No. 5

マレイシア

テカイ河水力発電開発計画調査

報　告　書

補足資料 建設費と単価

1983年 9月

国際協力事業団

鉱計資
CR 11
83－85％

マレイシア

テカイ河水力発電開発計画調査

報　告　書

補足資料 建設費と単価

JICA LIBRARY
1031300[5]

1983年 9 月

国際協力事業団

国際協力事業団	
受入月日 '85. 6. 26	113
	643
登録No. 11663	MPN

はしがき

日本国政府は、マレイシア国政府の要請に基づき、同国パハン州において早急に開発することが望まれているテンブリン川支流テカイ川の水力発電開発計画のフィージビリティ調査を行うこととなり、その実施を国際協力事業団に委託した。事業団はこの水力発電計画の重要性を考慮し、1981年3月1日から1982年12月15日まで、高比良敬一氏を団長とする各分野の専門家から成る調査団をマレイシアに派遣し、同国政府関係機関の協力を得て現地調査を実施した。

本報告書は、現地調査及び収集した資料に基づき、帰国後調査検討を行い、その成果を取りまとめたものである。本報告書が、マレイシアの電源開発に寄与するとともに、同国と日本との経済交流及び友好親善の一助となれば誠に喜ばしい次第である。

終わりに、今回の調査の実施に当たられた団員各位に謝意を表するとともに、熱意ある支援と協力を賜いたマレイシア国政府関係機関の方々、ならびに外務省、通商産業省及び在マレイシア日本国大使館の関係者各位に対し、この機会に心より感謝の意を表わすものである。

1983年8月

国際協力事業団

総裁　有田圭輔

目　　次

	Page
1. The Estimated Construction Cost for the Optimum Development Scheme	1
1-1. Upper Tekai	1
Roads	2
River Treatment	4
Dam	6
Spillway	8
Intake	9
Penstock	10
Power House	12
Outdoor Switch Yard	14
Gate Screen	15
1-2. Lower Tekai (Series Development)	16
Roads	17
River Treatment (Coffer Dam)	18
Dam	19
Spillway	21
Intake	22
Penstock	23
Power House	24
Gate Screen	25

Page

2. Unit Price 26

2-1. Adopted Unit Cost 28

2-2. Breakdown of Unit Price for Direct Construction Cost 29

Rock Excavation (Diversion) 29
Tunnel Excavation (Diversion and Penstock) 33
Diversion Tunnel Lining Concrete (Fill Dam) 35
Diversion Inlet Concrete (Fill Dam) 37
Reinforcement Bar 39
Anchor Bar 40
Plug Concrete 41
Common Ex. Dam 43
Common Excavation (Spillway) 48
Rock Excavation (Dam. Spillway) 50
Rock Embankment 54
Rock Embankment (In case of Re-use of Excavated Rock Materials) 58
Filter Embankment 62
Core Embankment 66
Rip-rap 70
Grout Hole Drilling (Rotary Type Machine ϕ46 mm) 74
Cement Grouting 76
Spillway Wall Concrete (Fill Dam) 78
Spillway Floor Concrete (Fill Dam) 80
Spillway Crest Concrete (Fill Dam) 82
Spillway Pier Concrete (Fill Dam) 84
Backfill Concrete 86
Inlet Structure Concrete (Fill Dam) 88
Tailrace Concrete (Fill Dam) 90
Tunnel Excavation (Penstock) 92
Power House Foundation Concrete (Fill Dam) 94
Switchyard Concrete (Fill Dam) 96
Embankment for Switchyard 98
Rock Excavation (Road) 101
Asphalt Concrete Surfacing (t = 5 cm) 105

Page

Subgrade (t: 30) 107
Diversion Tunnel Lining Concrete (Conc. Dam) 110
Diversion Inlet Concrete (Concrete Dam) 112
Sheet Pile (12m.7m placing) 114
Dam Concrete (Class A) 116
Dam Concrete (Class B) 118
Dam Concrete (Class C) 120
Power House Foundation Concrete (Concrete Dam) 122
Tailrace Concrete (Concrete Dam) 124
Switchyard Concrete (Concrete Dam) 129

3. Comparative Table of Unit Cost (Direct Construction Unit Cost) 131

1. The Estimated Construction Cost for the Optimum Development Scheme

1-1. Upper Tekai

10^3 M$

1. Preparatory Works	32,256	
Access Road	16,513	
Temporary Facilities	15,743	
2. Civil Works	156,194	
Diversion and Care of River	20,572	
Dam	59,976	
Spillway	21,200	
Intake Structure	3,512	
Penstock	25,654	
Powerhouse	20,450	
Switchyard	1,330	
Mechanical Equipment	3,500	
3. Generating Equipment	53,000	
4. Engineering Service	19,316	(1)+(2)+(3)x8%
5. Government Administration	7,244	(1)+(2)+(3)x3%
6. Contingency	21,441	(1)+ ... +(5)x8%
7. Grand Total	289,451	

Roads

M$ 16,512,650.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
(1)∿(2) 35km					
Subbase Coursing	m^3	66,200	49.00	3,243,800	
Asphalt	m^2	210,000	16.30	3,423,000	
Sub-Total				6,666,800	
(2)∿(3) 2km					
Common Excavation	m^3	11,520	9.00	103,680	
Rock Excavation	"	2,880	20.50	59,040	
Subbase Coursing	"	3,600	49.00	176,400	
Asphalt	m^2	12,000	16.30	195,600	
Drainage Appliance	set	l.s. 1		32,580	
Sub-Total				567,300	
(3)∿(4) 20km					
Common Excavation	m^3	273,800	9.00	2,464,200	4,032,150 ×0.2 = 806,400
Rock Excavation	"	68,400	20.50	1,402,200	
Embankment	"	33,150	5.00	165,750	
Subbase Coursing	"	36,000	49.00	1,764,000	
Asphalt	m^2	120,000	16.30	1,956,000	
Drainage Appliance	set	1		806,400	
Sub-Total				8,558,550	

(to be continued)

Roads (cont.)

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
Bridge	m^2	$60^m \times 6^m$	2,000	720,000	
Sub-Total				720,000	
Total				16,512,650	

River Treatment

M$20,572,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Coffering (1st)					
Banking	m^3	27,500	5.0	137,500	
Sub-Total				137,500	
2. Coffering (2nd)					
Rock Embankment	m^3	234,800	15.5	3,639,400	
Filter Embankment	"	25,300	17.5	442,750	
Core Embankment	"	70,300	14.0	984,200	
Miscellaneous	set	1		151,650	3%
Sub-Total				5,218,000	
3. Diversion Tunnel					
Common Excavation	m^3	11,400	9.0	102,600	
Rock Excavation	"	46,300	22.5	1,041,750	
Tunnel Excavation					
Horizontal	"	56,000	86.5	4,844,000	
Back Fill	"	3,500	5.0	17,500	
Concrete Lining					
Horizontal	"	16,500	305.0	5,032,500	
Intake Concrete	"	5,700	250.0	1,425,000	

(to be continued)

River Treatment (cont.)

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
Plug Concrete	m^3	2,800	225.0	630,000	
Reinforcement Bar	t	860	1,800.0	1,548,000	
Miscellaneous	set	1		483,650	3%
Sub-Total				15,080,000	
4. Grouting					
Contact Grouting	m^3	500	265.0	132,500	
Miscellaneous	set	l.s. 1		4,000	
Sub-Total				136,500	
Total				20,572,000	

Dam

(EL.165.00)

M$ 59,976,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Dam					
Common Excavation	m^3	221,000	9.5	2,099,500	
Rock Excavation	"	221,000	23.0	5,083,000	
Rock Embankment	"	1,927,000	15.5	29,868,500	
Filter Embankment	"	255,000	17.5	4,462,500	
Core Embankment	"	534,000	14.0	7,476,000	
Riprap	"	79,000	18.5	1,461,500	
Miscellaneous	set	l.s. 1		1,519,000	
Sub-Total				51,970,000	
2. Grouting					
Drilling	m	22,100	130	2,873,000	
Curtain Grouting	t	3,300	1,350	4,455,000	
Miscellaneous	set	l.s. 1		222,000	3%
Sub-Total				7,550,000	

Dam (cont.)

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
3. Foundation Treatment Tunnel (l=160m)					
Tunnel Excavation	m^3	1,850	86.5	160,025	
Concrete	"	750	305	228,750	
Reinforcement Bar	t	30	1,800	54,000	
Miscellaneous	set	l.s. 1		13,225	3%
Sub-Total				456,000	
Total				59,976,000	

Spillway

M$ 21,200,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Spillway					
Common Excavation	m^3	70,000	9.0	630,000	
Rock Excavation	"	213,000	23.0	4,899,000	
Floor and Wall Concrete	"	2,240	255.0	571,200	
Pier Concrete	"	780	265.0	206,700	
Overflow Section Concrete	"	8,370	230.0	1,925,100	
Concrete for Shute	"	11,270	255.0	2,873,850	
Stilling Base Concrete	"	25,790	255.0	6,576,450	
Backfill	"	6,620	5.0	33,100	
Reinforcement Bar	t	1,450	1,800.0	2,610,000	
Anchor Bar	"	48	2,200.0	105,600	
Bridge	set	1		106,000	L = 37m
Miscellaneous	set	1		663,000	
Total				21,200,000	

Intake

M$3,512,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Intake					
Common Excavation	m^3	23,100	9.5	219,450	
Rock Excavation	"	9,900	23.0	227,700	
Embankment	"	5,300	5.0	26,500	
Retaining Wall Concrete	"	6,200	255.0	1,581,000	
Concrete in Intake Body	"	1,330	265.0	352,450	
Invert Concrete	"	723	250.0	180,750	
Slug Concrete	"	310	265.0	82,150	
Pier Concrete	"	482	265.0	127,730	
Reinforcement Bar	t	340	1,800.0	612,000	
Miscellaneous	set	1		102,270	3%
Total				3,512,000	

Penstock

M$25,654,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Penstock					
Tunnel Excavation					
Horizontal Section	m^3	32,600	86.5	2,819,900	
Vertical Section	"	6,700	110.0	737,000	
Concrete Lining					
Horizontal Section	"	11,400	230.0	2,622,000	
Vertical Section	"	2,900	230.0	667,000	
Reinforcement Bar	t	46	1,800.0	82,800	
Miscellaneous	set	l.s. 1		208,300	
Sub-Total				7,137,000	3%
2. Grouting					
Contact Grouting	m^3	1,050	350.0	367,500	
Drilling	m	1,900	130.0	247,000	
Consolidation Grouting	t	285	1,350.0	384,750	
Miscellaneous		l.s. 1		7,750	
Sub-Total				1,007,000	

(to be continued)

Penstock (cont.)

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
3. Steel Penstock					
Steel Penstock	t	3,000	5,400.0	16,200,000	
Sub-Total				16,200,000	
4. Service Adit					
Tunnel	m	150	8,730.0	1,310,000	
Sub-Total				1,310,000	
Total				25,654,000	

Power House

M$20,450,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Power House					
Common Excavation	m^3	58,400	9.0	525,600	
Rock Excavation	"	25,100	22.5	564,750	
Embankment	"	13,200	5.0	66,000	
Concrete for Side Wall	"	7,100	255.0	1,810,500	
Concrete for Foundation	"	8,300	250.0	2,075,000	
Barell Casing Concrete	"	4,800	255.0	1,224,000	
Slab Concrete	"	2,100	265.0	556,500	
Outlet Concrete	"	5,000	255.0	1,275,000	
Retaining Wall	"	2,700	255.0	688,500	
Reinforcement Bar	t	1,870	1,800.0	3,366,000	
Miscellaneous	set	l.s. 1		368,150	3%
Sub-Total				12,520,000	

(to be continued)

Power House (cont.)

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
2. Architectural Work					
Main Control Building	m^3	25,100	230.0	5,773,000	
Plumbing, Air Conditioning and Ventilation Works	"	35,000	55.0	1,925,000	
Miscellaneous	set	l.s. 1		232,000	3%
Sub-Total				7,930,000	
Total				20,450,000	

Outdoor Switch Yard

M$1,330,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Outdoor Switch Yard					
Excavation	m^3	7,500	9.0	67,500	
Embankment	"	47,000	5.0	235,000	
Concrete for Retaining Wall	"	2,660	235.0	625,100	
Concrete for Foundation	"	630	255.0	160,650	
Reinforcement	t	85	1,800.0	153,000	
Bullast	m^3	970	49.0	47,530	
Miscellaneous	set	l.s. 1		41,220	3%
Total				1,330,000	

Gate Screen

M$3,500,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Gate Screen					
Intake Gate	t	85	9,300.0	790,500	
Screen	"	150	5,000.0	750,000	
Outlet Gate	"	150	8,700.0	1,305,000	
Diversion Channel Gate	"	62	8,730.0	541,260	
Miscellaneous	set	1		113,240	3%
Total				3,500,000	

1-2. Lower Tekai

10^3 M$

1. Preparatory Works	3,930	
Access Road	103	
Temporary Facilities	3,827	
2. Civil Works	34,773	
Diversion and care of River	5,078	
Dam	16,000	
Spillway	4,950	
Intake Structure	920	
Penstock	1,010	
Power House	6,440	
Mechanical Equipment	575	
3. Generating Equipment	13,000	
4. Engineering Service	4,136	(1)+(2)+(3)x8%
5. Government Administration	1,551	(1)+(2)+(3)x3%
6. Contingency	4,591	(1)+ ... +(5)x8%
7. Grand Total	61,981	

Roads

M$103,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
(2)∿(6) 0.34km					
Common Excavation	m^3	2,300	9.0	20,700	
Rock Excavation	"	580	20.50	11,890	
Subbase Coursing	"	620	49.00	30,380	
Asphalt	m^2	2,040	16.30	33,252	
Drainage Appliance	set	1		6,778	
Sub-Total				103,000	
Total				103,000	

River Treatment (Coffer Dam)

M$5,078,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Coffering (1st)					
Sheet Pile	m	590	4,475.0	2,640,250	
Fill Work	m^3	10,600	2.0	21,200	
Sub-Total				2,661,450	
2. Coffering (2nd)					
Sheet Pile	m	340	4,475.0	1,521,500	
Fill Work	m^3	8,200	2.0	16,400	
Excavation	"	500	5.6	2,800	
Concrete	"	2,400	142.0	340,800	
Gate	t	10	8,000.0	80,000	
Withdrawal Quantity	set	l.s. 1		455,050	
Sub-Total				2,416,550	
Total				5,078,000	

Dam

M$ 16,000,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Dam Body					
Common Excavation	m^3	18,200	9.5	172,900	
Rock Excavation	"	24,100	23.0	554,300	
Concrete Class A	"	800	235.0	188,000	δck=270
Concrete Class B	"	45,700	190.0	8,683,000	δck=230
Concrete Class C	"	10,400	170.0	1,768,000	δck=170
Reinforcement Bar	t	58	1,800.0	104,400	
Miscellaneous	set	l.s. 1		349,400	3%
Sub-Total				11,820,000	
2. Foundation Treatment Tunnel (ℓ=70m)					
Tunnel Excavation	m^3	810	86.5	70,065	
Concrete	"	330	305.0	100,650	
Reinforcement Bar	t	13	1,800.0	23,400	
Miscellaneous	set	l.s. 1		5,885	3%
Sub-Total				200,000	
3. Grouting					
Drilling	m	12,500	130.0	1,625,000	
Curtain Grouting	t	1,425	1,350.0	1,923,750	
Consolidation		450	700.0	315,000	

(to be continued)

Dam (cont.)

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
Miscellaneous	set	l.s. 1		116,250	3%
Sub-Total				3,980,000	
Total				16,000,000	

Spillway

M$4,950,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Spillway					
Common Excavation	m^3	22,500	9.0	202,500	
Rock Excavation	"	10,400	23.0	239,200	
Side Wall Concrete	"	7,700	255.0	1,963,500	
Invert Concrete	"	6,100	250.0	1,525,000	
Guide Wall Concrete	"	1,100	255.0	280,500	
Reinforcement Bar	t	331	1,800.0	595,800	
Miscellaneous	set	1		143,500	3%
Total				4,950,000	

Intake

M$920,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Intake					
Common Excavation	m^3	1,100	9.5	38,000	
Rock Excavation	"	3,100	23.0	276,000	
Retaining Wall Concrete	"	1,200	255.0	459,000	
Concrete in Body Intake	"	750	265.0	275,600	
Invert Concrete	"	500	250.0	217,500	
Reinforcement Bar	t	180	1,800.0	180,000	
Miscellaneous	set	l.s. 1		28,500	3%
Total				920,000	

Penstock

M$ 810,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Penstock					
Common Excavation	m^3	1,100	9.5	10,450	
Rock Excavation		2,500	23.0	57,500	
Foundation Concrete	"	1,150	250.0	287,500	
Reinforcement Bar	t	23	1,800.0	41,400	
Miscellaneous	set	l.s. 1		13,150	3%
Sub-Total				410,000	
2. Steel Penstock					
Steel Penstock	t	72	5,400.0	388,800	
Miscellaneous	set	l.s. 1		11,200	
Sub-Total				400,000	
Total				810,000	

Power House

(Power House, Outlet)

M$6,440,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Power House					
Common Excavation	m^3	8,500	9.0	76,500	
Rock Excavation	"	12,700	22.5	285,750	
Concrete for Side Wall	"	2,470	255.0	629,850	
Concrete for Foundation	"	2,070	250.0	517,500	
Borrel Casing Concrete	"	1,000	255.0	255,000	
Slab Concrete	"	320	265.0	84,800	
Outlet Concrete	"	340	255.0	86,700	
Retaining Wall Concrete	"	2,280	255.0	581,400	
Reinforcement Bar	"	450	1,800.0	810,000	
Miscellaneous	set	1		102,500	3%
Sub-Total				3,430,000	
2. Architectural Work					
Power House Building	m^3	10,000	230.0	2,300,000	
Plumbing, Air Conditioning and Ventilation Work	"	11,400	55.0	627,000	
Miscellaneous	set	l.s. 1		83,000	3%
Sub-Total				3,010,000	
Total				6,440,000	

Gate Screen

M$575,000.-

Item	Unit	Quantity	Unit Cost	Cost (M$)	Remarks
1. Gate, Screen					
Intake Gate	t	27	9,300.0	251,100	
Outlet Gate	"	18	8,700.0	156,600	
Screen	"	45	5,000.0	150,000	
Miscellaneous	Set	1		17,300	3%
				575,000	

2. Unit Price

Item	Labour Cost	Material Cost	Equipment Cost	Overhead	Total
1-1. Access road					
1) Common excavation	1.039	1.302	3.288	3.371	9.00
2) Rock excavation	3.390	5.230	4.485	7.395	20.50
3) Subgrade	6.950	6.657	17.057	18.336	49.00
4) Asphalt concrete surfacing	0.362	9.521	0.329	6.088	16.30
1-2. Diversion tunnel					
1) Common excavation	1.039	1.302	3.288	3.371	9.00
2) Rock excavation	2.092	7.135	4.688	8.585	22.50
3) Tunnel excavation	20.489	18.192	9.288	38.531	86.50
4) Inlet concrete	27.532	94.415	17.937	110.116	250.00
5) Concrete linning	34.546	114.450	20.210	135.794	305.00
6) Plug concrete	15.571	90.039	19.065	100.325	225.00
1-3. Dam					
1) Common excavation	1.050	1.300	3.706	3.444	9.50
2) Rock excavation	2.478	7.135	4.688	8.699	23.00
3) Embankment					
•Core	2.566	1.348	4.974	5.112	14.00
•Filter	1.405	4.689	4.783	6.623	17.50
•Rock	1.284	4.150	4.182	5.884	15.50
•Riprap	2.861	4.176	4.584	6.879	18.50
4) Grouting					
•Drilling for grout hole	24.418	47.445	9.600	48.537	130.00
•Cement grouting	222.299	308.515	311.355	507.831	1,350.00
1-4. Spillway					
1) Common excavation	1.039	1.302	3.288	3.371	9.00
2) Rock excavation	2.478	7.135	4.688	8.699	23.00
3) Crest concrete	16.823	94.249	19.160	99.768	230.00
4) Floor concrete	25.429	95.023	19.160	110.388	250.00
5) Wall concrete	26.617	95.849	19.160	113.374	255.00
6) Pier concrete	33.610	96.363	17.937	117.090	265.00
7) Reinforcement bar	108.689	1,040.500	10.000	640.811	1,800.00

Item	Labour Cost	Material Cost	Equipment Cost	Overhead	Total
1-5. Intake					
1) Common excavation	1.039	1.302	3.288	3.371	9.00
2) Rock excavation	2.478	7.135	4.688	8.699	23.00
3) Concrete	28.931	95.240	17.937	112.892	255.00
4) Reinforcement bar	108.689	1,040.500	10.000	640.811	1,800.00
1-6. Penstock					
1) Excavation for penstock	20.489	18.192	9.288	38.531	86.50
2) Steel penstock					5,400.00
3) Backfill concrete	15.571	94.239	19.065	101.125	230.00
1-7. Power house					
1) Common excavation	1.039	1.302	3.288	3.371	9.00
2) Rock excavation	2.092	7.135	4.688	8.585	22.50
3) Concrete for foundation	26.617	95.408	16.607	111.368	250.00
4) Reinforcement bar	108.689	1,040.500	10.000	640.811	1,800.00
5) Architectual work					
6) Miscellaneous					
1-8. Switchyard					
1) Embankment	0.482	0.571	1.904	2.043	5.00
2) Concrete (concrete dam)	21.935	91.643	17.937	103,485	235.00
3) Reinforcement bar	108.689	1,040.500	10.000	640.811	1,800.00
1-9. Tailrace					
1) Common excavation	1.039	1.302	3.288	3.371	9.00
2) Rock excavation	2.092	7.135	4.688	8.585	22.50
3) Concrete	27.532	94.415	17.937	110.116	250.00
4) Reinforcement bar	108.689	1,040.500	10.000	640.811	1,800.00
1-10. Gravity dam concrete					
•Class A (290 kg)	19.633	94.799	15.926	104.642	235.00
•Class B (230 kg)	12.637	78.601	15.926	82.836	190.00
•Class C (170 kg)	12.637	65.988	15.926	75.449	170.00

2-1. Adopted Unit Cost

Item	Unit Cost(M$)
∘Labour Cost	
Foreman	32.0
Operator (H)	24.0
Operator (L)	18.0
Mechanic	20.0
Labor	16.0
Driller	20.0
Electrician	18.0
Blacksmith	18.0
Masonry	18.0
Carpenter	20.0
∘Material Cost	
Cement	200.0/t
Aggregate	12.7/t
Reinforcement	1,000.0/t
Steel (H,L)	1,150.0/t
Dynamite	9.40/kg
Detonator	1.70/piece
Gasoline	1.04/ℓ
Light Oil	0.49/ℓ

Item	Unit Cost		Direct Cost Percentage
∘Construction Cost (Direct Cost)			
Excavation			
Sand	5.6		60%
Rock	13.1		60%
Reinforcement	1,160/t		60%
Dam Concrete	107		80%
Concrete	139 ∿ 142/m^3		80%
∘Machinery Cost			
Bulldozer	D-85	61.0/H	
Bulldozer	D-8	62.0/H	
Wheel loader	KLD-9	80.0/H	
Dump truck	8t	15.0/H	
Drill	CD-3	31.0/H	
Dump truck	18t	36.0/H	
Dump truck	11t	23.0/H	
Bulldozer	D-50	38.0/H	
Jack-hammer	TY-24	6.0/H	
Truck-mixer	6m^3	26.7/H	
Concrete pump	30m^3/H	39.3/H	

2-2. BREAKDOWN OF UNIT PRICE FOR DIRECT CONSTRUCTION COST

Work; Rock Excavation (Diversion)

Unit Price; 22.50 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0075	32.00	0.240
Driller		"	0.0209	20.00	0.418
Labor		"	0.0325	16.00	0.520
Mechanic		"	0.0089	20.00	0.178
Blacksmith		"	0.0015	18.00	0.027
Operator (L)		"	0.2000	18.00	0.360
Sub-Total					(1.743)
[Material Cost]					
Oils and fats, consumed articles					
Drill	CD-3	H/m³	0.0215	1.50	0.032
Compresser		"	0.0066	7.00	0.046
Bulldozer	D-8	"	0.0103	20.00	0.206
"	D-50	"	0.0029	4.80	0.014
Dump truck	18t	"	0.0617	15.00	0.926
Wheel loader		"	0.0119	10.00	0.119
Dynamite		kg/m³	0.356	8.10	2.884
Detonator		piece /m³	0.158	1.70	0.269
Bit & rod		LS/m³			2.299

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Sub-Total					(6.795)
[Equipment Cost]					
Drill	TY-24	day/m^3	0.0021	6.00	0.013
"	CD-3	H/m^3	0.0215	31.00	0.667
Compresser		"	0.0066	13.00	0.086
Bulldozer	D-8	"	0.0103	62.00	0.639
"	D-50	"	0.0029	38.00	0.110
Dump truck	18t	"	0.0617	36.00	2.221
Wheel loader		"	0.0119	80.00	0.952
Sub-Total					(4.688)
[Miscellaneous]					
(1.743 × 0.2 + 6.795 × 0.05)					(0.688)
Total (Direct Cost)					13.914
Unit Price					
(13.914 × 1.6)					22.50

ROCK EXCAVATION (SMALL SCALE) MATERIAL COST, MECHANIC COST

	Dynamite	Detonator	Bit & lod	CD-3	Compresser	D-8	Wheel loader	18t Dump	D-50	
(1) Excavation, blasting	0.353 @ 8.1 = 2.859	0.143 @ 1.7 = 0.243	2.299	0.0215 @ 1.5 = 0.032	0.0066 @ 7.0 = 0.046					
(2) Muck treatment						0.0103 @ 20 = 0.206				
(3) Loading							0.0119 @ 10 = 0.119			
(4) Carriage								0.0617 @ 15 = 0.926		
(5) Spoil treatment									0.0029 @ 4.8 = 0.0139	
(6) Slope completion	0.003 @ 8.1 =0.024	0.015 @ 1.7 = 0.026								
	0.356 @ 8.1 = 2.884	0.518 @ 1.7 =0.269	2.299	0.0215 @ 1.5 = 0.032	0.0066 @ 7.0 =0.046	0.0103 @ 20 =0.206	0.0119 @ 10 = 0.119	0.0617 @ 15 = 0.926	0.0029 @ 4.8 = 0.014	
			jack hammer $0.0021^{day/m^3}$ @ 6 = 0.013	0.0215 @ 31 = 0.667	0.0066 @ 13 = 0.086	0.0103 @ 62 = 0.639	0.0119 @ 80 = 0.952	0.0617 @ 36 = 2.221	0.0029 @ 38 = 0.110	

ROCK EXCAVATION (SMALL SCALE) LABOR COST

	(32) Foreman	(20) Driller	(16) Labor	(20) Mechanic	(18) Blacksmith	(18) Operator(H)				
(1) Excavation, blasting	0.0042	0.0126	0.0160	0.0015	0.0015	0.0015				
(2) Muck treatment			0.0042	0.0008		0.0021				
(3) Loading	0.0012		0.0024	0.0010		0.0024				
(4) Carriage			0.0049	0.0054		0.0134				
(5) Soil treatment			0.0006	0.0002		0.0006				
(6) Slope completion	0.0021	0.0083	0.0044							
	0.0075	0.0209	0.0325	0.0089	0.0015	0.0200				
	32	20	16	20	18	18				
	0.240	0.418	0.520	0.178	0.027	0.360		1.743		

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Tunnel Excavation (Diversion and Penstock Tunnel)
(Horizontal)

Unit Price; 86.50 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.079	32.00	2.528
Driller		"	0.160	20.00	3.200
Labor		"	0.383	16.00	6.128
Operator (H)		"	0.059	24.00	1.416
" (L)		"	0.119	18.00	2.142
Mechanic		"	0.047	20.00	0.940
Electrician		"	0.040	18.00	0.720
Sub-Total					(17.074)
[Material Cost]					
Oils and fats, consumed articles					
Compresser		H/m³	0.0922	7.0	0.645
Shovel	D-50S	"	0.0686	5.00	0.343
Dump truck	8t	"	0.1346	4.60	0.616
Bulldozer	D-50	"	0.0052	4.80	0.025
Dynamite		kg/m³	1.07	9.40	10.058
Detonator		piece /m³	1.666	1.70	2.832
Bit		LS/m³			2.807
Sub-Total					(17.326)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Compresser		H/m³	0.0922	13.00	1.199
Shovel	D-50S	"	0.0686	49.00	3.361
Dump truck	8t	"	0.1340	15.00	2.010
Bulldozer	D-50	"	0.0052	38.00	0.198
Drill	TY-24	day/m³	0.0578	9.00	0.520
Others	Crawler jumbo	LS/m³			2.000
Sub-Total					(9.288)
[Miscellaneous]					
(17.074 × 0.2 + 17.326 × 0.05)					(4.281)
Total (Direct Cost)					47.969
Unit Price					
47.969 × 1.8					86.50

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Diversion Tunnel Lining Concrete (Fill Dam)

Unit Price; 305.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.1598	32.00	5.114
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.1304	18.00	2.347
Mechanic		"	0.0279	20.00	0.558
Electrician		"	0.0213	18.00	0.383
Labor		"	1.0921	16.00	17.474
Carpenter		"	0.2053	20.00	4.106
Sub-Total		"			(30.455)
[Material Cost]					
Cement		t/m³	0.321	200.00	64.200
Aggregate		"	2.000	12.659	25.318
Sliding form	Incl. metal form	LS/m³			19.180
Oils and fats consumed articles					
Batching & concrete plant	1.5 m³ plant	H/m³	0.0253	7.41	0.184
Compresser	125 kw	"	0.102	0.50	0.051
Truck mixer	6 m³	"	0.203	7.00	1.422
Concrete pump	30 m³/H	"	0.102	4.00	0.408
Others					2.500
Sub-Total					(113.263)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work:

Unit Price:

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Batching & concrete plant	1.5 m^3 plant	H/m^3	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Compresser	125 kw	"	0.102	8.1	0.823
Truck mixer	6 m^3	"	0.203	26.7	5.425
Concrete pump	30 m^3/H	"	0.102	39.3	3.992
Others		LS/m^3			2.000
Sub-Total					(20.210)
[Miscellaneous]					
(30.455 × 0.2 + 23.745 × 0.05)					(7.278)
Total (Direct Cost)					171.206
Unit Price					
171.206 × 1.8					305.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Diversion Inlet Concrete (Fill Dam)

Unit Price; 250.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
				M$/man	M$/m³
Foreman		man/m³	0.1217	32.00	3.894
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.1312	18.00	2.362
Mechanic		"	0.0279	20.00	0.558
Electrician		"	0.0214	18.00	0.385
Labor		"	0.6082	16.00	9.731
Carpenter		"	0.2770	20.00	5.540
Sub-Total					(22.943)
[Material Cost]					
				M$/t	
Cement		t/m³	0.294	200.00	58.800
				M$/t	
Aggregate		"	2.0	12.659	25.318
				M$/m²	
Plywood		m²/m³	0.945	1.605	1.517
				M$/m³	
Timber		m³/m³	0.0108	97.200	1.049
Oil and fats, consumed articles					
Batching & concrete plant		H/m³	0.0253	7.41	0.187
Compresser	125 KW	"	0.084	0.50	0.042
Truck mixer	6 m³	"	0.168	7.0	1.176
Concrete pump	30 m³/H	"	0.084	4.0	0.336

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Others (Form material, piping material, water-reducing agent)		LS/m³			5.500
Sub-Total					(93.925)
[Equipment Cost]					
Batching & concrete plant		H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Compresser	125 KW	"	0.084	8.1	0.680
Truck mixer	6 m³	"	0.168	26.7	4.486
Concrete pump	30 m³/H	"	0.084	39.3	3.301
Others (Vibrater, pump in the water etc.)		LS/m³			1.500
Sub-Total					(17.937)
[Miscellaneous]					
(22.943 × 0.2 + 9.807 × 0.05)					(5.079)
Total (Direct Cost)					139.884
Unit Price					
139.884 × 1.8					250.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Reinforcement Bar

Unit Price; 1,800,000 M$/t

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/t	0.440	M$/man 32.00	14.080
Reinforcement work		"	2.530	22.00	55.660
Operator (H)		"	0.077	24.00	1.848
" (L)		"	0.077	18.00	1.386
Labor		"	1.100	16.00	17.600
Sub-Total					M$/t (90.574)
[Material Cost]					
Reinforcement bar		t	1.03	M$/t 1,000.00	1,030.000
Steel fiber etc.		LS/t			10.000
Sub-Total					(1,040.000)
[Equipment Cost]	Crane, cutting machine etc.	LS/t			(10.000)
[Miscellaneous]					
(90.574 × 0.2 + 10.0 × 0.05)					(18.615)
Total (Direct Cost)					M$/t 1,159.189
Unit Price					
1,159.2 × 1.6					1,800.000

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Anchor Bar

(Based on ℓ = 3.00)

Unit Price; 2,200.000 M$/t

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/t	0.0406	M$/man 32.00	1.299
Driller		"	0.0888	20.00	1.776
Operator (L)		"	0.0450	18.00	0.810
Labor		"	0.2664	16.00	4.262
Sub-Total					(8.147)
[Material Cost]					
Reinforce bar		t	1.05	M$/t 1,000.00	1,050.000
Others	Oils and fats, cement pasts	LS/t			2,500
Sub-Total					(1,052.500)
[Equipment Cost]					
Compresser		H/t	38.4	M$/t 6.96	267.264
Drill	TY-24L	day/t	8.77	M$/day 11.24	98.575
Sub-Total					(365.839)
[Miscellaneous]					
(8.147 × 0.2 + 2.5 × 0.05)					(1.754)
Total (Direct Cost)					1,428.240
Unit Price					
1.428.240 × 1.6					2,200.000

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Plug Concrete

Unit Price; 225.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0591	32.00	1.891
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.1293	18.00	2.327
Mechanic		"	0.0248	20.00	0.496
Electrician		"	0.0182	18.00	0.328
Labor		"	0.4373	16.00	6.997
Carpenter		"	0.0232	20.00	0.464
Sub-Total					(12.976)
[Material Cost]					
Cement		t/m³	0.300	200.00	60.000
Aggregate		"	2.000	12.659	25.318
Oils and fats, consumed articles					
Batching & concrete plant	1.5 m³ plant	H/m³	0.0253	7.41	0.184
Compresser	125 kw	"	0.071	0.50	0.036
Truck mixer	6 m³	"	0.213	7.00	1.491
Concrete pump	30 m³/H	"	0.071	4.00	0.284
Others					2.500
Sub-Total					(89.814)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Batching & concrete plant	1.5 m^3 plant	H/m^3	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Compresser	125 kw	"	0.071	8.1	0.578
Truck mixer	6 m^3	"	0.213	26.7	5.714
Concrete pump	30 m^3/H	"	0.071	39.3	2.803
Others		LS/m^3			2.000
Sub-Total					(19.065)
[Miscellaneous]					
(12.976 × 0.2 + 4.496 × 0.05)					(2.820)
Total (Direct Cost)					124.675
Unit Price					
124.675 × 1.8					225.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work: Common Ex. Dam

Unit Price: 9.500 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]			man/m³	M$	
Foreman		man/m³	0.0012	32.00	0.038
Operator (H)		"	0.0162	24.00	0.389
Mechanic		"	0.0065	20.00	0.130
Labor		"	0.0199	16.00	0.318
Sub-Total					(0.875)
[Material Cost]					
Oils and fats, consumed articles					
Bulldozer	D-85	H/m³	0.0132	12.00	0.158
"	D-8K	"	0.0101	20.00	0.202
Wheel loader	KLD-9	"	0.0076	10.00	0.076
Dump truck	18t	"	0.0463	15.00	0.695
Dynamite		kg/m³	0.006	9.4	0.056
Detonator		piece /m³	0.03	1.7	0.051
Sub-Total					(1.238)
[Equipment Cost]					
Bulldozer	D-85	H/m³	0.0132	61.00	0.805
"	D-8	"	0.0101	62.00	0.626
Wheel loader	KLD-9	"	0.0076	80.00	0.608

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Dump truck		H/m³	0.0463	36.0	1.667
Sub-Total					(3.706)
Miscellaneous					
(0.875 × 0.2 + 1.238 × 0.05)					(0.237)
Total (Direct Cost)					6.056
Unit Price					
6.056 × 1.6					9.500

COMMON EX. (LARGE SCALE) LABOR COST

	Foreman	Operator(M)	Mechanic	Labor						
(1) Surface treatment	0.0002	0.0004	0.0002	0.0022						
(2) Picking	0.0010	0.0021	0.0008	0.0103						
(3) Muck treatment		0.0014	0.0006	0.0014						
(4) Loading		0.0015	0.0006	0.0015						
(5) Carriage		0.0094	0.0037	0.0031						
(6) Spoil treatment		0.0014	0.0006	0.0014						
Total	0.0012	0.0162	0.0065	0.0199						
Unit cost	32 M$	24 M$	20 M$	16 M$						

COMMON EX. (LARGE SCALE) MATERIAL COST

	Dynamite	Detonator	D-85	D-8K	KLD-9	18t Dump				
(1) Surface treatment	0.006 kg/m³ × 9.4 = 0.056	0.03 Y/m³ × 1.7 = 0.051	0.002 M/m³ × 12 = 0.024							
(2) Picking				0.0101 M/m³ × 20 = 0.2020						
(3) Muck treatment			0.007 M/m³ × 12 = 0.084							
(4) Loading					0.0076 M/m³ × 10 = 0.076					
(5) Carriage						0.0463 M/m³ × 15 = 0.695				
(6) Spoil treatment			0.0042 M/m³ × 12 = 0.050							
	0.006 kg/m³ × 9.4 = 0.056	0.03 Y/m³ × 1.7 = 0.051	0.0132 M/m³ × 12 = 0.158	0.0101 M/m³ × 20 = 0.202	0.0076 M/m³ × 10 = 0.076	0.0463 M/m³ × 15 = 0.695				

COMMON EX. (LARGE SCALE) MECHANIC COST

	D-85	D-8K	KLD-9	18t Dump						
(1) Surface treatment	0.002 H/m³ × 61 = 0.122									
(2) Picking		0.0101 H/m³ × 62 = 0.626								
(3) Muck treatment	0.007 × 61 = 0.427									
(4) Loading			0.0076 H/m³ × 80 = 0.608							
(5) Carriage				0.0463 H/m³ × 36 = 1.667						
(6) Spoil treatment	0.0042 × 61 = 0.256									
	0.0132 H/m³ × 61 = 0.805	0.0101 H/m³ × 62 = 0.626	0.0076 H/m³ × 80 = 0.608	0.0463 H/m³ × 36 = 1.667						

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Common Excavation (Spillway)

Unit Price; 9.00 $/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0012	$/m³ 32.0	0.038
Operator (H)		"	0.0157	24.0	0.377
Mechanic		"	0.0063	20.0	0.126
Labor		"	0.0203	16.0	0.325
Sub-Total					(0.866 $/m³)
[Material Cost]					
Bulldozer	D-85	hr/m³	0.0133	$/hr 12.0	0.160
D-8K		"	0.0101	20.0	0.202
XL D-9		"	0.0076	10.0	0.076
Dump truck		"	0.0463	15.0	0.695
Dynamite		kg/m³	0.006	$/kg 9.4	0.056
Detonator		piece /m³	0.030	$/piece 1.7	0.051
Sub-Total					(1.240 $/m³)
[Equipment Cost]					
Bulldozer	D-85	hr/m³	0.0133	$/hr 61.0	0.811
D-8K		"	0.0101	20.0	0.202
KL D-9		"	0.0076	80.0	0.608
Dump truck		"	0.0463	36.0	1.667

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Sub-Total					3.288$/m^3
[Miscellaneous]					
(0.866 x 0.2) +	1.240 x 0.05)				0.235$/m^3
Total (Direct Cost)					5.629$/m^3
Unit Price					
5.629 x 1.6					9.00$/m^3

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Rock Ex. (Dam·Spillway)

Unit Price; 23.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0086	32.00	0.275
Driller		"	0.0209	20.00	0.418
Labor		"	0.0435	16.00	0.696
Operator (H)		"	0.0185	24.00	0.444
" (L)		"	0.0015	18.00	0.027
Mechanic		"	0.0089	20.00	0.178
Blacksmith		"	0.0015	18.00	0.027
Sub-Total					(2.065)
[Material Cost]					
Oils and fats, consumed articles					
Drill	CD-3	H/m³	0.0215	1.50	0.032
Compresser		"	0.0066	7.00	0.046
Bulldozer	D-8	"	0.0103	20.00	0.206
Wheel loader	KLD-9	"	0.0119	10.00	0.119
Dump truck	18t	"	0.0617	15.00	0.926
Bulldozer	D-50	"	0.0029	4.8	0.014
Bit & rod		LS/m³			2.299
Dynamite		kg/m³	0.356	8.1	2.884
Detonator		piece /m³	0.158	1.7	0.269

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Sub-Total					(6.795)
[Equipment Cost]					
Drill	CD-3	H/m³	0.0215	31.00	0.667
Compresser		"	0.0066	13.00	0.086
Bulldozer	D-8	"	0.0103	62.00	0.639
"	D-50	"	0.0029	38.00	0.110
Wheel loader	KLD-9	"	0.0119	80.00	0.952
Dump truck	18t	"	0.0617	36.00	2.221
Jack hammer	TY-24	day/m³	0.0021	6.00	0.013
Sub-Total					(4.688)
[Miscellaneous]					
(2.065 × 0.2 + 6.795 × 0.05)					(0.753)
Total (Direct Cost)					14.301
Unit Price					
14.301 × 1.6					23.00

ROCK EX. (LARGE SCALE) LABOR COST

	Foreman	Driller	Labor	Mechanic	Blacksmith	Operator (L)	Operator (H)			
(1) Excavation, blasting	0.0042	0.0126	0.0160	0.0015	0.0015	0.0015				
(2) Muck treatment			0.0042	0.0008			0.0021			
(3) Loading	0.0012		0.0024	0.0010			0.0024			
(4) Carriage			0.0049	0.0054			0.0134			
(5) Spoil treatment			0.0006	0.0002			0.0006			
(6) Slope completion	0.0021	0.0083	0.0044							
(7) Rock cleaning	0.0011		0.0011							
	0.0086	0.0209	0.0435	0.0089	0.0015	0.0015	0.0185			
	32 M$	20	16	20	18	18	24			
	0.275	0.418	0.696	0.178	0.027	0.027	0.444			

ROCK EX. (LARGE SCALE) MATERIAL COST

	Dynamite	Detonator	Bit & lod	CD-3	Compresser	D-8	XLD-9	18t Dump	D50	
(1) Excavation, blasting	0.353 kg/m³ × 8.1 = 2.8593	0.143 Y/m³ × 1.7 = 0.244	2.299 -/m³	0.0215 H/m³ × 1.5 = 0.032	0.0066 × 7 = 0.046					
(2) Muck treatment						0.0103 × 20 = 0.206				
(3) Loading							0.0119 × 10 = 0.119			
(4) Carriage								0.0617 × 15 = 0.926		
(5) Spoil treatment									0.0029 × 4.8 = 0.014	
(6) Slope completion	0.003 × 8.1 = 0.024	0.015 × 1.7 = 0.026								
	0.356 kg/m³ × 8.1 = 2.884	0.158 Y/m³ × 1.7 = 0.269	2.299 Y/m³	0.0215 H/m³ × 1.5 = 0.032	0.0066 H/m³ × 7.0 = 0.046	0.0103 H/m³ × 20 = 0.206	0.0119 × 10 = 0.119	0.0617 × 15 = 0.926	0.0029 × 4.8 = 0.014	

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Rock Embankment

Unit Price; 15.50 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0044	32.00	0.141
Operator (H)		"	0.0154	24.00	0.370
" (L)		"	0.0008	18.00	0.014
Mechanic		"	0.0071	20.00	0.142
Labor		"	0.0203	16.00	0.325
Driller		"	0.0025	20.00	0.050
Electrician		"	0.0008	18.00	0.014
Blacksmith		"	0.0008	18.00	0.014
Sub-Total					(1.070)
[Material Cost]					
Oils and fats, consumed articles					
Bulldozer	D-85	H/m³	0.0038	12.00	0.046
"	D-8	"	0.0131	20.00	0.262
Blast hall drill	50R	"	0.0027	4.00	0.011
Drill	CD-3	"	0.0016	1.50	0.002
Wheel loader	KLD-9	"	0.0092	10.00	0.092
Dump truck	18t	"	0.0359	15.00	0.539
Vibration roller	13.5t	"	0.0017	4.00	0.007

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Bits & rods	50R + CD-3	LS/m^3			0.474
Dynamite		kg/m^3	0.262	9.40	2.463
Detonator		piece /m^3	0.033	1.70	0.056
Sub-Total					(3.952)
[Equipment Cost]					
Bulldozer	D-85	H/m^3	0.0038	61.00	0.232
"	D-8	"	0.0131	62.00	0.812
Blast hall drill	50R	"	0.0027	380.00	1.026
Drill	CD-3	"	0.0016	31.00	0.050
Wheel loader	KLD-9	"	0.0092	80.00	0.736
Dump truck	18t	"	0.0359	36.00	1.292
Vibration roller	13.5t	"	0.0017	20.00	0.034
Sub-Total					(4.182)
[Miscellaneous]					
(1.070 × 0.2 + 3.952 × 0.05)					(0.412)
Total (Direct Cost)					9.616
Unit Price					
9.616 × 1.6					15.50

ROCKFILL EMBANKMENT LABOR COST

	(32) Foreman	(24) Operator (H)	(20) Mechanic	(16) Labor	(20) Driller	(18) Operator (L)	(18) Electrician	(18) Blacksmith		
(1) Clearing and grubbing	0.0002	0.0004	0.0002	0.0022						
(2) Surface treatment		0.0011	0.0005	0.0011						
(3) Bench cut	0.0017	0.0008	0.0008	0.0050	0.0025	0.0008	0.0008	0.0008		
(4) Poor soil treatment		0.0003	0.0001	0.0003						
(5) Loading	0.0016	0.0024	0.0010	0.0040						
(6) Loading support		0.0008	0.0003	0.0008						
(7) Carriage		0.0080	0.0032	0.0016						
(8) Spreading	0.0009	0.0016	0.0007	0.0046						
(9) Compacted		0.0007	0.0003	0.0007						
	0.0044	0.0154	0.0071	0.0025	0.0025	0.0008	0.0008	0.0008		
	32	24	20	16	20	18	18	18		
	0.141	0.370	0.142	0.325	0.050	0.014	0.014	0.014	1.070	

ROCKFILL EMBANKMENT MATERIAL COST & MECHANIC COST

	Dynamite	Detonator	D-85	D-8	Bit & lod (50R + CD-3)	50R	CD-3	KLD-9	18t	13.5t Vib-roller
(1) Clearing and grubbing	0.006 kg/m³ @ 9.4 = 0.056	0.03 Y/m³ @ 1.7 = 0.051	0.0021 @ 12 = 0.025							
(2) Surface treatment				0.0041 @ 20 = 0.082						
(3) Bench cut	0.256 @ 9.4 = 2.406	0.003 @ 1.7 = 0.005			0.474	0.0027 @ 4.0 = 0.011	0.0016 @ 1.5 0.002			
(4) Poor soil treatment				0.0012 @ 20 = 0.024						
(5) Loading								0.0092 @ 10 = 0.092		
(6) Loading support				0.0030 @ 20 = 0.060						
(7) Carriage									0.0359 @ 15 = 0.539	
(8) Spreading				0.0048 @ 20 = 0.096						
(9) Compacted			0.0017 @ 12 = 0.020							0.0017 @ 4 = 0.007
	0.262 @ 9.4 = 2.463	0.033 @ 1.7 = 0.056	0.0038 @ 12 = 0.046	0.0131 @ 20 = 0.262	0.474	0.0027 @ 4.0 = 0.011	0.0016 @ 1.5 = 0.002	0.0092 @ 10 = 0.092	0.0359 @ 15 = 0.539	0.0017 @ 4.0 = 0.0068
Mechanic cost			0.0038 @ 61 = 0.232	0.0131 @ 62 =0.812		0.0027 @ 380 = 1.026	0.0016 @ 31 = 0.050	0.0092 @ 80 =0.736	0.0359 @ 36 = 1.292	0.0017 @ 20 = 0.034

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Rock Embankment (In case of Re-use of Excavated Rock Materials)

Unit Price; 4.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0009	32.00	0.029
Operator (B)		"	0.0103	24.00	0.247
Mechanic		"	0.0040	20.00	0.080
Labor		"	0.0070	16.00	0.112
Sub-Total					(0.468)
[Material Cost]					
Oils and fats, consumed articles					
Dump truck	18t	"	0.0359	15.00	0.539
Vibration roller	13.5t	"	0.0017	4.00	0.007
Sub-Total					(0.546)
[Equipment Cost]					
Dump truck	18t	"	0.0359	36.00	1.292
Vibration roller	13.5t	"	0.0017	20.00	0.034
Sub-Total					(1.326)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Miscellaneous]					
(0.468 × 0.2 + 0.546 × 0.05)					(0.121)
Total (Direct Cost)					(2.461)
Unit Price					
2.461 × 1.6					4.00

ROCKFILL EMBANKMENT LABOR COST

	(32) Foreman	(24) Operator (H)	(20) Mechanic	(16) Labor	(20) Driller	(18) Operator (L)	(18) Electrician	(18) Blacksmith	
(1) Carriage		0.0080	0.0032	0.0016					
(2) Spreading	0.0009	0.0016	0.0007	0.0046					
(3) Compacted		0.0007	0.0003	0.0007					
	0.0009	0.0103	0.004	0.007					
	32	24	20	16					
	0.029	0.247	0.080	0.112					

ROCKFILL EMBANKMENT MATERIAL COST & MECHANIC COST

	Dynamite	Detonator	D-85	D-8	Bit & lod (50R + CD-3)	50R	CD-3	KLD-9	18t	13.5t Vib-roller
(1) Carriage									0.0359 @ 15 = 0.539	
(2) Spreading										
(3) Compacted										0.0017 @ 4 = 0.007
									0.0359 @ 15 = 0.539	0.0017 @ 4.0 = 0.007
Mechanic cost									0.0359 @ 36 = 1.292	0.0017 @ 20 = 0.034

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Filter Embankment

Unit Price; 17.50 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0055	32.00	0.176
Operator (H)		"	0.0169	24.00	0.406
" (L)		"	0.0009	18.00	0.016
Mechanic		"	0.0073	20.00	0.146
Labor		"	0.0212	16.00	0.339
Driller		"	0.0028	20.00	0.056
Electrician		"	0.0009	18.00	0.016
Blacksmith		"	0.0009	18.00	0.016
Sub-Total					(1.171)
[Material Cost]					
Oils and fats, Consumed articles					
Bulldozer	D-85	H/m³	0.0056	12.00	0.067
"	D-8	"	0.0172	20.00	0.344
Blast hall drill	50R	"	0.0031	4.0	0.012
Drill	CD-3	"	0.0018	1.5	0.003
Wheel loader	KLD-9	"	0.0094	10.0	0.094
Dump truck	18t	"	0.0368	15.00	0.552
Vibration roller	13.5t	"	0.0032	4.00	0.013

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Bit & rod		LS/m^3			0.536
Dynamite		kg/m^3	0.296	9.40	2.782
Detonator		piece /m^3	0.037	1.70	0.063
Sub-Total					(4.466)
[Equipment Cost]					
Bulldozer	D-85	H/m^3	0.0056	61.00	0.342
"	D-8	"	0.0172	62.00	1.066
Blast hall drill	50R	"	0.0031	380.00	1.178
Drill	CD-3	"	0.0018	31.00	0.056
Wheel loader	KLD-9	"	0.0094	80.00	0.752
Dump truck	18t	"	0.0368	36.00	1.325
Vibration roller	13.5t	"	0.0032	20.00	0.064
Sub-Total					(4.783)
[Miscellaneous]					
(1.171 × 0.2 + 4.466 × 0.05)					0.458
Total (Direct Cost)					10.878
Unit Price					
10.878 × 1.6					17.50

FILTER EMBANKMENT LABOR COST

	Foreman	Operator (H)	Operator (L)	Mechanic	Labor	Driller	Electrician	Blacksmith		
(1) Clearing and grubbing	0.0002	0.0004		0.0002	0.0022					
(2) Surface treatment		0.0011		0.0005	0.0011					
(3) Bench cut	0.0017	0.0008	0.0008	0.0008	0.0050	0.0025	0.0008	0.0008		
(4) Poor soil treatment		0.0003		0.0001	0.0003					
	0.0021	0.0029	0.0009	0.0018	0.0097	0.0028	0.0009	0.0009		
(5) Loading	0.0016	0.0024		0.0010	0.0040					
(6) Loading treatment		0.0008		0.0003	0.0008					
(7) Carriage		0.0080		0.0032	0.0016					
	0.0016	0.0115		0.0046	0.0066					
(8) Spreading	0.0018	0.0018		0.0007	0.0035					
(9) Compacted		0.0007		0.0003	0.0014					
Total	0.0055	0.0167	0.0009	0.0073	0.0212	0.0028	0.0009	0.0009		
Unit cost	32	24	18	20	16	20	18	18		
Sum of money	0.176	0.406	0.016	0.146	0.339	0.056	0.016	0.016		

FILTER EMBANKMENT MATERIAL COST & MECHANIC COST

	Dynamite	Detonator	D-85	D-8	Bit & rod	50R	CD-3	KLD-9	18t	13.5t
(1) Clearing and grubbing	(0.262 × 1.3/1.15)	(0.033 × 1.3/1.15)	(0.0021 × 1.3/1.15)	(0.0053 × 1.3/1.15)	(0.474 × 1.3/1.15)	(0.0027 × 1.3/1.15)	(0.0016 × 1.3/1.15)			
(2) Surface treatment	0.296 @ 9.4	0.037 @ 1.7	0.0024 @ 12	0.0060 @ 20	0.536 M3	0.0031 @ 4.0	0.0018 @ 1.5			
(3) Bench cut										
(4) Poor soil treatment										
(5) Loading				(0.0030 × 1.0245)				(0.0092 × 1.0245)	(0.0359 × 1.0245)	
(6) Loading support				0.0031 @ 20				0.0094 @ 10	0.0368 @ 15	
(7) Carriage										
(8) Spreading				0.0081 @ 20						
(9) Compacted			0.0032 @ 12							0.0032 @ 4
Material cost	0.296 @ 9.4 = 2.782	0.037 @ 1.7 = 0.063	0.0056 @ 12 = 0.067	0.0172 @ 20 = 0.344	= 0.536	0.0031 @ 4.0 = 0.012	0.0018 @ 1.5 = 0.003	0.0094 @ 10 = 0.094	0.0368 @ 15 = 0.552	0.0032 @ 4 = 0.013
Mechanic cost			0.0056 @ 61 = 0.342	0.0172 @ 62 = 1.066		0.0031 @ 380 = 1.178	0.0018 @ 31 = 0.056	0.0094 @ 80 = 0.752	0.0368 @ 36 = 1.325	0.0032 @ 20 = 0.064

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Core Embankment

Unit Price; 14.00 M$/m³

Particular	Description	Unit	Quantity	Unit cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0080	32.00	0.256
Operator (H)		"	0.0138	24.00	0.331
" (L)		"	0.0234	18.00	0.421
Mechanic		"	0.0149	20.00	0.298
Labor		"	0.0520	16.00	0.832
Sub-Total					(2.138)
[Material Cost]					
Oils and fats, consumed articles					
Bulldozer	D-85	H/m³	0.0021	12.00	0.025
"	D-8	"	0.0208	20.00	0.416
Wheel loader	KLD-9	"	0.0127	10.00	0.127
Damp truck	8t	"	0.1093	4.6	0.503
Tumping roller	825B	"	0.0066	16.00	0.106
Dynamite		kg/m³	0.006	9.40	0.056
Detonator		piece /m³	0.030	1.70	0.051
Sub-Total					(1.284)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Bulldozer	D-85	H/m^3	0.0021	61.00	0.038
"	D-8	"	0.0208	62.00	1.290
Wheel loader	KLD-9	"	0.0127	80.00	1.016
Dump truck	8t	"	0.1093	15.00	1.640
Tumping roller	825B	"	0.0066	150.00	0.990
Sub-Total					(4.974)
[Miscellaneous]					
(2.138 × 0.2 + 1.284 × 0.05)					(0.492)
Total (Direct Cost)					8.888
Unit Price					
8.888 × 1.6					14.00
60%					

CORE EMBANKMENT LABOR COST

	(32) Foreman	(24) Operator (M)	(20) Mechanic	(16) Labor	(18) Operator (L)					
(1) Clearing and grubbing	0.0002	0.0004	0.0002	0.0022						
(2) Surface treatment		0.0011	0.0005	0.0011						
(3) Picking		0.0026	0.0010	0.0026						
(4) Loading	0.0026	0.0026	0.0010	0.0026						
(5) Carriage			0.0094	0.0104	0.0234					
(6) "		0.0013	0.0005	0.0013						
(7) Temporary spreading		0.0006	0.0003	0.0006						
(8) Spreading		0.0026	0.0010	0.0078						
(9) Compacted	0.0052	0.0026	0.0010	0.0234						
	0.0080	0.0138	0.0149	0.0520	0.0234					
	32	24	20	16	18					
	0.256	0.331	0.298	0.832	0.421		2.138			

CORE EMBANKMENT MATERIAL COST & MECHANIC COST

	Dynamite	Detonator	D-85	D-8	KLD-9	St Dump	Tumping roller 825B			
(1) Clearing and grubbing	0.006 kg/m³ @ 9.4 = 0.056	0.03 Y/m³ @ 1.7 = 0.051	0.0021 H @ 12 = 0.025							
(2) Surface treatment				0.0041 @ 20 = 0.082						
(3) Picking				0.0041 @ 20 = 0.082						
(4) Loading					0.0083 @ 10 = 0.083					
(5) Carriage						0.1093 @ 4.6 = 0.503				
(6) "					0.0044 @ 10 = 0.044					
(7) Temporary spreading				0.0029 @ 20 = 0.058						
(8) Spreading				0.0097 @ 20 = 0.194						
(9) Compacted							0.0066 @ 16 = 0.106			
Material cost	0.006 @ 9.4 = 0.056	0.03 @ 1.7 = 0.051	0.0021 @ 12 = 0.025	0.0208 @ 20 = 0.416	0.0127 @ 10 = 0.127	0.1093 @ 4.6 = 0.503	0.0066 @ 16 = 0.106			
Mechanic cost			0.0021 @ 61 = 0.043	0.0208 @ 62 = 1.290	0.0427 @ 80 = 1.016	0.1093 @ 15 = 1.640	0.0066 @ 150 = 0.990			

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Rip-rap

Unit Price; 18.50 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0173	32.00	0.554
Operator (H)		"	0.0165	24.00	0.396
Mechanic		"	0.0059	20.00	0.118
Labor		"	0.0454	16.00	0.726
Driller		"	0.0024	20.00	0.048
Operator (L)		"	0.0008	18.00	0.014
Electrician		"	0.0008	18.00	0.014
Blacksmith		"	0.0008	18.00	0.014
Masonry		"	0.0278	18.00	0.500
Sub-Total					(2.384)
[Material Cost]					
Oils and fats, consumed articles					
Bulldozer	D-85	H/m³	0.0020	12.00	0.024
"	D-8	"	0.0237	20.00	0.474
Blast hall drill	50R	"	0.0026	4.00	0.010
Drill	CD-3	"	0.0015	1.50	0.002
Wheel loader	KLD-9	"	0.0089	10.00	0.089
Dump truck	18t	"	0.0346	15.00	0.519

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Bit & rod		LS/m^3			0.456
Dynamite		kg/m^3	0.252	9.40	2.369
Detonator		piece /m^3	0.032	1.70	0.054
Sub-Total					(3.997)
[Equipment Cost]					
Bulldozer	D-85	H/m^3	0.0020	61.00	0.122
"	D-8	"	0.0237	62.00	1.469
Blast hall drill	50R	"	0.0026	380.00	0.988
Drill	CD-3	"	0.0015	31.00	0.047
Wheel loader	KLD-9	"	0.0089	80.00	0.712
Dump truck	18t	"	0.0346	36.00	1.246
Sub-Total					(4.584)
[Miscellaneous]					
(2.384 × 0.2 + 3.997 × 0.05)					(0.677)
Total (Direct Cost)					11.642
Unit Price					
11.642 × 1.6					18.50

RIPRAP EMBANKMENT MATERIAL COST & MECHANIC COST

	Dynamite	Detonator	D-85	D-8	Bit & lod	50R	CD-3	KLD-9	18t	
(1) Clearing and grubbing										
(2) Surface treatment										
(3) Bench cut	(0.262 × 1.3/1.35)	(0.033 × 1.3/1.35)	(0.0021 × 1.3/1.35)	(0.0083 × 1.3/1.35)	(0.474 × 1.3/1.35)	(0.0027 × 1.3/1.35)	(0.0016 × 1.3/1.35)	(0.0092 × 1.3/1.35)	(0.0359 × 1.3/1.35)	
(4) Poor soil treatment										
(5) Loading	0.252 @ 9.4	0.032 @ 1.7	0.0020 @ 12.0	0.0080 @ 20.0	0.456	0.0026 @ 4.0	0.0015 @ 1.5	0.0089 @ 10.0	0.0346 @ 15.0	
(6) Loading support										
(7) Carriage										
(8) Mechanic works				0.0157 @ 20						
Material cost	0.252 @ 9.4 = 2.369	0.032 @ 1.7 = 0.054	0.0020 @ 12.0 = 0.024	0.0237 @ 20 = 0.474	0.456	0.0026 @ 4.0 = 0.010	0.0015 @ 1.5 = 0.002	0.0089 @ 10.0 = 0.089	0.0346 @ 15.0 = 0.519	(3.997)
Mechanic cost			0.0020 @ 61 = 0.122	0.0237 @ 62 = 1.469		0.0026 @ 380 = 0.988	0.0015 @ 31 = 0.047	0.0089 @ 80.00 = 0.712	0.0346 @ 36 = 1.246	(4.584)

RIPRAP EMBANKMENT LABOR COST

	Foreman	Operator(H)	Mechanics	Labor	Driller	Operator(L)	Electrician	Blacksmith	Masonry	
(1) Clearing and grubbing										
(2) Surface treatment										
(3) Bench cut	(0.0035 × 1.3/1.35)	(0.0138 × 1.3/1.35)	(0.0061 × 1.3/1.35)	(0.0150 × 1.3/1.35)	(0.0025 × 1.3/1.35)	(0.0008 × 1.3/1.35)	(0.0008 × 1.3/1.35)	(0.0008 × 1.3/1.35)		
(4) Poor soil treatment	0.0034	0.0133	0.0059	0.0144	0.0024	0.0008	0.0008	0.0008		
(5) Loading										
(6) Loading support										
(7) Carriage										
(8) Handpressing	0.0139			0.0278					0.0278	
(9) Mechanic works		0.0032		0.0032						
	0.0173	0.0165	0.0059	0.0454	0.0024	0.0008	0.0008	0.0008	0.0278	
	32	24	20	16	20	18	18	18	18	
	0.554	0.396	0.118	0.726	0.048	0.014	0.014	0.014	0.500	

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Grout Hole Drilling (Rotary Type Machine ϕ46 mm)

Unit Price; 130.00 M$/m

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m	0.097	M$/man 32.00	3.104
Driller		"	0.360	20.00	7.200
Labor		"	0.585	16.00	9.360
Mechanic		"	0.018	20.00	0.360
Electrician		"	0.018	18.00	0.324
Sub-Total					M$/m (20.348)
[Material Cost]					
Bits	Diamond bit	LS/m			40.000
Rots		"			3.330
Oils and fats					
Rotary type machine	D-1 class	H/m	1.2	0.55	0.660
Pump for water	MG-5	"	"	0.58	0.696
Others					0.500
Sub-Total					(45.186)
[Equipment Cost]					
Rotary type machine	D-1 class	H/m	1.2	4.50	5.400
Pump for water	MG-5 class	"	"	3.50	4.200
Sub-Total					(9.600)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Miscellaneous]					
(20.348 × 0.2 + 45.186 × 0.05)					4.329
Total (Direct Cost)					79.463
Unit Price					
79.463 × 1.6					130.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Cement Grouting

Unit Price; 1,350 M$/t

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/t	0.8170	M$/man 32.00	26.144
Groutman		"	2.0424	20.00	40.848
Labor		"	7.1484	16.00	114.377
Mechanic		"	0.1021	20.00	2.042
Electrician		"	0.1021	18.00	1.838
Sub-Total					185.249
[Material Cost]					
Cement		t	1.05	M$/t 200.00	210.000
Oils and fats, consumed articles					
Pump	MG-15	H/t	8.51 H/t	M$/H 0.70	5.957
	MG-10	"	"	" 0.55	4.681
	H.F.V	"	"	" 2.10	17.871
Others	Packer, horse, pipe, pressure gauge	"	"	" 6.50	55.315
Sub-Total					293.824
[Equipment Cost]					
Mixer	400 ℓ class	H/t	8.51 H/t	M$/H 1.567	13.335
	200 ℓ class	"	"	0.720	6.127

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Cement Grouting

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
				M$/t	
Pump	MG-15	H/t	8.51	3.00	25.530
	MG-10	"	"	2.30	19.573
	HPV	"	"	20.00	170,200
Flow meter		"	"	9.0	76.590
Sub-Total					(311.355)
[Miscellaneous]					
(185.249 × 0.2 + 83.824 × 0.05)					(41.241)
Total (Direct Cost)					831.669
Unit Price					
831.669 × 1.6					1,350 m$/t

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Spillway Wall Concrete (Fill Dam)

Unit Price; 255.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.1061	32.00	3.395
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.0780	18.00	1.404
Mechanics		"	0.0213	20.00	0.426
Electrician		"	0.0147	18.00	0.265
Labor		"	0.5950	16.00	9.520
Carpenter		"	0.3349	20.00	6.698
Sub-Total					(22.181)
[Material Cost]					
Cement		t/m³	0.294	200.00	58.800
Aggregate		"	2.000	12.659	25.318
Plywood		m²/m³	1.155	1.605	1.854
Timber		m³/m³	0.0132	97.200	1.283
Oils and fats, consumed articles					
Batching & concrete plant		H/m³	0.0253	7.41	0.187
Compresser	125 kw	"	0.087	0.50	0.044
Truck mixer	6 m³	"	0.208	7.00	1.456
Concrete pump	30 m³/H	"	0.087	4.00	0.348

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Others		LS/m³			6.000
Sub-Total					(95.290)
[Equipment Cost]					
Batching & concrete plant	1.5 m³ plant	H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Compresser	125 kw	"	0.087	8.1	0.701
Truck mixer	6 m³	"	0.208	26.7	5.570
Concrete pump	30 m³/H	"	0.087	39.3	3.419
Others					1.500
Sub-Total					(19.160)
[Miscellaneous]					
(22.181 × 0.2 + 11.172 × 0.05)					4.995
Total (Direct Cost)					141.626
Unit Price					
141.626 × 1.8					255.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Spillway Floor Concrete (Fill Dam)

Unit Price; 250.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.1061	32.00	3.395
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.0780	18.00	1.404
Mechanic		"	0.0213	20.00	0.426
Electrician		"	0.0147	18.00	0.265
Labor		"	0.5675	16.00	9.080
Carpenter		"	0.3074	20.00	6.148
Sub-Total					(21.191)
[Material Cost]					
Cement		t/m³	0.294	200.00	58.800
Aggregate		"	2.000	12.659	25.318
Plywood		m²/m³	1.05	1.605	1.685
Timber		m³/m³	0.012	97.200	1.166
Oils and fats, consumed articles					
Batching & concrete plant		H/m³	0.0253	7.41	0.187
Compresser	125 kw	"	0.087	0.50	0.044
Truck mixer	6 m³	"	0.208	7.00	1.456
Concrete pump	30 m³/H	"	0.087	4.00	0.348

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Others		LS/m^3			5.500
Sub-Total					(94.504)
[Equipment Cost]					
Batching & concrete plant	1.5 m^3 plant	H/m^3	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Compresser	125 kw	"	0.087	8.1	0.701
Truck mixer	6 m^3	"	0.208	26.7	5.570
Concrete pump	30 m^3/H	"	0.087	39.3	3.419
Others					1.500
Sub-Total					(19.160)
[Miscellaneous]					
(21.191 × 0.2 + 10.386 × 0.05)					(4.758)
Total (Direct Cost)					139.613
Unit Price					
139.613 × 1.8					250.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Spillway Crest Concrete (Fill Dam)

Unit Price; 230.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0676	32.00	2.163
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.0780	18.00	1.404
Mechanic		"	0.0213	20.00	0.426
Electrician		"	0.0147	18.00	0.265
Labor		"	0.4025	16.00	6.440
Carpenter		"	0.1424	20.00	2.848
Sub-Total					(14.019)
[Material Cost]					
Cement		t/m³	0.294	200.00	58.800
Aggregate		"	2.0	12.659	25.318
Plywood		m²/m³	0.42	1.605	0.674
Timber		m³/m³	0.0048	97.200	0.466
Oils and fats, consumed articles					
Batching & concrete plant		H/m³	0.0253	7.41	0.187
Compresser	125 kw	"	0.056	0.50	0.028
Truck mixer	6 m³	"	0.168	7.00	1.176
Concrete pump	30 m³/H	"	0.056	4.00	0.224

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work:

Unit Price:

Particular	Description	Unit	Quantity	Unit Cost	Amount
Others		LS/m³			3.420
Sub-Total					(90.713)
[Equipment Cost]					
Batching & concrete plant	1.5 m³	H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Compresser	125 kw	"	0.087	8.1	0.701
Truck mixer	6 m³	"	0.208	26.7	5.570
Concrete pump	30 m³/H	"	0.087	39.3	3.419
Others					1.500
Sub-Total					(19.160)
[Miscellaneous]					
(14.019 × 0.20 + 6.595 × 0.05)					(3.134)
Total (Direct Cost)					127.026
Unit Price					
127.026 × 1.8					230.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Spillway Pier Concrete (Fill Dam)

Unit Price; 265.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0788	32.00	2.522
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.1312	18.00	2.362
Mechanic		"	0.0279	20.00	0.558
Electrician		"	0.2140	18.00	3.852
Labor		"	0.6907	16.00	11.051
Carpenter		"	0.3595	20.00	7.190
Sub-Total					(28.008)
[Material Cost]					
Cement		t/m³	0.294	200.00	58.800
Aggregate		"	2.000	12.659	25.318
Plywood		m²/m³	1.26	1.605	2.022
Timber		m³/m³	0.0144	97.200	1.399
Oils and fats, consumed articles					
Batching & concrete plant	1.5 m³ plant	H/m³	0.0253	7.41	0.187
Compresser	125 kw	"	0.084	0.50	0.042
Truck mixer	6 m³	"	0.168	7.0	1.176
Concrete pump	30 m³/H	"	0.084	4.0	0.336

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Others		LS/m^3			6.500
Sub-Total					(95.780)
[Equipment Cost]					
Batching & concrete plant	1.5 m^3 plant	H/m^3	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Compresser	125 kw	"	0.084	8.1	0.680
Truck mixer	6 m^3	"	0.168	26.7	4.486
Concrete pump	30 m^3/H	"	0.084	39.3	3.301
Others					1.500
Sub-Total					(17.937)
[Miscellaneous]					
(28.008 × 0.2 + 11.662 × 0.05)					(6.185)
Total (Direct Cost)					147.910
Unit Price					
147.910 × 1.8					265.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Backfill Concrete

Unit Price; 230.00

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m^3	0.0591	32.00	1.891
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.1293	18.00	2.327
Mechanic		"	0.0248	20.00	0.496
Electrician		"	0.0182	18.00	0.328
Labor		"	0.4373	16.00	6.997
Carpenter		"	0.0232	20.00	0.464
Sub-Total		"			(12.976)
[Material Cost]					
Cement		t/m^3	0.321	200.00	64.200
Aggregate		"	2.000	12.659	25.318
Oils and fats, consumed afticles					
Batching & concrete plant	1.5 m^3 plant	H/m^3	0.0253	7.41	0.184
Compresser	125 kw	"	0.071	0.50	0.036
Truck mixer	6 m^3	"	0.213	7.00	1.491
Concrete pump	30 m^3/H	"	0.071	4.00	0.284
Others					2.500
Sub-Total					(94.014)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; _____

Unit Price; _____

Paritcular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Batching & concrete plant	1.5 m^3 plant	H/m^3	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Compresser	125 kw	"	0.071	8.1	0.578
Truck mixer	6 m^3	"	0.213	26.7	5.714
Concrete pump	30 m^3/H	"	0.071	39.3	2.803
Others		LS/m^3			2.000
Sub-Total					(19.065)
[Miscellaneous]					
(12.976 × 0.2 + 4.496 × 0.05)					(2.820)
Total (Direct Cost)					128.875
Unit Price					
128.875 × 1.8					230.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Inlet Structure Concrete (Fill Dam)

Unit Price; 255.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.1272	32.00	4.070
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.1312	18.00	2.362
Mechanic		"	0.0279	20.00	0.558
Electrician		"	0.0214	18.00	0.385
Labor		"	0.6357	16.00	10.171
Carpenter		"	0.3045	20.00	6.090
Sub-Total					(24.109)
[Material Cost]					
Cement		t/m³	0.294	200.00	58.800
Aggregate		"	2.0	12.659	25.318
Plywood		m²/m³	1.05	1.605	1.685
Timber		m³/m³	0.012	97.200	1.166
Oils and fats, consumed articles					
Batching & concrete plant	1.5 m³ plant	H/m³	0.0253	7.41	0.187
Compresser	125 kw	"	0.084	0.50	0.042
Truck mixer	6 m³	"	0.168	7.00	1.176
Concrete pump	30 m³/H	"	0.084	4.0	0.336

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Others		LS/m³			6.00
Sub-Total					(94.710)
[Equipment Cost]					
Batching & concrete plant	1.5 m³ plant	H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Truck mixer	6 m³	"	0.168	26.7	4.486
Concrete pump	30 m³/H	"	0.084	39.3	3.301
Compresser	125 kw	"	0.084	8.1	0.680
Others					1.500
Sub-Total					(17.937)
Miscellaneous					
(24.109 × 0.2 + 10.592 × 0.05)					(5.351)
Total (Direct Cost)					142.107
Unit Price					
142.107 × 1.8					255.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Tailrace Concrete (Fill Dam)

Unit Price; 250.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
				M$/man	M$/m³
Foreman		man/m³	0.1217	32.00	3.894
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.1312	18.00	2.362
Mechanic		"	0.0279	20.00	0.558
Electrician		"	0.0214	18.00	0.385
Labor		"	0.6082	16.00	9.731
Carpenter		"	0.2770	20.00	5.540
Sub-Total					(22.943)
[Material Cost]					
				M$/t	
Cement		t/m³	0.294	200.00	58.800
				M$/t	
Aggregate		"	2.0	12.659	25.318
				M$/t	
Plywood		m²/m³	0.945	1.605	1.517
				M$/m³	
Timber		m³/m³	0.0108	97.200	1.049
Oils and fats, consumed articles					
Batching & concrete plant		H/m³	0.0253	7.41	0.187
Compresser	125 kw	"	0.084	0.50	0.042
Truck mixer	6 m³	"	0.168	7.0	1.176
Concrete pump	30 m³/H	"	0.084	4.0	0.336

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Others		LS/m³			5.500
Sub-Total					(93.925)
[Equipment Cost]					
Batching & concrete plant		H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Compresser	125 kw	"	0.084	8.1	0.680
Truck mixer	6 m³	"	0.168	26.7	4.486
Concrete pump	30 m³/H	"	0.084	39.3	3.301
Others	Vibrater pump in the water	LS/m³			1.500
Sub-Total					(17.937)
[Miscellaneous]					
(22.775 × 0.2 + 9.807 × 0.05)					(5.079)
Total (Direct Cost)					139.884
Unit Price					
139.884 × 1.8					250.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Tunnel Excavation (Penstock) ; Vertical

Unit Price; 110.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.103	32.00	3.296
Driller		"	0.208	20.00	4.160
Labor		"	0.498	16.00	7.968
Operator (H)		"	0.077	24.00	1.848
" (L)		"	0.155	18.00	2.790
Mechanic		"	0.061	20.00	1.220
Electrician		"	0.052	18.00	0.936
Sub-Total					(22.218)
[Material Cost]					
Oils and fats, consumed articles					
Compresser		H/m³	0.1199	7.00	0.839
Shovel	D-50S	"	0.0892	5.00	0.446
Dump truck	8t	"	0.1742	4.60	0.801
Bulldozer	D-50	"	0.0068	4.80	0.033
Dynamite		kg/m³	1.284	9.40	12.070
Detonator		piece /m³	1.833	1.70	3.116
Bit		LS/m³			3.000
Sub-Total					(20.305)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Compresser		H/m³	0.1199	13.00	1.559
Shovel	D-50S	"	0.0892	49.00	4.371
Dump truck	8t	"	0.1742	15.00	2.613
Bulldozer	D-50	"	0.0068	38.00	0.258
Drill	TY-24	day/m³	0.0751	9.00	0.676
Others	Crawler jumbo	LS/m³			2.000
Sub-Total					(11.477)
[Miscellaneous]					
(22.218 × 0.2 + 20.305 × 0.05)					(5.459)
Total (Direct Cost)					59.459
Unit Price					
59.459 × 1.8					110.000

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Power House Foundation Concrete (Fill Dam)

Unit Price; 250.00 M$/$m^3$

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m^3	0.1061	32.00	3.395
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.0780	18.00	1.404
Mechanic		"	0.0213	20.00	0.426
Electrician		"	0.0147	18.00	0.265
Labor		"	0.5950	16.00	9.520
Carpenter		"	0.3349	20.00	6.698
Sub-Total					(22.181)
[Material Cost]					
Cement		t/m^3	0.294	200.00	58.800
Aggregate		t/m^3	2.000	12.659	25.318
Plywood		m^2/m^3	1.155	1.605	1.854
Timber		m^3/m^3	0.0132	97.200	1.283
Oil and fats, consumed articles					
Batching & concrete plant	1.5m^3 plant	H/m^3	0.0253	7.41	0.187
Compresser	125 KW	"	0.056	0.50	0.028
Truck mixer	6 m^3	"	0.168	7.00	1.176
Concrete pump	30 m^3/H	"	0.056	4.00	0.224
Others		LS/m^3			6.000
Sub-Total					(94.870)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Batching & concrete plant	1.5m³ plant	H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Truck mixer	6 m³	"	0.168	26.7	4.486
Concrete pump	30 m³/H	"	0.056	39.3	2.201
Compresser	125 KW	"	0.056	8.1	0.450
Others					1.500
Sub-Total					(16.607)
[Miscellaneous]					
(22.181 × 0.20 + 10.752 × 0.05)					(4.974)
Total (Direct Cost)					138.632
Unit Price					
138.632 × 1.8					250.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Switchyard Concrete (Concrete Dam)

Unit Price; 235.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0997	32.00	3.190
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.1312	18.00	2.362
Mechanic		"	0.0279	20.00	0.558
Electrician		"	0.0214	18.00	0.385
Labor		"	0.4982	16.00	7.971
Carpenter		"	0.1670	20.00	3.340
Sub-Total					(18.279)
[Material Cost]					
Cement		t/m³	0.294	200.00	58.8000
Aggregate		"	2.000	12.659	25.318
Plywood		m²/m³	0.525	1.605	0.843
Timber		m³/m³	0.006	97.200	0.583
Oil and fats, consumed articles					
Batching & concrete plant	1.5m³ plant	H/m³	0.0253	7.41	0.187
Compresser	125 KW	"	0.084	0.50	0.042
Truck mixer	6 m³	"	0.168	7.00	1.176
Concrete pump	30 m³/H	"	0.084	4.00	0.336
Others		LS/m³			4.000
Sub-Total					(91.285)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Batching & concrete plant	1.5m³ plant	H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Truck mixer	6 m³	"	0.168	26.7	4.486
Concrete pump	30 m³/H	"	0.084	39.3	3.301
Compresser	125 KW	"	0.084	8.1	0.680
Others					1.500
Sub-Total					(17.937)
[Miscellaneous]					
(18.279 × 0.2 + 7.167 × 0.05)					(4.014)
Total (Direct Cost)					131.515
Unit Price					
131.515 × 1.8					235.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Embankment for Switchyard

Unit Price; 5,00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0010	32.00	0.032
Operator (H)		"	0.0040	24.00	0.096
" (L)		"	0.0069	18.00	0.124
Mechanic		"	0.0016	20.00	0.032
Labor		"	0.0074	16.00	0.118
Sub-Total					(0.402)
[Material Cost]					
Oils and fats, consumed articles					
Wheel loader	1.9 m³	H/m³	0.0068	11.00	0.075
Dump truck	11t	"	0.0323	6.60	0.213
Bulldozer	D-8	"	0.0128	20.00	0.256
Sub-Total					(0.544)
[Equipment Cost]					
Wheel loader	1.9 m³	H/m³	0.0068	54.00	0.367
Dump truck	11t	"	0.0323	23.00	0.743
Bulldozer	D-8	"	0.0128	62.00	0.794
Sub-Total					(1.904)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Miscellaneous]					
(0.402 × 0.2 + 0.544 × 0.05)					(0.108)
Total (Direct Cost)					2.958
Unit Price					
(2.958 × 1.6)					5.000

EMBANKMENT FOR SWITCHYARD

	24 Operator(M)	20 Mechanic	16 Labor	(18) Operator(L)	(32) Foreman					
(1) Loading	0.0014	0.0005	0.0014							
(2) Carriage			0.0014	0.0069						
(3) Levelling	0.0019	0.0008	0.0039		0.0010					
(4) Compacted	0.0007	0.0003	0.0007							
	(1.9 m^3) Wheel loader	11t Dump	D-8							
(1) Loading	0.0068 @ 11									
(2) Carriage		0.0323 @ 6.6								
(3) Levelling			0.0095 @ 20							
(4) Compacted			0.0033 @ 20							
	0.0068 @ 54	0.0323 @ 23	0.0128 @ 62							

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Rock Excavation (Road)

Unit Price; 20.50 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0098	32.00	0.314
Driller		"	0.0315	20.00	0.630
Labor		"	0.0556	16.00	0.890
Operator (H)		"	0.0104	24.00	0.250
" (L)		"	0.0254	18.00	0.457
Mechanic		"	0.0142	20.00	0.284
Sub-Total					(2.825)
[Material Cost]					
Oils and fats, consumed articles					
Compresser	-	H/m³	0.0383	7.00	0.268
Bulldozer	D-85	"	0.0148	12.00	0.178
"	D-50	"	0.0029	4.80	0.014
Shovel	D-75	"	0.0296	7.50	0.222
Dump truck	8t	"	0.0996	4.60	0.458
Dynamite		kg/m³	0.293	8.10	2.373
Detonator		piece /m³	0.478	1.70	0.813
Bit		LS/m³			0.661
Sub-Total					(4.981)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Compresser		H/m³	0.0383	13.00	0.498
Bulldozer	D-85	"	0.0148	61.00	0.903
"	D-50	"	0.0029	38.00	0.110
Shovel	D-75	"	0.0296	50.00	1.480
Dump truck	8t	"	0.0996	15.00	1.494
Sub-Total					(4.485)
[Miscellaneous]					
(2.825 × 0.2 + 4.981 × 0.05)					(0.814)
Total (Direct Cost)					13.105
Unit Price					
13.105 × 1.6					20.50

ROCK EX. MATERIAL COST & MECHANIC COST

	Dynamite	Detonator	Bit	Compressor	D-85	D-75 shovel	8t	D-50		
(1) Excavation, blasting	0.29 kg @ 8.1 = 2.349	0.463 Y @ 1.7 = 0.787	0.0059 $/m³ @ 112 = 0.661	0.0383 @ 7.0 = 0.268						
(2) Muck treatment					0.0148 @ 12 = 0.178					
(3) Loading						0.0296 @ 7.5 = 0.222				
(4) Carriage							0.0996 @ 4.6 = 0.458			
(5) Spoil treatment								0.0029 @ 4.8 = 0.0139		
(6) Slope Completion	0.003 @ 8.1	0.015 @ 1.7								
	0.293 @ 8.1 = 2.373	0.478 @ 1.7 = 0.813	0.0059 @ 112 = 0.661	0.0383 @ 7.0 = 0.268	0.0148 @ 12 = 0.178	0.0296 @ 7.5 = 0.222	0.0996 @ 4.6 = 0.458	0.0029 @ 4.8 = 0.014	4.987	
				0.0383 @ 13 = 0.498	0.0148 @ 61 = 0.903	0.0296 @ 50 = 1.480	0.0996 @ 15 = 1.494	0.0029 @ 38 = 0.110	Drill (TY-24) 0.0144 @ 6 = 0.0086	

ROCK EXCAVATION LABOR COST

	(32) Foreman	(20) Driller	(16) Labor	(24) Operator(H)	(20) Mechanic	(18) Operator(L)				
(1) Excavation, blasting	0.0077	0.0232	0.0310							
(2) Muck treatment			0.0070	0.0035	0.0014					
(3) Loading			0.0063	0.0063	0.0025					
(4) Carriage			0.0063		0.0101	0.0254				
(5) Spoil treatment			0.0006	0.0006	0.0002					
(6) Slope completion	0.0021	0.0083	0.0044							
	0.0098	0.0315	0.0556	0.0104	0.0142	0.0254				
	32	20	16	24	20	18				
	0.314	0.630	0.890	0.250	0.284	0.457	2.825			

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work: Asphalt Concrete Surfacing (t = 5 cm)

Unit Price: 16.30 M$/m²

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m²	0.0011	32.00	0.035
Operator (H)		"	0.0022	24.00	0.053
" (L)		"	0.0011	18.00	0.020
Labor		"	0.0110	16.00	0.176
Mechanic		"	0.0009	20.00	0.018
Sub-Total					0.302
[Material Cost]					
Oil and fats, consumed articles					
Asphalt finisher		H/m²	0.005	7.00	0.035
Macadam roller		"	0.005	8.00	0.040
Tire roller		"	0.005	8.00	0.040
Asphalt concrete & emulsion		LS/m²			9.400
Sub-Total					9.515
[Equipment Cost]					
Asphalt finisher		H/m²	0.005	42.00	0.210
Macadam roller		"	0.005	18.00	0.009
Tire roller		"	0.005	22.00	0.110
Sub-Total					0.329

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price:

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Miscellaneous]					
(0.302 × 0.2 + 0.115 × 0.05)					0.066
Total (Direct Cost)					10.212
Unit Price					
(10.212 × 1.6)					16.30

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Subgrade (t: 30)

Unit Price; 49.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0203	32.00	0.650
Operator (H)		"	0.0196	24.00	0.470
" (L)		"	0.0422	18.00	0.760
Mechanic		"	0.0383	20.00	0.766
Electrician		"	0.0077	18.00	0.139
Labor		"	0.0973	16.00	1.557
Driller		"	0.0025	20.00	0.050
Blacksmith		"	0.0008	18.00	0.014
Truck driver		"	0.0770	18.00	1.386
Sub-Total					(5.792)
[Material Cost]					
Oils and fats, consumed articles					
Bulldozer	D-8	H/m³	0.0041	20.00	0.082
"	D-85	"	0.0048	12.00	0.058
Drill	50R	"	0.0027	4.00	0.011
"	CD-3	"	0.0016	1.50	0.002
Tructor shovel	D-75S	"	0.0380	7.50	0.285
Dump truck	8t	"	0.3270	4.60	1.504

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Grader		H/m³	0.0237	13.00	0.308
Macadam roller		"	0.0183	5.00	0.092
Dynamite		kg/m³	0.2994	9.40	2.814
Detonator		piece /m³	0.0119	1.70	0.020
Bit & rod		LS/m³			0.474
Plant		"			0.690
Sub-Total					6.340
[Equipment Cost]					
Bulldozer	D-8	H/m³	0.0041	62.00	0.254
"	D-85	"	0.0048	61.00	0.293
Drill	50R	"	0.0027	380.00	1.026
"	CD-3	"	0.0016	31.00	0.050
Tructor shovel	D-75S	"	0.0380	50.00	1.900
Dump truck	8t	"	0.3270	15.00	4.905
Grader		"	0.0237	32.00	0.758
Macadam roller		"	0.0183	17.00	0.311
Plant		LS/m³			7.560
Sub-Total					17.057

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Miscellaneous]					
(5.792 × 0.2 + 6.340 × 0.05)					1.475
Total (Direct Cost)					30.664
Unit Price					
30.664 × 1.6					49.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Diversion Tunnel Lining Concrete (Conc. Dam)

Unit Price; 305.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.1598	32.00	5.114
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.1304	18.00	2.347
Mechanic		"	0.0279	20.00	0.558
Electrician		"	0.0213	18.00	0.383
Labor		"	1.0921	16.00	17.474
Carpenter		"	0.2053	20.00	4.106
Sub-Total					(30.455)
[Material Cost]					
Cement		t/m³	0.321	200.00	64.200
Aggregate		"	2.000	12.659	25.318
Sliding form	incl. metal form	LS/m³			19.180
Oils and fats, consumed articles					
Batching & concrete plant	1.5 m³ plant	H/m³	0.0253	7.41	0.184
Compresser	125 kw	"	0.102	0.50	0.051
Truck mixer	6 m³	"	0.203	7.00	1.422
Concrete pump	30 m³/H	"	0.102	4.00	0.408
Others					2.500
Sub-Total					(113.263)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Batching & concrete plant	1.5 m^3 plant	H/m^3	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Compresser	125 kw	"	0.102	8.1	0.823
Truck mixer	6 m^3	"	0.203	26.7	5.425
Concrete pump	30 m^3/H	"	0.102	39.3	3.992
Others		LS/m^3			2.000
Sub-Total					(20.210)
[Miscellaneous]					
(30.455 × 0.2 + 23.745 × 0.05)					(7.278)
Total (Direct Cost)					171.206
Unit Price					
171.206 × 1.8					305.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Diversion Inlet Concrete (Concrete Dam)

Unit Price; 250.00 M$/m^3

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
				M$/man	M$/m^3
Foreman		man/m^3	0.1217	32.00	3.894
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.1312	18.00	2.362
Mechanic		"	0.0279	20.00	0.558
Electrician		"	0.0214	18.00	0.385
Labor		"	0.6082	16.00	9.731
Carpenter		"	0.2770	20.00	5.540
Sub-Total					(22.943)
[Material Cost]					
				M$/t	
Cement		t/m^3	0.293	200.00	58.800
				M$/t	
Aggregate		"	2.0	12.659	25.318
				M$/m^2	
Plywood		m^2/m^3	0.945	1.605	1.517
				M$/m^3	
Timber		m^3/m^3	0.0108	97.200	1.049
Oil and fats, consumed articles					
Batching & concrete plant		H/m^3	0.0253	7.41	0.187
Compresser	125 KW	"	0.084	0.50	0.042
Truck mixer	6 m^3	"	0.168	7.0	1.176
Concrete pump	30 m^3/H	"	0.084	4.0	0.336

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Others (Form material, piping material, water-reducing agent)		LS/m³			5.500
Sub-Total					(93.925)
[Equipment Cost]					
Batching & concrete plant		H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Compresser	125 KW	"	0.084	8.1	0.680
Truck mixer	6 m³	"	0.168	26.7	4.486
Concrete pump	30 m³/H	"	0.084	39.3	3.301
Others (Vibrator, pump in the water etc.)		LS/m³			1.500
Sub-Total					(17.937)
[Miscellaneous]					
(22.943 × 0.2 + 9.807 × 0.05)					(5.079)
Total (Direct Cost)					139.884
Unit Price					
139.884 × 1.8					250.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Sheet Pile (12m*7m placing)

Unit Price; 4,707.00 M$/m

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m	0.350	32.00	11,200
Operator (H)		"	0.350	24.00	8,400
" (L)		"	0.245	18.00	4,410
Mechanic		"	0.140	20.00	2,800
Labor		"	1.225	16.00	19,600
Sub-Total					46,410
[Material Cost]					
Oil and fats, consumed articles					
Crowler crane	37t (capacity)	H/m	1.318	10.00	13,180
Sub-Total					13,180
[Equipment Cost]					
Crowler crane	37t (capacity)	H/m	1.318	62.00	81,716
Vibro-hammer		"	1.318	39.00	51,402
Sheet pile		t/m	1.756	1,560.00	2,739,360
Sub-Total					2,872,478
[Miscellaneous]					
(46.410 × 0.2 + 13.180 × 0.05)					9,941

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Total (Direct Cost)					2,942.009
Unit Price					
(2,942.009 × 1.6)					4,707.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Dam Concrete (Class A)

Unit Price; 235.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0781	32.00	2.499
Operator (H)		"	0.0285	24.00	0.684
" (L)		"	0.0396	18.00	0.713
Mechanic		"	0.0220	20.00	0.440
Electrician		"	0.0154	18.00	0.277
Labor		"	0.4606	16.00	7.370
Carpenter		"	0.2189	20.00	4.378
Sub-Total					(16.361)
[Material Cost]					
Cement		t/m³	0.3045	200.00	60.900
Aggregate		"	2.00	12.659	25.318
Plywood		m²/m³	0.735	1.605	1.180
Timber		m³/m³	0.0084	97.200	0.816
Oils and fats, consumed articles					
Batching & concrete plant	1.5 m³	H/m³	0.0253	7.41	0.184
Compresser	160 kw	"	0.0458	0.70	0.030
Truck mixer	6 m³	"	0.1374	7.00	0.962
Others					5.000

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
Sub-Total					(94.390)
[Equipment Cost]					
Batching & concrete plant	1.5 m^3 plant	H/m^3	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Crane	180 t·m	day/m^3	0.003	696.5	2.090
Truck mixer	6 m^3	H/m^3	0.1374	26.7	3.682
Compresser	160 kw	"	0.0458	15.00	0.684
Others		LS/m^3			1.500
Sub-Total					(15.926)
[Miscellaneous]					
(16.361 × 0.2 + 8.172 × 0.05)					(3.681)
Total (Direct Cost)					130.358
Unit Price					
130.358 × 1.8					235.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Dam Concrete (Class B)

Unit Price; 190.00 M$/m^3

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m^3	0.0506	32.00	1.619
Operator (H)		"	0.0285	24.00	0.684
" (L)		"	0.0396	18.00	0.713
Mechanic		"	0.0220	20.00	0.440
Electrician		"	0.0154	18.00	0.277
Labor		"	0.3231	16.00	5.170
Carpenter		"	0.0814	20.00	1.628
Sub-Total					(10.531)
[Material Cost]					
Cement		t/m^3	(230 kg) 0.2415	200.00	48.300
Aggregate		"	2.000	12.659	25.318
Plywood		m^2/m^3	0.21	1.605	0.337
Timber		m^3/m^3	0.0024	97.200	0.233
Oil and fats, consumed materials					
Batching & Conc., plant	1.5m^3 plant	H/m^3	0.0253	7.41	0.184
Compresser	160 FW	"	0.0458	0.70	0.030
Truck mixer	6 m^3	"	0.1374	7.00	0.962
Others					3.000
Sub-Total					(78.364)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; _____

Unit Price; _____

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Batching & concrete plant	1.5m³ plant	H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Crane	180 t.m	day/m³	0.003	696.5	2.090
Truck mixer	6 m³	H/m³	0.1374	26.7	3.682
Compresser	160 KW	"	0.0458	15.0	0.684
Others		LS/m³			1.500
Sub-Total					(15.926)
[Miscellaneous]					
(10.531 × 0.2 + 4.746 × 0.05)					(2.344)
Total (Direct Cost)					107.165
Unit Price					
107.165 × 1.8					190.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Dam Concrete (Class C)

Unit Price; 170.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0506	32.00	1.619
Operator (H)		"	0.0285	24.00	0.684
" (L)		"	0.0396	18.00	0.713
Mechanic		"	0.0220	20.00	0.440
Electrician		"	0.0154	18.00	0.277
Labor		"	0.3231	16.00	5.170
Carpenter		"	0.0814	20.00	1.628
Sub-Total					(10.531)
[Material Cost]					
Cement		t/m³	(170 kg) 0.1785	200.00	35.700
Aggregate		"	2.000	12.659	25.318
Plywood		m²/m³	0.21	1.605	0.337
Timber		m³/m³	0.0024	97.20	0.233
Oil and fats, consumed articles					
Batching & conc. plant	1.5m³ plant	H/m³	0.0253	7.41	0.184
Compresser	160 KW	"	0.0458	0.70	0.030
Truck mixer	6 m³	"	0.1374	7.00	0.962
Others					3.000
Sub-Total					(65.764)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Batching & concrete plant	1.5m³ plant	H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Crane	180 t.m	day/m³	0.003	696.5	2.090
Truck mixer	6 m³	H/m³	0.1374	26.7	3.682
Compresser	160 KW	"	0.0458	15.0	0.684
Others		LS/m³			1.500
Sub-Total					(15.926)
[Miscellaneous]					
(10.531 × 0.2 + 4.746 × 0.05)					(2.344)
Total (Direct Cost)					94.565
Unit Price					
94.565 × 1.8					170.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Power House Foundation Concrete (Concrete Dam)

Unit Price; 250.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.1061	32.00	3.395
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.0780	18.00	1.404
Mechanic		"	0.0213	20.00	0.426
Electrician		"	0.0147	18.00	0.265
Labor		"	0.5950	16.00	9.520
Carpenter		"	0.3349	20.00	6.698
Sub-Total					(22.181)
[Material Cost]					
Cement		t/m³	0.294	200.00	58.800
Aggregate		"	2.000	12.659	25.318
Plywood		m²/m³	1.155	1.605	1.854
Timber		m³/m³	0.0132	97.200	1.283
Oil and fats, consumed articles					
Batching & concrete plant	1.5m³ plant	H/m³	0.0253	7.41	0.187
Compresser	125 KW	"	0.056	0.50	0.028
Truck mixer	6 m³	"	0.168	7.00	1.176
Concrete pump	30 m³/H	"	0.056	4.00	0.224
Others		LS/m³			6.000
Sub-Total					(94.876)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work;

Unit Price;

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Batching & concrete plant	1.5m³ plant	H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Truck mixer	6 m³	"	0.168	26.7	4.486
Concrete pump	30 m³/H	"	0.056	39.3	2.201
Compresser	125 KW	"	0.056	8.1	0.450
Others					1.500
Sub-Total					(16.607)
[Miscellaneous]					
(22.181 × 0.20 + 10.752 × 0.05)					(4.974)
Total (Direct Cost)					138.632
Unit Price					
138.632 × 1.8					250.00

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Tailrace Concrete (Concrete Dam)

Unit Price; 250.00 M$/m³

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
				M$/man	M$/m³
Foreman		man/m³	0.1217	32.00	3.894
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.1312	18.00	2.362
Mechanic		"	0.0279	20.00	0.558
Electrician		"	0.0214	18.00	0.385
Labor		"	0.6082	16.00	9.731
Carpenter		"	0.2770	20.00	5.540
Sut-Total					(22.943)
[Material Cost]					
				M$/t	
Cement		t/m³	0.294	200.00	58.800
				M$/t	
Aggregate		"	2.0	12.659	25.318
				M$/m³	
Plywood		m²/m³	0.945	1.605	1.517
				M$/m³	
Timber		m³/m³	0.0108	97.200	1.049
Oils and fats, consumed articles					
Batching & concrete plant		H/m³	0.0253	7.41	0.187
Compresser	125 kw	"	0.084	0.50	0.042
Truck mixer	6 m³	"	0.168	7.0	1.176
Concrete pump	30 m³/H	"	0.084	4.0	0.336

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work:

Unit Price:

Particular	Description	Unit	Quantity	Unit Cost	Amount
Others	Form, piping, water reducing agent, etc.	LS/m³			5.500
Sub-Total					(93.925)
[Equipment Cost]					
Batching & concrete plant		H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Compresser	125 kw	"	0.084	8.1	0.680
Truck mixer	6 m³	"	0.168	26.7	4.486
Concrete pump	30 m³/H	"	0.084	39.3	3.301
Others	Vibrater pump in the water	LS/m³			1.500
Sub-Total					(17.937)
[Miscellaneous]					
(22.943 × 0.2 + 9.807 × 0.05)					(5.079)
Total (Direct Cost)					139.884
Unit Price					
139.884 × 1.8					250.00

Machinery Cost

	Batching & Concrete Plant	Cement Sailo	Belt Conveyor	Cooling Plant		
Mixing	0.025 H @187.6 = 4.69	1.728/m3	0.820	0.025 H @28.96 = 0.732		
	Compressor	Crane	Truck Mixer (6m3)		Others (Concrete Bat) (Vibrates)	Concrete Pump
Concreting Carriage (Open) 19.177 (8.843)	(160 kw) 0.0458 H/m3 @15.00 = 0.684	180 t 0.003 D/m3 @696.5 = 2.090	0.1374 H/m3 @26.7 = 3.682		2.384	
21.340 (9.225)	(125 kw) 0.056 H/m3 @8.10 = 0.450		0.168 H/m3 @26.7 = 4.486		2.088	0.056 H/m3 @39.3 = 2.201
24.284(11.518)	0.087 H/m3 @8.1 = 0.701		0.208 H/m3 @26.7 = 5.570		1.829	0.087 H/m3 @39.3 = 3.419
25.715 (9.599)	(125 kw) 0.084 H/m3 @8.1 = 0.680		0.618 H/m3 @26.7 = 4.486		1.132	0.084 H/m3 @39.3 = 3.301
(Tunnel) 27.682(10.654)	0.071 H/m3 @8.1 = 0.578		0.213 H/m3 @26.7 = 5.714		1.559	0.071 H/m3 @39.3 = 2.803
29.683(12.345)	0.102 H/m3 @8.1 = 0.823		0.203 H/m3 @26.7 = 5.425		2.105	0.102 H/m3 @39.3 = 3.992

Material Cost

	Aggregate	Batching Plant	Cement Sailo	Belt Conveyor	Cement		(1.605M$) Plywood	(97.200) Square Wood	Framing Wood & Others
						200M$/t			
Mixing	2t @12.659	0.0253H @6.1	0.0253H @0.71	0.0253H @0.60	(280) 0.294t/m3	58.800			
	25.318	0.154	0.018	0.015	(290) 0.3045	60.900			
					(230) 0.2415	48.300			
					(170) 0.1785	35.700			
Form (x1.2)							1.26 /2.022	0.0144/1.399	4.019
(x1.1)							1.155/1.854	0.0132/1.283	3.684
(x1.0)							1.05m2/m3 1.685	0.012m3/m3 1.166	3.349
(x0.9)							0.945/1.517	0.0108/1.049	3.014
(x0.7)							0.735/1.180	0.0084/0.816	2.344
(x0.5)							0.525/0.843	0.006 /0.583	1.675
(x0.4)							0.42 /0.674	0.0048/0.466	1.340
(x0.2)							0.21 /0.337	0.0024/0.233	0.670
Carriage Concreting			Compressor		Truck Mixer (6m3)		Others		Concrete Pump
19.117	(3.426)		(160kw)0.0458H @0.70/0.030		0.1374H @13.8/1.896		/1.500		
21.340	(4.054)		(125kw)0.084H @0.50/0.042		0.168H @7.0/1.176		2.500		(30m3/L)0.084H @4.0/0.336
24.284	(3.928)		(125kw)0.056H @0.50/0.028		0.168H @7.0/1.176		2.500		(30m3/L)0.056H @4.0/0.224
25.715	(4.054)		(125kw)0.084H @0.50/0.042		0.168H @7.0/1.176		2.500		(30m3/L)0.084H @4.0/0.336

Inlet Concrete

Labor Cost

	Foreman	Operator(N)	Operator(L)	Mechanic	Electrician	Labor	Carpenter
Mixing	0.0132	0.0197	0.0132	0.0132	0.0066	0.0657	
Form (x1.2)	0.066					0.3300	0.3300
(Plywood) (x1.1)	0.0605					0.3025	0.3025
(x1.0)	0.055					0.275	0.275
(x0.9)	0.0495					0.2475	0.2475
(x0.7)	0.0385					0.1925	0.1925
(x0.5)	0.0275					0.1375	0.1375
(x0.4)	0.022					0.1100	0.1100
(x0.2)	0.011					0.055	0.055
Carriage 19.177	0.0264	0.0088	0.0264	0.0088	0.0088	0.2024	0.0264
Concreting 21.343	0.0324		0.0648	0.0081	0.0081	0.2268	0.0324
24.284	0.0324		0.0648	0.0081	0.0081	0.2268	0.0324
25.715	0.0590		0.118	0.0147	0.0148	0.2950	0.0295
Bulk Form	0.0880					0.7041	0.7160
(10.411) 29.683	0.0439		0.1161	0.0116	0.0116	0.3716	0.0232
27.682	0.0586		0.1172	0.0147	0.0147	0.3223	0.0293
Wages	32M$	24	18	20	18	16	20

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; Switchyard Concrete (Concrete Dam)

Unit Price; 235.00 M$/m

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Labor Cost]					
Foreman		man/m³	0.0997	32.00	3.190
Operator (H)		"	0.0197	24.00	0.473
" (L)		"	0.1312	18.00	2.362
Mechanic		"	0.0279	20.00	0.558
Electrician		"	0.0214	18.00	0.385
Labor		"	0.4982	16.00	7.971
Carpenter		"	0.1670	20.00	3.340
Sub-Total					(18.279)
[Material Cost]					
Cement		t/m³	0.294	200.00	58.800
Aggregate		"	2.000	12.659	25.318
Plywood		m²/m³	0.525	1.605	0.843
Timber		m³/m³	0.006	97.200	0.583
Oil and fats, consumed articles					
Batching & concrete Plant	1.5m³ plant	H/m³	0.0253	7.41	0.187
Compresser	125 KW	"	0.084	0.50	0.042
Truck mixer	6 m³	"	0.168	7.00	1.176
Concrete pump	30 m³/H	"	0.084	4.00	0.336
Others		LS/m³			4.000
Sub-Total					(91.285)

BREAKDOWN OF UNIT PRICE

FOR DIRECT CONSTRUCTION COST

Work; _____

Unit Price; _____

Particular	Description	Unit	Quantity	Unit Cost	Amount
[Equipment Cost]					
Batching & concrete plant	1.5m³ plant	H/m³	0.0253	286.1	7.238
Cooling plant		"	0.0253	28.96	0.732
Truck mixer	6 m³	"	0.168	26.7	4.486
Concrete pump	30 m³/H	"	0.084	39.3	3.301
Compresser	125 KW	"	0.084	8.1	0.680
Others					1.500
Sub-Total					(17.937)
[Miscellaneous]					
(18.279 × 0.2 + 7.167 × 0.05)					(4.014)
Total (Direct Cost)					131.515
Unit Price					
131.515 × 1.8					235.00

3. Comparative Table of Unit Cost (Direct Construction Unit Cost)

Item	Unit Cost	Asahan (1979)	Tekai	Batang Ai (Malaysia) Direct Construction Unit Cost at M Site	Batang Ai (Malaysia) Left x0.9	Batang Ai (Malaysia) Assumed Unit Cost	Maninjou (Aug 1982)	Mrica	Sagulin	Kotapanjang
◦Excavation (sand) (including clearing, grubbing)	m^3	914	860	for 1,000,000m^3 610	550	1,000	840	1,300	420	Dam 1,000 Powerhouse 1,200
◦Excavation (rock)	m^3	2,572	2,100			2,500	7,500	3,400	1,000	Dam 2,500 Powerhouse 4,000
◦Completion of Excavation (rock cleaning)	m^2			for 15,000m^2 2,920	2,630	2,850			2,800	2,850
◦Dam Foundation Treatment ◦Consolidation, Boring. Grout	m t	Boring 1,441 Grout 128,447	Boring Grout 63,000	Boring 10,400 Grout(50kg/m) 2,000	11,200	11,400	Percussion 11,200 Rotary 13,300		Percussion 11,700 Rotary 18,800	11,400
◦Curtain, Boring, Grout	m t	Boring 6,887 Grout 176,688	Boring 11,700 Grout 122,000	Boring 13,600 Grout(50kg/m) 5,000	16,700	17,000				17,000
◦Dam Concrete	m^3	21,056	17,100	Ref. Concrete, Form, Temporary work 14,000	12,600	13,000	24,500		14,000	14,000
◦Powerhouse Concrete	m^3		23,000	Ref. Concrete, Form, Temporary work 22,500	20,300	22,000	31,000	44,000		24,000
◦Composition of Reinforcement	t	173,385	162,000	171,000	154,000	160,000	137,000			160,000
◦Embankment of Fill Dam — Core Wall	m^3		1,260							
◦Embankment of Fill Dam — Rock	m^3		1,400							
Remarks		Aggregate, temporary works for supply of electrical machinery and appliance. (Removal is not included.) Dam concrete (arch).		In case of a rock fill dam, embankment unit cost of rock is as the following (referring Batan Ai), 750 yen/m^3 for the embankment of 2,000,000m^3. Assumed embankment unit cost of core type dam for the scale of 1,000,000m^3 Rock: 1,500 yen/m^3 Core, Filter: 2,800~3,000 yen/m^3 Mean is 2,000 yen/m^3 90% of Malaysian unit cost → considered as Indonesian unit cost 100 yen is $111(1983.3 currently money)						In addition to above, taking into account the following ones as construction work. Main work x α gravity dam α = 0.20 fill dam α = 0.20 Work of powerhouse x 0.29

JICA