| Name of Structure | INSPECTION ROAD FOR ASIN DRAINAGE SYSTEM | Category Calculation | Works Volume | Page | 1/5 |
|---|---|---|---|---|---|

## SUMMARY OF WORK VOLUME

| | | | | |
|---|---|---|---|---|
| I. | SEMARANG RIVER | | | |
| | 1. STRIPPING | = | 1,196 | $m^3$ |
| | 2. EMBANKMENT | = | 5,089 | $m^2$ |
| | 3. AGGREGATE CLASS B | = | 1,430 | $m^3$ |
| | 4. AGGREGATE CLASS A | = | 947 | $m^3$ |
| | 5. SAND BEDDING | = | 459 | $m^3$ |
| | 6. CONCRETE BLOCK PAVEMENT | = | 7,651 | $m^2$ |
| | 7. CEMENT MORTAR | = | 18 | $m^3$ |
| | 8. CONCRETE CURB | = | 184 | $m^3$ |
| | 9. SODDING | = | 5,741 | $m^2$ |
| II. | ASIN RETARDING POND | | | |
| | 1. STRIPPING | = | - | |
| | 2. EMBANKMENT | = | 863.14 | $m^3$ |
| | 3. AGGREGATE CLASS B | = | 811.14 | $m^3$ |
| | 4. AGGREGATE CLASS A | = | 533.65 | $m^3$ |
| | 5. SAND BEDDING | = | 213.46 | $m^3$ |
| | 6. CONCRETE BLOCK | = | 3,557.15 | $m^2$ |
| | 7. CEMENT MORTAR | = | 8.54 | $m^3$ |
| | 8. CONCRETE CURB | = | 85.38 | $m^3$ |
| III. | ASIN RIVER | | | |
| | 1. AGGREGATE CLASS B | = | 224.06 | $m^3$ |
| | 2. SAND BEDDING | = | 672.05 | $m^3$ |
| | 3. CONCRETE BLOCK | = | 11,202.90 | $m^2$ |
| | 4. CEMENT MORTAR | = | 26.89 | $m^3$ |
| | 5. CONCRETE CURB | = | 268.87 | $m^3$ |
| | 6. SODDING | = | 7,150.47 | $m^2$ |

| Name of Structure | INSPECTION ROAD FOR ASIN DRAINAGE SYSTEM | Category Calculation | Works Volume | Page | 2/5 |
|---|---|---|---|---|---|

I. SEMARANG LEFT
(SM 21+23 TO SM 30) + (SM 30 TO AS.2)

Length = (913.481 – 645.161) + (50 + 39.31)
= 268.32 + 89.31
= 357.63 m

1. Stripping of Top Soil (SM 30 TO AS.2) = -

2. Embankment (SM 30 TO AS.2) = -

3. Aggregate Class B (SM 30 TO AS.2)

$5.2 \times 0.2 \times 89.3$ = 92.87 m³

4. Aggregate Class A (SM 30 TO AS.2)

$5 \times 0.15 \times 89.3$ = 66.98 m³

5. Sand Bedding (SM 21 + 23 to AS.2)

$5 \times 0.06 \times 357.63$ = 107.30 m³

6. Concrete Block Pavement

$5 \times 357.63$ = 1788.15 m²

7. Cement Mortar

$2 \times 0.2 \times 0.003 \times 357.63$ = 4.29 m³

8. Concrete Kerb

$2 \times 0.3 \times 0.2 \times 357.63$ = 42.92 m³

9. Sodding

$\left\{2 \times \left(\sqrt{0.6^2 + 1.2^2} + 0.5\right)\right\} \times 357.63$ = 959.62 m²

II. SEMARANG RIGHT
(SM 07 TO SM 45)

Length = 1172.58

1. Stripping (0.10 thick)

$10.20 \times 0.10 \times 1172.58$ = 1196.03 m³

2. Embankment (average thick 0.30 m)

$\left\{9.6 \times 0.30 + 2 \times \frac{1.0 + 1.98}{2} \times 0.49\right\} \times 1172.58$ = 5089.23 m³

3. Aggregate Class B

$\{(5.2 \times 0.20) + (2 \times 6.5 \times 0.1)\} \times 1172.58$ = 1336.74 m³

| Name of Structure | INSPECTION ROAD FOR ASIN DRAINAGE SYSTEM | Category Calculation | Works Volume | Page | 3/5 |
|---|---|---|---|---|---|

4. Aggregate Class A

   $5 \times 0.15 \times 1172.58 = 879.6 \text{ m}^3$

5. Sand Bedding

   $5 \times 0.06 \times 1172.58 = 351.77 \text{ m}^3$

6. Concrete Block Pavement

   $5 \times 1172.58 = 5862.9 \text{ m}^2$

7. Cement Mortar

   $2 \times 0.2 \times 0.03 \times 1172.58 = 14.07 \text{ m}^3$

8. Concrete Kerb

   $2 \times 0.3 \times 0.2 \times 357.63 = 42.92 \text{ m}^3$

9. Sodding

   $\left\{2 \times \left(\sqrt{0.8^2 + 1.6^2} + 0.5\right)\right\} \times 1172.58 = 4781.44 \text{ m}^2$

## II. SUMMARY OF SEMARANG RIVER

| | | | | |
|---|---|---|---|---|
| 1. | Stripping | 1196.03 | = | 1196 m³ |
| 2. | Embankment | 5089.23 | = | 5089 m³ |
| 3. | Aggregate Class B = | 92.87 + 1336.74 | = | 1430 m³ |
| 4. | Aggregate Class A = | 66.98 + 879.60 | = | 947 m³ |
| 5. | Sand bedding = | 107.3 + 351.77 | = | 459 m³ |
| 6. | Concrete block = | 1788.15 + 5862.9 | = | 7651 m² |
| 7. | Cement mortar = | 4.29 + 14.07 | = | 18 m³ |
| 8. | Concrete curb = | 42.92 + 140.71 | = | 184 m³ |
| 9. | Sodding = | 959.62 + 4781.44 | = | 5741 m² |

## IV. ASIN RETARDING POND

Length = (10.0 + 97.5 + 54.8 + 47.5 + 8.0 + 7.0 + 10.0 + 74.5 + 10.0)
+ (350 + 7.0 + 8.0 + 27.23)
= 319.3 + 392.23
= 711.53 m

1. Stripping of Top Soil = -

2. Embankment

$$\left(1.0 \times \frac{1.0 + 1.98}{2}\right) \times 0.49 \times 711.53 = 863.14 \text{ m}^3$$

3. Aggregate Class B

$(5.2 \times 0.2 + 2 \times 0.5 \times 0.1) \times 711.53 = 811.14 \text{ m}^3$

4. Aggregate Class A

$5 \times 0.15 \times 711.53 = 533.65 \text{ m}^3$

5. Sand Bedding (SM 21 + 23 to AS.2)

$5 \times 0.06 \times 711.53 = 213.46 \text{ m}^3$

6. Concrete Block Pavement

$5 \times 711.53 = 3557.65 \text{ m}^2$

7. Cement Mortar

$2 \times 0.2 \times 0.03 \times 711.53 = 8.54 \text{ m}^3$

8. Concrete Kerb

$2 \times 0.3 \times 0.2 \times 711.53 = 85.38 \text{ m}^3$

9. Sodding = -

## IV. ASIN RIVER

Length = 2 × 1120.09
= 2240.18 m (both side)

1. Stripping of Top Soil = -

2. Embankment = -

3. Aggregate Class B

$2 \times 0.5 \times 0.10 \times 2240.58 = 224.06 \text{ m}^3$

4. Aggregate Class A = -

5. Sand Bedding

$5 \times 0.06 \times 2240.58 = 672.174 \text{ m}^3$

| Name of Structure | INSPECTION ROAD FOR ASIN DRAINAGE SYSTEM | Category Calculation | Works Volume | Page | 5/5 |
|---|---|---|---|---|---|

6. Concrete Block Pavement

   $5 \times 2240.58$ = 1120.9 $m^2$

7. Cement Mortar

   $2 \times 0.2 \times 0.03 \times 2240.58$ = 26.89 $m^3$

8. Concrete Kerb

   $2 \times 0.3 \times 0.2 \times 2240.58$ = 268.87 $m^3$

9. Sodding = 959.62 $m^2$

   $\left\{2 \times \left(0.5 + \sqrt{0.49^2 + 0.98^2}\right)\right\} \times 2240.58$ = 7150.47 $m^2$

| Name of Structure | ASIN BOX CULVERT | Category Calculation | Work Volume | Page | 1/6 |
|---|---|---|---|---|---|

## SUMMARY OF ASIN BOX CULVERT, INLET STRUCTURE AND OUTLET STRUCTURE

| | | | | | |
|---|---|---|---|---|---|
| 1. | STRUCTURE EXCAVATION | = 3729 + 415 + 1071 | = 5,215 | $m^3$ |
| 2. | BACK FILL | = 1,350 + 240 + 534 | = 2,124 | $m^3$ |
| 3. | LEVELING CONCRETE (E) | = 85.5 + 0.70 + 4.53 | = 90.70 | $m^3$ |
| | FORM WORK | = 39.68 + 0.34 + 12.22 | = 52.24 | $m^2$ |
| 4. | CONCRETE TYPE C1 | = 950.50 + 24 + 30.01 | = 1005 | $m^3$ |
| | FORM WORK | = 2694 + 58 + 135 | = 2,887 | $m^2$ |
| | SCAFFOLDING | = 1843 + 54 + 62 | = 1,959 | $m^2$ |
| | FALSE WORK | = 1358 + 11 + 16 | = 1,385 | $m^3$ |
| 5. | REINFORCING BAR | = 92600 + 1438 + 1218 | = 95,256 | Kg |
| 6. | WATER STOP | | = 212 | m' |
| 7. | GRAVEL BEDDING | = 15.39 + 104.78 | = 120.17 | $m^3$ |
| 8. | COBBLE STONE | = 5.93 + 12.15 | = 18.08 | $m^3$ |
| 9. | WET STONE MASONRY | = 120 + 460.32 | = 580.32 | $m^3$ |
| 10. | LOG PILE $\phi$ 150, L=3.0 m | = 120 + 321 | = 441 | m' |
| 11. | WEEP HOLE $\phi$ 50 | = 36 + 39 | = 75 | nos |
| 12. | POINTING | = 44.28 + 397.63 | = 441.91 | $m^2$ |
| 13. | ASPHALT CONCRETE | = 47.12 x 2.3 | = 108.38 | ton |
| 14. | ASPHALT TREATED BASE | = 47.12 x 2.3 | = 108.38 | ton |
| 15. | AGGREGATE CLASS A | | = 176.70 | $m^3$ |
| 16. | AGGREGATE CLASS B | | = 252.70 | $m^3$ |

| Name of Structure | ASIN BOX CULVERT | Category Calculation | Work Volume | Page | 2/6 |
|---|---|---|---|---|---|

1. **Excavation of Structure**

   - Total length = 194 m
   - Excavation width = 6.20 m
   - Depth of Excavation = 3.10 m

   Excavation volume = $6.20 \times 3.10 \times 194 = 3729$ m³

2. **Leveling Concrete**

   $V_{LC} = 4.4 \times 0.10 \times 194 = 85.50$ m³

   Form Work = $0.1 \times (2 \times 4.4 + 2 \times 194) = 39.68$ m²

3. **Concrete $K_{225}$**

   (a.) Normal Section

   - $2 \times 0.35 \times 2.75 = 1.925$ m²
   - $0.35 \times 3.50 = 1.225$ m²
   - $0.40 \times 3.50 = 1.400$ m²
   - $4.0 \times \frac{0.30 \times 0.30}{2} = 0.180$ m²

   $= 4.730$ m²

   Number of manhole = $\frac{194}{10} = 19.4 \sim 19 nos$

   Length of normal section = $194 - 1.7 \times 19 = 161.70$ m

   Volume of normal section = $161.70 \times 4.73 = 764.841$ m³

   (b.) Manhole Section

   | | | |
   |---|---|---|
   | – Volume of normal section | = $1.7 \times 4.73$ | = 8.041 m² |
   | – Decrease of ending of hole | = $1.0 \times 1.0 \times 0.1$ | = 0.100 m³ (-) |
   | – Top of manhole | = $0.35 \times (0.96 - 0.25) \times 4 \times 1.35$ | = 1.342 m³ |
   | | = $0.15 \times 0.25 \times 4 \times 1.55$ | = 0.250 m³ |
   | | **Volume per block** | = **9.766** m³ |

   Volume of manhole section = $19 \times 9.766 = 185.554$ m³

   Total volume of Concrete $K_{225}$ = $764.841 + 185.554 = 950.395$ m³

4. **Steel Reinforcement**

   (a.) Normal Section

   Weight per meter = 458.126 kg (see Table)
   Total weight for normal section = $161.70 \times 458.126 = 74078.974$ kg

(b.) Manhole Section

- Steel weight for normal section (see Table) = 458.126 × 1.70 = 778.814 kg
- Steel weight for manhole & cover (see Table) = 239.320 kg
- Decrease of ending of hole

| | | | |
|---|---|---|---|
| $S_1$(D16) | = 5 × 1.04 × 1.58 | = 7.900 | |
| $S_2$(D16) | = 9 × 1.0 × 1.58 | = 14.220 | |
| $S_3$(D16) | = 4 × 1.0 × 1.58 | = 6.320 | |
| $S_4$(D13) | = 5 × 1.18 × 1.04 | = 6.136 | |
| $S_5$(D13) | = 5 × 1.00 × 1.04 | = 5.200 | |
| $S_6$(D13) | = 4 × 0.87 × 1.04 | = 3.619 | |
| | | = 43.395 | kg |
| Steel weight for manhole section/block | | = 974.739 | kg |

Total steel weight = 74078.974 + 19 × 974.739 = 92599.015 kg = 92.60 ton

5. **Backfill**

Volume of structure space

| | | | |
|---|---|---|---|
| – Box culvert | = 2.75 × 4.20 × 194 | = 2240.70 | m³ |
| – Leveling concrete | = 0.10 × 4.40 × 194 | = 85.36 | m³ (-) |
| – Manhole | = 1.7 × 1.7 × 0.96 × 19 | = 52.71 | m³ |
| | **Total volume of structure space** | = **2378.77** | **m³** |

– Volume of excavation = 3729 m³

Volume of backfill = 3729 – 2379 = 1350 m³

6. **Road Pavement (Standard)**

- Length of Reconstruction Road = 190 m
- Width of existing pavement = 6 m
- Reconstruction with Road Class IIIA, width of pavement = 6.20 m

6.1 Demolition of Existing Pavement

6 × 190 = 1140 cm²

6.2 Stripping

- width of stripping = 2 × 1 m = 2 m
- thickness of stripping = 0.30 m

V = 0.3 × 2 × 190 = 114 cm

6.3 Embankment with Sandy Soil

- width of base embankment = 2 + 7 m = 9 m
- thickness of base embankment = 0.30 m
- width of shoulder embankment = 2 × 1 m = 2 m
- thickness of shoulder embankment = 0.43 m

Embankment : $\left\{(0.3\times 9)+\left(0.43\times\frac{1+1.43}{2}\times 2\right)\right\}\times 190 = 712m^2$

6.4 Asphalt Concrete ($A_C$)

- width = 6.20 m, thickness = 0.04 m

$V_{AC} = 0.04 \times 6.20 \times 190 = 47.12 \text{ m}^3$

6.5 Asphalt Treated Base ($A_{TB}$)

$V_{TB} = 0.04 \times 6.20 \times 190 = 47.12 \text{ m}^3$

6.6 Aggregate Class A

$V_{CA} = 0.15 \times 6.20 \times 190 = 176.70 \text{ m}^2$

6.7 Aggregate Class B

- pavement over shoulder with aggregate Class B, gate class B, width = 0.50 m, thickness = 0.10 m

$\{(2 \times 0.45 \times 0.1) + (0.2 \times 6.20)\} \times 190 = 252.7 \text{ m}^3$

7. **Water Stop (w=200, t=20) with Rubber Joint Filler**

- Distance of joint = 10 m
- Number of joint = $\frac{194}{10} - 2 = 17 nos$

Water stop length = 2 ×(2.375 + 3.850)× 17 = 211.65 m

8. **Excavation of Structure**

(a.) Normal section

$\left(2 \times 2.75 + 2 \times 1.4 + 2.9 + 4 \times \sqrt{0.3^2 + 0.3^2}\right) \times 194 = 2502.029 \text{ m}^2$

(b.) Manhole section

$4 \times 1.7 \times 0.775 + 4 \times 1.0 \times 0.875 + 4 \times 1.4 \times 0.25 = 10.170 \text{ m}^2$

(c.) Cover manhole

$(4 \times 1.4 + 2 \times 1.4) \times 0.25 = 2.100 \text{ m}^2$

(d.) Decrease of normal section

$1.0 \times 1.0 = 1.000 \text{ m}^2$

Manhole portion $= 11.270 \text{ m}^2$

(e.) For all manhole

$17 \times 11.27 = 191.590 \text{ m}^2$

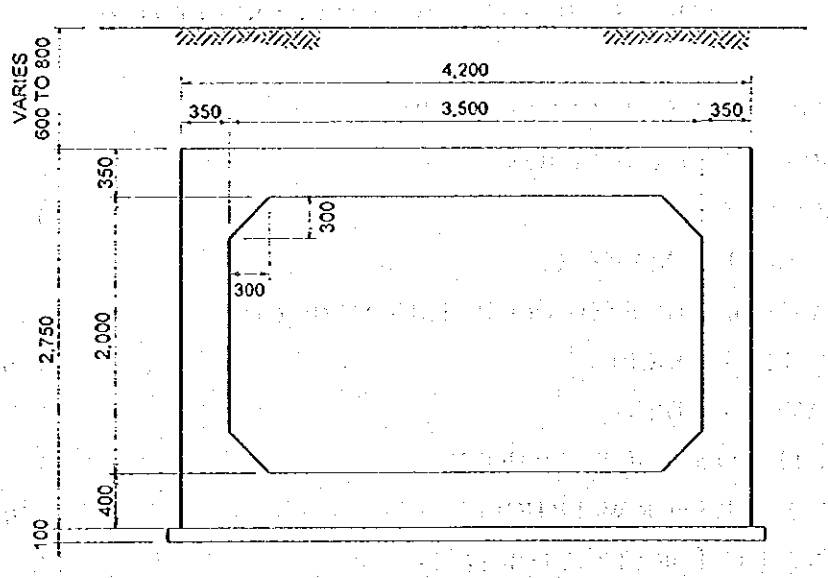
Total of form work = 2502.029 + 191.59 $= 2693.619 \text{ m}^2$

| Name of Structure | ASIN BOX CULVERT SCAFOLDING AND FORM SUPPORT | Category Calculation | Work Volume | Page | 1/2 |
|---|---|---|---|---|---|

## SUMMARY OF SCAFOLDING AND FORM SUPPORT VOLUME FOR ASIN RIVER DRAINAGE SYSTEM IMPROVEMENT.

| No | Structure | Volume | |
|---|---|---|---|
| | | Scafolding ($m^2$) | Form Support ($m^3$) |
| 1 | Asin Pumping Station | 1342 | 941 |
| 2 | Asin Pumping Station, Gate | 732 | 254 |
| 3 | Asin Box Culvert | 1843 | 1358 |
| 4 | Asin Box Culvert Inlet Structure | 54 | 11 |
| 5 | Asin Box Culvert Outlet Structure | 62 | 16 |
| 6 | Secondary Channel Outlet on Asin River | - | 34 |
| 7 | Fuel Tank Box for Asin Pumping Station | 133 | 62 |
| 8 | Asin Pumping Station Bridge, Sub Structure | 166 | - |
| 9 | Asin No.1 Bridge, Sub Structure | 293 | - |
| 10 | Asin No.2 Bridge, Sub Structure | 251 | - |
| **Total** | | 4876 | 2676 |

| Name of Structure | ASIN BOX CULVERT SCAFOLDING AND FORM SUPPORT | Category Calculation | Work Volume | Page | 2/2 |
|---|---|---|---|---|---|




GENERAL CROSS SECTION
SCALE A

1. Scafolding Area

   Total length of box culvert = 194 m

   $(2 \times 2.75 + 2 \times 2.0) \times 194$ = 1843 m²

2. Form Support

   3.5 x 2 x 194 = 1358 m³

| Name of Structure | ASIN BOX CULVERT INLET STRUCTURE | Category Calculation | Work Volume | Page | 1/7 |
|---|---|---|---|---|---|

## SUMMARY OF WORK VOLUME
## FOR ASIN BOX CULVERT INLET STRUCTURE

| | | | | |
|---|---|---|---|---|
| 1. | DEMOLITION OF STONE MASONRY | = | 97 | $m^3$ |
| 2. | STRUCTURE EXCAVATION | = | 415 | $m^3$ |
| 3. | BACK FILL | = | 240 | $m^3$ |
| 4. | WET COBBLE MASONRY | = | 120 | $m^3$ |
| 5. | PLAIN CONCRETE FOR DROP STRUCTURE (C1) | = | 7 | $m^3$ |
| 6. | LEVELING CONCRETE | = | 0.70 | $m^3$ |
| 7. | GRAVEL BEDDING | = | 13 | $m^3$ |
| 8. | PVC PIPE Ø 50 FOR WEEP HOLE | = | 36 | nos |
| 9. | PALM FIBRE FOR WEEP HOLE | = | 0.10 | $m^3$ |
| 10. | CONCRETE FOR STRUCTURE (C1) | = | 17 | $m^3$ |
| 11. | REINFORCING BAR FOR WING WALL | = | 1,438 | Kg |
| 12. | FORM WORK | = | 58 | $m^2$ |
| 13. | SAFETY SCREEN 3,500 x 4,200 | = | 1 | set |
| 14. | LOG PILE Ø150, L=3,000 | = | 120 | $m^1$ |
| 15. | COBBLE STONE | = | 5.93 | $m^3$ |

| Name of Structure | ASIN BOX CULVERT INLET STRUCTURE | Category Calculation | Work Volume | Page | 2/7 |
|---|---|---|---|---|---|

1. **Demolition of Stone Masonry**

| | | | |
|---|---|---|---|
| – $\frac{0.80+1.40}{2}\times 3.0\times(2\times 6.7+7.0)$ | = | 67.32 | m³ |
| – $1.40\times 1.0\times(2\times 6.7+7.0)$ | = | 28.56 | m³ |
| – $1.95\times 0.40\times 1.50$ | = | 1.17 | m³ |
| | | 97.05 | m³ |

2. **Structure Excavation**

| | | | |
|---|---|---|---|
| – $2\times\frac{0.2+4.9}{2}\times 4.7\times 2.25$ | = | 53.933 | m³ |
| – $2\times 1.65\times 4.7\times 2.25$ | = | 34.898 | m³ |
| – $2\times\frac{0.2+1.1}{2}\times 0.9\times 2.25$ | = | 2.633 | m³ |
| – $0.80\times 4.2\times 2.25$ | = | 7.560 | m³ |
| – $2\times\frac{0.2+6.1}{2}\times 5.9\times 3.95$ | = | 146.822 | m³ |
| – $2\times 2.05\times 5.9\times 3.95$ | = | 95.551 | m³ |
| – $2\times\frac{0.2+1.3}{2}\times 1.1\times 3.95$ | = | 6.518 | m³ |
| – $1.8\times 4.2\times 3.95$ | = | 29.862 | m³ |
| – $2\times\frac{0.2+6.1}{2}\times 5.9\times 1.0$ | = | 37.170 | m³ |
| | | 414.947 | m³ |

3. **Wet Cobble Masonry**

| | | | |
|---|---|---|---|
| – $2\times\frac{0.95+1.65}{2}\times 3.5\times 2.25$ | = | 20.475 | m³ |
| – $2\times 1.2\times 1.65\times 2.25$ | = | 8.910 | m³ |
| – $0.5\times 4.2\times 1.25$ | = | 2.625 | m³ |
| – $0.3\times 2.05\times 4.2$ | = | 2.583 | m³ |
| – $0.3\times 0.7\times 4.2$ | = | 0.882 | m³ |
| – $2\times\frac{1.2+2.05}{2}\times 4.4\times 3.95$ | = | 56.485 | m³ |
| – $2\times 1.5\times 2.05\times 3.95$ | = | 24.293 | m³ |
| – $0.3\times 4.2\times 3.05$ | = | 3.843 | m³ |
| | | 120.096 | m³ |

4. **Plain Concrete ($C_2$)**

$0.2\times(1.0-+1.0+2.55+2.92+0.8)\times 4.2$ = 6.95 m³

| Name of Structure | ASIN BOX CULVERT INLET STRUCTURE | Category Calculation | Work Volume | Page | 3/7 |
|---|---|---|---|---|---|

5. **Gravel Bedding**

| | | | |
|---|---|---|---|
| – $2 \times 0.2 \times 3.40 \times 2.25$ | = | 3.060 | $m^3$ |
| – $2 \times 0.2 \times 4.29 \times 3.95$ | = | 6.778 | $m^3$ |
| – $0.2 \times 1.5 \times 4.8$ | = | 1.440 | $m^3$ |
| – $0.2 \times 4.2 \times 4.9$ | = | 4.116 | $m^3$ |
| | | 15.394 | $m^3$ |

6. **PVC Ø50 for Weep Hole**

| | | | |
|---|---|---|---|
| – $3 \times 1 \times 1.6$ | = | 4.800 | $m^3$ |
| – $4 \times 2 \times 2.05$ | = | 16.400 | $m^3$ |
| – $3 \times 0.4$ | = | 1.200 | $m^3$ |
| | | 22.400 | $m^3$ |

7. **Concrete for Structure ($C_1$)**

| | | | |
|---|---|---|---|
| – $0.35 \times \left( 6.2 \times 5.0 - 3.5 \times 2 + 4 \times \frac{0.3+0.3}{2} \right)$ | = | 8.463 | $m^3$ |
| – $\frac{0.25+0.25}{2} \times \{(2 \times 2.75) + 4.2\}$ | = | 0.303 | $m^3$ |
| – $1.7 \times \begin{Bmatrix} 0.35 \times 4.2 + 2 \times (0.35 \times 2.0) \\ + (0.4 \times 4.2) \end{Bmatrix}$ | = | 7.735 | $m^3$ |
| | | 16.501 | $m^3$ |

8. **Reinforcing Bar**

$(1.7 \times 458.822) + 657.568 = 1437.565$ kg

9. **Leveling Concrete**

| | | | |
|---|---|---|---|
| $1.7 \times 4.4 \times 0.1$ | = | 0.714 | $m^3$ |
| Form Work = $0.1 \times 1.7 \times 2$ | = | 0.340 | $m^2$ |

10. **Backfill**

| | | | |
|---|---|---|---|
| – $2 \times \frac{0.2+4.9}{2} \times 4.7 \times 2.25$ | = | 53.933 | $m^3$ |
| – $2 \times \frac{0.7+3.5}{2} \times 2.25$ | = | 9.450 | $m^3$ |
| – $2 \times \frac{0.2+1.1}{2} \times 0.9 \times 2.25$ | = | 2.633 | $m^3$ |
| – $2 \times \frac{0.2+6.1}{2} \times 5.9 \times 3.95$ | = | 146.822 | $m^3$ |

| Name of Structure | ASIN BOX CULVERT INLET STRUCTURE | Category Calculation | Work Volume | Page | 4/7 |
|---|---|---|---|---|---|

- $2 \times \frac{0.85 + 4.4}{2} \times 3.95$ = 20.738 m³
- $2 \times \frac{0.2 + 1.3}{2} \times 1.1 \times 3.95$ = 6.518 m³

240.094 m³

11. **Form Work**

- $2 \times 2 \times 0.75 \times 3.9$ = 5.850 m²
- $2 \times 0.9 \times 4.7$ = 8.460 m²
- $2 \times 1.1 \times 6.2$ = 13.640 m²
- $2 \times \sqrt{0.25^2 + 0.25^2} \times 3$ = 2.121 m²
- $\sqrt{0.25^2 + 0.25^2} \times 4.7$ = 1.662 m²
- $2 \times 1.45 \times 2.75$ = 7.975 m²
- $1.45 \times 4.2$ = 6.090 m²
- $2 \times 1.45 \times 1.6$ = 4.640 m²
- $1.45 \times 2.9$ = 4.205 m²
- $4 \times \sqrt{0.3^2 + 0.3^2} \times 2.05$ = 3.479 m²

58.122 m³

12. **Pointing**

- $(2.9 + 0.6) \times 1.8 \times 2$ = 12.600 m²
- $(3.8 + 0.6) \times 3.6 \times 2$ = 31.680 m²

44.280 m²

13. **Plastering**

$0.5 \times 2 \times 6.2 = 6.20$ m²

14. **Log Pile (Ø150; L=3,000 m)**

(a.) Section A-A

Length of structure = 4.20 m, ctc = 1.0 m; 2 coluns

$2 \times 3.0 \times \left( \frac{4.20 - 2 \times 0.4}{1.0} + 1 \right)$ = 24 m'

(b.) Section C-C & D-D

Length of structure = 7.70 m, ctc = 1.0 m; 2 columns

$2 \times 2 \times 3.0 \times \left( \frac{7.70 - 2 \times 0.4}{1.0} + 1 \right)$ = 96 m'

(a) + (b) = 120 m'

| Name of Structure | ASIN BOX CULVERT INLET STRUCTURE | Category Calculation | Work Volume | Page | 5/7 |
|---|---|---|---|---|---|

15. Cobble Stone

(a.) Section A-A

Length of structure = 4.20 m

$0.15 \times 1.6 \times 4.2 = 1.008 \text{ m}^3$

(b.) Section C-C

Length of structure = 1.8 + 0.5 = 2.30 m

$2 \times 0.15 \times 1.85 \times 2.3 = 1.277 \text{ m}^3$

(c.) Section D-D

Length of structure = 2.4 + 2.0 + 1.0 = 5.40 m

$2 \times 0.15 \times 2.25 \times 5.4 = 3.645 \text{ m}^3$

(a) + (b) + (c) = 5.930 $\text{m}^3$

| Name of Structure | ASIN BOX CULVERT INLET STRUCTURE SCAFOLDING AND FORM SUPPORT | Category Calculation | Work Volume | Page | 6/7 |
|---|---|---|---|---|---|

SUMMARY OF SCAFOLDING AND FORM SUPPORT VOLUME
FOR ASIN RIVER DRAINAGE SYSTEM IMPROVEMENT.

| No | Structure | Volume | |
|---|---|---|---|
| | | Scafolding ($m^2$) | Form Support ($m^3$) |
| 1 | Asin Pumping Station | 1342 | 941 |
| 2 | Asin Pumping Station, Gate | 732 | 254 |
| 3 | Asin Box Culvert | 1843 | 1358 |
| 4 | Asin Box Culvert Inlet Structure | 54 | 11 |
| 5 | Asin Box Culvert Outlet Structure | 62 | 16 |
| 6 | Secondary Channel Outlet on Asin River | - | 34 |
| 7 | Fuel Tank Box for Asin Pumping Station | 133 | 62 |
| 8 | Asin Pumping Station Bridge, Sub Structure | 166 | - |
| 9 | Asin No.1 Bridge, Sub Structure | 293 | - |
| 10 | Asin No.2 Bridge, Sub Structure | 251 | - |
| Total | | 4876 | 2676 |

| Name of Structure | ASIN BOX CULVERT INLET STRUCTURE SCAFOLDING AND FORM SUPPORT | Category Calculation | Work Volume | Page | 7/7 |
|---|---|---|---|---|---|

1. **Scafolding Area**

   (a.) Box Culvert

   $(2 \times 2.75 + 2 \times 2) \times 1.50 = 14.25\ m^2$

   (b.) Wing Wall

   $(6.2 \times 5.0 - 3.5 \times 2.0) + (2 \times 0.75 \times 5.0) + (4.7 \times 0.90) + (2 \times 0.35 \times 5.0) = 39.23\ m^2$

   (a) + (b) $= 53.48\ m^2$

2. **For Support Area**

   $3.5 \times 1.5 \times 2.0 = 10.5\ m^3$

| Name of Structure | ASIN BOX CULVERT OUTLET STRUCTURE | Category Calculation | Work Volume | Page | 1/11 |
|---|---|---|---|---|---|

## SUMMARY OF WORK VOLUME

| | | | | |
|---|---|---|---|---|
| 1. | STRUCTURE EXCAVATION | = | 1,070.55 | $m^3$ |
| 2. | BACK FILL | = | 533.44 | $m^3$ |
| 3. | LEVELING CONCRETE, TYPE E | = | 4.53 | $m^3$ |
| 4. | CONCRETE FOR STRUCTURE, TYPE C1 | = | 31.01 | $m^3$ |
| 5. | WET COBBLE MASONRY | = | 460.32 | $m^3$ |
| 6. | GRAVEL BEDDING | = | 104.78 | $m^3$ |
| 7. | STEEL REINFORCING | = | 1,217.29 | Kg |
| 8. | LOG PILE Ø150, L=3,000 | = | 321 | m' |
| 9. | WEEP HOLE PVC Ø50 | = | 39 | Nos |
| 10. | PALM FIBRE | = | 0.14 | $m^3$ |
| 11. | BOULDER FILLING | = | 11.27 | $m^3$ |
| 12. | FORM WORK | = | 134.91 | $m^3$ |
| 13. | COBBLE STONE | = | 12.15 | $m^3$ |

| Name of Structure | ASIN BOX CULVERT OUTLET STRUCTURE | Category Calculation | Work Volume | Page | 2/11 |
|---|---|---|---|---|---|

1. **Structure Excavation**

(a.) Section A-A (L=6.70 m)

$$\left(\frac{0.2+1.0}{2}\times 0.8+\frac{0.3+0.5}{2}\times 0.5+0.3\times 4.0+\frac{0.2+0.7}{2}\times 0.5+0.4\times 1.10+\frac{0.2+1.2}{2}\times 1.0+0.4\times 1.0\right)\times 6.70 = 24.421\ m^3$$

(b.) Section B-B (L=2.25 m)

$$\left(2\times\frac{0.2+4.1}{2}\times 4.0+4.4\times 4.0\right)\times 2.25 = 78.300\ m^3$$

(c.) Section C-C (L=5.0+3.90 m)

$$\left(\frac{0.2+1.0}{2}\times 0.8+\frac{0.3+0.5}{2}\times 0.5+0.3\times 4.0+\frac{0.2+1.3}{2}\times 1.1+\frac{0.2+5.7}{2}\times 5.5+2.0\times 5.5\right)\times(5.0+3.90) = 266.377\ m^3$$

(d.) Section D-D (L=3.90 m)

$$\left(\frac{0.2+1.0}{2}\times 0.8+\frac{0.3+0.5}{2}\times 0.5+0.3\times 4.0+\frac{0.2+0.9}{2}\times 0.7+\frac{0.8+1.4}{2}\times 3+1.0\times 1.4\right)\times 3.9 = 29.621\ m^3$$

(e.) Section E-E (L=6.20 m)

$$\left(\frac{0.2+1.0}{2}\times 0.8+\frac{0.3+0.5}{2}\times 0.5+0.3\times 4.0+\frac{0.2+0.9}{2}\times 0.7+\frac{0.2+4.2}{2}\times 4.0+\frac{0.8+1.4}{2}\times 3.0+1.4\times 1.0\right)\times 6.2 = 97.743\ m^3$$

(f.) Section F-F

- Retaining wall (L=8.50 m)

$$\left(\frac{0.2+5.7}{2}\times 5.5+2.0\times 5.5+\frac{0.2+1.6}{2}\times 1.4\right)\times 8.5 = 242.123\ m^3$$

- Bank protection portion (See Section H-H)

  - Slope 1 : 0.5 (L=13.50)

$$\left(\begin{array}{l}\dfrac{0.2+0.85}{2}\times 0.65+1.5\times 0.65\\ +\dfrac{\left(0.1+\sqrt{0.1^2+0.2^2}\right)}{2}\times 0.65\\ +\dfrac{0.45+0.90}{2}\times 3.1+\sqrt{0.1^2+0.2^2}\times 3.1\end{array}\right)\times 13.5 = 58.216\ m^3$$

- Flat area (L=12.50 m)

$$\left(\frac{3.0+2.8}{2}\times 0.4+0.9\times 0.3\right)\times\left(8.6+\frac{3.9}{2}\right) = 15.087\ m^3$$

- Slope 1:2.0 (L=19.5 m)

$$\left(\frac{0.9+2.3}{2}\times 0.6+\frac{\sqrt{2^2+1^2}+\sqrt{1^2+0.5^2}}{2}\times 0.5\right)\times\left(17.3+\frac{2.2}{2}\right) = 48.522\ m^3$$

$$= 363.948\ m^3$$

(g.) Section G-G (L=6.9 m)

$$\left(\frac{0.2+0.9}{2}\times 0.7+\frac{0.2+4.3}{2}\times 4.1+1.45\times 4.1\right)\times 6.9 = 107.330\ m^3$$

(h.) Section H-H

- Slope 1:0.5 (L=8.90 m)

$$\left(\begin{array}{l}\dfrac{2.60+1.7}{2}\times 0.65+\dfrac{0.68+1.09}{2}\times 3.5\\ +\dfrac{0.3+0.35}{2}\times 0.2\end{array}\right)\times 8.90 = 40.584\ m^3$$

- Flat area (L=12.90 m)

$$\left(\frac{3.0+2.8}{2}\times 0.4+0.9\times 0.3\right)\times 12.90 = 18.447\ m^3$$

- Slope 1:2.0 (L=16.60 m)

$$\left(\frac{0.9+2.3}{2}\times 0.6+\frac{\sqrt{2^2+1^2}+\sqrt{1^2+0.5^2}}{2}\times 0.5\right)\times 16.6 = 43.775\ m^3$$

(a)+(b)+(c)+(d)+(e)+(f)+(g)+(h) $= 1070.546\ m^3$

2. **Backfill**

(a.) Section A-A (L=6.70 m)

$$\left(\frac{0.2+1.0}{2}\times 0.8+\frac{0.2+0.8}{2}\times 0.6+\frac{0.2+1.2}{2}\times 1.0\right)\times 6.70 = 9.916\ m^3$$

(b.) Section B-B (L=2.25 m)

$$\left(2\times\frac{0.2+4.1}{2}\times 3.9+1.15\times 4.2\right)\times 2.25 \quad = \quad 48.600 \text{ m}^3$$

(c.) Section C-C (L=5.0+3.90 =8.9 m)

$$\left(\frac{0.2+1.0}{2}\times 0.8+\frac{0.2+1.3}{2}\times 1.1+\frac{0.2+5.7}{2}\times 5.5+\frac{0.9+4.1}{2}\right)\times 8.9 \quad = \quad 172.438 \text{ m}^3$$

(d.) Section D-D (L=3.90 m)

$$\left(\frac{0.2+1.0}{2}\times 0.8+\frac{0.2+0.9}{2}\times 0.7\right)\times 3.9 \quad = \quad 3.374 \text{ m}^3$$

(e.) Section E-E (L=6.20 m)

$$\left(\frac{0.2+1.0}{2}\times 0.8+\frac{0.2+0.9}{2}\times 0.7+\frac{0.2+4.2}{2}\times 4.0\right)\times 6.2 \quad = \quad 59.923 \text{ m}^3$$

(f.) Section F-F

- Retaining wall (L=8.50 m)

$$\left(\frac{0.2+1.0}{2}\times 5.5+\frac{0.9+4.10}{2}+\frac{1.85+1.25}{2}\right)\times 8.5 \quad = \quad 163.423 \text{ m}^3$$

(g.) Section G-G (L=6.90 m)

$$\left(\frac{0.2+0.9}{2}\times 0.7+\frac{0.2+4.3}{2}\times 4.1+\frac{0.6\times 3.1}{2}\right)\times 6.9 \quad = \quad 72.726 \text{ m}^3$$

(h.) Section H-H (L=8.90 m)

$$\frac{0.2+0.85}{2}\times 0.65\times 8.9 \quad = \quad 3.037 \text{ m}^3$$

(a)+(b)+(c)+(d)+(e)+(f)+(g)+(h) = 533.437 m³

3. **Leveling Concrete (E)**

(a.) Section A-A (L=2.25-0.4 = 1.85 m)

$1.85 \times 4.4 \times 0.10$ = 0.814 m³ | fw = 0.37

(b.) Detail I (L=18.05+19.50 = 37.55 m)

$37.55 \times 0.70 \times 0.10$ = 2.629 m³ | fw = 7.51

(c.) Detail II (L=10.2+11.50 = 21.7 m)

$21.7 \times 0.50 \times 0.10$ = 1.085 m³ | fw = 4.34

4.528 m³ | fw = 12.22

4. **Concrete for Structure ($C_1$)**

(a.) Section A-A (L=2.25 m)

$$\left(6.2\times 5.0-2.0\times 3.5+4\times\frac{0.3+0.3}{2}\right)\times 0.4 \quad = \quad 9.672 \text{ m}^3$$

$$\left\{\begin{matrix}(0.35\times 4.2)+(0.4\times 4.2)+(2\times 0.35\times 2.0)\\ +\left(4\times\dfrac{0.3\times 4.3}{2}\right)\end{matrix}\right\}\times 1.85 = 8.750\ m^3$$

$$2\times\frac{0.25+0.25}{2}\times 3.0+\frac{0.25+0.25}{2}\times 4.7 = 0.334\ m^3$$

$$= 18.756\ m^3$$

(b.) Detail I (L=37.55 m) (Base concrete)

$$(0.5\times 0.5-0.3\times 0.15)\times 37.55 = 7.698\ m^3$$

(c.) Detail II (L=21.7 m) (Top concrete)

$$0.30\times 0.70\times 21.70 = 4.557\ m^3$$

$$(a)+(b)+(c) = 31.011\ m^3$$

5. **Wet Cobble Masonry**

(a.) Section A-A (L=18.0 m)

$$\frac{0.3+0.8}{2}\times 1.25\times 18 = 12.375\ m^3$$

(b.) Section C-C (L=5.85 + 5.35 = 11.20 m)

$$\left\{\left(\frac{1.10+2.0}{2}\right)\times 4.10+(2\times 1.40)\right\}\times 11.20 = 102.536\ m^3$$

(c.) Section D-D (L=3.90 m)

$$\left\{\left(\frac{6.8+1.40}{2}\right)\times 3+(1\times 1.40)\right\}\times 3.9 = 18.330\ m^3$$

(d.) Section E-E (L=10.85 m)

$$\left\{\left(\frac{0.8+1.4}{2}\right)\times 3+(1\times 1.40)\right\}\times 10.85 = 50.995\ m^3$$

(e.) Section F-F (L=8.5 m)

- Retaining wall (L=8.50 m)

$$\left\{\frac{1.1+2}{2}\times 4.10+(1.4\times 2)\right\}\times 8.5 = 77.818\ m^3$$

- Bank Protection / Slope 1:0.5 (L=14 m)

$$\left\{\left(\frac{0.45+0.9}{2}\right)\times 3.6+(1.5\times 0.65)\right\}\times 14 = 42.670\ m^3$$

- Bed Protection (L=5+2.6+3.9 = 11.50 m)

$$\left\{(5\times 3)+(1.85\times 3)+\left(\frac{2.85\times 3.9}{2}\right)\right\}\times 0.3 = 7.832\ m^3$$

- Bank Protection / Slope 1:2 (L=5+3.6+3.9+4.8+2.2 = 19.5 m)

$\left(\sqrt{2^2+1^2}\right)\times 0.3+19.5$ = 13.081 m³

= 146.401 m³

(f.) Section G-G (L= 2 + 3 + 1.9 = 6.9 m)

$\left\{\left(\frac{0.85+1.45}{2}\right)\times 3.10+\left(1\times 1.45\right)\right\}\times 6.9$ = 34.604 m³

(g.) Section H-H

- Bank Protection / Slope 1:0.5 (L=5 + 4.25 = 9.25 m)

$\left\{\left(\frac{0.45+0.9}{2}\right)\times 3.6+\left(1.5\times 0.65\right)\right\}\times 9.25$ = 31.496 m³

- Bed Protection (L= 5 + 7.95 = 12.95 m)

$3\times 0.3\times 12.95$ = 11.655 m³

- Bank Protection / Slope 1:2 (L=5 + 11.65 = 16.65 m)

$\left(\sqrt{2^2+1^2}\right)\times 0.3\times 16.65$ = 11.169 m³

= 54.320 m³

(h.) Apron

Area :

(I) $(11.6\times 6.55)-\left(\frac{90}{360}\times \frac{1}{2}\times \pi\times 6.55^2\right)-\frac{1.85\times 3.4}{2}$ = 55.987 m²

(II) $\frac{5.50+9.90}{2}\times 3.80$ = 29.260 m²

(III) $\frac{8.65+9.65}{2}\times 4.0$ = 36.600 m³

A = 121.847 m²

$V_A = 121.847\times 0.30$ = 36.554 m³

$T_{OE}$ = (L = 9.9 + 5.5 + 8.65 = 24.05 m)

$V_T = \left(\frac{0.4+0.3}{2}\right)\times 0.5\times 24.05$ = 4.209 m³

= 40.763 m³

Total (a)+(b)+(c)+(d)+(e)+(f)+(g)+(h) =460.324 m³

6. Gravel Bedding

(a.) Section C-C (L=5.85 + 5.35 = 11.20 m)

$\left(\sqrt{4^2+0.9^2}\right)\times 0.30\times 11.20$ = 13.776 m³

(b.) Section F-F (L=8.5 m)

- Retaining wall (L=8.50 m)

$\left(\sqrt{4^2+0.9^2}\right)\times 0.30\times 11.20$ = 10.455 m³

- Bank Protection / Slope 1:0.5 (L=14 m)

$$\left\{\left(\sqrt{1.35^2+3.4^2}\right)\times 0.20+0.20+\frac{0.25+0.10}{2}\times 0.65\right\}\times 14 = 42.670 \text{ m}^3$$

- Bed Protection (L=5+2.6+3.9 = 11.50 m)

$$\left\{(3\times 0.2)+\left(\frac{0.4\times 0.2}{2}\times 0.3\right)\right\}\times 11.50 = 7.935 \text{ m}^3$$

- Bank Protection / Slope 1:2 (L= 19.5 m)

$$\left\{\left(\sqrt{2^2+1^2}\right)\times 0.3+\frac{0.4+0.2}{2}\times 0.3\right\}\times 19.5 = 10.476 \text{ m}^3$$

$$= 42.064 \text{ m}^3$$

(c.) Section G-G

$$\left(\sqrt{0.6^2+3^2}\right)\times 0.20\times 6.9 = 4.222 \text{ m}^3$$

(d.) Section H-H

- Bank Protection / Slope 1:0.5 (L=5 + 4.25 = 9.25 m)

$$\left\{\sqrt{2.25^2+3.6^2}\times 0.2+0.3\times 0.2+\frac{0.25+0.10}{2}\times 0.65\right\}\times 9.25 = 9.461 \text{ m}^3$$

- Bed Protection (L= 5 + 7.95 = 12.95 m)

$$\left\{(3\times 0.2)+\frac{0.4+0.2}{2}\times 0.3\right\}\times 9.25 = 6.383 \text{ m}^3$$

- Bank Protection / Slope 1:2 (L= 19.50 m)

$$\left\{\left(\sqrt{2^2+1^2}\right)\times 0.2+\frac{0.4+0.2}{2}\times 0.30\right\}\times 19.50 = 10.476 \text{ m}^3$$

(e.) Bed Channel

$0.2 \times 4.0 \times 23.0 = 18.40 \text{ m}^3$

$= 26.320 \text{ m}^3$

**Gravel bedding (a)+(b)+(c)+(d)+(e) = 104.782 m³**

7. **Steel Reinforcing**

(a.) Detail I (Base concrete)

Stirrup : $L = 0.4 + 0.25 + 0.4 + 0.15 + \left(\sqrt{0.25^2+0.15^2}\right) + 2\times 0.02 = 1.532$ m

Length of bed concrete = 37.500 m

Weight of stirrup = $\frac{37.5}{0.3}\times 1.532\times 0.617 = 118.116$ kg

Main reinforcement = $6 \times 37.5 \times 1.040 = 234.000$ kg

**= 352.116 kg**

(b.) Detail II (Top concrete)

Stirrup : $L = 2\times 0.2 + 2.0\times 0.6 + 0.15 + \left(\sqrt{0.25^2+0.15^2}\right) + 2\times 0.02 = 1.532$ m

Length of bed concrete = 21.70 m

Weight of stirrup = $\frac{21.70}{0.3} \times 1.640 \times 0.617$ = 72.181 kg

Main reinforcement = 6 × 21.70 ×1.040 = 135.408 kg

= 207.589 kg

(c.) Wing Wall

Weight of reinforcement (see Table) = 657.580 kg

---

= 1217.285 kg

8. Weep Hole (PVC Ø50)

(a.) Section C-C

Length of masonry = 11.20 m

Line number of weep hole = $\frac{11.20}{2.0} = 5.6 \sim 6$

Length of weep hole = 6 ×(1.5 + 2.0) = 21 m' → 2 × 6 = 12 nos

(b.) Section F-F

- Retaining Wall (L= 8.5 m)

Line number of weep hole = $\frac{8.5}{2.0} = 4.25 \sim 5$ → 2 × 5 = 10 nos

Length of weep hole = 5 ×(1.5 + 2.0) = 17.500 m³

- Bank protection/Slope 1:0.5 (L= 13.50 m)

Line number of weep hole = $\frac{13.50}{2.0} = 6.75 \sim 7$ → 1 × 7 = 7 nos

Length of weep hole = 7×(0.70+0.8+0.90)= 16.800 m³

- Bank protection/Slope 1:2.0 (L= 19.50 m)

Line number of weep hole = $\frac{19.50}{2.0} = 9.75 \sim 10$ → 1 × 10 = 10 nos

Length of weep hole = 10 × 0.80 = 8.000 m³

42.300 m³ → = 139 nos

(c.) Section F-F

- Retaining Wall (L= 6.90 m)

Line number of weep hole = $\frac{6.9}{2.0} = 3.45 \sim 4$

Length of weep hole = 4 ×(1.25 + 1.50) = 11.5 m'

(d.) Section H-H

- Bank protection/Slope 1:0.5 (L= 8.90 m)

Line number of weep hole = $\frac{8.9}{2.0} = 4.45 \sim 5$

Length of weep hole = 5×(0.70+0.8+0.90)= 12.00 m'

- Bank protection/Slope 1:2.0 (L= 18.05 m)

Line number of weep hole = $\frac{18.05}{2.0} = 9$

Length of weep hole = $9 \times 0.80$ = 7.20 m'

19.20 m'

**Total length of weep hole** = **93.50 m'**

9. **Palm Fibre**

Total number of weep hole = 12 + 41 + 8 + 24 = 85 nos

Palm fibre dimension 200 × 200 × 40

Volume of palm fibre = $0.2 \times 0.2 \times 0.04 \times 85$ = 0.136 m³

10. **Boulder Filling**

(a.) Section F-F (L= 19.50 m)

$V = \frac{0.8 + 0.2}{2} \times 0.6 \times 19.50$ = 5.850 m³

(b.) Section H-H (L= 18.05 m)

$V = \frac{0.8 + 0.2}{2} \times 0.6 \times 18.05$ = 5.415 m³

= **11.265 m³**

11. **Form Work**

(a.) Section A-A & B-B

$6.2 \times 5.0 - 3.5 \times 2.0 + 6.2 \times 0.9 + 22.75 \times 2.25$
$+ 1.10 \times 6.20 + 4.2 \times \sqrt{0.25^2 + 0.25^2} + 22.75$ = 65.704 m²
$\times \sqrt{0.25^2 + 0.25^2} + 21.5 \times 2.25 + 3.0 \times 2.25$

(b.) Top Concrete (L=21.70 m)

$21.70 \times 0.7 \times 2$ = 30.38 m²

(c.) Base Concrete (L=37.50 m)

$37.5 \times \left(0.5 + \sqrt{0.15^2 + 0.3^2} + 0.20\right)$ = 38.828 m²

Total (a)+(b)+(c) = **134.912 m²**

| Name of Structure | ASIN BOX CULVERT OUTLET STRUCTURE | Category Calculation | Work Volume | Page | 10/11 |
|---|---|---|---|---|---|

12. Cobble Stone

(a.) Section C-C (L= 8.90 m)
$0.15 \times 2.20 \times 8.90$ = 2.937 m³

(b.) Section D-D (L= 3.90 m)
$0.15 \times 1.6 \times 3.90$ = 0.936 m³

(c.) Section E-E (L= 6.20 m)
$0.15 \times 1.6 \times 6.20$ = 1.488 m³

(d.) Section F-F (L= 8.50 m)
$0.15 \times 2.20 \times 8.50$ = 2.805 m³

(e.) Section G-G (L= 6.90 m)
$0.15 \times 1.65 \times 6.90$ = 1.708 m³

(f.) Section H-H (L= 8.90 m)
$0.15 \times 1.70 \times 8.90$ = 2.270 m³

Total (a)+(b)+(c) +(d)+(e)+(f)+(g) +(h) = 12.144 m³

13. Timber Log Pile

(a.) For bed concrete (total length of bed concrete = 37.55 m)(etc=2,100)

Total length of log pile = $\left(\frac{37.55 - 0.4 \times 2}{2} + 1\right) \times 3.0$ = 57 m'

(b.) Section C-C (Total length of Structure = 8.90 m, etc=2,100, 2 columns)

$2 \times 3.0 \times \left(\frac{8.9 - 2 \times 0.4}{1} + 1\right)$ = 54 m'

(c.) Section D-D (Total length of Structure = 3.90 m, etc=1.0, 2 columns)

$2 \times 3.0 \times \left(\frac{3.9 - 2 \times 0.4}{1} + 1\right)$ = 24 m'

(d.) Section E-E (Total length of Structure = 6.20 m, etc=1.0, 2 columns)

$2 \times 3.0 \times \left(\frac{6.20 - 2 \times 0.4}{1} + 1\right)$ = 36 m'

(e.) Section F-F (Total length of Structure = 8.50 m, etc=1.0, 2 columns)

$2 \times 3.0 \times \left(\frac{8.5 - 2 \times 0.4}{1} + 1\right)$ = 54 m'

(f.) Section G-G (Total length of Structure = 6.90 m, etc=1.0, 2 columns)

$2 \times 3.0 \times \left(\frac{6.9 - 2 \times 0.4}{1} + 1\right)$ = 42 m'

(g.) Section H-H (Total length of Structure = 8.90 m, etc=1.0, 2 columns)

$2 \times 3.0 \times \left(\frac{8.9 - 2 \times 0.4}{1} + 1\right)$ = 54 m'

Total (a)+(b)+(c) +(d)+(e)+(f)+(g) = 321 m³

| Name of Structure | ASIN BOX CULVERT OUTLET STRUCTURE | Category Calculation | Work Volume | Page | 11/11 |
|---|---|---|---|---|---|

14. Pointing

(a.) Section C-C (L=11.20 m)

$(3.7 + 0.40) \times 11.2$ = 45.92 m²

(b.) Section D-D (L= 3.90 m)

$(3.7 - 0.7) \times 3.90$ = 11.70 m²

(c.) Section E-E (L= 10.85 m)

$(3.7 - 0.7) \times 10.85$ = 32.55 m²

(d.) Section F-F

$\left(\sqrt{1^2 + 1.55^2}\right) \times 19.5$ = 43.600 m²

$(3.7 + 0.4) \times 7.0$ = 53.900 m²

$3.0 \times (5 + 2.6 + 3.9)$ = 34.500 m²

$\left(\sqrt{3.1^2 + 1.55^2}\right) \times 15$ = 51.990 m²

(e.) Section G-G

$(2.7 + 0.4) \times 6.90$ = 21.390 m²

(f.) Section H-H

$\left(\sqrt{3.1^2 + 1.55^2}\right) \times 18.05$ = 31.260 m²

$3.0 + 12.93$ = 38.790 m²

$\left(\sqrt{3.1^2 + 1.55^2}\right) \times 9.24$ = 32.025 m²

= 397.630 m²

| Name of Structure | SCAFOLDING AND FORM SUPPORT FOR ASIN DRAINAGE SYSTEM | Category Calculation | Work Volume | Page | 1/2 |
|---|---|---|---|---|---|

## SUMMARY OF SCAFOLDING AND FORM SUPPORT VOLUME FOR ASIN RIVER DRAINAGE SYSTEM IMPROVEMENT.

| No | Structure | Volume | |
|---|---|---|---|
| | | Scafolding ($m^2$) | Form Support ($m^3$) |
| 1 | Asin Pumping Station | 1342 | 941 |
| 2 | Asin Pumping Station, Gate | 732 | 254 |
| 3 | Asin Box Culvert | 1843 | 1358 |
| 4 | Asin Box Culvert Inlet Structure | 54 | 11 |
| 5 | Asin Box Culvert Outlet Structure | 62 | 16 |
| 6 | Secondary Channel Outlet on Asin River | - | 34 |
| 7 | Fuel Tank Box for Asin Pumping Station | 133 | 62 |
| 8 | Asin Pumping Station Bridge, Sub Structure | 166 | - |
| 9 | Asin No.1 Bridge, Sub Structure | 293 | - |
| 10 | Asin No.2 Bridge, Sub Structure | 251 | - |
| **Total** | | 4876 | 2676 |

| Name of Structure | SCAFOLDING AND FORM SUPPORT FOR ASIN BOX CULVERT OUTLET STRUCTURE | Category Calculation | Work Volume | Page | 2/2 |
|---|---|---|---|---|---|

1. **Scafolding Area**

   (a) Box culvert = $(2 \times 2.75 + 2 \times 2.0)$ = 21.375

   (b) Wing Wall

   $(6.2\times5.0-3.5\times2.0)+(2\times0.75\times5.0)+(0.9\times4.70)+(2\times0.4\times5.0)$ = 39.730

   (a)+(b) = 61.105 $m^2$

2. **Form Support Area**

   $3.50 \times 2.25 \times 2.0$ = 15.75 $m^3$

| Name of Structure | ASIN RIVER No.1 BRIDGE SUPER STRUCTURE | Category Calculation | Concrete Volume | Page | 1/5 |
|---|---|---|---|---|---|

## SUMMARY OF QUANTITIES OF SUPER STRUCTURE

| | | | | | |
|---|---|---|---|---|---|
| 1. | STRUCTURE CONCRETE K400 | | = | 68.31 | $m^3$ |
| 2. | STRUCTURE CONCRETE K250 | | = | 77.46 | $m^3$ |
| 3. | REINFORCING STEEL | = 15,787 kg | | | |
| 4. | PC CABLE K1 Ø12.7 7 STRANDS | = 769,000 kg | | | |
| | PC CABLE K2 Ø12.7 12 STRANDS | = 1,320,000 kg | | | |
| | PC CABLE K1 Ø12.7 7 STRANDS | = 771,000 kg | | | |
| | PC CABLE MONO STRAND CABLE/FS | = 48,500 kg | | | |
| | TOTAL | | = | 2,908,500 | kg |
| 5. | BRIDGE RAILLING | | = | 43.60 | m |
| 6. | EXPANSION JOINT | | = | 20.10 | m |
| 7. | BEARING SHOE AND RUBBER SHEET | | = | 12.00 | pieces |
| 8. | PVC DRAINAGE PIPE Ø10 cm | | = | 10.50 | m' |
| 9. | ASPHALT PAVEMENT AC ON TOP OF SLAB | | = | 14.60 | $m^3$ |
| 10. | FORM WORK | | = | 881.31 | $m^2$ |

| Name of Structure | ASIN RIVER No.1 BRIDGE SUPER STRUCTURE | Category Calculation | Concrete Volume | Page | 2/5 |
|---|---|---|---|---|---|

## SUMMARY CONCRETE VOLUME

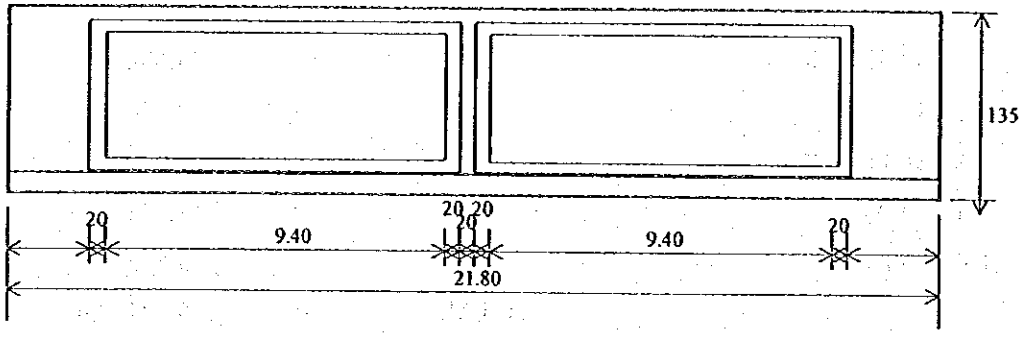
| | | | | |
|---|---|---|---|---|
| - | MAIN GIRDER | = | 64,638 | kg |
| - | SLAB | = | 48,256 | kg |
| - | PANEL PLATE | = | 10,759 | kg |
| - | SIDE WALK | = | 18,443 | kg |
| - | CROSS BEAM | = | 3,675 | kg |
| | TOTAL | = | 145,771 | kg |

SO:

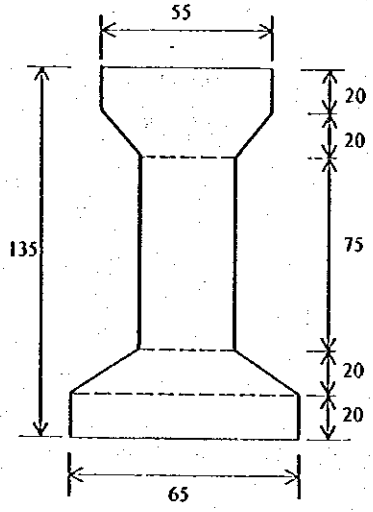
| | | | | |
|---|---|---|---|---|
| - | CONCRETE QUALITY FOR K400 | = | 68,313 | kg |
| - | CONCRETE QUALITY FOR K250 | = | 77,458 | kg |

| Name of Structure | ASIN RIVER No.1 BRIDGE SUPER STRUCTURE | Category Calculation | Concrete Volume | Page | 3/5 |
|---|---|---|---|---|---|

## 1. Main Girder

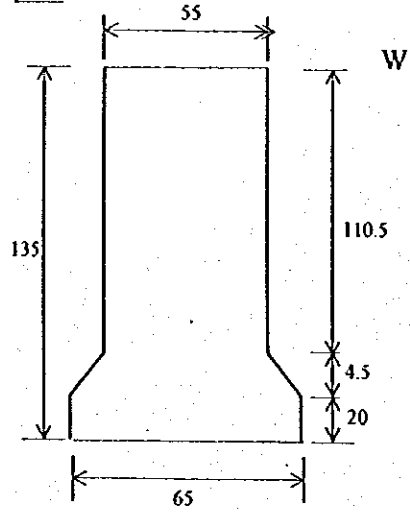



**Center**




Wide
$A_1 = 0.65 \times 0.20 = 0.1300\ m^2$
$A_2 = \frac{0.20 + 0.65}{2} \times 0.20 = 0.0850\ m^2$
$A_3 = 0.20 \times 0.75 = 0.1500\ m^2$
$A_4 = \frac{0.55 + 0.20}{2} \times 0.10 = 0.0375\ m^2$
$A_5 = 0.55 \times 0.10 = 0.130\ m^2$
Sub Total = $0.4575\ m^2$

**End**




Wide
$A_1 = 0.65 \times 0.20 = 0.130\ m^2$
$A_2 = \frac{0.65 + 0.55}{2} \times 0.045 = 0.027\ m^2$
$A_3 = 0.55 \times 1.105 = 0.108\ m^2$
Sub Total = $0.765\ m^2$

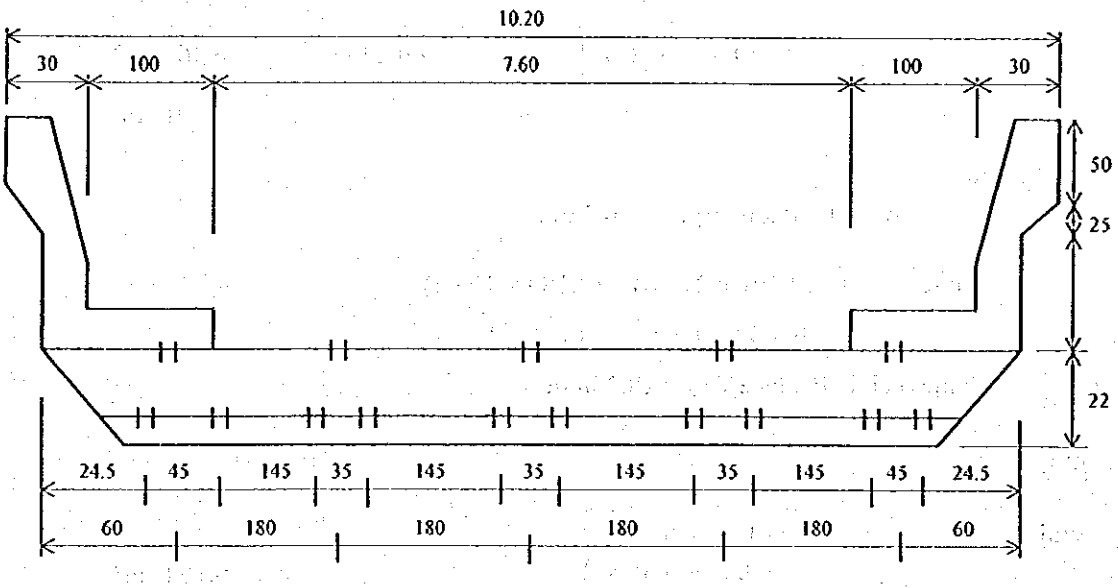
$A = \frac{0.4575 + 0.765}{2} = 0.611\ m^2$

Volume $= [(0.4575 \times 9.40 \times 2) + (0.765 \times (100 \times 2 + 0.20) + (0.611 \times 0.20 \times 4))]$
$= 8.601 + 1.683 + 0.489$
$= 10.773\ m^3$

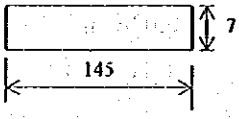
Volume Main Girder Total ($V_G$)
$= 6 \times 10.773 = 64.638\ m^3$

| Name of Structure | ASIN RIVER No.1 BRIDGE SUPER STRUCTURE | Category Calculation | Concrete Volume | Page | 4/5 |
|---|---|---|---|---|---|

## 2. Slab, Side Walk and Panel Plate




**Panel Plate K250**




Length = 1.00 m

One Panel :

Volume = 1.45 × 0.07 × 1.0 = 0.1015 m³

In one span = (21.80 – 0.30 × 2)

= 21.20 m

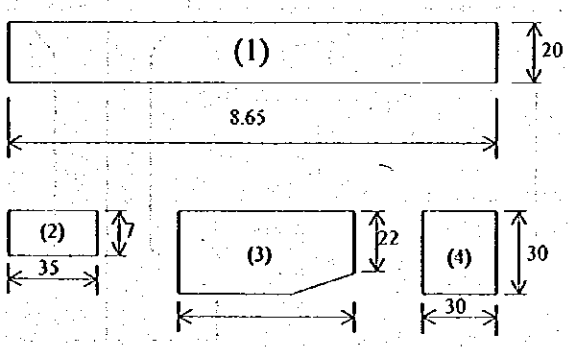
Volume = (21 + 0.20) × 0.1015

= 2.1518 m³

Total volume panel plate in Bridge ($V_P$)

$V_P = 5 \times 2.1518 = 10.759$ m³

**Slab**




End Plate

Wide :

$A_1 = 8.65 \times 0.20 = 1.730\ m^2$

$A_2 = 0.35 \times 0.07 \times 4 = 0.098\ m^2$

$A_3 = (0.45 \times 0.27) + \left(\frac{0.27 + 0.22}{2} \times 0.245\right) \times 2 = 0.363\ m^2$

$= 2.191\ m^2$

**End Plate**

$A_4 = (0.30 \times 0.30) \times 2 = 0.180\ m^2$

Volume $= (2.191 \times 21.20) + (0.180 \times 10.04)$

$= 46.449 + 1.807 = 48.256\ m^3$

Volume Slab in Bridge (VS) = **48.256 m³**

**Side Walk**

Wide :

$A_4 = 1.00 \times 0.25 \times 2 = 0.500\ m^2$

$A_5 = 0.22 \times 0.35 \times 2 = 0.154\ m^2$

$A_6 = \left(\frac{0.17 + 0.22}{2} \times 0.40 \times 2\right) = 0.164\ m^2$

$A_7 = \left(\frac{0.20 + 0.25}{2} \times 0.08 \times 2\right) = 0.036\ m^2$

$= 0.846\ m^2$

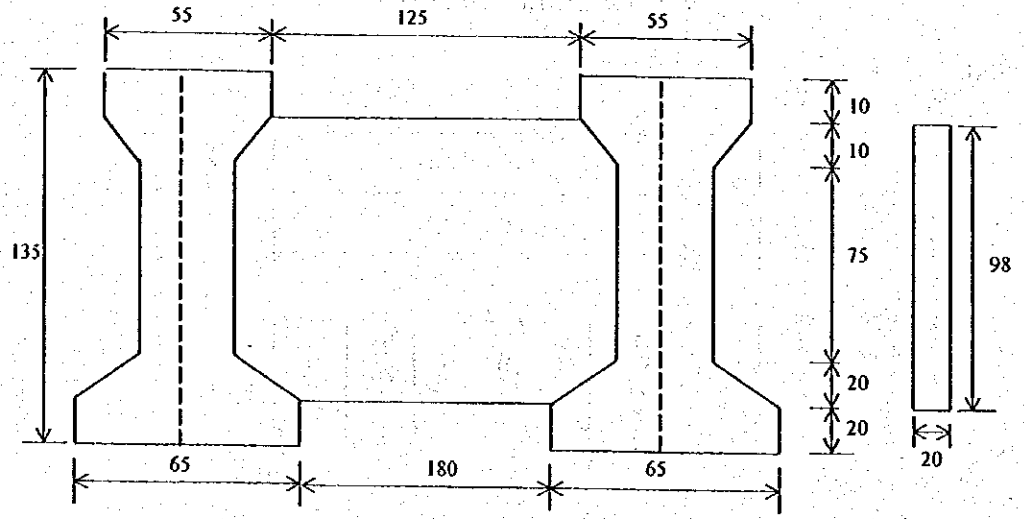
Volume $= \Sigma A \times L$

$= 0.846 \times 21.80 = 18.443\ m^3$

Volume Side walk in Bridge ($V_{SW}$) = **18.443 m³**

**Slab and Side walk = 48.256 + 18.443 = 66.699 ~ 66.70 m³**

3. **Cross Beam / Diapraghm K400**




Volume = 0.20 × 0.98 × 1.25 = 0.245 m³

Total volume Cross Beam in Bridge ($V_{CB}$)

$V_{CB} = 5 \times 3 \times 0.245 = 3.675\ m^3$

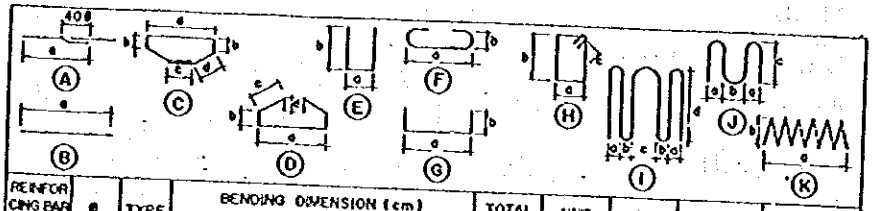
| Name of Structure | ASIN RIVER No.1 B R I D G E | Category Calculation | Reinforcing Volume | Page | 1/4 |
|---|---|---|---|---|---|

## SUMMARY CONCRETE VOLUME

| | | | | |
|---|---|---|---|---|
| - | MAIN GIRDER | = | 9,616 | kg |
| - | SLAB | = | 8,231 | kg |
| - | HAND RAIL AND KERB | = | 6,033 | kg |
| - | PANEL PLATE | = | 1,526 | kg |
| - | DIAPRAGHM | = | 378 | kg |
| | TOTAL | = | 25,784 | kg |

| | | | | |
|---|---|---|---|---|
| - | PC CABLE K1 Ø12.7 7 STRANDS | = 769.000 | kg | |
| | PC CABLE K2 Ø12.7 12 STRANDS | = 1320.000 | kg | |
| | PC CABLE K1 Ø12.7 7 STRANDS | = 771.000 | kg | |
| | PC CABLE for DIAPRAGHM Ø12.5 | = 48.520 | kg | |
| | TOTAL | = | 2908.520 | kg |

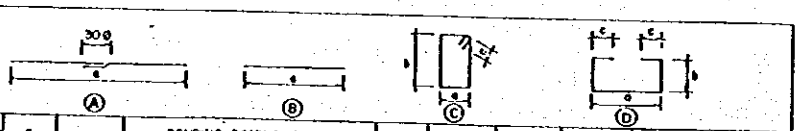
## MAIN GIRDER




| REINFORCING BAR NO. | ø (mm) | TYPE | BENDING DIMENSION (cm) a | b | c | d | e | f | TOTAL LENGTH (m) | UNIT WEIGHT/m (kg/m) | NUMBER | WEIGHT (kg) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B1 | 13 | D | 57 | 15 | 33 | 10 | | | 1.77 | 1.04 | 6x94 | 10382 | |
| B2 | 13 | E | 12 | 166 | | | | | 3.44 | 1.04 | 6x94 | 2016 | |
| B3 | 13 | C | 47 | 4 | 12 | 20 | | | 1.12 | 1.04 | 6x76 | 564 | |
| B4 | 13 | A | 21.70 | | | | | | 22.22 | 1.04 | 6x4 | 555 | |
| B5 | 13 | A | 20.28 | | | | | | 80.80 | 1.04 | 6x8 | 1036 | |
| B6 | 13 | G | 55 | 10 | | | | | 0.75 | 1.04 | 6x1 | 5 | |
| B7 | 16 | A | 21.70 | | | | | | 22.54 | 1.58 | 6x8 | 1694 | |
| B8 | 13 | A | 21.70 | | | | | | 22.54 | 1.04 | 6x2 | 279 | |
| B9 | 13 | H | 47 | 127 | 6.5 | | | | 3.61 | 1.04 | 6x18 | 406 | |
| B10 | 13 | B | 92 | 23 | 15 | | | | 1.30 | 1.04 | 6x10 | 129 | |
| B11 | 10 | F | 16 | 4 | | | | | 0.24 | 0.617 | 6x356 | 261 | |
| B12 | 16 | A | 21.70 | | | | | | 22.54 | 1.58 | 6x4 | 847 | |
| B13 | 13 | I | 6 | 6 | 12 | 36 | | | 2.565 | 1.04 | 6x1 | 15 | |
| B14 | 13 | J | 7 | 10 | 24 | | | | 0.93 | 1.04 | 6x2 | 12 | |
| B15 | 13 | K | 30 | 18 | | | | | 3.391 | 1.04 | 6x6 | 127 | |
| B16 | 13 | B | 15 | | | | | | 0.90 | 1.04 | 6x2 | 11 | |
| B17 | 13 | B | 30 | | | | | | 1.80 | 1.04 | 6x1 | 11 | |
| | | | | | | | | | | | TOTAL | 9616 kg. | |

LIST OF REINFORCING BAR OF MAIN GIRDER

## SLAB



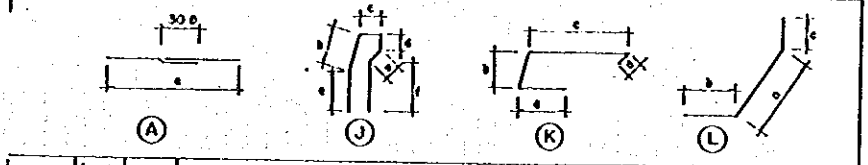

| REINFORCING BAR NO. | ø (mm) | TYPE | BENDING DIMENSION a | b | c | d | e | TOTAL LENGTH (m) | UNIT WEIGHT (kg/m) | WEIGHT PER BAR | NUMBER | WEIGHT (kg) | REMARK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S1 | D16 | B | 130 | | | | | 1.30 | 1.58 | 2.054 | 420 | 863 | |
| S2 | D16 | B | 1013 | | | | | 10.13 | 1.58 | 16.005 | 114 | 1825 | |
| S3 | D16 | B | 130 | | | | | 1.30 | 1.58 | 2.054 | 525 | 1078 | |
| S4 | D16 | B | 971 | 35 | 32.5 | 10 | | 11.26 | 1.58 | 17.79 | 110 | 1956 | |
| S5 | D16 | B | 115 | | | | | 1.15 | 1.58 | 1.817 | 30 | 55 | |
| S6 | D10 | C | 30 | 22 | 5 | | | 0.84 | 0.56 | 0.4704 | 70 | 33 | |
| S7 | D10 | D | 25 | 10 | 5 | | | 0.55 | 0.56 | 0.308 | 100 | 31 | |
| S8 | D13 | A | 2209 | | | | | 22.09 | 1.04 | 22.974 | 52 | 1195 | |
| S9 | D13 | A | 2209 | | | | | 22.09 | 1.04 | 22.974 | 52 | 1195 | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | TOTAL | 8231 kg | |

LIST OF REINFORCING BAR OF DECK SLAB

| Name of Structure | ASIN RIVER No.1 BRIDGE | Category Calculation | Reinforcing Volume | Page | 3/4 |
|---|---|---|---|---|---|

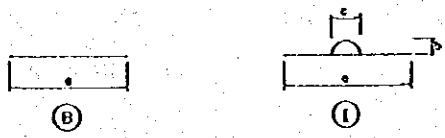
## SIDEWALK AND KERB

LIST OF REINFORCING BAR OF SIDE WALK




| REINFORCING BAR NO. | ø (mm) | TYPE | BENDING DIMENSION (cm) a | b | c | d | e | f | TOTAL LENGTH (m) | UNIT WEIGHT/m (kg/m) | NUMBER | WEIGHT (kg) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T 1 | 13 | J | 45 | 55 | 20 | 15 | 10 | 55 | 1.93 | 1.04 | 2x110 | 442 | |
| T 2 | 13 | K | 35 | 30 | 96 | 85 | | | 1.66 | 1.04 | 2x110 | 384 | |
| T 3 | 13 | L | 12 | 40 | 15 | | | | 0.67 | 1.04 | 2x110 | 153 | |
| T 4 | 13 | A | 22.09 | | | | | | 22.09 | 1.04 | 2x14 | 5054 | |
| | | | | | | | | | | | TOTAL | = 6033 | kg |

## PANEL PLATE

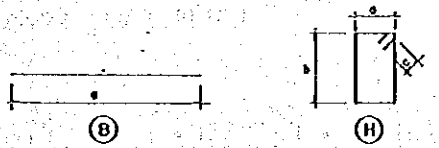



| REINFORCING BAR NO. | ø (mm) | TYPE | BENDING DIMENSION (cm) a | b | c | d | e | f | TOTAL LENGTH (m) | UNIT WEIGHT/m (kg/m) | NUMBER | WEIGHT (kg) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ▱ 145 x 100 (NUMBER OF PANELS=105) | | | | | | | | | | | | | |
| P 1 | 13 | B | 90 | | | | | | 0.80 | 1.04 | 630 | 590 | |
| P 2 | 13 | B | 130 | | | | | | 1.30 | 1.04 | 630 | 852 | |
| P 3 | 9 | I | 20 | 10 | 12 | | | | 0.40 | 0.50 | 420 | 84 | |
| | | | | | | | | | | | TOTAL | = 1526 | kg |

LIST OF REINFORCING BAR OF PANEL PLATE

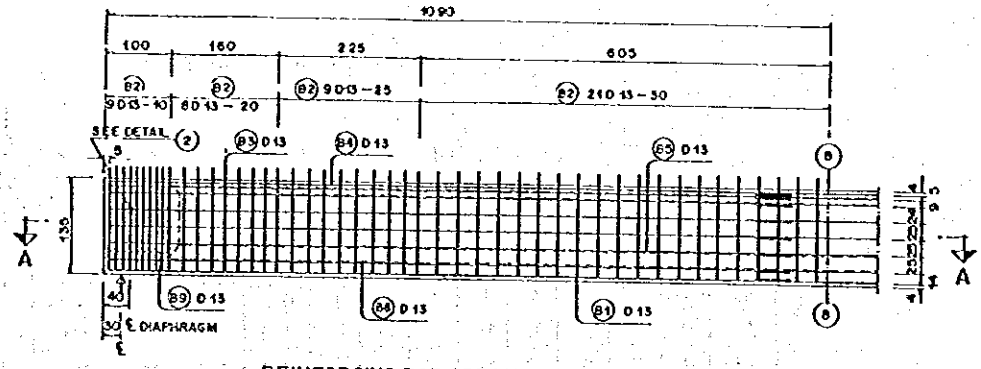
## DIAPRAGHM

LIST OF REINFORCING BAR OF DIAPHRAGM

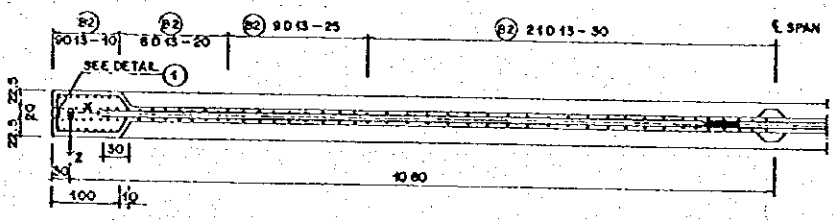



| REINFORCING BAR NO. | ø (mm) | TYPE | BENDING DIMENSION (cm) a | b | c | d | e | f | TOTAL LENGTH (m) | UNIT WEIGHT/m (kg/m) | NUMBER | WEIGHT (kg) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D 1 | 13 | B | 107 | | | | | | 1.20 | 1.04 | 180 | 225 | |
| D 2 | 9 | H | 12 | 97 | 45 | | | | 2.27 | 0.50 | 135 | 153 | |
| | | | | | | | | | | | TOTAL | = 378 | kg |

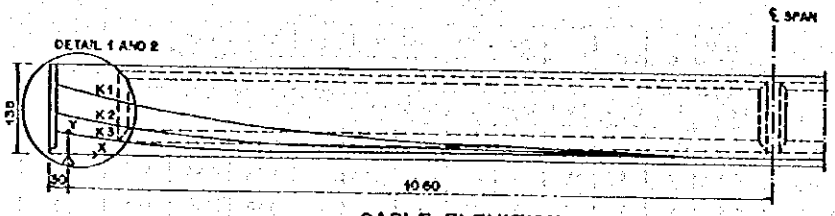
| Name of Structure | ASIN RIVER No.1 BRIDGE | Category Calculation | Reinforcing Volume | Page | 4/4 |
|---|---|---|---|---|---|




REINFORCING BAR ARRANGEMENT OF MAIN BEAM
SCALE A




SECTION A-A
SCALE A




CABLE ELEVATION
SCALE A

| | | X | 0 | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 | 1060 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CABLE 3 | Y | 27.0 | 24.0 | 21.4 | 19.0 | 16.9 | 15.1 | 13.5 | 12.2 | 11.3 | 10.6 | 10.1 | 10.0 |
| (K3) | Z | 0 | 2.1 | 4.0 | 5.7 | 7.1 | 8.4 | 9.5 | 10.4 | 11.1 | 11.6 | 11.9 | 12.0 |
| CABLE 2 | Y | 58.5 | 50.1 | 42.5 | 35.7 | 29.6 | 24.4 | 20.0 | 16.4 | 13.6 | 11.6 | 10.4 | 10.0 |
| (K2) | Z | 0 | 0 | 0 | 0 | 0 | -3.2 | -5.9 | -8.1 | -9.8 | -11.0 | -11.6 | -12.0 |
| CABLE 1 | Y | 90.0 | 76.1 | 63.6 | 52.3 | 42.4 | 33.8 | 26.5 | 20.6 | 17.7 | 13.4 | 10.9 | 10.0 |
| (K1) | Z | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

LIST OF CABLE COORDINATE (cm)

| REINFORCING BAR NO. | ϕ (mm) | TYPE | BENDING DIMENSION (cm) a | b | c | d | e | f | TOTAL LENGTH (m) | UNIT WEIGHT/m (kg/m) | NUMBER | WEIGHT (kg) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K 3 | 12.7 | 7 STRANDS | 16244 | | | | | | 162.44 | 0.789 | 6 | 769 | |
| K 2 | 12.7 | 12 STRANDS | 27877 | | | | | | 278.77 | 0.789 | 6 | 1320 | |
| K 1 | 12.7 | 5 STRANDS | 16295 | | | | | | 162.95 | 0.789 | 6 | 771 | |
| | | | | | | | | | | | TOTAL | = 2860 kg | |

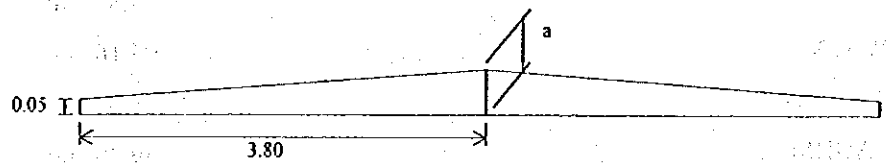
LIST OF PC CABLE OF MAIN GIRDER

| Name of Structure | ASIN RIVER No.1 B R I D G E | Category Calculation | Pavement Volume | Page | 1/1 |
|---|---|---|---|---|---|

**7. Pavement**

Span of bridge : 21.80 m

Thick of Asphalt at side : 5 cm




a : $2\% \times 3.80 = 0.076 + 0.05 = 0.126$

Volume : $A = 2 \times \frac{0.05 + 0.126}{2} \times 3.80 = 0.67\ m^2$

$V = 0.67 \times 21.80 = 14.606\ m^3$

$= 14.606 \times 2.2 = 32.13\ t.m$

| Name of Structure | ASIN RIVER No.1 BRIDGE | Category Calculation | Form Volume | Page | 1/6 |
|---|---|---|---|---|---|

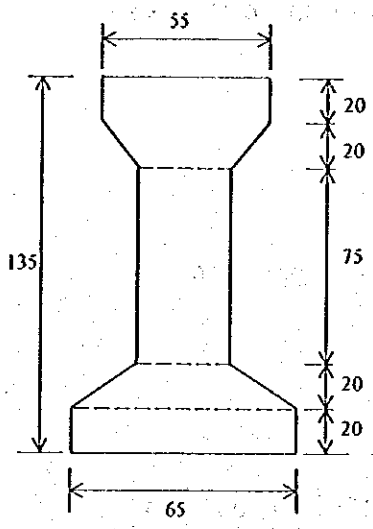
## SUMMARY OF BROAD FORM WORK

| | | | | |
|---|---|---|---|---|
| - | MAIN GIRDER | = | 519.01 | m² |
| - | SLAB | = | 9.84 | m² |
| - | SIDE WALK | = | 94.16 | m² |
| - | PANEL PLATE | = | 208.01 | m² |
| - | DIAPRAGHM | = | 50.30 | m² |
| | TOTAL | = | 881.31 | m² |

| Name of Structure | ASIN RIVER No.1 BRIDGE | Category Calculation | Form Volume | Page | 2/6 |
|---|---|---|---|---|---|

## 1. Main Girder

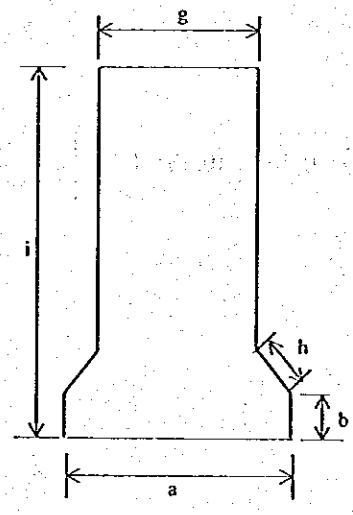
### Center Beam




Thick of Plate = 3 cm

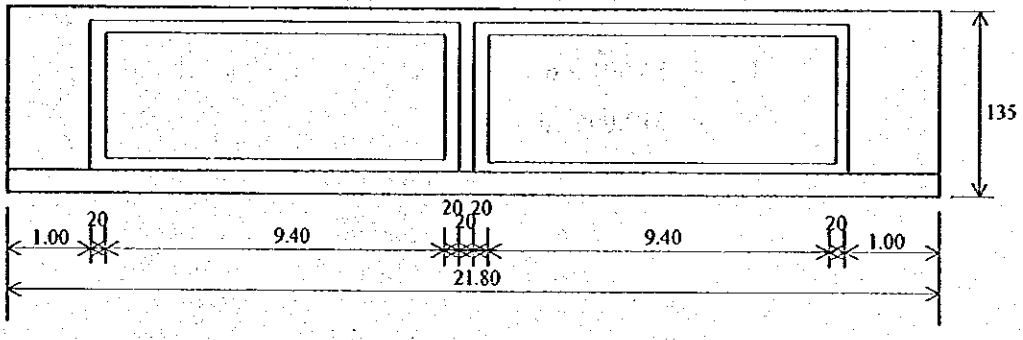
| | | | | |
|---|---|---|---|---|
| a | = | $65 + \frac{3}{2} \times 2$ | = | 68 cm |
| b | = | $20 + \frac{3}{2} \times 2$ | = | 23 cm |
| c | = | $35 + \frac{3}{2} \times 2$ | = | 38 cm |
| d | = | $75 + \frac{3}{2} \times 2$ | = | 78 cm |
| e | = | $12 + \frac{3}{2} \times 2$ | = | 15 cm |
| f | = | $10 + \frac{3}{2}$ | = | 11.5 cm |

### End Beam




| | | | | |
|---|---|---|---|---|
| a | = | 68 cm | | |
| b | = | 23 cm | | |
| h | = | $6.75 + \frac{3}{2} \times 2$ | = | 9.75 cm |
| i | = | $110.5 + \frac{3}{2}$ | = | 112 cm |

Length of Beam = 21.80 m



Broad

- Center

$$A_1 = (a + 2b + 2c + 2d + 2e + 2f) \times L$$
$$= (0.68 + 0.46 + 0.76 + 1.56 + 0.30 + 0.23) \times 18.80$$
$$= 3.99 \times 18.80$$
$$= 75.012 \text{ m}^2$$

- End

$$A_2 = (a + 2b + 2h + 2i) \times L$$
$$= (0.68 + 0.46 + 0.76 + 0.195 + 2.24) \times 2.20$$
$$= 3.575 \times 2.20$$
$$= 7.865 \text{ m}^2$$

- Between

$$A_3 = \left[\left(\frac{0.75 + 1.05}{2} \times 0.20 + 2 \times \tfrac{1}{2} \times 0.20 \times 0.20\right) \times 4\right] \times 2$$
$$= (0.18 + 0.04) \times 4 \times 2$$
$$= 1.76 \text{ m}^2$$

Cover End Beam

$$A_4 = \left[(0.68 \times 0.23) + \left(\frac{0.68 + 0.58}{2} \times 0.20\right) + (0.58 \times 1.12)\right] \times 2$$
$$= (0.1564 + 0.126 + 0.6496) \times 2$$
$$= 0.932 \times 2$$
$$= 1.864 \text{ m}^2$$

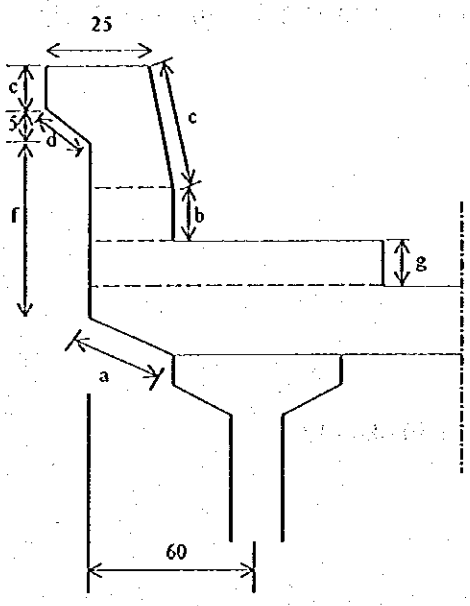
**Total Form in Bridge ($F_G$)**

$$F_G = \Sigma A \times 6$$
$$= (75.012 + 7.865 + 1.76 + 1.864) \times 6$$

$$F_G = 86.501 \times 6$$
$$= 519.006 \text{ m}^2$$

| Name of Structure | ASIN RIVER No.1 BRIDGE | Category Calculation | Form Volume | Page | 4/6 |
|---|---|---|---|---|---|

**2. Bed Plate and Hand Rail + Side Walk**




Thick of Plate = 3 cm

| | | | |
|---|---|---|---|
| a | = | $32.88 + 3/2$ | = 34.38 cm |
| b | = | $10 + 3/2$ | = 11.50 cm |
| c | = | $40.31 + 3/2$ | = 41.81 cm |
| d | = | $9.43 + 3/2 \times 2$ | = 12.43 cm |
| e | = | $20 + 3/2$ | = 21.50 cm |
| f | = | $72 + 3/2 \times 2$ | = 75.00 cm |
| g | = | | = 25.00 cm |

Handrail + Sidewalk

Length of Beam = 21.80 m

Wide : $A_1 = (a + b + c + d + e + f + g) \times L \times 2$

$= (34.38 + 11.5 + 41.81 + 12.43 + 21.5 + 75 + 25) \times 21.8 \times 2$

$= 92266.2 \text{ m}^2$

End Cover

Wide : $A_2 = \left[(g \times 128) + (b \times 0.28) + \left(\frac{0.20 + 0.28}{2} \times 0.40\right) + \left(\frac{0.20 + 0.25}{2} \times 0.11\right)\right] \times 4$

$= [(0.25 \times 128) + (0.115 \times 0.28) + (0.096 + 0.025)] \times 4$

$= 0.473 \times 4$

$= 1.892 \text{ m}^2$

**Total wide $F_{SW1}$ = 92.266 + 1.892 = 94.158 m²**

**Total wide in Bridge = 94.158 m²**

Slab

End wide : A $= [(0.33 \times 8.65) - 2(½ \times 0.344 \times 0.05) + 5(0.30 \times 1.25) + 2(0.30 \times 0.344)] \times 2$

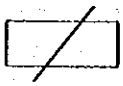
$= (2.854 - 0.017 + 1.875 + 0.206) \times 2$

$= 9.838\ m^2$

Panel Plate

Thick of Plate = 3 cm

Thick of Plate = 7 cm

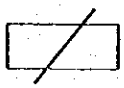


145 × 100

Wide $A_1 = (1.45 \times 1.03) + 4 \times (0.085 \times 1.48) + 2 \times (0.086 \times 1.03)$

$= 1.5244 + 0.2516 + 0.1751$

$= 1.951\ m^2$



145 × 20

Wide $A_2 = (1.48 \times 0.23) + 2 \times (0.085 \times 1.48) + 2 \times (0.085 \times 0.23)$

$= 0.3404 + 0.2516 + 0.0391$

$= 0.6311\ m^2$

Total Wide = $(21 \times 1.951) + 0.6311 = 41.602\ m^2$

Total Wide in Bridge $F_P = 5 \times 41.602 = 208.01\ m^2$

Cross Beam

Wide : A $= 2 \times (1.25 \times 0.98) + (1.25 \times 0.26) + 4 \times (0.175 \times 0.81)$

$= 2.45 + 0.325 + 0.567$

$= 3.342\ m^2$

Total Wide = $5 \times 3.342 = 16.71\ m^2$

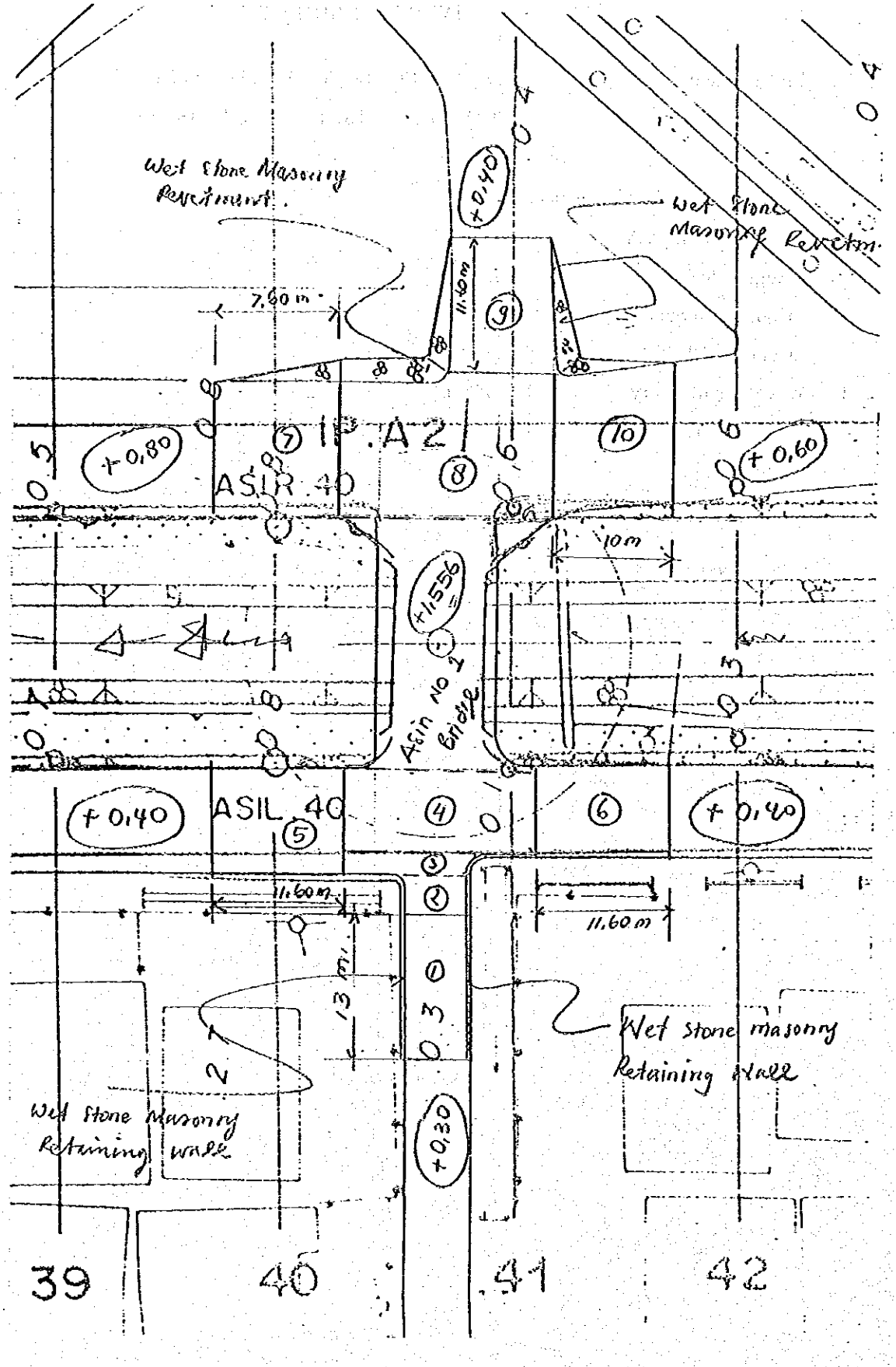
Total Wide in Bridge $F_{CB} = 3 \times 16.71 = 50.13\ m^2$

| Name of Structure | ASIN RIVER No.1 B R I D G E | Category Calculation | Approach Road Bridge Volume | Page | 1/8 |
|---|---|---|---|---|---|

## SUMMARY OF QUANTITY APPROACH ROAD OF ASIN RIVER NO.1 BRIDGE

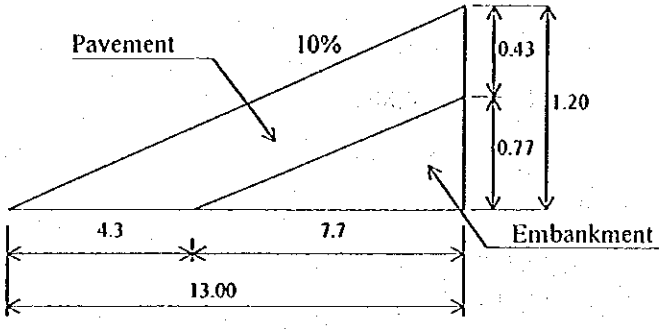
1. Embankment = 17.787 + 16.17 + 18.48 + 98.175 + 24.624
   + 20.74 + 6.455 + 161.17 + 24.624 + 16.854
   = 405.082 $m^3$
2. Pavement (Standard by Inspection Road)
   - Aggregate Class A = 149.225 $m^3$
   - Aggregate Class B = 199.260 $m^3$
   - Compacted Sand = 59.420 $m^3$
   - Concrete Block = 996.200 $m^3$
3. Wet Stone Masonry = 183.348 $m^3$
4. PVC Weep Hole = 70 holes
5. Pointing = 223.220 $m^2$

| Name of Structure | ASIN RIVER No.1 BRIDGE | Category Calculation | Approach Road Bridge Volume | Page | 2/8 |
|---|---|---|---|---|---|



| Name of Structure | ASIN RIVER No.1 B R I D G E | Category Calculation | Approach Road Bridge Volume | Page | 3/8 |
|---|---|---|---|---|---|

**(No.1)** Area : 13.055 x 6 = 78.33 m²




Embankment : $\frac{7.7 \times 0.77}{2} \times 6 = 17.787$ m²

Pavement :

| | | |
|---|---|---|
| Aggregate Class A | = | 78.33 x 0.15 = 11.75 m³ |
| Aggregate Class B | = | 78.33 x 0.20 = 15.67 m³ |
| Sand | = | 78.33 x 0.06 = 4.69 m³ |
| Concrete Block | = | 78.33 m² |
| Wet Stone Masonry | = | 25.56 m³ |
| Pointing | = | |

**(No.2)** Area : 6 x 3.5 = 21 m²

Embankment : 21 x 0.77 = 16.17 m²

Pavement :

| | | |
|---|---|---|
| Aggregate Class A | = | 21 x 0.15 = 3.15 m³ |
| Aggregate Class B | = | 21 x 0.20 = 4.20 m³ |
| Sand | = | 21 x 0.06 = 1.26 m³ |
| Concrete Block | = | 21 m² |
| Wet Stone Masonry | = | 19.66 m³ |
| PVC Weep Hole | = | 8 holes |
| Pointing | = | 30.6 m² |

(No.3) Area : 12 × 2 = 24 m²

Embankment : 24 × 0.77 = 18.48 m²

Pavement :

Aggregate Class A = 24 × 0.15 = 3.60 m³

Aggregate Class B = 24 × 0.20 = 4.80 m³

Sand = 24 × 0.06 = 1.14 m³

Concrete Block = 24 m²

Wet Stone Masonry = 9.83 m³

PVC Weep Hole = 4 holes

Pointing = 37.69 m²

(No.4) Area : 17 × 7.5 = 127.5 m²

Embankment : 127.5 × 0.77 = 98.175 m²

Pavement :

Aggregate Class A = 127.5 × 0.15 = 19.175 m³

Aggregate Class B = 127.5 × 0.20 = 25.50 m³

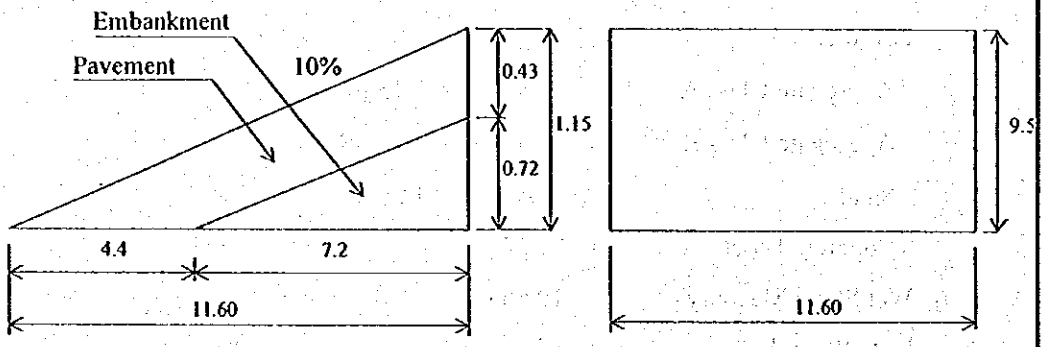
Sand = 127 × 0.06 = 7.65 m³

Concrete Block = 127.5 m²

Wet Stone Masonry = 21.412 m³

Pointing =

(No.5) Area : 11.5 × 9.5 = 109.250 m²




Embankment : $\frac{7.2 \times 0.77}{2} \times 9.50 = 24.624$ m²

Pavement :

Aggregate Class A = 109.25 × 0.15 = 16.4 m³

Aggregate Class B = 109.25 × 0.20 = 21.85 m³

Sand = 109.25 x 0.06 = 6.55 m³

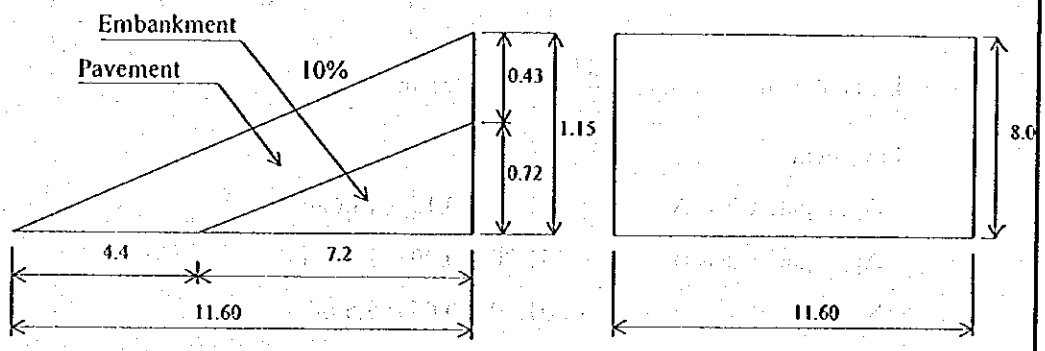
Concrete Block = 109.25 m²

Wet Stone Masonry = 22.05 m³

PVC Weep Hole = 5 hole ~ 5 m

Pointing = 18.61 m²

(No.6) Area : 11.5 x 9.5 = 109.250 m²




Embankment : $\frac{7.2 \times 0.77}{2} \times 8.0 = 20.736$ m²

Pavement :

Aggregate Class A = 92.80 x 0.15 = 13.920 m³

Aggregate Class B = 92.80 x 0.20 = 18.56 m³

Sand = 92.80 x 0.06 = 5.51 m³

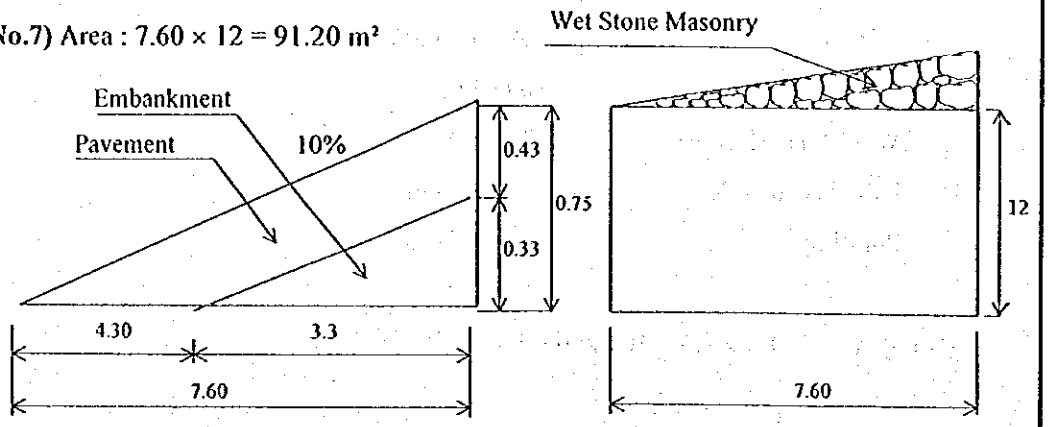
Concrete Block = 92.80 m²

Wet Stone Masonry = 26.86 m³

PVC Weep Hole = 5 holes ~ 5 m

Pointing = 18.61 m²

(No.7) Area : 7.60 × 12 = 91.20 m²

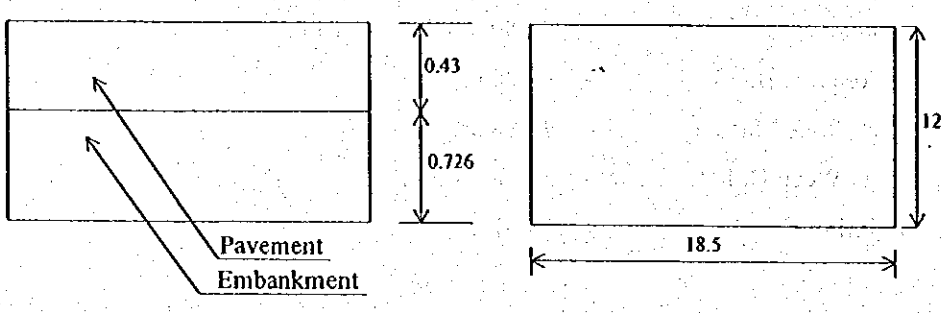



Embankment : $3.3 \times \frac{0.33}{2} \times 12 = 6.455$ m²

Pavement :

| | | |
|---|---|---|
| Aggregate Class A | = | 91.20 × 0.15 = 13.680 m³ |
| Aggregate Class B | = | 91.20 × 0.20 = 18.24 m³ |
| Sand | = | 91.20 × 0.06 = 5.5 m³ |
| Concrete Block | = | 91.20 m² |
| Wet Stone Masonry | = | 12.494 m³ |
| PVC Weep Hole | = | 5 holes ~ 5 m |
| Pointing | = | 10.26 m² |

(No.8) Area : 18.5 × 12 = 222.00 m²

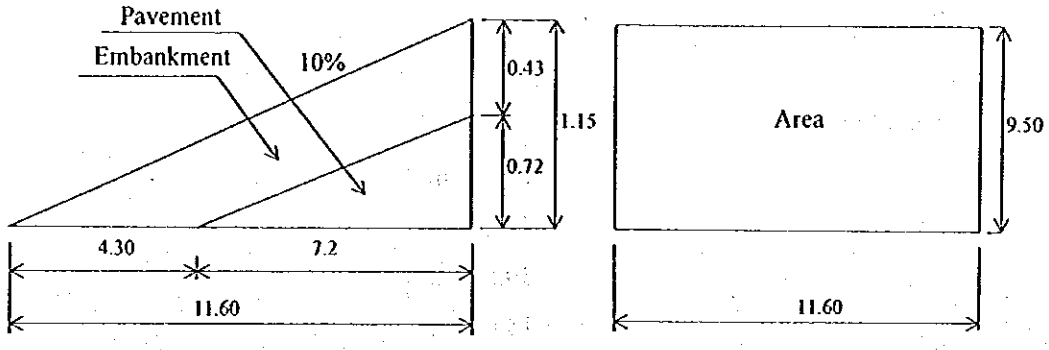



Embankment : 222 × 0.726 = 161.17 m²

Pavement :

| | | |
|---|---|---|
| Aggregate Class A | = | 222 × 0.15 = 33.30 m³ |
| Aggregate Class B | = | 222 × 0.20 = 44.40 m³ |
| Sand | = | 222 × 0.06 = 13.32 m³ |
| Concrete Block | = | 222 m² |
| Wet Stone Masonry | = | 9.97 m³ |
| PVC Weep Hole | = | 8 holes ~ 8 m |
| Pointing | = | 23.0 m² |

**(No.9)** Area : 11.60 × 9.50 = 110.20 m²

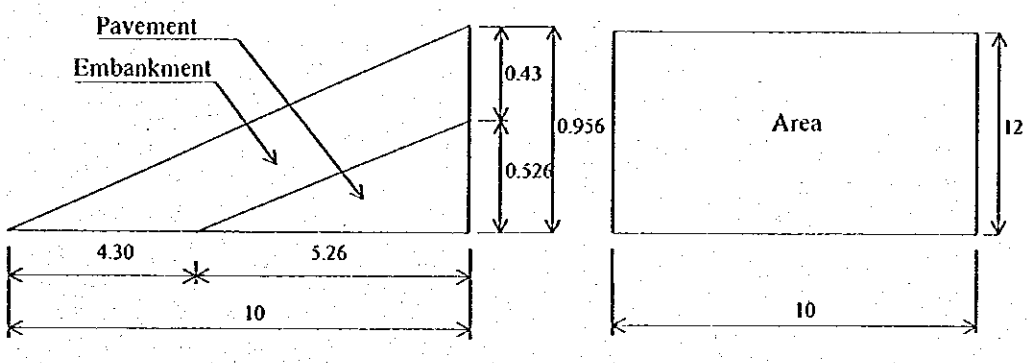



Embankment : $\frac{7.2 \times 0.72}{2} \times 9.5 = 24.624$ m³

Pavement :

| | | |
|---|---|---|
| Aggregate Class A | = | 110.20 × 0.15 = 16.30 m³ |
| Aggregate Class B | = | 110.20 × 0.20 = 22.04 m³ |
| Sand | = | 110.20 × 0.06 = 6.60 m³ |
| Concrete Block | = | 110.20 m² |
| Wet Stone Masonry | = | 19.07 m³ |
| PVC Weep Hole | = | 10 holes ~ 10 m |
| Pointing | = | 22.04 m² |

**(No.10)** Area : 10 × 12 = 120 m²




Embankment : $\frac{5.3 \times 0.53}{2} \times 12 = 16.854$ m³

Pavement :

| | | |
|---|---|---|
| Aggregate Class A | = | 120 × 0.15 = 18.00 m³ |
| Aggregate Class B | = | 120 × 0.20 = 24.00 m³ |
| Sand | = | 120 × 0.06 = 7.2 m³ |
| Concrete Block | = | 120 m² |

| Name of Structure | ASIN RIVER No.1 B R I D G E | Category Calculation | Approach Road Bridge Volume | Page | 8/8 |
|---|---|---|---|---|---|

Wet Stone Masonry = 16.44 m³

PVC Weep Hole = 4 holes ~ 4 m

Pointing = 8 m²

Total Pointing :

| | | |
|---|---|---|
| 1. | 30.60 | m² |
| 2. | 23.56 | m² |
| 3. | 37.69 | m² |
| 4. | 30.85 | m² |
| 5. | 18.61 | m² |
| 6. | 18.61 | m² |
| 7. | 10.26 | m² |
| 8. | 23.00 | m² |
| 9. | 22.09 | m² |
| 10. | 8.00 | m² |
| | **223.22** | **m²** |

| Name of Structure | ASIN RIVER No.1 BRIDGE | Category Calculation | Stone Masonry for Approach Road Bridge Volume | Page | 1/2 |
|---|---|---|---|---|---|

## STONE MASONRY FOR APPROACH BRIDGE

(1) Section E-F

$$0.5 \times 0.3 + \frac{0.5 + 0.80}{2} \times 1.256 + 1.00 \times 1.0 = 1.966 \text{ m}^2$$

$$\text{Volume} : 2 \times \frac{1.966}{2} \times 13 = 25.56 \text{ m}^3$$

Pointing : $1.25 + 0.3 + 0.5 + 0.3 \times 13 = 30.6 \text{ m}^2$

(2) Section F-F

$1.966 \times 5 \times 2 = 19.66 \text{ m}^3$

Pointing : $(1.256 + 0.6 + 0.5) \times 5 \times 2 = 23.56 \text{ m}^2$

(3) Section F-F

$1.966 \times 5 = 9.83 \text{ m}^3$

Pointing : $(1.256 + 0.6 + 0.5) \times 8 \times 2 = 37.69 \text{ m}^2$

(4) Section E-E

$$0.5 \times 1.00 + \frac{0.5 \times 0.8}{2} \times 1.256 + 1 \times 1 = 2.316 \text{ m}^2$$

Volume : $2.316 \times (2.5 + 2.5) = 11.582 \text{ m}^3$

$1.966 \times 5 = 9.83 \text{ m}^3$

$= 21.412 \text{ m}^3$

Pointing : $(1.156 + 1.1 + 0.5 + 1.1) \times 4 \times 2 = 30.85 \text{ m}^2$

(5) Section D-D

$$0.5 \times 0.3 + \frac{0.5 + 0.8}{2} \times 1.156 + 1 \times 1 = 1.901 \text{ m}^2$$

$$\text{Volume} : \frac{1.901 + 0}{2} \times 11.60 \times 2 = 22.0516 \text{ m}^3$$

Pointing : $1.156 \times 2 \times 11.60/2 = 13.41 \text{ m}^2 + 5.2 = 18.61 \text{ m}^2$

(6) Section E-E

$$0.5 \times 0.3 + \frac{0.5 + 0.8}{2} \times 1.256 + 1 \times 1 = 2.316 \text{ m}^2$$

$$\text{Volume} : \frac{2.316}{2} \times 11.60 \times 2 = 26.86 \text{ m}^3$$

Pointing : $1.156 \times 2 \times 11.60/2 = 13.41 \text{ m}^2 + 5.2 = 18.61 \text{ m}^2$

| Name of Structure | ASIN RIVER No.1 BRIDGE | Category Calculation | Stone Masonry for Approach Road Bridge Volume | Page | 2/2 |
|---|---|---|---|---|---|

(7) Section G-G

$$0.5 \times 0.3 + \frac{0.5 + 0.8}{2} \times 0.76 + 1 \times 1 = 1.644 \text{ m}^2$$

Volume : $\frac{1.644}{2} \times 7.60 \times 2 = 12.494 \text{ m}^3$

Pointing : $(0.8 \times 2 + 0.6 + 0.5) \times 7.6/2 = 10.26 \text{ m}^2$

(8) Section G-G

$1.644 \times 7.5 = 12.3 \text{ m}^2$

$$0.5 \times 1 + \frac{0.5 + 0.8}{2} \times 0.76 + 1 \times 1 = 1.994 \text{ m}^2$$

Volume ; $1.994 \times 2.5 \times 2 = 9.97 \text{ m}^3$

Pointing : $0.8 + 0.5 + 0.6 \times 7.5 + 0.8 + 2.2 + 0.5 \times 2.5 = 23 \text{ m}^2$

(9) Section H-H

$$0.5 \times 0.3 + \frac{0.5 + 0.8}{2} \times 0.76 + 1 \times 1 = 1.644 \text{ m}^2$$

Volume : $\frac{1.644}{2} \times 11.60 \times 2 = 19.07 \text{ m}^3$

Pointing : $0.8 + 0.5 + 0.6 \times 2 \times 11.6/2 = 22.04 \text{ m}^2$

(10) Section H-H

Volume : $\frac{1.644}{2} \times 10 \times 2 = 16.44 \text{ m}^3$

Pointing : $0.8 \times 2 \times 10/2 = 8 \text{ m}^2$

| | | |
|---|---|---|
| Total of Stone Masonry : | 1. | 25.560 m³ |
| | 2. | 19.660 m³ |
| | 3. | 9.830 m³ |
| | 4. | 21.412 m³ |
| | 5. | 22.052 m³ |
| | 6. | 26.860 m³ |
| | 7. | 12.494 m³ |
| | 8. | 9.970 m³ |
| | 9. | 19.070 m³ |
| | 10. | 16.440 m³ |
| | | 183.348 m³ |