PACKAGE 2
ASIN RIVER DRAINAGE SYSTEM IMPROVEMENT

Package 2: A General

FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG

Component: Urban Drainage System Improvement

Package 2: Asin River Drainage System Improvement

BILL OF QUANTITIES

Item No.	Description	Unit	Quantity
A	**GENERAL**		
A.1	Mobilization and Demobilization	L.S.	
A.2	**Establishment**		
A.2.1	Contractor's Site Office and Facilities	L.S.	
A.2.2	Engineer's Site Office and Facilities	L.S.	
A.3	Drawings	L.S.	
A.4	Surveying	L.S.	
A.5	**Relocation/Demolition of Existing Facilities**		
A.5.1	Demolition of Existing Pumping Stations	No.	6
A.5.2	Felling and Grubbing of Existing Trees	L.S.	
A.5.3	Relocation of Existing Utilities	L.S.	
B	**SEMARANG RIVER IMPROVEMENT**		
B.1	**Preparatory Works**		
B.1.1	Coffering and Dewatering	L.S.	
B.1.2	Clearing of Garbage	L.S.	
B.2	**Channel Excavation**		
B.2.1	Common Channel Excavation including Hauling and Spoiling	m^3	21,187
B.2.2	Excavation below Water Level including Hauling and Treatment of Contaminated Soil	m^3	36,475
B.3	**Revetment Type A-1**		
B.3.1	Structural Excavation	m^3	2,566
B.3.2	Backfill with Cobble	m^3	403
B.3.3	Backfill with Gravel	m^3	1,018
B.3.4	Backfill with Sandy Soil	m^3	188
B.3.5	Concrete, Type C1 including Formwork	m^3	228
	formwork	m^2	1,246
B.3.6	Concrete, Type E including Formwork	m^3	64
	formwork	m^2	209
B.3.7	Deformed Reinforcing Bars	kg	12,627
B.3.8	Wet Stone Masonry	m^3	1,543
B.3.9	Pointing	m^2	4,428
B.3.10	Weep Hole, Dia.50mm	No.	845
B.3.11	Log Pile, Dia.150 mm, L=3.0m	m	840
B.3.12	Gabion Mattress t=500mm (Galvanized)	m^3	420
B.4	**Revetment Type C (concrete sheet pile)**		
B.4.1	Furnishing and Driving PC Sheet Pile(t=220 mm)	m	7,715
B.4.2	Concrete, Type C1 including Formwork	m^3	39
	formwork	m^2	290
B.4.3	Deformed Reinforcing Bars	kg	4,636

Item No.	Description	Unit	Quantity
B.5	Dike Raising		
B.5.1	Structural Excavation	m^3	236
B.5.2	Backfill with Selected Soil	m^3	117
B.5.3	Sand Bedding	m^3	27
B.5.4	Wet Stone Masonry	m^3	272
B.5.5	Joint Filler, 10mm thick (Elastic Material)	m^2	14
B.5.6	Pointing	m^2	595
B.6	Inspection Road		
B.6.1	Stripping of Top Soil	m^3	1,196
B.6.2	Embankment	m^3	5,089
B.6.3	Aggregate Class A	m^3	947
B.6.4	Aggregate Class B	m^3	1,430
B.6.5	Sand Bedding	m^3	459
B.6.6	Concrete Block Pavement	m^2	7,651
B.6.7	Cement Mortar	m^3	18
B.6.8	Concrete Kerb	m^3	184
B.6.9	Sodding	m^2	5,741
C	ASIN RIVER IMPROVEMENT		
C.1	Preparatory Works		
C.1.1	Coffering and Dewatering	L.S.	
C.1.2	Clearing of Garbage	L.S.	
C.1.3	Demolition of Existing Revetment	L.S.	
C.2	Channel Excavation		
C.2.1	Common Channel Excavation including Hauling and Treatment of Contaminated Soil	m^3	31,770
C.3	Revetment Type A-2 (lower channel)		
C.3.1	Structural Excavation	m^3	5501
C.3.2	Backfill with Cobble	m^3	626
C.3.3	Backfill with Gravel	m^3	1,914
C.3.4	Concrete, Type C1 including Formwork	m^3	1,055
	formwork	m^2	5,310
C.3.5	Concrete, Type E including Formwork	m^3	294
	formwork	m^2	863
C.3.6	Deformed Reinforcing Bars	kg	50,407
C.3.7	Wet Stone Masonry	m^3	1,584
C.3.8	Weep Hole, Dia.50mm	No.	2,158
C.3.9	Log Pile, Dia. 150mm, L=4.0m	m	8,631
C.3.10	Joint Filler, 10mm thick (Elastic Material)	m^2	62
C.4	Revetment Type B (higher channel)		
C.4.1	Structural Excavation	m^3	28,036
C.4.2	Backfill with Cobble	m^3	2,054
C.4.3	Backfill with Gravel	m^3	4,300
C.4.4	Backfill with Sandy Soil	m^3	15,293
C.4.5	Concrete, Type E including Formwork	m^3	642
	formwork	m^2	432
C.4.6	Wet Stone Masonry	m^3	8,713
C.4.7	Pointing	m^2	1,186

Item No.	Description	Unit	Quantity			
C.4.8	Weep Hole, Dia.50mm	No.	4,316			
C.4.9	Log Pile, Dia. 150mm, L=4.0m	m	69,047			
C.5	**Revetment Type C (concrete sheet pile)**					
C.5.1	Furnishing and Driving PC Sheet Pile (t=220 mm)	m	2,448			
C.5.2	Concrete, Type C1 including Formwork	m^3	14			
C.5.3	Deformed Reinforcing Bars	kg	806			
C.6	**Inspection Road**					
C.6.1	Sand Bedding	m^3	672			
C.6.2	Concrete Block Pavement	m^2	11,203			
C.6.3	Cement Mortar	m^3	27			
C.6.4	Concrete Kerb	m^3	269			
C.6.5	Aggregate Class A	m^3	200			
C.6.6	Aggregate Class B	m^3	224			
C.7	**Asin Box Culvert**					
C.7.1	Coffering and Dewatering	L.S.				
C.7.2	Structural Excavation with Shoring	m^3	5,215			
C.7.3	Backfill with Sandy Soil	m^3	2,124			
C.7.4	Concrete, Type C1 including Formwork, Scaffolding and Falsework	m^3	1,005			
	formwork	m^2	2,887			
	scaffolding	m^2	1,959			
	falsework	m^3	1,385			
C.7.5	Concrete, Type E including Formwork	m^3	91			
	formwork	m^2	52			
C.7.6	Deformed Reinforcing Bars	kg	95,255			
C.7.7	Water Stop, 200 mm Wide	m	212			
C.7.8	Gravel Bedding	m^3	120			
C.7.9	Cobble Stone	m^3	18			
C.7.10	Wet Stone Masonry	m^3	580			
C.7.11	Log Pile, Dia. 150mm, L=3.0m	m	441			
C.7.12	Weep Hole, Dia.50mm	No.	75			
C.7.13	Pointing	m^2	442			
C.7.14	Asphalt Concrete	tonne	109			
C.7.15	Asphalt Treated Base	tonne	109			
C.7.16	Aggregate Class A	m^3	177			
C.7.17	Aggregate Class B	m^3	253			
C.8	**Asin No.1 Bridge**					
	(Superstructure)					
C.8.1	Precast Prestressed Concrete Beam including Tensioning and Erection	L.S.				
C.8.2	Precast Prestressed Concrete Diaphragm including Tensioning and Erection	L.S.				
C.8.3	Precast Concrete Panel including Erection	L.S.				
C.8.4	Deformed Reinforcing Bars	kg	14,264			
C.8.5	Concrete, Type B including Formwork	m^3	67			
	formwork	m^2	104			
C.8.6	Asphalt Concrete	tonne	32			
C.8.7	Expansion Joint	m	20			
C.8.8	Hand Rail	kg	44			

Item No.	Description	Unit	Quantity
C.8.9	Drain Pipe, PVC Pipe Dia. 100 mm	m	11
C.8.10	Utility Pipe, PVC Pipe Dia. 150mm	m	60
C.8.11	Elastomeric Bearing Pad (350x280x73.)	No.	12
C.8.12	Rubber Sheet (40x10x3)	No.	12
	(Sub Structure)		
C.8.13	Structural Excavation	m^3	1,219
C.8.14	Backfill with Sandy Soil	m^3	422
C.8.15	Embankment	m^3	405
C.8.16	Furnishing and Driving PC Piles, Dia. 500 mm, Type A	m	1,260
C.8.17	Furnishing and Driving PC Test Pile, Dia. 500mm, Type A	m	18
C.8.18	Concrete, Type C1 including Formwork and Scaffolding	m^3	310
	formwork	m^2	371
	scaffolding	m^2	293
C.8.19	Concrete, TypeE1 including Formwork	m^3	14
	formwork	m^2	7
C.8.20	Deformed Reinforcing Bars	kg	19,782
C.8.21	Wet Stone Masonry	m^3	184
C.8.22	Weep Hole, Dia.50mm	No.	70
C.8.23	Pointing	m^2	223
C.9	**Asin No.2 Bridge**		
	(Super Structure)		
C.9.1	Precast Prestressed Concrete Beam including Tensioning and Erection	L.S.	
C.9.2	Precast Prestressed Concrete Diaphragm including Tensioning and Erection	L.S.	
C.9.3	Precast Concrete Panel including Erection	L.S.	
C.9.4	Deformed Reinforcing Bars	kg	5,050
C.9.5	Concrete, Type B including Formwork	m^3	48
	formwork	m^2	90
C.9.6	Asphalt Concrete	tonne	27
C.9.7	Expansion Joint	m	18
C.9.8	Hand Rail	kg	44
C.9.9	Drain Pipe, PVC Pipe Dia. 100 mm	m	11
C.9.10	Elastomeric Bearing Pad (350x280x73.)	No.	10
C.9.11	Rubber Sheet (40x10x3)	No.	10
	(Sub Structure)		
C.9.12	Structural Excavation	m^3	1,013
C.9.13	Backfill with Sandy Soil	m^3	345
C.9.14	Embankment	m^3	343
C.9.15	Furnishing and Driving PC Piles, Dia. 500 mm, Type A	m	1,080
C.9.16	Furnishing and Driving PC Test Pile, Dia. 500mm, Type A	m	36
C.9.17	Concrete, Type C1 including Formwork and Scaffolding	m^3	263
	formwork	m^2	333
	scaffolding	m^2	251
C.9.18	Concrete, TypeE1 including Formwork	m^3	13

Item No.	Description	Unit	Quantity
	formwork	m^2	6
C.9.19	Deformed Reinforcing Bars	kg	14,246
C.9.20	Wet Stone Masonry	m^3	211
C.9.21	Weep Hole, Dia.50mm	No.	60
C.9.22	Pointing	m^2	232
C.10	**Water Supply Pipe Reconstruction**		
C.10.1	Coffering and Dewatering	L.S.	
C.10.2	Structural Excavation	m^3	561
C.10.3	Backfill	m^3	524
C.10.4	Concrete, Type C1 including Formwork	m^3	35
	formwork	m^2	136
C.10.5	Concrete, Type E including Formwork	m^3	2
	formwork	m^2	2
C.10.6	Deformed Reinforcing Bars	kg	3,230
C.10.7	Pipe Connection Works	L.S.	
C.11	**Telephone Cable Duct Reconstruction**		
C.11.1	Coffering and Dewatering	L.S.	
C.11.2	Structural Excavation	m^3	280
C.11.3	Backfill	m^3	270
C.11.4	Concrete, Type C1 including Formwork	m^3	10
	formwork	m^2	22
C.11.5	Concrete, Type E including Formwork	m^3	1
	formwork	m^2	2
C.11.6	Deformed Reinforcing Bars	kg	896
C.11.7	Cable Connection Works	L.S.	
C.12	**Secondary Channel Outlet Reconstruction**		
C.12.1	Structural Excavation	m^3	382
C.12.2	Backfill	m^3	100
C.12.3	Concrete, Type C1 including Formwork and Falsework	m^3	37
	form work	m^2	14
	falsework	m^3	34
C.12.4	Concrete, Type E including Formwork	m^3	7
	form work	m^2	10
C.12.5	Deformed Reinforcing Bars	kg	3,138
C.12.6	Wet Stone Masonry	m^3	197
C.12.7	Pointing	m^2	33
C.12.8	Gravel Filling	m^3	134
C.12.9	Gravel Bedding	m^3	118
C.12.10	Cobble Stone	m^3	1
C.12.11	Weep Hole, Dia.50mm	No.	132
C.12.12	Log Pile, Dia. 150 mm L=2.0 m	m	189
D	**ASIN PUMPING STATION**		
D.1	**Preparatory Works**		
D.1.1	Coffering and Dewatering	L.S.	
D.1.2	Clearing of Garbage	L.S.	
D.1.3	Demolition of Existing Revetment	L.S.	
D.2	**Pumping Station**		

Item No.	Description	Unit	Quantity
D.2.1	Structural Excavation	m^3	1,264
D.2.2	Backfill	m^3	104
D.2.3	Embankment	m^3	913
D.2.4	Concrete, Type C1 including Formwork, Scaffolding and Falsework	m^3	1,120
	formwork	m^2	1,891
	scaffolding	m^2	1,342
	falsework	m^3	941
D.2.5	Concrete, Type E including Formwork	m^3	66
	formwork	m^2	17
D.2.6	Secondary Concrete, Type C2	m^3	131
D.2.7	Deformed Reinforcing Bars	kg	~~77,567~~ 78,173
D.2.8	Water Stop, 200 mm Wide	m	44
D.2.9	Dowel Bar. Dia. 19mm, 1.0m Long (round bar and PVC pipe)	kg	293
D.2.10	Furnishing and Driving PC Piles, Dia. 500 mm, Type A	m	3,655
D.2.11	Furnishing and Driving PC Test Pile, Dia. 500 mm, Type A	m	20
D.2.12	Furnishing and Driving Steel Sheet Pile, Type II	m	488
D.2.13	Furnishing and Driving PC Sheet Piles (t=220 mm)	m	484
D.2.14	Gabion Mattress t=500mm (Galvanized)	m^3	49
D.2.15	Safety Hand Rail (Type-I)	kg	1,123
D.2.16	Safety Hand Rail (Type-II)	kg	595
D.2.17	Wet Stone Masonry	m^3	29
D.2.18	Pointing	m^2	42
D.2.19	Weep Hole, Dia.50mm	No.	12
D.3	**Pump Mechanical Works**		
D.3.1	Furnishing and Installing Main Pump Units	set	3
D.3.2	Gear Boxes	set	3
D.3.3	Diesel Engine Units	set	3
D.3.4	Fuel Service Tank	set	1
D.3.5	Fuel Transfer Pump	set	1
D.3.6	Auxiliary Drainage Pump System	L.S.	
D.3.7	Overhead Crane	set	1
D.3.8	Piping System	L.S.	
D.3.9	Inspection and Test	L.S.	
D.3.10	Spare Parts	L.S.	
D.3.11	Maintenance Tools	L.S.	
D.4	**Pump Electrical Works**		
D.4.1	Main Control Panel	L.S.	
D.4.2	Local Switch	L.S.	
D.4.3	Inspection and Test	L.S.	
D.4.4	Spare Parts	L.S.	
D.4.5	Maintenance Tools	L.S.	
D.4.6	Control Panel for Auxiliary Drainage Pump	L.S.	
D.4.7	Generator System	L.S.	
D.5	**Inspection Bridges**		
D.5.1	Concrete, Type B including Formwork	m^3	54
	formwork	m^2	109
D.5.2	Deformed Reinforcing Bars	kg	2,968

Item No.	Description	Unit	Quantity			
D.5.3	Safety Hand Rail (Type I)	kg	200			
D.6	**Asin Pumping Station Bridge**					
	Superstructure					
D.6.1	Precast Prestressed Concrete Beam including Tensioning and Erection	L.S.				
D.6.2	Precast Prestressed Concrete Diaphragm including Tensioning and Erection	L.S.				
D.6.3	Precast Concrete Panel including Erection	L.S.				
D.6.4	Deformed Reinforcing Bars	kg	4,485			
D.6.5	Concrete, Type B including Formwork	m^3	33			
	formwork	m^2	94			
D.6.6	Asphalt Concrete	tonne	19			
D.6.7	Expansion Joint	m	11			
D.6.8	Hand Rail	kg	47			
D.6.9	Drain Pipe, PVC Pipe Dia. 100 mm	m	11			
D.6.10	Elastomeric Bearing Pad (350x280x73.)	No.	6			
D.6.11	Rubber Sheet (40x10x3)	No.	6			
	(Sub Structure)					
D.6.12	Structural Excavation	m^3	302			
D.6.13	Backfill with Sandy Soil	m^3	265			
D.6.14	Furnishing and Driving PC Piles, Dia. 500 mm, Type A	m	900			
D.6.15	Furnishing and Driving PC Test Pile, Dia. 500mm, Type A	m	36			
D.6.16	Concrete, Type C1 including Formwork and Scaffolding	m^3	133			
	formwork	m^2	271			
	scaffolding	m^2	166			
D.6.17	Concrete, TypeE1 including Formwork	m^3	9			
	formwork	m^2	4			
D.6.18	Deformed Reinforcing Bars	kg	13,782			
D.7	**Fuel Tank**					
D.7.1	Structural Excavation	m^3	621			
D.7.2	Backfill	m^3	512			
D.7.3	Concrete, Type C1 including Formwork, Scaffolding and Falsework	m^3	49			
	formwork	m^2	167			
	scaffolding	m^2	133			
	falsework	m^3	62			
D.7.4	Concrete, Type E including Formwork	m^3	3			
	formwork	m^2	3			
D.7.5	Deformed Reinforcing Bars	kg	6,810			
D.7.6	Fuel Tank and Accessories	L.S.				
D.7.7	Grounding	L.S.				
E	**ASIN PUMPING STATION GATE**					
E.1	**Gate Pier and Foundation**					
E.1.1	Structural Excavation	m^3	419			
E.1.2	Backfill with Sandy Soil	m^3	204			

Item No.	Description	Unit	Quantity
E.1.3	Concrete, Type C1 including Formwork, Scaffolding and Falsework	m^3	386
	formwork	m^2	745
	scaffolding	m^2	732
	falsework	m^3	254
E.1.4	Concrete, Type E including Formwork	m^3	18
	formwork	m^2	5
E.1.5	Secondary Concrete, Type C2	m^3	9
E.1.6	Deformed Reinforcing Bars	kg	25195
E.1.7	Water Stop, 200 mm Wide	m	12
E.1.8	Dowel Bar. Dia. 19mm, 1.0m Long (round bar and PVC pipe)	kg	112
E.1.9	Furnishing and Driving PC Piles, Dia. 500 mm, Type A	m	565
E.1.10	Furnishing and Driving Steel Sheet Pile, Type II	m	440
E.1.11	Gabion Mattress t=500mm (Galvanized)	m^3	36
E.1.12	Safety Hand Rail (Type-I)	kg	280
E.1.13	Ladder	L.S.	
E.1.14	Window	L.S.	
E.1.15	Door	L.S.	
E.1.16	Roof Sealing	L.S.	
E.2	**Gate Mechanical Works**		
E.2.1	Gate Leaf	set	2
E.2.2	Guide Frame	set	2
E.2.3	Hoist	set	2
E.2.4	Stop Log	set	2
E.2.5	Spare Parts	L.S.	
F	**BUILDINGS**		
F.1	**Buildings**		
F.1.1	Pump Control Building	L.S.	
F.1.2	Management Office	L.S.	
F.1.3	Garage	L.S.	
F.1.4	Staff House	L.S.	
F.1.5	External Works	L.S.	
G	**ASIN RETARDING POND**		
G.1	**Earth Works**		
G.1.1	Common Excavation including Hauling and Spoiling	m^3	31,039
G.1.2	Embankment	m^3	4,402
G.2	**Revetment Works**		
G.2.1	Coffering and Dewatering	L.S.	
G.2.2	Structural Excavation	m^3	2,802
G.2.3	Backfill with Cobble	m^3	590
G.2.4	Backfill with Gravel	m^3	506
G.2.5	Backfill with Sandy Soil	m^3	5
G.2.6	Wet Stone Masonry	m^3	1,363
G.2.7	Concrete, Type C1 including Formwork	m^3	147
	formwork	m^2	781

Item No.	Description	Unit	Quantity
G.2.8	Concrete, Type E including Formwork	m^3	34
	formwork	m^2	112
G.2.9	Deformed Reinforcing Bars	kg	15,076
G.2.10	Pointing	m^2	1,804
G.2.11	Weep Hole, Dia.50mm	No.	292
G.2.12	Log Pile, Dia. 150 mm L=2.0 m	m	2,160
G.2.13	Furnishing and Driving PC Sheet Pile (t=220 mm)	m	8,533
G.3	**Inspection Road**		
G.3.1	Stripping of Top Soil	m^3	712
G.3.2	Embankment	m^3	864
G.3.3	Aggregate Class A	m^3	534
G.3.4	Aggregate Class B	m^3	811
G.3.5	Sand Bedding	m^3	214
G.3.6	Concrete Block Pavement	m^2	3,558
G.3.7	Cement Mortar	m^3	9
G.3.8	Concrete Kerb	m^3	86
H	**MISCELLANEOUS WORKS**		
H.1	**Tree Planting**		
H.1	Tree Planting	L.S.	
H.2	Staff Gauge	L.S.	
I	**SUPPLYING MAINTENANCE EQUIPMENT**		
I.1	**Supplying Maintenance Equipment**		
I.1.1	Supply of Backhoe, 0.35m^3	No.	1
I.1.2	Supply of Dump Truck, 8t	No.	1
I.1.3	Supply of Truck Crane, 2.2t	No.	1
I.1.4	Supply of Garbage Container, 6m^3	No.	2

Package 2: B Semarang River Improvement

EXCAVATION OF SEMARANG RIVER

Cross Section	Distance (m)	EXCAVATION		FILL		STRIPPING		CUT	
		AREA	VOLUME	AREA	VOLUME	LENGTH OF STRIPPING	VOLUME	AREA	VOLUME
		(m^2)	(m^3)	(m^2)	(m^3)	(m)	(m^2)	(m^2)	(m^3)
SMR- 00	0.000	44.389							
SMR- 01	32.190	39.065	1343.200						
SMR- 02	27.090	37.283	1034.140						
SMR- 03	33.510	54.129	1531.610						
SMR- 04	37.620	35.622	1688.219						
SMR- 05	22.420	17.874	599.699						
SMR- 06	25.960	83.353	1313.933						
SMR- 07	27.050	25.658	1474.373	4.667	63.120	9.675			
SMR- 08	29.720	44.247	1038.784	1.832	96.571	8.055		0.0001	0.001
SMR- 09	33.370	60.777	1752.323	1.527	56.037	8.080			0.002
SMR- 10	27.390	43.660	1430.262	1.092	35.860	6.026		0.1430	1.958
SMR- 11	33.400	55.287	1652.408	1.154	37.498	7.925			2.388
SMR- 12	31.490	53.727	1716.419	1.439	40.819	7.894			
SMR- 13	29.450	52.175	1559.406	1.482	43.013	6.663		0.0966	1.422
SMR- 14	29.500	56.787	1607.191	0.065	22.827	2.485		0.2480	5.083
SMR- 15	28.610	61.312	1689.411					3.1694	48.886
SMR- 16	30.140	53.382	1728.446	0.131	1.974	1.981		1.3211	67.672
SMR- 17	32.300	56.094	1768.037	1.971	33.949	7.921			21.336
SMR- 18	32.360	51.875	1746.930	2.687	75.373	7.843			
SMR- 19	31.100	46.453	1528.989	1.318	62.289	3.976		1.6905	26.287
SMR- 20	29.100	35.076	1186.240	1.653	43.230	6.302		1.8248	51.148
SMR- 21	28.330	31.495	942.971	1.348	42.498	5.469			25.848
SMR- 21+23	19.960	53.220	845.450						
SMR- 23	31.840	11.710	1033.680						
SMR- 24	32.290	13.746	410.993						
SMR- 25	32.740	19.576	545.492						
SMR- 26	31.380	19.849	618.575						
SMR- 27	29.820	14.281	508.873						
SMR- 28	29.720	12.920	404.208						
SMR- 29	30.260	14.017	407.560						
SMR- 30	28.930	8.873	331.112						
SUB TOTAL1		**1207.912**	**35438.934**	**22.365**	**655.057**	**90.294**	**0.000**	**8.494**	**252.032**
SMR- N1	27.650	14.268	319.925						
SMR- N2	14.970	62.590	575.280						
SMR- N3	20.410	68.580	1338.590						
SMR- N4	30.440	68.488	2086.169						
SMR- N5	30.490	71.493	2134.003						
SMR- N6	39.040	65.247	2669.154						
SMR- N7	31.370	65.155	2045.356						
SMR- N8	32.780	62.050	2084.905						
SMR- N9	30.330	61.961	1880.628						
SMR- N10	29.430	67.934	1911.401						
SMR- N11	29.050	67.842	1972.147						
SMR- N12	28.960	42.642	1599.812						
SMR- N13	26.520	0.325	569.745						
SUB TOTAL2		**718.575**	**21187.116**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
SMR- 43	27.450	7.551	108.099						
SMR- 44	26.510	14.304	289.696						
SMR- 45	27.440	32.248	638.698						
SUB TOTAL3		**54.104**	**1036.493**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
SMR- 46	29.400	18.518	746.257						
SMR- 47	29.580	17.932	539.089						
SMR- 48	31.250	17.388	551.869						
SMR- 49	30.720	16.934	527.177						
SMR- 50	30.580	3.508	312.553						
SMR- 51	31.550	18.975	354.666						
SMR- 52	29.700	11.254	448.889						
SMR- 53	30.480	11.294	343.625						
SMR- 53+17	20.560	15.854	279.086						
SMR- 54	13.510	12.781	193.434						

Name of Structure	EXCAVATION OF SEMARANG RIVER FOR ASIN DRAINAGE SYSTEM	Category of calculation	WORK VOLUME	Page	

SUMMARY OF EXCAVATION :

1. Common Channel Excavation = 21,187.116 m^3
2. Excavation below Water Level
   = 35438.934 + 1036.493 = 36475.427 m^3

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EXCAVATION OF SEMARANG RIVER

Cross Section	Distance (m)	EXCAVATION		FILL		STRIPPING		CUT	
		AREA	VOLUME	AREA	VOLUME	LENGTH OF STRIPPING	VOLUME	AREA	VOLUME
		(m^2)	(m^3)	(m^2)	(m^3)	(m)	(m^3)	(m^2)	(m^3)
SMR- 00	0.000	44.389							
SMR- 01	32.190	39.065	1343.200						
SMR- 02	27.090	37.283	1034.140						
SMR- 03	33.510	54.129	1531.610						
SMR- 04	37.620	35.622	1688.219						
SMR- 05	22.420	17.874	599.699						
SMR- 06	25.960	83.353	1313.933						
SMR- 07	27.050	25.658	1474.373	4.667	63.120	9.675			
SMR- 08	29.720	44.247	1038.784	1.832	96.571	8.055		0.0001	0.001
SMR- 09	33.370	60.777	1752.323	1.527	56.037	8.080			0.002
SMR- 10	27.390	43.660	1430.262	1.092	35.860	6.026		0.1430	1.958
SMR- 11	33.400	55.287	1652.408	1.154	37.498	7.925			2.388
SMR- 12	31.490	53.727	1716.419	1.439	40.819	7.894			
SMR- 13	29.450	52.175	1559.406	1.482	43.013	6.663		0.0966	1.422
SMR- 14	29.500	56.787	1607.191	0.065	22.827	2.485		0.2480	5.083
SMR- 15	28.610	61.312	1689.411					3.1694	48.886
SMR- 16	30.140	53.382	1728.446	0.131	1.974	1.981		1.3211	67.672
SMR- 17	32.300	56.094	1768.037	1.971	33.949	7.921			21.336
SMR- 18	32.360	51.875	1746.930	2.687	75.373	7.843			
SMR- 19	31.100	46.453	1528.989	1.318	62.289	3.976		1.6905	26.287
SMR- 20	29.100	35.076	1186.240	1.653	43.230	6.302		1.8248	51.148
SMR- 21	28.330	31.495	942.971	1.348	42.498	5.469			25.848
SMR- 21+23	19.960	53.220	845.450						
SMR- 23	31.840	11.710	1033.680						
SMR- 24	32.290	13.746	410.993						
SMR- 25	32.740	19.576	545.492						
SMR- 26	31.380	19.849	618.575						
SMR- 27	29.820	14.281	508.873						
SMR- 28	29.720	12.920	404.208						
SMR- 29	30.260	14.017	407.560						
SMR- 30	28.930	8.873	331.112						
SUB TOTAL1		1207.912	35438.934	22.365	655.057	90.294	0.000	8.494	252.032
SMR- N1	27.650	14.268	319.925						
SMR- N2	14.970	62.590	575.280						
SMR- N3	20.410	68.580	1338.590						
SMR- N4	30.440	68.488	2086.169						
SMR- N5	30.490	71.493	2134.003						
SMR- N6	39.040	65.247	2669.154						
SMR- N7	31.370	65.155	2045.356						
SMR- N8	32.780	62.050	2084.905						
SMR- N9	30.330	61.961	1880.628						
SMR- N10	29.430	67.934	1911.401						
SMR- N11	29.050	67.842	1972.147						
SMR- N12	28.960	42.642	1599.812						
SMR- N13	26.520	0.325	569.745						
SUB TOTAL2		718.575	21187.116	0.000	0.000	0.000	0.000	0.000	0.000
SMR- 43	27.450	7.551	108.099						
SMR- 44	26.510	14.304	289.696						
SMR- 45	27.440	32.248	638.698						
SUB TOTAL3		54.104	1036.493	0.000	0.000	0.000	0.000	0.000	0.000
SMR- 46	29.400	18.518	746.257						
SMR- 47	29.580	17.932	539.089						
SMR- 48	31.250	17.388	551.869						
SMR- 49	30.720	16.934	527.177						
SMR- 50	30.580	3.508	312.553						
SMR- 51	31.550	18.975	354.666						
SMR- 52	29.700	11.254	448.889						
SMR- 53	30.480	11.294	343.625						
SMR- 53+17	20.560	15.854	279.086						
SMR- 54	13.510	12.781	193.434						

Cross Section	Distance (m)	EXCAVATION		FILL		STRIPPING		CUT	
		AREA	VOLUME	AREA	VOLUME	LENGTH OF STRIPPING	VOLUME	AREA	VOLUME
		(m^2)	(m^3)	(m^2)	(m^3)	(m)	(m^2)	(m^2)	(m^3)
SMR- 55	31.370	16.366	457.177						
SMR- 56	30.760	3.616	307.325						
SMR- 57	35.140	9.160	224.464						
SMR- 58	37.220	20.634	554.450						
SMR- 59	29.590	26.063	690.869						
SMR- 60	27.660	19.764	633.775						
SMR- 61	26.170	14.859	455.034						
SMR- 62	24.840	15.149	372.696						
SMR- 63	28.930	20.161	510.758						
SMR- 64	27.030	12.321	438.997						
SMR- 65	25.410	15.535	353.912						
SMR- 66	26.150	19.063	452.371						
SMR- 67	31.430	12.826	501.144						
SMR- 68	32.870	10.708	386.788						
SMR- 69	34.380	9.897	354.212						
SMR- 69+14	12.890	17.486	176.486						
SMR- 70	16.180	7.989	206.092						
SMR- 71	31.130	14.785	354.471						
SMR- 72	28.440	18.274	470.091						
SMR- 73	31.430	16.191	541.609						
SMR- 74	31.850	10.239	420.893						
SMR- 75	32.100	12.282	361.464						
SMR- 76	32.820	18.080	498.247						
SMR- 77	30.760	18.525	562.985						
SMR- 78	28.940	17.062	514.946						
SMR- 79	28.030	19.708	515.344						
SMR- 80	30.210	20.349	605.070						
SMR- 81	29.790	21.518	623.614						
SMR- 82	27.590	20.392	578.155						
SMR- 83	28.870	21.132	599.400						
SMR- 84	29.510	20.886	619.972						
SMR- 85	29.720	9.357	449.409						
SMR- 86	29.590	17.167	392.413						
SMR- 87	30.730	11.062	433.729						
SMR- 88	33.630	5.649	281.000						
SMR- 89	35.230	2.573	144.844						
SMR- 90	31.720	1.013	56.877						
SMR- 90+11	11.180	22.194	129.728						
SMR- 91	14.820	16.756	288.623						
SMR- 92	22.640	15.055	360.100						
SMR- 93	20.830	5.436	213.409						
SMR- 94	26.750	10.472	212.768						
SMR- 95	28.930	16.244	386.447						
SMR- 96	25.270	9.337	323.209						
SMR- 97	27.470	7.384	229.662						
SMR- 98	27.280	9.945	236.375						
SMR- 99	30.560	11.261	324.026						
SMR- 100	28.880	8.621	287.092						
SMR- 101	30.800	9.974	286.369						
SMR- 102	30.820	18.143	433.283						
SMR- 103	33.100	17.287	586.365						
SMR- 104	33.130	14.785	531.272						
SMR- 105	39.510	7.157	433.463						
SMR- 106	33.710	8.789	268.768						
SMR- 106+13	5.280	20.376	76.995						
SMR- 107	27.780	6.139	368.291						
SMR- 108	32.400	7.157	215.389						
SMR- 109	27.130	7.191	194.632						
SMR- 110	28.510	9.540	238.495						
SMR- 111	30.640	8.569	277.426						
SMR- 112	29.760	8.629	255.906						
SMR- 113	30.230	16.786	384.147						
SMR- 114	26.020	9.049	336.114						
SMR- 115+15	13.340	22.432	209.980						
SMR- 116	16.510	17.954	333.393						
SMR- 116+8	9.640	19.217	179.165						
SMR- 117	20.680	9.541	297.359						
SMR- 118	29.190	16.786	384.253						
SMR- 119	28.280	9.049	365.307						

Cross Section	Distance (m)	EXCAVATION		FILL		STRIPPING		CUT	
		AREA	VOLUME	AREA	VOLUME	LENGTH OF STRIPPING	VOLUME	AREA	VOLUME
		(m^2)	(m^3)	(m^2)	(m^3)	(m)	(m^2)	(m^2)	(m^3)
SMR- 120	26.970	22.432	424.524						
SMR- 121	27.900	17.954	563.397						
SMR- 121+3	4.190	19.217	77.873						
SMR- 122	27.150	9.541	390.391						
SMR- 123	29.900	12.221	325.344						
SMR- 124	29.940	9.934	331.658						
SMR- 125	30.050	10.417	305.777						
SMR- 126	29.950	13.962	365.075						
SMR- 126+17	17.570	14.807	252.735						
SMR- 127	15.520	3.815	144.509						
SMR- 128	31.650	6.612	165.007						
SMR- 129	35.800	8.759	275.143						
SMR- 130	31.860	5.650	229.537						
SMR- 131	29.090	12.049	257.424						
SMR- 132	27.430	12.884	341.948						
SMR- 133	28.070	4.175	239.419						
SMR- 134	29.290	8.022	178.622						
SMR- 135	26.360	7.196	200.566						
SMR- 136	29.830	12.269	290.316						
SMR- 137	30.300	13.614	392.118						
SMR- 137+14	14.290	14.746	202.631						
SMR- 138	19.300	11.910	257.237						
SMR- 139	31.960	10.656	360.606						
SMR- 140	32.540	10.558	345.154						
SMR- 141	33.270	10.047	342.769						
SMR- 142	32.920	10.365	335.979						
SMR- 142+23	24.480	12.828	283.878						
SMR- 143	6.690	13.391	87.701						
SMR- 144	28.320	6.010	274.719	0.039	1.076	0.444	12.290		
SMR- 145	27.030	6.663	171.273						
SMR- 146	30.960	10.006	258.033	0.015	0.444	2.061	61.898		
SMR- 147	29.100	6.982	247.170	0.009	0.251	0.393	10.814		
SMR- 148	25.990	8.601	202.492						
SMR- 149	28.170	9.247	251.381						
SMR- 150	22.690	6.844	182.551						
SMR- 151	27.270	8.484	209.000						
SMR- 152	27.350	9.312	245.141						
SMR- 153	29.000	9.023	265.856						
SMR- 154	26.600	11.752	276.307						
SMR- 155	28.050	8.914	289.839						
SMR- 156	31.550	6.463	242.571						
SMR- 156+17	17.820	8.785	135.863						
SMR- 157	11.910	8.282	101.633						
SMR- 158	30.760	8.491	257.963						
SMR- 159	29.920	8.175	249.327						
SMR- 160	30.390	9.553	269.373	0.059	1.865	0.463	14.755		
SMR- 161	33.360	7.477	284.053						
SMR- 162	30.190	7.191	221.421						
SMR- 163	29.250	9.373	242.262						
SMR- 164	29.700	7.384	248.841						
SMR- 165	29.490	6.922	210.936						
SMR- 166	28.000	7.497	201.873						
SMR- 167	30.580	8.913	250.920						
SMR- 168	30.290	9.080	272.515						
SMR- 168+7	7.010	8.994	63.349						
SMR- 169	23.540	8.176	202.087						
SMR- 170	29.980	11.190	290.302						
SMR- 171	29.390	11.149	328.278						
SMR- 172	27.720	9.706	289.046						
SMR- 173	30.840	9.563	297.120						
SMR- 174	33.000	8.599	299.676						
SMR- 175	31.710	8.125	265.155						
SMR- 176	30.660	9.520	270.498						
SMR- 177	27.740	7.757	239.642						
SMR- 178	27.400	6.465	194.849						
SMR- 179	28.310	7.630	199.513						
SMR- 180	24.320	8.307	193.789						
SMR- 181	28.810	6.502	213.322						
SMR- 182	30.800	7.741	219.344						

Cross Section	Distance (m)	EXCAVATION		FILL		STRIPPING		CUT	
		AREA	VOLUME	AREA	VOLUME	LENGTH OF STRIPPING	VOLUME	AREA	VOLUME
		(m^2)	(m^3)	(m^2)	(m^3)	(m)	(m^2)	(m^2)	(m^3)
SMR- 183	31.360	9.588	271.721						
SMR- 184	30.450	8.129	269.743						
SMR- 185	30.000	8.324	246.805						
SMR- 186	30.850	8.007	251.916						
SMR- 187	33.000	7.350	253.394						
SMR- 188	31.030	6.113	208.883						
SMR- 189	29.880	6.407	187.055						
SMR- 190	29.660	5.104	170.706						
SMR- 191	26.320	7.638	167.676						
SMR- 192	29.440	6.463	207.554						
SMR- 193	28.440	7.206	194.371						
SMR- 194	31.120	6.937	220.072						
SMR- 195	29.740	2.777	144.449						
SMR- 195+17	17.180	5.103	67.686						
SMR- 196	13.110	5.393	68.799						
SMR- 197	30.170	5.990	171.717						
SMR- 198	29.240	5.288	164.883						
SMR- 199	30.110	5.915	168.653						
SMR- 200	30.020	5.725	174.717						
SMR- 201	30.180	5.457	168.739	0.026	0.789	0.425	12.814		
SMR- 202	30.080	4.310	146.890	0.050	1.530	0.463	14.066		
SMR- 203	30.720	5.667	153.244	0.023	0.686	0.425	12.785		
SMR- 204	29.390	6.048	172.159						
SMR- 205	29.770	6.393	185.195						
SMR- 206	25.650	5.972	158.580						
SMR- 207	32.070	6.799	204.780						
SMR- 208	30.130	6.061	193.742						
SMR- 209	30.120	5.683	176.868						
SMR- 210	30.150	5.762	172.540						
SMR- 211	22.740	0.574	72.049						
SMR- 212	30.400	5.338	89.874						
SMR- 213	30.050	6.040	170.960						
SMR- 214	29.790	6.654	189.080						
SMR- 215	31.090	7.038	212.841						
SMR- 215+22	22.730	6.446	153.242						
SMR- 216	7.440	7.517	51.942						
SMR- 217	30.640	6.563	215.710	0.026	0.790	0.431	13.040		
SMR- 218	29.940	6.455	194.878	0.033	0.988	0.437	13.220		
SMR- 219	30.550	6.016	190.485	0.006	0.192	0.404	12.352		
SMR- 220	30.540	5.522	176.180	0.030	0.913	0.837	25.541		
SMR- 221	30.520	6.792	187.909	0.054	1.631	0.861	25.976		
SMR- 222	29.840	6.478	197.992	0.054	1.652	0.876	26.673		
SMR- 223	31.050	6.228	197.266						
SMR- 224	29.230	6.635	187.990						
SMR- 225	29.380	6.215	188.763						
SMR- 225+10	10.180	6.628	65.371						
SMR- 226	19.780	5.825	123.159	0.043	1.080	0.769	19.235		
SMR- 227	30.240	5.891	177.138	0.067	2.021	0.865	25.976		
SMR- 228	29.800	6.014	177.375	0.017	0.485	0.433	12.641		
SMR- 229	28.560	5.850	169.408	0.021	0.598	0.415	11.657		
SMR- 230	27.660	4.108	137.714	0.007	0.211	0.407	11.612		
SMR- 231	29.430	6.108	150.329	0.006	0.168	0.030	0.876		
SMR- 232	29.560	6.735	189.822						
SMR- 233	29.270	6.418	192.492	0.035	1.040	2.541	74.798		
SMR- 234	29.610	6.214	187.013	0.016	0.483	2.463	73.210		
SMR- 235	29.840	5.703	177.800	0.076	2.072	0.818	22.164		
SMR- 235+24	24.350	6.084	143.502						
SMR- 236	6.750	5.848	40.270	0.022	0.411	0.882	16.290		
SMR- 237	30.210	5.685	174.207	0.006	0.193	0.402	12.159		
SMR- 238	30.360	5.603	171.349						
SMR- 239	29.810	5.388	163.816						
SMR- 240	29.510	5.417	159.432						
SMR- 241	29.920	4.269	144.915						
SMR- 241+13	13.850	0.731	34.628						
SUB TOTAL4	**2137.051**	**58440.602**		**0.742**	**21.569**	**18.543**	**536.844**	**0.000**	
TOTAL		**116103.146**		**23.107**	**676.626**	**108.837**	**536.844**	**8.494**	

Name of Structure	REVETMENT FOR SEMARANG RIVER AND ASIN RETARDING	Category Calculation	Work Volume	Page	1/13

I. REVETMENT TYPE WET MASONRY (A)
(SEMARANG RIVER)

1.	STRUCTURE EXCAVATION	=	2,566	m^3
2.	BACK FILL WITH BOULDER	=	403	m^3
3.	BACK FILL WITH GRAVEL	=	1,018	m^3
4.	BACK FILL WITH SANDY SOIL	=	188	m^3
5.	CONCRETE (C1)	=	228	m^2
6.	LEVELING CONCRETE	=	64	m^3
7.	REINFORCING BAR	=	12,627	ton
8.	WET STONE MASONRY	=	1,543	Kg
9.	POINTING	=	4,428	m^3
10.	WEEP HOLE	=	845	nos
11.	PALM FIBRE	=	7	m^3
12.	GABION MATTRESS	=	420	m^3
13.	TIMBER PILE	=	840	m^1
14.	FORM WORK (for concrete C1)	=	1,246	m^2
15.	FORM WORK (for concrete E)	=	209	m^2

II. REVETMENT WET MASONRY
(ASIN RETARDING POND)

1.	STRUCTURE EXCAVATION	=	2,802	m^3
2.	BACK FILL WITH COBBLE	=	590	m^3
3.	BACK FILL WITH GRAVEL	=	506	m^3
4.	BACK FILL WITH SANDY SOIL	=	5	m^3
5.	WET STONE MASONRY	=	1,363	m^3
6.	CONCRETE TYPE (C1)	=	147	m^2
	FORM WORK	=	891	m^2
7.	CONCRETE TYPE E	=	34	m^3
	FORM WORK	=	112	m^2
8.	REINFORCING BAR	=	9,889	Kg
9.	POINTING	=	1,804	m^2
10.	SODDING	=	-	
11.	WEEP HOLE Ø50	=	292	nos
12.	LOG PILE Ø150, L = 2,000	=	2,160	m

Name of Structure	REVETMENT FOR SEMARANG RIVER AND ASIN RETARDING	Category Calculation	Work Volume	Page	2/13

III. REVETMENT TYPE (C)
(CONCRETE SHEET PILE)

1. SEMARANG RIVER

a.	Concrete Sheet Pile (L=12,000)	=	7,714.8	m^1
b.	Concrete Type C_1 (pile cap)	=	38.574	m^3
c.	Form Work	=	289.305	m^2
d.	Reinforcing Bar	=	4,635.309	Kg

2. ASIN RETARDING POND

a.	Concrete Sheet Pile (L=12,000)	=	8,032.8	m
b.	Concrete Sheet Pile (L=10,000)	=	500	m
c.	Concrete C_1 (pile cap)	=	43.164	m^3
d.	Form Work	=	323.73	Sg.m
e.	Reinforcing Bar	=	5,186.874	Kg

Name of Structure	REVETMENT FOR SEMARANG RIVER AND ASIN RETARDING	Category Calculation	Work Volume	Page	3/13

I. REVETMENT TYPE WET MASONRY (A)

1. Section A-A, (L= 23 + 7 = 30 m)

1.1 Structure Excavation

$$A = \frac{3.6+0.45}{2}\times 1.1+\frac{0.3+0.45}{2} = 2.295$$

$$0.5 \times 0.5 = 0.250$$

$$\frac{3.5+4.3}{2}\times 0.5 = 1.950$$

$$\frac{1.8+0.9}{2}\times 0.6 = 0.810$$

$$A = 5.305 \text{ m}^2$$

$$V = 30 \times 5.305 = 159.15 \text{ m}^3$$

1.2 Backfill with Boulder

$$A = \frac{1\times 0.5}{2} = 0.250$$

$$\frac{0.2+0.7}{2}\times 0.6 = 0.270$$

$$\frac{0.1+0.6}{2}\times 0.5 = 0.175$$

$$\frac{0.2+1.0}{2}\times 0.8 = 0.27$$

$$A = 0.815 \text{ m}^2$$

$$V = 0.815 \times 30 = 24.450 \text{ m}^3$$

1.3 Backfill with Gravel Bedding

$$V = 0.2 \times (6.4 + 0.7)\times 30 = 31.42 \text{ m}^3$$

1.4 Backfill with Sandy Soil

$$V = \frac{0.2+0.5}{2}\times 0.2\times 30 = 2.1 \text{ m}^3$$

1.5 Concrete (C_1)

$$V = \left\{(0.3\times 0.7)+\left(0.3\times\frac{0.3+0.5}{2}+0.2\times 0.5\right)\right\}\times 23 = 9.55 \text{ m}^3$$

$$\text{form work} = \left(2\times 0.7+0.5+0.2+\sqrt{0.3^2\times 0.2^2}\times 23\right) = 56.59 \text{ m}^2$$

1.6 Leveling Concrete

V = $\{(0.1\times0.5)+(0.1\times0.7)\}\times23$ = 2.76 m³

form work = $0.1\times4\times23$ = 9.2 m²

1.7 Reinforcing Bar

$23\times(10.99+12.75)$ = 546.02 kg

1.8 Wet Stone Masonry

V = $0.3\times(6.4+0.7)\times30$ = 63.9 m³

1.9 Pointing

V = $\left(0.70+\sqrt{2.635^2+5.27^2}\times30\right)$ = 197.76 m²

1.10 Plastering

V = $(0.70+0.10)\times30$ = 24.0 m²

1.11 Weep Hole PVC Ø150

V = $\left(\frac{30}{2}+1\right)\times2$ = 32.0 nos

1.12 Gabion Mattress

V = $30\times0.5\times1.5$ = 22.5 m³

1.13 Log pile

V = $\left(\frac{23}{2}+1\right)\times3$ = 36.0 m³

2. Section C-C & D-D, (L= 106.434 m & 224.8 m = 331.234 m)

2.1 Structure Excavation

A = $\frac{3.6+0.45}{2}\times1.1+\frac{0.3\times0.45}{2}$ = 2.295

0.5×0.5 = 0.250

$0.5\times\sqrt{2.499^2+4.998^2}$ = 1.950

A = 5.339 m³

$V_{C\text{-}C}$ = 5.339×106.434 = 568.25 m³

$V_{D\text{-}D}$ = 5.339×224.8 = 1200.21 m³

A = 1768.46 m³

2.2 Backfill with Boulder

$A = \frac{1 \times 0.5}{2} = 0.250$

$\frac{0.2 + 0.7}{2} \times 0.6 = 0.270$

$\frac{0.1 + 0.6}{2} \times 0.5 = 0.175$

$V_{C\text{-}C} = 5.339 \times 106.434 = 568.25\ m^3$

$V_{D\text{-}D} = 5.339 \times 224.8 = 1200.21\ m^3$

$A = 230.208\ m^3$

2.3 Backfill with Gravel Bedding

$V_{C\text{-}C} = 0.2 \times (8.768+0.7) \times 106.434 = 201.543\ m^3$

$V_{D\text{-}D} = 0.2 \times (8.768+0.7) \times 224.8 = 425.681\ m^3$

$A = 627.224\ m^2$

2.4 Backfill with Sandy Soil

$A = 0.4 \times \frac{0.7 \times 1.5}{2} = 0.44\ m^3$

$V_{C\text{-}C} = 0.44 \times 106.434 = 46.831\ m^3$

$V_{D\text{-}D} = 0.44 \times 224.8 = 98.912\ m^3$

$A = 145.743\ m^3$

2.5 Concrete (C_1)

$V_{C\text{-}C} = (0.21 + 0.22) \times 331.234 = 142.431\ m^3$ (CC+DD)

$V_{D\text{-}D} = 0.12 \times 224.8 = 26.976\ m^3$

$A = 72.743\ m^3$

form work D-D $= (2 \times 0.3 + 2 \times 0.15) \times 224.8 = 202.32\ m^2$

2.6 Leveling Concrete (E)

CC & DD $= \{(0.5 \times 0.7) \times 0.1\} \times (106.434 + 224.8) = 39.745\ m^3$

2.7 Form Work for (C_1) C-C

$\left\{\left(0.5 + 0.15 + \sqrt{0.3^2 + 0.2^2}\right) + 2 \times 0.7\right\} \times 106.434 = 256.565$

Form Work for (C_1) D-D

$\left\{\left(0.5 + 0.15 + \sqrt{0.3^2 + 0.2^2}\right) + 2 \times 0.7\right\} \times 224.8 = 541.880$

$= 798.458\ m^2$

2.8 Form Work for (E) C-C & D-D

$0.10 \times 4 \times 331.234$ = 132.494 m²

2.9 Pointing

$\left(0.70 + \sqrt{3.421^2 + 6.842^2}\right) \times 331.234$ = 2765.67 m²

2.10 Log Pile

$\left\{\left(\frac{106.434}{2} + 1\right) + \left(\frac{224.8}{2} + 1\right)\right\} \times 3$ = 501 m

2.11 Reinforcing bar

D-D = $(10.99 + 12.75) \times 224.8$ = 5337 kg

C-C = $(10.99 + 12.75) \times 106.434$ = 25.27 kg

D-D = 14.42×224.8 = 3242 kg

2.12 Wet Stone Masonry

= $0.30 \times (8.768 + 0.7) \times 331.234$ = 940.837 m³

2.13 Weep Hole

= $\left(\frac{331.234}{2} + 1\right) \times 3$ = 498 nos

2.14 Plastering

= 0.8×331.234 = 265 m²

2.15 Log Pile

= $\frac{331.234}{2} \times 3$ = 501 m

2.16 Gabion Mattress

= $331.234 \times 0.5 \times 1.5$ = 248.43 m³

3. Section E-E, (L= 290 m)

3.1 Structure Excavation

A = $\frac{0.75 + 1.1}{2} \times 3.354$ = 3.102

0.2×0.350 = 0.070

1×1.70 = 1.700

$\frac{1.1 + 0.1}{2} \times 1$ = 0.600

A = 5.472 m³

$V_{E\text{-}E}$ = 290×5.472 = 1586.88 m³

3.2 Backfill with Boulder

$$V = \frac{1+0.1}{2} \times 1 \times 290 = 174 \text{ m}^3$$

3.3 Backfill with Gravel Bedding

$$V_{E\text{-}E} = \left\{(3.354+0.7)\times 0.2 + \left(\frac{0.1+0.2}{2}\times 1\right)\right\} \times 290 = 278.632 \text{ m}^3$$

3.8 Wet Stone Masonry

$$= \left\{\left(\frac{0.45+0.9}{2}\times 3\right) + (1\times 1.5)\right\} \times 290 = 1022.25 \text{ m}^3$$

3.9 Pointing

$$= (0.45 + 0.10) \times 290 = 159.5 \text{ m}^2$$

3.10 Weep hole

$$= \left(\frac{290}{2}+1\right)\times 2 = 292 \text{ nos}$$

3.11 Log Pile

$$= \frac{331.234}{2}\times 3 = 501 \text{ m}$$

3.12 Cobble stone

$$= 0.15 \times 1.7 \times 290 = 73.95 \text{ m}^3$$

4. Section F-F, (L= 2 x 140 = 280 m)

4.1 Structure Excavation

$$A = \frac{3.6+0.45}{2}\times 1.1 + \frac{0.3\times 0.45}{2} = 2.295$$

$$0.5 \times 0.5 = 0.250$$

$$2.236 + 1 \times 0.5 = 1.118$$

$$\frac{0.8+0.5}{2}\times 0.3 = 0.195$$

$$\frac{1+0.2}{2}\times 0.8 = 0.480$$

$$A = 4.338 \text{ m}^3$$

$$V_{F\text{-}F} = 280 \times 4.338 = 1214.64 \text{ m}^3$$

4.2 Backfill with Boulder

$$A = \frac{2.5+0.7}{2}\times 0.5 = 0.875$$

$$= \frac{0.2+0.7}{2}\times 0.5 = 0.225$$

$\frac{0.2+0.1}{2} \times 0.8$ = 0.120

A = 1.220 m³

V_{F-F} = 280 × 1.22 = 341.60 m³

4.3 Backfill with Gravel Bedding

V_{F-F} = (3.354 + 0.7)× 0.2 × 280 = 227 m³

4.4 Backfill with Sandy Soil

A = $\frac{0.5 \times 0.2}{2} \times 0.3 \times 280$ = 4.20 m³

4.5 Concrete (C_1)

V_{F-F} = (0.21 + 0.22) × 280 = 120.4 m³

Form work for (C_1)

= $\left\{2 \times 0.7 + \left(0.2 + \sqrt{0.3^2 + 0.22} + 0.5\right)\right\} \times 280$ = 548.955 m²

4.6 Leveling Concrete (E)

= (0.7 + 0.5) × 0.1 × 280 = 33.60 m³

4.7 Reinforcing bar

F-F = (10.99 + 12.75) × 280 = 6647.2 kg

4.8 Wet Stone Masonry

= (3.354 + 0.7) × 0.3 × 280 = 340.50 m³

4.9 Pointing

= (2 × 2.236 + 2 × 0.7) × 280 = 1644.16 m³

4.10 Plastering

= (0.7 + 0.1) × 280 = 224 m²

4.11 Log Pile Ø150

= $\frac{280}{2} \times 3$ = 420 m

5. Section G-G, (L= 68 m)

5.1 Structure Excavation

A = $\frac{3.6+0.45}{2} \times 1.1 + \frac{0.3 \times 0.45}{2}$ = 2.295

0.5 x 0.5 = 0.250

0.5 x 0.5 = 0.250

Name of Structure	REVETMENT FOR SEMARANG RIVER AND ASIN RETARDING	Category Calculation	Work Volume	Page	9/13

A = 2.795 m²

V_{G-G} = 68 × 2.795 = 190.06 m³

5.2 Backfill with Boulder

A = $\frac{1+0.5}{2}$ = 0.250

$\frac{0.2+0.7}{2} \times 0.6$ = 0.270

$\frac{0.1+0.6}{2} \times 0.5$ = 0.175

A = 0.695 m³

V_{G-G} = 68 × 0.695 = 47.26 m³

5.3 Form Work for (C_1) (G-G)

$\left\{\left(0.5+0.15+\sqrt{0.3^2+0.2^2}\right)+2\times0.7\right\}\times68$ = 163.918 m²

5.4 Form Work for (E) (G-G)

0.10 x 4 x 68 = 27.2 m²

5.5 Pointing

$\left(0.7+\sqrt{3.423^2+6.846^2}\right)\times68$ = 568.08 m²

5.6 Backfill with Gravel Bedding

V_{G-G} = 0.2 × (8.772 + 0.7)× 68 = 128.82 m³

5.7 Backfill with Sandy Soil

A = $\frac{0.2+0.5}{2} \times 0.3 \times 2 \times 68$ = 14.28 m³

5.8 Concrete (C_1)

V_{G-G} = (0.21 + 0.22)× 68 = 29.24 m³

5.9 Leveling Concrete (E)

(0.5 + 0.7) × 0.1 × 68 = 8.16 m³

5.10 Reinforcing bar

G-G (10.99 + 12.75) × 68 = 1614.32 kg

5.11 Wet Stone Masonry

(8.772 + 0.7) × 0.3 × 68 = 193.23 m³

5.12 Plastering

(0.7 + 0.1) x 68 = 54.4 m²

5.13 Weep hole Ø150

$$\left(\frac{68}{2}+1\right)\times 3 = 105 \text{ nos}$$

5.14 Log Pile Ø150

$$\left(\frac{68}{2}+1\right)\times 3 = 105 \text{ nos}$$

5.15 Gabion Mattress

$68 \times 0.5 \times 1.5 = 51 \text{ m}^3$

6. Existing Bridge Protection (Section K-K & J-J)

$L_{Total} = 63 + 67 = 130$ m

$L_{without\ abutment} = 130 - 2 \times 22 = 130$ m

6.1 Structure Excavation

$$A = \frac{3.6+0.45}{2}\times 1.1 + \frac{0.3\times 0.45}{2} = 2.295$$

$0.5 \times 0.5 = 0.250$

$0.3 \times 0.3 = 0.900$

$A = 3.445 \text{ m}^2$

$V_{K\text{-}K\ \&\ J\text{-}J} = 130 \times 3.445 = 447.85 \text{ m}^3$

6.2 Backfill with Boulder

$$A = \frac{1+0.5}{2} = 0.250$$

$$\frac{0.2+0.7}{2}\times 0.6 = 0.270$$

$$\frac{0.1+0.6}{2}\times 0.5 = 0.175$$

$A = 0.695 \text{ m}^3$

$$\frac{0.2+0.1}{2}\times 0.8 = 0.12 \text{ m}^2$$

$V_{K\text{-}K} = 130 \times 0.695 = 90.35 \text{ m}^3$

$V_{J\text{-}J} = 86 \times 0.12 = 10.32 \text{ m}^3$

$= 100.67 \text{ m}^3$

6.3 Backfill with Gravel Bedding

$(8.739 + 0.7) \times 0.2 \times 130$ = 245.41 m³

$0.2 \times 3.5 \times 22$ = 15.40 m³

= 230.01 m³

6.4 Backfill with Sandy Soil

$V = \frac{0.7 + 1.3}{2} \times 0.3 \times 68$ = 25.80 m³

6.5 Concrete (C_1)

0.22×130 = 28.60 m³

0.21×86 = 18.06 m³

= 46.66 m³

Form Work for (C_1)

$\left(0.5 + 0.15 + \sqrt{0.3^2 + 0.22}\right) \times 130$ = 131.372 m²

$2 \times 0.7 \times 68$ = 95.20 m²

= 226.572 m²

6.6 Leveling Concrete (E)

$0.7 \times 0.1 \times 130$ = 9.10 m³

$0.5 \times 0.1 \times 86$ = 4.30 m³

= 13.40 m³

Form Work for (E_1)

$0.1 \times 2 \times 130 + 0.1 \times 2 \times 68$ = 39.60 m²

6.7 Reinforcing bar

12.75×130 = 1657.50 kg

10.99×86 = 945.14 m³

= 2602.40 m³

6.8 Pointing

$\left(0.7 + \sqrt{3.411^2 + 6.822^2}\right) \times 130$ = 1082.54 m²

$(0.7 + 3.528) \times 2 \times 22$ = 186.03 m²

= 896.51 m²

6.9 Wet Stone Masonry

$0.3 \times (8.739 + 0.7) \times 130$ = 368.121 m³

$0.3 \times 3.5 \times 22$ = 23.100 m²

= 345.02 m²

6.10 Plastering

$(0.7 + 0.1) \times 68 = 54.4\ m^2$

6.11 Weep hole Ø50

$\left(\frac{130}{2}+1\right)\times 3.0 = 198$ nos

$\left(\frac{22}{2}+1\right)\times 1 = 12$ nos

$= 210$ nos

6.12 Log Pile

$\left(\frac{130}{2}+1\right)\times 3.0.0 = 198\ m'$

6.13 Gabion Mattress

$130 \times 0.5 \times 1.5 = 97.5\ m^3$

II. REVETMENT TYPE C (CONCRETE SHEET PILE)

1. Semarang River

a. Concrete sheet pile (L=12,000, W=500, t=220)

Length of structure

$(2 \times 25 + 74.5)+(12.5 + 60.2)+(10 + 35 + 30.25 + 20 + 29) = 321.45$ m

$V = \frac{321.45}{0.5} \times 12 = 7714.8\ m'$

b. Concrete Type C1 (pile cap)

$V = 0.12 \times 321.45 = 38.574\ m^3$

c. Form work

$V = (2 \times 0.15 + 2 \times 0.3) \times 321.45 = 289.305\ m^2$

d. Reinforcing bar

$V = 14.42 \times 321.45 = 4635.309$ kg

2. Asin Retarding Pond

a. Concrete sheet pile (L=12,000, W=500, t=220)

Length of structure

$= 18 + 37 + 12.5 + 106 + 43.2 + 87 + 21 + 10 = 334.7$ m

$V = \frac{334.7}{0.5} \times 12 = 8032.8$ m

b. Concrete sheet pile (L=10,000, W=500, t=220)

Length of structure = 9 + 12 + 4 = 25 m

$V = \frac{25}{0.5} \times 10 = 500$ m

Total Volume of Concrete Sheet Pile = 8032.8 + 500 = 8532.8 m

c. Concrete C_t (pile cap)

V = 0.12 × (334.7 + 25) = 43.164 m³

d. Form work

V = (2 × 0.15 + 2 × 0.3) × (334.7 + 25) = 323.73 m²

e. Reinforcing bar

V = 14.42 × (334.7 + 25) = 5186.874 kg

III. FORM WORK

1. Revetment Type Wet Masonry

Section A-A, L = 23 + 7 = 30 m

Section C-C, L = 106.434 m

Section D-D, L = 224.80 m

Section F-F, L = 2 x 140 = 280 m

Section G-G, L = 68 m

Section K-K, L = 63 m } Base concrete, L=63+67 =130m

Section J-J, L = 67 m } Top concrete, L=130-2x22=86 m

Total length for base concrete = 709.234 + 130 = 839.234 m

Total length for top concrete = 709.234 + 86 = 795.234 m

Form work:

a. base concrete = $\left(0.5 + 0.2 + \sqrt{0.20^2 + 0.30^2}\right) \times 839.234$ = 890.054 m²

b. top concrete = (2 x 0.7) x 795.234 = 1113.328 m²

= 2003.382 m²

2. Revetment Type Concrete Sheet Pile, for pile cap:

Section A-A, L = 30 m

Section B-B, L = 254 m

Section F-F, L = 140 m

Section H-H, L = 211.75 m

L = 635.75 m

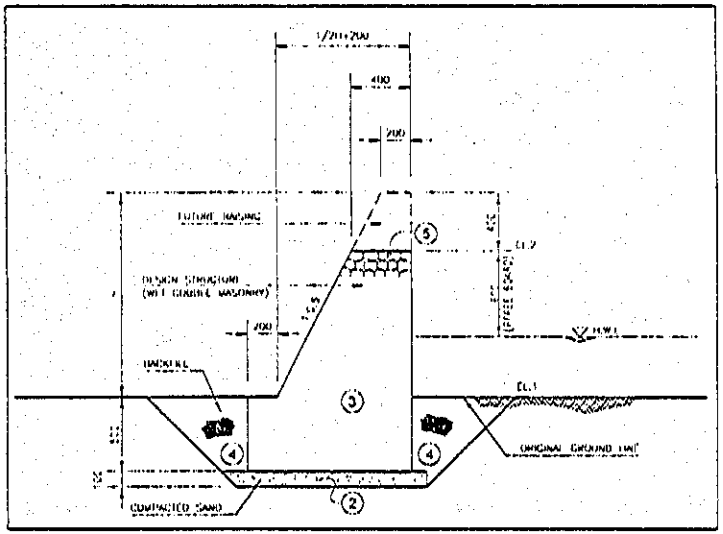
Form work = 2 x 0.30 x 635.75 = 381.45 m²

Name of Structure	DIKE RAISING OF SEMARANG RIVER (ASIN PACK)	Category of calculation	WORKS VOLUME	Page	1 / 2

SUMMARY OF WORK VOLUME

1.	STRUCTURE EXCAVATION	=	236.03	m^3
2.	COMPACTED SAND	=	27.10	m^3
3.	WET COBBLE MASONRY	=	271.45	m^3
4.	BACK FILL	=	116.88	m^3
5.	PLASTERING	=	594.44	m^2
6.	JOINT FILLER	=	13.41	m^2

B5 / P2



Notes :

① STRUCTURE EXCAVATION (m^3)
② COMPACTED SAND (m^3)
③ WET COBBLE MASONRY (m^3)
④ BACKFILL (m^3)
⑤ PLASTER (m^3)
⑥ JOINT FILLER = $\frac{256.89}{20} \times 1.044 \times 13.41 (m^2)$

(EVERY 20 M OF DISTANCE)

STA. (SMR)	DIST. (m)	EL.1 (m)	EL.2 (m)	H1 (m)	H (m)	½H+0.20 (m)	AREA ⑥	VOLUME ①	②	③	④	⑤
21+23	32.62	+0.98	-0.03	1.01	1.41	0.91	1.217	32.62	3.68	38.54	14.51	87.01
23	32.53	+0.98	-0.02	1.00	1.40	0.90	1.2	34.25	3.92	43.23	14.80	95.65
24	32.67	+0.98	-0.23	1.21	1.61	1.01	1.458	33.23	3.74	46.47	14.86	87.77
25	31.22	+0.99	+0.23	0.76	1.16	0.78	1.387	29.32	3.17	35.26	14.21	66.67
26	29.83	+0.99	+0.30	0.69	1.09	0.75	0.872	27.38	2.92	24.85	13.57	58.96
27	39.71	+1.00	+0.39	0.61	1.01	0.71	0.794	36.45	3.89	33.20	18.07	78.92
28	30.23	+1.01	+0.31	0.70	1.10	0.75	0.878	22.52	3.01	27.01	13.75	63.51
29	28.81	+1.01	+0.34	0.67	1.07	0.74	0.852	20.46	2.77	22.89	13.11	55.95
30		+1.01	+0.46	0.55	0.95	0.68	0.737					
TOTAL	256.89						9.395	236.03	27.10	271.45	116.88	594.44

AVERAGE : $\frac{9.395}{9} = 1.044 \ m^2$

Package 2: C Asin River Improvement

Name of Structure	EXCAVATION OF ASIN RIVER	Category Calculation	WORK VOLUME	Page	1/1

SUMMARY OF ASIN RIVER EXCAVATION

1. COMMON EXCAVATION =31,769.371 m^3

CUT and FIIL OF ASIN RIVER

Cross Section LINE	CUT AREA	FILL AREA	Distance	VOLUME CUT (m^2)	VOLUME FILL (m^2)
0					
1			20.790		
2	32.092	3.606	19.205	308.170	34.626
3	32.792	3.332	20.329	659.514	70.521
4	31.235	1.709	18.778	601.155	47.332
5	32.901	1.646	21.341	684.373	35.807
6	29.924	2.135	19.926	625.943	37.680
7	30.080	3.069	20.291	608.779	52.805
8	33.426	3.553	19.325	613.641	63.985
9	29.852	4.299	8.399	265.743	32.974
10	24.047	7.881	12.219	329.279	74.411
11	30.495	7.624	17.444	475.709	135.235
12	29.601	8.706	17.863	536.743	145.851
13	27.035	8.128	7.793	220.693	65.597
14	27.785	6.730	17.831	488.738	132.463
15	22.099	7.321	23.573	587.951	165.609
16	25.318	7.418	20.534	486.825	151.332
17	24.760	8.772	19.716	493.662	159.602
18	24.095	7.668	20.305	496.007	166.911
19	34.786		19.968	587.877	76.563
20	20.054		21.501	589.559	
21	30.709		19.688	499.707	
22	31.969		19.918	624.209	
23	29.942		21.311	659.706	
24	33.433		21.030	666.380	
25	35.776		20.862	721.919	
26	32.410		20.997	715.837	
27	33.171		19.628	643.612	
28	31.883		20.565	668.894	
29	32.060		19.278	616.336	
30	35.256		20.103	676.631	
31	22.379		21.457	618.325	
32	39.365		20.464	631.767	
33	34.977		21.568	801.708	
34	34.741		20.807	725.317	
35	33.569		20.636	704.811	
36	33.512		21.631	725.497	
37	35.028		19.996	685.245	
38	35.151		18.870	662.143	
39	33.731		20.770	715.344	
40	23.413		20.870	596.296	
40+14	45.159		22.108	757.983	
41	40.157		19.324	824.309	
42	12.984	6.942	20.335	540.314	70.586
43	17.227	3.686	19.690	297.427	104.632
44	21.758	3.567	19.635	382.738	71.206
45	10.195	5.011	19.916	318.177	85.423
46	22.015	1.439	21.409	344.779	69.048
47	14.965	1.529	19.171	354.470	28.455
48	14.942	2.087	19.382	289.830	35.050
49	16.632	2.869	20.265	319.932	50.217
49+13	18.870	4.216	22.475	398.955	79.611
50	17.092	2.269	23.475	422.100	76.118
51	18.414	2.400	24.475	434.506	57.137
52	14.266	2.412	25.475	416.258	61.289
53	19.276	1.501	26.475	444.012	51.799
54	14.616	3.452	27.475	465.596	68.039
55	19.775	3.118	28.475	489.647	93.540
56	21.035	3.261	29.475	601.448	94.016
57	21.416	2.135	30.475	646.846	82.214
			TOTAL	31769.3715	2827.68613

Name of Structure	REVETMENT OF ASIN RIVER	Category Calculation	Works Volume	Page	1/25

SUMMARY OF WORK VOLUME

A. REVETMENT TYPE A–2 (LOWER CHANNEL)

1.	STRUCTURE EXCAVATION	=	5501	m^3
2.	BACK FILLING WITH BOULDER	=	626	m^3
3.	BACK FILLING WITH GRAVEL	=	1,914	m^3
4.	CONCRETE, TYPE C1	=	1055	m^3
5.	FORM WORK FOR TYPE C1	=	5,310	m^2
6.	LEVELING CONCRETE, TYPE E	=	294	m^3
7.	FORM WORK FOR TYPE E	=	863	m^2
8.	REINFORCING BAR, U 30	=	50442	Kg
9.	WET STONE MASONRY	=	1,584	m^3
10.	WEEP HOLE, PVC Ø 50	=	2,158	nos
11.	LOG PILE, L = 4,000	=	8,631	m^1
12.	RUBBER JOINT FILLER	=	62	m^2

B. REVETMENT TYPE B (HIGHER CHANNEL)

1.	STRUCTURE EXCAVATION	=	28,036	m^3
2.	BACK FILLING WITH BOULDER	=	2,054	m^3
3.	BACK FILLING WITH GRAVEL	=	4,300	m^3
4.	BACK FILLING WITH SANDY SOIL	=	15,293	m^3
5.	LEVELING CONCRETE, TYPE E	=	642	m^3
6.	FORM WORK FOR CONCRETE TYPE E	=	432	m^2
7.	WET STONE MASONRY	=	8,713	m^3
8.	POINTING	=	1,186	m^2
9.	WEEP HOLE, PVC Ø 50	=	4,316	nos
10.	LOG PILE, Ø 150, L = 4.0 m	=	69,047	m^1

C. REVETMENT TYPE C (CONCRETE SHEET PILE)

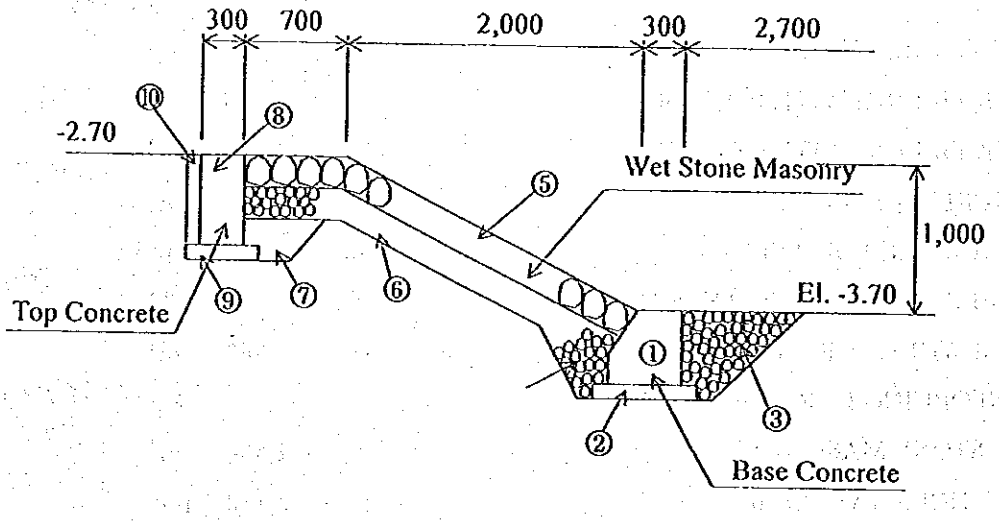
1.	FURNISHING AND DRIVING PC SHEET PILE	=	2,448	m^1
2.	CONCRETE, TYPE C1	=	14	m^3
3.	REINFORCING BAR, SII U 30	=	806	kg

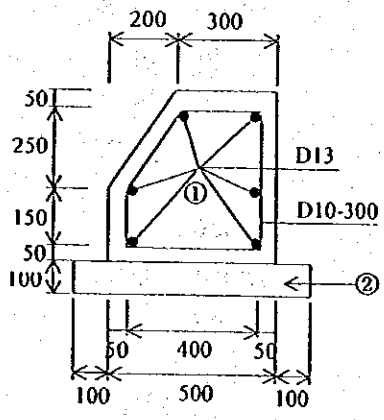
Name of Structure	REVETMENT OF ASIN RIVER	Category Calculation	Works Volume	Page	2/25

C31 I. REVETMENT TYPE A-2 (LOWER CHANNEL)

C.3.1 Structure Excavation

For Left and Right





(1)	$\frac{0.3+0.5}{2}\times 0.3+0.2\times 0.5$	=	0.220
(2)	0.7×0.1	=	0.070
(3)	$\frac{0.2+0.8}{2}\times 0.6-0.1\times 0.1$	=	0.290
(4)	$0.75\times 0.2\times \frac{1}{2}+0.1\times 0.1$	=	0.085
(5)	$\sqrt{2^2+1^2}\times 0.25+0.7\times 0.25$	=	0.734
(6)	$\sqrt{2^2+1^2}\times 0.25+0.6\times 0.25$	=	0.709
(7)	$\frac{(0.3+0.2)+0.2}{2}\times 0.3-0.1\times 0.1$	=	0.095
(8)	0.3×0.7	=	0.210
(9)	0.5×0.1	=	0.050
(10)	0.1×0.7	=	0.070
		=	2.533

FOR CONSTRUCTION JOINT

(2) $0.82\times 0.10 = 0.082\ m^2$

Length of construction joint = 2.95 m /nos.

Left

Length = 1165.32 – 39.31 = 1126.01 m (TL 58 + 5.92 – TL 2)

Right

Length = 1165.32 – 133.48 = 1031.84 m (TL 58 + 5.92 – TL 6+15)

Total of length = 2158.00 m

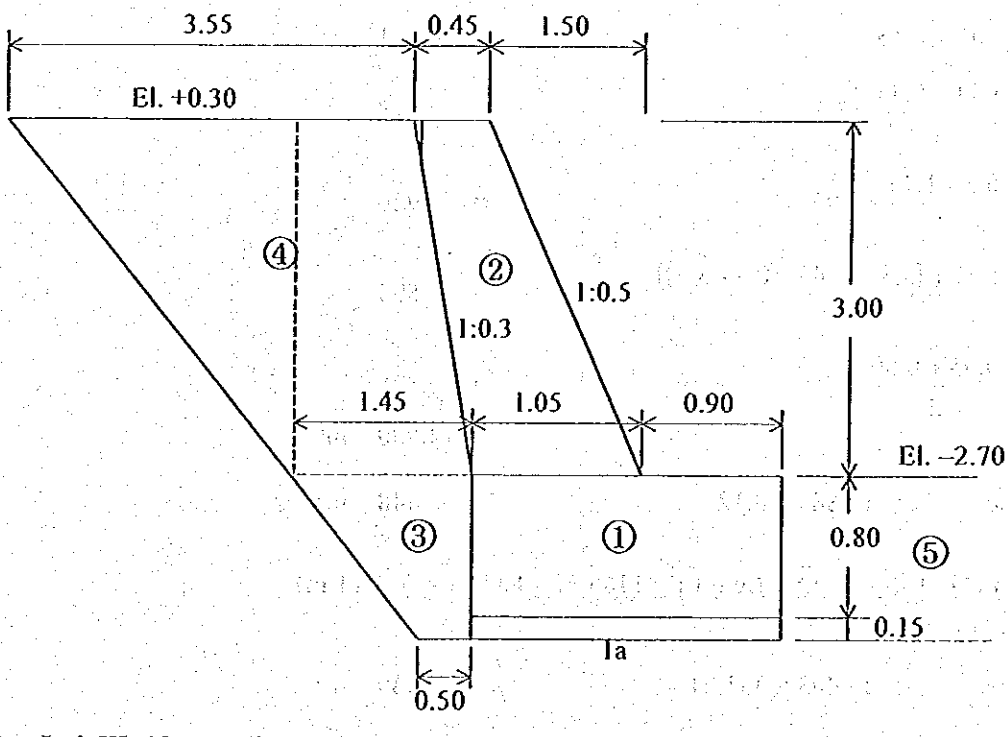
Vol. C.3.1 = $2.533 \times 2158 + 0.082 \times \frac{2158}{15} \times 2.96 = 5501.13$ m³

Form work (C_1) = $\left(2 \times 0.7 + 0.2 + 0.5 + \sqrt{0.3^2 + 0.2^2}\right) \times 2158$ = 5309.88 m²

Form work (E) = $4 \times 0.10 \times 2158$ = 863.2.00 m²

C.4. REVETMENT TYPE B (RIGHT CHANNEL).

C.4.1 Structure Excavation



Left TL.18+5 – TL.33+10 (length = 669.13 – 363.50 = 305.63 m)

H = 3.00; B = 1.05

(1) 2×0.8 = 1.60

(2) 2×0.15 = 0.30

(3) $\frac{1.10 + 0.45}{2} \times 3.250$ = 2.518

(4) $\frac{0.5 + 1.45}{2} \times 0.95$ = 0.926

(5) $\frac{1.45+(3.25+(1.45-0.3\times3.25))}{2}\times3.250$ = 8.409

(6) $\frac{0.95+0.80}{2}\times1$ = 0.825

Volume = 14.628 × 305.63 = 4470 m³

Left TL.33+10 – TL.40+5 (length = 803.99 – 669.13 = 134.86 m)

H = 3.000; B = 1.05

Volume = 13.403 × 134.86 = 1807 m³

Left TL.40+5 – TL.41+15 (length = 834.11 – 803.99 = 30.12 m)

H = 3.300; B = 1.110

(1) $(1.11\times0.9)\times0.8$ = 1.608

(2) 2.01×0.15 = 0.301

(3) $\frac{1.11+0.45}{2}\times3.3$ = 2.518

(4) $\frac{0.5+1.45}{2}\times0.95$ = 0.926

(5) $\frac{1.45+(3.3+(1.45-0.3\times3.3))}{2}\times3.3$ = 8.596

(6) $\frac{0.95+0.80}{2}\times1$ = 0.825

= 14.880 m³

Volume = 14.88 × 30.12 = 448 m³

Left TL.41+15 – TL.ASU (length = 1165.32 – 834.11 = 331.21 m)

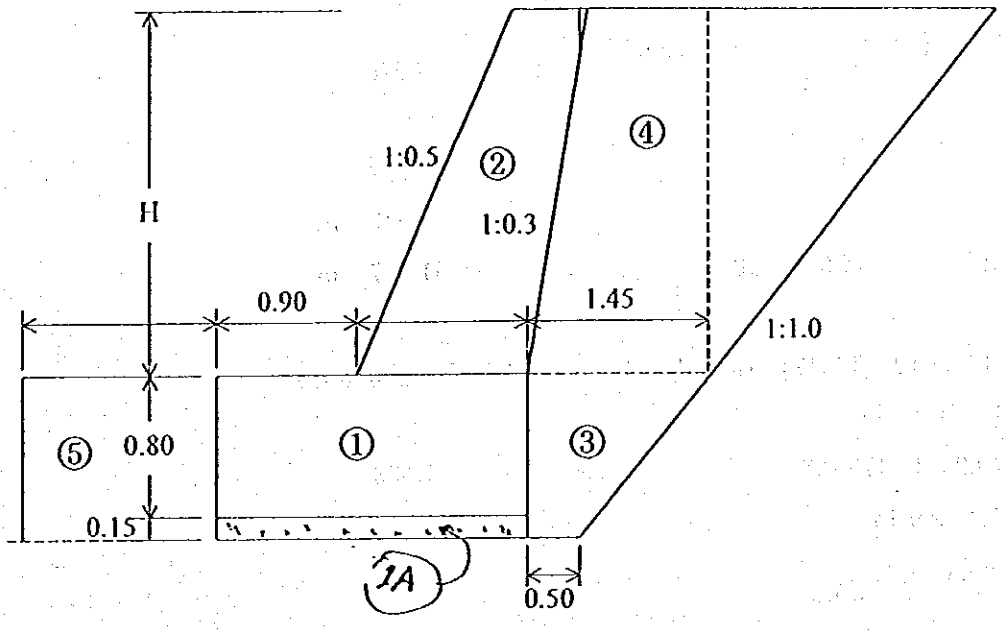
H = 3.000; B = 1.05

Volume = 13.403 × 331.21 = 4.439 m³

TOTAL: 4345 + 4470 + 1807 + 448 + 4439 = 15509 m³

~~L = 324.19 + 305.63 + 30.12 + 331.21 = 991.15 m~~

Name of Structure	REVETMENT OF ASIN RIVER	Category Calculation	Works Volume	Page	5/25



Right TL.6+15 – TL.7+10 (length = 148.29 – 133.48 = 14.74 m)

H = 2.965; B = 1.043

(1) $(1.043 + 0.9) \times 0.8$ = 1.554

(2) $1.943 + 0.15$ = 0.291

(3) $\frac{0.45 + 1.043}{2} \times 2.965$ = 2.213

(4) $\frac{0.5 + 1.45}{2} \times 0.95$ = 0.926

(5) $\frac{1.45 + \left(2.965 + \left(1.45 - 0.3 \times 2.965\right)\right)}{2} \times 2.965$ = 8.409

(7) $\frac{0.95 + 0.80}{2} \times 1$ = 0.875

= 13.236 m³

Volume = 13.236 × 14.74 = 195 m³

Right TL.7+10 – TL.8+10 (length = 168.47 – 148.29 = 20.18 m)

H = 3.40; B = 1.13

(1) $(1.13 + 0.9) \times 0.8$ = 1.624

(2) 2.03×0.15 = 0.304

(3) $\frac{0.45 + 1.043}{2} \times 3.40$ = 2.686

(4) $\frac{0.5+1.45}{2}\times 0.95$ = 0.926

(5) $\frac{1.45+\left(2.965+\left(1.45-0.3\times 2.965\right)\right)}{2}\times 3.40$ = 8.976

(8) $\frac{0.95+0.80}{2}\times 1$ = 0.875

= 15.628 m³

Volume = 15.628 x 20.18 = 315.37 m³

Right TL.8+10 – TL.17+5 (length = 343.35 – 168.47 = 174.88 m)

H = 3.8; B = 1.21

(1) (0.9 x 1.21) x 0.8 = 1.688

(2) 2.11 x 0.15 = 0.316

(3) $\frac{0.45+1.21}{2}\times 3.8$ = 3.154

(4) $\frac{0.5+1.45}{2}\times 0.95$ = 0.926

(5) $\frac{1.45+\left(3.80+1.45-0.3\times 3.8\right)}{2}\times 3.8$ = 10.564

(6) $\frac{0.95+0.80}{2}\times 1$ = 0.875

= 17.378 m³

Volume = 17.378 x 174.88 = 3039 m³

Right TL.17+5 – TL.18+5 (length = 363.50 – 343.35 = 20.15 m)

H = 3.60; B = 1.17

(1) (0.9 x 1.17) x 0.8 = 1.656

(2) 2.07 x 0.15 = 0.310

(3) $\frac{0.45+1.17}{2}\times 3.6$ = 2.916

(4) $\frac{0.5+1.45}{2}\times 0.95$ = 0.926

(5) $\frac{1.45+\left(3.60+1.45-0.3\times 3.6\right)}{2}\times 3.6$ = 9.756

(6) $\frac{0.95+0.80}{2}\times 1$ = 0.875

= 16.439 m³

Volume = 16.439 x 20.15 = 331 m³

Right TL.18+5 – TL.33+10 (length = 669.13 – 363.50 = 305.63 m)

H = 3.25; B = 1.10

Volume = 14.628 × 305.63 = 4470 m³

Right TL.33+10 – TL.45+10 (length = 908.79 – 669.13 = 239.66 m)

H = 3.30; B = 1.11

Volume = 14.88 × 239.66 = 3566 m³

Right TL.45+10 – TL.58+5.92 (length = 1165.32 – 908.79 = 256.53 m)

H = 3.00; B = 1.05

Volume = 13.403 × 256.53 = 3438 m³

TOTAL: 3438 + 3566 + 4470 + 331 + 3039 + 315 + 195 = 15354 m³

TOTAL VOLUME C.4.1 :

15354 + 15508 = 30863 m³ (both side).

L = 14.74 + 20.18 + 174.88 + 20.15 + 305.63 + 239.66 + 256.53

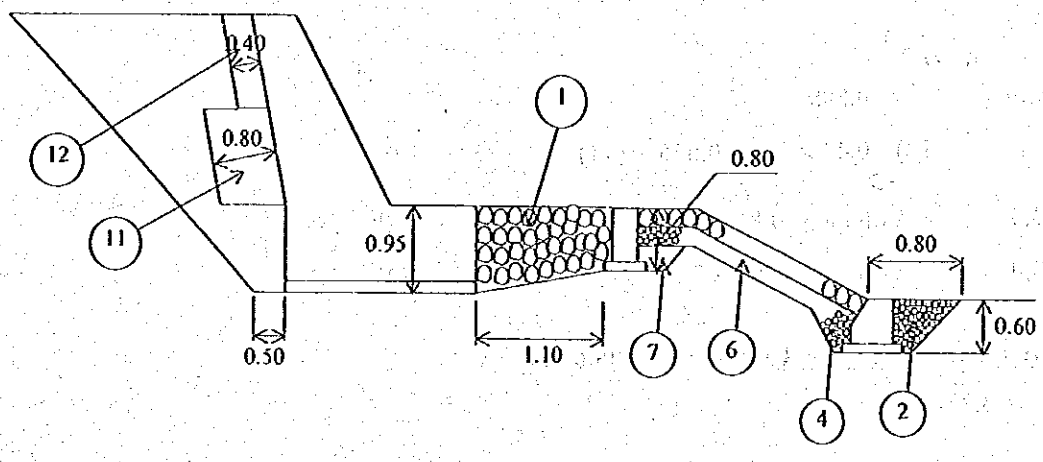
= 1031.77 m

= 991.15 m

= 2022.92 m

Form work (E) = 2 × 0.1 × 2022.92 = 404.584 m²

C.3.2 & C.4.2 Backfilling with Boulder



(1) $\frac{0.95 + 0.80}{2} \times 1.10 - 0.1 \times 0.1$ = 0.952

(2) $\frac{0.8 + 0.2}{2} \times 0.60 - 0.1 \times 0.1$ = 0.290

(1) $\frac{0.95+0.80}{2} \times 1.10 - 0.1 \times 0.1$ = 0.952

(2) $\frac{0.8+0.2}{2} \times 0.60 - 0.1 \times 0.1$ = 0.290

Right TL.6+15 – TL.58+5.92 (length = 1165.32 – 133.48 = 1031.84 m)

Volume C.3.2 = 0.290 × 1031.84 = 299.2 m³

Volume C.4.2 = 0.952 × 1031.84 = 982.3 m³

Left TL.2 – TL.58+5.92 (length = 1165.32 – 39.31 = 1126.01 m)

Volume C.3.2 = 0.290 × 1126.01 = 326.5 m³

Volume C.4.2 = 0.952 × 1031.84 = 1071.9 m³

Total C.3.2 = 299.2 + 326.5 = 625.7 m³

Total C.4.2 = 982.3 + 1071.9 = 2054.2 m³

C.3.3 & C.4.2 Backfilling with Gravel

(4) 0.75 × 0.2 × ½ + 0.1 × 0.1 = 0.085

(6) $\sqrt{2^2+1^2} \times 0.25 + 0.6 \times 0.25$ = 0.709

(7) $\frac{(0.3+0.2)+0.2}{2} \times 0.30 - 0.1 \times 0.1$ = 0.095

C.3.3 = 0.889

(11) 0.85 × 1.50 = 1.275 → C.4.3 + (12)

Left TL.2 – TL.18+5 (length = 324.19 m)

H = 3.0 n

Total = 0.889

(12) 0.43 × 1.5 = 0.645 + (11) = 1.92

C.3.3 Volume = 0.889 × 324.19 = 288 m³

C.3.4 Volume = 1.92 × 324.19 = 622 m³

Left TL.18+5 – TL.33+10 (length = 305.63 m)

H = 3.250 m

Total = 2.164

(12) 0.43 × 1.75 = 0.752 + (11) = 2.027

C.3.3 Volume = 0.889 × 305.63 = 271.7 m³

C.3.4 Volume = 2.0271 × 305.63 = 619 m³

Left TL.33+10 – TL.40+5 (length = 134.86 m)

H = 3 m

C.3.3 Volume = 0.889 × 134.86 = 119.8 m³

C.3.4 Volume = 1.92 × 134.86 = 258.9 m³

Left TL.40+5 – TL.41+15 (length = 30.12 m)

H = 3.300 m

Total = 2.164

(12) 0.43 × 1.8 = 0.774 + (11) = 2.05

C.3.3 Volume = 0.889 × 30.12 = 26.7 m³

C.3.4 Volume = 2.05 × 30.12 = 61.7 m³

Left TL.41+15 – TL.ASU (length = 331.21 m)

H = 3 m C.3.3 volume ; 0.889 × 331.21 = 294.4
C.3.4 volume ; 1.92 × 331.21 = 635.9

C.3.3 Total Volume = 294.4 + 26.7 + 119.8 + 271.7 + 288 = 1001 m³

C.3.4 total Volume = 635.9 + 61.7 + 258.9 + 619 + 622 = 2197 m³

Right TL.6+15 – TL.7+10 (length = 14.74 m)

H = 2.965 m

Total = 2.164

(12) 0.43 × 1.65 = 0.629 + (11) = 1.904

C.3.3 Volume = 0.889 × 14.74 = 13 m³

C.3.4 Volume = 1.964 × 14.74 = ~~38.1~~ 28.06 m³

Right TL.7+10 – TL.8+10 (length = 20.18 m)

H = 3.40 m

Total = 2.164

(12) 0.43 × 1.90 = 0.817 + (11) = 2.092

C.3.3 Volume = 0.889 × 20.18 = 17.9 m³

C.3.4 Volume = ~~1.964~~ 2.092 × 20.18 = 42.2 m³

Right TL.8+10 – TL.17+5 (length = 174.88 m)

H = 3.8 m

Total = 2.164

Name of Structure	REVETMENT OF ASIN RIVER	Category Calculation	Works Volume	Page	10/25

(13) $0.43 \times 2.3 = 0.989 + (11)$ = 2.264

C.3.3 Volume = 0.889×174.88 = 155.5 m³

C.3.4 Volume = 2.264×174.88 = 395.9 m³

Right TL.18+5 – TL.33+10 (length = 300.63 m)

H = 3.25 m

C.3.3 Volume = 0.889×300.63 = 267.3 m³

C.3.4 Volume = 2.027×300.63 = 609.49 m³

Right TL.33+10 – TL.45+10 (length = 239.66 m)

H = 3.30 m

C.3.3 Volume = 0.889×239.66 = 213.06 m³

C.3.4 Volume = 2.049×239.66 = 491.1 m³

Right TL.45+10 – TL.58+5.92 (length = 256.53 m)

H = 3.0 m

C.3.3 Volume = 0.889×256.53 = 228.05 m³

C.3.4 Volume = 1.92×256.53 = 492.5 m³

Total C.3.3 = 228.05 + 213.06 + 267.3 + 18 + 155.5 + 17.9 + 13 = 913 m³

Total B.3.3 = 3015.7 + 3199.3 = 6215 m³

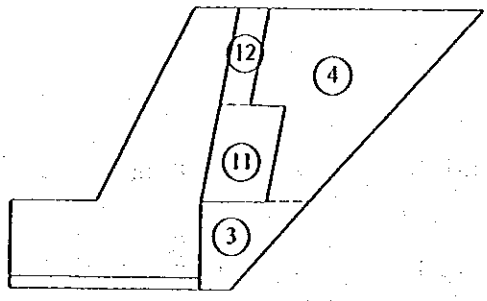
Total C.4.3 = 492.5 + 491.1 + 609.4 + 43.8 + 395.9 + 42.2 + 28.1 = 2103 m³

Total C.3.3 = 913 + 1001 = 1914 m³

Total C.4.3 = 2103 + 2197 = 4300 m³

Name of Structure	REVETMENT OF ASIN RIVER	Category Calculation	Works Volume	Page	11/25

C.4.4 Backfilling with ~~Gravel~~ Sandy Soil.



Left TL.2 – TL.18+5 (length = 363.50 – 39.31 = 324.19 m)

(3)	0.926				
(4)	7.500				
-(11)	1.275				
-(12)	0.645				
	6.506	→ Volume	= 6.506 × 324.19	=	2109.1 m³

Left TL.18+5 – TL.33+10 (length = 305.63 m)

(3)	0.926				
(4)	8.409				
-(11)	1.275				
-(12)	0.752				
	7.308	→ Volume	= 7.308 × 305.63	=	2233.54 m³

Left TL.33+10 – TL.40+5 (length = 134.86 m)

(3)	0.926				
(4)	7.500				
-(11)	1.275				
-(12)	0.645				
	6.506	→ Volume	= 6.506 × 134.86	=	877.4 m³

Left TL.40+5 – 41+15 (length = 30.12 m)

(3)	0.926				
(4)	8.596				
-(11)	1.275				
-(12)	0.774				
	7.474	→ Volume	= 7.474 × 30.12	=	225.1 m³

Left TL.41+15 – TL.ASU (length = 331.21 m)

(3)	0.926
(4)	7.500

Left TL.41+15 – TL.ASU (length = 331.21 m)

(3)	0.926					
(4)	7.500					
-(11)	1.275					
-(12)	0.645					
	6.506	→	Volume	= 6.506 x 331.21	=	2154.8 m³

TOTAL = 2154.8 + 225.1 + 2233.54 + 2109.1 = 7599.9 m³

Right TL.6+15 – TL.7+10 (length = 14.74 m)

(3)	0.926					
(4)	7.377					
-(11)	1.275					
-(12)	0.629					
	6.399	→	Volume	= 6.399 x 14.74	=	94.3 m³

Right TL.7+10 – TL.8+10 (length = 20.18 m)

(3)	0.926					
(4)	8.976					
-(11)	1.275					
-(12)	0.817					
	7.810	→	Volume	= 7.81 x 20.18	=	157.6 m³

Right TL.8+10 – TL.17+5 (length = 174.8 m)

(3)	0.926					
(4)	10.564					
-(11)	1.275					
-(12)	0.989					
	9.226	→	Volume	= 9.226 x 174.8	=	1612.7 m³

Right TL.17+5 – TL.18+5 (length = 20.15 m)

(3)	0.926					
(4)	9.756					
-(11)	1.275					
-(12)	0.903					
	8.504	→	Volume	= 8.504 x 20.15	=	171.3 m³

Right TL.18+5 – TL.33+10 (length = 300.63 m)

(3)	0.926
(4)	8.409

Right TL.33+10 – TL.45+10 (length = 239.66 m)

(3)	0.926					
(4)	8.596					
-(11)	1.275					
-(12)	0.774					
	7.474	→	Volume	= 7.473 x 239.66	=	1790.9 m³

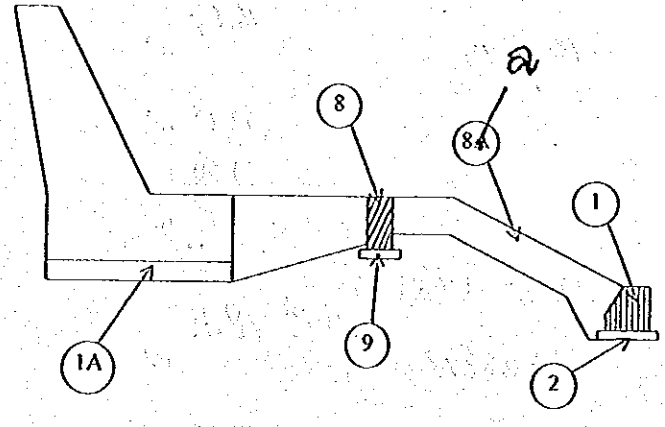
Right TL.45+10 – TL.58+5.92 (length = 256.53 m)

(3)	0.926					
(4)	7.500					
-(11)	1.275					
-(12)	0.645					
	6.506	→	Volume	= 6.506 x 256.53	=	1668.9 m³

Total = 1668.9 + 1790.9 + 2197 + 171.3 + 1612.7 + 157.6 + 94.3 = 7692.7 m³

TOTAL C.4.4 = 7599.9 + 7692.7 = 15,293 m³ ✓

C.3.5 Concrete (C_1)



(8a) Cancestruction joint, length = 2.95 m.
V = 2 x 0.3 x 0.5 x 2.95
= 0.885 m³

Right TL.6+15 – TL.ASU (length = 1165.32 – 133.48 = 1031.84 m)

(8a)		0.885 x (1031.84 / 15)	=	60.9	m³
(1)	0.22 x 1031.84		=	227.0	m³
(8)	0.21 x 1031.84		=	216.6	m³
			=	504.5	m³

left TL.2 – TL.ASU (length = 1165.32 – 39.31 = 1126.01 m)

(8a) $0.885 \times \frac{1126.01}{15}$ = 66.43 m³

(1) 0.22 × 1126.01 = 247.72 m³

(8) 0.21 × 1126.01 = 236.46 m³

Total = 550.61 m³

TOTAL C.3.5 = 504.5 + 550.6 = 1055.11 m³

C.3.6 Leveling Concrete (E) (2a) Construction joint length = 2.95 m

Right TL.6+15 – TL.ASU (length = 1165.32 – 133.48 = 1031.84 m)

(2a) $0.1 \times 0.82 \times 2.95 \times \frac{1031.84}{15}$ = 16.64 m³

(2) 0.07 × 1031.84 = 72.20 m³

(9) 0.05 × 1031.84 = 51.50 m³

Total = 140.34 m³

Left TL.2 – TL.ASU (length = 1165.32 – 39.31 = 1126.01 m)

(2a) $0.1 \times 0.82 \times 2.95 \times \frac{1126.01}{15}$ = 18.16 m³

(2) 0.07 × 1126.01 = 78.80 m³

(9) 0.05 × 1126.01 = 56.30 m³

Total = 153.26 m³

TOTAL C.3.6 = 140.34 + 153.26 = 293.60 m³

C.4.6 Leveling Concrete (E) /Revetment Type B

Left TL.2 – TL.18+5 (length = 363.50 – 39.31 = 324.19 m)

(1a) 0.292 → Volume = 0.292 × 324.19 = 94.660 m³

Left TL.18+5 – TL.33+10 (length = 669.13 – 363.50 = 305.63 m)

(1a) 0.30 → Volume = 0.30 × 305.63 = 91.700 m³

Left TL.33+10 – TL.40+5 (length = 803.99 – 669.13 = 134.86 m)

(1a) 0.292 → Volume = 0.292 × 134.86 = 39.400 m³

Left TL.40+5 – TL.41+15 (length = 834.11 – 803.99 = 30.12 m)

(1a) 0.301 → Volume = 0.301 × 30.12 = 9.066 m³

Left TL.41+15 – TL.ASU (length = 1165.32 – 834.11 = 331.21 m)

(1a) 0.292 → Volume = 0.292 × 331.21 = 96.710 m³

TOTAL ~~C.4.6~~ left = 96.71 + 9.066 + 39.4 + 91.7 + 94.66 = 331.500 m³

Right TL.6+15 – TL.7+10 (length = 148.29 – 133.48 = 14.81 m)

(1a) 0.291 → Volume = 0.291 × 14.74 = 4.300 m³

Right TL.7+10 – TL.8+10 (length = 168.47 – 148.29 = 20.18 m)

(1a) 0.304 → Volume = 0.304 × 20.18 = 6.100 m³

Right TL.8+10 – TL.17+5 (length = 343.35 – 168.47 = 174.88 m)

(1a) 0.316 → Volume = 0.316 × 174.88 = 55.300 m³

Right TL.17+5 – TL.18+5 (length = 363.50 – 343.35 = 20.15 m)

(1a) 0.310 → Volume = 0.310 × 20.15 = 6.200 m³

Right TL.18+5 – TL.33+10 (length = → 669.13 – 363.5 = 305

(1a) 0.300 → Volume = 0.30 × 305.63 = 91.700 m³

Right TL.33+10 – TL.45+10 (length = 908.79 – 669.13 = 239.66 m)

(1a) 0.301 → Volume = 0.301 × 239.66 = ~~72.000~~ 72.10 m³

Right TL.45+10 – TL.ASU (length = 1165.32 – 908.79 = 256.53 m)

(1a) 0.292 → Volume = 0.292 × 256.53 = 75.000 m³

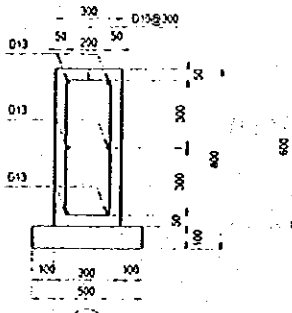
Total = 75 + 72.1 + 91.7 + 6.2 + 55.3 + 6.1 + 4.3 = 310.700 m³

TOTAL C.4.6 = 310.7 + 331.5 = 642.0 m³

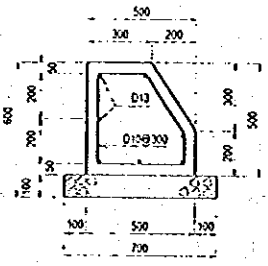
Form work for E = 2 × 0.1 × 2157.85 = 431.57 m²

Name of Structure	REVETMENT OF ASIN RIVER	Category Calculation	Works Volume	Page	16/25

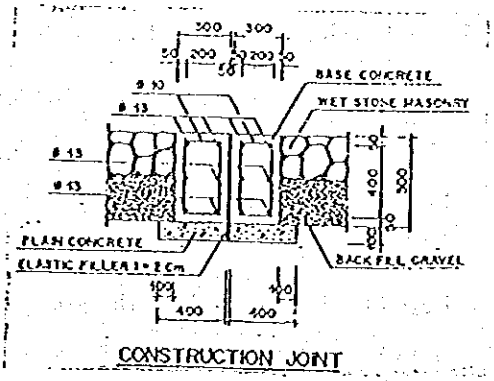
C.3.7 Reinforcing Bar (SII U30)



① TOP CONCRETE TYPE II END WALL



② BASE CONCRETE



③ PARTITION WALL

(1) 6 Ø 13 - 100 cm 6 × 1.04 = 6.24 kg/m'

Ø 10 - 60 × 2 + 20 × 2 + 6 × 2 = 172 cm → 1.72 × 0.617 = 1.061 kg/m'

Right TL 6 + 15 - TL.ASO Left TL.2 – TL.ASO

Left = 1031.84 + 1126.01 = 2157.85 m

Total weight Ø 13 → 6.24 × 2157.85 = 13,465 kg

Ø 10 → $1.061 \times \left(\frac{2157.85}{0.3} + 1\right)$ = 7,630 kg +

= 21,095 kg

(2) 6 Ø 13 - 100 cm 6 × 1.04 = 6.24 kg/m'

Ø 10 - 40 + 22 + 40 + 45 + 6 × 2 = 159 cm → 1.59 × 0.617 = 0.981 kg/m'

Right TL 6 + 15 - TL.ASO Left TL.2 – TL.ASO

Left = 1031.84 + 1126.01 = 2157.85 m

Total weight Ø 13 → 6.24 × 2157.85 = 13,465 kg

Ø 10 → $0.981 \times \left(\frac{2157.85}{0.3} + 1\right)$ = 7,057 kg +

= 20,522 kg

(3) 6 Ø 13 - 100 cm 6 × 1.04 = 6.24 kg/m'

Ø 10 – 2 × 40 + 2 × 20 + 6 × 2 = 132 cm → 1.32 × 0.617 = 0.814 kg

Length : 2.95 m

Distance : 15 m

Ø 13 → 6.24 × (2.95 × + 0.25 + 0.25) = 21.53 kg

Ø 10 → $0.814 \times \left(\frac{2.95}{0.3} + 1\right)$ = 8.95 kg +

= 30.48 kg

Total length : Left & Right = 2157.85 m

= 2 × 30.48 = 60.96 kg/Set

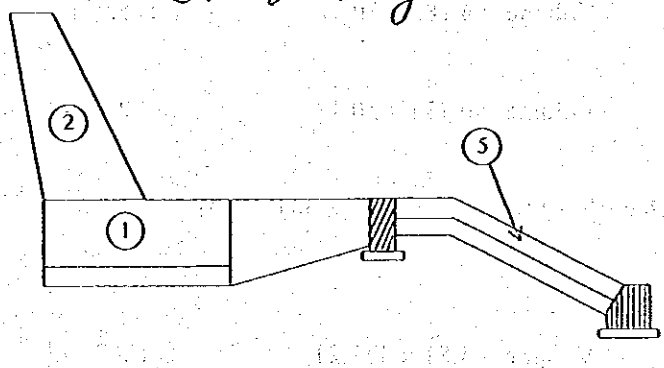
Total weight → $\left(\frac{2157.85}{15}+1\right)\times$ 60.76 : 8830 kg.

TOTAL C.3.7 =

21095 + 20522 + 8830 = 50447 kg.

C.3.8

Wet Stone Masonry.



Left TL.2 – TL.18+5 (length = 363.50 – 39.31 = 324.19 m)

H = 3.00 m; B = 1.05

1235

(1) 1.56
(2) 2.25 } C.4.8 Volume = 3.81 × 324.19 = m³

(5) 0.734 C.3.8 Volume = 0.734 × 324.19 = 237.90 m³ ✓

Name of Structure	REVETMENT OF ASIN RIVER	Category Calculation	Works Volume	Page	18/25

Left TL.18.5 – TL.33+10 (length = 669.13 – 363.50 = . m) 305.63

H = 3.25 m; B = 1.10

(1) 1.60 — C.4.8 Volume = 4.118 × 305.63 = 1258 m³

(2) 2.518

(5) 0.734 C.3.8 Volume = 0.734 × 305.63 = 224.3 m³ ✓

Left TL.33+10 – TL.40+5 (length = 803.99 – 669.13 = 134.86 m)

H = 3.00 m; B = 1.05

(1) 1.56 — C.4.8 Volume = 3.81 × 134.86 = 513.81 m³

(2) 2.25

(5) 0.734 C.3.8 Volume = 0.734 × 134.86 = 98.98 m³ ✓

Left TL.40+5 – TL.41+15 (length = 834.11 – 803.99 = 30.12 m)

H = 3.30 m; B = 1.10

(1) 1.608 — C.4.8 Volume = 4.182 × 30.12 = 125.9 m³

(2) 2.574

(5) 0.734 C.3.8 Volume = 0.734 × 30.12 = 22.1 m³ ✓

Left TL.41+15 – TL.ASO (length = 1165.32 – 834.11 = 331.21 m)

H = 3.00 m; B = 1.05

(1) 1.56 — C.4.8 Volume = 3.81 × 331.21 = 1262 m³

(2) 2.25

(3) 0.734 C.3.8 Volume = 0.734 × 331.21 = 243 m³ ✓

TOTAL C.3.8 = 243 + 22.1 + 98.98 + 224.3 + 237.9 = 826 m^3

TOTAL C.4.8 = 1262 + 125.9 + 513.81 + 1258 + 1235 = 4394 m^3

Right TL.6+15 – TL.7+10 (length = 148.29 – 133.48 = 14.74 m)

H = 2.965 m; B = 1.043

(1) 1.554 — C.4.8 Volume = 3.767 × 14.74 = 55.5 m³

(2) 2.213

(5) 0.734 C.3.8 Volume = 0.734 × 14.74 = 10.8 m³

Right TL.7+10 – TL.8+10 (length = 168.47 – 148.29 = 20.18 m)

H = 3.40 m; B = 1.13

(1) 1.624 — C.4.8 Volume = 4.31 × 20.18 = 86.9 m³

(2) 2.686 —

(5) 0.734 C.3.8 Volume = 0.734 × 20.18 = 14.8 m³

Right TL.8+10 – TL.17+5 (length = 343.35 – 168.47 = 174.86 m)

H = 3.80 m; B = 1.21

(1) 1.688 — C.4.8 Volume = 4.842 × 174.88 = 846.7 m³

(2) 3.154 —

(5) 0.734 C.3.8 Volume = 0.734 × 174.88 = 128 m³

Right TL.17.5 – TL.18+5 (length = 363.50 – 343.35 = 20.15 m)

H = 3.60 m; B = 1.17

(1) 1.656 — C.4.8 Volume = 4.572 × 20.15 = 92.12 m³

(2) 2.916 —

(5) 0.734 C.3.8 Volume = 0.734 × 20.15 = 14.8 m³

Right TL.18+5 – TL.33+10 (length = 669.13 – 363.50 = 305.63 m)

H = 3.25 m; B = 1.10

(1) 1.600 — C.4.8 Volume = 4.118 × 305.63 = 1258 m³

(2) 2.518 —

(5) 0.734 C.3.8 Volume = 0.734 × 305.63 = 224.3 m³

Right TL.33+10 – TL.45+10 (length = 908.79 – 669.13 = 239.66 m)

H = 3.30 m; B = 1.11

(1) 1.608 — C.4.8 Volume = 4.182 × 239.66 = 1002.2 m³

(2) 2.574 —

(5) 0.734 C.3.8 Volume = 0.734 × 239.66 = 175.9 m³

Right TL.45+10 – TL.ASO (length = 1165.32 – 908.79 = 256.53 m)

H = 3.00 m; B = 1.05

(1) 1.560 — C.4.8 Volume = 3.81 × 256.53 = 977.3 m³

(2) 2.25

(3) 0.734 C.3.8 Volume = 0.734 × 256.53 = 188.3 m³

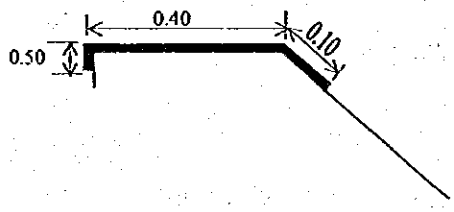
C.3.8 Total = 188.3 + 175.9 + 224.3 + 14.8 + 128 + 14.8 + 10.8 = 757 m³

C.4.8 Total = 977.3 + 1002.2 + 1258 + 92.12 + 846.7 + 86.9 + 55.5 = 4319 m³

TOTAL C.3.8 = 826.1 + 757 = 1584 m³

TOTAL C.4.8 = 4319 + 4394 = 8713 m³

C.4.9 Plastering



Right : TL.6+15 – TL.ASO

Length : 1165.32 – 133.48 = 1031.84

Volume : (0.40+0.1+0.05)×10.31.84 = 567 m²

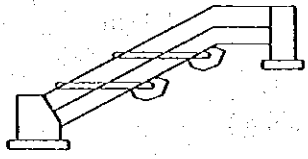
Left TL.2 – TL.ASO (length = 1165.32 – 39.31 = 1126.01 m)

Volume = (0.4 + 0.1 + 0.05) = 1126.01 m

Total C.4.9. = 619 + 567 = 1186 m²

C.3.10 & C.4.10 Weep Hole (PVC)

C.3.10 Low Water Channel



Right : TL.6+15 – TL.ASO

Length : 1165.32 – 133.48 = 1031.84

Volume : $\frac{1031.84}{2} \times 1 \times 2 = 1032$ nos

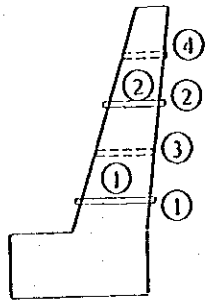
Left TL.2 – TL.ASO (length = 1165.32 – 39.31 = 1126.01 m)

Volume = $\frac{1126.01}{2} \times 1 \times 2 = 1126$ nos

Total C.3.10 = ~~m²~~ 1032 + 1126 = 2158 nos

Name of Structure		Category Calculation	WORK VOLUME	Page	

C.4.10 High Water Channel



(1) 1.15; (2) 0.85; (3) 1.00; (4) 0.70

Right : TL.6+15 – TL.ASO

Length : 1165.32 – 133.48 = 1031.84

Volume : $\frac{1031.84}{2} \times$ ~~0.5~~ 4 = ~~1032~~ 2064 nos

Left TL.2 – TL.ASO (length = 1165.32 – 39.31 = 1126.01 m)

(1) $\frac{1126.01}{2} \times$ ~~1~~ 4 = . -2252 nos.

Total C.4.10. = 2064 + 2252 = 4316 nos

C.4.5 & C.4.7 Sheet Pile

Type C – Revetment

Right : TL.2 - TL.6+15

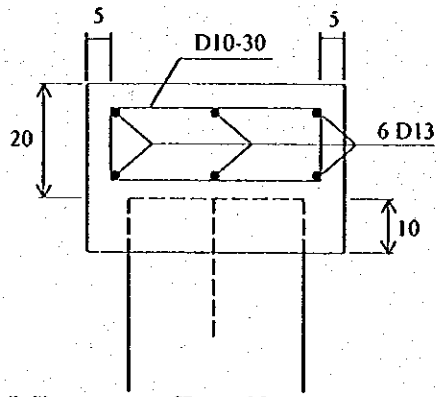
Length : 133.48 – 39.31 = 94.17 m

Pile Cap

Concrete (C_1)

$0.50 \times 0.3 \times 94.17 = 14.12\ m^3$

Reinforcing Bar (SII U30)



$6 \times 1.04 \times 94.17 = 587.6$ kg

$(0.4 \times 2 + 0.1 \times 2 + 6 \times 2) = 1.12$ m

$1.12 \times 0.617 \times \frac{94.17}{0.30} = 217$ kg

Total weight = 217 + 587.6 = 806 kg

C.5 Revetment Type (Concrete Sheet Pile)

Pile Type C

: 13 m × 94.17 = 1224.2 m^2

Volume

C.3.13 Log Pile

* High water channel (Φ150 ; L = 4.0m ; c/c = 0.50 m/.

Left : (TL.2 - TL.ASO)

Length : 1165.32 – 39.31 = 1126.01 m

Number of Log Pile = $\frac{1126.01}{0.50} \times 4 \times 4.0$ = 22,520 m

Right : (TL.6+15 - TL.ASO)

Length : 1165.32 – 133.48 = 1031.8 m

Number of Log Pile = $\frac{1031.8}{0.50} \times 4 \times 4.0$ = 33,017 m

Total of High water channel = 69,047 m ✓

* how water channel (ϕ150 ; L=4.0m ; cte = 1.0 m).

left : (TL.2 – TL.ASO)

length = 1165.32 – 39.31 = 1126.01 m.

Volume of hog fill = $\frac{1126.01}{1.0} \times 1 \times 4.0 = 4504$ m³ 4504.04

Right : (TL 6+15 – TL.ASO)

length = 1165.32 – 133.48 = 1031.8 m.

volume of hog fill = $\frac{1031.8}{1.0} \times 1 \times 4.0 = 4127$ m³ 4127.2

Total of how water ch = 8631 m. 8631

C.3.14 Rubber Joint Filler

Area (8) + (5) + (1) + (2) + (9)

(1) $\frac{0.3 + 0.5}{2} \times 0.3 + 0.2 \times 0.5$ = 0.220

(5) $\frac{2}{\sqrt{2^2 + 1^2}} \times 0.25 + 0.7 \times 0.25$ = 0.734

(8) 0.7×0.3 = 0.210

(2) $0.7 + 0.1$ = 0.070

(9) 0.5×0.1 = 0.050 +

= 1.284

Left : (TL.2 - TL.ASO)

Length : 1165.32 – 39.31 = 1126.01 m

Volume = $\frac{1126.01}{1} \times 1.284$ = 32.1 m

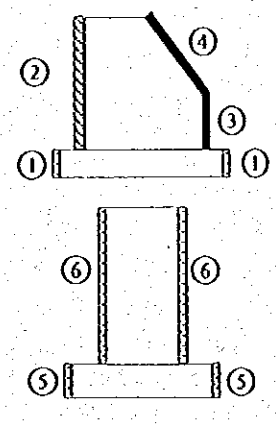
Right : (TL.6+15 - TL.ASO)

Length : 1165.32 – 133.48 = 1031.8 m

Volume = $\frac{1031.8}{45} \times 1.284$ = 29.5 m

= 61.6 m

C.3.16 Form Work



(1) 0.1×2 = 0.20 m

(2) = 0.50 m

(3) = 0.20 m

(4) $\sqrt{0.2^2 + 0.3^2}$ = 0.36 m

(5) 0.1×2 = 0.20 m

(6) 0.7×2 = 1.40 m

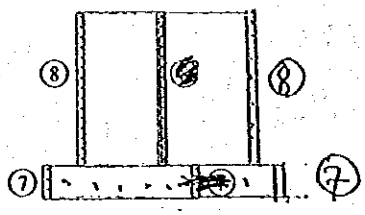
= 2.86 m

Left : length = 1165.32 – 39.31 = 1126.01 m

Right : length = 1165.32 – 133.48 = 1031.8 m

Area : 2.86 × 215.8 = 6172 m²

CONSTRUCTION JOINT



Length of joint : 2.95

(7) 0.1 × 2 = 0.20 m

(8) 0.5 × 2.95 × 2 = 2.95 m

= 3.15 m

Left Side

Length : 1165.32 – 39.31 = 1126.01 m

Number of joint = $\frac{1126.01}{15} + 1 = 76$ m

Right Side

Length : 1165.32 – 133.48 = 1031.84 m

Number of joint = $\frac{1031.8}{15} + 1 = 70$ m

Total = 76 + 70 = 146

Area = 3.15 × 146 = 459.9 m²

Volume C.3.16 : 460 + 6172 = 6632 m²