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Appendix III-3.1 Basic Cost Data

Table 1 Estimated Combined Cost

| | | Unit: US Dollar | |
|---------------------|---|-----------------|-----------|
| Works | Specifications | Unit | Unit Cost |
| 1. Site Clearance | | ha | — |
| 2. Dredging | With disposal 7 km (1,000,000 m ³) | m ³ | 3.00 |
| 3. Dredging | (10,000 m ³) | m ³ | 5.00 |
| 4. Reclamation | 20 km Handling (1,000,000 m ³) | m ³ | 3.00 |
| 5. Reclamation | On-land material | m ³ | 5.00 |
| 6. Excavation | With fill | m ³ | 10.00 |
| 7. Rock Works | Riprapping | m ³ | 85.00 |
| 8. Crushed Rocks | | m ³ | 50.00 |
| 9. Sub-Base | For basement | m ³ | 45.00 |
| 10. C. Pavement | 25 cm thick | m ² | 50.00 |
| 11. Side Walk | Concrete block | m ² | 10.00 |
| 12. Fence | Steel h = 2.1 m | m | 65.00 |
| 13. Reinforced C. | With R-Bar and form | m ³ | 200.00 |
| 14. Office Building | (Administration) | m ² | 400.00 |
| 15. Storage | (CFS) | m ² | 325.00 |

Source: PSO

Table 2 Minimum Salary and Wage in the Market

Unit: US Dollar/Hour

| Category | Contractor Market | |
|----------|-------------------------|------|
| A | Carpenter | 1.00 |
| C | Electrician | 1.00 |
| D | Plumber | 1.00 |
| E | Painter | 1.00 |
| G-1 | Survey Chief | 2.00 |
| G-2 | Chairman | 1.50 |
| H-1 | Concrete Mix (Operator) | 1.40 |
| H-2 | Winch Man | 1.40 |
| H-5 | Derrick Crane | 1.60 |
| H-6 | Heavy Machine | 2.00 |
| I-1 | Driver Truck | 1.75 |
| I-2 | Driver Vehicle | 1.35 |
| J | Mechanic | 1.60 |
| L | Framer (site) | 2.00 |
| M | Welder (site) | 3.20 |
| N | Plumber | 2.80 |
| O | Welder (shop) | 1.80 |
| P | Framer (shop) | 1.25 |

Source: PSO

Note :

"Contractor" means actual market rate.

Table 3 Typical Material Cost (before Overheads)

Unit: US Dollar

| Material | Specification | Unit | Real Material Cost |
|---------------|---------------|----------------|--------------------|
| 1. Cement | Gris, 50 kg | sack | 1.25 |
| 2. Sand | 280 km Carry | m ³ | 10.0 |
| 3. Concrete | Premixed | m ³ | 32.0 |
| 4. Steel | Grade 40 | ton | - |
| 5. Metal | Corrugated | foot | - |
| 6. Local Wood | For form work | m ³ | 175 |
| 7. Gasoline | 87 Octane | gl | 0.25 |

Source: PSO

Note: Cement in bulk, 12,000 Ris/t
Transport 40,000 Ris/t

Table 4 Material Cost (Steel and Pile)
(before overheads)

Unit: US Dollar

| No. | Materials | Dec. 1993 | Aug. 1994 | Rate for Estimation | | |
|-----|----------------------|----------------|-------------|-------------------------|---|--------------|
| 1. | Steel pile | 114,000 y/t | 114,000 y/t | x 0.85 + 100 | = | 969.0 \$/t |
| 2. | Steel sheet pile | 102,000 y/t | 102,000 y/t | | = | 867.0 \$/t |
| 3. | H shaped | | | | | |
| | H300 x 300 x 10 x 15 | 39,000 y/t | 35,000 y/t | 37,000 x 0.85 + 100 | = | 314.5 \$/t |
| 4. | L300 x 90 x 9 | 64,000 y/t | 44,000 y/t | 54,000 x 0.85 + 100 | = | 459.0 \$/t |
| 5. | L100 x 100 x 10 | 55,000 y/t | 46,000 y/t | 50,000 " | = | 425.0 \$/t |
| 6. | Concrete pile (PC) | | | | | |
| | 300 x 60 x 10 m | 46,300 | 46,300 | 46,300 x 0.7 + 100 + 10 | = | 32.4 \$/m |
| | 400 x 65 x 10 m | 71,400 | 71,400 | 71,400 " | = | 50.0 \$/m |
| | 500 x 80 x 10 m | 101,000 | 101,000 | 101,000 " | = | 70.7 \$/m |
| | 600 x 90 x 10 m | 139,000 | 139,000 | 139,000 " | = | 97.3 \$/m |
| | 700 x 95 x 10 m | | 189,000 | 189,000 " | = | 132.3 \$/m |
| | 800 x 100 x 10 m | | 255,000 | 255,000 " | = | 178.5 \$/m |
| 7. | Concrete pile (RC) | | | | | |
| | 300 x 60 x 10 m | 29,100 | 29,100 | x 0.7 + 100 + 10 | = | 20.4 \$/m |
| | 400 x 70 x 10 m | 36,200 | 36,200 | " | = | 25.3 \$/m |
| | 500 x 80 x 10 m | | 50,000 | " | = | 35.0 \$/m |
| 8. | Tie-rod | | | | | |
| | Ø90 | 10 m x 4,240 m | | | | 2,685 |
| | | 315,900 | 315,900 | x 0.85 + 100 | = | 2,585 \$/set |

Source: Monthly Construction Material Index published by the Construction Material Cost Survey Institute of Japan.

Note: These are data for reference in preparation of import material and special materials costs.

Necessary adjustment to get real cost is carried out by the Study Team. Exchange rate: One US Dollar equals 100 Japanese Yen.

Table 5 Equipment Cost (1/2), Rental Hour

| | | Unit: US Dollar |
|---------------------------|---------------------------------------|-----------------|
| Type | Specifications | Unit Rate |
| <u>Land Equipment</u> | | |
| 1. Bulldozer | Caterpillar - D5 | 25.00 (30.00) |
| | Caterpillar - D8, 45A | 45.00 (50.00) |
| | Caterpillar - D 9G | 60.00 (75.00) |
| | Ripper - D65 | 35.00 |
| 2. Motor Trailer | Caterpillar - 621, 21 yd ³ | 45.00 |
| 3. Excavator | HC 90 | 48.00 |
| | Excavator 0.60 m ³ | 45.00 |
| 4. Truck | 8 yd ³ | 7.50 |
| | Truck 14 yd ³ | 32.00 |
| 5. Compressor | 170 P.C.M. | 13.5 (15.00) |
| 6. Truck Crane | 20 ton | 50.00 (65.00) |
| 7. Trailer Head | 15 m ³ | 50.00 |
| 8. Grader | Cat 8T - 9K | 23.00 |
| <u>Floating Equipment</u> | | |
| 1. Dredger | Grab, 0.5 yd ³ | (not known yet) |
| | Grab, 1.0 yd ³ | - |
| | Grab, 3.0 yd ³ | - |
| 2. Dredger | Pump, 1,000 HP | - |
| | Pump, 5,000 Ph | - |
| 3. Floating Crane | 100 ton | - |
| | 500 ton | - |
| 4. Barge | 200 ton | - |
| 5. Pile Driving | Flect, | - |

Source: PSO

Table 6 Equipment Cost (2/2) (Miscellaneous)

Unit: US Dollar

| Equipment | Monthly | Weekly | Daily |
|---------------------------|---------|--------|-------|
| a. Air Hammer | 200.00 | 45.00 | 8.00 |
| b. Flat Lander | 650.0 | 200.00 | 38.00 |
| c. Surfacing Machine | 650.0 | 200.00 | 38.00 |
| d. Vibro Compactor | 420.0 | 125.0 | 20.00 |
| e. Floor Polisher | 480.0 | 125.0 | 20.00 |
| f. Steel Cutter | 175.0 | 50.00 | - |
| g. Wood Saw | 140.0 | 45.00 | - |
| h. Electric Vibrator | 350.0 | 105.00 | 18.00 |
| i. Gasoline Vibrator | 480.0 | 125.00 | 20.00 |
| j. Electric Hammer | 420.0 | 125.00 | 20.00 |
| k. Welding Machine | 700.0 | 200.00 | 30.00 |
| l. Oxyacetylene Equipment | 45.00 | 15.00 | - |
| m. Pump (Honda) 2" | 350.00 | 100.00 | 16.00 |

Appendix III-3.2 Unit Cost Study Sheet
 «Imam Khomeini Port»

(1)

| Works | Specification | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labor (US\$) | M(%) P(%) L(%) |
|------------------------|-------------------|----------|------------------|---------------------|---|----------------------|
| A.General items | | | | | | |
| Mobilization | Const. Machines | | | 500,000 | 0- 450,000- 50,000 | 0-90-10 |
| | Dredgers | | | 1,625,000 | 0- 1,462,500- 162,500 | 0-90-10 |
| | | | Sub-total | 2,125,000 | 0- 1,912,500- 212,500 | 0-90-10 |
| Site installation | Common Temp. Work | | B 500,000 | B 500,000 | 300,000- 100,000- 100,000 | 60-20- 20 |
| Management | | | B 1,500,000 | B 1,500,000 | 0- 0- 1,500,000 | 0-0-100 |
| Site Clearance | | | B 250,000 | B 250,000 | 0- 225,000- 25,000 | 0-90-10 |
| Miscellaneous | | | B 125,000 | B 125,000 | 75,000- 25,000- 25,000 | 60-20- 20 |
| | | | Sub-Total | 2,375,000 | 375,000- 350,000- 1,650,000 | 16-15- 69 |
| | | | Total | B 4,500,000 | 375,000- 2,262,500- 1,862,500 | 8-50-42 |
| B.Marine works | | | | | | |
| Seabed clearance | Wreck Survey | ha/B 7.5 | ha 1,000 | B 7,500 | 0- 0- 7,500 | 0-0-100 |
| | Wreck Survey | ea/B 0.3 | ea 20,000 | B 6,000 | 300- 4,200- 1,500 | 5-70-25 |
| | | | Sub-Total | B13,500 | 4,000- 56,000- 41,000 | 4-55-41 |
| Ordging/reclam | (1) Normal Soil | | | m ³ 3.00 | 0.15- 2.70- 0.15 | 5-90-5 |
| | (2)Hard Soil | | | m ³ 6.00 | 0.30- 5.40- 0.30 | 5-90-5 |
| | (3)Rock | | | m ³ 48.0 | 2.40- 43.20- 2.40 | 5-90-5 |

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| Works | Specification | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labo (US\$) | M (%) P (%) L (%) |
|-------------------|--------------------|-----|----------------|----------------------|--|-------------------------|
| Dredging/Disposal | 1 Normal Soil | | | m ³ 4.00 | 0.20-3.60-0.20 | 5-90-5 |
| | 2 Hard soil | | | m ³ 7.00 | 0.35-6.30-0.35 | 5-90-5 |
| Borrow/Reclam | | | | m ³ 6.70 | 0.25-4.50-0.25 | 5-90-5 |
| Caisson Wharf | | | | | | |
| Dredging/Replace | | | | m ³ 10.70 | 0.54-9.60-0.54 | 5-90-5 |
| Base Rock Mound | | | | m ³ 70.70 | 35.5-17.6-17.6 | 50-25-25 |
| Caisson | Prefabrication | | | m ³ 319.2 | 188-54-77.2 | 59-17-24 |
| Caisson | Towing/ Setting | | | ea 45,000 | 2,250-38,250- 4,500 | 5-85-10 |
| | | | | | | |
| Sand Fill | | | | m ³ 9.60 | 4.80-2.40-2.40 | 50-25-25 |
| | | | | | | |
| Concrete Cap | | | | m ³ 173.0 | 104-29-40 | 60-17-23 |
| Head Beam | | | | m ³ 319.2 | 188-54-77.2 | 59-17-24 |
| | | | | | | |
| Rubble Backfill | +1.0- -14.0 m | | | m ³ 56.6 | 35.2-10.7-10.7 | 62-19-19 |
| | +3.3- +1.0 m | | | m ³ 56.6 | 42-9.6-5 | 75-17-8 |
| Sheet | t = 5 mm | | | m ³ 14.0 | 9.8-0.7-3.5 | 70-5-25 |
| Crane Beam | | | | m ³ 319.2 | 146-51-122.2 | 61-16-23 |
| Pile Material | Steel d900 x 16 | | | t 1,282.0 | 1,089.7-128.2- 64.1 | 85-10-5 |
| Pile Driving | | | | m 54.0 | 2.7-40.5-10.8 | 5-75-20 |
| Apron Pavement | Conc t = 0.3 m | | | m ³ 122.0 | 70.8-23.2-28.0 | 58-19-23 |

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| Works | Specifica-tion (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labor (US\$) | M(%) P(%) L(%)Rem |
|----------------|--------------------|-----------|------------------|----------------|---|-------------------------|
| Fender | | | | ea 20,000 | 18,600- 1,000- 400 | 93-5-2 |
| Bollard | | | | ea 2,000 | 1,500- 200- 300 | 75-10- 15 |
| Fittings | Misc fit util cr | | | LS 1,600 | 1,200- 120- 240 | 75-10- 15 |
| | | | | | | |
| Const.Equip | Fl.Dock Mobil | | | LS 3,023 | 0- 2,721- 302 | 0-90-10 |
| | Fl.Dock Oper | | | LS 9,870 | 493- 8,884- 493 | 5-90-5 |
| | | | | | | |
| | | | | | | |
| Seawall | + 4.0~0.0m | | | | | |
| Concrete Wall | | m3/m 1.6 | m3 266.0 | m 426 | 251- 72- 103 | 59-17- 24 |
| Concrete Apron | t = 0.25m | m2/m 10.0 | m2 96.8 | m 968 | 542- 194- 232 | 56-20- 24 |
| Crushed Rock | | m3/m 7.0 | m3 66.5 | m 466 | 326- 70- 70 | 70-15- 15 |
| Sheet | | m2/m 3.4 | m2 14.0 | m 48 | 33.6- 2.4- 12.0 | 70-5-25 |
| Armor Rock | + 2.0~ +1.0m | m3/m 4.6 | m3 56.6 | m 260 | 195- 44- 21 | 75-17-8 |
| | | | Sub-Total | m 2,168 | 1,348- 382- 438 | 62-18- 20 |
| | | | | | | |
| Seawall | + 0.0~ -5.0m | | | | | |
| Seawall | + 4.0~ + 0.0m | | | m 2,168 | 1,348- 382- 438 | 62-18- 20 |
| Armor Rock | + 1.0~ -3.6m | m3/m 12.4 | m3 113.1 | m 136 | 68- 34- 34 | 50-25- 25 |
| Second Layer | | m3/m 20.0 | m3 56.6 | m 1,132 | 702- 215- 215 | 62-19- 19 |
| Sheet | | m2/m 17.3 | m2 14.0 | m 243 | 170- 12- 61 | 70-5-19 |
| | | | Sub-Total | m 3,679 | 2,288- 643- 748 | 62- 18- 20 |

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| Works | Specifica- tion (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labor (US\$) | M(%) P(%) L(%)Rem |
|--------------|---------------------------|-----------|------------------|----------------|---|-------------------------|
| Seawall | -5.0~-10.0m | | | | | |
| Seawall | +0.0~-5.0m | | | m 3,679 | 2,288- 643- 748 | 62- 18- 20 |
| Armor Rock | -3.6~-8.6m | m3/m 13.4 | m3 113.1 | m 1,516 | 758- 379- 379 | 50-25- 25 |
| Second Layer | | m3/m 22.0 | m3 56.6 | m 1,245 | 771- 237- 237 | 62-19- 19 |
| Sheet | | m2/m 14.7 | m2 14.0 | m 206 | 144- 10- 52 | 70-5-25 |
| Misc. | | m3/m 20.0 | m3 15.0 | m 300 | 150- 75- 75 | 50-25- 25 |
| | | | Sub-total | m 6,946 | 4,11- 1,344- 1,491 | 59-19- 22 |
| | | | | | | |
| Seawall | - 10.0~ -15.0m | | | | | |
| Seawall | -5.0~-10.0m | | | m 6,945 | 4,111- 1,344- 1,491 | 59-19- 22 |
| Armor Rock | -8.6~-14.0m | m3/m 24.3 | m3 113.1 | m 2,748 | 1,374- 687- 687 | 50-25- 25 |
| Second Layer | | m3/m 77.0 | m3 56.6 | m 4,358 | 2,702- 828- 828 | 62-19- 19 |
| Sheet | | m2/m 17.1 | m2 14.0 | m 239 | 167- 12- 60 | 70-5-25 |
| Misc. | | m3/m 32.4 | m3 15.0 | m 486 | 242- 122- 122 | 50-25- 25 |
| | | | Sub-Total | m 14,777 | 8,596- 2,993- 3,188 | 59-20- 21 |
| | | | | | | |
| | | | | | | |
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| Works | Specifica- tion (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labor (US\$) | M(%) P(%) L(%)Rem |
|-------------------|---------------------------|------------|-----------------|----------------|---|-------------------------|
| C-Orland | | | | | | |
| Pavement 1 light | | | | | | |
| | Subgrade CBR > 10 | | | m2 4.0 | 0- 3.0- 1.0 | 0-75-25 |
| | Subbase t=0.3m | m3/m2 0.3 | m3 59.9 | m2 18.0 | 10.8- 4.5- 2.7 | 60-25-15 |
| | Crushrock t=0.2m | m3/m2 0.2 | m3 66.5 | m2 13.3 | 8.0- 3.3- 2.0 | 60-25-15 |
| | Curb | m/m2 0.1 | m 46.0 | m2 4.6 | 3.2- 0.2- 1.2 | 70-5-25 |
| | | | Subtotal | m2 39.9 | 22.0- 11.0- 6.9 | 55- 28- 17 |
| Pavement 2 Normal | Asphalt | | | | | |
| | Subgrade CBR > 7 | | | m2 4.0 | 0- 3.0- 1.0 | 0-75-25 |
| | Subbase t=0.5m | m3/m2 0.5 | m3 59.9 | m2 30.0 | 18.0- 7.5- 4.5 | 60-25-15 |
| | Asphalt t=0.1m | m3/m2 0.1 | m3 294.0 | m2 29.4 | 19.1- 5.9- 4.4 | 65-20-15 |
| | Curb | m/m2 0.05 | m 46.0 | m2 2.3 | 1.6- 0.1- 0.6 | 70-5-25 |
| | Road sign/paint | | | m2 2.0 | 1.0- 0.5- 0.5 | 50-25-25 |
| | | | Subtotal | m2 67.7 | 39.7- 17.0- 11.0 | 60-24-16 |
| Pavement 2 Normal | Concrete | | | | | |
| | Subgrade CBR > 5 | | | m2 5.0 | 0- 4.0- 1.0 | 0-80-20 |
| | Subbase t=0.35m | m3/m2 0.35 | m3 59.9 | m2 21.0 | 12.6- 5.3- 3.1 | 60-25-15 |
| | Re Con t=0.25m | m3/m2 0.25 | m3 266.0 | m2 66.5 | 39.2- 11.3- 16.0 | 59-17-24 |
| | Curb | m/m2 0.05 | m 46.0 | m2 2.3 | 1.6- 0.1- 0.6 | 70-5-25 |
| | Road Sign/Paint | | | m2 2.0 | 1.0- 0.5- 0.5 | 50-25-25 |
| | | | Subtotal | m2 96.8 | 54.4- 21.2- 21.2 | 56-22-14 |
| | | | | | | |

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| Works | Specification (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labor (US\$) | M(%) P(%) L(%)Rem |
|------------------|-------------------|------------|---------------------|----------------|---|-------------------------|
| Pavement 2 Norm | Interlock | | | | | |
| | Subgrade CBR7 | | | m2 4.0 | 0-3.0-1.0 | 0-75-25 |
| | Subgrade t=0.5m | m3/m2 0.5 | m ³ 59.9 | m2 30.0 | 18.0-7.5-4.5 | 60-25-15 |
| | Re Coat=0.12m | m3/m2 0.12 | m3 266.0 | m2 31.9 | 19.1-6.4-6.4 | 60-20-20 |
| | Curb | m/m2 0.05 | m3 46.0 | m2 2.3 | 1.6-0.1-0.6 | 70-5-25 |
| | Road Sign/Paint | | | m2 2.0 | 1.0-0.5-0.5 | 50-25-25 |
| | | | Subtotal | m2 70.2 | 39.7-17.5-13.0 | 56-24-20 |
| Pavement 3 Heavy | Concrete | | | | | |
| | Subgrade CBR>5 | | | m2 4.0 | 0-3.0-1.0 | 0-75-25 |
| | Subbase t=0.45m | m3/m2 0.45 | m3 59.9 | m2 27.0 | 17.4-6.8-2.8 | 60-25-15 |
| | Concrete t=0.3m | m3/m2 0.30 | m3 266.0 | m2 79.8 | 47.1-13.6-19.1 | 59-17-24 |
| | Curb | m/m2 0.05 | m 184.0 | m2 9.2 | 6.0-0.5-2.7 | 65-5-30 |
| | Road sign/paint | | | m2 2.0 | 1.0-0.5-0.5 | 50-25-25 |
| | | | Subtotal | m2 122.0 | 71.5-24.4-26.1 | 59-20-21 |
| Pavement 4 Heavy | Concrete | | | | | |
| | Subgrade CBR>5 | | | m2 4.0 | 0-3.0-1.0 | 0-75-25 |
| | Subbase t=0.5m | m3/m2 0.50 | m3 59.9 | m2 30.0 | 18.0-7.5-4.5 | 60-25-15 |
| | Re Coat=0.35m | m3/m2 0.35 | m3 266.0 | m2 93.1 | 54.9-15.8-22.4 | 59-17-24 |
| | Curb | m/m2 0.05 | m 184.0 | m2 9.2 | 6.0-0.5-2.7 | 65-5-30 |
| | Road Sign/Paint | | | m2 2.0 | 1.0-0.5-0.5 | 50-25-25 |
| | | | Subtotal | m2 138.3 | 79.9-27.3-31.1 | 58-20-22 |

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| Works | Specification (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labor (US\$) | M(%) P(%) L(%)Rem |
|---------------------|----------------------|-------------|------------------|----------------|---|-------------------------|
| Pavement5 Heavy | Concrete | | | | | |
| | Subgrade CBR > 5 | | | m2 4.0 | 0 3.0 1.0 | 0-75-25 |
| | Subbase t=0.3m | m3/m2 0.30 | m3 59.9 | m2 18.0 | 10.8- 4.5- 2.7 | 60-25-15 |
| | Re Con t=1.20m | m3/m2 1.20 | m3 266.0 | m2 319.2 | 188.3- 54.3- 76.6 | 59-17-24 |
| | | | Sub-Total | m2 341.2 | 199.1- 61.8- 80.3 | 58- 18-24 |
| | | | | | | |
| Stormwater Drain | Re Con Pipe d32" | m/ha 170.0 | m 133.0 | ha 22,610 | 14,697- 4,522- 3,391 | 65-20-15 |
| | Earth Work | m3/ha 578.0 | m3 13.3 | ha 7,687 | 3,075- 3,075- 1,537 | 40-40-20 |
| | Manhole | ea/ha 2 | ea 2,100 | ha 4,200 | 2,310- 830- 1,260 | 55-15-30 |
| | Miscellan- eous | | | ha 1,503 | 751- 376- 376 | 50-25-25 |
| | | | Sub-total | ha 36,000 | 20,833- 8,603- 6,564 | 58-24-18 |
| | | | | | | |
| Flyover | Superstruc- ture | | | m2 1,700 | 935- 340- 425 | 55-20-25 |
| | Substructure | | | m2 800 | 440- 160- 200 | 55-20-25 |
| | | | Sub-total | m2 2,500 | 1,375- 500- 625 | 55-20-25 |
| | | | | | | |
| Soil Improvement | Paper Drain | | | | | |
| | Drain | m/m2 50.0 | m 0.8 | m2 40.0 | 8.0- 28.0- 4.0 | 20-70-10 |
| | Sand Mat t=0.1m | m/m2 1.0 | m 7.0 | m2 7.0 | 3.5- 2.8- 0.7 | 50-40-10 |
| | Earth Load t=3.0m | m3/m2 3.0 | m3 3.5 | m2 10.5 | 4.2- 5.3- 1.0 | 40-50-10 |
| | Miscellan- eous | | | m2 5.0 | 2.6- 1.2- 1.2 | 50-20-20 |
| | | | Sub-Total | m2 62.5 | 18.3- 37.3- 6.9 | 29- 60-11 |

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| Works | Specification (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labor (US\$) | M(%) P(%) L(%)Rem |
|---------------|--------------------|-----|----------------|----------------|---|-------------------------|
| D. Building | | | | | | |
| Main Gate | Steel Open Strc | | | m2 345.8 | 225- 35- 85.8 | 65-10-25 |
| | Power/ Lighting | | | m2 50.0 | 32.5- 2.5- 15.0 | 65-5-30 |
| | Water Supply | | | m2 10.0 | 6.5- 0.5- 3.0 | 65-5-30 |
| | Furniture | | | m2 2.0 | 1.8- 0- 0.2 | 90-0-10 |
| | Equipment | | | m2 5.0 | 4.5- 0- 0.5 | 90-0-10 |
| | | | Sub-Total | m2 412.8 | 270.3- 38.0- 104.5 | 65-9-26 |
| | | | | | | |
| Control House | Conc.struc. 2story | | | m2 532.0 | 345.8- 53- 133.2 | 65-10-25 |
| | Power/Lighti ng | | | m2 100.0 | 65- 5- 30 | 65-5-30 |
| | Water Supply | | | m2 20.0 | 13- 1- 6 | 65-5-30 |
| | Furniture | | | m2 20.0 | 18.0- 0- 2.0 | 90-0-10 |
| | Equipment | | | m2 50.0 | 45.0 0 5.0 | 90-0-10 |
| | | | Sub-Total | m2 722.0 | 486.8- 59.0- 176.2 | 67-8-25 |
| | | | | | | |
| Maintenance | Steel Frame | | | m2 475.5 | 332.9- 47.6- 95.0 | 70-10-20 |
| | Power/ Lighting | | | m2 100.0 | 65- 5- 30 | 65-5-30 |
| | Water Supply | | | m2 20.0 | 13.0- 1.0- 6.0 | 65-5-30 |
| | Furniture | | | m2 2.0 | 1.8- 0- 0.2 | 90-0-10 |
| | Equipment | | | m2 150.0 | 121.5- 0- 28.5 | 90-0-10 |
| | | | Sub-Total | m2 747.5 | 534.2- 53.6- 159.7 | 71-7-22 |
| | | | | | | |

(9)

| Works | Specification (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labor (US\$) | M(%) P(%) L(%)Rem |
|----------------------------|-------------------|-----|----------------|----------------|---|-------------------------|
| CFS, Transit Shed, W.house | Steel Frame | | | m2 432.3 | 302.6- 43.2- 86.5 | 70-10-20 |
| | Power/lighting | | | m2 80.0 | 52.0- 4.0- 24.0 | 65-5-30 |
| | Water Supply | | | m2 10.0 | 6.5- 0.5- 3.0 | 65-5-30 |
| | Furniture | | | m2 1.0 | 0.9- 0- 0.1 | 90-0-10 |
| | Equipment | | | m2 5.0 | 4.5- 0- 0.5 | 90-0-10 |
| | | | Sub-Total | m2 528.3 | 366.5- 47.7- 114.1 | 69-9-22 |
| Control House | Conc Structure | | | m2 478.8 | 311- 47.8- 120 | 65-10-25 |
| | Power/Lighting | | | m2 80.0 | 52.0- 4.0- 24.0 | 65-5-30 |
| | Water Supply | | | m2 20.0 | 13.0- 1.0- 6.0 | 65-5-30 |
| | Furniture | | | m2 2.0 | 1.8- 0- 0.2 | 90-0-10 |
| | Equipment | | | m2 --- | | |
| | | | Sub-Total | m2 580.8 | 377.8- 52.8- 150.2 | 65-9-26 |
| | | | | | ----- | --- |
| Power House | Conc Structure | | | m2 478.8 | 311- 47.8- 120 | 65-10-25 |
| | Power/Lighting | | | m2 80.0 | 52.0- 4.0- 24.0 | 65-5-30 |
| | Water Supply | | | m2 20.0 | 13.0- 1.0- 6.0 | 65-5-30 |
| | Furniture | | | m2 2.0 | 1.8- 0- 0.2 | 90-0-10 |
| | Equipment | | | m2 --- | ----- | --- |
| | | | Sub-Total | m2 580.8 | 377.8- 52.8- 150.2 | 65-9-26 |

(10)

| Works | Specification (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labor (US\$) | M(%) P(%) L(%)Rem |
|----------------|-------------------|-------------|----------------|----------------|---|-------------------------|
| Misc. Building | Conc/Conc Block | | | m2 372.4 | 242.0- 37.2- 93.2 | 65-10-25 |
| | Power/Lighting | | | m2 50.0 | 32.5 2.5 15.0 | 65-5-30 |
| | Water Supply | | | m2 20.0 | 13.0 1.0 6.0 | 65-5-30 |
| | Furniture | | | m2 --- | --- | --- |
| | Equipment | | | m2 --- | --- | --- |
| | | | Sub-Total | m2 442.4 | 287.5- 40.7- 114.2 | 65-9-26 |
| Weigh Bridge | Conc Structure | m3/set 35.0 | m3 266.0 | set 9,310 | 6,517- 466- 2,327 | 70-5-25 |
| | Foundation Piles | | | set 5,600 | 3,360- 1,400- 840 | 60-25-15 |
| | Earth Work | m3/set 70.0 | m3 13.3 | set 931 | 372- 372- 187 | 40-40-20 |
| | Power/Lighting | | | set 700 | 630- 0- 70 | 90-0-10 |
| | Water Supply | | | set 500 | 325- 25- 150 | 65-5-30 |
| | Equipment | | | set 40,000 | 38,400- 800- 800 | 96-2-2 |
| | | | Sub-Total | set 57,041 | 49,604- 3,063- 3,474 | 84- 5- 11 |
| Gate | Steel B=10m | t/set 1.0 | t 2,250 | set 2,250 | 1,688- 113- 449 | 75-5-20 |
| Fence | Steel H=2.1m | | | m 86.5 | 69.2- 4.3- 13.0 | 80-5-15 |
| | Foundation Conc | m3/m 0.1 | m3 199.5 | m 20.0 | 10.0- 4.0- 6.0 | 50-20-30 |
| | | | Sub-Total | m 106.5 | 79.2- 8.3- 19.0 | 74- 8- 21 |

(11)

| Works | Specifica- tion (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labor (US\$) | M(%) P(%) L(%)Rem |
|------------------------------|---------------------------|-----------|----------------|----------------|---|-------------------------|
| Landscaping | Grading/ Lawn | | | m2 6.0 | 3.0- 0.6- 2.4 | 50-10- 40 |
| | Ground Prepr. | m3/m2 0.3 | m3 18.0 | m2 5.4 | 3.5- 0.5- 1.4 | 65-10- 25 |
| | | | Sub-Total | m2 11.4 | 6.5- 1.1- 3.8 | 57-10- 33 |
| | | | | | | |
| Landscaping | Plant | | | m2 20.0 | 13.0- 2.0- 5.0 | 65-10- 25 |
| | Ground Prepr. | m3/m2 0.5 | m3 30.0 | m2 15.0 | 9.8- 1.5- 3.7 | 65-10- 25 |
| | | | Sub-Total | m2 35.0 | 22.8- 3.5- 8.7 | 65-10- 25 |
| | | | | | | |
| | | | | | | |
| K.Utillities | | | | | | |
| Water Supply Main | Connection Fee | | | B 4,000 | 0- 0- 4,000 | 0-0- 1000 |
| | Connection Main d12" | m/B 300 | m 97.5 | B 29,250 | 20,475- 2,925- 5,850 | 70-10- 20 |
| | Undergr. Rcv. Tank | m3/B 30 | m3 332.5 | B 9,975 | 6,484- 998- 2,493 | 65-10- 25 |
| | Press. Tank w/Pump | set/B 0.4 | set50,000 | B 20,000 | 17,000- 1,000- 2,000 | 85-5-10 |
| | | | Sub-Total | B 63,225 | 43,959- 4,923- 14,343 | 70- 8- 22 |
| | | | | | | |
| Water Supply Distribution | Dist.Pipe d10" | m/ha 120 | m 74.75 | ha 8,970 | 6,279- 897- 1,794 | 70-10- 20 |
| | Earth Work | m3/ha 130 | m3 13.3 | ha 1,729 | 692- 692- 345 | 40-40- 20 |
| | Fittings | | | ha 2,880 | 2,016- 288- 576 | 70-10- 20 |
| | | | Sub-Total | ha 13,579 | 8,987- 1,877- 2,715 | 66-14- 20 |
| | | | | | | |
| | | | | | | |

(12)

| Works | Specification (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labor (US\$) | M(%) P(%) L(%)Rem |
|---------------|-----------------------|------------|----------------|----------------|---|-------------------------|
| Fire Fighting | Hydrant/ Hoses | ea/ha 1 | ea 1,500 | ha 1,500 | 1,125- 75- 300 | 75-5-20 |
| | | | | | | |
| Sewerage | Septic Tank 20m3 | set/ha 0.1 | set 20,000 | ha 2,000 | 1,300- 200- 500 | 65-10- 25 |
| | Collect.Pipe d8" | m/ha 10.0 | m 40.0 | ha 400 | 280- 20- 100 | 70-5-25 |
| | Effluent Pipe d12" | m/ha 3.0 | m 70.0 | ha 210 | 147- 11- 52 | 70-5-25 |
| | Earth Work | m3/ha 15.0 | m3 13.5 | ha 203 | 81- 81- 41 | 40-40- 20 |
| | | | Sub-Total | ha 2,813 | 1,808- 312- 693 | 64-11- 25 |
| | | | | | | |
| Power Supply | Connection | set/B 1 | set 20,000 | B 20,000 | 0- 0- 20,000 | 0-0-100 |
| | Ductbank (concr) | m/B 750 | m 210 | B 157,500 | 110,250- 15,750- 31,500 | 70-10- 20 |
| | Manholes | ea/B 10 | ea 4,900 | B 49,000 | 26,950- 7,350- 14,700 | 55-15- 30 |
| | Cables | m/B 10,000 | m 10.5 | B 105,000 | 73,500- 5,250- 26,250 | 70-5-25 |
| | Misc. | | | B 21,000 | 14,700- 1,050- 5,250 | 70-5-25 |
| | | | Sub-Total | B 352,500 | 225,400- 29,400- 97,700 | 64-8-28 |
| Power Plant | Panel | set/B 0.33 | set130,000 | B 42,900 | 38,610- 1,287- 3,003 | 90-3-7 |
| | Stdby.Gener 600KVA | set/B 1 | set130,000 | B 130,000 | 117,000- 6,500- 6,500 | 70-5-25 |
| | Misc. | | | B 10,000 | 7,000- 500- 2,500 | 70- 5- 25 |
| | | | Sub-Total | B 182,900 | 162,610- 8,287- 12,003 | 89- 5- 6 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

(13)

| Works | Specification (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Material (US\$) Plant (US\$) Labor (US\$) | M(%) P(%) L(%)Rem |
|----------------|-------------------|------------|----------------|----------------|---|-------------------------|
| Power to Crane | Collect Feed 5kv | m/B 100 | m 850 | B 85,000 | 72,250- 4,250- 8,500 | 85-5-10 |
| | Trolley | set/B 0.67 | set 100,000 | B 67,000 | 56,900- 3,350- 6,700 | 85-5-10 |
| | | | Sub-Total | B 152,000 | 129,200- 7,600- 15,200 | 85-5-10 |
| | | | | | | |
| Lighting (1) | High Pole Light | ea/B 4 | ea 28,000 | B 112,000 | 78,400- 16,800- 16,800 | 70-15- 15 |
| | | | | | | |
| Lighting (2) | Road | | | ha 24,000 | 16,800 2,400 4,800 | 70-10- 20 |
| | | | | | | |
| Telecom. | | | | ha 4,000 | 2,800 200 1,000 | 70-5-25 |
| | | | | | | |
| Refer System | Reefer points | ea/B 33 | ea 1,000 | B 33,000 | 28,050- 1,650- 3,300 | 85-5-10 |
| | | | | | | |
| Bunker System | 2 lines d10" | t/m 0.3 | t 2,000 | m 600 | 360 90 150 | 60-15- 25 |
| | Fitting/ Pump | | Sub-Total | m 400 | 300 40 60 | 75-10- 15 |
| | | | | m 1,000 | 660 130 210 | 66-13- 21 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

(14)

| Works | Specification (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Remarks |
|-------------------|-------------------|-----|----------------|--------------------|------------------------------------|
| F. Basic Material | | | | | |
| Steel Pipe Pile | | | | | |
| Material | Steel | | | t 969.0 | $Y114,000 \times 0.85/100 = 969.0$ |
| Transport | | | | t 100.0 | |
| Allowance | | | | t 53.5 | $(969 + 100) \times 0.05 = 53.5$ |
| | | | Sub-Total | t 1,122.5 | |
| Overhead | 5 % | | | t 65.1 | |
| | | | Total | t 1,178.6 | |
| Driving Marine | d = 1,000 | | | m 152.0 ~ 228.0 | |
| | d = 900 | | | m 137.0 ~ 205.5 | |
| | d = 800 | | | m 122.0 ~ 183.0 | |
| | d = 700 | | | m 106.0 ~ 159.0 | |
| | d = 600 | | | m 91.0 ~ 136.5 | |
| | d = 500 | | | m 76.0 ~ 114.0 | |
| Driving Land | d = 1,000 | | | m 60.0 ~ 90.0 | |
| | d = 900 | | | m 54.0 ~ 81.0 | |
| | d = 800 | | | m 48.0 ~ 72.0 | |
| | d = 700 | | | m 42.0 ~ 63.0 | |
| | d = 600 | | | m 36.0 ~ 54.0 | |
| | d = 500 | | | m 30.0 ~ 45.0 | |

(15),

| Works | Specification (m) | Qty | Unit Rate (\$) | Unit Cost (\$) | Remarks |
|----------------------|-------------------|----------|----------------|----------------|---|
| Steel Pipe Joint | | | | | |
| Material | | t/m 0.04 | t 1,500 | m 60.0 | |
| Transport | | t/m 0.04 | t 100 | m 4.0 | |
| Allowance | | | | m 3.2 | $(60.0 + 4.0) \times 0.05 = 3.2$ |
| | | | Sub-Total | m 67.2 | |
| Overhead | 5 % | | | m 3.4 | |
| | | | Total | m 70.6 | |
| H300 x 300 x 10 x 15 | 94.5 kg/m | | | t 314.5 | $\text{¥}37,000 \times 0.85 + 100 = 314.5$ |
| 300 x 10 x 10 | 38.1 kg/m | | | t 459.0 | $\text{¥}54,000 \times 0.85 + 100 = 459.0$ |
| L100 x 100 x 10 | 14.9 kg/m | | | t 425.0 | $\text{¥}50,000 \times 0.85 + 100 = 425.0$ |
| Average Material | | | | t 399.5 | |
| Transport | | | | t 100.0 | |
| Overhead | 5 % | | | t 25.0 | |
| | | | Total | t 524.5 | |
| Tie Rod | 90 ton | | | ea 2,685.0 | $\text{¥}315,900 \times 0.85 + 100 = 2,685$ |
| Overhead | 5 % | | | ea 934.3 | |
| | | | Total | ea 2,819.3 | |

Appendix III-3.2 Additional Data

(16)

| Works | Specification | Qty | Unit Rate | | Unit Cost | | Material Plant Labor | | | Share | | | | | | |
|--|---------------------------|-------------------|-----------|----------------|-----------|-----------------------|----------------------|------------|------------|------------|-------|----|-----|----|----|----|
| | | | | (\$) | | (\$) | | (\$) | | M | P (%) | L | | | | |
| Bridges (Road) | (50 m x 20 m) | | | | | | | | | | | | | | | |
| | Steel | t | 600 | | 7,500 | | 4,500,000 | 675,000 | 2,025,000 | 1,800,000 | 15 | 45 | 40 | | | |
| | Super Str. | m ² | 1,000 | | 50 | | 50,000 | 30,000 | 5,000 | 15,000 | 60 | 10 | 30 | | | |
| | Foundation | t | 140 | | 2,000 | | 280,000 | 140,000 | 112,000 | 28,000 | 50 | 40 | 10 | | | |
| | Abutment | m ³ | 300 | | 600 | | 180,000 | 63,000 | 72,000 | 45,000 | 35 | 40 | 25 | | | |
| | Others | | | | | | 89,000 | 62,300 | 8,900 | 17,800 | 70 | 10 | 20 | | | |
| | | | | | | 5,099,000 | 970,300 | 2,222,900 | 1,905,800 | 19 | 44 | 37 | | | | |
| | | m ² | | | | 5,100 | | | | | | | | | | |
| Bridges (Road) | (500 m x 20 m) | | | | | | | | | | | | | | | |
| | Steel | t | 7,500 | | 10,000 | | 75,000,000 | 9,000,000 | 36,000,000 | 30,000,000 | 12 | 48 | 40 | | | |
| | Super Str. | m ² | 10,000 | | 50 | | 500,000 | 300,000 | 50,000 | 150,000 | 60 | 10 | 30 | | | |
| | Foundation | t | 700 | | 2,000 | | 1,400,000 | 700,000 | 560,000 | 140,000 | 50 | 40 | 10 | | | |
| | Abutment | m ³ | 1,500 | | 600 | | 900,000 | 315,000 | 360,000 | 225,000 | 35 | 40 | 25 | | | |
| | Tower | t | 3,000 | | 5,000 | | 15,000,000 | 1,800,000 | 7,200,000 | 6,000,000 | 12 | 48 | 40 | | | |
| | Anchor | m ³ | 10,000 | | 400 | | 4,000,000 | 1,400,000 | 1,600,000 | 1,000,000 | 35 | 40 | 25 | | | |
| | Others | | | | | | 3,200,000 | 2,240,000 | 320,000 | 640,000 | 70 | 10 | 20 | | | |
| | | | | | | 100,000,000 | 15,755,000 | 46,090,000 | 38,155,000 | 16 | 46 | 38 | | | | |
| | | | | | | m ² 10,000 | | | | | | | | | | |
| Utility Main Water Supply Station (Center) | Connection Fee | | | | | | 20,000 | 0 | 0 | 20,000 | 0 | 0 | 100 | | | |
| | Connection Main d12" | m/p | 4,500 | m | 97.5 | p | 438,750 | 307,125 | 43,875 | 87,750 | 70 | 10 | 20 | | | |
| | Underground Rec. Tank (1) | m ³ /p | 300 | m ³ | 333 | p | 99,900 | 64,935 | 9,990 | 24,975 | 65 | 10 | 25 | | | |
| | Underground Rec. Tank (2) | m ³ /p | 600 | m ³ | 333 | p | 199,800 | 129,870 | 19,980 | 49,950 | 65 | 10 | 25 | | | |
| | Press, Tanks w/Pumps (1) | set/p | 4 | set | 50,000 | p | 200,000 | 170,000 | 10,000 | 20,000 | 85 | 5 | 10 | | | |
| | Press, Tanks w/Pumps (2) | set/p | 4 | set | 50,000 | p | 200,000 | 170,000 | 70,000 | 20,000 | 85 | 5 | 10 | | | |
| | | | | | | p | 1,158,450 | 841,930 | 93,845 | 222,675 | 73 | 8 | 19 | | | |
| Main to Areas | Main d12" | | | m | 98 | | | m | 69 | m | 10 | m | 19 | 70 | 10 | 20 |
| Power Supply | Connection | set/p | 1 | set | 40,000 | p | 40,000 | 0 | 0 | 40,000 | 0 | 0 | 100 | | | |
| | Duct bank | m/p | 4,500 | m | 105 | p | 472,500 | 330,750 | 47,250 | 94,500 | 70 | 10 | 20 | | | |
| | Cables | m/p | 4,500 | | 50 | p | 225,000 | 157,500 | 11,250 | 56,250 | 70 | 5 | 25 | | | |
| | Equipment | | | | | p | 200,000 | 160,000 | 20,000 | 20,000 | 80 | 10 | 10 | | | |
| | | | | | | p | 937,500 | 648,250 | 78,500 | 210,750 | | | | | | |
| Main Cables | | | | m | 50 | | | m | 35 | m | 5 | m | 10 | 70 | 10 | 20 |
| Bunker Mains | 3 lines d12" | t/m | 0.6 | t | 2,000 | m | 1,200 | 720 | 180 | 300 | 60 | 15 | 25 | | | |
| | Fitting/Pump | | | | | m | 400 | 300 | 40 | 60 | 75 | 10 | 15 | | | |
| | | | | | | m | 1,600 | 1,020 | 220 | 360 | 64 | 14 | 22 | | | |

Appendix III-3.3 Structure Alternatives and Cost Estimates (-14m wharf)

A. Open Structure

1. Piles

$$\begin{aligned} & \text{Ø800 prestressed concrete pile, L = 35.0 m} \\ & (15 \text{ piles}) \times 35.0 \text{ m} + 5.0 \text{ m} = 105.0 \text{ m} \end{aligned}$$

For crane foundation

$$2 \text{ piles} \times 35.0 \text{ m} + 5.0 \text{ m} = 14.0 \text{ m}$$

2. Relieving Piles

$$\begin{aligned} & \text{Ø500 concrete pile, L = 12.5 m} \\ & 4 \text{ piles} \times 12.5 \text{ m} + 3.5 \text{ m} = 14.3 \text{ piles/m} \end{aligned}$$

3. Front Structure

3-1. Service Tunnel

$$\begin{aligned} & 3.50 \times 4.25 - 2.50 \times 2.75 + 5.45 \times 0.5 + 0.4 \times 0.7 \\ & = 14.9 - 6.9 + 2.7 + 0.3 = 11.0 \text{ m}^3 \end{aligned}$$

3-2. Parapet Wall

$$3.25 \times 0.65 \times 3.5 \div 15.0 = 0.5 \text{ m}^3$$

3-3. Support Wall

$$8.5 \times 6.25 \times 0.5 \times 2 \div 15.0 = 3.5 \text{ m}^3$$

$$\text{Total} = 15.0 \text{ m}^3$$

4. Rear Structure

$$10.2 \times 0.5 + 1.90 \times 1.00 \times 1/2 = 6.1 \text{ m}^3$$

5. Pile Capping

5-1. Pile Capping (Single Piles)

$$1.4 \times 1.4 \times 0.7 \times 10 \text{ piles} + 5.0 \text{ m} = 2.7 \text{ m}^3$$

5-2. Capping Beam

$$(4.26 \times 1.10 \times 0.9 + 6.40 \times 1.40 \times 0.7) \div 5.0 \text{ m} \\ = (4.2 + 6.3) \div 5.0 \text{ m} = 2.1 \text{ m}^3$$

$$\text{Total} = 4.8 \text{ m}^3$$

6. Riprapping

$$24.0 \times 1.25 \text{ m} = 30.0 \text{ m}^3$$

7. Slab and Beam, Cast in Situ

7-1. Slab

$$(40.5 + 2 \times 4.0) \times 0.15 = 7.2 \text{ m}^3$$

7-2. Beam

$$\{(40.5 + 2 \times 4.0) \times 0.75 \times 0.40 + (5.0 - 0.40) \times 0.4 \times 11 \text{ piles} \times 0.75\} \\ \div 5.0 \text{ m} = (14.6 + 15.2) \div 5.0 \text{ m} = 6.0 \text{ m}^3$$

$$\text{Total} = 13.2 \text{ m}^3$$

8. Concrete for Relieving Piles

$$2.0 \times 2.0 \times 0.4 \times 4 \div 3.5 \text{ m} = 1.8 \text{ m}^3$$

9. Timber Fender

$$0.40 \text{ m} \times 0.4 \text{ m} \times 3 \text{ sets} = 0.5 \text{ m}^3$$

10. Precast Deck Element (Type-C)

$$(3.60 \times 4.60 \times 0.75 - 3.80 \times 2.60 \times 0.5) \times 10 \div 5.0 \text{ m} \\ = (12.4 - 4.9) \times 10 \div 5.0 \text{ M} = 15.0 \text{ m}^3$$

$$\text{unit weight } 7.5 \times 2.45 \text{ t/m}^3 = 18.4 \text{ ton}$$

11. Crane Beam Additional

$$1.0 \times 1.0 = 1.0 \text{ m}^3$$

(1) Container Berth

Unit Cost Study Sheet (1/4), Wharf -14.0m: Open Structure Type
Container Berth

| Works | Specifications | Quantity | | Unit Rate | | Unit Cost | |
|----------------------------|--|-------------------|-------|-------------------|--------|-----------|----------|
| | | Unit | | Unit | | Unit | |
| <u>Open structure type</u> | Vertical type | | | | | | |
| dredging | | m ³ /m | 100.0 | \$/m ³ | 4.00 | \$/m | 400.0 |
| pile | | | | \$/m | | | |
| | Material, Ø800 | m/m | 105.0 | \$/m | 178.5 | \$/m | 18,742.5 |
| | PC. L = 35.0 m | | | | | | |
| | driving | m/m | 105.0 | \$/m | 82.3 | \$/m | 8,641.5 |
| Relieving piles | Ø500 concrete, | m/m | 14.3 | \$/m | 35.0 | \$/m | 500.5 |
| | L = 12.5 m | | | | | | |
| | Driving | m/m | 14.3 | \$/m | 30.0 | \$/m | 429.0 |
| Crane foundation pile | Material, Ø800 | m/m | 14.0 | \$/m | 178.5 | \$/m | 2,499.0 |
| | PC. L = 35.0 m | | | | | | |
| | Driving | m/m | 14.0 | \$/m | 122.0 | \$/m | 1,708.0 |
| Slope protection | | m ³ /m | 30.0 | \$/m ³ | 113.1 | \$/m | 3,393.0 |
| Front structure | | m ³ /m | 15.0 | \$/m ³ | 319.2 | \$/m | 4,788.0 |
| Rear structure | | m ³ /m | 6.1 | \$/m ³ | 319.2 | \$/m | 1,947.1 |
| Pile capping | | m ³ /m | 4.8 | \$/m ³ | 319.2 | \$/m | 1,532.2 |
| Pile capping | for relieving p. | m ³ /m | 1.8 | \$/m ³ | 319.2 | \$/m | 574.6 |
| Slab | Precast element | m ³ /m | 15.0 | \$/m ³ | 271.3 | \$/m | 4,069.5 |
| Slab element | setting | ea/m | 2.20 | \$/ea | 300.0 | \$/m | 660.0 |
| Slab in situ | | m ³ /m | 13.2 | \$/m ³ | 319.2 | \$/m | 4,213.4 |
| Crane beam | | m ³ /m | 1.0 | \$/m ³ | 319.2 | \$/m | 319.2 |
| Apron pavement | | m ² /m | 0 | \$/m ² | 122.0 | \$/m | 0 |
| Fender | | ea/m | 0.1 | \$/ea | 20,000 | \$/m | 2,000.0 |
| Bollard | | ea/m | 0.04 | \$/ea | 2,000 | \$/m | 80.0 |
| Fittings, etc. | Misc. fittings, Utilities, Crane Rail | | | LS | 160 | \$/m | 160 |
| | Subtotal | | | | | \$/m | 56,637.5 |
| Construction eqmmt. | Pile driving | | | LS | | \$/m | 946.0 |
| | fleet mobilization | | | | | | |
| | Pile yard | | | LS | | \$/m | 785.0 |
| | Precast yard | | | LS | | \$/m | 516.7 |
| | Yard operation | | | LS | | \$/m | 814.3 |
| | Subtotal | | | | | \$/m | 3,062.0 |
| | Grand Total | | | | | \$/m | 59,699.5 |

B. Concrete Caisson Wall Type

1. Dredging and Replacement by Sand

$$(50.0 + 18.0) \times 6 - 1/2 \times (21 + 28.2) \times 3 = 334 \text{ m}^3$$

2. Rubble Base

$$1/2 \times (21 + 28.2) \times 3 = 74 \text{ m}^3$$

3. Concrete Caisson

Width 15 m, Depth 15 m, Height 18 m

$$\text{Total} = 1,100 \text{ m}^3$$

$$1,100 \div 15 = 73.3 \text{ m}^3$$

Towing and Setting each 15 m

$$12 \times 20 \times 15 = 3,600 \text{ m}^3$$

$$\text{Concrete } 48.2 \times 20 = 964 \text{ m}^3$$

$$964 \text{ m}^3 \div 3,600 \text{ m}^3 = 0.268$$

$$15 \times 15 \times 18 = 4,050 \text{ m}^3$$

$$4,050 \times 0.27 = 1,094 \text{ m}^3$$

4. Concrete Capping

$$(15 - 1.2)^2 \times 0.6 \div 15 = 114.3 \div 15 = 7.6 \text{ m}^3$$

5. Sand Fill in Caisson Box

$$(15 \times 15 \times 18 - 1,100 - 7.6) \div 15 = 196 \text{ m}^3$$

6. Rubble Fills

$$1/2 \times (2 + 4.4) \times 2.0 + 1/2 \times (2.0 + 11.6) \times 8.0 + 1/2 \times (4.0 + 16.0) \times 10.0 = 3.2 + 54.4 + 100.0 = 157.6 \text{ m}^3$$

7. Sheet

$$3 + 7 = 10 \text{ m}^2$$

8. Head Beam, RC

$$2 \times 1.2 \times 3.35 + (3.6 - 2 \times 1.2) \times 0.6 + 0.6 \times 2.0$$
$$= 8.04 + 5.18 + 1.20 = 14.42 \text{ m}$$

9. Crane Beam, Steel Pile

Ø900 mm t = 16 mm L = 33.5 m etc 7.2 m W = 355 kg/m

$$0.355 \times 33.5 \div 7.2 = 1.65 \text{ t}$$
$$\text{Driving, } 33.5 \div 7.2 = 4.6 \text{ m}^3$$

10. R.C. Crane Beam

$$2.20 \times 1.60 = 3.52 \text{ m}^3$$

11. Apron Pavement, Concrete t = 30 cm

$$60.0 - (3.6 + 1.6) = 54.8 \text{ m}^3$$

12. Fender

Type _____ each 10 m

13. Bollard

_____ ton each 25 m

Unit Cost Study Sheet (2/4), Wharf -14.0m: Caisson Type

| Works | Specifications | Quantity | | Unit Rate | | Unit Cost | |
|----------------------|--|-------------------|--------|-------------------|----------|-----------|----------|
| | | Unit | | Unit | | Unit | |
| <u>Caisson type</u> | | | | | | | |
| Dredging & replacing | | m ³ /m | 334 | \$/m ³ | 10.7 | \$/m | 3,573.8 |
| Base rock mound | | m ³ /m | 74 | \$/m ³ | 70.0 | \$/m | 5,231.8 |
| Caisson | Prefabrication | m ³ /m | 73.3 | \$/m ³ | 319.2 | \$/m | 23,397.4 |
| Caisson | Towing & setting | ea/m | 0.0667 | \$/ea | 45,000.0 | \$/m | 3,001.5 |
| Sand fill | | m ³ /m | 196 | \$/m ³ | 9.6 | \$/m | 1,881.6 |
| Concrete capping | | m ³ /m | 7.6 | \$/m ³ | 173.0 | \$/m | 1,314.8 |
| Head beam | | m ³ /m | 14.42 | \$/m ³ | 319.2 | \$/m | 4,602.9 |
| Rubble back fill | +6.0m ~ -14.0m | m ³ /m | 157.6 | \$/m ³ | 56.6 | \$/m | 8,920.2 |
| Sheet | t=5mm | m ² /m | 10 | \$/m ² | 14.0 | \$/m | 140.0 |
| Crane beam | | m ³ /m | 3.52 | \$/m ³ | 319.2 | \$/m | 1,123.6 |
| Piles, material | Steel, Ø900 t=1.6cm L=33.5m etc 7.2m | t/m | 1.65 | \$/t | 1,178.5 | \$/m | 1,944.5 |
| Pile driving (land) | | m/m | 4.6 | \$/m | 54.0 | \$/m | 248.4 |
| Apron pavement | | m ² /m | 54.8 | \$/m ² | 96.8 | \$/m | 5,304.6 |
| Fender | | ea/m | 0.10 | \$/ea | 20,000 | \$/m | 2,000.0 |
| Bollard | | ea/m | 0.04 | \$/ea | 2,000 | \$/m | 80.0 |
| Fittings, etc. | Misc. fittings, Utilities, Crane rail | | 1 | LS | 200 | \$/m | 200.0 |
| | Subtotal | | | LS | | \$/m | 62,965.1 |
| Construction eqpmnt. | Floating dock mobilization | | | LS | | \$/m | 2,167.0 |
| | Floating dock operation | | | LS | | \$/m | 11,575.0 |
| | Subtotal | | | | | \$/m | 13,742.0 |
| | Grand total | | | | | \$/m | 76,707.1 |

C. Sheet Pile Wall Type

1. Dredging and Replacement by Sand
 $(50.0 + 18.0) \times 6 = 408 \text{ m}^3$
2. Selected Fill
 $1/2 \times (44.5 + 7.0) \times 15.5 = 399 \text{ m}^3$
3. Rubble Fill
 $1/2 \times (18.0 + 4.0) \times 11.4 + 1/2 \times (18.0 + 12.5) \times 4.6 + 1/2 \times (2.4 + 7.2) \times 4.4 - 7.5 \times 4.5$
 $= 125.4 + 70.2 + 21.1 - 33.8 = 183.2 \text{ m}^3$
4. Steel Sheet Pile (Front Wall)
 $\text{Ø}1,000 \text{ mm } t = 22 \text{ mm } L = 30.5 \text{ m ctc } 1.2 \text{ m } W = 542 \text{ kg/m}$
 $0.542 \times 30.5 \div 1.2 = 13.78 \text{ t}$
 $\text{Driving } 30.5 \div 1.2 = 25.4 \text{ m}$
5. Sheet Pile Joint
 $(30.5 - 8.0) \div 1.2 = 18.8 \text{ m}$
6. Anchor Pile, Steel Pile
 $\text{Ø}900 \text{ mm } t = 22 \text{ mm } L = 30.5 \text{ m ctc } 3.6 \text{ m } W = 488 \text{ kg/m}$
 $0.488 \times 30.5 \div 3.6 = 4.13 \text{ t}$
 $\text{Driving } 30.5 \div 3.6 = 8.5 \text{ m}$
7. Wale, I300 x 10 x 10 W = 38.1 kg/m
 $4 \times 0.0381 = 0.15 \text{ t}$
8. Tie-Rope 90 t L = 37 m
 $1/1.2 = 0.83 \text{ t}$

*9. Crane Beam, Steel Pile

$$\begin{aligned} \text{Ø900 mm } t = 16 \text{ mm } L = 33.5 \text{ m ctc } 7.2 \text{ m } W = 355 \text{ kg/m} \\ 0.355 \times 33.5 \times 2 \div 7.2 &= 3.30 \text{ t} \\ \text{Driving } 2 \times 33.5 \div 7.2 &= 9.3 \text{ m} \end{aligned}$$

10. R.C. Front Wall

$$7.85 \times 1.6 - 3.35 \times 0.8 = 9.88 \text{ m}^3$$

11. R.C. Anchor Wall

$$3.00 \times 1.6 = 4.80 \text{ m}^3$$

*12. R.C. Crane Beams

$$2 \times 2.20 \times 1.60 = 7.04 \text{ m}^3$$

13. Cathodic Protection for Front Wall

$$(1/2 \times 1.00 \times 3.14 + 0.2) \times 15.0 = 26.55 \text{ m}^2$$

14. Apron Pavement, Concrete $t = 30 \text{ cm}$

$$60.0 - (1.6 + 2 \times 1.6) = 55.2 \text{ m}^2$$

15. Fender

Type _____ each 10 m

16. Bollard

_____ ton each 25 m

Unit Cost Study Sheet (3/4), Wharf -14.0m: Steel Pile Wall Type
Container Berth

| Works | Specifications | Quantity | | Unit Rate | | Unit Cost | |
|--|---|-------------------|-------|------------------|---------|-----------|----------|
| | | Unit | | Unit | | Unit | |
| Sheet Pile Wall | | | | | | | |
| Dredging & replacing Sheet Pile main-body | -14.0m ~ -20.0m Material, Ø1,000 t=2.2m L=30.5m | m ³ /m | 408 | S/m ³ | 10.7 | S/m | 4,365.6 |
| | | t/m | 13.78 | S/t | 1,178.5 | S/m | 16,239.7 |
| Sheet pile joint | Material | m/m | 18.8 | S/m | 114.4 | S/m | 1,372.3 |
| Sheet pile | Driving | m/m | 25.4 | S/m | 152.0 | S/m | 3,860.8 |
| Anchor pile | Steel pile, Ø900 t=2.2cm L=30.5m | t/m | 4.13 | S/t | 1,178.5 | S/m | 4,867.2 |
| | | Driving | m/m | 8.5 | S/m | 137.0 | S/m |
| Wale | | t/m | 0.15 | S/t | 798.0 | S/m | 119.7 |
| Tie-rod | 90 ton | ea/m | 0.83 | S/ea | 2,819.0 | S/m | 2,340.0 |
| Selected fill | | m ³ /m | 399 | S/m ³ | 9.6 | S/m | 3,830.4 |
| Rubble back fill | +1.5m ~ -14.0m | m ³ /m | 183.2 | S/m ³ | 56.6 | S/m | 10,369.1 |
| Concrete capping | Anchor wall | m ³ /m | 4.80 | S/m ³ | 319.2 | S/m | 1,532.2 |
| Concrete capping | Front wall | m ³ /m | 9.88 | S/m ³ | 319.2 | S/m | 3,153.7 |
| Concrete capping | Crane beams | m ³ /m | 7.04 | S/m ³ | 319.2 | S/m | 2,247.2 |
| Pile, material | Steel Ø900 t=1.6cm L=33.5m, etc=7.2m | t/m | 3.30 | S/t | 1,178.5 | S/m | 3,889.1 |
| Pile | driving (land) | m/m | 9.3 | S/m | 54.0 | S/m | 502.2 |
| Cathodic protection | | m ² /m | 26.55 | S/m ² | 75 | S/m | 1,991.3 |
| Apron pavement | Concrete t=25cm | m ² /m | 55.2 | S/m ² | 96.8 | S/m | 5,343.4 |
| Fender | | ea/m | 0.1 | S/ea | 20,000 | S/m | 2,000.0 |
| Bollard | | ea/m | 0.04 | S/ea | 2,000 | S/m | 80.0 |
| Fittings, etc. | Misc. fitting, Utilities, Crane Rail | | 1 | LS | 200 | S/m | 200.0 |
| | Subtotal | | | | | S/m | 69,468.4 |
| Construction eqpmnt. | Pile driving fleet mobilization | | | LS | 1 | S/m | 652.0 |
| | Pile Yard | | | LS | 1 | S/m | 710.0 |
| | Subtotal | | | | | S/m | 1,362.0 |
| | Grand Total | | | | | S/m | 70,830.4 |

D. Concrete Block Wall Type

1. Dredging and Replacement by Sand

$$(50.0 + 18.0) \times 6 - 1/2 \times (23 + 31.4) \times 3.5 = 408 - 95 = 313 \text{ m}^3$$

2. Rubble Base

$$1/2 \times (23 + 31.4) \times 3.5 = 95 \text{ m}^3$$

3. Concrete Blocks

| | | | | |
|------|-----|------------------|---|----------------------|
| Type | (1) | 6.0 x 2.2 x 2.5 | = | 33.00 m ³ |
| | (2) | 5.6 x 2.2 x 2.5 | = | 30.80 |
| | (3) | 7.6 x 2.3 x 2.5 | = | 43.70 |
| | (3) | 7.6 x 2.3 x 2.5 | = | 43.70 |
| | (4) | 9.6 x 2.2 x 2.5 | = | 52.80 |
| | (4) | 9.6 x 2.2 x 2.5 | = | 52.80 |
| | (5) | 12.1 x 1.8 x 2.5 | = | 54.45 |
| | (6) | 12.5 x 1.6 x 2.5 | = | 50.00 |
| | (7) | 16.0 x 1.4 x 2.5 | = | 56.00 |

$$417.25 \text{ m}^3 / 2.5 \text{ m}$$

$$166.90 \text{ m}^3/\text{m}$$

$$\text{maximum weight} \quad 56.0 \times 2.3 = 128.8 \text{ t/ea}$$

4. Block Setting

$$9 \text{ layers} \div 2.5 \text{ m} = 3.60 \text{ ea/m}$$

5. Rubble Fills

$$\begin{aligned} & 1/2 \times (2.4 + 4.8) \times 2.0 + 2.0 \times 4.4 + 6.8 \times 7.0 + 1/2 \times 6.8 \times 8.2 + 2.0 \times 2.2 + \\ & 2.5 \times 6.4 + 2.5 \times 9.7 + 1/2 \times 11.2 \times 13.4 - 1.2 \times 6.8 - 1.2 \times 11.2 \\ & = 7.2 + 8.8 + 98.0 + 27.9 + 4.4 + 16.0 + 24.3 + 75.0 - 21.6 = 189.6 \text{ m}^3 \end{aligned}$$

6. Sheet

$$35 \text{ m}^2$$

7. Head Beam, R.C.

$$2 \times 1.2 \times 3.35 + (3.6 - 2 \times 1.2) \times 0.6 = 13.22 \text{ m}^3$$

8. Crane Beam, Steel Pile

$$\text{Ø}900 \text{ mm } t = 16 \text{ mm } L = 33.5 \text{ m ctc } 7.2 \text{ m } W = 355 \text{ kg/m}$$

$$0.355 \times 33.5 \div 7.2 = 1.65 \text{ t}$$

$$\text{Driving } 33.5 \div 7.2 = 4.6 \text{ m}$$

9. R.C. Crane Beam

$$2.20 \times 1.60 = 3.52 \text{ m}^3$$

10. Apron Pavement, Concrete $t = 30 \text{ cm}$

$$60.0 - (3.6 + 1.6) = 54.8 \text{ m}^2$$

11. Fender

Type _____ each 10 m

12. Bollard

_____ ton each 25 m

Unit Cost Study Sheet (4/4), Wharf -14.0m: Concrete Block Type
Container Berth

| Works | Specifications | Quantity | | Unit Rate | | Unit Cost | |
|----------------------------|--|-------------------|-------|-------------------|---------|-----------|----------|
| | | Unit | | Unit | | Unit | |
| Concrete block type | | | | | | | |
| Dredging & replacing | | m ³ /m | 313 | \$/m ³ | 10.7 | \$/m | 3,349.1 |
| Base rock mound | | m ³ /m | 95 | \$/m ³ | 70.7 | \$/m | 6,716.5 |
| Concrete blocks | Prefabrication & storage | m ³ /m | 166.9 | \$/m ³ | 200.0 | \$/m | 33,380.0 |
| Concrete blocks | Transp. team. storage & setting | ea/m | 3.60 | \$/ea | 1,560 | \$/m | 5,616.0 |
| Head beam | | m ³ /m | 13.22 | \$/m ³ | 319.2 | \$/m | 4,219.8 |
| Rubble back fill | +6.0m ~ -14.0m | m ³ /m | 189.6 | \$/m ³ | 56.6 | \$/m | 10,731.4 |
| Sheet | t=5mm | m ² /m | 3.5 | \$/m ² | 14.0 | \$/m | 49.0 |
| Crane beam | | m ³ /m | 3.52 | \$/m ³ | 319.2 | \$/m | 1,123.6 |
| Piles, material | Steel, Ø900 t=1.6cm t=33.5m, etc=7.2m | t/m | 1.65 | \$/t | 1,178.6 | \$/m | 1,944.7 |
| Pile driving (land) | | m/m | 4.6 | \$/m | 54.0 | \$/m | 248.4 |
| Apron pavement | Concrete t=25cm | m ² /m | 54.8 | \$/m ² | 96.8 | \$/m | 5,304.6 |
| Fender | | ea/m | 0.10 | \$/ea | 20,000 | \$/m | 2,000.0 |
| Bollard | | ea/m | 0.04 | \$/ea | 2,000 | \$/m | 80.0 |
| Fittings, etc. | Misc. fittings, Utilities, Crane rail | | 1 | LS | 200 | \$/m | 200.0 |
| | Subtotal | | | | | \$/m | 74,963.1 |
| Construction Eqpmnt. | Block yard installation | | | LS | | \$/m | 1,041.7 |
| | Block yard operation | | | LS | | \$/m | 2,602.0 |
| | Floating crane mobilization | | | LS | | \$/m | 277.0 |
| | Subtotal | | | | | \$/m | 3,920.7 |
| | Grand total | | | | | \$/m | 78,883.8 |

Rockmound $113.1 \times 0.25 + 56.6 \times 0.75 = 70.7$

Appendix III-3.4 Typical Cost by Depth, -14m wharf

| Structures | | Unit, 10 ⁶ USD per m | | |
|------------------|-------|---------------------------------|-----------------|--------|
| | | Application | | |
| | | Ordinary Wharf | Container Wharf | |
| Open Structure | -10 m | 52.00 | | |
| | -11 m | 53.22 | 56.05 | (2.82) |
| | -12 m | 54.44 | 57.26 | |
| | -13 m | 55.66 | 58.48 | |
| | -14 m | 56.88 | 59.70 | (2.82) |
| | -15 m | 58.10 | 60.92 | |
| Concrete Block | -10 m | 67.14 | | |
| | -11 m | 68.72 | 74.14 | |
| | -12 m | 70.30 | 75.72 | |
| | -13 m | 71.88 | 77.30 | |
| | -14 m | 73.46 | 78.88 | (5.42) |
| | -15 m | 74.04 | 79.46 | |
| Steel Sheet Pile | -10 m | 58.61 | | |
| | -11 m | 60.00 | 66.66 | |
| | -12 m | 61.39 | 68.05 | |
| | -13 m | 62.78 | 69.44 | |
| | -14 m | 64.17 | 70.83 | (6.66) |
| | -15 m | 65.56 | 72.22 | |
| Caisson Block | -10 m | 67.04 | | |
| | -11 m | 68.63 | 71.94 | |
| | -12 m | 70.22 | 73.52 | |
| | -13 m | 71.81 | 75.12 | |
| | -14 m | 73.40 | 76.71 | (3.31) |
| | -15 m | 74.99 | 78.30 | |

Appendix III-3.5 Cost Estimate, Grain Berth Extension, (60m x 24m)

Grain Berth Extension

Size of Extension

$$\begin{aligned} B \times L &= 24.0 \text{ m} \times 60.0 \text{ m} &= 1,440.0 \text{ m}^2 \\ \text{Total Piles } 13 \times 6 &&= 78 \text{ piles} \end{aligned}$$

1. Piles

Steel Pipe $\text{Ø}600 \text{ mm}$ $t = 16 \text{ mm}$ $L = 30.0 \text{ m}$ $W = 240 \text{ kg/m}$

$$\begin{aligned} \text{Total Piles } 78 \text{ piles} & \\ \text{Weight } 0.24 \text{ t/m} \times 78 \times 30.0 \text{ m} &= 561.50 \text{ ton} \end{aligned}$$

2. Pile Protection by Concrete Casing

Protection upto DL - 0.50 m $l = 6.5 \text{ m}$

$$\begin{aligned} \text{Total length } 78 \text{ piles} \times 6.5 \text{ m} &= 507.0 \text{ m} \\ \text{Total Area } 507.0 \times 3.14 \times 0.60 &= 955.2 \text{ m}^2 \end{aligned}$$

3. Cathodic Protection

Between DL - 0.50 m and DL - 17.5 m $L = 17.0 \text{ m}$

$$\begin{aligned} \text{Total Area} & \\ A = 17.0 \text{ m} \times 78 \text{ piles} \times 3.14 \times 0.6 &= 2,498 \text{ m}^2 \end{aligned}$$

4. Concrete in Situ, Deck

$$\begin{aligned} 60 \times 24 \times 1.4 + (2 \times 60 + 24) \times (2.95 \times 1.40 + 1/2 \times 0.8^2) & \\ = 2,016.0 + 144 \times (4.13 + 0.32) & \\ = 2,016.0 + 640.8 &= 2,656.8 \text{ m}^2 \end{aligned}$$

Unit Cost Study Sheet (1), Berth -13.0m: Open Structure Type
 Grain Berth Extension

| Works | Specifications | Quantity | | Unit Rate | | Unit Cost | |
|----------------------------|------------------------------------|-------------------|-----------------------|-------------------|---------|-----------|-----------|
| | | Unit | | Unit | | Unit | |
| <u>Open structure type</u> | Vertical type | | | | | | |
| | Material, Ø600 t=1.6cm, L=30.0 | t/m | 56/5 56/60 | \$/t | 1,178.6 | \$ | 661,784 |
| | Driving | m/m | 2,340 | | 91.0 | | 212,940 |
| Crane foundation pile | | t/m | 0 | \$/t | - | \$ | 0 |
| | Driving | m | 0 | \$/m | - | \$ | 0 |
| Cathodic protection | | m ² /m | 2,480 | \$/m ² | 50 | \$ | 124,000 |
| Concrete deck | | m ³ | 2,656.8 | \$/m ³ | 319.2 | \$ | 848,051 |
| Pile protection | | m ² /m | 955.2 | \$/m ² | 100 | \$/m | 95,520 |
| Fender | | ea | 10 | \$/ea | 20,000 | \$ | 200,000 |
| Bollard | | ea | 5 | \$/ea | 2,000 | \$ | 10,000 |
| Fittings, etc. | Misc. fittings, Utilities, Rail | | | LS | 18,000 | \$ | 18,000 |
| | Subtotal | | | | | \$ | 2,170,295 |
| Construction eqpmnt. | Pile Driving fleet mobilization | | | LS | | \$ | 189,200 |
| | Pile Yard | | | LS | | \$ | 51,670 |
| | Subtotal | | | | | \$ | 240,870 |
| | Grand Total | | | | | \$ | 2,411,165 |

Appendix III-3.6 Cost Estimate, Western Jetty Extension, (260m -14.0m)

Western Jetty Extension

1. Size of Works

Total berth length 260 m, DL - 14.0 m depth

Deck area, Alternative-A, 2,600 m²
Alternative-B, 2,184 m²

Following calculation is for alternative-A.

2. Piles

Steel pipe pile Ø600 t = 16 mm, L = 35.0 m W = 240 kg/m

Total piles

$$41 \text{ lines} \times 2 \text{ piles} + 25 \text{ lines} \times 3.5 \text{ piles} = 170 \text{ piles}$$

$$\text{Total length } 170 \times 35.0 = 5,950 \text{ m}$$

$$\text{Total weight } 5,950 \times 0.24 = 1,428.0 \text{ ton}$$

3. Pile Protection by Concrete Casing

Protection upto DL - 0.50 m, l = 7.2 m

$$\text{Total area } 170 \times 3.14 \times 0.6 \times 7.2 = 2,306 \text{ m}^2$$

4. Cathodic Protection

Between DL - 0.50 m and DL - 19.0 m, l = 18.5 m

Total area

$$A = 18.5 \times 3.14 \times 0.6 \times 170 = 5,925 \text{ m}^2$$

5. Concrete Situ

$$260 \times 4.65 \times 1.4 + (7.00 - 1.40) \times 260 \times 0.70$$

$$+ 1/2(23.0 - 1.4 + 7.0 - 1.4) \times 97.7$$

$$= 1,692.6 + 1,019.2 + 1,328.7 = 4,040.5 \text{ m}^3$$

Unit Cost Study Sheet (1), Berth -14.0m: Open Structure Type
Western Jetty Extension

| Works | Specifications | Quantity | | Unit Rate | | Unit Cost | |
|----------------------------|--|----------------|---------|-------------------|---------|-----------|-----------|
| | | Unit | | Unit | | Unit | |
| <u>Open structure type</u> | Vertical type | | | | | | |
| Pile | Material, Ø600 t=1.6cm, L=35.0 driving | t | 1,528.0 | \$/t | 1,178.6 | S | 1,800,900 |
| Cathodic protection | | m | 5,950 | \$/m | 91.0 | S | 541,450 |
| Concrete deck | | m ² | 5,925 | \$/m ² | 50 | S | 296,250 |
| Pile protection | | m ³ | 4,040.5 | \$/m ³ | 319.2 | S | 1,289,728 |
| Fender | | m ² | 2,306 | \$/m ² | 100 | S | 230,600 |
| Bollard | | ca | 26 | \$/ca | 20,000 | S | 520,000 |
| Fittings, etc. | | ca | 13 | \$/ca | 2,000 | S | 26,000 |
| | Misc. fittings, Utilities, Rail | | | LS | 52,000 | S | 52,000 |
| | Subtotal | | | | | & | 4,756,928 |
| Construction eqpmnt. | Pile Driving fleet mobilization | | | LS | | S | 189,200 |
| | Pile Yard | | | LS | | S | 51,670 |
| | Subtotal | | | | | S | 240,870 |
| | Grand Total | | | | | S | 4,997,798 |

Appendix III-3.7 Cost Estimate, Existing Open Structure, -11.0m

Open Structure (11.0 m Container Wharf)

1. Piles

Ø800 prestressed concrete pile, L = 35.0 m
 (14 piles) x 35.0 m ÷ 5.0 m = 98.0 m

For crane foundation
 2 piles x 35.0 m ÷ 5.0 m = 14.0 m

2. Relieving piles

Ø500 concrete pile, L = 12.5 m
 4 piles x 12.5 m ÷ 3.5 m = 14.3 piles/m

3. Front Structure

3-1. Service Tunnel

$3.50 \times 4.25 - 2.50 \times 2.75 + 5.45 \times 0.5 + 0.4 \times 0.7$
 $= 14.9 - 6.9 + 2.7 + 0.3 = 11.0 \text{ m}^3$

3-2. Parapet Wall

$3.25 \times 0.65 \times 3.5 \div 15.0 = 0.5 \text{ m}^3$

3-3. Support Wall

$8.5 \times 6.25 \times 0.5 \times 2 \div 15.0 = 3.5 \text{ m}^3$

Total = 15.0 m³

4. Rear Structure

$10.2 \times 0.5 + 1.90 \times 1.00 \times 1/2 = 6.1 \text{ m}^3$

5. Pile Capping

5-1. Pile Capping (Single Piles)

$1.4 \times 1.4 \times 0.7 \times 9 \text{ piles} \div 5.0 \text{ m} = 2.5 \text{ m}^3$

| | | |
|-----------------------------------|--|----------------------|
| 5-2. Capping Beam | | |
| | $(4.26 \times 1.10 \times 0.9 + 6.40 \times 1.40 \times 0.7) \div 5.0 \text{ m}$ | |
| | $= (4.2 + 6.3) \div 5.0 \text{ m}$ | $= 2.1 \text{ m}^3$ |
| | Total | $= 4.6 \text{ m}^3$ |
| 6. Riprapping | | |
| | $24.0 \times 1.25 \text{ m}$ | $= 30.0 \text{ m}^3$ |
| 7. Slab and Beam, Cast in Situ | | |
| 7-1. Slab | | |
| | $(30.5 + 2 \times 4.0) \times 0.15$ | $= 5.8 \text{ m}^3$ |
| 7-2. Beam | | |
| | $\{(30.5 + 2 \times 4.0) \times 0.75 \times 0.40 + (5.0 - 0.40) \times 0.4 \times 9 \text{ piles} \times 0.75\}$ | |
| | $+ 5.0 \text{ m} = (11.6 + 12.4) \div 5.0 \text{ m}$ | $= 4.8 \text{ m}^3$ |
| | Total | $= 10.6 \text{ m}^3$ |
| 8. Concrete for Relieving Piles | | |
| | $2.0 \times 2.0 \times 0.4 \times 4 \div 3.5 \text{ m}$ | $= 1.8 \text{ m}^3$ |
| 9. Timber Fender | | |
| | $0.40 \text{ m} \times 0.4 \text{ m} \times 3 \text{ sets}$ | $= 0.5 \text{ m}^3$ |
| 10. Precast Deck Element (Type-C) | | |
| | $(3.60 \times 4.60 \times 0.75 - 3.80 \times 2.60 \times 0.5) \times 8 \div 5.0 \text{ m}$ | |
| | $= (12.4 - 4.9) \times 8 \div 5.0 \text{ m}$ | $= 12.0 \text{ m}^3$ |
| | unit weight $7.5 \times 2.45 \text{ t/m}^3$ | $= 18.4 \text{ m}^3$ |
| 11. Crane Beam Additional | | |
| | 1.0×1.0 | $= 1.0 \text{ m}^3$ |

Unit Cost Study Sheet (1), Wharf -11.0m: Open Structure Type
Container Berth

| Works | Specifications | Quantity | | Unit Rate | | Unit Cost | |
|----------------------------|---------------------------------|-------------------|-------|-------------------|--------|-----------|----------|
| | | Unit | | Unit | | Unit | |
| <u>Open structure type</u> | Vertical type | | | | | | |
| dredging pile | | m/m ³ | 100.0 | \$/m ³ | 4.00 | \$/m | 400.0 |
| | Material, Ø800 | m/m | 98.0 | \$/m | 178.5 | \$/m | 17,493.0 |
| | PC. PL = 35.0 m | | | | | | |
| | driving | m/m | 98.0 | \$/m | 82.3 | \$/m | 8,065.4 |
| Relieving piles | Ø500 concrete, | m/m | 14.3 | \$/m | 35.0 | \$/m | 500.5 |
| | L = 12.5 m | | | | | | |
| | driving | m/m | 14.3 | \$/m | 30.0 | \$/m | 429.0 |
| Crane foundation pile | Material, Ø800 | t/m | 14.0 | \$/m | 178.5 | \$/m | 2,499.0 |
| | PC. PL = 35.0 m | | | | | | |
| | Driving | m/m | 14.0 | \$/m | 122.0 | \$/m | 1,708.0 |
| Rock riprapping | Slope protection | m ³ /m | 30.0 | \$/m ³ | 113.1 | \$/m | 3,393.0 |
| Front structure (conc.) | | m ³ /m | 15.0 | \$/m ³ | 319.2 | \$/m | 4,788.0 |
| Rear structure (conc.) | | m ³ /m | 6.1 | \$/m ³ | 319.2 | \$/m | 1,947.1 |
| Pile capping | | m ³ /m | 4.6 | \$/m ³ | 319.2 | \$/m | 1,468.3 |
| Pile capping (R.P.) | | m ³ /m | 1.8 | \$/m ³ | 319.2 | \$/m | 574.6 |
| Slab | Precast element | m ³ /m | 12.0 | \$/m ³ | 271.3 | \$/m | 3,255.6 |
| Slab element | setting | ca/m | 1.60 | \$/ca | 300.0 | \$/m | 480.0 |
| Slab in situ | | m ³ /m | 10.6 | \$/m ³ | 319.2 | \$/m | 3,383.5 |
| Crane beam | | m ³ /m | 1.0 | \$/m ³ | 319.2 | \$/m | 319.2 |
| Apron pavement | | m ² /m | 0 | \$/m ² | 122.0 | \$/m | 0 |
| Fender | | ca/m | | \$/ca | | | |
| Fender tember | | ca/m | 0.1 | \$/ca | 20,000 | \$/m | 2,000.0 |
| Bollard | | ca/m | 0.04 | \$/ca | 2,000 | \$/m | 80.0 |
| Fittings, etc. | Misc. fittings, | | 1 | LS | 200 | \$/m | 200 |
| | Utilities, Crane Rail | | | | | \$/m | |
| | Subtotal | | | | | \$/m | 52,984.2 |
| Construction eqpmnt. | Pile driving fleet mobilization | | | LS | | \$/m | 946.0 |
| | Pile yard | | | LS | | \$/m | 785.0 |
| | Precast yard | | | LS | | \$/m | 516.7 |
| | Yard operation | | | LS | | \$/m | 814.3 |
| | Subtotal | | | | | \$/m | 3,062.0 |
| | Grand Total | | | | | \$/m | 56,046.2 |

**Appendix III-3.8 Cost Estimate, Improvement of Four Berth Extension
Additional 20m Wide Deck Seaward**

Four Berth Extension

A. Additional 20.00 advance

1. Piles

R.C. pile 450 sq. L = 29.0 m

9 piles x 29.0 m ÷ 4.0 = 65.3 m

2. Concrete in Situ

2-1. Slab

0.70 m x 20.0 = 14.00 m³

2-2. Service Tunnel

2.7 x 3.5 - 2.30 x 2.75

= 9.45 - 6.33 = 3.12 m³

2-3. Fender Wall

(7.65 m - 0.70) x 3.50 x 0.75 ÷ 12.0 = 1.52 m³

2-4. Parapet Wall

2(1/2 x 6.95 x 7.90 - 2.8 x 3.5) x 0.6 ÷ 12.0

= (27.45 - 9.80) x 0.1 = 1.77 m³

Total = 20.41 m³

3. Selected Fill

18.0 x 6.0 + 9.0 x 1.2 = 108.8 m³

B. Open Basin Structure

1. Piles

R.C. pile 450 sq. L = 29.0 m

$$10 \text{ piles} \times 29.0 \text{ m} \div 4 \text{ m} = 72.5 \text{ m}$$

2. Concrete in Situ

$$(15.5 + 3.2 + 1.5) \times 0.7 = 14.14 \text{ m}^3$$

3. Riprapping Removal

$$(1.50 \times 14.5 + 2.8) \times 1.20 \times 0.5 = 11.23 \text{ m}^3$$

4. Concrete pavement, t = 25 cm

$$3.50 + 11.50 + 2.50 = 17.5 \text{ m}^2$$

Unit Cost Study Sheet (1), Wharf -11.0m: Open Structure Type
Widening of Berth No. 7 to No. 10

| Works | Specifications | Quantity | | Unit Rate | | Unit Cost | |
|----------------------------|--|-------------------|-------|-------------------|--------|-----------|---------|
| | | Unit | | Unit | | Unit | |
| Open structure type | Vertical type and Batter type | | | | | | |
| pile, R.C. pile, 450 sq. | | | | | | | |
| | L=29m | m/m | 137.8 | \$/m | 35.0 | \$/m | 4,823 |
| | driving | m/m | 137.8 | \$/m | 61.0 | \$/m | 8,406 |
| Crane foundation pile | | t/m | 0 | \$/t | - | \$/m | 0 |
| | Driving | m/m | 0 | \$/m | - | \$/m | 0 |
| Cathodic protection | | m ² /m | 0 | \$/m ² | - | \$/m | 0 |
| Selected fill | under the deck | m ³ /m | 108.8 | \$/m ³ | 9.6 | \$/m | 1,045 |
| Rubble back-fill | | m ³ /m | 0 | \$/m ³ | - | \$/m | 0 |
| Armor rock | | m ³ /m | 11.23 | \$/m ³ | 113.1 | \$/m | 1,270 |
| Concrete deck | | m ³ /m | 34.55 | \$/m ³ | 319.2 | \$/m | 11,028 |
| Apron pavement | t=25cm concrete | m ² /m | 17.5 | \$/m ² | 96.8 | \$/m | 1,791 |
| Sheet | t=5 | m ² /m | 12.0 | \$/m ² | 14.0 | \$/m | 168 |
| Fender | | ca/m | 0.1 | \$/ca | 10,000 | \$/m | 1,000 |
| Bollard | | ca/m | 0.04 | \$/ca | 1,000 | \$/m | 40 |
| Fittings, etc. | Misc. fittings, Utilities, Crane Rail | ca/m | 1 | LS | 500 | \$/m | 500 |
| | Subtotal | | | | | \$/m | 30,071 |
| Construction eqpmnt. | Boring fleet mobilization | | | LS | | \$/m | 946.0 |
| | Pile yard | | | LS | | \$/m | 785.0 |
| | Precast yard | | | LS | | \$/m | 514.3 |
| | Yard operation | | | LS | | \$/m | 814.3 |
| | Subtotal | | | | | \$/m | 3,062.0 |
| | Grand Total | | | | | \$/m | 33,133 |

Appendix III-3.9 Cost Estimate, Existing Open Structure Improvement

A. -11.0 m Wharf to -12.0 m Wharf

Additional Cost

1. Piles

Ø800 prestressed concrete pile L = 35.0 m

$$3 \text{ piles} \times 35.0 \text{ m} + 5.0 \text{ m} = 21.0 \text{ m}$$

2. Concrete in Situ

$$5.35 \times 0.60 + 3.40 \times 2.20 - 2.40 \times 1.20 + 1.30 \times 1.40 \times 3.40 \div 2.5$$

$$0.70 \times 1.00 \times 1.40 \div 2.5 + 1.3 \times 1.4 \times 8.5 \div 5.0 + 1.5 \times 1.5 \times 4.5 \div 5.0$$

$$= 3.21 + 7.48 - 2.88 + 2.48 + 0.39 + 4.59 + 2.03$$

$$= 17.30 \text{ m}^3$$

3. Concrete Slab Break and Rebuilt

$$\text{Area } 2 \text{ piles} \times (0.8 \text{ m} + 2 \times 0.5)^2$$

$$\text{Volume } 2 \times 3.24 \times 0.4 \text{ m} \div 5.0 \text{ m} = 0.52 \text{ m}^3$$

4. Fender, Bollard, Fittings

5. Required Cost

5-1. Pile, Materials and Land Driving Cost

$$14.0 \text{ m} \times 178.5 \text{ \$/m} = 2,499.0 \text{ \$/m}$$

$$14.0 \text{ m} \times 48.0 \text{ \$/m} = 672.0 \text{ \$/m}$$

5-2. Concrete

$$10.68 \text{ m}^3 \times 319.2 \text{ \$/m} = 3,409.1 \text{ \$/m}$$

5-3. Concrete Break and Rebuilt

$$\text{Breaking } 0.52 \times 500 \text{ \$/m}^3 = 260.0 \text{ \$/m}$$

$$\text{Reinforcement } 0.52 \times 150 \text{ \$/m}^3 = 78.0 \text{ \$/m}$$

$$\text{Casting } 0.52 \times 800 \text{ \$/m}^3 = 416.0 \text{ \$/m}$$

$$\text{Subtotal} = 754.0 \text{ \$/m}$$

5-4. Fender, Bollard, Fittings

| | | | |
|--------------|------------------------|---|--------------|
| Fender (New) | per 10 m each x 20,000 | = | 2,000 \$/m |
| Bollard | 25 m x 2,000m | = | 80 \$/m |
| Fittings | | = | 2,000 \$/m |
| | Subtotal | = | 4,080.0 \$/m |

5-5. Total Additional

| | |
|------------|---------------|
| 5-1 ~ 5-4, | 15,112.7 \$/m |
|------------|---------------|

B. -11.0 m Wharf to -14.0 m Wharf

Additional Cost

1. Piles

Ø800 prestressed concrete pile L = 35.0 m

$$2 \text{ piles} \times 35.0 \text{ m} \div 5.0 \text{ m} = 14.0 \text{ m}$$

2. Concrete in Situ

$$5.09 + (4.50 - 0.5) \times (10.0 - 0.5) = 12.09 \text{ m}^3$$

3. Required Cost

3-1. Cost for -12.0 m wharf, as previously, 15,112.7 \$/m

3-2. Piles

$$14.0 \times 178.5 \text{ $/m} = 2,499.0 \text{ $/m}$$

$$14.0 \times 48.0 \text{ $/m} = 672.0 \text{ $/m}$$

3-3. Concrete

$$12.09 \text{ m}^3 \times 319.2 \text{ $/m} = 3,859.1 \text{ $/m}$$

3-4. Total Cost

$$= 22,142.8 \text{ $/m}$$

C. -11.0 m Wharf to -13.0 m Wharf

Additional Cost

1. Piles

Ø800 prestressed concrete pile L = 35.0 m

$$1 \text{ pile} \times 35.0 \text{ m} \div 5.0 \text{ m} = 7.0 \text{ m}$$

2. Concrete in Situ

For -12.0 m wharf, as previously 16.68 m³

$$\text{Slab } 0.5 \text{ m} \times (4.50 - 0.50) = 2.00$$

$$\text{Pilecap } 1.30 \times 1.40 \times (4.50 - 0.50) \div 2.5 \text{ m} = 2.91$$

Service access

$$\begin{aligned} (1.07 \times 2.20 - 1.20 \times 1.20) \times (4.50 - 0.50) \div 50.0 \text{ m} \\ = 2.30 \times 4.0 \div 50.0 = 0.18 \text{ m}^3 \end{aligned}$$

$$\text{Additional} = 5.09 \text{ m}^3$$

3. Required Cost

3-1. Cost for -12.0 m wharf, as previously, 15,112.7 \$/m

3-2. Piles

$$7.0 \times 178.5 \text{ \$/m} = 1,249.5 \text{ \$/m}$$

$$7.0 \times 48.0 \text{ \$/m} = 336.0 \text{ \$/m}$$

3-3. Concrete

$$5.09 \text{ m}^3 \times 319.2 \text{ \$/m} = 1,624.7 \text{ \$/m}$$

$$3-4. \text{ Total Cost} = 18,322.9 \text{ \$/m}$$

Appendix III-3.10 Cost Estimate, Common Access and Utility Main

Route, D1

Common Access and Utilities

| Work Category | Works | Unit Rate | | Works | | Cost |
|--------------------------------|------------------------|-----------|---------|-------|--------|-------------|
| | | Unit | | Unit | | |
| <u>To the Drag West</u> | | | | | | |
| (1) Roads | | | | | | |
| Roads | 500m x 20m | S/m2 | 67.7 | m2 | 10,000 | 677,000 |
| Tunnel 2,800m | (Crossing the channel) | S/m2 | 140,000 | m | 2,800 | 392,000,000 |
| | | | | | | 392,677,000 |
| (2) Water Supply | | | | | | |
| Station Centor | | | | | | 1,158,450 |
| Mains to Block | 1,550m | S/m | 98 | m | 1,550 | 151,900 |
| | | | | | | 1,310,350 |
| (3) Power Supply | | | | | | |
| Station Centor | | | | | | 937,500 |
| Main Cables | | S/m | 50 | m | 1,550 | 77,500 |
| Duckbank | | S/m | 105 | m | 1,550 | 162,750 |
| | | | | | | 1,177,750 |
| (4) Banker Supply | Underwater laying | S/m | 2,000 | m | 1,550 | 3,100,000 |
| | Subtotal | | | | | 398,265,100 |
| <u>Distributions</u> | See Route D2 | | | | | 9,332,190 |
| | Total | | | | | 407,597,290 |

Route, D2

Common Access and Utilities

| Work Category | Works | Unit Rate | | Works | | Cost |
|------------------------|-----------------------|-----------|---------|-------|--------|-------------|
| | | Unit | | Unit | | |
| Before Point ND | | | | | | |
| (1) Roads | 650+329+700 = 21,670 | | | | | |
| Roads | 1,670 x 20 = | S/m2 | 67.7 | m2 | 33,400 | 2,261,180 |
| Bridges (1) 600m | 60m span x 20m | S/m | 200,000 | m | 600 | 120,000,000 |
| Flyover | 650 x 20 | S/m2 | 2,500 | m2 | 13,000 | 32,500,000 |
| Approach Road | 3,600 x 25 = 90,000m2 | S/m2 | 67.7 | m | 90,000 | 6,093,000 |
| | | | | | | 160,854,180 |
| (2) Water Supply | | | | | | |
| Station Centor | | | | | | 1,158,450 |
| Mains to Block | 700 + 1,500 + 350 | S/m | 98 | m | 2,550 | 249,900 |
| | | | | | | 1,408,350 |
| (3) Power Supply | | | | | | |
| Station Centor | | | | | | 937,500 |
| Main Cables | | S/m | 50 | m | 2,550 | 127,500 |
| Duckbank | | S/m | 105 | m | 2,550 | 267,750 |
| | | | | | | 1,332,750 |
| (4) Banker Supply | | S/m | 1,600 | m | 2,550 | 4,080,000 |
| | Subtotal | | | | | 167,675,280 |

Common Access and Utilities

| Work Category | Works | Unit Rate | | Works | | Cost |
|-----------------------|---|-----------|-------|-------|--------|-------------|
| | | Unit | | Unit | | |
| After Point ND | | | | | | |
| D - Block | | | | | | |
| (1) Roads | 2,150 + 1,500 + 400 + 250 + 170 = 4,470m | | | | | |
| Roads | 4,470 x 20 = 89,400 | S/m2 | 67.7 | m2 | 89,400 | 6,052,380 |
| (2) Water Supply | | | | | | |
| Mains to Block | 400 + 1,370 = 1,770m | S/m | 98 | m | 1,770 | 173,460 |
| (3) Power Supply | | | | | | |
| Main Cables | | S/m | 50 | m | 1,770 | 88,500 |
| Duckbank | | S/m | 105 | m | 1,770 | 185,850 |
| | | | | | | 274,350 |
| (4) Banker Supply | | S/m | 1,600 | m | 1,770 | 2,832,000 |
| | | | | | | |
| | Subtotal | | | | | 9,332,190 |
| | Total Route D2 | | | | | 177,007,470 |

Route, D3

Common Access and Utilities

| Work Category | Works | Unit Rate | | Works | | Cost |
|------------------------|-------------------------------|-----------|---------|-------|--------|-------------|
| | | Unit | | Unit | | |
| <u>Before Point ND</u> | | | | | | |
| (1) Roads | | | | | | |
| Roads | 4,350m x 20m | S/m2 | 67.7 | m2 | 87,000 | 5,889,900 |
| Bridges (1) 500m | 500m (10x50m span) | S/m | 100,000 | m | 500 | 50,000,000 |
| Bridges (2) 500m | 500m (10x50m span) | S/m | 100,000 | m | 500 | 50,000,000 |
| Flyover | | S/m2 | 2,500 | m2 | 0 | 0 |
| | | | | | | 105,889,900 |
| (2) Water Supply | | | | | | |
| Station Centor | | | | | | 1,158,450 |
| Mains to Block | additional 7,050m - 4,500m | S/m | 98 | m | 2,550 | 249,900 |
| | | | | | | 1,408,350 |
| (3) Power Supply | | | | | | |
| Station Centor | | | | | | 937,500 |
| Main Cables | additional 7,050m - 4,500m | S/m | 50 | m | 2,550 | 127,500 |
| Overhead Wiring | 7,050 - 1,000 | S/m | 50 | m | 6,050 | 302,500 |
| Duckbank | | S/m | 105 | m | -4,500 | -472,500 |
| | | | | | | 895,000 |
| (4) Banker Supply | | S/m | 1,600 | m | 7,050 | 11,280,000 |
| | Subtotal | | | | | 119,473,250 |
| <u>After Point ND</u> | See Route D2 | | | | | 9,332,190 |
| | Total | | | | | 128,805,440 |

Route, D4

Common Access and Utilities

| Work Category | Works | Unit Rate | | Works | | Cost |
|-------------------------------|--------------------|-----------|---------|-------|---------|-------------|
| | | Unit | | Unit | | |
| <u>Before Point ND</u> | | | | | | |
| (1) Roads | | | | | | |
| Roads | 7,550m x 20m | S/m2 | 67.7 | m2 | 151,000 | 10,222,700 |
| Bridges (1) 500m | 500m (10x50m span) | S/m | 100,000 | m | 500 | 50,000,000 |
| Bridges (2) 500m | 500m (10x50m span) | S/m | 100,000 | m | 500 | 50,000,000 |
| Flyover | | S/m2 | 2,500 | m2 | 0 | 0 |
| | | | | | | 110,222,700 |
| (2) Water Supply | | | | | | |
| Station Centor | additional | | | | | 1,158,450 |
| Mains to Block | 7,050m - 4,500m | S/m | 98 | m | 2,550 | 249,900 |
| | | | | | | 1,408,350 |
| (3) Power Supply | | | | | | |
| Station Centor | additional | | | | | 937,500 |
| Main Cables | 7,050m - 4,500m | S/m | 50 | m | 2,550 | 127,500 |
| Overhead Wiring | 7,050 - 1,000 | S/m | 50 | m | 6,050 | 302,500 |
| Duckbank | | S/m | 105 | m | -4,500 | -472,500 |
| | | | | | | 895,000 |
| (4) Banker Supply | | S/m | 1,600 | m | 7,050 | 11,280,000 |
| | Subtotal | | | | | 123,806,050 |
| <u>After Point ND</u> | See Route D2 | | | | | 9,332,190 |
| | Total | | | | | 133,138,240 |

Route, D5

Common Access and Utilities

| Work Category | Works | Unit Rate | | Works | | Cost |
|------------------------|--|-----------|---------|-------|---------|-------------|
| | | Unit | | Unit | | |
| Before Point ND | | | | | | |
| (1) Roads | 300+600+250+1,150 +2,750+300+700=6,050m | | | | | |
| Roads | 6,050m x 20m | S/m2 | 67.7 | m2 | 121,000 | 8,191,700 |
| Bridges (1) 500m | 500m (10x50m span) | S/m | 100,000 | m | 500 | 50,000,000 |
| Bridges (2) 500m | 500m (10x50m span) | S/m | 100,000 | m | 500 | 50,000,000 |
| Flyover | | S/m2 | 2,500 | m2 | 0 | 0 |
| | | | | | | 108,191,700 |
| (2) Water Supply | | | | | | |
| Station Center | | | | | | 1,158,450 |
| Mains to Block | additional 7,050m - 4,500m | S/m | 98 | m | 2,550 | 249,900 |
| | | | | | | 1,408,350 |
| (3) Power Supply | | | | | | |
| Station Center | | | | | | 937,500 |
| Main Cables | additional 7,050m - 4,500m | S/m | 50 | m | 2,550 | 127,500 |
| Overhead Wiring | 7,050 - 1,000 | S/m | 50 | m | 6,050 | 302,500 |
| Duckbank | | S/m | 105 | m | -4,500 | -472,500 |
| | | | | | | 895,000 |
| (4) Banker Supply | | S/m | 1,600 | m | 7,050 | 11,280,000 |
| | Subtotal | | | | | 121,775,050 |
| After point ND | See Route D2 | | | | | 9,332,190 |
| | Total | | | | | 131,107,240 |

Route, D6

Common Access and Utilities

| Work Category | Works | Unit Rate | | Works | | Cost |
|------------------------|--------------------|-----------|---------|-------|---------|-------------|
| | | Unit | | Unit | | |
| Before Point ND | | | | | | |
| (1) Roads | 14,000 + 2,000 | | | | | |
| Roads | 16,000m x 20m | S/m2 | 67.7 | m2 | 320,000 | 21,664,000 |
| Bridges (1) 500m | 500m (10x50m span) | S/m | 100,000 | m | 500 | 50,000,000 |
| Bridges (2) 500m | 500m (10x50m span) | S/m | 100,000 | m | 500 | 50,000,000 |
| Flyover | | S/m2 | 2,500 | m2 | 0 | 0 |
| | | | | | | 121,664,000 |
| (2) Water Supply | | | | | | |
| Station Centor | additional | | | | | 1,158,450 |
| Mains to Block | 16,000m - 4,500m | S/m | 98 | m | 11,500 | 1,127,000 |
| | | | | | | 2,285,450 |
| (3) Power Supply | | | | | | |
| Station Centor | additional | | | | | 937,500 |
| Main Cables | 16,000m - 4,500m | S/m | 50 | m | 11,500 | 575,000 |
| Overhead Wiring | 16,000 - 1,000 | S/m | 50 | m | 15,000 | 750,000 |
| Duckbank | | S/m | 105 | m | -4,500 | -472,500 |
| | | | | | | 1,790,000 |
| (4) Banker Supply | | S/m | 1,000 | m | 16,000 | 16,000,000 |
| | Subtotal | | | | | 141,739,450 |
| After Point ND | See Route D2 | | | | | 9,332,190 |
| | Total | | | | | 151,071,640 |

Route, Z1

Common Access and Utilities

| Work Category | Works | Unit Rate | | Works | | Cost |
|-------------------|------------------------|------------------|-------|----------------|--------|-----------|
| | | Unit | | Unit | | |
| (1) Roads | 3,700m x 20m | S/m ² | 67.7 | m ² | 74,000 | 5,009,800 |
| (2) Water Supply | 1,500 - 4,500 - 3,000m | | | | | |
| Mains to Block | 1,550m | S/m | 98 | m | -3,000 | -294,000 |
| (3) Power Supply | | | | | | |
| Main Cables | | S/m | 50 | m | -3,000 | -150,000 |
| Duckbank | | S/m | 105 | m | -3,000 | -315,000 |
| | | | | | | -465,000 |
| (4) Banker Supply | | S/m | 1,600 | m | 3,000 | 4,800,000 |
| | Total | | | | | 9,050,800 |

Route Z2

Common Access and Utilities

| Work Category | Works | Unit Rate | | Works | | Cost |
|-------------------|------------------------|-----------|---------|-------|--------|-------------|
| | | Unit | | Unit | | |
| (1) Roads | | | | | | |
| Roads | 4,700m x 20m | S/m2 | 67.7 | m2 | 9,400 | 636,380 |
| Bridges (1) 500m | 500m (10x50m span) | S/m | 100,000 | m | 500 | 50,000,000 |
| Bridges (2) 500m | 500m (10x50m span) | S/m | 100,000 | m | 500 | 50,000,000 |
| Flyover | | S/m2 | 2,500 | m2 | 0 | 0 |
| | | | | | | 100,636,380 |
| (2) Water Supply | 1,500 - 4,500 - 3,000m | | | | | |
| Mains to Block | | S/m | 98 | m | -3,000 | -294,000 |
| (3) Power Supply | | | | | | |
| Main Cables | | S/m | 50 | m | -3,000 | -150,000 |
| Duckbank | | S/m | 105 | m | -3,000 | -315,000 |
| | | | | | | -465,000 |
| (4) Banker Supply | | S/m | 1,600 | m | 3,000 | 4,800,000 |
| | Total | | | | | 104,677,380 |

Route Z3

Common Access and Utilities

| Work Category | Works | Unit Rate | | Works | | Cost |
|-------------------|------------------------|-----------|---------|-------|---------|-------------|
| | | Unit | | Unit | | |
| (1) Roads | | | | | | |
| Roads | 19,500m x 20m | S/m2 | 67.7 | m2 | 390,000 | 26,403,000 |
| Bridges (1) 500m | 500m (10x50m span) | S/m | 100,000 | m | 500 | 50,000,000 |
| Bridges (2) 500m | 500m (10x50m span) | S/m | 100,000 | m | 500 | 50,000,000 |
| Flyover | | S/m2 | 2,500 | m2 | 0 | 0 |
| | | | | | | 126,403,000 |
| (2) Water Supply | 1,500 - 4,500 - 3,000m | | | | | |
| Mains to Block | | S/m | 98 | m | -3,000 | -294,000 |
| (3) Power Supply | | | | | | |
| Main Cables | | S/m | 50 | m | -3,000 | -150,000 |
| Duckbank | | S/m | 105 | m | -3,000 | -315,000 |
| | | | | | | -465,000 |
| (4) Banker Supply | | S/m | 1,600 | m | -3,000 | 4,800,000 |
| | Total | | | | | 130,444,000 |

Appendix (III)-4 Construction Arrangement

III-4.1 Construction Works of Major Facility (wharf)

Appendix III-4.1

Construction Works of Major Facility (Wharf)

1. Fundamental Condition to Construction Arrangement

Four basic structural types were selected for comparison study marine temporary works.

- a. Open structure, same type of existing wharf
- b. Concrete caisson box wall
- c. Steel sheet pile wall
- d. Concrete block wall

Total length of wharf in continuous construction is 1,200 m long.

Large floating plants will be mobilized from elsewhere in 1,350 nautical miles away.

2. Open Structure, Vertical Pile, Apply to 14 m Wharf

2.1 General Conditions

Total materials for 1,200 m wharf

(1) Total Piles

Ø800 prestressed pile

$$19 \text{ piles} \div 5 \text{ m} \times 1,200 = 4,560 \text{ piles}$$

Ø500 R.C pile

$$4 \text{ piles} \div 3.5 \text{ m} \times 1,200 = 1,371 \text{ piles}$$

(2) Total Concrete Volume

R.C cast in site

$$(15.0 + 6.1 + 6.2 + 13.4) \times 1,200 = 48,840 \text{ m}^2$$

Precast element

$$\text{Ø800; } 3.14 (0.4^2 - 0.28^2) \times 35.0 \text{ m} \times 4,560 = 40,893 \text{ m}^3$$

$$\text{Ø500; } 3.14 (0.25^2 - 0.21^2) \times 12.5 \text{ m} \times 1,371 = 990 \text{ m}^3$$

$$\text{Deck ; } 16.5 \text{ m}^3/\text{m} \times 1,200 = 19,800 \text{ m}^3$$

| | | |
|---------|----------------|------------------------|
| Precast | Subtotal | 61,683 m ³ |
| | Total concrete | 110,523 m ³ |

(3) Riprapping on Slope
 30.0 x 1,200 = 36,000 m³

2.4 Pile Driving

Ø800 x 4,560 piles
 unit weight 8.97 x 2.45 = 22.0 ton

Equipment arrangement and operation cost a day

| | |
|---|------------------|
| 1) Pile driving barge, D-70, 420 ps, 3 sets x 7,200 | = 21,600 \$ |
| 2) Crane barge 40 t, 3 sets x 1,600 | = 4,800 \$ |
| 3) Tug 50 t, 350 ps 2 sets x 1,500 | = 3,000 \$ |
| 4) Misc | 3,000 \$ |
| 5) Overhead 20 % 32,400 x 0.2 | = 6,480 \$ |
| Total | 38,880 \$ |

Driving speed, 4.5 piles a day per fleet

Required length of day
 4,560 piles ÷ 4.5 piles/day ÷ 3 sets = 338 days

Unit driving cost per pile
 38,880 \$/day ÷ 4.5 piles ÷ 3 sets = 2,880 \$/pile

Cost per meter
 2,880 ÷ 35.0 m = 82.3 \$/m
 (included in unit cost)

Total pile length,
 4,560 piles x 35 m = 159,600 m

2.3 Mobilization/Demobilization Cost, Pile Driving Fleet

Length of voyage 2,500 km (1,350 miles)

Required length of voyage

| | |
|--------------------------------|-------------|
| 1,350 miles + (20 hr x 5 knot) | = 13.5 days |
| Preparation | 2.0 days |
| Total | 15.5 days |

| | |
|---|-------------|
| Total length of mobilization/demobilization | |
| 15.5 days x 2 trips | = 31.0 days |
| Say | 30 days |

| | |
|---|--------------|
| Required cost | |
| Tug 1,000 ps, 28 days x 3,800 \$ x 3 sets | = 319,200 \$ |
| Pile driving fleet, 30 days x 38,880 \$ x 0.7 | = 816,480 \$ |
| Total | 1,135,680 \$ |

| | |
|-------------------------------|------------|
| Required cost per berth meter | |
| 1,135,680 \$ + 1,200 m | = 946 \$/m |

2.4 Pile Preparation Yard

| | |
|------------|----------------------|
| Total area | 9,000 m ² |
|------------|----------------------|

| | | |
|-----------------|--|------------|
| Required cost | | |
| 1) Land cost, | free of charge | |
| 2) Grading | 5 \$/m ² x 9,000 m ² | 45,000 \$ |
| 3) Civil works | 10 \$/m ² x 9,000 m ² | 9,000 \$ |
| 4) Loading pier | 5,000 \$/m ² x 100 m ² | 500,000 \$ |
| 5) Equipment | | 150,000 \$ |
| 6) Utility | | 30,000 \$ |
| 7) Overhead | 20 % 785,000 x 0.20 | 157,000 \$ |
| Total | | 942,000 \$ |

| | |
|-------------------------------|------------|
| Required cost per berth meter | |
| 942,000 \$ + 1,200 m | = 785 \$/m |

2.5 Precast/element Prefabrication Yard

| | |
|---------------------------|----------------|
| Number of deck element | |
| 11 blocks + 5 m x 1,200 m | = 2,640 blocks |

7.5 m³/block

Concrete placing a day (all concrete works)

$$110,523 \text{ m}^3 \div 340 \text{ days} = 325 \text{ m}^3/\text{day}$$

Deck element

$$19,800 \text{ m}^3 \div 340 \text{ days} = 58 \text{ m}^3/\text{day}$$

Number of block a day

$$58 \text{ m}^3/\text{day} \div 7.5 = 7.76$$

Say

$$8 \text{ block}/\text{day}$$

Required area for deck element casting assuming 7 day stay there,

$$8 \text{ blocks}/\text{day} \times 7 \text{ day}/\text{yard} = 56 \text{ blocks}/\text{yard}$$

$$\text{Required day} \quad 2,640 \text{ blocks} \div 8 \text{ blocks} = 330 \text{ days}$$

Casting lane

$$(4.5 \text{ m} + 1.5 \text{ m}) \times 56 \text{ blocks} \times 1.4 = 470 \text{ m}$$

Required yard area

$$\text{Casting yard} \quad 470 \text{ m} \times 6 \text{ m} = 2,820 \text{ m}^2$$

$$\text{Storage yard} \quad 2,820 \times 2.0 = 5,640 \text{ m}^2$$

$$\text{Material yard} \quad 5,000 \text{ m}^2$$

$$\text{Access} \quad 4,000 \text{ m}^2$$

$$\text{Total} \quad 17,460 \text{ m}^2$$

$$\text{Say} \quad 18,000 \text{ m}^2$$

Required cost

1) Land cost, free of charge

$$2) \text{ Grading} \quad 5 \text{ \$/m}^2 \times 18,000 \text{ m}^2 = 90,000 \text{ \$}$$

$$3) \text{ Civil works} \quad 10 \text{ \$/m}^2 \times 18,000 \text{ m}^2 = 180,000 \text{ \$}$$

4) Loading pier, use pile pier

$$5) \text{ Equipment} \quad 100,000 \text{ \$/sets} \times 3 \text{ sets} = 300,000 \text{ \$}$$

$$6) \text{ Utility} \quad 50,000 \text{ \$}$$

$$\text{Total} \quad 620,000 \text{ \$}$$

Required cost berth meter

$$620,000 \$ \div 1,200 \text{ m} = 516.7 \$/\text{m}$$

2.6 Precast Yard Operation

Yard operation cost, replacing and loading cost a day

| | | |
|--------------------|---------------------------|---------------------|
| 1) Assisting crane | 10 t, 2 sets | 1,000 \$ |
| 2) Fuel and power | | 200 \$ |
| 3) Utility | | 200 \$ |
| 4) Yard workers | 16 blocks x 2 x 10 \$/day | 320 \$ |
| 5) Crane operators | 2 x 25 \$/day | = 50 \$ |
| 6) Maintenance | 1,250,000 x 0.03 % | = 375 \$ |
| 7) Misc. | | 250 \$ |
| 8) Overhead | 20 % 2,395 x 0.20 | = 479 \$ |
| Total | | 2,874 \$/day |

Required cost per concrete volume

$$2,874 \$/\text{day} \div 60 \text{ m}^3/\text{day} \div 2.0 = 24.0 \$/\text{m}^3$$

Required cost per berth meter

$$2,874 \times 340 \text{ days} \div 1,200 \text{ m} = 814.3 \$/\text{m}$$

2.7 Precast Deck Element Transport and Setting

Average element setting speed, 8 blocks/day

$$\text{Unit weight} \quad 7.5 \times 2.45 = 18.4 \text{ t/block}$$

| | | |
|--------------------|-------------------|--------------|
| 1) Main crane | 30 t 2 sets | 1,400 \$ |
| 2) Yard workers | 15 x 10 \$/day | 150 \$ |
| 3) Crane operators | 2 x 25 \$/day | 50 \$ |
| 4) Misc. | | 400 \$ |
| 5) Overheads | 20 % 2,000 x 0.20 | = 400 \$ |
| Total | | 2,400 |

Required cost per block (included in unit cost)

$$2,400 \$ \div 8 = 300.0 \$/\text{block}$$

Required cost per berth meter
 $4,860 \times 2,640 \text{ blocks} + 1,200 \text{ m} = 10,692 \text{ \$/m}$

3. Concrete Caisson Box, Apply to 14 m Wharf

3.1 General Condition and Operation Cost

Size Caisson box, L x B x H = 15 m x 15 m x 18 m
 Weight of caisson $1,100 \text{ m}^3/\text{box} \times 2.4 \text{ t/m}^3 = 2,640 \text{ t/box}$

Number of concrete casting per box

$1 \text{ m} + 5 \text{ times} \times 3 \text{ m} + 2 \text{ m} = 7 \text{ times}$ for 18 m height

Max. box weight on the floating dock $2,640 \times 0.70 = 1,848 \text{ t/box}$

last two casting layers to be made on free water

Required length of stay on the floating dock

$5 \text{ layers casting} \times 5 \text{ days} = 25 \text{ days/box}$

Floating dock: assuming 6,000 ton carrying capacity

loading deck 50 m x 30 m, draft = 10 m

Casting arrangement

$5 + 15 + 10 + 15 + 5 = 50 \text{ m}$

Two boxes simultaneous casting on the deck

Production speed

$25 + 2 = 12.5 \text{ day/box}$

3.2 Prefabrication

Equipment arrangement and operation cost

| | | |
|-------------------------------|-----------------------|----------------------|
| 1) Floating dock | 2 sets x 9,000 \$/day | 18,000 \$/day |
| 2) Support crane barge 25 ton | 3 sets x 1,200 \$/day | 3,600 \$/day |
| 3) Barge 500 t (plant) | | 550 \$/day |
| 4) Misc | | 1,000 \$/day |
| 5) Overhead | 20 % | 4,630 \$/day |
| Total | | 27,780 \$/day |

Total box,
 1,200 m + 15 m = 80 boxes

Required length of day,
 12.5 days/box x 80 boxes x 1/2 = 500 days

Required cost
 500 days x 27,780 = 13,890,000 \$

Unit cost per berth meter
 13,890,000 \$ ÷ 1,200 m = 11,575.0 \$/m

Required concrete placing capacity a day
 1,100 m³/box x 0.70 + 5 layers = 154.0 m³/day
 using 200 m³ concrete plant

3.3 Towing and Setting

| | | |
|----------------|----------------------------|---------------------|
| 1) Crane barge | 25 t 2 sets x 1,000 | = 2,000 \$ |
| 2) Tug | 30 t 200 Hp 2 sets x 1,000 | = 2,000 \$ |
| 3) Misc | | 2,000 \$ |
| 4) Overhead | 20 % | 1,200 \$ |
| Total | | 7,200 \$/day |

Required length of day for a box setting

| | |
|------------------------------------|---------------|
| 1) Towing to last concrete casting | 1 day |
| 2) Towing to temporary anchorage | 1 day |
| 3) Towing to site | 1 day |
| 4) Setting assist | 3 days |
| 5) Misc | 2 days |
| Total | 8 days |

Required length of day for a berth
 following to box production speed = 500 days

Required cost per box
 500 days x 7,200 \$/day + 80 boxes = 45,000.0 \$/Box

(including unit cost)

3.4 Mobilization/Demobilization Cost

Length of voyage, assuming 2,500 km (1,350 miles)

Required length of voyage

$$1,350 \div (20 \text{ hr} \times 3.0 \text{ knot}) = 22.5 \text{ days}$$

Preparation

7.0 days

Total

29.5 days

Total length of mobilization//demobilization

$$29.5 \times 2 \text{ trips} = 59.0 \text{ days}$$

Say

60.0 days

Required cost

$$\text{Tug } 1,000 \text{ ps, } 46 \text{ days} \times 3,800 \times 4 \text{ sets} = 699,200$$

$$60 \text{ days} \times 34,980 \times 0.7 = 1,469,160$$

Total

2,168,360

Unit cost per berth meter

$$2,168,360 \div 1,200 \text{ m} = 2,167 \text{ \$/m}$$

4. Steel Sheet Pile Wall, Apply to 14 m Wharf

4.1 General Conditions

Using steel pipe sheet pile, $\text{Ø}1,000 \text{ L} = 30.5 \text{ m}$

Foundation pile, $\text{Ø}900 \text{ L} = 30.5 \text{ m}$

Number of piles

$$1,200 \text{ m} \div 1.2 \text{ p/m} + 1,200 \text{ m} \div 3.6 \text{ p/m}$$

$$= 1,000 + 333$$

$$= 1,333 \text{ piles}$$

Total pile length

$$1,000 \times 30.5 \text{ m} + 333 \times 30.5 \text{ m}$$

$$= 30,500 + 10,157$$

= 40,657 m

Average pile length

40,657 m ÷ 1,333 piles = 30.5 m/pile

Equipment arrangement and operation cost a day

| | | | |
|------------------------|---------------|----------------|---------------|
| 1) Pile driving barge, | D-7-, 420 ps, | 2 sets x 7,200 | = 14,400 \$ |
| 2) Crane barge | 40 t, | 2 sets x 1,600 | = 3,200 \$ |
| 3) Tug | 50 t 350 ps | 2 sets x 1,500 | = 3,000 \$ |
| 4) Misc | | | 2,000 \$ |
| 5) Overhead | 20 % | | 4,500 \$ |
| Total | | | 27,120 \$/day |

Driving speed, 3 piles a day

Required length of day

1,333 piles ÷ 3 piles/day ÷ 2 sets = 222 days

Unit driving cost per pile

27,120 \$/day ÷ 3 piles ÷ 2 sets = 4,520 \$/pile

Unit driving cost per meter

4,520 \$/pile ÷ 30.5 m = 148.2 \$/m

(included in unit cost)

Unit price per diameter/meter

Ø1,000 152 \$/m

Ø900 137 \$/m

(included in unit cost)

Confirmation, total cost for 1,200 m wharf

152 x 30,500 m + 137 x 10,157 m = 6,027,500 \$

222 days x 27,120 \$/day = 6,020,640 \$

4.2 Mobilization/Demobilization Cost, Pile Driving Fleet

Length of voyage 2,500 km (1,350 miles)

| | |
|--------------------------------|-------------|
| Required length of voyage | |
| 1,350 miles + (20 hr x 5 knot) | = 13.5 days |
| Preparation | 2.0 days |
| Total | 15.5 days |

| | |
|---|-------------|
| Total length of mobilization/demobilization | |
| 15.5 days x 2 trips | = 31.0 days |
| Say | 30 days |

| | |
|--|--------------|
| Required cost | |
| Tug 1,000 ps 28 days x 3,800 \$ x 2 sets | = 212,800 \$ |
| Pile driving fleet, 30 days x 27,120 x 0.7 | = 569,520 \$ |
| Total | 782,320 \$ |

| | |
|-------------------------------|------------|
| Required cost per berth meter | |
| 782,320 \$ + 1,200 m | = 652 \$/m |

4.3 Pile Preparation Yard

Total area

Required cost

| | | |
|-----------------|--|----------------|
| 1) Land cost | free of charge | |
| 2) Grading | 5 \$/m ² x 6,000 m ² | = 30,000 \$ |
| 3) Civil works | 10 \$/m ² x 6,000 m ² | = 60,000 \$ |
| 4) Loading pier | 5,000 \$/m ² x 100 m ² | = 500,000 \$ |
| 5) Equipment | | 100,000 \$ |
| 6) Utility | | 20,000 \$ |
| 7) Overhead | 20 % | 142,000 \$ |
| Total | | 852,000 \$/day |

| | |
|----------------------------------|------------|
| Requirement cost per berth meter | |
| 852,000 \$ + 1,200 m | = 710 \$/m |

5. Concrete Block, Apply to 14 m Wharf

5.1 General Condition

Number of blocks

$$1,200 \text{ m} \times 9 \text{ layer/section} + 2.5 \text{ m/layers} = 4,320 \text{ blocks}$$

Unit block volume: Average

$$166.9 \text{ m}^3/\text{m} \times 2.5 \text{ m} + 9 \text{ layers} = 46.36 \text{ m}^3/\text{block}$$

$$\text{Maximum weight} \quad 56.00 \text{ m}^3 \times 2.3 \text{ t/m}^3 = 128.8 \text{ t/block}$$

Max. concrete placing, less than 350 m³/day

$$350 \div 46.36 = 7.5 \text{ blocks}$$

$$\text{Say} \quad 7 \text{ blocks}$$

Concrete work a day

$$46.36 \text{ m}^3/\text{block} \times 7 \text{ blocks} = 324.5 \text{ m}^3/\text{day}$$

Blocks in casting area assuming 7 day stay in concrete casting yard

$$7 \text{ blocks/day} \times 7 \text{ day/yard} = 49 \text{ blocks/yard}$$

Casting lane

$$(2.5 \text{ m} + 0.5 \text{ m}) \times 49 \text{ blocks} \times 1.4 = 210.0 \text{ m}$$

5.2 Prefabrication Yard

$$\text{Casting yard} \quad 210 \text{ m} \times 12 \text{ m} = 2,520 \text{ m}^2$$

$$\text{Storage yard} \quad 1,800 \times 3 = 5,400 \text{ m}^2$$

$$\text{Material} \quad 4,000 \text{ m}^2$$

$$\text{Access} \quad 3,000 \text{ m}^2$$

$$\text{Total} \quad 14,920 \text{ m}^2 = 15,000 \text{ m}^2$$

Required cost

$$1) \text{ Land cost} \quad \text{free of charge}$$

$$2) \text{ Grading} \quad 5 \text{ \$/m}^2 \times 15,000 \text{ m}^2 = 75,000 \text{ \$}$$

$$3) \text{ Civil works} \quad 15 \text{ \$/m}^2 \times 15,000 \text{ m}^2 = 225,000 \text{ \$}$$

$$4) \text{ Loading pier} \quad 5,000 \text{ \$/m}^2 \times 100 \text{ m}^2 = 500,000 \text{ \$}$$

$$5) \text{ Equipment} \quad 100,000 \text{ \$/set} \times 4 \text{ sets} = 400,000 \text{ \$}$$

$$6) \text{ Utilities} \quad 50,000 \text{ \$}$$

Total 1,250,000 \$

Required cost per berth meter,
 $1,250,000 \$ + 1,200 \text{ m}$ = 1,041.7 \$/m

5.3 Yard Operation

Yard operation cost, replacing and loading cost per day

| | | |
|--------------------|--------------------|--------------|
| 1) Assisting | 10 t 3 sets | 1,500 \$ |
| 2) Fuel and power | | 500 \$ |
| 3) Utility | | 250 \$ |
| 4) Yard workers | 25 x 10 \$/day | 250 \$ |
| 5) Crane operators | 6 x 25 \$/day | 150 \$ |
| 6) Maintenance | 1,250,000 x 0.03 % | 375 \$ |
| 7) Misc materials | | 3,000 \$ |
| 8) Overhead | 20 % | 1,205 \$ |
| Total | | 7,230 \$/day |

Required cost per concrete volume
 $7,230 \text{ \$/day} + 463.6$ = 15.59 \$/m³

Required cost per berth number
 $15.59 \text{ \$/m}^3 + 166.9 \text{ m}^3/\text{m}$ = 2,602 \$/m

5.4 Block Transport, Temporary Storage and Setting

Floating equipment for setting block

Average block setting speed, 7 blocks/day

Required length of day
 $4,320 \text{ blocks} + 7 \text{ block/day}$ = 617 days

Crane fleet, cost per day

1) Crane barge, 300 ton, 330 ps 6,000 \$

| | | |
|-------------|------------------|---------------|
| 2) Barge | 550 ton x 2 sets | 1,000 \$ |
| 3) Misc | (30 %) | 2,100 \$ |
| 4) Overhead | (20 %) | 1,800 \$ |
| Subtotal | | 10,920 \$/day |

Required cost per block (included in unit cost)
 $10,920 \$ \div 7 = 1,560 \$/\text{block}$

Required cost per berth meter
 $10,920 \times 617 \text{ days} \div 1,200 \text{ m} = 5,615 \$/\text{m}$

5.5 Mobilization/Demobilization Cost

Length of voyage, 2,500 km (1,350 miles)

Required length of voyage
 $1,350 \div (20 \text{ hr} \times 5 \text{ knot}) = 13.5 \text{ day}$
 Preparation 2.0 days
 Total 15.5 days

Total length of mobilization/demobilization
 $15.5 \times 2 \text{ trips} = 31.0 \text{ days}$
 Say 30.0 days

Required cost
 Tug 1,000 ps 28 days x 3,800 \$ = 106,400 \$
 Crane fleet, 30 days x 9,432 \$ x 0.8 = 226,400 \$
 Total 332,800 \$

Cost per berth meter
 $332,800 \$ \div 1,200 \text{ m} = 277 \$/\text{m}$

Appendix 2B6 Siltation Study

East Musa Channel, Alternative - 1

Original dredging height

$$5.9 \text{ m} + 2.0 \text{ m} = 7.9 \text{ m}$$

Siltation for 20 years by graph

| | |
|-------------------------------|--------|
| Siltation | 4.8 m |
| Recovery rate | 61 % |
| Theoretical annual siltation, | 0.24 m |

Annual maintenance depth ; D

- a. Every three year dredging
- b. 50 % concentration to first three years

Thus,

$$\begin{aligned} D &= 0.24 \text{ m} \times 3 \text{ years} \times 1.5 \div 3 \text{ years} \\ &= 0.36 \text{ m} \end{aligned}$$

Dredging seabed

$$27 \text{ sections} \times 100 \text{ m} \times 200 \text{ m} = 540,000 \text{ m}^2$$

Thus, annual dredging volume for costing

$$\begin{aligned} V &= 0.36 \text{ m} \times 540,000 \text{ m}^2 \\ &= 194,400 \text{ m}^3 \\ \text{Say } &200,000 \text{ m}^3 \end{aligned}$$

East Musa Channel, Alternative - 2

Original dredging height

$$5.9 \text{ m} + 4.0 \text{ m} = 9.9 \text{ m}$$

Siltation for 20 years by graph

| | |
|-------------------------------|---------|
| Siltation | 6.0 m |
| Recovery rate | 61 % |
| Theoretical annual siltation, | 0.300 m |

Annual maintenance depth ; D

- a. Every three year dredging
- b. 50 % concentration to first three years

Thus,

$$D = 0.30 \text{ m} \times 3 \text{ years} \times 1.5 \times 3 \text{ years} \\ = 0.45 \text{ m}$$

Dredging seabed

$$27 \text{ sections} \times 100 \text{ m} \times 150 \text{ m} = 405,000 \text{ m}^2$$

Thus, annual dredging volume for costing

$$V = 0.45 \text{ m} \times 405,000 \text{ m}^2 \\ = 182,250 \text{ m}^3 \\ \text{Say } 200,000 \text{ m}^3$$

West Musa Channel

| | |
|-------------------------|------------|
| Present depth | DL -6.5 m |
| Future depth | DL -13.0 m |
| Original dredging depth | 6.5 m |

Siltation for 20 years by graph, using "Draq line",

| | |
|-------------------------------|--------|
| Siltation | 1.8 m |
| Recovery rate | 28 % |
| Theoretical annual siltation, | 0.09 m |

Annual maintenance depth; D

- a. Every three year dredging
- b. 50 % concentration to first three years

Thus,

$$D = 0.09 \text{ m} \times 3 \text{ years} \times 1.5 \div 3 \text{ years} \\ = 0.135 \text{ m}$$

Dredging seabed

$$30 \text{ sections} \times 100 \text{ m} \times 150 \text{ m} = 450,000 \text{ m}^2$$

Thus, annual dredging volume for costing

$$V = 0.135 \text{ m} \times 450,000 \text{ m}^2 \\ = 60,750 \text{ m}^3$$

Say 100,000 m³

Draq Channel

Original dredging height

$$8.6 \text{ m} + 2.0 \text{ m} = 10.6 \text{ m}$$

Siltation for 20 years by graph

| | |
|--------------------------|---------|
| Siltation | 2.9 m |
| Recovery rate | 27 % |
| Theoretical annual rate, | 0.145 m |

Annual maintenance depth ; D

- a. Every three year dredging
- b. 50 % concentration to first three years

Thus,

$$D = 0.145 \text{ m} \times 3 \text{ years} \times 1.5 \div 3 \text{ years} \\ = 4.22 \text{ m}$$

Dredging seabed

$$52 \text{ sections} \times 100 \text{ m} \times 600 \text{ m} \times 60 \% = 1,872,000 \text{ m}^2$$

Thus, annual dredging volume for costing

$$V = 0.22 \text{ m} \times 1,872,000 \text{ m}^2 \\ = 411,400 \text{ m}^3$$

Say 450,000 m³

Zangi Channel, Alternative - 3

| | |
|-------------------------|------------|
| Present depth | DL -4.9 m |
| Future depth | DL -13.0 m |
| Original dredging depth | 8.1 m |

Siltation for 20 years by graph

| | |
|-------------------------------|---------|
| Siltation | 3.5 m |
| Recovery rate | 43 % |
| Theoretical annual siltation, | 0.175 m |

Annual maintenance depth; D

- Every three year dredging
- 50 % concentration to first three years

Thus,

$$D = 0.175 \text{ m} \times 3 \text{ years} \times 1.5 \div 3 \text{ years} \\ = 0.263 \text{ m}$$

Dredging seabed

$$25 \text{ sections} \times 100 \text{ m} \times 500 \text{ m} = 1,250,000 \text{ m}^2$$

Thus, annual dredging volume for costing

$$V = 0.263 \text{ m} \times 1,250,000 \text{ m}^2 \\ = 328,750 \text{ m}^3 \\ \text{Say } 350,000 \text{ m}^3$$

Appendix (III)-5 Siltation, Dredging and Reclamation

- III-5.1 Siltation Study
- III-5.2 Change of Channel Section
- III-5.3 Dredging and Reclamation by Section

Siltation Rate, Dorag
Entrance to Zangi Channel

| Location | Section | Width (m) | Original Dredging (m ²) | Present Siltation (m ²) | Original Dredging Height | Siltation Height | Siltation Rate (%) | Note |
|-----------------------|---------|-----------|-------------------------------------|-------------------------------------|--------------------------|------------------|--------------------|------|
| Existing Berth No. 10 | D - 2 | 680 | 4,100 | 1,500 | 6.0 | 2.2 | 37 | |
| Corner | D - 1 | 535 | 4,400 | 1,200 | 8.2 | 2.2 | 27 | |
| Container Berth | 3 | 360 | 3,800 | 1,200 | 10.6 | 3.3 | 32 | |
| | 5 | 260 | 2,600 | 800 | 10.0 | 3.1 | 31 | |
| | 7 | 230 | 2,350 | 450 | 10.2 | 2.0 | 19 | |
| | 9 | 240 | 2,180 | 480 | 9.1 | 2.0 | 22 | |
| Existing Berth No. 15 | 11 | 250 | 2,450 | 250 | 9.8 | 2.2 | 22 | |
| Total (Average) | | 2,555 | 21,880 | 6,180 | 8.6 | 2.4 | 28 | |

Siltation Rate, Zangi

| Location | Section | Width (m) | Original Dredging (m ³) | Present Siltation (m ³) | Original Dredging Height | Siltation Height | Siltation Rate (%) | Note |
|------------------------|---------|--------------|-------------------------------------|-------------------------------------|--------------------------|------------------|--------------------|------|
| Dorag to Zangi | D50 | 410 | 0 | 1,900 | 0 | 4.6 | - | |
| | 52 | 510 | 0 | 1,800 | 0 | 3.5 | - | |
| Zangi Entrance | 54 | 775 | 0 | 200 | 0 | 0.3 | - | |
| | Z 1 | 410 | 0 | 200 | 0 | 0.5 | - | |
| | 3 | 380 | 0 | -300 | 0 | -0.8 | - | |
| | 5 | 380 | 0 | 800 | 0 | 2.1 | - | |
| | 7 | 425 | 0 | 500 | 0 | 1.2 | - | |
| | 10 | 425 | 0 | -300 | 0 | -0.7 | - | |
| | 12 | 490 | 0 | 400 | 0 | 0.8 | - | |
| | 14 | 520 | 0 | 300 | 0 | 0.6 | - | |
| | 16 | 520 | 0 | 1,100 | 0 | 2.1 | - | |
| | 18 | 540 | 0 | 200 | 0 | 0.4 | - | |
| 20 | 590 | 0 | 1,100 | 0 | 1.9 | - | | |
| Total (Average) | | 6,395 | 0 | 7,900 | 0 | 1.2 | - | |

Appendix III-5.2 Change of Channel Section

Change of Channel Section (1)

| Note | Section | Area (m ²) | | Proposed | Ratio | Existing Channel | |
|---------------|-----------|------------------------|------------------|----------|--------|--------------------------|---------------------------------|
| | | Existing | Waterlevel +3.0m | | | Average Width at DL±0(m) | Average Depth below, DL +3.0(m) |
| DORAG CHANNEL | D 4 (85%) | 12,700 | 14,900 | 1.17 | 780 | 16.3 | 13.3 |
| | 5 (90%) | 11,100 | 15,400 | 1.39 | 620 | 17.9 | 14.9 |
| | 6 | 11,400 | 16,800 | 1.47 | 570 | 20.0 | 17.0 |
| | 8 | 10,400 | 16,900 | 1.63 | 580 | 17.9 | 14.9 |
| | 10 | 9,600 | 15,700 | 1.64 | 570 | 16.8 | 13.8 |
| | 12 | 10,000 | 18,100 | 1.81 | 580 | 17.2 | 14.2 |
| | 14 | 9,800 | 14,300 | 1.64 | 630 | 15.6 | 12.6 |
| | 17 | 8,800 | 11,900 | 1.35 | 600 | 14.7 | 11.7 |
| | 20 | 9,700 | 9,700 | 1.00 | 670 | 14.5 | 11.5 |
| | 23 | 9,900 | 9,400 | 1.05 | 670 | 14.8 | 11.8 |
| | 26 | 9,900 | 9,800 | 0.99 | 660 | 15.0 | 12.0 |
| | 29 | 9,600 | 9,800 | 1.02 | 640 | 15.0 | 12.0 |
| | 32 | 10,100 | 10,300 | 1.02 | 620 | 16.3 | 14.3 |
| | 35 | 10,400 | 9,900 | 0.95 | 630 | 16.5 | 14.5 |
| | 38 | 10,900 | 9,800 | 0.90 | 660 | 16.5 | 14.5 |
| | 41 | 10,800 | 10,000 | 0.93 | 670 | 16.1 | 14.1 |
| | 44 (95%) | 10,700 | 11,300 | 1.06 | 570 | 18.8 | 14.8 |
| | 47 | 11,000 | 12,500 | 1.34 | 520 | 21.2 | 18.2 |
| | 48 | 9,600 | 11,500 | 1.20 | 480 | 20.0 | 17.0 |
| | 50 (90%) | 8,000 | 12,200 | 1.53 | 400 | 20.0 | 17.0 |
| | 51 (85%) | 7,500 | 12,800 | 1.71 | 340 | 22.1 | 19.1 |
| | 52 | 9,800 | 16,700 | 1.70 | 390 | 25.1 | 22.1 |
| Total | | 221,700 | 279,700 | | 12,850 | | |
| Average | | 10,080 | 12,710 | 1.26 | 643 | 17.3 | 14.3 |

Change of Channel Section (2)

| Note | Section | Area (m ²) | | Proposed | Ratio | Existing Channel | |
|---------------|-----------|------------------------|------------------|----------|-------|--------------------------|---------------------------------|
| | | Existing | Waterlevel +3.0m | | | Average Width at DL±0(m) | Average Depth below, DL +3.0(m) |
| ZANGI CHANNEL | Z 1 (85%) | 5.610 | 11,900 | 2.12 | 540 | 10.4 | 7.4 |
| | 3 (90%) | 2.880 | 8,100 | 2.81 | 270 | 10.7 | 7.7 |
| | 5 (95%) | 2.280 | 8,210 | 4.04 | 270 | 8.4 | 5.4 |
| | 7 | 2,400 | 8,700 | 3.63 | 320 | 7.5 | 3.5 |
| | 8 | 2,300 | 8,600 | 3.74 | 320 | 7.2 | 3.2 |
| | 10 (90%) | 2,430 | 7,920 | 3.25 | 460 | 5.8 | 2.8 |
| | 12 (95%) | 1,900 | 7,260 | 3.82 | 370 | 5.1 | 2.1 |
| | 14 | 2,300 | 7,800 | 3.39 | 360 | 6.4 | 3.4 |
| | 16 | 2,200 | 7,700 | 3.50 | 320 | 6.9 | 3.9 |
| | 18 | 2,200 | 7,600 | 3.45 | 320 | 6.9 | 3.9 |
| | 20 | 2,100 | 7,700 | 3.67 | 330 | 6.4 | 3.4 |
| | 22 | 1,700 | 7,400 | 4.35 | 250 | 6.8 | 3.8 |
| | 24 | 3,300 | 7,300 | 2.21 | 440 | 7.5 | 4.5 |
| | 26 | 3,200 | 7,500 | 2.34 | 460 | 7.0 | 4.0 |
| | 28 | 3,600 | 7,500 | 2.08 | 530 | 6.0 | 3.0 |
| | 30 | 3,100 | 7,500 | 2.42 | 510 | 6.1 | 3.0 |
| | 32 | 2,900 | 7,400 | 2.55 | 480 | 6.0 | 3.1 |
| | 34 | 3,200 | 7,500 | 2.34 | 470 | 6.8 | 3.8 |
| | 35 | 2,800 | 7,500 | 2.68 | 380 | 7.4 | 4.4 |
| | 36 | 2,400 | 8,100 | 3.38 | 300 | 8.0 | 5.0 |
| | 37 (95%) | 2,945 | 6,650 | 2.26 | 330 | 8.9 | 5.9 |
| | 38 (90%) | 4,770 | 8,190 | 1.72 | 390 | 12.2 | 9.2 |
| | 39 (80%) | 4,880 | 9,120 | 1.87 | 400 | 12.2 | 9.2 |
| | | 69,895 | 184,150 | | 8,820 | | |
| Average | | 2,930 | 8,007 | 2.73 | 383 | 7.9 | 4.9 |

Appendix III-5.3 Dredging and Reclamation by Section

East Musa Channel

Basic Volume, Alternative - 1 or 2

EM-PI

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | RECLAMATION - I | | | RECLAMATION - II | | | | | | |
|-----------------|------------------|--------------|----------|--------|-----------------|-------|--------|------------------|------|--------|------------|--|--|--|
| | | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 | | | |
| Alternative - 1 | EM 1 | - | | | | | | | | | | | | |
| | 2 | 50 | 51 | 51 | 2,550 | 1,575 | 1,575 | 78,750 | | | | | | |
| | 3 | 100 | 455 | | | 2,259 | | | | | | | | |
| | 4 | 100 | 188 | | | 2,296 | | | | | | | | |
| | 5 | 100 | 60 | | | 2,676 | | | | | | | | |
| | 6 | 100 | 0 | | | 3,388 | | | | | | | | |
| | 7 | 100 | 0 | | | 3,397 | | | | | | | | |
| | 8 | 100 | 0 | | | 3,369 | | | | | | | | |
| | 9 | 100 | 0 | | | 2,747 | | | | | | | | |
| | 10 | 100 | 0 | | | 1,577 | | | | | | | | |
| | 11 | 100 | 0 | | | 1,789 | | | | | | | | |
| | 12 | 100 | 0 | | | 1,623 | | | | | | | | |
| | 13 | 100 | 0 | 703 | 70,300 | 0 | 25,121 | 2,512,100 | | | | | | |
| | 14 | 0 | 58 | 58 | 0 | 978 | 978 | 0 | | | | | | |
| | 15 | 80 | 0 | 0 | 0 | 179 | 1,179 | 94,320 | | | | | | |
| | 16 | 100 | 0 | | | 1,111 | | | | | | | | |
| | 17 | 100 | 0 | | | 1,069 | | | | | | | | |
| | 18 | 100 | 0 | | | 697 | | | | | | | | |
| | 19 | 100 | 38 | | | 878 | | | | | | | | |
| | 20 | 100 | 40 | | | 793 | | | | | | | | |
| | 21 | 100 | 712 | | | 0 | | | | | | | | |
| | 22 | 100 | 2,305 | | | 0 | | | | | | | | |
| | 23 | 100 | 2,936 | | | 0 | | | | | | | | |
| | 24 | 100 | 1,538 | | | 0 | | | | | | | | |
| | 25 | 100 | 1,415 | | | 0 | | | | | | | | |

| TYPICAL NOTES | SECTION | | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | |
|---------------|---------|-----|-----------------|----------|--------|------------|-----------------|-----------|------------|------------------|--------|------------|
| | AREA | NO. | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 |
| | EM | 26 | 100 | 1,117 | | 0 | 0 | | | | | |
| | | 27 | 100 | 35 | | 0 | 0 | | | | | |
| | | 28 | 100 | 0 | | 0 | 0 | | | | | |
| | | 29 | 100 | 0 | | 0 | 0 | | | | | |
| | | 30 | 100 | 0 | 10,136 | 1,013,600 | 0 | 4,548 | 454,800 | | | |
| Total | | | | | | 1,086,450 | | 3,139,970 | | | 0 | |
| | | | | | | | | | | | | |
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East Musa Channel

EM-P3

Basic Volume, Alternative - 3

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | | | |
|-----------------|------------------|--------------|----------|--------|------------|-----------------|--------|------------|------------------|--------|------------|--|--|
| | | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 | | |
| Alternative - 3 | EM 1 | 70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| | 2 | 100 | 847 | | | 0 | | | | | | | |
| | 3 | 100 | 739 | | | 81 | | | | | | | |
| | 4 | 100 | 550 | | | 169 | | | | | | | |
| | 5 | 100 | 329 | | | 263 | | | | | | | |
| | 6 | 100 | 0 | | | 450 | | | | | | | |
| | 7 | 100 | 0 | | | 457 | | | | | | | |
| | 8 | 100 | 60 | | | 372 | | | | | | | |
| | 9 | 100 | 273 | | | 210 | | | | | | | |
| | 10 | 100 | 834 | | | 0 | | | | | | | |
| | 11 | 100 | 912 | 4,544 | 454,400 | 0 | 2,002 | 200,200 | | | | | |
| | 12 | 80 | 905 | 905 | 72,400 | 0 | 0 | 0 | | | | | |
| | 13 | 0 | 0 | 0 | 0 | 980 | 0 | 0 | | | | | |
| | 14 | 80 | 0 | 0 | 0 | 808 | 808 | 64,640 | | | | | |
| | 15 | 100 | 0 | | | 819 | | | | | | | |
| | 16 | 100 | 0 | | | 835 | | | | | | | |
| | 17 | 100 | 0 | | | 906 | | | | | | | |
| | 18 | 100 | 0 | | | 549 | | | | | | | |
| | 19 | 100 | 0 | | | 580 | | | | | | | |
| | 20 | 100 | 0 | | | 577 | | | | | | | |
| | 21 | 100 | 705 | | | 0 | | | | | | | |
| | 22 | 100 | 2,250 | | | 0 | | | | | | | |
| | 23 | 100 | 2,913 | | | 0 | | | | | | | |
| | 24 | 100 | 1,576 | | | 0 | | | | | | | |
| | 25 | 100 | 1,381 | | | 0 | | | | | | | |

EM-P4

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | | | |
|---------------|------------------|-----------------|----------|--------|------------|-----------------|--------|------------|------------------|--------|------------|--|---|
| | | | A m2 | ∑ A m2 | L x ∑ A m3 | B m2 | ∑ B m2 | L x ∑ B m3 | C m2 | ∑ C m2 | L x ∑ C m3 | | |
| | EM 26 | 100 | 1,093 | | | 0 | | | | | | | |
| | 27 | 100 | 31 | | | 0 | | | | | | | |
| | 28 | 100 | 0 | | | 0 | | | | | | | |
| | 29 | 100 | 0 | | | 0 | | | | | | | |
| | 30 | 100 | 0 | 9,949 | 994,900 | 0 | 4,266 | 426,600 | | | | | |
| Total | | | | | 1,521,700 | | | 691,440 | | | | | 0 |
| | | | | | | | | | | | | | |
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East Musa Channel

| Present Siltation | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - L | | | RECLAMATION - C | | | EM-P5 |
|-------------------|------------------|--------------|----------|-------|----------|-----------------|------|----------|-----------------|------|----------|--------|
| | | | A m2 | A m2 | L x A m3 | B m2 | B m2 | L x B m3 | C m2 | C m2 | L x C m3 | |
| | EM 1 | 70 | - | - | - | | | | | | | -10.0m |
| | 2 | 100 | 650 | | | | | | | | | |
| | 3 | 100 | 600 | | | | | | | | | |
| | 4 | 100 | 500 | | | | | | | | | |
| | 5 | 100 | 300 | | | | | | | | | |
| | 6 | 100 | 20 | | | | | | | | | |
| | 7 | 100 | 20 | | | | | | | | | |
| | 8 | 100 | 100 | | | | | | | | | |
| | 9 | 100 | 300 | | | | | | | | | |
| | 10 | 100 | 500 | | | | | | | | | -12.5m |
| | 11 | 100 | 600 | 3,590 | 359,000 | | | | | | | (-3.0) |
| | 12 | 80 | - | | | | | | | | | |
| | 13 | 0 | - | | | | | | | | | |
| | 14 | 80 | - | | | | | | | | | |
| | 15 | 100 | - | | | | | | | | | |
| | 16 | 100 | 220 | | | | | | | | | |
| | 17 | 100 | - | | | | | | | | | |
| | 18 | 100 | 150 | | | | | | | | | |
| | 19 | 100 | 110 | | | | | | | | | |
| | 20 | 100 | 150 | | | | | | | | | |
| | 21 | 100 | 880 | | | | | | | | | |
| | 22 | 100 | 2,430 | | | | | | | | | -4.0m |
| | 23 | 100 | 2,350 | | | | | | | | | |
| | 24 | 100 | 850 | | | | | | | | | |
| | 25 | 100 | 1,300 | | | | | | | | | -12.5m |

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | | | |
|---------------|------------------|--------------|----------|--------|-----------|-----------------|------|----------|------------------|------|----------|--|--|
| | | | A m2 | A m2 | L x A m3 | B m2 | B m2 | L x B m3 | C m2 | C m2 | L x C m3 | | |
| | EM 26 | 100 | 1,750 | | | | | | | | | | |
| | 27 | 100 | 0 | | | | | | | | | | |
| | 28 | 100 | 0 | | | | | | | | | | |
| | 29 | 100 | 0 | | | | | | | | | | |
| | 30 | 100 | 0 | 10,190 | 1,019,000 | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Total | | | | | | 1,378,000 | | | | | | | |
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East Musa Channel Summary

EM-P8

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | | | | |
|----------------------|------------------|--------------|----------|-----------|------------|-----------------|--------|------------|------------------|-----------|------------|--|--|---|
| | | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 | | | |
| Master plan | | | | | | | | | | | | | | |
| Alternative - 1 or 2 | EM 1~30 | | | 1,086,450 | | | | | | 3,139,370 | | | | 0 |
| Present siltation | EM 1~30 | | | 1,378,000 | | | | | | 0 | | | | 0 |
| | | | | | | | | | | | | | | |
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| Master plan | | | | | | | | | | | | | | |
| Alternative - 3 | EM 1~30 | | | 1,521,700 | | | | | | 691,440 | | | | 0 |
| Present siltation | EM 1~30 | | | 1,378,000 | | | | | | 0 | | | | 0 |
| | | | | | | | | | | | | | | |
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Dorag Channel

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | |
|---------------|------------------|--------------|------------------|--------------------|------------------------|------------------|--------------------|------------------------|------------------|--------------------|------------------------|
| | | | A m ² | Σ A m ² | L x Σ A m ³ | B m ² | Σ B m ² | L x Σ B m ³ | C m ² | Σ C m ² | L x Σ C m ³ |
| | D 1 | 50 | 3,146 | 3,146 | 157,300 | 0 | 0 | 0 | | | |
| | 2 | 100 | 2,356 | | | 0 | | | | | |
| | 3 | 100 | 3,541 | | | 0 | | | | | |
| | 4 | 100 | 4,812 | | | 1,545 | | | | | |
| | 5 | 100 | 5,599 | | | 1,260 | | | | | |
| | 6 | 100 | 6,101 | | | 1,109 | | | | | |
| | 7 | 100 | 6,782 | | | 888 | | | | | |
| | 8 | 100 | 6,939 | | | 506 | | | | | |
| | 9 | 100 | 7,274 | | | 586 | | | | | |
| | 10 | 100 | 6,762 | 50,166 | 5,016,600 | 679 | 6,573 | 657,300 | | | |
| | 11 | 102 | 6,324 | 6,324 | 645,048 | 612 | 612 | 62,424 | | | |
| | 12 | 100 | 7,451 | | | 882 | | | | | |
| | 13 | 100 | 6,992 | | | 559 | | | | | |
| | 14 | 100 | 5,266 | | | 664 | | | | | |
| | 15 | 100 | 5,300 | | | 643 | | | | | |
| | 16 | 100 | 4,674 | | | 570 | | | | | |
| | 17 | 100 | 3,684 | | | 537 | | | | | |
| | 18 | 100 | 2,343 | | | 539 | | | | | |
| | 19 | 100 | 2,786 | | | 562 | | | | | |
| | 20 | 100 | 2,729 | 41,225 | 4,122,500 | 510 | 5,466 | 546,600 | | | |
| | 21 | 61 | 2,507 | 2,507 | 152,927 | 626 | 626 | 38,186 | | | |
| | 22 | 50 | 2,669 | 2,669 | 133,450 | 556 | 556 | 27,800 | | | |
| | 23 | 100 | 2,470 | | | 518 | | | | | |
| | 24 | 100 | 2,355 | | | 587 | | | | | |
| | 25 | 100 | 2,424 | | | 537 | | | | | |

D-P2

| TYPICAL NOTES | SECTION | | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | |
|---------------|----------|----|-----------------|----------|--------|------------|-----------------|--------|------------|------------------|--------|------------|
| | AREA NO. | D | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 |
| | | 26 | 100 | 2,322 | | | 528 | | | | | |
| | | 27 | 100 | 2,452 | | | 534 | | | | | |
| | | 28 | 100 | 2,535 | | | 600 | | | | | |
| | | 29 | 100 | 2,581 | | | 564 | | | | | |
| | | 30 | 100 | 2,688 | | | 517 | | | | | |
| | | 31 | 100 | 2,579 | | | 540 | | | | | |
| | | 32 | 100 | 2,520 | 24,926 | 2,492,600 | 574 | 5,499 | 549,900 | | | |
| | | 33 | 174 | 2,799 | 2,799 | 487,026 | 584 | 584 | 101,616 | | | |
| | | 34 | 180 | 1,784 | 1,784 | 321,120 | 538 | 538 | 96,840 | | | |
| | | 35 | 100 | 1,545 | | | 568 | | | | | |
| | | 36 | 100 | 1,424 | | | 572 | | | | | |
| | | 37 | 100 | 1,283 | | | 567 | | | | | |
| | | 38 | 100 | 1,060 | | | 841 | | | | | |
| | | 39 | 100 | 1,160 | | | 689 | | | | | |
| | | 40 | 100 | 1,331 | | | 609 | | | | | |
| | | 41 | 100 | 1,241 | | | 639 | | | | | |
| | | 42 | 100 | 1,268 | | | 564 | | | | | |
| | | 43 | 100 | 2,492 | | | 547 | | | | | |
| | | 44 | 100 | 2,677 | | | 542 | | | | | |
| | | 45 | 100 | 1,968 | | | 582 | | | | | |
| | | 46 | 100 | 1,501 | | | 0 | | | | | |
| | | 47 | 100 | 2,060 | 21,010 | 2,101,000 | 0 | 6,720 | 672,000 | | | |
| | | 48 | 108 | 2,704 | 2,704 | 292,032 | 0 | 0 | 0 | | | |
| | | 49 | 50 | 3,440 | 3,440 | 172,000 | 105 | 105 | 5,250 | | | |
| | | 50 | 100 | 3,754 | | | 0 | | | | | |

D-P3

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | |
|---------------|------------------|--------------|----------|--------|------------|-----------------|--------|------------|------------------|--------|------------|
| | | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 |
| | D 51 | 100 | 4,158 | | | 0 | | | | | |
| | 52 | 100 | 4,201 | | | 0 | | | | | |
| | 53 | 100 | 5,766 | | | 0 | | | | | |
| | 54 | 100 | 4,932 | | | 0 | | | | | |
| | 55 | 100 | 5,859 | 27,480 | 2,748,000 | 0 | 0 | 0 | | | |
| | 56 | 50 | 6,092 | 6,092 | 304,600 | 0 | 0 | 0 | | | |
| | D -4 | 100 | 0 | | | 0 | | | | | |
| | -3 | 100 | 469 | | | 0 | | | | | |
| | -2 | 100 | 2,074 | 2,543 | 254,300 | 0 | 0 | 0 | | | |
| | -1 | 150 | 3,148 | 3,148 | 472,200 | 0 | 0 | 0 | | | |
| Total | | | | | 19,872,703 | | | 2,757,916 | | | |
| | D 4 | 100 | 0 | | | 0 | | | | | |
| | 3 | 100 | 529 | | | 0 | | | | | |
| | 2 | 100 | 2,024 | 2,553 | 255,300 | 0 | 0 | 0 | | | |
| | 1 | 150 | 3,105 | 3,105 | 465,750 | 0 | 0 | 0 | | | |

Dorag Channel (Existing -11.0 and -12.0 m)

D-P4

Present Siltation

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | | |
|---------------|------------------|--------------|----------|--------|------------|-----------------|--------|------------|------------------|--------|------------|---|
| | | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 | |
| | D 1 | 50 | 2,720 | 2,720 | 136,000 | - | - | - | - | - | - | - |
| | 2 | 100 | 2,020 | | | | | | | | | |
| | 3 | 100 | 1,500 | | | | | | | | | |
| | 4 | 100 | 1,300 | | | | | | | | | |
| | 5 | 100 | 900 | | | | | | | | | |
| | 6 | 100 | 800 | | | | | | | | | |
| | 7 | 100 | 400 | | | | | | | | | |
| | 8 | 100 | 300 | | | | | | | | | |
| | 9 | 100 | 400 | | | | | | | | | |
| | 10 | 100 | 400 | 8,020 | 802,000 | | | | | | | |
| | 11 | 102 | 500 | 500 | 51,000 | | | | | | | |
| | 12 | 100 | 200 | | | | | | | | | |
| | 13 | 100 | 200 | | | | | | | | | |
| | 14 | 100 | 50 | | | | | | | | | |
| | 15 | 100 | 50 | | | | | | | | | |
| | 16 | 100 | 25 | | | | | | | | | |
| | 17 | 100 | 25 | | | | | | | | | |
| | 18 | 100 | 25 | | | | | | | | | |
| | 19 | 100 | 25 | | | | | | | | | |
| | 20 | 100 | 50 | 650 | 65,000 | | | | | | | |
| | 21 | 61 | 50 | 50 | 3,050 | | | | | | | |
| | 22 | 50 | 50 | 50 | 2,500 | | | | | | | |
| | 23 | 100 | 25 | | | | | | | | | |
| | 24 | 100 | 25 | | | | | | | | | |
| | 25 | 100 | 25 | | | | | | | | | |

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | | | |
|---------------|------------------|--------------|----------|--------|------------|-----------------|--------|------------|------------------|--------|------------|--|--|
| | | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 | | |
| | D 26 | 100 | 25 | | | | | | | | | | |
| | 27 | 100 | 10 | | | | | | | | | | |
| | 28 | 100 | 50 | | | | | | | | | | |
| | 29 | 100 | 100 | | | | | | | | | | |
| | 30 | 100 | 100 | | | | | | | | | | |
| | 31 | 100 | 25 | | | | | | | | | | |
| | 32 | 100 | 25 | 410 | 41,000 | | | | | | | | |
| | 33 | 174 | 25 | 25 | 4,350 | | | | | | | | |
| | 34 | 180 | - | | | | | | | | | | |
| | 35 | 100 | 50 | | | | | | | | | | |
| | 36 | 100 | 50 | | | | | | | | | | |
| | 37 | 100 | 50 | | | | | | | | | | |
| | 38 | 100 | 50 | | | | | | | | | | |
| | 39 | 100 | 25 | | | | | | | | | | |
| | 40 | 100 | 50 | | | | | | | | | | |
| | 41 | 100 | 100 | | | | | | | | | | |
| | 42 | 100 | 100 | | | | | | | | | | |
| | 43 | 100 | 200 | | | | | | | | | | |
| | 44 | 100 | 200 | | | | | | | | | | |
| | 45 | 100 | 200 | | | | | | | | | | |
| | 46 | 100 | 200 | | | | | | | | | | |
| | 47 | 100 | 300 | 1,575 | 157,500 | | | | | | | | |
| | 48 | 108 | 300 | 300 | 32,400 | | | | | | | | |
| | 49 | 50 | 500 | 500 | 25,000 | | | | | | | | |
| | 50 | 100 | 1,200 | 1,200 | 120,000 | | | | | | | | |

D-P6

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | | |
|-----------------------|------------------|--------------|----------|---------------|-------------------|-----------------|---------------|-------------------|------------------|---------------|-------------------|--|
| | | | A m2 | ΣA m2 | L x ΣA m3 | B m2 | ΣB m2 | L x ΣB m3 | C m2 | ΣC m2 | L x ΣC m3 | |
| Subtotal | D 1~50 | | | | 1,439,800 | | | | | | | |
| -10.0m Rehabilitation | D -1 | 150 | 800 | 800 | 120,000 | | | | | | | |
| | | 100 | 150 | 150 | 15,000 | | | | | | | |
| Subtotal | | | | | 135,000 | | | | | | | |
| Total | | | | | 1,574,800 | | | | | | | |

Dorag North Corner Cutting

North Cut

D-P7

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | | | | |
|---------------|------------------|-----------------|----------|--------|------------|-----------------|--------|------------|------------------|--------|------------|--|--|--|
| | | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 | | | |
| 500m x -13.0m | D 46 | 100 | 1,501 | | | | | | | | | | | |
| | 47 | 100 | 2,060 | 3,561 | 356,100 | | | | | | | | | |
| | 48 | 108 | 2,704 | 2,704 | 292,032 | | | | | | | | | |
| | 49 | 50 | 3,440 | 3,440 | 172,000 | | | | | | | | | |
| | 50 | 100 | 3,754 | | | | | | | | | | | |
| | 51 | 100 | 4,158 | | | | | | | | | | | |
| | 52 | 100 | 4,201 | | | | | | | | | | | |
| | 53 | 100 | 4,576 | | | | | | | | | | | |
| | 54 | 100 | 4,932 | | | | | | | | | | | |
| | 55 | 100 | 5,859 | 27,480 | 2,748,000 | | | | | | | | | |
| | 56 | 50 | 6,092 | 6,092 | 304,600 | | | | | | | | | |
| Total | D 46-56 | | | | 3,872,732 | | | | | | | | | |

Dorag South Corner Cutting

D-P8

South Cut

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | | | |
|--------------------|------------------|--------------|----------|--------|------------|-----------------|--------|------------|------------------|--------|------------|--|--|
| | | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 | | |
| 550m x -12.0m | D 6 | 100 | 900 | | | | | | | | | | |
| | 7 | 100 | 1,600 | | | | | | | | | | |
| | 8 | 100 | 1,700 | | | | | | | | | | |
| | 9 | 100 | 1,950 | | | | | | | | | | |
| | 10 | 100 | 1,350 | | | | | | | | | | |
| | 11 | 100 | 900 | | | | | | | | | | |
| | 12 | 100 | 980 | | | | | | | | | | |
| | 13 | 100 | 1,120 | | | | | | | | | | |
| | 14 | 100 | 900 | | | | | | | | | | |
| | 15 | 100 | 900 | | | | | | | | | | |
| | 16 | 100 | 800 | | | | | | | | | | |
| | 17 | 100 | 750 | | | | | | | | | | |
| | 18 | 100 | 420 | | | | | | | | | | |
| | 19 | 100 | 450 | 14,720 | 1,472,000 | | | | | | | | |
| Addition to -13.0m | | | | | 120,000 | | | | | | | | |
| Total | | | | | 1,592,000 | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
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Dorag Channel Summary

D-P9

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | | | |
|-------------------|------------------|--------------|----------|------------|------------|-----------------|-----------|------------|------------------|--------|------------|--|-----|
| | | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 | | |
| Basic Volume | D 4-56 | | | 19,872,703 | | | 2,757,916 | | | | | | |
| Master Plan | | | | | | | | | | | | | |
| Alternative - 1 | D 4-33 | | | 13,933,951 | | | 1,963,826 | | | | | | |
| Alternative - 2 | D 18-32 | | | 1,783,389 | | | 0 | | | | | | 50% |
| Alternative - 3 | D 4-41 | | | 15,159,471 | | | 2,538,866 | | | | | | |
| South Cut | | | | 1,592,000 | | | 0 | | | | | | |
| North Cut | | | | 3,872,730 | | | 0 | | | | | | |
| Site Selection | | | | | | | | | | | | | |
| Alternative | | | | | | | | | | | | | |
| 2,500m, C+D | D 1-33 | | | 13,933,951 | | | 1,963,826 | | | | | | |
| 2,500m, D+E | | | | | | | | | | | | | |
| | D 1-4 | | | 726,500 | | | 0 | | | | | | |
| | D 1-18 | | | 9,389,948 | | | 0 | | | | | | |
| | D 19-45 | | | 5,883,523 | | | 1,593,542 | | | | | | |
| Total | | | | 15,999,971 | | | 1,593,542 | | | | | | |
| Present Siltation | D 4-50 | | | 1,574,800 | | | 0 | | | | | | |
| (-11.0/-12.5) | | | | | | | | | | | | | |

West Musa Channel

| TYPICAL NOTES | SECTION | | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | | WM-PI |
|---------------|----------|----|-----------------|----------|--------|------------|-----------------|--------|------------|------------------|--------|------------|-------|
| | AREA NO. | WM | | A.m2 | Σ A.m2 | L x Σ A.m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 | |
| -14.0m | 1 | | 50 | - | - | - | - | - | - | - | - | - | |
| | 2 | | 100 | 2,000 | | | 1,500 | | | | | | |
| | 3 | | 100 | 900 | | | 1,300 | | | | | | |
| | 4 | | 100 | 900 | | | 1,700 | | | | | | |
| | 5 | | 100 | 700 | | | 2,500 | 7,000 | 700,000 | | | | |
| | 6 | | A 100 B 50 | 500 | | | 1,200 | 1,200 | 120,000 | | | | |
| | 7 | | 100 | 300 | | | 1,500 | | | | | | |
| | 8 | | 100 | 100 | | | 1,600 | | | | | | |
| | 9 | | 100 | 200 | | | 1,500 | | | | | | |
| | 10 | | 100 | 400 | | | 1,600 | | | | | | |
| | 11 | | 100 | 300 | | | 2,000 | | | | | | |
| | 12 | | 100 | 500 | | | 1,700 | | | | | | |
| | 13 | | 100 | 700 | | | 1,400 | | | | | | |
| | 14 | | 100 | 800 | | | 1,500 | | | | | | |
| | 15 | | 100 | 900 | | | 1,700 | | | | | | |
| | 16 | | 100 | 900 | | | 1,900 | | | | | | |
| | 17 | | 100 | 1,200 | | | - | | | | | | |
| | 18 | | 100 | 900 | | | 2,400 | | | | | | |
| | 19 | | 100 | 1,200 | | | 1,600 | | | | | | |
| | 19' | | 100 | 1,100 | | | 1,900 | | | | | | |
| | 20 | | 100 | 1,000 | | | 1,700 | | | | | | |
| | 21 | | 100 | 1,000 | 16,500 | 1,650,000 | 1,600 | 25,600 | 2,560,000 | | | | |
| | 22 | | 0 | 800 | 800 | 0 | 1,500 | 1,500 | 0 | | | | |
| | 23 | | 150 | 600 | 600 | 90,000 | 1,600 | 1,600 | 240,000 | | | | |
| | 24 | | 100 | 400 | | | 1,600 | | | | | | |

| TYPICAL NOTES | SECTION AREA NO. | | LENGTH | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | |
|-------------------|------------------|----|--------|----------|---------------|-------------------|-----------------|---------------|-------------------|------------------|---------------|-------------------|
| | WM | 25 | L (m) | A m2 | $\Sigma A m2$ | L x $\Sigma A m3$ | B m2 | $\Sigma B m2$ | L x $\Sigma B m3$ | C m2 | $\Sigma C m2$ | L x $\Sigma C m3$ |
| | | | 100 | 300 | | | 1,500 | | | | | |
| | | | 100 | 500 | | | 1,500 | | | | | |
| | | | 100 | 700 | | | 1,500 | | | | | |
| | | | 100 | 900 | | | 1,700 | | | | | |
| | | | 100 | 1,200 | | | 1,500 | | | | | |
| | | | 100 | 1,600 | | | 1,500 | | | | | |
| | | | 100 | 1,800 | | | 1,600 | | | | | |
| | | | 100 | 2,000 | | | 1,500 | | | | | |
| | | | 100 | 2,200 | | | 1,600 | | | | | |
| | | | 100 | 2,200 | | | 1,700 | | | | | |
| | | | 100 | 2,400 | | | 1,700 | | | | | |
| | | | 100 | 2,300 | | | 1,600 | | | | | |
| | | | 100 | 2,300 | | | 1,500 | | | | | |
| | | | 100 | 2,300 | | | 1,500 | | | | | |
| | | | 100 | 2,300 | | | 1,400 | | | | | |
| | | | 100 | 2,200 | | | 1,200 | | | | | |
| | | | 100 | 2,200 | | | 1,200 | | | | | |
| | | | 100 | 2,200 | | | 1,100 | | | | | |
| | | | 100 | 2,200 | | | 1,100 | | | | | |
| | | | 100 | 2,000 | | | 1,100 | | | | | |
| | | | 100 | 2,000 | 38,200 | 3,820,000 | 1,100 | 31,700 | 3,170,000 | | | |
| Total | | | | | | 5,560,000 | | | 6,790,000 | | | 0 |
| Reduction +0 -13m | | | | | | -225,000 | | | | | | |
| | | | | | | 5,335,000 | | | | | | |

West Musa Channel Summary

WM-P3

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | RECLAMATION - I | | | RECLAMATION - II | | | | | |
|---------------|------------------|--------------|----------|---------------|-------------------|------|---------------|-------------------|------|---------------|-------------------|--|--|
| | | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 | | |
| Basic Volume | WM 1~45 | | | 5,335,000 | | | 6,730,000 | | | 0 | | | |
| Alternative | | | | | | | | | | | | | |
| 2,500 m wharf | 1~23 | | | 1,740,000 | | | 3,560,000 | | | 0 | | | |
| | 24~33 | | | 1,160,000 | | | 1,550,000 | | | 0 | | | |
| Total | | | | 2,900,000 | | | 5,110,000 | | | 0 | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | |

Zangi Channel

Z-P1

Basic Volume

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | |
|---------------|------------------|--------------|----------|--------|------------|-----------------|--------|------------|------------------|--------|------------|
| | | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 |
| -13.0m | Z 1 | 50 | 9,855 | 9,855 | 492,750 | 0 | 0 | 0 | 1,092 | 1,092 | 54,600 |
| | 2 | 100 | 9,435 | | | 115 | | | 1,104 | | |
| | 3 | 100 | 8,174 | | | 232 | | | 1,054 | | |
| | 4 | 100 | 7,371 | | | 562 | | | 1,030 | | |
| | 5 | 100 | 7,467 | | | 386 | | | 1,098 | | |
| | 6 | 100 | 7,334 | | | 445 | | | 1,031 | | |
| | 7 | 100 | 7,455 | | | 211 | | | 1,018 | | |
| | 8 | 100 | 7,414 | 54,650 | 5,465,000 | 160 | 2,111 | 211,100 | 1,018 | 7,353 | 735,300 |
| | 9 | 50 | 6,863 | 6,863 | 343,150 | 219 | 219 | 10,950 | 1,080 | 1,080 | 54,000 |
| | 10 | 100 | 6,876 | | | 235 | | | 1,089 | | |
| | 11 | 100 | 7,768 | | | 568 | | | 1,016 | | |
| | 12 | 100 | 7,515 | | | 415 | | | 1,004 | | |
| | 13 | 100 | 7,235 | | | 341 | | | 1,000 | | |
| | 14 | 100 | 7,134 | | | 419 | | | 1,070 | | |
| | 15 | 100 | 7,241 | | | 423 | | | 1,074 | | |
| | 16 | 100 | 7,257 | | | 500 | | | 1,062 | | |
| | 17 | 100 | 7,190 | | | 597 | | | 1,050 | | |
| | 18 | 100 | 7,132 | | | 832 | | | 1,103 | | |
| | 19 | 100 | 7,229 | | | 820 | | | 1,037 | | |
| | 20 | 100 | 7,311 | | | 920 | | | 1,016 | | |
| | 21 | 100 | 7,543 | | | 1,022 | | | 1,045 | | |
| | 22 | 100 | 8,050 | | | 920 | | | 1,078 | | |
| | 23 | 100 | 6,391 | | | 1,622 | | | 1,031 | | |
| | 24 | 100 | 6,624 | | | 1,901 | | | 1,059 | | |
| | 25 | 100 | 6,707 | | | 2,239 | | | 1,073 | | |

Z-P2

| TYPICAL NOTES | SECTION | | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | |
|---------------|----------|--------|-----------------|----------|---------|------------|-----------------|--------|------------|------------------|--------|------------|
| | AREA NO. | Z | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 |
| | | 26 | 100 | 6,920 | | | 2,270 | | | 1,054 | | |
| | | 27 | 100 | 6,763 | | | 2,655 | | | 1,089 | | |
| | | 28 | 100 | 6,775 | | | 2,836 | | | 1,041 | | |
| | | 29 | 100 | 7,448 | | | 2,889 | | | 1,048 | | |
| | | 30 | 100 | 7,584 | | | 3,023 | | | 1,066 | | |
| | | 31 | 100 | 7,843 | | | 3,099 | | | 1,076 | | |
| | | 32 | 100 | 7,845 | | | 3,205 | | | 1,041 | | |
| | | 33 | 100 | 7,743 | | | 3,105 | | | 1,057 | | |
| | | 34 | 100 | 7,380 | | | 2,919 | | | 1,090 | | |
| | | 35 | 100 | 7,724 | | | 2,718 | | | 1,063 | | |
| | | 36 | 100 | 3,117 | | | 2,358 | | | 0 | | |
| | | 37 | 100 | 3,389 | | | 2,442 | | | 0 | | |
| | | 38 | 100 | 3,257 | | | 2,064 | | | 0 | | |
| | | 39 | 100 | 3,283 | | | 2,134 | | | 0 | | |
| | | 40 | 100 | 0 | | | 2,044 | | | 0 | | |
| | | 41 | 100 | 0 | 202,274 | 20,227,400 | 1,843 | 55,369 | 5,536,900 | 0 | 27,432 | 2,743,200 |
| Total | | Z 1~41 | | | | 26,528,300 | | | | | | 3,587,100 |

Zangi Channel Summary

Z-P3

| TYPICAL NOTES | SECTION AREA NO. | LENGTH L (m) | DREDGING | | | RECLAMATION - I | | | RECLAMATION - II | | | | |
|----------------------------------|------------------|--------------|----------|------------|------------|-----------------|-----------|------------|------------------|--------|------------|--|-----|
| | | | A m2 | Σ A m2 | L x Σ A m3 | B m2 | Σ B m2 | L x Σ B m3 | C m2 | Σ C m2 | L x Σ C m3 | | |
| Basic Volume | Z 1~41 | | | | 26,548,300 | | | 5,758,950 | North | | 3,587,100 | | |
| Dorag South Cut 550m x -13.0m | D 6~19 | | | 1,592,000 | | | 0 | | | | 0 | | |
| Dorag Middle | D 18~32 | | | 1,783,389 | | | 0 | | | | 0 | | 50% |
| Dorag North Cut | D 46~56 | | | 3,872,732 | | | 0 | | | | 0 | | |
| Total | | | | 33,796,421 | | | 5,758,950 | | | | 3,587,100 | | |
| Alternative 2,500m wharf | | | | 32,013,032 | | | 5,758,950 | | | | 3,587,100 | | |
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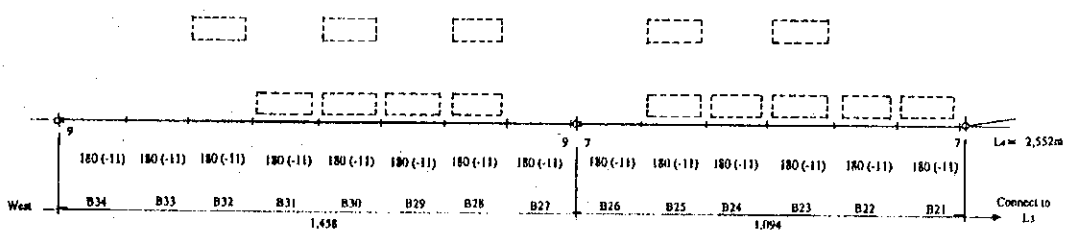
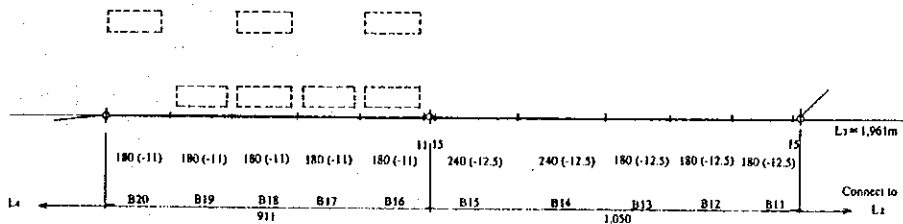
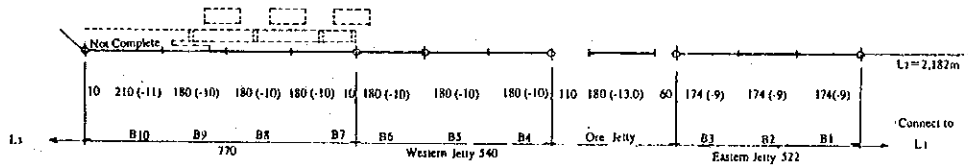
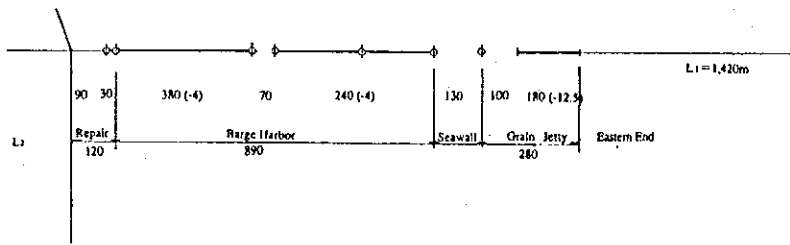
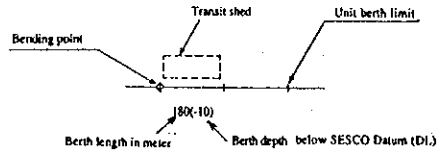
Appendix (III)-6 Plans and Drawings

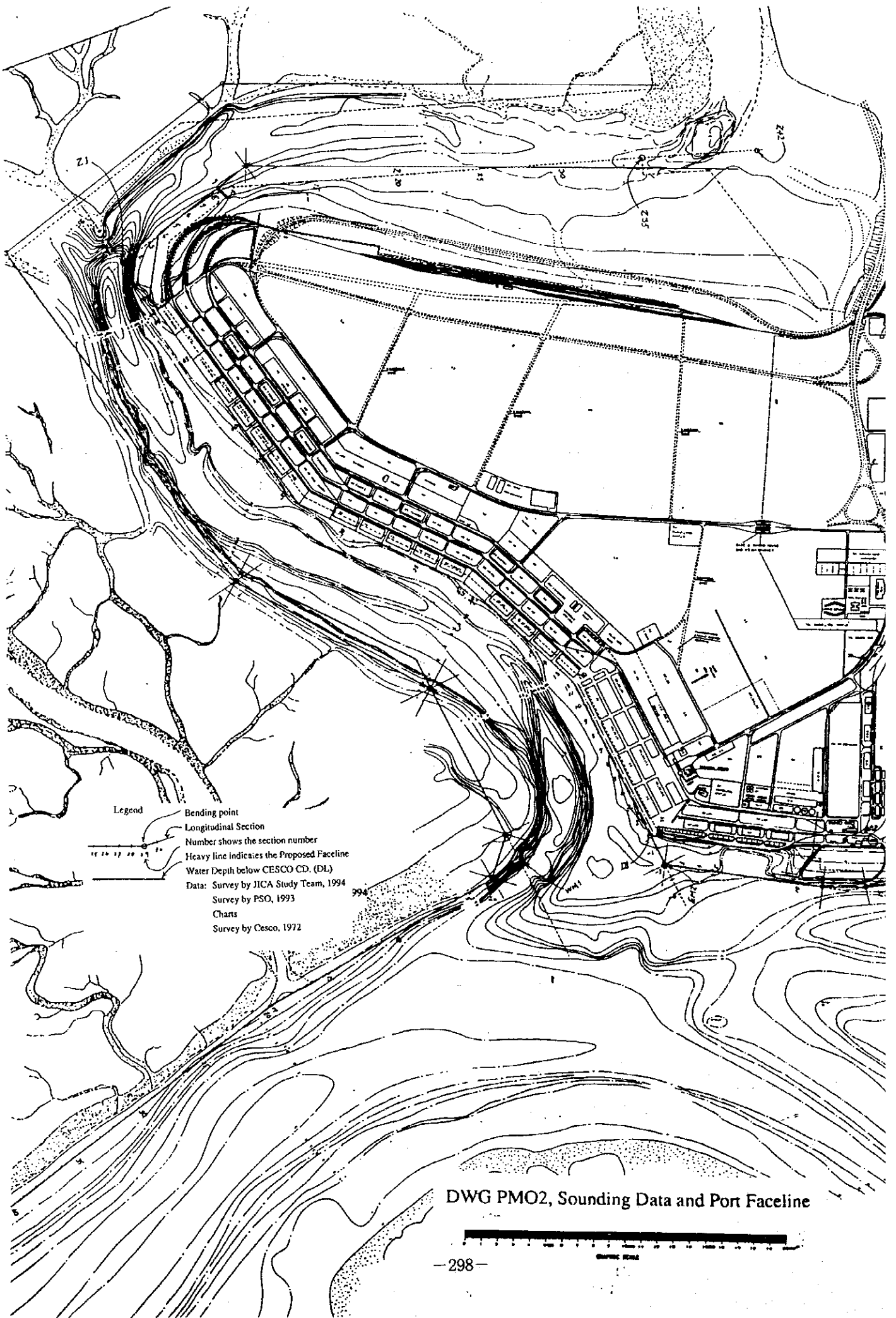
III-6.1 Drawings

Appendix III-6.1 Drawings

- MP 01 Existing Faceline Arrangement
 - 02 Sounding Data and Port Faceline
 - 03 None
 - 04 Standard Section, Open Structure, Existing -11.0 m Wharf, 50.0 m wide
 - 05 Standard Section, Open Structure, Existing -12.5 m Wharf, 55.0 m wide
 - 06 Standard Section, Open Structure, New Development, Modification of Existing -12.5 m Wharf Design to -14.0 m (Wharf Alternative -1)
 - 07 Wharf Structure Alternative -2, Caisson Box Wall, -14.0 m Wharf
 - 08 Wharf Structure Alternative -3, Steel Sheet Pile Wall -14.0 m Wharf
 - 09 Wharf Structure Alternative -4, Concrete Block Wall -14.0 m Wharf
 - 10 Standard Section, Open Structure, New Development, Modification of Existing -12.5 m Wharf Design to -15.0 m
 - 11 Standard Section, Open Structure, Deep Berth by One Meter, Existing -11.0 m Wharf to -12.0 m
 - 12 Standard Section, Open Structure, Deep Berth by Two Meters, Existing -11.0 m Wharf to -13.0 m
 - 13 Standard Section, Open Structure, Deep Berth by Three Meters, Existing -11.0 m Wharf to -14.0 m
 - 14 Standard Section, Four Berth Extension, Existing Structure
 - 15 Standard Section, Improvement of Four Berths, Existing -10.0 m Pier to -11.0 m Wharf, 27.0 m Deck to 66.0 m
 - 16 Alternatives for Existing Jetty Improvement, Typical Arrangement to Western Jetty
 - 17 Standard Section, Open Structure, Improvement of Existing Structures
 - 18 Plan of Grain Berth Extension by Dolphin
 - 19 Standard Section of Slope Protection (1/2)
 - 20 Standard Section of Slope Protection (2/2)

DWG. MP01 EXISTING FACELINE ARRANGEMENT

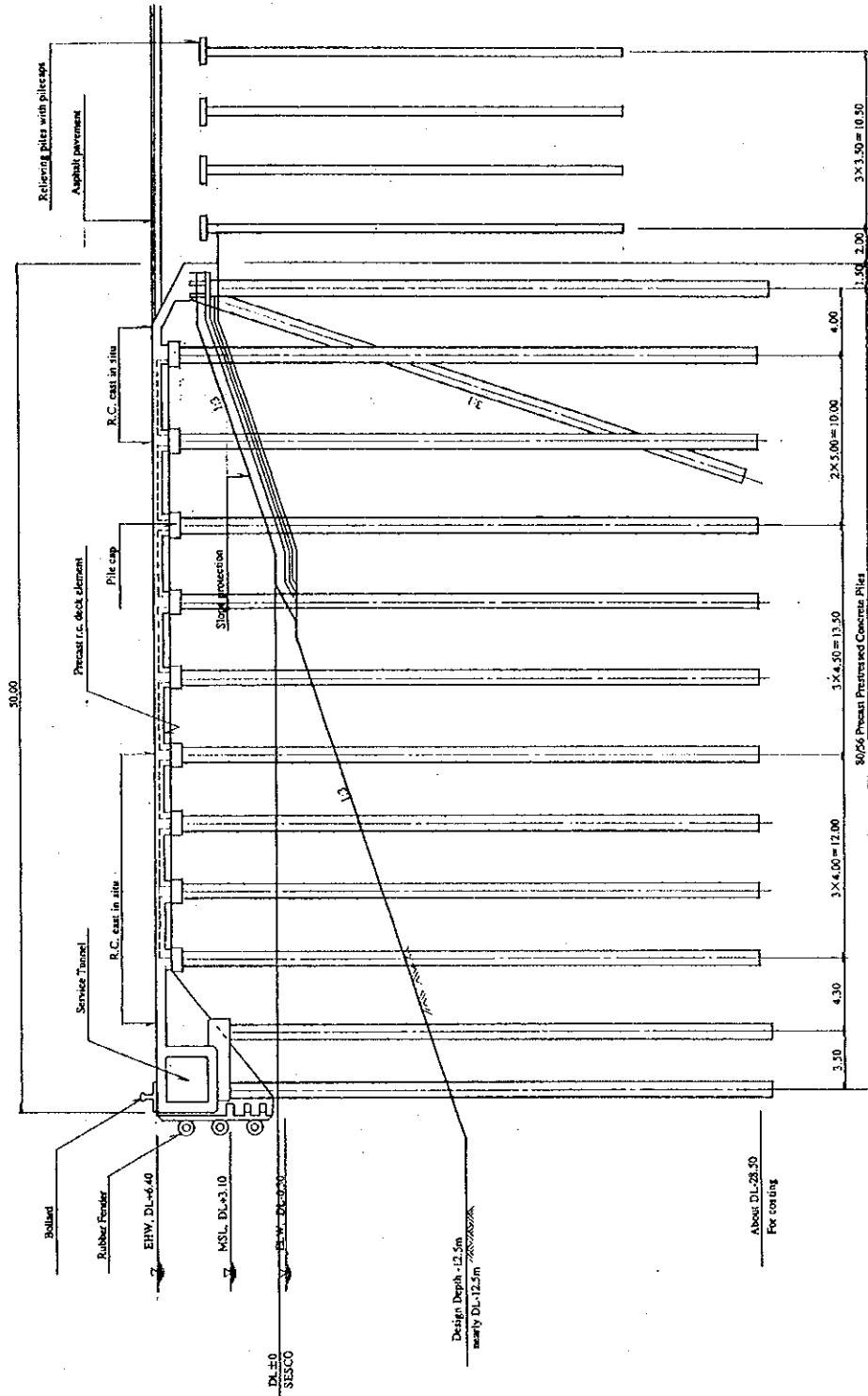






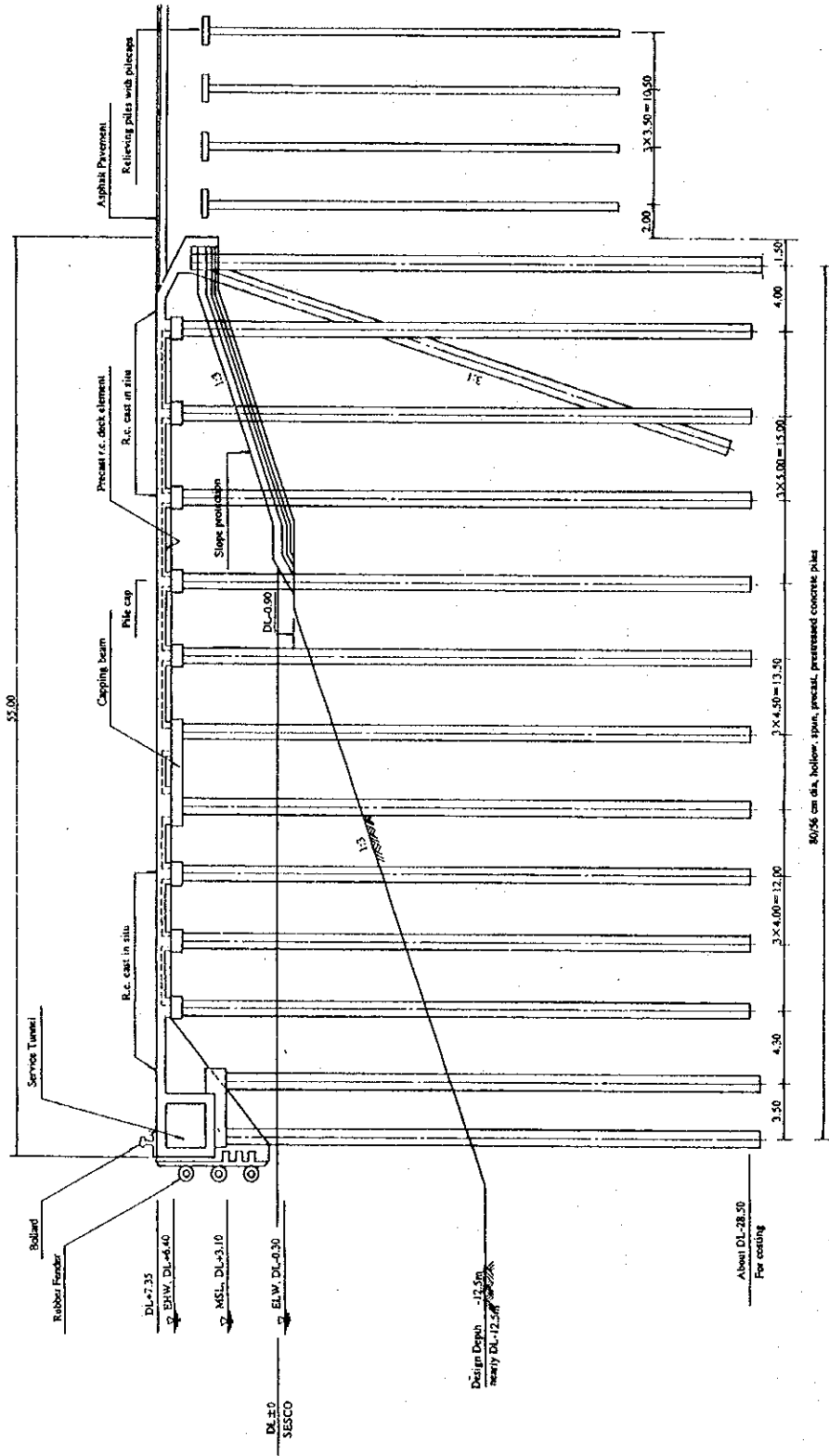
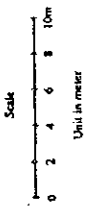
DWG. MP04

STANDARD SECTION, OPEN STRUCTURE
EXISTING -11.0M WHARF
50.0M WIDE



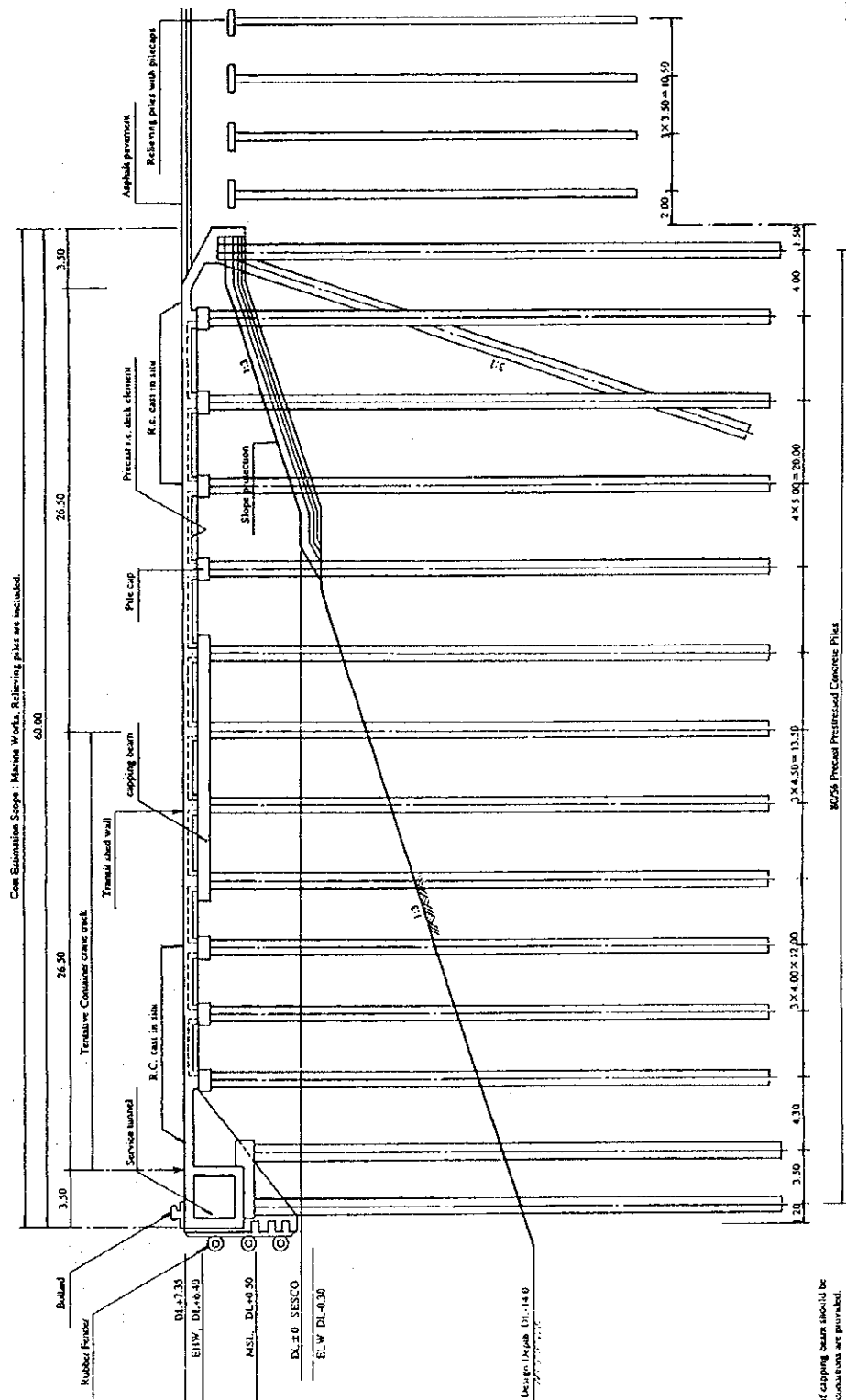
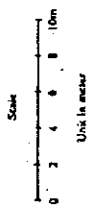
STANDARD SECTION, OPEN STRUCTURE
EXISTING -12.3M WHARF
55M WIDE

DWG. MP05



STANDARD SECTION OPEN STRUCTURE, NEW DEVELOPMENT
MODIFICATION OF EXISTING -12.5M WHARF DESIGN TO -14.0M
 ALTERNATIVE - 1

DWG. MP06



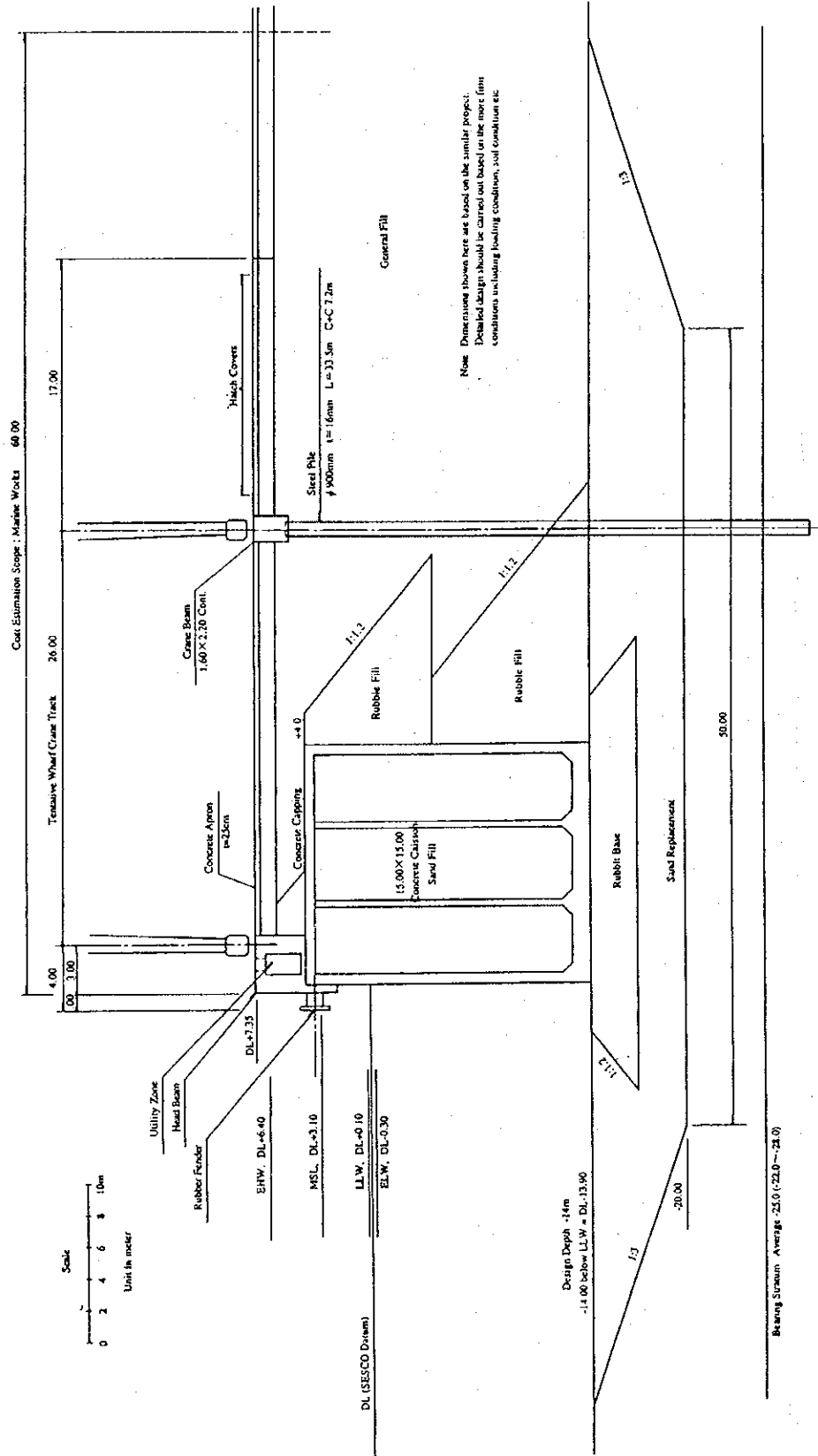
Note: Size and location of capping beams should be fixed after loading conditions are provided. Slope stability should be reviewed by detailed soil data.

Note: Number of relieving piles should be checked based on soil condition at the site.

DWG. MP07

WHARF STRUCTURE ALTERNATIVE-2, CAISSON BOX WALL

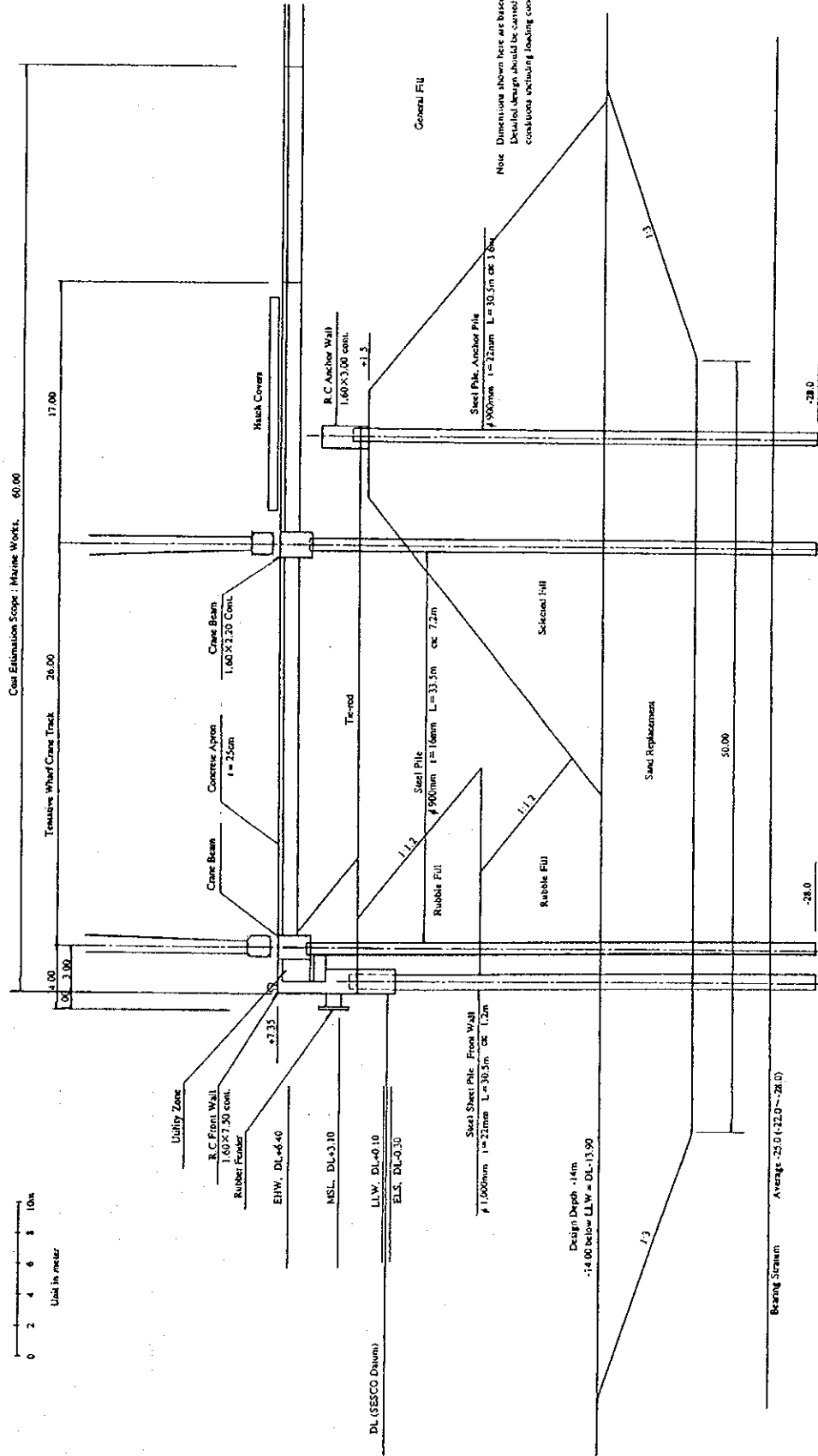
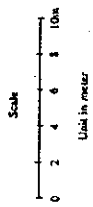
-14.0M WHARF



DWG. MP08

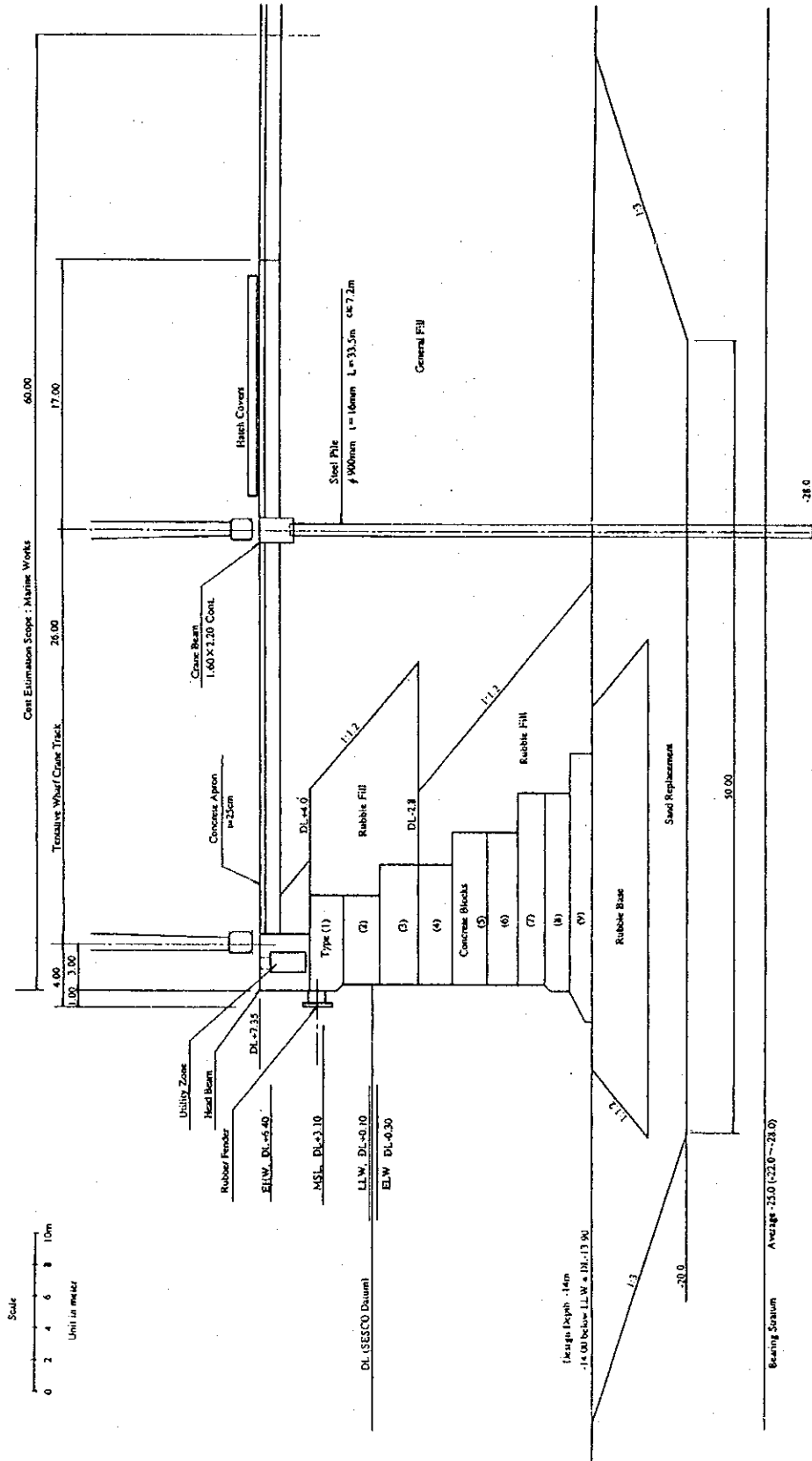
WHARF STRUCTURE ALTERNATIVE-3, STEEL SHEET PILE WALL

-14.0M WHARF



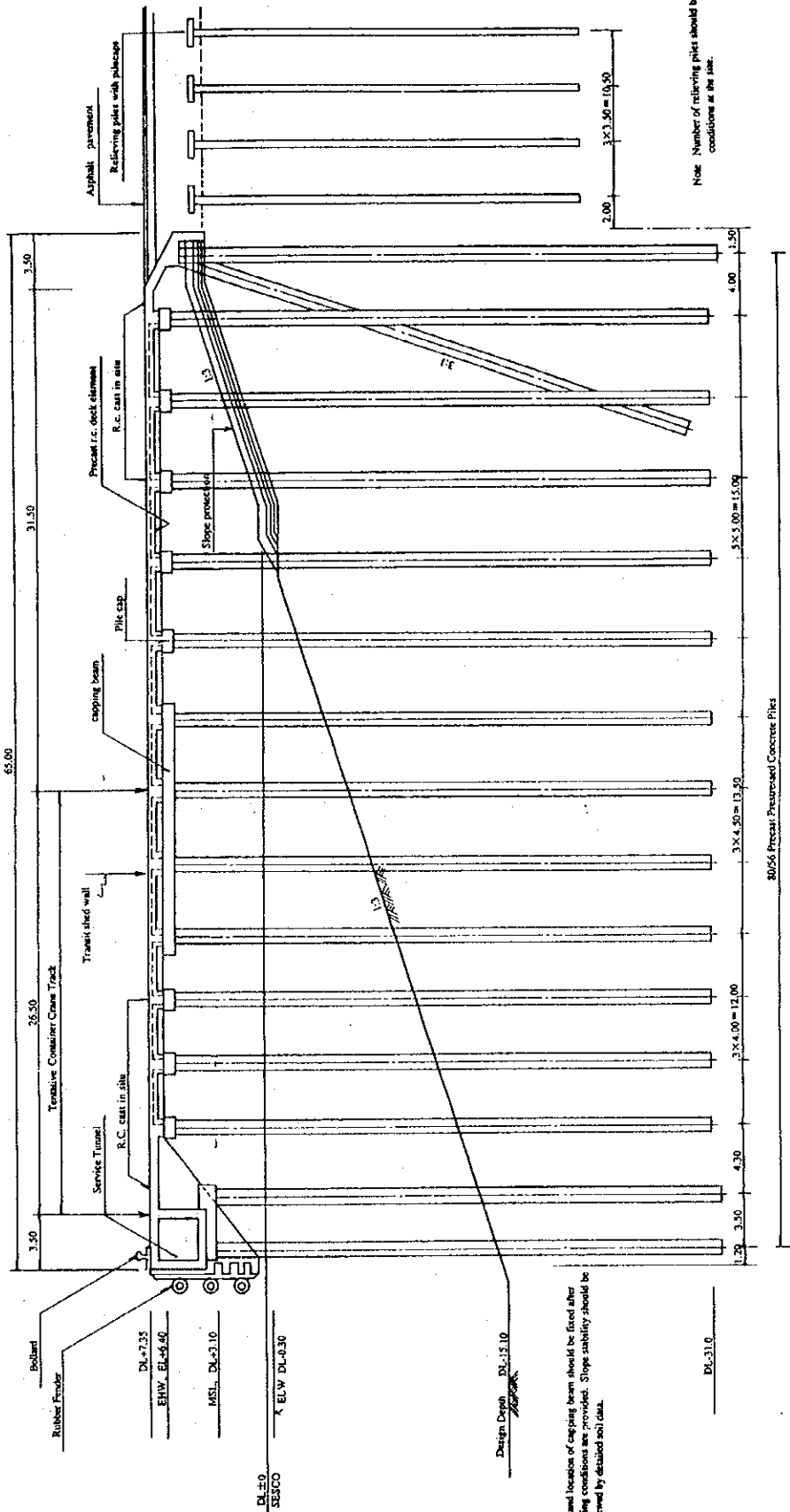
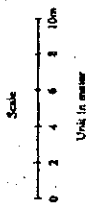
TYPICAL SECTION OF CONCRETE BLOCK WALL
 -14.0M WHARF
 ALTERNATIVE - 4

DWG. MP09



STANDARD SECTION, OPEN STRUCTURE, NEW DEVELOPMENT
 MODIFICATION OF EXISTING -12.5M WHARF DESIGN TO -15.0M

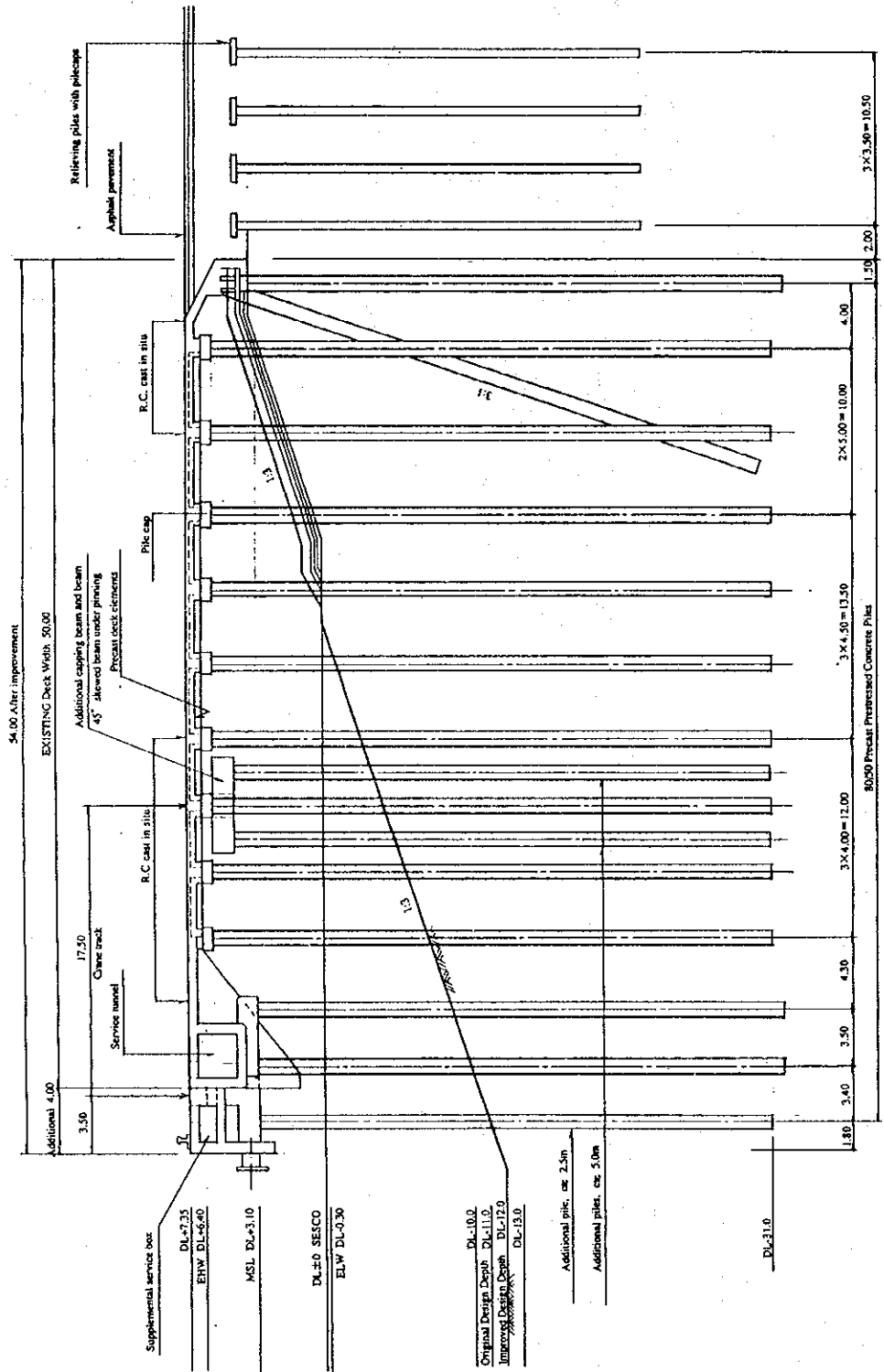
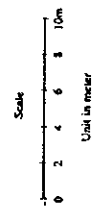
DWG. MP010



Note: Number of retaining piles should be decided based on soil conditions at the site.

DWG. MP011 STANDARD SECTION, OPEN STRUCTURE, DEEP BERTH BY ONE METER

EXISTING -11.0M WHARF TO -12.0M
50.00M DECK TO 54.0M



Supplemental service box
DL+7.35
ELW DL+6.40
MSL DL+3.10
DL±0 SESCO
ELW DL-0.30
DL-10.0
Original Design Depth DL-11.0
Improve Design Depth DL-12.0
DL-13.0
Additional pile, ca. 2.5m
Additional piles, ca. 5.0m
DL-31.0

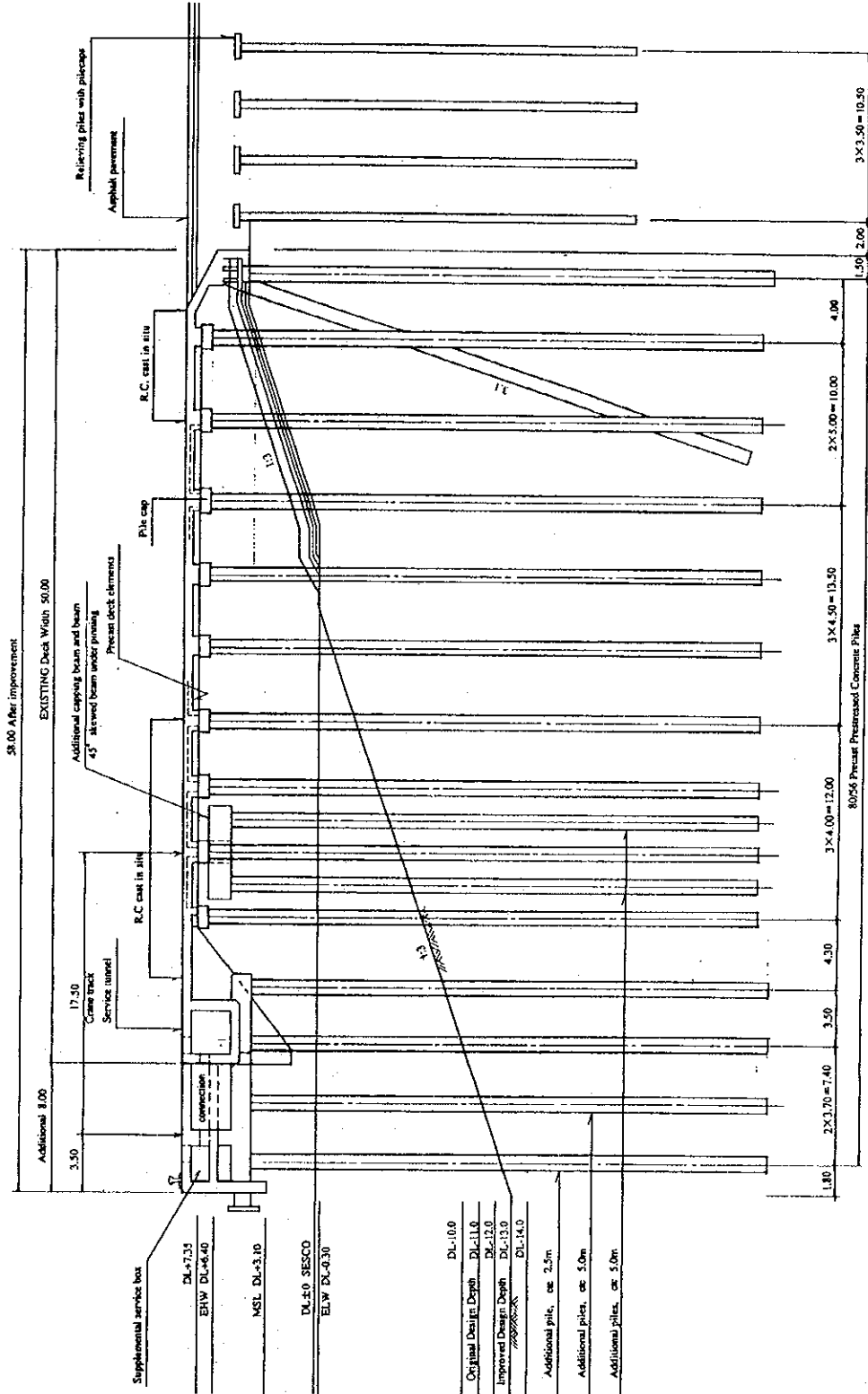
Note
Location of additional pile for crane rail track will be fixed later. Temporary open to site should be provided for pile driving. Slope stability should be reviewed by situated soil data.

DWG. MF012

STANDARD SECTION, OPEN STRUCTURE, DEEP BERTH BY TWO METER

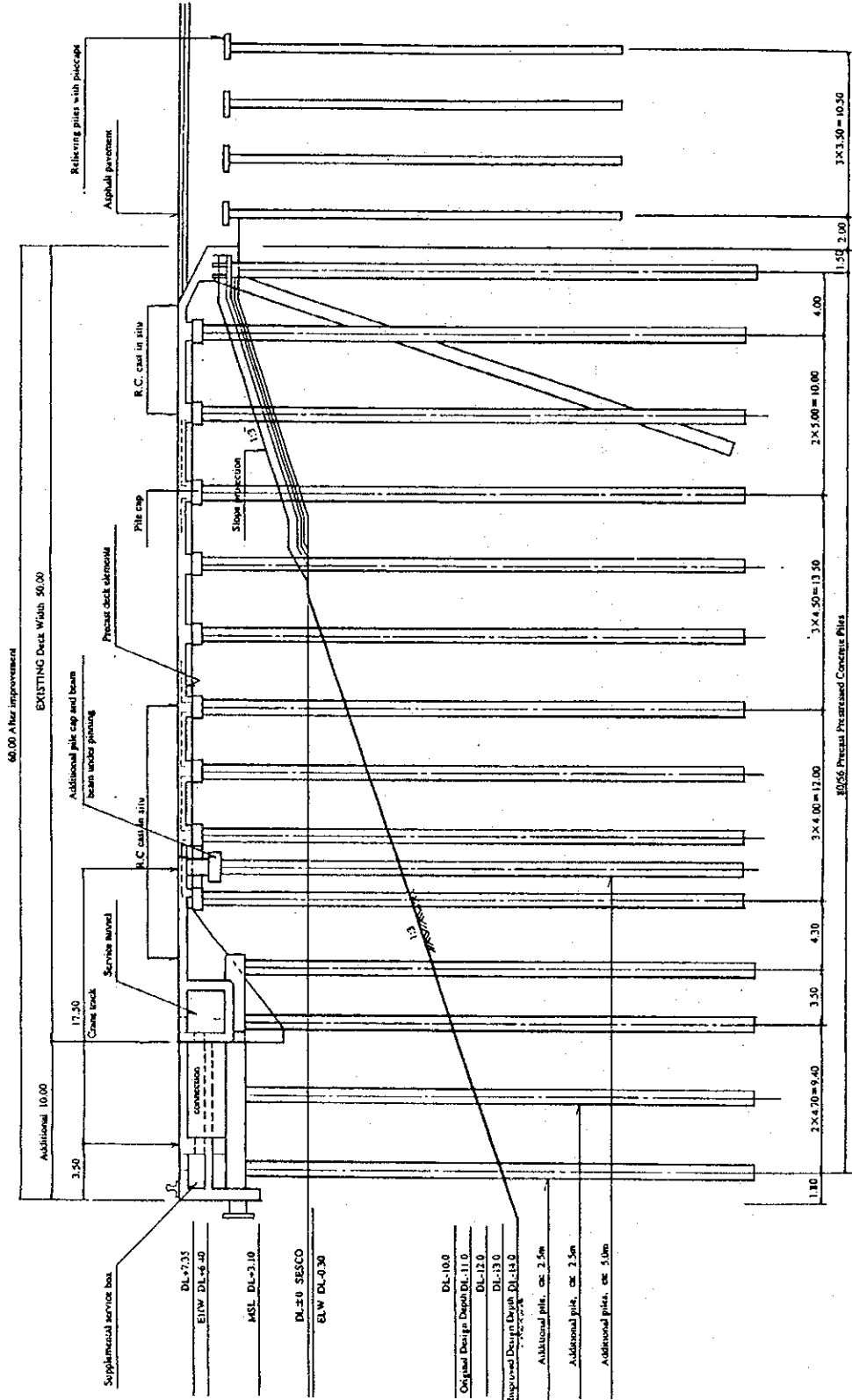
EXISTING -11.0M WHARF TO -13.0M

50.00M DECK TO 38.0M



Note: Location of additional piles for crane rail track will be fixed later. Temporary open to slab should be provided for pile driving. Slope stability should be reviewed by detailed soil data.

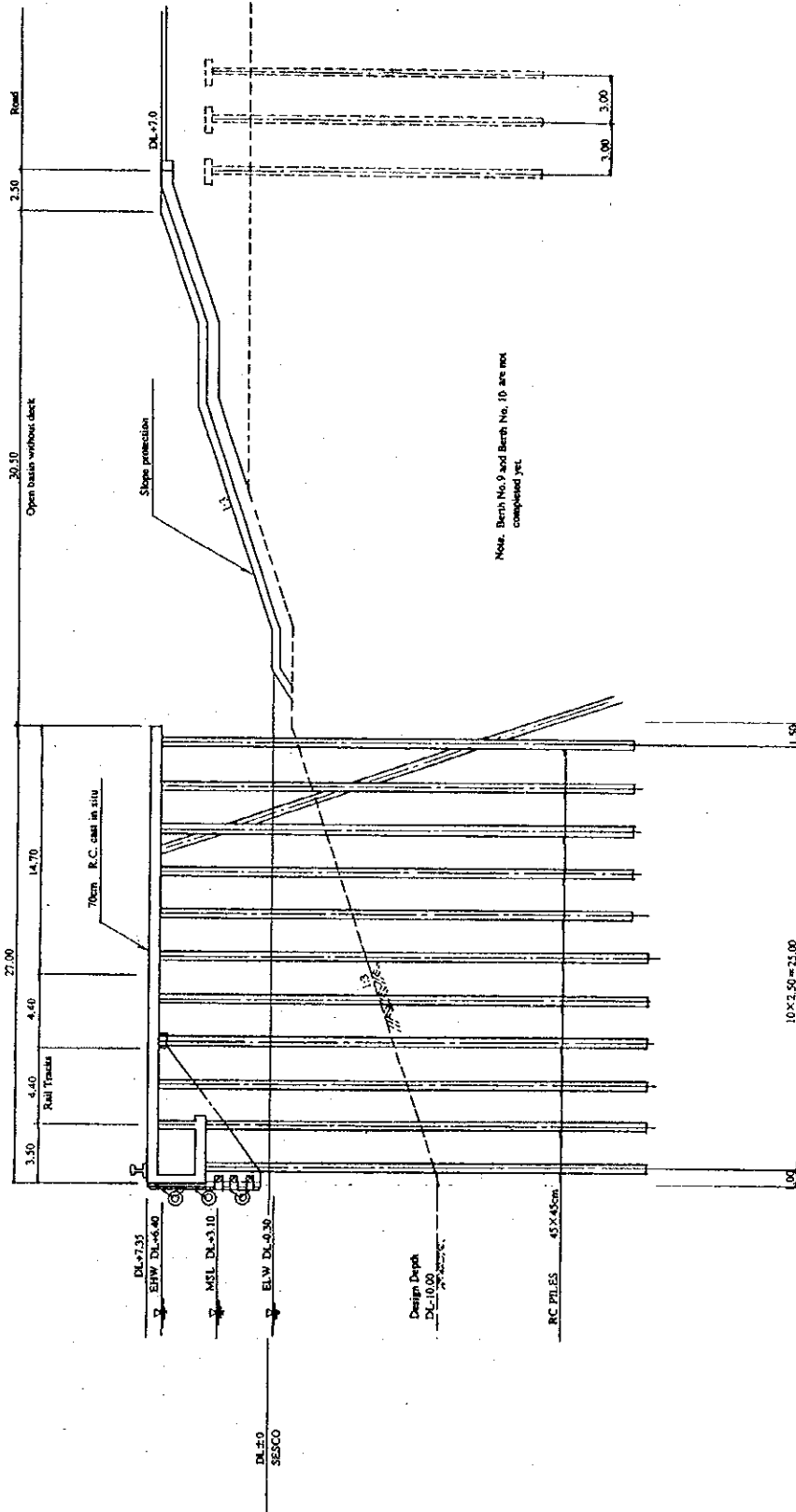
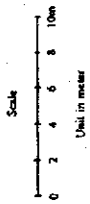
DWG. MP013
 STANDARD SECTION, OPEN STRUCTURE, DEEP BERTH BY THREE METER
 EXISTING -11.0M WHARF TO -14.0M
 30.0M DECK TO 60.0M



Note
 Location of additional piles for crane rail track will be fixed later. Temporary open to slab should be provided for pile driving. Slope stability should be reviewed by geotechnical data.

DWG. MP014

STANDARD SECTION, FOUR BERTH EXTENSION
EXISTING STRUCTURE

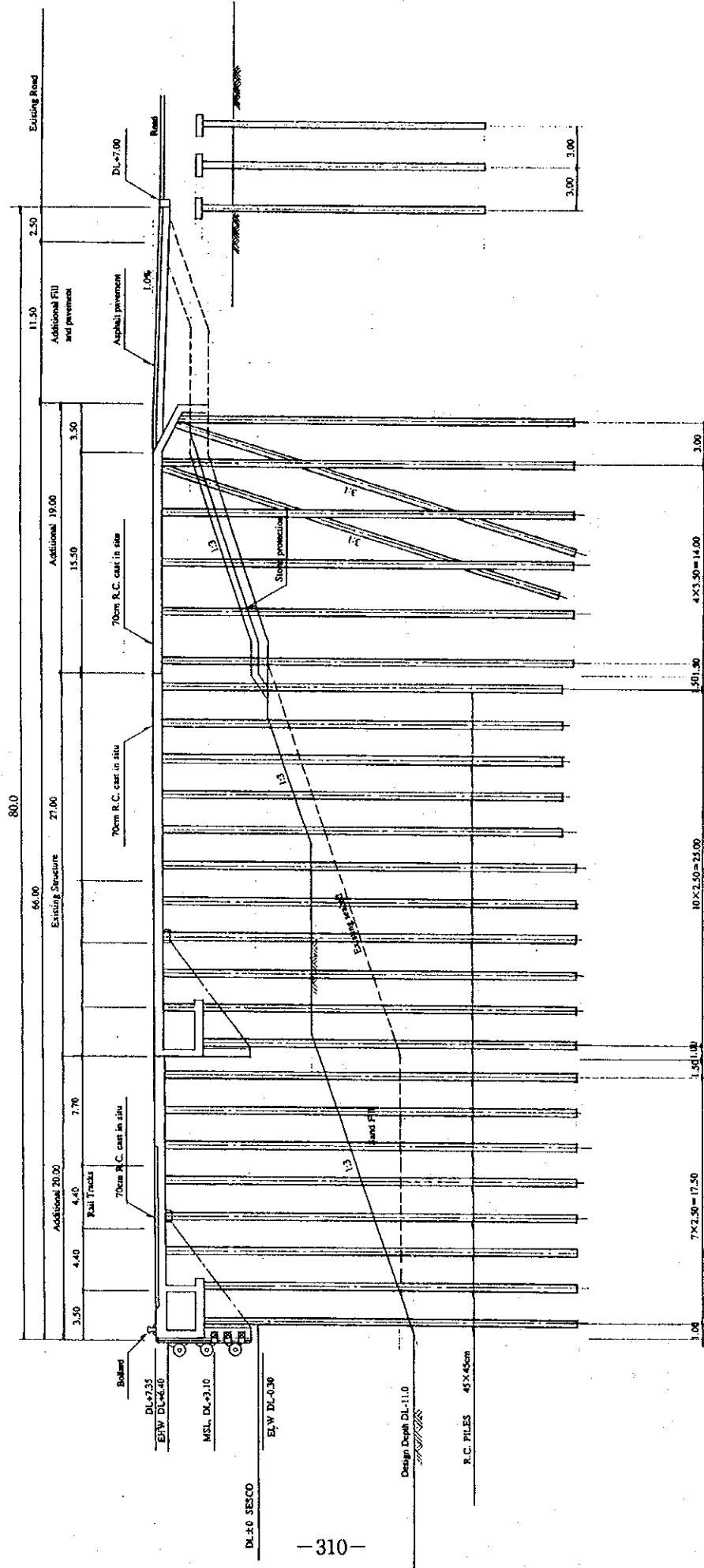
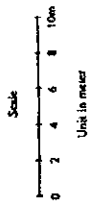


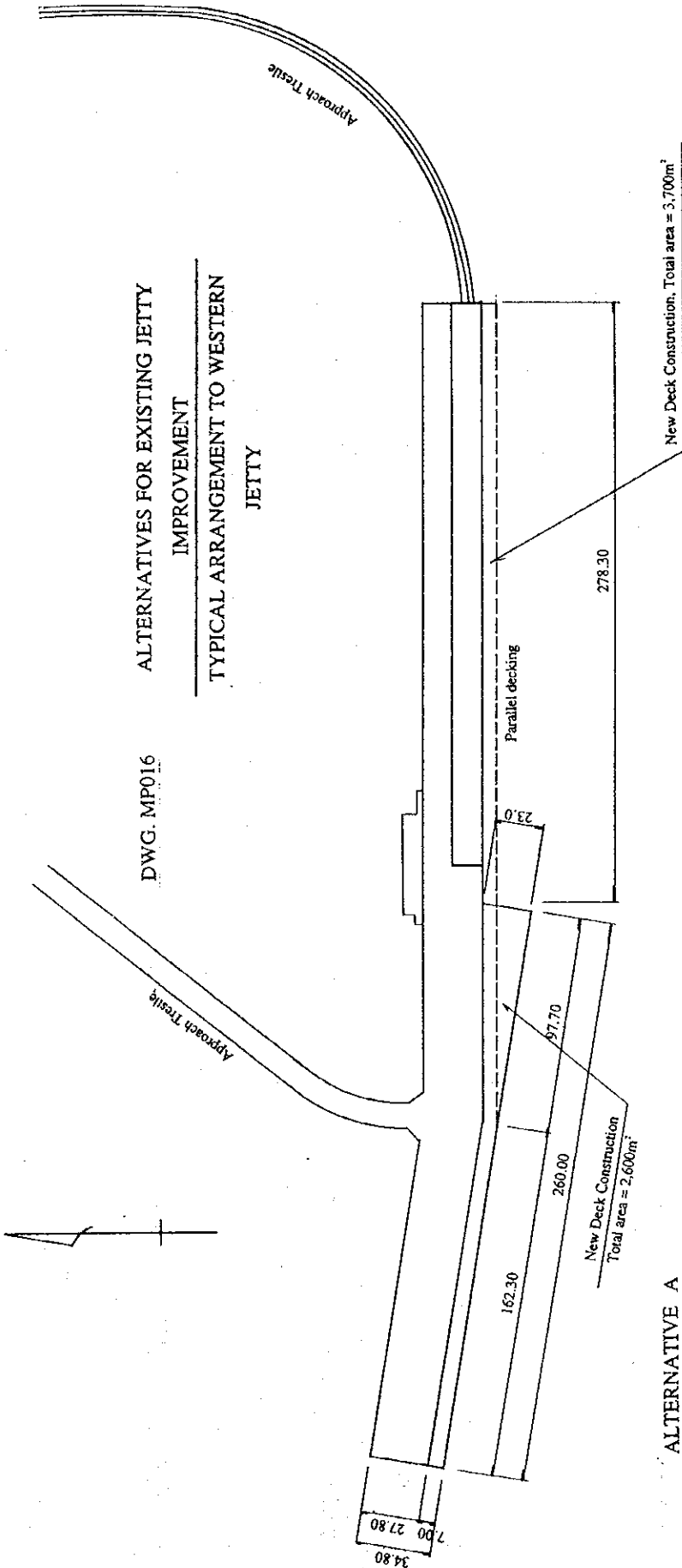
DWG. MF015

STANDARD SECTION, IMPROVEMENT OF FOUR BERTHS

EXISTING -10.0M PIER TO -11.0M WHARF

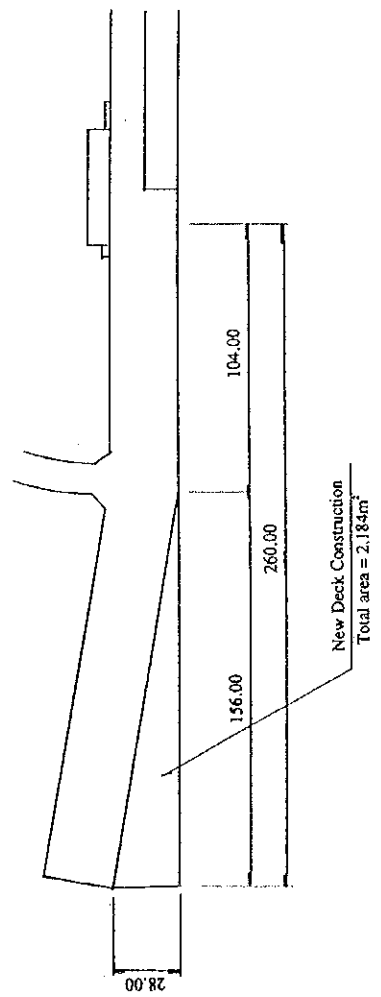
27.0M DECK TO 66.0M





ALTERNATIVE A

ALTERNATIVE C

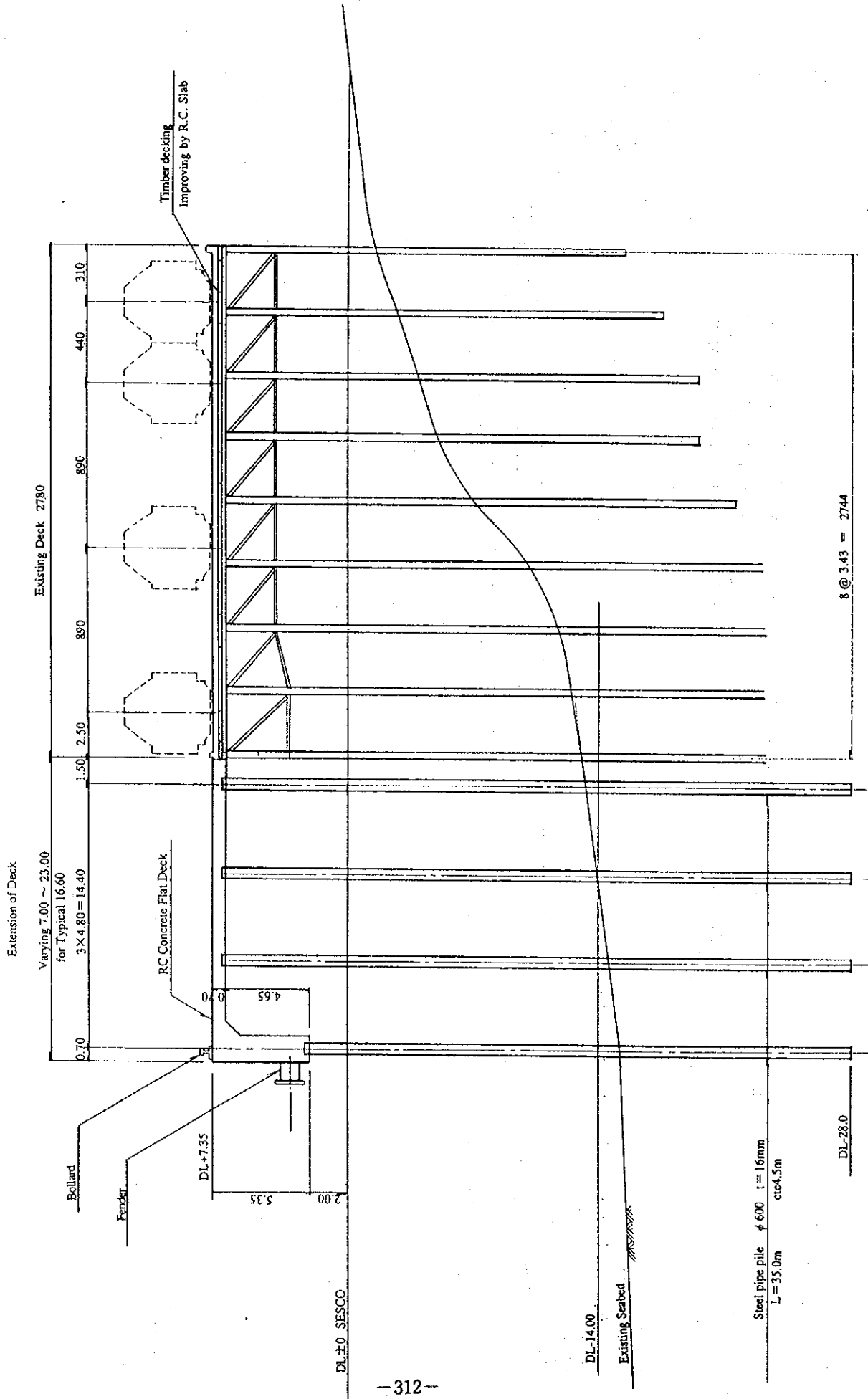


ALTERNATIVE B

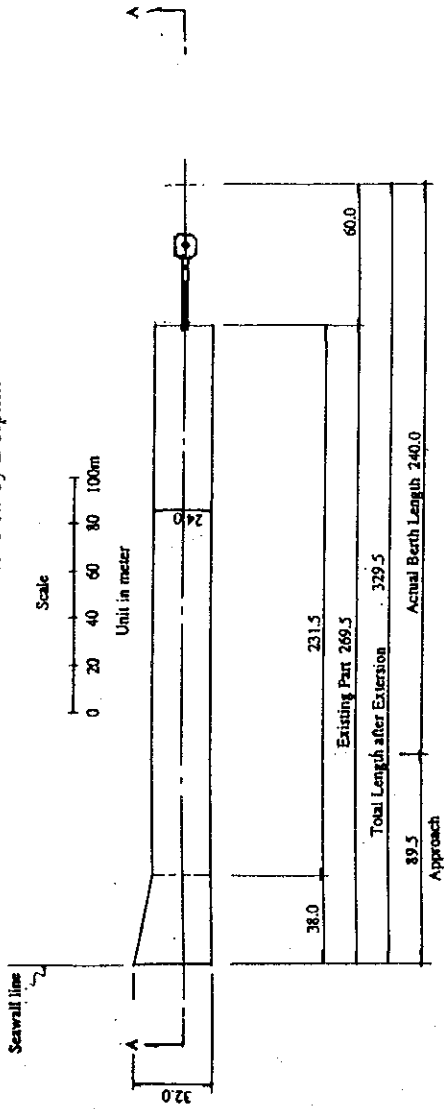
STANDARD SECTION, OPEN STRUCTURE, EXISTING JETTIES

DWG. MP017

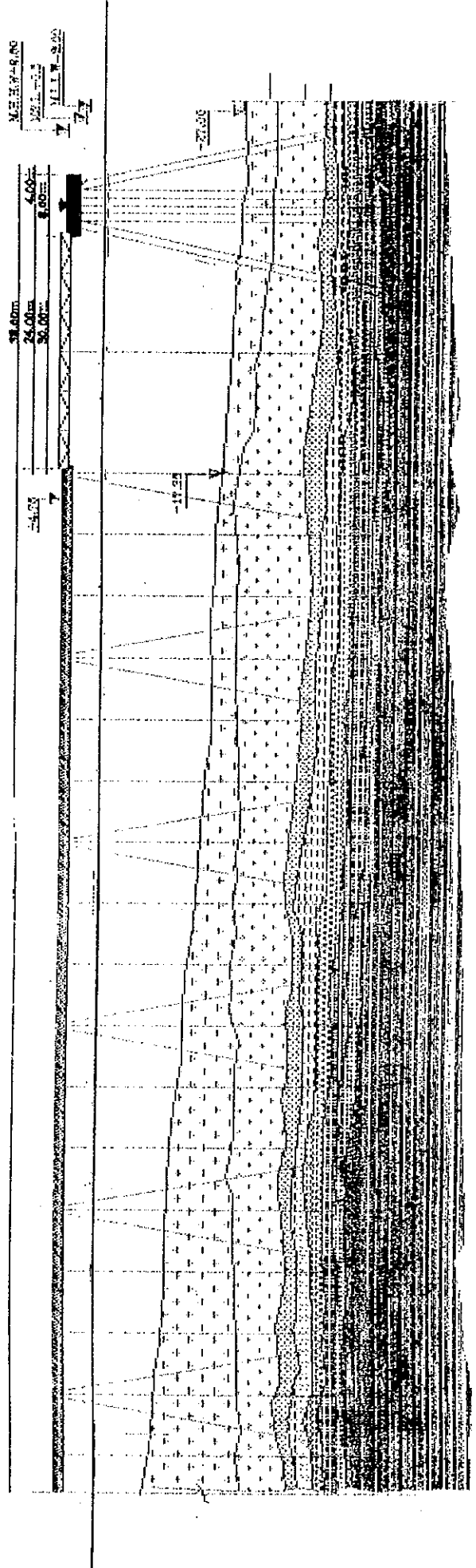
IMPROVEMENT OF EXISTING STRUCTURE



Plan of Grain Berth Extension by Dolphin



SECTION A-A



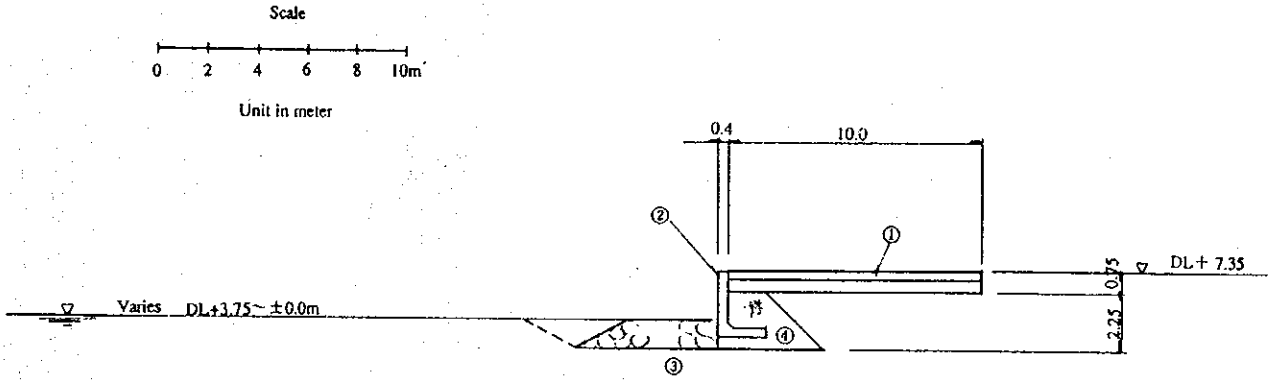


Figure Seawall : DL±0 - +7.35m

- Legend
- ① Apron Concrete $t=0.25m$
 - ② L-shaped Concrete Retaining Wall
 - ③ Armor Rock
 - ④ Rubble Backfill

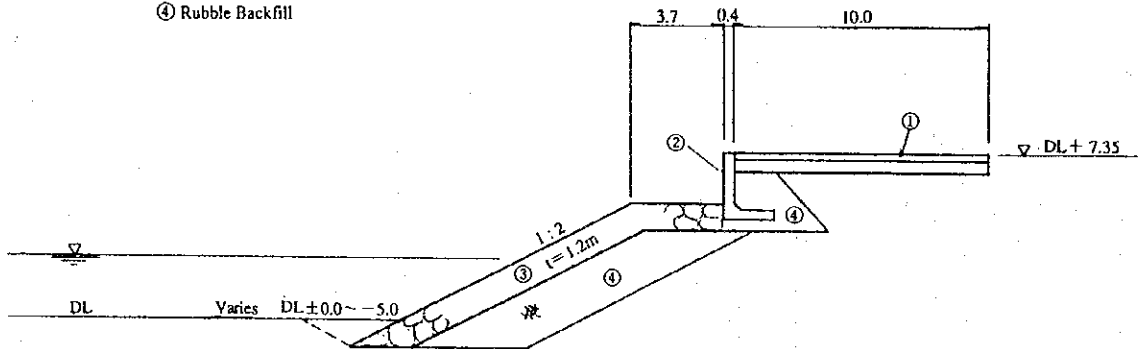


Figure Seawall : DL +0.0 - -5.0m

DWG. MP019

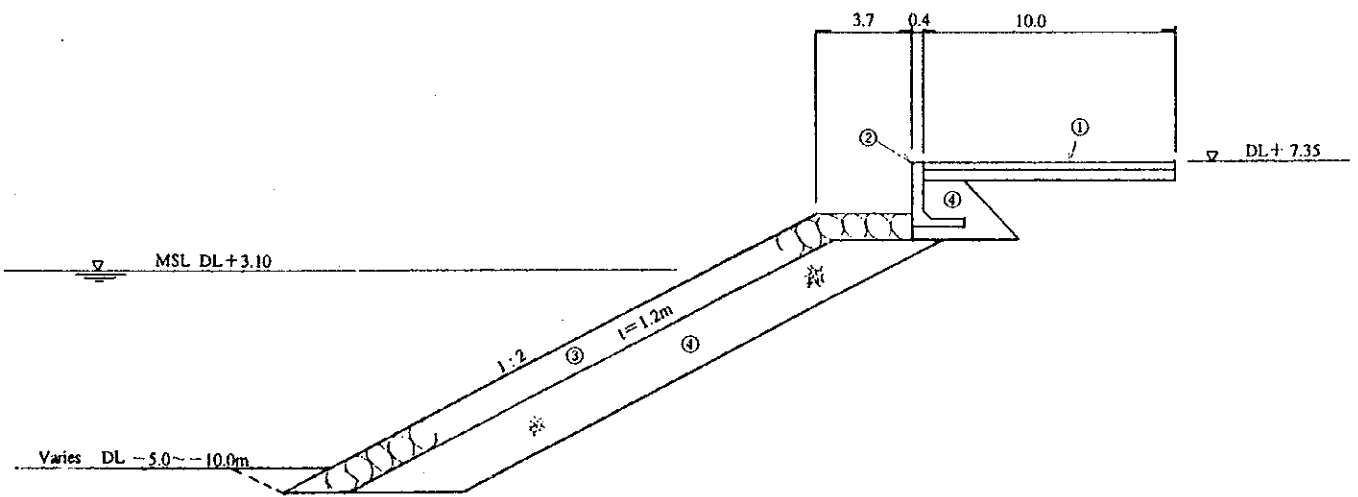


Figure Seawall: DL -5.0 - -10.0m

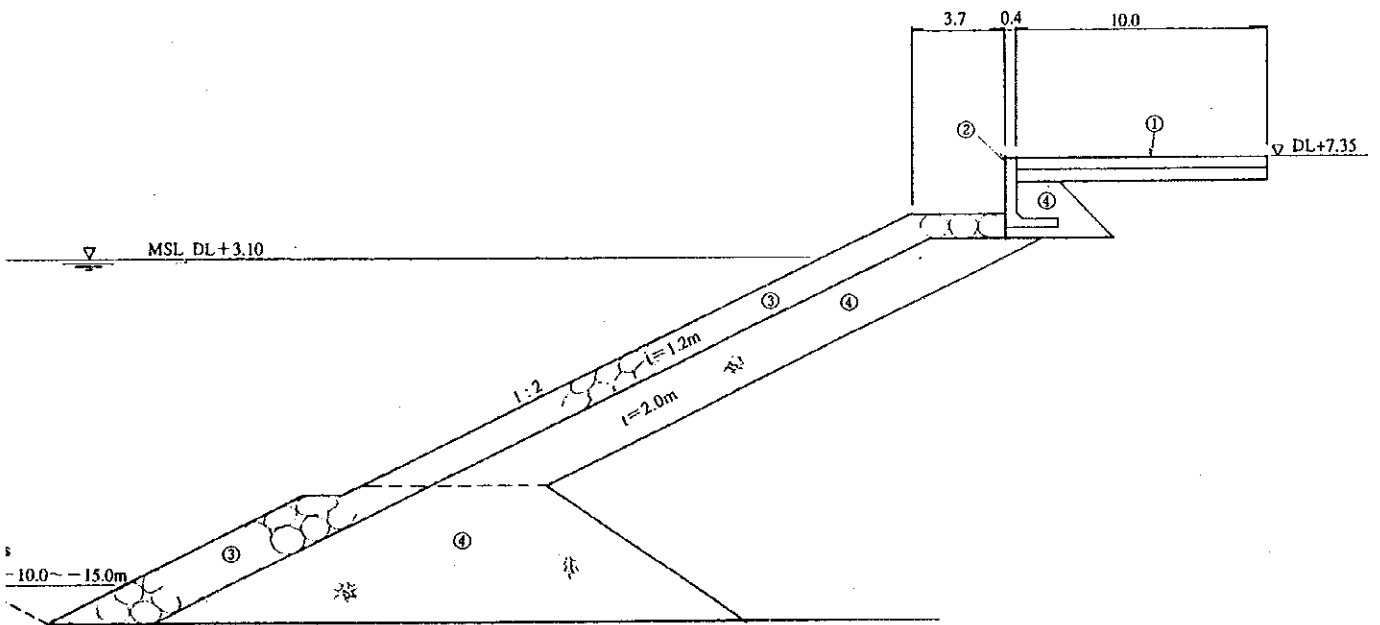


Figure Seawall: DL -10.0 - -15.0m

DWG. MP020

Appendix (III)-7 Financial Analysis

| | |
|------------------|---|
| Appendix III-7.1 | Operating Income of Imam Khomeini Port |
| Appendix III-7.2 | Project Cost of Imam Khomeini Port |
| Appendix III-7.3 | Calculation of FIRR (Imam Khomeini Port) |
| Appendix III-7.4 | Financial Statements of Short-term Projects (Imam Khomeini Port) |

Appendix III-7.1 Operating Income of Imam Khomeini Port

Imam Khomeini Port Income

| Year | 1993/94 | 2001 |
|--|----------------|------|
| Container Cargo Income | 22,000 RIs/TEU | 2001 |
| Income from Shipping Company(1,000 US\$)/1,000 GRT = | 1.36 | |
| Unloading Income(1,000 US\$)/1,000 tons = | 6.87 | |
| Loading Income(1,000 US\$)/1,000 tons = | 6.81 | |
| Other Cargo Income(1,000 US\$)/1,000 tons = | 3.19 | |
| Total berth number:25, Number of non-rehabilitation berth:4(steel) | | |

C. Cargo handling tariff revise
 1993 22,000 RIs/TEU
 1995 120,000 RIs/TEU
 1997 138,000 RIs/TEU
 1999 147,000 RIs/TEU
 2001 168,000 RIs/TEU

C. Volume related to Long-term plan (2010)(1,000tons)
 Steel 3,334
 General 2,292
 Total 5,626 (Container 2 berth)

| Year | Import | | | | Export | | | | Av. GRT of Container Vessels | Income Increase (Import & Export) | | | |
|------|---------------------|-------------|-----------------------|-----------------|---------------------|-------------|-----------------------|-----------------|------------------------------|-----------------------------------|-----------|-------------|-------|
| | Container Total (1) | Transit (2) | Other Cargo Total (3) | Grand Total (4) | Container Total (5) | Transit (6) | Other Cargo Total (7) | Grand Total (8) | | Cargo | Container | Other Cargo | Total |
| 1995 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 |
| 1996 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 |
| 1997 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 |
| 1998 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 |
| 1999 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 |
| 2000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 |
| 2001 | 948 | 258 | 1,207 | 13,702 | 189 | 340 | 529 | 5,618 | 233 | 17,021 | 14,955 | 31,976 | |
| 2002 | 1,136 | 263 | 1,419 | 12,405 | 280 | 372 | 652 | 6,086 | 278 | 20,355 | 17,182 | 37,537 | |
| 2003 | 1,360 | 310 | 1,670 | 11,478 | 403 | 407 | 810 | 6,596 | 333 | 24,427 | 19,430 | 43,857 | |
| 2004 | 1,628 | 340 | 1,968 | 13,925 | 557 | 446 | 1,013 | 7,149 | 401 | 29,429 | 21,685 | 51,094 | |
| 2005 | 1,948 | 347 | 2,295 | 14,729 | 784 | 439 | 1,223 | 7,698 | 473 | 34,771 | 23,851 | 58,622 | |
| 2006 | 2,332 | 378 | 2,710 | 15,604 | 1,069 | 480 | 1,549 | 8,343 | 572 | 42,131 | 25,939 | 68,069 | |
| 2007 | 2,791 | 413 | 3,204 | 16,531 | 1,443 | 526 | 1,969 | 9,042 | 695 | 51,228 | 27,846 | 79,075 | |
| 2008 | 3,341 | 451 | 3,792 | 17,514 | 1,930 | 577 | 2,507 | 9,800 | 847 | 62,448 | 29,494 | 91,940 | |
| 2009 | 3,995 | 493 | 4,492 | 18,557 | 2,562 | 633 | 3,195 | 10,622 | 1,038 | 76,240 | 30,773 | 107,013 | |
| 2010 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 87,461 | 31,528 | 118,989 | |
| 2011 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2012 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2013 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2014 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2015 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2016 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2017 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2018 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2019 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2020 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2021 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2022 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2023 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2024 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2025 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2026 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2027 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2028 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2029 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |
| 2030 | 4,786 | 540 | 5,326 | 19,663 | 3,381 | 695 | 4,076 | 11,513 | 1,011 | 56,601 | 19,587 | 76,188 | |

Appendix III-7.2 Project Cost of Imam Khomeini Port

Project Cost of Imam Khomeini Port

| | Cost | | Foreign P | | Direct Cost | | Initial Investment Costs by Facilities | | | Total | Maintenance Cost | Depreciation Period | Depreciation Per Year | Unit: 1,000\$ |
|---------------------------------|---------|-----------|--------------|-------------|----------------|-------------|--|-------------|----------------|---------|------------------|---------------------|-----------------------|---------------|
| | Local P | Foreign P | Mobilization | Engineering | P. Contingency | Engineering | P. Contingency | Engineering | P. Contingency | | | | | |
| Rehabilitation Cost | 16,870 | 12,953 | 16,770 | 1,687 | 1,687 | 1,687 | 0 | 0 | 0 | 20,244 | 154 | 0 | 272 | |
| Mobilization | 100 | 23 | 0 | 0 | 0 | 100 | 10 | 10 | 0 | 120 | 0 | 0 | 0 | |
| Structural Repair | 5,000 | 3,842 | 5,000 | 0 | 0 | 500 | 500 | 0 | 0 | 6,000 | 60 | 50 | 120 | |
| Dredging(1) | 9,320 | 7,162 | 9,320 | 0 | 0 | 932 | 932 | 0 | 0 | 11,184 | 0 | 0 | 0 | |
| CH Equipment Repair | 1,350 | 1,037 | 1,350 | 0 | 0 | 135 | 135 | 0 | 0 | 1,620 | 81 | 15 | 108 | |
| Navigation Aids, Others | 1,100 | 845 | 1,100 | 0 | 0 | 110 | 110 | 0 | 0 | 1,320 | 13 | 30 | 44 | |
| Construction Cost | 46,130 | 35,447 | 45,830 | 300 | 0 | 4,618 | 4,618 | 0 | 0 | 55,366 | 435 | 0 | 1,211 | |
| Mobilization | 300 | 231 | 0 | 0 | 0 | 300 | 30 | 0 | 0 | 360 | 0 | 0 | 0 | |
| Grain Jetty CH Equipment Repair | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Grain Jetty Extension | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Bagged Cargo Berth | 5,880 | 4,518 | 5,880 | 0 | 0 | 588 | 588 | 0 | 0 | 7,056 | 71 | 50 | 141 | |
| Ore Berth CH Equipment Repair | 4,100 | 3,150 | 4,100 | 0 | 0 | 410 | 410 | 0 | 0 | 4,920 | 0 | 0 | 0 | |
| Mineral Berth | 9,050 | 6,954 | 9,050 | 0 | 0 | 905 | 905 | 0 | 0 | 10,860 | 109 | 50 | 217 | |
| Dredging(2) | 5,480 | 4,211 | 5,480 | 0 | 0 | 548 | 548 | 0 | 0 | 6,576 | 0 | 0 | 0 | |
| Warehouse | 19,820 | 15,230 | 19,820 | 0 | 0 | 1,987 | 1,987 | 0 | 0 | 23,794 | 238 | 30 | 793 | |
| Container Yard Extension | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Navigation Aids, Others | 1,500 | 1,153 | 1,500 | 0 | 0 | 150 | 150 | 0 | 0 | 1,800 | 18 | 30 | 60 | |
| Equipment | 40,550 | 31,159 | 40,550 | 0 | 0 | 4,055 | 4,055 | 0 | 0 | 48,660 | 2,433 | 0 | 4,103 | |
| Unloader | 7,000 | 5,379 | 7,000 | 0 | 0 | 700 | 700 | 0 | 0 | 8,400 | 420 | 15 | 560 | |
| Transfer Crane | 7,500 | 5,763 | 7,500 | 0 | 0 | 750 | 750 | 0 | 0 | 9,000 | 450 | 15 | 600 | |
| Mobile Crane | 20,680 | 15,891 | 20,680 | 0 | 0 | 2,068 | 2,068 | 0 | 0 | 24,816 | 1,241 | 15 | 1,654 | |
| Forklift, Others | 5,370 | 4,126 | 5,370 | 0 | 0 | 537 | 537 | 0 | 0 | 6,444 | 322 | 5 | 1,289 | |
| Engineering and Sup. | 10,360 | 7,961 | 10,360 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Physical Contingency | 10,360 | 7,961 | 10,360 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Total | 124,270 | 95,490 | 103,150 | 400 | 0 | 10,360 | 10,360 | 0 | 0 | 124,270 | 3,022 | 0 | 5,587 | |

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|------------------|------|------|--------|--------|--------|--------|-------|
| Investment Total | 0 | 0 | 20,244 | 16,248 | 36,192 | 51,586 | 0 |
| Maintenance | 0 | 0 | 154 | 154 | 154 | 2,843 | 3,022 |
| Depreciation | 0 | 0 | 272 | 272 | 272 | 5,228 | 5,587 |

Appendix III-7.3 Calculation of FIRR (Imam Khomeini Port)

| Result of Calculation | |
|------------------------|-----------------------------------|
| Original Case | 22.5% |
| Sensitivity Analysis A | 19.9% Revenue 10%Down |
| Sensitivity Analysis B | 20.2% Cost 10%Up |
| Sensitivity Analysis C | 17.5% Revenue 10%Down, Cost 10%Up |

Unit: 1,000US\$

| Year | Revenues | | Investment | Cost | | Revenue-Cost | Revenues | Cost | Net Present Value | Difference |
|-------|--------------------|-------------------|------------|---------|-----------|--------------|----------|--------|-------------------|------------|
| | Operating Revenues | Subsidy (G. Fund) | | Expense | Total | | | | | |
| 1995 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1996 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 0 | 0 | 20,244 | 0 | 0 | -20,244 | 0 | 0 | 13,482 | -13,482 |
| 1998 | 0 | 0 | 16,248 | 154 | 0 | -16,402 | 0 | 0 | 8,915 | -8,915 |
| 1999 | 0 | 0 | 36,192 | 154 | 0 | -36,346 | 0 | 0 | 16,121 | -16,121 |
| 2000 | 0 | 0 | 51,586 | 2,843 | 0 | -54,429 | 0 | 0 | 19,701 | -19,701 |
| 2001 | 31,976 | 0 | 31,976 | 11,815 | 0 | 20,161 | 9,446 | 0 | 3,490 | 5,955 |
| 2002 | 37,537 | 0 | 37,537 | 13,345 | 0 | 24,192 | 9,049 | 0 | 3,217 | 5,832 |
| 2003 | 43,857 | 0 | 43,857 | 15,083 | 0 | 28,774 | 8,628 | 0 | 2,967 | 5,661 |
| 2004 | 51,094 | 0 | 51,094 | 17,073 | 0 | 34,021 | 8,203 | 0 | 2,741 | 5,462 |
| 2005 | 58,622 | 0 | 58,622 | 19,143 | 0 | 39,479 | 7,681 | 0 | 2,508 | 5,173 |
| 2006 | 68,069 | 0 | 68,069 | 21,741 | 0 | 46,328 | 7,278 | 0 | 2,325 | 4,954 |
| 2007 | 79,075 | 0 | 79,075 | 24,768 | 0 | 54,307 | 6,900 | 0 | 2,161 | 4,739 |
| 2008 | 91,940 | 0 | 91,940 | 28,306 | 0 | 63,635 | 6,547 | 0 | 2,016 | 4,531 |
| 2009 | 107,013 | 0 | 107,013 | 32,451 | 0 | 74,562 | 6,219 | 0 | 1,886 | 4,383 |
| 2010 | 118,989 | 0 | 118,989 | 35,744 | 0 | 83,245 | 5,649 | 0 | 1,695 | 3,948 |
| 2011 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 2,949 | 0 | 1,520 | 1,428 |
| 2012 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 2,406 | 0 | 1,241 | 1,166 |
| 2013 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 1,964 | 0 | 1,013 | 951 |
| 2014 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 1,603 | 0 | 826 | 776 |
| 2015 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 1,308 | 0 | 674 | 633 |
| 2016 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 1,067 | 0 | 550 | 517 |
| 2017 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 871 | 0 | 449 | 422 |
| 2018 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 711 | 0 | 367 | 344 |
| 2019 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 580 | 0 | 299 | 281 |
| 2020 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 473 | 0 | 244 | 229 |
| 2021 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 386 | 0 | 199 | 187 |
| 2022 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 315 | 0 | 163 | 153 |
| 2023 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 257 | 0 | 133 | 125 |
| 2024 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 210 | 0 | 108 | 102 |
| 2025 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 171 | 0 | 88 | 83 |
| 2026 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 140 | 0 | 72 | 68 |
| 2027 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 114 | 0 | 59 | 55 |
| 2028 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 93 | 0 | 48 | 45 |
| 2029 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 76 | 0 | 39 | 37 |
| 2030 | 76,188 | 0 | 76,188 | 39,286 | 0 | 36,902 | 62 | 0 | 32 | 30 |
| Total | 2,211,932 | 0 | 2,211,932 | 124,270 | 1,008,338 | 1,132,608 | 91,350 | 91,350 | 91,350 | 0 |



Appendix (III)-8 Scoping Sheet of Ports

Appendix III-8.1 Scoping Sets

Table Scoping Sheet at Chabahai

| Iron | Before completion of the project | | | After completion of the project | | | | Total evaluation |
|---------------------|---|---|--------------------|---------------------------------|------------------|---------------|--------|------------------|
| | Occupancy of space and geological changes | Construction machines, vehicles and ships | Occupancy of space | Working of vehicles | Working of ships | Port activity | Others | |
| Social Environment | 1. Resettlement | | | | | | | |
| | 2. Economic activities | | | | | | | |
| | 3. Traffic and public facilities | C | | A | | A | | A |
| | 4. Dispersion of local community | | | | | | | |
| | 5. Cultural practices | | | | | | | |
| | 6. Wild birds | | | | | | | |
| | 7. Health and sanitation | | | | | | | |
| | 8. Waste | | | | | C | | C |
| | 9. Hazards | | | | | | | |
| Natural Environment | 10. Topography and geology | | | | | | | |
| | 11. Land erosion | | | | | | | |
| | 12. Oronomax | | | | | | | |
| | 13. Hydrological situation | | | | | | | |
| | 14. Coastal zone | | | | | | | |
| | 15. Flora and fauna | | | | | | | |
| | 16. Weather | | | | | | | |
| | 17. Landscape | | | | | | | C |
| Pollution | 18. Air Pollution | | | | | | | |
| | 19. Water Pollution | C | | | | | | C |
| | 20. Soil Contamination | | | | | | | |
| | 21. Noise and vibration | | | | | | | |
| | 22. Subsidence of ground | | | | | | | |
| | 23. Offensive odor | | | | | | | |

Note: A-Very large impact, B-Large impact, C-Small impact

Table Scoping Sheet at Shahid Rajae

| Item | Before completion of the project | | | After completion of the project | | | | Others | Total evaluation | | |
|--------------------|--|---|--------------------------|---------------------------------|------------------|---------------|---|--------|------------------|--|---|
| | Occupancy of space and Geological Change | Construction machines, Vehicles and ships | Occupancy of space | Working of vehicles | Working of ships | Post activity | | | | | |
| Social Environment | 1. Resettlement | | | | | | | | | | |
| | 2. Economic Activities | C | | | | | | | C | | |
| | 3. Traffic and public facilities | | | | A | | A | | A | | |
| | 4. Separation of local community | | | | | | | | | | |
| | 5. Cultural Properties | C | | | | | | | C | | |
| | 6. Water rights | | | | | | | | | | |
| | 7. Health and sanitation | | | | | C | | | C | | |
| | 8. Waste | | | | | | | | | | |
| | 9. Hazards | | | | | | | | | | |
| | Natural Environment | 10. Topography and geology | | | | | | | | | |
| | | 11. Land erosion | | | | | | | | | |
| | | 12. Groundwater | | | | | | | | | |
| | | 13. Psychological situation | | | | | | | | | |
| | | 14. Coastal zone | | | | | | | | | |
| | | 15. Piers and fairs | | | | | | | | | |
| | | 16. Weather | | | | | | | | | |
| | | 17. Landmarks | | | | | | | | | |
| | | Pollution | 18. Air Pollution | | | | | | | | |
| | | | 19. Water Pollution | C | | | | | | | C |
| | | | 20. Soil Contamination | | | | | | | | |
| | | | 21. Noise and Vibration | | | | | | | | |
| | | | 22. Subsidence of ground | | | | | | | | |
| | | | 23. Offensive odor | | | | | | | | |

Note: A-Very large impact B-Large impact, C-Small impact

Table Scoping Sheet at Bahonai

| Item | Before completion of the project | | | After completion of the project | | | | Others | Total evaluation |
|---------------------|---|---|--------------------|---------------------------------|------------------|---------------|---|--------|------------------|
| | Occupancy of space and geological changes | Construction machines, vehicles and ships | Occupancy of space | Working of vehicles | Working of ships | Port activity | | | |
| Social Environment | 1. Resettlement | | C | | | | | | C |
| | 2. Economic activities | | C | | | | B | | B |
| | 3. Traffic and public facilities | | C | A | | A | | | A |
| | 4. Formation of local community | | | C | | C | | | C |
| | 5. Cultural heritage | | | | | | | | |
| | 6. Noise, health, right of common | | | | | C | | | C |
| | 7. Health and sanitation | | | | | | B | | B |
| | 8. Waste | | | C | | | B | | B |
| | 9. Marine | | | | | C | C | | C |
| Natural Environment | 10. Topography and geology | C | | C | | | | | C |
| | 11. Land erosion | | | | | | | | |
| | 12. Groundwater | C | | | | | | C | C |
| | 13. Hydrological situation | | | C | | | | | C |
| | 14. Coastal zone | C | | | | | | | C |
| | 15. Flora and fauna | | | C | | | | | C |
| | 16. Weather | | | | | | | | |
| Pollution | 17. Landscape | | | | | | | | |
| | 18. Air Pollution | B | | | A | | | A | A |
| | 19. Marine Pollution | | | | | C | | C | C |
| | 20. Soil Contamination | | | C | | | | C | C |
| | 21. Noise and vibration | | | | | | | | |
| | 22. Subsidence of ground | | | | | | | | |
| | 23. Offensive odor | | | | | | | | |
| | 24. Other | | | | | | | | |

Note: A=Very large impact, B=Large impact, C=Small impact

Table Scoping Sheet at Now Shahi

| Item | before completion of the project | | after completion of the project | | | Others | Total evaluation |
|---------------------|--|---|---------------------------------|---------------------|------------------|--------|------------------|
| | occupancy of space and geological change | construction machines, vehicles and ships | occupancy of space | working of vehicles | working of ships | | |
| Social Environment | 1. Resettlement | | A | | | | A |
| | 2. Economic activities | | | | | | |
| | 3. Traffic and public facilities | | | | | | |
| | 4. Separation of social community | | | | | | |
| | 5. Cultural properties | | | | | | |
| | 6. Water intake | | | | | | |
| | 7. Health and sanitation | | | | | | |
| | 8. Noise | | | | | | |
| | 9. Vibration | | | | | | |
| | 10. Topography and geology | C | | C | | | C |
| | 11. Land erosion | C | | | | | C |
| | 12. Groundwater | C | | | | | C |
| | 13. Environmental situation | C | | | | | C |
| 14. Coastal zone | | | | | | A | |
| Natural Environment | 15. Flora and fauna | | C | | | | C |
| | 16. Weather | | | | | | |
| | 17. Landscape | | | C | | | C |
| | 18. Air Pollution | | | | | | |
| | 19. Water Pollution | | | | | | |
| | 20. Soil contamination | | | | | | |
| | 21. Noise and vibration | | | | B | | B |
| Pollution | 22. Subsidence of ground | | | | | | A |
| | 23. Offensive odor | | | | | | A |
| | | | | | | | |
| | | | | | | | |

Note: A=Very large impact B=Large impact, C=Small impact

Table Scoping Sheet at Bandar Busher

| Item | Before completion of the project | | After completion of the project | | | Others | Total evaluation |
|---------------------|--|---|---------------------------------|---------------------|------------------|--------|------------------|
| | Occupancy of space and geological change | Construction machines, vehicles and ships | Occupancy of space | Working of vehicles | Working of ships | | |
| Social Environment | 1. Resettlement | | B | | | | B |
| | 2. Economic activities | | | | C | | C |
| | 3. Traffic and public facilities | | | C | | | C |
| | 4. Separation of local community | | | | | | |
| | 5. Cultural properties | | | | | | |
| | 6. Water rights | | | | | | |
| | 7. Health and sanitation | | | | | | |
| | 8. Waste | | | | | | |
| | 9. Hazards | | | | | | |
| Natural Environment | 10. Topography and geology | C | | | | | C |
| | 11. Land erosion | | | | | | |
| | 12. Groundwater | C | | C | | | C |
| | 13. Hydrological situation | C | | C | | | C |
| | 14. Channels | | | | | | |
| | 15. Flora and fauna | C | | | | | C |
| | 16. Marine | | | C | | | C |
| | 17. Landscape | | | C | | | C |
| | 18. Air pollution | | | | | | |
| Pollution | 19. Noise pollution | C | | | A | | A |
| | 20. Soil contamination | | | | | | |
| | 21. Noise and vibration | | C | | | | C |
| | 22. Subsidence of ground | | | | | | |
| | 23. Offensive odor | | | | | | |

Note: A=Very large impact, B=Large impact, C=Small impact

Table Scoping Sheet at Anzali

| Item | Before completion of the project | | After completion of the project | | | | Others | Total evaluation |
|--------------------|--|---|---------------------------------|---------------------|------------------|---------------|--------|------------------|
| | occupancy of space and geographical change | Construction machines, vehicles and ships | occupancy of space | Working of vehicles | Working of ships | Post activity | | |
| Social Environment | 1. Resettlement | | A | | | | | A |
| | 2. Economic activities | | | | | | | |
| | 3. Traffic and public facilities | B | | | B | | | B |
| | 4. Separation of local community | | | | | | | |
| | 5. Cultural properties | | | | | | | |
| | 6. Minor lands | | | | | | | |
| | 7. Right of common | | | | | | | |
| | 8. Health and sanitation | | | | | | C | C |
| | 9. Waste | | | | | | | |
| | 10. Hazards | | | | | C | | C |
| | 11. Topography and geology | | | | | | | |
| | 12. Land erosion | | | | | | | |
| | 13. Groundwater | | | | | | | |
| | 14. Hydrological situation | | | | | | | |
| | 15. Coastal zone | | | | | | | A |
| | 16. Flora and fauna | | | | | | | A |
| | 17. Weather | | | | | | | |
| Pollution | 18. Air pollution | | | | | | | |
| | 19. Water pollution | C | | | | B | | B |
| | 20. Soil contamination | | | | | | | |
| | 21. Noise and vibration | | B | | | | | B |
| | 22. Subsidence of ground | | | | | | | |
| | 23. Offensive odor | | | | | | | |
| | | | | | | | | A |

Note: A=Very large impact, B=Large impact, C=Small impact

Table Scoping Sheet at Imam Khomeini

| Item | Before completion of the project | | | After completion of the project | | | | Others | Total evaluation |
|---------------------|--|--------------------|---------------------|---------------------------------|---------------|---|--|--------|------------------|
| | Occupancy of space and construction machines, vehicles and ships | Occupancy of space | Working of vehicles | Working of ships | Port activity | | | | |
| Social Environment | 1. Resettlement | | | | | | | | |
| | 2. Economic activities | | | | | | | | |
| | 3. Traffic and public facilities | | | B | | | | | |
| | 4. Separation of local community | | | | | | | | |
| | 5. Cultural Properties | | | | | | | | |
| | 6. Water Table | | | | | | | | |
| | 7. Right of common | | | | | A | | | A |
| | 8. Health and sanitation | | | | A | A | | | A |
| Natural Environment | 9. Waste | | | | | | | | |
| | 10. Hazards | | | | C | | | | C |
| | 11. Topography and geology | | | | | | | | |
| | 12. Land erosion | | | | | | | | |
| | 13. Groundwater | | | | | | | | |
| | 14. Hydrological situation | | | | | | | | |
| | 15. Coastal zone | | | | | | | | |
| | 16. Flora and fauna | | | | | | | | |
| Pollution | 17. Air Pollution | | | | | | | | B |
| | 18. Water Pollution | | | | | | | | A |
| | 19. Soil Contamination | | | | | | | | A |
| | 20. Noise and Vibration | | | | | | | | B |
| | 21. Subsidence of ground | | | | | | | | |
| | 22. Offensive odor | | | | | | | | |
| | 23. Offensive odor | | | | | | | | B |
| | 23. Offensive odor | | | | | | | | B |

Note: A-Very large impact B-Large impact, C-Small impact