

### 3. ENGINEERING

#### 3.1 Materials and Boring Results

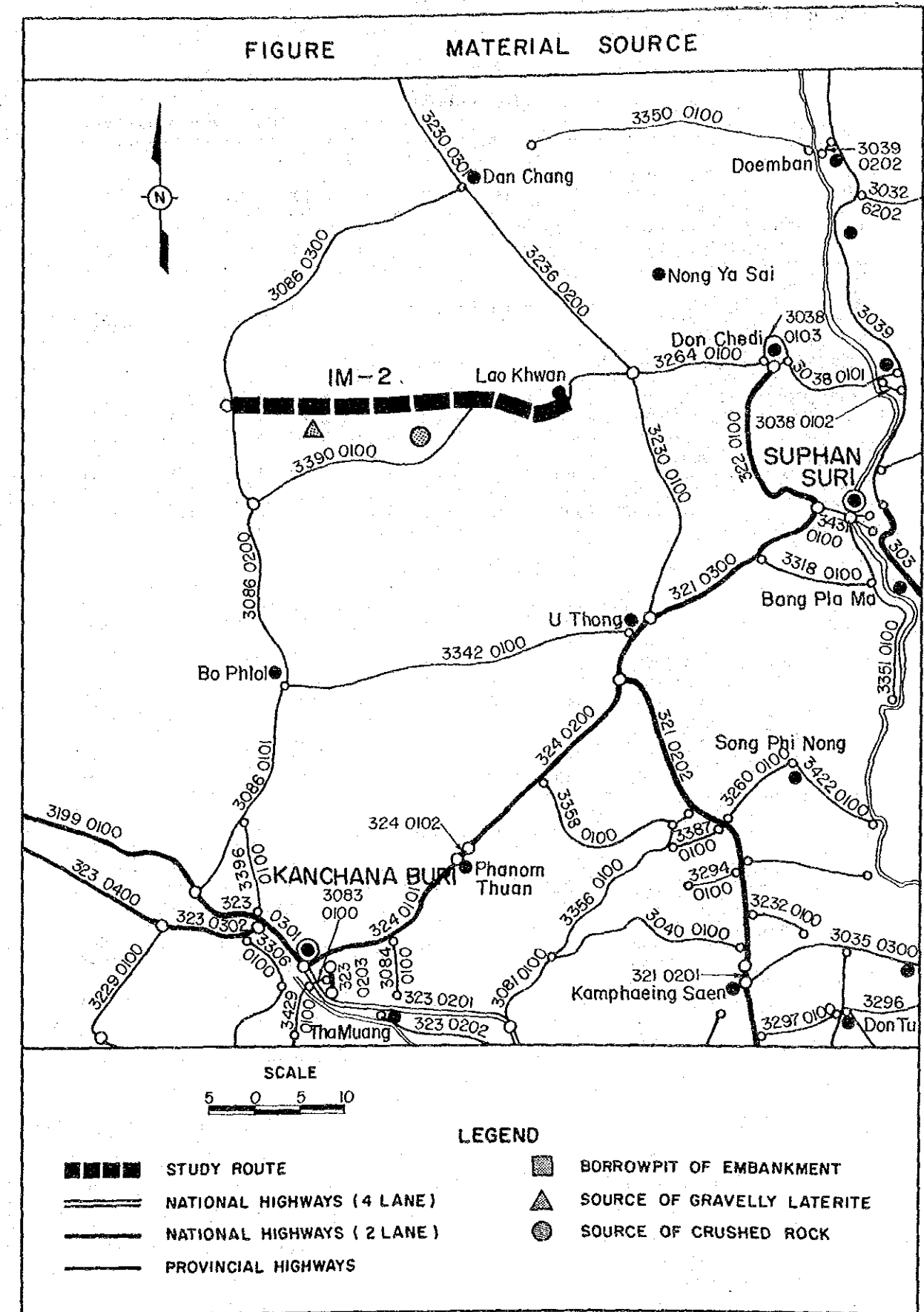
##### (1) Materials

DESCRIPTION OF MATERIAL SOURCES C

Material	Source	Description of Sample	Estimated Quantity cu.m.	Hauling Distance (km)
Soil	Along Route 3306 Both Sides 0 Km	Coarse & Fine Sand	Plentiful	0
Laterite	Route 3086 Km 63+400 Left Side Km	Gravelly Laterite	48,000	17
Crushed Rock	Route 3390 Km 16+500 Left Side 0.2 Km	Lime Stone	60,000	36

RESULTS OF LABORATORY TESTS

	Sieve Analysis % Passing					Plasticity		Comp. DH-T Stand.		Lab. C.B.R.	
	50.0	25.0	19.0	9.5	#4 #10 #40 #200	LL	PI	Opt. 95%	gn/cc	CBR 95%	Swell %
Soil	100	96	74	67	23	-	NP	11.7	1.75	16.0	-0.3
Laterite	100	96	79	59	32	20	26.5	9.6	8.5	2.11	25
Crushed Rock										>80	-



3.2 Preliminary Design

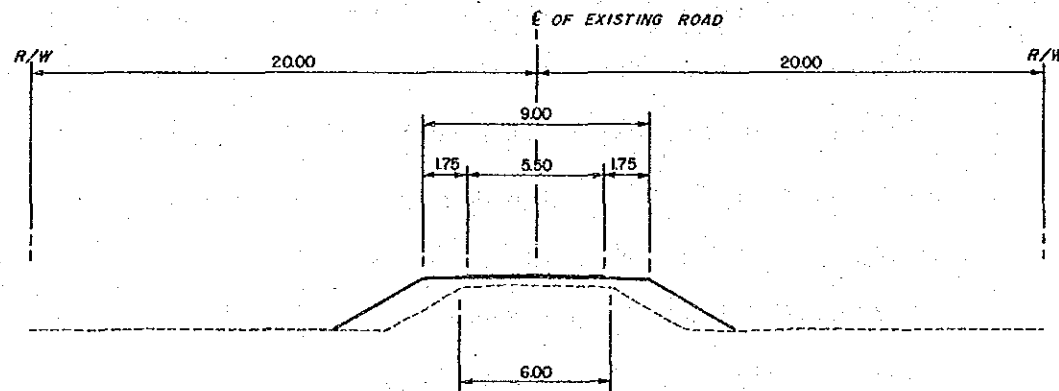
(1) Geometric Design Criteria

Design Standard : F 4

Design Speed : 60 km/h

Geometric Design Criteria

Description	Design Speed (km/h)
	60
Minimum Radius & Curvature (m)	120
Minimum Stopping Sight Distance (m)	75
Maximum Gradient (%)	8



TYPICAL CROSS SECTION  
IM-2 ROAD CLASS F4

(2) Pavement Design

Design CBR of Subgrade	Cumulative No. of ESA W18 x 10 (10 years)	Thickness of Pavement Structure (cm)
12.0	150	Surface 2.5 (DBST) Base 15 Subbase 15

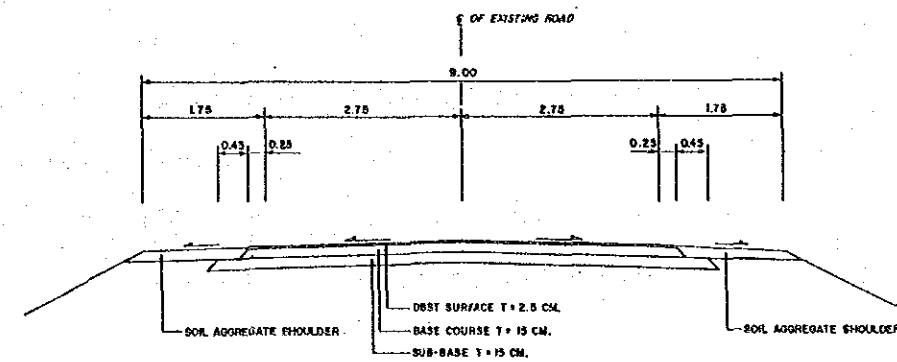


FIGURE TYPICAL PAVEMENT STRUCTURE FOR FLEXIBLE PAVEMENT IM-2

## (3) Culverts

NO.	CHAINAGE	EXISTING CULVERT	NEW CULVERT
1	0+150	RCP Dia 2-1.00x15.00	EXTEND 2-Dia 1.00x2.00
2	0+219	BOX 3-2.65x2.50x12.50	REMAIN
3	0+712	RCP 1-Dia 0.60x13.00	EXTEND 1-Dia 0.60x4.00
4	2+781	RCP 2-Dia 0.60x13.50	EXTEND 2-Dia 0.60x4.00
5	4+053	RCP 1-Dia 0.60x12.70	EXTEND 1-Dia 0.60x4.00
6	4+543	RCP 1-Dia 0.80x17.00	EXTEND 1-Dia 0.80x2.00
7	5+403	RCP 1-Dia 0.60x13.00	EXTEND 1-Dia 0.60x2.00
8	5+753	RCP 1-Dia 0.80x17.00	REMAIN
9	5+852	RCP 2-Dia 1.00x16.00	REMAIN
10	6+775	RCP 1-Dia 0.80x15.00	REMAIN
11	7+410	RCP 1-Dia 0.80x16.00	EXTEND 1-Dia 0.80x6.00
12	7+439	RCP 1-Dia 0.80x16.00	EXTEND 1-Dia 0.80x4.00
13	8+361	RCP 1-Dia 0.60x13.00	EXTEND 1-Dia 0.60x4.00
14	8+676	RCP 2-Dia 1.00x14.00	REMAIN
15	8+864	BOX 3-2.65x3.00x10.00	REMAIN
16	9+492	RCP 2-Dia 0.80x13.50	EXTEND 2-Dia 0.80x4.00
17	10+060	RCP 2-Dia 0.60x14.00	REMAIN
18	10+495	RCP 2-Dia 0.80x13.00	EXTEND 2-Dia 0.80x4.00
19	11+131	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x4.00
20	12+144	RCP Dia 1-0.60x12.00	EXTEND 1-Dia 0.60x6.00

NO.	CHAINAGE	EXISTING CULVERT	NEW CULVERT
21	12+988	RCP 2-Dia 0.80x15.00	EXTEND 2-Dia 0.80x2.00
22	13+637	BOX 3-2.65x3.15x11.00	REMAIN
23	14+188	RCP 2-Dia 0.80x15.00	REMAIN
24	14+364	RCP 1-Dia 0.60x13.00	REMAIN
25	14+528	RCP 2-Dia 0.80x14.50	EXTEND 2-Dia 0.80x2.00
26	15+061	RCP 2-Dia 0.60x13.00	EXTEND 2-Dia 0.60x4.00
27	16+877	BOX 2-2.00x2.30x11.00	REMAIN
28	17+829	RCP 1-Dia 1.00x17.00	EXTEND 1-Dia 1.00x2.00
29	18+152	RCP 2-Dia 0.80x15.00	EXTEND 2-Dia 0.80x2.00
30	18+803	RCP 1-Dia 0.60x13.00	EXTEND 1-Dia 0.60x2.00
31	19+410	RCP 3-Dia 1.00x12.00	EXTEND 3-Dia 1.00x2.00
32	19+582	RCP 2-Dia 1.00x13.50	EXTEND 2-Dia 1.00x2.00
33	21+089	RCP 1-Dia 1.00x12.00	REMAIN
34	21+110	RCP 1-Dia 0.60x11.00	EXTEND 1-Dia 0.60x2.00
35	21+495	RCP 1-Dia 0.60x13.00	EXTEND 1-Dia 0.60x4.00
36	21+587	RCP 1-Dia 0.80x12.00	EXTEND 1-Dia 0.80x2.00
37	22+074	RCP 2-Dia 0.80x13.00	REMAIN
38	23+766	RCP 2-Dia 0.40x11.00	RCP 1-Dia 1.00x14.00
39	24+558	RCP 1-Dia 1.00x12.00	EXTEND 1-Dia 1.00x2.00
40	25+813	RCP 1-Dia 0.60x13.00	REMAIN

NO.	CHAINAGE	EXISTING CULVERT	NEW CULVERT
41	26+038	RCP 1-Dia 0.60x14.00	REMAIN
42	26+050	RCP 2-Dia 0.80x12.50	EXTEND 2-Dia 0.80x2.00
43	26+204	RCP 1-Dia 0.60x14.00	REMAIN
44	26+403	RCP 1-Dia 0.60x13.00	REMAIN
45	26+634	BOX 3-2.20x2.50x8.00	EXTEND 3-2.20x2.50x3.00
46	26+741	RCP 2-Dia 0.60x15.50	REMAIN
47	27+024	RCP 2-Dia 1.00x13.50	EXTEND 2-Dia 1.00x2.00
48	27+244	BOX 2-2.20x2.30x8.00	EXTEND 2-2.20x2.30x2.00
49	27+438	RCP 1-Dia 0.60x12.50	REMAIN
50	28+996	RCP 1-Dia 0.80x14.00	REMAIN
51	29+366	RCP 1-Dia 0.80x13.00	EXTEND 1-Dia 0.80x4.00
52	31+205	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x2.00
53	31+266	RCP 1-Dia 0.60x12.00	REMAIN
54	31+416	RCP 1-Dia 0.60x12.50	EXTEND 1-Dia 0.60x2.00
55	31+929	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x2.00
56	32+116	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x4.00
57	34+201	RCP 1-Dia 1.00x12.00	REMAIN
58	34+696	RCP 1-Dia 0.80x12.50	EXTEND 1-Dia 0.80x2.00
59	35+169	RCP 1-Dia 0.80x12.00	EXTEND 1-Dia 0.80x4.00
60	35+360	RCP 1-Dia 0.60x12.50	EXTEND 1-Dia 0.60x2.00
61	35+975	RCP 1-Dia 0.60x13.00	REMAIN

### 3.3 Quantities and Construction and Road Maintenance Costs

#### (1) CONSTRUCTION QUANTITIES AND COSTS

(Project IM-2 Length = 35.9 km)

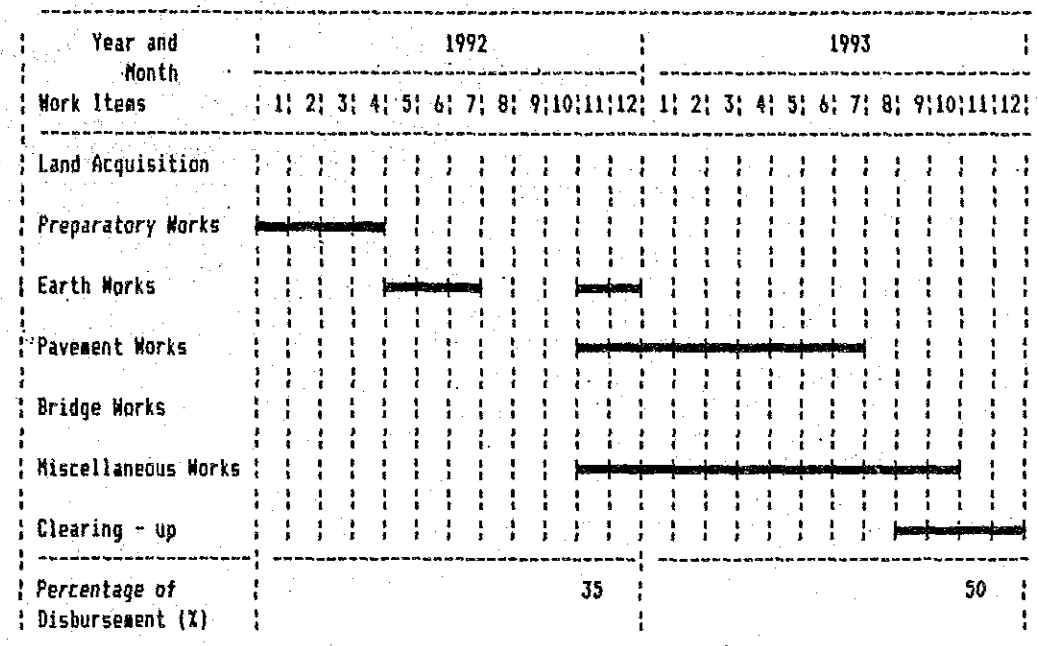
Item	Unit	Financial	Quantity	Financial	Economic Cost		Residual Value	
		Unit Rate Baht		Total Cost 1000 Baht	%	1000 Baht	%	1000 Baht
<b>EARTHWORK</b>								
Clearing & Grubbing	ha	10,000	26	260	85	221	90	199
Roadway Excavation (Unclassified)	m <sup>3</sup>	18	43,200	778	84	654	90	589
Roadway Excavation (Classified Unsuitable Material below Grade)	m <sup>3</sup>	38	0	-	84	-	90	-
Embankment (Common)	m <sup>3</sup>	33	187,000	6,171	86	5,307	90	4,776
Embankment (Borrow)	m <sup>3</sup>	72	-	-	86	-	90	-
Removal of Existing Structure	each	60,000	-	-	84	-	90	-
Sub Total				7,209		6,182		5,564
<b>SUBBASE and BASE COURSES</b>								
Subbase	m <sup>3</sup>	140	17,600	2,464	83	2,045	50	1,023
Aggregate base	m <sup>3</sup>	277	48,300	13,379	84	11,238	50	5,619
Shoulder (Soil Aggregate)	m <sup>3</sup>	165	20,100	3,317	83	2,753	50	1,377
Sub Total				19,160		16,036		8,019
<b>SURFACE COURSES</b>								
Asphaltic Prime Coat	m <sup>2</sup>	12	234,900	2,819	93	2,622	50	1,311
Asphaltic Tack Coat	m <sup>2</sup>	6	-	-	93	-	50	-
Double Bituminous Surface Treatment	m <sup>2</sup>	32	197,700	6,326	91	5,757	50	2,879
Asphalt Concrete Surfacing	ton	905	100	91	90	82	50	41
Portland Cement Concrete Pavement	m <sup>3</sup>	1,620	-	-	90	-	50	-
Sub Total				9,236		8,461		4,231
<b>STRUCTURES (Equivalent Cost)</b>								
RC Pipe Culvert (D=1.00 m)	m	1,800	110	198	88	174	50	87
RC Box Culvert (2-2.40x 2.40 m)	m	9,000	7	63	90	57	50	29
RC Bridge (W=9.0 m)	m	51,500	-	-	87	-	50	-
PC Bridge (W=9.0 m)	m	70,400	-	-	87	-	50	-
Bearing Unit	m <sup>2</sup>	1,600	-	-	87	-	50	-
Sub Total				261		231		116
<b>Total (a)</b>				<b>35,866</b>		<b>30,910</b>		<b>17,930</b>
Miscellaneous Work ( (a) x 7% )		1s		2,511	87	2,185	0	0
<b>CONTRACT AMOUNT (b)</b>				<b>38,377</b>		<b>33,095</b>		<b>17,930</b>
PHYSICAL CONTINGENCIES ( (b) x 10% ) (c)		1s		3,838		3,310		1,793
<b>ENGINEERING AND SUPERVISION</b> ( ((b) + (c)) x 10% ) (d)				<b>4,222</b>	<b>100</b>	<b>4,222</b>	<b>0</b>	<b>0</b>
<b>LAND ACQUISITION</b>								
Developed Land	ha	20,000	-	-				
Less Developed Land	ha	12,000	-	-				
Total (e)				0	100	0	100	0
<b>PROJECT COST ( (b) + (c) + (d) + (e) )</b>				<b>46,437</b>		<b>40,627</b>		<b>19,723</b>
<b>AVERAGE COST PER KM</b>				<b>1,294</b>				

(2) Road Maintenance Costs

(Unit : Baht/Year)

	Without Project	With Project
1994	468,577	403,464
2004	537,920	651,382

3.4 Construction Schedule



4. BENEFITS

ROAD CONDITIONS

(unit : km)

Section	Road Length	Without Project						With Project					
		Paved			Laterite			No. of Narrow Bridge	No. of Wooden Bridge	Road Paved		No. of Narrow Bridge	No. of Wooden Bridge
		Good	Fair	Poor	Good	Fair	Poor			Length	Good		
3306-0100-W	31.1	-	-	-	1.0	-	30.1	-	-	31.1	31.1	-	-
3306-0100-E	4.8	-	-	-	-	-	4.8	-	-	4.8	4.8	-	-

VOC AND TIME SAVINGS

(1000 BAHT)

Year	VOC Savings			Time Savings			Total Savings		
	Normal Traffic	Induced Traffic	Total	Normal Traffic	Induced Traffic	Total	Normal Traffic	Induced Traffic	Total
1994	8,876	909	9,785	2,285	2,345	4,630	11,160	3,254	14,415
2000	11,438	1,191	12,629	3,018	3,092	6,110	14,456	4,283	18,739
2008	16,190	1,690	17,880	4,374	4,406	8,780	20,564	6,096	26,660

## 5. ECONOMIC EVALUATION

### COST AND BENEFIT STATEMENT

(1000 BAHT)







YEAR	COST		BENEFITS			DISCOUNTED (12%)	
	CONST. COST	VOC SAVING	TIME SAVING	MAINT. SAVING	TOTAL	COST	BENEFIT
1992	18,282				0	22,933	0
1993	22,345				0	25,026	0
1994		9,785	4,630	65	14,480	0	12,929
1995		10,259	4,877	52	15,188	0	12,108
1996		10,733	5,123	39	15,895	0	11,314
1997		11,207	5,370	26	16,603	0	10,552
1998		11,681	5,617	13	17,311	0	9,823
1999		12,155	5,863	0	18,018	0	9,128
2000		12,629	6,110	(13)	18,726	0	8,471
2001		13,286	6,444	(26)	19,704	0	7,958
2002		13,942	6,778	(39)	20,681	0	7,458
2003		14,598	7,111	(52)	21,657	0	6,973
2004	6,318	15,255	7,445	(65)	22,635	2,034	6,507
2005		15,911	7,779	(78)	23,612	0	6,061
2006		16,567	8,113	(91)	24,589	0	5,635
2007		17,224	8,446	(104)	25,566	0	5,231
2008	(19,723)	17,880	8,780	(113)	26,547	(4,036)	4,850
TOTAL	27,222	203,112	98,486	(386)	301,212	45,957	124,998

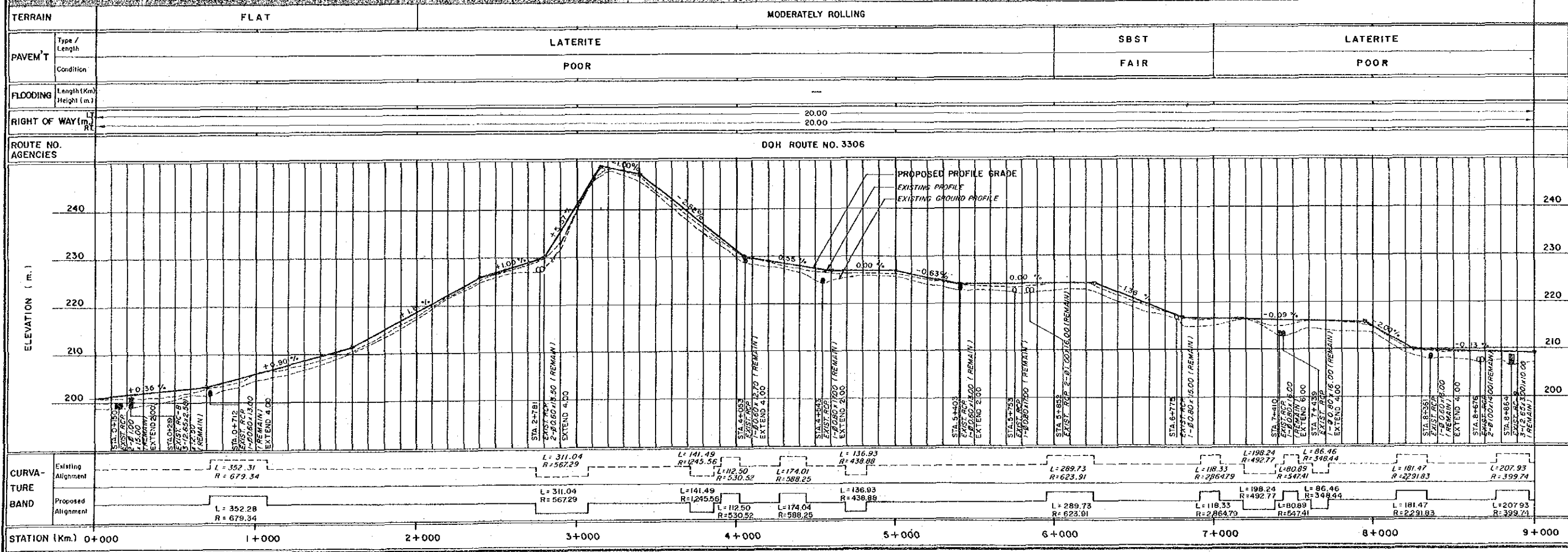
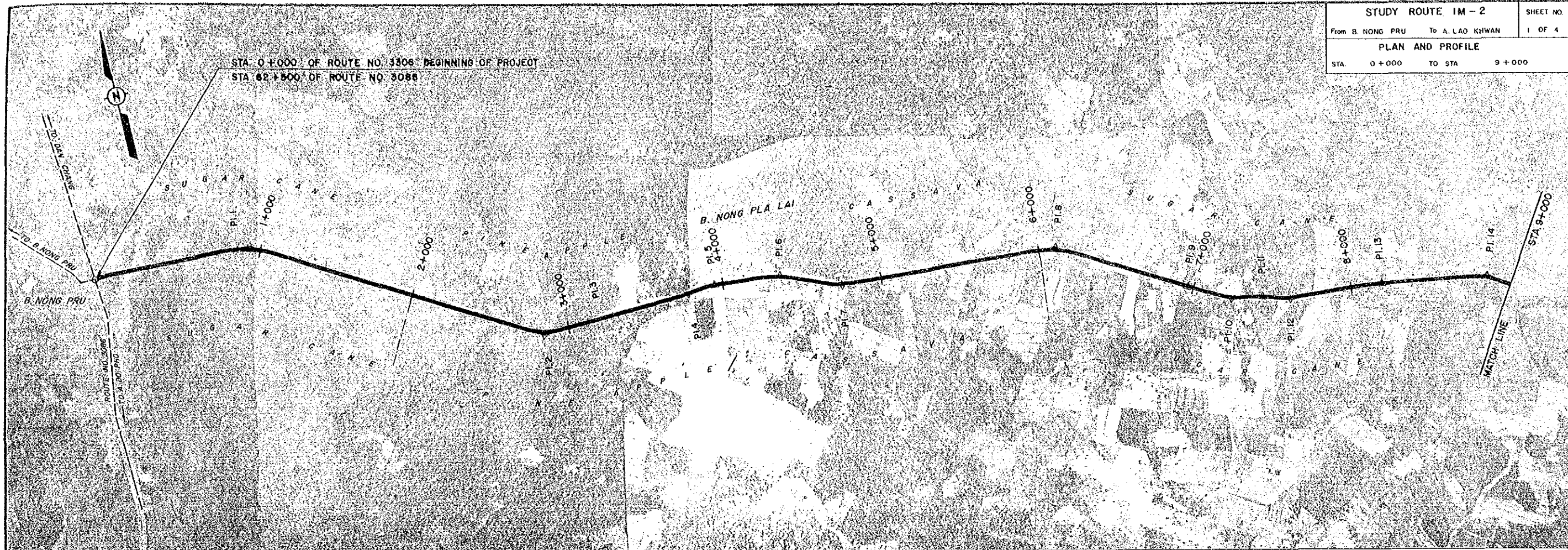
NET PRESENT VALUE : 79,041  
 BENEFIT COST RATIO : 2.72  
 INTERNAL RATE OF RETURN : 28.1%  
 FIRST YEAR RATE OF RETURN : 27.0%

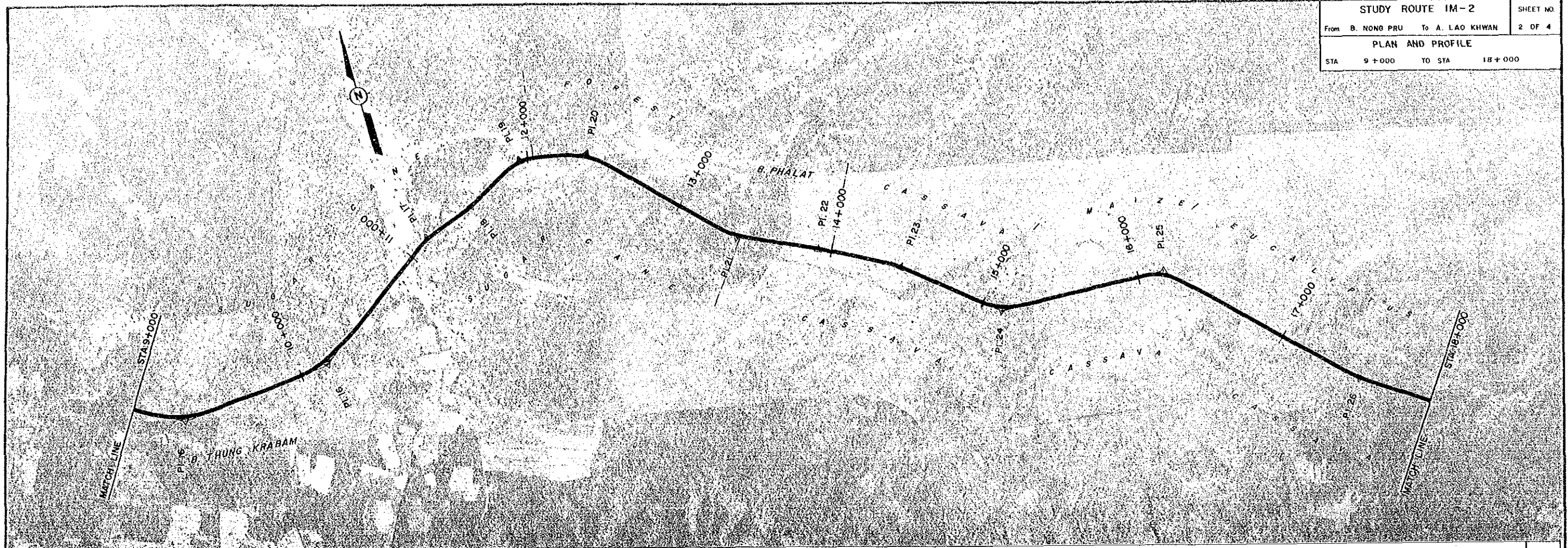


## 6. DRAWINGS

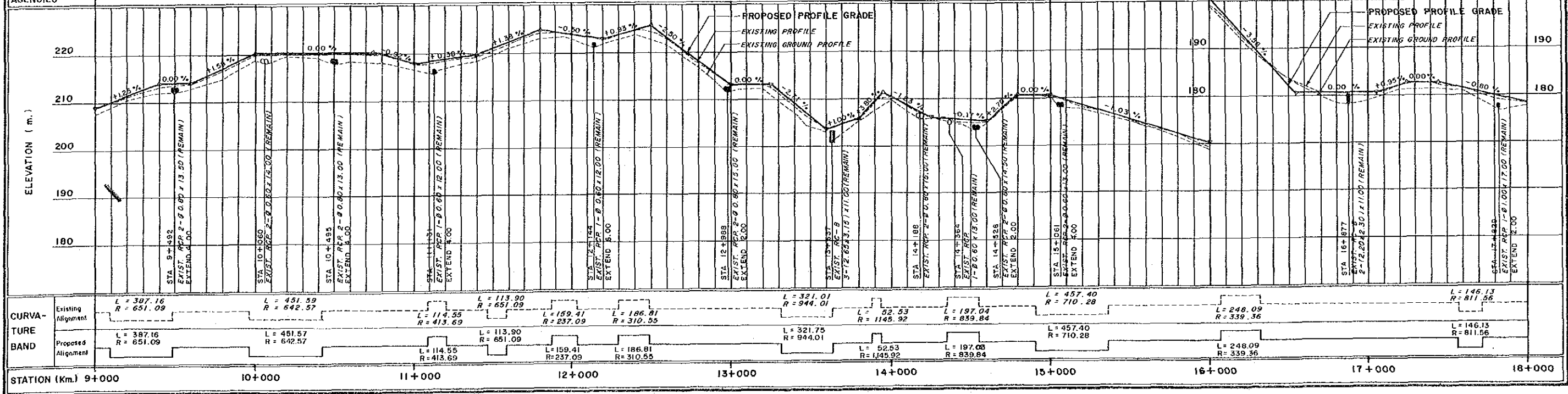
### ABBREVIATIONS and SYMBOLS for PLAN and PROFILE

	NEW CONSTRUCTION SECTION OF STUDY ROUTE
	IMPROVEMENT SECTION OF STUDY ROUTE
	BRIDGE (PROPOSED, EXISTING)
	BOX CULVERT (PROPOSED, EXISTING)
	PIPE CULVERT (PROPOSED, EXISTING)
	HIGH WATER LEVEL
HWY	HIGHWAY
PI	POINT OF HORIZONTAL INTERSECTION
NO. or #	NUMBER
$\Delta$	DEFLECTION ANGLE
R	RADIUS OF CURVATURE
T	TANGENT LENGTH
L	LENGTH OF CURVE
RT	RIGHT
LT	LEFT
EXIST.	EXISTING
EXTD.	EXTEND
RC-P-n- $\phi a \times l$	PIPE CULVERT, n (ROW), $\phi a$ (DIAMETER, m), l (LENGTH, m)
RC-B-n-a $\times b \times l$	BOX CULVERT, n (NO. OF CELLS), a $\times b \times l$ (CLEAR SPAN $\times$ DEPTH $\times$ LENGTH, m)
BR-T-a $\times l - n$	TIMBER BRIDGE, a $\times l$ (WIDTH $\times$ LENGTH, m), n (NO. OF SPANS)
BR-RC-a $\times l - n$	CONCRETE BRIDGE, a $\times l$ (ROADWAY WIDTH $\times$ LENGTH, m) n (NO. OF SPANS)

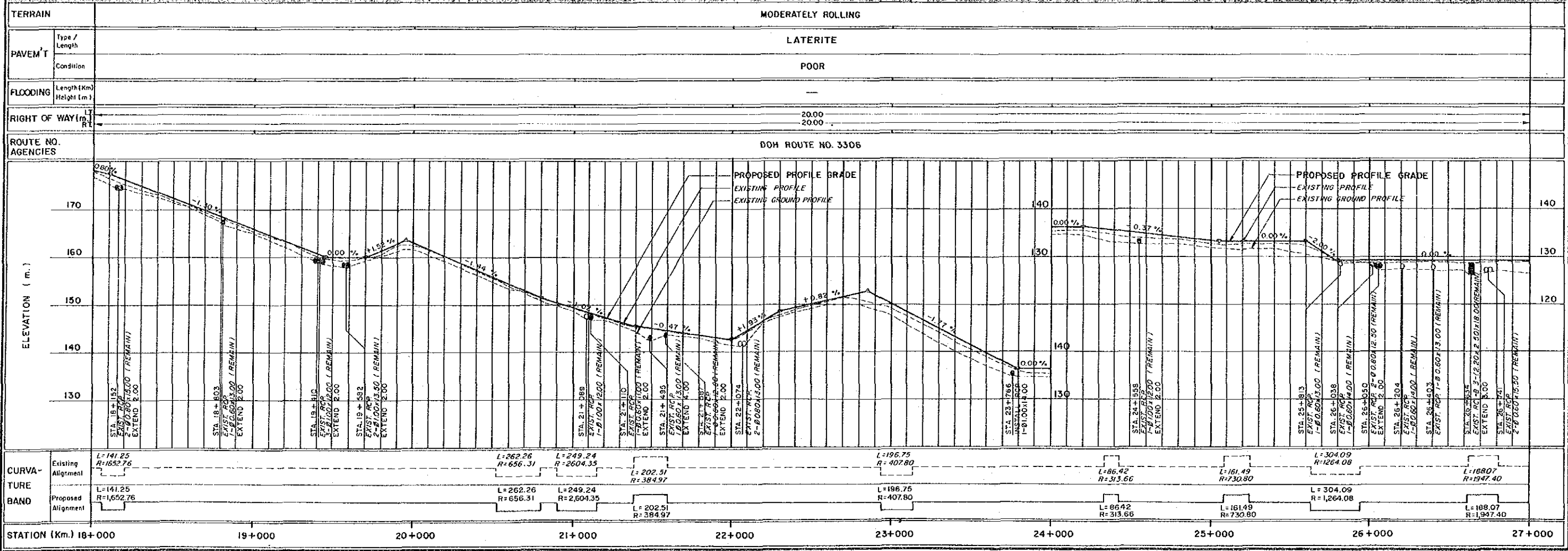
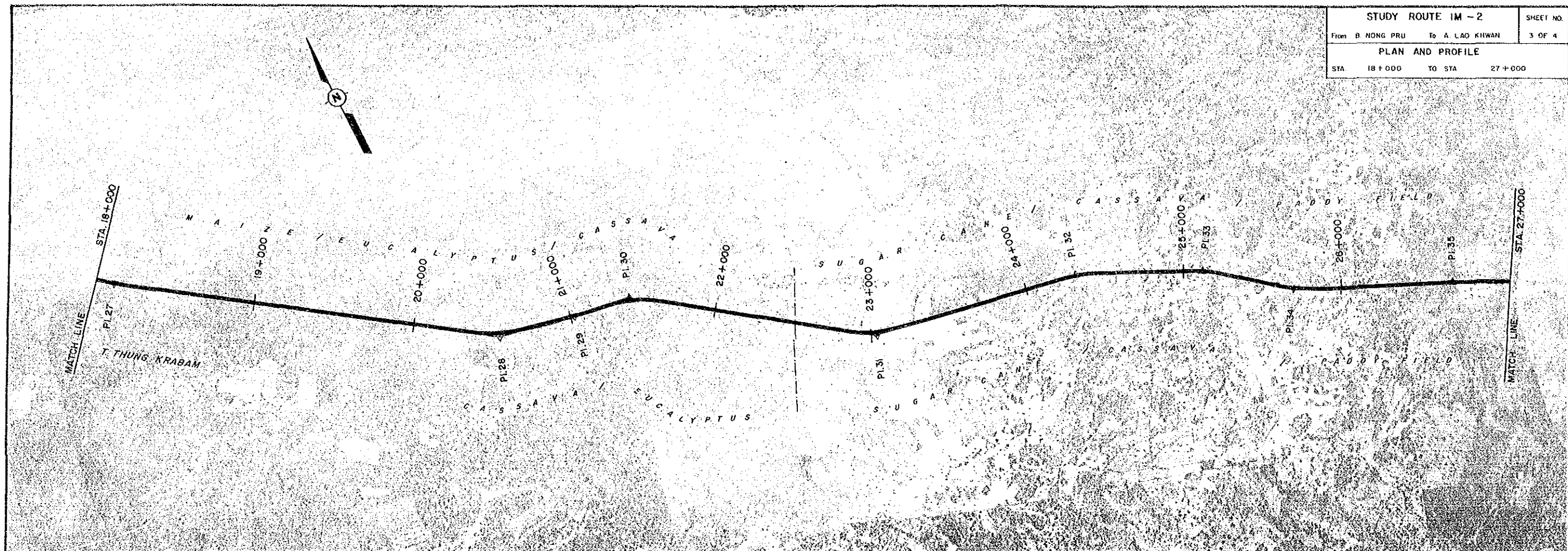


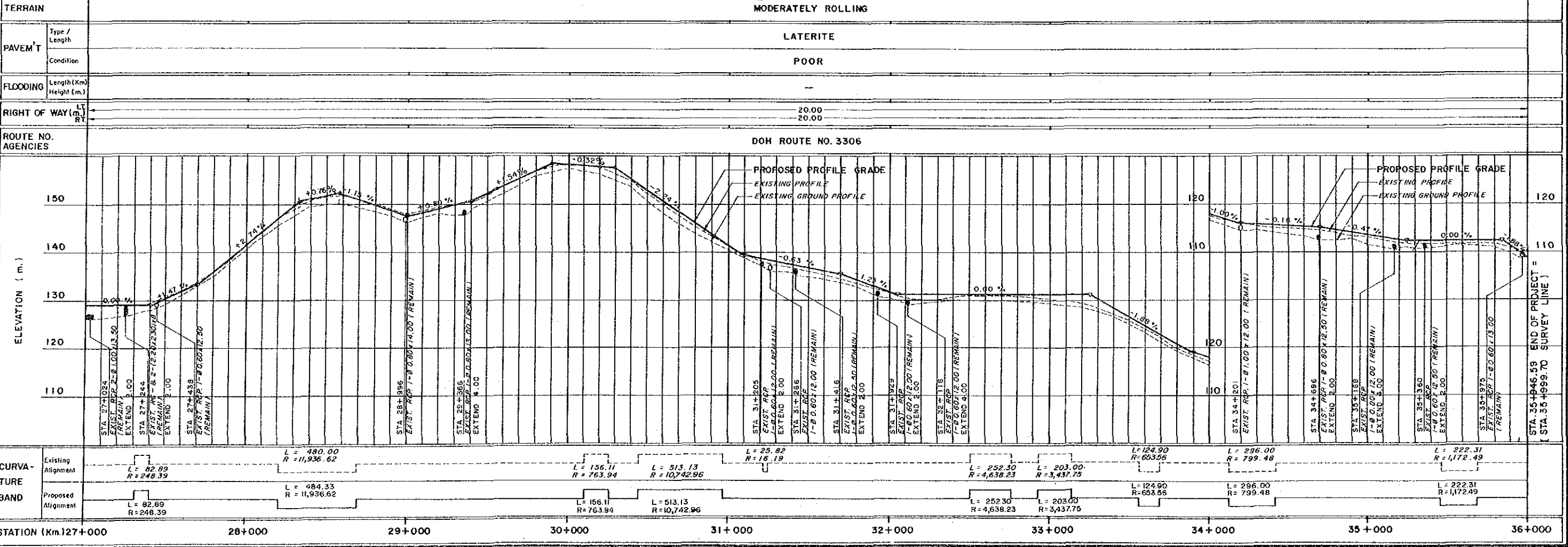
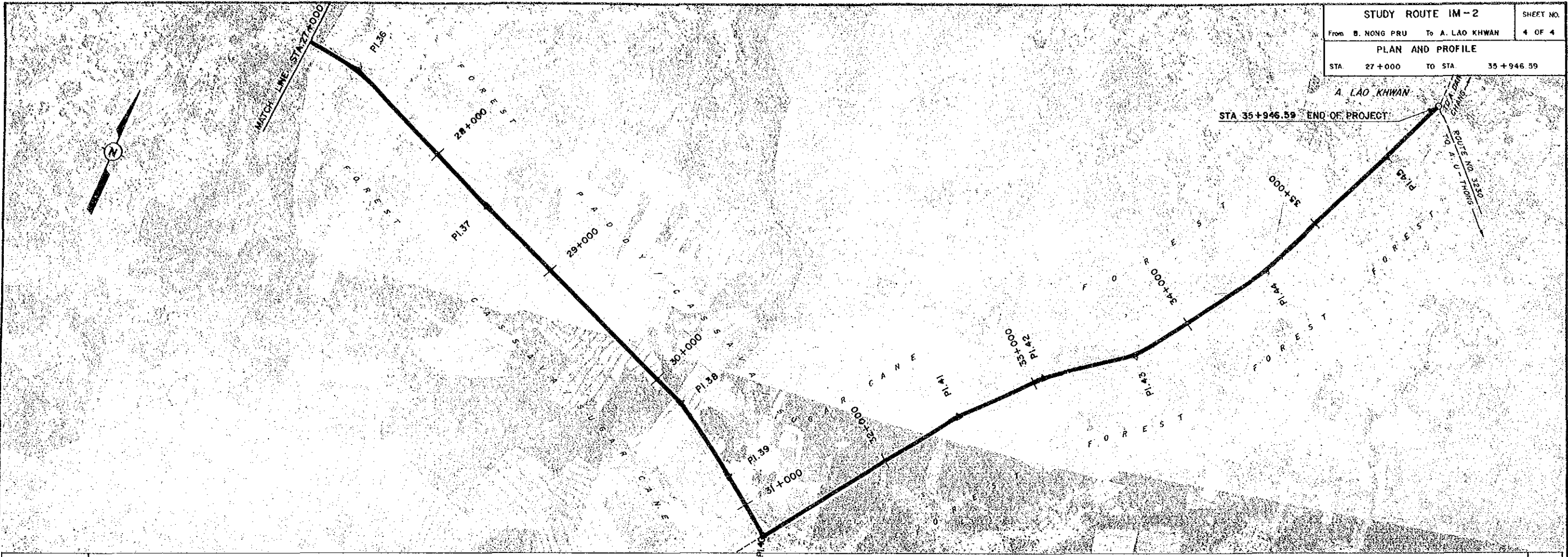


TERRAIN	Moderately Rolling
PAVEM'T	Laterite
FLOODING	Poor
RIGHT OF WAY (m.)	20.00
ROUTE NO. AGENCIES	DOH ROUTE NO. 3306



CURVA-TURE BAND	Existing Alignment		Proposed Alignment	
	L	R	L	R
1	387.16	651.09	387.16	651.09
2	451.59	642.57	451.57	642.57
3	114.55	413.69	114.55	413.69
4	113.90	651.09	113.90	651.09
5	159.41	237.09	159.41	237.09
6	186.81	310.55	186.81	310.55
7	321.01	944.01	321.75	944.01
8	52.53	1145.92	52.53	1145.92
9	197.04	859.84	197.03	859.84
10	457.40	710.28	457.40	710.28
11	248.09	339.36	248.09	339.36
12	146.13	811.56	146.13	811.56





**PROJECT IM - 11**

**Changwat : Sing Buri/Ang Thong**

**B. Channasut - A. Pho Thong**

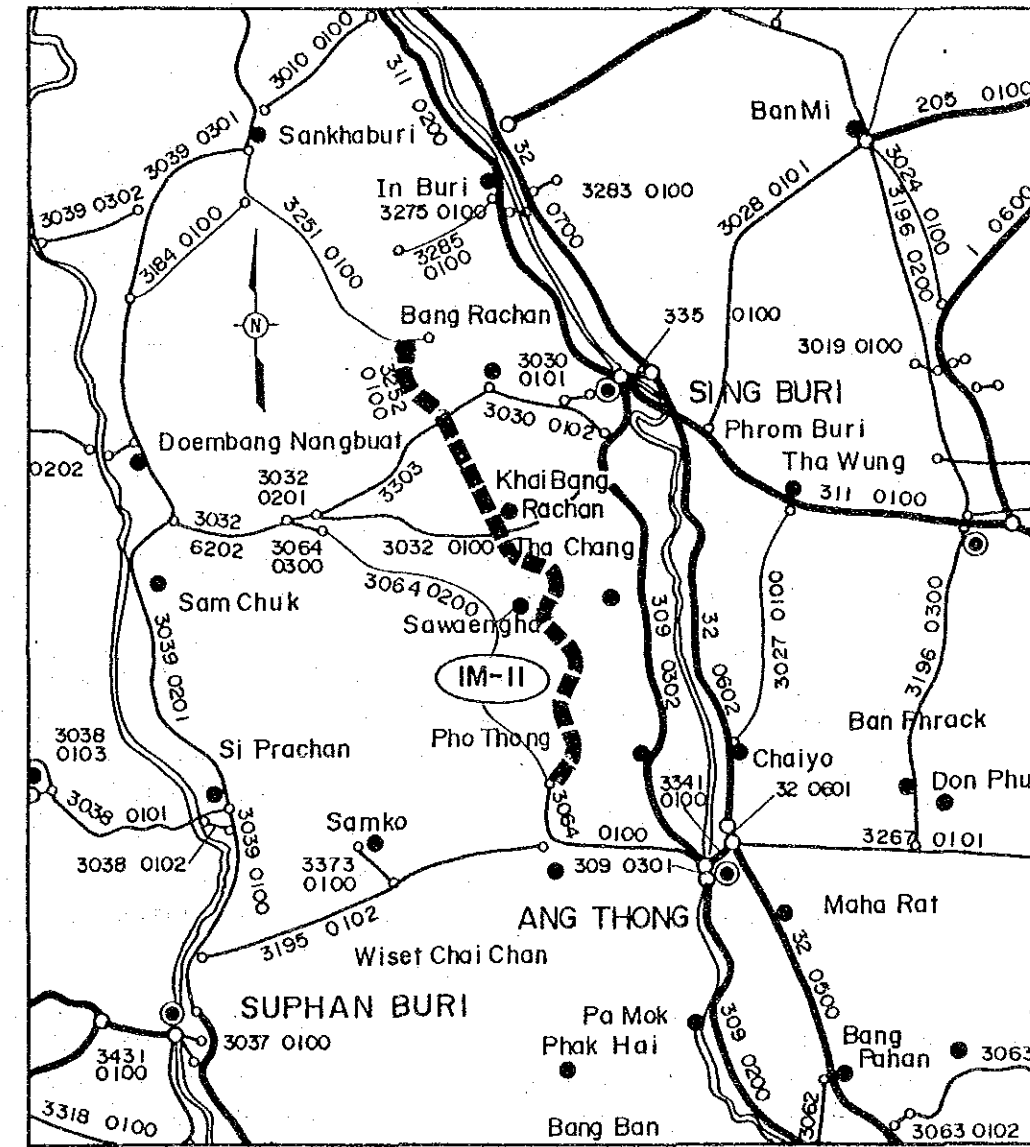
**Length : 40.7 km**

SUMMARY

PROJECT IM-11

ITEM	DESCRIPTION
Changwat	Sing Buri/Ang Thong
Origin	Ban Channasut
Destination	A. Pho Thong (Rt. 3064)
Route No.	RID
Project Length	40.70 km
Standard	
- Existing	—
- Proposed	F2
Traffic	
- Base	149 ~ 721
- 2000	500 ~ 2,000
- 2008	800 ~ 3,000
Pavement Type	
- Existing	SBST
- Proposed	AC pavement (t=7.5)
Bridges	
- New Construction	1 site, 27 m
- Replacement	—
Construction Costs	
- Financial	139,179,000 Baht
- Economic	122,930,000 Baht
Economic Evaluation	
- IRR	23.9%
- B/C	2.14

LOCATION OF PROJECT ROUTE



## 1. GENERAL

The proposed road is located in Changwat Ang Thong and Changwat Sing Buri. It originates at the junction with Route 3251 in Ban Channasut in Sing Buri, runs southward paralleling the Chao Phya River at a distance and ends at the junction with Route 3064 in Ang Thong. Its total length is 40.7 km.

The road is made on top of the eastern embankment of a large-scale irrigation canal for its entire length. Asphaltic pavement is applied for the entire length but its condition is generally poor and occasionally very poor, particularly in the middle section. Paddy fields alternating with sugarcane fields are observed in the first 10 km section on both sides of the road. In the next 10 km section both sides (the western side lies across the canal) are sugarcane fields. The remaining section runs through rice fields on both sides. Houses are concentrated on the immediate eastern side as a river flows about 1 km from the road. There is a very large sugar mill one-third along the road length. Heavy 10-wheel trucks laden with sugarcane stacked high can often be observed. At many places the pavement is so poor that trucks have to negotiate over shoulders at a crawl. Horizontal alignment is fair to good. The embankment is high, up to 3.0 m.

The problem point of this road in terms of horizontal alignment was found at Km 30+000, where there is a water intake to the adjoining canal. The original canal crossing point is closed to traffic and a small bridge is placed instead to shortcut the route but sharp curves still remain at present. An improved alignment satisfying DOH standards is proposed.

In most parts this road adjoins a canal on its west side as shown in the typical cross section. It was decided to move the shoulder for a distance of 1 m away from the canal for the purpose of shoulder protection and to upgrade the road class to F2. The new center line, therefore, will be removed from the existing one about 3 m away from the canal.

No problem was found with the existing pavement height in comparison with H.W.L. data. The new pavement was determined to be placed on top of the existing road surface height.

There is a plan to upgrade this road in future to a secondary national highway together with Route 3111 and IM-2, as it is considered an important one by DOH. Improved alignment of this road was determined with such future upgrading in mind.

Upon completion this road, together with IM-12, will form an alternate to Route 309.



2. TRAFFIC FORECAST

Base Traffic Volume

(Unit: Vehicles/Day)

Project Code	Section	Year	Traffic Volume							ADT
			MC	PC	LB	HB	LT	MT	HT	
IM-11	RID-N	1988	844	38	12	38	229	55	33	405
	RID-M	1988	245	10	9	0	98	18	14	149
	RID-S	1988	610	73	26	2	275	285	60	721

Traffic Growth Rate

(Unit: Percent)

Project	Section	Period	MC	PC	LB	HB	LT	MT	HT
IM-11	RID-N	-1993	8.46	8.80	5.44	6.77	9.17	7.93	9.14
		1994-2000	6.86	6.25	5.28	7.57	7.06	7.67	7.95
		2000-2008	5.39	5.70	4.99	2.31	4.92	6.18	6.76
	RID-M	-1993	8.46	8.80	5.44	6.77	9.17	7.93	9.14
		1994-2000	6.86	6.25	5.28	7.57	7.06	7.67	7.95
		2000-2008	5.39	5.70	4.99	2.31	4.92	6.18	6.76
RID-S	-1993	8.46	8.80	5.44	6.77	9.17	7.93	9.14	
	1994-2000	6.86	6.25	5.28	7.57	7.06	7.67	7.95	
	2000-2008	5.39	5.70	4.99	2.31	4.92	6.18	6.76	

Diverted Traffic Volume

(Unit: Vehicles/Day)

Project	Section	Year	MC	PC	LB	HB	LT	MT	HT	ADT
IM-11	RID-N	1994	0	2	0	0	10	0	37	49
		2000	0	2	0	0	15	0	58	75
		2008	0	4	0	0	22	0	98	124
	RID-M	1994	0	2	0	0	10	0	37	49
		2000	0	2	0	0	15	0	58	75
		2008	0	4	0	0	22	0	98	124
	RID-S	1994	0	6	0	0	63	14	37	120
		2000	0	9	0	0	95	22	58	184
		2008	0	15	0	0	139	36	98	288

Induced Traffic Volume

(Unit: Vehicles/Day)

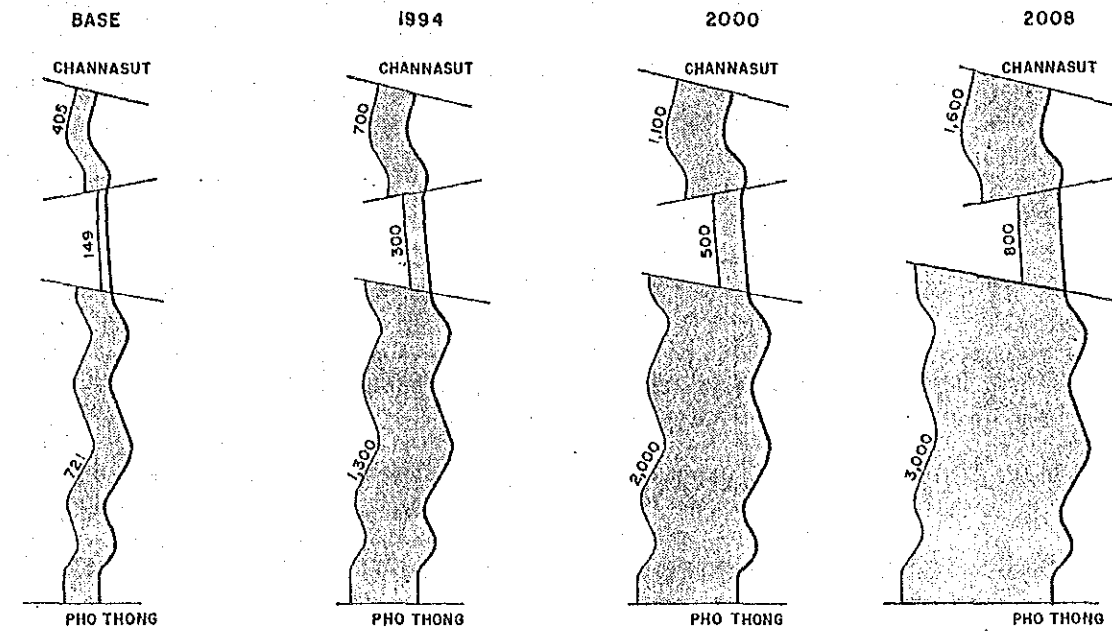
Project	Section	Year	MC	PC	LB	HB	LT	MT	HT	ADT
IM-11	RID-M	1994	81	4	3	0	43			50
		2000	121	6	5	0	65			76
		2008	177	9	7	0	95			111

Future Traffic Volume

(Unit: Vehicles/Day)

Project	Section	Year	MC	PC	LB	HB	LT	MT	HT	ADT
IM-11	RID-N	1994	1354	63	16	57	390	87	92	705
		2000	2016	91	22	88	587	135	146	1069
		2008	3068	142	33	105	862	218	246	1606
	RID-M	1994	474	22	16	2	216	28	60	344
		2000	706	32	21	3	325	44	95	520
		2008	1068	49	32	3	477	71	161	793
	RID-S	1994	978	125	36	3	520	464	137	1285
		2000	1457	179	49	5	782	722	217	1954
		2008	2217	280	72	6	1149	1167	366	3040

Note. N: North section M: Middle section S: South section



UNIT : VEHICLE / DAY

PROJECT IM - II

### 3. ENGINEERING

#### 3.1 Materials and Boring Results

##### (1) Materials

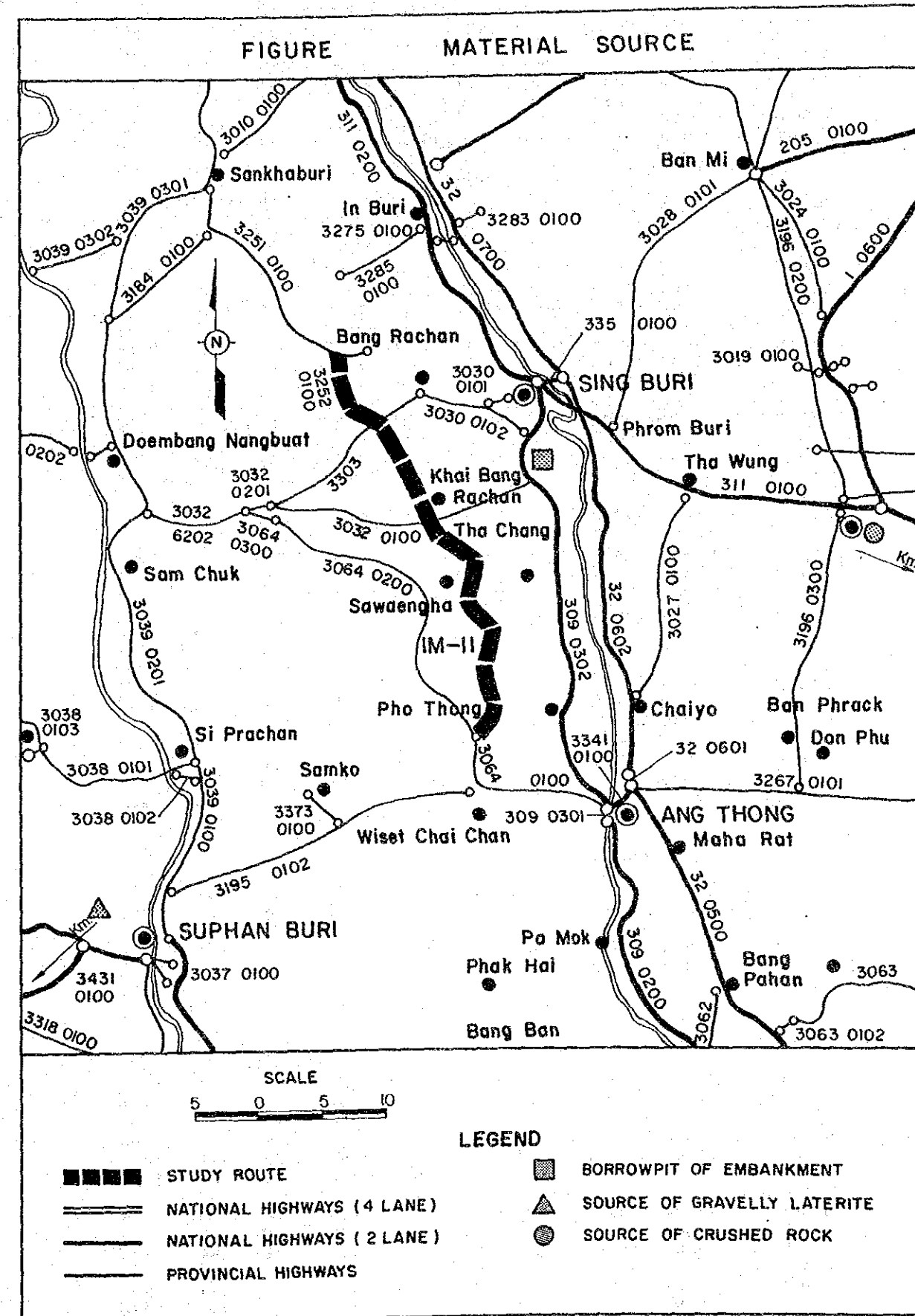
#### DESCRIPTION OF MATERIAL SOURCES

Material	Source	Description of Sample	Estimated Quantity cu.m.	Hauling Distance (km)
Soil	Route 309 Km 72+300 Left Side 0.2 Km	Silty Fine & Medium Sand	Plentiful	23
Laterite	Route 324 Km 130+000 Left Side 7.0 Km	Gravelly Laterite	Plentiful	58
Crushed Rock	Route 1 Km 130+000 Both Sides	Lime Stone	Plentiful	63

#### RESULTS OF LABORATORY TESTS

	Sieve Analysis % Passing								Plasticity		Comp. DH-T Stand.		Lab. C.B.R.	
	50.0	25.0	19.0	9.5	#4	#10	#40	#200	LL	PI	Opt. 95%	gn/cc	CBR 95%	Swell %
Soil		100	98	86	32	-	NP	15.2	1.57	11.9	-0.3			
Laterite	100	98	96	89	75	52	29	17	28.5	10.0	8.4	2.11	25	-
Crushed Rock													>80	-

Note : Abrasion test result of Crushed Rock 22.5 %



3.2 Preliminary Design

(1) Geometric Design Criteria

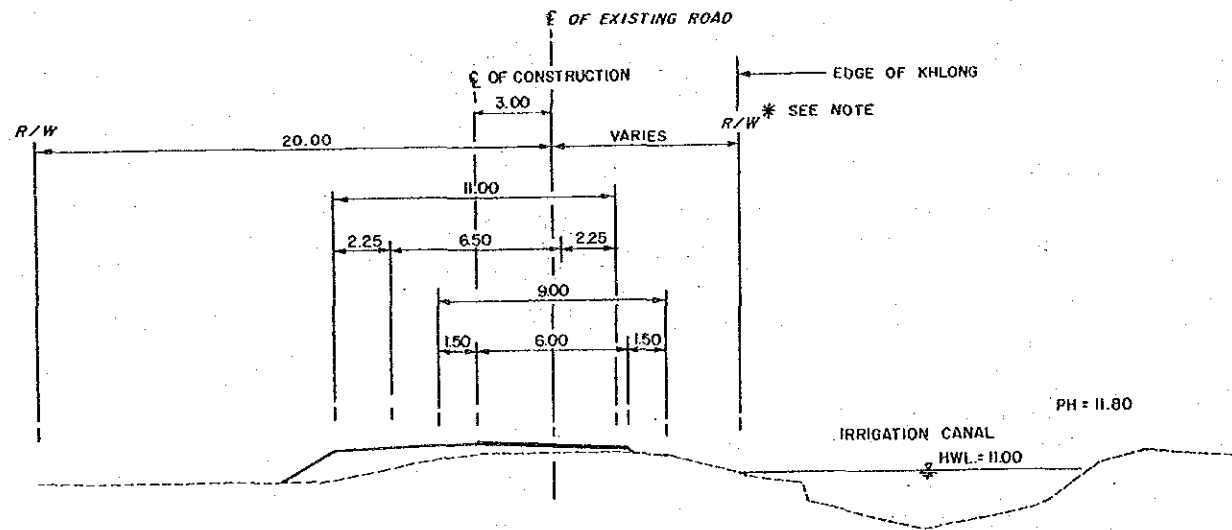
Design Standard : F-2  
 Design Speed : 70-90 km/h

Geometric Design Criteria

Description	Design Speed (km/h)		
	70	80	90
Minimum Radius & Curvature (m)	160	210	280
Minimum Stopping Sight Distance (m)	90	115	140
Maximum Gradient (%)	7	6	5

(2) Pavement Design

Design CBR of Subgrade	Cumulative No. of ESA W18 x 10 (10 years)	Thickness of Pavement Structure (cm)	
4.0	1,320	Surface	7.5
		Base	20
		Subbase	20



STA. 0+000 TO STA. 28+500  
 STA. 30+164 TO STA. 40+652

TYPICAL CROSS SECTION  
 IM-II ROAD CLASS F2

NOTE  
 FROM STA 28+500 TO STA. 30+164.  
 R/W WIDTH 40 M.

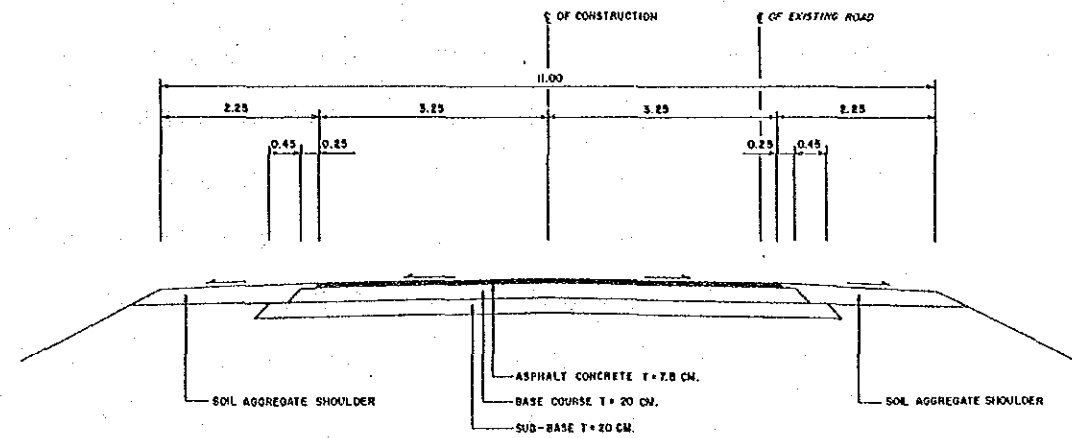


FIGURE TYPICAL PAVEMENT STRUCTURE FOR FLEXIBLE PAVEMENT IM-II

(3) Culverts

NO.	CHAINAGE	EXISTING CULVERT	NEW CULVERT
1	0+930	RCP 1-Dia 0.30x18.00	RCP 1-Dia 0.60x18.00
2	1+507	RCP 1-Dia 0.30x14.50	RCP 1-Dia 0.60x18.00
3	4+428	RCP 1-Dia 0.30x14.70	RCP 1-Dia 0.60x18.00
4	7+053	RCP 1-Dia 0.30x14.00	RCP 1-Dia 0.60x17.00
5	9+531	RCP 1-Dia 0.40x12.60	RCP 1-Dia 0.60x16.00
6	10+232	RCP 1-Dia 0.40x16.50	RCP 1-Dia 0.60x18.00
7	13+251	RCP 1-Dia 0.30x18.00	RCP 1-Dia 0.60x18.00
8	17+096	RCP 1-Dia 0.30x13.50	RCP 1-Dia 0.60x18.00
9	18+100	RCP 1-Dia 0.80x15.50	EXTEND 1-Dia 0.80x 3.00
10	19+737	RCP 1-Dia 1.00x13.00	EXTEND 1-Dia 1.00x 5.00
11	21+317	RCP 1-Dia 0.30x12.00	RCP 1-Dia 0.60x16.00
12	23+067	RCP 1-Dia 0.30x12.00	RCP 1-Dia 0.60x16.00
13	23+608	RCP 1-Dia 0.30x17.00	RCP 1-Dia 0.60x17.00
14	25+057	RCP 1-Dia 0.30x14.00	RCP 1-Dia 0.60x17.00
15	26+173	RCP 1-Dia 0.30x16.00	RCP 1-Dia 0.60x17.00
16	26+490	RCP 1-Dia 0.30x12.00	RCP 1-Dia 0.60x21.00
17	27+788	RCP 1-Dia 0.80x10.00	RCP 1-Dia 0.80x11.00
18	28+368	RCP 1-Dia 0.30x14.70	RCP 1-Dia 0.60x18.00
19	28+627	RCP 1-Dia 0.30x12.30	RCP 1-Dia 0.60x18.00
20	29+626	RCP 1-Dia 0.30x13.50	RCP 1-Dia 0.60x18.00

NO.	CHAINAGE	EXISTING CULVERT	NEW CULVERT
21	30+649	RCP 1-Dia 0.30x13.00	RCP 1-Dia 0.60x19.00
22	31+442	RCP 1-Dia 0.30x13.00	RCP 1-Dia 0.60x16.00
23	32+963	RCP 1-Dia 0.30x13.00	RCP 1-Dia 0.60x19.00
24	34+643	RCP 1-Dia 0.30x14.00	RCP 1-Dia 0.60x17.00
25	35+560	RCP 1-Dia 0.30x14.00	RCP 1-Dia 0.60x18.00
26	37+826	RCP 1-Dia 0.30x12.50	RCP 1-Dia 0.60x17.00
27	38+854	RCP 1-Dia 0.30x14.00	RCP 1-Dia 0.60x18.00
28	39+465	RCP 1-Dia 0.30x17.00	RCP 1-Dia 0.60x20.00
29	40+677	RCP 1-Dia 0.30x15.00	RCP 1-Dia 0.60x19.00

(4) Bridges

NO	CHAINAGE	EXISTING BRIDGE	PROPOSED BRIDGE
1	30+085	-	11.00x27.00 SLAB TYPE

3.3 Quantities and Construction and Road Maintenance Costs

(1) CONSTRUCTION QUANTITIES AND COSTS

(Project IM-11 Length = 40.7 km)

Item	Unit	Financial Unit Rate Baht	Quantity	Financial Total Cost 1000 Baht	Economic Cost		Residual Value	
					%	1000 Baht	%	1000 Baht
<b>EARTHWORK</b>								
Clearing & Grubbing	ha	10,000	34	340	85	289	90	260
Roadway Excavation (Unclassified)	m <sup>3</sup>	18	19,800	356	84	299	90	269
Roadway Excavation (Classified Unsuitable Material below Grade)	m <sup>3</sup>	38	-	-	84	-	90	-
Embankment (Common)	m <sup>3</sup>	33	-	-	86	-	90	-
Embankment (Borrow)	m <sup>3</sup>	111	213,700	23,721	86	20,400	90	18,360
Removal of Existing Structure	each	60,000	-	-	84	-	90	-
Sub Total				24,417		20,988		18,889
<b>SUBBASE and BASE COURSES</b>								
Subbase	m <sup>3</sup>	215	21,500	4,623	83	3,837	50	1,919
Aggregate base	m <sup>3</sup>	339	62,700	21,255	84	17,854	50	8,927
Shoulder (Soil Aggregate)	m <sup>3</sup>	249	30,900	7,694	83	6,386	50	3,193
Sub Total				33,572		28,077		14,039
<b>SURFACE COURSES</b>								
Asphaltic Prime Coat	m <sup>2</sup>	12	306,600	3,679	93	3,421	50	1,711
Asphaltic Tack Coat	m <sup>2</sup>	6	-	-	93	-	50	-
Double Bituminous Surface Treatment	m <sup>2</sup>	33	-	-	91	-	50	-
Asphalt Concrete Surfacing	ton	927	46,700	43,291	90	38,962	50	19,481
Portland Cement Concrete Pavement	m <sup>3</sup>	1,689	-	-	90	-	50	-
Sub Total				46,970		42,383		21,192
<b>STRUCTURES (Equivalent)</b>								
RC Pipe Culvert (D=1.00 m)	m	1,800	250	450	88	396	50	198
RC Box Culvert (2-2.40x 2.40 m)	m	10,000	-	-	90	-	50	-
RC Bridge (W=11.0 m)	m	66,000	27	1,782	87	1,550	50	775
PC Bridge (W=11.0 m)	m	96,000	-	-	87	-	50	-
Bearing Unit	m <sup>2</sup>	1,600	-	-	87	-	50	-
Sub Total				2,232		1,946		973
Total (a)				107,191		93,394		55,093
Miscellaneous Work ( (a) x 7% )				1s	7,503	87	6,528	0
CONTRACT AMOUNT (b)				114,694		99,922		55,093
PHYSICAL CONTINGENCIES ( (b) x 10% ) (c)				1s	11,469		9,992	5,509
ENGINEERING AND SUPERVISION ( ((b) + (c)) x 10% ) (d)				1s	12,616	100	12,616	0
<b>LAND ACQUISITION</b>								
Developed Land	ha	200,000	2	400				
Less Developed Land	ha	-	-	-				
Total (e)				400	100	400	100	400
PROJECT COST ( (b) + (c) + (d) + (e) )				139,179		122,930		61,002
AVERAGE COST PER KM				3,420				

(2) Road Maintenance Costs

(Unit : Baht/Year)

	Without Project	With Project
1994	689,743	435,372
2004	781,666	707,477

3.4 Construction Schedule

Year and Month	1992												1993											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Land Acquisition																								
Preparatory Works	█	█	█	█																				
Earth Works					█	█	█	█																
Pavement Works													█	█	█	█	█	█	█	█	█	█	█	█
Bridge Works					█	█	█	█					█	█	█	█	█	█	█	█	█	█	█	█
Miscellaneous Works													█	█	█	█	█	█	█	█	█	█	█	█
Clearing - up																								
Percentage of Disbursement (%)																								

#### 4. BENEFITS

##### ROAD CONDITIONS

(unit : km)

Section	Without Project									With Project					
	Road Length	Paved			Laterite			No. of Narrow Bridge	No. of Wooden Bridge	Road Length	Road Paved	No. of Narrow Bridge	No. of Wooden Bridge		
		Good	Fair	Poor	Good	Fair	Poor							Good	Fair
RID-N	6.6	-	-	-	-	6.6	-	-	-	-	-	6.6	6.6	-	-
RID-M	13.3	-	-	-	-	13.3	-	-	-	-	-	13.3	13.3	-	-
RID-S	21.1	-	-	-	14.0	7.1	-	-	-	-	-	20.8	20.8	-	-

##### VOC AND TIME SAVINGS

(1000 BAHT)

Year	VOC Savings			Time Savings			Total Savings		
	Normal Traffic	Induced Traffic	Total	Normal Traffic	Induced Traffic	Total	Normal Traffic	Induced Traffic	Total
1994	27,433	79	27,513	6,206	396	6,603	33,640	475	34,115
2000	36,369	119	36,489	8,173	597	8,770	44,543	716	45,259
2008	51,023	176	51,199	11,146	877	12,023	62,169	1,053	63,222

5. ECONOMIC EVALUATION

COST AND BENEFIT STATEMENT

(1000 BAHT)






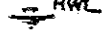
YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	VOC SAVING	TIME SAVING	MAINT. SAVING	TOTAL	COST	BENEFIT
1992	43,026				0	53,972	0
1993	79,905				0	89,494	0
1994		27,513	6,603	254	34,370	0	30,687
1995		29,009	6,964	241	36,214	0	28,870
1996		30,505	7,325	228	38,058	0	27,089
1997		32,001	7,686	215	39,902	0	25,358
1998		33,497	8,047	202	41,746	0	23,688
1999		34,993	8,409	189	43,591	0	22,085
2000		36,489	8,770	176	45,435	0	20,552
2001		38,328	9,177	163	47,668	0	19,252
2002		40,166	9,583	150	49,899	0	17,994
2003		42,005	9,990	137	52,132	0	16,785
2004	28,448	43,844	10,396	124	54,364	9,159	15,628
2005		45,683	10,803	111	56,597	0	14,527
2006		47,521	11,210	98	58,829	0	13,482
2007		49,360	11,616	85	61,061	0	12,494
2008	(61,002)	51,199	12,023	74	63,296	(12,482)	11,564
TOTAL	90,377	582,113	138,602	2,447	723,162	140,143	300,055

NET PRESENT VALUE : 159,912  
 BENEFIT COST RATIO : 2.14  
 INTERNAL RATE OF RETURN : 23.9%  
 FIRST YEAR RATE OF RETURN : 21.4%



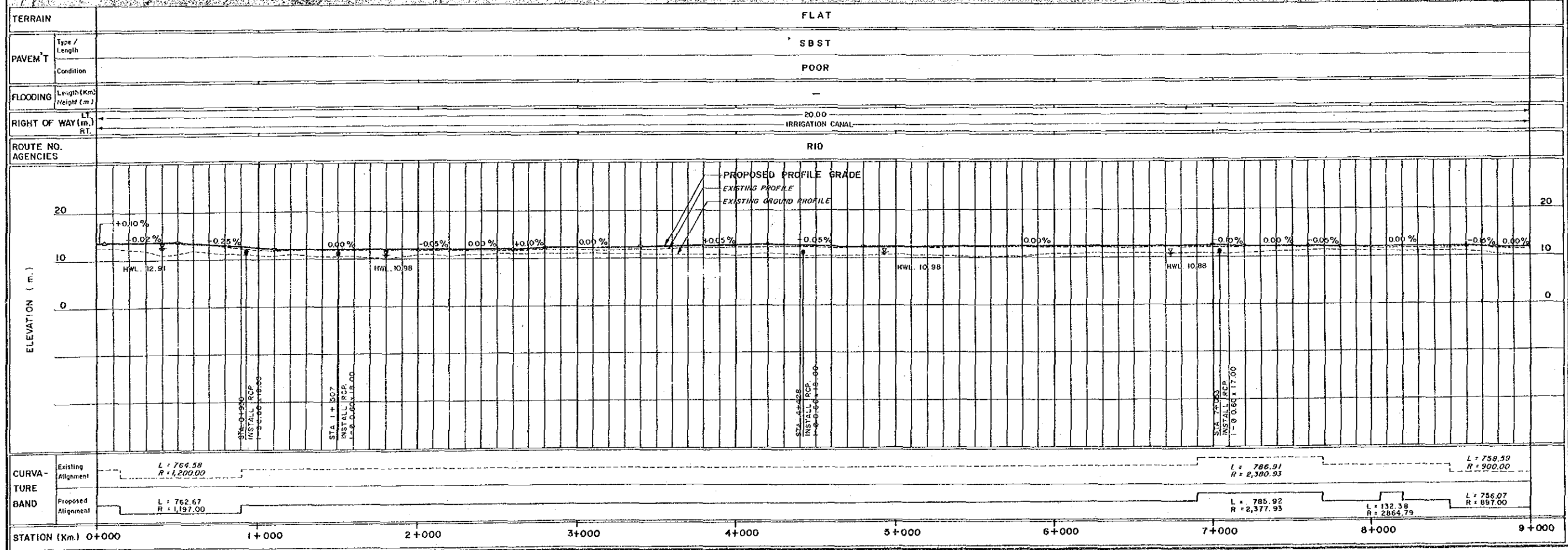
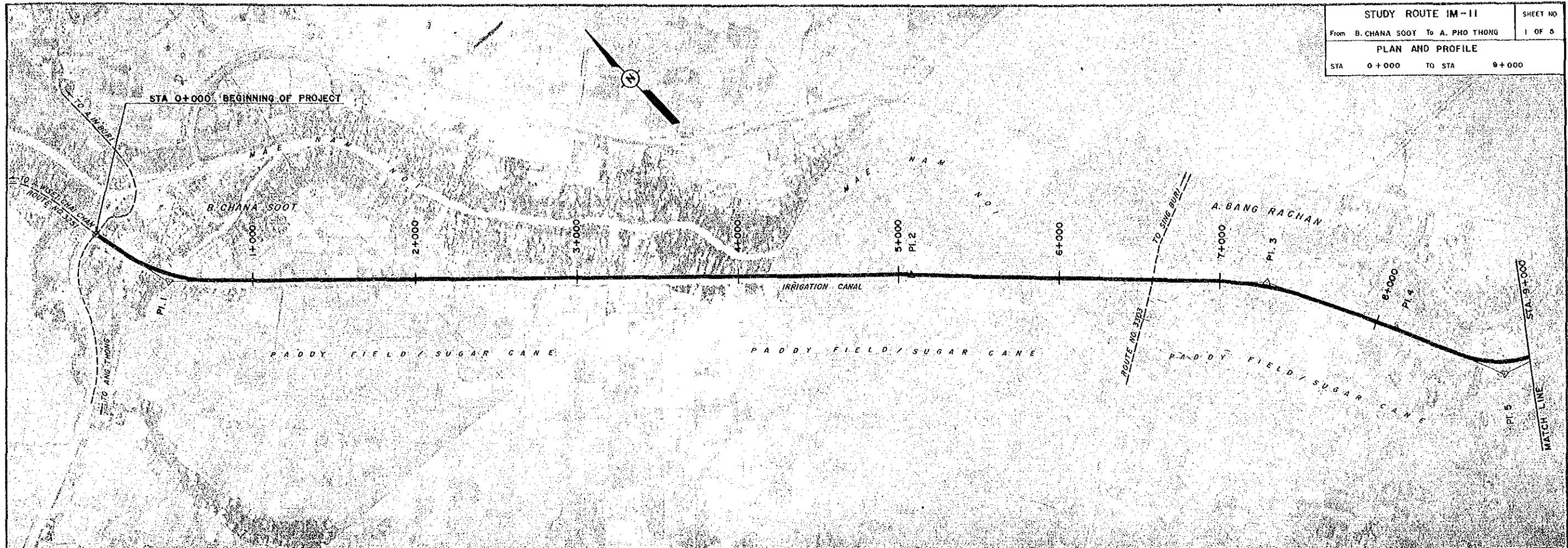
## 6. DRAWINGS

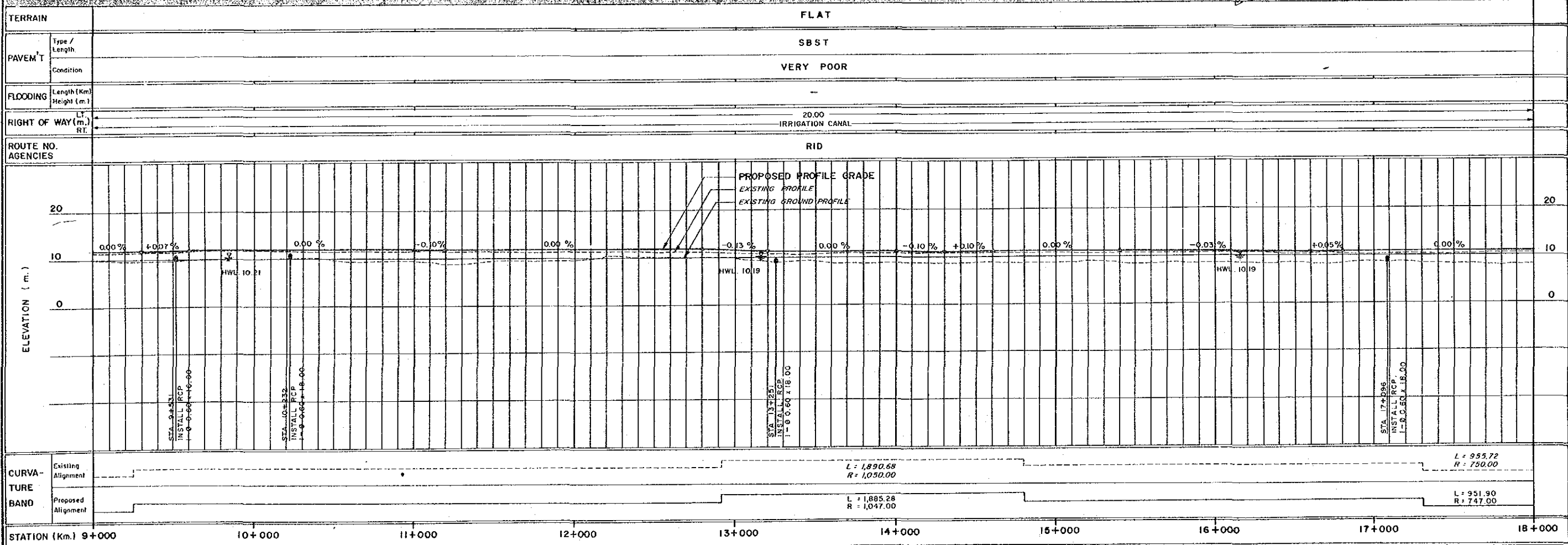
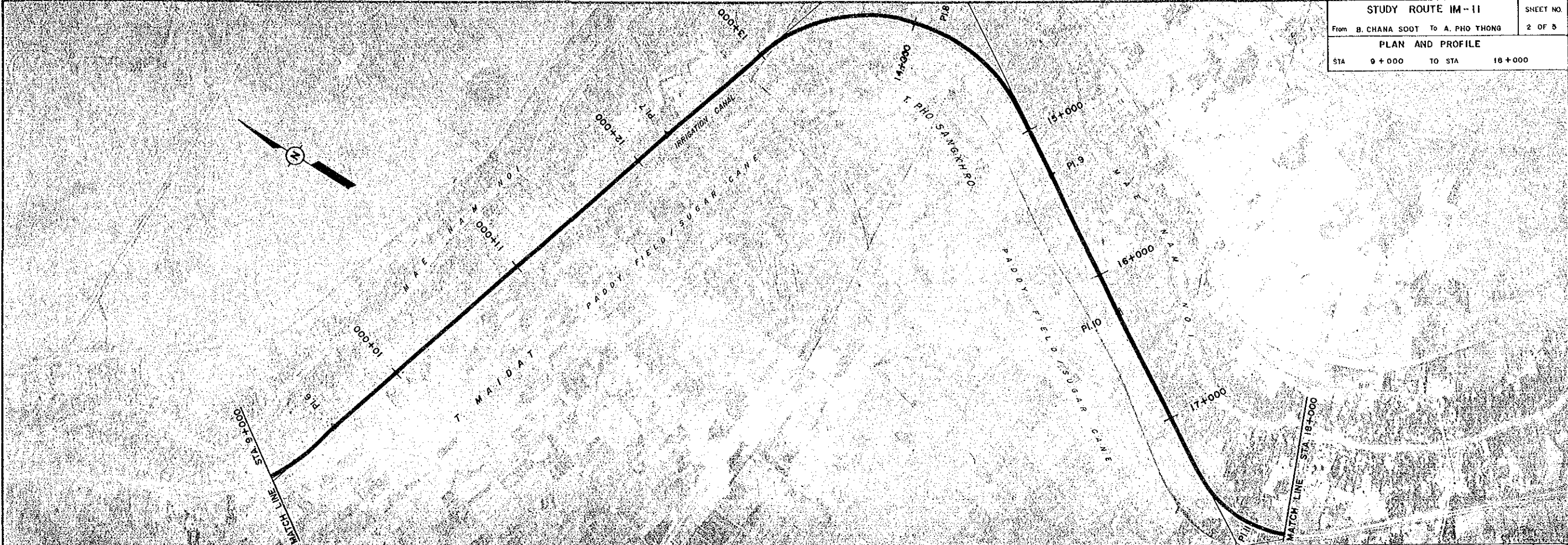
### ABBREVIATIONS and SYMBOLS for PLAN and PROFILE

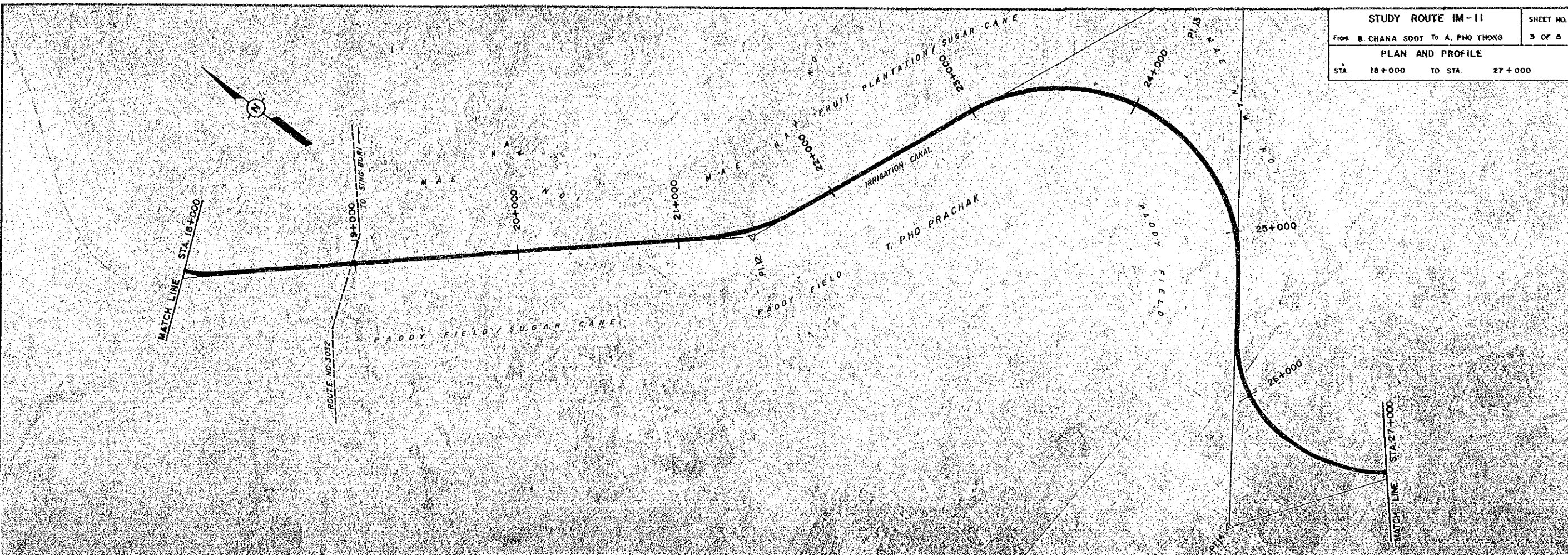
	NEW CONSTRUCTION SECTION OF STUDY ROUTE
	IMPROVEMENT SECTION OF STUDY ROUTE
	BRIDGE (PROPOSED, EXISTING)
	BOX CULVERT (PROPOSED, EXISTING)
	PIPE CULVERT (PROPOSED, EXISTING)
	HIGH WATER LEVEL

HWY	HIGHWAY
PI	POINT OF HORIZONTAL INTERSECTION
NO. or #	NUMBER
$\Delta$	DEFLECTION ANGLE
R	RADIUS OF CURVATURE
T	TANGENT LENGTH
L	LENGTH OF CURVE
RT	RIGHT
LT	LEFT
EXIST.	EXISTING
EXTD.	EXTEND

RC-P-n- $\phi$ a x l	PIPE CULVERT, n (ROW), $\phi$ a (DIAMETER, m), l (LENGTH, m)
RC-B-n-a x b x l	BOX CULVERT, n (NO. OF CELLS), a x b x l (CLEAR SPAN x DEPTH x LENGTH, m)
BR-T-a x l - n	TIMBER BRIDGE, a x l (WIDTH x LENGTH, m), n (NO. OF SPANS)
BR-RC-a x l - n	CONCRETE BRIDGE, a x l (ROADWAY WIDTH x LENGTH, m) n (NO. OF SPANS)







TERRAIN	FLAT	
PAVEM <sup>T</sup>	Type / Length	SBST
	Condition	POOR
FLOODING	Length (Km) Height (m.)	-
RIGHT OF WAY (m.)	LT RT	20.00 IRRIGATION CANAL
ROUTE NO. AGENCIES	RID	
CURVA- TURE BAND	Existing Alignment	$L = 751.09$ $R = 1,640.49$
	Proposed Alignment	$L = 749.70$ $R = 1,637.49$
		$L = 2,240.19$ $R = 1,100.00$
		$L = 1,698.39$ $R = 900.00$
		$L = 2,234.08$ $R = 1,097.00$
		$L = 1,692.73$ $R = 897.00$
ELEVATION ( m. ) 20 10 0 PROPOSED PROFILE GRADE EXISTING PROFILE EXISTING GROUND PROFILE 0.00% +0.15% 0.00% -0.06% 0.00% +0.05% 0.00% -0.05% 0.00% -0.07% 0.00% -0.05% 0.00% +0.00% 0.00% +0.00% 0.00%		
STA 18+100 EXIST. RCP I-Ø 0.80x15.50 (REMAIN) EXTEND 5.00  STA 19+137 EXIST. RCP I-Ø 0.80x15.50 (REMAIN) EXTEND 5.00  STA 21+017 INSTALL RCP I-Ø 0.60x16.00  STA 23+287 INSTALL RCP I-Ø 0.60x16.00  STA 23+408 INSTALL RCP I-Ø 0.60x16.00  STA 25+087 INSTALL RCP I-Ø 0.60x17.00  STA 26+173 INSTALL RCP I-Ø 0.60x17.00  STA 26+490 INSTALL RCP I-Ø 0.60x21.00		
STATION (Km.) 18+000      19+000      20+000      21+000      22+000      23+000      24+000      25+000      26+000      27+000		

