PACKAGE 3
BANDARHARJO DRAINAGE SYSTEM IMPROVEMENT

Package 3: A General

FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG

Component: Urban Drainage System Improvement

Package 3: Bandarharjo 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	Relocation of Existing Utilities	L.S.	
B	BARU RIVER IMPROVEMENT		
B.1	Preparatory Works		
B.1.1	Coffering and Dewatering	L.S.	
B.1.2	Clearing of Garbage	L.S.	
B.1.3	Demolition of Existing Revetment	L.S.	
B.2	Earthwork		
B.2.1	Common Channel Excavation including Hauling and Treatment of Contaminated Soil	m^3	25,390
B.2.2	Channel Excavation below Water Level including Hauling and Treatment of Contaminated Soil	m^3	4,724
B.2.3	Stripping of Top Soil	m^3	1,436
B.2.4	Embankment	m^3	2,703
B.3	Revetment Type A-3 (wet masonry)		
B.3.1	Structural Excavation	m^3	11,324
B.3.2	Backfill with Cobble	m^3	2,150
B.3.3	Backfill with Gravel	m^3	3,400
B.3.4	Backfill with Sandy Soil	m^3	495
B.3.5	Concrete, Type C1 including Formwork	m^3	1,440
	formwork	m^2	7,156
B.3.6	Concrete, Type E including Formwork	m^3	379
	formwork	m^2	1,198
B.3.7	Deformed Reinforcing Bars	kg	66,143
B.3.8	Wet Stone Masonry	m^3	3,342
B.3.9	Pointing	m^2	12,124
B.3.10	Weep Hole, Dia. 50 mm	No.	4,472
B.4	Revetment Type-C (concrete sheet pile)		
B.4.1	Furnishing and Driving PC Sheet Pile(t=220 mm)	m	5,200
B.4.2	Concrete, Type C1 including Formwork	m^3	8
	formwork	m^2	50
B.4.3	Deformed Reinforcing Bars	kg	2,500
B.5	Inspection Road		
B.5.1	Sand Bedding	m^3	492
B.5.2	Concrete Block Pavement	m^2	8,200
B.5.3	Cement Mortar	m^3	20
B.5.4	Concrete Kerb	m^3	197
B.6	Closing Structure of Baru River		
B.6.1	Coffering and Dewatering	L.S.	
B.6.2	Structural Excavation	m^3	1
B.6.3	Backfill	m^3	1

Item No.	Description	Unit	Quantity
B.6.4	Chipping of Existing Concrete Surface	m^2	10
B.6.5	Concrete, Type C1 including Formwork	m^3	36
	formwork	m^2	37
B.6.6	Concrete, Type E including Formwork	m^3	1
	formwork	m^2	1
B.6.7	Deformed Reinforcing Bars	kg	2,078
B.6.8	Furnishing and Driving Steel Sheet Pile, Type II	m	228
B.7	**Outlet Works of Baru Conveyance Channel**		
B.7.1	Structural Excavation	m^3	226
B.7.2	Backfill with Sandy Soil	m^3	153
B.7.3	Concrete, Type C1 including Formwork, Scaffolding and Falsework	m^3	33
	formwork	m^2	127
	scaffolding	m^2	106
	falsework	m^3	20
B.7.4	Concrete, Type E including Formwork	m^3	2
	formwork	m^2	2
B.7.5	Deformed Reinforcing Bars	kg	2,324
B.7.6	Wet Stone Masonry	m^3	19
B.7.7	Weep Hole, Dia. 50 mm	No.	14
B.7.8	Pointing	m^2	18
B.8	**Outlet Works of Bandarhardjo East Secondary Channel**		
B.8.1	Structural Excavation	m^3	219
B.8.2	Backfill	m^3	131
B.8.3	Concrete, Type C1 including Formwork, Scaffolding and Falsework	m^3	28
	formwork	m^2	119
	scaffolding	m^2	90
	falsework	m^3	31
B.8.4	Concrete, Type E including Formwork	m^3	2
	formwork	m^2	4
B.8.5	Deformed Reinforcing Bars	kg	1,610
B.9	**Secondary Channel Outlet Reconstruction**		
B.9.1	Structural Excavation	m^3	766
B.9.2	Backfill	m^3	643
B.9.3	Concrete, Type C1 including Formwork	m^3	22
	formwork	m^2	123
B.9.4	Concrete, Type E including Formwork	m^3	6
	formwork	m^2	20
B.9.5	Deformed Reinforcing Bars	kg	713
B.9.6	Wet Stone Masonry	m^3	137
B.9.7	Gravel Bedding	m^3	94
B.9.8	Cobble Stone	m^3	3
B.9.9	Weep Hole, Dia. 50 mm	No.	70
B.9.10	Pointing	m^2	365
B.9.11	Log Pile, Dia. 150 mm L=2.0m	m	10
B.9.12	Precast Concrete Pipe, Dia. 800 mm	m	83
B.10	**Bridge Protection**		
B.10.1	Concrete, Type C1 including Formwork	m^3	5
	formwork	m^2	34
B.10.2	Deformed Reinforcing Bars	kg	889
B.10.3	Furnishing and Driving PC Sheet Pile (t=220 mm)	m	570
C	**BARU PUMPING STATION**		
C.1	**Preparatory Works**		
C.1.1	Demolition of Existing Revetment	L.S.	

Item No	Description	Unit	Quantity			
C.2	**Pumping Station**					
C.2.1	Structural Excavation	m^3	855			
C.2.2	Backfill	m^3	151			
C.2.3	Embankment	m^3	880			
C.2.4	Concrete, Type C1 including Formwork, Scaffolding and Falsework	m^3	948			
	formwork	m^2	1,310			
	scaffolding	m^2	1,040			
	falsework	m^3	549			
C.2.5	Concrete, Type E including Formwork	m^3	39			
	formwork	m^2	21			
C.2.6	Secondary Concrete, Type C2	m^3	83			
C.2.7	Deformed Reinforcing Bars	kg	49,094			
C.2.8	Water Stop, 200 mm Wide	m	30			
C.2.9	Furnishing and Driving PC Pile, Dia. 500 mm, Type A	m	2,906			
C.2.10	Furnishing and Driving PC Test Pile, Dia. 500 mm, Type A	m	20			
C.2.11	Furnishing and Driving Steel Sheet Pile, Type II	m	387			
C.2.12	Furnishing and Driving PC Sheet Pile (t=220 mm)	m	916			
C.2.13	Gabion Mattress t=500mm (Galvanized)	m^3	34			
C.2.14	Safety Hand Rail (Type-I)	kg	858			
C.2.15	Safety Hand Rail (Type-II)	kg	481			
C.2.16	Dowel Bar. Dia. 19mm, 1.0m Long (round bar and PVC pipe)	kg	119			
C.2.17	Wet Stone Masonry	m^3	27			
C.2.18	Weep Hole, Dia. 50 mm	No.	15			
C.2.19	Pointing	m^2	38			
C.3	**Pump Mechanical Works**					
C.3.1	Furnishing and Installing Main Pump Units	set	2			
C.3.2	Gear Boxes	set	2			
C.3.3	Diesel Engine Units	set	2			
C.3.4	Fuel Service Tank	set	1			
C.3.5	Fuel Transfer Pump	set	1			
C.3.6	Auxiliary Drainage Pump System	L.S.				
C.3.7	Overhead Crane	set	1			
C.3.8	Piping System	L.S.				
C.3.9	Inspection and Test	L.S.				
C.3.10	Spare Parts	L.S.				
C.3.11	Maintenance Tools	L.S.				
C.4	**Pump Electrical Works**					
C.4.1	Main Control Panel	L.S.				
C.4.2	Local Switch	L.S.				
C.4.3	Inspection and Test	L.S.				
C.4.4	Spare Parts	L.S.				
C.4.5	Maintenance Tools	L.S.				
C.4.6	Control Panel for Auxiliary Drainage Pump	L.S.				
C.4.7	Generator System	L.S.				
C.5	**Inspection Bridges**					
C.5.1	Concrete, Type B including Formwork	m^3	55			
	formwork	m^2	100			
C.5.2	Deformed Reinforcing Bars	kg	2,968			
C.5.3	Safety Hand Rail	kg	40			
C.6	**Fuel Tank**					
C.6.1	Structural Excavation	m^3	621			
C.6.2	Backfill	m^3	512			

Item No	Description	Unit	Quantity			
C.6.3	Concrete, Type C1 including Formwork, Scaffolding and Falsework	m^3	49			
	formwork	m^2	167			
	scaffolding	m^2	133			
	falsework	m^3	62			
C.6.4	Concrete, Type E including Formwork	m^3	3			
	formwork	m^2	3			
C.6.5	Deformed Reinforcing Bars	kg	6,810			
C.6.6	Fuel Tank and Accessories	L.S.				
C.6.7	Grounding	L.S.				
C.7	Parapet Wall					
C.7.1	Structural Excavation	m^3	8			
C.7.2	Backfill with Sandy Soil	m^3	3			
C.7.3	Wet Stone Masonry	m^3	8			
C.7.4	Pointing	m^2	50			
D	BARU PUMPING STATION GATE					
D.1	Gate Pier and Foundation					
D.1.1	Structural Excavation	m^3	336			
D.1.2	Backfill with Sandy Soil	m^3	138			
D.1.3	Concrete, Type C1 including Formwork, Scaffolding and Falsework	m^3	193			
	formwork	m^2	479			
	scaffolding	m^2	345			
	falsework	m^3	202			
D.1.4	Concrete, Type E including Formwork	m^3	9			
	formwork	m^2	4			
D.1.5	Secondary Concrete, Type C2	m^3	9			
D.1.6	Deformed Reinforcing Bars	kg	1650			
D.1.7	Water Stop, 200 mm Wide	m	19			
D.1.8	Dowel Bar. Dia. 19mm, 1.0m long (round bar and PVC pipe)	kg	156			
D.1.9	Furnishing and Driving PC Piles, Dia. 500 mm, Type A	m	339			
D.1.10	Furnishing and Driving Steel Sheet Pile, Type II	m	273			
D.1.11	Gabion Mattress t=500mm (Galvanized)	m^3	18			
D.1.12	Safety Hand Rail (Type-I)	kg	113			
D.1.13	Ladder	L.S.				
D.1.14	Window	L.S.				
D.1.15	Door	L.S.				
D.1.16	Roof Sealings	L.S.				
D.2	Gate Mechanical Works					
D.2.1	Gate Leaf	set	1			
D.2.2	Guide Frame	set	1			
D.2.3	Hoist	set	1			
D.2.4	Stop Log	set	3			
D.2.5	Spare Parts	L.S.	1			
E	BUILDINGS					
E.1	Buildings					
E.1.1	Pump Control Building	L.S.				
E.1.2	Management Office	L.S.				
E.1.3	Garage	L.S.				
E.1.4	Staff House	L.S.				
E.1.5	External Works	L.S.				
F	BARU RETARDING POND					
F.1	Preparatory Works					

Item No	Description	Unit	Quantity			
F.1.1	Coffering and Dewatering	L.S.				
F.2	**Earth Work**					
F.2.1	Common Excavation including Hauling and Spoiling	m^3	30,411			
F.3	**Revetment Type A-4**					
F.3.1	Structural Excavation	m^3	2,832			
F.3.2	Backfill with Cobble	m^3	605			
F.3.3	Backfill with Gravel	m^3	822			
F.3.4	Backfill with Sandy Soil	m^3	241			
F.3.5	Wet Stone Masonry	m^3	822			
F.3.6	Concrete, Type C1 including Formwork	m^3	320			
	formwork	m^2	1,540			
F.3.7	Concrete, Type E including Formwork	m^3	100			
	formwork	m^2	288			
F.3.8	Deformed Reinforcing Bars	kg	12,948			
F.3.9	Pointing	m^2	3,215			
F.3.10	Weep Hole, Dia. 50 mm	No.	482			
F.3.11	Log Pile, Dia. 150 mm L=3.0 m	m	723			
F.3.12	Sodding	m^2	668			
F.4	**Outlet Works of Bandarharjo West Secondary Channel**					
F.4.1	Structural Excavation	m^3	1,120			
F.4.2	Backfill	m^3	271			
F.4.3	Backfill with Gravel	m^3	31			
F.4.4	Cobble Stone	m^3	12			
F.4.5	Concrete, Type C1 including Formwork and Falsework	m^3	37			
	formwork	m^2	94			
	falsework	m^3	77			
F.4.6	Concrete, Type E including Formwork	m^3	5			
	formwork	m^2	18			
F.4.7	Deformed Reinforcing Bars	kg	2,292			
F.4.8	Wet Stone Masonry	m^3	258			
F.4.9	Log Pile, Dia. 150 mm L=2.0 m	m	144			
F.4.10	Weep Hole, Dia. 50 mm	No.	48			
F.4.11	Pointing	m^2	141			
F.4.12	Stop Log (wood)	L.S.				
F.5	**Inlet Works of Baru Conveyance Channel**					
F.5.1	Structural Excavation	m^3	328			
F.5.2	Backfill	m^3	220			
F.5.3	Backfill with Gravel	m^3	42			
F.5.4	Cobble Stone	m^3	6			
F.5.5	Concrete, Type C1 including Formwork, Scaffolding and Falsework	m^3	56			
	formwork	m^2	227			
	scaffolding	m^2	150			
	falsework	m^3	35			
F.5.6	Deformed Reinforcing Bars	kg	3,618			
F.5.7	Concrete, Type E including Formwork	m^3	5			
	formwork	m^2	9			
F.5.8	Wet Stone Masonry	m^3	93			
F.5.9	Log Pile, Dia. 150 mm L=2.0 m	m	90			
F.5.10	Weep Hole, Dia. 50 mm	No.	140			
F.5.11	Pointing	m^2	112			
F.6	**Outlet Works of Future Secondary Channel**					
F.6.1	Structural Excavation	m^3	378			
F.6.2	Backfill	m^3	209			
F.6.3	Backfill with Gravel	m^3	18			

Item No.	Description	Unit	Quantity
F.6.4	Cobble Stone	m^3	6
F.6.5	Concrete, Type C1 including Formwork and Falsework	m^3	15
	formwork	m^2	42
	falsework	m^3	96
F.6.6	Concrete, Type E including Formwork	m^3	2
	formwork	m^2	5
F.6.7	Deformed Reinforcing Bars	kg	837
F.6.8	Wet Stone Masonry	m^3	137
F.6.9	Log Pile, Dia. 150mm L=2.0 m	m	156
F.6.10	Weep Hole, Dia. 50 mm	No.	26
F.6.11	Pointing	m^2	149
F.7	**Inspection Road**		
F.7.1	Stripping of Top Soil	m^3	375
F.7.2	Embankment	m^3	1,517
F.7.3	Aggregate Class A	m^3	403
F.7.4	Aggregate Class B	m^3	555
F.7.5	Sand Bedding	m^3	156
F.7.6	Concrete Block Pavement	m^2	2,600
F.7.7	Cement Mortar	m^3	7
F.7.8	Concrete Kerb	m^3	63
F.7.9	Sodding	m^2	958
G	**BARU CONVEYANCE CHANNEL**		
G.1	**Preparatory Works**		
G.1.1	Coffering and Dewatering	L.S.	
G.2	**Channel Works**		
G.2.1	Structural Excavation	m^3	14,030
G.2.2	Structural Excavation with Shoring	m^3	8,544
G.2.3	Backfill with Sandy Soil	m^3	16,110
G.2.4	Concrete, Type C1 including Formwork, Scaffolding and Falsework	m^3	2,982
	formwork	m^2	10,990
	scaffolding	m^2	6,574
	falsework	m^3	2,768
G.2.5	Concrete, Type E including Formwork	m^3	241
	formwork	m^2	166
G.2.6	Deformed Reinforcing Bars	kg	225,220
G.2.7	Water Stop, 200 mm Wide	m	382
G.3	**Inspection Road**		
G.3.1	Embankment	m^3	1,944
G.3.2	Aggregate Class A	m^3	225
G.3.3	Sand Bedding	m^3	79
G.3.4	Concrete Block Pavement	m^2	1,315
G.3.5	Cement Mortar	m^3	3
G.3.6	Concrete Kerb	m^3	32
H	**BANDARHARHO WEST SECONDARY CHANNEL**		
H.1	**Preparatory Works**		
H.1.1	Coffering and Dewatering	L.S.	
H.2	**Channel Works**		
H.2.1	Common Excavation including Hauling and Spoiling	m^3	11,240
H.2.2	Structural Excavation	m^3	1,968
H.2.3	Backfill with Sandy Soil	m^3	7,849
H.2.4	Cobble Stone	m^3	232

Item No.	Description	Unit	Quantity
H.2.5	Wet Stone Masonry	m^3	3,753
H.2.6	Cement Mortar Plastering	m^3	16
H.2.7	Pointing	m^2	2,399
H.2.8	Weep Hole, Dia. 50 mm	No.	1,433
H.2.9	Water Stop, 200 mm Wide	m	198
H.2.10	Log Pile, Dia. 150mm L=2.0 m	m	6,864
H.3	**Inspection Road**		
H.3.1	Stripping of Top Soil	m^3	347
H.3.2	Embankment	m^3	1,144
H.3.3	Aggregate Class A	m^3	478
H.3.4	Aggregate Class B	m^3	596
H.3.5	Sand Bedding	m^3	174
H.3.6	Concrete Block Pavement	m^2	2,886
H.3.7	Cement Mortar	m^3	7
H.3.8	Concrete Kerb	m^3	63
I	**BANDARHARJO EAST SECONDARY CHANNEL**		
I.1	**Preparatory Works**		
I.1.1	Coffering and Dewatering	L.S.	
I.2	**Channel Works**		
I.2.1	Structural Excavation	m^3	3,136
I.2.2	Backfill with Sandy Soil	m^3	2,455
I.2.3	Concrete, Type C1 including Formwork, Scaffolding and Falsework	m^3	439
	formwork	m^2	1,555
	scaffolding	m^2	1,166
	falsework	m^3	491
I.2.4	Concrete, Type E including Formwork	m^3	36
	formwork	m^2	25
I.2.5	Deformed Reinforcing Bars	kg	32,875
I.2.6	Water Stop, 200 mm Wide	m	65
J	**MISCELLANEOUS WORKS**		
J.1	Tree Planting	L.S.	
J.2	Staff Gauge	L.S.	
K	**MAINTENANCE EQUIPMENT**		
K.1	**Supplying Maintenance Equipment**		
K.1.1	Supply of Backhoe, 0.35m^3	No.	1
K.1.2	Supply of Dump Truck, 8t	No.	1
K.1.3	Supply of Truck Crane, 2.2t	No.	1
K.1.4	Supply of Garbage Container, 6m^3	No.	2

Package 3: B Baru River Improvement

Name of Structure	BARU RIVER	Category Calculation	WORK VOLUME	Page	1 / 11

SUMMARY OF EARTH WORK

1.	Common Channel Excavation	=	25,390 m^3
2.	Channel Excavation below water	=	7,724 m^3
3.	Embankment	=	2,703 m^3

Name of Structure	BARU RIVER	Category Calculation	WORK VOLUME	Page	2 / 11

Cross Section	Cut Area	Fill Area	Distance	Volume Cut (m^2)	Volume Fill (m^2)
BA 21	12.856	0.000	0.000		
BA 22	17.294	0.000	20.790	313.409	0.000
BA 23	25.534	0.000	19.205	411.273	0.000
BA 24	31.278	0.000	20.239	577.474	0.000
BA 25	12.637	0.000	18.778	412.318	0.000
BA 26	33.171	0.000	21.341	488.793	0.000
BA 27	35.080	0.000	19.926	680.004	0.000
BA 28	35.645	0.000	20.291	717.543	0.000
BA 29	45.825	0.000	19.325	787.219	0.000
BA 29+8	34.068	0.000	8.399	335.522	0.000
SUB TOTAL	283.389	0.000		4723.554	0.000
BA 30	29.055	0.000	12.219	385.630	0.000
BA 31	41.668	0.000	17.444	616.840	0.000
BA 32	39.258	0.000	17.863	722.787	0.000
BA 32+11	45.187	0.000	7.793	329.056	0.000
BA 33	33.853	10.389	17.831	704.665	92.623
BA 34	32.098	7.800	23.573	777.327	214.382
BA 35	32.726	6.641	20.534	665.556	148.261
BA 36	35.687	7.262	19.716	674.405	137.056
BA 37	0.000	9.653	20.305	362.310	171.732
BA 38	0.000	0.000	19.968	0.000	96.375
BA 39	0.000	0.000	21.501	0.000	0.000
BA 40	0.000	0.000	19.688	0.000	0.000
BA 41	0.000	0.000	19.918	0.000	0.000
BA 42	33.083	6.428	21.311	352.519	68.494
BA 43	34.371	5.958	21.030	709.266	130.232
BA 44	34.220	5.576	20.862	715.480	120.308
BA 45	34.787	3.641	20.997	724.470	96.763
BA 46	36.287	6.336	19.628	697.533	97.918
BA 47	36.517	5.261	20.565	748.589	119.246
BA 48	36.032	4.506	19.278	699.292	94.142
BA 49	36.490	5.207	20.103	728.958	97.627
BA 50	3.422	5.415	21.457	428.186	113.953
BA 51	41.305	6.258	20.464	457.649	119.445
BA 52	41.763	4.097	21.568	895.816	111.676
BA 53	39.216	4.983	20.807	842.473	94.470
BA 54	43.694	3.594	20.636	855.451	88.499
BA 55	34.960	3.284	21.631	850.672	74.392
BA 56	44.764	2.876	19.996	797.059	61.586
BA 57	42.125	3.004	18.870	819.803	55.476
BA 58	48.020	4.097	20.770	936.169	73.743
BA 59	46.766	2.813	20.870	989.095	72.105
BA 60	50.439	1.128	22.108	1074.484	43.563
BA 61	46.762	0.000	19.324	939.135	10.896
BA 62	37.463	0.943	20.335	856.366	9.591
BA 63	24.945	2.287	19.690	614.409	31.804
BA 64	24.984	0.556	19.635	489.293	27.931
BA 65	24.179	0.611	19.916	488.661	11.641
BA 66	20.679	0.422	21.409	480.182	11.062
BA 67	23.573	0.103	19.171	424.178	5.036
BA 68	30.250	0.000	19.382	521.594	1.000
BA 69	26.119	0.000	20.265	571.162	0.000
BA 70	13.314	0.000	22.4755	443.125	0.000
SUB TOTAL	1279.970	131.132		25389.642	2703.029
TOTAL	1563.358	131.132		30113.196	2703.029

Name of Structure	BARU RIVER REVETMENT	Category Calculation	VOLUME CALCULATION	Page	3 / 11

SUMMARY OF BARU RIVER REVETMENT
TYPE A – 3 / WET MASONRY

1.	STRUCTURE EXCAVATION	=	11,324	m^3
2.	BACK FILL WITH COBBLE	=	2,150	m^3
3.	BACK FILL WITH GRAVEL	=	3,400	m^3
4.	BACK FILL WITH SANDY SOIL	=	495	m^3
5.	CONCRETE TYPE C1	=	1440	m^3
6.	FORM WORK FOR TYPE C1	=	7,156	m^2
7.	LEVELING CONCRETE TYPE E	=	379	m^3
8.	FORM WORK FOR TYPE E	=	1,198	m^2
9.	REINFORCING BAR	=	66,143	Kg
10.	WET STONE MASONRY	=	3,342	m^3
11.	WEEP HOLE PVC ϕ 150	=	4,472	nos.
12.	POINTING	=	12,124	m^2

Name of Structure	BARU RIVER REVETMENT	Category Calculation	VOLUME CALCULATION	Page	4 / 11

REVETMENT TYPE A-3

Area for Cross Section:

1. Wet Stone Masonry:

0.25 x (0.70 + 6.93) + 0.25 x (0.7 + 2.2)	=	2.575 m^2
For left and right	=	5.27 m^2
Length of Revetment Type A-3	=	634 m (From P_{39} to P_{70})
Volume of Wet Masonry	=	5.27 x 634 = 3,342.02 m^3

2. Back Filling with Boulder

1. (0.5 x 1) / 2	=	0.25 m^2
2. 0.5 x 0.3	=	0.15 m^2
3. (0.3 x 1.1 + (1.1 x 1.1) / 2	=	0.935 m^2
4. (0.3 x 0.60 + (0.6 x 0.6) / 2	=	0.360 m^2
Sub Total	=	1.695 m^2
Total = 2 x 1.695	=	3.39 m^2
Length of Revetment Type A-3	=	634 m
Volume of Back Filling with Boulder		
3.39 x 634 m	=	2,150 m^3

3. Gravel Filling

1. 0.25 x (0.7 + 6.93) + 0.25 x (0.70 x 2.2) x 2	=	5.27 m^2
2. (0.3 x 0.6) / 2 x 2 x 2	=	0.36 m^2
Total	=	5.63 m^2
Volume of Gravel Filling = 5.63 x 634	=	3,399.09 m^3

4. Concrete

1. Top Concrete		
(0.7 x 0.3) x 2	=	0.42 m^2
2. Base Concrete		
((0.3 + 0.5) / 2 x 0.3 + 0.2 x 0.5) x 2	=	0.50 m^2
Total 1 & 2	=	0.92 m^2
For Left and Right = 0.92 x 2	=	1.84 m^2
Length of Structure	=	634 m
Volume = 634 x 1.84	=	1,166.85 m^3

3. For Construction Joint

0.3 x 0.5 x 2 = 0.30 m^2

Length of Construction Joint

0.7 + 6.93 + 0.7 + 2.23 = 10.60 m

Volume of Construction Joint

0.30 x 10.6 = 3.18 m^3

For Left and Right = 3.18 x 2 = 6.36 m^3

Length of Revetment = 634 m

Number of Construction Joint

634 / 15 + 1 = 43 nos.

Total Volume of Construction Joint

6.36 x 43 = 273.48 m^3

Total Concrete C1

1,166.85 + 273.48 = 1,440.33 m^3

5. Leveling Concrete

1. For Top Concrete

(0.1 x 0.5) x 2 = 0.10 m^2

2. For Base Concrete

(0.1 x 0.7) x 2 = 0.14 m^2

Total 1 & 2 = 0.24 m^2

For Left and Right = 0.48 m^2

Length of Revetment = 634 m

Volume Concrete

634 x 0.48 = 304.3 m^3

3. For Construction Joint

0.1 x 0.82 x 10.60 = 0.869 m^3

For Left and Right = 0.869 x 2 = 1.738 m^3

Length of Revetment = 634 m

Number of Construction Joint

634 / 15 + 1 = 43 nos.

Volume Concrete

43 x 1.738 = 74.75 m^3

Total Volume of Leveling Concrete

304.3 + 74.75 = 379.05 m^3

Name of Structure	BARU RIVER REVETMENT	Category Calculation	VOLUME CALCULATION	Page	6 / 11

6. Reinforcing

1. For Top Concrete (per m)

(6 D13) x 1.04 x 1 m	=	6.24	kg
(3.33 D10) x 0.56 x 1.7 m	=	3.2	kg
Total	=	9.41	kg/m
Length = 634 x 4	=	2,536	m
Volume = 2,536 x 9.41	=	23,864.2	kg

2. For Base Concrete (per m)

(6 D13) x 1.04 x 1.00	=	6.24	kg
(3.33 D10) x 0.56 x 2.00	=	3.73	kg
Total	=	9.97	kg/m
Length = 634 x 4	=	2,536	m
Volume = 2,536 x 9.97	=	25,282.91	kg

3. For Construction Joint (per m)

(6 D13) x 1.04 x 1 m x 2	=	12.48	kg
(3.33 D10) x 0.617 x 1.5 m x 2	=	6.164	kg
Total	=	18.644	kg/m
Length of Construction Joint	=	10.60	m
Volume = 10.6 x 18.644 kg	=	197.63	kg
Number of Construction Joint = 43 x 2	=	86	nos.
Volume = 86 x 197.63 kg	=	16,995.87	kg
Total Volume of Reinforcing	=	66,142.98	kg

7. Sandy Soil

1. (0.80 + 0.2) / 2 x 0.6	=	0.30	m^2
2. (0.40 + 0.2) / 2 x 0.3	=	0.09	m^2
Total	=	0.39	m^2
Length of Revetment	=	634	m
v = 0.39 x 634 x 2	=	495	m^3

8. Weep Hole (52 holes / 15 m)

Length of Revetment	=	634	
Number of hole = 2 x 634/15 x 52	=	4,472	nos.

Name of Structure	BARU RIVER REVETMENT	Category Calculation	VOLUME CALCULATION	Page	7 / 11

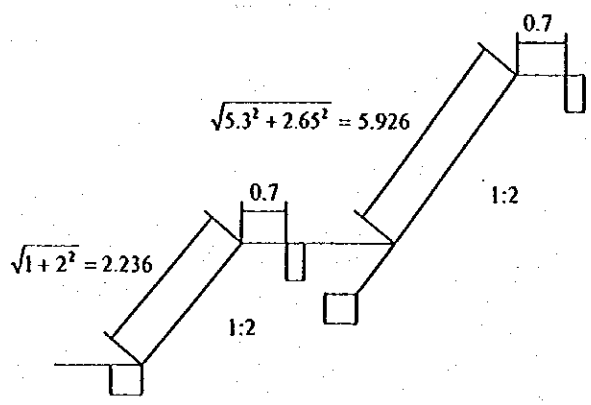
9. Plastering:

1.2 x 2 x 634 = 1,521.6 m^2

(For Top of Revetment)

Name of Structure	BARU RIVER REVETMENT	Category Calculation	FORM WORK VOLUME	Page	8 / 11

10. Pointing



Total Wide = 2.236 + 5.926 + 0.7 + 0.7 = 9.562 m

Length of Revetment = 634 m

Area = 9.562 x 2 x 634 = 12,124.6 m^2

11. Form work Type E

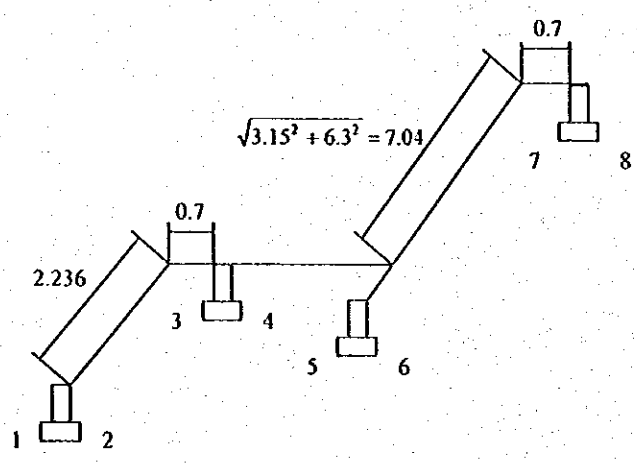
Form I

0.1 x 8 x 634 x 2 = 1,014 m^2

Form II

2 x (634/15 + 1) x (2.236 + 0.7 + 7.04 + 0.7) x 0.1 x 2

= 2 x 43 x 10.676 x 0.1 x 2 = 183.62 m^2



Total = 1,014 + 183.62 = 1197.63 m^2

12. Structural Excavation

Back Filling with Cobble = 2,150 m^3

Back Filling with Gravel = 3,400 m^3

Wet Stone Masonry = 3,342 m^3

Concrete (C1) = 1,303 m^3

Leveling Concrete (E) = 350 m^3

Sandy Soil = 495 m^3

Total = 11,040 m^3

13. Form work Type C1

1. Top Concrete

0.70 x 2 x 2 = 2.8 m^2

2. Base Concrete

$(0.5 + 0.2 + \sqrt{0.2^2 + 0.3^2}\} \times 2$ = 2.12 m^2

Total = 4.92 m^2

For Left and Right = 4.92 x 2 x 634 = 6,238.5 m^2

3. Construction Joint

0.5 x (0.7 + 2.236 + 0.7 + 7.04) x 2 = 10.676 m^2

0.5 x 10.676 x 2 = 10.676 m^2

For Left and Right = 10.676 x 2 x (634/15 + 1) = 918.14 m^2

Total Form work Type C = 6,238.5 + 918.14 = 7,156.64 m^2

Name of Structure	INSPECTION ROAD OF BANDARHARJO DRAINAGE SYSTEM	Category Calculation	Volume Calculation	Page	1 / 4

SUMMARY OF WORK VOLUME

I.	BARU RIVER			
1.	SAND BEDDING	=	492	m^3
2.	CONCRETE CONBLOCK	=	8,200	m^2
3.	CEMENT MORTAR	=	20	m^3
4.	CONCRETE KERB	=	197	m^3
II.	BARU CONVEYANCE CHANNEL			
1.	EMBANKMENT	=	1,944	m^3
2.	SAND BEDDING	=	79	m^3
3.	CONCRETE CONBLOCK	=	1,315	m^2
4.	CEMENT MORTAR	=	3	m^3
5.	CONCRETE CURB	=	32	m^3
6.	AGGREGATE CLASS A	=	225	m^3
III.	BARU RETARDING POND			
1.	STRIPPING	=	375	m^3
2.	EMBANKMENT	=	1,517	m^3
3.	SODDING	=	958	m^2
4.	AGGREGATE CLASS A	=	403	m^3
5.	AGGREGATE CLASS B	=	555	m^3
6.	SAND BEDDING	=	156	m^3
7.	CONCRETE CONBLOCK	=	2,600	m^2
8.	CEMENT MORTAR	=	7	m^3
9.	CONCRETE CURB	=	63	m^3
IV.	BANDARHARJO WEST SECONDARY CHANNEL			
1.	STRIPPING	=	347	m^3
2.	EMBANKMENT	=	1,144	m^3
3.	AGGREGATE CLASS A	=	438	m^3
4.	AGGREGATE CLASS B	=	596	m^3
5.	SAND BEDDING	=	174	m^3
6.	CONCRETE CONBLOCK	=	2,885	m^2
7.	CEMENT MORTAR	=	7	m^3
8.	CONCRETE CURB	=	63	m^3

Name of Structure	INSPECTION ROAD OF BANDARHARJO DRAINAGE SYSTEM	Category Calculation	Volume Calculation	Page	2 / 4

1. BARU RIVER

Length of Inspection Road, L=1,640 m (both side).

A. Sand Bedding = 5 x 0.06 x 1,640 = 492 m^3

B. Concrete Block = 5 x 1,640 = 8,200 m^2

C. Cement Mortar = 2 x 0.2 x 0.03 x 1,640 = 19.68 m^3

D. Concrete Kerb = 2 x 0.3 x 0.2 x 1,640 = 196.8 m^3

2. BARU CONVEYANCE CHANNEL

A. Sta. 0.00 to sta. 263.00 (Concrete Block Pavement)

A.1 Embankment (0.27 m thick)

0.27 x 6.93 x 263 + 2 x (1.0 + 1.43) / 2 x 0.43 x 263 = 766.91 m^3

A.2 Sand Bedding = 5 x 0.06 x 263 = 78.90 m^3

A.3 Concrete Block = 5 x 263 = 1315 m^2

A.4 Cement Mortar = 2 x 0.2 x 0.03 x 263 = 3.16 m^3

A.5 Concrete Kerb = 2 x 0.3 x 0.2 x 263 = 31.56 m^3

B. Sta. 263.00 to sta. 545.00 (Aggregate Pavement)

B.1 Embankment (0.55 m thick / 7.0 m width)

0.55 x 7.0 x 282 + 2 x (1.0 + 1.15) / 2 x 0.15 x 282 =1,176.65 m^3

B.2 Aggregate Class A = 0.15 x 5.30 x 282 = 224.19 m^3

C. Total of Baru Conveyance Channel

C.1 Embankment = 766.91 + 1,176.65 =1,943.56 m^3

C.2 Sand Bedding = 78.90 m^3

C.3 Concrete Block = 1315 m^2

C.4 Cement Mortar = 3.16 m^3

C.5 Concrete Kerb = 31.56 m^3

C.6 Aggregate Class A = 224.19 m^3

3. BARU RETARDING POND

Length of Inspection Road, L=520 m.

A. Stripping (0.10 m thick)

0.10 x 7.2 x 520 = 374.4 m^3

B. Embankment (0.27 m thick)

0.27 x 6.93 x 520 + 2 x (1.0 + 1.43) / 2 x 0.43 x 520 =1,516.32 m^3

C. Sodding

$(\sqrt{0.6^2 + 1.2^2} + 0.5) \times 520$ = 957.65 m^2

D. Aggregate Class A

0.15 x 5.16 x 520 = 402.48 m^3

E. Aggregate Class B

0.20 x 5.33 x 520 = 554.32 m^3

F. Sand Bedding = 5 x 0.06 x 520 = 156 m^3

G. Concrete Block = 5 x 520 = 2,600 m^2

H. Cement Mortar = 2 x 0.2 x 0.03 x 520 = 6.24 m^3

I. Concrete Kerb = 2 x 0.3 x 0.2 x 520 = 62.4 m^3

4. BANDARHARJO WEST SECONDARY CHANNEL

Length of Inspection Road, L=577 m.

A. Stripping (0.10 m thick)

0.10 x 6.0 x 577 = 346.2 m^3

B. Embankment (0.27 m thick)

0.27 x 6.0 x 520 + 1 x (1.0 + 1.43) / 2 x 0.43 x 577 =1,143.85 m^3

C. Aggregate Class A

0.15 x 5.06 x 577 = 437.94 m^3

D. Aggregate Class B

0.20 x 5.16 x 577 = 595.46 m^3

E. Sand Bedding = 5 x 0.06 x 577 = 173.10 m^3

F. Concrete Block = 5 x 577 = 2,885 m^2

G. Cement Mortar = 2 x 0.2 x 0.03 x 577 = 6.92 m^3

H. Concrete Kerb = 2 x 0.3 x 0.2 x 577 = 69.24 m^3

5. BANDARHARJO WEST SECONDARY CHANNEL

Inspection Road includes Baru River.

Name of Structure	CLOSING STRUCTURE OF BARU RIVER	Category Calculation	VOLUME CALCULATION	Page	1 / 4

RESUME OF VOLUME CALCULATION

CLOSING OF BARU RIVER

1.	STRUCTURE EXCAVATION	=	0.64 m^3
2.	BACK FILLING GRAVEL	=	0.19 m^3
3.	CONCRETE (C1)	=	36.192 m^3
4.	CONCRETE LEVELING	=	0.444 m^3
5.	REINFORCING BAR	=	2,078 Kg
6.	STEEL SHEET PILE (TYPE 2)	=	227.50 m'
7.	FORM WORK (TYPE C1)	=	37.12 m^2
8.	FORM WORK (TYPE E)	=	0.74 m^2

Name of Structure	CLOSING STRUCTURE OF BARU RIVER	Category Calculation	VOLUME CALCULATION	Page	2 / 4

CLOSING STRUCTURE OF BARU RIVER

1. STRUCTURE EXCAVATION

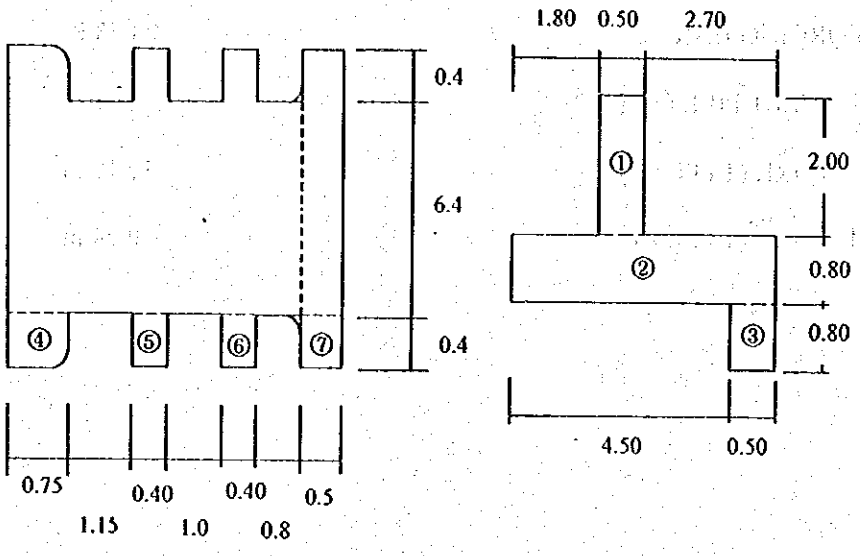
   Length of excavation = 8.00 m

   Volume = 0.80 x 0.1 x 8 = 0.64 m^3

2. BACKFILLING GRAVEL

   Volume = (0.2 x 0.3) / 2 x 7.4 x 0.1 = 0.185 m^3

3. BACKFILLING GRAVEL



   ① 0.5 x 2 x 6.40 = 6.400 m^3

   ② 0.8 x 6.4 x 5.00 = 25.60 m^3

   ③ 0.8 x 6.4 x 0.5 = 2.56 m^3

   ④ 0.75 x 0.4 x 0.80 x 2 = 0.48 m^3

   ⑤ & ⑥ 0.40 x 0.40 x 0.8 x 4 = 0.512 m^3

   ⑦ 0.4 x 0.5 x 1.6 x 2 = 0.64 m^3

   Total Volume = 36.192 m^3

4. Concrete Leveling (Type E)

   0.10 x 0.60 x 7.4 = 0.444 m^3

   Form work = 0.1 x 7.4 = 0.74

5. Reinforcing Bar = 2.078 kg

6. Steel Sheet Pile (Type 2)

   7 / 0.4 x 13 = 227.5 m'

Name of Structure	CLOSING STRUCTURE OF BARU RIVER	Category Calculation	VOLUME CALCULATION	Page	3 / 4

7. FORM WORK

1. 0.80 x 7.20 = 5.76 m^2
2. 2.00 x 6.40 = 12.80 m^2
3. 2.00 x 6.40 = 12.80 m^2
4. 0.80 x 7.20 = 5.76 m^2

Total Form work = 37.12 m^2

Name of Structure	OUTLET STRUCTURE OF BARU CONVEYANCE CHANNEL	Category of calculation	WORK VOLUME	Page	1 / 7

WORK VOLUME OF OUTLET STRUCTURE OF BARU CONVEYANCE CHANNEL

1.	EXCAVATION STRUCTURE	=	225.85	m^3
2.	LEVELING CONCRETE (E)	=	2.07	m^3
3.	CONCRETE (C1)	=	33.35	m^3
4.	WET COBBLE MASONRY	=	18.95	m^3
5.	BACK FILL	=	152.90	m^3
6.	STEEL REINFORCING	=	2,324	ton
7.	FORM WORK FOR CONCRETE TYPE E	=	2	m^2
8.	FORM WORK FOR CONCRETE TYPE C1	=	127	m^2
9.	SCAFFOLDING	=	106	m^2
10.	FALSE WORK	=	20	m^3

Name of Structure	OUTLET STRUCTURE OF BARU CONVEYANCE CHANNEL	Category of calculation	WORK VOLUME	Page	2 / 7

1. Excavation of structure

   a. Box Culvert

   $\frac{2.9 + 5.6}{2} \times 0.8$ = 3.40

   $\frac{5.6 + 8.9}{2} \times 2.9$ = 21.03

   24.43 m^2

   l = 2.5 + 3.14 + 1.5 = 7.14 m

   V = 24.43 x 7.14 = 174.430 m^3

   b. Trench

   $\frac{3.7 + 5.6}{2} \times 1.4$ = 7.14 m^2

   l = 7.2 m

   v = 7.14 x 7.2 = 51.41 m^3

   Excavation volume = 174.43 + 51.41 = 225.84 m^3

2. Leveling Concrete

   2.9 x 0.1 x 7.14 = 2.07 m^3

3. Concrete K.225

   a. Box Culvert

   2 x 2.75 x 0.35 = 1.925

   2.0 x 0.35 = 0.70

   2.0 x 0.4 = 0.80

   4 x $\frac{0.15 + 0.15}{2}$ = 0.045

   3.47 m^2

   ℓ = 7.14 m

   V = 3.47 x 7.14 = 24.78 m^3

   b. Wing wall

   $\frac{5 + 7}{2} \times 1$ = 6.0

   7 x 3.6 = 25.2

   31.2 m^2

   2.7 x 2.75 = 7.425 m^2

   23.775 m^2

   t = 0.35 m

   V = 0.35 x 23.775 = 8.32 m^3

$\frac{0.25 \times 0.25}{2}$ x (2 x 2.75 + 2.7) = 0.25 m^3

= 8.57 m^3

V of concrete K.225 = 24.78 + 8.57 = 33.35 m^3

4. Masonry

a. Tranch

$0.3 \times 2 \times \sqrt{1.1^2 + 1.1^2}$ = 0.933 m^2

0.3 x 3.7 = 1.111 m^2

0.3 x (7 – 2 x 1.1 – 3.7) = 0.33 m^2

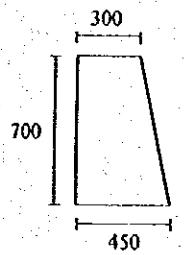
2.374 m^2

ℓ = 7.2 m

V = 7.2 x 2.374 = 17.09 m^3

b. Edge Road

$\frac{0.3 + 0.45}{2}$ x 0.7 = 0.263 m^2



ℓ = 7 m

V = 7 x 0.263 = 1.84 m^3

Total V = 17.09 + 1.84 = 18.93 m^3

5. Back fill

V = 1 – V . box – 4.a

V . box = 2.7 x 2.75 = 7.425 m^2

2.9 x 0.1 = 0.29 m^2

7.715 m^2

ℓ = 7.14 m

V = 7.14 x 7.715 = 55.085 m^3

225.84 – 55.85 – 17.09 = 152.90 m^3

6. Steel Reinforcing

a. Normal Section (See Table) x (ℓ= 2.5 m)

V = 248.748 x 2.5 = 621.87 kg

b. Curve Section & wing wall

See Table V = 1702.03 kg

V = 621.87 + 1702.03 = 2323.90 kg

Name of Structure	OUTLET STRUCTURE OF BARU CONVEYANCE CHANNEL	Category of calculation	WORK VOLUME	Page	4 / 7

7. Form Work

a. Wing Wall

$7.0 \times 4.6 - (2.0 \times 2.0) = 28.20\ m^2$

$1.10 \times 7.0 + (2 \times 1.90 \times 3.5) = 21.00\ m^2$

$0.50 \times 3.20 = 1.60\ m^2$

$0.35 \times 7.0 + (2 \times 0.35 \times 3.7) = 5.04\ m^2$

$(\sqrt{0.25^2 + 0.25^2}) \times (2 \times 2.875 + 2.95) = 3.076\ m^2$

Total a $= 58.916\ m^2$

b. Box Culvert

$(2 \times 1.5 + 2 \times 0.9 + 1.021 + 5.262) \times 2.75 = 30.478\ m^2$

$(2 \times 1.5 + 2 \times 0.9 + 1.571 + 4.712) \times 1.70 = 18.841\ m^2$

$(1.5 + 3.141 + 0.9) \times 1.70 = 9.420\ m^2$

$4 \times (2 \times 1.5 + 2 \times 0.9 + 1.57 + 4.712) \times \sqrt{0.15^2 + 0.15^2} = 9.404\ m^2$

Total b $= 68.143\ m^2$

Total a & b $= 127.059\ m^2$

Form Work

Leveling Concrete (Type E)

$0.1 \times (1.5 + 3.141 + 0.9) \times 3.4 = 1.88\ m^2$

Pointing

$(\sqrt{1^2 + 1^2} \times 5.2) \times 2 = 14.71\ m^2$

$\frac{\sqrt{1^2 + 1^2} \times 2)}{2} \times 2 = 2.82\ m^2$

Total Pointing $= 17.53\ m^2$

Name of Structure	SCAFFOLDING AND FORM SUPPORT, FOR BANDAR-HARJO DRAINAGE SYSTEM	Category of calculation	WORK VOLUME	Page	5 / 7

SUMMARY SCAFFOLDING AND FORM SUPPORT VOLUME, FOR BANDARHARJO DRAINAGE SYSTEM

No.	VOLUME / STRUCTURE	SCAFFOLDING (m^2)	FORM SUPPORT (m^3)
1	BARU PUMPING STATION	1,049	549
2	BARU PUMPING STATION GATE	350	120
3	BARU CONVEYANCE CHANNEL	6,574	2,768
4	BARU CONVEYANCE CHANNEL INLET STRUCTURE	150	35
5	BARU CONVEYANCE CHANNEL OUTLET STRUCTURE	106	20
6	BANDARHARJO EAT SECONDARY CHANNEL	1,166	491
7	BANDARHARJO EAST SECONDARY CHANNEL OUTLET STRUCTURE	90	31
8	BARU RETARDING POND INLET STRUCTURE No. 1	-	77
9	BARU RETARDING POND INLET STRUCTURE No. 2	-	42
10	FUEL TANK BOX FOR BARU PUMPING STATION	133	62
TOTAL		9,618	4,195

Name of Structure	BARU CONVEYANCE CH OUTLET STRUCTUCTURE, FOR SCAFOLDING & FROM SUPPORT	Category of calculation	WORK VOLUME	Page	6 / 7

1. SCAFOLDING AREA

   a. Box Culvert = {(2 x 2.75) + (2 x 2.0)} x 5.541 = 52.640 Sg.m

   b. Wing Wall

   (7 x 4.6 – 2 x 2) + (2 x 2.0 x 4.6) + (3 x 1.0) + (2 x 0.35 x 4.6) = 52.82 Sg.m

   (a) + (b) = 105.46 Sg.m

2. FORM SUPPORT

   2 x 2.0 x 5.0 = 20.0 cu.m

Name of Structure	BANDARHARJO EAST SECONDARY CHANNEL OUTLET	Category Calculation	VOLUME CALCULATION	Page	1 / 8

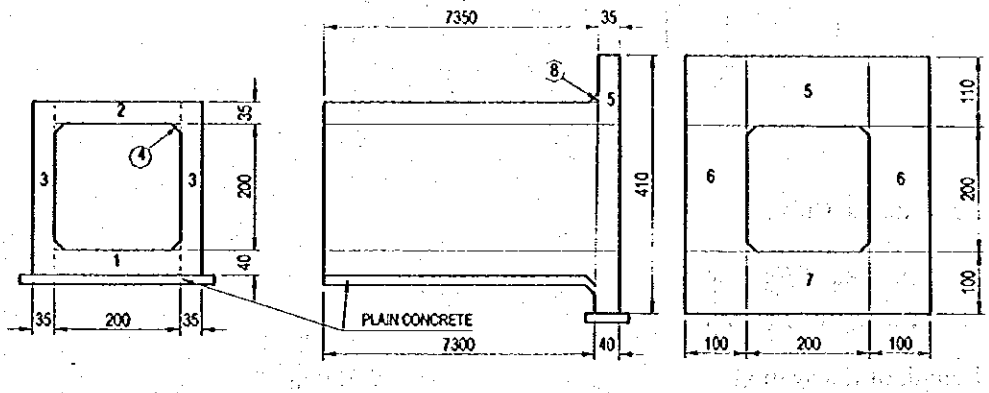
BANDARHARJO EAST SECONDARY CHANNEL OUTLET

SUMMARY OF WORK VOLUME

1.	CONCRETE, TYPE C1	=	28.307 m^3
2.	LEVELING CONCRETE, TYPE E	=	2.37 m^3
3.	REINFORCING BAR	=	1,610 Kg
4.	EXCAVATION	=	219.07 m^3
5.	BACK FILLING	=	130.62 m^3
6.	FORM WORK FOR TYPE C1	=	122.82 m^2
7.	FORM WORK FOR TYPE E	=	4 m^2

BANDARHARJO EAST SECONDARY CHANNEL OUTLET

CONCRETE VOLUME



Concrete K 225

1. Bottom Slab	= 0.40 x 2.00 x 7.30	=	5.84 m³
2. Top Slab	= 0.35 x 2.00 x 7.35	=	5.145 m³
3. Side Wall	= 0.35 x 2.75 x 7.35 x 2	=	14.150 m³
4. Footing	= 0.50 x 0.15 x 0.15 x 7.30	=	0.082 m³
5. Wing Wall	= 0.35 x 2.00 x 1.10	=	0.77 m³
6. Wing Wall	= 0.35 x 1.00 x 4.10	=	1.435 m³
7. Wing Wall	= 0.40 x 2.00 x 1.00	=	0.80 m³
8. Footing Wing	= 0.15 x 0.15 x (2 x 2.6 + 2 x 2.75) x 0.5	=	0.080 m³
Total Concrete Volume		=	28.307 m³

PLAIN CONCRETE

1. At Bottom Culvert, t = 10 cm

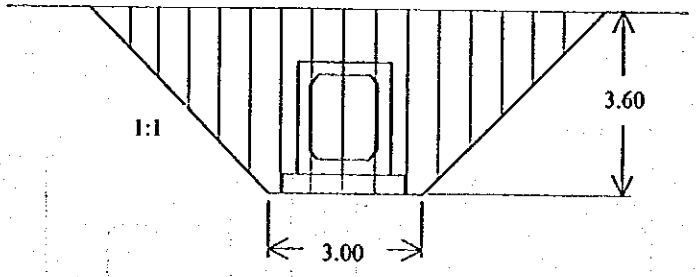
Area of Bottom	= 2.9 x 7.3	=	21.17 m²
Volume of Plain Concrete	= 21.17 x 0.10	=	2.117 m³

2. At Bottom of Wing Wall

Area of Bottom Wall	= 4.20 x 0.60	=	2.52 m²
Volume of Plain Concrete	= 2.52 x 0.10	=	0.252 m³
Total of Volume of Plain Concrete		=	2.369 m³

Name of Structure	BANDARHARJO EAST SECONDARY CHANNEL OUTLET	Category Calculation	EXCAVATION	Page	3 / 8

EXCAVATION



Excavation to Culvert

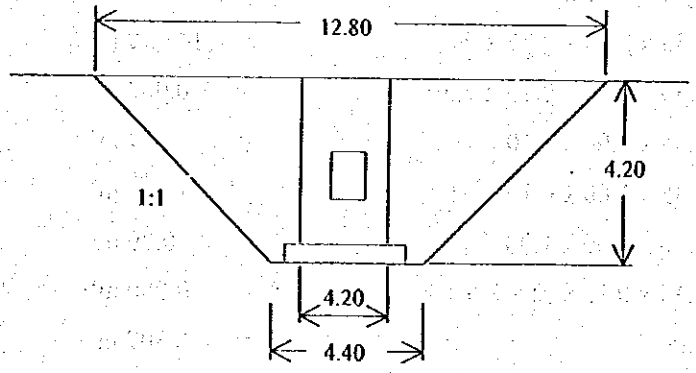
- Section Area of Excavation:

(3 + 10.2) / 2 x 3.60 = 23.76 m²

- Length of Excavation = 7.700 m

- Volume of Excavation = 7.700 x 23.76 = 182.95 m³

Excavation to Wing Wall



- Section Area of Excavation:

(12.80 + 4.40) / 2 x 4.20 = 36.12 m²

- Length of Excavation = 1.00 m

- Volume of Excavation = 36.12 x 1.00 = 36.12 m³

Total of Excavation = 219.07 m³

BACK FILLING

- Volume of Excavation = 219.07 m³

- Volume of Box Culvert and Wing Wall

2.70 x 2.85 x 7.300 + 4.00 x 4.20 x 0.35 = 88.455 m³

Volume of Back Fill = 219.07 – 88.455 = 130.615 m³

Name of Structure	BANDARHARJO EAST SECONDARY CHANNEL OUTLET	Category Calculation	REINFORCING BAR VOLUME	Page	4 / 8

REINFORCING BAR

TYPE	DIA	LENGTH (m)	Number	WEIGHT per m (kg.f/m)	WEIGHT per bar (kg.f)	WEIGHT (kg)	REMARK
S1	D13	5.380	32	1.040	5.595	179.04	
S2	D13	2.520	62	1.040	2.621	162.50	
S3	D13	0.970	64	1.040	1.001	64.064	
S4	D13	2.134	64	1.040	2.220	142.08	
S5	D13	1.000	20	1.040	1.040	20.80	
S6	D13	0.870	24	1.040	0.905	21.72	
W1	D13	2.550	64	1.040	2.652	169.73	
W2	D13	1.000	28	1.040	1.040	29.12	
W3	D13	0.40	58	1.040	0.416	24.13	
F1	D13	5.430	32	1.040	5.647	180.704	
F2	D13	2.520	62	1.040	2.630	163.06	
F3	D13	1.010	64	1.040	1.050	67.20	
F4	D13	2.102	64	1.040	2.186	139.904	
F5	D13	1.000	20	1.040	1.040	20.80	
F6	D13	0.920	28	1.040	0.95	26.60	
WW1	D13	1.120	14	1.040	1.165	16.31	
WW2	D13	1.020	28	1.040	1.061	29.71	
WW3	D13	1.040	14	1.040	1.082	15.15	
WW4	D13	3.820	18	1.040	3.973	71.514	
WW5	D13	3.920	16	1.040	4.980	65.28	
					TOTAL	1,610 kg	

Name of Structure	BANDARIHARJO EAST SECONDARY CHANNEL OUTLET	Category Calculation	FORM WORK VOLUME	Page	5 / 8

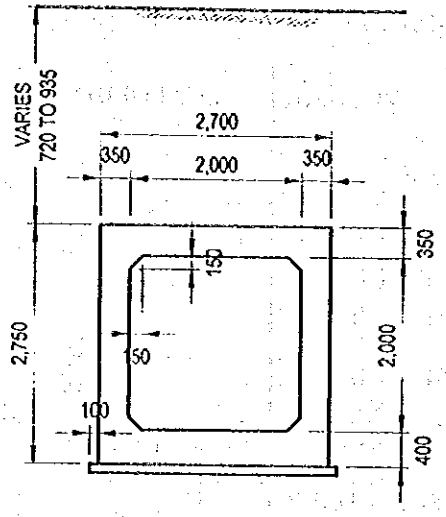
FORM WORK

③ Wall:		2.75 x 7.35 x 2	=	40.425 m²
		1.70 x 7.75 x 2	=	26.35 m²
		0.45 x 7.78 x 4	=	13.95 m²
		Total of Wall	=	80.725 m²
② Top Slab:		1.75 x 7.75 x 1	=	13.563 m²
Wing Wall:	⑤	1.10 x 2.00 x 2	=	4.40 m²
	⑥	1.00 x 4.10 x 4	=	16.40 m²
	⑦	1.00 x 2.00 x 2	=	4.0 m²
		Total of Wing Wall	=	24.80 m²
Plain Concrete:				
		0.10 x 7.35 x 2 + 0.10 x 2.70 x 2	=	2.01 m²
		0.10 x 0.6 x 2 + 0.10 x 4 x 2	=	1.72 m²
		Total of Plain Concrete	=	3.73 m²
Total Form Work			=	122.818 m²
Total Form Work (Type C)			=	119.08 m²
Total Form Work (Type E)			=	3.73 m²

SUMMARY OF SCAFOLDING AND FORM SUPPORT VOLUME, FOR BANDARHARJO DRAINAGE SYSTEM

No.	VOLUME / STRUCTURE	SCAFOLDING (m^2)	FORM SUPPORT (m^3)
1	BARU PUMPING STATION	1,049	549
2	BARU PUMPING STATION GATE	350	120
3	BARU CONVEYANCE CHANNEL	6,574	2,768
4	BARU CONVEYANCE CHANNEL INLET STRUCTURE	150	35
5	BARU CONVEYANCE CHANNEL OUTLET STRUCTURE	106	20
6	BANDARHARJO EAST SECONDARY CHANNEL	1,166	491
7	BANDARHARJO EAST SECONDARY CHANNEL OUTLET STRUCTURE	90	31
8	BARU RETARDING POND INLET STRUCTURE No. 1	-	77
9	BARU RETARDING POND INLET STRUCTURE No. 2	-	42
10	FUEL TANK BOX FOR BARU PUMPING STATION	133	62
TOTAL		9,618	4,195

Name of Structure	BANDARHARJO EAST S.C. SCAFOLDING AND FORM SUPPORT	Category Calculation	Work Volume	Page	7 / 8



GENERAL CROSS SECTION

Length of Box Culvert

1. Scaffolding Area = (2 x 2.75 + 2 x 2.0) x 122.70 = 1165.65 m²
2. Support Area = 2.0 x 2.0 x 122.70 = 490.80 m³

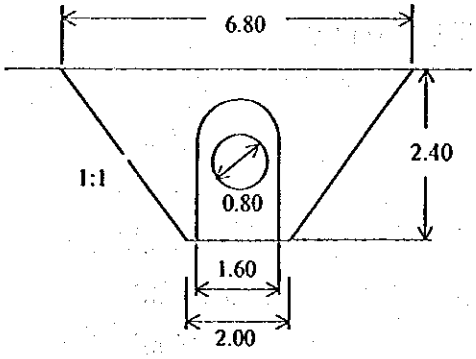
Name of Structure	OUTLET STRUCTURE OF SECONDARY CHANNEL	Category Calculation	VOLUME CALCULATION	Page	1/5

SUMMARY OF WORK VOLUME
SECONDARY CHANNEL OUTLET FOR BARU RIVER
RIGHT BANK (5 LOCATIONS)

1.	EXCAVATION STRUCTURE	=	765.6 m^3
2.	LEVELING CONCRETE (TYPE E)	=	6.00 m^3
3.	CONCRETE (TYPE C1)	=	21.50 m^3
4.	WET COBBLE MASONRY	=	137.10 m^3
5.	BACK FILL	=	643.40 m^3
6.	REINFORCING STEEL	=	713.81 Kg
7.	ROAD PAVEMENT (STANDARD)	=	125 m^2
8.	GRAVEL BEDDING	=	94.1 m^3
9.	COBBLE STONE	=	3 m^3
10.	WEEP HOLE ϕ 50 (PVC)	=	70 nos.
11.	WOODEN PILE ϕ 150, L=2,000	=	10 m'
12.	PRECAST CONCRETE PIPE ϕ 80 cm	=	82.50 m'

Name of Structure	OUTLET STRUCTURE OF SECONDARY CHANNEL	Category Calculation	WORK VOLUME	Page	2 / 5

1. EXCAVATION STRUCTURE



Area of Excavation = (6.80 + 2) / 2 x 2.40 = 10.56 m²

Length of Excavation = 12.5 + 4/2 = 14.5 m

Volume of Excavation = 10.56 x 14.5 = 153.12 m³

For 5 locations = 5 x 153.12 = 765.6 m³

2. LEVELING CONCRETE

For Base Concrete = 0.7 x 0.10 x 5 x 2 = 0.70 m³

For Top Concrete = 0.5 x 0.10 x 5 x 2 = 0.50 m³

Total = 1.20 m³

For 5 locations = 5 x 1.20 = 6.00 m³

3. CONCRETE K 225

For Base Concrete = ((0.3 + 0.5)/ 2 x 0.3 + (0.2 x 0.5)) x 5 x 2 = 2.20 m³

For Top Concrete = (0.3 x 0.70) x 5 x 2 = 2.10 m³

Total = 4.30 m³

For 5 locations = 5 x 4.30 = 21.50 m³

4. WET COBLE MASONRY

a. Pack of Precast Concrete Ø 800:

$(1.60 \times 0.7 + 0.5 \times 0.25 \times 3.14 \times 1.2^2 - 0.25 \times 3.14 \times 0.18^2) \times 14.50$ = 34.69 m³

b. $0.3 \times \sqrt{6^2 + 2.7^2} + (1 \times 0.3)) \times 5$ = 5.924 m³

c. 0.3 x 6.00 x 5 = 9.00 m³

d. $(1 \times 0.3 + 0.3 \times \sqrt{2^2 + 1^2}) \times 5$ = 4.85 m³

e. (0.3 x 0.6 + 0.3 x (2.3 + 0.6)) x 5 = 5.25 m³

Total = 27.42 m³

For 5 locations = 5 x 27.42 = 137.10 m³

Name of Structure	OUTLET STRUCTURE OF SECONDARY CHANNEL	Category Calculation	WORK VOLUME	Page	3 / 5

5. BACK FILL

Volume Excavation – Volume Construction

$153.12 - (1.60 \times 0.7 + 0.5 \times 0.25 \times 3.14 \times 1.2^2) \times 14.50$ = 128.68 m³

For 5 locations = 128.68 x 5 = 643.4 m³

6. STEEL REINFORCING

For Base Concrete:

6D13 x 5 = 6 x 1.04 x 5 = 31.2 kg

D10 – 300 = 1.7 x 0.503 x (500 / 30 + 1) = 15.11 kg

Total = 46.31 kg

For two Base Concrete = 2 x 46.31 = 92.61 kg

For Top Concrete:

6D13 x 5 = 6 x 1.04 x 5 = 31.2 kg

D10 – 300 = 1.10 x 0.503 x (500 / 30 + 1) = 9.22 kg

Total = 40.422 kg

For two Base Concrete = 2 x 40.422 = 80.843 kg

Total Reinforcing Concrete = 142.763 kg

For 5 locations = 5 x 142.763 = 713.81 kg

7. GRAVEL BEDDING

b. $0.25 \times (\sqrt{6^2 + 2^2} + 1.00) \times 5$ = 9.156 m³

c. 0.25 x 435 x 5 = 5.625 m³

d. $(0.25 \times 1 + 0.25 \times \sqrt{2^2 + 1^2}) \times 5$ = 4.04 m³

Total = 18.82 m³

For 5 locations = 5 x 18.82 = 94.10 m³

8. BOULDER FILLING

(0.6 + 0.2) / 2 x 0.6 x 5 x 2 = 0.60 m³

For 5 locations = 5 x 0.60 = 3.00 m³

9. WEEP HOLE PVC Ø 50

14 x 5 = 70 Nos.

10. WOODEN PILE Ø 15 cm, L = 2000

2 x 5 = 10

Name of Structure	OUTLET STRUCTURE OF SECONDARY CHANNEL	Category Calculation	WORK VOLUME	Page	4 / 5

11. Inspection Road

5 x 5 = 25 m²

12. PRECAST CONCRETE Ø 80 cm

16.5 m x 5 = 82.5 m³

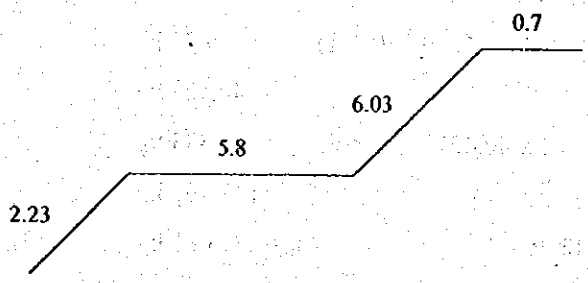
13. FORM WORK TYPE E

8 x 0.1 x 5 x 5 = 20

14. FORM WORK TYPE C1

{0.7 x 4 + 2 x 0.5 + 2 x 0.2 + 2 x 0.36} x 5 x 5 = 123

15. POINTING



(2.23 + 5.8 + 6.03 + 0.7) x 5 x 5 = 369 m²

Loading = - (1 x 0.8 x 5) = - 4 m²

Total = 365 m²

Name of Structure	OUTLET STRUCTURE OF SECONDARY CHANNEL	Category Calculation	VOLUME CALCULATION	Page	1/7

SUMMARY OF WORK VOLUME
SECONDARY CHANNEL OUTLET FOR BARU RIVER
RIGHT BANK (5 LOCATIONS)

1.	EXCAVATION STRUCTURE	=	765.6 m^3
2.	LEVELING CONCRETE (TYPE E)	=	6.00 m^3
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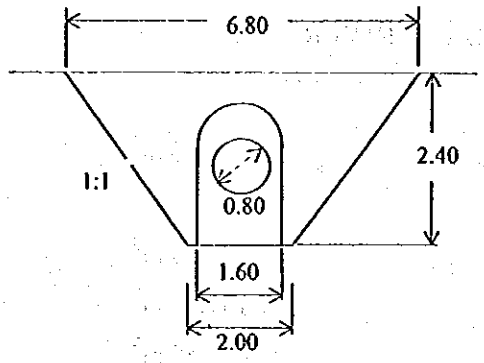
4.	WET COBBLE MASONRY	=	137.10 m^3
5.	BACK FILL	=	643.40 m^3
6.	REINFORCING STEEL	=	713.81 Kg
7.	ROAD PAVEMENT (STANDARD)	=	125 m^2
8.	GRAVEL BEDDING	=	94.1 m^3
9.	COBBLE STONE	=	3 m^3
10.	WEEP HOLE ϕ 50 (PVC)	=	70 nos.
11.	WOODEN PILE ϕ 150, L=2,000	=	10 m'
12.	PRECAST CONCRETE PIPE ϕ 80 cm	=	82.50 m'

Name of Structure	OUTLET STRUCTURE OF SECONDARY CHANNEL	Category Calculation	WORK VOLUME	Page	2/7

1. EXCAVATION STRUCTURE



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For 5 locations = 5 x 153.12 = 765.6 m³

2. LEVELING CONCRETE

For Base Concrete = 0.7 x 0.10 x 5 x 2 = 0.70 m³

For Top Concrete = 0.5 x 0.10 x 5 x 2 = 0.50 m³

Total = 1.20 m³

For 5 locations = 5 x 1.20 = 6.00 m³

3. CONCRETE K 225

For Base Concrete = ((0.3 + 0.5)/ 2 x 0.3 + (0.2 x 0.5)) x 5 x 2 = 2.20 m³

For Top Concrete = (0.3 x 0.70) x 5 x 2 = 2.10 m³

Total = 4.30 m³

For 5 locations = 5 x 4.30 = 21.50 m³

4. WET COBLE MASONRY

a. Pack of Precast Concrete Ø 800:

$(1.60 \times 0.7 + 0.5 \times 0.25 \times 3.14 \times 1.2^2 - 0.25 \times 3.14 \times 0.18^2) \times 14.50$ = 34.69 m³

b. $0.3 \times \sqrt{6^2 + 2.7^2} + (1 \times 0.3)) \times 5$ = 5.924 m³

c. 0.3 x 6.00 x 5 = 9.00 m³

d. $(1 \times 0.3 + 0.3 \times \sqrt{2^2 + 1^2}) \times 5$ = 4.85 m³

e. (0.3 x 0.6 + 0.3 x (2.3 + 0.6)) x 5 = 5.25 m³

Total = 27.42 m³

For 5 locations = 5 x 27.42 = 137.10 m³

Name of Structure	OUTLET STRUCTURE OF SECONDARY CHANNEL	Category Calculation	WORK VOLUME	Page	3/7

5. BACK FILL

Volume Excavation – Volume Construction

$153.12 - (1.60 \times 0.7 + 0.5 \times 0.25 \times 3.14 \times 1.2^2) \times 14.50$ = 128.68 m³

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c. 0.25 x 435 x 5 = 5.625 m³

d. $(0.25 \times 1 + 0.25 \times \sqrt{2^2 + 1^2}) \times 5$ = 4.04 m³

Total = 18.82 m³

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8. BOULDER FILLING

(0.6 + 0.2) / 2 x 0.6 x 5 x 2 = 0.60 m³

For 5 locations = 5 x 0.60 = 3.00 m³

9. WEEP HOLE PVC Ø 50

14 x 5 = 70 Nos.

10. WOODEN PILE Ø 15 cm, L = 2000

2 x 5 = 10

Name of Structure	OUTLET STRUCTURE OF SECONDARY CHANNEL	Category Calculation	WORK VOLUME	Page	4/7

11. Inspection Road

5 x 5 = 25 m²

12. PRECAST CONCRETE Ø 80 cm

16.5 m x 5 = 82.5 m'

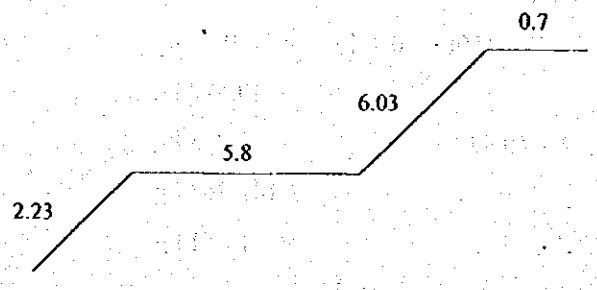
13. FORM WORK TYPE E

8 x 0.1 x 5 x 5 = 20

14. FORM WORK TYPE C1

{0.7 x 4 + 2 x 0.5 + 2 x 0.2 + 2 x 0.36} x 5 x 5 = 123

15. POINTING



(2.23 + 5.8 + 6.03 + 0.7) x 5 x 5 = 369 m²

Loading = - (1 x 0.8 x 5) = - 4 m²

Total = 365 m²

Name of Structure	BARU RIVER BRIDGE PROTECTION	Category Calculation	WORKS VOLUME	Page	1 / 3

SUMMARY OF WORK VOLUME

1.	CONCRETE SHEET PILE, L=6 m	=	570 m'
2.	CONCRETE FOR PILE CAP, TYPE C1	=	4.56 m^3
3.	REINFORCING BAR FOR PILE CAP, U 30	=	889 Kg
4.	FORM WORK	=	34 m^2

Name of Structure	BARU RIVER BRIDGE PROTECTION	Category Calculation	WORKS VOLUME	Page	2 / 3

BARU RIVER BRIDGE PROTECTION

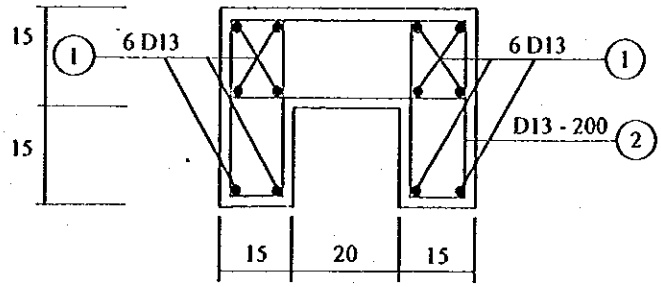
Revetment Type (Concrete Sheet Pile)

1. Revetment Concrete Sheet Pile (L=6.0 m)

   Length of structure 9.50 x 4 = 38 m

   Total length sheet pile $\frac{38}{0.4}$ x 6 = 570 m'

2. Concrete (C1) for Top of Sheet Pile



Concrete = 0.15 x 0.3 x 2 + 0.15 x 0.20 = 0.120 m²

Volume = 0.12 x 38 m = 4.56 m³

3. Reinforcing Bar

(1) D 13 = 38 x 6 x 2 = 456 m

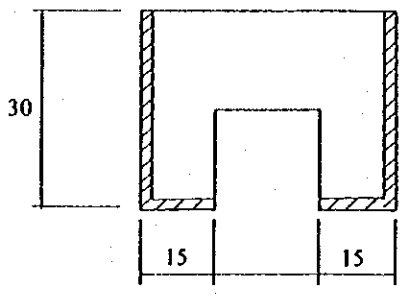
Weight = 456 x 1.040 = 474.24 kg

(2) D13 = 2.032 x 196 = 398.27 m

Weight = 398.3 x 1.040 = 414.2 kg

Total = 888.5 kg

4. Form Work



2 x 0.3 + 2 x 0.15 x 38 = 34 m²