

**TABLES**

**CHAPTER 6**

**DETAILED DESIGN**

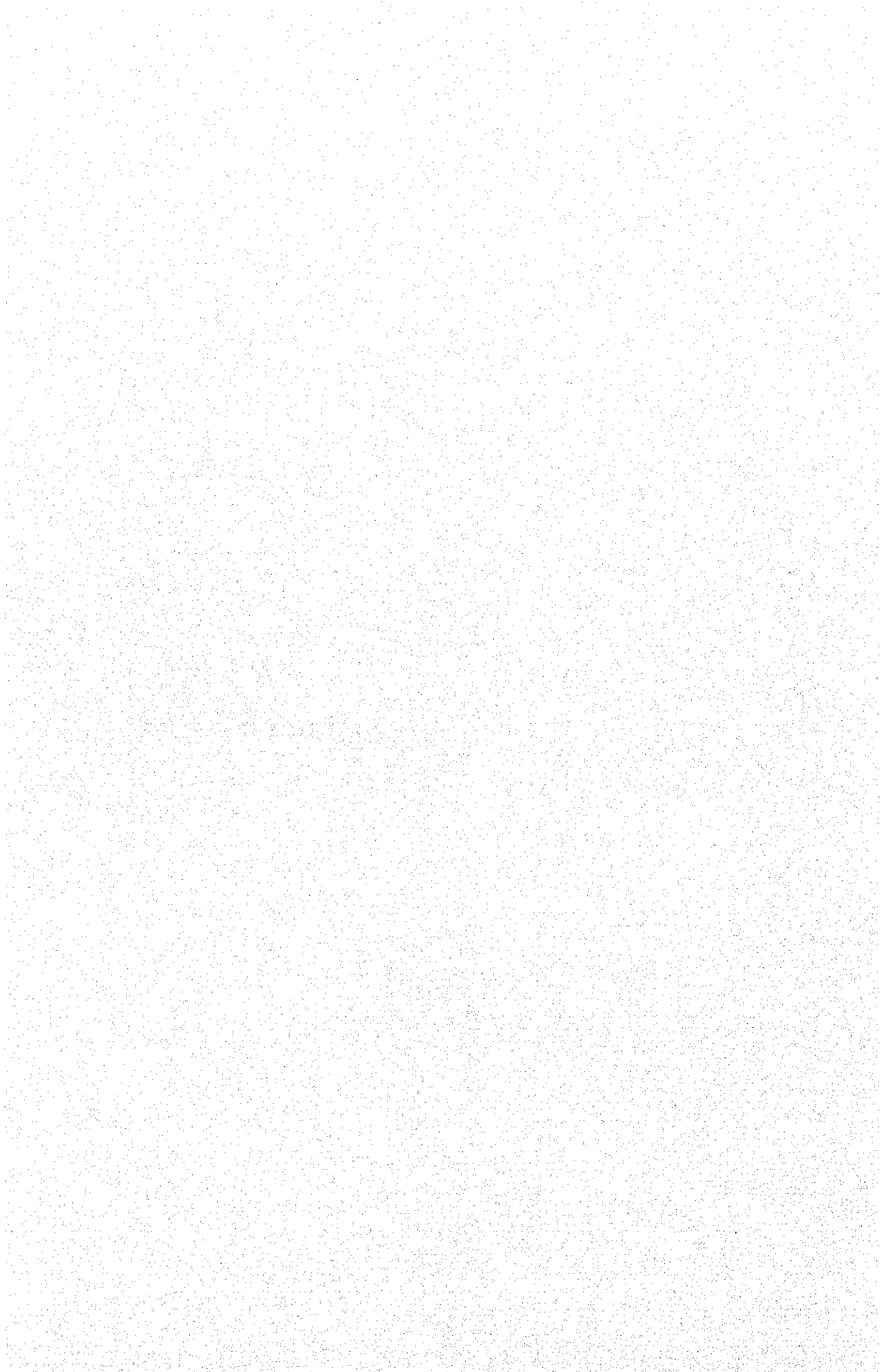
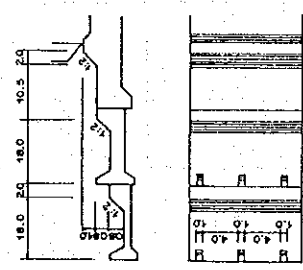
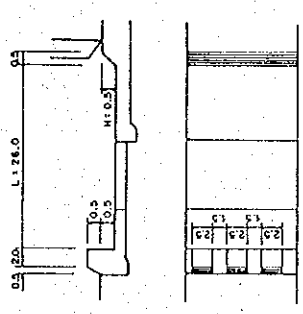
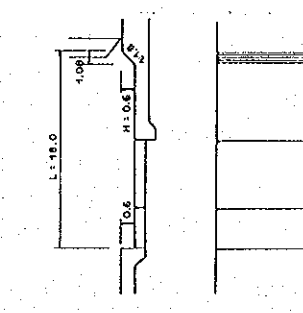
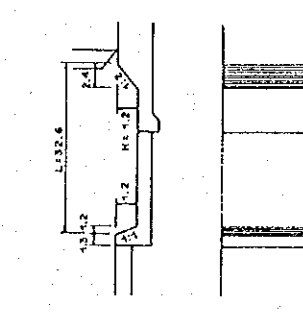
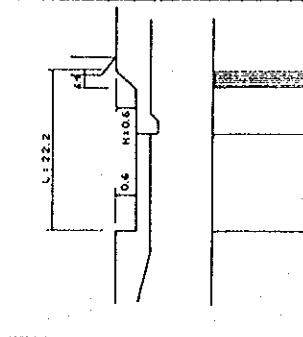


Table 6.4.1 DECISION PROCEDURE FOR DIMENSIONS OF STILLING BASIN AND BUFFLE PIER

|  | Weir A  | Weir B   | Weir C   | Weir D   | Weir E  |
|--|---|--|--|--|---|
| Water Level Difference Between Up and Downstream | 8.00 m  | 5.50 m   | 3.78 m   | 6.00 m   | 3.50 m  |
| Minimum Water Depth of Downstream                | 0.00 m  | 0.00 m   | 0.72 m   | 0.00 m   | 3.70 m  |
| Necessity of Stilling Basin or baffle Pier       | There is an elevation difference of 2.6 m between up and downstream riverbeds. To facilitate dissipation of flow, baffle pier of stilling pool are necessary. | Water discharged under gates becomes exposed super critical flow with a flow length of 30 m.<br><br>A pool is necessary to complete the hydraulic jump phenomenon. | In case that an apron is placed on the level, local scouring expands to the downstream from the proposed riverbed protection. Energy dissipation effect by concrete block is not high. | Exposed super critical flow arises on the concrete apron with a rather long distance especially, in case of under flow.                  | Effectiveness of stilling pool was confirmed by hydraulic model test.                 |
| Type and Dimensions                              | Baffle pier type  | Stilling basin and baffle pier, H=0.5 m, L=26.0 m  | Stilling basin type, H=0.60 m, L=18.0 m  | Stilling basin type, H=1.20 m, L=32.6 m  | Stilling basin type, H=0.60 m, L=22.2 m   |
| Profile and Plan                                 |   |    |   |    |     |
| Decision of Dimensions                           | Hydraulic Model Test  | Hydraulic Model Test   | Hydraulic Model Test   | Hydraulic Model Test   | Hydraulic Model Test  |
| Effect of Energy Dissipator                      | Effectiveness of baffle piers was confirmed.  | In case H=0.5 m and L=26 m, dissipation effect was excellent.  | Effectiveness of dissipation was clearly confirmed, when H=0.6 m, L=18.0 m.  | Effectiveness of dissipation was clearly confirmed, when H=1.2m, L=14.5m. But L was extended to 32.6 m because of the structural reason. | With a stilling basin H=0.6 m and L=22 m, effectiveness of dissipation was confirmed. |

**Table 6.4.2 (1/4) DESIGN LOADS ON CENTER PIER**  
**(Case-1 Normal Loading Condition : Flow Direction)**

|                              | Vertical        |        |                  | Horizontal     |        |                |
|------------------------------|-----------------|--------|------------------|----------------|--------|----------------|
|                              | V(t)            | X(m)   | Mx(t-m)          | H(t)           | Y(m)   | My(t-m)        |
| Weight of body               | 1640.800        | 8.852  | 14524.362        |                |        |                |
| Weight of muddy soil         | 32.180          | 3.250  | 104.585          |                |        |                |
| Weight of water              | 155.510         | 3.250  | 505.408          |                |        |                |
| Weight of earth              |                 |        |                  |                |        |                |
| Weight of maintenance bridge | 344.000         | 15.000 | 5160.000         |                |        |                |
| Weight of control house      | 39.200          | 6.500  | 254.800          |                |        |                |
| Weight of machine            | 25.000          | 6.500  | 162.500          |                |        |                |
| Weight of gate               | 50.000          | 6.500  | 325.000          |                |        |                |
| Hydrostatic pressure         |                 |        |                  | 255.200        | 3.071  | 783.719        |
| Flowing water force          |                 |        |                  | 0.267          | 4.810  | 1.284          |
| Earth pressure               |                 |        |                  | 6.447          | 0.733  | 4.728          |
| Muddy soil pressure          |                 |        |                  | 3.150          | 2.533  | 7.979          |
| Wind pressure                |                 |        |                  | 14.210         | 13.566 | 192.773        |
| Uplift                       | -524.854        | 8.598  | -4512.709        |                |        |                |
| <b>Total</b>                 | <b>1761.836</b> |        | <b>16523.945</b> | <b>279.274</b> |        | <b>990.483</b> |

Acting force at toe of Center pier

$V_0 = 1761.836 \text{ tf}$

$H_0 = 279.274 \text{ tf}$

$M_0 = |M_x + M_y| = 17514.428 \text{ tf-m}$

Acting force at middle of bottom slab of Center pier

$V_c = 1761.836 \text{ tf}$

$H_c = 279.274 \text{ tf}$

$M_c = M_x + M_y = -1217.445 \text{ tf-m}$

**(Case-2 Normal Loading Condition : Perpendicular to Flow Direction)**

|                              | Vertical        |       |                 | Horizontal    |        |                |
|------------------------------|-----------------|-------|-----------------|---------------|--------|----------------|
|                              | V(t)            | Z(m)  | Mz(t-m)         | H(t)          | Y(m)   | My(t-m)        |
| Weight of body               | 1640.800        | 4.000 | 6563.200        |               |        |                |
| Weight of muddy soil         | 32.180          | 4.000 | 128.720         |               |        |                |
| Weight of water              | 155.520         | 4.000 | 622.080         |               |        |                |
| Weight of earth              |                 |       |                 |               |        |                |
| Weight of maintenance bridge | 388.800         | 4.000 | 1555.200        |               |        |                |
| Weight of control house      | 39.200          | 4.000 | 156.800         |               |        |                |
| Weight of machine            | 25.000          | 4.000 | 100.000         |               |        |                |
| Weight of gate               | 50.000          | 4.000 | 200.000         |               |        |                |
| Hydrostatic pressure         |                 |       |                 |               |        |                |
| Flowing water force          |                 |       |                 |               |        |                |
| Earth pressure               |                 |       |                 |               |        |                |
| Muddy soil pressure          |                 |       |                 |               |        |                |
| Wind pressure                |                 |       |                 | 15.510        | 12.150 | 188.447        |
| Uplift                       | -524.854        | 4.000 | -2099.416       |               |        |                |
| <b>Total</b>                 | <b>1806.646</b> |       | <b>7226.584</b> | <b>15.510</b> |        | <b>188.447</b> |

Acting force at toe of Center pier

$V_0 = 1806.646 \text{ tf}$

$H_0 = 15.510 \text{ tf}$

$M_0 = |M_z - M_y| = 7038.138 \text{ tf-m}$

Acting force at middle of bottom slab of Center pier

$V_c = 1806.646 \text{ tf}$

$H_c = 15.510 \text{ tf}$

$M_c = M_z - M_y = 188.447 \text{ tf-m}$

**Table 6.4.2 (2/4) DESIGN LOADS ON CENTER PIER**  
(Case-3 Design Flooding Condition : Flow Direction)

|                              | Vertical  |        |            | Horizontal |        |         |
|------------------------------|-----------|--------|------------|------------|--------|---------|
|                              | V(t)      | X(m)   | Mx(t-m)    | H(t)       | Y(m)   | My(t-m) |
| Weight of body               | 1640.800  | 8.852  | 14524.362  |            |        |         |
| Weight of muddy soil         |           |        |            |            |        |         |
| Weight of water              | 781.630   | 9.250  | 7230.078   |            |        |         |
| Weight of earth              |           |        |            |            |        |         |
| Weight of maintenance bridge | 388.800   | 15.000 | 5832.000   |            |        |         |
| Weight of control house      | 39.200    | 6.500  | 254.800    |            |        |         |
| Weight of machine            | 25.000    | 6.500  | 162.500    |            |        |         |
| Weight of gate               | 50.000    | 6.500  | 325.000    |            |        |         |
| Hydrostatic pressure         |           |        |            |            |        |         |
| Flowing water force          |           |        |            | 0.258      | 6.100  | 1.574   |
| Earth pressure               |           |        |            | 6.447      | 0.733  | 4.728   |
| Muddy soil pressure          |           |        |            |            |        |         |
| Wind pressure                |           |        |            | 18.140     | 13.486 | 244.636 |
| Uplift                       | -1287.600 | 9.250  | -11910.300 |            |        |         |
| Total                        | 1637.830  |        | 16418.439  | 24.845     |        | 250.938 |

Acting force at toe of Center pier

$V_0 = 1637.830 \text{ tf}$

$H_0 = 24.845 \text{ tf}$

$M_0 = |M_x + M_y| = 16669.377 \text{ tf-m}$

Acting force at middle of bottom slab of Center pier

$V_{cd} = 1637.830 \text{ tf}$

$H_{cd} = 24.845 \text{ tf}$

$M_{cd} = M_x + M_y = -1519.449 \text{ tf-m}$

(Case-4 Design Flooding Condition : Perpendicular to Flow Direction)

|                              | Vertical  |       |           | Horizontal |        |         |
|------------------------------|-----------|-------|-----------|------------|--------|---------|
|                              | V(t)      | Z(m)  | Mz(t-m)   | H(t)       | Y(m)   | My(t-m) |
| Weight of body               | 1640.800  | 4.000 | 6563.200  |            |        |         |
| Weight of muddy soil         |           |       |           |            |        |         |
| Weight of water              | 781.630   | 4.000 | 3126.520  |            |        |         |
| Weight of earth              |           |       |           |            |        |         |
| Weight of maintenance bridge | 388.800   | 4.000 | 1555.200  |            |        |         |
| Weight of control house      | 39.200    | 4.000 | 156.800   |            |        |         |
| Weight of machine            | 25.000    | 4.000 | 100.000   |            |        |         |
| Weight of gate               | 50.000    | 4.000 | 200.000   |            |        |         |
| Hydrostatic pressure         |           |       |           |            |        |         |
| Flowing water force          |           |       |           |            |        |         |
| Earth pressure               |           |       |           |            |        |         |
| Muddy soil pressure          |           |       |           |            |        |         |
| Wind pressure                |           |       |           | 10.190     | 14.516 | 147.918 |
| Uplift                       | -1287.600 | 4.000 | -5150.400 |            |        |         |
| Total                        | 1637.830  |       | 6551.320  | 10.190     |        | 147.918 |

Acting force at toe of Center pier

$V_0 = 1637.830 \text{ tf}$

$H_0 = 10.190 \text{ tf}$

$M_0 = |M_z - M_y| = 6403.402 \text{ tf-m}$

Acting force at middle of bottom slab of Center pier

$V_{cd} = 1637.830 \text{ tf}$

$H_{cd} = 10.190 \text{ tf}$

$M_{cd} = M_z - M_y = 147.918 \text{ tf-m}$

**Table 6.4.2 (3/4) DESIGN LOADS ON CENTER PIER**  
**(Case-5 Loading Condition during Construction : Flow Direction)**

|                              | Vertical        |        |                  | Horizontal    |        |                |
|------------------------------|-----------------|--------|------------------|---------------|--------|----------------|
|                              | V(t)            | X(m)   | Mx(t-m)          | H(t)          | Y(m)   | My(t-m)        |
| Weight of body               | 1640.800        | 8.852  | 14524.362        |               |        |                |
| Weight of muddy soil         |                 |        |                  |               |        |                |
| Weight of water              |                 |        |                  |               |        |                |
| Weight of earth              |                 |        |                  |               |        |                |
| Weight of maintenance bridge | 260.800         | 15.000 | 3912.000         |               |        |                |
| Weight of control house      | 39.200          | 6.500  | 254.800          |               |        |                |
| Weight of machine            | 25.000          | 6.500  | 162.500          |               |        |                |
| Weight of gate               | 50.000          | 6.500  | 325.000          |               |        |                |
| Hydrostatic pressure         |                 |        |                  |               |        |                |
| Flowing water force          |                 |        |                  |               |        |                |
| Earth pressure               |                 |        |                  |               |        |                |
| Muddy soil pressure          |                 |        |                  |               |        |                |
| Wind pressure                |                 |        |                  | 20.570        | 12.542 | 257.989        |
| Uplift                       |                 |        |                  |               |        |                |
| <b>Total</b>                 | <b>2015.800</b> |        | <b>19178.662</b> | <b>20.570</b> |        | <b>257.989</b> |

Acting force at toe of Center pier

$V_0 = 2015.800$  tf

$H_0 = 20.570$  tf

$M_0 = |M_x + M_y| = 19436.651$  tf-m

Acting force at middle of bottom slab of Center pier

$V_{cc} = 2015.800$  tf

$H_{cc} = 20.570$  tf

$M_{cc} = M_x + M_y = -790.501$  tf-m

**(Case-6 Loading Condition during Construction : Perpendicular to Flow Direction)**

|                              | Vertical        |       |                 | Horizontal     |       |                |
|------------------------------|-----------------|-------|-----------------|----------------|-------|----------------|
|                              | V(t)            | Z(m)  | Mz(t-m)         | H(t)           | Y(m)  | My(t-m)        |
| Weight of body               | 1640.800        | 4.000 | 6563.200        |                |       |                |
| Weight of muddy soil         |                 |       |                 |                |       |                |
| Weight of water              |                 |       |                 |                |       |                |
| Weight of earth              |                 |       |                 |                |       |                |
| Weight of maintenance bridge | 260.800         | 4.000 | 1043.200        |                |       |                |
| Weight of control house      | 39.200          | 4.000 | 156.800         |                |       |                |
| Weight of machine            | 25.000          | 4.000 | 100.000         |                |       |                |
| Weight of gate               | 50.000          | 4.000 | 200.000         |                |       |                |
| Hydrostatic pressure         |                 |       |                 | 321.993        | 1.967 | 633.252        |
| Flowing water force          |                 |       |                 |                |       |                |
| Earth pressure               |                 |       |                 |                |       |                |
| Muddy soil pressure          |                 |       |                 |                |       |                |
| Wind pressure                |                 |       |                 | 26.272         | 8.967 | 235.581        |
| Uplift                       | -524.854        | 4.000 | -2099.416       |                |       |                |
| <b>Total</b>                 | <b>1490.946</b> |       | <b>5963.784</b> | <b>348.265</b> |       | <b>868.833</b> |

Acting force at toe of Center pier

$V_0 = 1490.946$  tf

$H_0 = 348.265$  tf

$M_0 = |M_z - M_y| = 5094.951$  tf-m

Acting force at middle of bottom slab of Center pier

$V_{cc} = 1490.946$  tf

$H_{cc} = 348.265$  tf

$M_{cc} = M_z - M_y = 868.833$  tf-m

**Table 6.4.2 (4/4) DESIGN LOADS ON CENTER PIER**  
(Case-7 Seismic Loading Condition : Flow Direction)

|                              | Vertical        |        |                  | Horizontal     |        |                 |
|------------------------------|-----------------|--------|------------------|----------------|--------|-----------------|
|                              | V(t)            | X(m)   | Mx(t-m)          | H(t)           | Y(m)   | My(t-m)         |
| Weight of body               | 1640.800        | 8.852  | 14524.362        | 196.896        | 4.830  | 951.008         |
| Weight of muddy soil         | 32.180          | 3.250  | 104.585          | 3.862          | 2.700  | 10.426          |
| Weight of water              | 155.510         | 3.250  | 505.408          |                |        |                 |
| Weight of earth              |                 |        |                  |                |        |                 |
| Weight of maintenance bridge | 260.800         | 15.000 | 3912.000         | 31.296         | 10.510 | 328.921         |
| Weight of control house      | 24.500          | 6.500  | 159.250          | 2.940          | 18.375 | 54.023          |
| Weight of machine            | 25.000          | 6.500  | 162.500          | 3.000          | 16.450 | 49.350          |
| Weight of gate               | 50.000          | 6.500  | 325.000          | 6.000          | 4.050  | 24.300          |
| Hydrostatic pressure         |                 |        |                  | 255.200        | 3.071  | 783.719         |
| Hydrodynamic pressure        |                 |        |                  | 63.067         | 2.620  | 165.236         |
| Flowing water force          |                 |        |                  | 0.267          | 4.810  | 1.284           |
| Earth pressure               |                 |        |                  | 9.854          | 0.733  | 7.226           |
| Muddy soil pressure          |                 |        |                  | 3.150          | 2.533  | 7.979           |
| Wind pressure                |                 |        |                  |                |        |                 |
| Uplift                       | -524.854        | 8.598  | -4512.709        |                |        |                 |
| <b>Total</b>                 | <b>1663.936</b> |        | <b>15180.395</b> | <b>575.532</b> |        | <b>2383.472</b> |

Acting force at toe of Center pier

V0= 1663.936 tf

H0= 575.532 tf

M0=| Mx+My | = 17563.867 tf-m

Acting force at middle of bottom slab of Center pier

Vcs= 1663.936 tf

Hcs= 575.532 tf

Mcs=Mx+My= -2172.459 tf-m

(Case-8 Seismic Loading Condition : Perpendicular to Flow Direction)

|                              | Vertical        |       |                 | Horizontal     |        |                 |
|------------------------------|-----------------|-------|-----------------|----------------|--------|-----------------|
|                              | V(t)            | Z(m)  | MSS(t-m)        | H(t)           | Y(m)   | My(t-m)         |
| Weight of body               | 1640.800        | 4.000 | 6563.200        | 196.896        | 4.830  | 951.008         |
| Weight of muddy soil         | 32.180          | 4.000 | 128.720         | 3.862          | 2.700  | 10.426          |
| Weight of water              | 155.510         | 4.000 | 622.040         |                |        |                 |
| Weight of earth              |                 |       |                 |                |        |                 |
| Weight of maintenance bridge | 260.800         | 4.000 | 1043.200        | 31.296         | 10.510 | 328.921         |
| Weight of control house      | 24.500          | 4.000 | 98.000          | 2.940          | 18.375 | 54.023          |
| Weight of machine            | 25.000          | 4.000 | 100.000         | 3.000          | 16.450 | 49.350          |
| Weight of gate               | 50.000          | 4.000 | 200.000         | 6.000          | 4.050  | 24.300          |
| Hydrostatic pressure         |                 |       |                 |                |        |                 |
| Hydrodynamic pressure        |                 |       |                 | 21.860         | 3.940  | 86.128          |
| Flowing water force          |                 |       |                 |                |        |                 |
| Earth pressure               |                 |       |                 |                |        |                 |
| Muddy soil pressure          |                 |       |                 |                |        |                 |
| Wind pressure                |                 |       |                 |                |        |                 |
| Uplift                       | -524.854        | 4.000 | -2099.416       |                |        |                 |
| <b>Total</b>                 | <b>1663.936</b> |       | <b>6655.744</b> | <b>265.854</b> |        | <b>1504.156</b> |

Acting force at toe of Center pier

V0= 1663.936 tf

H0= 265.854 tf

M0=| Mz-My | = 5151.588 tf-m

Acting force at middle of bottom slab of Center pier

Vcs= 1663.936 tf

Hcs= 265.854 tf

Mcs=Mz-My= 1504.156 tf-m

**Table 6.4.3 (1/4) DESIGN LOADS ON END PIER**  
**(Case-1 Normal Loading Condition : Flow Direction)**

|                              | Vertical        |        |                  | Horizontal     |        |                 |
|------------------------------|-----------------|--------|------------------|----------------|--------|-----------------|
|                              | V(t)            | X(m)   | Mx(t-m)          | H(t)           | Y(m)   | My(t-m)         |
| Weight of body               | 3196.950        | 8.811  | 28168.326        |                |        |                 |
| Weight of muddy soil         | 48.260          | 3.250  | 156.845          |                |        |                 |
| Weight of water              | 233.370         | 3.250  | 758.453          |                |        |                 |
| Weight of earth              | 510.950         | 9.838  | 5026.726         |                |        |                 |
| Weight of maintenance bridge | 328.800         | 15.000 | 4932.000         |                |        |                 |
| Weight of control house      | 75.600          | 6.500  | 491.400          |                |        |                 |
| Weight of machine            | 49.000          | 6.500  | 318.500          |                |        |                 |
| Weight of gate               | 35.000          | 6.500  | 227.500          |                |        |                 |
| Hydrostatic pressure         |                 |        |                  | 291.830        | 2.755  | 803.992         |
| Flowing water force          |                 |        |                  | 0.217          | 4.810  | 1.044           |
| Earth pressure               |                 |        |                  |                |        |                 |
| Muddy soil pressure          |                 |        |                  | 2.585          | 2.533  | 6.548           |
| Wind pressure                |                 |        |                  | 20.416         | 14.327 | 292.500         |
| Uplift                       | -984.101        | 8.598  | -8461.330        |                |        |                 |
| <b>Total</b>                 | <b>3493.829</b> |        | <b>31618.420</b> | <b>315.048</b> |        | <b>1104.083</b> |

Acting force at toe of End pier

$V_0 = 3493.829$  tf

$H_0 = 315.048$  tf

$M_0 = |M_x + M_y| = 32722.504$  tf-m

Acting force at middle of bottom slab of End pier

$V_c = 3493.829$  tf

$H_c = 315.048$  tf

$M_c = M_x + M_y = -404.587$  tf-m

**(Case-2 Normal Loading Condition : Perpendicular to Flow Direction)**

|                              | Vertical        |        |                  | Horizontal     |        |                 |
|------------------------------|-----------------|--------|------------------|----------------|--------|-----------------|
|                              | V(t)            | Z(m)   | Mz(t-m)          | H(t)           | Y(m)   | My(t-m)         |
| Weight of body               | 3196.950        | 7.500  | 23977.125        |                |        |                 |
| Weight of muddy soil         | 48.260          | 5.792  | 279.522          |                |        |                 |
| Weight of water              | 233.370         | 5.792  | 1351.679         |                |        |                 |
| Weight of earth              | 510.950         | 13.875 | 7089.431         |                |        |                 |
| Weight of maintenance bridge | 328.800         | 5.251  | 1726.529         |                |        |                 |
| Weight of control house      | 75.600          | 7.125  | 538.650          |                |        |                 |
| Weight of machine            | 49.000          | 7.125  | 349.125          |                |        |                 |
| Weight of gate               | 35.000          | 4.250  | 148.750          |                |        |                 |
| Hydrostatic pressure         |                 |        |                  | 230.600        | 2.183  | 503.400         |
| Flowing water force          |                 |        |                  |                |        |                 |
| Earth pressure               |                 |        |                  | 519.941        | 3.965  | 2061.357        |
| Muddy soil pressure          |                 |        |                  |                |        |                 |
| Wind pressure                |                 |        |                  | 9.590          | 15.112 | 144.924         |
| Uplift                       | -984.101        | 7.500  | -7380.759        |                |        |                 |
| <b>Total</b>                 | <b>3493.829</b> |        | <b>28080.052</b> | <b>760.131</b> |        | <b>2709.681</b> |

Acting force at toe of End pier

$V_0 = 3493.829$  tf

$H_0 = 760.131$  tf

$M_0 = |M_z - M_y| = 25370.370$  tf-m

Acting force at middle of bottom slab of End pier

$V_c = 3493.829$  tf

$H_c = 760.131$  tf

$M_c = M_z - M_y = 833.345$  tf-m



**Table 6.4.3 (2/4) DESIGN LOADS ON END PIER**  
**(Case-3 Design Flooding Condition : Flow Direction)**

|                              | Vertical        |        |                  | Horizontal    |        |                |
|------------------------------|-----------------|--------|------------------|---------------|--------|----------------|
|                              | V(t)            | X(m)   | Mx(t-m)          | H(t)          | Y(m)   | My(t-m)        |
| Weight of body               | 3196.950        | 8.811  | 28168.326        |               |        |                |
| Weight of muddy soil         |                 |        |                  |               |        |                |
| Weight of water              | 992.063         | 9.250  | 9176.583         |               |        |                |
| Weight of earth              | 439.360         | 9.934  | 4364.602         |               |        |                |
| Weight of maintenance bridge | 328.800         | 15.000 | 4932.000         |               |        |                |
| Weight of control house      | 75.600          | 6.500  | 491.400          |               |        |                |
| Weight of machine            | 49.000          | 6.500  | 318.500          |               |        |                |
| Weight of gate               | 35.000          | 6.500  | 227.500          |               |        |                |
| Hydrostatic pressure         |                 |        |                  |               |        |                |
| Flowing water force          |                 |        |                  | 0.258         | 6.100  | 1.574          |
| Earth pressure               |                 |        |                  |               |        |                |
| Muddy soil pressure          |                 |        |                  |               |        |                |
| Wind pressure                |                 |        |                  | 23.266        | 14.444 | 336.054        |
| Uplift                       | -2414.250       | 9.250  | -22331.813       |               |        |                |
| <b>Total</b>                 | <b>2702.523</b> |        | <b>25347.099</b> | <b>23.524</b> |        | <b>337.628</b> |

Acting force at toe of End pier

V0= 2702.523 tf

H0= 23.524 tf

M0=| Mx+My | = 25684.727 tf-m

Acting force at middle of bottom slab of End pier

Vcd= 2702.523 tf

Hcd= 23.524 tf

Mcd=Mx+My= -686.389 tf-m

**(Case-4 Design Flooding Condition : Perpendicular to Flow Direction)**

|                              | Vertical        |        |                  | Horizontal     |        |                 |
|------------------------------|-----------------|--------|------------------|----------------|--------|-----------------|
|                              | V(t)            | Z(m)   | Mz(t-m)          | H(t)           | Y(m)   | My(t-m)         |
| Weight of body               | 3196.950        | 7.500  | 23977.125        |                |        |                 |
| Weight of muddy soil         |                 |        |                  |                |        |                 |
| Weight of water              | 992.060         | 5.792  | 5746.012         |                |        |                 |
| Weight of earth              | 439.360         | 13.875 | 6096.120         |                |        |                 |
| Weight of maintenance bridge | 328.800         | 5.251  | 1726.529         |                |        |                 |
| Weight of control house      | 75.600          | 7.125  | 538.650          |                |        |                 |
| Weight of machine            | 49.000          | 7.125  | 349.125          |                |        |                 |
| Weight of gate               | 35.000          | 4.250  | 148.750          |                |        |                 |
| Hydrostatic pressure         |                 |        |                  |                |        |                 |
| Flowing water force          |                 |        |                  |                |        |                 |
| Earth pressure               |                 |        |                  | 445.212        | 3.986  | 1774.565        |
| Muddy soil pressure          |                 |        |                  |                |        |                 |
| Wind pressure                |                 |        |                  | 9.590          | 15.112 | 144.924         |
| Uplift                       | -2414.250       | 7.500  | -18106.875       |                |        |                 |
| <b>Total</b>                 | <b>2702.520</b> |        | <b>20475.435</b> | <b>454.802</b> |        | <b>1919.489</b> |

Acting force at toe of End pier

V0= 2702.520 tf

H0= 454.802 tf

M0=| Mz-My | = 18555.947 tf-m

Acting force at middle of bottom slab of End pier

Vcd= 2702.520 tf

Hcd= 454.802 tf

Mcd=Mz-My= 1712.953 tf-m

**Table 6.4.3 (3/4) DESIGN LOADS ON END PIER**  
**(Case-5 Loading Condition during Construction : Flow Direction)**

|                              | Vertical        |        |                  | Horizontal    |        |                |
|------------------------------|-----------------|--------|------------------|---------------|--------|----------------|
|                              | V(t)            | X(m)   | Mx(t-m)          | H(t)          | Y(m)   | My(t-m)        |
| Weight of body               | 3196.950        | 8.811  | 28168.326        |               |        |                |
| Weight of muddy soil         |                 |        |                  |               |        |                |
| Weight of water              |                 |        |                  |               |        |                |
| Weight of earth              | 655.810         | 9.708  | 6366.603         |               |        |                |
| Weight of maintenance bridge | 193.800         | 15.000 | 2907.000         |               |        |                |
| Weight of control house      | 75.600          | 6.500  | 491.400          |               |        |                |
| Weight of machine            | 49.000          | 6.500  | 318.500          |               |        |                |
| Weight of gate               | 35.000          | 6.500  | 227.500          |               |        |                |
| Hydrostatic pressure         |                 |        |                  |               |        |                |
| Flowing water force          |                 |        |                  |               |        |                |
| Earth pressure               |                 |        |                  |               |        |                |
| Muddy soil pressure          |                 |        |                  |               |        |                |
| Wind pressure                |                 |        |                  | 27.650        | 13.020 | 360.003        |
| Uplift                       |                 |        |                  |               |        |                |
| <b>Total</b>                 | <b>4206.160</b> |        | <b>38479.330</b> | <b>27.650</b> |        | <b>360.003</b> |

Acting force at toe of End pier

V0= 4206.160 tf

H0= 27.650 tf

M0=| Mx+My |= 38839.333 tf-m

Acting force at middle of bottom slab of End pier

Vcc= 4206.160 tf

Hcc= 27.650 tf

Mcc=Mx+My= 67.647 tf-m

**(Case-6 Loading Condition during Construction : Perpendicular to Flow Direction)**

|                              | Vertical        |        |                  | Horizontal     |        |                 |
|------------------------------|-----------------|--------|------------------|----------------|--------|-----------------|
|                              | V(t)            | Z(m)   | Mz(t-m)          | H(t)           | Y(m)   | My(t-m)         |
| Weight of body               | 3196.950        | 7.500  | 23977.125        |                |        |                 |
| Weight of muddy soil         |                 |        |                  |                |        |                 |
| Weight of water              |                 |        |                  |                |        |                 |
| Weight of earth              | 655.810         | 13.875 | 9099.364         |                |        |                 |
| Weight of maintenance bridge | 193.800         | 5.251  | 1017.644         |                |        |                 |
| Weight of control house      | 75.600          | 7.125  | 538.650          |                |        |                 |
| Weight of machine            | 49.000          | 7.125  | 349.125          |                |        |                 |
| Weight of gate               | 35.000          | 4.250  | 148.750          |                |        |                 |
| Hydrostatic pressure         |                 |        |                  |                |        |                 |
| Flowing water force          |                 |        |                  |                |        |                 |
| Earth pressure               |                 |        |                  | 617.725        | 3.683  | 2274.851        |
| Muddy soil pressure          |                 |        |                  |                |        |                 |
| Wind pressure                |                 |        |                  | 9.590          | 15.112 | 144.924         |
| Uplift                       |                 |        |                  |                |        |                 |
| <b>Total</b>                 | <b>4206.160</b> |        | <b>35130.658</b> | <b>627.315</b> |        | <b>2419.775</b> |

Acting force at toe of End pier

V0= 4206.160 tf

H0= 627.315 tf

M0=| Mz-My |= 32710.882 tf-m

Acting force at middle of bottom slab of End pier

Vcc= 4206.160 tf

Hcc= 627.315 tf

Mcc=Mz-My= -1164.682 tf-m

**Table 6.4.3 (4/4) DESIGN LOADS ON END PIER**  
(Case-7 Seismic Loading Condition : Flow Direction)

|                              | Vertical        |        |                  | Horizontal     |        |                 |
|------------------------------|-----------------|--------|------------------|----------------|--------|-----------------|
|                              | V(t)            | X(m)   | Mx(t-m)          | H(t)           | Y(m)   | My(t-m)         |
| Weight of body               | 3196.950        | 8.811  | 28168.326        | 383.634        | 4.917  | 1886.328        |
| Weight of muddy soil         | 48.260          | 3.250  | 156.845          | 5.791          | 2.700  | 15.636          |
| Weight of water              | 233.370         | 3.250  | 758.453          |                |        |                 |
| Weight of earth              | 490.150         | 9.863  | 4834.349         | 58.818         | 6.360  | 374.082         |
| Weight of maintenance bridge | 193.800         | 15.000 | 2907.000         | 23.256         | 10.510 | 244.421         |
| Weight of control house      | 47.250          | 6.500  | 307.125          | 5.670          | 18.375 | 104.186         |
| Weight of machine            | 49.000          | 6.500  | 318.500          | 5.880          | 16.450 | 96.726          |
| Weight of gate               | 35.000          | 6.500  | 227.500          | 4.200          | 4.571  | 19.198          |
| Hydrostatic pressure         |                 |        |                  | 291.830        | 2.755  | 803.992         |
| Hydrodynamic pressure        |                 |        |                  | 51.800         | 2.620  | 135.716         |
| Flowing water force          |                 |        |                  | 0.217          | 4.810  | 1.044           |
| Earth pressure               |                 |        |                  |                |        |                 |
| Muddy soil pressure          |                 |        |                  | 2.585          | 2.533  | 6.548           |
| Wind pressure                |                 |        |                  |                |        |                 |
| Uplift                       | -984.101        | 8.598  | -8461.330        |                |        |                 |
| <b>Total</b>                 | <b>3309.679</b> |        | <b>29216.769</b> | <b>833.681</b> |        | <b>3687.877</b> |

Acting force at toe of End pier

V0= 3309.679 tf

H0= 833.681 tf

M0=| Mx+My | = 32904.646 tf-m

Acting force at middle of bottom slab of End pier

Vcs= 3309.679 tf

Hcs= 833.681 tf

Mcs=Mx+My= -2290.117 tf-m

**(Case-8 Seismic Loading Condition : Perpendicular to Flow Direction)**

|                              | Vertical        |        |                  | Horizontal      |        |                 |
|------------------------------|-----------------|--------|------------------|-----------------|--------|-----------------|
|                              | V(t)            | Z(m)   | Mz(t-m)          | H(t)            | Y(m)   | My(t-m)         |
| Weight of body               | 3196.950        | 7.500  | 23977.125        | 383.634         | 4.917  | 1886.328        |
| Weight of muddy soil         | 48.260          | 5.792  | 279.522          | 5.791           | 2.700  | 15.636          |
| Weight of water              | 233.370         | 5.792  | 1351.679         |                 |        |                 |
| Weight of earth              | 490.150         | 13.875 | 6800.831         | 58.818          | 6.360  | 374.082         |
| Weight of maintenance bridge | 193.800         | 5.251  | 1017.644         | 23.256          | 10.510 | 244.421         |
| Weight of control house      | 47.250          | 7.125  | 336.656          | 5.670           | 18.375 | 104.186         |
| Weight of machine            | 49.000          | 7.125  | 349.125          | 5.880           | 16.450 | 96.726          |
| Weight of gate               | 35.000          | 4.250  | 148.750          | 4.200           | 4.571  | 19.198          |
| Hydrostatic pressure         |                 |        |                  | 230.600         | 2.183  | 503.400         |
| Hydrodynamic pressure        |                 |        |                  |                 |        |                 |
| Flowing water force          |                 |        |                  |                 |        |                 |
| Earth pressure               |                 |        |                  | 705.734         | 3.675  | 2593.610        |
| Muddy soil pressure          |                 |        |                  |                 |        |                 |
| Wind pressure                |                 |        |                  |                 |        |                 |
| Uplift                       | -984.101        | 7.500  | -7380.759        |                 |        |                 |
| <b>Total</b>                 | <b>3309.679</b> |        | <b>26880.573</b> | <b>1423.584</b> |        | <b>5837.588</b> |

Acting force at toe of End pier

V0= 3309.679 tf

H0= 1423.584 tf

M0=| Mz-My | = 21042.985 tf-m

Acting force at middle of bottom slab of End pier

Vcc= 3309.679 tf

Hcc= 1423.584 tf

Mcc=Mz-My= 3779.606 tf-m

Table 6.4.4 (1/2) COMPARATIVE STUDY ON PILE FOUNDATION FOR END PIER

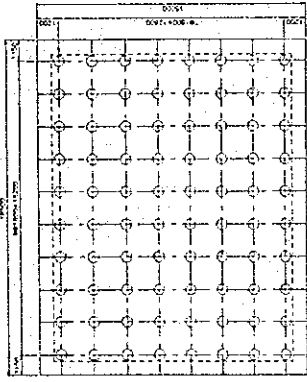
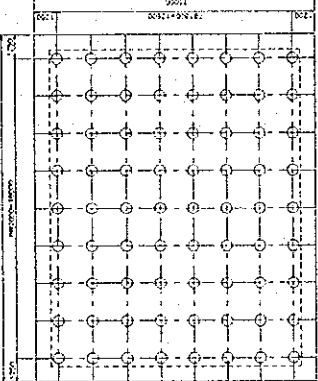
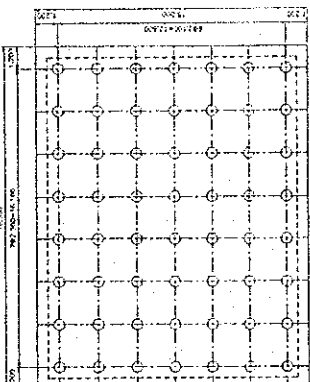
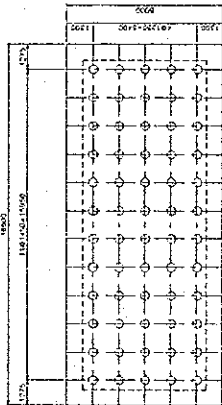
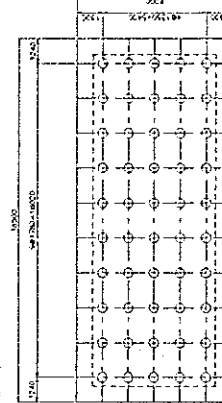
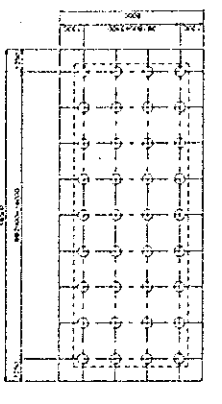
| Kind of pile  | Alternative-1 Dia. 600 (A)   | Alternative-2 Dia. 600 (B)  | Alternative-3 Dia. 600 (A)<br>+Concrete Filling |
|---|--|---|---|
| Pile Arrangement<br><br> |  |  |   |
| Number of necessary pile  | 80 piles (L=10.30m)  | 72 piles (L=10.30m)   | 56 piles (L=10.30m)                             |
| Displacement  | Calculation (mm)   | Calculation (mm)  | Calculation (mm)                                |
| Normal Case   | 0.7  | 0.8   | 0.9   |
| Design flooding Case  | 0.4  | 0.4   | 0.5   |
| Constructional Case   | 0.6  | 0.7   | 0.8   |
| Seismic Case  | 0.7  | 0.8   | 0.9   |
| Force / Moment Acting on Pile   | Axial load (tf/pile)   | Axial load (tf/pile)  | Axial load (tf/pile)                            |
| Normal Case   | 42.84  | 48.34   | 75.85   |
| Design flooding Case  | 28.07  | 43.82   | 50.41   |
| Constructional Case   | 44.31  | 67.59   | 104.68  |
| Seismic Case  | 28.69  | 58.94   | 53.80   |
| Bearing capacity (tf)   | Normal   | Normal  | Normal  |
| Seismic   | 106.88   | 106.88  | 106.88  |
| Summary of cost   | Rp 142.5 million   | Rp 155.4 million  | Rp 117.3 million                                |
| Evaluation  | Not adopted  | Not adopted   | Adopted   |
|   | Calculation (mm)   | Calculation (mm)  | Calculation (mm)                                |
|   | Allowable capacity (mm)  | Allowable capacity (mm)   | Allowable capacity (mm)                         |
|   | Bending moment (tf-m)  | Bending moment (tf-m)   | Bending moment (tf-m)                           |
|   | Calculation  | Calculation   | Calculation                                     |
|   | Allowable capacity   | Allowable capacity  | Allowable capacity                              |
|   | 11.42  | 10.56   | 12.15   |
|   | 9.88   | 11.01   | 11.94   |
|   | 11.57  | 8.66  | 11.89   |
|   | 15.20  | 24.50   | 18.87   |
|   | 106.88   | 106.88  | 106.88  |
|   | 160.33   | 160.33  | 160.33  |

Table 6.4.4 (2/2) COMPARATIVE STUDY ON PILE FOUNDATION FOR CENTER PIER

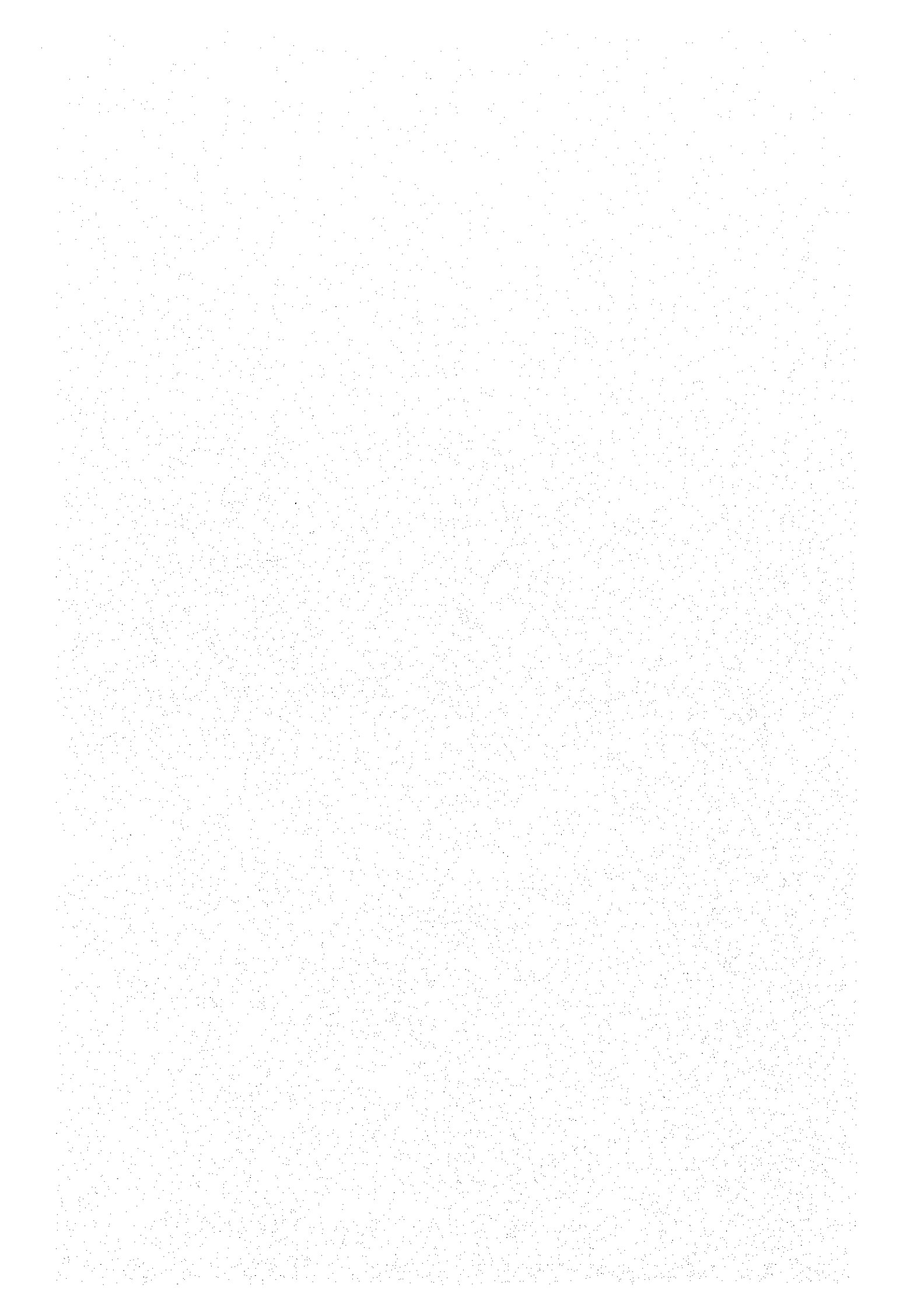
| Kind of pile                  | Alternative-1 Dia. 450 (A)  | Alternative-2 Dia. 500 (A)   | Alternative-3 Dia. 600 (A)  |
|-------------------------------|---|--|---|
| Pile Arrangement              |  |  |  |
| Number of necessary pile      | 60 piles (L=10.30m)   | 50 piles (L=10.30m)  | 36 piles (L=10.30m)   |
| Displacement (Horizontal)     | Calculation (mm) Allowable capacity (mm)  | Calculation (mm) Allowable capacity (mm)   | Calculation (mm) Allowable capacity (mm)  |
| Normal Case                   | 1.0 10  | 1.0 10   | 0.99 10   |
| Design flooding Case          | 0.1 10  | 0.1 10   | 0.06 10   |
| Constructional Case           | 0.1 10  | 0.1 10   | 0.05 10   |
| Seismic Case                  | 1.0 15  | 1.0 15   | 1.10 15   |
| Force / Moment Acting on Pile | Axial load (tf/pile) Bending moment (tf-m) Calculation Allowable capacity           | Axial load (tf/pile) Bending moment (tf-m) Calculation Allowable capacity          | Axial load (tf/pile) Bending moment (tf-m) Calculation Allowable capacity         |
| Normal Case                   | 23.00 4.39  | 27.59 5.82   | 41.46 8.76  |
| Design flooding Case          | 21.88 0.23  | 26.34 0.30   | 33.14 1.04  |
| Constructional Case           | 29.72 0.25  | 35.78 0.33   | 49.64 0.77  |
| Seismic Case                  | 15.67 6.23  | 18.99 8.26   | 32.61 14.98   |
| Bearing capacity (tf)         | Normal 50.13 Seismic 75.19  | 54.96 82.45  | 73.93 110.89  |
| Summary of cost               | Rp 96.5 million   | Rp 98.3 million  | Rp 85.3 million   |
| Evaluation                    | Not adopted   | Not adopted  | Adopted   |



**FIGURES**

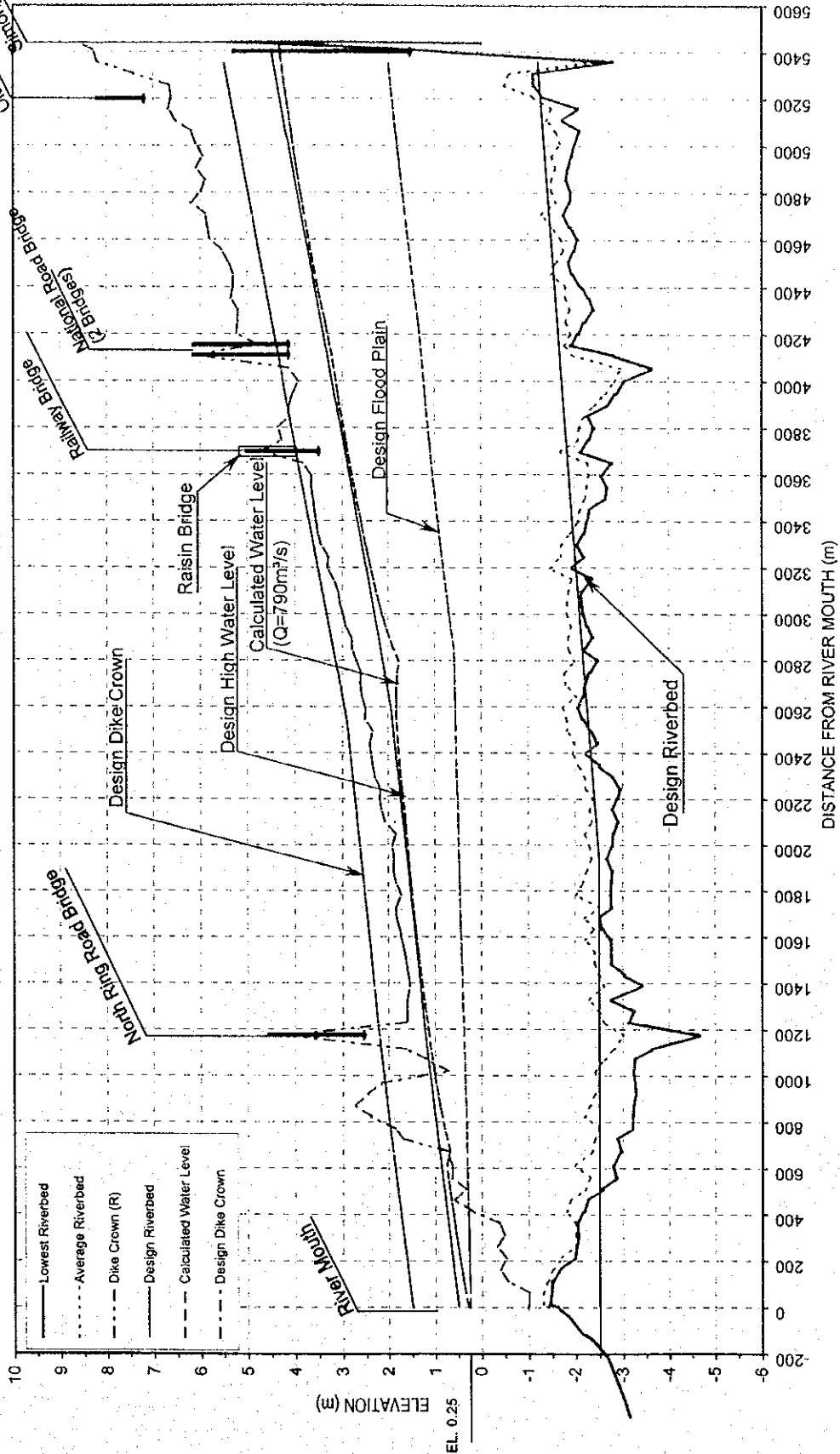
**CHAPTER 6**

**DETAILED DESIGN**





DESIGN HIGH WATER LEVEL AND CALCULATED WATER LEVEL

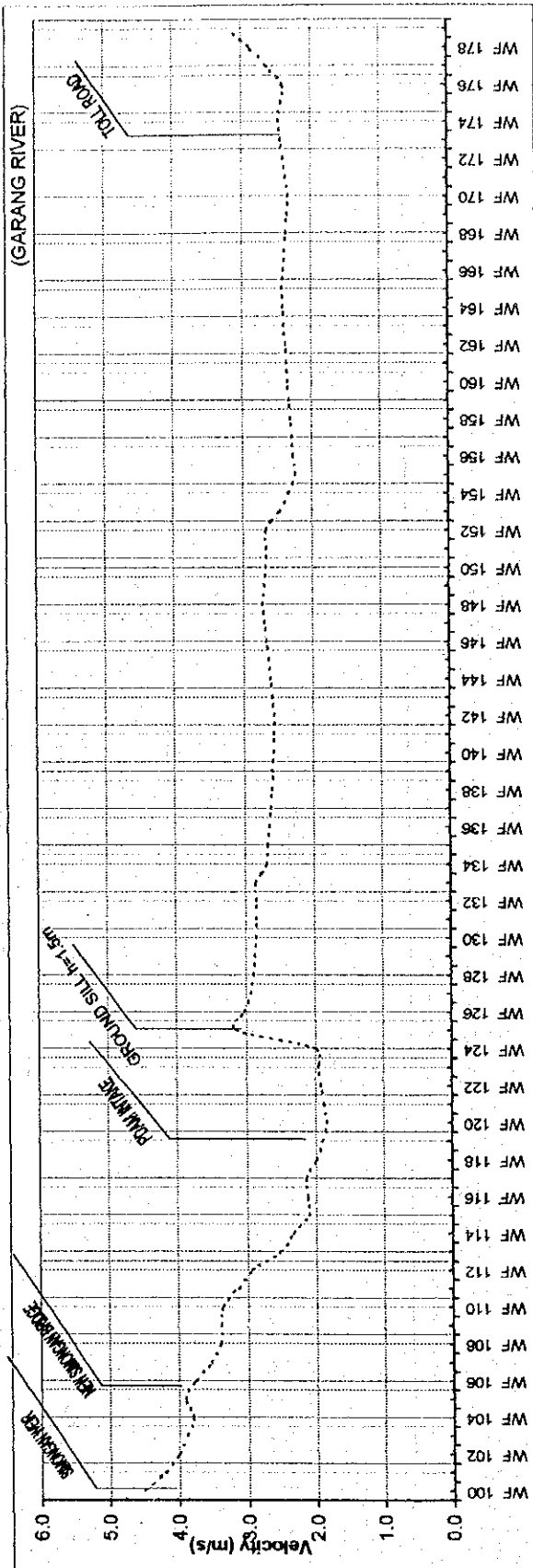
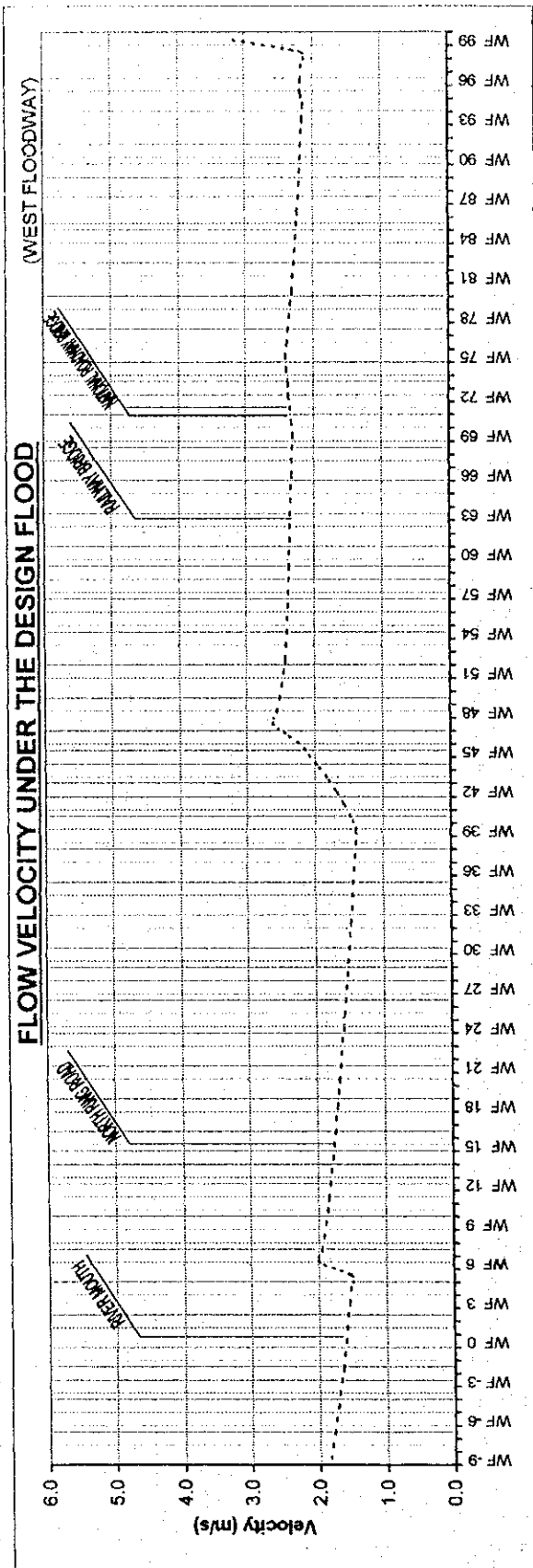


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.1

CALCULATED WATER LEVEL AND DESIGN HIGH WATER LEVEL IN WEST FLOODWAY



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

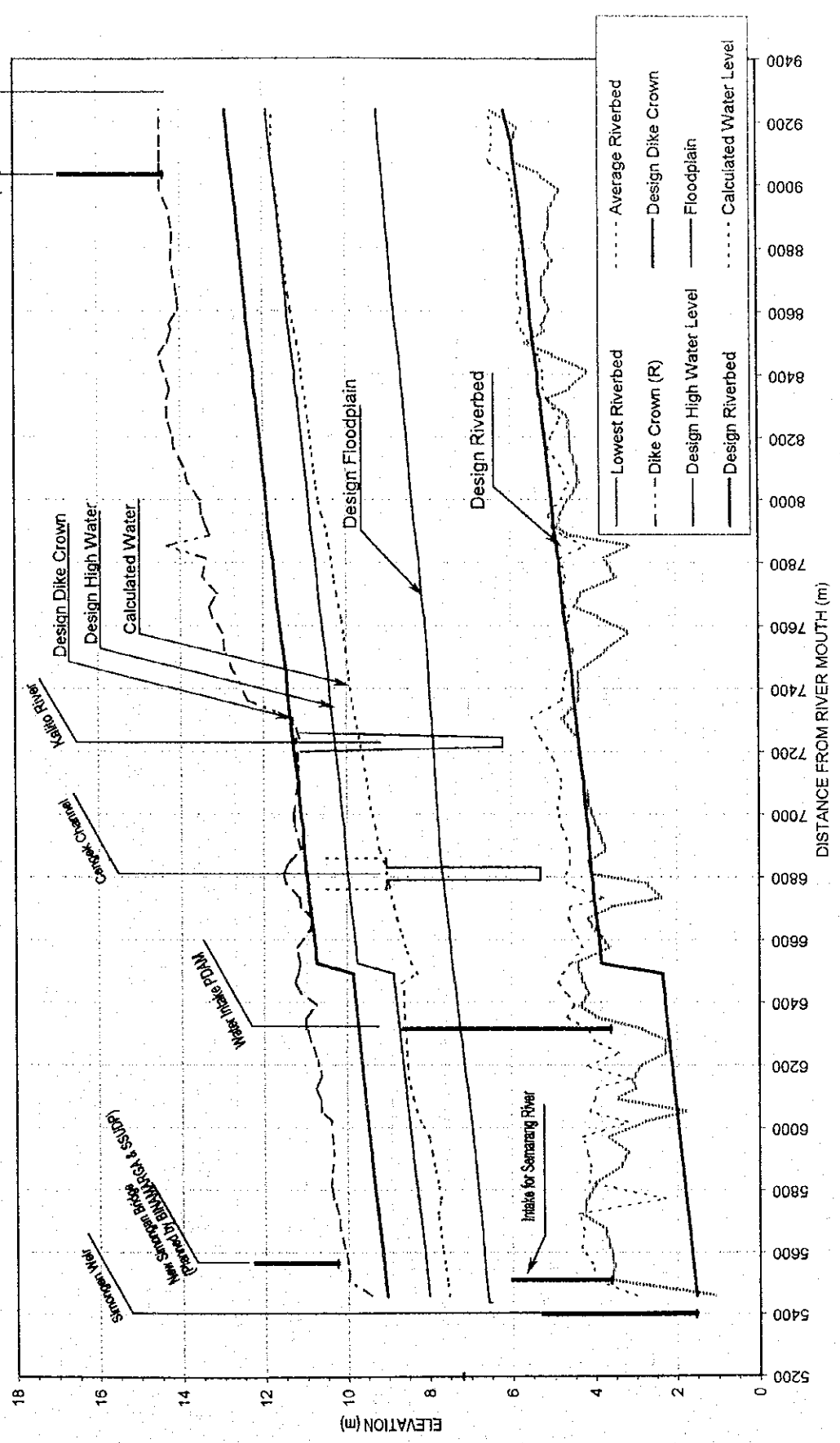
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.2

FLOW VELOCITY OF DESIGN RIVER CHANNEL UNDER DESIGN FLOOD DISCHARGE

Confluence with Koro River  
 80349 (R02) (01)

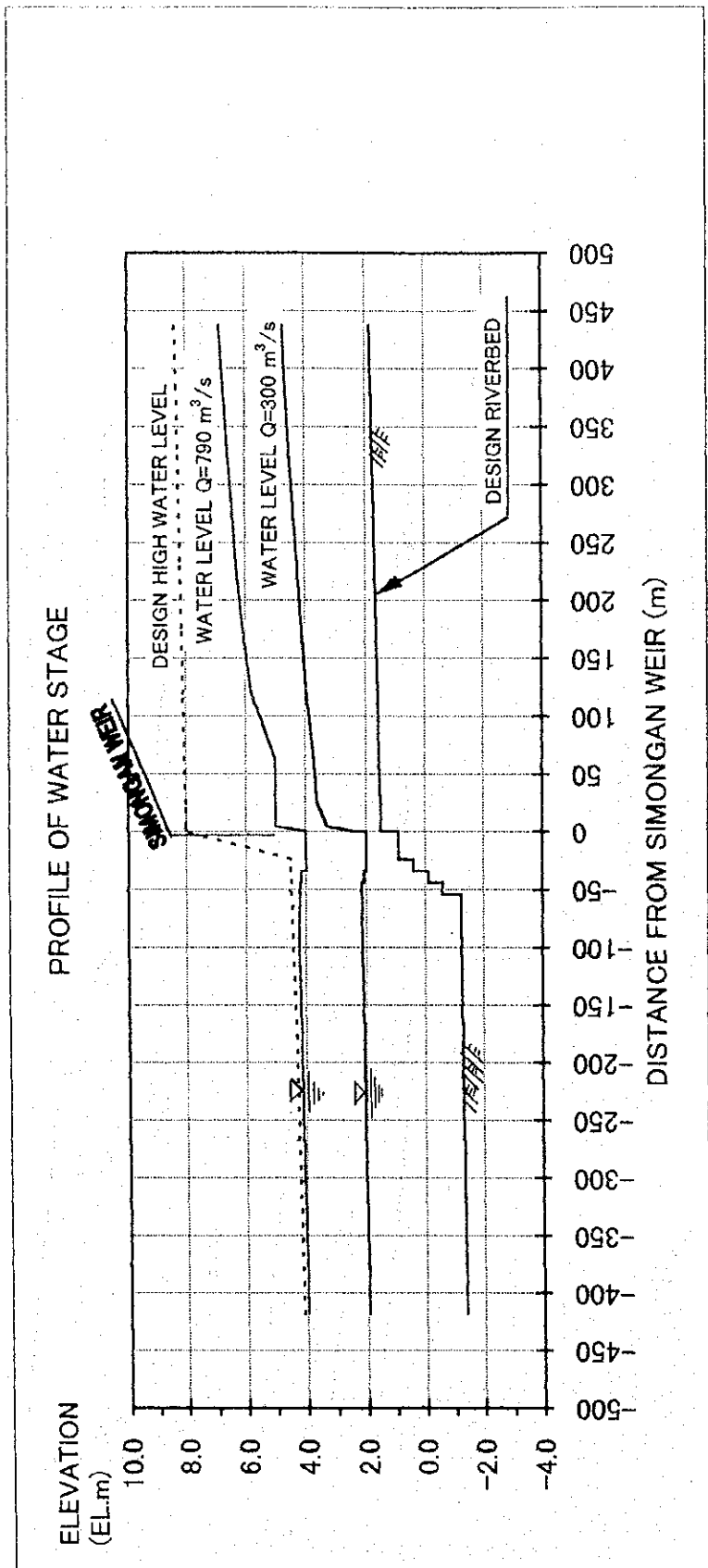
CALCULATED WATER LEVEL AND DESIGN HIGH WATER LEVEL



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

Fig. 6.2.3  
 CALCULATED WATER LEVEL AND DESIGN HIGH WATER LEVEL IN GARANG RIVER

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THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

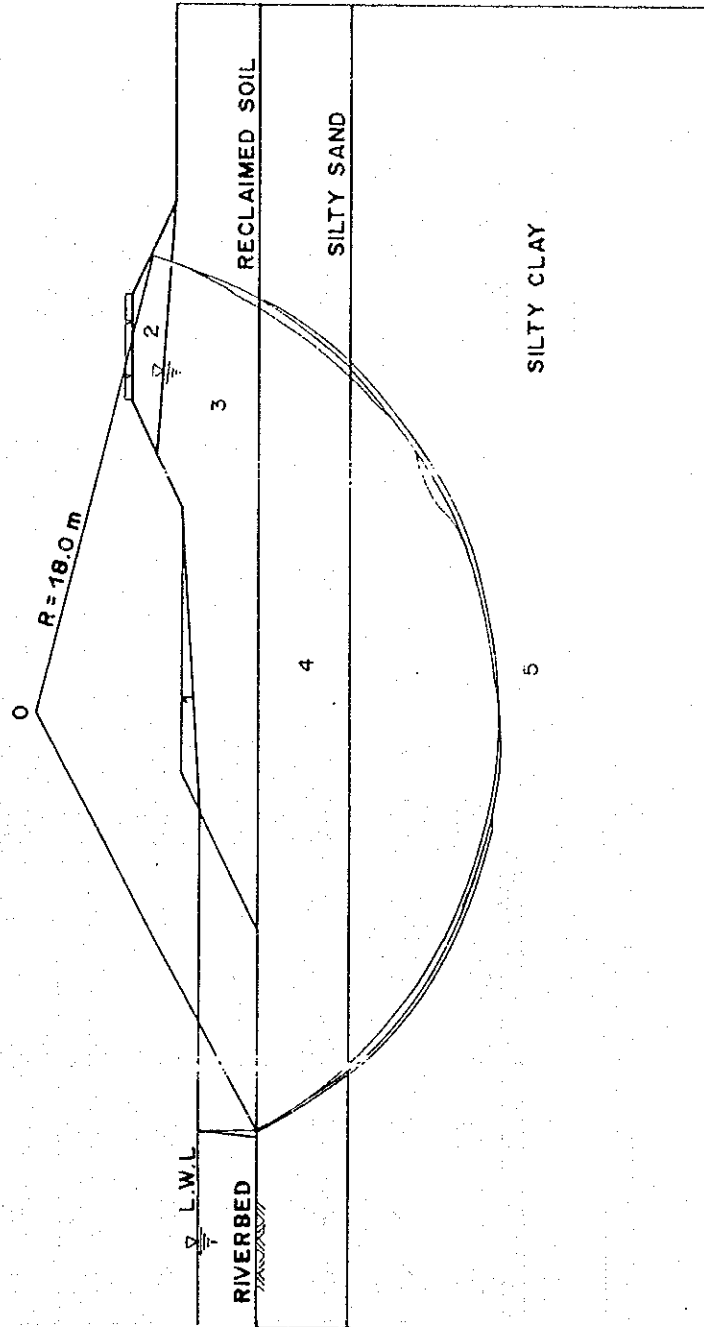
Fig. 6.2.4

WATER LEVEL PROFILE IN THE UPSTREAM AND DOWNSTREAM OF SIMONGAN WEIR

## RIVER MOUTH DIKE

|                            |         |       |
|----------------------------|---------|-------|
| MINIMUM SAFETY FACTOR (FS) | 1.48    |       |
| COORDINATE                 | X (m)   | 8.14  |
|                            | Y (m)   | 6.21  |
| RADIUS OF ARC              | R (m)   | 18.00 |
| RESISTANT MOMENT (tf.m)    | 1817.90 |       |
| SLIPPING MOMENT (tf.m)     | 1448.23 |       |

| NO | NAME OF BLOCK | $t$ (tf/m <sup>3</sup> ) | $C_0$ (tf/m <sup>2</sup> ) | $\phi$ (DEGREE) |
|----|---------------|--------------------------|----------------------------|-----------------|
| 1  | m1            | 1.80                     | 0.00                       | 30.00           |
| 2  | m2            | 1.80                     | 0.00                       | 30.00           |
| 3  | m3            | 1.80                     | 0.00                       | 30.00           |
| 4  | g1            | 1.60                     | 0.50                       | 25.00           |
| 5  | g2            | 1.50                     | 2.00                       | 0.00            |

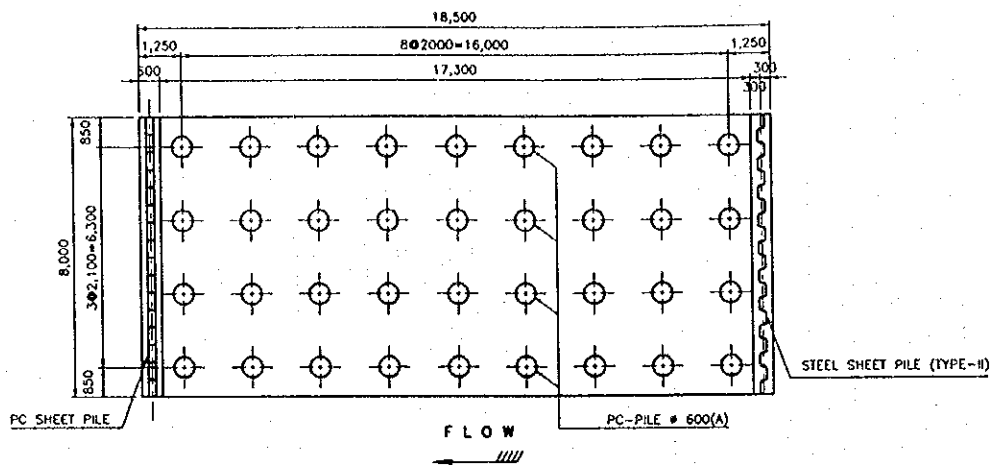


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

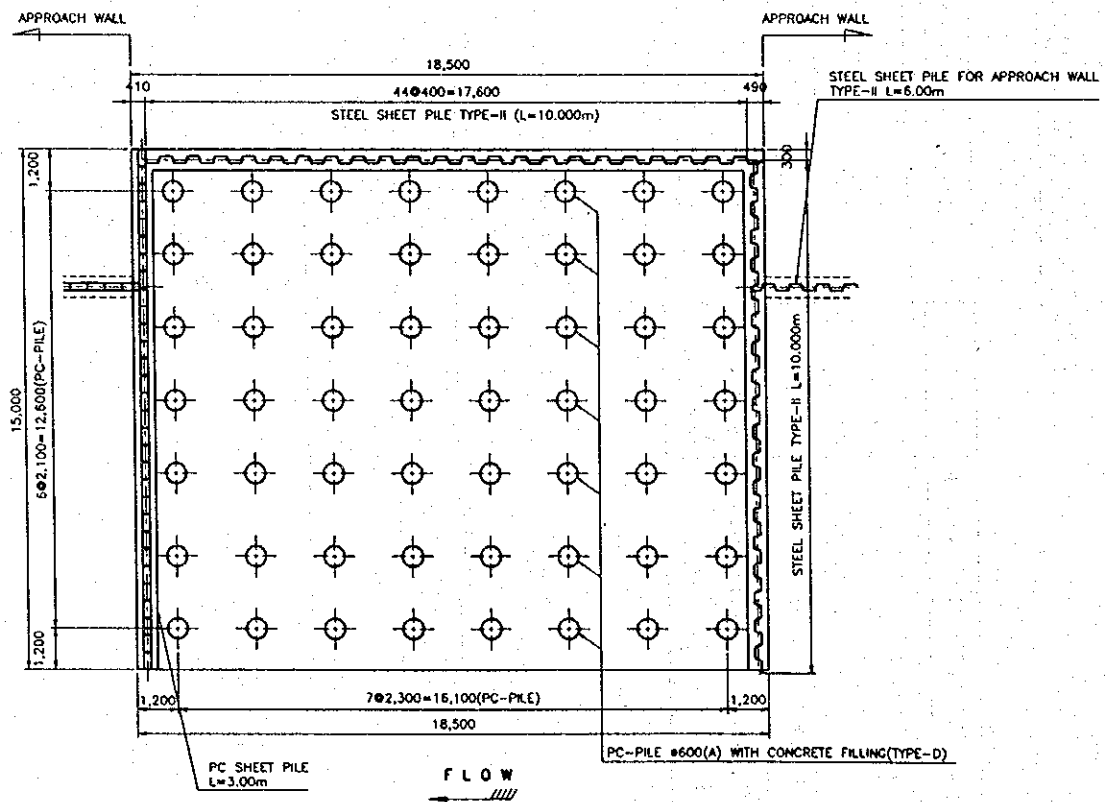
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Fig.6.3.1

RESULT OF STABILITY AT RIVER MOUTH DIKE



PILE ARRANGEMENT OF CENTER PIER



PILE ARRANGEMENT OF END PIER

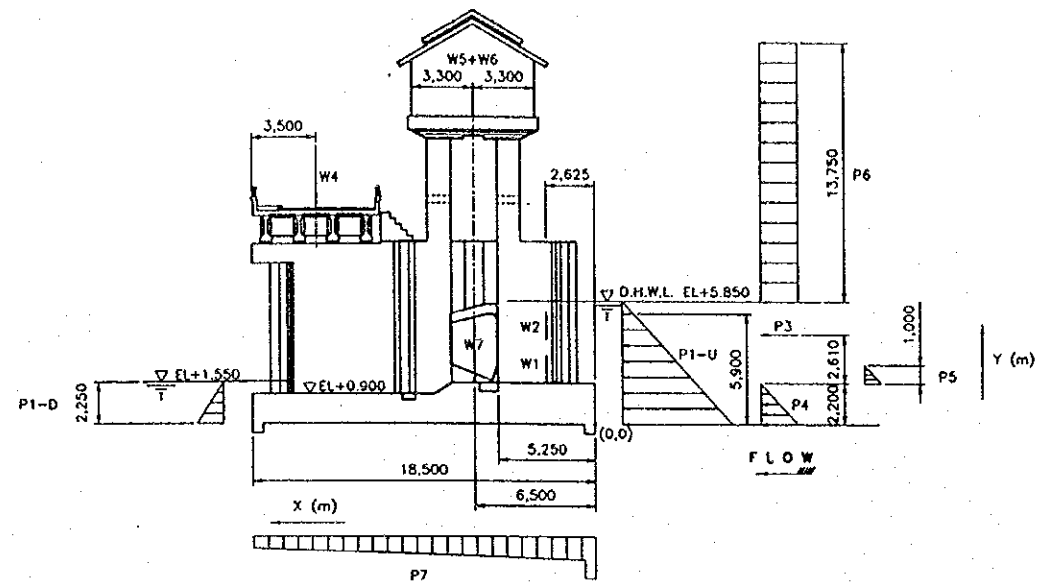
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

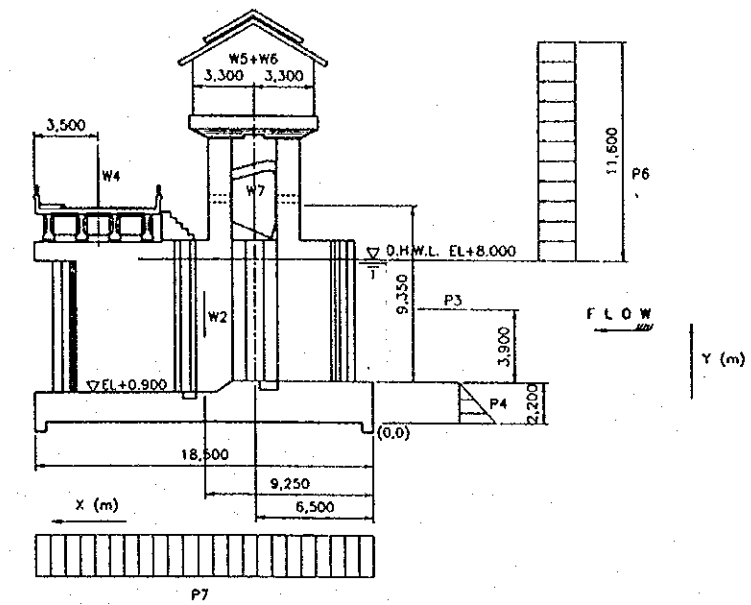
Fig. 6.4.1

PILE ARRANGEMENT FOR FOOTING OF BOTH CENTER PIER AND END PIER

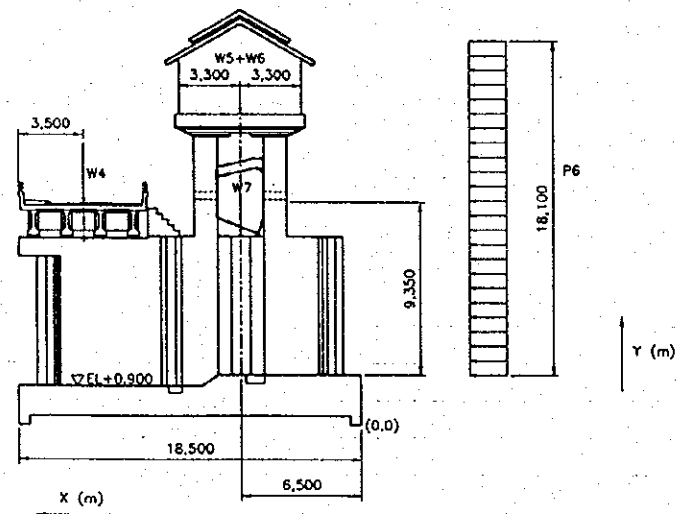




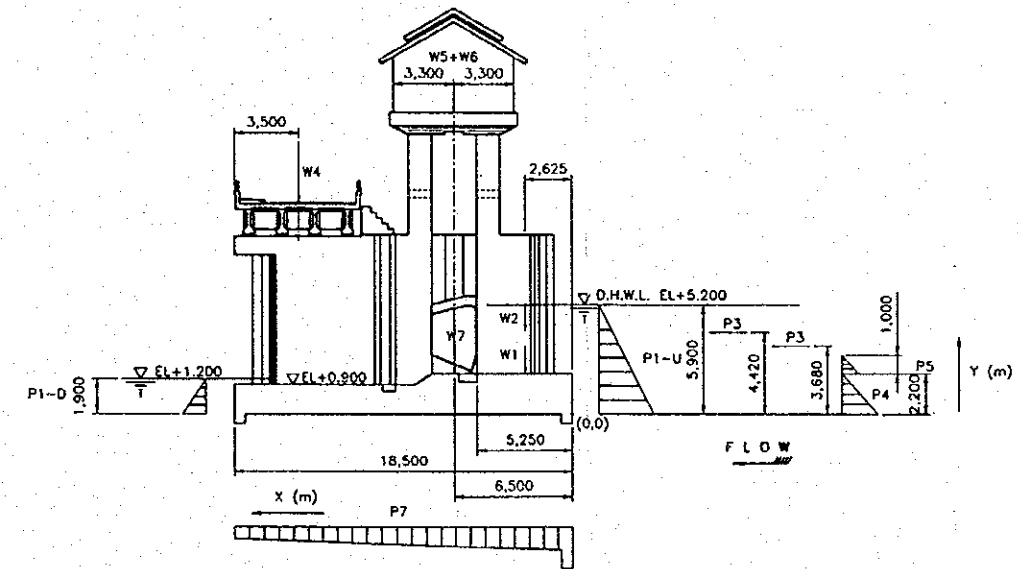
NORMAL CONDITION



DESIGN FLOOD CONDITION



CONSTRUCTIONAL CONDITION



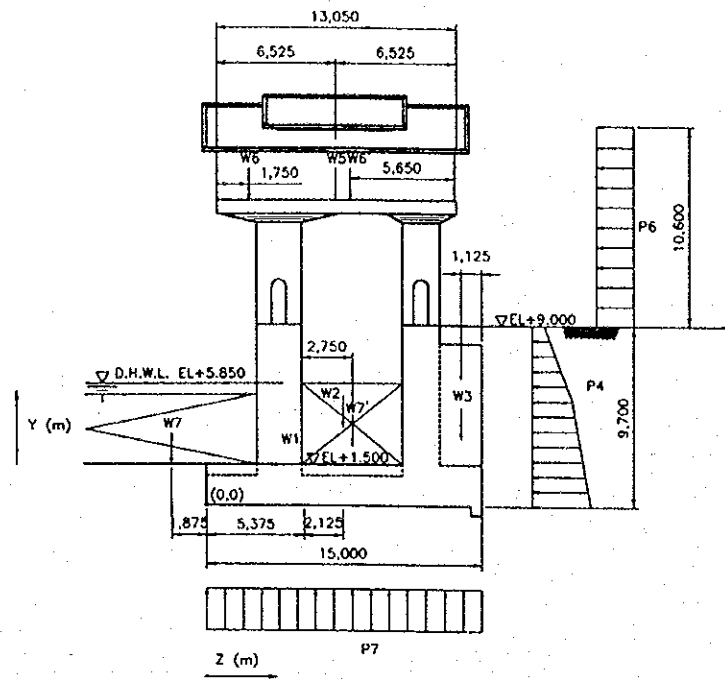
SEISMIC CONDITION

| LEGEND                            |                            |
|-----------------------------------|----------------------------|
| W1 : WEIGHT OF MUDDY SOIL         | P1 : HYDROSTATIC PRESSURE  |
| W2 : WEIGHT OF WATER              | P2 : HYDRODYNAMIC PRESSURE |
| W3 : WEIGHT OF EARTH              | P3 : FLOWING WATER FORCE   |
| W4 : WEIGHT OF MAINTENANCE BRIDGE | P4 : MUDDY SOIL PRESSURE   |
| W5 : WEIGHT OF CONTROL HOUSE      | P5 : EARTH PRESSURE        |
| W6 : WEIGHT OF MACHINE            | P6 : WIND PRESSURE         |
| W7 : WEIGHT OF GATE               | P7 : UPLIFT                |

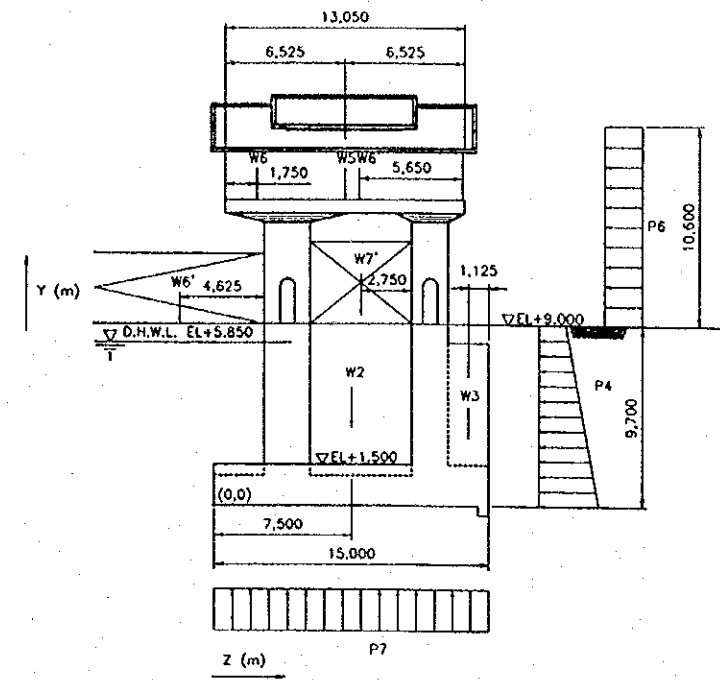
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA  
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig.6.4.2 (1/2)  
LOADS ACTING ON WEIR

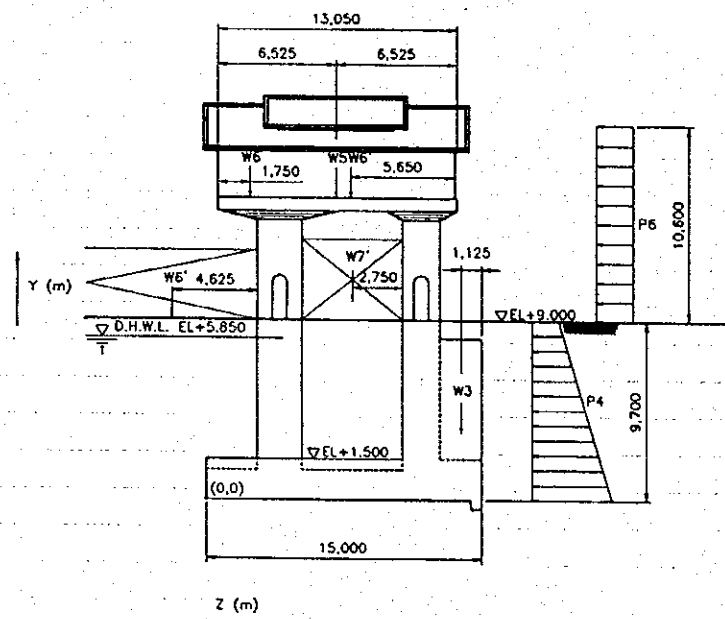




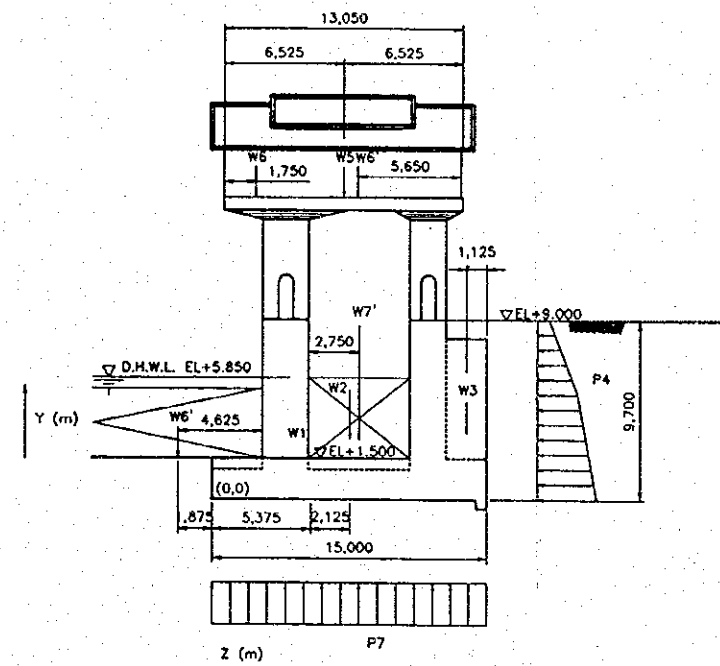
NORMAL CONDITION



DESIGN FLOOD CONDITION



CONSTRUCTIONAL CONDITION



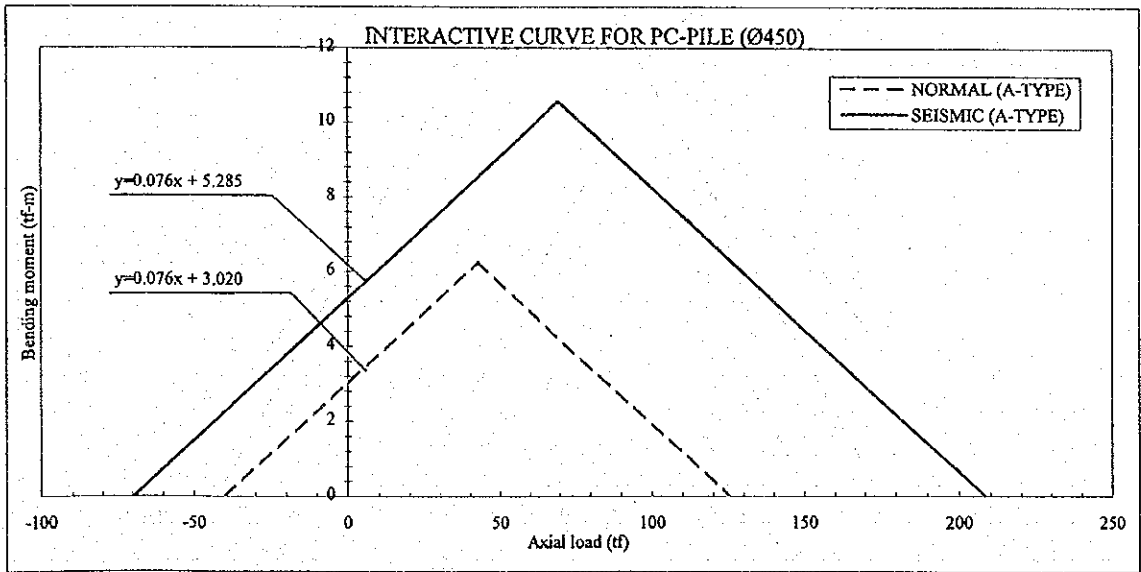
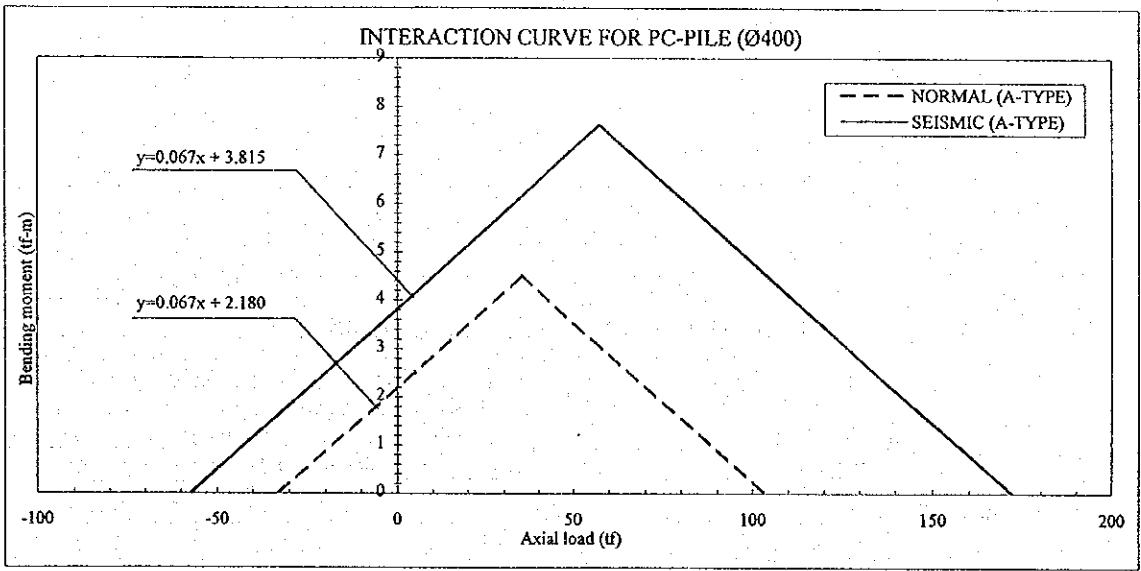
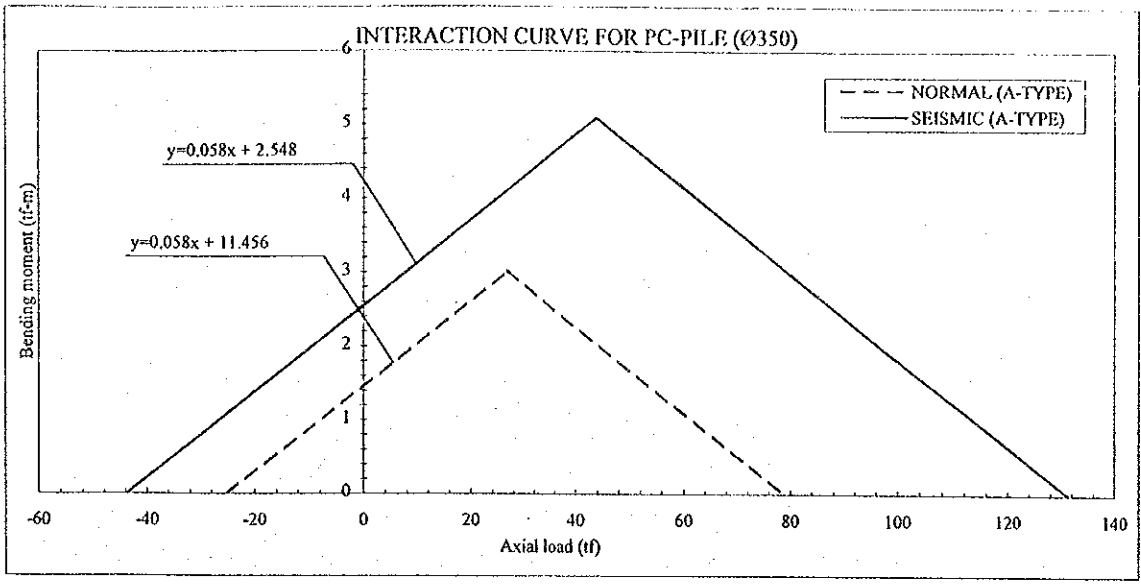
SEISMIC CONDITION

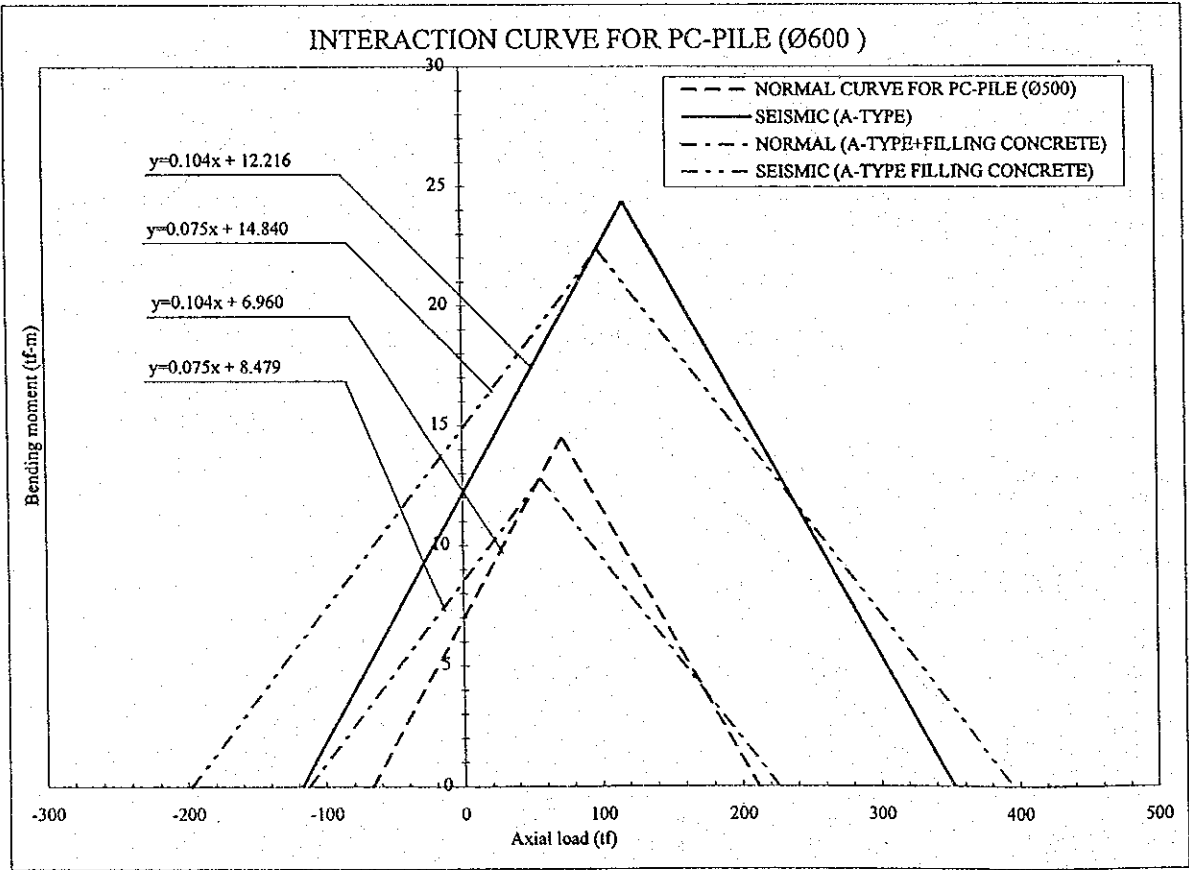
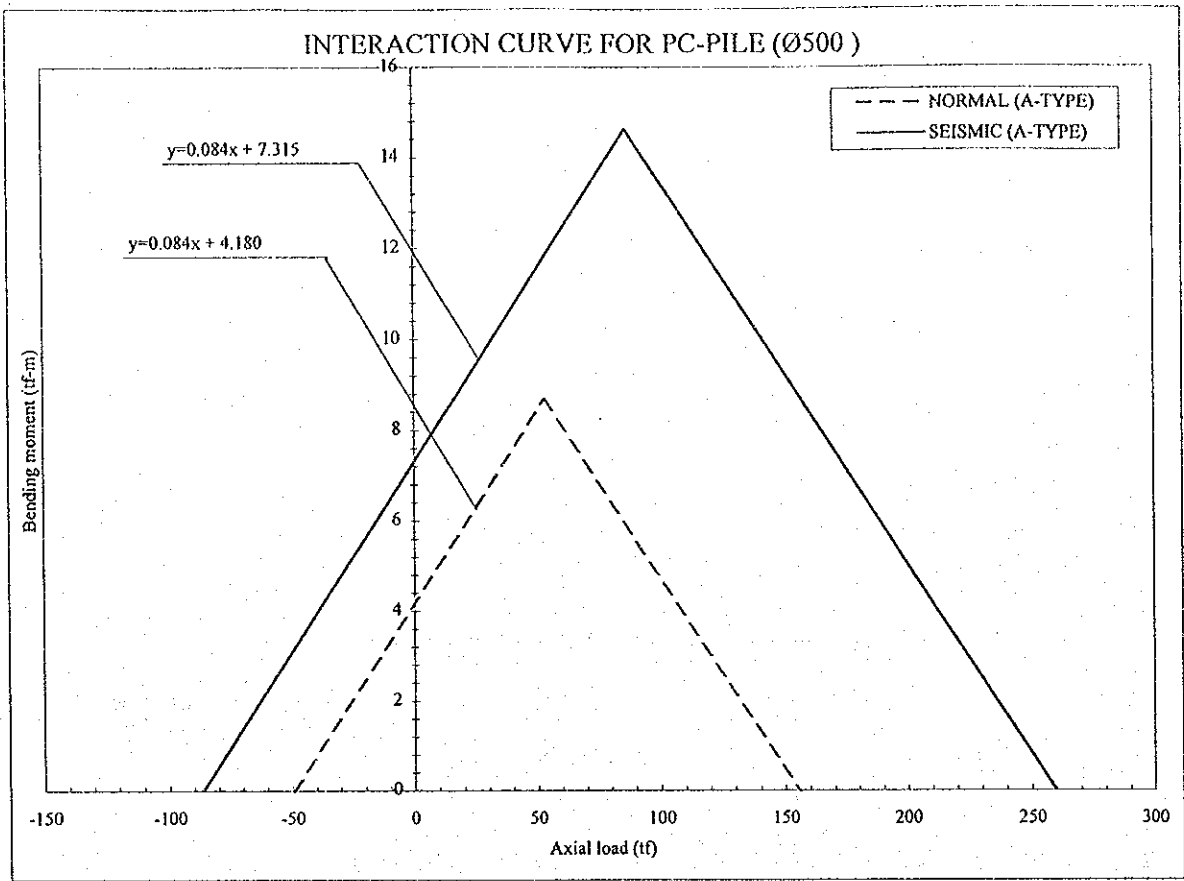
| LEGEND                            |                            |
|-----------------------------------|----------------------------|
| W1 : WEIGHT OF MUDDY SOIL         | P1 : HYDROSTATIC PRESSURE  |
| W2 : WEIGHT OF WATER              | P2 : HYDRODYNAMIC PRESSURE |
| W3 : WEIGHT OF EARTH              | P3 : FLOWING WATER FORCE   |
| W4 : WEIGHT OF MAINTENANCE BRIDGE | P4 : MUDDY SOIL PRESSURE   |
| W5 : WEIGHT OF CONTROL HOUSE      | P5 : EARTH PRESSURE        |
| W6 : WEIGHT OF MACHINE            | P6 : WIND PRESSURE         |
| W7 : WEIGHT OF GATE               | P7 : UPLIFT                |

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Fig. 6.4.2 (2/2)  
 LOADS ACTING ON WEIR







THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

Fig. 6.4.3 (2/2)  
INTERACTION CURVE ON PC PILE STRENGTH

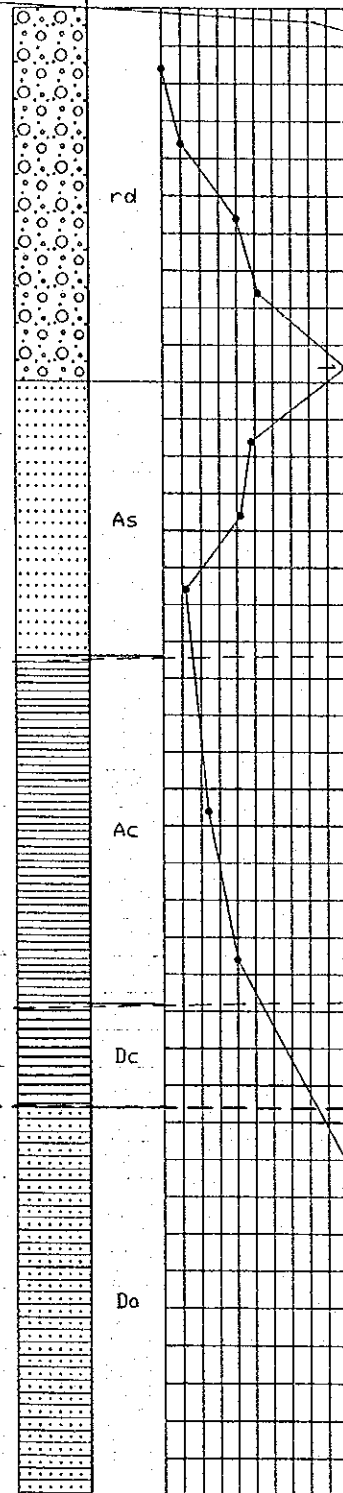
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SB-2

dp=20.00m  
EL=3.99m

0 10 20 30 40 50



EL. -0.700

BOTTOM OF FOOTING

100

PC PILE  $\phi 600(A)$   
L=10.300m

ESTIMATED BEARING LAYER

SEDIMENTARY ROCK

CENTER PIER

(BOR-No.SB.-2)

| LAYER | THICKNESS ( m ) | N-VALUE AVERAGE | $f_i$ ( tf/m ) | $\alpha_i \cdot f_i$ ( tf/m ) |
|-------|-----------------|-----------------|----------------|-------------------------------|
| As    | 5.30            | 17.00           | 3.40           | 18.02                         |
| Ac    | 3.50            | 16.00           | 9.60           | 33.60                         |
| Dc    | 1.40            | 35.00           | 15.00          | 21.00                         |
| TOTAL | 10.20           |                 |                | 72.62                         |

$$u = q_d \times A + \sum \alpha_i \cdot f_i$$

$$q_d = 300 \text{ tf/m}^2$$

$$A = \pi/4 D^2 = \pi/4 \times (0.6)^2 = 0.283 \text{ m}^2$$

$$U = \pi D = \pi \times 0.6 = 1.885 \text{ m}$$

$$R_u = 84.90 + 136.89 = 221.790 \text{ tf/pile}$$

ALLOWABLE BEARING CAPACITY

(NORMAL)

$$R_o = 1/3 R_u = 73.93 \text{ tf/pile}$$

(SEISMIC)

$$R_o' = 1/2 R_u = 110.90 \text{ tf/pile}$$

NOTE: BORING LOG SHOWN ON THIS DRAWING IS FOR DETAIL DESIGN ONLY. THEREFORE, IN CONSTRUCTION, CONTRACTOR NEED TO RECONFIRM BORING LOG ON THIS AREA.

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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Fig. 6.4.4  
CALCULATION OF BEARING CAPACITY OF PC PILE

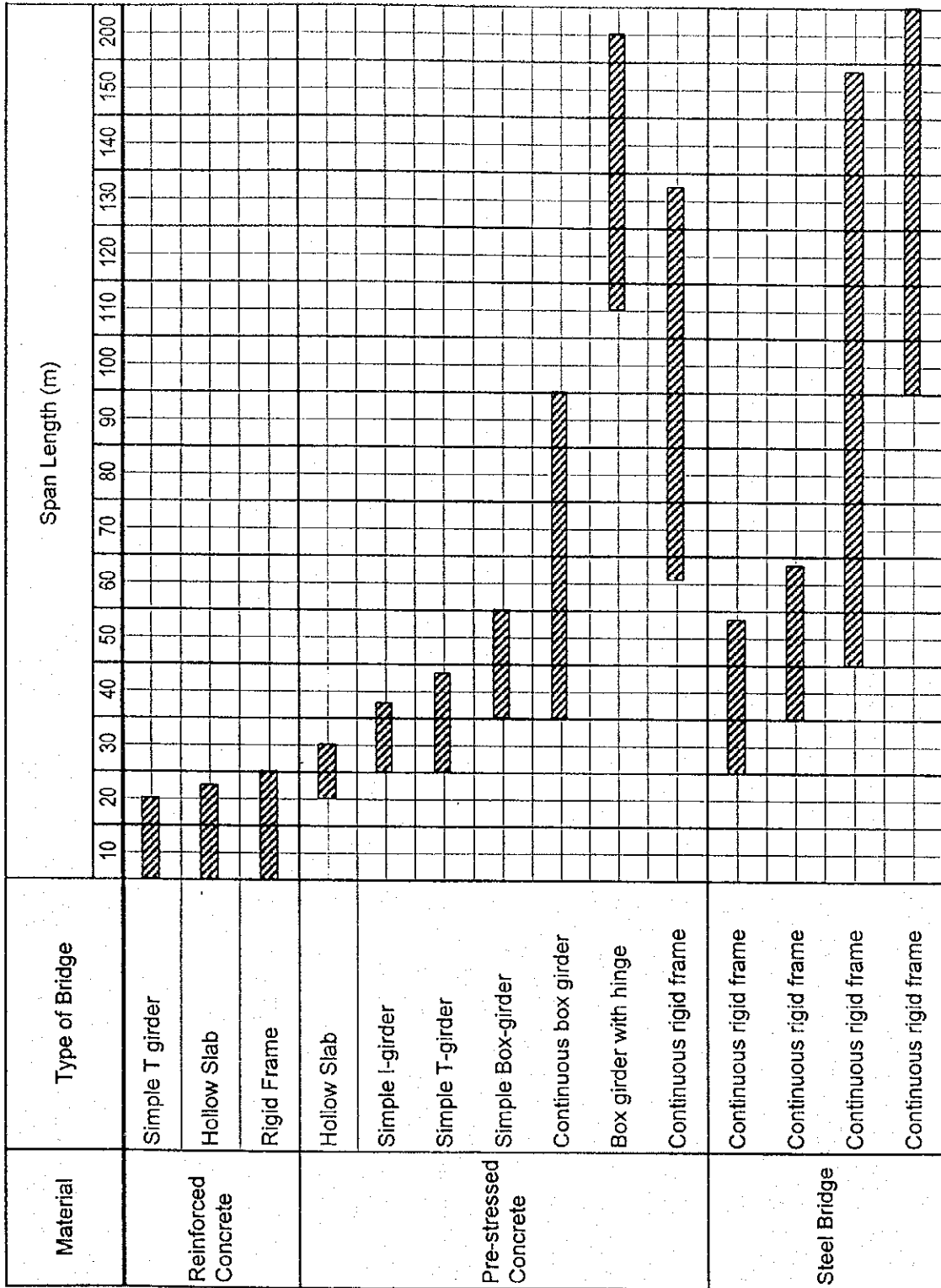
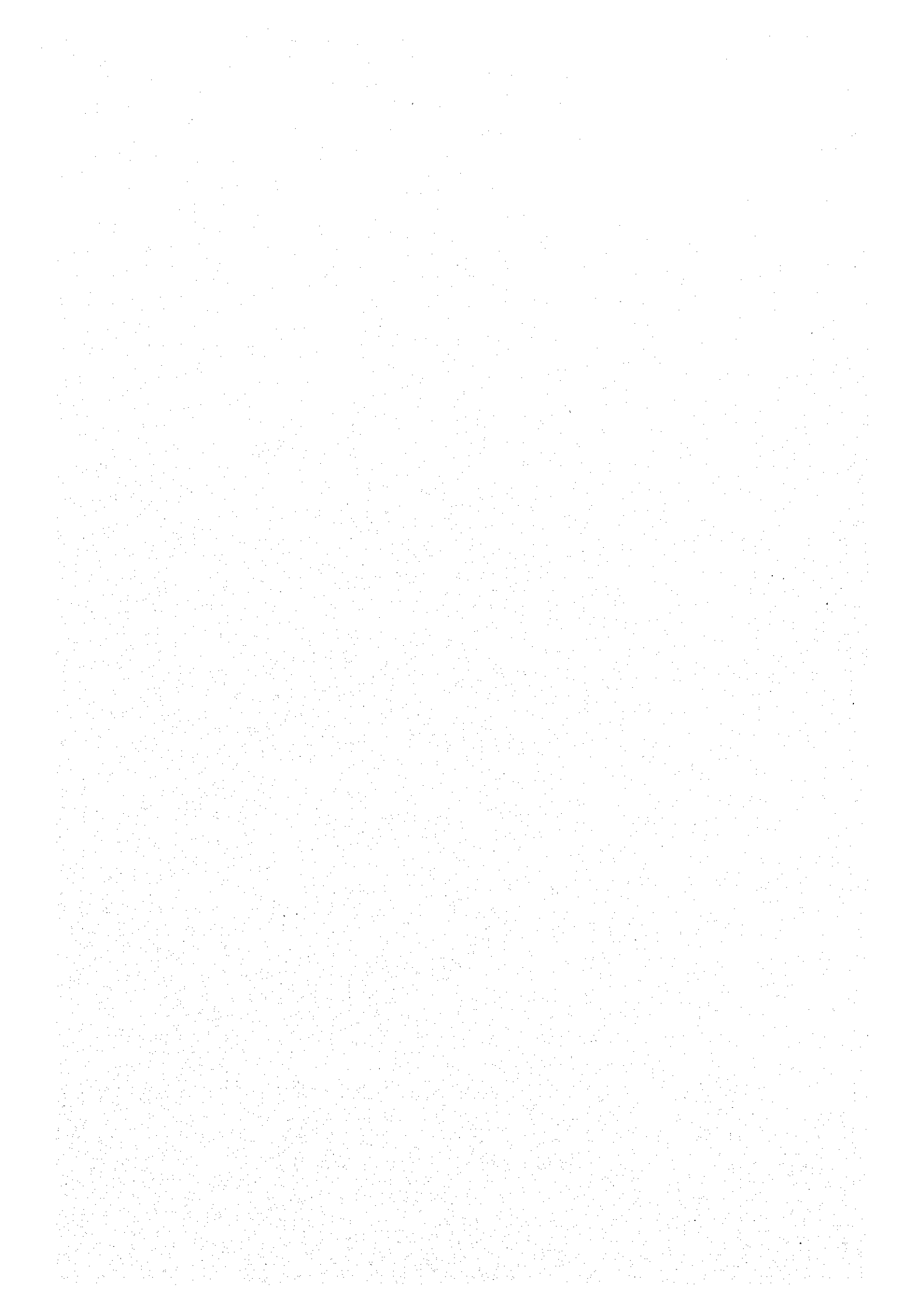
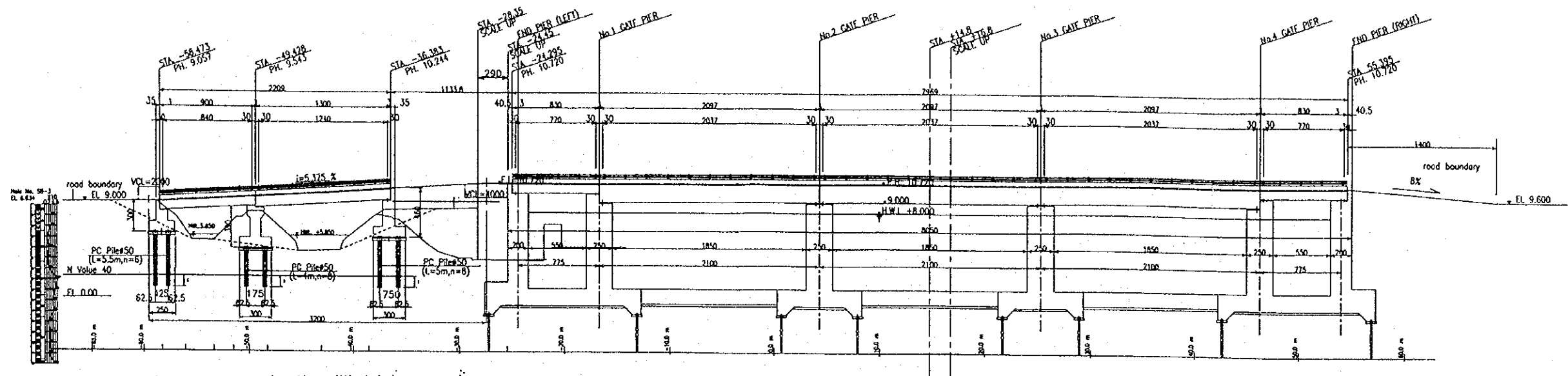


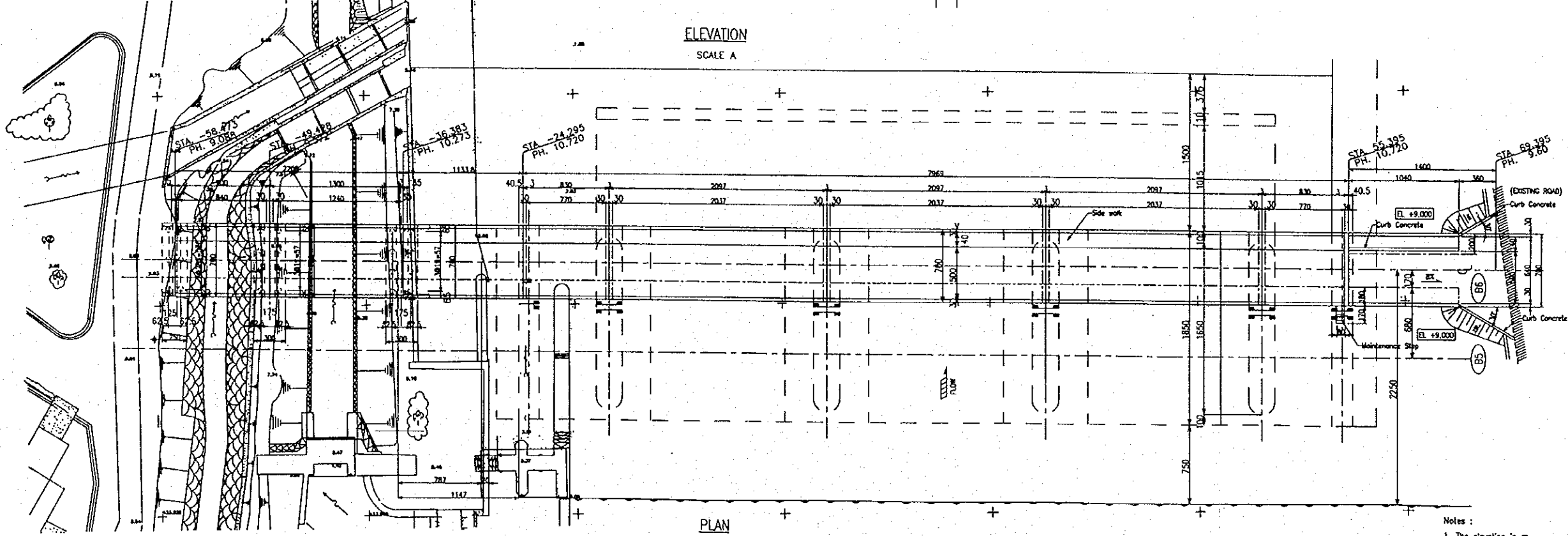
Fig. 6.4.5  
RELATION BETWEEN BRIDGE SPAN LENGTH  
AND BRIDGE TYPE





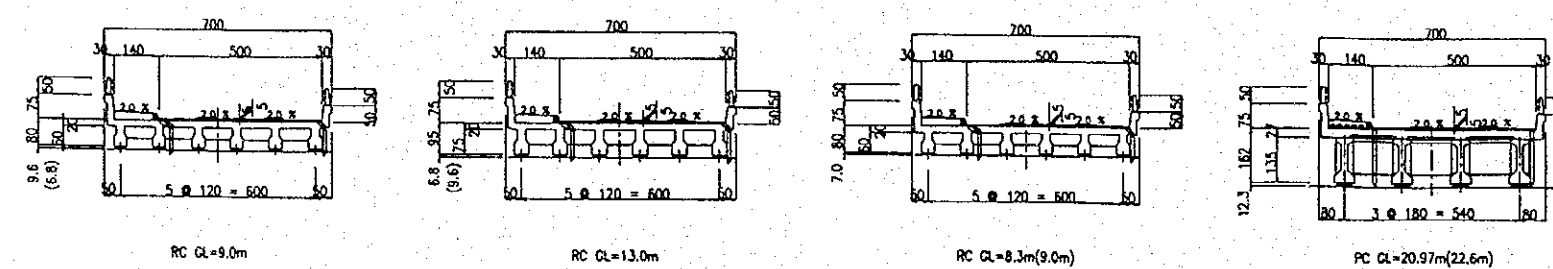


ELEVATION  
SCALE A

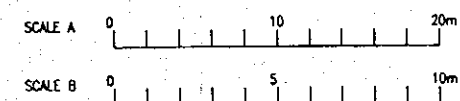


PLAN  
SCALE A

- Notes :
1. The elevation in m
  2. The dimension in cm
  3. The station in m
  4.  $t$  = more than 1.2 m



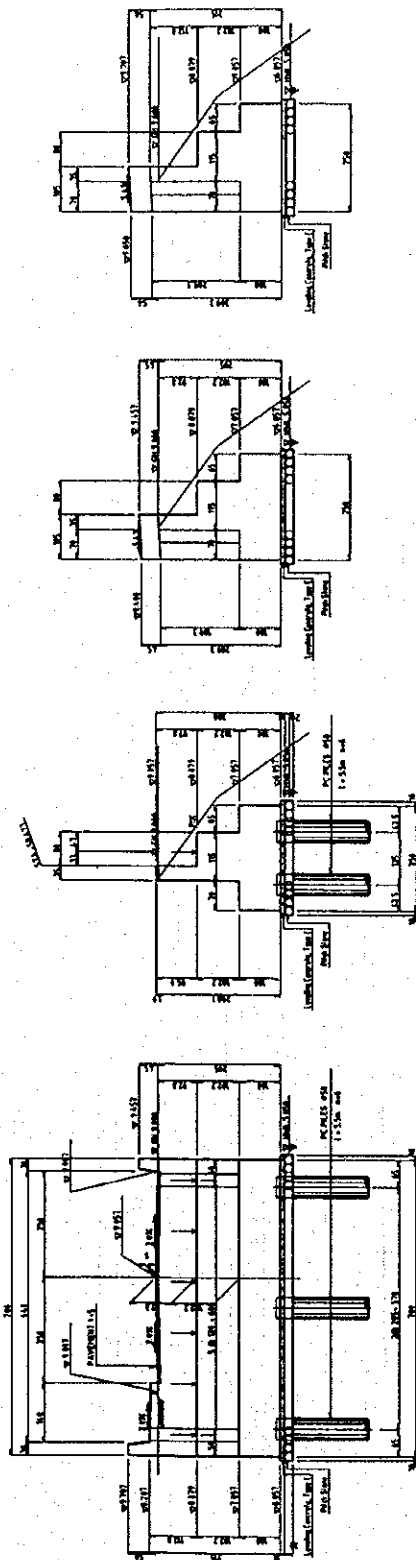
TYPICAL CROSS SECTION  
SCALE B



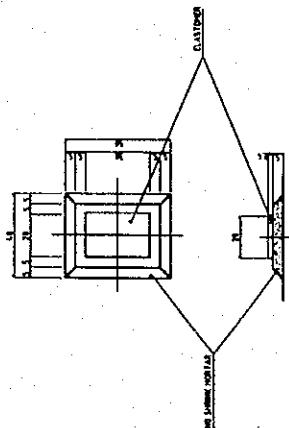
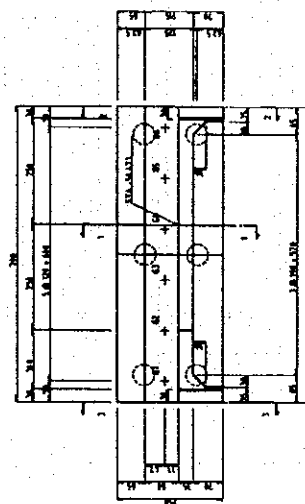
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA  
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Fig. 6.4.6  
GENERAL VIEW OF MAINTENANCE BRIDGES

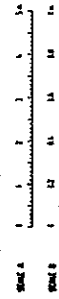




ELEVATION  
SCALE A



Notes:  
1. The dimensions in m  
2. The dimensions in m  
3. Concrete for structure, Type C2

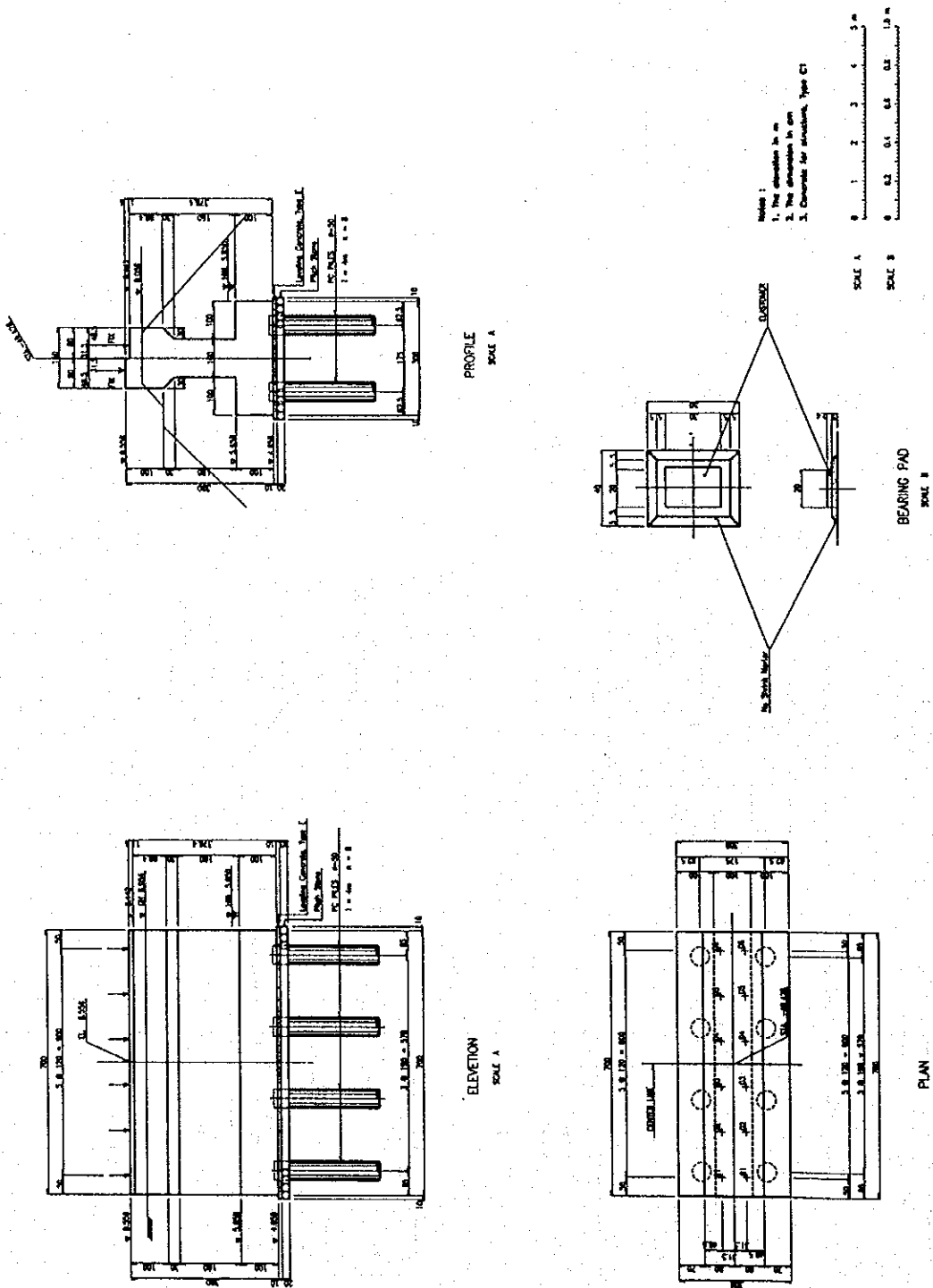


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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Fig. 6.4.7 (1/3)

STRUCTURE OF SIMONGAN APPROACH BRIDGE



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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Fig. 6.4.7 (2/3)

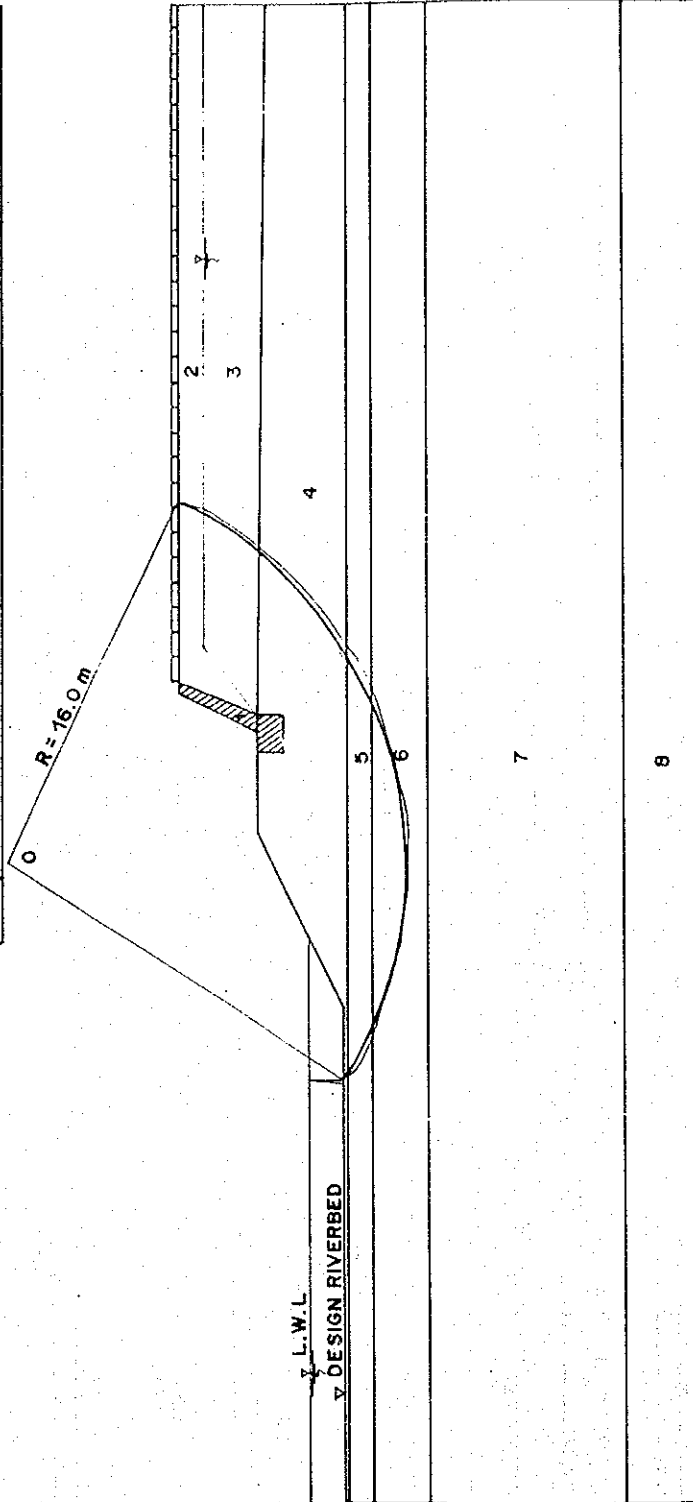
STRUCTURE OF SIMONGAN APPROACH BRIDGE



CALCULATION SECTION : WF 75 R

|                            |         |
|----------------------------|---------|
| MINIMUM SAFETY FACTOR (Fs) | 1.27    |
| COORDINATE                 |         |
| X ( m )                    | 5.76    |
| Y ( m )                    | 11.76   |
| RADIUS OF ARC ( m )        | 16.00   |
| RESISTANT MOMENT (tf.m)    | 1023.06 |
| SLIPPING MOMENT (tf.m)     | 802.58  |

| NO | NAME OF BLOCK | t (tf/m <sup>3</sup> ) | Co (tf/m <sup>2</sup> ) | Ø (DEGREE) |
|----|---------------|------------------------|-------------------------|------------|
| 1  | C1            | 2.50                   | 20.00                   | 0.00       |
| 2  | M1            | 1.70                   | 1.00                    | 25.00      |
| 3  | M2            | 1.70                   | 1.00                    | 25.00      |
| 4  | M3            | 1.60                   | 2.50                    | 0.00       |
| 5  | M4            | 1.70                   | 4.00                    | 0.00       |
| 6  | M5            | 1.80                   | 0.00                    | 30.00      |
| 7  | M6            | 1.65                   | 3.00                    | 0.00       |
| 8  | M7            | 1.80                   | 0.00                    | 36.00      |



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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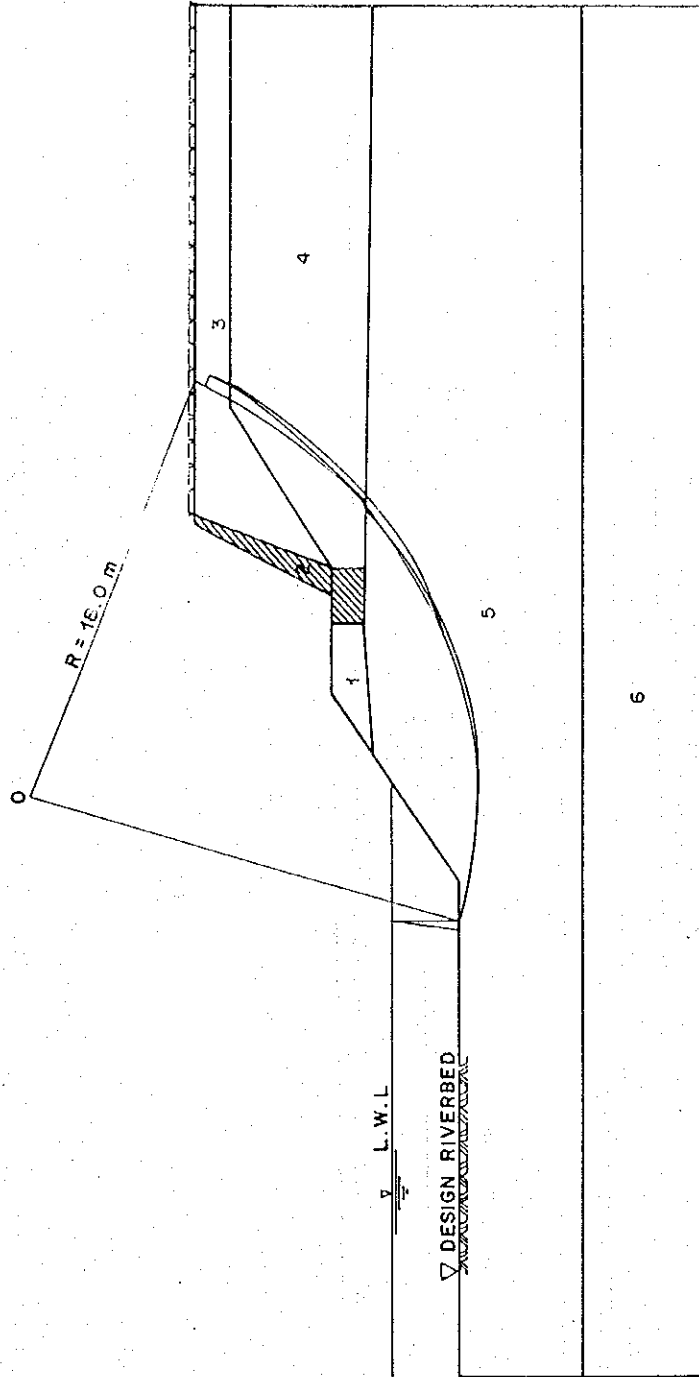
Fig. 6.5.1 (1/4)

RESULT OF STABILITY ANALYSIS ON RIVER BANK SLOPE

**CALCULATION SECTION : WF 110R**

|                            |         |
|----------------------------|---------|
| MINIMUM SAFETY FACTOR (FS) | 1.38    |
| COORDINATE                 |         |
| X (m)                      | 3.38    |
| Y (m)                      | 19.22   |
| RADIUS OF ARC              | 18.00   |
| RESISTANT MOMENT (tf.m)    | 1642.92 |
| SLIPPING MOMENT (tf.m)     | 1187.00 |

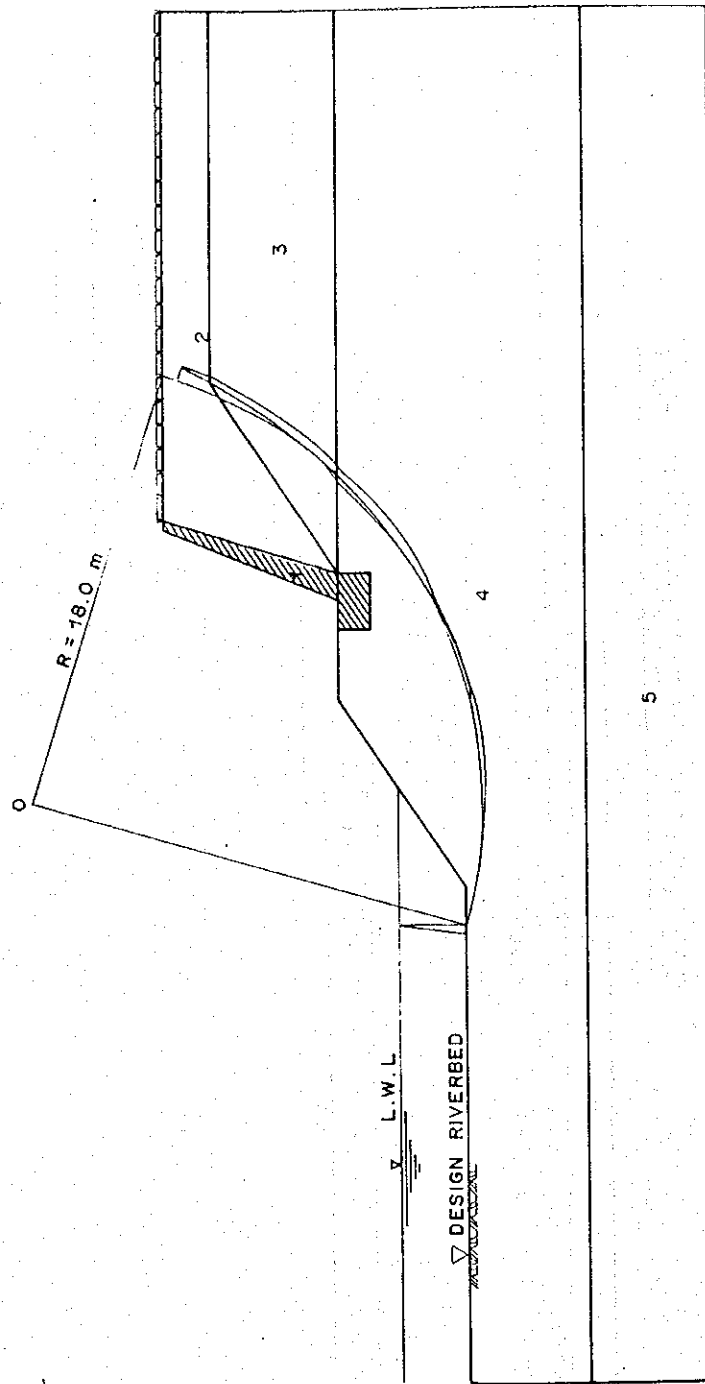
| NO | NAME OF BLOCK | $\gamma$ (tf/m <sup>3</sup> ) | $C_0$ (tf/m <sup>2</sup> ) | $\phi$ (DEGREE) |
|----|---------------|-------------------------------|----------------------------|-----------------|
| 1  | L1            | 1.70                          | 5.00                       | 0.00            |
| 2  | C             | 2.50                          | 20.00                      | 0.00            |
| 3  | L2            | 1.70                          | 5.00                       | 0.00            |
| 4  | L3            | 1.70                          | 5.00                       | 0.00            |
| 5  | L4            | 1.80                          | 0.00                       | 36.00           |
| 6  | L5            | 1.80                          | 0.00                       | 40.00           |



**CALCULATION SECTION : WF 10 L**

|                            |         |
|----------------------------|---------|
| MINIMUM SAFETY FACTOR (FS) | 1.29    |
| COORDINATE                 |         |
| X (m)                      | 3.39    |
| Y (m)                      | 19.24   |
| RADIUS OF ARC (m)          | 18.00   |
| RESISTANT MOMENT (tf.m)    | 1817.90 |
| SLIPPING MOMENT (tf.m)     | 1448.23 |

| NO | NAME OF BLOCK | $\gamma$ (tf/m <sup>3</sup> ) | $C_0$ (tf/m <sup>2</sup> ) | $\phi$ (DEGREE) |
|----|---------------|-------------------------------|----------------------------|-----------------|
| 1  | C             | 2.50                          | 20.00                      | 0.00            |
| 2  | L1            | 1.70                          | 5.00                       | 0.00            |
| 3  | L2            | 1.70                          | 5.00                       | 0.00            |
| 4  | L3            | 1.80                          | 0.00                       | 36.00           |
| 5  | L4            | 1.80                          | 0.00                       | 40.00           |





CALCULATION SECTION : WF 154 R

| NO | NAME OF BLOCK | $t$ (tf/m <sup>3</sup> ) | $C_0$ (tf/m <sup>2</sup> ) | $\theta$ (DEGREE) |
|----|---------------|--------------------------|----------------------------|-------------------|
| 1  | L1            | 1.70                     | 0.00                       | 30.00             |
| 2  | L2            | 1.55                     | 6.00                       | 0.00              |
| 3  | L3            | 1.80                     | 0.00                       | 40.00             |

|                            |         |
|----------------------------|---------|
| MINIMUM SAFETY FACTOR (Fs) | 1.41    |
| COORDINATE :               |         |
| X (m)                      | 5.40    |
| Y (m)                      | 19.38   |
| RADIUS OF ARC (m)          | 16.00   |
| RESISTANT MOMENT (tf.m)    | 1240.92 |
| SLIPPING MOMENT (tf.m)     | 878.84  |

