Appendix 6

CONSTRUCTION QUANTITIES BY LINK

TABLE 6A-1 CONSTRUCTION QUANTITIES BY LINK

DESCRIPTION	UNIT OF Q'TY	ROAD LINK NUMBER										
		3	6	7	8	10	11	12	15	16	17	18
LINK LENGTH	km	12.5	18.0	17.0	13.2	10.0	24.0	20.5	15.7	21.0	18.0	5.3
WORK ITEMS												
Clearing & Grubbing	ha	-	-	68	-	32	-	82	-	-	30	-
Soil Excavation	m^3	38,100	24,000	40,800	146,900	56,100	101,500	99,800	44,300	64,800	64,300	-
Rock Excavation	m^3	-	-	2,200	-	6,400	-	11,600	-	-	10,700	-
Embankment	m^3	94,200	116,600	209,700	163,900	121,700	142,700	201,100	51,100	102,600	202,800	4,500
Selected Fill	m^3	9,700	19,200	36,700	14,000	21,600	23,200	44,300	17,000	16,700	36,000	500
Subbase/1	m^3	13,100	22,400	34,000	15,800	20,000	27,100	41,000	19,600	22,300	34,000	2,600
Shoulder/2	m^3	6,000	8,600	8,200	6,200	4,800	11,400	9,800	7,500	10,300	8,600	2,200
Base/2	m^3	11,400	16,500	15,600	10,700	9,100	19,200	18,800	14,400	19,600	16,400	4,100
Prime & SBST/2	m^2	72,100	104,300	98,600	71,600	57,800	121,400	118,900	90,900	124,100	104,000	26,000
Pipe Culvert	m	80	85	720	135	270	380	540	420	285	700	5
Box Culvert	m	25	50	90	-	55	-	195	-	25	25	-
Long Span Bridge	m	-	-	-	90	-	-	-	-	65	-	-
Short Span Bridge	m	-	-	-	125	40	265	-	25	40	65	15
LAND ACQUISITION	ha	-	-	68	-	40	-	82	-	-	60	-

Remarks: /1 To be understood as laterite surfacing in case that F5 Standard is applied.
/2 To be excluded in case that F5 Standard is applied.

Table 6A-1 CONSTRUCTION QUANTITIES BY LINK (continued)

DESCRIPTION	UNIT OF Q'TY	ROAD LINK NUMBER										
		19	20	22	23	25	27	28	29	30	33	35
LINK LENGTH	km	14.2	12.8	14.0	4.4	6.0	4.5	15.5	9.0	10.0	6.5	8.5
WORK ITEMS												
Clearing & Grubbing	ha	44	-	-	-	-	-	50	-	12	-	-
Soil Excavation	m^3	51,900	159,500	40,500	800	-	-	110,300	50,300	163,400	27,200	40,900
Rock Excavation	m^3	5,000	-	-	-	-	-	15,500	-	13,800	-	-
Embankment	m^3	162,000	178,900	50,400	5,900	6,900	4,900	184,900	48,700	175,300	39,000	58,500
Selected Fill	m^3	29,600	14,500	5,700	700	700	500	33,400	5,500	21,600	4,900	7,300
Subbase/1	m^3	27,400	16,400	11,000	2,600	3,400	2,500	30,900	7,600	20,000	6,300	9,500
Shoulder/2	m^3	6,600	6,000	7,000	2,000	2,900	2,100	7,400	3,700	4,800	3,100	4,300
Base/2	m^3	12,500	11,500	13,300	3,900	5,400	4,100	14,200	7,000	9,200	5,900	8,200
Prime & SBST/2	m^2	79,500	72,900	84,400	24,600	34,400	25,700	89,700	44,300	58,000	37,700	52,200
Pipe Culvert	m	135	215	280	220	95	5	185	5	260	75	115
Box Culvert	m	105	25	25	-	-	-	40	-	40	5	10
Long Span Bridge	m	-	-	-	-	-	-	-	90	-	-	-
Short Span Bridge	m	-	165	150	60	70	65	30	125	-	-	-
LAND ACQUISITION	ha	55	-	-	-	-	-	62	-	40	-	-

Remarks: /1 To be understood as laterite surfacing in case that F5 Standard is applied.
/2 To be excluded in case that F5 Standard is applied.

Table 6A-1 CONSTRUCTION QUANTITIES BY LINK (continued)

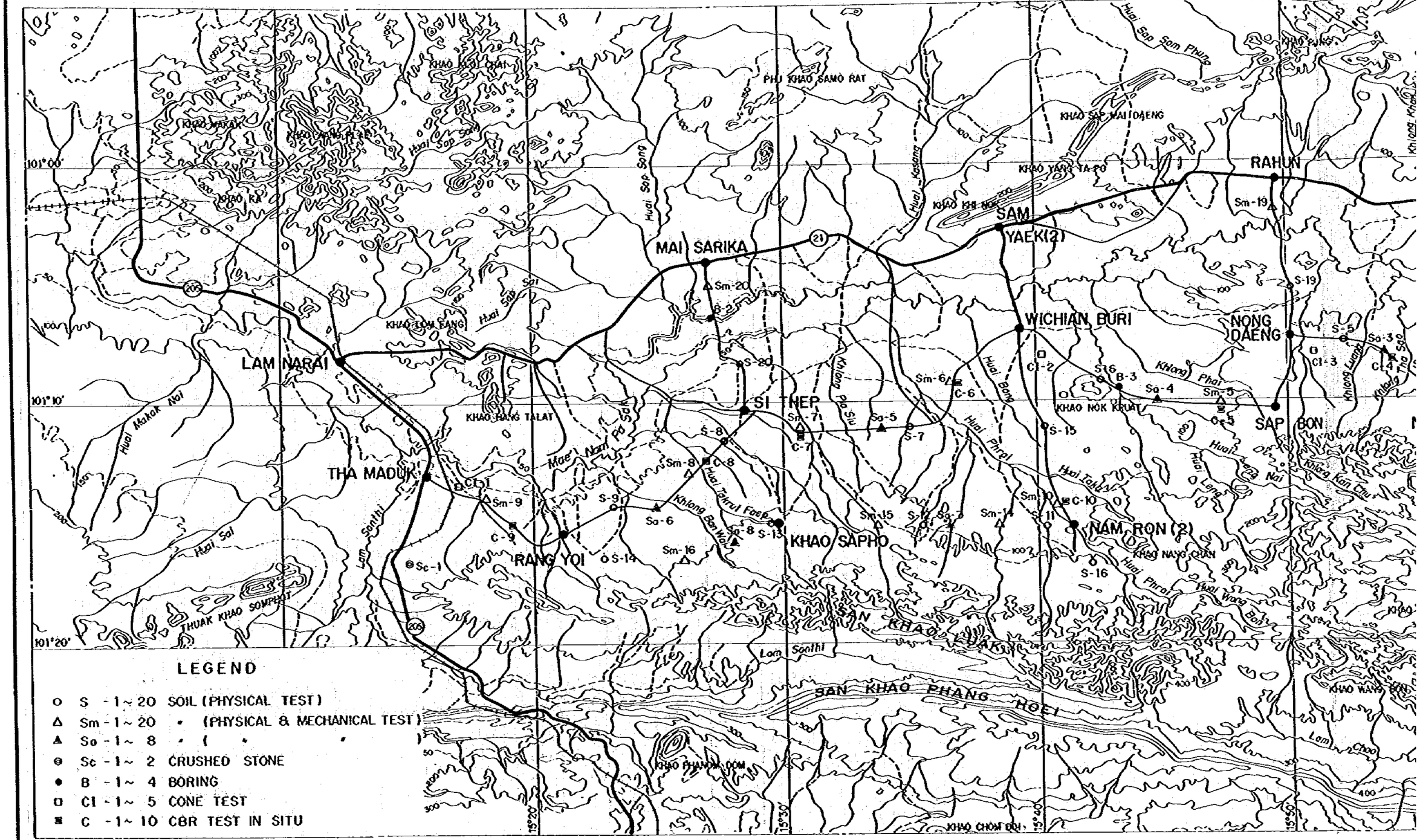
DESCRIPTION	UNIT OF Q'TY	ROAD LINK NUMBER								
		36	37	40	10*	15*	18*	27*	36*	40*
LINK LENGTH	km	8.0	11.7	11.0	2.0	4.5	2.5	4.3	4.5	3.0
WORK ITEMS										
Clearing & Grubbing	ha	-	-	-	6	14	8	13	15	10
Soil Excavation	m^3	150,300	49,000	284,200	11,200	25,200	14,000	24,100	25,200	16,800
Rock Excavation	m^3	-	-	-	1,300	2,900	1,600	2,800	2,900	1,900
Embankment	m^3	142,200	71,500	264,100	24,300	54,800	30,400	52,300	54,800	36,500
Selected Fill	m^3	10,300	9,000	22,300	4,300	9,700	5,400	9,300	9,700	6,500
Subbase/1	m^3	10,300	11,600	21,100	4,000	9,000	5,000	8,600	9,000	6,000
Shoulder/2	m^3	2,200	5,600	5,600	1,000	2,200	1,200	2,100	2,200	1,400
Base/2	m^3	4,200	10,700	10,300	1,800	4,100	2,300	3,900	4,100	2,700
Prime & SBST/2	m^2	26,400	67,900	65,400	11,600	26,000	14,400	24,800	26,000	17,300
Pipe Culvert	m	40	140	90	50	120	70	120	120	80
Box Culvert	m	-	15	-	10	25	15	25	25	20
Long Span Bridge	m	110	-	-	-	-	-	-	-	-
Short Span Bridge	m	145	-	230	-	20	20	20	20	20
LAND ACQUISITION	ha	-	-	-	8	18	10	17	18	12

Remarks: /1 To be understood as laterite surfacing in case that F5 Standard is applied.
/2 To be excluded in case that F5 Standard is applied.

Appendix 7

SOIL AND MATERIAL INVESTIGATION

FIGURE 7A-1 LOCATION OF SOIL AND MATERI



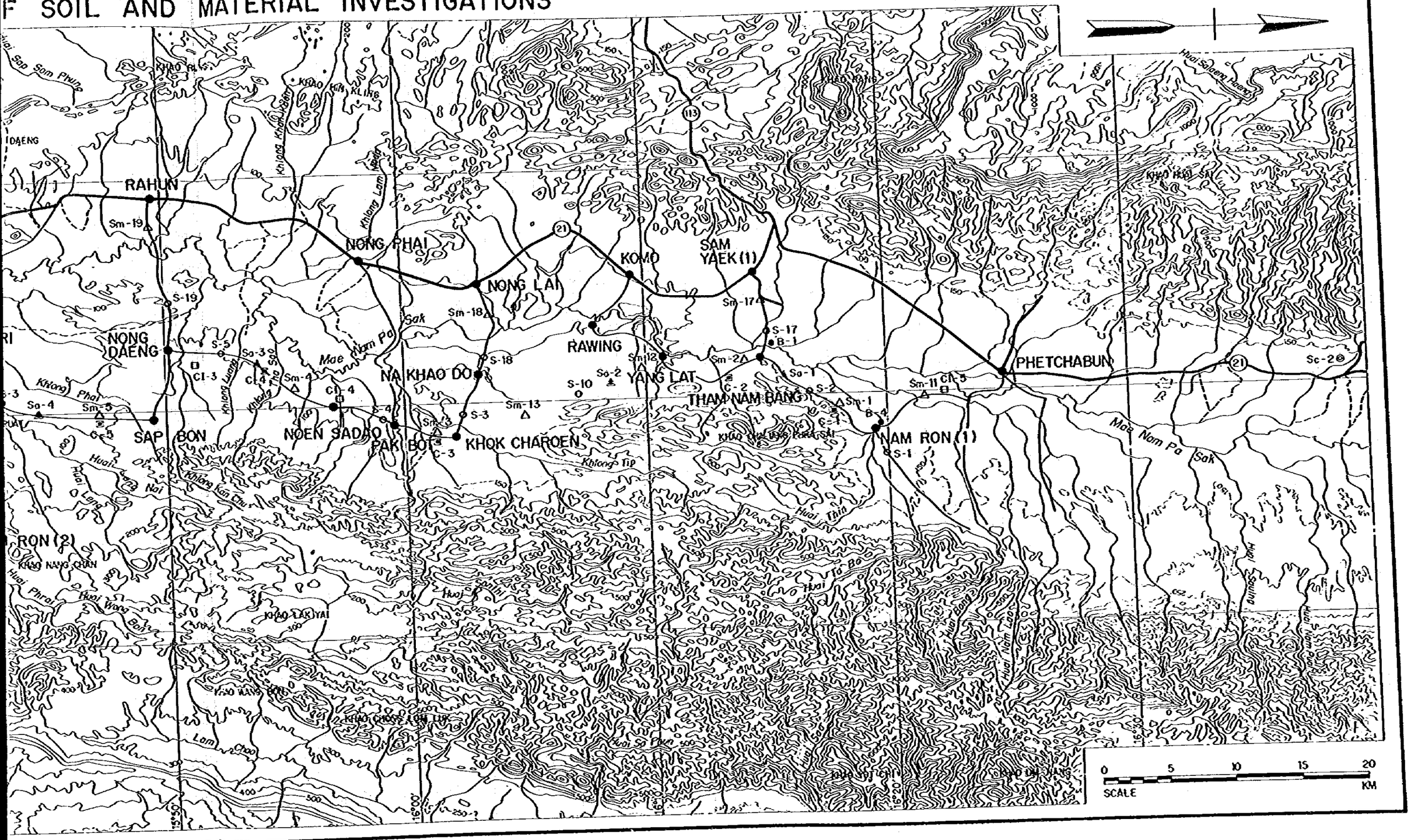
LEGEND

○	S -1~20	SOIL (PHYSICAL TEST)
△	Sm-1~20	" (PHYSICAL & MECHANICAL TEST)
▲	Sa-1~ 8	" (" "
◎	Sc-1~ 2	CRUSHED STONE
●	B -1~ 4	BORING
□	Cl-1~ 5	CONE TEST
■	C -1~10	CBR TEST IN SITU

F SOIL AND MATERIAL INVESTIGATIONS

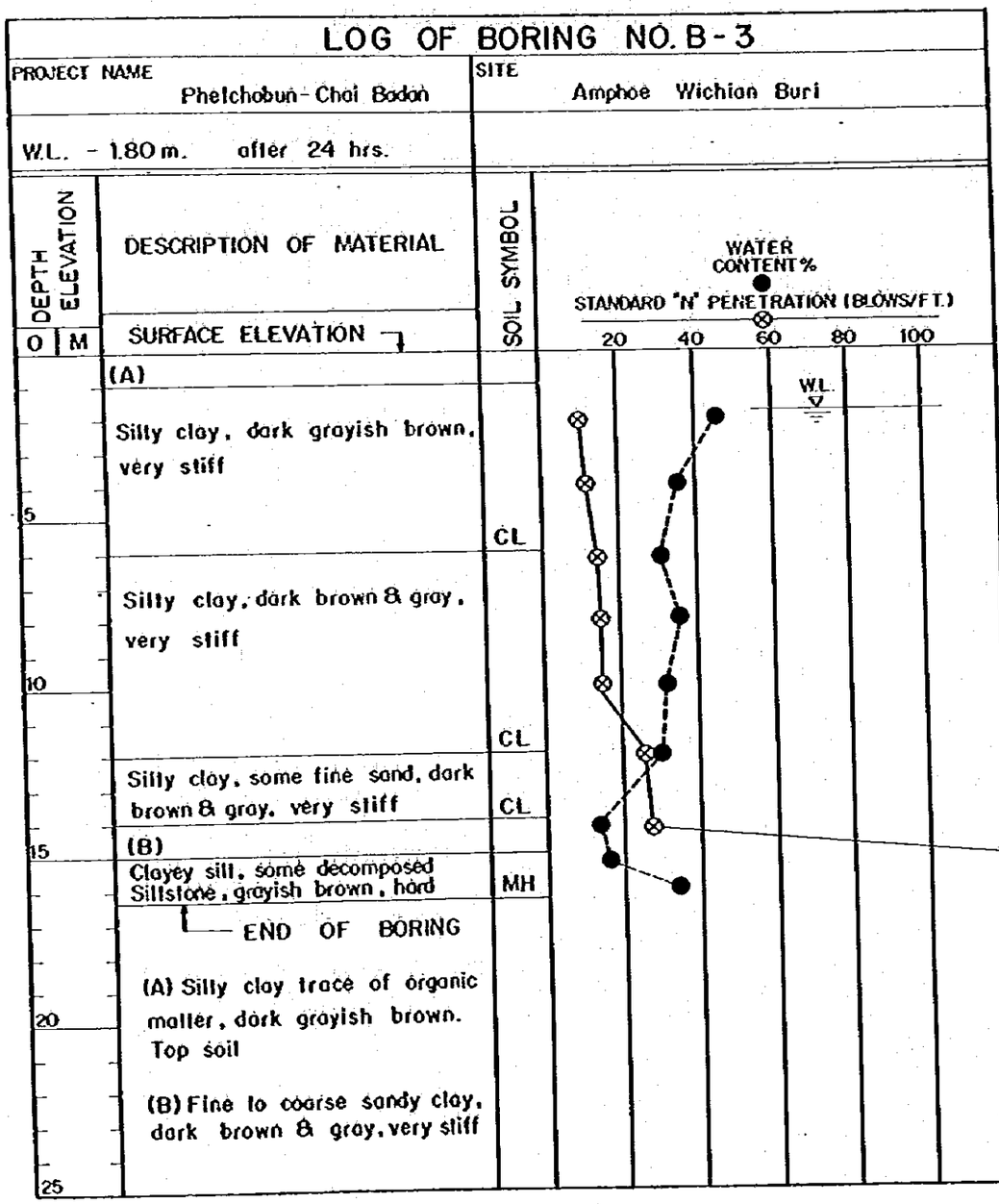
FIGURE 7A - 1

LOCATION OF SOIL AND MATERIAL INVESTIGATIONS



PIGURE 7A - 2

Figure 7A-2 LOG OF BORING



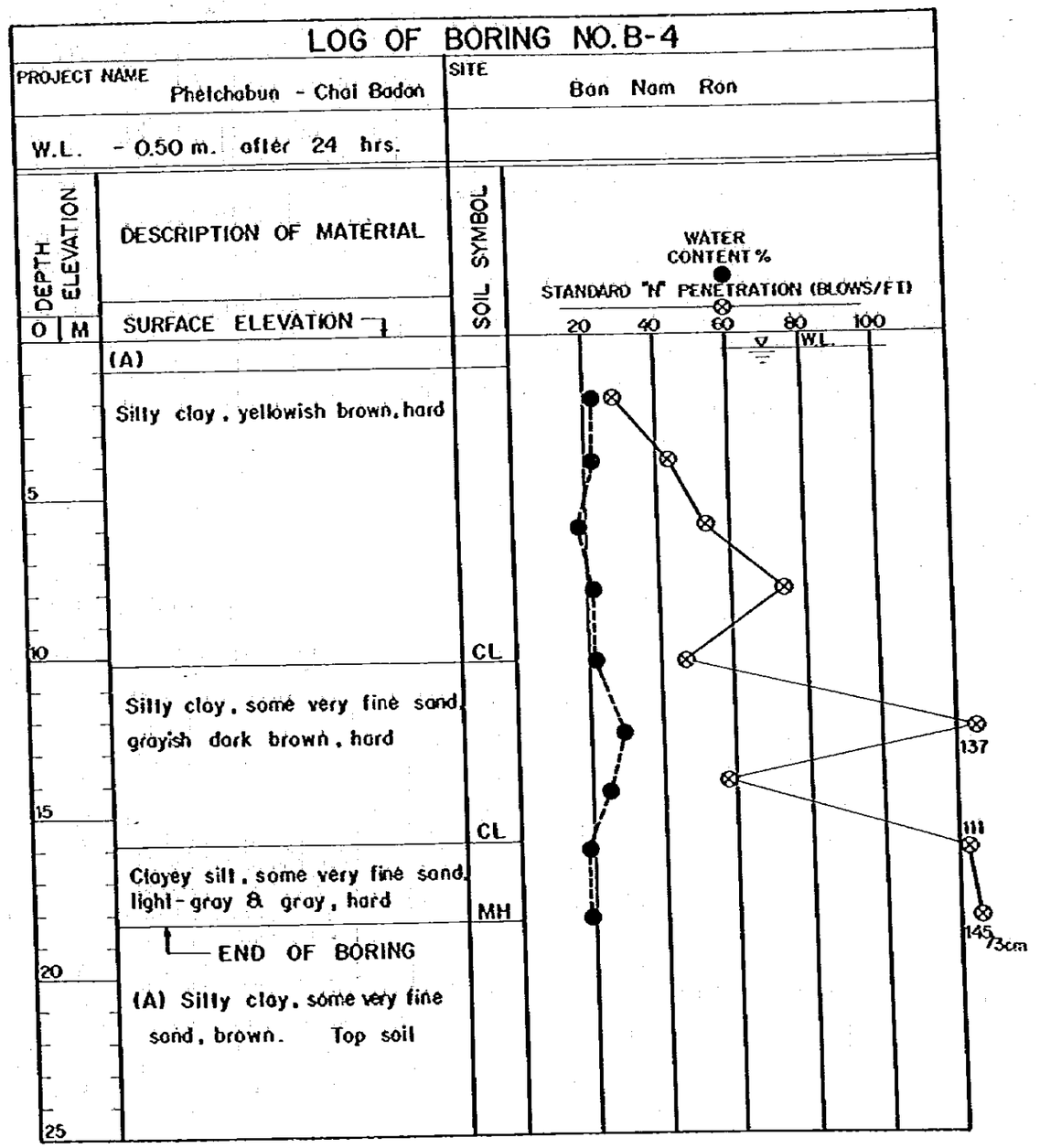
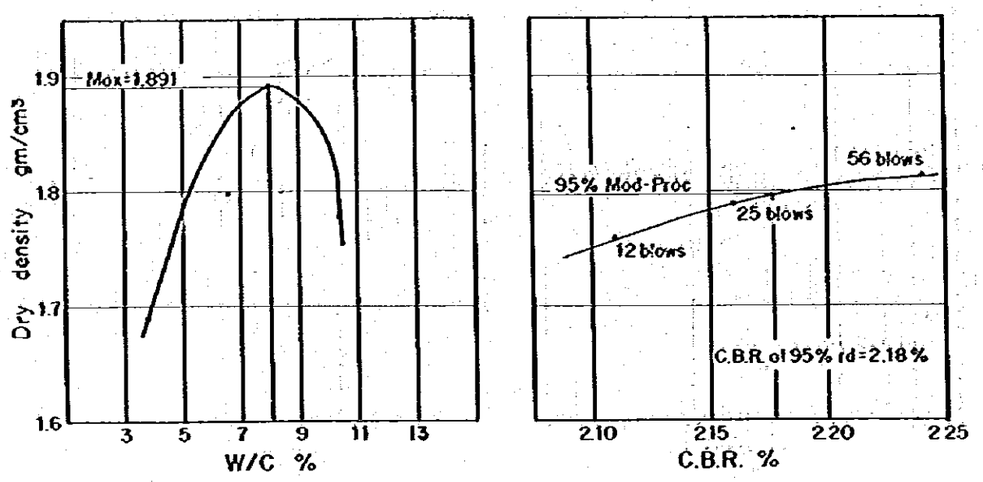
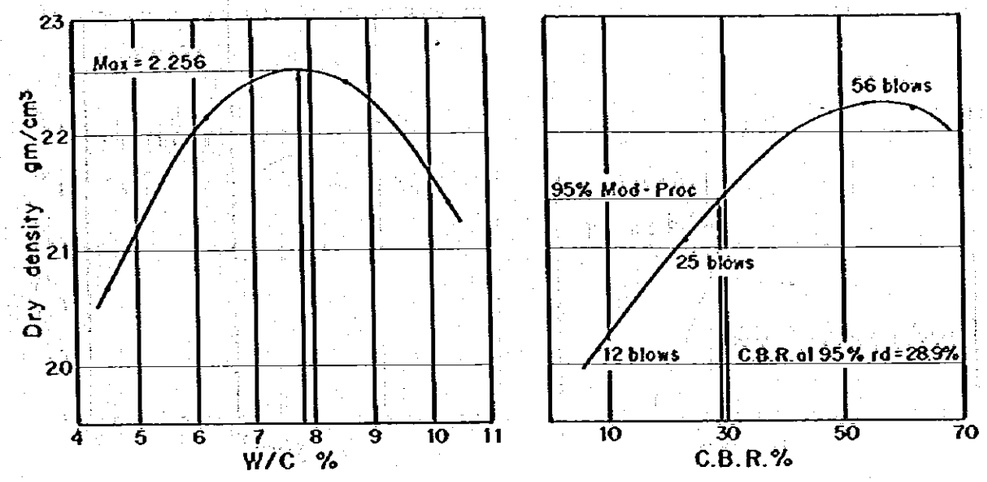


Figure 7A-3 RESULTS OF C.B.R. TEST (1)

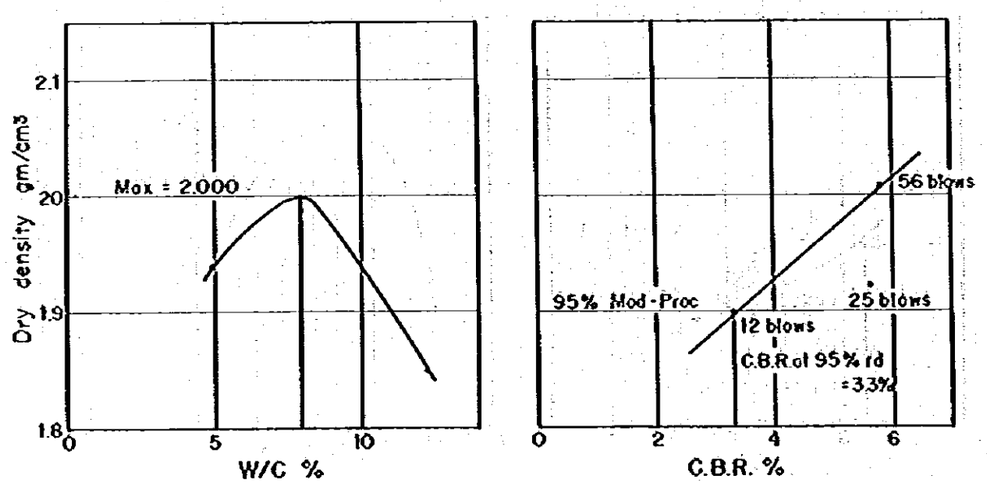
LINK NO.3
Sample NO.Sm-9



LINK NO.6
Sample NO.Sm-8



LINK NO.6
Sample NO.Sa-6



LINK NO.11
Sample NO.Sm-7

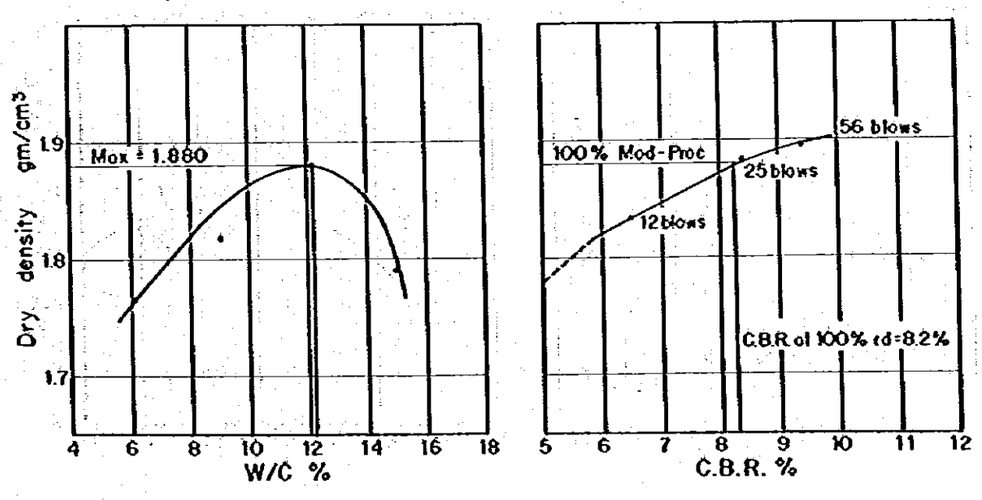
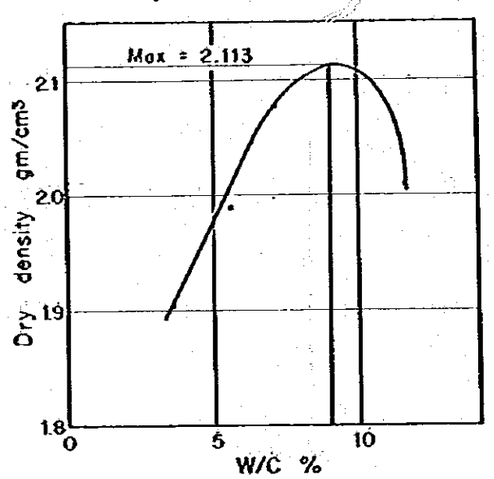
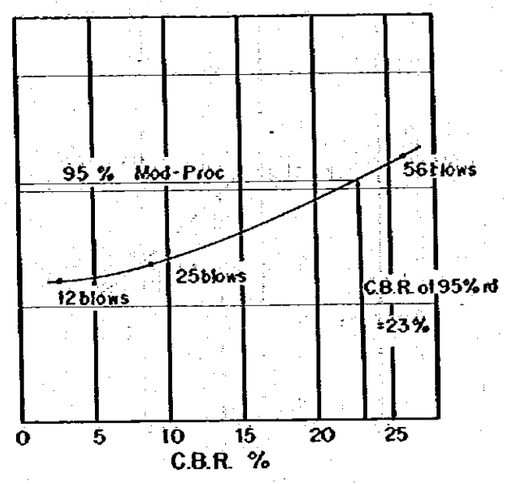


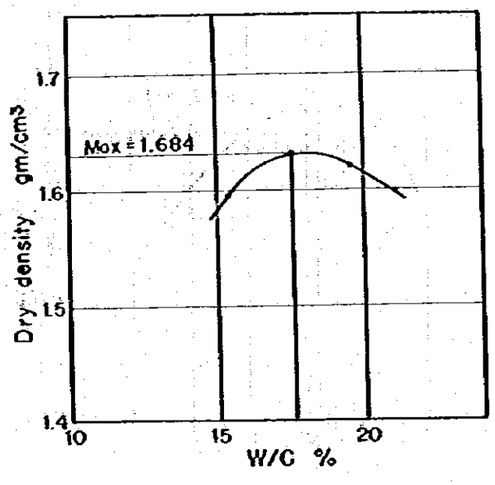
Figure 7A-3 RESULTS OF C.B.R. TEST (2)

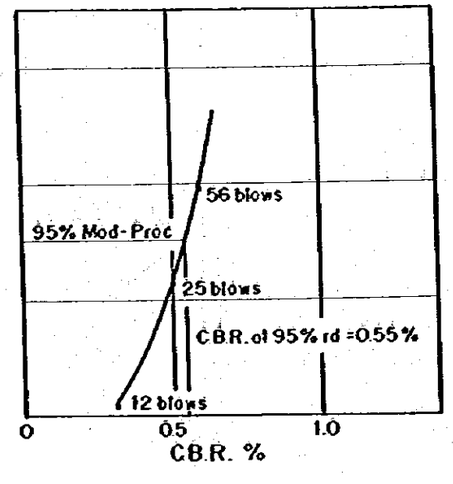
LINK NO.11
Sample NO.Sa-5



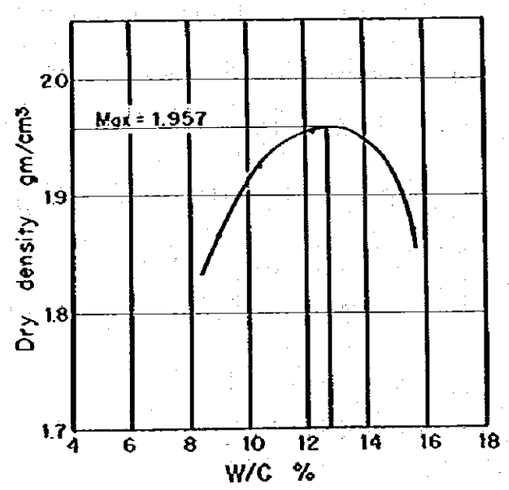


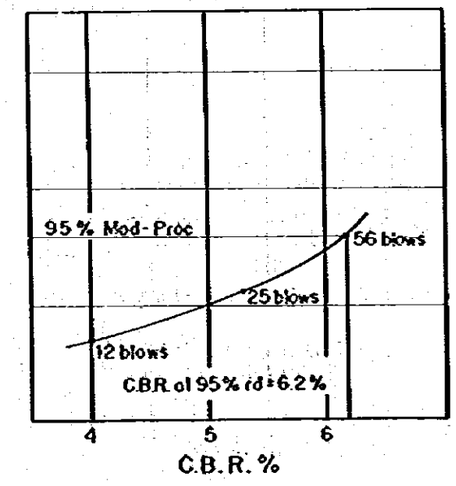
LINK NO.16
Sample NO.Sa-4



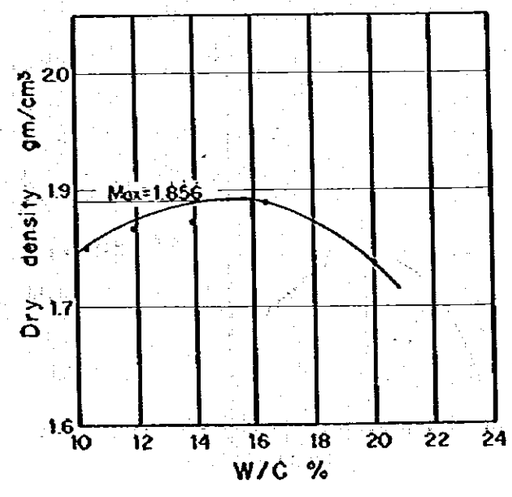


LINK NO.11
Sample NO.Sm-6





LINK NO.16
Sample NO.Sm-5



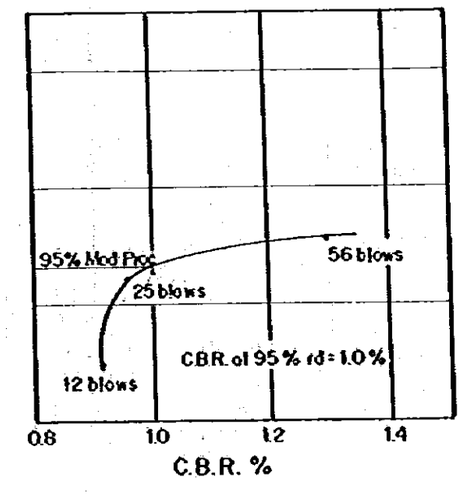
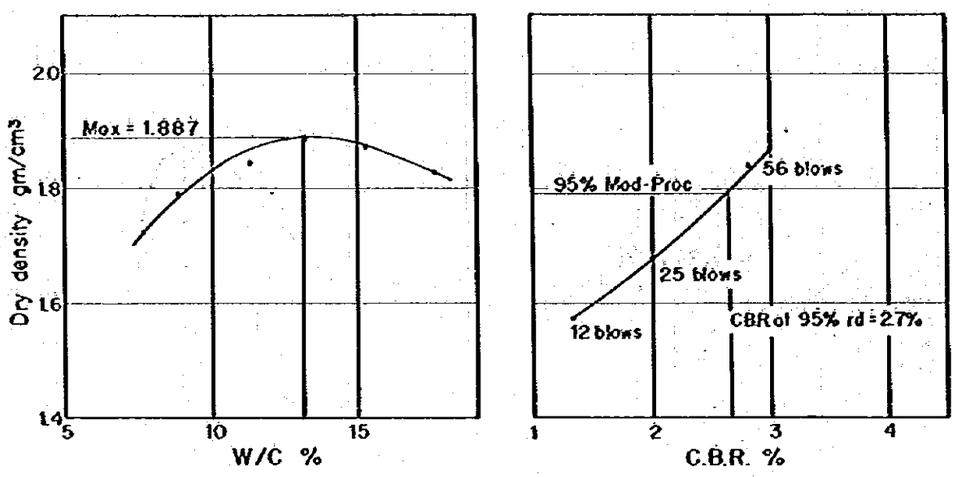
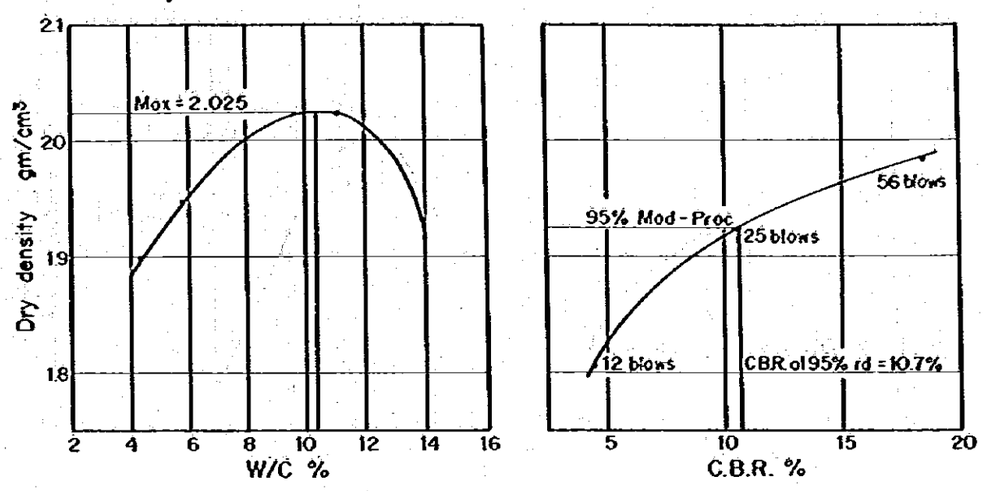


Figure 7A-3 RESULTS OF C.B.R. TEST (3)

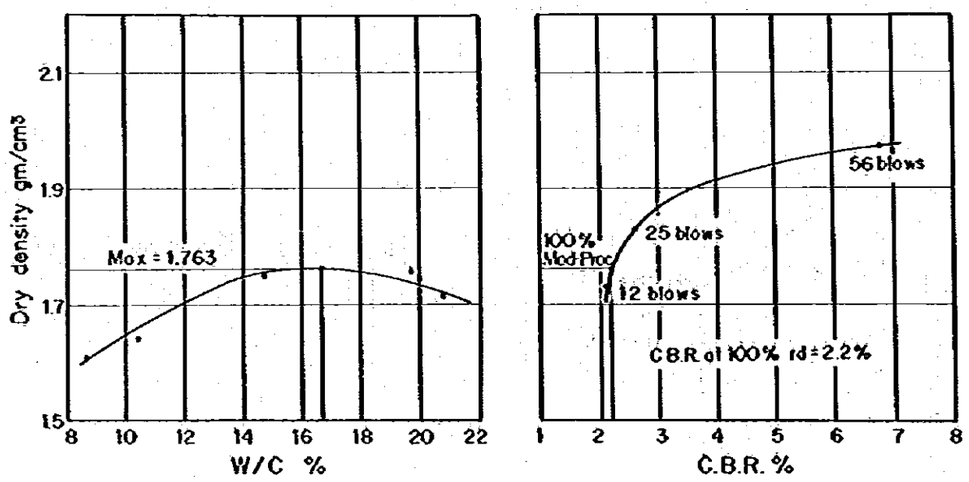
LINK NO.22
Sample NO.Sa-3



LINK NO.25
Sample NO.Sm-3



LINK NO.22
Sample NO.Sm-4



LINK NO.28
Sample NO.Sm-13

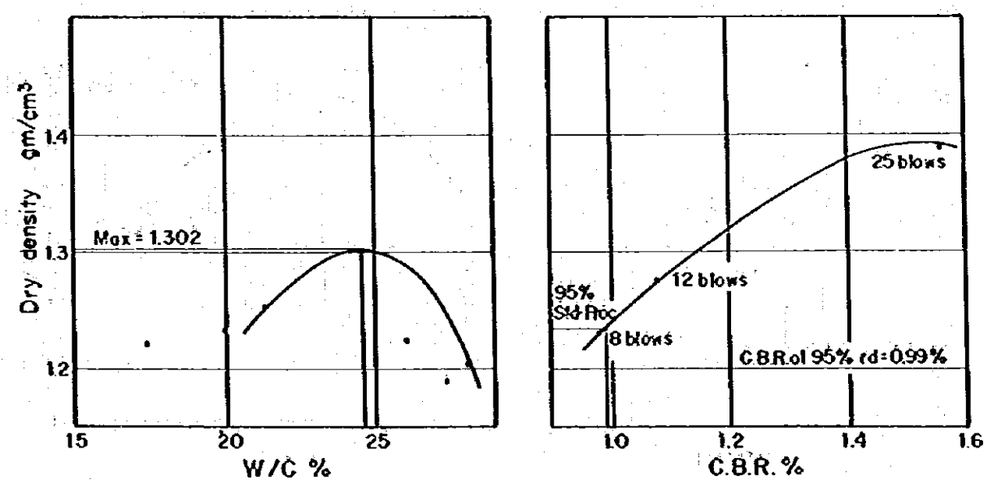
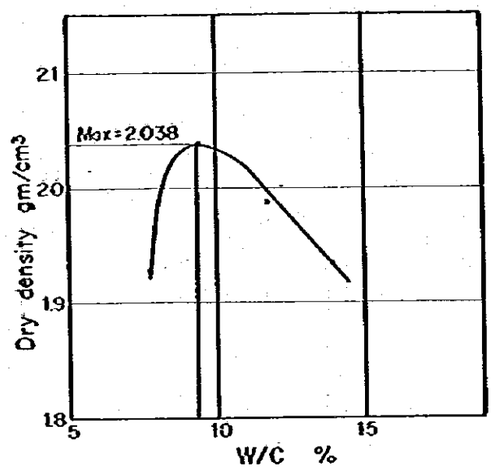
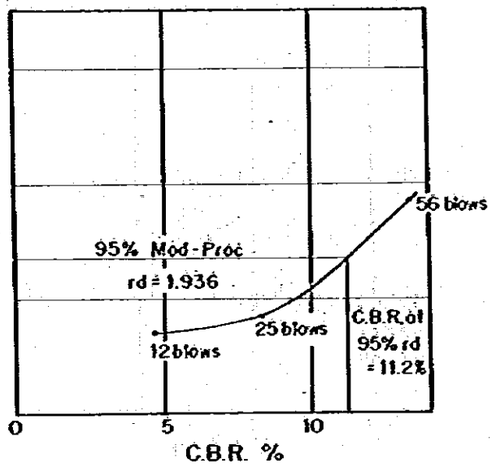


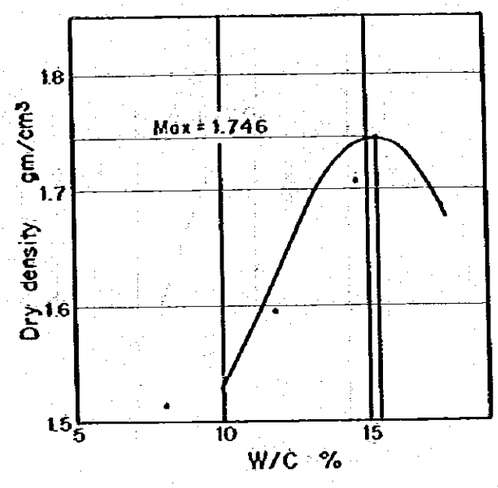
Figure 7A-3 RESULTS OF C.B.R. TEST (4)

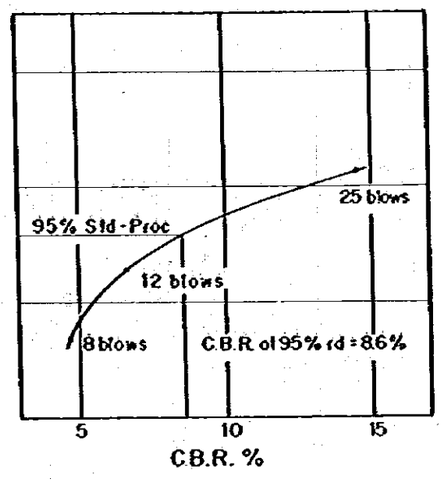
LINK NO.28
Sample NO.Sa-2



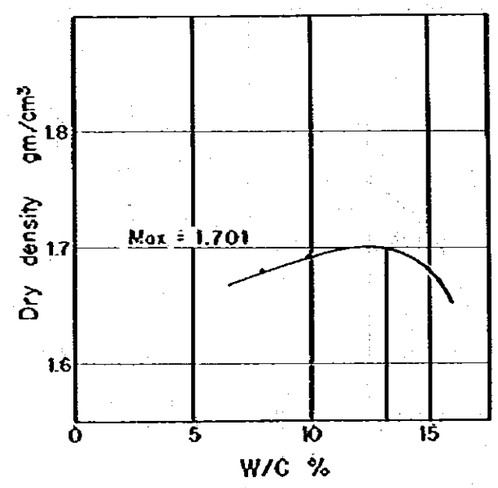


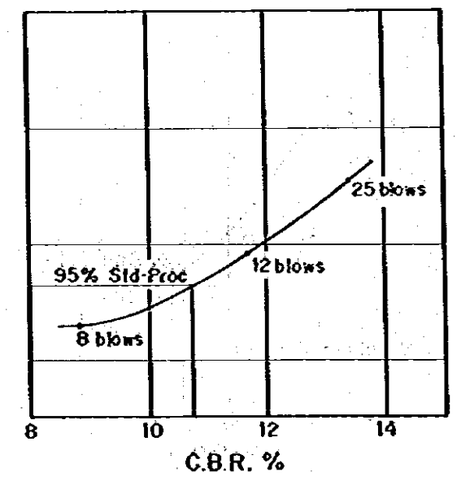
LINK NO.35
Sample NO.Sm-2



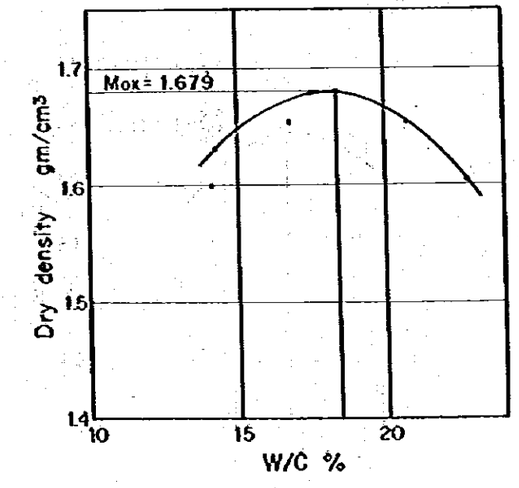


LINK NO.28
Sample NO.Sm-12





LINK NO.37
Sample NO.Sa-1



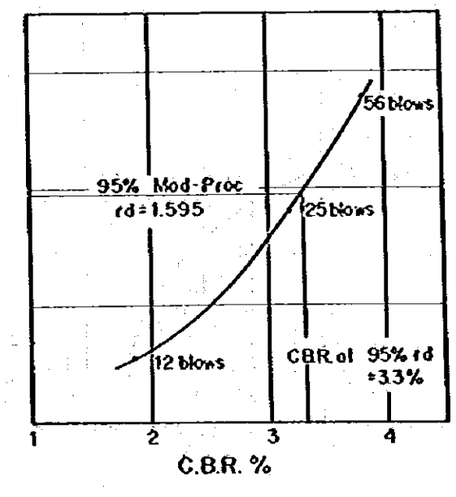
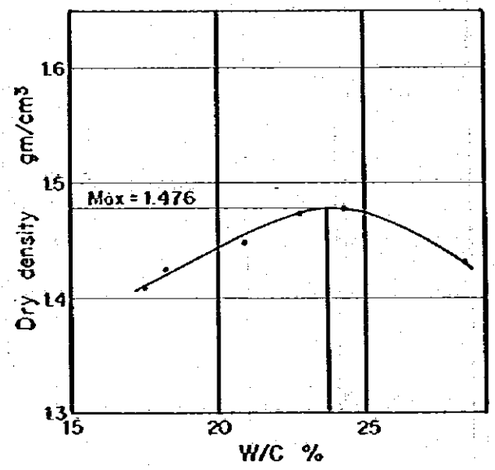
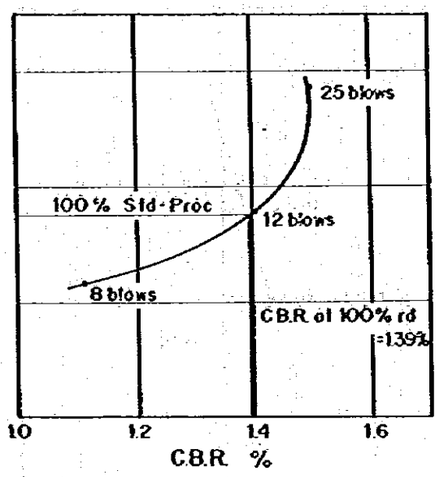


Figure 7A-3 RESULTS OF C.B.R. TEST (5)

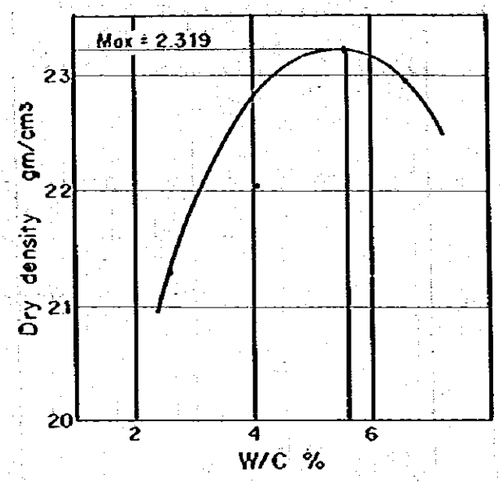
LINK NO.37

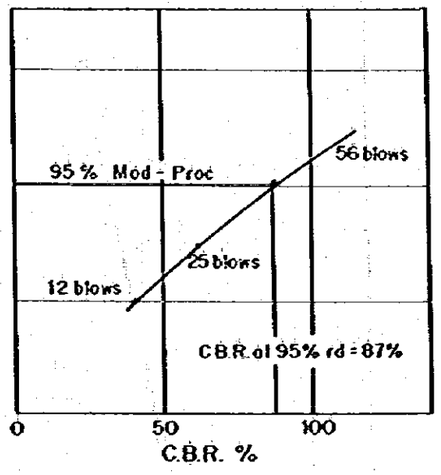
Sample NO.Sm-1





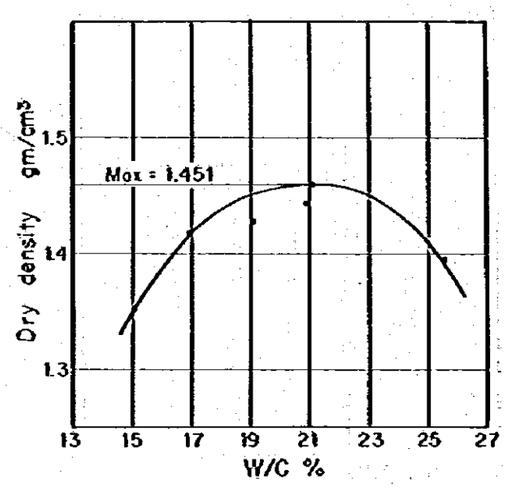
Sample NO.Sc-1

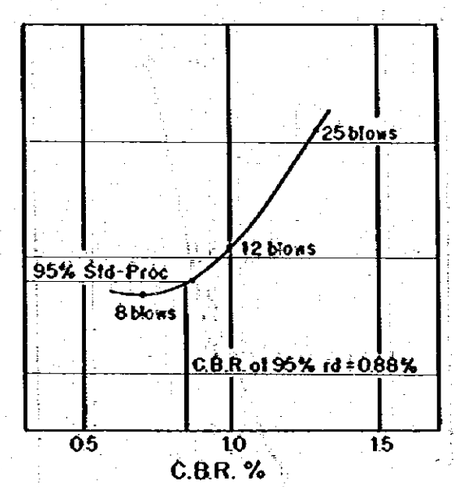




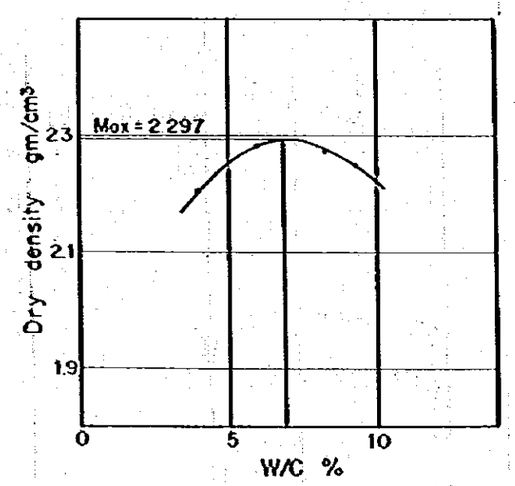
LINK NO.40

Sample NO.Sm-11





Sample NO.Sc-2



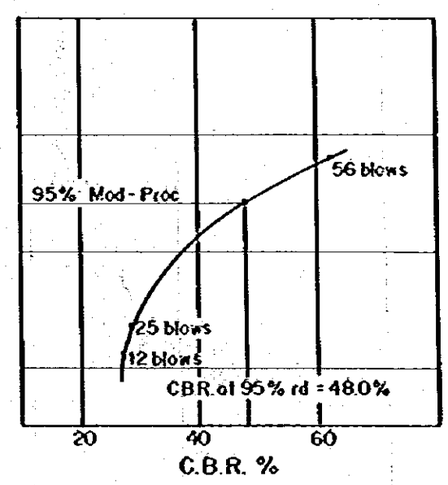
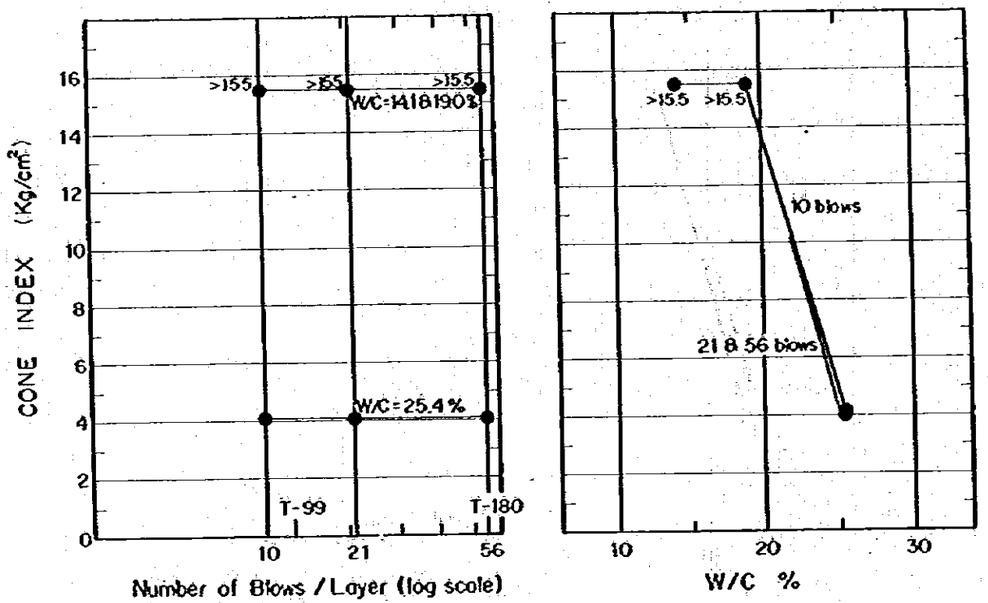


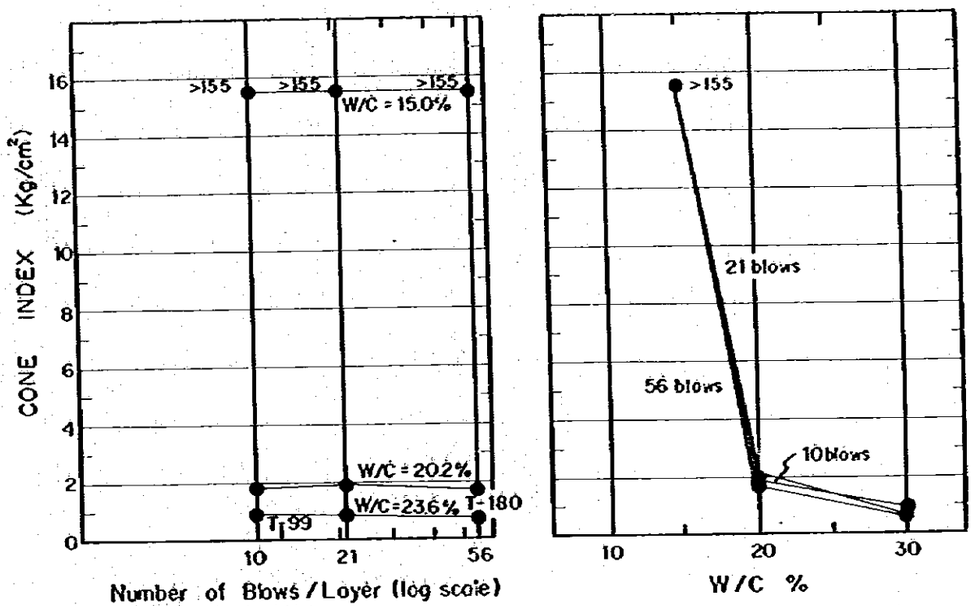
FIGURE 7A - 4
1 of 2

Figure 7A-4 RESULTS OF CONE TEST (1)

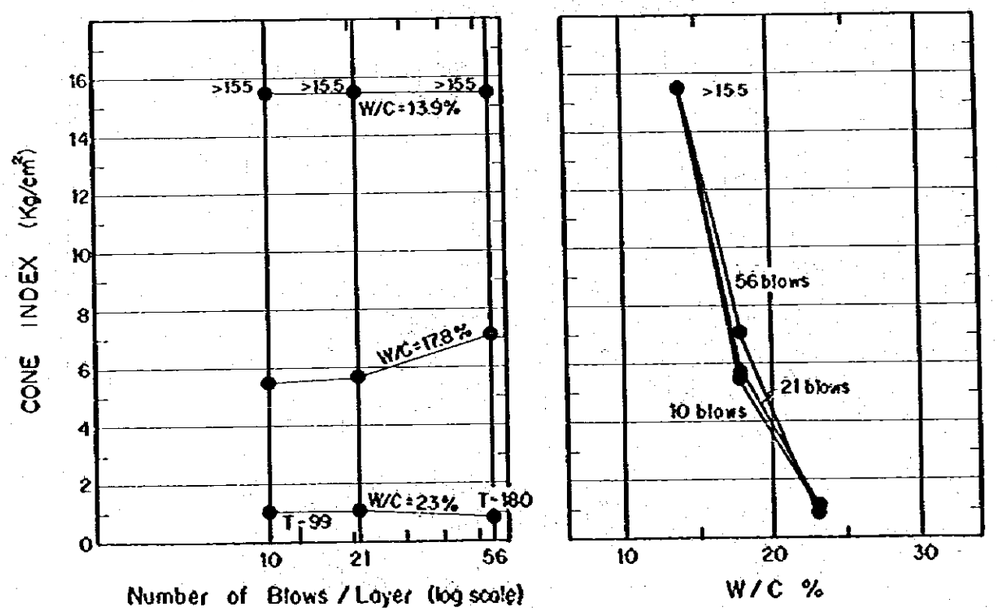
LINK NO.3
Sample NO.CI-1
Natural Water Content 20.7%
Soil Description Dark gray silty clay



LINK NO.22
Sample NO.CI-3
Natural Water Content 21.2%
Soil Description Li-gray and brown silty clay



LINK NO.16
Sample NO.CI-2
Natural Water Content 19.0 %
Soil Description Gray and brown silty clay



LINK NO. 23
Sample NO.CI-4
Natural Water Content 39.8%
Soil Description Yellowish brown clay

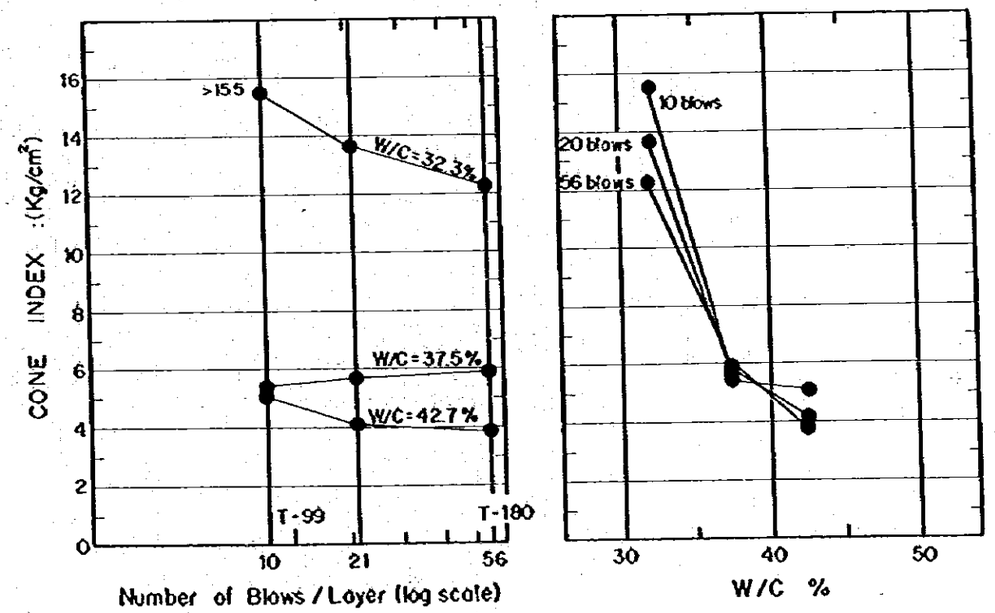


Figure 7A-4 RESULTS OF CONE TEST (2)

LINK NO. 40
Sample NO.C1-5
Natural Water Content 13.5%
Soil Description Brown silty clay

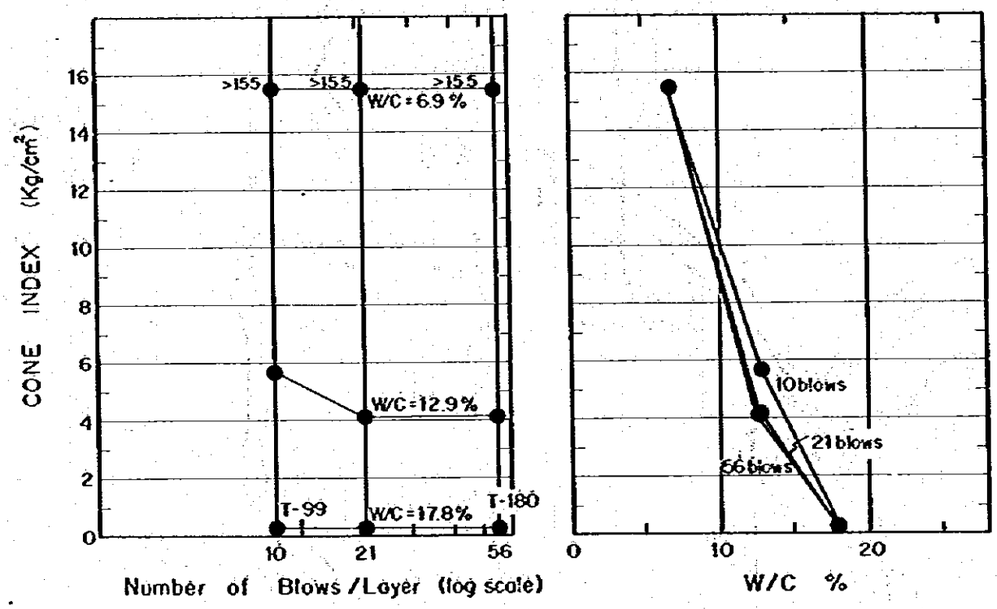
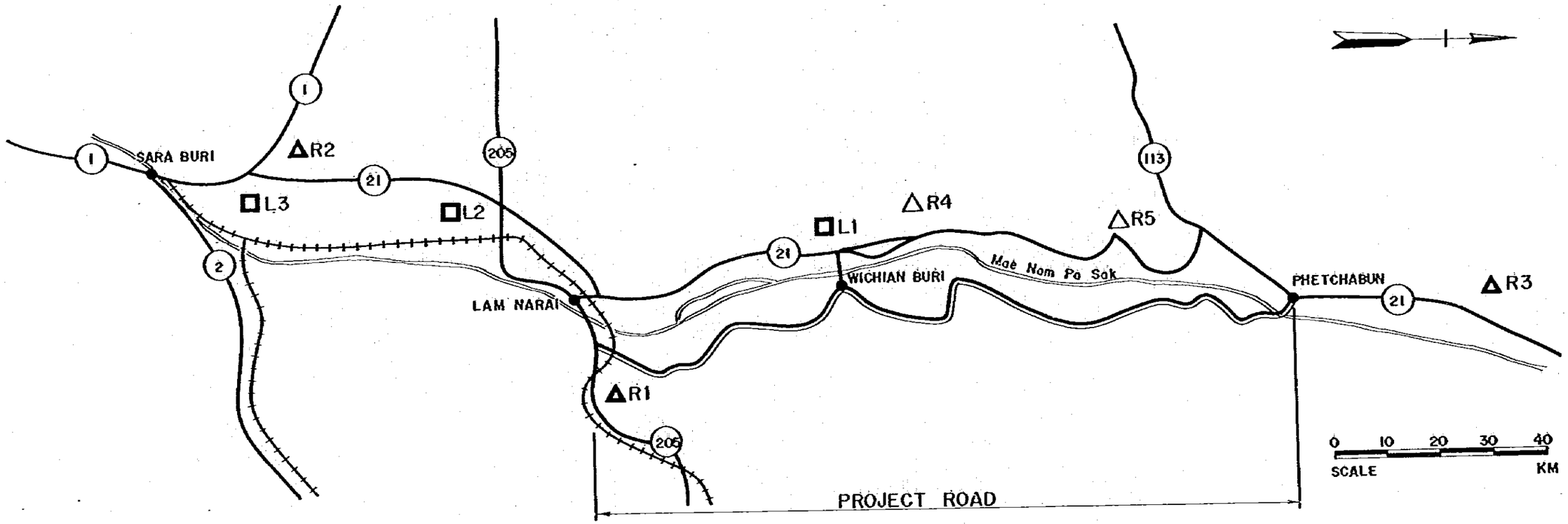


FIGURE 7A-5 LATERITE AND ROCK MATERIALS



MATERIAL	SOURCE OF MATERIAL			SIEVE ANALYSIS (%)									ATTERBERG LIMIT (%)		CBR	REMARKS
	ROUTE NO.	LOCATION	OFFSET (KM)	2"	1"	1/2"	3/4"	3/8"	#4	#10	#40	200	LL	PI	(%)	
L1	21	46KM FROM LAM NARAI	2.0	100	90.3	74.1	85.5	63.6	30.0	20.2	14.6	11.9	25.0	4.7	86.0	
L2	21	41KM FROM SARA BURI	4.0	100	99.4	87.5	97.1	74.8	33.3	24.8	20.6	11.0	21.9	3.6	36.5	
L3	21	6KM FROM SARA BURI	0.5	100	97.8	84.2	93.6	75.7	51.8	40.0	26.0	20.3	26.1	6.9	22.4	
R1	205	20KM FROM LAM NARAI	1.0	ABRASION TEST 26.8 %											87.0	BAN KHAO TAMBON
R2	1	20KM FROM SARA BURI	—	ABRASION TEST 29.1 %												
R3	21	30KM FROM PHETCHABUN	4.0												48.0	BAN TAM PA
R4	21	20KM FROM WICHIAN BURI	4.0													
R5	21	70KM FROM WICHIAN BURI	2.0													KHAO CHON THO

L: LATERITE
R: ROCK QUARRY

Appendix 8

HYDROLOGICAL STUDY

Appendix 8

HYDROLOGICAL STUDY

8-1 UNIT HYDROGRAPH METHOD

The Unit Hydrograph Method was firstly advocated by Sherman. This method bases on the following three assumptions:

a) In the same river basin, the time between the beginning of flood and the occurrence of peak discharge and duration of flood discharge are constant regardless of the rainfall intensity.

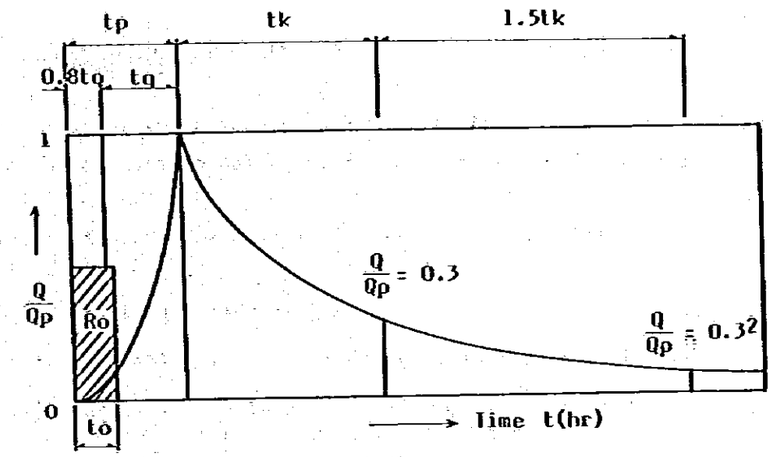
b) In the same river basin, the time proportion corresponding to the changes of discharge is kept constant regardless of the intensity of the effective rainfall.

c) The discharge by the effective rainfall in long duration can be calculated by the sum of discharges corresponding to the rainfalls in short divided durations.

In other words, the factors which specify the form of unit hydrograph are the characteristics of the respective river basin rather than those of rainfall.

Many calculation methods have been studied to formulate the unit hydrograph which shows the relationship between unit discharge and unit effective rainfall occurred in unit time. The calculation method used in the study was Nakayasu's Method, which is explained herein.

The unit hydrograph is considered to have the form shown in the following figure:



The increasing and decreasing curves in the figure are expressed by the following equations:

Increasing Curve $$\frac{Q}{Qp} = \left(\frac{t}{tp}\right)^{2.4} \quad \cdots\cdots (1)$$

Decreasing Curve $$\frac{Q}{Qp} = 0.3^{\frac{t-tp}{tk}} \quad \left(1 > \frac{Q}{Qp} \geqq 0.3\right) \cdots\cdots (2)$$

$$\frac{Q}{0.3Qp} = 0.3^{\frac{t-(tp+tk)}{1.5tk}} \quad \left(0.3 > \frac{Q}{Qp} \geqq 0.3^2\right) \cdots (3)$$

$$\frac{Q}{0.3^2 Q_p} = 0.3^{\frac{t-(tp+tk+1.5tk)}{2.0tk}} \quad \left(0.3^2 > \frac{Q}{Qp}\right) \cdots (4)$$

Where, Qp: Peak discharge by the effective rainfall Ro in a time of to (m^3/sec)

tp: Time in which the discharge increases from zero to the peak (hr)

tk: Time in which the discharge decreases from Qp to 0.3Qp (hr)

These equations are for the case that the unit time (to) is taken as 0.5 to 1.0 times of the time lag between the beginning and the peak of flood (tg), which is measured starting from the time point of 0.8 to.

The total flood discharge (Qt) is calculated as follows by the integration of Q, based on the above equations, (1), (2), (3) and (4):

$$Qt = \int Q.dt = Qp(0.3tp + tk) \quad \ldots\ldots\ldots\ldots \quad (5)$$

Where, Qt: Total flood discharge (m^3/h)

On the other hand, the total flood discharge is also given by the following equation:

$$Qt = 0.2778Ro.A \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$

Where, Ro: Effective rainfall (mm)

A : Catchment area (km^2)

Therefore, the peak discharge (Qp) is calculated from the equations (5) and (6).

$$Qp = \frac{0.2778A.Ro}{0.3tp + tk} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (7)$$

$$tp = 0.8tg + to \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (8)$$

The figures of tg and tk are given as follows:

$$tg = 0.21L^{0.7} \qquad (L < 15)$$

$$tg = 0.4 + 0.058L \quad (L > 15)$$

Where, tg: Time lag between the beginning and the peak of flood (hr)

L : Length of river channel (km)

tk = 1.5tg (for the river that the flood appears slowly and disappears quickly)

tk = 3.0tg (for the river that the flood appears quickly and disappears slowly)

tp: Time in which the discharge decreases from zero to the peak (Qp) (hr)

8-2 EXAMPLE OF DETERMINATION OF BRIDGE LENGTH FOR RELIEF OPEN

The case of the Catchment Area No. 12 for Road Link 11 is described herein as one example to determine the bridge length for relief open.

The conditions for calculation are summarized below:

i) Existing bridge length : 34.4 (m)

ii) Allowable water level on upstream area : 66.5 (m)

iii) Inflow volume less basic-flow discharge (Ref: Discharge curve in Figure 10-2 of Chapter X in Volume I) : 478.9 (m^3/sec)

iv) Water level - Reserved volume curve, shown in Figure 8A-2

v) Water level - Discharge curve at downstream, shown in Figure 8A-3

At first, the water level on upstream area was checked for the existing bridge length, but it exceeded the allowable one. Then, the bridge length was prolonged and another calculation was made until the calculated water level becomes below the allowable one. The water level - discharge curves are shown in Figures 8A-4, 8A-5, 8A-6 and 8A-7 for the existing bridge length of 34.4 meters and the prolonged 50, 75 and 100 meters, respectively. The results are summarized as follows and illustrated in Figure 8A-8.

Bridge Length (m)	Inflow Volume (m^3/sec)	Outflow Volume (m^3/sec)	Reserved Volume (1,000 m^3)	Calculated Water Level (m)
34.4	478.9	43.9	16,000	66.725
50.0	478.9	59.6	14,780	66.638
75.0	478.9	80.9	13,264	66.531
100.0	478.9	100.0	12,109	66.449

Note: Allowable water level is 66.5 (m).

Based on the above, the required bridge length for relief open was concluded at 84 meters for the Catchment Area No. 12.

Table 8A-1 RAINFALL PATTERN (Effective Rainfall)

(mm)

Time (hr)	Total Rainfall	Loss	Effective Rainfall
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	8.1	8.0	0.1
4	0.0	0.0	0.0
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	0.4	0.4	0.0
10	0.0	0.0	0.0
11	0.0	0.0	0.0
12	0.2	0.3	0.0
13	3.7	3.6	0.1
14	12.0	11.1	0.9
15	129.4	40.6	88.8
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	0.0	0.0
19	0.0	0.0	0.0
20	0.0	0.0	0.0
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	0.0	0.0	0.0
24	0.0	0.0	0.0
Total	153.8	63.9	89.9

Table 8A-2 DRAINAGE CAPACITY OF BRIDGES AND CULVERTS

CATCHING BASIN NO.	EXISTING STRUCTURE		DISCHARGE CALCULATION							CAPACITY CALCULATION			
	STATION (km)	TYPE OF STRUCTURE	CATCHMENT AREA (km^2)	LENGTH OF RIVER CHANNEL (km)	HEIGHT DIFFERENCE (m)	GRADIENT (x10-3)	VELOCITY (km/hr)	TIME OF CONCENTRATION (hr)	DESIGN DISCHARGE (m^3/sec)	PROPOSED STRUCTURE	AREA OF WATER WAY (m^2)	HYDRAULIC RADIUS (m)	CAPACITY (m^3/sec)
1	4+550	Box culvert 4(2.4x2.4)	36.0	4.5 11.3	18 75	4.0 6.6	2.62 3.54	4.91	79	Box culvert 4(2.4x2.4)	23.0	0.80	83
2	10+700	Box culvert 3(3.6x3.3)	5.8	3.5 3.0	30 170	18.6 56.6	4.15 12.85	1.08	58	Box culvert 3(3.6x3.3)	35.6	1.16	240
3	12+400	Concrete bridge (7.0x36.0)	5.7	4.2 3.8	44 240	10.5 63.2	4.68 13.73	1.17	52	Concrete bridge (7.0x36.0)	68.2	1.86	210
4	12+500	Concrete bridge (7.0x41.0)	19.6	7.8 4.1	44 200	5.6 48.8	3.21 11.76	2.78	76	Concrete bridge (7.0x41.0)	55.0	1.33	99
5	17+200	Box culvert 3(2.4x2.4)	25.9	11.3 2.4	62 140	5.5 58.3	3.17 13.08	3.74	74	Box culvert 3(2.4x2.4)	17.3	0.80	74
6	20+200	Box culvert 3(3.0x2.4)	39.1	12.8 6.6	42 260	3.3 39.4	2.34 10.34	6.11	68	Box culvert 3(3.0x2.4)	21.6	0.92	78
7	23+300	Box culvert 4(3.3x3.0)	36.8	12.3 10.7	42 300	3.4 28.0	2.38 8.43	6.44	61	Box culvert 4(3.3x3.0)	39.6	1.06	160
8	24+150	Box culvert 3(3.0x3.0)	6.9	4.8 4.8	12 35	2.5 7.3	1.98 3.76	3.70	20	Box culvert 3(3.0x3.0)	27.0	1.00	90
9	27+700	Concrete bridge (7.0x22.5)	38.1	15.9 6.4	40 250	2.5 39.1	1.98 10.30	8.65	48	Concrete bridge (7.0x22.5)	41.2	1.75	60
10	30+0	Box culvert 3(2.1x2.1)	7.7	6.0 2.0	20 7	3.3 3.5	2.34 2.42	3.39	24	Box culvert 3(2.1x2.1)	13.2	0.70	40
13	50+0	Pipe culvert 4ϕ 1.0 ϕ 0.8	27.0	8.3 6.0	7 10	0.8 1.7	1.00 1.57	12.12	24	Pipe culvert 16ϕ 1.0 ϕ 0.8	12.6	0.28	26
14	57+700	Pipe culvert 4ϕ 0.8	11.9	4.8 5.1	7 15	1.5 2.9	1.46 2.16	5.65	23	Box culvert 2(2.4x2.4)	11.5	0.80	26

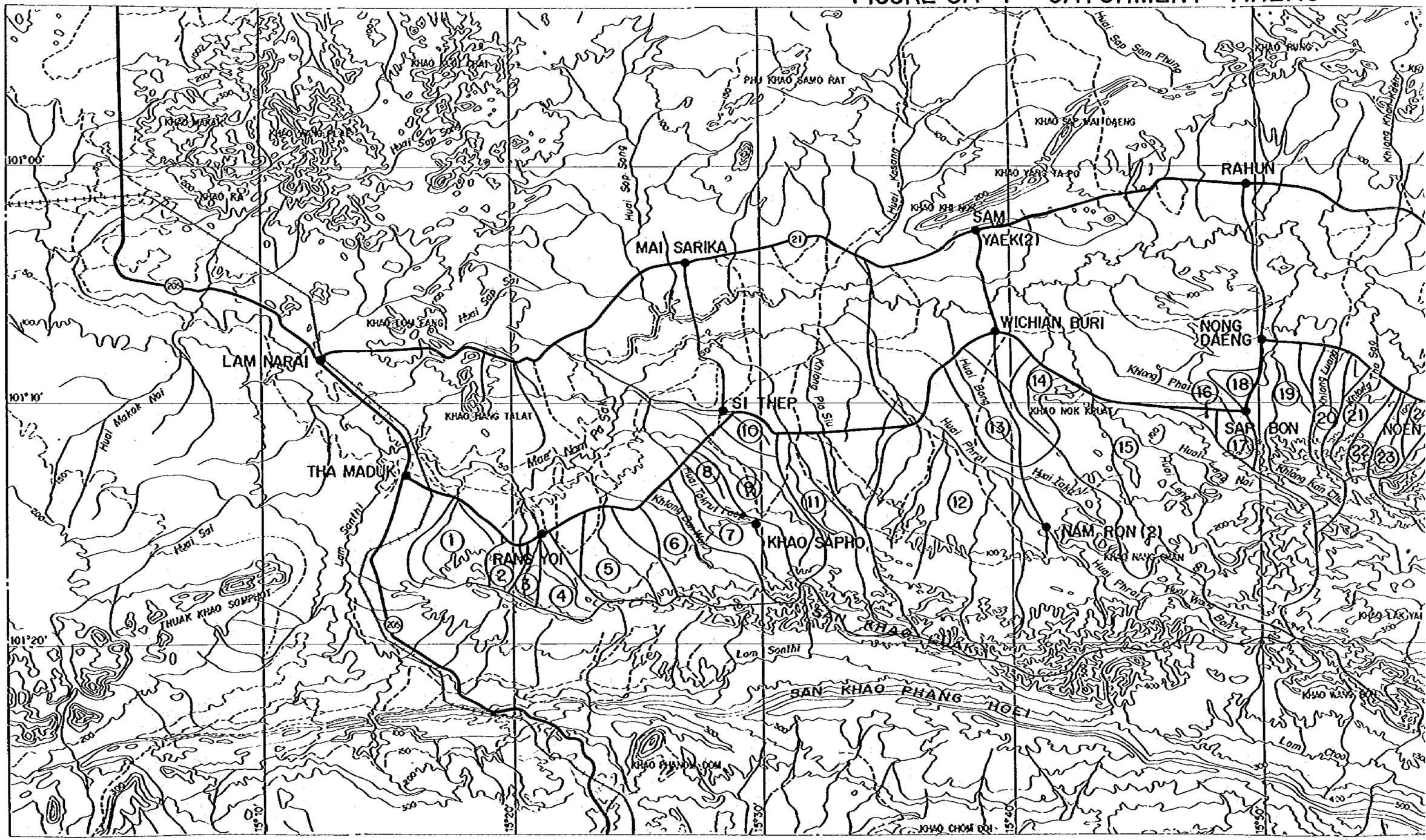
Table 8A-2 DRAINAGE CAPACITY OF BRIDGES AND CULVERTS (continued)

CATCHING BASIN NO.	EXISTING STRUCTURE		DISCHARGE CALCULATION							CAPACITY CALCULATION			
	STATION (km)	TYPE OF STRUCTURE	CATCHMENT AREA (km^2)	LENGTH OF RIVER CHANNEL (km)	HEIGHT DIFFERENCE (m)	GRADIENT ($\times 10^{-3}$)	VELOCITY (km/hr)	TIME OF CONCENTRATION (hr)	DESIGN DISCHARGE (m^3/sec)	PROPOSED STRUCTURE	AREA OF WATER WAY (m^2)	HYDRAULIC RADIUS (m)	CAPACITY (m^3/sec)
16	69+400	Timber bridge (4.2x11.3)	5.2	2.4 4.5	10 40	4.2 8.9	2.69 4.23	1.96	28	Concrete bridge (7.0x14.0)	22.0	1.45	36
17	72+950	Timber bridge (4.2x11.5)	6.9	4.1 3.5	30 160	7.3 45.7	3.76 11.31	1.40	53	Concrete bridge (7.0x14.0)	29.0	1.83	74
18	76+900	Timber bridge (4.2x15.0)	4.1	1.0 3.0	5 60	5.0 20.0	3.00 6.89	0.77	57	Concrete bridge (7.0x14.0)	32.0	1.95	71
19	81+0	Timber bridge (4.2x14.9) (4.2x11.2) (4.2x22.5)	55.2	15.3 9.8	78 222	5.1 22.6	3.03 7.41	6.37	93	Concrete bridge (7.0x14.0) (7.0x14.0) (7.0x21.0)	60.8	1.18	97
20	85+700	Timber bridge (4.3x11.5)	14.2	8.3 5.4	30 175	3.6 32.4	2.46 9.20	3.96	38	Concrete bridge (7.0x14.0)	24.3	1.58	40
21	89+0	Logs (2.7x2.5)	17.2	7.6 8.5	42 270	5.5 31.7	3.17 9.08	3.57	55	Concrete bridge (7.0x14.0)	26.3	1.65	55
22	90+850	Timber bridge (4.2x11.2)	10.5	5.5 6.6	22 290	4.0 43.9	2.62 11.04	2.70	41	Concrete bridge (7.0x14.0)	24.3	1.58	42
23	89+850	Logs (2.7x4.5)	6.5	6.0 2.3	30 180	5.0 78.3	3.00 15.62	2.15	32	Concrete bridge (7.0x14.0)	22.0	1.45	40
24	91+650	Timber bridge (4.2x15.0)	11.1	6.9 3.9	32 280	4.6 71.8	2.85 14.83	2.68	44	Concrete bridge (7.0x21.0)	36.0	1.62	67
25	94+350	Timber bridge (4.4x15.4)	6.9	8.4 1.5	30 180	3.6 120.0	2.46 20.18	3.49	21	Concrete bridge (7.0x14.0)	22.0	1.45	34
26	97+0	Timber bridge (4.2x18.4) (4.5x24.3)	46.0	13.1 5.3	70 240	5.3 45.3	3.10 11.25	4.70	105	Concrete bridge (7.0x21.0) (7.0x24.0)	82.1	1.81	178
29	108+800	–	7.6	5.0 2.4	40 140	8.0 58.3	3.97 13.08	1.44	56	Box culvert 2(2.4x3.0)	14.4	0.90	77

Table 8A-2 DRAINAGE CAPACITY OF BRIDGES AND CULVERTS (continued)

CATCHING BASIN NO.	EXISTING STRUCTURE		DISCHARGE CALCULATION							CAPACITY CALCULATION			
	STATION (km)	TYPE OF STRUCTURE	CATCHMENT AREA (km^2)	LENGTH OF RIVER CHANNEL (km)	HEIGHT DIFFERENCE (m)	GRADIENT (x10-3)	VELOCITY (km/hr)	TIME OF CONCENTRATION (hr)	DESIGN DISCHARGE (m^3/sec)	PROPOSED STRUCTURE	AREA OF WATER WAY (m^2)	HYDRAULIC RADIUS (m)	CAPACITY (m^3/sec)
30	109+800	_	11.0	7.0 2.5	35 140	5.0 56.0	3.00 12.77	2.53	47	Box culvert 2 (2.4x3.0)	14.4	0.90	61
31	118+0	_	4.3	2.3 2.7	10 160	4.3 59.2	2.74 13.20	1.04	44	Box culvert 2(2.4x3.0)	14.4	0.90	57
32	119+0	_	11.9	5.0 6.8	40 160	8.0 23.5	3.97 7.59	2.16	59	Box culvert 2(2.4x3.0)	14.4	0.90	77
33	124+500	Timber bridge (3.5x21.9)	48.5	7.0 9.0	65 220	9.3 24.4	4.35 7.76	2.77	188	Concrete bridge (7.0x21.0)	55.2	2.39	191

FIGURE 8A-1 CATCHMENT AREAS



CATCHMENT AREAS

FIGURE 8 A - 1

HMENT AREAS

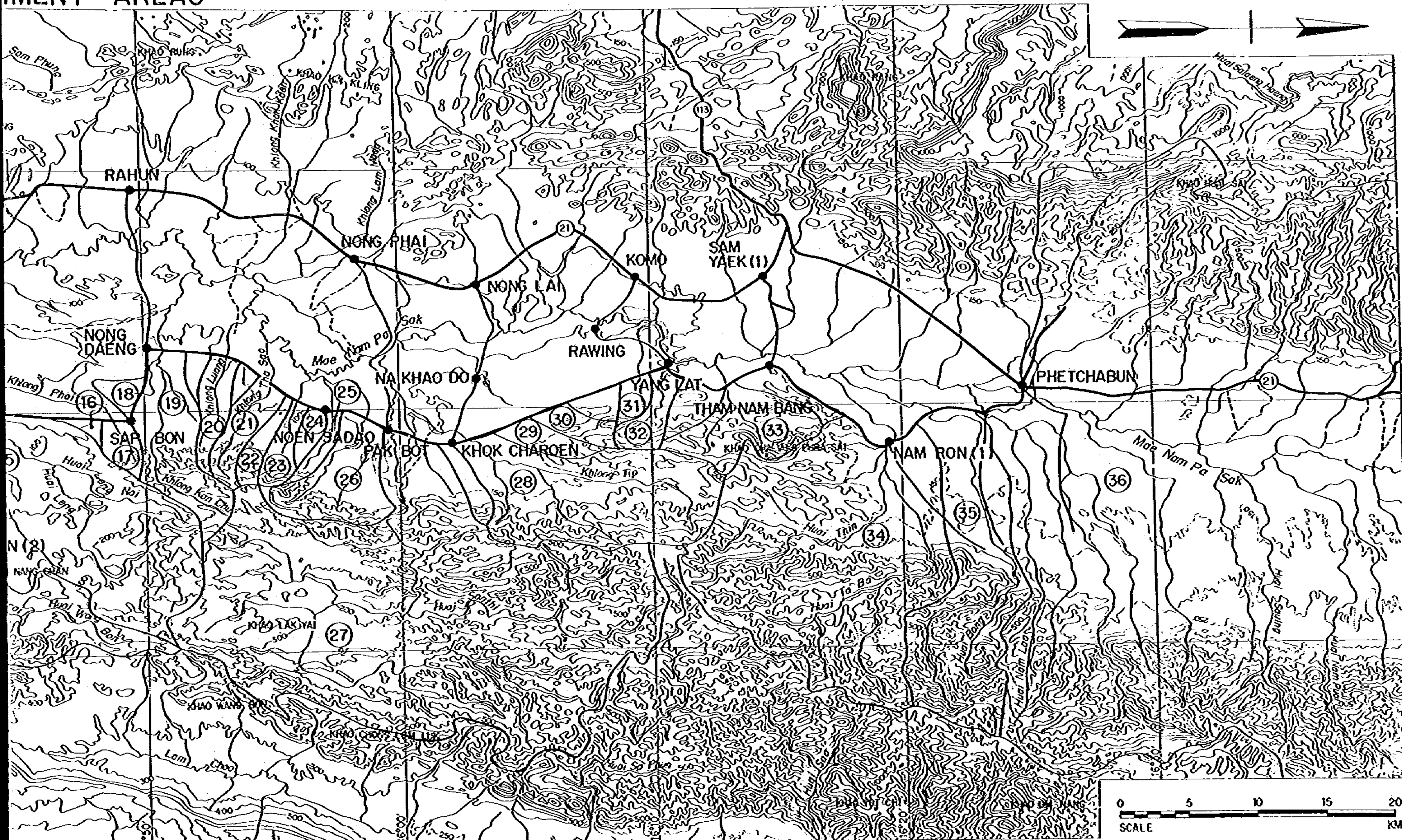


FIGURE 8A - 2 to 4

Figure 8A-2 WATER LEVEL - RESERVED VOLUME CURVE

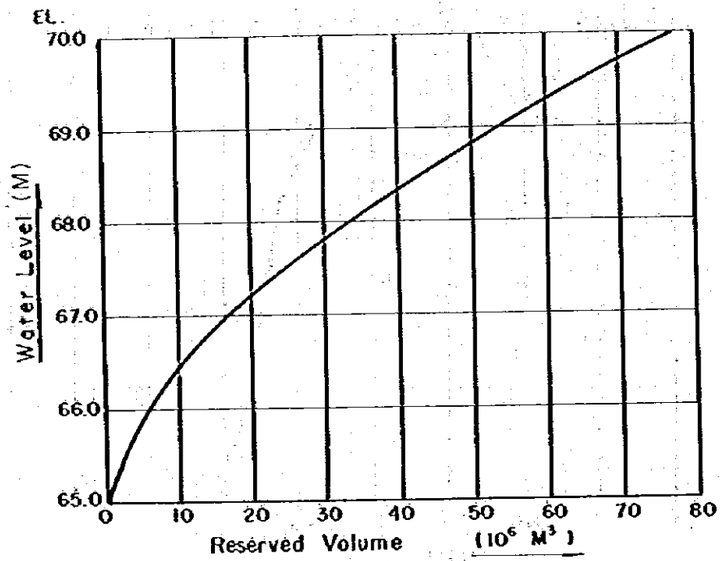


Figure 8A-3 WATER LEVEL - DICHARGE CURVE

(Downstream)

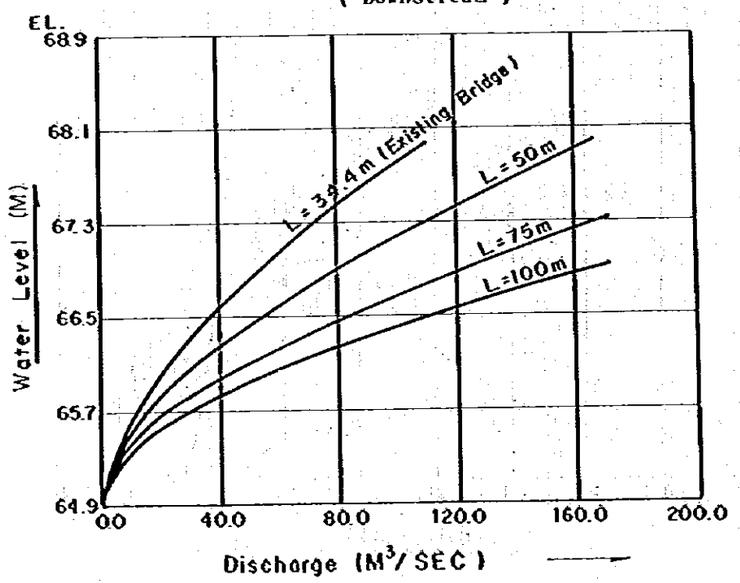


Figure 8A-4 WATER LEVEL AND DISCHARGE (Bridge Length 34.4 m)

(Existing Bridge)

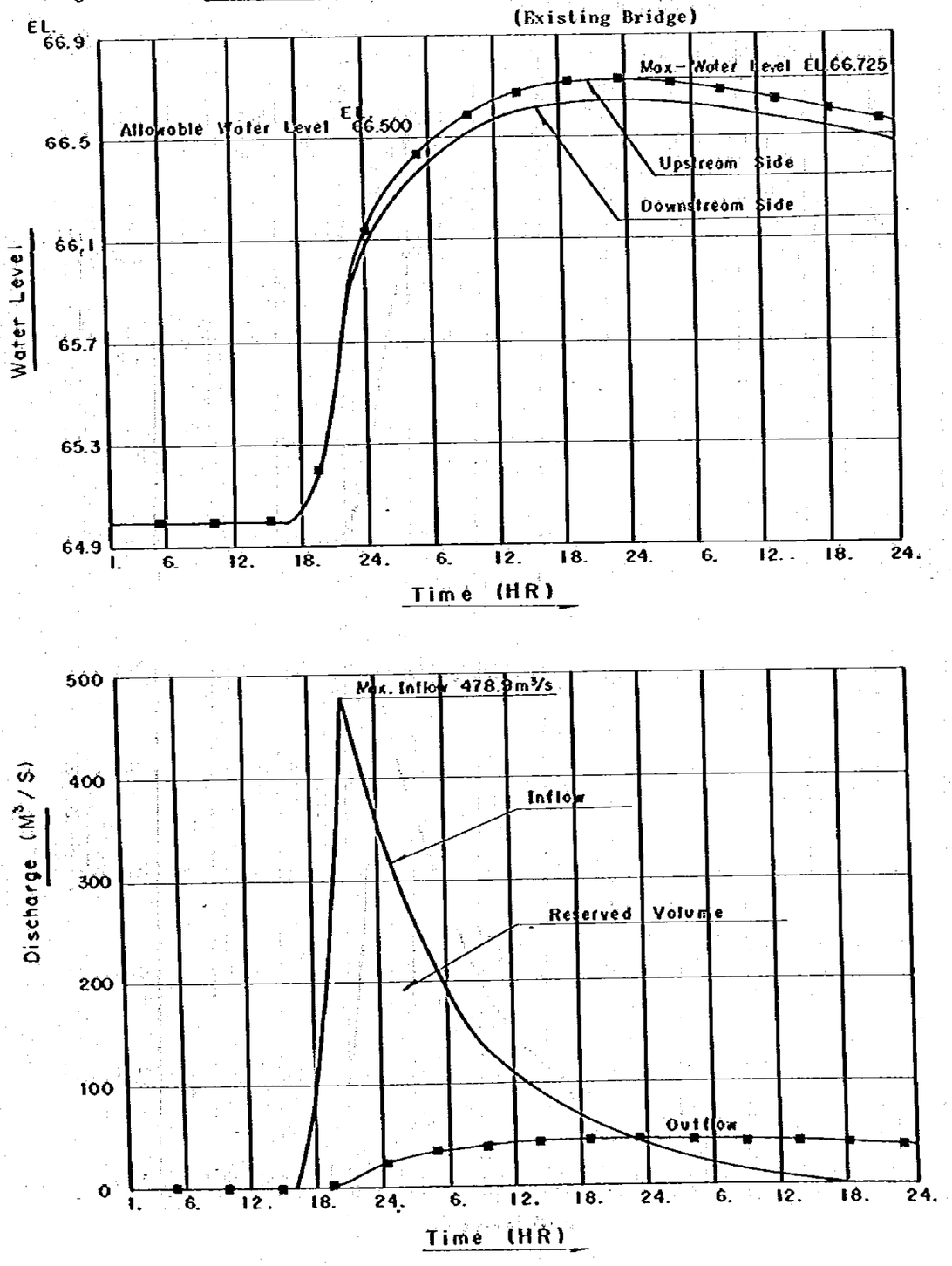


Figure 8A-5 WATER LEVEL AND DISCHARGE (Bridge Length 50.0 m)

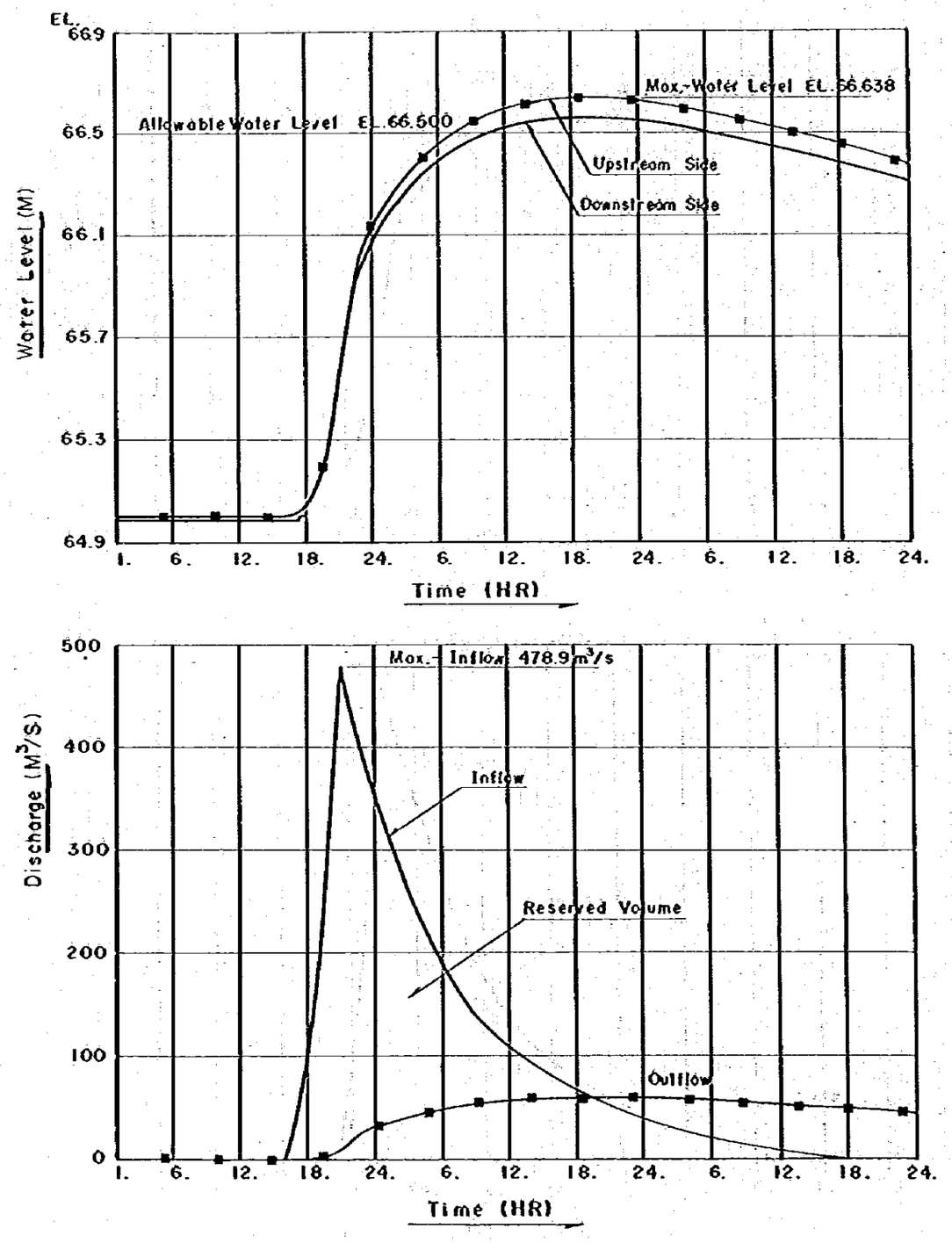


Figure 8A-6 WATER LEVEL AND DISCHARGE (Bridge Length 75.0 m)

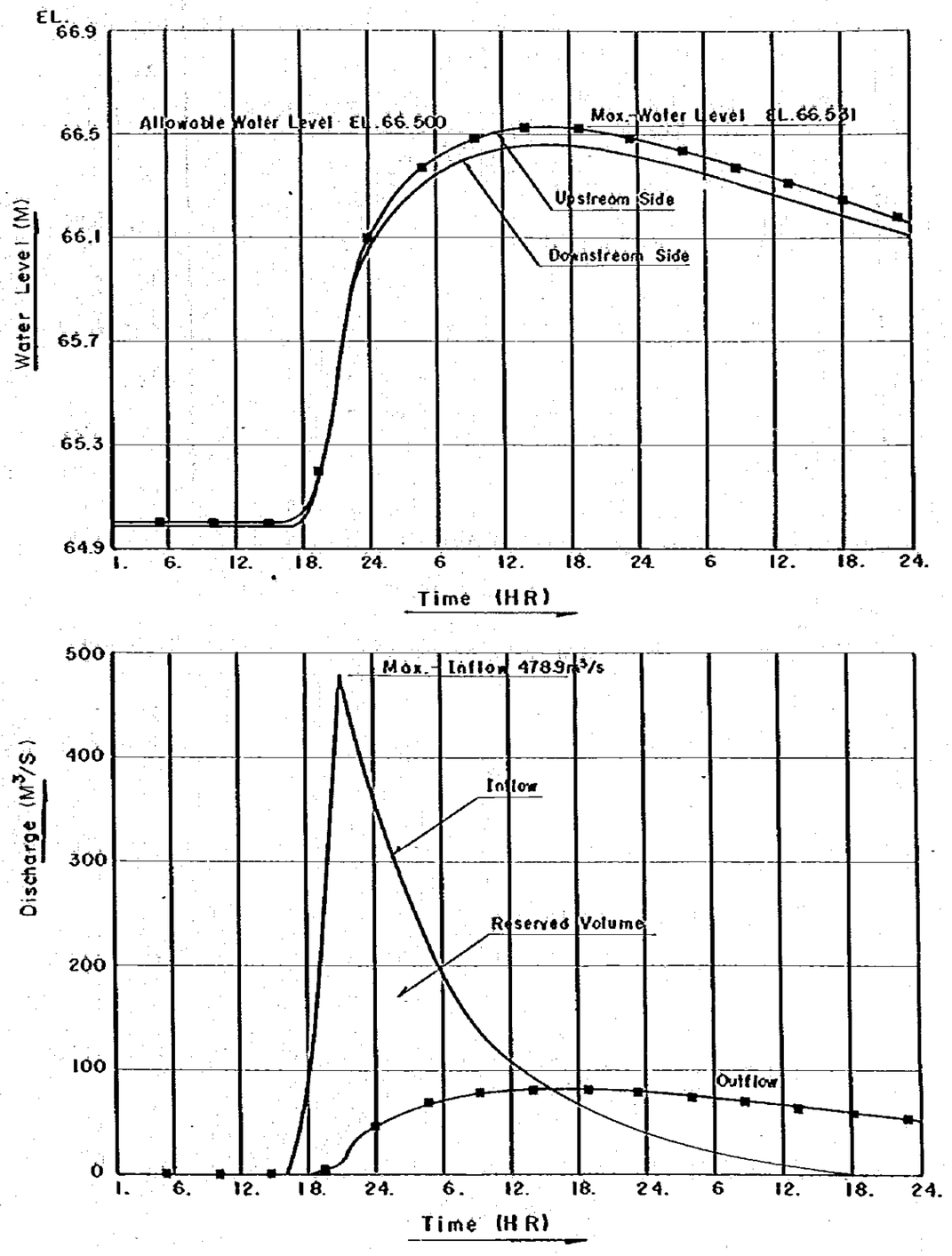


Figure 8A-7 WATER LEVEL AND DISCHARGE (Bridge Length 100.0 m)

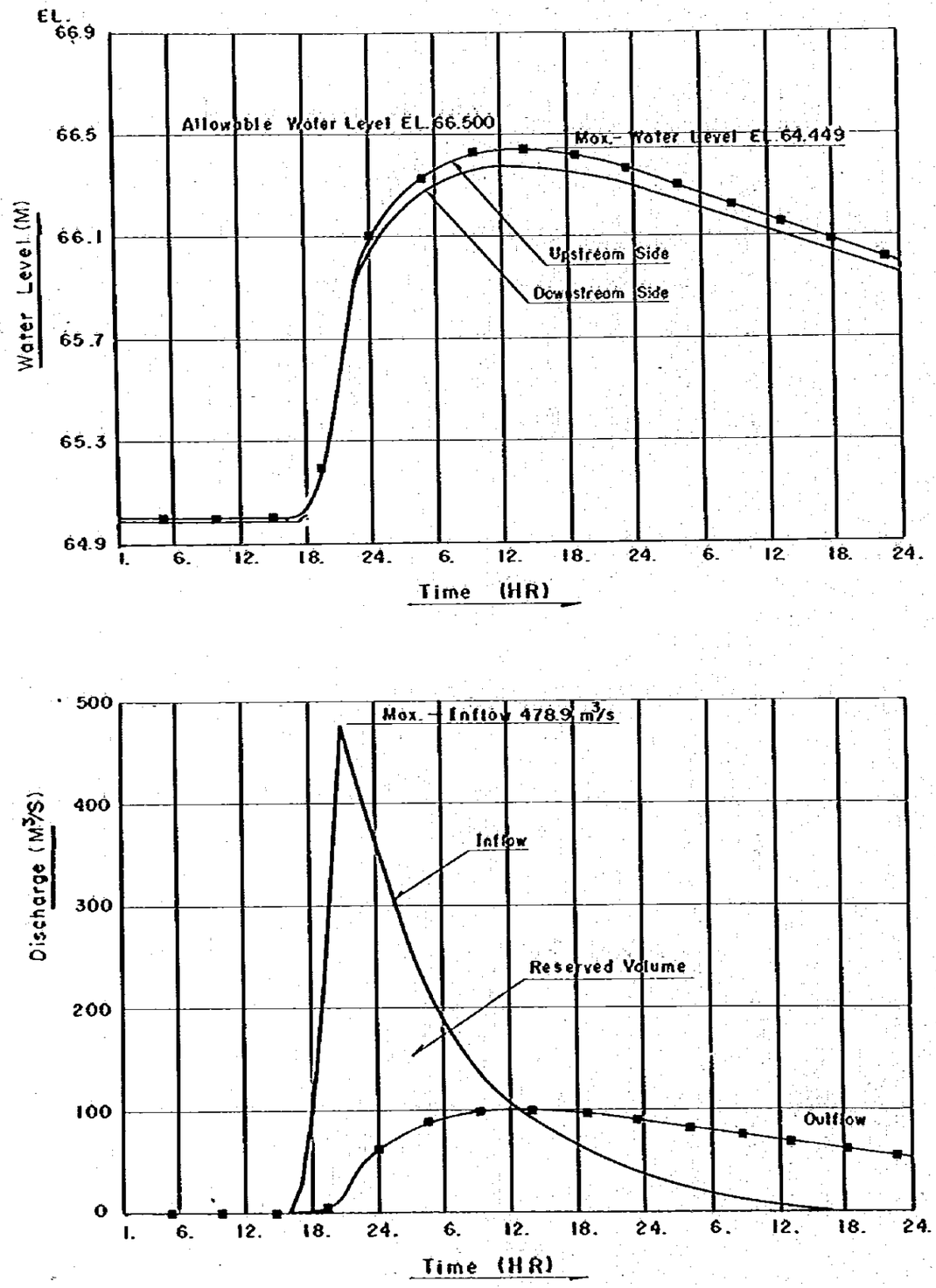
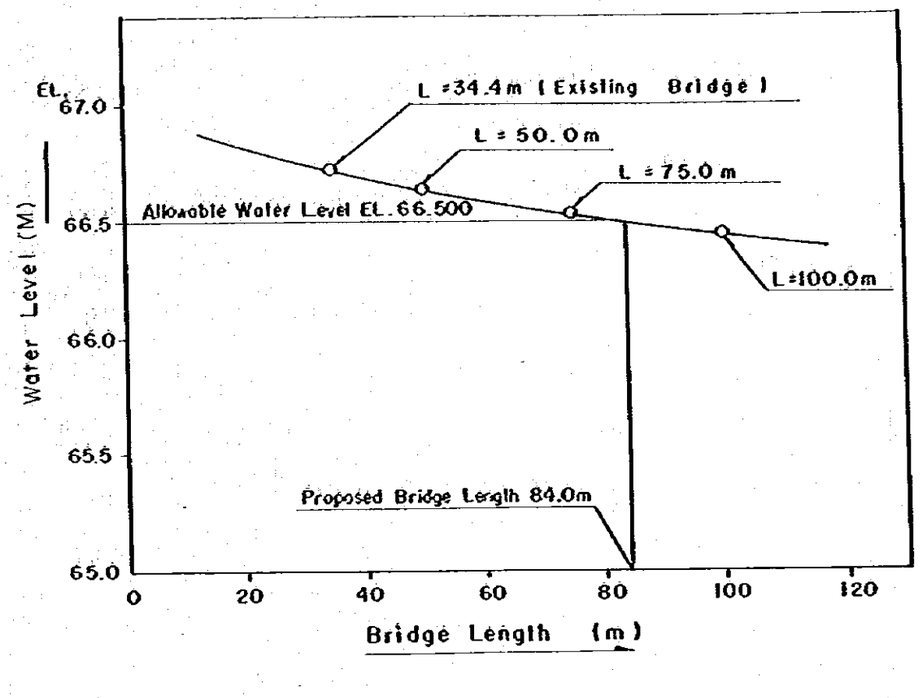


Figure 8A-8 BRIDGE LENGTH FOR RELIEF OPEN

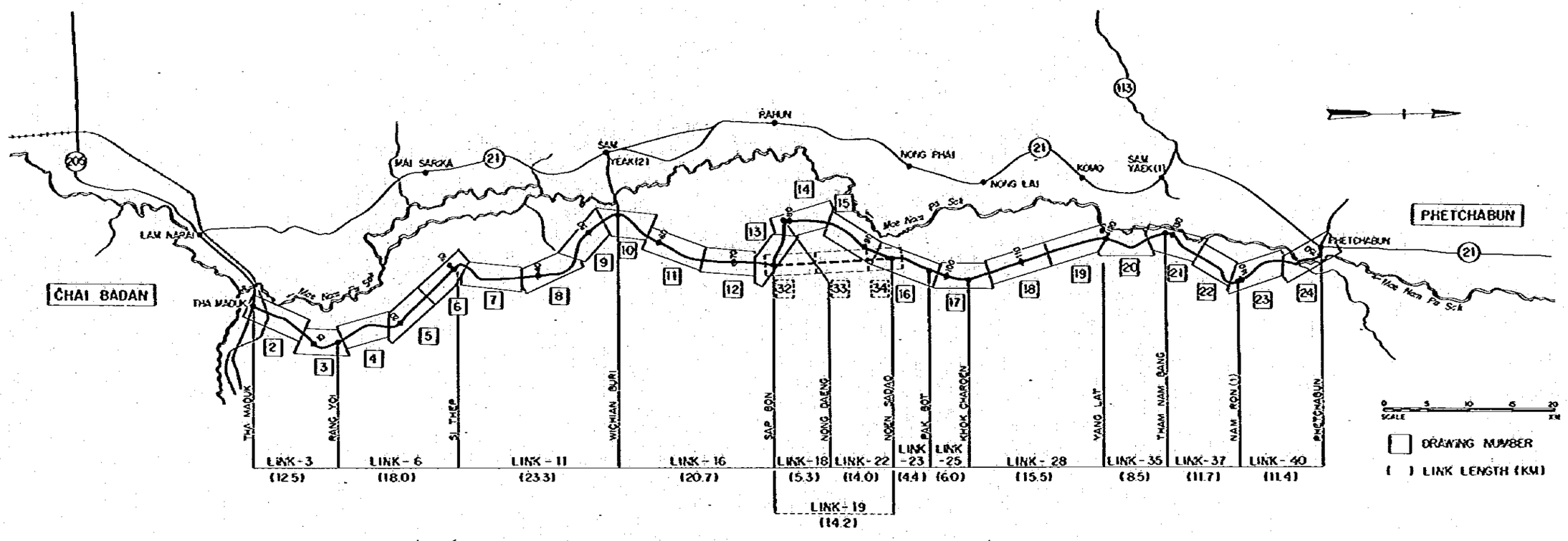
PIGURE 8A-7 to 8



PART II

DRAWINGS

PHETCHABUN CHAI BADAN HIGHWAY FEASIBILITY STUDY	SHEET No
COVER SHEET	DWG - 1



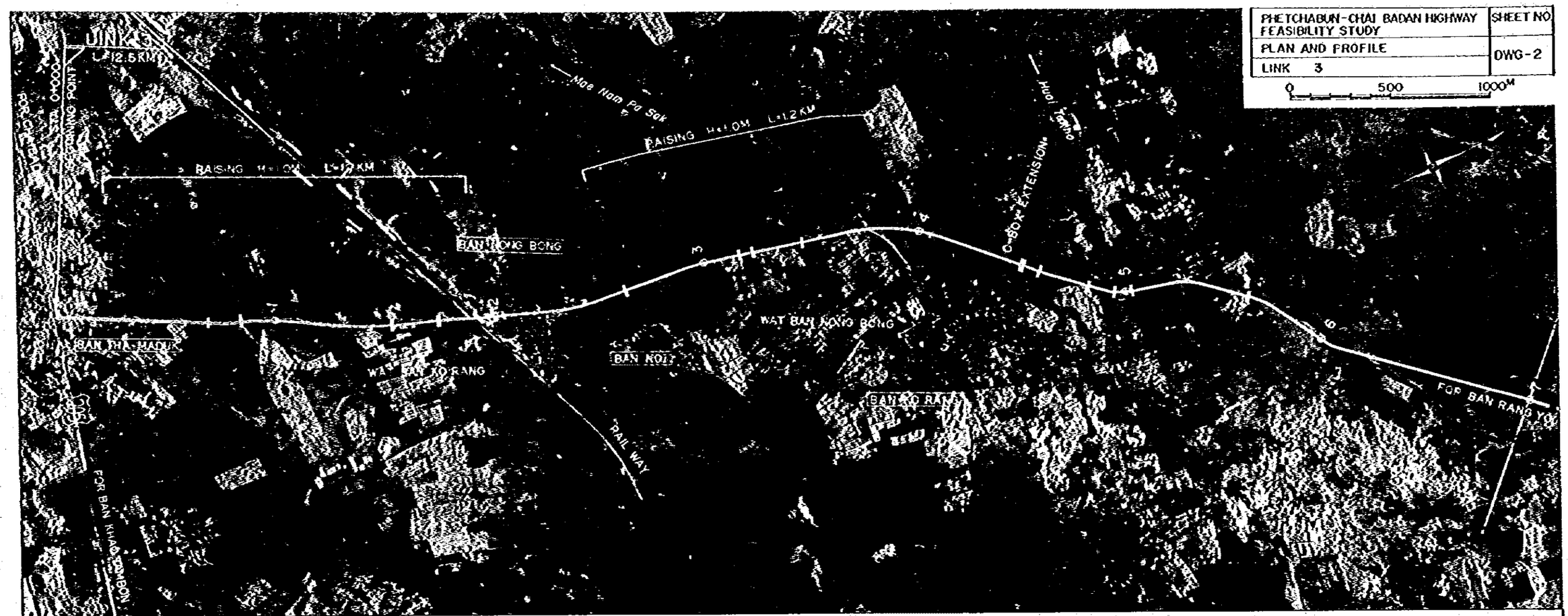
INDEX OF DRAWINGS	SHEET NUMBER
COVER SHEET	DWG - 1
PLAN AND PROFILE	DWG - 2 ~ DWG - 24
TYPICAL CROSS SECTION (EXISTING ROAD SECTION)	DWG - 25
TYPICAL CROSS SECTION (NEW ROAD SECTION)	DWG - 26
TYPICAL PAVEMENT STRUCTURE	DWG - 27
STANDARD BRIDGE	DWG - 28
STANDARD BOX CULVERT	DWG - 29
STANDARD PIPE CULVERT	DWG - 30
DIAGRAMMATIC LAYOUTS OF INTERSECTIONS	DWG - 31
PLAN AND PROFILE	DWG - 32 ~ DWG - 34

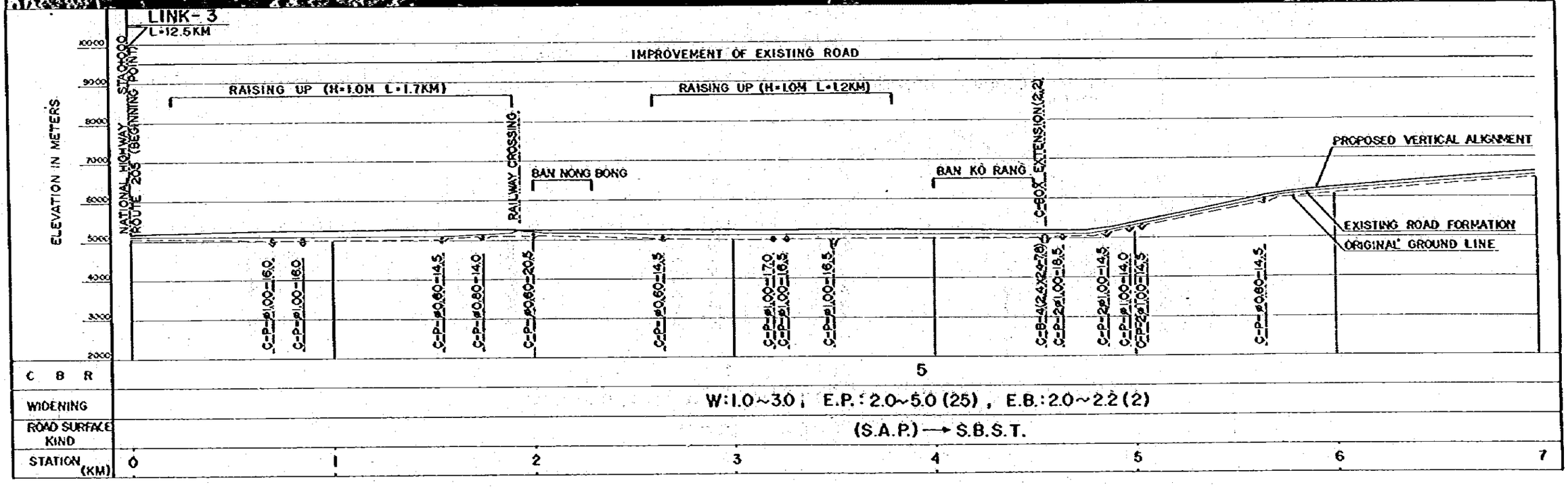
ABBREVIATIONS

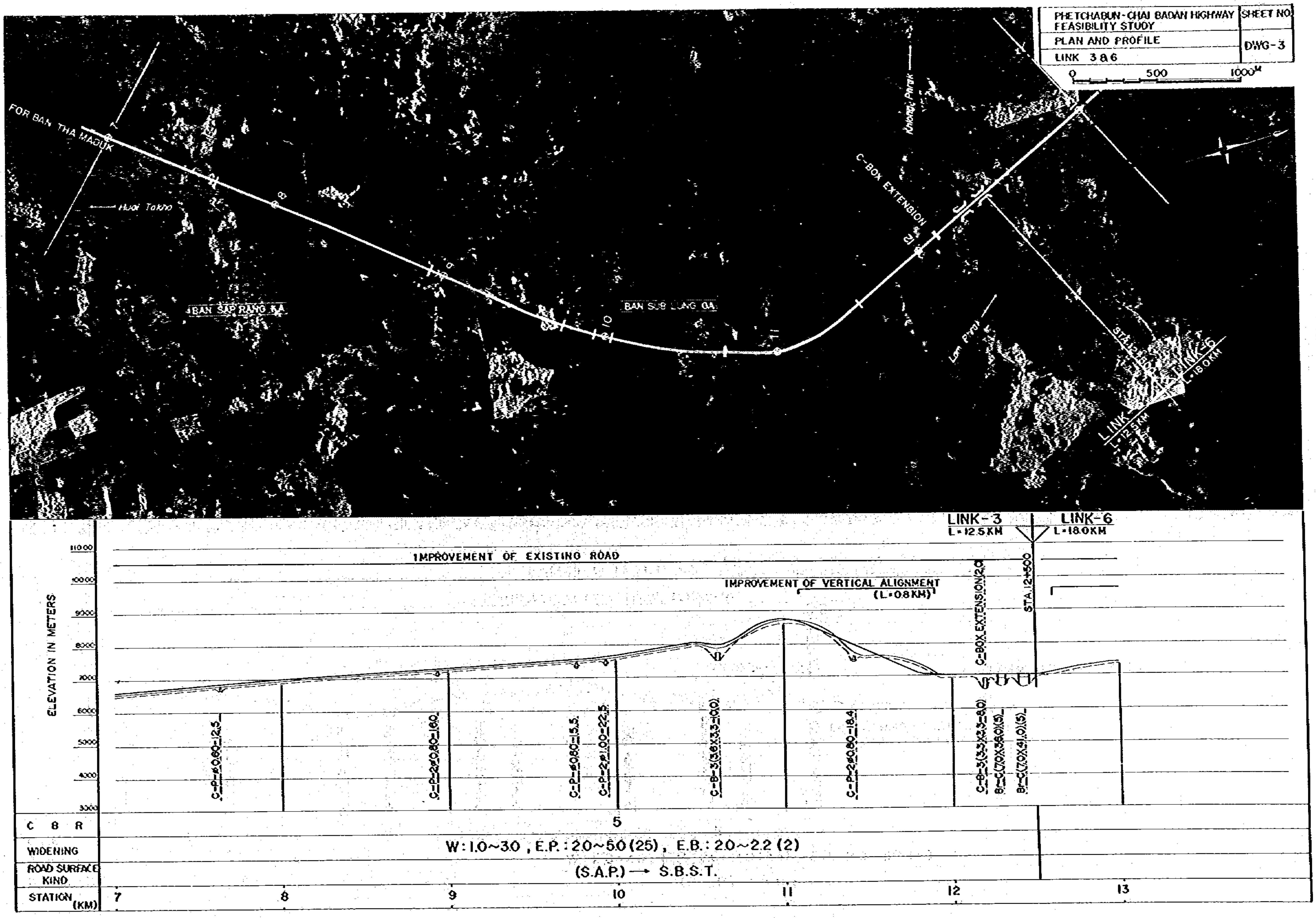
W : a ~ b	WIDENING OF ROAD WIDTH : a ~ b METERS
E.P. a ~ b (n)	EXTENSION OF PIPE CULVERT : a ~ b METERS (NUMBER)
E.B. a ~ b (n)	EXTENSION OF BOX CULVERT : a ~ b METERS (NUMBER)
(S.A.P.)	SOIL AGGREGATE PAVEMENT (EXISTING CONDITION)
S.B.S.T.	SINGLE BITUMINOUS SURFACE TREATMENT
L.T.	LATERITE PAVEMENT
C-P-nØo-ℓ	EXISTING PIPE CULVERT, n (ROW), Øo (DIAMETER, M), ℓ (LENGTH, M)
C-B-n(o x b)-ℓ	EXISTING BOX CULVERT, n (NOS. OF TUBE), o x b (LATERAL x VERTICAL, M), ℓ (LENGTH, M)
Br-T (o x ℓ) (n)	EXISTING TIMBER BRIDGE, o x ℓ (WIDTH x LENGTH, M), n (NOS. OF SPAN)
Br-C (o x ℓ) (n)	EXISTING CONCRETE BRIDGE, o x ℓ (CARRIAGE WAY WIDTH x LENGTH, M), n (NOS. OF SPAN)
Br-CIS(o x ℓ)(n @ s)	PROPOSED CONCRETE SLAB BRIDGE, o x ℓ (CARRIAGE WAY WIDTH x LENGTH, M), n @ s (NOS. OF SPAN @ SPAN LENGTH, M)
C-P-nØo-ℓ	PROPOSED PIPE CULVERT, n (ROW), Øo (DIAMETER, M), ℓ (LENGTH, M)
C-B-n(o x b)-ℓ	PROPOSED BOX CULVERT, n (NOS. OF TUBE), o x b (LATERAL x VERTICAL, M), ℓ (LENGTH, M)
C - BOX EXTENSION (ℓ)	PROPOSED BOX CULVERT, ℓ (EXTENSION LENGTH, M)
RAISING UP (H.L.)	RAISING UP OF EXISTING ROAD FORMATION HIHEIGHT OF RAISING UP, M), L (LENGTH OF RAISING UP SECTION, KM)

PHETCHABUN-CHAI BADAN HIGHWAY FEASIBILITY STUDY	SHEET NO
PLAN AND PROFILE	DWG-2
LINK 3	

0 500 1000M

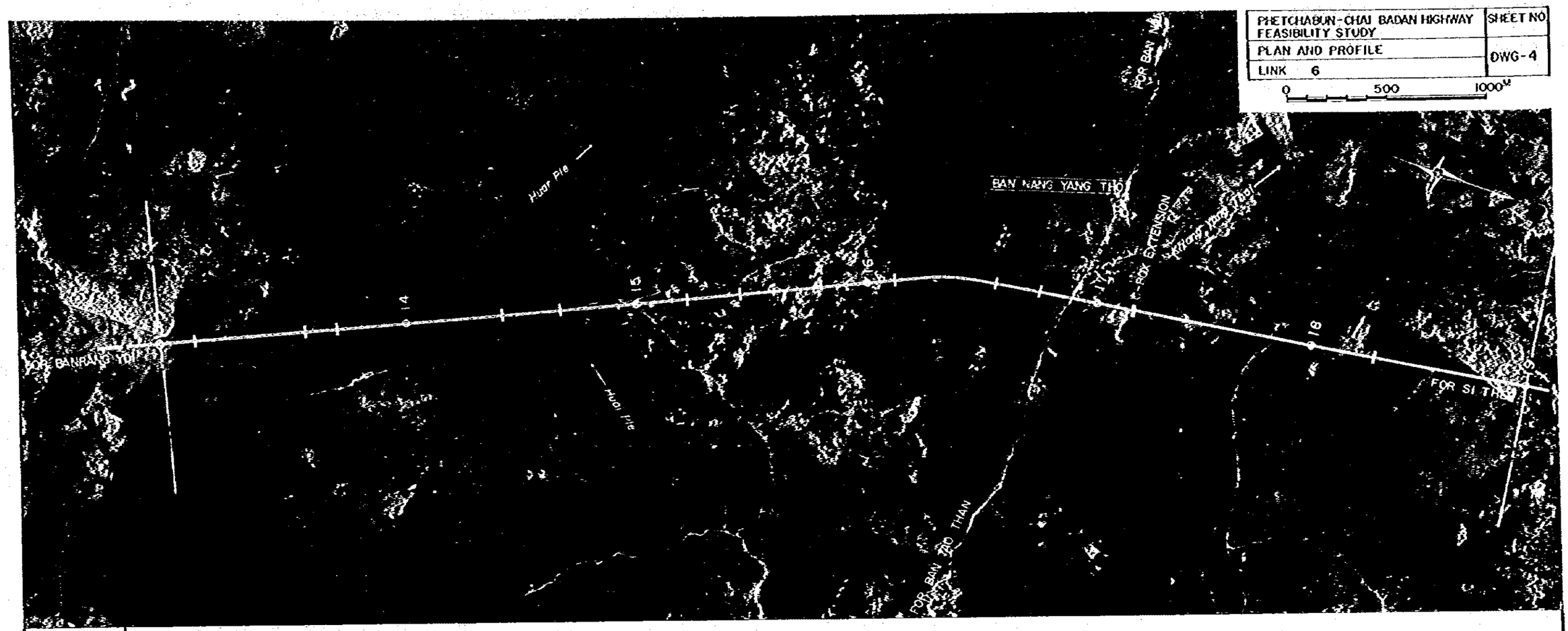


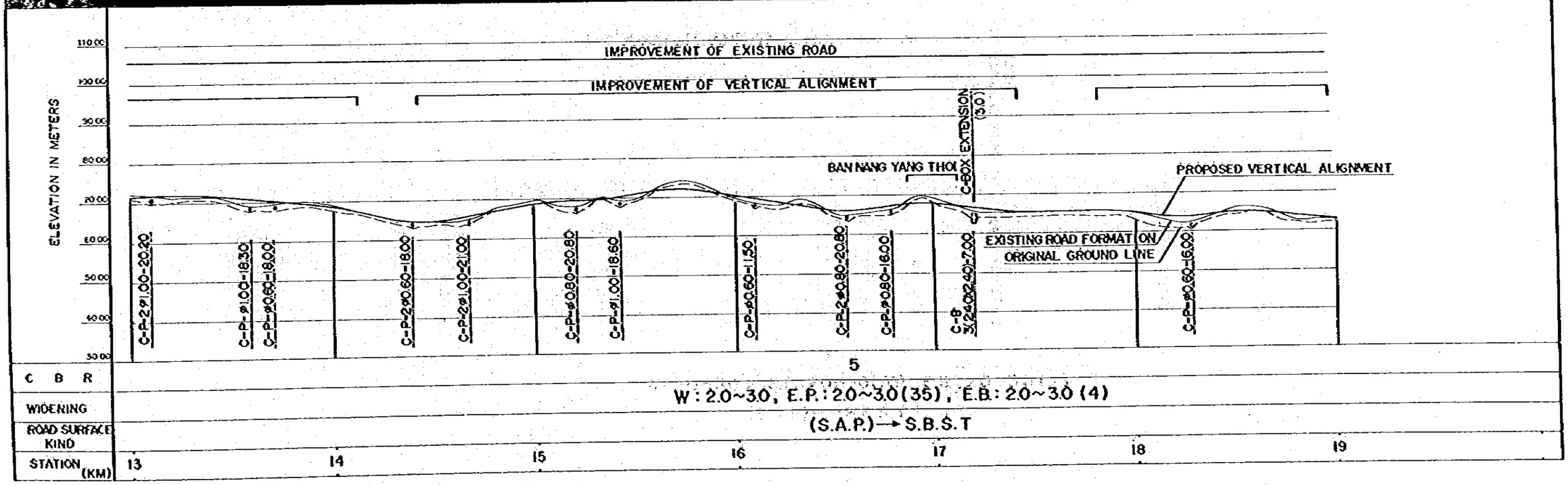



PHETCHABUN-CHAI BADAN HIGHWAY FEASIBILITY STUDY
PLAN AND PROFILE
LINK 3 & 6
SHEET NO.
DWG-3
0 500 1000M
FOR BAN THA MADUK
Huai Takho
BAN SAP RANG KA
BAN SUB LUNG OA
C-BOX EXTENSION
Lam Pyai
LINK-3 L=12.5KM
LINK-6 L=18.0KM
LINK-3
L=12.5KM
LINK-6
L=18.0KM
IMPROVEMENT OF EXISTING ROAD
IMPROVEMENT OF VERTICAL ALIGNMENT
(L=0.8KM)
C-BOX EXTENSION(2.0)
STA.12+500
ELEVATION IN METERS
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
C-P-ø0.60-12.5
C-P-2ø0.80-16.0
C-P-ø0.80-15.5
C-P-2ø1.00-22.5
C-B-3(3.6X3.3-10.0)
C-P-2ø0.80-18.4
C-B-3(3.3X3.3-8.0)
Br-C(7.0X36.0)(5)
Br-C(7.0X41.0)(5)
C B R
5
WIDENING
W:1.0~3.0 , E.P.:2.0~5.0(2.5), E.B.:2.0~2.2 (2)
ROAD SURFACE KIND
(S.A.P.) → S.B.S.T.
STATION (KM)
7
8
9
10
11
12
13

PHETCHABUN-CHAI BADAN HIGHWAY FEASIBILITY STUDY	SHEET NO
PLAN AND PROFILE	DWG-4
LINK 6	

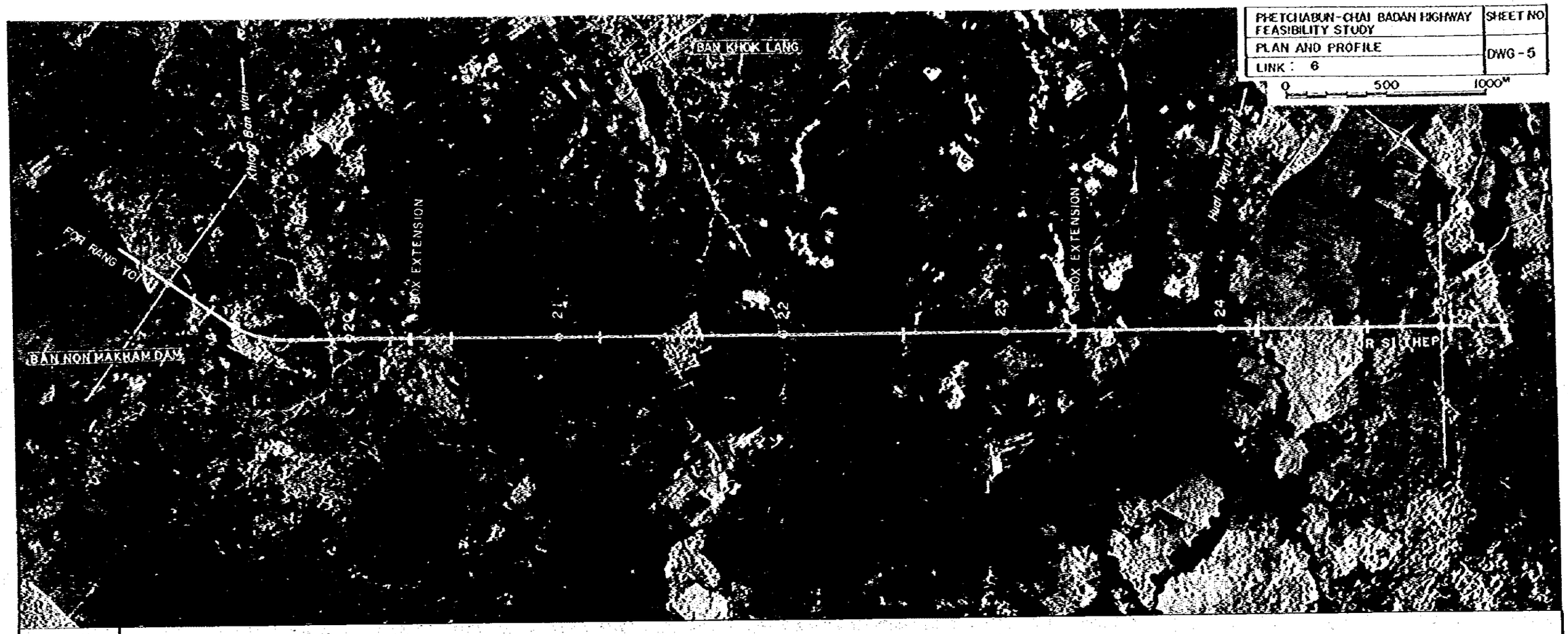
0 500 1000M

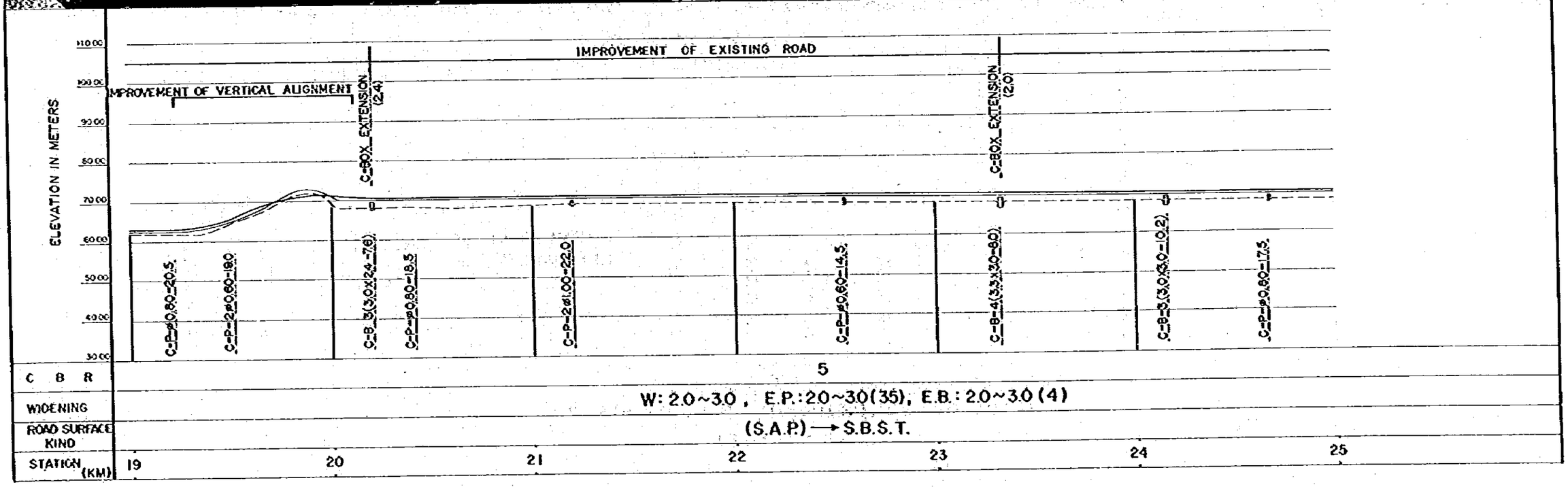




PHETCHABUN-CHAI BADAN HIGHWAY FEASIBILITY STUDY	SHEET NO
PLAN AND PROFILE	DWG - 5
LINK : 6	

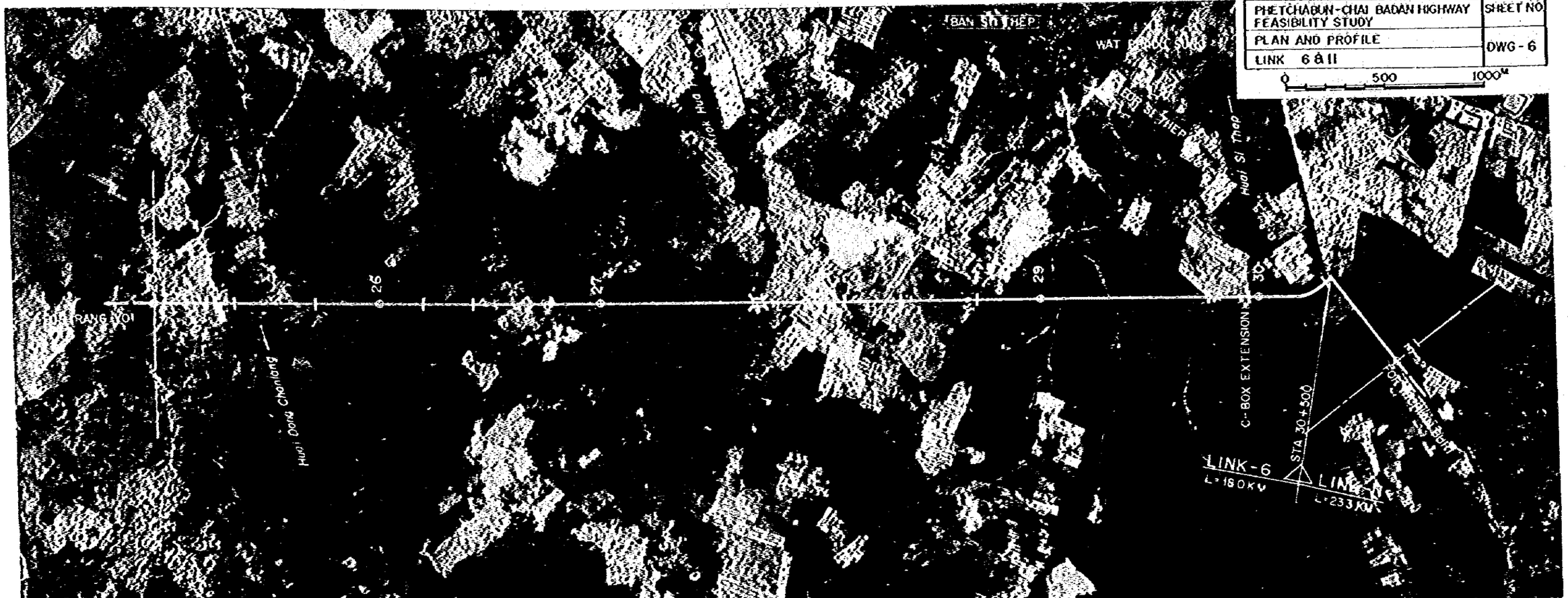
0 500 1000M

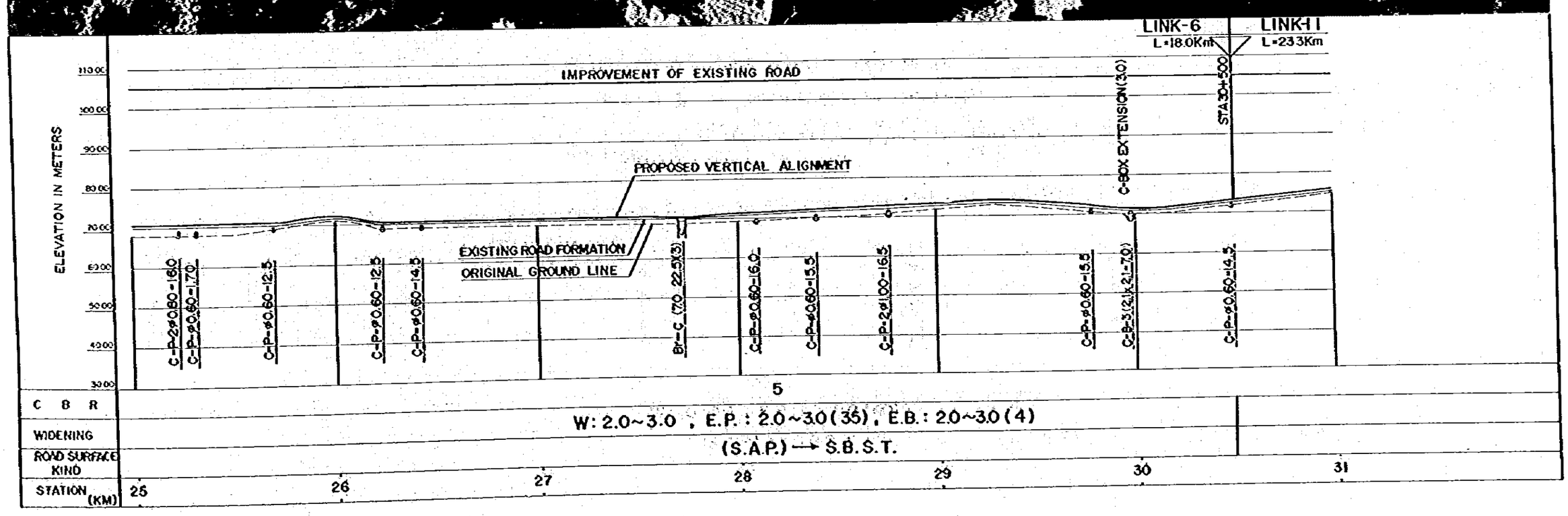




PHETCHABUN-CHAI BADAN HIGHWAY FEASIBILITY STUDY	SHEET NO.
PLAN AND PROFILE	DWG - 6
LINK 6 & 11	

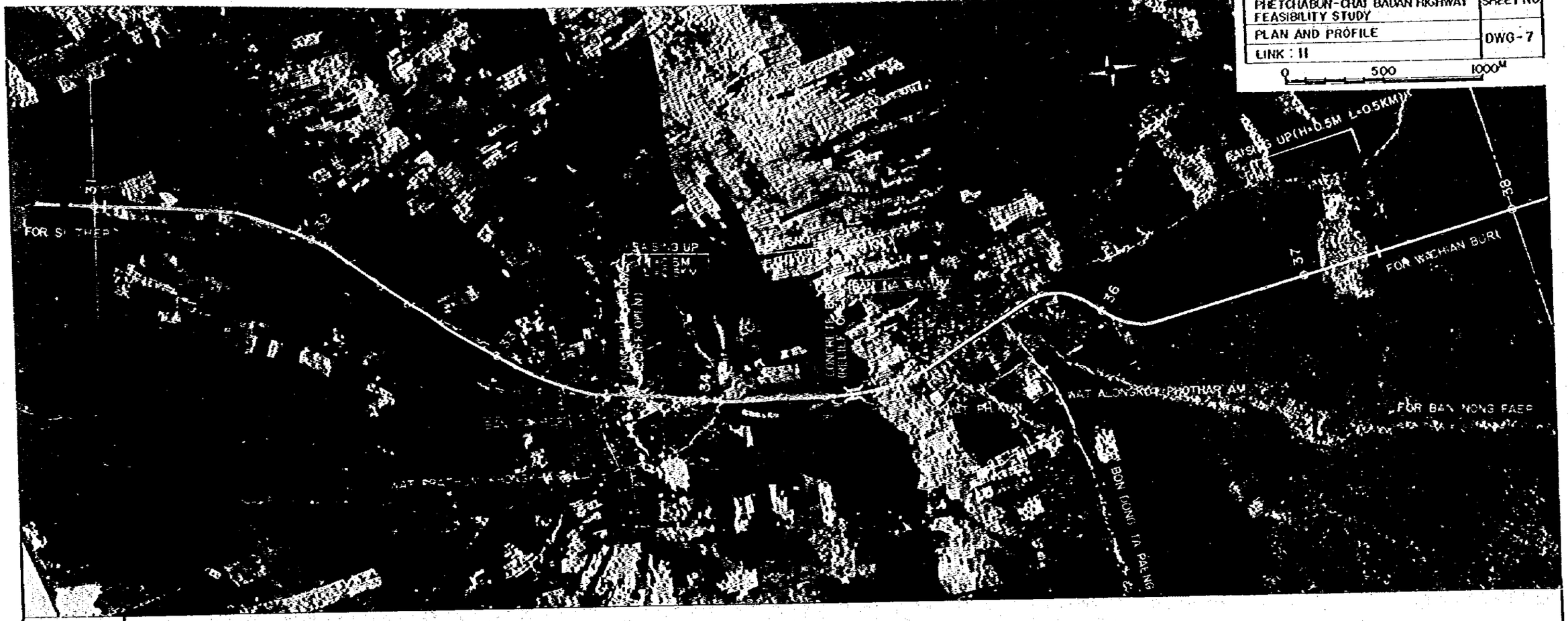
0 500 1000M

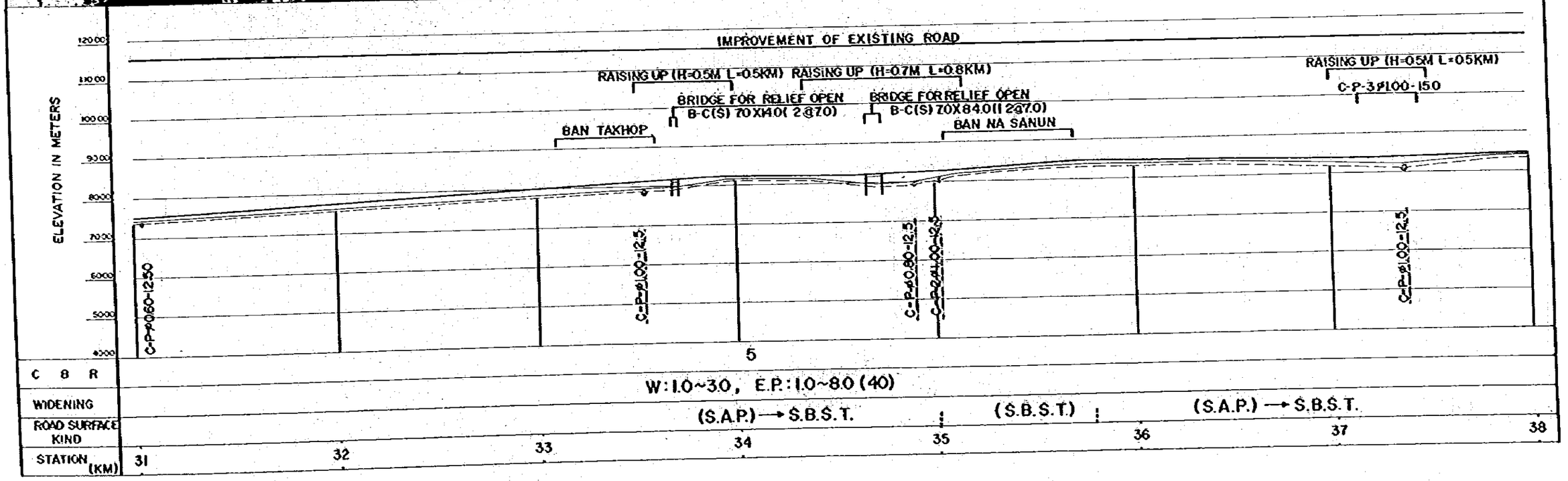




PHETCHABUN-CHAI BADAN HIGHWAY FEASIBILITY STUDY	SHEET NO
PLAN AND PROFILE	DWG-7
LINK : II	

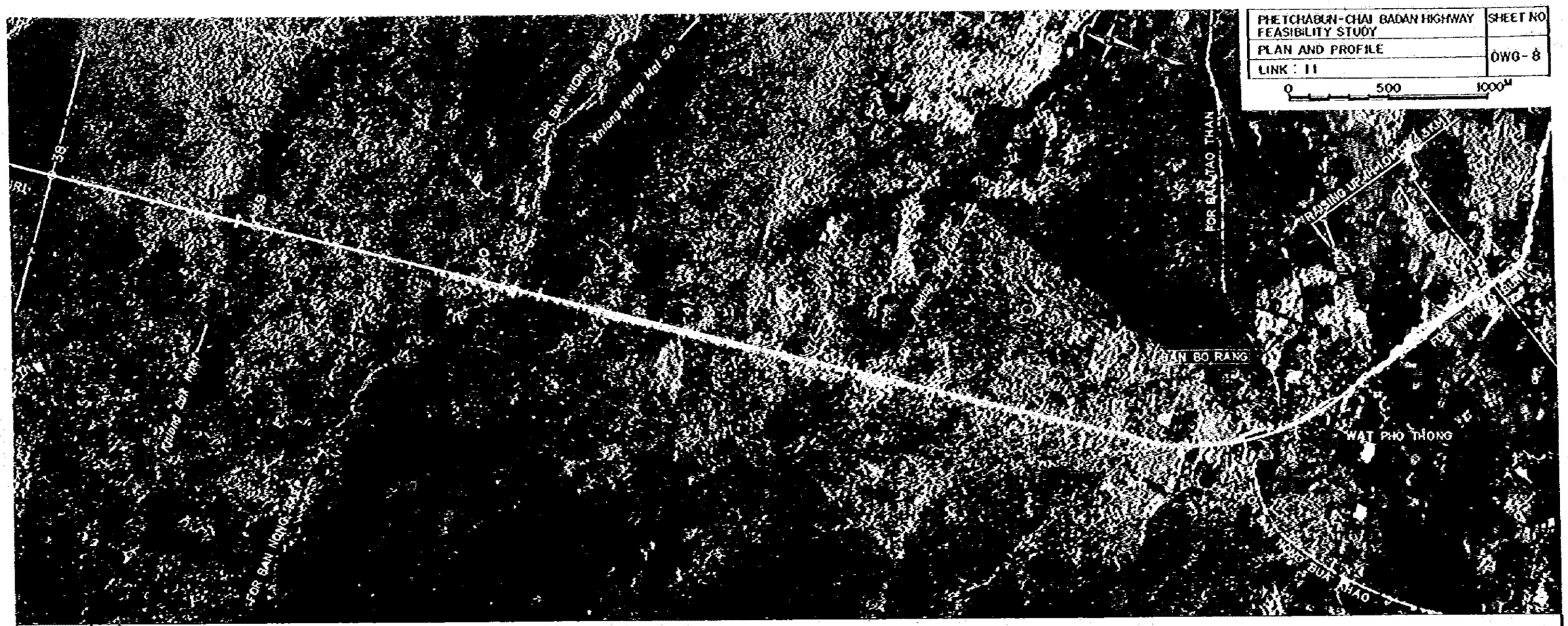
0 500 1000M

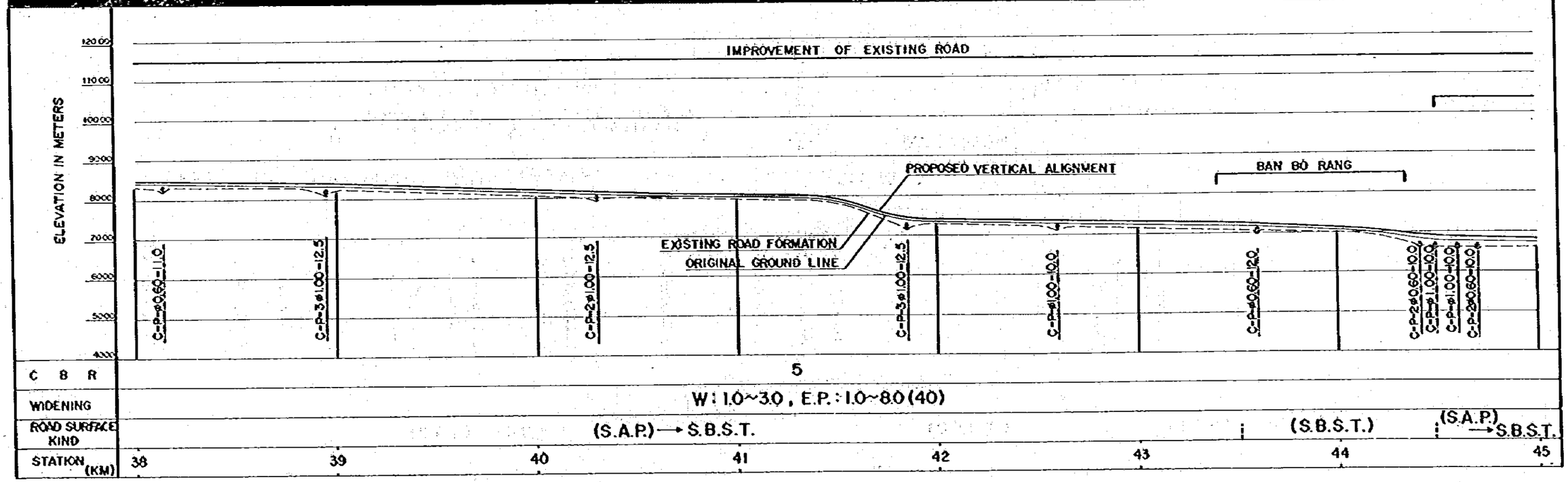




PHETCHABUN-CHAI BADAN HIGHWAY FEASIBILITY STUDY	SHEET NO
PLAN AND PROFILE	DWG-8
LINK : 11	

0 500 1000M





PHETCHABUN-CHAI BADAN HIGHWAY FEASIBILITY STUDY	SHEET NO.
PLAN AND PROFILE	DWG-9
LINK II	

0 500 1000M