Table 9-8-2 Cost Breakdown of the Ordinary Construction Works Existing Container Terminal Upgrading

Unit: US\$		Remarks		Provisional	Routine maintenance Area A (10,000m²)			including pier and mole	250m × 20m × 50% 1000m × 20m × 50%	
	Term	Cost	693,750	1,157,540 575,000 1,732,540	* . •	3,391,660 175,960 3,566,620	285,000 12,300 35,000 332,300	2,040,000 480,000 18,480 90,000 2,628,480	348,000 60,000 180,000 588,000	9,541,690 (68.0%)
	Long	Quantity		3,734m 1set	1 +	32,200m 3,32ha -	500m² 100m 1,000m²	2.0B 2.0B 0.77ha	10,000m ² 20,000m ² 1,800m ²	
	Short Term	Cost	693,750	- 0	1,853,280	99,110 86,860 2,039,250	12,300 43,700 35,000 91,000	102,000 168,000 12,240 60,000 342,240	87,000 36,000 20,000 143,000	3,309,240 (32.0%)
	Short	Quantity		1 1	17,600m²	11.87ha 4,300m²	100m 2,300m ² 1,000m ²	0.1B 0.7B 0.51ha	2,500m² 12,000m² 200m²	
	Total	Cost	1,387,500	1,575,540 575,000 1,732,540	1,853,280	3,390,660 275,070 86,860 5,605,70	285,000 24,600 43,700 70,000 423,300	2,142,000 648,000 30,720 150,000 2,970,720	87,000 348,000 96,000 200,000 731,000	12,850,930 (100%)
		Quantity		3734m 1set	1,848m² 17,600m²	32,200m² 5.19ha 4,300m²	500m² 200m 2,300m² 2,000m²	2.1B 2.7B 1.28ha LS	2,500m² 10,000m² 32,000m² 2,00m²	
		Unit Rate		310\$/m 575,000\$/m	100\$/m 105.3\$/m²	105.3\$/m² 53,000\$/ha 20.2\$/m²	570\$/m² 123\$/m 19\$/m³ 35\$/m²	1,020,000S/B 240,000S/B 24,000S/ha	34.8S/m² 34.8S/m³ 3.0S/m² 100S/m²	
		Work Categories	A.General Works	B.Marine Works Seawall Improvement Ro-Ro System	C.On-land Works Pavement Repairing Normal Pavement (1)	Normal Pavement (2) Storm Water Drainage (1) Pavement Making and Sign	D.Building Misc. Buildings Fence Landscaping Park	E.Utilities Power Supply (Distribution) Lighting (Yard) Lighting (Road) Misc. Utilities	F.Supplemental Works Outer Access (Improve) I Outer Access (improve) II Demolishing (On-land Civil) Demolishing (Building)	Total

Note: Outer Access (Improve) I is the required work seawards the existing railway.

Outer Access (Improve) II is the required work between the railway and Colon Free Zone.

ii) Additional cost for the Area "B"

Area "B" = 8,700 m2

It is assumed that 900 m2 of this area will be used for landscaping etc, thus the net area to be paved is 7,600 m2. It is also assumed this area should completely re-paved.

 $7,600 \text{ m2} \times 105.3 \text{ }/\text{m2} = 800,280 \text{ US}$

iii) Required cost for the road sign and bay marking paint

The required marking area reducing the other area,

 $11,900 \text{ m}^2 - 7,600\text{m}^2 = 4,300\text{m}^2$

Assuming the required unit cost is 20.2 m^2 , the required marking cost will be, 4,300 m2 x 20.2 m^2 = 86,860 US\$

iv) Stormwater drainage

Area 18,700 m2

Assuming the required cost is 75% of those for new one.

The required cost is,

 $18,700 \text{ m2} \times 5.3 \text{ }/\text{m2} = 99,110 \text{ US}$

v) Total cost during the Short Term Development

-	Stormwater drainage	99,110	
_	Marking cost	86,860	
-	Additional cost, Area "B"	800,280	
-	Additional cost, Area "A"	1,053,000	US\$

Total 2,039,250 US\$

Addition to these items, routine maintenance work of the existing concrete pavement should be conducted. Required maintenance cost for the pavement is estimated as follows. (Note; This cost will be covered by the operation and maintenance cost.)

Repair cost of the existing concrete pavement

Total area 83,600 m2

Nos. of pavement bays

 $83,600 / (3.5 \times 8.0) = 2,725$ bays

Affected bays according to the visual inspection

About 40 bays

Rate of damage

40 / 2,725 = 1.5%

Net damaged bays

Since about 40% of the pavement areas were covered by the container,

40 bays / 0.6 = 66 bays

Assuming the required repair unit cost is 100\$/m2, the repair cost will be, 66 bays x (3.5m x 8.0m) x 100\$/m2 = 184,800 US\$

(2) Long Term Development

i) Pavement cost

Total area 33,200 m2

The required pavement area reducing the coastal area and other area not to be paved,

$$33,200 - 1,000 = 32,200 \text{ m}$$
2

This area is partly paved, however it is assumed that completely new pavement should be provided, adjusting the formation and pavement strength. Thus, the required cost will be,

$$32,000 \text{ m2} \times 105.3 \text{ }/\text{m2} = 3,390,660 \text{ US}$$

Note: 105.3 \$/m2 is the required cost for concrete pavement (t=25cm) including the concrete curb and road marking cost.

ii) Stormwater drainage

Total area 33,200 m2 The required cost is, $33,200 \text{ m2} \times 5.3 \text{ }/\text{m2} = 175,960 \text{ US}$

iii) Total Cost

3,390,660 + 175,960 = 3,566,620 US\$

9.8.3 Related Instrument Work for Modernization

Details of related instrument works for modernization of container terminal operation are shown in Table 9-8-3. The required costs for this category amounts to 8.5 million US\$ which shares 25.2% of the total initial cost. As shown in the table, costs for computer introduction amounts to 4.5 million US\$ which shares about 53.0% of the required cost. Investment will be conducted separately in both stages, Short Term and Long Term.

Related Instrument Works	Total	Short Term 1999	Master Plan 2009
a. Maintenance Instrument	\$ 84,000	\$ 84,000	0
b. Computer	4,514,000	514,000	4,000,000
c. Container Repair Instrmt	1,131,800	0	1,131,800
d. Electric Power Supply	788,360	0	788,360
e. Others	1,978,206	0	1,978,206
		$(x_1, \dots, x_n) \in \mathcal{C}_{p_n}$	4
Total	\$8,496,366	\$598,000	\$7,898,366

Note: Basic investment for existing facilities is the Short Term in 1994/1955 and Long Term in 2001/2002, however this instrument work has an independent schedule.

Due to the characteristics of works, periodical renewal should be considered. It is estimated that this renewal will be conducted every five years. Thus, initial cost and periodical cost of works are shown as below.

Table 9-8-3a Summary of Instrument Replacement Cost: Existing Terminal

Unit: 1,000 US\$

Short Term 1999	Long Term 2009	Total Master Plan
598.00	7,898.37	8,496.37
598.00	31,592.00	32,190.00
1,196.00	39,490.37	40,686.37
(2.9%)	(97.1%)	·
	1999 598.00 598.00 1,196.00	1999 2009 598.00 7,898.37 598.00 31,592.00 1,196.00 39,490.37

Table 9-8-3b Cost Breakdown of Related Instrument Works for Modernization of Existing Container Terminal

Unit: US\$ Work Categy Works Unit Rate Works <u>Cost</u> Short Long Term Term Unit Unit 2009 1999 A. Maintenance Instrument 48,000 48,000 LS 48,000 1.5 1 Repar Instrument Movable Repair * - 1 36,000 36,000 36,000 Shop truck 84,000 84,000 Sub-Total В. Computer Personal Computer LS 34,000 LS 1 34,000 34,000 Small Scale 480,000 480,000 480,000 Computer System 1 4.000,000 4,000,000 4,000,000 1 Total Computer System 4,000,000 4,514,000 514,000 Sub-Total C. Container Repair Instrument Work Shop \$/m2 1,042 m₂ 600 625,200 625,200 2 448,000 448,000 Roof Crane (3ton) \$/ea 224,000 ea 3,600 3,600 Instrument LS 3,600 LS 1 55,000 55,000 Others 55,000 1 1,131,800 1,131,800 Sub-Total D. **Electric Power Supply** 108,360 Power House \$/m2 602 m2 180 108,360 Generator (1,000KVA) \$/ea 320,000 2 640,000 640,000 ea 40,000 40,000 40,000 Others LS LS 1 788,360 Sub-Total 788,360 E. Others 1,872,000 Terminal Office \$/m2 1,170 m2 1,600 1,872,000 567 18 10,206 10,206 Main Gate 48,000 2 96,000 96,000 Truck Scale \$/ea ea 1,978,206 1,978,206 Sub-Total 7,898,366 Total 8,496,366 598,000 (100%)(7.0%)(93.0%)

9.8.4 Renewal and Replacement of Cargo Handling Equipment

The required costs for cargo handling equipment renewal and replacement amount to 77.4 million by 2029. Between 1995/2029, 238 sets of various machines should be purchased as shown below.

Wharf crane (Gantry crane)	5	sets x	8,800,000\$/set =	44,000,000 US\$
Yard crane (Transfer crane)	6	" X	1,344,000\$/set =	8,064,000 US\$
" (") Rep,	11	" x	1,334,000\$/set =	14,784,000 US\$
Top-loader	- 5	п X	480,000\$/set =	2,400,000 US\$
Forklift truck (average 4ton)	26	" x	44,800\$/set =	1,164,800 US\$
Tractor	70	н х	62,710\$/set =	4,389,700 US\$
Chassis	38	" x	22,400\$/set =	851,200 US\$
" Rep,	77	· x	22,400\$/set =	1,724,800 US\$
Total	238	sets		77,378,500 US\$

Table 9-8-4b shows the annual renewal and replacement cost of equipment for the existing container terminal.

Table 9-8-5 shows the cost breakdown.

Table 9-8-4a Summary of Equipment Renewal and Replacement Cost: Existing Terminal

Unit: 1000 US\$ Short Term Long Term Master plan Type of Cost 1994-1999 2000/2029 Tota! Initial Purchase (12) 1,590,40 (4) 5,376.00 (16) 6,966.40 Renewal (41) 15,487.18 (109) 45,382.52 (150) 60,869.70 Replacement $\{0\}$ 0 (72) 9,542.40 (72) 9,542.40 Total (53) 17,077.58 (185) 60,300.92 (238) 77,378.50 (22.1%)(77.9%)(100%)

Notes: 1. Both renewal and replacement costs indicate the required cost by 2029.

2. Figures in parenthesis show the total number of machine units.

Table 9-8-4b Annual Equipment Cost for Existing Container Terminal

1,000 US\$	Sub-total	1 1 5	4,602.12 480.00	945.06 0 9,760.00 448.00	8,800.00	438.97	936.26	000	0 4,368.00	438.97	600.26 8,800.00	336.00 8,800.00	5,376.00 438.97	336.00	600.26 0	00	4,368.00	438.97	9,400.26	70,412.10
Unit	Replace Sul		500 (2000 246.40	0	000	246.40	000	0 1,590.40	0	000	246.40 0	5,376.00	246.40	00	00	1,590.40		00	9,542.40
	Renewal Re		4,602.12 480.00	9,760.06 201.60	8,800.00	438.97	. 86.86 0.00	000	2,777.60	438.97	600.26 8.800.00	8,800.00	0 0 438.97	99.68	600.26	00	2,777.50	438.97	9,400.26	02.898.70
	Sub-total R	h h d	1,590.40	1001	Õ	5,376.00	> ' '	. 10	o i											6,966.40
	Breakdown (2) initial Replace		1,590.40	1001	0	5,376.00	ייכ	10	o !	***************************************										6,966.40
	Renewal	1 4 (001	100 1	O	000	o ' '		0'				-							0
	Replace	*) (1,590.40 0 0	2 0 0 2 46.40	Õ	5,376.00	246.40		1,590.40	0		246.40 0 0	5,376.00	246.40			1,590.40	000	00	16,508.80 (21.3%)
	Benewal Renewal	n k :	0 4,602.12 480.00	645.06 0 9,760.00 201.60	8,800.00	438.97	98.689 0	000	2,777.60	438.97	600.26 8.800.00	8,800.00	0 0 438 97	89.60	600.26	00	2,777.60	438.97	9,400.26	60,869.70 (78,7%)
	rer rear Tab9-8-5	1 1	6,192.52 480.00	645.06 0 9,760.00 448.00	8,800.00	5,814,97	936.26	000	4,368.00	438.97	600.26 8,800.00	336.00 8,800.00	5,376.00 438.97	336.00	600.26	00	4,368.00	438.97	9,400.26	77,378.50 (100%)
	Year	1992	1994 1995 1996	1997 1998 2000	2001	5005 5005 5005 5005	2002 2005 2005	2002 2004 2004 2004	2009 2010	2011	2013 2013 2014	2015 2016	2017 2018 2019	2020	2021	2023 2023	2023 2025 2025	2022	2029	Total

Table 9-8-5 Cost Breakdown of Cargo Handling Equipment Renewal and Replacement for Existing Container Terminal

			Neprace.	incpracement for L	LAISUNG CONGENIE		16 H			Unit: 1,000 US\$
			Renewal					Replacement		i F
Transfer Top- Crane Loader 1,344 480	Top- Loader 480		Forklift Truck 44.8	Tractor 62.71	Chassis 22.4	Sub- Total	Transfer Crane 1,344	Chassis 22.4	Sub- Total	255
(2)2688 (2)960 (1)480	(2)960			(12)752.52	(9)201.6	(25)4602.12 (1)480.00	*(1)1,344	(11)246,40	-(12)1,596,40 0	(37)6,192.52
			(6)268.8	(6)376.26		(12)645.06			000	(12)645.06
(1)8800	(2)960				6.102(6)	(3)9760.00 (9)201.60		(11)246.40	0 (11)246.40	(3)9,760.00 (20)448.00
						(1)8800.00			00	(1.)8,800.00
	•			(7)438.97		7,438.97	*(4)5376	-	-(4)5376.00	(11)5,814.97
			(5)224.0	(6)376.26	(4)89.6	(15)689.86		(11)246.40	(11)246.40	0 (26)936.26
						2 <u>88</u> 8		٠.	000	900
(2)2688					(4)89.6	(0)0 (6)2777.60	(1)1,344	(11)246.40	0 (12)1,590,40	(18)4,368.00
				75.38.97		(7)438.97			0.6	79.8£4(7)
			(5)224.0	(6)376.26		(11)60026				(11)600.26
					(4)89.6	(4)89.60 (1)8800.00		(11)246.40	(11)246.40	(15)336.00
				í		00 00 00 00	(4)5376		00'923(4)	0 (4)5,376.00
				/5.864/J	(4)89.6	(4)89.60 (4)89.60		(11)246.40	0 (11)246.40	(7)¥38.97 (15)336.00
			(5)224.0	(6)376.26		(11)600.26 (0)0	·			(11)600.26
8896(C)					200(2)	000 000 000 000 000 000 000 000 000 00	776 115	0.0000000000000000000000000000000000000	000	0
2002(7)					0,40(4)	0(0)	5 , 3.1	(11)240.4()	04.0%5,1(2.1)	(18)4,368.00
				(7)438.97		(7)438.97			000	(7)438.97
		ı	(5)224.0	(6)376.26		(12)9400.26			0	(12)9,400,26
(6)8064 (5)2400	(5)2400		(26)1164.8	(70)4389.7	(38)851.2	(150)60869.70	(11)14784	(77)1,724.8	(88)16,508.80	(238)77,378.50

Notes: 1. Figures in parenthesis indicate numbers of required machine. 2. Figures with asterisk indicates the initial investment.

9.8.5 Disbursement Schedule for Existing Container Terminal

Based on the development phasing as shown in Section 9.4 the estimated annual expenditure plan of these costs is shown in Table 9-8-6.

Table 9-8-6 Cost Disbursement Schedule for Existing Container Terminal

Unit: 1,000 US\$

Year	Phase	Ordinary Const- ruction Works	Instrument Initial	Instrument Replace	Equipment Replace	Equipment Initial	Equipment Renewal	Total
1992 1993		•	-	:	-	-	•	
1993	-	in the second	-		-			
1994	1	1,655 1,655	•	•	-	=	.0	1,65 7,84 48 64
1995	•	1,655	-	-	-	1,590	4,602 480	7,84
1996	•	_ ·	•	-	•	-	480	48
1997	-	-	-	_	-	-	645	64
1998	•	-	-	-	-	-	. 0	
1999	•	· _	598		-	-	9,760	10,35
1998 1999 2000	2	<u>-</u>	-	-	246		202	44
2001		4 771	-		:	-	8,800	13,57 4,77 5,81 59 93
2002		4,771 4,771	_	*	_	_	0	4.77
2001 2002 2003 2004	વં	7,77		_	_	5,376	439	5.81
2003	2	-		598	_	0,070	ő	59
2005	. •			370	246		69Ŭ	9.1
2005					2-10		ň	,,,
2000		-	_	_	_		. ň	
2007		_	=	=			ň	
2000	.=	-	7,898	-	_		ň	7.89
2006 2007 2008 2009 2010		-	7,070	<u>-</u>	1,590		2,778	7,89 4,36
2010					1,000			
2011 2012	•	-	-				439	43
2012		-	•	-	-		Û	**
2013			=		-		600	60 16,69
2014	-	-	-	7 .898	- · ·		8,800	10,03
2013 2014 2015 2016	•			-	246		90	30 8,80
2016		-		-	-		8,800	
703.7	•	-	-	•	·		Ď	F 22
2018	-	~	•		5,376		0	5,37
2018 2019 2020	•		-	7,898			439	8,33
2020	.	·····	-	***************************************	246		90	33
2021 2022	•	_	~		-		600	60
2022	•	-		-	-		0	
2023	• .	-	-		-		. 0	
2024 2025 2026 2027	-	-	_	7,898	-		0	7,89 4,36
2025	•	_		· · · · · ·	1,590		2,778	
2026	*	-		· -	• • •		0	
2027	•	-	-		-		439	43
2028	-	-		· -	-		0	
2028 2029	•	:	-	7,898	-		9,400	17,29
Tot		12,852	8,496	32,190	9,540	6,966	60,871	130.91

9.9 Required Cost for Upgrading of Existing Finger Pier and Mole

This section deals with the cost estimation with respect to the upgrading of the existing finger piers No.6, No.7 and No.8 and mole.

9.9.1 Summary of Required Cost

The required total costs including equipment renewal by 2029 amounts to 15.6 million US\$ which consists of the initial construction together with equipment purchase costs and equipment renewal by 2029 of 5.6 million US\$ and 10.0 million US\$ respectively. Among the initial costs, construction cost amounts to 4.8 million US\$ which shares 85.0% of the required initial ones. During the Short Term Development, 2.4 million US\$ will be spent and another 3.2 million US\$ will be spent for the Long Term Plan. Refer to Table 9-9-1 below.

Table 9-9-1 Summary of Required Cost for Existing Piers and Mole

Unit: Million \$ Short Term Long Term Category Total 1994/1999 2000/2029 A. Initial Cost a) Construction 3.2 4.8(85.0%) 1.6 b) Cargo Handling E. 0 0.8(15.0%) 0.8 Sub-Total 5.6(100%) 2.4 3.2 (100%)(42.9%) $\{57.1\%\}$ B. Periodical Cost a) Cargo Handling E. Renewal by 2029* 6.8 5.5 1.3 b) Replacement 3.2 3.2 0 Sub-Total 10.0 8.7 1.3 Grand Total 15.6 11.9 3.7

Notes: Figures shown above do not include contingency and engineering cost.

Refer to Table 9-9-3 for Cargo Handling Equipment Renewal and Replacement by 2029.

9.9.2 Construction Works

The required cost for ordinary construction works amount to 4.8 million US\$. All the required costs are categorized into the Short Term Development stage 1994/1995 and the Long Term stage 2001/2002 as indicated in Table 9-9-2.

As shown in the table, the required works on the pier deck amount to 2.5 million US\$ sharing about 67.4% of this category. The other is mainly for enlarging of the yard and access pavement at the mole.

Table 9-9-2 Cost Breakdown of Construction Works for Upgrading of Existing Finger Piers and Mole

Works Categories	Short Term 1994/1995	Long Term 2001/2002	Total	Finger Piers	Mole
a Demolishing of Shed of Pier No.7	80.0\$/m²x7,900m²=632,000	~	632,000		
b.Pavement of Deck Face after Demolishing of Shed of Pier No.7	66.0\$/m²x7,900m²=521,400		521,400		٠
c.Passenger Terminal at Pier No.8	• •	450.0\$/m²x3,000m²=1,350.000	1,350,000	(2,503,400)	
d.Open Storage pavement at Mole	69.6\$/m²x4,860m²=338,250	69.6\$/m*x24,000m*=1,670,400	2,008,650		
e.Upgrading of Road on Mole	100.0\$/m²x600m²=60,000	· ·	60,000		
f.Road pavement on Mole		105.3\$/m²x1,800m²=189,540	189,540		(2,258,190)
	(32.6%)1,551,650	(67.4%)3,209,940	[100%]4,761,590		

9.9.3 Renewal and Replacement of Cargo Handling Equipment

The required costs for cargo handling equipment renewal and replacement amount to 10.8 million US\$ by 2029. Between 1995/2029, 168 sets of various machines should be purchased as shown below.

Mobile crane	5 sets x	800,000\$/set =	4,000,000 US\$
Forklift truck	112 " x	44,800\$/set =	5,017,600 US\$
Tractor	16 " x	62,710\$/set =	1,003,360 US\$
Chassis	35 " x	22,400\$/set =	784,000 US\$
T-4.1	169		10.804.960 US\$
Total	168 sets		10.004.900 0.55

Table 9-9-3 shows the annual renewal and replacement cost of equipment for the existing finger piers.

Among these machines, the following will be purchased in 1995 as a part of the initial requirement.

Mobile crane (Gantry crane) 1 sets x = 800,000\$/set = 800,000 US\$

Table 9-9-3 Cost Breakdown of Cargo Handling Equipment Renewal and Replacement for Existing Finger Piers

Unit: 1,000 US\$

					L	mic: 1,000 US
Cldr.		Reno	ewal		Replacement	Total
Year	1 Forklift Truck	2 Tractor	3 Chassis	Sub- Total	4 Mobile Crane	
	44.8	62.71	22,4		800	*
93						,
94						
1995		•	(5)112	(5)112	(1)800	(6)912.00
96	·	•		0	0	0
97	(11)492.8	(4)250.84		(15)743.64	0	(15)743.64
98	(9)403.2			(9)403.2	0	(9)403.20
99	•			0	0	. 0
2000			(5)112	(5)112	0	(5)112.00
01	•••••••••••••••••••••••••••••••••••••••			0	0	. 0
02				0	- 0	0
03	(8)358.4			(8)358.4	(1)800	(9)1,158.4
04				0	. 0	0
2005	(11)492.8	(4)250.84	(5)112	(20)855.64	0	(20)855.64
06	(9)403.2	•		(9)403.2	0	(9)403.2
07				0	0	0
08				0	0	0
09				0	0	0
2010			(5)112	(5)112	0	(5)112.00
11	(8)358.4	***************************************		(8)358.4	(1)800	(9)1,158.4
- 12				0	0	, 0
13	(11)492.8	(4)250.84		(15)743.64	0	(15)743.64
14	(9)403.2			(9)403.2	0	(9)403.20
2015			(5)112	(5)112	0	(5)112.00
16				0	. 0	.0
17				0	0	0
18		•		0	0	.0
19	(8)358.4		•	(8)358.4	(1)800	(9)1,158.4
2020			(5)112	(5)112	0	(5)112,00
21	(11)492.8	(4)250.84		(15)743.64	0	(15)743.64
22	(9)403.2			(9)403.2	0	(9)403.20
23				0	. 0	0
24				0	0	0
2025			(5)112	(5)112	0	(5)112.00
- 26				0	0	0
27	(8)358.4			(8)358.4	(1)800	(9)1,158.4
28				0	0	0
29				0	0	0
Total	(112)5017.6	(16)1003.36	(35)784	(163)6804.96	(5)4000	(168)10804.96

Note: Figures in parenthesis indicate numbers of required machine.

9.10 Required Cost for Access Roads

This section deals with the cost estimation of the related inland road networks.

There are three sections, namely Section I, Section II and Section III. The Section-I is the road construction and existing road improvement in the Short Term Development and the Section II is the works in the Long Term Development. The Section III is however the works for further improvement in the Long Term Development and is excluded from the project cost.

Section I (Short Term)

(1)	For the Existing Container Terminal: B1	
	a. Improvement between the terminal and existing free zone	2,500m²

(2) For the New Container Terminal: B2

a. Improvement between the new terminal and Bolivar Road 7,2

7,200m²(2 lanes)

b. New access between the new terminal and Bolivar Road Subtotal

20,000m²(2 lanes)

29,700m²

Section II (Long Term)

(1) For the Existing Container Terminal: B1

a. Improvement between the terminal to the Expanded Free Zone Area

10,000m²(4 lanes)

(2) For the New Container Terminal: B2

a. Improvement between the new terminal and Bolivar Road

27,000m²(4 lanes)

b. New bridge construction

Subtotal

1 unit 37,000m²

Section III (Long Term, but for reference only)

a. Improvement between Bolivar Road to France Field	82,000m ² (4 lanes)
b. New bridge construction	4 units
Subtotal	82,000m ²
Total Area	148,700m ²

The required initial cost amounts to 6.3 million US\$ as shown in Table 9-10-1. Among this, the cost for the Short Term Development and Long Term Development are 2.4 million US\$ and 3.9 million US\$ respectively.

Table 9-10-1 Cost Breakdown for Upgrading of Inland Road Networks

* * * * * * * * * * * * * * * * * * *			Unit: US\$
Work Calegories	Short Term	Long Term	Master Plan Total
A Existing C. Terminal (B1) Section I, road Section II, road	348\$/m² x 2,500m² = 87,000	34.85/m² x 10.000m² =348,000	87,000 348,000
B.New Container Terminal (B2)(83/4) Section I, road road Section II, road bridge	$34.85/m^2 \times 7,200m^2 = 250,560$ $105.35/m^2 \times 20,000m^2 = 2,106.000$	105.3\$/m² × 27,000m² = 2,843,100 700,0006 × 1unit = 700,000	250,560 2,106,000 2,843,100 700,000
Subtotal (A+B)	2,443,560	3.891.100	6,334,660
C.New Container Terminal (B3/4) Section III, road bridges Subtotal (C)		105.3\$/m² × 82.000 = 8.634.600 700.006 × 4units = 2.800.000 11.434.600	8,634,600 2,800,000 11,434,600

Note: The required costs for items A and B are included in cost estimation of Section 9.7 and Section 9.8

9.11 Operation and Maintenance Cost

This section deals with the scale of required routine maintenance cost. The maintenance cost, for the existing facilities is estimated based on the scale of fixed facilities and number of cargo handling equipment. Those for new container terminal is also calculated based on the final data indicated in subsection 9.7.

In order to evaluate the scale of these maintenance costs, operation and maintenance cost is roughly estimated based on the last similar project.

Operation and Maintenance Cost: O/M Cost

The operation and maintenance costs are tentatively estimated by the following formula. More detailed information for the short term development will be given in Chapter 9 and Chapter 10 of Part III.

 $C = U \times V$

where, C: O/M cost per year (\$)

U: Unit O/M cost per unit cargo = 40 \$/TEU

V: Cargo volume per year (TEUs/year)

Cargo volume for the existing finger piers, Prospective 1/2

V1 = 40,000 TEUs

Cargo volume for the existing container terminal, Prospective 1/2

V2 = 150,000 TEUs

Cargo volume for the first container wharf at Telfers Island, Prospective 3 (Short Term Development: STD)

V3s = 150,000 TEUs

Cargo volume for the next two container wharves at Telfers Island, Prospective 3 (Long Term Development: LTD)

V3m = 300,000 TEUs

Thus, the required operation and maintenance cost for each phase is;

Prospective 1/2 : C = 2,000,000 \$/year Prospective 1/2 : C = 6,000,000 \$/year Prospective 3 (STD) : C = 6,000,000 \$/year Prospective 3 (LTD) : C = 12,000,000 \$/year

Maintenance Costs

According to the past experience, the required maintenance cost relates to the initial investment cost.

Average annual maintenance cost ratio adopted are shown below:

Table 9-11-1 Annual Maintenance Cost

Type of Facility	% of Initial Cost
Fixed Facilities a. Aged and Flexible Structure b. New and Rigid Structure	1.25 1.75
Cargo Handling Euipment	5.00

The required maintenance costs for fixed facilities and cargo handling equipment are estimated as follows. Note; Fixed facilities mean the civil works, building works and Utilities.

a) Existing facility routine maintenance for piers and mole

Total deck area of the existing piers and mole;

Pier No.6	14,000	m2
Pier No.7	14,400	m2
Pier No.8	13,700	m2
Pier No.16	20,000	m2
Mole	7,475	m2
Total	69,575	m2

Estimated initial cost assuming an unit cost of 1,000 m^2 ; 69,575 $m^2 \times 1,000$ $m^2 = 69,575,000$

Thus, an annual routine maintenance cost will be;

 $69,575,000 \times 1.25\% = 869,000$ \$ year

Estimated annual routine maintenance cost in Section 9.13 for piers and mole is;

Pier No.6	46,000	\$/year
Pier No.7	11,700	и .
Pier No.8	13,500	10
Pier No.16	364,000	а
Mole etc.	215,400	н
Total	650,600	it .

This cost is for the structural maintenance works. The required total repair cost including other items will amount to 150,000\$/year which is lower than 869,000\$/year. This may attribute to the existing healthy structures considering the actual age.

The required maintenance cost for the existing cargo handling equipment is roughly estimated.

Forklift	11	sets	X	44,800 = 492,800 \$	
Tractor	·· 4	sets	x	62,710 = 250,840	
Chassis	5	sets	x	22,400 = 112,000	
Sub-Total				855,640 \$	

Thus, an annual routine maintenance cost for the existing equipment will be;

```
856,000 \times 5.00\% = 42,800 $/year
```

It is estimated that the estimated O/M cost of 2 million US\$ can cover these required costs for routine maintenance works.

b) Existing facility routine maintenance for the existing container terminal

It is expected that the existing terminal area will be enlarged to 13.6 ha from the present 8.4 ha in near future. The initial cost is estimated using the cost data for the new terminal at SITE-T.

```
10,465 m2 x
                                     1000 $/m2
                                                  = 10,465,000 $
Piers No.9/10 :
Onland works:
                     7,800,000 \times 0.7 \times 13.6/8.4
                                                  = 8,810,000 $
Building
                     6,500,000 x
                                             0.5
                                                  = 3,250,000 $
                                                  = 2,650,000 $
Utilities
                     5,300,000 x
                                             0.5
                                                     24,710,000 $
Sub-Total
```

Thus, an annual routine maintenance cost for the fixed facilities will be;

```
24,710,000 \times 1.25\% = 309,000 $/year
```

The required maintenance cost for the existing cargo handling equipment is roughly.

Wharf Crane (Gantry C.)	2	sets x	8,800,000	=	17,600,000	US\$
Yard Crane (Transfer C.)	2	sets x	1,344,000	=	2,688,000	
Top-Loader	- 2	sets x	480,000	=	960,000	
Forklift	6	sets x	44,800	==	268,800	
Tractor	18	sets x	62,710	=	1,128,780	
Chassis	20	sets x	22,400	==	448,000	
Sub-total		•			23,093,580	US\$

Thus, an annual routine maintenance cost for the existing equipment will be:

```
23,100,000 \times 5.00\% = 1,150,000  US$/year
```

Total annual maintenance cost amounts to 1,459,000 US\$.

Estimated routine maintenance cost of existing concrete pavement is 184,800 US\$. Since the estimated annual routine maintenance cost of Piers No.9 and No.10 is 59,100 \$/year, the maintenance cost for pavement and piers will be 243,900 \$/year.

It is assumed that the estimated O/M cost of 6 million US\$ can cover this required cost.

c) Routine maintenance works for an unit container wharf to be constructed during the Short Term Development

According to the cost estimation for the new container terminal at SITE-T, the required initial construction cost is 72.2 million US\$. The required cost for mechanical works is 30.0 million US\$.

-	Initial construction cost	72,209,000 \$ (57,767,000×1.25)
-	Equipment cost	29,554,000 \$
	Total	101,763,000 \$

Note: Initial construction cost includes contingency and engineering cost.

Thus, an annual routine maintenance cost will be;

```
72,209,000 x 0.75% = 542,000 $/year
29,554,000 x 5.00% = 1,478,000 $/year
Total 2,020,000 $/year
```

It is assumed that the estimated O/M cost of 6 million US\$ can cover this maintenance cost.

d) Routine maintenance works for two unit container wharves to be constructed during the Long Term Development

The required initial construction cost and the equipment cost are 131.8 million US\$ and 59.1 million US\$ respectively.

- Initial construction cost 131,777,000 \$ (105,421,000x1.25)

- Equipment cost 59,108,000 \$ Total 190,885,000 \$

Note: Initial construction cost includes contingency and engineering cost.

Thus, an annual routine maintenance cost will be;

131,777,000 x 0.75% = 988,000 \$/year 59,108,000 x 5.00% = 3,003,000 \$/year Total 3,991,000 \$/year

It is estimated that the estimated M/O cost of 12 million US\$ can cover this maintenance cost.

9.12 Preliminary Construction Program

This section deals with the basic construction program of the new container terminal including alternative studies on the work quantity and construction method of marine works. It is concluded that the new container terminal will be constructed along the existing north-west coast of Telfers Island. It is also concluded that the terminal will be constructed berth by berth. Thus the preliminary construction program to be discussed in this section is for the first berth construction on the island.

9.12.1 Quantity of Major Works

Based on the study results of wharf structural type, two most possible cases are selected.

OSV: Open Structure by Vertical Pile

CC: Concrete Caisson

Table 9-12-1 shows the major works required for these two cases.

According to this table, dredging and reclamation volume is about 1.5 million m3. Among this, 0.6 million m3 of sandy soil should be borrowed from the specified site by APN at 25 km hauling distance. About 0.9 million m3 of marine soft clay should be

dredged and dumped for disposal at the specified site by APN at 8 km hauling distance.

The required earthworks can be summarized as follows.

Dredging works		
- Dredging and reclamation		180,000 m3
- Dredging and disposal		722,500 m3
- Borrowing and reclamation		607,000 m3
Rock and selected fill	OSV:	102,170 m3
	CC:	162,660 m3

As seen in the table, the required work quantities for OSV and CC are almost the same except the wharf construction.

OSV supports the earth pressure and vertical loads by steel piles driven into the Gatun formation. Thus, major wharf materials are steel and armor rock for slope rip-rapping. While CC consists of concrete structure to be placed on the Gatun formation. Due to this reason the required concrete volume for the CC wharf structure is 18,630 m3.

The on-land works, building and utilities, are just common works in Panama, thus there is nothing to discuss.

Table 9-12-1 Quantities of Major Works: "OSV" AND "CC"

		Wharf St	ructure
Major Work Item	-	OSV	CC
Marine works			
Dredging and reclamation	m3	1,510,000	1,510,000
Seawall, Armor rock and fill	m3	15,470	15,470
Wharf	m	300	300
- Preboring d=1,300	m	2,202	~
- Pile driving d=1,100	t	4,110	-
driving length	m	7,218	-
- Armor rock and fill	m3	86,700	45,090
- Concrete	m3 .	7,740	18,630
caisson box	ea	-	20
On-land Works			
Pavement	m2	93,600	93,600
Storm water drainage	m2	105,000	105,000
Building and office			
Building	m2	7,000	7,000
Weigh bridge	set	. 3	3
Park and landscaping	m2	4,200	4,200
Utilities	cs	1	1

Note: Further details of work quantity are attached in Appendix II-A.

9.12.2 Preliminary Construction Schedule

The required construction period is estimated to be about three years including one year for prequalification and contract. The required period of preparation work before this will depend upon engineering preparation and financial arrangements. Figure 9-12-1 shows a typical schedule to meet the phasing of project implementation as shown in Section 9.4. It is assumed that the required minimum time is one year for a series of financial arrangement, detailed design and contract.

			Year		
Items	1995	1996	1997 ^①	1998 [©]	₁₉₉₉ 3
Financial Arrangement					
Detailed Design					1 1 2
Contract					
Construction					
Operation				, let e	

Figure 9-12-1 Tentative Master Construction Schedule for Short Term Development: One Terminal Unit

Figure 9-12-2 shows a draft schedule when actual construction effort commences at the beginning of 1998.

After executing the construction contract, a contractor will dispatch their first team to the site within one month. Mobilization will be completed within two months.

The critical works will be wharf construction and yard pavement. Building and utilities will be constructed at the last year. It is expected that the first container berth at Telfers Island will commence its service at the beginning of year 2000.

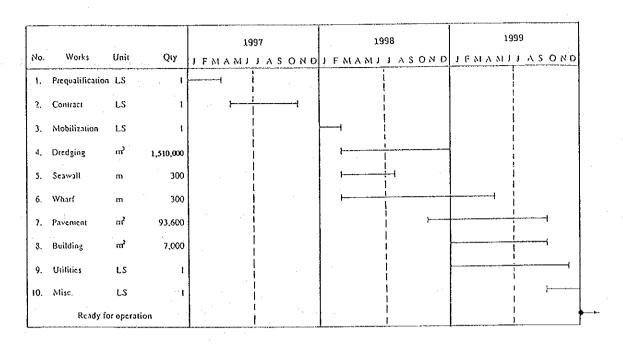


Figure 9-12-2 Preliminary Construction Schedule One Terminal Unit (300 m x 350 m)

9.12.3 Particular Construction Aspects

For the construction of a new terminal, an appropriate temporary construction site should be provided. The required area for this purpose is about 2.5 ha.

Site office and closed storage	0.1 ha
Material storage	0.4 ha
Machine pool	0.2 ha
Parking area	0.1 ha
Pile preparation yard or caisson preparation yard	1.0 ha
Preparation yard	0.5 ha
Other use	0.2 ha
Total Temporary Site Area	2.5 ha

It is proposed that APN provided a contractor with such an area near the existing Pier No.16. This site has various advantages including,

- Good access to inland area
- Good access to the sea
- Wide open space for construction activities

One of the important aspects is the loading and unloading point between land and sea. There are two methods on this matter, Scheme A and Scheme B.

Scheme A: Partial use of Pier No.16

It may be proposed that APN provides a contractor with use of eastern half of Pier 16. In case of caisson structure wharf, a floating dock of 6,000 ton capacity will be anchored here and will cast three concrete caisson boxes every 45 days.

Scheme B: Construction of temporary jetty near Pier No.16

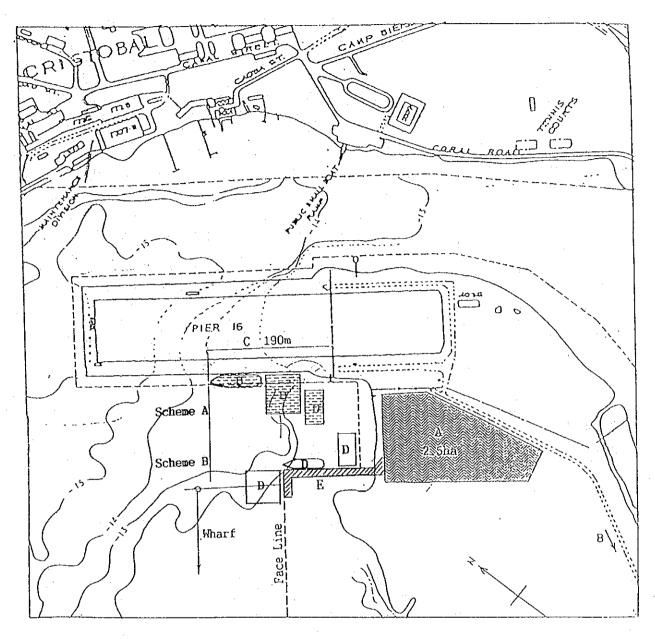
This scheme is an alternative plan against Scheme A.

It is known that Pier No.16 is being used under the concession contract between APN and a private company. Thus, this scheme recommends to construct a temporary jetty near Pier No.16 by a contractor. This means that the contract amount may increase.

Note: Possible solutions of this matter would be as follows:

- a. For the cost estimation purpose, it is assumed that a contractor should build a new temporary jetty near Pier No.16 for the construction works.
- b. At the tender stage, APN would finally decide the use of Pier No.16 by a contractor with conditions of its use and total economy of APN account.

Figure 9-12-3 shows the construction temporary yard at Telfers Island.



Legend

A: Main Construction Yard

B: Access to Colon City

C: Pier No.16

D: Floating Plant

E: Temporary Jetty for Construction Purpose

Figure 9-12-3 Construction Temporary Yard at Telfers Island

9.13 Routine Maintenance Work for Existing Piers and Mole

This section deals with the repair work for the existing piers. Refer to Chapter 7 of Part I. The scope of works are the required routine maintenance for six piers, including the finger piers No.6, No.7 and No.8 and marginal wharves of pier No.9 and No.10 and an independent pier No.16. The Cristobal mole is included also.

The quantities of work for the finger piers and Pier No.16 are based on the result of the visual investigation by the Study Team. However the work to be made for other piers and mole are estimated by the Study Team based on the information collected.

This section does not discuss any work for structural upgrading and improvement.

(Note: Upgrading means to give further modifications to allow for new functions and future loading conditions. For example, to add a wharf crane load on pier No.7.)

Another purpose of this section is to provide necessary data to estimate the required maintenance cost of the existing facilities.

9.13.1 Basic Cost Estimation Procedure

The required repair works depend on the damage scope of each structure.

Pier Structure

The required repair cost for deck structures will be estimated by the following formula.

 $C = Sum (Ci \times Ai)$

where, C: Required repair cost for a same member group (\$/pier)

Ci : Unit repair cost by Damage Grade (DG)

 $= ai \times C(III)$

C(III) : Unit cost per Damage Grade III = 100 \$/m2

ai : Constant figure by Damage Grade

Grade 0 ai = 0

Grade 1 ai = 0

Grade II ai = 0.5

Grade III ai = 1.0

Grade IV ai = 2.0

Grade V ai = 4.0

Ai : Area to be repaired by Damage Grade (m2)

= bi x ni x Ao

Ao : Unit area of member (m2/ea)

bi : Constant figure by Damage Grade

Grade 0 bi = 0
Grade I bi = 0
Grade II bi = 20%
Grade III bi = 40%
Grade IV bi = 60%

Grade V bi = 100%

ni : Number of damaged member by Damage Grade (ea/pier)

Refer to Chapter 7 of Part I and Chapter 6 of Part III.

Thus, $C = Sum (Ci \times Ai)$

= Sum (ai \times C(III)) \times (bi \times ni \times Ao)

= C(III) x Ao x Sum (ai x bi x ni)

= 100\$/m2 x Ao x (0.1*n2 + 0.4*n3 + 1.2*n4 + 4.0*n5}

Similar to deck structure, the pile foundation repair work will be estimated by using C(III) = 400 /m2.

Thus, $C = 400 \times Ao \times (0.1*n2 + 0.4*n3 + 1.2*n4 + 4.0*n5)$

Dike Structure

The existing mole consists of earth dike covered by pavement and protective rock riprapping armor. The required repair cost for mole will be estimated by the following formula.

 $C = Sum (Ci \times Ai)$

Where, C: Required repair cost

Ci : Unit repair cost

Cp = 100 \$/m2for pavement Cr =47 \$/m2for rock riprapping

Ai : Area to be repaired

Ap for pavement

Ar for rock riprapping

9.13.2 Required Repair Cost for Finger Piers

(1) Pier No.6

Deck structure: Concrete beams

Ao = 1/2 (8.1m + 13.8m) x 4.5m = 49.3 m2/beam

From the Table 7-2-8 in Part I

n2 = 5, n3 = 4

Thus, Cb = $100 \times 49.3 \times (0.1*5 + 0.4*4)$ = $4,930 \times 2.1 = 10,353$ \$/pier Deck structure: Concrete Slabs

 $A_0 = 8.1 \times 13.8 = 112 \text{ m}2/\text{slab}$

 $n^2 = 32, n^3 = 2$

Thus, Cs = $100 \times 112 \times (0.1*32 + 0.4*2)$ = $11,200 \times 4 = 44,800 \text{ }/pier$

Pile foundation: Concrete piles

 $A_0 = 3.14 \times D \times 1.5D(D : Pile diameter)$

 $= 3.14 \times 1.5 \times 1.80^2 = 15.3 \text{ m}^2/\text{pile}$

n2 = 6 piles

Thus, $Cp = 400 \times 15.3 \times 6 = 36,700$ \$/pier

Total costs is;

Sum $\{C\}$ = 10,353 + 44,800 + 36,720 = 91,873 \$/pier

It is assumed that this repair works will be conducted every two years. Thus, an annual repair cost for pier No.6 is;

$$91,873 \times 1/2 = 46,000$$
\$/pier.year

(2) Pier No.7

Deck structure : Concrete beams

 $Ao = 1/2 \times (8.1m + 13.8m) \times 4.5m = 49.3 \text{ m}2/\text{beam}$

n2 = 2

Thus, Cb = $100 \times 49.3 \times (0.1^{2}) = 986$ \$/pier

Deck structure: Concrete Slabs

 $A_0 = 8.1 \times 13.8 = 112 \text{ m}2/\text{slab}$

n2 = 9

Thus, $Cs = 100 \times 112 (0.1*9)$

 $= 11,200 \times 0.9 = 10,080$ \$/pier

Pile foundation: Concrete piles

Ao = $15.3 \text{ m}^2/\text{pile}$

n2 = 2 piles

Thus, $Cp = 400 \times 15.3 \times 2 = 12,240$ \$/pier

Total costs is;

Sum (C) = 986 + 10,080 + 12,240 = 23,306\$/pier

Similar to pier No.6, an annual repair cost for pier No.7 is;

 $23,306 \times 1/2 = 11,700$ \$/pier.year

(3) Pier No.8

Deck structure: Concrete beams

 $Ao = 1/2 \times (8.2m + 9.3m) \times 4.5m = 39.4 \text{ m}^2/\text{beam}$

n2 = 16

Thus, $C = 100 \times 39.4 \times (0.1*16) = 6,304$ \$/pier

Deck structure: Concrete Slabs

Ao = $8.2 \times 9.3 = 76.3 \text{ m}2/\text{slab}$

n2 = .7, n3 = 1

Thus, Cs = $100 \times 76.3 \times (0.1*7 + 0.4*1)$ = $7,630 \times 1.1 = 8,393 \text{ pier}$

Pile foundation: Concrete piles

Ao = 15.3 m2/pile

n2 = 2 piles

Thus, $Cp = 400 \times 15.3 \times 2 = 12,240$ \$/pier

Total costs is;

Sum (C) = 6.304 + 8.393 + 12.240 = 26.937\$/pier

Similar to pier No.6, an annual repair cost for pier No.7 is;

$$26,937 \times 1/2 = 13,500$$
\$/pier.year

(4) Total Repair Costs for Finger Piers

Required annual repair cost will be;

$$Cf = C6 + C7 + C8$$

= $46,000 + 11,700 + 13,500 = 71,200$ \$/year

Total area of finger piers is;

$$A = 21,455 \text{ m}2 + 20,672 \text{ m}2 + 20,623 \text{ m}2 = 62,750 \text{ m}2$$

Unit annual repair cost is;

Cf / A =
$$71,200 / 62,750 = 1.13$$
 \$\text{m2.year}

9.13.3 Required Repair Cost for Marginal Wharf: Pier No.9 and No.10

The marginal wharf was not visually inspected by the Study Team. According to the partial observation, the general damage grade is same as the finger piers or less. It is assumed that the unit repair cost per entire wharf area will be more than double of what the finger piers requires due to the intensive heavy traffic by container box transport.

The required routine repair cost for the marginal wharf is estimated as follows:

 $Cm = C' \times Am'$

where, Cm: Required routine repair cost per every three years

(\$/pier)

C': Unit repair cost for the entire area

 $C' = 5 \times 1.13 \text{ } / \text{m2} = 5.65 \text{ } / \text{m2}$

Am: Total marginal wharf area

Pier No.9 + No.10

= 7,475 + 2,990 = 10,465 m2

Thus, $Cm = 5.65 \times 10,465 = 59,100$ \$/pier.year

This cost is not an initial cost but a part of the maintenance cost of the marginal wharves.

9.13.4Required Repair Cost for Pier No.16

The required repair cost for deck structures will also be estimated by the same procedure. The damage grade is based on the result of visual investigation. Refer to Chapter 7 of Part I and Chapter 6 of Part III.

Deck Structure: Concrete beams

Ao = $7m \times 4.5m = 31.5 \text{ m}2/\text{beam}$

n2 = 180, n3 = 50, n4 = 74

Thus,

Cb = $100 \times 31.5(0.1 \times 180 + 0.4 \times 150 + 1.2 \times 78)$ = $3,150 \times 166.8 = 525,420 \text{ pier}$

Deck Structure: Concrete slabs

Ao = $7m \times 7m = 49 \text{ m2/beam}$

n2 = 85, n3 = 40

Thus,

Cb = $100 \times 49.0(0.1 \times 85 + 0.4 \times 40)$ = $4,900 \times 24.5 = 120,050$ \$/pier

Deck Structure: Concrete piles

Ao = $3.14 \times D \times 1.5D$

 $= 1.5 \times 3.14 \times 1.8^2 = 15.3 \text{ m}^2/\text{pile}$

n2 = 35, n3 = 25

Thus,

 $Cp = 400 \times 15.3 \times (0.1 \times 5 + 0.4 \times 25) = 82,620$ \$\frac{9}{pier}\$

Therefore, the total cost will be,

$$C = Cb + Cs + Cp$$

= $525,420 + 120,050 + 82,620 = 728,100$ \$/pier

Similar to the finger piers, an annual repair cost for Pier No.16 is;

$$728,100 \times 1/2 = 364,000$$
\$/year

9.13.5 Required Repair Cost for Mole

The mole is 1,030 m length. Width varies from 60 m to 120 m. Refer to Section 7.3.2 of Part I.

Pavement:

Total area,
$$Ap = 1,030 \times 90 \times 60\% \times 3\% = 1,670 \text{ m}2$$

Unit repair cost, $Cp = 100 \text{ } \text{/m}2$

Thus required repair cost for pavement is,

C1 =
$$Cp \times Ap$$

= $100 \times 1,670 = 167,000$ \$/mole

Rock Riprapping Protection:

Total area,
$$Ar = 2 \times 1,030 \times 10 \times 5\% = 1,030 \text{ m}2$$

Unit repair cost, $Cr = 47 \text{ } \text{/m}2$

Thus, required repair cost for dike protection is,

$$Cr = Cr \times Ar$$

= 47 x 1,030 = 48,400 \$/mole

Total cost are

Sum C =
$$Cp + Cr$$

= $167,000 + 48,400 = 215,400$ \$/mole

It is assumed that these repair works will be conducted every year.

CHAPTER 10 MANAGEMENT AND OPERATION

10.1 Basic Policy for Management and Operation

10.1.1 Key Factors

Key factors that will have a great impact on the future of port development are as follows.

(1) Progress of Containerization

The ports of Cristobal have excellent potential as a container port.

- 1) Location of the ports and presence of the Canal attract major container service lines.
- 2) Presence of Free Zone close to the ports.
- 3) The ports are situated in a calm and deep bay area.

The container terminals of the ports of Cristobal are already very busy. It is expected that container turn-over at the Ports will increase further in conjunction with the progress of containerization. The Ports must cope with this trend.

(2) Competition among the Neighboring Ports

The neighboring Caribbean and Central/South American container ports can potentially extend their roles because of the economic growth of these countries and progress of containerization. Competition among these ports will become keen. The ports of Cristobal function as a container distribution center of Caribbean and Central/South American countries. The ports of Cristobal have to maintain this situation.

(3) Commercialization Policy

Actual application of the Government's commercialization policy will have a great impact on the future of port development.

10.1.2 Required Function for the Port of Cristobal

To cope with progress of containerization and competition among the neighboring ports, the ports of Cristobal should be "an attractive and profitable port for users". It is thought that (1) highly efficient, (2) cost saving, (3) safe and reliable services are priority requirements in becoming an attractive port for users.

The most important function of a port is as a terminal where sea and land

transportation meet. Efficiency and safety in the transfer of cargo and passenger are therefore vital. For container cargo handling, quickness, reliability and cost effectiveness are strongly required in particular.

10.1.3 Major Issues of Present Port Management and Operation

The ports of Cristobal and Balboa originally functioned as supporting facilities for the Panama Canal and logistic centers for the United States Army. After being transferred to Panama, they began to be used as commercial ports. These ports are now involved in the progress of containerization. Due to rather short experience in managing large scale international ports, Panama is seeking the most suitable port management system to become a viable international port, mainly as a container terminal.

Under the situation, following problem areas in port management and operation are observed.

(1) Administration of Port Area

- 1) Under absence of basic policy and plan for development and conservation of Panamanian ports, the ports are not properly controlled with unified coordination.
- 2) Due to the limited legal port water area (only around piers), it is very difficult for Port Authority (APN) to manage their ports appropriately.

(2) Operation of Container Terminal

- 1) Container marshaling is managed in an outdated manner. (Card system is still used at the port of Cristobal)
- 2) Public sector (APN) directly performs container handling operation exclusively. There is no competition in this field.

(3) Organization, Personnel

- 1) APN has excess number of personnel in general.
- 2) The present personnel evaluation system is inadequate and does not contribute to the improvement of port efficiency.
- 3) There is no personnel transfer between APN Central Office and Port Administration offices.
- 4) Concerning training system, there is no special training program to make office work more efficient.

(4) Finance

- 1) Procurement system and other executing procedures of APN budget are inefficient.
- 2) While financial status of APN has been improving gradually in recent years, it seems still not in sound condition.

(5) Port Statistics and Promotion

- 1) Actual port statistics are not useful in analyzing the present condition in conducting a study on future strategy.
- 2) Port promotion activities are not effective enough to attract port users.

10.1.4 Basic Policy for Port Management and Operation

Taking into consideration the following issues, smooth and efficient operation and management systems should be introduced to Panamanian ports including the port of Cristobal in particular.

- (1) Port activity has a great influence on the national economy. Safeguarding the national interest should be the first priority issue concerning port management and operation.
- (2) The basic role of ports is normally considered to function as a public facility. Port infrastructure and facilities should be basically operated in open use to the public.
- (3) APN should establish a basic policy and plan for proper development and conservation of port area which should be controlled under the policy to realize proper port activity.
- (4) Safe and efficient transfer of cargo and passenger is vital. Container cargo handling efficiency is strongly required in particular.
- (5) Organization of APN should be improved to realize high efficiency.

10.2 Management and Operation of Terminals of Port of Cristobal

In this section we will focus on the management and operation of terminals at the port of Cristobal (Coco Solo Norte and Bahia Las Minas are excluded). Because the port of Cristobal can only accept large size vessels, the container terminals of this port will be improved and expanded to be a center of cargo handling in this area.

10.2.1 Management and Operation of Container Terminal of Port of Cristobal

(1) General

There is no single optimum system for the institution and organization of container terminal management which port related people all over the world agree on. Each country which manages and operates container terminals has its own management and operation system shown as follows.

- 1) In Hong-Kong, container terminals are constructed by private companies that manage and operate the terminals. The port authority only leases the water area to the companies.
- 2) In Japan, major container terminals are normally possessed by public corporations which were established to construct and manage such terminals. They lease the terminals to shipping companies which manage and operate them.
- 3) In Holland, at the port of Rotterdam, container terminals are possessed by the port authority which leases the terminal to private companies by long-term base contract. This system is common to the port of New York in the United States as well as in many ports in Europe and the United States.
- 4) In Singapore, the port authority owns, manages and operates the container terminals. This system is also used in the port of London, England.
- 5) At the German port of Bremerhafen, the port authority owns container terminals. The port authority leases them mainly to a semi-government corporation of which a 50% share is possessed by the state government.

In Panama, public institution (APN) owns the container terminal and provides cargo handling service (It is partly provided by private companies).

(2) Alternative Systems for Port Operation and Management

Alternative systems for port operation and management are developed considering three different aspects as shown below.

- 1) Type of Operation and Management
 - a) Whether owner of the terminal will be public sector or not.
 - b) Whether the terminal will be open use terminal or not.
 - c) Whether cargo handling operation will be done by private entity or not.
- 2) Container Terminals
 - a) Pier No. 9

- b) New container terminals constructed by the year 2000
- c) New container terminals constructed during the year 2000-2010 (except b)

3) Period

- a) Urgent
- b) Short Term (up to the year 2000)
- c) Long Term (up to the year 2010)
- d) Post Master Plan

While many alternatives can be considered logically, seven representative alternatives are selected and arranged as shown in the table 10-2-1.

Table 10-2-1 Alternatives of Cristobal Container Terminal Operation

		Urgent Short Term(~2000)		LONG TERM (~2010)			Post M.P.	
		Pier 9	Pier 9	Pier X	Pier 9	Pier X	Pier Y	
Alternative (A)	Owned by	Public	Public	Public	Public	Public	Public	Same as
	Provide service for	Open	Open	Open	Open	Open	Open	Long Term
	Cargo Handled by	Public	Public	Public	Public	Public	Private	Stage
Alternative (B)	Owned by	Public	Public	Public	Public	Public	Public	Same as
	Provide service for	Open	Open	Open	Open	Open	Open	Long Term
	Cargo Handled by	Public	Public	Private	Public	Private	Private	Stage
Alternative (C)	Owned by	Public	Public	Public	Public	Public	Public	Same as
	Provide service for	'Open	Open	Open	Open	Open	Exclusive	Long Term
	Cargo Handled by	Public	Public	Private	Private	Private	Private	Stage
Alternative	Owned by	Public	Public	Public	Public	Pub!ic	Public	Same as
· (D)	Provide service for	Open	Open	Open	Open	Open	Exclusive	Long Term
	Cargo Handled by	Public	Private	Private	Private	Private	Private	Stage
Alternative (E)	Owned by	Public	Public	Public	Public	Public	Private	Same as
	Provide service for	Open	Open	Exclusive	Open	Exclusive	Exclusive	Long Term
	Cargo Handled by	Public	Private	Private	Private	Private	Private	Stage
Alternative (F)	Owned by	Public	Public	Private	Public	Private	Private	Same as
	Provide service for	Open	Open	Exclusive	Exclusive	Exclusive	Exclusive	Long Term
	Cargo Handled by	Private	Private	Private	Private	Private	Private	Stage
Alternative (G)	Owned by	Public	Public	Private	Private	Private	Private	Same as
	Provide service for	Open	Exclusive	Exclusive	Exclusive	Exclusive	Exclusivo	Long Term
	Cargo Handled by	Private	Private	Private	Private	Private	Private	Stage

Pier X: A new container berth available in 2000

Pier Y., : Additional container berths available in 2010

Exclusive: The type of operation which allows only a limited number of companies to use berth(s).

(3) Basic Policy for Management and Operation

1) Major Issues

Major issues to be taken into consideration in examining management and operation system are listed below.

- a) Safe and punctual operation is the most vital requirement for container transportation. In this sense, container terminals are required to provide quick, reliable and economical service to users.
- b) The container terminal of port of Cristobal can be a very profitable

one if operated appropriately. Benefits derived from operation of such a beneficial port should be returned directly to the Panamanian economy.

- c) The basic role of ports is normally considered to function as a public facility. This concept means that public port should be managed and operated not for limited or specified users but for open public use.
- d) One of the most important national policies in this country is commercialization which will have a great impact on future port development.
- e) Efficient service can often be expected by establishing a competitive market among private entities.
- f) The port of Cristobal will be able to collect more cargoes because of its excellent location. If the port of Cristobal continues to provide inefficient cargo handling service, present port users shall move elsewhere. The neighboring Caribbean and Central South American container ports such as Kingston are aiming at becoming hub container ports of this area. APN should recognize that it faces an emergency; APN's action to improve its operation is therefore urgent.

2) Policy for Container Terminal Management and Operation

Taking into consideration the above mentioned issues, main policies for management and operation of the container terminals are formulated as follows.

- a) Ports are vital to the Panamanian economy. Revenue from ports is important income for Panama. Consumption goods for Panamanian people must be provided steadily through the ports. The container terminals should be owned by port of the public sector or entities under proper control of the government.
- b) At least one new container terminal which will be constructed by 2000 should be an open use terminal for the public. Under such operation, the terminal will accept all ships of different companies.
- c) In addition to a public container terminal mentioned above, an exclusive use container terminal can be constructed as second berth for the year 2010. At that time, some shipping companies will be able to collect adequate volume of cargo to manage one exclusive use terminal.
- d) To improve cargo handling efficiency, cargo handling service should be transferred to the private sector. At the same time, a competitive climate should be fostered.

3) Conclusion

According to above mentioned policies, Alternative (C) and Alternative (D) in Table 10-2-1 are considered the best selections for APN.

Under alternative (D), early introduction of commercialization in cargo handling operation is recommended. As is commonly understood, public sector is normally not flexible in providing personnel or investment in response to the actual fluctuation of demand. In this sense, full involvement of port authority in cargo handling services is not always suitable for improvement of efficiency of such services under a competitive market, and increased situation of cargo flow in particular.

Therefore, it is sound for the port of Cristobal to commercialize cargo handling function as soon as possible and improve their efficiency through competition among private companies. This will be a better solution to realize efficient cargo handling system in the future.

4) Management Entity of New Container Terminals Constructed in Long Term (up to the year 2010)

In the Long Term Plan, there is a possibility that new container terminals will be managed and operated exclusively by private companies such as shipping companies. In this case, it is very important to determine how to select the best entities for appropriate operation of the terminal. Examples of criteria for selection of such companies are shown as follows.

- a) Companies which are able to perform efficient container cargo handling to fit customer demand.
- b) Companies which can collect adequate quantity of container cargo while keeping sound financial position.
- c) Companies which can provide reliable services throughout its leasing term

(4) Semi-government Corporation

1) Owner of Container Terminal

The owner of a container terminal should be a public sector or entity under proper control of the government in the light of securing public benefit.

While there are some alternative types of public entities suitable for ownership of the container terminal, APN is recommended as the most appropriate owner organization of such infrastructure, considering that the container terminal to be constructed by the year 2000 (Short Term Plan) is the first full-scale and very important terminal for public use in Panama.

On the other hand, concerning the container terminals which will be constructed by the year 2010 (Long Term Plan), there is a possibility that a semi-government corporation will own these terminals.

However, in this case, the owner should be limited to an entity which port authority can control properly because port area is an important zone for public interest.

2) Cargo Handling Entities

Concerning cargo handling service, it is fair to say that the nature of this activity does not require direct service from a government entity.

However, there is a possibility that the public sector will have to establish a semi-governmental corporation if the private sector does not have enough capital to establish a new company or for other reasons.

(5) Introduction of competitive condition

Present operation of monopolistic cargo handling service by APN should be modernized by the year 2000. APN should encourage private sector to enter into the field of cargo handling service providing an attractive environment for competition. One of the methods is suggested as follows.

APN will deliberately commercialize the cargo handling sections; APN should give more business opportunities to private companies gradually by concession or other means by the year 2000.

At the same time, APN should introduce a system to encourage fair competition. A system in which a certain company is always appointed to a specified berth or pier is not preferable. Instead, a port user should be able to evaluate the ability of a company and make his selection accordingly.

(6) Introduction of Information System to Container Terminal Operation

1) Necessity of Information System

Container terminal operation can sometimes be conducted without a computer system. In fact, at some terminals, container operations are effectively conducted using the magnet board or cards. But, when the number of container increases and exceeds a certain level of handling activity, delay and mistakes in handling works usually increase. Generally, it is said that 60 thousand TEUs per year is the limit of manual processing of yard operation control.

Considering that Pier 9 at the port of Cristobal currently handles more than 100 thousand TEUs with irregular and narrow shaped container yard through complicated operation, an information system for container operation must be introduced.

2) Merit of Information System

The merits of introducing an information system are considered as follows:

- a) An optimum yard operation plan can be developed. Yard operation can be conducted more quickly and more accurately.
- b) Utilization of container yard can be rationalized
- c) Various kinds of information including container location for safety of container storage can be obtained more easily.

These merits greatly contribute to upgrading quality of service to the terminal users.

3) Outline of Information System to be Introduced

a) At Pier 9, a rather simple system should be introduced as soon as possible to improve container inventory management system. Examination should be started from this point of view.

This system consists of minimum data file of container and its location (container number, B/L number, name of a ship to be loaded, name of agency company, its location number (address)). In addition, a basic communication system to connect yard site and the control room is necessary.

b) At the terminal which will be constructed in the Short Term Plan (by the year 2000), a system which can control container operation in the yard should be introduced. The system should have detailed files for container inventory, location and history, on-line communication systems which connect the control room and terminal gates, container ban pool, billing system.

This system should be designed taking into consideration that this terminal will be used by plural private companies.

c) At the terminal which will be constructed in the Long Term Plan (by the year 2010), a more efficient system should be introduced by private companies. In addition to container operation system mentioned in b), stowage plan system which can automatically make a stowage plan to a container ship, data transmission system which can transmit the work instructions to the yard handling machines, i.e. transtainers by the displays on the machines should be introduced.

It should be recognized that detailed examination by system engineers and other proper staff is necessary to design above mentioned systems.

10.2.2 Management and Operation for General Cargo Terminal

At the port of Cristobal terminals other than the container terminal are mainly for general cargo handling. When examining the management and operation of these terminals, the same method as described in 12.2.1 should be adapted. Basic policies recommended for management and operation of these terminals are as follows.

- (1) General cargo terminals are normally used by various users and handle a smaller amount of cargo compared with container terminals. Naturally, these terminals should be open to public use.
- (2) To improve cargo handling efficiency, cargo handling service should be commercialized as soon as possible. At the same time, well arranged environment for fair and active competition should be prepared for private entities.
- (3) In the case of passenger terminal, APN will own and manage the berth, and passenger ship will be given priority to use it. One alternative may be a public berth with passenger terminal buildings for exclusive use by particular companies. Furthermore, where a private company is willing to invest, it can be the owner and exclusive user of that passenger terminal building.

10.3 Control of Port Area, Infrastructure and Facilities

10.3.1 General

Port should be properly controlled to provide efficient and reliable operation. To this end, APN should formulate basic policy for national ports and prepare plan concerning development and conservation of port area. In this policy and plan, basic roles and functions of ports, policy for usage of port area, location and scale of port infrastructure and facilities should be defined. (Hereafter this policy and plan will be referred to as "the port policy and plan".)

Construction work for port development, permission for usage of port infrastructure, facility and area should conform to the port policy and plan.

The port policy and plan should be coordinated among authorities concerned and other related entities. This system should be introduced as soon as possible.

10.3.2 Items to be included in the Port Policy and Plan

The port policy and plan are categorized into two levels, i.e., national level and individual port level.

(1) National Level

For the national level port policy and plan, following items are mainly defined.

- 1) Basic role of Panamanian ports
- 2) Capacity of Panamanian ports at target year
- 3) Functional allotment of each Panamanian port

(2) Individual Port Level

For the individual port level policy and plan, the following items are normally defined within the frame-work of the national level policy and plan.

- 1) Capacity of individual port at target year
- 2) Basic policy for utilization of water area in the port
- 3) Location and scale of port infrastructure and facilities

Important ports for the national economy, such as the ports of Cristobal and Balboa, should have an individual port policy and plan.

Considering tight financial conditions of APN, investment should be allocated preferentially to projects which are included in the policy and plan.

10.3.3 Effect of the Port Policy and Plan

To execute proper port development, port operation and management should be based on the port policy and plan. It is thought expedient to include certain control mechanisms of port development, port operation and management in the port policy and plan.

(1) Control of Water Area

Water area of port is one of the most important assets for port authorities because ports are the transit point of water and land transportation. If a port authority cannot control port area properly, it will be impossible even to accept ships in its port. Therefore, proper and strict control of water area by port authority is a necessity. Any kind of exclusive use or activities at the water area should be regulated with permission of port authority. The permission should not be based on arbitrary decisions, but on the port policy and plan.

(2) Control of Land Area

Land areas used for port activities are currently owned by APN under its exclusive control. But, it seems that there is no concrete policy for land use or management of the area which is currently conducted according to case-by-case decision. Any activities in APN areas need permission based on the port policy and plans.

There is a possibility in future that APN will control private area beyond the present APN area for the purpose of proper and smooth port management and operation. In this case it will be better that APN controls this area to a certain extent including the prohibition of activities which seriously impede the utilization or preservation of the ports.

(3) Construction of Port Infrastructure and Facilities

Infrastructure and facilities for new construction or large scale improvement described in the port policy and plan should be given priority with special allocation of National budget.

10.3.4 Regulations for The Port Policy and Plan

(1) Procedure for Formulation of The Port Policy and Plan

Ports are important infrastructure for national interest. The port policy and plan indicates future condition of ports. Furthermore, the port policy and plan controls various kinds of activities in port areas. Therefore, it should be coordinated among authorities concerned. The port policy and plan should be formulated in a proper and fair manner under formal regulation.

(2) Restriction of Activities in Port Areas

In Panama, it is now regulated by law that all entities have to make concession contracts when carrying out certain activities such as exclusive use of port area. The criteria for restriction and kinds of activities should also be regulated formally.

10.3.5 Estimation of Future Demand and Improvement of Statistic System

In the port policy and plan, capacity of ports of target year is an important issue. To estimate the capacity, present cargo turnover needs to be analyzed.

But, present port statistics are not sufficient to analyze actual condition to formulate the port policy and plan. While total cargo volume of each port is calculated commodity wise, cargo volume is not arranged by destination and origin. These information which is necessary to estimate future demand exists on the original data sheets, but it is not input into the computer.

It is necessary to improve statistic system for future demand estimation and port policy formulation. This can be realized simply by improving office work system without introducing any new computer system.

10.3.6 Port Area

In the future, APN should designate and control all land and water areas which are necessary for proper port activities. This will include not only the APN area but also private areas.

Concerning water area, it should include sufficient turning basin and access water way.

10.4 Organization and Personnel

Efficient and safe cargo handling operation is the most important target for APN. Whole organization of APN must cooperate to realize this target.

10.4.1 Organization and Personnel Affairs

(1) APN Central Office

Concerning APN Central Office,

- 1) APN is independent from other national ministries. Because;
 - a) APN has independent budget,
 - b) APN can decide the port tariff and
 - c) APN can execute construction work of port infrastructure and facilities.
- 2) APN Central Office has following divisions common to most port authorities.
 - a) Planning Division, Engineering Division: responsible for port development plan, conducts construction work and maintenance of port infrastructure and facilities.
 - b) Port Service Division: supervises cargo handling service and other port services.
 - c) Administrative Division, Financial Division: deals with personnel, financial matters.
 - d) Marketing Department: conducts port promotion activities.

As far as the organization structure concerned, no serious problems are observed.

However, if cargo handling service is commercialized, following administrative functions will be transferred to a private entity.

- 1) Calculation, billing, collection of cargo handling charge
- 2) Grievance procedure about cargo handling service
- 3) Management of cargo handling personnel

At the same time, each Division should tackle rather unexperienced field of works shown as follows.

- 1) Port Service Division;
 - a) Supervise new container terminals operation
 - b) Proper management of port area based on the port policy and plan
- 2) Administration Division:
 - a) Creation of new personnel system towards commercialization of cargo handling service
- 3) Planning Division:
 - a) Formulation of the port policy and plan described in 12.3
 - b) Creation of new tariff system towards commercialization of cargo handling service
 - c) Development of port statistic system
- 4) Financial Division:
 - a) Preparation of financial strategy towards commercialization of cargo handling service.

APN Central Office has about 650 personnel, which seems to be too much. (In the case of one Japanese major port, Port and Harbor Bureau carries 25 million tons of cargo yearly, with only 200 personnel)

This is partly because APN conducts cargo handling service directly by their personnel. APN Central Office has personnel who are in charge of administration of cargo handling service. If cargo handling service is commercialized, these personnel will be transferred to private sector.

One of the other reasons is that APN Central Office has 200 security guards for port activities and public facilities. While this kind of activity is not easy to commercialize, some security works may be shifted to the private entities.

(2) Port Administration Office

If cargo handling service is privatized, the sections for cargo verification, cargo handling, warehouse will be separated from APN. Eventually the organization for mooring, water supply, repair work of cargo handling equipment, should also be separated.

However, the organization which conducts management of port infrastructure and facilities should be left under APN administration. The following management activities will be done by APN in such case.

- 1) Permission of usage of port infrastructure and facilities, berth allotment
- 2) Calculation, billing and collection of usage fee of port infrastructure and facilities
- 3) Maintenance of port infrastructure

(3) New Container Terminal

At container terminals, uniform operation is normally preferable. Concerning the new container terminal which will be constructed by the year 2000, however, it will be open to plural companies. Therefore, there is a possibility that an organization which centrally controls container operation will be necessary at this terminal.

It may be one solution that a joint corporation is established for this purpose by shipping companies and/or cargo handling companies. This company will grasp container yard condition, make container operation plan, give directions to cargo handling entities to coordinate in-yard container operation.

10.4.2 Personnel Evaluation System and Personal Movement

(1) Personnel Evaluation System, Promotion

It is thought necessary to raise morale of port authorities' staff and to promote their ability to discharge duties for proper port management. Personnel management system to realize this will be important.

One solution will be the introduction of a modern personnel evaluation system by which APN staffs can be objectively evaluated. Proper promotion and transfer of APN personnel based on ability of each staff will be possible by the system.

Introducing a staff evaluation report system is one effective means. This system should be introduced as soon as possible. When introducing and designing this report, following items should be taken into consideration for objective evaluation.

- 1) Evaluation items should be objective as much as possible.
- 2) Various staff evaluation reports should be carefully designed corresponding with the type of job and rank.
- 3) Certain fixed evaluation period should be adopted.

Contribution to improvement of port management should be counted in evaluating staff performance. Whether a person made any proposal to develop the management system, working efficiency should be included in the evaluation items.

Based on the evaluation, proper measures should be taken such as sending a person to proper training courses, or having his superior give him the necessary guidance. A well designed promotion system will stimulate the personnel incentives and will greatly contribute to developing overall quality of APN organization.

(2) Personnel Change

It will become more important to post the right person to the right place for APN to cope with new structural changes such as commercialization of cargo handling service. The above mentioned staff evaluation report system will be very useful in this respect.

In addition to this, personnel transfer system between APN Central Office and Port Administration Offices should be introduced.

To realize development of port management and operation, APN Central Office and Port Administration Offices should cope with this theme in cooperation with each other.

On the other hand, ports are unique spots where sea transport and land transport meet. Expert knowledge is needed to control port management and operation. All APN staff should be well versed in actual condition of the ports. They should all be highly qualified and have experience in port operation and management. Port Service Division needs such staffs in particular because it must play the role of leader in developing port efficiency. Therefore, persons who have experience of port operation site should be sent to APN Central Office.

10.4.3 Training System

(1) Training System for Office Worker

Concerning training system, some Ministries conduct training courses which are supervised and coordinated by MIPPE (Ministry of Planning and Economic Policy). The themes of the training courses are, however, specialized such as tax system, accounting system, legal knowledge, mainly for national public service officials. Since APN does not have such a training course for office workers, APN should have its personnel join above mentioned training courses.

In future, APN needs to develop its own training course. The purpose of the course will be to change mentality of APN office workers to cope with promoting efficiency of port management and operation. This type of training has not yet been introduced. The themes of the training should be as follows.

- 1) To change APN office workers mentality from "strict supervisors of public port" to "aggressive businessmen and salesmen providing good service to port users".
- 2) To make APN office worker recognize that all APN staffs must contribute to improve efficiency of port activities to survive competition with rival ports.
- 3) To make APN office worker recognize cost-consciousness.

(2) Training system for Operational Employees

Cargo handling service will be commercialized, at the same time, the operational employees of APN will be transferred to private sector. It will be important to further improve their technical ability to cope with modernized container handling operation. APN should examine the training system for operational employees to develop their ability to cope with more quick and reliable cargo handling.

10.5 Procurement System and Financial System

10.5.1 Procurement System

(1) Necessity of Modernization of Procurement System

According to our observation, APN seems to take much time in concluding procurement procedure which is strictly regulated by law. Since it is very important in operating modern container terminal to minimize idling time of cargo handling equipment, more effective procurement activities for spare parts of maintenance works are required in order to avoid possible delay of cargo handling for highly time conscious container vessels.

(2) Modernization of Procurement System

It is desirable that APN is able to purchase spare parts for cargo handling equipment through a more simplified procedure, if it is urgently necessary to avoid long time stoppage of cargo handling operation.

APN should appeal to ministries concerned to modernize the procurement system and realize it as soon as possible. In this case, APN should point out that if cargo handling stops for long time, it will result in serious damage not only to this terminal but also to Panamanian national economy.

10.5.2 Financial System

(1) Financial System

APN uses normal financial statements and is financially independent from other Ministries. There is not a serious defect observed in the financial system.

However, if operational personnel is transferred to private sector, personnel expense will be reduced accordingly, but cargo handling revenue will also be decreased. Cargo handling revenue is currently the major source for APN, so the financial condition will be drastically changed. The concession revenue will partially cover such cargo handling revenue.

Before commercialization of cargo handling service, APN should make a strategy concerning financial matters to realize sound financial condition.

APN should rationalize its management, through simplification of its organization. On the other hand APN should aggressively invest in construction work of container terminals which will be the most vital source of revenue.

(2) Contribution to the Government

Financial status of APN has improved gradually in recent years. APN has to pay an annual contribution to the Government. APN pays back its income to the Government in this way. It is thought inevitable that the Government collects this kind of

contribution from profitable institutions and uses it un-profitable divisions.

However, the amount of the contribution has considerably increased compared with the original budget according to the financial condition of the nation. This system makes financial position of APN unstable.

Ports are vital for the national economy and its security. Panamanian ports, the port of Cristobal in particular, can make a profit in the short term thanks to their excellent location and infrastructure including facilities transferred from the United States. But, new container terminal is necessary to secure stable income in the future.

APN should appeal to the ministries concerned to define criterion as soon as possible for deciding the amount of the contribution and to reserve financial resources for important projects such as new container terminals.

10.6 Provision of Services for Ships

10.6.1 Water Supply and Bunkering

To become a more attractive port for ships, the port of Cristobal should continue necessary water supply or bunkering service in addition to cargo handling service.

At new container terminals, water supply facilities for ships should be installed. It is desirable that APN will own such water supply facilities, but provision of service should be performed by suitable private companies.

The port of Cristobal is now the bunkering center for the ships which pass through the Panama Canal and which use the ports of Cristobal. The number of ships which call at the port of Cristobal is expected to increase. Ships which need bunkering service will also increase. The port of Cristobal should continue bunkering service.

10.6.2 Rapier Service for Ships

PCC (Panama Canal Commission) has a small size rapier shop at the mouth of the French Canal. This shop provides rapier service mainly to small ships such as tug boats, gates of locks of Panama Canal. These services are necessary for Panama Canal operation. This rapier shop will continue its service in this area.

On the other hand, larger size ships will be provided with repair service mainly at the ship yard of the port of Balboa.

10.7 Port Promotion

10.7.1 Necessity of Port Promotion

The Marketing Department in the Planning Division is in charge of port promotion, however, it does not seem to be pursued aggressively. APN marketing staff seldom call

at shipping companies, shipping agents or shippers for sales.

Since the current container handling capacity of the ports is not sufficient, APN position for sales activities is considered not realistic. But it is recommendable that port promotion should be aggressively performed for new container facilities. They should recognize that even if the capacity is small, there will be a chance to attract shipping companies by appealing to the total merit of the port. The staffs of the Marketing Department should become aggressive, and approach all companies which might possibly bring cargo to Panamanian ports in the future.

10.7.2 Port Promotion Strategy

For performing port promotion activities, it will be effective to take aim at main targets and to make strategies to attack the targets. This strategy should be established as soon as possible.

APN should take aim at container cargo including transhipment cargo for the Caribbean and Central/South American countries in particular, and call for sales at the shipping companies and shippers which carry the transhipment cargo. In this case, sales point should be focused on not only on the port facilities but on the merit of using Panamanian ports for the companies.

To make an attractive brochure for this purpose will be necessary. In this brochure, merits of Panamanian ports should be described plainly. It should be well designed so that everyone wants to take a look.

Holding seminars to introduce Panamanian ports to shippers of various countries is thought also effective.

10.7.3 Improvement of Port Statistic System

To formulate port promotion strategy, analysis of cargo turnover is necessary. But, present port statistics are not sufficient to analyze actual condition. Cargo statistics are not arranged by destination and origin by each commodity as mentioned 12.3.5.

It also necessary to provide easy access to port information with port users. This service will make the ports more attractive. Proper information service is mandatory to survive competition with rival ports.

It is necessary to improve statistic system to support formulation of the strategy. To establish quick and proper information service system is also desirable. Panamanian ports will be able to lead rival ports by implementing these systems.

APPENDIX

Appendix II-A-1 Cost Comparison of Alternative Sites

This Appendix shows the summary of construction cost. Refer to Chapter 8 of Part II.

** Legend **

Case : SITE-P14 B1

Existing Pier and Existing Container Terminal

West Colon

Telfers

French Canal

Coco Solo

Depth of water and Wharf design depth 4 3

: Berth at the existing Pier No. 9 B1

New berth for the Short-term Development

New berths for the Master Plan stage Note B3/4

: Cost in case of depth change is also shown in the last page of each case.

The refined cost estimation is shown in Appendix III-A-1 of Part III.

CRISTOBAL PORT COST ESTIMATION: Summary TABLE P14 B1

Case: SITE - P14 B1

L			5	Unit Rate		Works	
	Work Calegory	Works	ij		i C		Cost
₹	General Works		-				1,387,500
œ	Marine Works						1,732,540
ပ	On-land Works				•		5,790,670
<u>ų</u>	Building		,				423,300
шi	Utilities						540,720
ír,	Supplemental Works						383,000
ö	Others						0
工		Subtotal					10,221,730
<u>-</u>	Conungency	Physical (15 % of H)					1,533,260
<u>~</u>	Engineering	(10 % of H)		-			1,022,170
×		Total (H + 1 + J)					12,777,160
	Land Use Total Area Back Apron Brack Apron Brack Apron Inner access Yard pavement Yard pavement Yard pavement Yard pavement Building Parks Reserves Multi-Purpose Area	(1) Gravel pavement (2) Light pavement (3) Normal pavement (4) Heavy pavement (5) Heavy pavement C2		13.30+0.25 1.50 - 2.13 0 0 0 0 6.61 0 0 0.78 0.78 0.20 1.14	***********	100.0% 11.1 15.7 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0	
₹	General Works	Mobilization/Demobilization Mobilization/Demobilization Site Common Works Sublotal					200,000
щi	. Marine Works						
		Scabed Clearance Dredging and reclamation Dredging and reclamation Dredging and reclamation Dredging and disposal Dredging and disposal	\$\$\$\$\$\$	101,000 1.80 5.40 2.76 9.96	និនិនិនិ ខ	00000	00000
			S#3 F#3 F#3	4.80 1,280 2,454	ÈEE	3100	0 396,800 760,740
		⊕ €6	883	7,987	EEE	000	000
		wran (1) -10.0 m (2) -12.0 m	E .5		3 6	0	0

			· · · · · · · · · · · · · · · · · · ·						
	Cost	96,000 200,000 0 0 383,000	00000	0	10,221,730	·		•	
Works		32,000 2,000 0 0	0000	•		: :	:		
	Unit	発生年 22	еййее	-				· · · · · · · · · · · · · · · · · · ·	
Unit Rate		10,000 3 100	2,500 11,000,000 440,000 2,000 4,000					_:	
ວັ	Unit	Spice Sm2 S/m2	System Sy		-				
	Works	Demolishing (Small pier) Demolishing (Orland civil) Demolishing (Building) Environmental protection Misc. works Subtotal	Flyover Burker pier reinstallation Loading arms Burker lines Breakwater Umprovement	Subtotal	81 B1				
	Work Category		Others		Cost by Wharf Depth Cost P-14/12 Cost P-12				
			oʻ						

			Ď	Unit Rate	>	Works	
Work Caregory	ح.	Works	Unit		č		Cost
		(3) -14.0 m Ro-Ro System	ž J	575,000	Εÿ	0	000,272
**********		Subiotal					1,732,540
C. On-land Works	য	Soil Improvement	S/ha	700,000	2	a ·	0
		band access	Sm. Sm.	131.5	<u>ይ</u> ይ	(15,000)	00
		Pavement Repairing	£.	100.0	Ė	1,848	184.800
		Pavement (1) Gravel pave. (2) Light pave.	į	9,69	È E		00
		(3) Normal pave.	S/m²	105.3	Ë	49,800	5,243,940
		(4) Heavy pave. (2)	S. J.	150.0	Έ ኘ	00	00
		(Storm water Drainage	5	53,000	: 2	5.19	275,070
		Pavement Marking Subjoical	Ę.	20.0	Ė	4,300	86,860 5,790,670
D. Building					· -	(7.850 m²)	
		Main Gate	SE J	567	ΈΊ	(450)	
		Control House Maintenance Shore	E S	1.042	ĖĖ	(S) (S)	٠, ٠
		CFS	S/m3	846	É,	(4,400)	
		Substation/Power station	S. J.	8 8	È ï	<u> </u>	0 6
		Misc., buildings		57.5	Ë	95	285,000
		Weigh bridge	S/set	76,300	3	00	0
		Over-head passenger bridge	<u> </u>	3,000	ΕE	 0 8	0 24 600
		Park	Ę	183	: "È '	2,000	70,000
		Landscaping	ZEE/\$	<u>\$</u>	È	2,300	43,70
		Subtotal					423,300
E. Unities							4
		Water Supply (Mann)	S	175,000	m	0	
	-	Water Supply (Dis.)	55	20,000	21	0 6	00
		Sewerasc	Z P	9,300	2	0	
		Power Supply (Distr.)	8/8	1,020,000	μq e	0.2	204,000
		Power Supply (P. Plant)	% %	530,000	20 02	50	> <
<u>.</u> .		Fower Supply (w. Crane)	- F	240,000) M	0.2	120.000
		Lighting (Road)	SMa	24,000	2	1.28	30,720
		Telecommunication	S/B	42,000	മ	00	
		Rector System	25	000	n E	00	
		Misc., unlities	Ē	200**	្ន	, ~	150,000
		Subtotal					\$40,720
F. Supplemental Works	al Works						,
		Navigational aid	S/B	500,000	ю'	0 0	
		Outer access (new)	S. S.	34.8	E E	2.500	87.000
		Demolishing	•	}	:	1	
-							

Summar
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CRISTO
C14 B2
TABLE

14,434,540 C. On-land Works Soil Improvement
3,232,56 2,884,06 52,080,26
2,884,05
52,080,26
Physical (15 % of H)

368,550 1,170,000 1,042,000 2,115,000 632,100 0 456,000 152,600

(7,000 m²) (650 1,000 1,000 2,500 1,050 0 800 2 2 0 1,560 2,100 2,100 2,100

333385353333

567 1,170 1,042 846 602 450 570 570 3,000 123 35

920,500 101,400 730,800 3,980,340 705,000 1,934,520

5.25 26.300 (5.100) 7.000 2.600 10,500 37,800 4,700

4 4 5 4 4 4 4 4 4

700,000 69.6 131.5 131.5 39.0 69.6 105.3 150.0 7

S/m² S/m² S/m² S/m² S/m²

2,172,800 20,787,600

Cos

Case: SITE - C14

Works

Unit Rate

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Unit E 3

EN

67.900 575.000

556,500 14,434,540 0 263,250 261,000

2,500 7,500

e 'è 'è

500,000 105.3 34.8

S/ms

175.500 210.000 21.000 21.000 97.650 1,020.000 455.000 240.000 88.320 42.000

Canagooogggg

20,000 2,000 2,000 9,300 530,000 530,000 240,000 42,000 1,000 1,000

3.68

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Summan
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TABLE C14 B3/4

Case: SITE - C14 B3/4

Works

Unit Rate

Uni.

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Works

30,486,280 16,567,060

79,607,520

7,215,000 4,737,950 145,926,310

21,888,950 14,592,630 182,407,890

(15 % of H) (10 % of H)

Physical

Subtotal

(H+1+3)

Total

7,312,500

Cost

- 50	8 9																	
3	8 9												•					
	632,000	30,000 100,000 324,850 353,340	521,400 338,250 60,000	2,884,090	90000	0		52,080,260	52,080,260	•					· .		-	
W G: KS	7,900	10,000	7,900 4,860 600		00000			-	,									
- 1	<u> </u>	FFFJJ	18 18 18		EXXEE													
Olai Palic	08 6	10,000	66.0 69.6 100.0		2,500 11,000,000 440,000 2,000 4,000				····				.				· .	
	.	Spice Sm² Sm²	S. First		S/85 E				•									
Works	Demolishing (Pier No. 7 shed) Demolishing (Pier No. 16)	Demoishing (Small pier) Demoishing (Small pier) Demoishing (Chland civil) Demoishing (Building) Environmental protection Misc. works	Pavement after P7 shed Mole yard pavement Mole road repair	Subioral	Pyover Bunker pier reinstallation Loading arms Bunker lines Breakwater lines	Subtotal		B2	82								·	
Work Calegory							Cost by Whard Deruh	Cost C-14/12	Cost C-14									
The Part Part Care Care Care Care Care Care Care Care	Works	Works Unit Demolishing (Pier No. 7 shed) Sm2 S0 m2 7,900	Works Unit Unit Unit Demolishing (Pier No. 7 shed) \$5m² \$0 m² 7,900 Demolishing (Pier No. 16) \$5m³ 40 m³ 0 Demolishing (Small pier) \$5pier 10,000 pier 0 Demolishing (Colland civil) \$m² 10,000 pier 0 Demolishing (Building) \$7m² 100 m² 10,000 Environmental protection LS 1 1 Misc. works LS 1 1	Works Unit Unit Unit Demolishing (Pier No. 7 shed) \$m² \$0 m² 7,900 Demolishing (Pier No. 16) \$m² 40 m² 7,900 Demolishing (Sauld liter) \$pier 10,000 pier 0 Demolishing (Building) \$m² 100 m² 1,000 Environmental protection \$m² 1,000 LS 1 Mole: works works \$m² 7,900 1 Mole yard pavement \$m² 69,6 m² 4,860 Mole road repair \$m² 100.0 m² 600	Work Calegory Works Unit Unit Demolishing (Pler No. 7 shed) \$fm² \$0 \$1,000 Demolishing (Pler No. 16) \$fm² \$40 \$m² 7,900 Demolishing (Pler No. 16) \$fm² \$40 \$m³ \$0 Demolishing (Pler No. 16) \$fm² \$40 \$m³ \$0 Demolishing (Pler No. 16) \$fm² \$fm² \$10,000 \$m² \$10,000 Demolishing (Chand civil) \$fm² \$fm² \$fm² \$10,000 \$fm² \$fm²	Works Unit Unit Unit Demolishing (Pier No. 7 shect) \$5m² \$6 m² 7,900 Demolishing (Pier No. 16) \$5m³ \$0 m² 7,900 Demolishing (Small pier) \$fpier 10,000 pier 0 Demolishing (Shuiding) \$fm² 10,000 pier 1,000 Demolishing (Building) \$fm² 10,000 pier 1,000 Demolishing (Building) \$fm² 66.0 m² 1,000 Mole road pavement \$fm² 66.0 m² 4,860 Mole road repair \$fm² 100.0 m² 600 Subtotal \$fm² 1,000 m² 600 Burker pier reinsullation \$fset 11,000,000 set 0 Loading arms \$fset 11,000,000 set 0 Burker lines \$fm² 4,000 m 0 Burker lines \$fm² 4,000 m 0	Work Calegory Works Unit Unit Unit Unit Unit Unit Unit Unit T,900 Demolishing (Pier No. 16) \$m² 7,900 Demolishing (Pier No. 16) \$m² 7,900 Demolishing (Pier No. 16) \$m³ 7,900 Demolishing (Chand (Chand civil) \$m³ 10,000 pier No. 10,000	Work Calegory Works Unit Unit Unit Demolishing (Pler No. 7 shed) \$fm² 80 m² 7,900 Demolishing (Pler No. 16) \$fm² 40 m³ 7,900 Demolishing (Pler No. 16) \$fm² 40 m³ 7,900 Demolishing (Chard give) \$fm² 10,000 m² 1,000 Environmental protection \$fm² 10,000 m² 1,000 Mist. works \$fm² 66,0 m² 4,860 Mole yard pavement \$fm² 100.0 m² 4,860 Mole road repair \$fm² 100.0 m² 4,860 Mole road repair \$fm² 100.0 m² 6,00 Bunker pier reinsullation \$fm² 2,500 m² 0 Bunker pier reinsullation \$fm² 4,000 m 0 Scott by Wharf Depth \$fm² 4,000 m 0 Subtotal \$fm² 4,000 m 0	Work Calegory Works Unit Chair Chair Demolishing (Pler No. 7 shed) 5/m² 80 m² 7,900 Demolishing (Pler No. 16) 5/m² 40 m³ 7,900 Demolishing (Pler No. 16) 5/m² 10,000 pier 0 Demolishing (Chaind evil) 5/m² 100 m² 1,000 Demolishing (Building) 5/m² 100 m² 1,000 Mole year Quavement 5/m² 66.0 m² 7,900 Mole year quavement 5/m² 100.0 m² 4,860 Mole road repair 5/m² 100.0 m² 60 Mole road repair 5/m² 100.0 m² 0 Bunker pie reinsullation 5/set 11,000,000 set 0 Bunker lines 5/m² 4,000 m 0 Bunker lines 5/m² 4,000 m 0 Bunker lines 5/m² 4,000 m 0 Bunker lines 5/	Work Category Works Unit Unit Unit Demolishing (Pler No. 7 sheet) \$Mm² 80 m² 7,900 Demolishing (Pler No. 16) \$fm² 40 m³ 7,900 Demolishing (Pler No. 16) \$fm² 40 m³ 1,000 Demolishing (Charud civil) \$fm² 10,000 m² 1,000 Demolishing (Charud civil) \$fm² 100 m² 1,000 Emolishing (Charud civil) \$fm² 100 m² 1,000 Emolishing (Building) \$fm² 100 m² 1,000 Misc. works \$fm² 66.0 m² 7,000 Mole yard pavement \$fm² 100.0 m² 4,860 Mole road repair \$fm² 2,500 m² 60 Subtotal \$fset 11,000 m² 0 Bunker pier reinsullation \$fset 44,000 m 0 Cost by Whard Depth \$fset 4,000 m 0 Banker pier	Work Calegory Works Unit Chair Chair	Work Cauegory Works Unit Chair 7,900 Demolishing (Pier No. 7 sheet) Symin 40 m² 7,900 Demolishing (Pier No. 7 sheet) Sym² 40 m² 7,900 Demolishing (Pier No. 7 sheet) Sym² 10,000 M² 10,000 M² A sheet D sheet B sheet	Work Caregory Works Unit Unit Demolishing (Pier No. 7 shed) 5m² 80 m² 7,900 Demolishing (Pier No. 10) 5m² 40 m³ 7,900 Demolishing (Pier No. 10) 5m² 40 m³ 10,000 Demolishing (Pielang) 5m² 10,000 m² 10,000 Environmental protection 5m² 66,0 m³ 10,000 Environmental protection 5m² 66,0 m³ 4,860 Misc. works 5m² 66,0 m³ 4,860 Mole road repair 5m² 66,0 m³ 4,860 Mole road repair 5m² 2,500 m³ 4,860 Bunker per reinsullation 5m² 2,500 m³ 6,0 Bunker per reinsullation 5m² 4,000 m³ 0 Bunker lines 5m² 4,000 m³ 0 Bunker lines 5m² 4,000 m³ 0 Cost Ev (-14/12 B2 2	Work Calegory Works Unit Unit Unit Unit Unit Unit Unit One One	Demolishing (Pier No. 7 sheet) Shiri Shi	Work Cacegory	Work Cuegory Works Unit 60 Demolishing (Per No. 7 shock) 5m² 40 m² 7,000 Demolishing (Per No. 7 shock) 5m² 40 m² 7,000 Demolishing (Per No. 7 shock) 5m² 40 m² 7,000 Demolishing (Per No. 7 shock) 5m² 100 pic Demolishing (Per No. 7 shock) 5m² 100 pic Employeer 5m² 66.0 m² 7,000 Misc. volx 5m² 66.0 m² 7,000 Mole road repair 5m² 66.0 m² 4,000 Mole road repair 5m² 2,000 m² 60 Loading are reissallation 5m² 4,000 m² 0 Cost C.14/12 B2 5m² 4,000 m² 0 Cost C.14/12 B2 5m² 4,000 m² 0	Work Cacegory

TAI		Work Caregory	A. General Works	B. Marine Works	C. On-land Works	D. Building			F. Supplemental Works	G. Others		1. Contingency	J. Enginecting	<u></u>	Land Use Total Area	Back apron	Yard pavement	Yard pavement	Yard pavement	Building	Reserves	A. General Works				B. Marine Works	√ ,•••		-			
						:	***								1								,									
Case: SITE - C14 B2	Cost	632,090	0 0 0	000'001	324,850	338,250	60,000	2,884,090		. 0 0		, ,			52,080,260	090 080 65	75,030,200			 -					-						_	
Case: SI	works	7,900	0 0	000:		7,900	8		O	00	00				•																	
	ig	2 3	ខ្លុំ	£ 2	33	ë ë	Ė		Ë	y y	EE					••••								•								
Place Owner	OFFICE OF	0.0 0.4	10,000	.8		66.0	100.0		2,500	11.000,000	2,000		-																			. 1
-	į	# #	Spice	Ş.W.		SAT.	Star	•	S/m²	S/sci S/sci	£ £						•					 ,						• ••••				
	Works	Demolishing (Pier No. 7 shed) Demolishing (Pier No. 16)	Demolishing (Small pier) Demolishing (Onland civit)	Demolishing (Building)	Misc. works	Povement after P7 shed Mole yard pavement	Mole road repair	Subtotal	Pyover	Bunker pier reinstallation Loading arms	Bunker lines Breakwater Improvement	Subtotal			. 32	82																
	Work Calegory								Control	·				Cost by Whard Deput	Cost C-14/12	Cost C-14														:		
		L							-						·		·							•••			·			<u> </u>		:

19,152,000 127,950 490,700 1,916,880 1,383,750

2,559 4,907 7,987 -. 15,375

500,000 3,250,000 3,562,500

Mobilization/Demobilization Mobilization/Demobilization Site Common Works

Subtour

21.00 5.26 0.44 0.21 0.94 0.94 0.94

(1) Gravel pavement (2) Light pavement (3) Normal pavement (4) Heavy pavement C2 (5) Heavy pavement C3

7,312,500

202,000

13,314,240

2, 0 0 0 0 0 0 3,990,000 50 100 240 240 0 0

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\$5.50 \$5.50

Scabed Clearance
Dredging and reclaration
Dredging and reclaration
Dredging and clearation
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Dredging and disposal
Borowing and reclaration
Seawall (1) 4-3.6 m-40.0m
(2) ±0.0 - - 5.0
(3) -5.0 - - 10.0
(4) -10.0 m
(1) -10.0 m
(2) -12.0 m

54.0 54.0 54.0 9.96 4.80

101,000

l						Case: SITE	E - C14 B3/4
			S	Unit Rate		Works	
	Work Category	Works	Unit		Unit		Cost
		Demolishing (Small pier) Demolishing (Onland civil)	S/micr S/m²	10,000	n,	0	00
		Demoishing (Building) Environmental protection	S/m1 ²	8	ĖΣ.	1,500	975.990
		Misc, works Mole yard pavement Mole road pavenient	S/m² S/m²	69.6	a a c	24,000 1,800	1,670,400
(Subtotal					4,737,930
<u>.</u>	Chers	Flyover Bunker pier reinstallation	S/m² S/xet	2,500	E 3	00	
		Loading arms Burker lines Breakwater Improvement	% % F	2,000 40,000 4,000	₹ E E	000	000
		Subtotal				•	0 - 0
	Cost by Wharf Druch						
	Cost C14	B 3/4					145,926,310
·	Marine Works	Dredging reduction Supplement reduction Total reduction	S/m/s	2.76	្នឹង 🕽	1,625,000	-4,485,000 0 -4,485,000
	Cost C14/12	B 3/4					141,441,310
<u>-</u>	Cost C14						145,926,310
	Marine Works	Reduction 14/12 Wharf cost reduction Supplemental reduction Total reduction	S/m	6,200	E 2	009	-4,485,000 -3,720,000 0 -8,205,000
	Cost C12	B 3/4					137,721,310
<u> </u>							

			I fair Data		Work.	
	Works	i i	3	Unit	240	Cost
	(3) -14,0 m Ro-Ro System	ឌីរ៉	67,900	εឌ	600	40,740,000
	Subtotal					79,607,520
	Soil Improvement Inner access	S/ha S/m²	700,000	5 %	14.70	10,290,000
	Back apron Side apron	S/m²	131.5	ë ë	(10,200)	0 526 000
	Pavement (1) Gravel pave.	S/m² S/m²	39.0	E E	5,000	195,000
	(3) Normal pave.	S/m²	105.3	T T	75,600	7,960,680
	(4) Heavy pave, C2 (5) Heave pave, C3 Scorm verier Projects		150,0	i i i	9.400	3,869,040
	Subioral	! }		3	2	30,486,280
					Em 000 007	
	Main Gate Control House Maintenance Shops		567 1,170 1,042	ë ë ë	1,300 2,000 3,000	737,100 2,340,000 3,126,000
	CPS Substation/Power station	S/m²	846	ë ë	000,	5.922,000
	Passenger Terminal	S. J.	450	É	000	1,350,000
	Weigh bridge	S/sct	76.300	. ₹ 1	7,000	305,200
	Over-mad passenger undge Fence Park	E 5.	50.5	e e ŝ	3.120	383,760 147,000
	Landscaping	S/m/z	61	Ë	4.200	79,800
	Subiom					16,567,060
	Water Supply (Main) Water Supply (Dis.)	88	20,000 20,000	m E	21.00	350,000
	Fire fighting	S	2,000	22	21.00	
	Power Supply (Distr.)	S/B	1,020,000	ı m	2	તં
	Power Supply (W. Cranc)	S/B	530,000 455,000	z 02	7 7	910,000
	Lighting (Yard)	8/8	240,000	<u></u>	6	
	Ligning (Road) Telecommunication	S/B	24,000 000,24	g m	7.36	176,640 84,000
	Recfer System Bunker System	# S	100,000	œ E	750	200,000
	Misc., unlines			រ	2 (1	507,060
	Subtotal					7,215,000
Supplemental Works						
	Navigational aid Outer access (new)	S/ms	500,000	m Ë	0 0	1,000,000
	Outer access (improve) Demolishing	S/m/s	34,8	<u>2</u>	٥	0
	Demolishing (Pier No. 16)	S/m³	100	fill:	0	

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Work				9	*****							Buildi		n n n n n n n n n n n n n n n n n n n			Suppl
				ن			.					ŭ		ш			u.
E - T14 B2	(Cost	5,250,000	29,403,020	9,913,140	6,172,650	3,732,500	4,847,790	0	59,319,100	8,897,860	5,931,910	74,148,870		500,000 1,625,000 3,125,000 5,250,000	101,000 162,000 486,000 1,994,100 2,913,600	1,472,100 479,220 615,000
Case: SITE	Works										:			001 002 003 000 000 000 000 000 000 000 000		90,000 90,000 722,500 0 607,000	, 888
	7	Cni		····					,					*********		រនីសិនិនិនិនិ ង	EEE
	Unit Rate													10.50 0.50 2.63 2.63 1.05 3.78 0.47 0.70 0.70		101,000 1,80 5,40 5,40 2,76 9,96 4,80	4,907 7,987 15,375
	Ü	Unit				· · · ·										£££££££	\$\$\$
	:	Works								Subtotal	Physical (15 % of H)	(10 % of H)	Total (H+1+1)	(1) Gravel pavement (2) Light pavement (3) Normal pavement (4) Heavy pavement C2 (5) Heavy pavement C3	Mobilization/Demobilization Mobilization/Demobilization Site Common Works Subjoral	Scabod Clearance Dreaging and reclamation Dreaging and reclamation Dreaging and reclamation Dreaging and disposal Dreaging and disposal Dreaging and disposal Barrowing and edisposal Barrowing and edisposal	
		Work Category	General Works	B. Marine Works	On-land Works	Building	Uulipes	Supplemental Works	Others		Contingency	Engineering		Land Use Total Area Back apton bine access Yard pavement Building Parks Reserves	General Works	Marine Works	:
l			₹	20,	ن	D.	ند	IL,	o,	n;	_i	<u>~:</u>	×		<u> </u>	ei .	

Work Category				On-land Works		4-6-5-6-		~				Building		Unities			Supplemental Works
				Ú			 -					ŭ		ய்			u.
E - T14 B2		Cost	5,250,000	29,403,020	9,913,140	6,172,650	3,732,500	4,847,790	0	59,319,100	8,897,860	5,931,910	74,148,870		500,000 1,625,000 3,125,000 5,250,000	101,000 162,000 486,000 0 1,994,100	2,913,600 0 1,472,100 479,220 615,000
Case: SITE	Works										:			2001 2004 2004 2005 2004		90,000 90,000 722,500	00,700 00,000 00,000 00,000 00,000 00,000 00,000
		Uni												**********			e e e e e e
	Unit Rate		- ·											0.50 0.50 2.50 2.23 0.22 1.05 3.78 0.47 0.70 0.70		101,000 1,80 5,40 5,40 2,76	4.80 2.559 4.907 7.987 15,375
	ວັ	Cai														2222	£88888
		Works		sa companio vol						Subrotal	Physical (15 % of H)	(H % OI)	Total (H+1+J)	(1) Gravel pavement (2) Light pavement (3) Normal pavement (4) Heavy pavement C2 (5) Heavy pavement C3	Mobilization/Demobilization Mobilization/Demobilization Site Common Works Subtotal	Scabod Clearance Predging and reclamation Predging and reclamation Predging and reclamation Dredging and disposal Dredging and disposal	Borrowing and reclamation Scawall (1) +3.6 m-±0.0m (2) ±0.05.0 (3) -5.010.0 (4) -10.015.0 Wharf (1) -10.0 m
		Work Category	General Works	Murine Works	On-land Works	Building	Uulipes	Supplemental Works	Others		Contingency	1. Engineering		Land Use Total Area Back sprion lune access Yard povement Parks Reserves	General Works	Marine Works	
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368,550 1,170,000 1,042,000 2,115,000 632,100

0 456,000 152,600

44444444

S/m² S/m² S/m² S/m² S/m² S/m² S/m² S/m²

Muin Gate
Control House
Maintenance Shops
Gra
Substation/Power station
Passenger Terminal
Misc., buildings
Weigh bridge
Over-head passenger bridge
Fence
Park
Landscaping

6,172,650

175,000 210,000 21,000 97,650 1,020,000 455,000 455,000 240,000 88,320 42,000 100,000 560,000 560,000 550,000

10.50 10.50 10.50 10.50 1 1 1 3.68

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2,000 9,300 530,000 455,000 240,000 24,000 1,000 1,000

Water Supply (Main)
Water Supply (Dis.)
For fighting
Sowerage
Power Supply (Distr.)
Power Supply (P. Piant)
Power Supply (W. Crane)
Lighting (Yard)
Lighting (Yard)
Lighting (Yard)
Telecommunication
Recommunication
Recommunication
Makeer System
Bunker System

500,000 2,106,000 250,560

20,000

a 2 2

500,000 105.3 34.8

5/B S/m² S/m²

Navigational aid
Outer access (new)
Outer access (improve)
Demolishing

175,560 730,800 3,980,340 705,000

25566666

700,000 69.6 131.5 39.0 69.6 105.3 150.0 m

\$2.55 \$2.55

Soil Improvement bind access
Back apron.
Side apron.
Pavement (1) Light pave.
(3) Nomal pave. (3) Nomal pave. (4) Heavy pave. (2) (5) Heavy pave. (2)

556,500 9,913,140

3.

53,000

Sha

Stom water Drainage

18,900,000

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63,000

83

(3) -14.0 m Ro-Ro System

Subtotal

Cost

Case: SITE - T14

Works

Unit Rate

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Unit

Works

29,403,020

CRISTOBAL PORT COST ESTIMATION: Summary
TABLE T14 B3/4

			Work	Genera	Marin	0 <u>1-12</u>		Build	Uúliú	Supple	Others		Conti	Engin		Land	m S	· > >	× ×	>- m c	., ex	Gene		Mari				
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				*																					****	~		
Case: SITE - T14 B2		Cost	632,000	000	0	166,670	521,400	338,250	000	4,547,790		000	00	0			59,319,100	-2,208,000	-2,208,000	57,111,100	59,319,100	-2,208,000 -1,290,000 0 -3,498,000	55,821,100					
Case: SIT	Works		7,900	> 0	0		7,900	4,860	}		0	000	00		<u>.</u>			000'008				980					·	
		Unit	εī	ğ :	ÈË	SI	i e	ëë	•		Ë	2 2	EE					Ę.Ŋ			• • • • •	E 3						
	Unit Rate		08	10,000	m <u>8</u>		66.0	0.69.6			2.500	11,000,000	4,000					2.76				4,300						
		Unit	Sm.	Spice	S/ms		S/m²	S, S,	;		Sm³	25 S/2	E S					\$/m³				w/S			· 			
		Works	Demolishing (Pier No. 7 shed)	Demolishing (Fier No. 10) Demolishing (Small pier)	Demolishing (Onland civil) Demolishing (Building)	Environmental protection	Pavement after P7 shed	Mole yard pavement		Subtotal	£ 2000	Bunker pier reinstallation Loading arms	Bunker lines Breakwater Improvement	Subtotal			B2	Dredging reduction Supplemental reduction	Total reduction	82		Reduction 14/12 Wharf cost reduction Supplemental reduction Total reduction	B2					
		Work Category						-			G. Others					Cest by Wharf Depth	Cost T-14	Munne Works		Cost T-14/12	Cos 7-14	Marine Works	Cost T-12					
			1								O																	 _

	:\$	Works								Case: SITE	- T14 B3/4
	ι _α C		Cost	<u> </u>			ב	Unit Rate	7	Works	
2 5	e T	7,900	632,000		Work Category	Works	Unit		Till C		Cost
8	. ji	• •		<u> </u>	A. General Works						6,437,500
ო <u>გ</u>	'nĖ	00	00		B. Marine Works						52,021,120
	2 S		166,670	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	C. On-land Works						19,826,280
66.0	e e	7.900	521,400 338,250		D. Building						16,429,300
100.0	Ë	009	900'09		E. Villides						7,065,000
			4,847,790	· · · · · · ·	F. Supplemental Works						6,851,940
500	Ë	. 0	0	 _	G. Others						0
000	<u> </u>	00	00		H	Subtotal					108,631,140
88	E E	00	00		I. Contingency	Physical (15 % of H)			-		16,294,670
			0		J. Engineering	(10 % of H)					10,863,110
					×	Total (H+1+1)					135.788.920
7 6	£ 7J	000'003	59,319,100 -2,208,000 0-2,208,000 57,111,100 59,319,100		Land Use Total Area Back apron Inne access Yard pavement Building Parks Reserves	(1) Gravel pavement (2) Light pavement (3) Normal pavement (4) Heavy pavement C2 (5) Heavy pavement C2		21.00 1.00 5.26 0.44 2.10 7.56 0.94 0.94 0.94 0.94	2222222222	100.0% 4.8 25.0 21.1 10.0 36.0 4.5 4.5 2.0 1.6	
1,300	ΕŊ	300	-2,208,000 -1,290,000 0 -3,498,000		A. General Works	Mobilization/Demobilization Mobilization/Demobilization Site Common Works					500,000 1,625,000 4,312,500
			55,821,100		:	Subtotal					6,437,500
	•				B. Marine Works	Scabed Clearance Dredging and reclamation Dredging and reclamation Dredging and reclamation Dredging and reclamation Dredging and disposal Dredging and disposal	2222 2222 2222 2222 2222 2222 2222 2222 2222	101,000 1,80 5,40 54,0 2,76 9,96	ส ฮิ ฮิ ฮิ ฮิ ซ	2 40,500 40,500 324,000	202,000 72,900 218,700 894,240
						Borrowing and reclamation Seawall (1) +3.6 m-±0.0m (2) ±0.05.0 (3) -5.010.0				366.980 200 360 370 370	7,516,800 511,800 1,472,100 718,830
,						Wharf (1) -10.0 m (2) -12.0 m				00	00

Work Caregory	
Demoisthing (Pier No. 16) Shed	
Demoisting (Sraul) piece) Spiece	Demofish
Demolishing (Onland civil) Simi 100	Demolish
Demolishing (Building) S/m² 100	Demolish
Mise. works Mole yard pavement Sublocat Others Plyover Bunker pier reissallation Loading arms Sublocat Cost T-14 B3/4 Manne Works Manne Works Supplemental Total reduction Supplemental Supplemental Total reduction Supplemental Total reduction Supplemental Supplemental Total reduction Supplemental Supplemental Total reduction Supplemental Supplemental Total reduction Supplemental Supplemental Supplemental Total reduction Supplemental Supplemental Total reduction Supplemental reduction	Demolish
Mole yard pavement Sm² 105.3	Misc wo
Mole raced gravement Simp 105.3	Mole vard
Sublocation Sublocation Sympton Sympto	Mole race
Plyover Sim² 2,500	
Flyover Flyover Syec 11,000,000	-
Elitore pier reinstallation Sizet 11,000,000 Sizet 10,000	Į
Loading arms Loading arms System Subtorial Subtorial Subtorial B3/4 B3/4 Reduction Total reduction Supplemental reduction Supplemental reduction B3/4 B3/4 B3/4 B3/4	Flyover Bunker pi
Burker lines S/m 2,000 Breakwater Improvement S/m 4,000 Subtotal B3/4 B3/4 Reduction 14/12 Wharf cost reduction Supplemental reduction B3/4 B3/4	Loading a
Break-water Improvement S/m 4,000 Subtotal B3/4 Dredging Reduction Reduction Total reduction B3/4 Reduction 14/12 Wharf cost reduction Supplemental reduction B3/4 B3/4	Bunker lit
Subiolal B3/4 Dredging Reduction Reduction Total reduction B3/4 Reduction 14/12 Wharf cost reduction Supplemental reduction B3/4 B3/4	Breakwar
B3/4 Dredging Reduction S/m³ 2.76 Reduction Toul reduction B3/4 Reduction 14/12 Wharf cost reduction Supplemental reduction B3/4	<u>.</u>
B3/4 Dreaging Reduction Reduction Total reduction B3/4 Reduction 14/12 Wharf cost reduction Supplemental reduction B3/4 B3/4	ųz
Dredging Reduction S/m³ 2.76 Reduction Tousl reduction B3/4 Reduction 14/12 Wharf cost reduction Sym 4,300 B3/4 B3/4	22.00
Dredging Reduction Reduction Total reduction B3/4 Reduction 14/12 Wharf cost reduction Supplemental reduction B3/4 B3/4	1
B3/4 Reduction 14/12 Wharf cost reduction Supplemental reduction B3/4	Dredging Reduction Total redu
B3/4 Reduction 14/12 Wharf cost reduction Supplemental reduction B3/4	
Reduction 14/12 Wharf cost reduction Supplemental reduction B3/4	B3/4
Wharf cost reduction Sym A, 300 B3/4	Reduction
	Wharf cos Supplemen
	B3/4
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Work Calegory						
	Works	Unii		5		Cost
	(3) -14.0 m Ro-Ro System	S. S.	63.000	εÿ	000	37,800,000
	Subtoral					52,021,120
On-land Works	Soil Improvement	Sfra	700,000	2	0	0
	limer access Back apron	S/m²	69.6	ëë	52,600	3,650,960
	: _	S/m/s	131.5	E	0	0.0
	Pavement (1) Gravel pave.	Ж.	39.6	ÉÉ	9,000	351,000
			105.3	Ê	009.57	089.096.7
		S/m²	150.0	音音	9,400	1,410,000
	Storm water Drinage	S/ha	53,000	2	21.0	1,113,000
	Subiolal					19,826,280
					(20 000 mg)	
	Main Gate	S/m²	567	Ë	1,300	737,100
	Maintenance Shops	S, m's	1.042	ĖĖ	3,000	3,126,000
	CFS	Sm.	846	Ë	2,000	5,922,000
	Substation/Power station Passenger Terminal	į į	657 750 750 750 750 750 750 750 750 750 7	ÈÈ	2,100	350,000
	Misc., buildings	S/m²	570	È	009'	912,000
	Weigh bridge Over-head passenger bridge	System System	3,000	<u> </u>	40	305,200
	Fence	Ę,	123	E	2,000	246,000
·	Park Landscaping	S/m²	55 E	ΈĒ	7,200	79,800
	Subson					16 476 100
	Water Supply (Main)	S/B	175,000	co	2	350 000
	Water Supply (Dis.)	S/ha	20,000		21.00	420,000
	Fire fighting	S/ha	2,000	2	21.00	42,000
	Power Supply (Digit.)	ž S	9.300	<u> </u>	21.00	195,300
	Power Supply (P. Plant)		530,000	- m	1 74	1.060,000
	Power Supply (W. Crane)	8/8	455,000	æ	C1 4	910,000
	Lighting (Road)	ŝ	24,000	n <u>1</u>	7 36	126 640
	Telecommunication	S/B	42,000	60	2	84,000
	Recfer System	S	100,000	ρΩ	7	200,000
	Misc., utilities	Ę,	000'1	ΕS	26 74	507,060
	Subtotal					7,065,000
Supplemental Works					-	
	Navigational aid	S/B	200,000	æ	_	500,000
	Outer access (to Bolivar) Outer access (bridge)	ž a	105.3	ឌ ន	27,000	2,843,100

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0 1.830,480 0 175,500 730,800 3,980,340 705,000 1,934,520

2222222

700,000 69.6 131.5 39.0 69.6 105.3 150.0 116.0 m

S/m² S/m² S/m² S/m² S/m²

25,744,040

Case: SITE - T14

Works

63,000

125 ES.

Cost

556,500

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S/ha

9,913,140

368,550 1,170,000 1,042,000 2,115,000 632,100 0 456,000 152,600 0 79,950 73,500 73,500

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S/m² S/m²

6,129,600

175,000 210,000 21,000 97,650 1,020,000 530,000 455,000 240,000 240,000 100,000 360,000 360,000 253,530

175,000 20,000 2,000 9,300 1,020,000 530,000 24,000 42,000 1,000 1,000

				715 mag	AG				Ш
	Umin	Unit Rate	*	Works	1		Work Calegory	Works	
	Chrit		- Ind		Cosi			(3) -14.0 m	
					5,250,000			South System	
					25,744,040			Subiotal	
					9,913,140		C. On-land Works	Soil Improvement	
			***************************************		6,129,600			Inner access Back apron	
					3,532,500				
					3,997,810			(2) Light pave. (3) Nomal pave.	
					O			(4) Heavy pave, C2 (5) Heavy pave, C3	
					54,567,090			Stom water Drumage	
			***************************************		8,185,060			Subiotal	
					5,456,710		D. Building		
					68,208,860			Main Gate Control House	
I		10.50 0.50 2.63 0.22 1.05 3.78 0.47 0.47	222222222	0000 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4				Mathematics singles Substation/Power station Passenger Torminal Misc., buildings Weigh bridge Over-head pussenger bridge Fence Park Landscaping Subtotal	
		0.47	9	2,4			E. Utilities		
		-			\$00,000 1,625,000 3,125,000			Water Supply (Main) Water Supply (Dis.) Fire fighting Sewerage	
					5,250,000			Power Supply (Pistr.) Power Supply (P. Plant) Power Supply (W. Crane)	
	S/m² S/m³ S/m³	101,000 1.80 5.40 540	ศ ริธิธิ	20,000	101,000 36,000 108,000			Lighing (Yard) Lighting (Road) Telecommunication Reefer System Bunker System	
	S/m³	2,76 2,96 3,08	ÈÈÈ	162,000	447,120			Misc., utilities Subtotal	
	£	2,559 4,907 7,987 15,375	6668	a 8 8 8	0 1,472,100 479,220 615,000		F. Supplemental Works	Navigational aid Outer access (fiew)	
	e sk	58,700	EE	00	00			Outer access (hinterland) Demolishing	

0 1,263,600 2,340,000

0 12,000 60,000

500,000 105,3 39,0

S/B S/m² S/m²

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CRISTOBAL
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TABL

			•	-	Marke		
Work Calegory	Works	3	Cuit Kaie	igi	works	Cost	
	Demolishing (Pier No. 16)	S.W.S.	07	ê	0	0 (»M
	Demolishing (Small pict) Demolishing (Onlard civil)	Spec	9000	ĘĘ.		000	A. Ga
	Demoishing (Building) Environmental protection Miss works	Ė	3	FJJ	5	125,300	B. Ma
	Subjected					3,997.810	ර සි ර සි
	Flyover		2,500	Ę	0	0	
	Bunker pier reinstallation		11,000,000	3 5	00	96	13. 14.
	Bunker lines	\$	5,000	E		00	8
	Breakwater Improvement		98	E	5	9	ı;
	Sublocal					0	,i
				-			7.
Cost by Wharf Depth							ν.
Cost T-14	B6					54,567,090	
Marine Works	Dredging reduction Supplemental reduction	\$/m ³	2.76	ES	50,000	-138,000	
-	Total reduction					138,000	
Cost T-14/12	. 9g					54,429,090	
Cost T.14						54,567,090	
Manne Works	Reduction 14/12 Wharf cost reduction Sumlemental reduction	S/m	4,300	EΞ	300	-138,000	
	Total reduction					-1,428,000	હ
Cost T-12	36					53,139,090	
			·-···				.8
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			٦	Unit Rate		Works	,
	Work Calegory	Works	Cait		Chić		Cosi
٠į	General Works						6,437,500
αį	Marine Works						62,499,460
ن	On-land Works				:		22,766,280
Ö	Building						14,998,120
ាក	Utiliies						7,265,000
μ.	Supplemental Works						4,086,300
Ö	Others						16,040,000
ı;		Subtotal			-		134,092,660
	Contingency	Physicai (15 % of H)					20,113,900
-:	Engineering	(10 % of H)					13,409,270
×		Total (H+1+1)					167,615,830
<u> </u>	Land Use Total Area Back spron Inne access Yard pavement Yard pavement Yard pavement Yard pavement Yard pavement Building Parks Reserves	(1) Gravel pavement (2) Light pavement (3) Normal pavement (4) Heavy pavement C2 (5) Heavy pavement C3		21.00 21.00 1.00 5.26 0.44 2.10 7.56 0.94 0.94 0.64	*********	100.0% 25.0 25.0 25.0 25.0 36.0 36.0 36.0 20.0 20.0 20.0 20.0 20.0 20.0 20.0 2	
.	. General Works	Mobilization/Denobilization Mobilization/Denobilization Site Common Works Subotal				:	500,000 1,625,000 4,312,500 6,437,500
<u>m</u>	Marine Works	Scabod Cicarance Dioding and reclamation Dioding and reclamation Drodging and reclamation Drodging and ordamation Drodging and disposal Drodging and disposal Borrowing and reclamation Seawall (1) +3.6 m~±0.0m	S. S	101,000 1.80 5.40 54.0 2.76 9.96 4.80 2,559		2 0 0 735,000 3,780,000	202,000 0 0 0 2,028,600 18,144,000
		ପ୍ରତିହ	5555	4,907 7,987 15,375		170	1,275,820 1,357,790 1,691,250
		Wharf (1) -10.0 m (2) -12.0 m	E E	58,700	8 E	00	

Work Cheepary Works Unit Unit Total Cheepary Works Unit Unit Total Cheepary Unit Unit Total Cheepary Unit Unit Total Cheepary Unit	L			:		3	Sc. Sile -	Case: SITE - F14 (2) B5/0
Demoishing (Pier No. 16) Smith at the profile of the profile o		Work Category	Works	1 1	I Pulle		SUL	So
Demolstring (Smail Per) Sym 40 m² 17,000 Demolstring (Smail Per) Sym² 40 m² 17,000 Demolstring (Chand civil) Sim² 100 m² 300 Demolstring (Chand civil) Sim² 2,500 m² 1,000 Bunker pier energablism Sym 2,500 m² 1,000 Bunker pier energablism Sym 2,700 m² 1,000 Suboral Sym² Sym² Sym² 2,500 m² 1,000 Braskwater Irresponder Sym 2,76 m² 1,000 Supplemental reduction Sym 2,76 m² 1,000 Cost F-14 (f) B\$/6 Sym²				120		į,		4
Demolstising Chand-civity Styne 10,000 pure 10,000			Demolishing (Pier No. 16)	Smy	04	È	17,500	700,000
Others Denoistang (building) S/m² 100 m² 300			Demolishing (Small pier)	S/pic	000,01	ğ.	^ 66	0000
Cost F-14 (f) B-566 Cost F-12 (f) Cost F-12 (f) B-566 Cost F-12 (f) Cost F-12 (f) B-566 Cost F-12 (f) Cost			Demolishing (Onizand civil)	E/A	^ <u>§</u>	Ė	32	200.02
Others Subotal Subo			Demonstrang (Semong)	1	3	1	3	081 505
Subotal Subo			Misc, works			រ		600,620
Prover Prover Smr 2,500 nr 0	•		Cubioral					4 086 300
Phyover Synore								
Pryover Pryover Pryover Pryover Pryover Pryover Pryover Promote Pryover Promote Promote Promote Promote Prediction Pre	ပ်							
Depth Supplemental refusion Supplemental reduction			Pyover	S/m²	2,590		۵-	000
Burker lines Sym 2,000 m 1,200			Durker pier remisialianon	X S	440,000		- 10	2,640,000
Denth Subtorial Subtorial Supplemental reduction Total reduction Similaria Similaria Supplemental reduction Similaria reduction			Bunker lines	S/m	2,000	ε	1,200	2,400,000
Subtotal Subtotal Signary Signary Signary Signary Signary Supplemental reduction Signary Signary Supplemental reduction Signary Si			Breakwater Improvement	E S	4,000	E	0	•
Dreuging reduction Supplemental reduction Total reduction Total reduction Shart cost reduction Shart cost reduction Supplemental reduction Supplemental reduction Supplemental reduction B5/6 B5/6 B5/6 B5/6 B5/6 B5/6 B5/6 B5/6			Subtotal					16,040,000
25/6 27/6 m² 0			٠.					
B5/6 Dredging reduction Supplemental reduction Total reduction 8/m³ 2.76 m³ 0 Supplemental reduction Sharf cost reduction Supplemental reduction Total reduction B5/6 B5/6		Cost by Wharf Depth						
Dredging reduction Supplemental reduction Total reduction Total reduction B5/6 Reduction 14/12 Wharf cost reduction Total reduction Sym 4,300 m 600 Supplemental reduction Total reduction B5/6 B5/6		Cost F-14 (f)	B5/6					134,092,660
B 5/6 Roduction 14/12 Wharf cost reduction Supplemental reduction Total reduction B 5/6		Marine Works	Dredging reduction Supplemental reduction	s/m/s	2.76		0	00
B5/6 Reduction 14/12 Wharf coss reduction Supplemental reduction Tous reduction B5/6			Total reduction					
B5/6 Reduction 14/12 Wharf cost reduction Supplemental reduction Toul reduction B5/6		Cost F-14 (I)/12						134,092,660
Reduction 14/12 Wharf cost reduction Supplemental reduction Total reduction B5/6		Cost F-14 (f)	B5/6					134,092,660
Supplemental reduction Tout reduction B 5/6		Marine Works	Reduction 14/12 Wharf cost reduction	S/m	4.300	Ę	99	0 00.085.2-
B5/6			Supplemental reduction Total reduction			3	0	-2,580,000
		Cost F-12 (I)	B5/6					131,512,660
				· · · · · ·				

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į	Z S	37,800,000 0	62,499,460	2,940,000	3,660,960	• •	351,000	1,461,600	7,960,680	3,869,040	1,113,000	22,766,280		737,100	3,126,000	5,922,060	1,264,200	912,000	305,200	164,820	79,800	14,998,120			420,000	-		000'090':		_	000,400		507,060	7,265,000		500,000	0
Works		009		4.20	52,600	0000	000'6	21,000	200	9,400	21.0		(17,000 m²)	1,300	3,000	7,000	2,100	1,600	40	1,340	4,200			5 5	21.00	21.00	61.6	4 (1	61	7.36	40	8	7			15 000	0
	Crit	ឧឌ្		Ž	Èì	ÈÈ	Ë	Ë.	È 7	ËË	Ħ			ر ا	e e	'n.	ΕÉ	ë	ខ្ល ខ	E å	ē.			œ.	2 E	2	ω i	u ca	æ	2 o	a a	: E	য়			ш 'ё	žE
Unit Rute	-	63,000		200 000	9.69	13.5	39.0	9.69	105.3	411.6	23,000			567	1,042	846	602	570	3,000	223	3 2			175,000	2000	9,300	1,020,000	455,000	240,000	24.000	000	1,000				500,000	34.8
ig.	C. Pir	s, S,		S.M.S	S/E	Į, į	S/m3	S/m³	i K	S/m²	S/ha		•	S/m²	E /S	S/m²	E E	s/m/s	S Ke	S/m	S. S.			8/9	E 5			2 % %	S/B	Sma	2 0	S. E.				% % % %	S/m²
717	Works	(3) -14.0 m Ro-Ro System	Subtotal	Soil Improvement	Inner access	Side apron	Pavement (1) Gravet pave.	<u> </u>		(5) Heavy pave, C3	Storm water Drinage	Subtoral		Main Gate	Maintenance Shops	CFS	Substation/Power station	Misc., buildings	Weigh bridge Over-head passenger bridge	Fence	Landscaping	Subiotal		Water Supply (Main)	Water Supply (Dis.) Fire fighting	Scwerage	Power Supply (Distr.)	Power Supply (P. Plant) Power Supply (W. Cranc)	Lighting (Yard)	Lighting (Road)	Paries Sustain	Bunker System	Misc., utilities	Subtotal		Navigational aid Outer access (new)	Outer access (improve)
C	Work Calegory			On-land Works		-	-						Building	5 .				-					Unhities					-							Supplemental Works	:	
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COST ESTIMATION: Summarx
FOBAL PORT C
CRIST
II) B5/6
TABLE F14 (

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																.:			
Case: SITE - F14 (b) B5/6	,	Cost	6,437,500	85,664,410	22,766,280	14,998,120	8,475,000	4,595,440	14,440,000	157,376,750	23,606,510	15,737,670	196,720,930		\$00,000 1,625,000 4,312,500 6,437,500	202,000 1,607,400 0 20,682,000	12,019,200	3,483,970 6,149,990	007,120,1
ise: SITE - I	Works												· .	25.001 25.002 25.002 36.003 36.003 4.45 4.55 4.55 5.003 5.00		2 893,000 0 383,000	2,504,000	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2 0
تا		Uni												*******		ស ដូ ដូ ដូ	è è è	EEEE	ž (
	Unit Rate										•			85.6 21.00 1.00 5.26 5.26 5.26 7.36 6.94 6.94 6.94 6.94 6.94 6.94 6.94		101,000	9.96	2,559 7,907 7,987	, ,
	5	Çni			***										-	\$ £ £ £ £ £ £ £ £ £ £ £ £ £ £ £ £ £ £ £	S/m/S	5555	
		Works								Subtokui	Physical (15 % of H)	(H Jo % OI)	Total (H + I + J)	Gravel pavement Light pavement Normal pavement Heavy pavement Heavy pavement C2 Heavy pavement C3	Mobilization/Demobilization Mobilization/Demobilization Site Common Works Subtotal	Seabod Clearance Dredging and reclamation Dredging and reclamation Dredging and reclamation	Dredging and disposal Dredging and disposal Burrowing and reclamation	Scawall (1) +3.6 m~±0.0m (2) ±0.05.0 (3) -5.010.0	0.01-10.01-10.01
		Work Category	General Works	Marine Works	On-land Works	Building	Utilities	Supplemental Works	Others		Contingency	Enginecting		Land Use Total Area Back apron hure access Yard pavement Yard pavement Yard pavement Yard pavement Yard pavement Building Parks Reserves	General Works	Marine Works			
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			Case: Sife -	c: SITE -	["	Case: SITE - F14 (b) B5/6		≩	Work Category	Works	in.
		5	Unit Rate	**	Works			-			5
	Works	Chit		ië O		Cost				(3) -14.0 m Ro-Ro System	¥ 2
ì						6,437,500				Cubtoral	
					,	85,664,410			On land Works		
						22,766,280			a-land works	Soil Improvement	\$;
						14,998,120				Back apron	355
						8,475,000				Pavement (1) Gravel pave.	555
						4,595,440					
						14,440,000				(5) Heavy pave. C3	
Subtotul	13					157,376,750			•	Storm water Drinage	\$
Physical	al (15 % of H)					23,606,510				Subtotal	
	(10 % of H)					15,737,670		Ω.	Building		į.
Total	(H+I+J)					196,720,930				Control House Maintenance Shops	ર્જ જ જ
53222	Gravel pavement Light pavement Normal pavement Heavy pavement C2 Heavy pavement C3		85/6 21.00 1.00 5.26 0.44 2.10 7.56 6.94 0.94 0.94 0.04	222222222	25.0 25.0 25.0 36.0 36.0 36.0 36.0 37.0 37.0 37.0 37.0				· . :	CFS Substation/Power station Passenger Terminal Misc., buildings Weigh bridge Overhead passenger bridge Fence Park Landscaping Subtotal	555555555
1 1 1 1 1 1 1	Mobilization/Demobilization Mobilization/Demobilization					\$00,000		i i	oning.	Water Supply (Main) Water Supply (Dis.) Fire fighting	\$888
ຊ	ommon Works Subtotal					6,437,500		·		Sewerage Power Supply (Distr.) Power Supply (P. Plant) Power Supply (W. Crane)	के <i>फे</i> जे ज
2 2 2	Seabed Clearance Dredging and reclamation Drefeins and reclamation	8% % % %	101,000	ω E ê	2 893,000	202,000	.:			Lighting (Yard) Lighting (Road) Telecommunication Reefer System	W W W W
9,6	ng and reclamation ng and disposal	S. S.	54.0 2.76	ê E	383,000	20,682,000				Bunker System Mise., utilities	<i>ب</i> ة
<u> </u>	ing and disposal ving and reclamation	S _{fm}	9.96		0 2,504,000	12,019,200		—		Subiolal	
3	11 (1) +3.6 m-±0.0m (2) ±0.05.0	55	2.559	EE	0 012	3,483,970		π. Ω	Supplemental Works		
,		S, e	15.375	EE	5 5 0 1	1,691,250			-	Navigational aid Outer access (new)	5 5
What	(1) -10.0 m (2) -12.0 m	e S	58,700	E E	00	0 0		\dashv		Outer access (improve) Demolishing	5

737,100 2,1340,000 3,126,000 1,264,200 1,264,200 912,000 305,200 164,820 147,000

\$67 1,170 1,042 846 602 602 570 570 3,000 3,000 123 35

(17,000 m²) 1,300 2,000 3,000 7,000 2,100 0

14,998,120

351,000 1,461,600 7,960,680 1,410,000 3,869,040

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700,000 69.6 131.5 131.5 39.0 69.6 105.3 150.0 170.0 180.0 180.0

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Cost

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Unit Rate

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Case: SITE - F14 (b) B5/6

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Case: SITE - F14 (c) B3/4

Works

Unit Rate

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Works

6,437,500

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87,788,010 23,501,280 16,319,830 9,415,000 6,028,630

163,930,250 24,589,540 16,393,020 204,912,810

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Physical Subiotal

(H+I+1)

Total

14,440,000

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Works Works	S	700,000	21,000	1,090,120		4,595,440	0	2,640,000	800,008	14,440,000			157,376,750	-2,484,000 -12,474,000 0 -14,958,000	142,418,750	157,376,750	-14,958,000 -2,580,000 0	139,838,750				
Works		17,500	7,000	3	•		0	· •	80					900,000 231,000 0			800	,				
ا اد	Unit	m, Dict	i i	S	}		H ₂	3 3	E E					E g S			ខ្ម				٠	
Unit Rate		10,000	m S	3			2,500	11,000,000	2,000					2,76			4,300		 			
٦	Ę	S/m³	Ę,					S/set	£%					S/m³			St.					
	Works	Demolishing (Pier No. 16) Demolishing (Small pier)	Demolishing (Onland civil)	Environmental protection Misc. works	G	oronome.	Flyovæ	Bunker pier reinstallation Loading arms	Bunker lines Breakwater Improvement	Subroral			85/6	Dredging reduction Reduction Supplemental reduction Total reduction		B5/6	Reduction 14/12 Wharf cost reduction Supplemental reduction Total reduction	B5/6			·	
	Work Category		·			(i. Others	,				Cost by Wharf Depth	Cost F-14 (II)	Munne Works	Cost F-14 (II)/12	Cost F-14 (II)	Marine Works	Cost F-12 (II)		-		

1			٦	Unit Rate		Works		2		100
; Table 1	Work Category	Works	Uni		Unit		Cost			
		Demolishing (Pier No. 16) Demolishing (Small pier)	S/m³ S/picr	10,000	m³ Dict	17,500 5	700,000		Work Category	gory
		Demolishing (Onland civil)	S/m³	m g	îŝ.	7,000	21,000		A. General Works	orks
		Environmental protection	111/0	3	S	3	1,090,120		B. Marine Works	orks
		Misc. Works			3		624,820		C. On-land Works	/orks
		Subtotal					4,595,440		D. Building	
\sim	Others						-			
		Flyover Bunker pier reinstallation	žž.	2,500	e s	0 ~	0 000.00011			
		Loading arms	Sysei	440,000	¥ 1	. 40 5	2,640,000		F. Supplemental Works	Sylvarks
		Breakwater Improvement	i k	4,000	EE	30	000,000		G. Others	
		Subiolal					14,440,000		н	
					•				1. Contingency	ે જ
	Cost by Wharf Depth								J. Engineering	ga Sa
_	Cost F-14 (II)	B5/6					157,376,750		×	
	Murine Works	Dredging reduction Reduction Supplemental reduction Total reduction	S/m³ S/m³	2.76 54.00	ใช้ สั	900,000 231,000 0	-2,484,000 -12,474,000 0 -14,958,600		Land Use Total Area Back apron Inner access	d Use Total Area Back apron Inner access
•	Cost F-14 (II)/12						142,418,750		Yard	Yard pavement
•	Cost F-14 (II)	B5/6					157,376,750		Yard	Yard pavement
	Marine Works	Reduction 14/12 Wharf cost reduction Supplemental reduction Total reduction	£.	4,300	E J	009	-14,958,000 -2,580,000 0		And pave Building Parks Reserves	r aro pavenen Building Parks Reserves
-	Cost F-12 (II)	B5/6					139,838,750		A. General Works	/orks
			·							
									B. Marine Works	orks
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202.000 5,709.600 0 33,480.000 2,522.090 0 147,210 239,610 7,687,500 0

3.172,000 620,000 913,800 0 30 30 30 500 500

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Dredging and reclamation
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Scawall (1) +3.6 m-±0.0m
(2) ±0.0 - -5.0
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58,700

1.80 5.40 5.40 5.40 2.76 9.96 4.80 2.559 4.907 7.987

500,000 1,625,000 4,312,500

Mobilization/Demobilization Mobilization/Demobilization Site Common Works

Subtotal

100.0 % 25.0 2.1 2.1 2.1 36.0 36.0 36.0 2.5 4.5 4.5 4.5 9.5 1.6 9.5 1.

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21.00 1.00 5.26 0.44 7.56 0.94 0.94 0.94

(1) Gravel pavement (2) Light pavement (3) Normal pavement (4) Heavy pavement C2 (5) Heavy pavement C3

6,437,500

	11/4-11-1	7	Unit Rate	- 1	Works	(
t to down with	WOTKS	Unit	-	Uni		Cost
	Demolishing (Pier No. 16) Demolishing (Small pier)	S/m³ S/pier	10,000	e b	17.500 5	700,000
	Demolishing (Onland civil)	Sm ²	۳ <u>و</u>	ËË	2,000	21,000
	Environmental protection		!			1,251,350
	Misc. works	5	7 07	<u> </u>	37,000	658.320
	Mole road pavement	S/ms	105.3	i i	1,800	189,540
	Subioral	•				6,028,630
Others						
	Flyover	S/m³	2,500	É	0	0
	Bunker pier reinstallation	5/SG S/SG	000,000.11	¥ 5	~ · · ·	11,000,000
	Bunker lines	S/m	2,000	Ε	, \$	800,000
	Breakwater Improvement	S/m	4,000	E	0	0
	Subtotal					14,440,000
Cost by Wharf Depth						
Cost F-14 (III)	B3/4					163,930,250
	: :					
Marine Works	Dredging reduction Reduction Supplemental reduction Total reduction	S/m³	2.76	E È S	900.000 264.000 0	-2,484,000 -14,256,000 0 -16,740,000
Cost F-14 (III)/12						147,190,250
Cost F-14 (III)	B3/4					163,930,250
Marine Works	Reduction 14/12 Wharf cost reduction Supplemental reduction Tout reduction	8/s	4,300	EΩ	009	-16,740,000 -2,580,000 0
Cost F-12 (311)	B3/4				·	144.610,250
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100	37.800,000	010'684'18	3,675,000	351,000	3,869,040	1.113.000	23,501,280	737,100 2,340,000 3,126,000 5,922,000 1,264,200	305,200	136,530 147,000 79,800	16,319,830	350,000 420,000 42,000	195,300	910,000	176,640	2,950,000 2,950,000 507,060	9,415,000	500,000 358,020 0
	8 0	•	5.25 52,600 (10,200)	2,000	9,400	21.0		(20,000 m²) 1,300 2,000 7,000 2,100 3,000	0097	1,110 4,200 4,200		21.00	21.00	446	7.36	2,950		3,400
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	63,000		700,000 69.6 131.5	39.0	150.0	53,000		567 1,170 1,042 846 602 602 450	575 078 086.37	35 123 35 19		175,000 20,000 2,000	9,300	530,000 455,000	24.000	1,000		500,000 105.3 34.8
5	ž Z		S. S	. E. E. S.	S.m.s	S/his			S/m/S	# # # # # # # # # # # # # # # # # # #		S. S. S.	S/Rs	S S S	Sylva	\$ \$ \$		S/m/2 5/m/2
243	(3) -14.0 m Ro-Ro System	Subrotal	Soil Improvement Inner access Back apron	893		Storm water Drinage	Subiotal	Main Gaic Control House Maintenance Shops CFS Substation/Power station	Misc., buildings Weigh bridge	Cyrer-nead passenger oringe Fence. Park. Landscaping	Subtotal	Water Supply (Main) Water Supply (Dis.) Fire fighang	Sewerage Power Supply (Distr.)	Power Supply (P. Plunt) Power Supply (W. Cranc) Linding (Vers)	Lighting (Road)	1 elecommunication Reafer System Burker System Misc., utilities	Subtotal	Navigational aid Outer access (new) Outer access (improve)
t man can be). Building				E. Utimics						F. Supplemental Works
	Cmi	(3) -14.0 m 5m 63.000 m 600 37.800,000 LS 2,280,000 set 0	Unit Unit	Unit Unit	On-land Works Soil Improvement Sha 700,000 ha 52,000 ha	Charles Char	Charles	Charles	Control House Control Hous	Dinit Dini	Dinit	Substitute	No. Ro. System Sm 65,000 m 600 37,8	Ro-Ro System Unit 65,000 End 65,000 End 600 31,	Chiland Works Chiland Works Subotal Su	Contact	Children	Building Subotal Sm Sm Sta Sta Subotal Subotal Subotal Subotal Subotal Subotal Subotal Subotal Subotal Sm Sm Sta Sta

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- F14 (C) BS	Cosi	3,625,000	18,900,000	9,913,140	6,130,210	3,532,500	1,545,410	0	43,646,260	6,546,940	4,364,630	54,557,830		\$00,000 0 3,125,000 3,625,000	002002220000
	* DIXS						,				-		100.0 % 25.0 25.0 10.0 % 36.0 36.0 4.4 4.4 4.4 4.5 6.7 6.7 6.7 6.7 6.7 6.7 6.7 6.7 6.7 6.7		0000000000000
7													********		ក្នុំ ទី ទី ទី ទី ៩ ៩ ៩ ៩ E E
	Chul Kaie			:		****				,			10.50 0.50 0.50 2.63 2.63 1.05 3.73 0.47 0.47 0.70		101,000 1.80 5.40 5.40 2.76 9.96 2.559 4.80 7.987 15,375
13	5 - - - - -											. ,·			\$/8 \$/m³ \$/m³ \$/m³ \$/m³ \$/m³ \$/m³ \$/m³ \$/m³
	Works								Subtotal	Physical (15 % of H)	(10 % of H)	Total (H+1+3)	(1) gravel pavement (2) Light pavement (3) Normal pavement (4) Heavy pavement C2 (5) Heavy pavement C3	Mobilization/Demobilization Mobilization/Demobilization Site Common Works Subiotal	Scabed Charance Dredging and reclamation Dredging and reclamation Dredging and reclamation Dredging and disposal Dredging and disposal Borrowing and reclamation Seawall (1) +3.6 m-±0.0m (2) ±0.0 5.0 (3) -5.0 10.0 (4) -10.0 m (2) -10.0 m (2) -12.0 m
	Work Category	General Works	Marine Works	On-land Works	Building	Usisies	Surplemental Works	Others		Coningency	Engineering		Land Use Toul Area Back apron Inne a person Inne a posement Yard posement Yard pasement Yard pasement Yard pasement Yard pasement Yard pasement Building Purks Reserves		Marine Works
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			Ď	Unit Rate	2	Works	
	Work Calegory	Works	Unit		Üni		Cost
		(3) -14.0 m Ro-Ro System	₽ S	63,000	៩ផ្ត	300	18,900,000
		Subloial				,	18,900,000
Ü	On-tand Works			000	, j	(
		Soil Improvement Inner access	S/m²	9765	ž Ė	26,300	1,830,480
		Back apron	S. S.	1315	ĖĖ	(5,100) (0,100)	96
		ε	S/m ²	39.0	E	4.500	175,500
		(2) Light pave. (3) Nomal pave.	S/m²	69.6	1 2	10,500	3.980,340
		(4) Heavy pave, C2 (5) Heavy pave, C3	S/m² S/m³	411.6	ËË	4,700 00.4	705.000
		Stom water Drainage	S/ha	53,000	ä	10.5	556,500
		Subtotal					9,913,140
۵	Building			-		(7,000 m²)	
	3 ·	Main Gate	S/m ²	567	'n ï	050	368,550
		Maintenance Shops	S, III	1.042	Ë	000,1	1,042,000
		CFS	S/m²	846	È	2,500	2,115,000
		Substation/Power station Passenger Terminal	S, E, E	50 4	ĖĖ	000	032,100
		Misc., buildings	\$/m²	570	È	98	456,000
		Weigh bridge Over-head passenger bridge	S/si	76.30 3.000.c	ផ្ល E	N 0	152,600
	•	Fence	S/m	123	ε'	\$59	80,560
		Park Landscaping	S.E.S.	Q 61	ė ė	3.12	39,900
		Subtotal					6,130,210
ti.	Unitries						
		Water Supply (Main)	S/B	175,000	ar ,	- 3	175,000
		Water Supply (Dis.)	S. A.	2000	2 £	05.01	21 (800
		Sewerage	N.	9,300	. E	10.50	
		Power Supply (Distr.)	S/B	1,020,000	2	_	1,020,000
		Power Supply (P. Piant)	\$ 5	530,000	cat: c		530,000
		Fower Supply (w. Cranc)	o e	240,000	0 00		240.000
		Lighting (Road)	S/ho	24,000	쿈	3.68	88,320
		Telecommunication	S/B	42,000	at c		42,000
		Recier System Bunker System Misc., utilities	E/S	000.1	o E ∑	300	300,000
		Subrotal					3,532,500
ĮĮ.	Surplemental Works			. <u>-</u>			
:		Navigational aid	SZ	500.000	œ	_	500,000
		Outer access (new)	S/m²	105.3	Ë	5,000	526,500

CRISTOBAL PORT COST ESTIMATION: Summary
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6,180,030 4,382,500

1,827,850 11,290,000 69,242,570

5,250,000 28,929,050 11,383,140

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Case: SITE - F14 (d)

Works

Unit Rate

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		Works								Subiotal	Physical (15 % of H)	(10 % of H)	Total (H+I+J)	The state of the s		(3) Normal pavement (4) Heavy pavement C2 (5) Heavy pavement C3		Mobilization/Demobilization Mobilization/Demobilization	Subletal		Scabed Clearance Dredging and reclamation	Dredging and reclamation Dredging and reclamation	Dredging and disposal Dredging and disposal	Borrowing and reclamation Scawall (1) +3.6 m~±0.0m	(3) -5.0 10.0 (3) -5.0 10.0	(4) -10.0 15.0 Wharf (1) -10.0 m
		Work Category	A. General Works	B. Manne Works	C. On-land Works	D. Building	. Uulities	F. Supplemental Works	Others		Conúngency	Engineering		Land Use Tout Area Back apron Inner access	5 F	ment ment		General Works	,	Manne Works			<u> </u>	<u> </u>		
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7	Unit	Spice	S/m/S				Smz	2, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5,	\$ £					S/m³			S/m	*								
	Works	Demolishing (Pier No. 16) Demolishing (Small pier)	Demolishing (Onland civil) Demolishing (Building)	Environmental protection Misc. works	Subjoint		Pyover	Bunker pier reinstallation	Bunker lines Breakwater Improvement	Subtotal			BS	Dredging reduction Supplemental reduction Total reduction	BS	n and	Reduction 14/12 Wharf cost reduction Supplemental reduction	Total reduction B5								
	Work Calegory						Others					ost hy Wharf Depth	lost F-14 (III)	furine Works	osi F-14 (III)/12	ost F-14 (III)	farine Works	ost F-12 (111)								

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	Works	Demolishing (Pier No. 16)	Demolishing (Small pier)	Demolishing (United Civil)	Environmental protection	Misc. works	Cubioral			(E)	Burker over reinsullation	Loading arms	Bunker lines Beeckwater Improvement		Subtolai		B\$		Dredging reduction Supplemental reduction Total reduction	BS		Reduction 14/12 What cast reduction	Supplemental reduction	Total reduction									
	Work Calegory									Oriers			··· -			 Cost by Wharf Depth	Cost F-14 (III)		Marine Works	Cost F-14 (III)/12	Cost F-14 (III)	Marine Works			Cost F-12 (III)				:		-		

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F14 (G)	S		50,000	21.	3 5	315,310	1,827,850			× (1)			11,290,000		69.242,570		69,242,570		69,242,570	0.1.290,000	67,952,570					
Case: SITE -	2	43.6	5,750	7,000	3 -				0	6.75	8 5	•				0 0				300						
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I Init Pote	200		10,000	ლ <u>წ</u>	3			-	2,500	440,000	2, 900 000 000	200.				2.76				4,300						
	, and a		S/m/ S/pic	S/m²	111/9				S/m²	2 5 Kg	Ę, Ę,					S/m³				S/m		· · · · · ·				
	Works	7.7	Demolishing (Pier No. 16) Demolishing (Smull pier)	Demolishing (Onland civil)	Environmental projection	Misc. works	Subtotal		Flyovæ	Loading arms	Bunker lines Breakwater Improvement		Subtotal		B5.	Dredging reduction Supplemental reduction Total reduction	B5			Reduction 14/12 Wharf cost reduction Supplemental reduction Total reduction	BS			~·		
	Work Calegory							Others						Cost by Whatf Depth	Cost F-14 (IV)	Marine Works	Cost F-14 (IV)/12		Cost F-14 (IV)	Marine Works	Cost F-12 (IV)		<u> </u>	**	 	
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Work Calegory	Works	ji ji	200	Light	A COKS	Cost
	(3) -14.0 m Ro-Ru System	ST ST	63,000	E 🕱	300	18,900,000
:	Subtotal					28,929,050
On-land Works	Soil Improvement Inner access	S/hii S/m²	700,000	3 是	26.300	1,470,000
	Back apron Side auton	S/m²	131.5	ëë	(5,100)	0 6
	ପ୍ର	S. S.	39.0	1 1	10,500	175,500
	(3) Nomal pave. (4) Heavy pave. C2 (5) Heavy pave. C3	i i i	105.3 150.0 411.6	E E E	37.800 4.700 007.4	3,980,340 705,000 1,934,520
,	Stom water Drainage	S/ha	53,000	Z	10.5	556,500
	Subtotal					11,383,140
Building	Main Carc Control House Maintenance Shops	\$ \$#. \$#. \$#.	567 1,170 1,042	2 2 2	(7,000 m²) 650 1,000 1,000	368,550 1,170,000 1,042,000
	CFS Substation/Power station	S/m2	846	e e	2,500	2,115,000 632,100
	Fassenger 1 crmmar Misc., buildings Weigh bridge	S/m²	450 570 76,300	e e x	0 8 6	0 456,000 152,600
	Over-head passenger bridge Fence Park	% # % }	3,000	e e 7	0,060	030,380
	Landscaping	S	G 62	ė e	2,100	39,900
	Subtotal		·			6,180,030
Ournes	Water Supply (Main) Water Supply (Dis.)	S/B S/na	175,000	m A	10.50	175,000
	Fire fighting Sewerage	S S	2,000 9,300	2 2	10.50	
	Power Supply (Distr.) Power Supply (P. Plant)	S/B	1,020,000	ga ee		2, 4
	Power Supply (W. Crane)	S.S.	455,000	o ec c		455,000
	Lighting (Road)	S.	24,000	22	3.68	
	Telecommunication Recter System Bunker System Misc., utilities	S/8 S/8 S/#	100,000	∞ cc E Z	1,150	42,000 100,000 1,150,000 253,530
	Subtotal					4,382,500
Supplemental Works						
	Navigational aid Outer access (new) Outer access (improve) Demolishing	S/B S/m² S/m²	500,000 105.3 34.8	α ξ ξ	2,000	500,000 210,600 0

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(3) -14.0 m Ro-Ro System

Subtotal

Works

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49,642,800

Case: SITE - CS14 82

Works

Unit Rate

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700,000 69.6 131.5 131.5 131.5 669.5 150.0 150.0 111.6

S/m² S/

Soil Inprovement Inner access Back access Side apron Side apron Pavement (1) Gravel pave. (2) Light pave. (3) Montal pave. (4) Heavy pave. (2) (5) Heavy pave. (2)

556,500 9,913,140

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S/ha

Storn water Drainage

Subject

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17.00	Cost	6,875,000	49,642,800	9.913,140	6,172,650	9,232,500	5,664,540	0	87,500,630	13,125,090	8,750,060	109.375,780		\$00,000 3,250,000 3,125,000 6,875,000	303,000 661,500 19,449,720 6,578,580 0
Works 3:12	S C C C C C C C C C C C C C C C C C C C												001 001 001 000 000 000 000 000 000 000		3 0 122,500 7,047,000 660,500 0 0 0 0
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de Drain	Olili Kale												0.05 0.05 0.02 0.02 0.02 0.02 0.03 0.03 0.03 0.03		101,000 1.80 5.40 2.40 2.76 9.96 2,559 4,907 7,987 15,375
=	Unit														& £ £ £ £ £ £ £ £ £ £ £ £ £ £ £ £ £ £ £
	Works								Subtoral	Physical (15 % of H)	(10 % of H)	Tow (H+1+1)	(1) Gravel pavement (2) Light pavement (3) Normal pavement (4) Heavy pavement C2 (5) Heavy pavement C3	Mobilization/Demobilization Mobilization/Demobilization Site Common Works Subrotat	Scabod Clearance Drodging and reclamation Drodging and reclamation Dredging and disposal Dredging and disposal Dredging and disposal Borrowing and reclamation Scawal (2) ±0.05.0 (3) -5.010.0 (4) -10.0 m (1) -10.0 m
	Work Calegory	General Works	Manine Works	On-land Works	Building	Utilities	Supplemental Works	Others		Contingency	Engineering		Land Use Total Area Back apron. Inner access Yard pavement Yard pavement Yard pavement Yard pavement Building Parks Reserves	General Works	Marrie vi or
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Case: STTE . CS14 B2 Cost CS14 B2 CS14 B		Supplemental Works										Utilities								Building				·	· · · · · · · · · · · · · · · · · · ·			On land Works			Work Calegory
Case: SITE - CS14		<u>tr.</u>									·	ui	<u>-</u>							Ä		•)				
Case: SITE - CS14																											٠				
Work Caegory Works Unit Rate Wildling	0000	0000	0,578,580	19,449,720	0	905'199	303,000		6,875,000	2,1,2,000	3,250,000			-					109.375,780	8,750,060	13,125,090	87,500,630	0	5,664,540	9,232,500	6,172,650	9,913,140	49,642,800	6,875,000	Cosi	. CS14 B2
Work Caugory Works Unit Rate Unit Rate General Works On-land Works Unit Rate Unit Rate On-land Works On-land Works Subtocal In Section of the sectio	0000	>000	000,000	7,047,000	0	122,500	ms						2.0	4.0	4.	10.0	25.0	100.0 %												2	Case: SITE
Work Cauegory Works Unit Rate General Works Unit of the control works Unit of the control works On-land Works Subtocal (10 % of H) Supplemental Works Subtocal (10 % of H) Contingency Physical (15 % of H) (10 % of H) Engineering Total Area (10 % of H) Contingency Physical (15 % of H) (10 % of H) Engineering (10 % of H) (10 % of H) Contingency Physical (15 % of H) (10 % of H) Pack upron (10 Gravel pavement (2) Light pavement (3) Worman pavement (2) Light pavement (3) Worman pavement (3) Howy pavement (3) How pavement (4) How pavement (4) How	8 E E E	ÈEEE	ÈÈ	Êí	Ê	Ê	т 7						2	2 2	Ø.	221	2	2 3												•	
Work Cauegory General Works Manine Works On-land Works Outlities Supplemental Works Outlities Supplemental Works Outlities Supplemental Works Outlities Supplemental Works Outlities Subtotal Total (H+1+1) Land Usc Total A+1+1) Land Usc Total A+1+1) Total (H+1+1) Land Usc Total A-1+1) Land Usc Total A-1+1-1) Land Usc Total A-1+1-1) Land Usc Total A-1+1-1) Total A-1+1-1) Subtotal Manine Works Seabod Clearance Some Dredging and reclamation Sinc Common Works Subtotal Manine Works Seabod Clearance Dredging and reclamation Sinc Dredging and reclamation Som Dredging and disposal Dredging and disposal Borrowing and reclamation Scanall (1) 7-3, 6, 10 Scanall (1	15,375	2,559 2,907 7,987	4.80	2.76	54.0	5,40	101,000						0.23	0.47	0.47	20.1	2.63	10.50													
Work Cauegory General Works Marine Works Building Uulities Supplemental Works Outhers Supplemental Works Outhers Contingency Physical Engineering Total Area Back apron Inner access Yard pevement (2) Light Yard pevement (3) Heavy Yard pevement (4) Heavy Yard pevement (5) Heavy Building Parks Reserves General Works Mobilizati Morkis Building Parks Reserves General Works Mobilizati Manine Works Seabod Cl Dredging Dredging Dredging Dredging Dredging Dredging Borrowing Seawall	5 555	£ £ £ £ £	Š,	ĵ.	S/m²	£ 5	e 3																							Unit	
	(3) -5.010.0 (4) -10.015.0 Wharf (1) -10.0 m (2) -12.0 m	<u>5</u> 388	🛩	Dredging and disposal	Dredging and reclamation	Dredging and reclamation	Seabed Clearance		Subrotat	Sile Collinea works	Mobilization/Demobilization Mobilization/Demobilization									(10 % of H)		Subtotal								Works	
रं सं रं वं वं वं वं वं वं								B. Marine Works					Parks	iii ii				Land Use Total Area Back apron		Engineening	Contingency		Others						A. General Works	Work Calegory	

368.550 1.170.000 1.042.000 2.115.000 632.100 456.000 152.600 123.600 73.500

(7,000 m²) 650 1,000 1,000 1,050 1,050 2 2 2 2 2 2 1,000 2,100 2,100 2,100

567 1,170 1,042 846 602 450 570 570 570 3100 3100 123 35

CFS
Substation/Power station
Passenger Terminal
Misc., buildings
Weigh bridge
Over-hoad passenger bridge

Main Gate Control House Maintenance Shops

6,172,650

175,000 210,000 21,000 97,650 11,020,000 534,000 45,000 100,000 100,000 253,530

175.600 20,000 2,000 9,300 1,020,000 530,000 240,000 24,000 120,000 12

S/B S/B S/B S/B S/B S/B S/B S/B S/B S/B

Water Supply (Main)
Water Supply (Dis.)
Fire fighting
Sewerage
Power Supply (P. Plant)
Power Supply (P. Plant)
Power Supply (W. Cranc)
Lighting (Yard)
Lighting (Yard)
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Refor System
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2,006,000

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105.3 34.8 50.40

S/m³ S/m³ S/m³

Navigational aid
Outer access (new)
Outer access (improve)
Demolishing

9.232.500

CRISTORAL PORT COST ESTIMATION: Summarx

Case: SITE - CS14 B3/4

Works

Unit Rate

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19.826.250 16,429,300 7,065,000

61,733,710

8,062,500

Cost

3,139,590

11,625,640

145,320,480

100 % 4.8 25.0 25.0 36.0 4.5 4.5 4.5 9.5 1.6

21.00 1.00 5.26 0.44 0.44 2.10 1.56 0.94 0.94 0.94

17,438,460

116,256,380

					Case: SITE	-CS14 B2		TABLE	TABLE CS14 B3/4	CRISTOBAL PORT	Ä
: 4		ځ	Unit Rate		Works						
Work Caregory	Works	Spirit Carit		Crit		Cost	L				
	Demolishing (Pier No. 7 shed) Demolishing (Pier No. 16)	S/m/S	% 4	ë ë	006,	632,000		Work Category		Works	٦
	Demolishing (Small pier)	Spice	10,000	pid.	0 0	000	≺	General Works			
	Demolishing (Building)	Š	8	1	200	20,000	EÌ	Marine Works			
	Environmental protection Misc. works			រ រ		382.910	ပ	On-land Works			
	Pavement after P7 shed	Skm	0.99	ቘ	7,900	521,400					
	Mole road repair	S. S.	0.001	ĖĖ	009	000'09	<u>i</u>				
	FroignS					5,664,540	ம்	Utilities			
							μ,	Supplemental Works			
Coedis	Flyover		2,500	ě	٥	0	<u> </u>	G. Others			
	Bunker pier reinstallation Loading arms		11,000,000	¥ ¥	00	00	11			Subiotal	
	Bunker lines Breakwater Improvement	£ £	2,000 4,000	E E	00	00	Τ.	Contingency	Physica!	(15 % of H)	
	Subtotal					0	:	Engineering		(H Jo % 01)	
					:		×		Total	(H+1+1)	
Cost by Wharf Depth]				
Cost CS-14	B2					87.500,630		Land Use Total Area			
Marine Works	Dredging Reduction	S/m³	2.76	Ê	2.519.000	-6.952.440	··········	Back apron			
	Supplemental reduction Total reduction			지.	0	6,952,440		Yard pavement	(1) Gravel (2) Lighto	Gravel pavement Light pavement	
\$1741-30 tax	C					00.00		Yard pavement		Normal pavement	
77/75	**					00,240,190		Yard pavement		Heavy pavement C3	
Cost CS-14						87,500,630		Parks			
Marine Works	Reduction 14/12	i				-6,952,440		AGSENCS			
	Whart cost reduction Supplemental reduction Total reduction	Ę	307.	ΕŞ	2°°	-1,860,000	«	General Works	Mobilization	Mobilization/Demobilization Mobilization/Demobilization	
Cost CS-12	B2				_	78.698.190			Site Common Works	on Works	
			-							Sublocal	
	_						æ	B. Marine Works			
									Scabed Clearance Dredging and reel	Scabed Clearance Dredging and reclamation	~~~·
									Dredging an	Dredging and reclamation Dredging and reclamation	w w .
						•••			Dredging and disposal Dredging and disposal	nd disposal ad disposal	w w
									Borrowing	Borrowing and reclamation	· 03 6
										(2) ±0.05.0	
										(3) -5.0 ~ -10.0 (4) -10.0 ~ -15.0	
		_							Wharf	(1) -10.0 m (2) -12.0 m	50

500,000 3,250,000 4,312,500

8.062,500

283,500 283,500 0 0 1,304,100 0 11,340,000

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61,700

G. Others

	So S		537,820 1,670,400 189,540	3,139,590	00000		-	116,320,480	0	116,320,480	.3.720.000 0 -3.720.000	112,600,480		
Works		2,000 2,000	24,000		00000	· ·					6000 0			
	5	E S S S	ን ጅ ጅ		<u> </u>						<u>s</u> 3			
Unit Rate		10,006 3 100	69.6	:	2.500 11.000,000 440,000 4.000				•		6,2(N)			
	Š	S/pica S/m² S/m²	S#S.		S/42 S/8ci 13/8ci 17/8ci 17/8ci						S/m		 	
	Works	Demolishing (Small pier) Demolishing (Chland civil) Demolishing (Building) Environmental protection Misc. works	Mole yard pavement Mole road pavement	Subiotal	Ryover Burker pier reinstallation Loading arms Burker lines Breakwater Improvement	Subiotal		B 3/4	Reduction	B 3/4	Reduction 14/12 Wharf cost reduction Supplemental reduction Total reduction	B 3/4		
	work Calegory				Others	: -	Cost by Wharf Depth	Cost CS14	Marine Works	Cost CS14/12 Cost CS14	Manne Works	Cost CS12		
1120010	work Calegory										G. Others Gost Dv Wharf Decth Cost CS14 Marine Works Cost CS14/12 Cost CS14/12			

													************														-				
Cost	40,740,000	61,733,710	0	0,000,900	351,000	7,960,680	3,869,040	1,113,000		737,100	3,126,000	5.922,000	1,350,000	305,200	246,000	147,000	16,429,300		350,000	42,000	2,040,000	000,090,1	480,000	176,640	200,000	\$00,000	2001	000'590'/	c	000	2 86 96
Works	009		0 8	(10,200)	9,000	25.600	9,400	21.0	720,000 223	1,300	3,000	7.80	3,000	4.0	2,000	4,200		•	21,00	21.00	2 2	77	4 (4	7.36	7 71	8,	•		0		, 8
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Unit Rute	67,900		700,000	2151	39.0	105.3	150.0	23.000		567	0.70	 \$ \$	230 230	76,300	223	32		000 301	20,000	2,000	1,020,000	530,000	240,000	2,000	00000	000.			200,000	34.8	Ç
z ig	£ 23		S/ha	S, W	S.	N. S.	S E	u e		S/m²	E S	S/m/S	S/m² S/m²	Sys	w.	ž Ķ		9	S S	\$ 5	S/B	6, 5, 6, 5	S/S	Sma	S/8	Ę,			\$/B	5/m² 5/m²	Ç.w.
Works	(3) -14.0 m Ro-Ro System	Subtotal	Soil Improvement	Back apron Side apron	Pavement (1) Gravel pave.	(3) Normal pave.	(4) Heavy pave, C2 (5) Heave pave, C3	Storm water Drainage Subtotal		Main Gate	Maintenance Shops	Substation/Power station	Passenger Terminal Misc., buildings	Weigh bridge Over-head mesenger heider	Fence	Landscaping	Subtom	Water Greenly (Marie)	Water Supply (Dis.)	Fire fighting Seweraee	Power Supply (Distr.)	Power Supply (P. Plant)	Lighting (Yard)	Lighting (Road)	Rocfer System	Bunker System Misc., uulities	Cubana		Navigational aid	Outer access (new) Outer access (improve)	Demolishing Demolishing (Pier No. 16)
Work Category			On-land Works						Building	•								Utilities											Sulpatemental works		
			Ú						Ċ									шi										Ŀ			

Appendix II-A-2 Wharf Cost by Structural Type

TABLE UNIT COST STUDY SHEET WHARF .12.0 m SITE . C

TABLE UNIT COST STUDY SHEET WHARF 12.0 m SITE - C

		ŏ	Quantity	Ď	Unit Rate	ວັ	Unit Cost	
Works	Specifications	Cnii		Unic		Unit		
Open Structure Type	Batter Pile Type							
Dredging and Replacing		m/m	192.0	S/m3	7.56	E/S	1,451.5	
Pile, Line-1, Ø900	Preboring,	m/m	0	Ę	1,084.0	m/s	0	
	Мацетаl, Ø900 ц=1.6 L=32.6	Ę	2.31	š	1,282.0	s/m	2,961.4	
	Driving Vertical	m/m	6.52	w/s	162.0	S/m	1,056.2	
Pile, Line-2, 3, 4, 5 Ø600	Proboring,	m/m	0	S/m	1,084.0	S/m	0	
	Material, 26600 (#1.3 L=32.6	Ę	5.00	ž	1,282.0	S/m	6,410.0	
	Driving Vertical	m/m	26.08	m/S	108.0	S/m	2,816.6	
Pile, Line-1, 2, @600	Matcrial, @600 (=1.3 L=33.8	Ę,	7.78	ž	1,282.0	m/s	9,974.0	
	Driving Bauter	m/m	40.6	e/s	108.0	E/S	4,384.8	
Crane foundation pile	Material, Ø900 (#1.6 L=32.1	Ę	1.52	St	1,282.0	m/S	1,948.6	
	Driving	m/m	4.28	S/m/S	54.0	m/s	231.1	
Cathodic protection		m-m	36.4	s/m²	65.0	£.	2,366,0	
Selected fill		m³/m	237.1	S/m3	25.0	S/m	5,927.5	
Rubble back-fill		m/cm	11,4	S/m3	56.4	s/m	643.0	
Armor rock		ш ₂ /ип	49.3	s/m	70.5	S/m	3,475.7	
Concrete deck		m/cm	20.8	S/m3	440.0	S/m	9,152.0	
L-shaped wall	-	m/m	2.2	S/m3	440.0	S/m	968.0	
Crane beam		m³/m	%; %;	S/m	440.0	S/m	1,232.0	
Apron pavement		m²/m	19.3	S/m²	131.5	s/m	2,538.0	
Pile protection	FRP covering1.0 m	m³/m	14.88	S/m3	100.0	S/m	1,488.0	
Sheet	1 # 5 mm	m²/m	71.0	S/m²	20.0	s/m	1,420.0	
Fender		E/N	0.1	S/c	20,000.0	S/m	2,000.0	
Bollard		m/m	0.02	5/53	2,000.0	E/S	40.0	
Fittings, etc.	Misc. fittings, Utilities, Crane Rail		_	rs	1,600.0	s/m	0.009,1	
.*	Subtotal					S/m	64,084.4	
Construction Equipment	Boring fleet mobilization		0	rs.	810.0	E/S	•	
	Pile driving fleet mobilization		-	S	1,304.0	S/m	1,304.0	
	Pile Yard		_	27	400.0	s/m	400.0	
	Subtotal					s/m	1,704.0	
	Grand Total					S/m	65,788,4	

	ð	Quantity	ລັ	Unit Rate		Unit Cost				충	Quantity	5	Unit Rute	Š	Unit Cost	٠
S	Unit		Unic		Chrit			Works	Specifications	Chit		Chi		Unit		
						:		Open Structure Type	Vertical Pile Type							
	m/m	192.0	S/m3	7.56	S/m	1,451.5		Dredging and Replacing		m/m	192.0	\$/m3	7.56	S/m	1,451.5	
	m/m	0	Ě	1,084.0	E/S	0		Pile, Line-1, 2, 3, 4, 5	Preboring,	m/m	0	w/s	1,034.0	ct/S	0	
.6 1,=32.6		2.31	š	1,282.0	S/m	2,961.4	-	001,100	Material, Ø1,100 t=1.6 L=32.6	us.	14.11	\$	1,282.0	S/m	0.680.81	
	m/m	6.52	s/m	162.0	S/m	1,056.2			Driving	пуш	32.60	e S/m	198.0	S/m	6,454.8	
	m/m	0	S/m	1,084.0	S/m	0				m/m		S/m		m/S	-	
.3 L=32.6		5.00	š	1,282.0	S/m	6,410.0				Œ,		র্জ		S/m	-	
	EL/B	26.08	S/m	108.0	S/m	2,816.6				m/m	:	m/S		S/m		
3 1=33.8	£	7.78	\$	1,282.0	s/m	9,974.0		. —		щ,		5		E/S		
	m/m	40.6	e,	108.0	El/S	4,384.8				m/m		S/m		s/m/S		
.6 -L=32.1		1.52	Ķ	1,282.0	m/S	1,948.6		Crane foundation pile	Material, Ø900 t=1.6 L=32.1	æ	1.52	55	1,282.0	S/m	1,948.6	
	m/m	4.28	S/m/S	54.0	S/m	231.1			Driving	m/m	4.28	m/S	54.0	s/m/S	231.1	
	m/m	36.4	s/m²	65.0	S/m/S	2,366,0		Cathodic protection		m/zm	27.3	s/m²	65.0	S/m	1.774.5	
	m3/tm	237.1	S/m3	25.0	S/m	5.927.5		Selected fill		m³/m	237.1	s/m³	25.0	S/m	5.927.5	
	m/cm	11,4	s/m³	56.4	s/m	643.0		Rubble back-fill		m³/m	11,4	S/m3	56.4	ë	643.0	
	ul/cm	49.3	s/m	70.5	S/m	3,475.7		Armor rock		m³/m	49.3	\$/m3	70.5	Sfm	3,475.7	
	m ² /m	20.8	S/m ³	440.0	S/m	9,152.0		Concrete deck		m³/m	20.8	S/m3	440.0	e#S	9,152.0	
•	m/u	2.2	S/m³	440.0	S/m	0.896		L-shaped wall		m³/m	2.2	S/m3	440.0	EJ/S	0.896	
	m³/m	2.8	S/m³	440.0	S/m	1,232.0		Crane beam		m³/m	2.8	£ S	440.0	S/m	1,232.0	
	т ² /т	19.3	S/m²	131.5	W/S	2,538.0		Apron pavement		m²/m	19.3	S/m²	131.5	m/S	2,538.0	
ε	m²/m	14.88	S/m²	100.0	S/m	1,488.0		Pile protection	FRP covering ~ -1.0 m	m²/m	11.74	S/m²	100.0	E/S	1,174.0	
	m-m	71.0	S/m²	20.0	s/m	1,420.0		Sheet	t = 5 mm	m²/m	71.0	S/m²	20.0	s/m	1,420.0	
	E S	0.1	S/ca	20,000.0	S/m/S	2,000.0		Fender		m/rs	0.1	S/ca	20,000,0	S/m	2.000.0	
	u/m	0.02	5/2	2,000.0	m/s	40.0		Bollard		m/cs	0.02	2/5	2,000.0	£	40.0	
Crane Rail		_	S	1,600,0	s/m	1,600.0		Fittings, etc.	Misc. fittings, Utilities, Crane Rail		ы	្ប	1,600.0	S/m	1,600.0	
					S/m	64,084.4			Subtotal					E/S	60,119.7	
g.		0	S	810.0	s/m	0		Construction Equipment	Boring fleet mobilization		0	S	810.0	Ê	0	
zation		_	2	1,304.0	S/m	1,304.0			Pile driving fleet mobilization		-	្ដ	1,304.0	S/m/	1,304.0	
		_	្ត	400.0	S/m	400.0			Pile Yard		, <u>.</u>	3	280.0	S/m/S	280.0	
					s/m	1,704.0			Subtotal					S/m	1,584.0	
					S/m;	65,788.4			Grand Total					S/m	61,703.7	

TABLE UNITCOST STUDY SHEET WHARF -12.0 m SITE · T

UNIT COST STUDY SHEET

TABLE

WHARF

		ਨੋ	Quantity	כ	Unit Rate	٦	Unit Cost			
Works	Specifications	Chit		Unit		Chil			Works	Specif
Open Structure Type	Vertical Piles							Open Structure Type	ture Type	Batter Pile Type
Dredging		m,	0	S/m³	5.4	SF.	0	Dredging a	Dredging and Replacing	
Pile, Line - 1/2, Ø1,100 Preboring, Ø1,300	Preboring, Ø1,300	m/m	1.23	E/S	1,300.0	S/m	1,599.0	Pile, Line-1,		Ø500 Preboring.
	Material, Ø1,100 t=1.6 L=25.1	£	4.35	ঠ	1,282.0	E/S	5,576.7	•		Matcriat, Ø900
	Driving	m/m	10.02	m/s	198.0	S/m	1,987,9			Driving V
Pile, Line - 3/5, Ø1,100	Preboring	Æ	1.85	m/s	1,300.0	S/m	2,405	Pile, Line-	Pile, Line-2, 3, 4, 5 Ø600 Prebaring,	Prebaring
	Maicrial, Ø1,100 t=1.6 L=22.6	£	5.87	š	1,282.0	S/m	7,525.3			Material, 2600
	Driving	m/m	13.56	e/S	198.0	S/m	2,684.9			Driving V
		Ę		Š		S/m		Pile, Line-1, 2,		2600 Material, 2600
		m/m	-	Ě		S/m				Driving B
Crane foundation pile	Material, 0900 t=1.6 L=22.1	Ē	1.04	S	1,282.0	m/s	1,333.3	Crane foun	Crane foundation pile	Material, Ø900
.*	Driving	EQ.	2.95	E/S	54.0	e S	159,3			Driving
Cathodic protection.		m²/m	16.7	S/m²	65.0	S/m	1,085.5	Cathodic protection	rotection	
Selected fill		m/m	237.1	S/m³	25.0	Ę	5,927.5	Selected fill		
Rubble back-fill		m³m	11.4	ξE/S	56.4	E/S	643.0	Rubbic back-fill	ck-fill	
Armor rock		m³/m	49.3	S/m³	70.5	S/m	3,475.7	Armor rock		
Concrete deck		m/m	20.8	s/m³	440.0	Sm	9,152.0	Concrete deck	teck	
L-shaped wall		m³/m	2,2	S/m3	440.0	S/E	968.0	L-shaped wall	wal	٠
Crane beam	-	m³/m	2.8	S/m3	440.0	S,	1,232.0	Crane beam	E	
Apron pavement		m³/m	19.3	S/m²	131.5	S/m	2,538.0	Apron pavement	cment	
Pile protection	FRP covering1.0 m	m ² /m	11.74	S/m ²	100.0	S/m	1,174.0	Pile protection	tion	FRP covering
Sheet	1 = 5 mm	ու/²m	71.0	S/m ²	20.0	E/S	1,420.0	Sheet		1 = 5 mm
Fender	-	E	0.1	5/62	20,000.0	E/S	2,000.0	Fender		
Bollard		E W	0.05	S/ca	2,000.0	S/m/S	40.0	Bollard		
Fittings, etc.	Misc. fittings, Utilities, Crane Rail			S	1,600.0	S/H	1,600.0	Fittings, etc.	<u></u>	Misc. fittings, Ur
	Subional	•	-		-	S/m	54,527.1			Set
Construction Equipment	Boring fleet mobilization		_	S	1,265.0	S/m	1,265.0	Construction	Construction Equipment	Boring fleet mob
	Pile driving fleet mobilization		~	S	1,304.0	e/S	1 304.0			Pile driving fleet
	Pile Yard		_	ವ	280.0	S/m	280.0			Pile Yard
	Subtotal					s/m	2,849.0			Sut
	Grand Total					S/m	57,376.1			un 5

1,633.0. 2,961.4 1,056.2 6,410.0 1,948.6 2,366.0 6,367.5 643.0 3,292.4 9,152.0 0.896 1,232.0 2,538.0 1,488.0 1,520.0 2,000.0 1,600.0 64,624,8 1,304.0 400.0 1,704.0 2,818.8 9.974.0 4,384.8 231.1 66,328.8 Unit Cost Sfm E/S S/H Ę Ę ř u/S 1,084.0 7.56 1,282.0 162.0 1,282.0 0.801 108.0 1,282.0 65.0 56.4 70.5 440.0 440.0 131.5 100.0 20.0 1,304.0 400.0 1,084.0 1,282.0 25.0 440.0 1,600.0 54.0 20,000.0 2,000.0 810 Unit Rate 3 S/ca m/s Ę E/S E/S E/S S/m3 S/m/S , W, S/m³ 3/m/s S/m² រ រ រ 5 Z 35 Z/m 5 S/m) S/m3 S/m3 Ę È/S 2.31 6.52 5.00 7.78 1.52 4,28 14.88 0.02 4 5 26.1 36.4 46.7 20.8 89 19.3 216.0 m³/m 254.7 2.2 76.0 40.6 Quantity աչխո m³/m m3/m EL/ES C2/13 m3/m m/m m/m 11/4m m²/m m²/m 更 ш/ш Unit Ë щ/ш EV. Ē Ę Ę 00 t≈1.6 L=32.6 00 t=1.3 L=32.6 00 t=1.3 L=33.8 00 t=1.6 L=32.3 Utilities, Crane Rail et mobilization --1.0 m noitzilide Vertical Venical cifications and Total Batter nbtotal Subtout

TABLE UNIT COST STUDY SHEET WHARF .14.0 m SITE · C

UNIT COST STUDY SHEET

TABLE

SITE - T

-14.0 m

WHARF

Concrete deck I shaped wall Fittings, etc. 1 Selected fill Armor rock Crane beam Bollard Sheet Fender 1,304.0 1,584.0 2,538.0 1,174.0 280.0 23,755.5 1,781.0 9.152.0 1,232.0 1,520.0 2,000.0 1.633.0 6,454.8 1,948.6 231.1 6,347.5 643.0 3,292.4 968.0 40.0 1,600.0 66,310.9 67,894.9 Unit Cost S/m/ S/m S/m S/m S/m E/S Š EJ/S S/m SFI Ę E/S Ę Ę <u></u> Ę Ϋ́ S/m £ £ 1,304.0 7.56 1,084.0 1,282.0 2,000.0 1,600.0 280.0 440.0 131,5 20.0 810.0 1,282.0 440.0 440.0 100.0 20,000.0 Unit Rate S/EI3 S/62 ζw s/m S/m3 S/m) S/E/S S/m's S/m³ 2/K/S S/co S1 S1 š Š Ş S/m² S s/m ξ 5 š Š 0.02 4.28 11.74 18.53 0.97 0.1 27.4 46.7 19.3 32.6 253.9 11,4 C. 216.0 20.8 2.8 Quantity m²/m និ m²/m m²/m 11,411 11.7H ទី Ē m/m m/m ξ Ę Ē Ē Ø1,100 Material, Ø1,100 t=2.1 L=32.6 t=1.6 L=32.1 Misc. fittings, Utilities, Crane Rail Pile criving fleet mobilization FRP covering - -1.0 m Boring fleet mobilization Specifications Crand Total Subtotal Preboring, Ø1,300 Material, 6900 Vertical Pile Type Pile Yard Driving Driving Construction Equipment Dredging and Replacing Pile, Line-1, 2, 3, 4, 5 Crane foundation pile Open Structure Type Cathodic protection Works Apron pavement Rubble back-fill Pile protection L-shaped wall Concrete deck Fittings, etc. Armor rock Crane beam Selected fill Fender Bollard Sheet

1,232.0 1,174.0 1,520.0 1,600.0 65,576.9 1,265.0 1,304.0 2,849.0 2,860.0 10,973.9 2.981.9 9.152.0 2,538.0 2,000,0 40.0 6,589.5 1,782.0 1,333,3 159.3 1,675.1 5,772.5 643.0 3,292.4 968.0 4,290 Unit Cost S/m E/S S/m E/S S/m S/u E/S S, Š Š S E/S S/m S/m S/m <u>.</u> Š ΕŞ S/EJ S, S/m Ë 똤 £ 25.0 131.5 70.5 1,300.0 1,282.0 198.0 1,300.0 1,282.0 198.0 54.0 65.0 56.4 440.0 440.0 440.0 100.0 20.0 20,000.0 2,000.0 1,600.0 1,265.0 1,304.0 280.0 Unit Rate S/co Skm3 Z,₩, S/m2 žEX S 녎 Ķ S/m³ 2 2 2 S/m \$ 11.74 2.95 25.77 76.0 0.02 230.9 19.3 15.06 3,30 5.14 <u>3</u> 7.1 20.8 2:3 0.1 9.00 46.7 2.8 Quantity m³/m m₂/m m³/m E/,E E /E m³/m E/3 15 El/El Ę Ę Ę Ę Ę Ę Material, Ø1,100 t=2,1 L=22.6 Muterial, Ø1,100 t=2.1 L=25.1 Material, 29900 (=1.6 L=22.1) Misc. fittings, Utilities, Crane Rail Pile driving fleet mobilization FRP covering ~-1.0 m Boring fleet mobilization Specifications Grand Total Subtotal Pile, Line - 1/3. Ø1,100 Preboring, Ø1,300 Vertical Pile Type Pile Yard Pile, Line - 3/4, Ø1,100 Preboring Driving Driving Driving Construction Equipment Dredging and Replacing Crane foundation pile Open Structure Type Cathodic protection Works A pron pavement tubble back-fill Pile protection

TABLE UNIT COST STUDY SHEET WHARF -12.0 m SITE - C

m³/m m/m m/m m-/m m, m m³/m m²/m m/m m/m Ę, g E m, u m-/m m/m Ę Steel, @900 tm1.6 Lm22.1 etc 7.5 Misc. fittings, Utilities, Crane Rail Floating dock mobilization Specifications Floating dock operation Grand total Subtotal Hard/weathered rock Towing and setting + 1.0 - -14.0 + 3.3 - +1.0 Prefabrication = 5 mm Construction Equipment Dredging and Replacing Base rock mound Works Concrete capping Rubble back fill. Rubble back fill Apron pavensent Piles, material Caisson Type Fittings, etc. Head beam Crane beam Pile driving Sand fill Bollard Caisson Caisson Fender Sheet 48,872.9 3,023.0 2,520.0 1,232.0 5,391.5 2,000.0 40.0 1,600.0 8,389.5 60,285.4 2,467.5 1,020.0 962.0 1,948.6 1,451.5 17,864.0 829.4 6,610.1 263.2 231.1 Unit Cost S/m S/m S/m/S s/m S/m S/m Š Ę E/S Ę E/S S/m S/m E/S S/m e/S S/m E/S s/m/s E/S E/S S/m 440.0 7.56 2,000,0 70.5 1,600.0 3,023.0 300.0 330.0 47.0 282.0 20,000.0 8,389.5 50,400.0 9.6 56.4 20.0 440.0 54.0 131.5 Unit Rate S/m3 \$/60 S/m³ S/m³ š S S/m 2/6 S/m? S/A ្ន ទ Š S/m3 E/S Š, S/m3 È/S Ķ E/S 0.05 1.52 0.02 48 4.28 192.0 35.0 40.6 117,2 5.6 5 5 5 41.0 0.1 3.4 86.4 Quantity Ę m/m ca/m m³/m E (E m)/m m,/m 114/2m m²/m m³/m Ç. m²/m m/m Ę Œ, Sicel, @900 1=1.6 L=32.1 cic 7.5 Misc. fluings, Utilities, Crane Rail Floating dock mobilization Specifications Floating dock operation Grand total Subtotal Towing and sening + 1.0 - -14.0 + 3.3 ~ +1.0 Prefabrication ≖ 5 ໝກ Construction Equipment Dredging and Replacing Works Base rock mound Concrete capping Rubble back fill Rubble back fill Аргоп раустеп Piles, material Caisson Type Crare beam Head beam Pile driving Fittings etc. Sand fill Bollard Caisson Caisson Fender Sheer

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TABLE UNIT COST STUDY SHEET
WHARF -12.0 m SITE - T

2,862.3

m/s m/s

70.5

S/m³ S/m³

Sa

5.4

S/m²

Unit Cost

Unit Rate

Quantity

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2,520.0

S/m

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S/m³ S/m³

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TABLE UNIT COST STUDY SHEET WHARF -14,0 m SITE - C

Misc. fluings, Utilities, Crane Rail Steel, @900 t=1.6 L=32.1 ctc 7.5 Construction Equipment Floating dock mobilization Floating dock operation Grand total Specifications Subtom Towing and scuing + 1.0 - -14.0 + 3.3 - +1.0 Prefabrication t = 5 mm Dredging and Replacing Base rock mound Concrete cupping Works Apron payement Rubble back fill Rubble back fill Piles, material Caisson Type Pile driving Fittings, etc. Crane beam Head beam Sheet Sand fill Caisson Caisson Bollard Fender

UNIT COST STUDY SHEET -14.0 m SITE - T WHARF TABLE

ğ	Quantity	<u>י</u>	Unit Rate	ົ່ວ	Unit Cost		-		Ö	Quantity	ວັ	Unit Rate	ב	Unit Cost
Unit		Ž ⁱ ič		Guit			Works	Specifications	Unit		Unit		Unit	
							Caisson Type				:		:	
աֆիո		S/m³	7.56	S/m	1,633.0		Dredging	Hard/weathered rock	m³/m	0	S/m/s	4,0	S/m	0
m³/m	4.64	S/m/S	70.5	S/m	3,482.7		Base rock mound		m²/m	17.5	S/m/s	70.5	m/5	1,233.8
m³/m	48.2	S/m ²	440.0	u/S	21,208.0		Caisson	Prefabrication	m³/m	48.2	S/m3	440.0	S/m	21,208.0
m/g	0.05	3/5	50,400.0	s/m	2,520.0		Caisson	Towing and sening	m/co	0.05	2/62	50,400.0	Ě	2,520.0
m³/m	119.8	S/m³	9.6	Ę	1,150.1		Sand fill		m³/m	119.8	S/m	9,6	S/m	1,150,1
													<u> </u>	
m³/m	3.7	S/m3	300.0	s/m	1,110.0		Concrete capping		m³/m	3.7	\$/m	300.0	S/m	1,110.0
m/m	7,4	S/m/s	330.0	S/m	2,442.0		Head beam		m/m	7.4	S/m)	330.0	S/m	2,442.0
		•												
m³∕m	127.2	S/m³	56.4	S/m	7,174.1		Rubble back fill	+1.014.0	m³/m	127,2	S/m³	56.4	E/S	7,174.1
m ² /m	5.6	S/m ³	47.0	S/m	263.2		Rubble back fill	+ 3.3 ~ +1.0	m³/m	5.6	S/m²	47.0	s/m/s	263.2
m²/m	1.09	S/m²	20.0	S/m	1,202.0		Sheet	mm 2 = 1	m²/m	60.1	S/m ₂	20.0	¥	1,202.0
m³/m	2.8	S/m3	440.0	E/S	1,232.0		Crane beam		m³/m	2.8	S/m³	440.0	S/m	1,232.0
Ę	1.52	5	1,282.0	m/s	1.948.6		Pites, material	Steel, Ø900 t=1.6 L=22.1 ctc 7.5	Ę	8	55	1,282.0	E/S	1,333.3
m/m	4.28	S/m	54.0	S/m	231.1		Pile driving		EL/AL	2.95	s/m	54.0	s/m/s	159.3
m²/m	0.14	S/m²	131,5	e/S	5,391.5		Apron pavement		m²/m	41.0	S/m²	131.5	¥	5,391.5
m/m	0.1	S/ca	20,000.0	S/m	2,000.0		Fender		ev/m	0.1	S/8	20,000.0	Ř	2,000.0
m/cs	0.02		2,000.0	S/m/	40.0	•	Bollard		m/s	0.02	S/e	2,000.0	S/m/S	40.0
		S	1,600.0	E/S	1,600.0		Fittings, etc.	Misc. fittings, Utilities, Crane Rail			S.	1,600.0	E/S	1,600.0
				e/s	54,628.3			Subtotal					F/S	50,059.3
	-	្ន	3,023.0	S/m	3,023.0		Construction Equipment	Floating dock mobilization		4	rs	3,023.0	£	3,023.0
	-	S.	9,870.0	S/m	9,870.0			Floating dock operation			ន	9,870.0	s/m	9,8700
				S/m	12,893.0			Subtotal					S/m	12,893.0
				S/E	67,521.3			Grand total					S/m	62,952.3
												_		
						_								
						_	7.7.4.4							

TABLE UNIT COST STUDY SHEET WHARF .12.0 m SITE . C

UNIT COST STUDY SHEET

SITE - T

-12,0 m

WHARF

main body Construction Equipment Sheet Pile Wall Type joint Cathodic protection Concrete capping Works Apron pavement Rubble back fill Anchor capping Foot protection Pile, material Fittings, etc. Selected fill Сгале beam Pile driving Anchor pile Anchor pile Sheet Pile Tic-rope Sheet Pile. Sheet Pile Dredging Bollard Fender Walc 1,521.5 831.6 2,112.0 3,168.0 2,464.0 1,378.0 5,523.0 2,000.0 1,600.0 58,889.9 1,304.0 440,0 1,744.0 1,451.5 5,227.2 1,910.2 207.5 5,937.5 6,666.5 3,884.5 462.2 40.0 6'606'6 2,594.8 Unit Cost S/m E/S s/m S/m E/S S/m S/A E/S E/S £ S/E S/m/S S/H Ë ë Ş £, E/S E/S S. S/m S/m Ş SA S/m S/m Š 1,282.0 114.4 216.0 198.0 440.0 1,282.0 54.0 65.0 131.5 2,000.0 810.0 1,304.0 1,282.0 798.0 6,178.0 440.0 440,0 20,000,0 1,600.0 440.0 1,084.0 25.0 56.4 Unit Rate S/m's S/G Ş S/m S/m3 S/H S/m3 S/ii ŽĘ/S 3/2 S/m S, S/m 5 S 5 S/a S SSS ĸ 5 1.49 0.26 7.73 0.42 0.02 24.2 13.3 4 237.5 118.2 44 \$5 7.2 3.03 8.56 42.0 0.1 5.6 21.7 192.0 Ountity EI/E m'm m, m m³/m ž. m/m Ę m/m m/m Ę EI/EI m)tm E, E m²/m m2/m Ę Ę Material, Ø1,000 t=1.3 L=29.0 Steel pile, Ø900 t=1.6 L=25.2 Siect @900 t=1.6 L=32.1 ctc=7.5 Misc. fittings, Utilities, Crane Rail Pile driving fleet mobilization Boring fleet mobilization Specifications Grand Total Subtotal 36 ton, (2,117 mm²) Preboring, Ø1,200 + 1.0 -- -14.0 Coral and sand Front wall Pile Yard Daving Material Driving Construction Equipment main body Dredging and Replacing Shoot Pile Wall Type Cathodic protection joint Works Concrete capping Apron pavement Rubble back-fill Anchor capping Pule, material Fittings, etc. Crane beam Pite driving Anchor pile Archor pile Selected fill Sheet Pile Sheet Pite Sheet Pile Tie-rope Bollard Fender Wate

207.5 2,594.8 2,112.0 3,168.0 1,378.0 1,265.0 7,345.9 1,521.5 237.6 803.7 4,810.0 2,464.0 5,523.0 1,600.0 1,304.0 3,009.0 1,320,5 6,666.5 313.2 2,000.0 40.0 54,578.7 440.0 3,866.4 2,628.1 3,978 Unit Cost S/B S/m S. S/m Ę E/S Š S/m S/E Š E/S S S/m S/m E/S SF E/S Ş Š S/m S'E Sign Ę ES SE 2,000,0 1,304.0 0.009,1 1,265.0 440.0 798.0 6,178.0 440.0 440.0 1,282.0 20,000.0 1,300.0 1,282.0 114,4 216.0 1,282.0 198.0 56.4 440.0 70.5 Unit Rate S/m² S/m² 2/2 S/c3 S/m3 ŝ S/m3 S/EE/S ¿E/S Š S. S S S Chit S S/a Š Ê Sa \$ S 5 0.43 5.80 21.2 1.03 0.26 118.2 2.05 6 11.4 192,4 7.2 3.06 5.73 4 90 5.6 1.2 3.3 17.9 Quantity Ħ m, m m²m m/m E) (E) m³/m m²/m m-/m EL, EL Çrii ij E E EL/CE ξ Ē Ę Ę Material, Ø1,000 t=1.3 L=21.5 Steel pile, Ø900 t=1.3 L=17.4 Steel @900 t=1.6 L=17.4 ctc=6.0 Misc. fittings, Utilities, Crane Rail Pile driving fleet mobilization Boring fleet mobilization Specifications Grand Total Subtotal 86 ton, (2,117 mm²) Preboring, Ø1,200 Coral and sand + 1.0 --14.0 Pile Yard Front wall Driving Driving Material Rock

UNIT COST STUDY SHEET SITE . C -14.0 m WHARF TABLE

man body Construction Equipment Sheet Pile Wall Type oin. Cathodic protection Concrete capping Works Apron pavement Rubble back fill Anchor capping Pile, material Crane peam Pite driving Fittings, etc. Selected fill Anchor pile Anchor pile Sheet Pile Sheet Pile Sheet Pile Tic-rope Dredging Bollard Fender ¥24 5,523.0 1,600.0 1.304.0 1,744.0 1,716.0 1,232.0 3,168.0 2,464.0 3,884.5 1,378.0 2,000.0 40.0 440.0 68,094.8 3,205.0 1,633.0 13,627.7 5,486,4 1,405.8 207.5 7,560.0 6,666.5 464.4 66,350.8 3,089.0 0 Unit Cost EJ/\$ S/m S/m s/m S/m/S W/S s/m S/m Ę E/S S/m S/m E/S S/m S/m S/m S/m S/m S/m/S S/m/ E/S S/m Ē J. S/m/S E/S 6,178.0 65.0 131.5 1,600.0 1,304.0 440.0 1,282.0 798.0 1,282.0 54:0 1,084.0 144 216.0 1,282.0 198.0 25.0 56.4 440.0 440.0 20,000.0 2,000.0 440.0 830 Unit Rate S/m² EV/S s/m/s S/m) S/m³ E/S S/c:1 S/ca LS LS Unit S/m S/c: S/H/S S/m3 S/m LS S/m S/m E/S S 5 22 ž 0.02 10.63 2.50 0.26 0.50 3.03 21.2 42.0 .. 302.4 7.2 9.8 25.4 118.2 2.8 5.6 15.0 7.1 216.0 0 Quintity m³/m m²/m 育 E/C m³/m m³/m m³/m m)/m m²/m E E ΕŅΨ Ç. щ⁄ш Ę m/u m/m m/m ξ Ę Steel pile, Ø900 t=1.6 L=25.4 Matcrial, Ø1,000 t=1.7 L=30.5 Steel @900 tal.6 La32.1 ctc=7.5 Misc. fittings, Utilities, Crane Rail Pile driving fleet mobilization Boring fleet mobilization Specifications Srand Total Subtotal 86 ton, (2,117 mm²) Preboring, Ø1,200 + 1.0 - -14.0 Coral and sand Pile Yard Front wall Driving Mulcrin Oriving Construction Equipment wain body Dredging and Replacing Sheet Pile Wall Type ቪ Cuthodic protection Concrete capping Works Apron pavement Rubble back fill Anchor capping Crane beam Pile, material Fittings, etc. Selected fill Pile driving Sheet Pile Anchor pile Anchor pile Sheet Pile Sheet Pile Tic-rope Bollard Fender V.uc

2,112.0

440.0

2,772.0

440.0 440.0 1 287.0

H,CH

Front wall

6,666.5

E/S E/S SF. S/m Ş S/m S# Š ES

5,892.5

S/m

25.0 56.4

ξĘ/\$ s/m/S S/m3 \$/m3 S/m3

235.7

m/m

118.2 8 6.3

m³/m m³/m

+ 1.0 ~ -14.0 Coral and sand

3,089.0

S/m

6,178.0

798.0

Š 2/83

0.26 0.50

£ 5

86 ton, (2,117 mm²)

Ę, EJ/S

m/s

4.83

£

š

1.39

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Steel pile, Ø900 t=1.3 L=17.4

Driving

Driving Material

Ę,

20.0

S/m

15.0

ű/E m/m

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8.36

Material, @1,000 t=1.7 L=24.0

2,464.0

2,679.4

1,378.0 5,523.0 2,000.0 40.0 1,600.0 63,604.8 1,265.0 1,304.0

65.0 131.5

S/m² S/m²

21.2

m³/m

318.1

54.0

S/m/S

5.89

m/m

5

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Steel @900 t=1.6 L=22.1 ctc=7.5

5.6 5.09

m3/m

3,009.0

K

E/S

S/m Ę S/m

1,265.0 1,304,0 440.0

3 3 3

Pile driving fleet mobilization Boring fleet mobilization

Pile Yard

Grand Total

Suptoral

S/m S/m

2,000,0 0.009,1

0.02

S/ca LS

Misc. fittings, Utilities, Crane Rail

20,000.0

S/ca

0.1

42.0

m²/m th the

UNIT COST STUDY SHEET SITE - T -14,0 m WHARF TABLE

7,371.0

S/m E/S Z/m S/m

1,300.0 1,282.0 14.4 236.0 1,282,0 198.0

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5.67

m/m Ę

Preboring, Ø1,200

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ξĒ/S

m³/m

Unit Cost

Unit Rate

Outmitty

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Specifications

10,717.5

1,716.0 4,320.0 1,782.0 956.3 207.5

UNIT COST STUDY SHEET SITE - C -12.0 m WHARF TABLE

Steel, @900 t=1.6 L=22.1 ctc=7.5 | t/m Misc. fittings, Utilities, Crane Rail Transp. Tem. Storage and setting Floating crane mobilization Prefabrication and storage Specifications Grand Total Subtotal Block yard installation Subtotal Block yard operation + 3.3 ~ +1.0 + 1.0 - -14.0 1 = 5 mm Construction Equipment Concrete Block Type Finings, ac. Works Base rock mound Concrete blocks Concrete blocks Apron pavement Rubble back fill Rubble back fill Piles, material Crane beam Pile, driving Dredging Head beam Bollard Fender Shee 2,131.9 2,784.8 36 400.0 5,493.0 2,442.0 Unit Cost S/m S/m S/m Ę ä ξ 2.07 350.0 2,357.5 5.6.4 330,0 Unit Rate 133.6 S/m³ s/m² 3 S/m3 S 2 S/m 0.50 2.33 39.5 282.0 τ, Quantity m/c my,cu m²/m m³/m ž m/co Transp. Tem. Storage and setting Prefabrication and storage Specifications Dredging and replacing Concrete Block Type Base rock mound Concrete blocks Concrete blocks Rubble back fill Head beam

UNIT COST STUDY SHEET -12.0 m SITE - T WHARF TABLE

3,482.7 36,400.0 5,493.0

£, £ E/S

70.5 350.0 2,357.5

S/m³

49.4

S/m3

0.50

m³/T 田,和 m³/m

3

2.33

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E/S

5.4

Unit Cost

Unit Rate

Quantity

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2,442.0

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330.0

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4.

m3/m

7,535.0 263.2 1,760.0 1,232.0 1,333.3 159.3

ĘŞ E/S

56.4

S/m/S

133.6

m/m: m/m m,tu m⁵m

£

20.0 440.0 1,282.0

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20,000,0

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2,000.0 1,600.0

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m in in

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£,

2,805.0

Stm. S/m

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1,109.0

5,274.0 74,406.0

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69,132.0

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	Kutoole back IIII	0.41 0.1 +	ř.	m/m 133.6 5/m ²	E/A	56.4	Š	7.535.0	
	Rubble back fill	+ 3.3 - +1.0		5.6	s/m²	47.0	S/m	263.2	
2	Sheet	mm 2 = 1	un ² /m	98.0	.m/\$	20.0	S/rrı	1,760.0	
-30	Crane beam		m³/m	2.8	S/m3	440.0	S/m	1.232.0	
1.4	Piles, material	Sicel. @900 t=1.6 t=32.1 ctc=7.5	Ē	1.52	ž	1,282.0	s/m/s	1,948.6	
	Pile, driving		m/m	4.28	S/m	54.0	¥,	231.1	
					,				
	Apron pavement		m²/m	41.0	S/m²	131.5	s/m	5.195,2	
	Fender	-	ធ/ធ	0,1	5/63	20,000,02	Sm	2,000.0	
	Rollard		E/G	0.02	5/63	2,000.0	E/S	40.0	
	Fittings, etc.	Misc. fittings, Utilities, Crane Rail			্র	1,600.0	s/m	0.009,1	
		Subtorat		••		·	S/m	71,253.1	
	Construction Equipment	Block yard installation	-		3	2,805.0	S/m	2,805.0	
		Block yard operation		-1	S.	1,360.0	s/m	1,360.0	
		Floating crane mobilization			Z.	1,109.0	S/m	1,109.0	
		Subtomi					E/S	5,274.0	
		Grand Total					S,	76,527.1	
			-						
					_				
					•				

TABLE UNIT COST STUDY SHEET
WHARF -14.0 m SITE - C

UNIT COST STUDY SHEET

TABLE

-14.0 m SITE - T

WHARF

		å	Quantity	ວັ	Unit Rate	ວັ	Unit Cost		
Works	Specifications	Unit		Crit		Cnit		-	Works
Concrete Block Type		m m	246.0	,	7,	ω _ν ς.	8 050 +		Concrete Block T.
Base rock mound		m, m	70.5	S/m3	70.5	S/m	4.970.3		Base rock mount
Concrete blocks	Prefabrication and storage	m/m	129.6	s/m/s	350.0	w/s	45,360.0		Concrete blocks
Concrete blocks	Trunsp. Tem. Storage and setting	Ę	2.67	5/63	2,357.5	s/m	6,294.5		Concrete blocks
Head beam		m)/m	7.4	S/m³	330.0	S/m	2,442.0		Head beam
Rubbie back fill	+ 1.0 ~ -14.0	m³/m	162.7	S/m3	56.4	S/m	9,176.3		Rubble back fill
Rubble back fill	+ 3.3 - +1.0	m ^t m	5.6	S/m/s	47.0	EKS.	263.2		Rubble back fill
Sheet	1 = 5 mm	m³/m	\$6.5	S/m²	20.0	E/S	1,730.0		Sheet
Crane beam		m/m	2.8	S/m3	440.0	¥	1,232.0		Crane beam
Piles, material	Steel, Ø900 t=1.6 L=32.1 ctc=7.5	Ē	1.52	š	1,282.0	£,	1,948.6		Piles, material
Pile, driving		щуш	4.28	S/m	54.0	S/tn	231.1		Pile, driving
		1	;	ĵ	ţ	i			
Apron payement		u.	 ⊇:	ie i	3.5	Ę	5,195,5		Apron pavement
Fender		m/s	0.1	3/8	20,000.0	S/m	2,000.0		Fender
Bollard		E/S	0.02	S/ca	2,000.0	s/m	70.0		Bollard
Fittings, etc.	Misc. filtings, Utilides, Crane Rail		-	Si	0.009,1	s/m/s	0'009'1		Fittings, etc.
	Subtoul					S/m	84,539.0		
Construction Equipment	Block yard installation			S	3,300.0	S/m	3,300.0		Construction Eq
	Block yard operation			រ	1,600.0	S/m	1,600.0		
	Floating crane mobilization			IJ	1,109.0	S/m	1,109.0		
AM A WATER	Subtout					S/m	6,009.0		
	Grand Total					S/m	90,548.3		

40.0 1,600.0 3,300.0 1,109.0 1,445,3 45,360.0 6,294.5 2,442.0 9,176.3 263.2 1,730.0 1,232.0 2,679.4 159.3 5,391.5 2,000.0 79,813.5 6,009.0 85,822.5 Unit Cost S/m S/m Ę 똤 .5.5 EL/\$ £//S #\$ #\$ #\$ #\$ E/S Z. E/S Ę E/S S/E 20,000.0 2,000.0 1,600.0 5.4 350.0 2,357.5 47.0 20.0 440.0 1,282.0 54.0 131.5 1,600.0 1,109.0 330.0 56.4 3,300.0 Unit Rate S/G S/G LS S/m² S/m³ S/m3 ,E/S S/m² S/m3 S/m³ S/EE/S 2 2 3 \$ Ę Unit 2,09 0.02 86.5 2.8 2.67 5.6 2.95 20.5 129.6 41.0 4, Quantity e a m³/m m³m m²/m ту/ш ım²/m m³/m m/ss m³/m Ę Š Steel, Ø900 t=1.6 L=22.1 ctc=7.5 Misc. fittings, Utilities, Crane Rail Transp. Tem. Storage and setting Floating crane mobilization Prefabrication and storage Grand Total Specifications Sublocal Block yard installation Subtotal Block yard operation + 1.0 ~ -14.0 + 3.3 ~ +1.0 m = 2 mm quipment eplacing 1,7pc



