

APPENDIX 9

WATER LEVEL OF TONLE SAP LAKE

WATER LEVEL OF TONLE SAP LAKE

| 1996 | Date | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|------|------|-----|-----|-----|-----|------|------|------|------|------|------|------|------|
| | 1 | | | | | | 1.08 | 1.93 | 3.02 | 5.52 | 8.33 | 9.76 | 8.80 |
| | 2 | | | | | | 1.18 | 1.97 | 3.02 | 5.62 | 8.47 | 9.74 | 8.75 |
| | 3 | | | | | | 1.21 | 2.00 | 3.12 | 5.70 | 8.62 | 9.70 | 8.71 |
| | 4 | | | | | | 1.21 | 2.02 | 3.24 | 5.73 | 8.77 | 9.66 | 8.67 |
| | 5 | | | | | | 1.17 | 2.04 | 3.37 | 5.78 | 9.02 | 9.64 | 8.63 |
| | 6 | | | | | | 1.14 | 2.07 | 3.43 | 5.81 | 9.26 | 9.60 | 8.58 |
| | 7 | | | | | | 1.16 | 2.11 | 3.53 | 5.84 | 9.50 | 9.58 | 8.53 |
| | 8 | | | | | | 1.16 | 2.14 | 3.60 | 5.89 | 9.61 | 9.56 | 8.49 |
| | 9 | | | | | | 1.16 | 2.18 | 3.70 | 5.89 | 9.69 | 9.54 | 8.43 |
| | 10 | | | | | | 1.24 | 2.18 | 3.80 | 5.95 | 9.77 | 9.54 | 8.39 |
| | 11 | | | | | | 1.28 | 2.20 | 3.90 | 5.99 | 9.82 | 9.52 | 8.33 |
| | 12 | | | | | | 1.32 | 2.27 | 4.00 | 6.07 | 9.87 | 9.50 | 8.27 |
| | 13 | | | | | | 1.32 | 2.27 | 4.09 | 6.11 | 9.87 | 9.49 | 8.19 |
| | 14 | | | | | | 1.34 | 2.27 | 4.17 | 6.19 | 9.87 | 9.49 | 8.14 |
| | 15 | | | | | | 1.38 | 2.31 | 4.29 | 6.23 | 9.87 | 9.45 | 8.09 |
| | 16 | | | | | | 1.41 | 2.33 | 4.39 | 6.25 | 9.89 | 9.42 | 8.04 |
| | 17 | | | | | | 1.44 | 2.33 | 4.49 | 6.29 | 9.87 | 9.38 | 7.90 |
| | 18 | | | | | | 1.41 | 2.33 | 4.57 | 6.35 | 9.97 | 9.33 | 7.83 |
| | 19 | | | | | | 1.51 | 2.33 | 4.67 | 6.41 | 9.85 | 9.31 | 7.79 |
| | 20 | | | | | 0.80 | 1.56 | 2.37 | 4.47 | 6.47 | 9.83 | 9.27 | 7.71 |
| | 21 | | | | | 0.81 | 1.58 | 2.40 | 4.82 | 6.53 | 9.82 | 9.22 | 7.63 |
| | 22 | | | | | 0.83 | 1.63 | 2.43 | 4.90 | 6.66 | 9.81 | 9.18 | 7.57 |
| | 23 | | | | | 0.83 | 1.63 | 2.45 | 4.98 | 6.81 | 9.79 | 9.14 | 7.53 |
| | 24 | | | | | 0.85 | 1.69 | 2.48 | 5.06 | 7.05 | 9.77 | 9.10 | 7.48 |
| | 25 | | | | | 0.89 | 1.81 | 2.55 | 5.16 | 7.32 | 9.77 | 0.06 | 7.40 |
| | 26 | | | | | 0.89 | 1.85 | 2.58 | 5.24 | 7.52 | 9.84 | 9.00 | 7.36 |
| | 27 | | | | | 0.93 | 1.85 | 2.63 | 5.27 | 7.72 | 9.80 | 8.97 | 7.28 |
| | 28 | | | | | 0.97 | 1.87 | 2.73 | 5.34 | 7.90 | 9.80 | 8.92 | 7.22 |
| | 29 | | | | | 1.03 | 1.87 | 2.87 | 5.42 | 8.05 | 9.80 | 8.87 | 7.16 |
| | 30 | | | | | 1.08 | 1.90 | 2.84 | 5.46 | 8.20 | 9.78 | 9.97 | 7.10 |
| | 31 | | | | | 1.08 | | 2.94 | 5.46 | | 9.78 | | 7.05 |

| 1997 | Date | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1 | 7.00 | 5.59 | 4.26 | 2.74 | 1.12 | 0.78 | 0.94 | 3.77 | 7.86 | 9.08 | 8.82 | 6.98 |
| | 2 | 6.97 | 5.53 | 4.21 | 2.62 | 1.11 | 0.78 | 0.94 | 3.93 | 7.90 | 9.09 | 8.77 | 6.95 |
| | 3 | 6.91 | 5.50 | 4.16 | 2.48 | 1.08 | 0.76 | 0.94 | 4.12 | 7.96 | 9.10 | 8.17 | 6.88 |
| | 4 | 6.85 | 5.46 | 4.10 | 2.35 | 1.08 | 0.76 | 0.96 | 4.29 | 8.00 | 9.13 | 8.66 | 6.80 |
| | 5 | 6.80 | 5.42 | 4.02 | 2.30 | 1.08 | 0.76 | 1.05 | 4.39 | 8.06 | 9.20 | 8.57 | 6.72 |
| | 6 | 6.68 | 5.38 | 3.97 | 2.08 | 1.07 | 0.76 | 1.13 | 4.51 | 8.10 | 9.25 | 8.49 | 6.65 |
| | 7 | 6.69 | 5.32 | 3.91 | 1.95 | 1.07 | 0.79 | 1.23 | 4.76 | 8.18 | 9.27 | 8.41 | 6.60 |
| | 8 | 6.65 | 5.27 | 3.86 | 1.83 | 1.07 | 0.83 | 1.33 | 5.03 | 8.20 | 9.27 | 8.34 | 6.54 |
| | 9 | 6.60 | 5.23 | 3.81 | 1.71 | 1.06 | 0.85 | 1.4 | 5.31 | 8.25 | 9.27 | 8.28 | 6.47 |
| | 10 | 6.55 | 5.17 | 3.76 | 1.62 | 1.04 | 0.85 | 1.53 | 5.58 | 8.29 | 9.27 | 8.22 | 6.43 |
| | 11 | 6.52 | 5.13 | 3.70 | 1.53 | 1.02 | 0.88 | 1.63 | 5.87 | 8.31 | 9.27 | 8.15 | 6.40 |
| | 12 | 6.46 | 5.07 | 3.65 | 1.47 | 1.00 | 0.89 | 1.72 | 6.15 | 8.34 | 9.27 | 8.08 | 6.37 |
| | 13 | 6.40 | 5.03 | 3.61 | 1.44 | 0.99 | 0.90 | 1.85 | 6.36 | 8.37 | 9.27 | 8.00 | 6.33 |
| | 14 | 6.35 | 5.01 | 3.58 | 1.42 | 0.99 | 0.90 | 1.96 | 6.56 | 8.39 | 9.27 | 7.95 | 6.30 |
| | 15 | 6.33 | 4.96 | 3.54 | 1.39 | 0.99 | 0.88 | 2.01 | 6.71 | 8.41 | 9.27 | 7.87 | 6.27 |
| | 16 | 6.31 | 4.93 | 3.50 | 1.37 | 0.98 | 0.86 | 2.09 | 6.83 | 8.44 | 9.27 | 7.82 | 6.24 |
| | 17 | 6.27 | 4.90 | 3.46 | 1.37 | 0.97 | 0.86 | 2.19 | 6.93 | 8.47 | 9.27 | 7.78 | 6.20 |
| | 18 | 6.22 | 4.84 | 3.43 | 1.37 | 0.97 | 0.86 | 2.29 | 6.99 | 8.54 | 9.27 | 7.73 | 6.17 |
| | 19 | 6.18 | 4.78 | 3.38 | 1.37 | 0.96 | 0.86 | 2.37 | 7.04 | 8.57 | 9.27 | 7.66 | 6.12 |
| | 20 | 6.13 | 4.73 | 3.34 | 1.36 | 0.94 | 0.86 | 2.47 | 7.05 | 8.61 | 9.27 | 7.58 | 6.07 |
| | 21 | 6.07 | 4.68 | 3.30 | 1.36 | 0.90 | 0.87 | 2.54 | 7.09 | 8.64 | 9.25 | 7.52 | 6.01 |
| | 22 | 6.01 | 4.62 | 3.27 | 1.34 | 0.88 | 0.85 | 2.64 | 7.15 | 8.67 | 9.23 | 7.46 | 5.97 |
| | 23 | 5.95 | 4.56 | 3.24 | 1.30 | 0.85 | 0.84 | 2.74 | 7.23 | 8.69 | 9.20 | 7.39 | 5.92 |
| | 24 | 5.90 | 4.51 | 3.21 | 1.26 | 0.85 | 0.87 | 2.89 | 7.35 | 8.71 | 9.17 | 7.31 | 5.87 |
| | 25 | 5.86 | 4.46 | 3.17 | 1.21 | 0.85 | 0.89 | 2.99 | 7.43 | 8.71 | 9.13 | 7.26 | 5.83 |
| | 26 | 5.86 | 4.42 | 3.13 | 1.19 | 0.84 | 0.89 | 3.09 | 7.53 | 8.77 | 9.09 | 7.21 | 5.79 |
| | 27 | 5.80 | 4.37 | 3.09 | 1.17 | 0.84 | 0.89 | 3.19 | 7.58 | 8.79 | 9.06 | 7.16 | 5.76 |
| | 28 | 5.76 | 4.30 | 3.02 | 1.14 | 0.82 | 0.91 | 3.34 | 7.64 | 8.89 | 9.02 | 7.12 | 5.71 |
| | 29 | 5.71 | | 2.98 | 1.14 | 0.82 | 0.91 | 3.59 | 7.70 | 9.04 | 8.99 | 7.08 | 5.64 |
| | 30 | 5.67 | | 2.93 | 1.14 | 0.80 | 0.92 | 3.59 | 7.77 | 9.06 | 8.94 | 7.03 | 5.56 |
| | 31 | 5.63 | | 2.84 | | 0.80 | | 3.69 | 7.82 | | 8.89 | | 5.48 |

| 1998 | Date | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1 | 5.43 | 2.86 | 1.43 | 0.98 | 0.84 | 0.70 | 0.99 | 3.15 | 5.16 | 7.11 | 6.71 | 5.20 |
| | 2 | 5.36 | 2.79 | 1.40 | 0.97 | 0.83 | 0.70 | 1.00 | 3.18 | 5.27 | 7.15 | 6.68 | 5.17 |
| | 3 | 5.30 | 2.72 | 1.40 | 0.96 | 0.83 | 0.70 | 1.03 | 3.22 | 5.42 | 7.20 | 6.66 | 5.13 |
| | 4 | 5.25 | 2.63 | 1.38 | 0.94 | 0.83 | 0.70 | 1.05 | 3.27 | 5.54 | 7.25 | 6.62 | 5.10 |
| | 5 | 5.21 | 2.55 | 1.36 | 0.94 | 0.83 | 0.70 | 1.06 | 3.30 | 5.64 | 7.31 | 6.57 | 5.07 |
| | 6 | 5.18 | 2.48 | 1.33 | 0.93 | 0.83 | 0.70 | 1.09 | 3.34 | 5.72 | 7.33 | 6.52 | 5.03 |
| | 7 | 5.11 | 2.41 | 1.31 | 0.94 | 0.82 | 0.70 | 1.13 | 3.37 | 5.81 | 7.33 | 6.48 | 4.99 |
| | 8 | 5.06 | 2.33 | 1.31 | 0.93 | 0.82 | 0.70 | 1.16 | 3.41 | 5.86 | 7.33 | 6.42 | 4.96 |
| | 9 | 5.00 | 2.24 | 1.29 | 0.91 | 0.82 | 0.70 | 1.21 | 3.44 | 5.90 | 7.33 | 6.39 | 4.91 |
| | 10 | 4.95 | 2.16 | 1.26 | 0.91 | 0.82 | 0.70 | 1.26 | 3.49 | 5.96 | 7.33 | 6.35 | 4.85 |
| | 11 | 4.91 | 2.11 | 1.25 | 0.90 | 0.82 | 0.70 | 1.32 | 3.53 | 5.99 | 7.28 | 6.30 | 4.81 |
| | 12 | 4.87 | 2.04 | 1.23 | 0.90 | 0.82 | 0.70 | 1.38 | 3.58 | 6.03 | 7.28 | 6.26 | 4.76 |
| | 13 | 4.84 | 1.98 | 1.23 | 0.89 | 0.81 | 0.70 | 1.43 | 3.61 | 6.08 | 7.28 | 6.22 | 4.70 |
| | 14 | 4.78 | 1.92 | 1.21 | 0.88 | 0.80 | 0.70 | 1.50 | 3.68 | 6.13 | 7.26 | 6.17 | 4.66 |
| | 15 | 4.71 | 1.85 | 1.19 | 0.88 | 0.80 | 0.70 | 1.60 | 3.80 | 6.21 | 7.24 | 6.10 | 4.62 |
| | 16 | 4.63 | 1.78 | 1.19 | 0.88 | 0.80 | 0.70 | 1.72 | 3.95 | 6.27 | 7.22 | 6.06 | 4.57 |
| | 17 | 4.53 | 1.74 | 1.17 | 0.88 | 0.80 | 0.70 | 1.85 | 4.08 | 6.32 | 7.20 | 5.97 | 4.51 |
| | 18 | 4.43 | 1.69 | 1.16 | 0.87 | 0.80 | 0.70 | 2.00 | 4.19 | 6.38 | 7.17 | 5.88 | 4.46 |
| | 19 | 4.33 | 1.65 | 1.14 | 0.87 | 0.80 | 0.72 | 2.15 | 4.26 | 6.44 | 7.14 | 5.80 | 4.42 |
| | 20 | 4.20 | 1.60 | 1.14 | 0.86 | 0.79 | 0.73 | 2.30 | 4.31 | 6.51 | 7.11 | 5.72 | 4.39 |
| | 21 | 4.08 | 1.57 | 1.13 | 0.86 | 0.77 | 0.73 | 2.43 | 4.38 | 6.57 | 7.06 | 5.67 | 4.35 |
| | 22 | 3.98 | 1.55 | 1.11 | 0.86 | 0.77 | 0.76 | 2.50 | 4.45 | 6.65 | 6.99 | 5.63 | 4.30 |
| | 23 | 3.85 | 1.55 | 1.10 | 0.85 | 0.76 | 0.78 | 2.56 | 4.53 | 6.73 | 6.94 | 5.56 | 4.26 |
| | 24 | 3.77 | 1.55 | 1.10 | 0.85 | 0.74 | 0.81 | 2.64 | 4.59 | 6.78 | 6.91 | 5.51 | 4.21 |
| | 25 | 3.58 | 1.52 | 1.08 | 0.85 | 0.72 | 0.83 | 2.69 | 4.66 | 6.86 | 6.89 | 5.45 | 4.15 |
| | 26 | 3.46 | 1.48 | 1.06 | 0.85 | 0.72 | 0.86 | 2.76 | 4.71 | 6.90 | 6.87 | 5.39 | 4.12 |
| | 27 | 3.34 | 1.45 | 1.06 | 0.85 | 0.70 | 0.88 | 2.90 | 4.78 | 6.93 | 6.84 | 5.35 | 4.07 |
| | 28 | 3.24 | 1.45 | 1.04 | 0.84 | 0.70 | 0.90 | 2.96 | 4.86 | 6.95 | 6.82 | 5.31 | 4.02 |
| | 29 | 3.14 | | 1.03 | 0.84 | 0.70 | 0.93 | 3.01 | 4.93 | 6.98 | 6.80 | 5.29 | 3.98 |
| | 30 | 3.04 | | 1.02 | 0.84 | 0.70 | 0.97 | 3.07 | 4.99 | 7.05 | 6.77 | 5.23 | 3.84 |
| | 31 | 2.94 | | 1.00 | | 0.70 | | | 5.04 | | 6.74 | | 3.79 |

APPENDIX 10

HYDROLOGICAL ANALYSIS

1. FLOOD DISCHARGE

1.1 Rainfall and Water Level Data

Rainfall data at Siem Reap Airport and water level data at Tonle Sap Lake are presented in Appendices 8 and 9, respectively.

1.2 Probable Daily Rainfall

The maximum daily rainfall for each year from 1988 to 1998, the probability of occurrence of the maximum daily rainfall, and the probability curve are shown in Table-1, Table-2 and Figure-1, respectively. The probability curve is similar to that in Chiang Mai in Thailand. The probable daily rainfall is shown in Table-3.

TABLE-1 MAXIMUM DAILY RAINFALL

| Year | | Maximum Daily Rainfall (mm) |
|------|---|-----------------------------|
| 1988 | ⑦ | 85.7 |
| 1989 | ⑨ | 85.2 |
| 1990 | ⑥ | 87.5 |
| 1991 | ⑧ | 85.6 |
| 1992 | ⑤ | 88.0 |
| 1993 | ③ | 99.1 |
| 1994 | ⑩ | 80.6 |
| 1995 | ④ | 90.8 |
| 1996 | ⑪ | 54.1 |
| 1997 | ① | 160.4 |
| 1998 | ② | 100.6 |

TABLE-2 PROBABILITY OF OCCURRENCE OF MAXIMUM DAILY RAINFALL

| Number | $1 / (n+1)$ | Maximum Daily Rainfall (mm) |
|--------|-------------|-----------------------------|
| 1 | 0.08 | 160.4 |
| 2 | 0.167 | 100.6 |
| 3 | 0.250 | 99.1 |
| 4 | 0.333 | 90.8 |
| 5 | 0.417 | 88.0 |
| 6 | 0.500 | 87.5 |
| 7 | 0.583 | 85.7 |
| 8 | 0.667 | 85.6 |
| 9 | 0.750 | 85.2 |
| 10 | 0.833 | 80.6 |
| 11 | 0.917 | 54.1 |

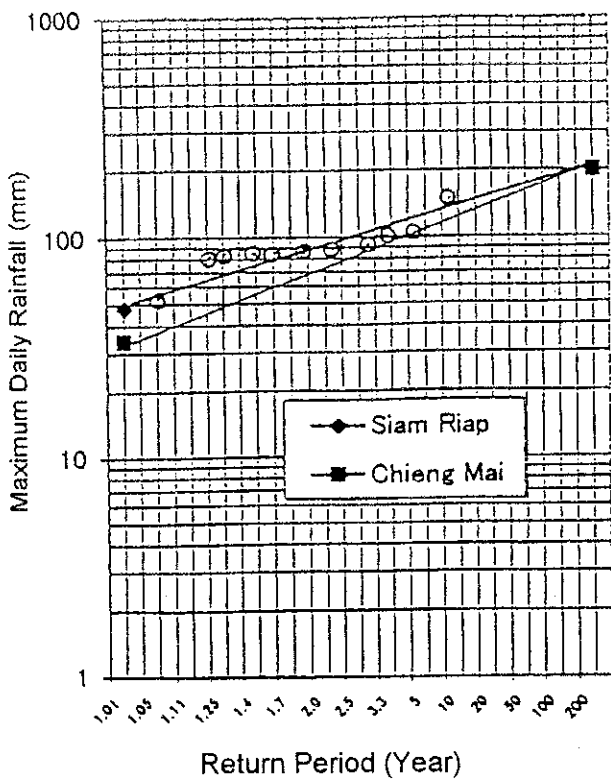


TABLE-3 PROBABLE DAILY RAINFALL

| Return Period (Year) | Daily Rainfall (mm) | Ratio to the 50-year Return Period Rainfall (%) |
|----------------------|---------------------|---|
| 3 | 100 | 59 |
| 5 | 120 | 71 |
| 10 | 140 | 82 |
| 20 | 160 | 94 |
| 50 | 170 | 100 |
| 100 | 190 | 112 |

FIGURE-1 PROBABILITY CURVE OF MAXIMUM DAILY RAINFALL

1.3 Rainfall Intensity

The rainfall intensity formula has not been established yet. In this Study, the rainfall intensity-duration curve in the Study area was estimated referring to that in Chieng Mai and taking into account the difference of probable daily rainfall between the Study area and Chieng Mai, as shown in Figure-2.

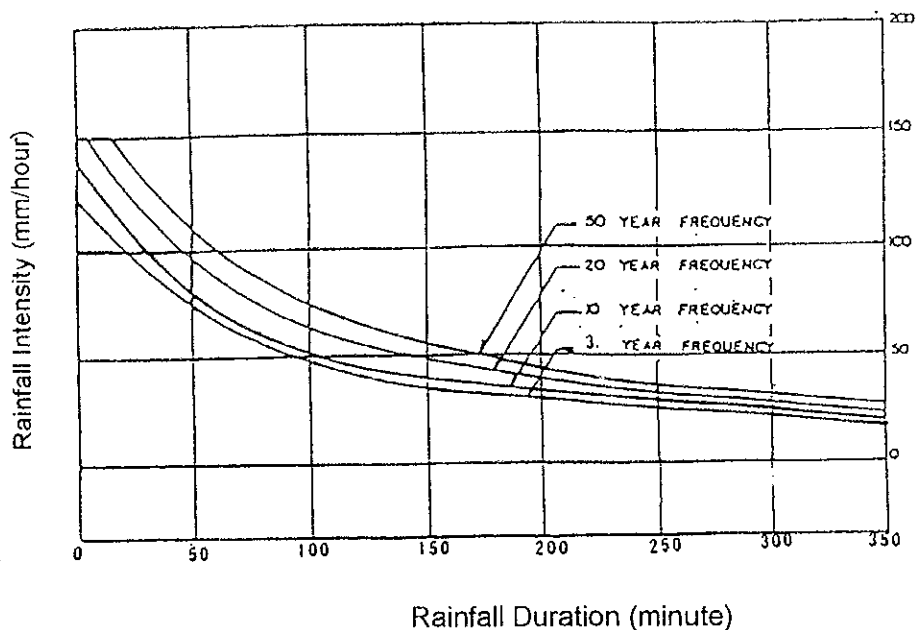


FIGURE-2 RAINFALL INTENSITY-DURATION CURVE

1.4 Flood Discharge

Figure-3 shows the specific discharge curve for 50-year return period in the region on the west of the Mekong River.

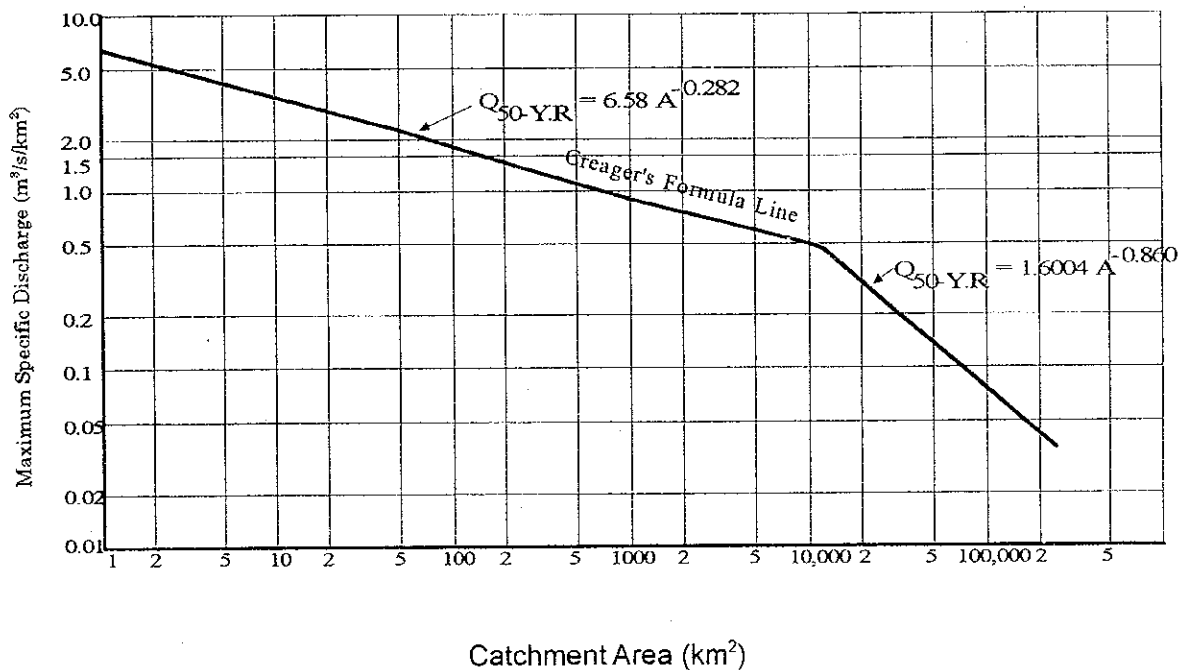


FIGURE-3 SPECIFIC DISCHARGE CURVE FOR 50-YEAR RETURN PERIOD (REGION ON THE WEST OF THE MEKONG RIVER)

Since the Study area belongs to the region on the west of the Mekong River and the probable daily rainfall is similar to that in Chiang Mai, the flood discharge for 50-year return period is estimated based on Figure-3. The flood discharge for other return period is estimated based on the ratio of probable daily rainfall to that of 50-year return period as shown in Table-3.

The catchment basin of the Study area is divided into two as follows (see Figure-4):

- Catchment-1 : Eastside area of Siem Reap River (catchment area 549 Km²)
- Catchment-2 : Siem Reap River basin and its western area (catchment area 522 Km²)

The flood discharge in each catchment is estimated as shown in Table-4.

TABLE-4 FLOOD DISCHARGE (WITHOUT ADJUSTMENT)

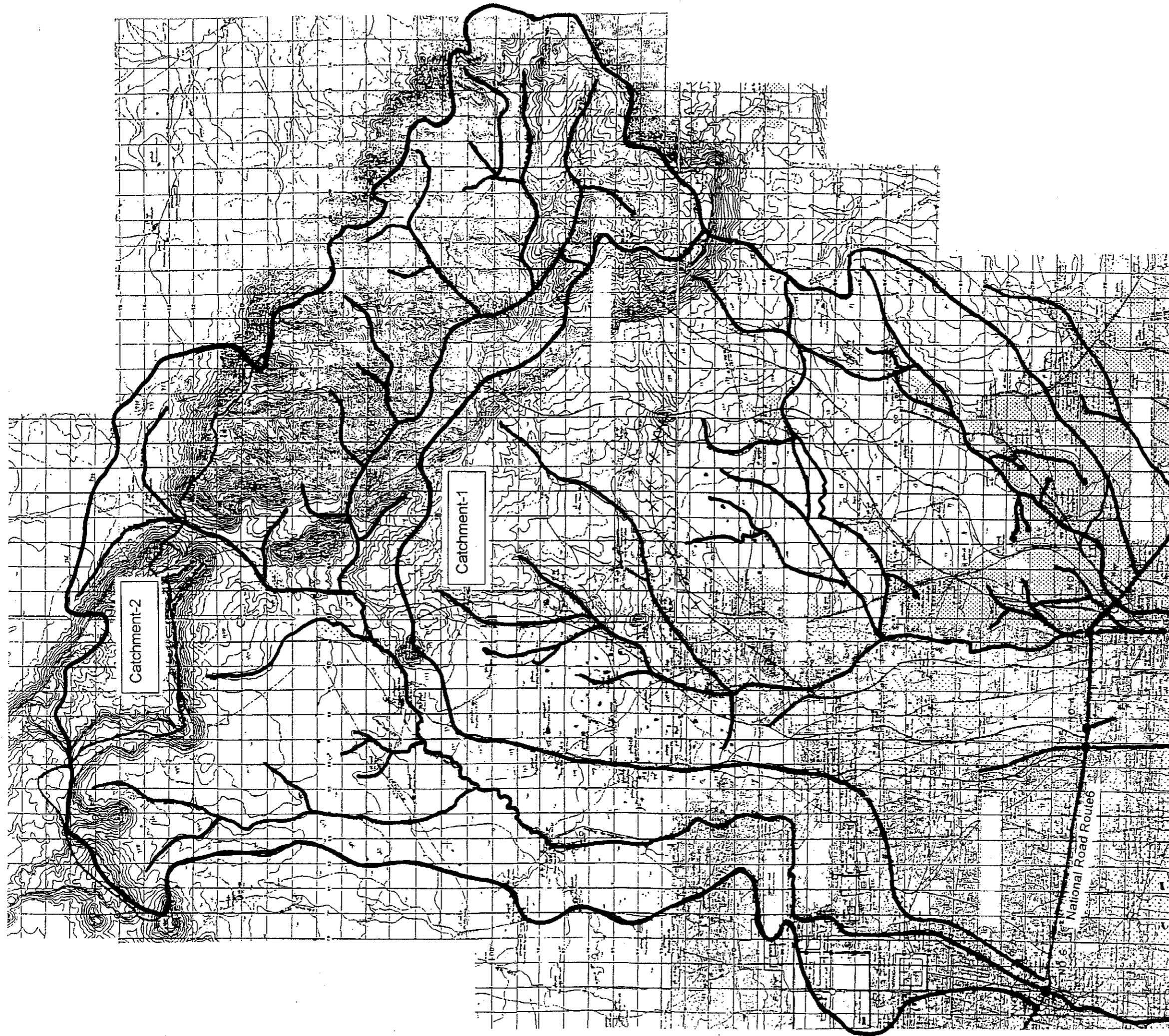
| Catchment | Catchment Area (km ²) A | Specific Discharge for 50-year Return Period (m ³ /s/Km ²) q | Flood Discharge (m ³ /s) | | |
|--------------|--|--|---|---|---|
| | | | 50-year Return Period Q ₅₀ = Aq | 10-year Return Period Q ₁₀ = 0.82 Q ₅₀ | 20-year Return Period Q ₂₀ = 0.94 Q ₅₀ |
| Catchment-1 | 549 | 1.111 | 610 | 500 | 573 |
| Catchment-2 | 522 | 1.127 | 588 | 482 | 553 |
| Total | 1,071 | | 1,198 | 982 | 1,126 |

The above discharge volumes need to be adjusted taking into account the fact that a part of overflowed water at the upstream area of the Catchment-2 flows into the Catchment-1. According to the hearing information, the maximum water level of Siem Reap River near National Road Route 6 is almost constant every year. This fact suggests that the discharge of the Catchment-2 (remaining volume subtracting the volume flowing into the Catchment-1) is almost constant every year. From the analysis results shown in 2 below, the discharge of the Catchment-2 is 208 m³/s. The volume in excess is considered to flow into the Catchment-1.

Accordingly, the discharge volumes are adjusted as shown in Table-5.

TABLE-5 FLOOD DISCHARGE (WITH ADJUSTMENT)

| Catchment | (m ³ /s) | | |
|--------------|-----------------------|-----------------------|-----------------------|
| | 10-year Return Period | 20-year Return period | 50-year Return period |
| Catchment-1 | 774 | 918 | 990 |
| Catchment-2 | 208 | 208 | 208 |
| Total | 982 | 1,126 | 1,198 |



Catchment Boundary
River

FIGURE - 4 CATCHMENT BASIN

2. ANALYSIS OF PRESENT SITUATION

The 1997 flood is analyzed. The maximum daily rainfall in 1997 was 160mm. This is estimated to be maximum rainfall for 20-year return period.

For each catchment, the non-uniform flow analysis is made assuming the water level of the Tonle Sap Lake at 9.27 m (the maximum level in 1997). The topography of the Study area and the location of the analysis sections are shown in Figures-5 and 6, respectively. Cross-sections of the analysis sections are shown in Figures 7 through 18. (Figures 11 and 17 are the cross-sections after the Project completion and therefore not used here.)

At the section crossing the road in the Catchment-1, flooded water on the upstream side flows down through bridge openings and culverts, taking the situation of submerged orifice. Partly, the flooded water overflows the road surface, taking the situation of submerged weir. Considering such situations, the section crossing the road is analyzed for both upstream and downstream sections.

Mean velocity at other sections than the section crossing the road in the Catchment-1 is calculated as follows:

- Open channel (including culverts with free surface)

$$v = \frac{1}{n} R^{2/3} i^{1/2}$$

- Culverts filled with water

$$v = C\sqrt{2gh}$$

where, v = mean velocity (m/s)
 n = coefficient of roughness
 R = hydraulic radius (m)
 i = hydraulic gradient
 C = velocity-water head coefficient
 g = gravitational acceleration (m/s²)
 h = difference in water level (m)

n and C are assumed as follows:

n = 0.035 (Siem Reap River)
= 0.030 (Culvert)
= 0.100 (Others)
 C = 0.7

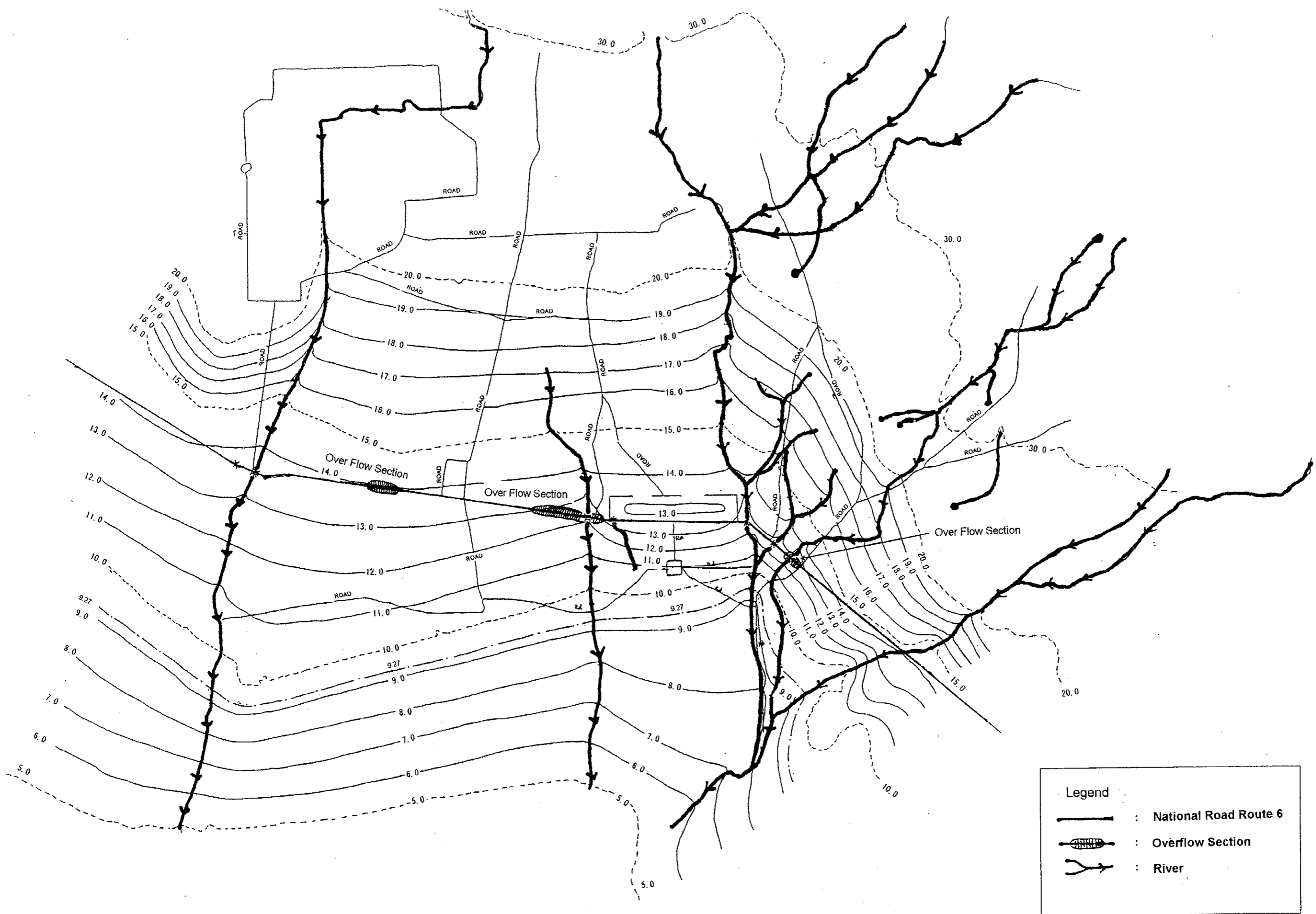


FIGURE-5 TOPOGRAPHY

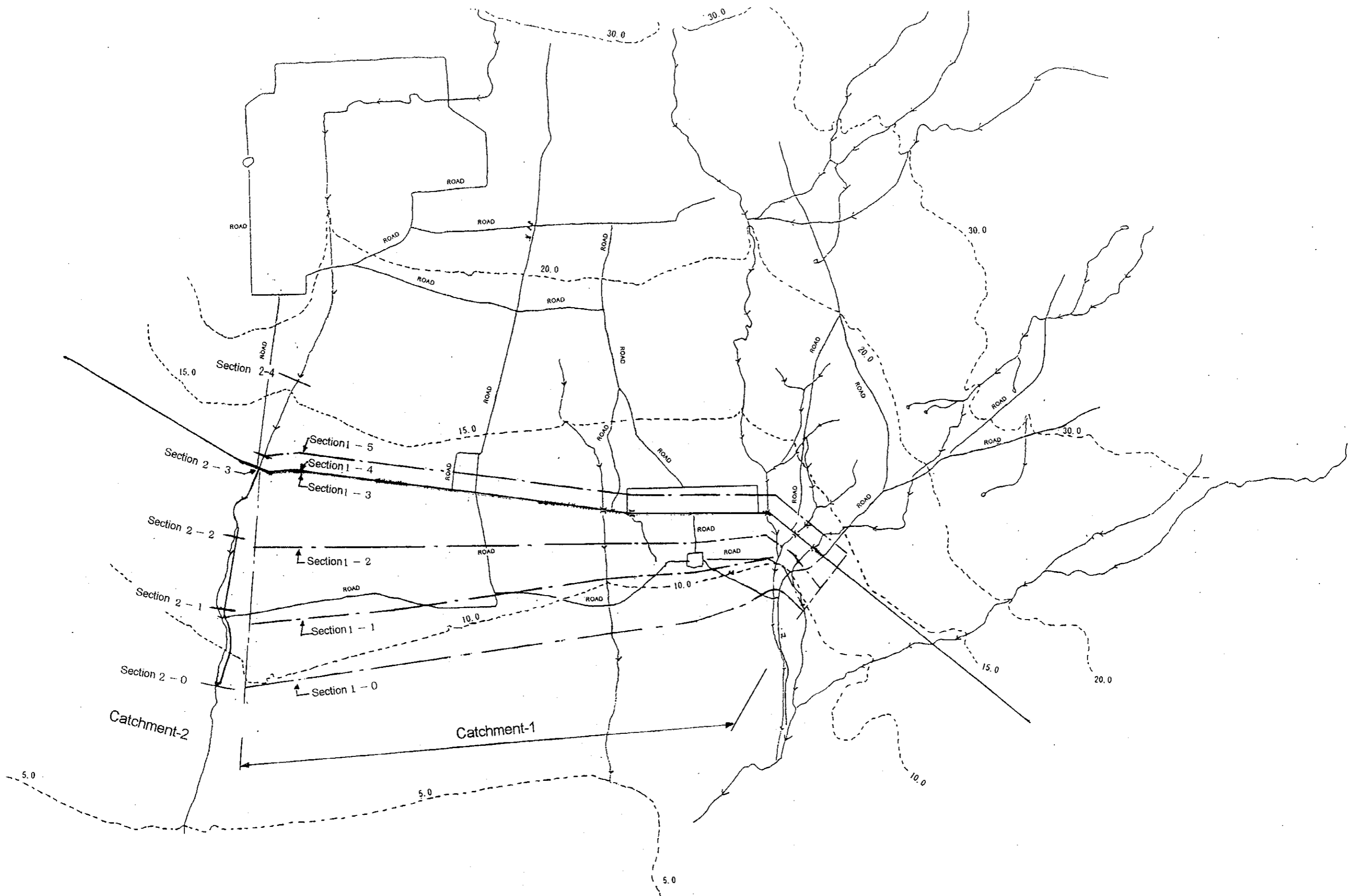


FIGURE-6 LOCATION OF ANALYSIS SECTIONS

15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000

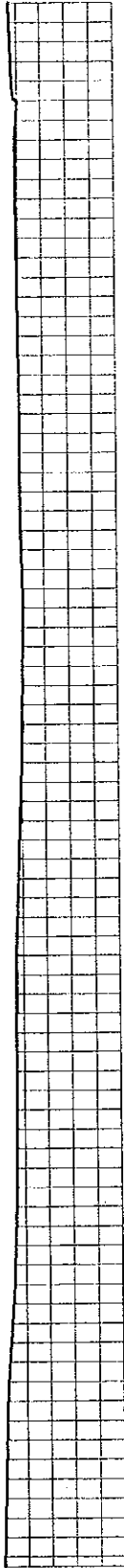


FIGURE-7 CROSS-SECTION (CATCHMENT-1, SECTION 1-0)

15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000

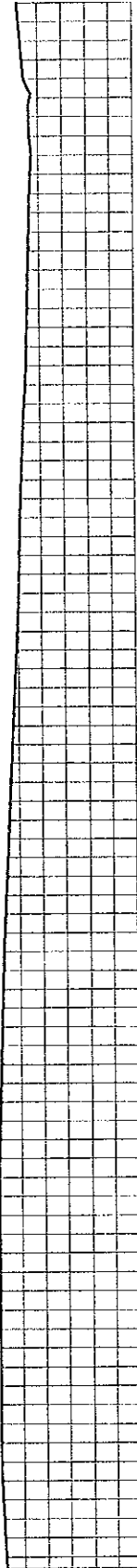


FIGURE-8 CROSS-SECTION (CATCHMENT-1, SECTION 1-1)

15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000

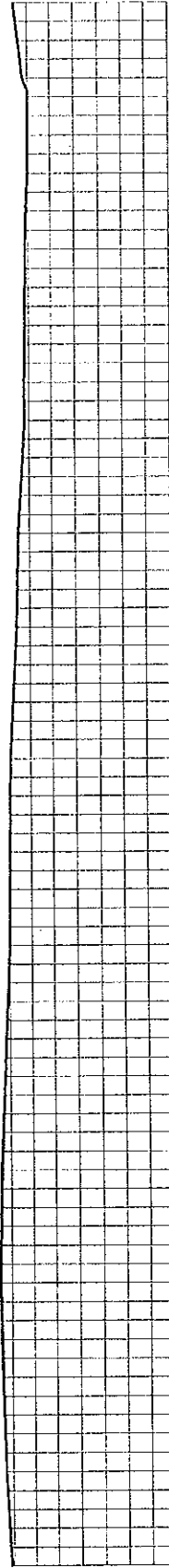


FIGURE-9 CROSS-SECTION(CATCHMENT-1, SECTION 1-2)

15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
5.000

15.000
14.000
13.000
12.000
11.000
10.000
9.000
8.000
7.000
6.000
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10.000
9.000
8.000
7.000
6.000
5.000

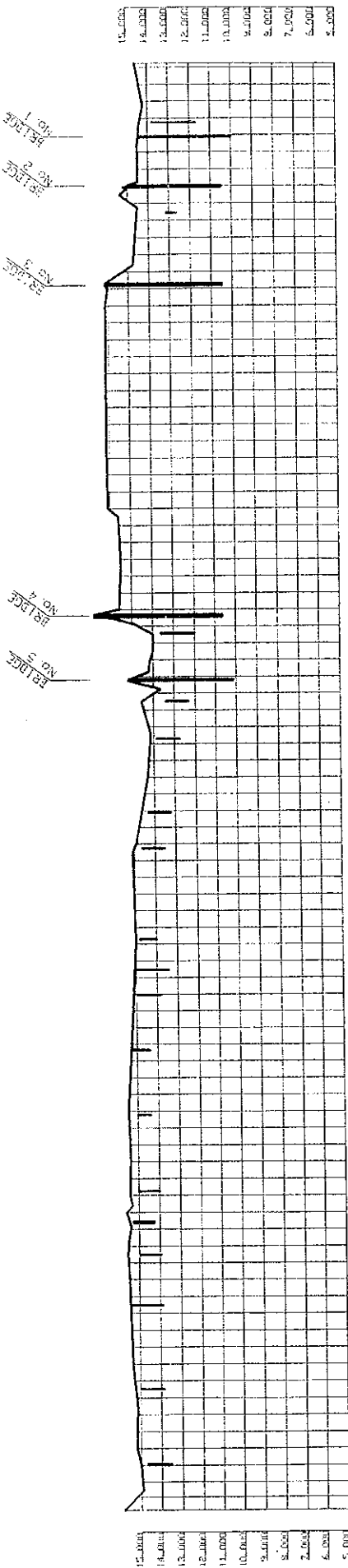


FIGURE - 10 CROSS-SECTION (CATCHMENT-1, SECTION 1-3 / SECTION 1-4, PRESENT)

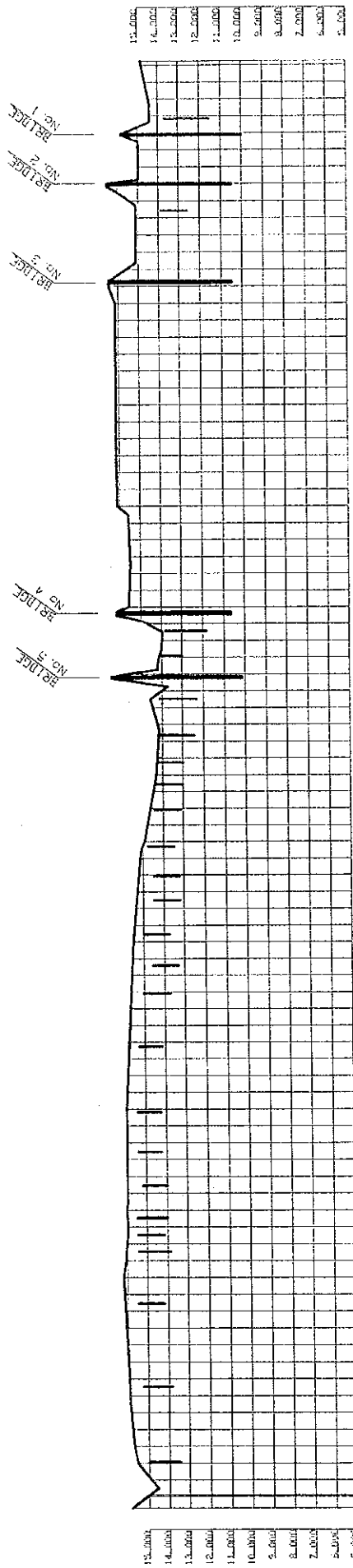


FIGURE - 11 CROSS-SECTION (CATCHMENT-1, SECTION 1-3 / SECTION 1-4, AFTER PROJECT COMPLETION)

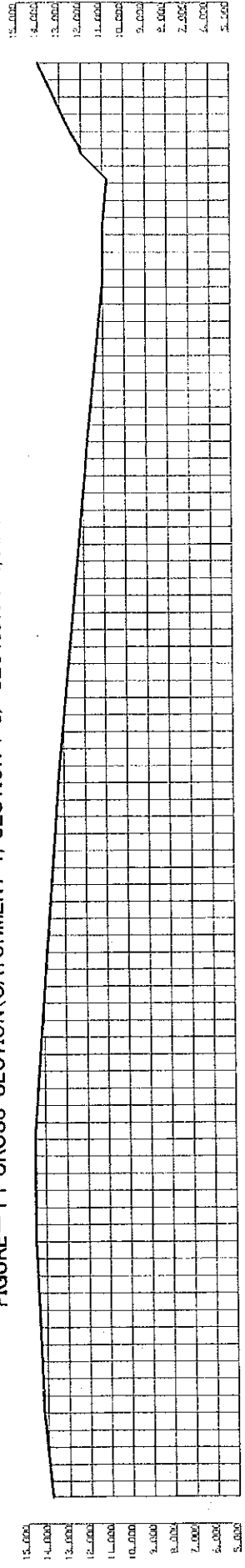


FIGURE - 12 CROSS-SECTION (CATCHMENT-1, SECTION 1-5)

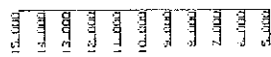


FIGURE - 13 CROSS-SECTION
(CATCHMENT-2, SECTION 2-0)

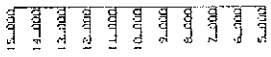


FIGURE - 14 CROSS-SECTION
(CATCHMENT-2, SECTION 2-1)

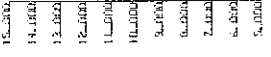


FIGURE - 15 CROSS-SECTION
(CATCHMENT-2, SECTION 2-2)

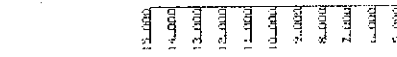


FIGURE - 16 CROSS-SECTION
(CATCHMENT-2, SECTION 2-3, PRESENT)

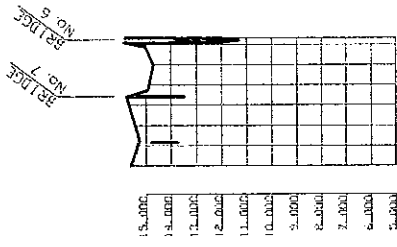


FIGURE - 17 CROSS-SECTION (CATCHMENT-2,
SECTION 2-3, AFTER PROJECT COMPLETION)

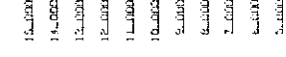


FIGURE-18 CROSS-SECTION
(CATCHMENT-2, SECTION 2-4)

Mean velocity at the section crossing the road is calculated as follows:

- Bridge and Culverts

$$v = C\sqrt{2gh}$$

where, C = discharge coefficient (0.7 for bridge and 0.6 for culvert)
 g = gravitational acceleration (m/s^2)
 h = difference in water level between upstream and downstream sides of the road (m)

- Overflow

$$v = C\sqrt{h}$$

where, C = discharge coefficient (1.0)
 h = overflow depth (m)

Analysis of Catchment-1

Discharge volume for 20-year return period is 918 m³/s (see Table-5).

Analysis results are as follows:

Section 1-1 : Water level = 10.148 m

Section 1-2 : Water level = 11.675 m

Section 1-3 (downstream side of the road) : Water level = 14.331 m

Section 1-4 (upstream side of the road) : Water level = 14.499 m

Discharge and mean velocity at bridge openings, culverts and overflow sections are as follows:

| | Discharge (m ³ /s) | Mean velocity (m/s) |
|--|----------------------------------|------------------------|
| Overflow Section on the east of Ang Chroung Br. (ℓ = 747m) | 44.04 | 0.389 |
| Ang Chroung Br. | 68.62 | 1.271 |
| Overflow Section on the west of Ang Chroung Br. (ℓ = 75m) | 0.29 | 0.157 |
| Ou Angchean Br. | 101.65 | 1.271 |
| Stung Br. | 127.06 | 1.271 |
| Lo Lum Br. | 136.97 | 1.271 |
| Overflow Section on the east of Kaek Br. (ℓ = 550 m) | 139.47 | 0.633 |
| Kaek Br. | 99.49 | 1.271 |
| Overflow Section on the west of Kaek Br. (ℓ = 1,300m) | 153.93 | 0.491 |
| Culverts Total | 46.48 | 1.089 |
| Total | 918.00 | |

Analysis of Catchment-2

Discharge volume for 20-year return period is 208 m³/s (see Table-5).

Analysis results are as follows:

Section 2-1 : Water level = 11.568 m

Section 2-2 : Water level = 12.829 m

Section 2-3 : Water level = 14.598 m

Discharge (Q) and mean velocity (v) at bridge openings and culvert are as follows:

- Thmor Br. (Siem Reap River) Q = 205.64 m³/s, v = 1.839 m/s
 - Wat Thom Yoth Br. Q = 1.96 m³/s, v = 0.297 m/s
 - Pipe Culvert Q = 0.40 m³/s, v = 0.535 m/s
- Σ Q = 208.00 m³/s

3. ANALYSIS FOR THE CONDITION AFTER PROJECT COMPLETION

The same simulation model as used in the analysis of present situation is used, except change of Sections 1-3, 1-4 and 2-3 from present cross-sections to those after the Project completion.

The water level of Tonle Sap Lake is assumed at 9.27m.

Discharge and mean velocity at the section crossing the road are as follows:

| | | 10-year Return Period | | 20-year Return Period | | 50-year Return Period | |
|-------------|-------------------|--------------------------|------------------|--------------------------|------------------|--------------------------|------------------|
| | | Discharge | Mean Velocity | Discharge | Mean Velocity | Discharge | Mean Velocity |
| Catchment-1 | Water Level | 14.257 | | 14.384 | | 14.434 | |
| | Ang Chroung Br. | 106.94 | 1.256 | 113.35 | 1.293 | 115.88 | 1.307 |
| | Ou Angchean Br. | 113.26 | 1.256 | 120.51 | 1.293 | 123.37 | 1.307 |
| | Stung Br. | 160.45 | 1.256 | 170.72 | 1.293 | 174.78 | 1.307 |
| | Lo Lum Br. | 154.04 | 1.256 | 164.12 | 1.293 | 168.12 | 1.307 |
| | Kaek Br. | 123.81 | 1.256 | 131.37 | 1.293 | 134.35 | 1.307 |
| | Overflow Sections | 59.63 | 0.314 ~0.436 | 154.40 | 0.407 ~0.553 | 206.93 | 0.442 ~0.592 |
| | Culverts | 55.87 | 1.077 | 63.53 | 1.108 | 66.57 | 1.120 |
| | Total | 774.00 | | 918.00 | | 990.00 | |
| Catchment-2 | Water Level | 14.598 | | 14.598 | | 14.598 | |
| | Thmor Br. | 205.64 | 1.839 | 205.64 | 1.839 | 205.64 | 1.839 |
| | Wat Thom Yoth Br. | 1.96 | 0.297 | 1.96 | 0.297 | 1.96 | 0.297 |
| | Culvert | 0.40 | 0.535 | 0.40 | 0.535 | 0.40 | 0.535 |
| | Total | 208.00 | | 208.00 | | 208.00 | |

When the water level of Tonle Sap Lake is assumed at 10.0m, water level at the section crossing the road is as follow:

| Return Period | 10 Years | 20 Years | 50 Years |
|---------------|----------|----------|----------|
| Catchment-1 | 14.385 | 14.483 | 14.524 |
| Catchment-2 | 14.606 | 14.606 | 14.606 |

APPENDIX 11

REFERENCES

REFERENCES

- First Socioeconomic Development Plan 1996 ~ 2000, Ministry of Planning, (Feb. 1996)
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- General Population Census of Cambodia 1998, Provisional Population Totals, National Institute of Statistics, Ministry of Planning (July 1998)
- Report on the Cambodia Socioeconomic Survey 1997, NIS, Ministry of Planning
- Road Rehabilitation Project Contract Nos. NR3 and NR6 Simplified Engineering Design – Final Design Report (June 1998)
- Feasibility Study for Selected Priority National / Provincial Roads in the Kingdom of Cambodia, December 1997, World Bank, JOC / ORIENTAL

| | | |
|---------------|----------|-------------|
| Option Report | Volume I | Main Report |
|---------------|----------|-------------|

- Road Rehabilitation Project, Simplified Engineering Design, Resettlement Action Plan, June 1998
- Project Preparation Technical Assistance for Transport Network Improvement Project, September 1997 (Cambodia TA No. 2722 – CAM) SMEC

| | | |
|-------------------|-----------------------------------|--|
| Final Report | Volume I Volume IV Volume V | Executive Summary and Introduction Detailed Engineering - Roads Detailed Engineering - Bridges |
| Bidding Documents | Volume III | Drawings 5B, 5C, 6B, 7A, 7E |

- Ho Chi Minh City to Phnom Penh Highway Improvement Project, November 1997 (Asian Development Bank, Greater Mekong Subregion Infrastructure Improvement : TA No. 5649 – REG) Scott Wilson Kirkpatrick / BCEOM

| | | |
|--------------|---|---|
| Final Report | Volume I Volume III Volume V Volume VI Volume VII | Pavement Evaluation and Design Materials Investigations Hydrology and Hydraulics Studies Initial Environmental Examination |
|--------------|---|---|

- Cambodian Standards

| | | |
|-------------|--------|----------|
| Road Design | Part 1 | Geometry |
| | Part 2 | Pavement |
| | Part 3 | Drainage |

Bridge Design

- ANGKOR Past, Present and Future

APPENDIX 12

DRAWINGS

**BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR THE IMPROVEMENT
OF
NATIONAL HIGHWAY ROUTE 6
SIEM REAP SECTION
IN
THE KINGDOM OF CAMBODIA**

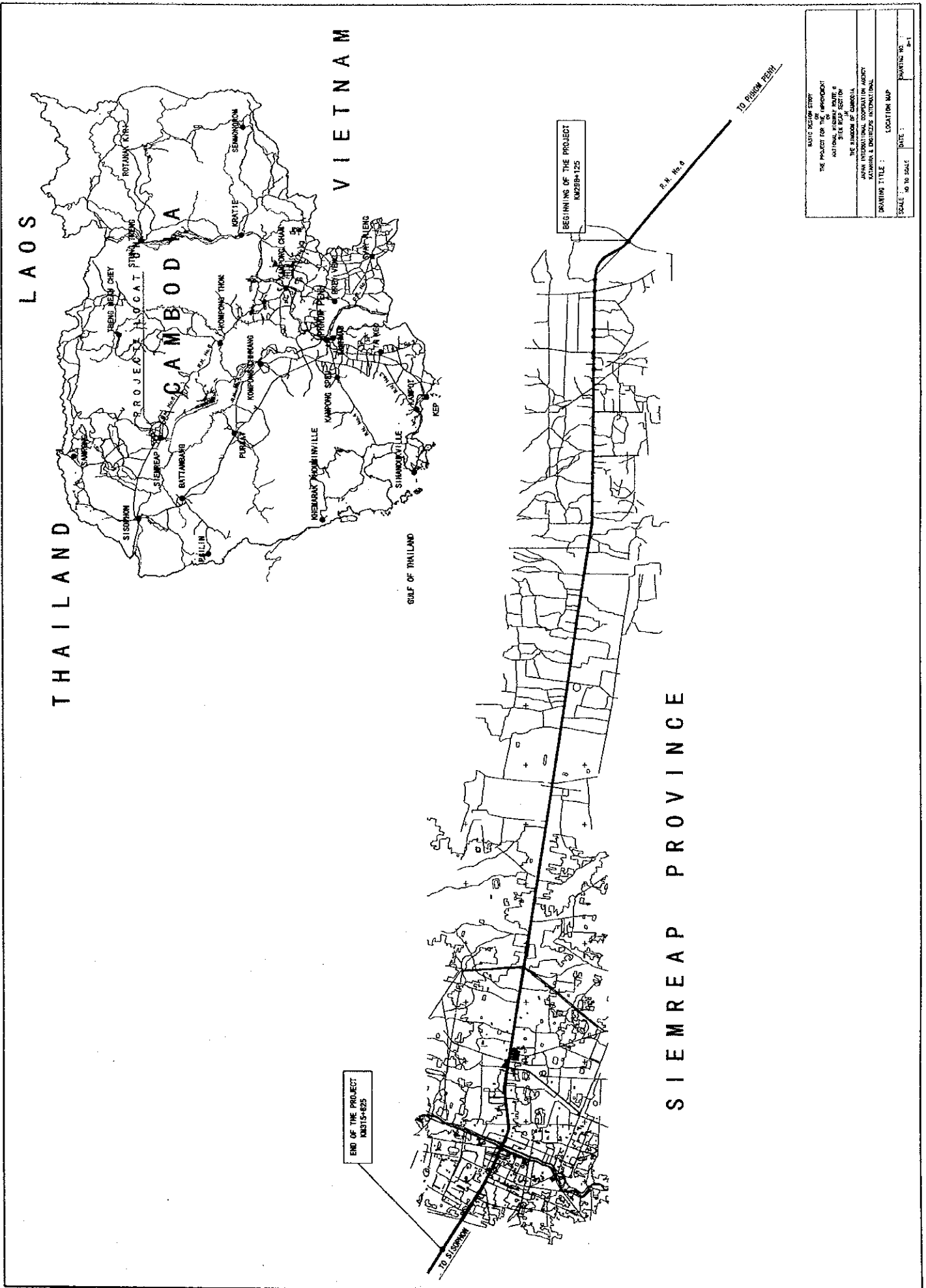
DRAWINGS

SEPTEMBER 1999

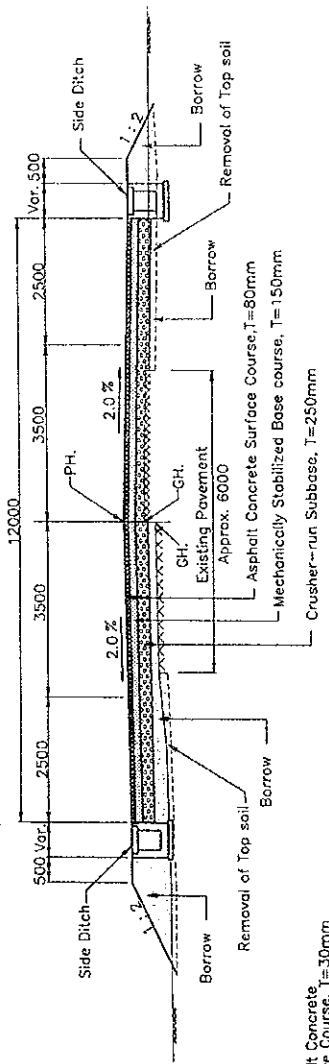
**JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL**

CONTENTS OF DRAWINGS

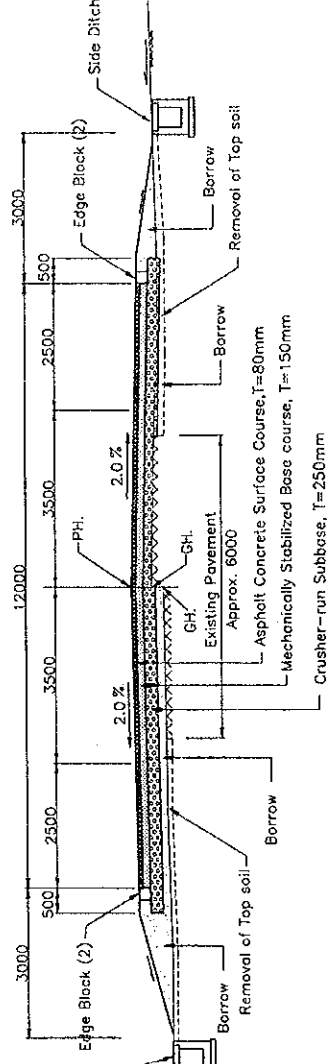
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| LOCATION MAP | G-1 |
| TYPICAL CROSS SECTIONS OF ROAD | G-2~3 |
| PLANS & PROFILES OF ROAD | P-1~28 |
| CROSS SECTIONS OF ROAD | C-1~13 |
| BRIDGES | B-1~3 |
| DRAINAGE | D-1~13 |
| ROAD MARKINGS & INTERSECTION | M-1 |
| ROAD SIGNS | M-2 |
| GUARDRAIL | M-3 |
| MISCELLANEOUS FACILITIES | M-4 |



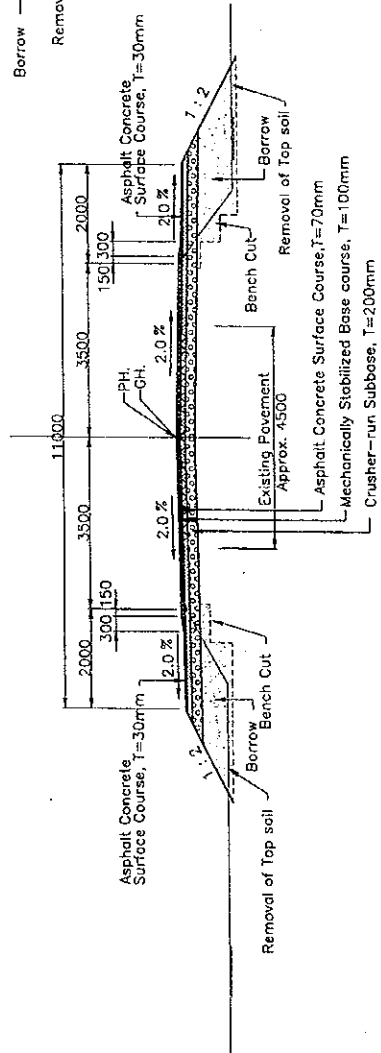
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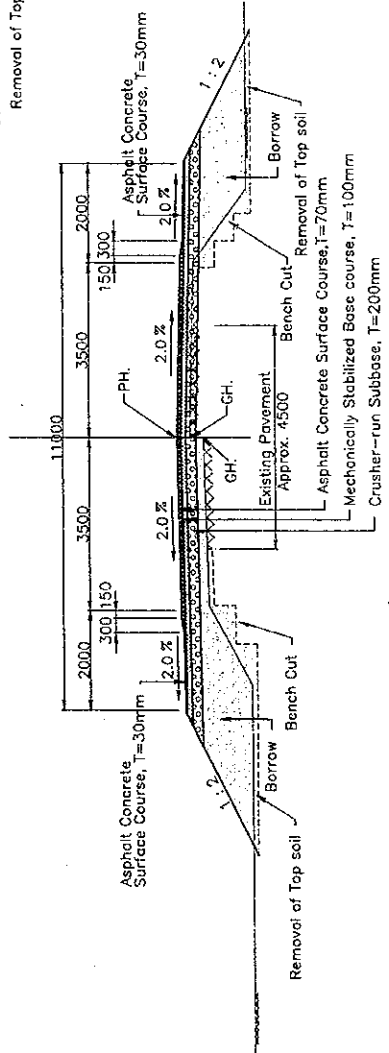
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Urban Section (East of Royal Palace)
TYPE-U2

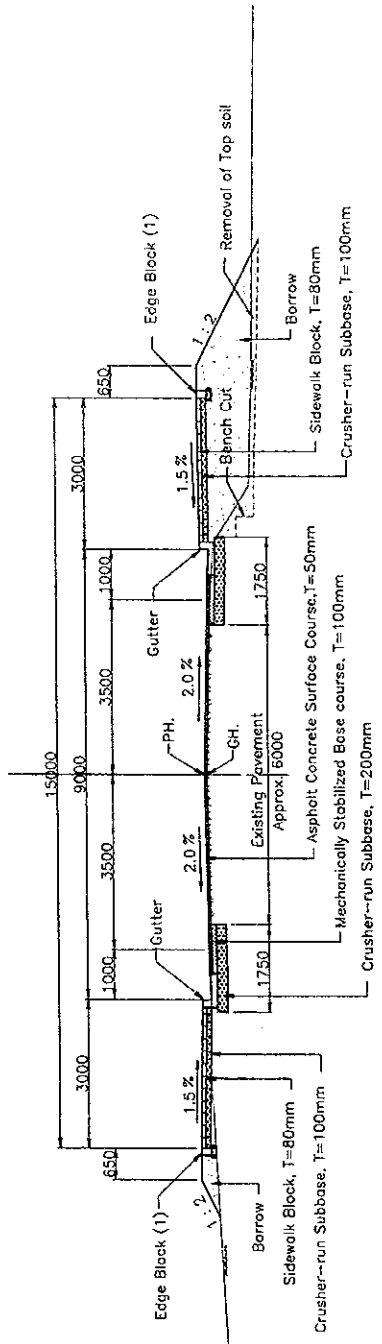


Rural Section (Baray & Overflow Section)
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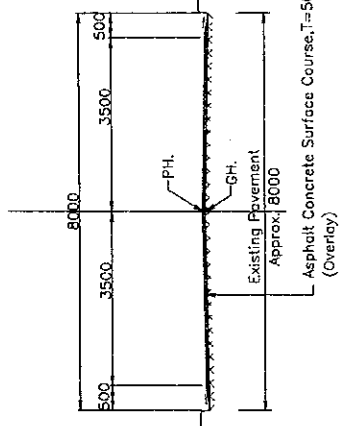


Rural Section
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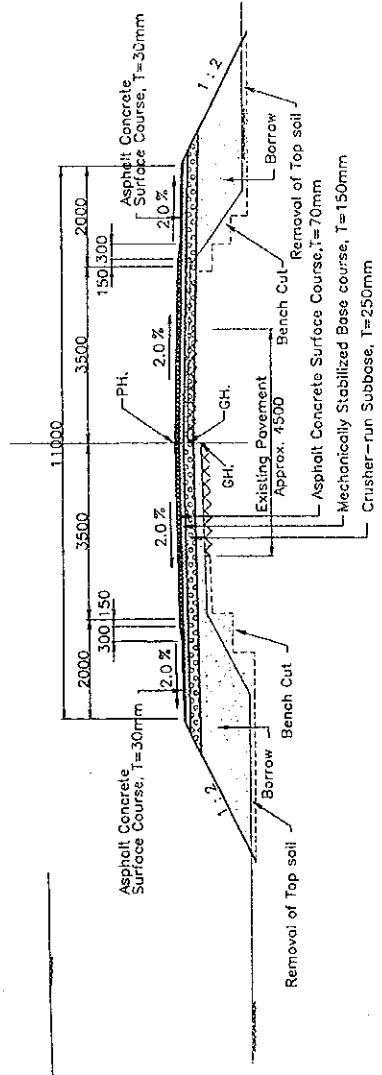
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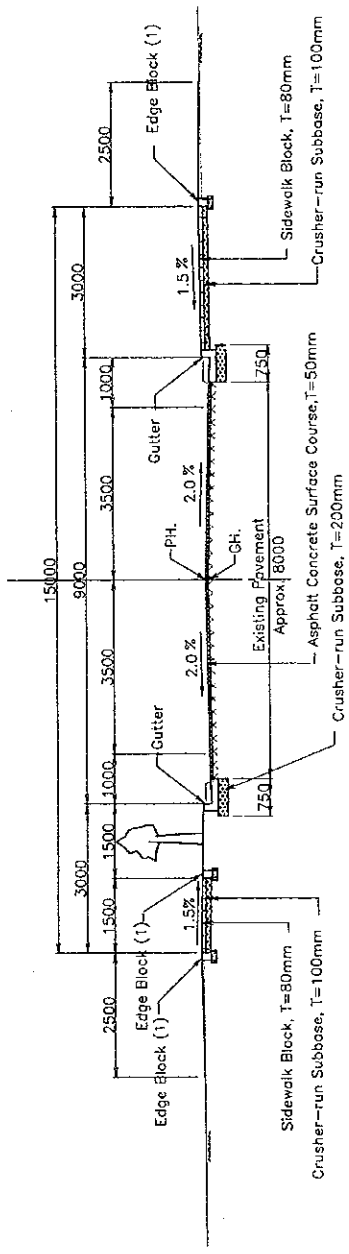
Urban Section (Bridge No.7 - JCT.)
TYPE-U5



Urban Section (in Front of Royal Palace)
TYPE-U3



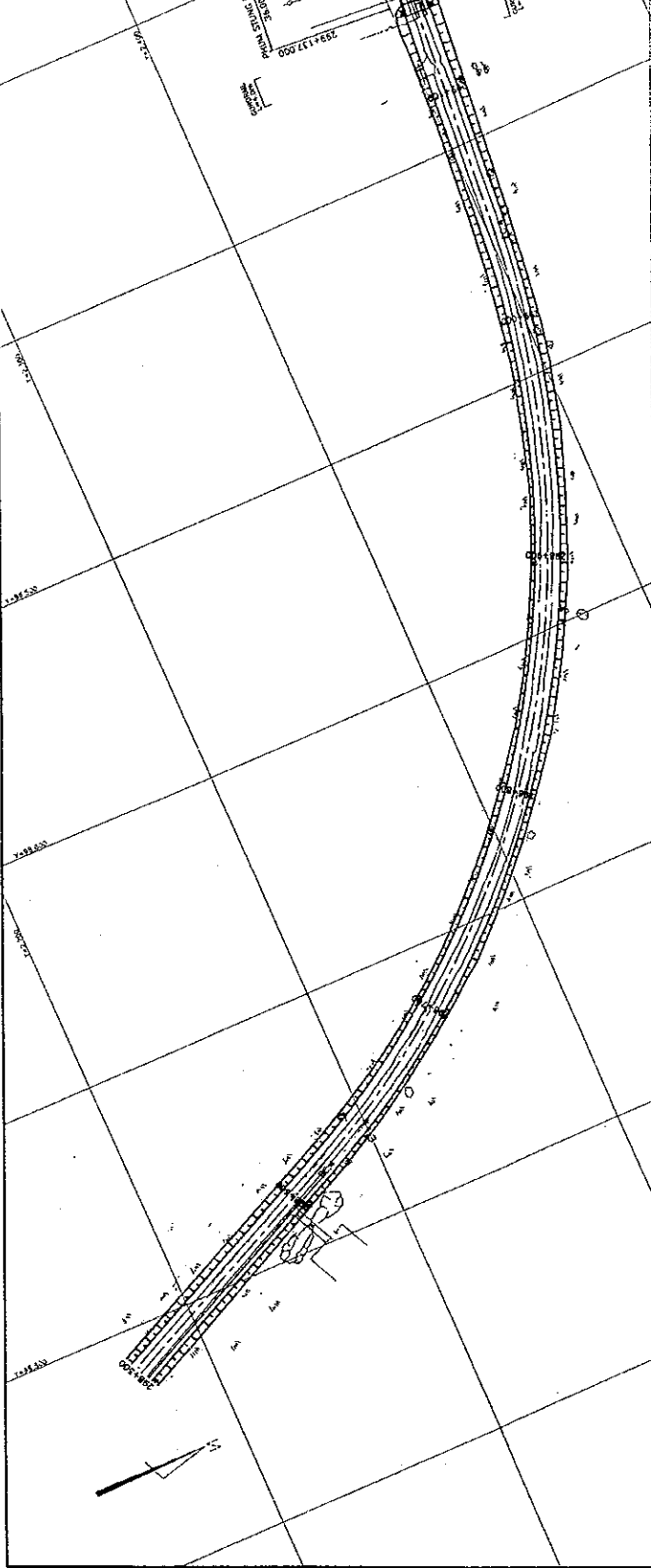
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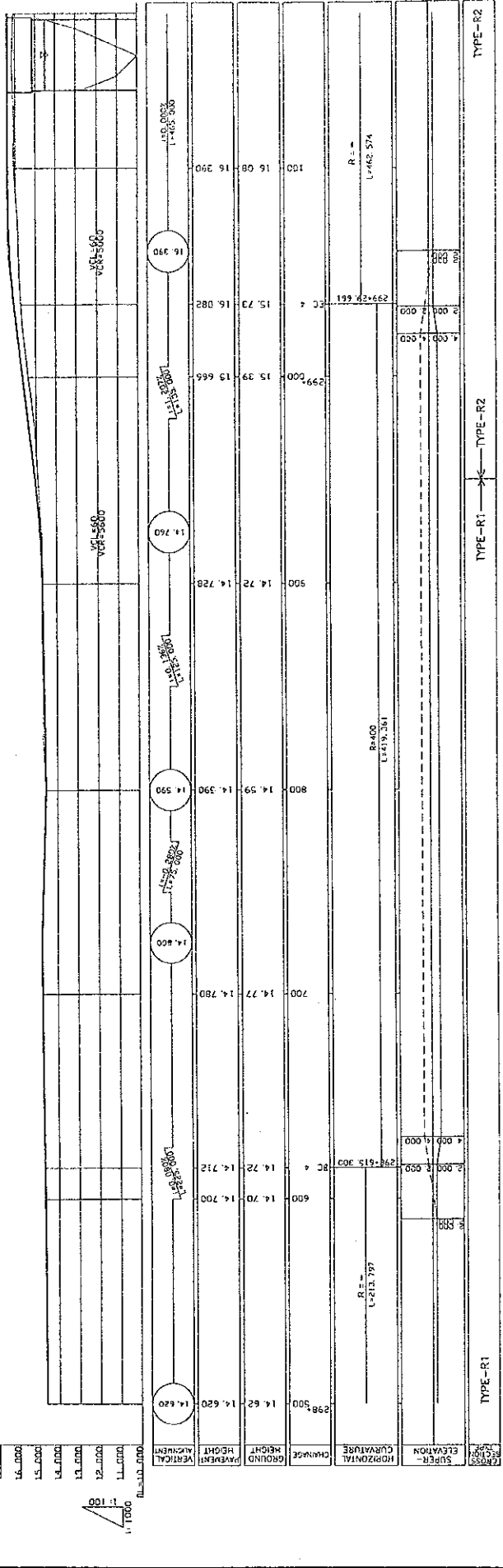
Urban Section (Royal Palace - Bridge No.7)
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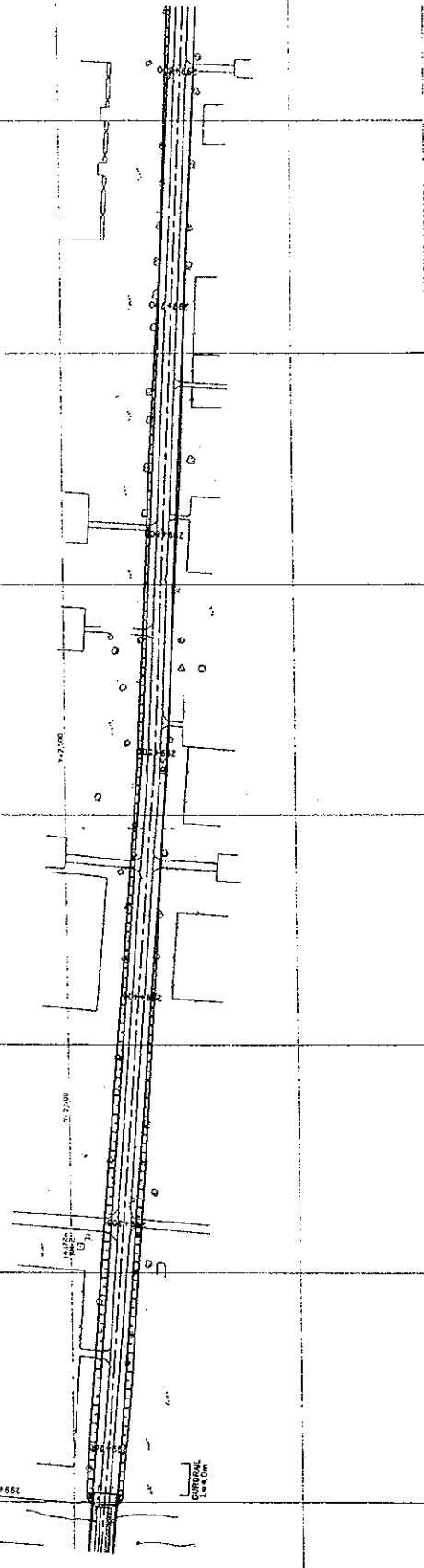
BASIC DESIGN STAGE
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 R=100.000
 L=1462.574
 R=100.000



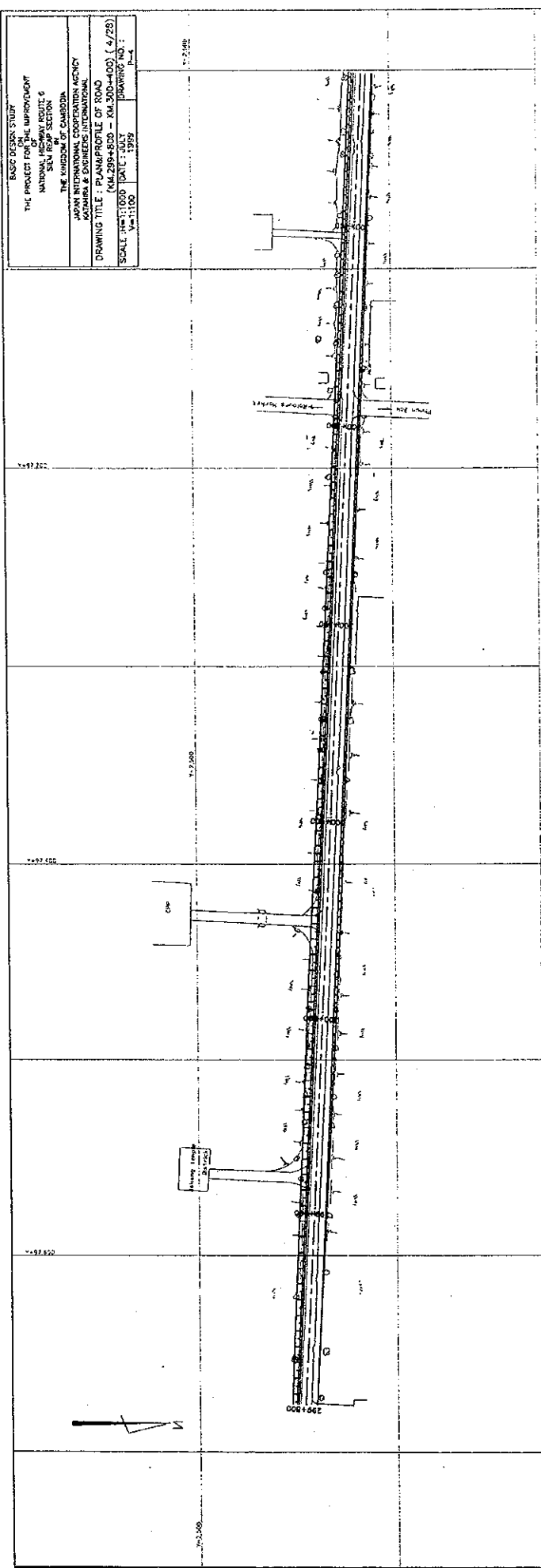
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BARAY SECTION L=3.735 KM
 KM. 299+400

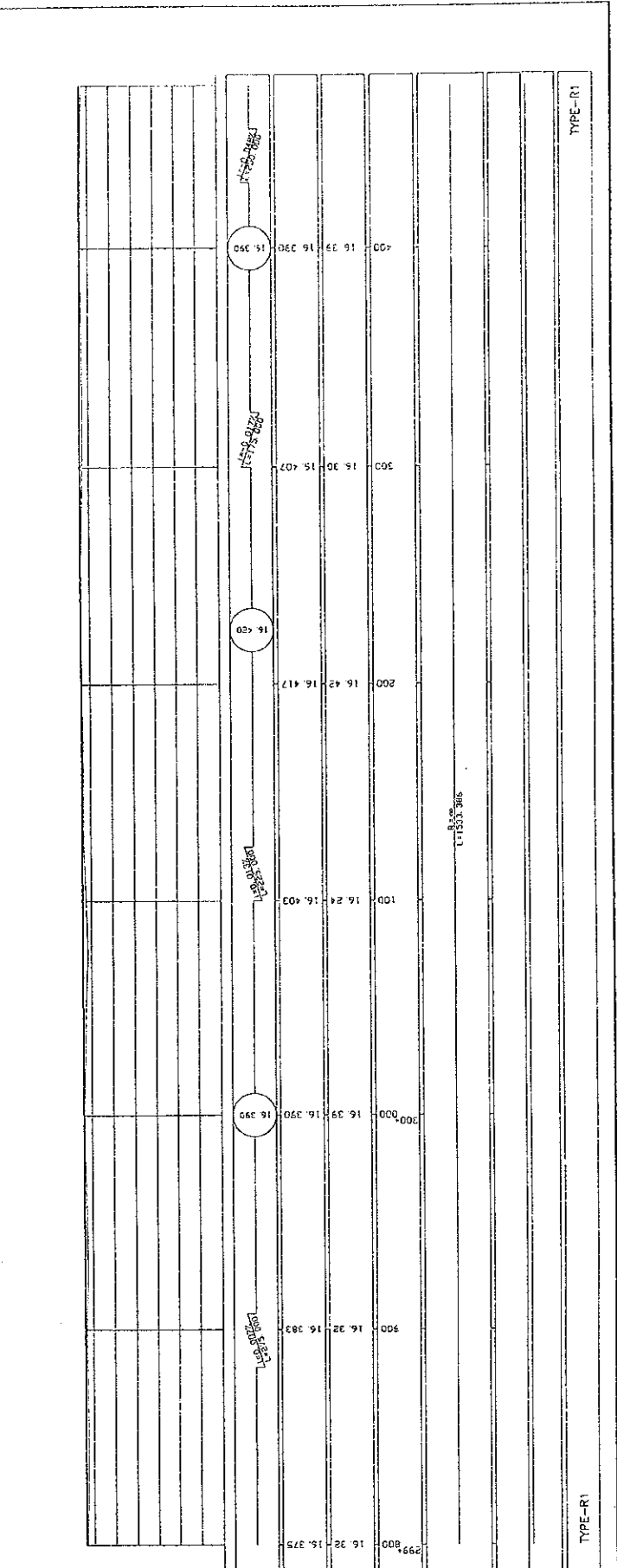
PHUM ANG STUNG BRIDGE
 L=56.000
 PHUM ANG STUNG BRIDGE
 L=36.200

| VERTICAL ALIGNMENT | PAVEMENT HEIGHT | GROUND HEIGHT | CHANNEL HEIGHT | CURVATURE | SUPER-ELEVATION | CROSS-SLOPE |
|--------------------|-----------------|---------------|----------------|-----------|-----------------|-------------|
| 16.390 | 16.390 | 16.03 | 16.390 | | | TYPE-R2 |
| 16.390 | 16.390 | 16.06 | 16.390 | | | TYPE-R2 |
| 16.390 | 16.390 | 15.11 | 16.390 | | | TYPE-R1 |
| 16.390 | 16.390 | 16.28 | 16.393 | | | TYPE-R1 |
| 16.390 | 16.390 | 16.33 | 16.373 | | | TYPE-R1 |
| 16.390 | 16.390 | 16.32 | 16.375 | | | TYPE-R1 |

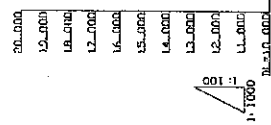
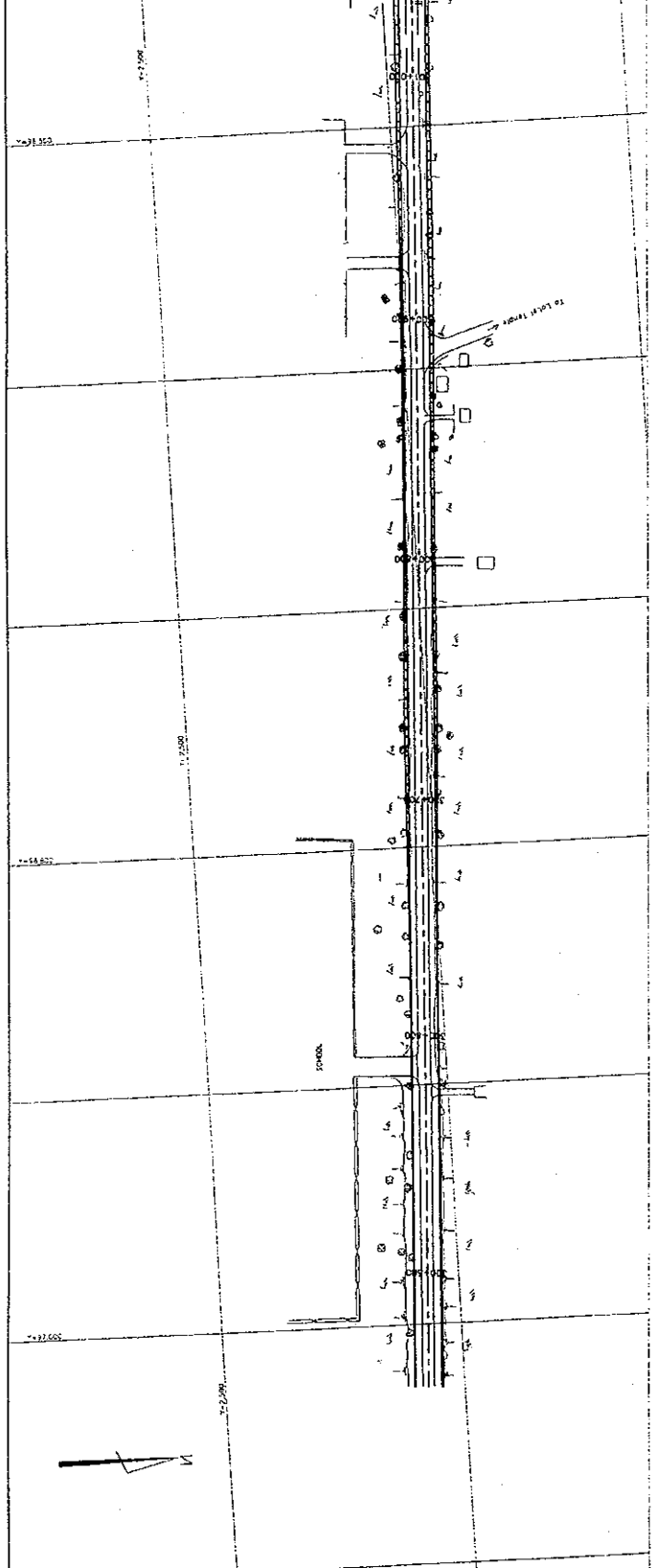


BASIC DESIGN STUDY
 THE PROJECT FOR THE IMPROVEMENT OF
 NATIONAL HIGHWAY NO. 6
 SECTION 100+00 TO SECTION 100+500
 PROVINCE OF CAMBODIA
 JOINT INTERNATIONAL COOPERATION AGENCY
 KATAHARA & ENGINEERS INTERNATIONAL
 DRAWING TITLE : PLAN PROFILE OF ROAD
 (KM.299+800 - KM.300+400) (4/28)
 SCALE: H=1:1000 DATE: JULY 1989 DRAWING NO.:
 P-4

| STATION | GROUND ELEVATION | PROPOSED ELEVATION | FINISH ELEVATION |
|---------|------------------|--------------------|------------------|
| 299+800 | 16.32 | 16.375 | 16.32 |
| 300+000 | 16.39 | 16.350 | 16.39 |
| 300+100 | 16.24 | 16.403 | 16.24 |
| 300+200 | 16.42 | 16.417 | 16.42 |
| 300+300 | 16.30 | 15.407 | 16.30 |
| 300+400 | 16.33 | 16.390 | 16.33 |



BASIC DESIGN STUDY
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 OF NATIONAL HIGHWAY ROUTE 6
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 KATAHIRA & ENGINEERS INTERNATIONAL
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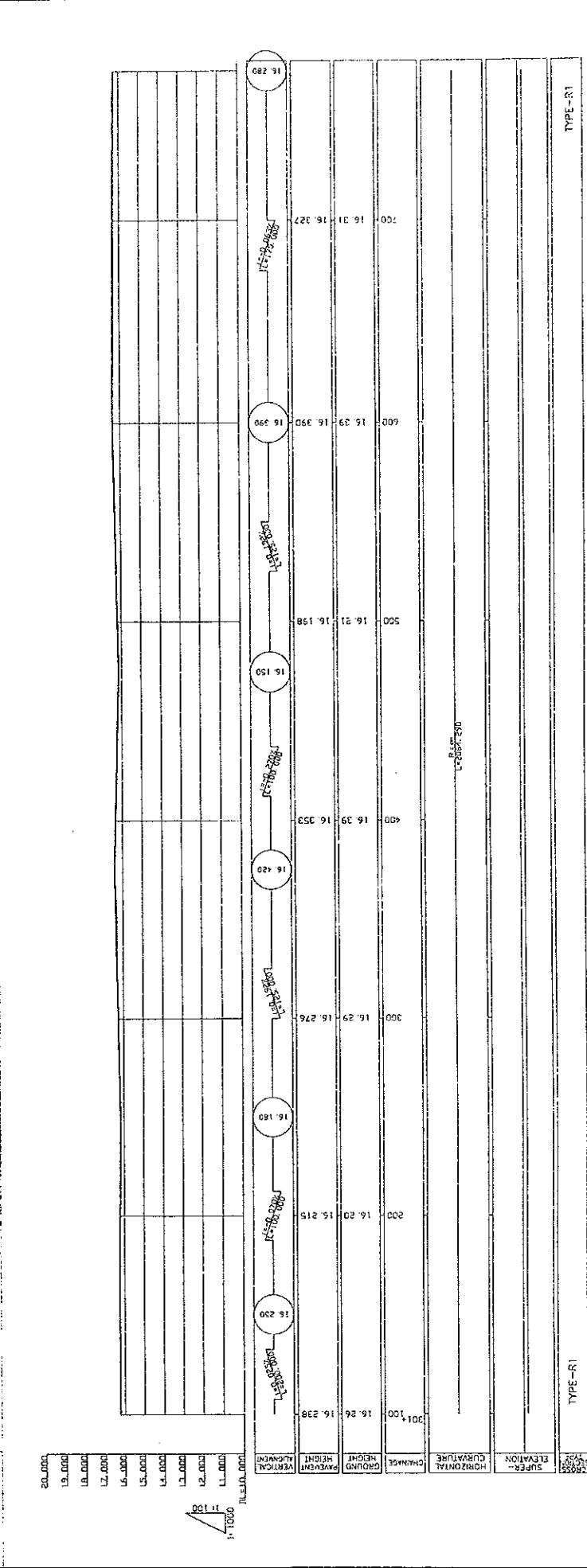
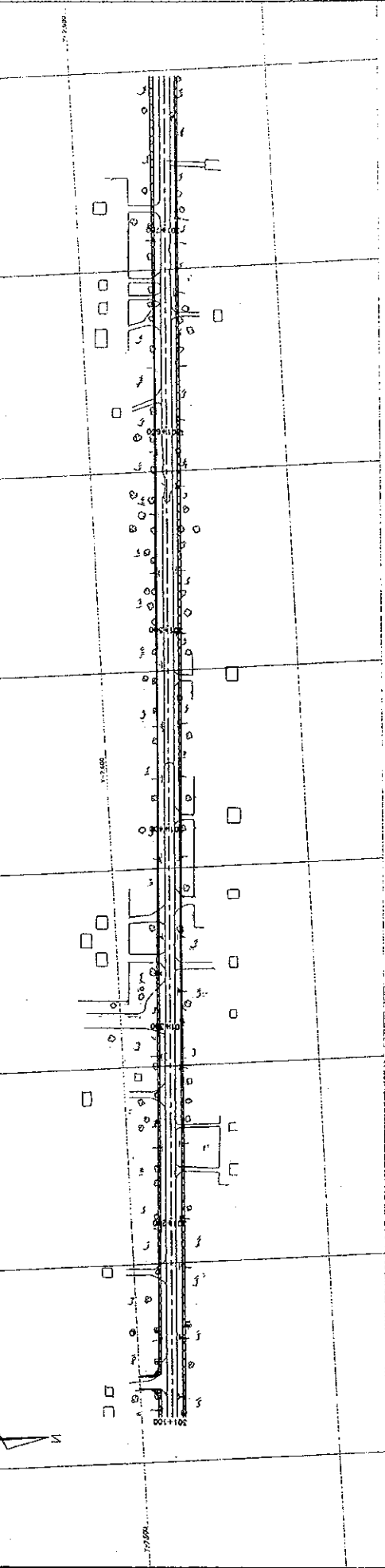


| STATION | GROUND HEIGHT | PAVEMENT HEIGHT | VERTICAL ALIGNMENT |
|---------|---------------|-----------------|--------------------|
| 300+500 | 16.27 | 16.342 | |
| 600 | 16.30 | 16.294 | 16.270 |
| 700 | 16.24 | 16.283 | |
| 800 | 16.31 | 16.210 | 16.210 |
| 900 | 16.23 | 16.237 | |
| 1000 | 16.24 | 16.212 | |
| 1P 6 | 16.23 | 16.220 | |
| 100 | 16.26 | 16.238 | |

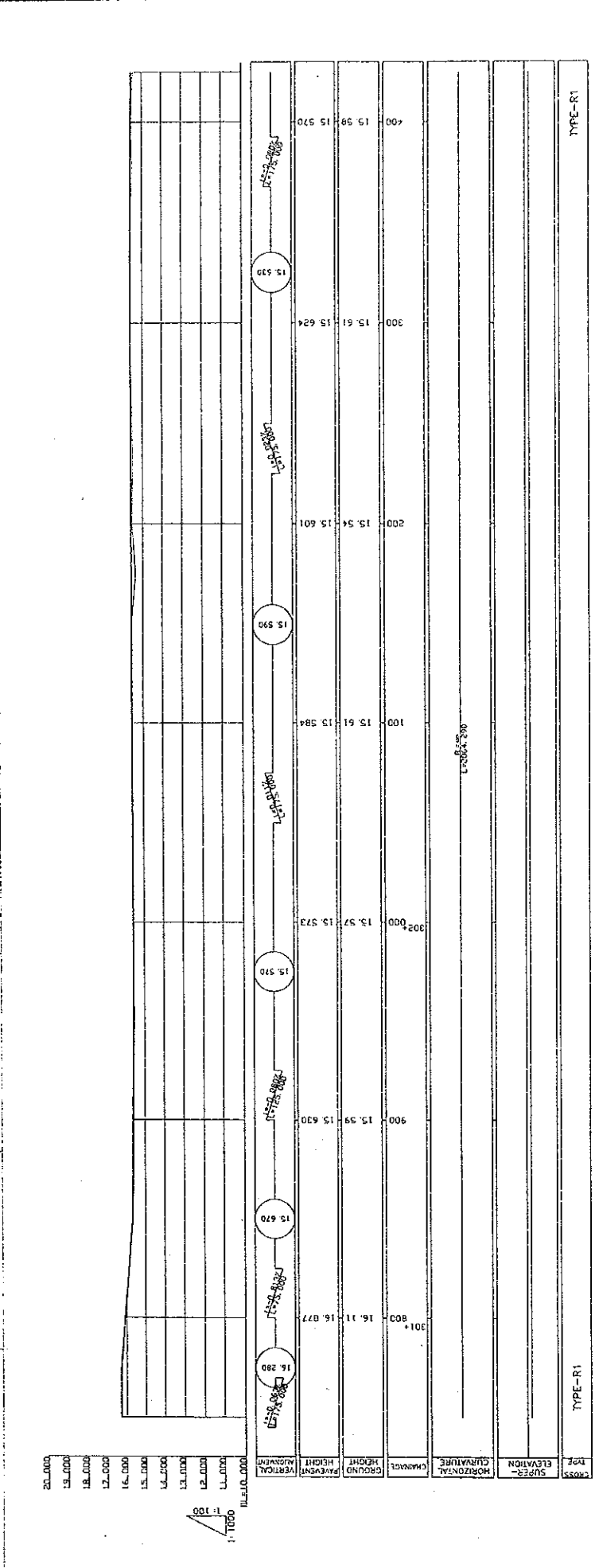
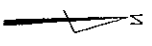
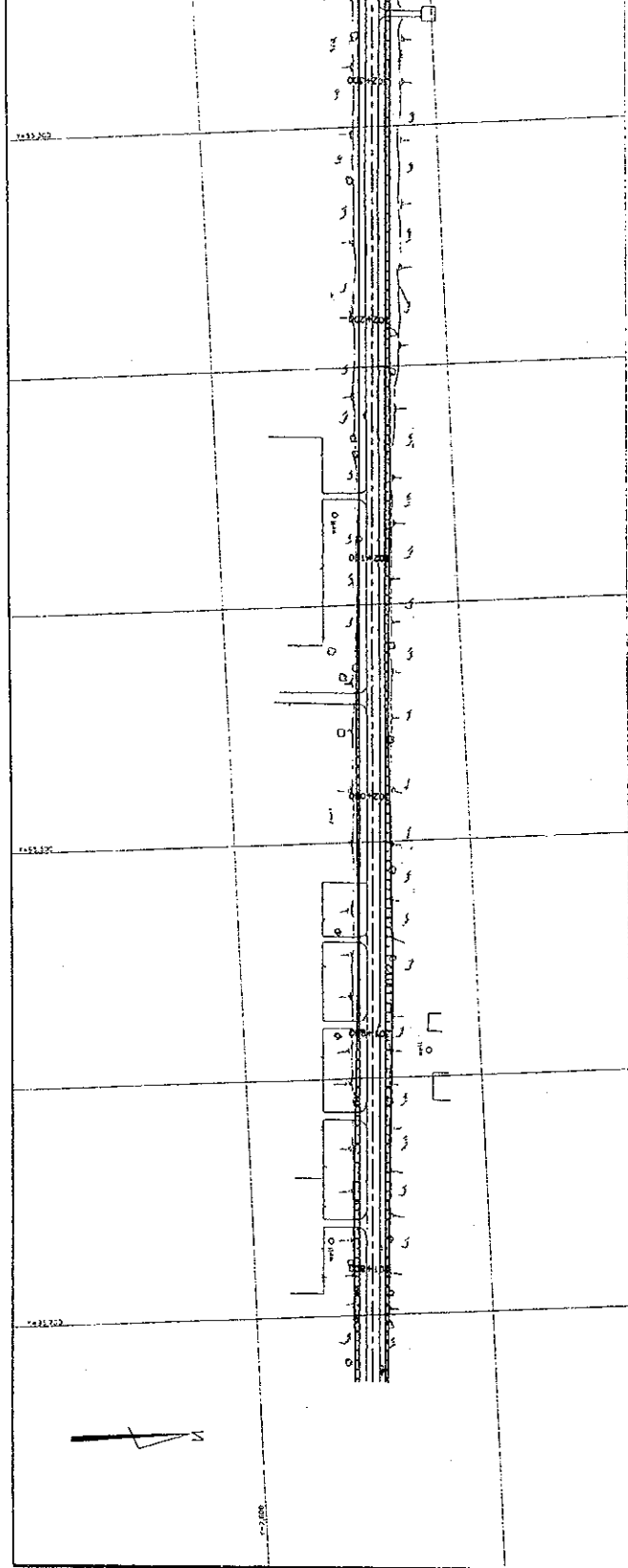
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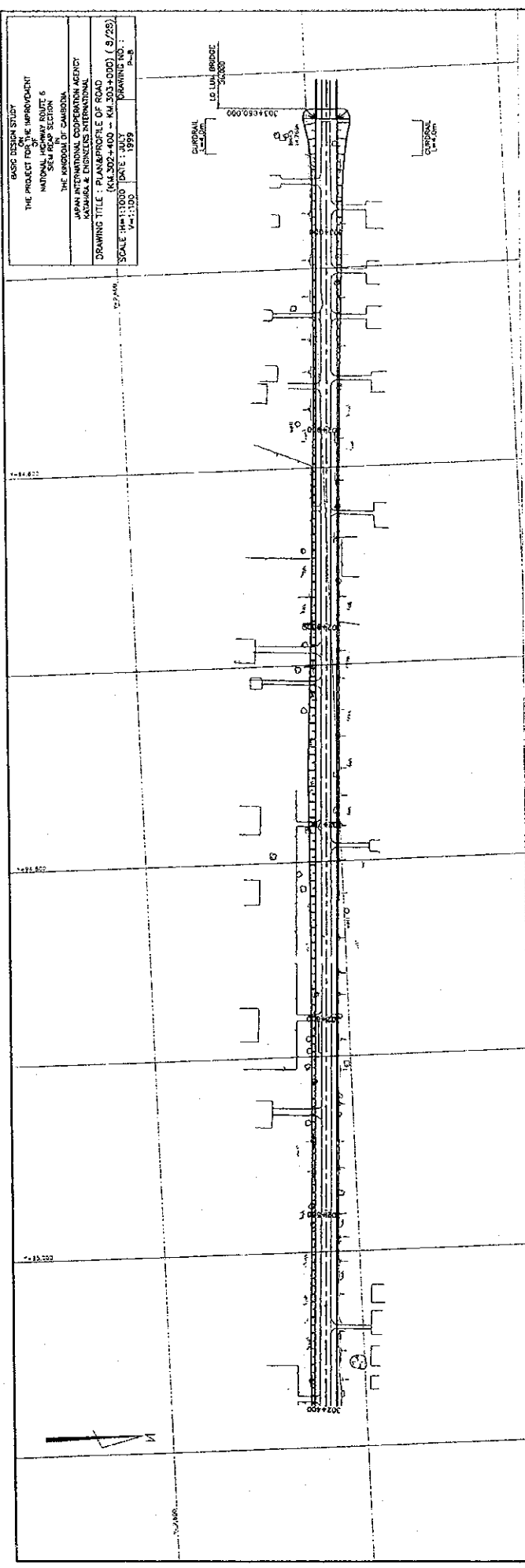
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BASE DESIGN STUDY
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 THE KINGDOM OF CAMBODIA
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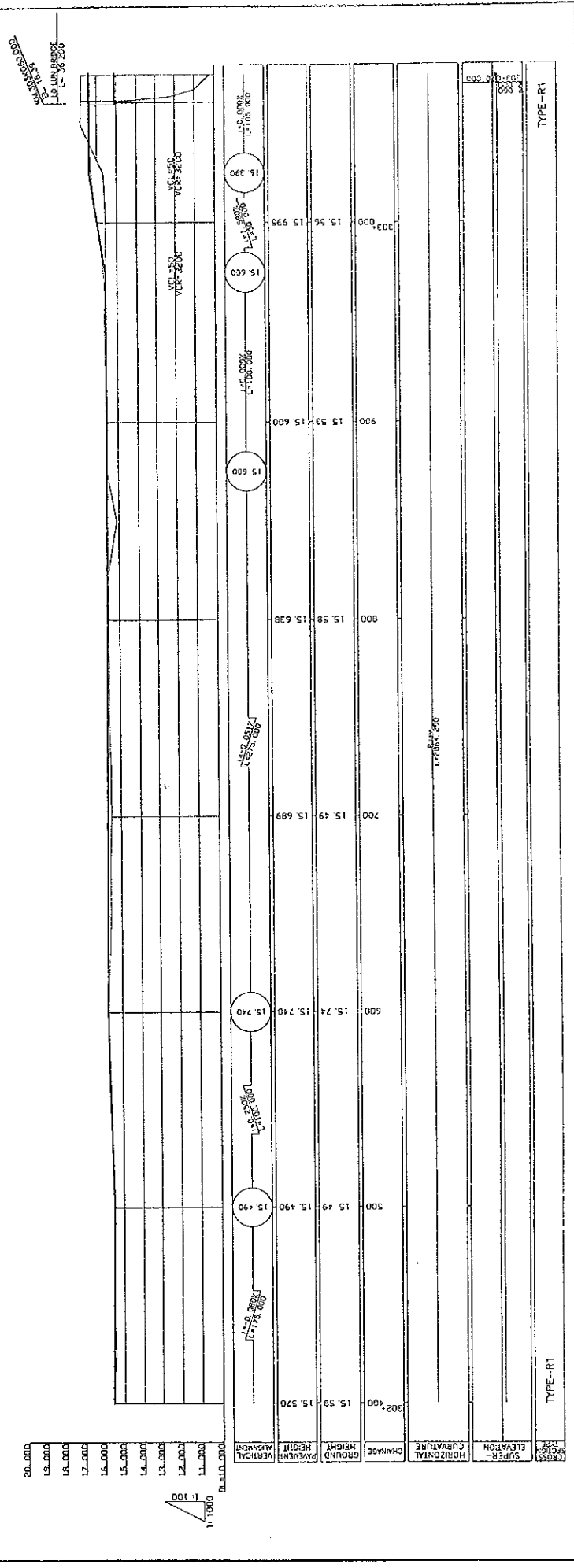


BASIC DESIGN STUDY
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 OF NATIONAL HIGHWAY ROUTE 6
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 THE KINGDOM OF CAMBODIA
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 KATAMURA & ENGINEERS INTERNATIONAL
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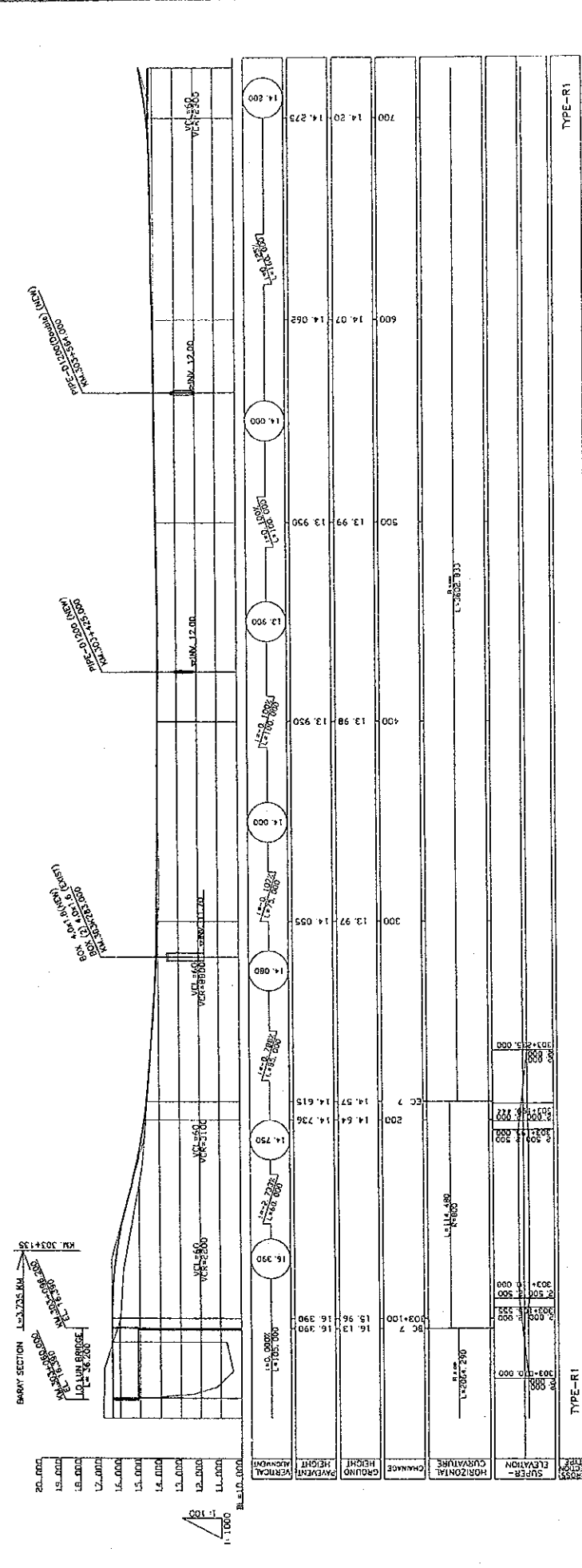
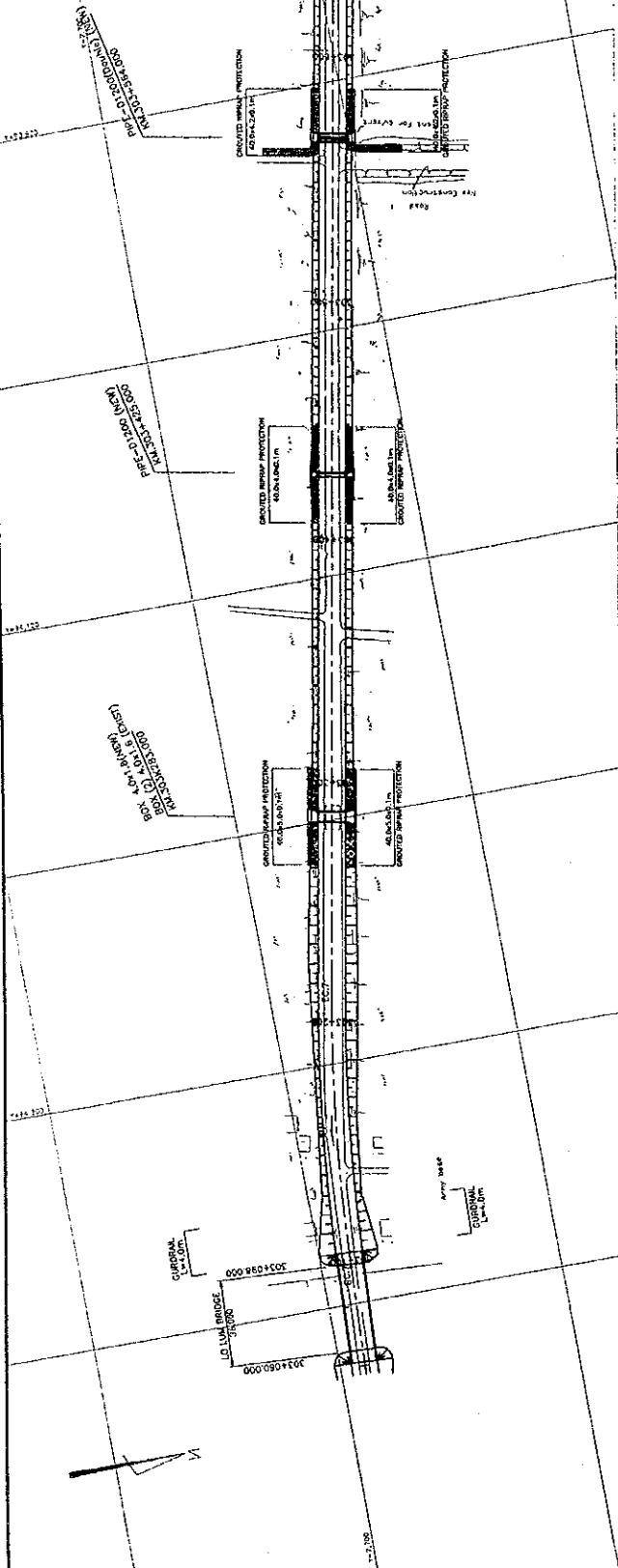




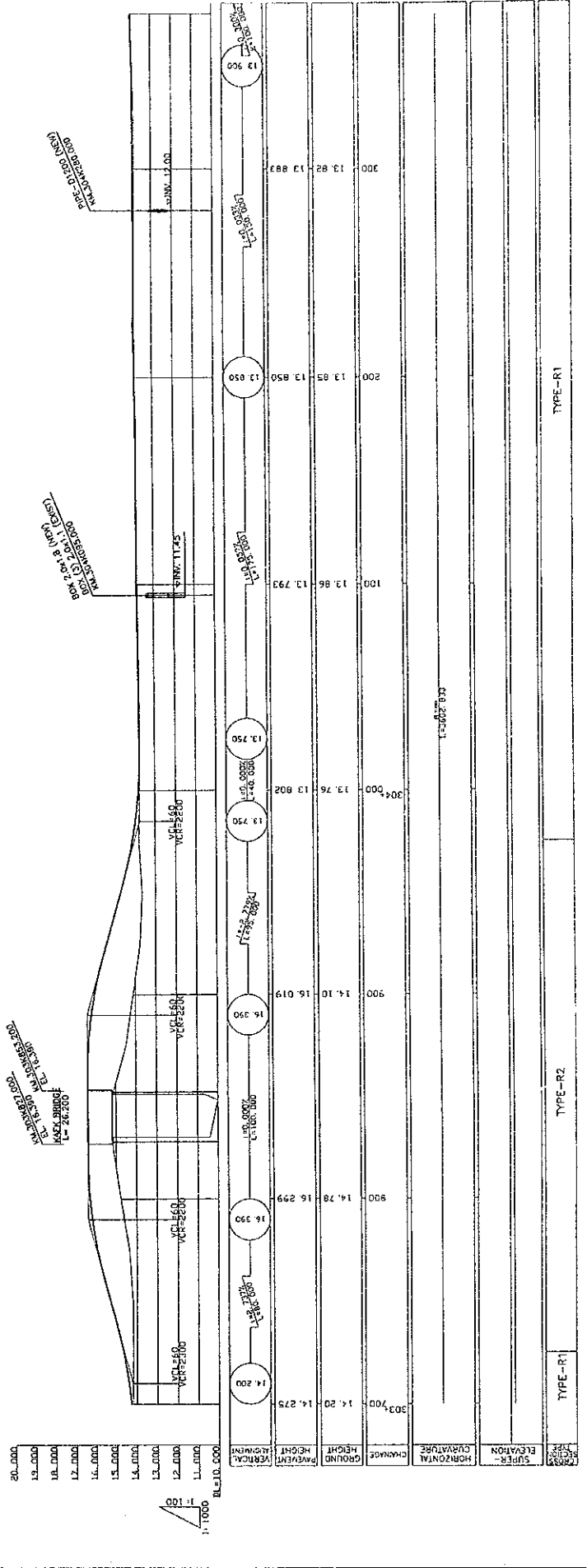
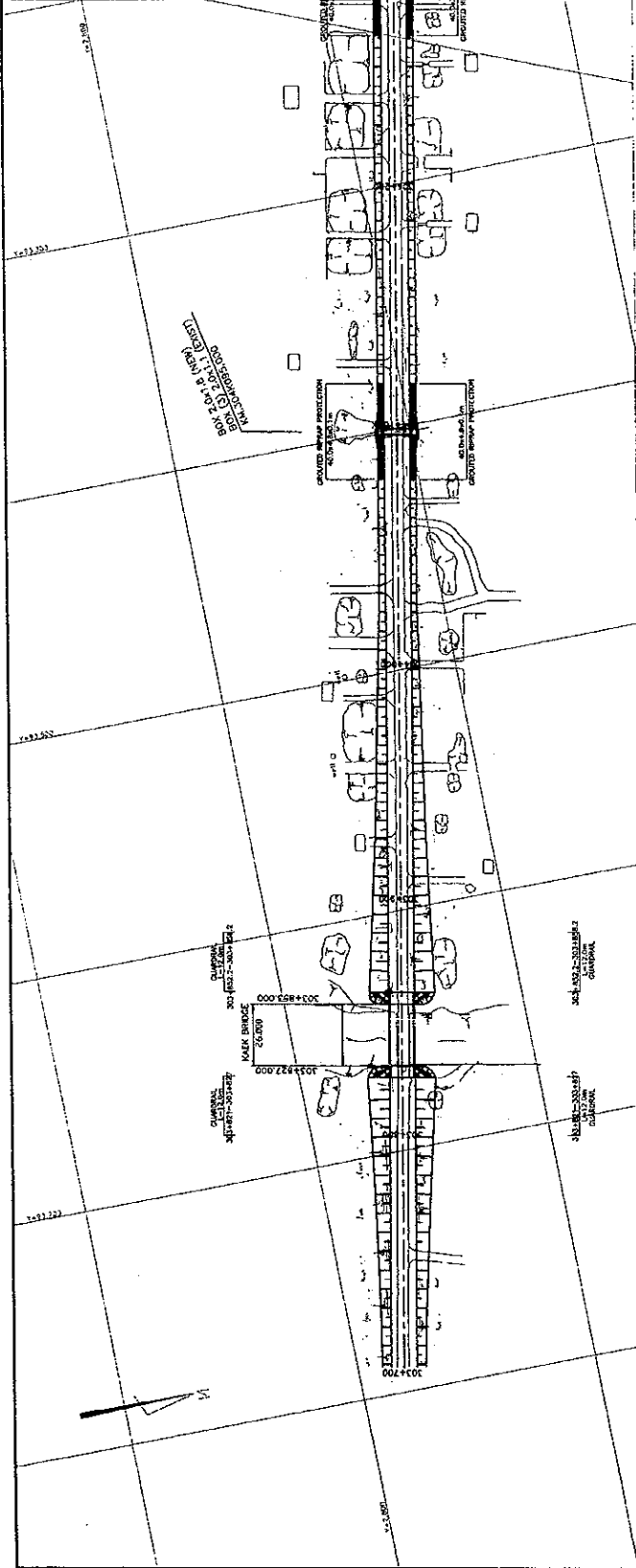
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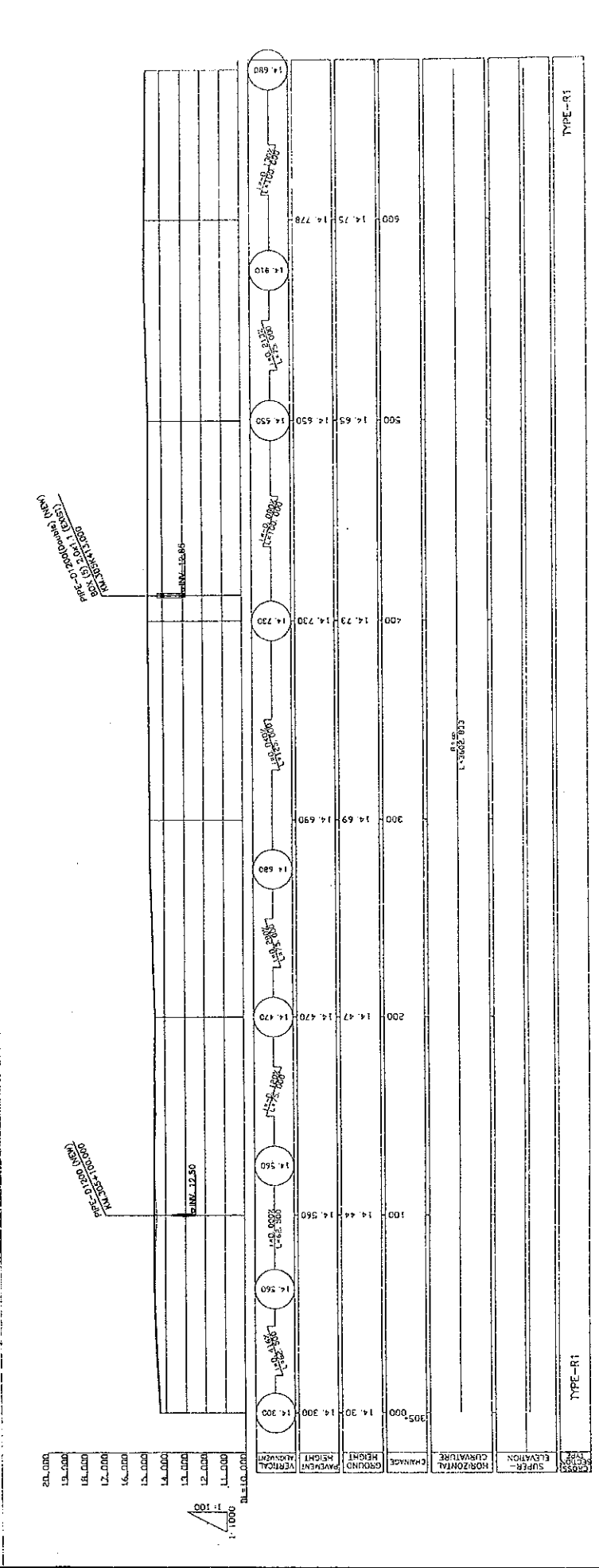
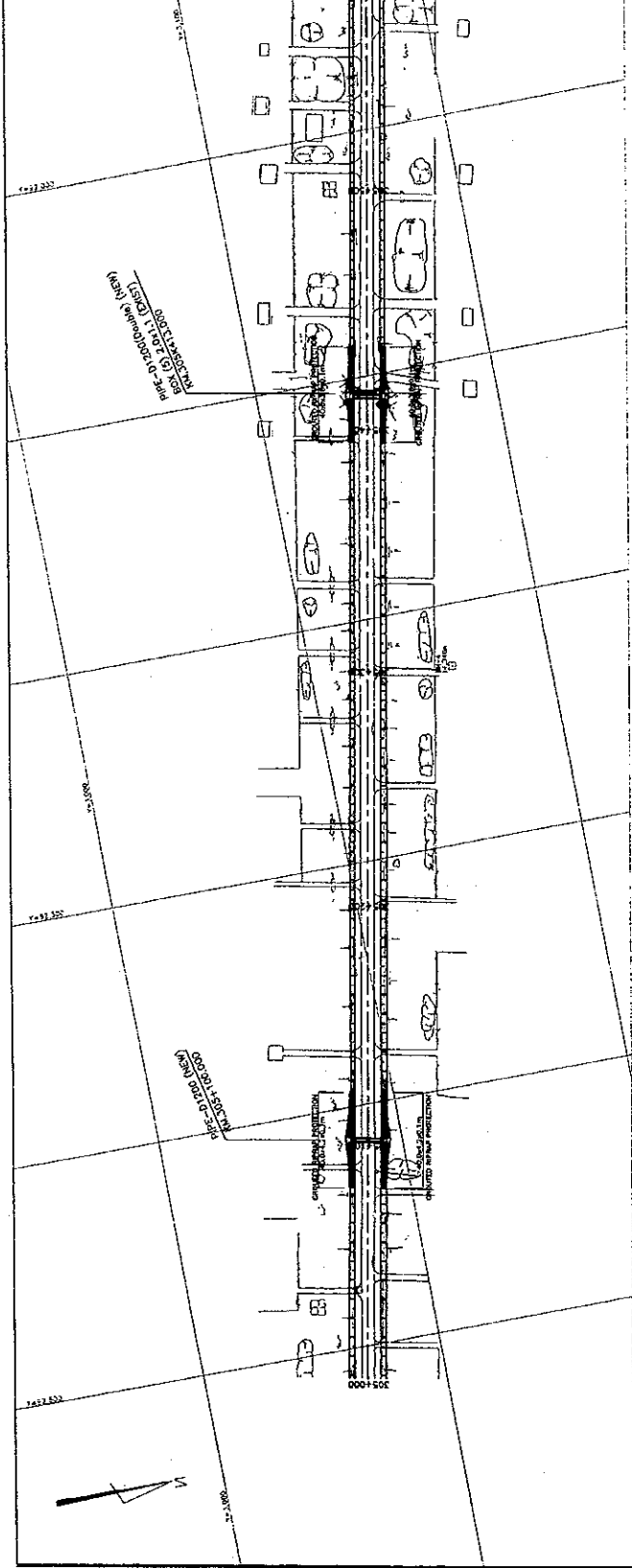
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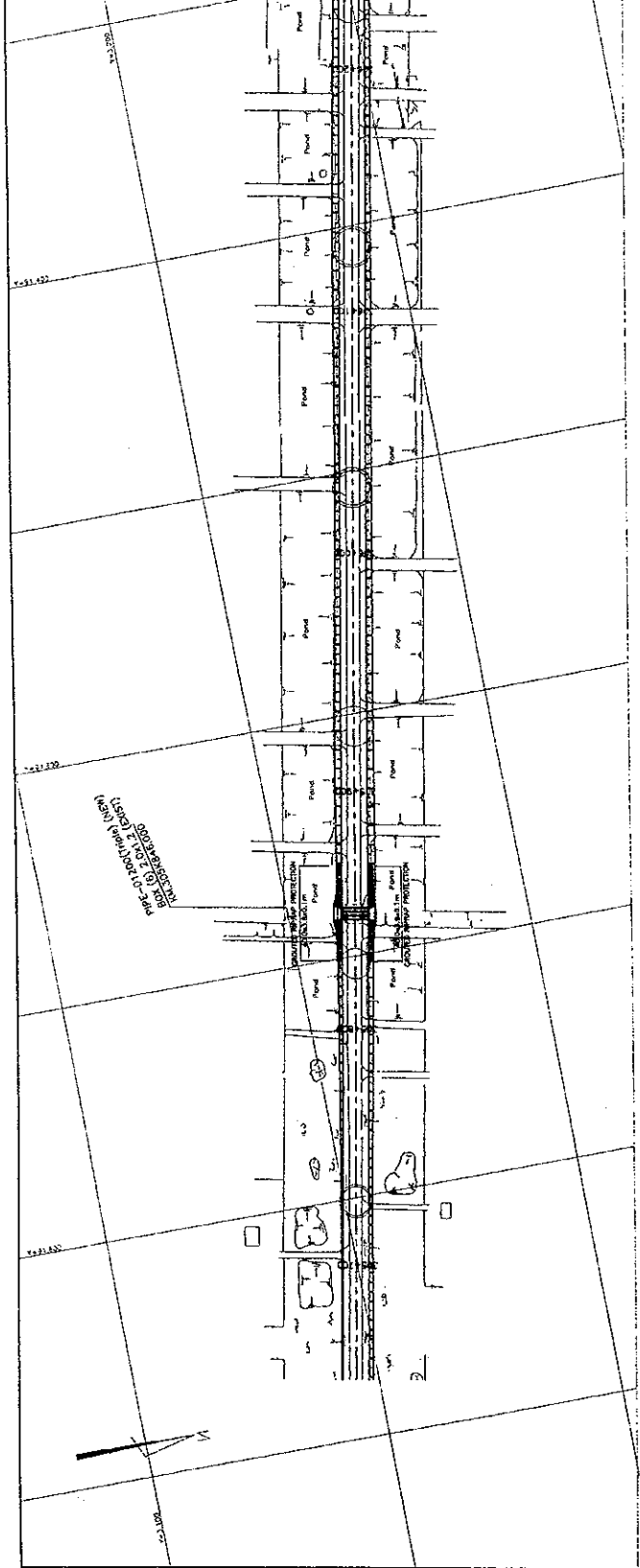
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 NATIONAL HIGHWAY SECTION 6
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BASIC DESIGN STUDY
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 NATIONAL HIGHWAY ROUTE 8
 SELA ROAD SECTION
 THE KINGDOM OF CAMBODIA
 JAPAN INTERNATIONAL COOPERATION AGENCY
 KATHIHA & ENGINEERS INTERNATIONAL
 DRAWING TITLE : PLAN & PROFILE OF ROAD
 (K4LJ303-4000 - K4LJ303-6000) (12/218)
 SCALE: Plan 1:1000 DATE: 10/11/89 DRAWING NO.:
 14-11-004 1/89

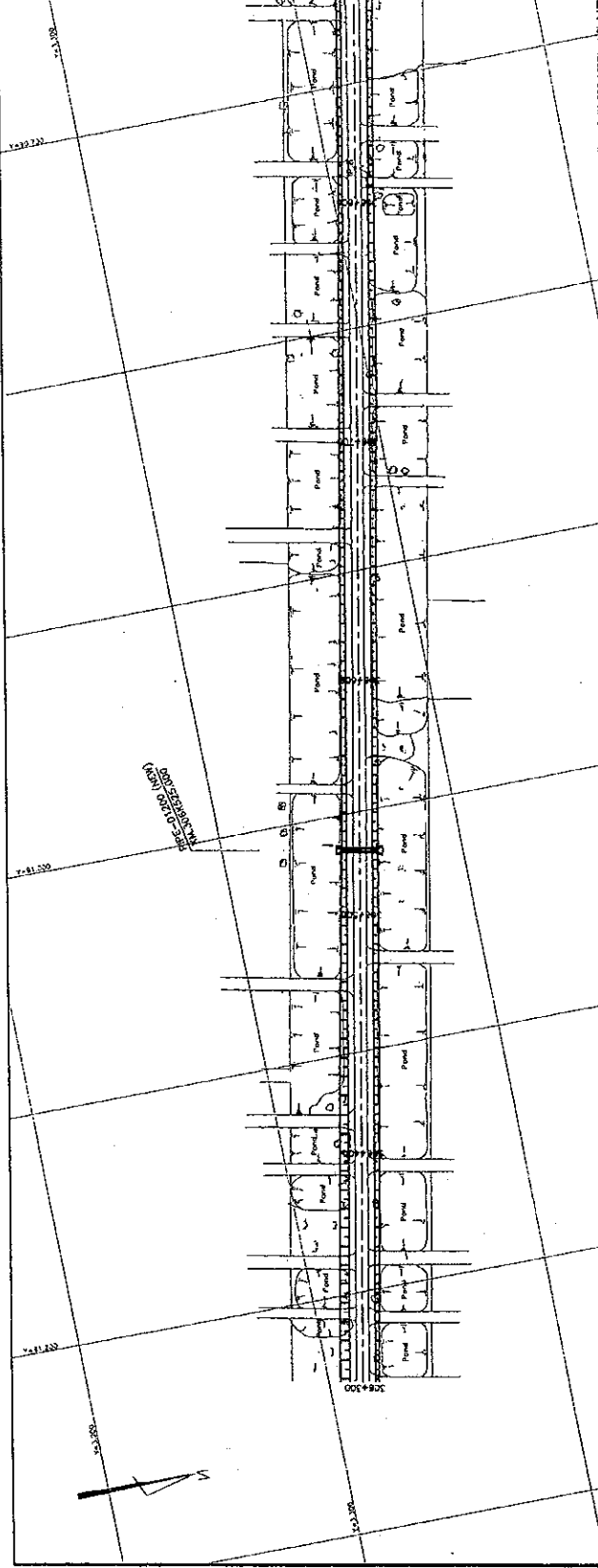


BASIC DESIGN STUDY
 THE PROJECT FOR THE IMPROVEMENT
 OF NATIONAL HIGHWAY ROUTE 6
 SELA NEAR SECTION
 THE KINGDOM OF CAMBODIA
 JAPAN INTERNATIONAL COOPERATION AGENCY
 KAMAHARA & ENGINEERS INTERNATIONAL
 DRAWING TITLE : PLANE-PROFILE OF ROAD
 (K.M. 305+700 - K.M. 308+500) (1/3/28)
 SCALE : SHEET 1:1000 (DATE : 1988) DRAWING NO. :
 44-11-020



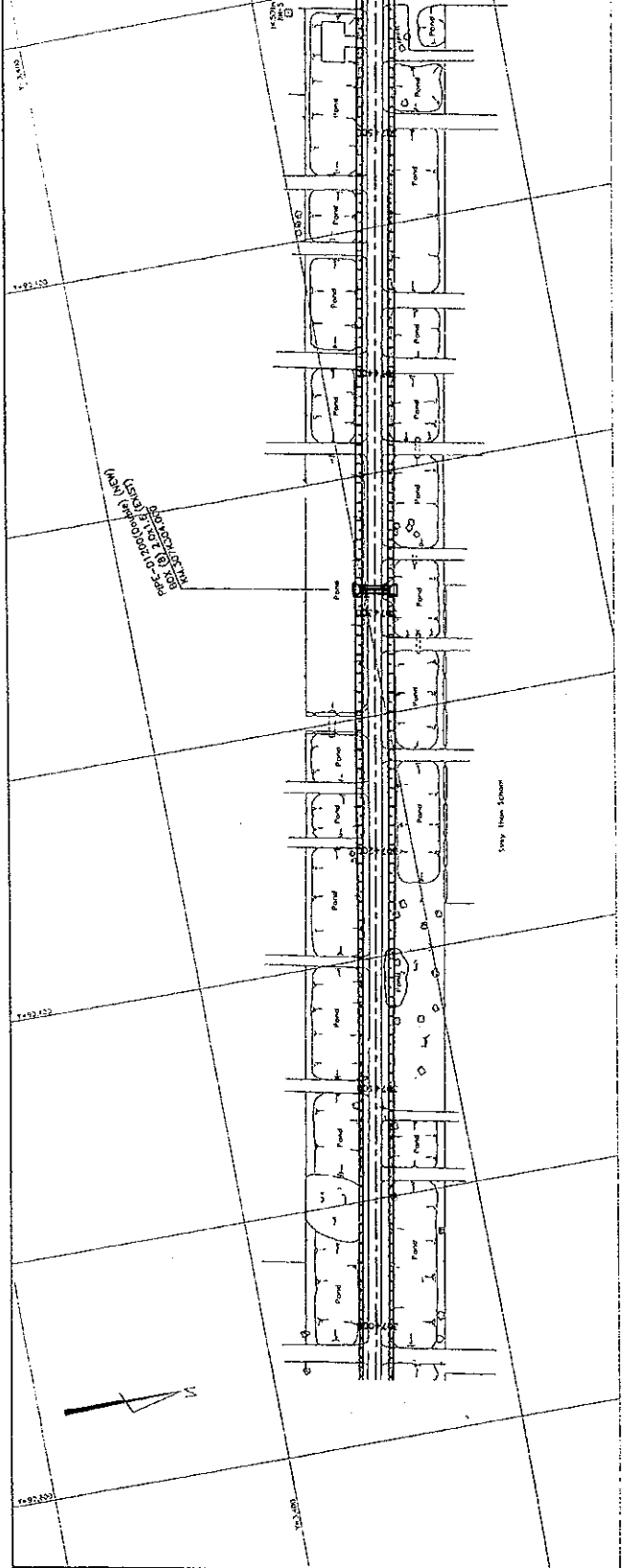
| STATION | GROUND ELEVATION | ROADWAY ELEVATION | ROADWAY TYPE |
|---------|------------------|-------------------|--------------|
| 305+700 | 14.727 | 14.916 | TYPE-R1 |
| 306+000 | 15.06 | 15.470 | TYPE-R2 |
| 306+300 | 15.03 | 15.470 | TYPE-R2 |
| 306+600 | 15.08 | 15.470 | TYPE-R2 |
| 307+000 | 14.97 | 15.470 | TYPE-R2 |
| 307+300 | 14.97 | 15.470 | TYPE-R2 |
| 307+600 | 15.03 | 15.470 | TYPE-R2 |
| 308+000 | 15.08 | 15.470 | TYPE-R2 |

BASIC DESIGN STUDY
 THE PROJECT FOR THE IMPROVEMENT
 NATIONAL HIGHWAY ROUTE 6
 SECTION
 THE KINGDOM OF CAMBODIA
 JOINT INTERNATIONAL COOPERATION AGENCY
 FOR TECHNICAL ASSISTANCE
 DRAWING TITLE : PLAN PROFILE OF ROAD
 SCALE : H=1:1000; V=1:100; DRAWING NO. :
 P-14

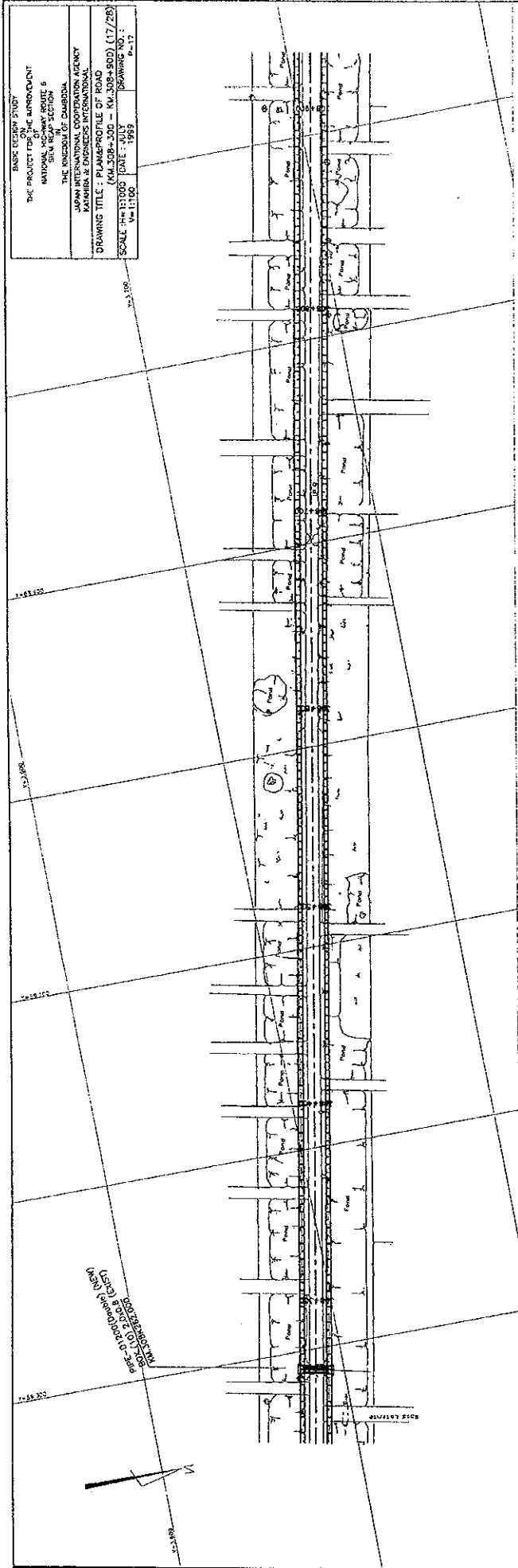


| ROAD VERTICAL CURVATURE | GROUND HEIGHT | PRESENT HEIGHT | PROPOSED HEIGHT |
|-------------------------------|------------------|-------------------|--------------------|
| 305.300 | 15.08 | 15.470 | 15.470 |
| 305.400 | 14.94 | 15.470 | 15.470 |
| 305.500 | 14.98 | 15.470 | 15.470 |
| 305.600 | 14.99 | 15.470 | 15.470 |
| 305.700 | 15.03 | 15.470 | 15.470 |
| 305.800 | 15.14 | 15.530 | 15.530 |
| 305.900 | 15.11 | 15.530 | 15.530 |
| 306.000 | 15.11 | 15.530 | 15.530 |
| 306.100 | 15.11 | 15.530 | 15.530 |
| 306.200 | 15.11 | 15.530 | 15.530 |
| 306.300 | 15.11 | 15.530 | 15.530 |
| 306.400 | 15.11 | 15.530 | 15.530 |
| 306.500 | 15.11 | 15.530 | 15.530 |
| 306.600 | 15.11 | 15.530 | 15.530 |
| 306.700 | 15.11 | 15.530 | 15.530 |
| 306.800 | 15.11 | 15.530 | 15.530 |
| 306.900 | 15.11 | 15.530 | 15.530 |
| 307.000 | 15.11 | 15.530 | 15.530 |
| 307.100 | 15.11 | 15.530 | 15.530 |
| 307.200 | 15.11 | 15.530 | 15.530 |
| 307.300 | 15.11 | 15.530 | 15.530 |
| 307.400 | 15.11 | 15.530 | 15.530 |
| 307.500 | 15.11 | 15.530 | 15.530 |
| 307.600 | 15.11 | 15.530 | 15.530 |
| 307.700 | 15.11 | 15.530 | 15.530 |
| 307.800 | 15.11 | 15.530 | 15.530 |
| 307.900 | 15.11 | 15.530 | 15.530 |
| 308.000 | 15.11 | 15.530 | 15.530 |
| 308.100 | 15.11 | 15.530 | 15.530 |
| 308.200 | 15.11 | 15.530 | 15.530 |
| 308.300 | 15.11 | 15.530 | 15.530 |
| 308.400 | 15.11 | 15.530 | 15.530 |
| 308.500 | 15.11 | 15.530 | 15.530 |
| 308.600 | 15.11 | 15.530 | 15.530 |
| 308.700 | 15.11 | 15.530 | 15.530 |
| 308.800 | 15.11 | 15.530 | 15.530 |
| 308.900 | 15.11 | 15.530 | 15.530 |
| 309.000 | 15.11 | 15.530 | 15.530 |
| 309.100 | 15.11 | 15.530 | 15.530 |
| 309.200 | 15.11 | 15.530 | 15.530 |
| 309.300 | 15.11 | 15.530 | 15.530 |
| 309.400 | 15.11 | 15.530 | 15.530 |
| 309.500 | 15.11 | 15.530 | 15.530 |
| 309.600 | 15.11 | 15.530 | 15.530 |
| 309.700 | 15.11 | 15.530 | 15.530 |
| 309.800 | 15.11 | 15.530 | 15.530 |
| 309.900 | 15.11 | 15.530 | 15.530 |
| 310.000 | 15.11 | 15.530 | 15.530 |
| 310.100 | 15.11 | 15.530 | 15.530 |
| 310.200 | 15.11 | 15.530 | 15.530 |
| 310.300 | 15.11 | 15.530 | 15.530 |
| 310.400 | 15.11 | 15.530 | 15.530 |
| 310.500 | 15.11 | 15.530 | 15.530 |
| 310.600 | 15.11 | 15.530 | 15.530 |
| 310.700 | 15.11 | 15.530 | 15.530 |
| 310.800 | 15.11 | 15.530 | 15.530 |
| 310.900 | 15.11 | 15.530 | 15.530 |
| 311.000 | 15.11 | 15.530 | 15.530 |
| 311.100 | 15.11 | 15.530 | 15.530 |
| 311.200 | 15.11 | 15.530 | 15.530 |
| 311.300 | 15.11 | 15.530 | 15.530 |
| 311.400 | 15.11 | 15.530 | 15.530 |
| 311.500 | 15.11 | 15.530 | 15.530 |
| 311.600 | 15.11 | 15.530 | 15.530 |
| 311.700 | 15.11 | 15.530 | 15.530 |
| 311.800 | 15.11 | 15.530 | 15.530 |
| 311.900 | 15.11 | 15.530 | 15.530 |
| 312.000 | 15.11 | 15.530 | 15.530 |
| 312.100 | 15.11 | 15.530 | 15.530 |
| 312.200 | 15.11 | 15.530 | 15.530 |
| 312.300 | 15.11 | 15.530 | 15.530 |
| 312.400 | 15.11 | 15.530 | 15.530 |
| 312.500 | 15.11 | 15.530 | 15.530 |
| 312.600 | 15.11 | 15.530 | 15.530 |
| 312.700 | 15.11 | 15.530 | 15.530 |
| 312.800 | 15.11 | 15.530 | 15.530 |
| 312.900 | 15.11 | 15.530 | 15.530 |
| 313.000 | 15.11 | 15.530 | 15.530 |
| 313.100 | 15.11 | 15.530 | 15.530 |
| 313.200 | 15.11 | 15.530 | 15.530 |
| 313.300 | 15.11 | 15.530 | 15.530 |
| 313.400 | 15.11 | 15.530 | 15.530 |
| 313.500 | 15.11 | 15.530 | 15.530 |
| 313.600 | 15.11 | 15.530 | 15.530 |
| 313.700 | 15.11 | 15.530 | 15.530 |
| 313.800 | 15.11 | 15.530 | 15.530 |
| 313.900 | 15.11 | 15.530 | 15.530 |
| 314.000 | 15.11 | 15.530 | 15.530 |
| 314.100 | 15.11 | 15.530 | 15.530 |
| 314.200 | 15.11 | 15.530 | 15.530 |
| 314.300 | 15.11 | 15.530 | 15.530 |
| 314.400 | 15.11 | 15.530 | 15.530 |
| 314.500 | 15.11 | 15.530 | 15.530 |
| 314.600 | 15.11 | 15.530 | 15.530 |
| 314.700 | 15.11 | 15.530 | 15.530 |
| 314.800 | 15.11 | 15.530 | 15.530 |
| 314.900 | 15.11 | 15.530 | 15.530 |
| 315.000 | 15.11 | 15.530 | 15.530 |
| 315.100 | 15.11 | 15.530 | 15.530 |
| 315.200 | 15.11 | 15.530 | 15.530 |
| 315.300 | 15.11 | 15.530 | 15.530 |
| 315.400 | 15.11 | 15.530 | 15.530 |
| 315.500 | 15.11 | 15.530 | 15.530 |
| 315.600 | 15.11 | 15.530 | 15.530 |
| 315.700 | 15.11 | 15.530 | 15.530 |
| 315.800 | 15.11 | 15.530 | 15.530 |
| 315.900 | 15.11 | 15.530 | 15.530 |
| 316.000 | 15.11 | 15.530 | 15.530 |
| 316.100 | 15.11 | 15.530 | 15.530 |
| 316.200 | 15.11 | 15.530 | 15.530 |
| 316.300 | 15.11 | 15.530 | 15.530 |
| 316.400 | 15.11 | 15.530 | 15.530 |
| 316.500 | 15.11 | 15.530 | 15.530 |
| 316.600 | 15.11 | 15.530 | 15.530 |
| 316.700 | 15.11 | 15.530 | 15.530 |
| 316.800 | 15.11 | 15.530 | 15.530 |
| 316.900 | 15.11 | 15.530 | 15.530 |
| 317.000 | 15.11 | 15.530 | 15.530 |
| 317.100 | 15.11 | 15.530 | 15.530 |
| 317.200 | 15.11 | 15.530 | 15.530 |
| 317.300 | 15.11 | 15.530 | 15.530 |
| 317.400 | 15.11 | 15.530 | 15.530 |
| 317.500 | 15.11 | 15.530 | 15.530 |
| 317.600 | 15.11 | 15.530 | 15.530 |
| 317.700 | 15.11 | 15.530 | 15.530 |
| 317.800 | 15.11 | 15.530 | 15.530 |
| 317.900 | 15.11 | 15.530 | 15.530 |
| 318.000 | 15.11 | 15.530 | 15.530 |
| 318.100 | 15.11 | 15.530 | 15.530 |
| 318.200 | 15.11</ | | |

BASIC DESIGN STUDY
 THE PROJECT FOR THE IMPROVEMENT
 NATIONAL HIGHWAY ROUTE 6
 S&W R&P SECTION
 THE KINGDOM OF SAUDI ARABIA
 JAPAN INTERNATIONAL COOPERATION AGENCY
 JICA
 JAPAN ROAD & CONSTRUCTION ENGINEERS ASSOCIATION
 DRAWING TITLE: PLAN & PROFILE OF ROAD
 (KMS. 37+000 - KMS. 40+000) (15/28)
 SCALE: PLAN 1:1000 PROFILE 1:500
 DATE: 1998 DRAWING NO.:
 P-15



| STATION | GROUND ELEVATION | PAVEMENT HEIGHT | GROUND HEIGHT | CHANGE | HORIZONTAL CURVATURE | SUPER-ELEVATION | TYPE-R2 |
|---------|------------------|-----------------|---------------|--------|----------------------|-----------------|---------|
| 37+000 | 15.00 | 15.04 | 15.530 | | | | TYPE-R2 |
| 100 | 15.04 | 15.530 | | | | | |
| 200 | 15.00 | 15.530 | | | | | |
| 300 | 15.05 | 15.530 | | | | | |
| 400 | 15.07 | 15.530 | | | | | |
| 500 | 15.15 | 15.530 | | | | | |
| 600 | 15.00 | 15.530 | | | | | TYPE-R2 |



| TYPE-R2 | TYPE-R2 |
|---------|---------|
| 208+300 | 15.33 |
| 400 | 15.38 |
| 500 | 15.44 |
| 600 | 15.41 |
| 700 | 15.49 |
| 800 | 15.44 |
| 900 | 15.53 |
| 1000 | 15.930 |

VERTICAL CURVE DATA:
 15.730
 15.850
 15.930

VERTICAL ALIGNMENT DATA:
 15.33
 15.38
 15.44
 15.41
 15.49
 15.44
 15.53

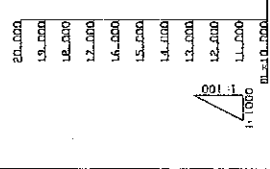
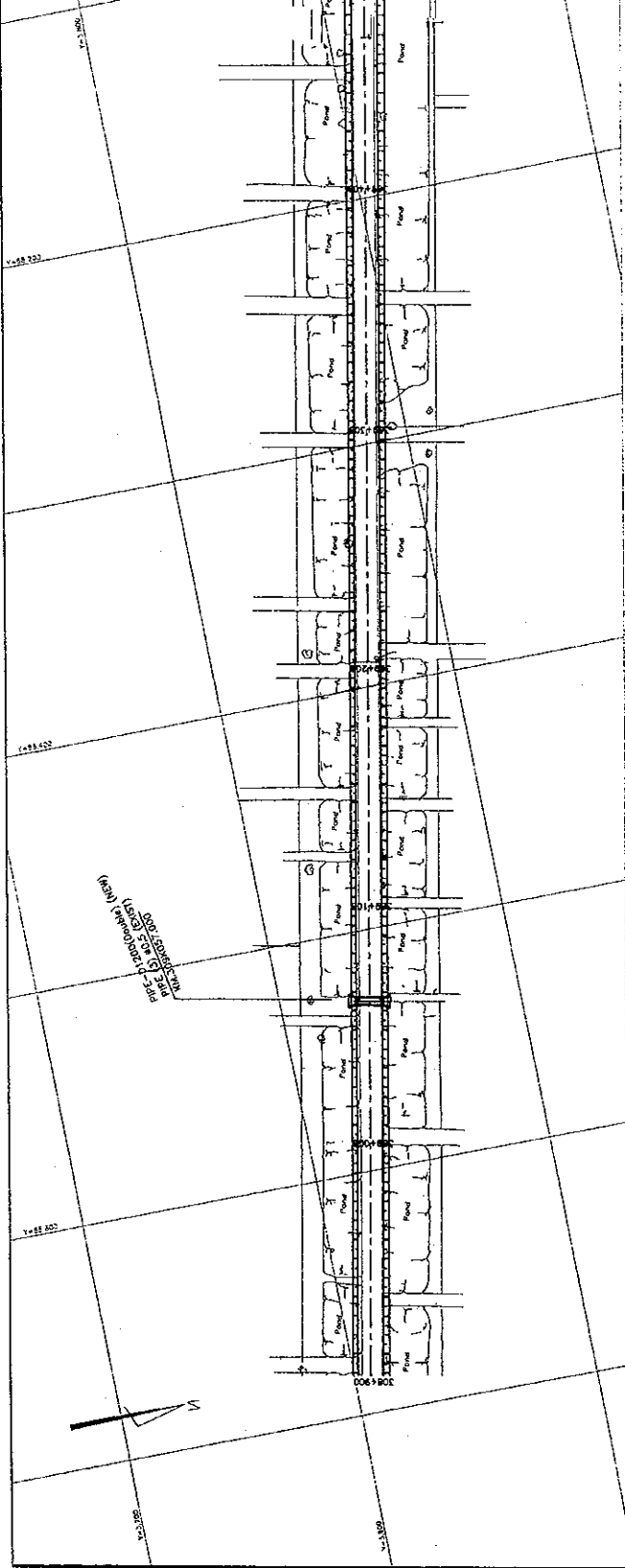
VERTICAL CURVE DATA:
 15.730
 15.850
 15.930

VERTICAL ALIGNMENT DATA:
 15.33
 15.38
 15.44
 15.41
 15.49
 15.44
 15.53

VERTICAL CURVE DATA:
 15.730
 15.850
 15.930

VERTICAL ALIGNMENT DATA:
 15.33
 15.38
 15.44
 15.41
 15.49
 15.44
 15.53

BASIC DESIGN STUDY
 THE PROJECT FOR THE IMPROVEMENT
 NATIONAL HIGHWAY ROUTE 6
 SECTION 10
 THE PROVINCE OF CAMBODIA
 JAPAN INTERNATIONAL COOPERATION AGENCY
 TECHNICAL ASSISTANCE PROGRAM
 DRAWING TITLE : PLAN PROFILE OF ROAD
 (KM 108+000 - KM 109+500) (18/2/8)
 SCALE: H=1:1000 V=1:100 DRAWING NO. :
 P-18



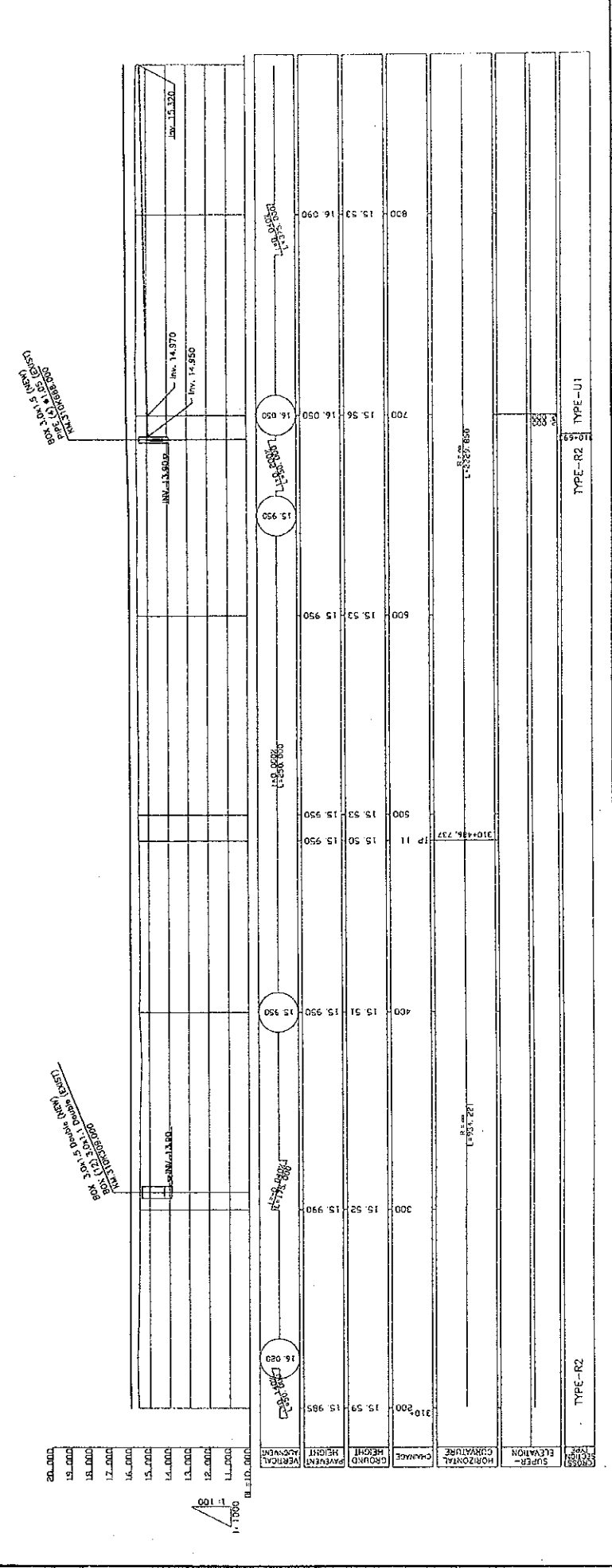
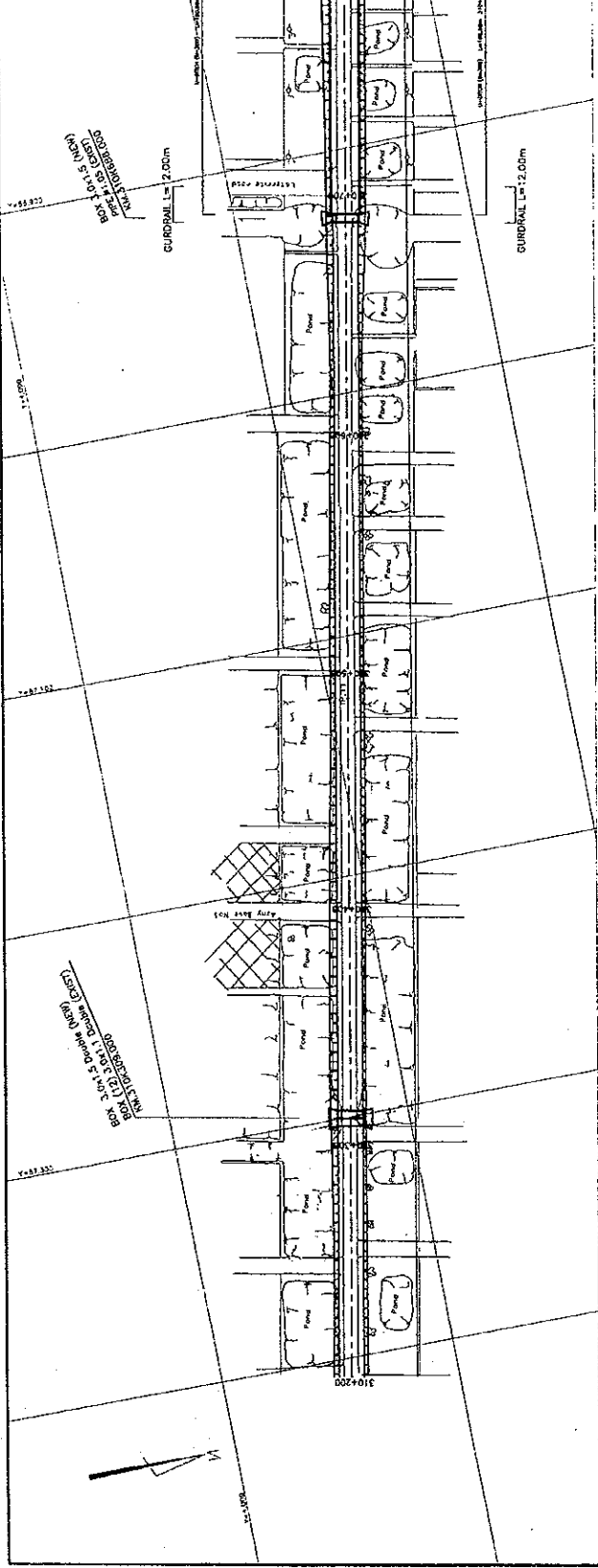
Vertical Curve Data Table

| Station (m) | Elevation (m) |
|-------------|---------------|
| 108+000 | 15.46 |
| 108+100 | 15.950 |
| 108+200 | 15.45 |
| 108+300 | 15.62 |
| 108+400 | 15.52 |
| 108+500 | 15.41 |
| 108+600 | 15.930 |
| 108+700 | 15.43 |
| 108+800 | 15.930 |
| 108+900 | 15.53 |
| 109+000 | 15.930 |

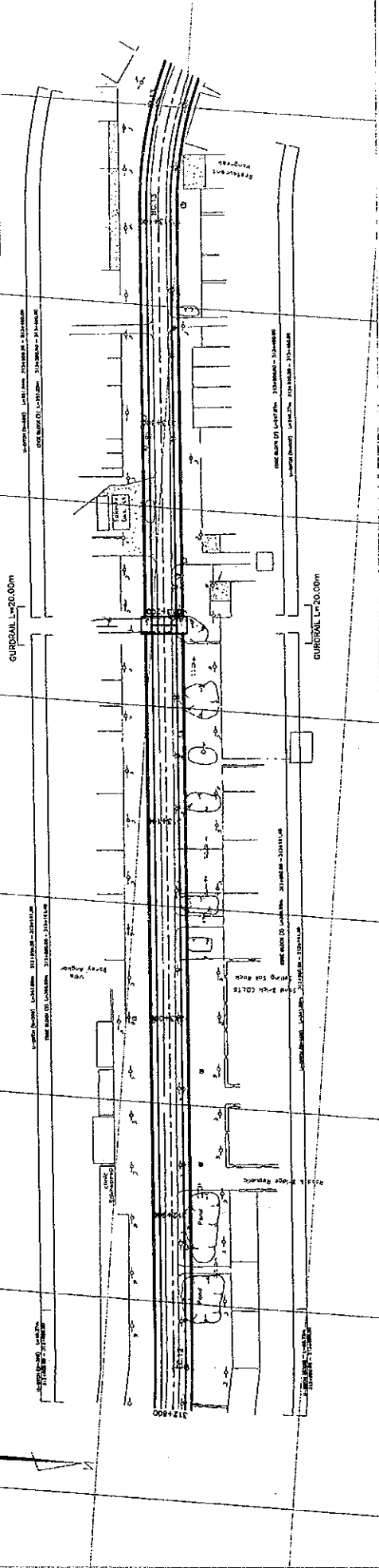
Profile Data Table

| Station (m) | Ground Elevation (m) | Pavement Height (m) | Horizontal Curvature | Superelevation |
|-------------|----------------------|---------------------|----------------------|----------------|
| 108+000 | 15.46 | 15.950 | | |
| 108+100 | 15.48 | 15.950 | | |
| 108+200 | 15.45 | 15.950 | | |
| 108+300 | 15.62 | 15.950 | | |
| 108+400 | 15.52 | 15.950 | | |
| 108+500 | 15.41 | 15.950 | | |
| 108+600 | 15.43 | 15.930 | | |
| 108+700 | 15.43 | 15.930 | | |
| 108+800 | 15.53 | 15.950 | | |
| 108+900 | 15.53 | 15.950 | | |
| 109+000 | 15.930 | 15.930 | | |

BASIC DESIGN STUDY
 THE PROJECT FOR THE IMPROVEMENT
 NATIONAL HIGHWAY ROUTE 5
 SIDE RAMP SECTION
 THE KINGDOM OF CAMBODIA
 JAPAN INTERNATIONAL COOPERATION AGENCY
 TECHNICAL ASSISTANCE PROGRAM
 DRAWING TITLE : PLAN PROFILE OF ROAD
 DRAWING NO. : KM 310+200 - KM 310+800 (20/28)
 SCALE : H=1:1000 DATE : JULY 1989 DRAWING NO. :
 V=1:100 P=20



BASIC DESIGN STUDY
 THE PROJECT FOR THE IMPROVEMENT
 NATIONAL HIGHWAY ROUTE 6
 SIEM REAP SECTION
 THE PROVINCE OF CAMBODIA
 JAPAN INTERNATIONAL COOPERATION AGENCY
 KAJIUMA & ENGINEERS INTERNATIONAL
 DRAWING TITLE : PLAN&PROFILE OF ROAD
 (KM.312+000 - KM.313+000) (24/28)
 SCALE : 1:1000
 DATE : 1999
 DRAWING NO. : 1024



BOX-4.0x1.2 Double (NEW)
 BOX (15) 4.0x1.2 Double (EXIST)
 RW:3.3x136.000

