Dredging	-14.0m	m^3	0	0	0	0
3	Pier	L=600m, B=40m	m	600	354,843	23,656	2,839
4	Retaining Wall Revetment	L=600m	m	600	5,017	334	40
5	Rubble Stone Revetment	L=1440m	m	1,440	6,376	425	51
6	Yard Construction	for 2 Berth	m^2	223,400	106,990	7,133	856
7	Buildings	for 2 Berth	m^2	26,000	39,000	2,600	312
8	Utilities	for 2 Berth	set	1	33,226	2,215	266
9	Equipment	for 2 Berth	unit	133	418,250	27,883	3,346
10	Basin	0	m^2	0	0	0	0
	Total				1,206,397	80,426	9,651

B. Thi Vai General Berth for 30,000DWT 2 Berths

No.	Item	Description	Unit	Quantity	Amount of Construction Cost		
					Mill. VND	Thou. USD	Mill. Yen
1	Land Reclamation	520 × 280m	m^2	140,560	131,343	8,756	1,051
2	Dredging	-14.0m	m^3	11,300	735	49	6
3	Pier	L=500m, B=40m	m	500	231,762	15,451	1,854
4	Retaining Wall Revetment	L=500m	m	500	4,181	279	33
5	Rubble Stone Revetment	L=1,040m	m	1,040	4,495	300	36
6	Yard Construction	For 2 Berth	m^2	120,800	55,780	3,719	446
7	Buildings	For 2 Berth	m^2	16,200	29.990	1,999	240
8	Utilities	For 2 Berth	set	1	28,900	1,927	231
9	Equipment	For 2 Berth	unit	102	380,000	25,333	3,040
10	Basin	0	m^2	0	0	0	0
	Total				867,186	57,812	6,937

C. Access Road for Thi Vai L=3,000m W= 20m

No.	Item	Description	Unit	Quantity	Amount of Construction Cost		
					Mill. VND	Thou. USD	Mill. Yen
1	Access Road	L=2,000m W=20	m	2,000	60,612	4,041	485

D. Channel for Thi Vai

No.	Item	Description	Unit	Quantity	Amount of Construction Cost		
					Mill. VND	Thou. USD	Mill. Yen
1	Channel (Cai Mep-Thi Vai)	L=12,000m, B=310m -14.0m	Thou m³	13,398	669,915	44,661	5,359

E. Master Plan for Thi Vai

	Grand Total				**2,804,110**	**186,941**	**22,433**

Chapter 20 Preliminary Economic Analysis

This chapter presents the results of the preliminary evaluation of the economic viability of the port development project in the South of Vietnam (This is referred to as the Project hereinafter in this chapter). It is concerned with the determination of the net benefits that will accrue to the economy as a result of the Project as a whole. The Project is composed of various ports planned in Thi Vai area and Vung Tau area as well as the deepening and widening of the navigation channels associated with these planned ports located in different areas apart from each other. The economic analysis for the Project is carried out not only for examination of viability of the Project as a whole but also to provide the indicators to seek the most optimum sequence and timing of the development of respective component within the time frame set out for this Master Plan Study. The economic analysis of the Project is carried out to verify the economic viability of the Project as a whole by analyzing the benefits accrue to the Project as the difference of various costs between the With Project Case and Without Project Case. As for the economic analysis of the Project, only tangible costs and benefits are considered in evaluation.

The Study has already identified two different configurations of port groups, which are planned to be developed newly as a major alternative port group for the Ho Chi Min City port group in the Thi Vai area and Vung Tau area, respectively. These are refereed to as either the Cai Mep Port with the Phu My Port Group or the Ben Dinh Sao Mai Port with the Phu My Port Group. Both of which are planned to cope with the cargo demand forecasted up to the year 2020 in combination with the port expansion program of other ports such as Go Dau Port and Baria Serece as well as Dong Xuyen Port. Thus, the preliminary economic analysis is prepared purely to compare the superiority of either group of ports in a view of national economic benefit, which is appeared as the rates of EIRR and B/C for respective package of port development plans.

20.1 Methodology

The relevant economic feasibility criterion is derived from a procedure aimed at maximizing the overall objectives of the national economy. Economic feasibility is measured by comparing the Economic Internal Rate of Return (EIRR) of the project, which is assumed to be minimum EIRR of ten (10 %) percent for infrastructure project in Vietnam. (ADB 1998) This 10 percent discount rate is used as the economic opportunity cost of capital and this rate is used to calculate B/C, NPV and EIRR.

(1) Cost

The cost of the Project was estimated firstly on the basis of the market price as financial cost and it is converted to the economic cost for the economic analysis. As for the economic analysis, it is assumed that the Project is owned and operated fully by the public entity. Therefore, the cost estimated therein covers fully the requirement to operate whole cargo handling activity in the project ports.

The monetary unit shown therein, therefore, is based on prevailing market prices of required goods and services as of February 2002. Taxes composed of the current tax and import duties are subtracted as transfer payment from the total financial cost estimated. The combined tax rates applied for this subtraction were 10 % on all prices estimated for local components and 8 % as import duties on all prices estimated for foreign components. However, it is to be noted that the estimated project cost are of preliminary nature at the time this report is prepared.

(2) Benefits

The benefits are estimated based on the comparison of With Case and Without Case of the Project. The quantifiable benefits applied for the economic analysis are as follows:

(A) Benefits from avoiding vessel waiting time;
(B) Benefits from saving of vessel cost due to elimination of channel navigation;
(C) Benefits derived from reduction of cost associated with maritime accident; and
(D) Benefits from saving cargo transport costs or trucking costs;

Before the economic evaluation is carried out and various inputs factors determined, the framework has to be established and defined. The data framework consists of the following components.

a) Investment plan period
b) Design and construction period
c) Project commissioning year
d) Currency

1) Investment Plan Period

The investment plan period is defined as the total time period between the starting of the cost stream and the end of benefit stream. The cost stream is assumed to start with the detailed design of the Project. The investment plan period for a project normally extends over a period of 20 – 30 years. In the evaluation of the Project, twenty-five (25) years is considered applicable taking into account the scale and type of the project. During the investment plan period, the cost and benefit are recorded annually over the whole period separately for each cost and benefit components.

2) Design and Construction Period

After the completion of financial arrangement and detailed design of the Project, the tender is called and contract will be awarded to the selected contractors to execute required works. The necessary period of detailed design is estimated as one (1) year and the construction period counted from the date of awarding contractors to the completion of each project component (except channel dredging work) is estimated as four (4) years. Thus, the total period for design and construction is assumed as five (5) years for each port planned to be developed. The required period to complete the channel dredging works is preliminary estimated for each case of the project package.

3) Project Commissioning Year

Judging from the cargo demand forecast and the foreseeable cargo handling capacity of existing ports located along the Soai Rap and the Dong Nai Rivers (or Ho Chi Min Port Group), the commissioning of new ports and/or expansion of the existing ports planned along the Thi Vai River Channel and/or Vung Tau would become indispensable as the port capacity of the group of former ports would reach to almost maximum to maintain their operation at economically functional level. It is assumed that the construction works of the selected port to be completed first among other ports will be fully completed at the beginning of 2010, and the cargo handling operations will commence immediately. The strategic planning relative to the commencement of port operation at each port has not been determined yet at the time this report is prepared, however, the development schedule including the timing, location, capacity of each port planned, etc. will be determined in the mean time to proceed to the feasibility study of such prioritized ports.

4) *Currency*

The currency used in the economic evaluation is US Dollar. The exchange rate of Vietnam Dong to one United States Dollar is VND 15,000 as of February 2002.

20.2 Prerequisites

The cargo demand forecast suggests that the present port capacity of the port group situated in Ho Chi Min City namely Saigon, Tan Cang, Ben Nghe, VICT, etc. (This group of ports in Ho Chi Min City is referred to HCMC Port Group in this chapter.) in total will not be able to handle with the cargo volume forecasted for the year 2010 and beyond due to a lack of port as well as a cargo handling capacity at an acceptable level of functional efficiency. The estimated total cost of vessel waiting time at these four (4) major ports alone would drastically increase from the year 2009 in accordance with the result of analysis with respect to the vessel waiting time in this study.
The relationship between the cargo demand-forecast and expected port capacity of Ho Chi Min Port Group composed of Saigon, Tan Cang, Ben Nghe, VICT, and other ports are shown in Figure 20.1. Therefore, the Project envisages to develop new ports at the most appropriate locations and at the most beneficial timing in the future to handle the cargo which will not be handled by Ho Chi Min Port Group from the year 2010 and beyond. This means that operation of cargo handling at any new port should be made available at the year 2010, thus, the design and construction works of such new port should be commenced from the year 2005 at the latest.

It is assumed that the port capacity of the HCMC Port Group will be increased to the level indicated as improved port capacity in the above mentioned figure, which would possibly handle the cargo volume projected up to the year 2009 without substantial economic loss. It is to be noted that the economic analysis for the improvement or capacity expansion project being thought within the Ho Chi Min City area is not studied due to a lack of time and necessary data for such particular study.

20.3 Economic Prices

The economic cost used for the analysis of economic viability of the Project are obtained by means of converting the market or financial price to the economic price using the following standard conversion factors for each type of works after deducting transfer payment such as import duties, taxes and adjusted labor cost taking into account the seasonal fluctuation of labor cost. These standard conversion factors are determined by following process.

1) Conversion Factors

The financial price is converted into economic price using the following shadow rates.

a) Shadow Exchange Rate

Shadow exchange rate is applied to the foreign currency portion of the price being converted to the economic price. This rate is obtained by the following formula.

$$SER = (Impi + Expi)/(Impi + Expi + ImpDi + ExpSi)$$

Where;

SER = shadow exchange rate
Impi = total amount of imports in year i
Expi = total amount of exports in year i
ImpDi = total amount of import duties in year i
ExpSi = total amount of export subsidies in year i, if any

The average shadow exchange rate of the past 5 years (1996 – 2000) computed based on these data available from the Statistic Year Book 2001 of Vietnam, is 0.95.

b) Shadow Rate of Labor Cost

Shadow rate of labor cost is applied to the cost of unskilled labor in the local labor cost component order to adjust the fluctuation of seasonal labor cost into an average labor cost. The seasonal fluctuation of labor cost is chiefly caused by the seasonal condition of unskilled labor available from the agricultural labor sector.

This rate is obtained through dividing the average annual income of agricultural labor by the average annual income of total labor. The average shadow rate of labor cost computed based on the data mentioned in the preceding paragraph in the past 5 years is 0.75.

2) Proportion of Costs by Currency

The financial cost is divided into foreign currency portion and local currency portion. The major cost items of foreign currency portion are deemed to be the cost related to imported materials, equipment, and construction plant, supervisory services conducted by the foreign experts, fuel, machine oil, etc. The local currency portion is deemed to be the cost related to locally available labor for related works and installation of electro-mechanical works as well as locally available materials for the construction or fabrication works. In order to proceed to arrive the standard conversion factor, the proportion of foreign currency portion and local currency portion for different works in percentage in total cost of each type of works are computed.

The standard conversion factors (SCF) for direct body cost by type of works are obtained based on the cost demarcation between foreign and local currency portion and with the application of the shadow exchange rate for foreign currency portion as well as the shadow rate of labor cost for labor cost of unskilled labor as shown in Table 20.1 below.

Table 20.1 Standard Conversion Factors and Cost Demarcation

Type of Works	SCF	Foreign	Local
Marine Engineering Works	0.85	73%	27%
Civil Engineering Woks	0.80	26%	74%
Electro-mechanical Works	0.84	77%	23%
Machinery & Equipment	0.83	89%	11%

Source: JICA Study Team

20.4 Economic Costs and Benefits of the Project

1) Construction Cost in Economic Price

The economic construction cost estimated for the Project in February 2002 based on the market price as well as the economic price computed by application of the conversion factors mentioned above to the financial price is shown in Table 20.2 below. The total capital outlay of the Project is estimated around US$ 1.1 billion over twenty (20) years development period excluding the replacement cost of equipment and machinery needed for cargo handling operation.

2) Schedule for Replacement of Machinery

The cost of major machinery for cargo handling operation shall be estimated taking into account their replacement costs in the future at an appropriate interval for each type of machine. The residual value of relevant machinery, if life of machine remains, shall be estimated and presented in the terminal year. However, these are not considered in this report, as such analysis will be conducted at the later stage of the Study in details.

Table 20.2 Economic Cost of the Project (US$ Million)

	Cai Mep	Ben Din Sao Mai	Phu My
Port	294	308	111
Channel	79	79	38
Sub-total	373	387	149

Source: JICA Study Team

3) Engineering Cost

The engineering cost including detailed design, consultancy services, construction supervisory services, etc. is estimated at eight (8) percent of total capital investment cost for respective port construction works and included in the construction cost estimated as above.

4) Physical and Price Contingency

Price contingency is added on top of the direct body costs including the above mentioned engineering cost estimated at the rate of five (5 %) on both foreign and local portion taking into account the cost inflation in the future. The ratio applied for the physical contingency, which is added on top of the cost including price contingency is ten (10 %) percent on both foreign and local currency portion of the cost. However, these are included in the construction cost estimated as above.

5) Operation Cost of the Port

The data and information concerned to the operation cost of the existing ports were not available except some business reports of Vietnam Maritime Bureau issued in February 2001. The record of operation cost relating to the cargo handling in this report is based on the actual performance of Nghe Tinh Port, Qui Nhon Port and Nha Trang Port in the year 2000. However, these data are judged to be applicable for the analysis of the port operation cost relevant to the Study.

The average cargo handling and port operation cost per metric ton of cargo handled is obtained as US$1.99 as appeared in Table 20.3 below. Then, it is converted to the economic price (conversion factor: 0.80) as US$ 1.60, which is used for the economic analysis in this report.

Table 20.3 Average Cost of Cargo Handling and Port Operation per Ton in US$

Article	Data
Cargo Throughput (MT)	2,659,000
Revenue (Million VND)	89,641
Contribution (Million VND)	10,183
Expenditure (Million VND)	79,458
Expenditure converted in US$	5,300,000
Cost per Ton in US$	1.99
Cost per Ton in US$ in Economic Price	1.60

Source: Ministry of Transport, Vietnam Maritime Bureau, February 2001

6) Maintenance Cost

The annual maintenance cost for port facilities and maintenance dredging works of channels are estimated at two (2%) percent and five (5 %) percent of the total amount of each capital investment amount, respectively.

7) Composition of Economic Benefits

The development of the Project ports may be expected to result in:

(A) Reduction in vessel's waiting time due to the increased port capacity;
(B) Net saving of vessel's time cost by eliminating channel navigation;
(C) Reduction of material loss and expenditure associated with maritime accidents;
(D) Net saving in land transport (trucking or hauling) cost; and
(E) Net saving in maritime transportation cost.

The assumptions used in estimating the direct benefits of reduction in vessel waiting time at ports are presented in subsequent paragraphs. A detailed description of each potential benefit is presented as follows:

(A) Reduction in Vessel's Waiting Time due to Increase of Port Capacity

The reduction in vessel's waiting time derived due to the congestion in the Ho Chi Min City port group as a whole, which will become greater and greater from the year 2005 or so is considered as a direct benefit for the ports envisioned in the Thi Vai area and the Vung Tau area, respectively. In estimating the benefits from reduction in vessel's waiting time at Saigon Port, Tan Cang Port, Ben Nghe Port, VICT and other port situated in Ho Chi Min City from the year 2010 on ward up to the year 2020 are analyzed and estimated using the formula presented below:

The waiting time of vessels in day under With Project Case is assumed to be none or as least as possible for both HCMC port group and ports envisioned in the Project. The benefit estimated for each year is accumulated through the whole project plan period discussed above except the period for the design and construction of the subject port.

ASCRVWT = (WTVDo – WRVD1) x DVC

Where;

ASCRVWT	=	annual saving cost from reduction in vessel's waiting time
WTVDo	=	waiting time of vessel in days under Without Project Case
WTVD1	=	waiting time of vessel in days under With Project Case
DVC	=	daily vessel cost

The vessel's waiting time was obtained from the application of queuing theory to approximate the vessel's waiting time based on the relationship between berth utilization ratio and average ship waiting time in accordance with the recommended formula to use for the port development planning by UNCTAD (A Handbook for Planners in Developing Countries, Second Edition 1985). More specifically the quantification of relationship between waiting time and berth utilization in units of average service time based on E2/E2/n system, which is considered as the best estimate of queuing time for specialized terminal, is applied. Table 20.4 shows the ratios of average vessel's waiting time by number of berthing points. The number of berthing points required to handle assigned cargo volume at these ports are determined taking into account of the number of existing berth and the average size of ship calling these port respectively. When the berth operation ratio exceed 1.0, then, it is assumed that the subject port's capacity reached to maximum and the vessel waiting time remain to the terminal year of the project plan period.

Table 20.4 Average Waiting Time of Ships in Queue

(Unit: Average Service Time in Day)

	Number of Berthing Point											
Utilization	1	2	3	4	5	6	7	8	9	10	11	12
0.10	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.15	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.20	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.25	0.09	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.30	0.13	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.35	0.17	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.40	0.24	0.06	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.45	0.30	0.09	0.04	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
0.50	0.39	0.12	0.05	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
0.55	0.49	0.16	0.07	0.04	0.02	0.02	0.02	0.01	0.00	0.00	0.00	0.00
0.60	0.63	0.22	0.11	0.06	0.04	0.03	0.02	0.01	0.01	0.00	0.00	0.00
0.65	0.80	0.30	0.16	0.09	0.06	0.05	0.03	0.02	0.01	0.01	0.00	0.00
0.70	1.04	0.41	0.23	0.14	0.10	0.07	0.05	0.04	0.03	0.02	0.00	0.00
0.75	1.38	0.58	0.32	0.21	0.14	0.11	0.08	0.07	0.05	0.03	0.01	0.00
0.80	1.87	0.83	0.46	0.33	0.23	0.19	0.14	0.12	0.09	0.07	0.03	0.01
0.85	2.80	1.30	0.75	0.55	0.39	0.34	0.26	0.22	0.20	0.13	0.08	0.05
0.90	4.36	2.00	1.20	0.92	0.65	0.57	0.44	0.40	0.34	0.25	0.18	0.12
0.95	5.00	3.40	2.80	2.10	2.00	1.75	1.35	0.95	1.02	0.62	0.32	0.30
1.00	6.60	6.00	4.30	3.20	3.10	2.60	2.10	1.80	1.60	1.40	1.10	0.95

Source: E. Page, Queuing Theory in OR (London, Butterworths, 1972) p. 155

The average sizes of ships called these ports and the average number of containers in TEU for the container ship are analyzed for each port, respectively as shown in Table 20.5 below:

Table 20.5 Average Size of Ship Calling at Each Port (DWT)

Name of Port	Container Ship	General Cargo Ship
Saigon Port	14,000 (780 TEU)	13,000
Tan Cang Port	15,000 (800 TEU)	9,000
Ben Nghe Port	13,000 (520 TEU)	9,000
VICT	13,000 (540 TEU)	10,000

Source: JICA Study Team, Interim Report 1, September 2001

The daily vessel cost by size, which is the major factor of benefit derived from the saving in vessel's waiting time, is as tabulated in Table 20.6 below.

Table 20.6 Average Daily Cost of Vessel by Type and Size in US$

CS Size	CS Value	GC Size	GC Value
15,000 DWT	US$ 11,000	13,000 DWT	US$ 10,500
14,000 DWT	US$ 10,700	10,000 DWT	US$ 9,900
13,000 DWT	US$ 10,500	9,000 DWT	US$ 9,500

Source: Ministry of Land, Transport and Infrastructure, Port Bureau 1999

Legend: CS means Container Ship and GS means General Cargo Ship

(B) Net Saving of Vessel's Time Cost by Eliminating Channel Navigation

It requires around 6.0 hours for container ship and 7.0 hours for general cargo ship in total respectively for the channel navigation to reach the geographical center of Ho Chi Min Port Group from the river mouth of the Soai Rap River (Distance is 80 miles) and vise versa. If the Thi Vai Port Group were developed, the distance of channel navigation between the river mouth and the geographical center of the port become shorter, thereby, the required time of channel navigation would be shortened. The time required for the same are assumed as 1.8 hours and 2.0 hours, respectively, taking into account a shortened distance of channel and the easiness of navigation due to lesser number of curves of channel relative to Thi Vai Port Group. The difference of the ship cost due to this shortened navigation time is considered as the benefit accrues from the Project.

(C) Reduction of Material Loss and Expenditure Associated with Maritime Accidents

Number of maritime accidents of collision of vessels against vessel, run aground, sinking, etc. during the navigation of channel and other peripheral area within the vicinity of southern port area or in the mouth of the Soai Rap River are reported. In the past eight (8) years, twelve (12) accidents occurred and caused environment damage; damage on fishery production and reduction of tourism related income. Such damage in total reached to almost US$ 20 million in the past 8 years. The major reason of such accident happened in this area is thought to be a congested traffic in a narrow and meandering feature of the existing channel. The average damage in monetary value due to such accident can be estimated at US$ 2.5 million a year as shown in Table 20.7. The number of accident and the amount of damage would increase rapidly unless the channel navigation system is improved and the navigation of vessel in and around channel becomes safer and the number of traffic would be controlled as minimum as possible. It is anticipated that the number of maritime accident would increase sharply unless such improvement or shifting of vessel traffic to other port area which do not need to use the existing channel, is realized. Since the vessel traffic along the channel would increase year by year at a rather rapid pace. Such provable damage in the future is considered as the economic benefit accrue to the Project, as the Project would lessen the vessel traffic in the existing channel and provide the safety measures to avoid the maritime accident caused by collision of vessels in the channel. The provable annual damage due to the maritime accident is assumed at US$ 2.5 million annually throughout the project plan period.

Table 20.7 Average Amount of Damage per Year due to Maritime Accident

	Name of Ship	Month	Year	DWT	Volume	Damage
					m^3	US$ Mil
1	Pan Harvest	September	1993	300	15	0.27
2	Viking Career	October	1993	380	19	0.35
3	Ham Rong 10	July	1994	100	5	0.09
4	Lam Son 10	July	1994	80	4	0.07
5	Phu Quoc 179	July	1994	50	3	0.05
6	Gegek Extajo	October	1995	400	20	0.36
7	Andhika Wanadharma	November	1995	250	13	0.23
8	Sirithorn	November	1995	200	10	0.18
9	Jenifer	December	1995	160	8	0.15
10	Memeo Abashidze	December	1995	500	26	0.46
11	Mearsk Retrierver	July	1996	1560	80	1.42
12	Formosa 1	September	2001	17560	900	16.00
	Total				1,104	19.63
	Total Years		8			
	Average per Year					2.50

Source: Vung Tau Port 2001

Note: The estimated damage in monetary value of Formosa 1 is used as a base to estimate the same of other accidents.

(D) Net Saving in Land Transport (trucking or hauling) Cost

The benefit is computed based on a comparison of the land transport costs of cargoes. The difference of trucking or hauling cost to transport the cargoes between the geographical center of the major destination of cargoes transported and Ho Chi Min Port Group; and Thi Vai/Vung Tau Port Group is analyzed to obtain the economic benefit associated with the land transport cost. Once the port facilities are improved and more international shipping calls are realized at Thi Vai and/or Vun Tao Port Group, the distance of land transport for cargoes from the port to the major destination of cargoes will be shortened, thereby, the necessary time for land transportation will be shortened as well, since the speed of transport will be increased as a traffic congestion can be avoided. If the total vehicle operation cost relative to the later port group is less than the former port group, such difference of the vehicle operation cost in total can be considered as the benefit accrue to the Project. The basic transport costs and additional costs of traffic congestion and waiting time at the port anchorage are the parameters used in determining whether shippers may obtain savings from diverting their shipment from Ho Chi Min Port Group to Thi Vai and Vun Tao Port Group. The formula used to determine this type of benefit is as follows:

SCTC = (TCHt +TCHd) – (TCTt +TCTd)

Where;

SCTC = saving in cargo transport cost

TCHt = trucking time cost to and from Ho Chi Min Port Group

TCHd = trucking distance cost to and from Ho Chi Min Port Group

TCTt = trucking time cost to and from the project port group
TCTd = trucking distance cost to and from the project port group

The benefit estimated for each year is accumulated through the total project plan period mentioned above. The type of vehicle used for the container cargo transport and non-containerized cargo are assumed as 40-footer trailer truck and 10-ton medium size truck, respectively. The distance and running speed of respective vehicles are assumed as shown in Table 20.8 below:

Table 20.8 Distances and Speed of Land Transport by Trucks

	Ho Chi Min Port	Cai Mep +Phu My	Vun Tao + Phu My
Distance (Round Trip)	50 km	18 km	85 km
Running Speed	30 kph	60 kph	60 kph

Source: JICA Study Team

The average distance assumed for each case is of approximated distance between the geographical center and the major industrial zones or present inland container deposits. The assumed average distance for the land transport of cargoes relative to Cai Mep, Phu My and Vun Tao Ports are computed by weighted average of ton-kilometers of cargo transport provisionally forecasted for each port to and from different port locations to the major destinations mentioned above. The average running speed of vehicles are assumed taking into account the present road condition, truck ban, surface condition, number of lanes of highway, etc. The VOC of 40-footer trailer truck and 10-ton medium size truck are computed as shown in Table 20.9 below:

Table 20.9 Vehicle Operation Cost (VOC)

	40-footer trailer truck	10-ton medium truck
Distance VOC per km (US$)	0.1376	0.1011
Time VOC per minute (US$)	0.0209	0.0147

Source: JICA Study Team

The basic Vehicle Operating Cost (VOC) by distance and by time for 40-footer trailer truck to transport 40-footer container and 10-ton cargo truck to transport non-containerized cargo applied for the estimation of benefit are based on the determined rates prepared by the study team as shown in Appendix 20-2. The road conditions assumed for the above rates are good paved surface, at least 6 meter carriageway width, more than 2 x 2 shoulder width, gradient below 1 %, design speed of 60 kph for truck and considering the average 2 drivers.

20.5 Economic Viability

1) Summary of Economic Analysis

The financial cost as well as the economic cost as the capital cost of each port composing the Project is shown in Table 20.2.

2) Distribution of Aggregated Economic Benefits

The benefits estimated through the preceding procedures is further distributed to the project ports envisaged to be developed newly and the other existing port planned to be expanded in the Thi Vai area in accordance with the cargo volume assigned to each port for the benefits derived from the net saving of vessel's waiting time and the number of vessels for the benefits derived from the net saving of channel navigation. The ratio of distribution are assumed as twenty (20 %) percent of total benefits associated with the non-containerized cargo and eighty (80%) percent of total

benefits associated with the containerized cargo, respectively. These shares are proportion of the cargo volume by type planned to be handled by the project ports and other ports in the year 2020. As in the case of total cargo volume handled by the project port, the same is assumed as seventy (70%) percent. The total economic benefits derived from the respective project ports are summarized in Table 20.10 below.

Table 20.10 Distributed Aggregated Economic Benefits (US$ Million)

Cai Mep with Phu My Port

Year	A	B	C	D	Total
2010	7.6	0.3	2.0	16.3	26.3
2011	17.9	0.6	2.0	16.1	36.6
2012	65.4	0.9	2.0	15.9	84.3
2013	98.1	1.2	2.0	15.7	117.0
2014	114.0	1.6	2.0	15.5	133.0
2015	120.5	2.0	2.0	15.2	140.7
2016	129.4	2.4	2.0	14.9	148.8
2017	137.7	2.9	2.0	14.6	157.2
2018	146.6	3.3	2.0	14.3	166.3
2019	156.0	3.9	2.0	14.0	175.8
2020	166.2	4.3	2.0	13.6	186.1
Total	1,160.4	23.4	22.0	166.3	1,372.0
Share	84.6%	1.7%	1.6%	120%	100%

Ben Din Sao Mai with Phu My Port

Year	A	B	C	D	Total
2010	7.6	0.4	2.5	11.1	20.7
2011	17.9	0.9	2.5	10.4	31.7
2012	65.5	1.3	2.5	9.6	78.9
2013	98.2	1.8	2.5	8.7	111.3
2014	114.3	2.4	2.5	7.8	126.9
2015	122.0	2.9	2.5	6.7	134.2
2016	130.3	3.5	2.5	5.6	142.0
2017	139.1	4.2	2.5	4.4	150.2
2018	148.6	4.8	2.5	3.2	159.0
2019	158.6	5.5	2.5	1.8	168.4
2020	166.2	6.1	2.5	0.2	175.0
Total	1,168.2	33.9	27.5	69.6	1,299.2
Share	89.9%	2.6%	20%	5.4%	100%

Legend:

(A) Vessel's waiting time at the existing ports

(B) Channel Navigation

(C) Reduction of maritime accident

(D) Vehicle operation costs for related land transport

2) Distribution of Capital Investment Cost

The navigation channel dredging works is necessary to function the project ports. However, the other ports located in the Thi Vai area commonly use this subject channel for the navigation of ships calling those ports. Therefore, the capital investment cost for the navigation channel should

be distributed at a certain ratio to the project ports and other ports. In accordance with the proportion of cargo volume planned to be handled by these ports, the share of the project port is assumed as eighty (80%) percent of the total capital investment cost estimated in the economic price.

3) Results of the Economic Evaluation

The benefits obtained using the formula described in foregoing leads to the annual saving cost accrue from the Project Port in total. Then, based on such estimation of costs and benefit flow throughout the project plan period, the economic viability was analyzed based on various assumptions of development sequence and schedule and two most optimum cases were selected as shown in Table 20.11 for respective group of the port project at Cai Mep and Vung Tau area.

Table 20.11 Assumed Development Sequence and Schedule

Case	Case-1			Case-2		
Implementation Period	2005-10	2010-15	2015-20	2005-10	2010-15	2015-20
PA1 30000 DWT		XXXX			XXXX	
PA2 50000 DWT			XXXX		XXXX	
PB1 50000 DWT	XXXX			XXXX		
PB2 80000 DWT		XXXX				XXXX
CA1 30000 DWT		XXXX			XXXX	
CA2 50000 DWT			XXXX			XXXX
CB1 50000 DWT	XXXX			XXXX		
CB2 80000 DWT		XXXX			XXXX	
CC1 50000 DWT	XXXX			XXXX		
CC2 80000 DWT		XXXX				XXXX

Legend:

PA1 30000 DWT berth, CA1 Channel at and for Phu My

PA2 50000 DWT berth, CA2 Channel at and for Phu My

PB1 50000 DWT berth, CB1 Channel at and for Cai Mep or Ben Dinh Sao Mai

PB2 80000 DWT berth, CB2 Channel at and for Cai Mep or Ben Dinh Sao Mai

CC1 Channel at Ganh Rai Pay for 50000 DWT Vessel

CC2 Channel at Ganh Rai Pay for 80000 DWT Vessel

The economic viability indicators analyzed are summarized in Table 20.12 below. As shown in this table, the economic viability of the Project as whole disregarding the configuration of project components and development timing indicates more than the criteria set out in the preceding section of this chapter when the net present value is discounted at ten (10%) percent. Thus, the Project as a whole is evaluated as viable from the national economic point of view.

Table 20.12 Summary of Economic Analysis

Cai Mep with Phu My Project

Project	**Case-1**	**Case-2**
EIRR	18.70	18.80
B/C at 10% D.R.	1.45	1.46

Ben Dinh Sao Mai with Phu My Project

Project	Case-1	Case-2
EIRR	15.60	17.00
B/C at 10% D.R.	1.28	1.35

Various case studies were conducted and the both cases are selected as the most feasible and optimum development schedule. As the above table show clearly that the combination of the Cai Mep Port and Phu My Port is superior than that of Ben Dinh Sao Mai Port and Phu My Port in view of a national economic point-of-view. However, it is to be noted that this analysis is totally based on the mathematical calculation without taking into account of other development elements related to environment, socio-economic, industrial and urban development planning, etc.

4) Projection of Cargo Volume

The projection of cargo volume by type of cargo, which is to be handled by the Project from the year 2010 up to 2020 was carried out by subtracting the provable cargo volume handled by the HCMC Port Group in 2010 from the total cargo volume projected for the SFEA port as a whole as discussed in the relevant section of the Interim Report of September 2001.

The total cargo volume handled by all SFEA ports in 2000 is summarized by cargo type, by trade, which forms a basis of cargo volume projection by type of cargo for the whole project plan period. The cargo demand forecast for the SFEA up to 2020 was prepared by the study team as discussed in the September Interim Report, however, it did not summarize the cargo volume in similar form used for the demand forecast. Thus, the cargo volume of the year 2000 was arranged in the same form used for the demand forecast, thereby, create a basis for the cargo volume projection for each year to compute the cost and benefit flow necessary for the computation of economic viability indicators.

This process is necessary to obtain the cargo volume projection by year, by type of cargo as containerized cargo and non-containerized cargo. The cargo volume projection for each major port in the HCMC port group is analyzed as shown in Table 20.13.

5) Estimation of Vessel's Waiting Time

The number of vessels calling these ports by type of cargo as container and non-container cargoes are projected based on the prepared data through the preceding process for the cargo volume projection. The formula for the calculation of vessel's waiting time discussed in the above section of this chapter was used to estimate the total waiting time and equivalent value of ship time.

6) Estimation of Vehicle Operation Costs

The difference of aggregate vehicle operation costs between With Project Case and Without Project Case was obtained based on the cargo volume projection by type of cargo for each year throughout the project plan period.

7) Ship-time Cost for Channel Navigation

The difference of channel navigation costs estimated by aggregation of ship-time cost and the projection of the number of traffic per year by type and kind of ship between With Project Case and Without Project Case was obtained.