



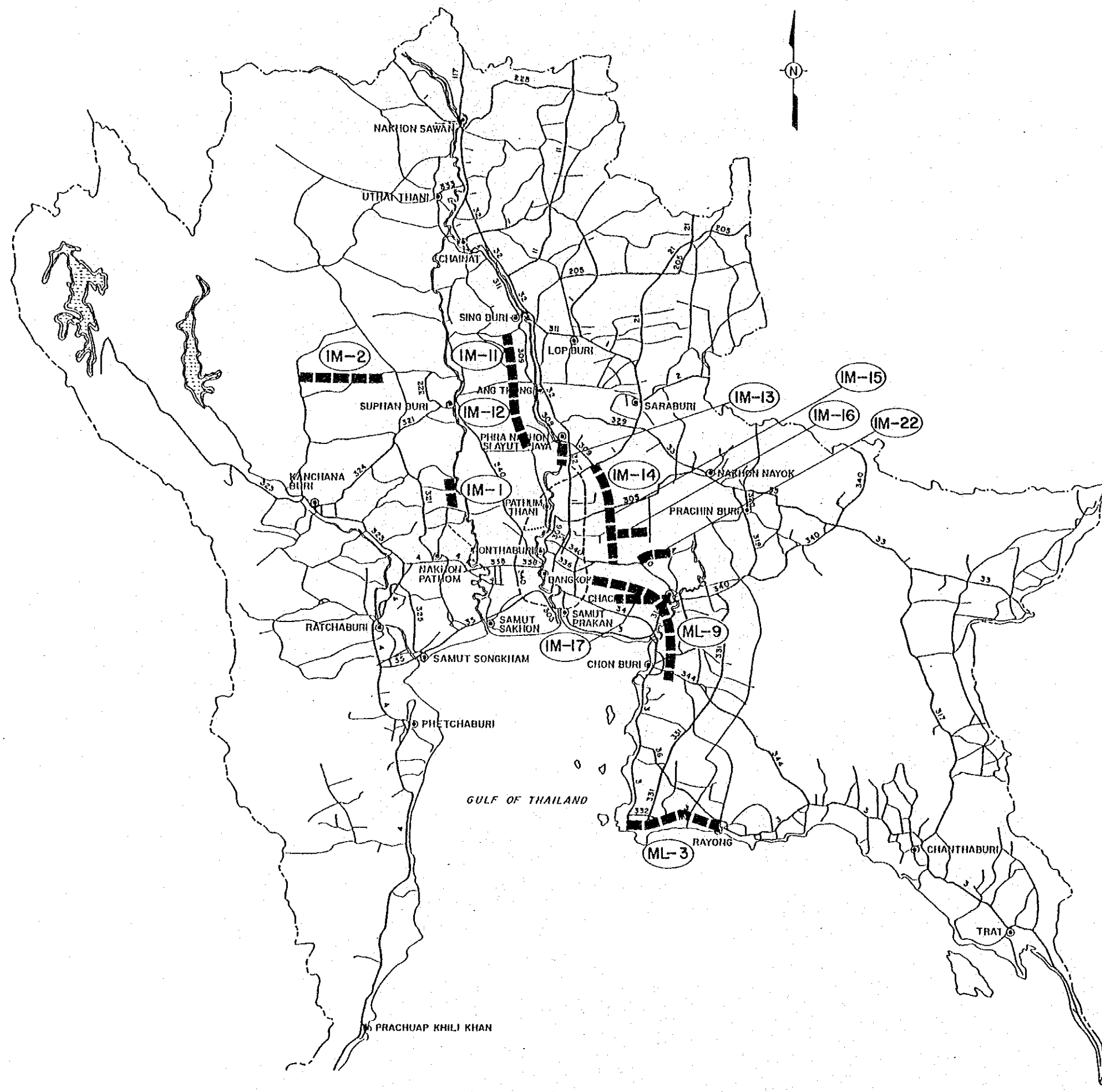
TERRAIN	FLAT	
PAVEM T	Type / Length	AC. PAVEMENT
	Condition	FAIR / POOR POOR
FLOODING	Length (km) Height (m)	—
RIGHT OF WAY (m.)	50.00	
ROUTE NO. AGENCIES	DOH ROUTE NO. 3267	
CURVA-TURE BAND	Existing Alignment	L = 244.26 R = 2,592.90
	Proposed Alignment	L = 244.26 R = 2,592.90
ELEVATION (m.)	<p>PROPOSED PROFILE GRADE EXISTING PROFILE EXISTING GROUND PROFILE</p> <p>Grades: 0.00%, +0.10%, 0.00%, +0.10%, 0.00%, -0.10%, 0.00%, +0.25%, 0.00%</p> <p>Vertical Curve Data: STA. 18+170: EXIST. RCP 1-90.60+7.00 (REMAIN), EXTEND 4.00 STA. 18+287: EXIST. RCP 1-91.00+7.00 (REMAIN), EXTEND 4.00 STA. 18+881: EXIST. RCP 1-91.00+7.00 (REMAIN), EXTEND 9.00 STA. 19+450: EXIST. RCP 2-12.80+2.80+1.45 (2.00) (REMAIN), EXTEND 4.00 STA. 19+934: EXIST. RCP 1-92.00+5.00 (REMAIN), EXTEND 4.00 STA. 20+404: EXIST. RCP 1-92.00+5.00 (REMAIN), EXTEND 4.00 STA. 20+779: EXIST. RCP 1-92.00+5.00 (REMAIN), EXTEND 4.00 STA. 20+970: EXIST. RCP 1-92.00+5.00 (REMAIN), EXTEND 4.00 STA. 21+323: EXIST. RCP 2-91.00+5.00 (REMAIN), EXTEND 4.00 STA. 21+506: EXIST. RCP 1-92.00+5.00 (REMAIN), EXTEND 5.00 STA. 21+886: EXIST. RCP 1-92.00+5.00 (REMAIN), EXTEND 5.00 STA. 22+816: EXIST. RCP 1-90.60+7.00 (REMAIN), EXTEND 3.00 STA. 23+407: EXIST. RCP 1-90.60+7.00 (REMAIN), EXTEND 3.00 STA. 23+534: EXIST. RCP 1-90.60+7.00 (REMAIN), EXTEND 4.00 STA. 23+938: EXIST. RCP 1-90.60+7.00 (REMAIN), EXTEND 5.00 STA. 24+135: EXIST. RCP 1-90.60+7.00 (REMAIN), EXTEND 4.00 STA. 24+585: EXIST. RCP 1-91.00+7.00 (REMAIN), EXTEND 4.00 STA. 24+877: EXIST. RCP 1-91.00+7.00 (REMAIN), EXTEND 4.00 STA. 25+133: EXIST. RCP 1-90.60+7.00 (REMAIN), EXTEND 4.00 STA. 25+760: EXIST. RCP 1-90.60+7.00 (REMAIN), EXTEND 4.00 STA. 26+163: EXIST. RCP BRIDGE 8-00+2.00 (REMAIN), EXTEND 4.00 STA. 26+537: EXIST. RCP 1-90.60+7.00 (REMAIN), EXTEND 4.00 STA. 26+852: EXIST. RCP 1-90.60+7.00 (REMAIN), EXTEND 4.00 STA. 26+836: EXIST. RCP 1-90.60+7.00 (REMAIN), EXTEND 4.00</p>	
STATION (Km.)	18+000	19+000 20+000 21+000 22+000 23+000 24+000 25+000 26+000 26+871.670

FEASIBILITY STUDY

PHASE II

STUDY ROUTES

Project No.	Changwat	Division	Route No.	Origin - Destination
ML-3	Rayong	Chachoengsao	3	A. Sattahip - C. Rayong
ML-9	Bangkok, Chachoengsao, Chon Buri	Bangkok, Chachoengsao	New Route	J.R. 3344 (Bangkok) - Chon Buri - Pattaya New Highway
IM-1	Nakhon Pathom	Bangkok	PWD	A. Bang Len - B. Bang Noi Noi
IM-2	Kanchanaburi	Bangkok	3306	B. Nong Pru - A. Lao Khwan
IM-11	Sing Buri, Ang Thong	Lop Buri	RID	B. Channasut - A. Pho Thong
IM-12	Ang Thong, Ayutthaya	Bangkok	RID	A. Pho Thong - A. Sena
IM-13	Ayutthaya	Bangkok	3059	A. Bang Pa-In - C. Ayutthaya
IM-14	Ayutthaya, Pathum Thani	Bangkok	Rural	A. Wang Noi - A. Thanyaburi
IM-15	Pathum Thani, Bangkok	Bangkok	Rural	B. Khlong Luang - A. Min Buri
IM-16	Pathum Thani	Bangkok	3312	A. Lam Luk Ka - B. Khlong 16
IM-17	Bangkok	Chachoengsao	PWD	A. Lat Krabang - B. Khlong Tha Thua
IM-22	Bangkok, Chachoengsao	Chachoengsao	Rural	A. Nong Chok - A. Bang Nam Prieo



LEGEND

- ▬▬▬▬ PROJECT ROUTE
- NATIONAL HIGHWAYS
- PROVINCIAL HIGHWAYS
- ⊙ CHANGWAT

10 0 10 30 50 70 90 KM.

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- 3.3 Quantities and Construction and Road Maintenance Costs

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- o Time Savings
- o Total Benefits

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- o Cost and Benefit Statement

6. DRAWINGS

PROJECT ML - 3

Changwat : Rayong

A. Sattahip - C. Rayong

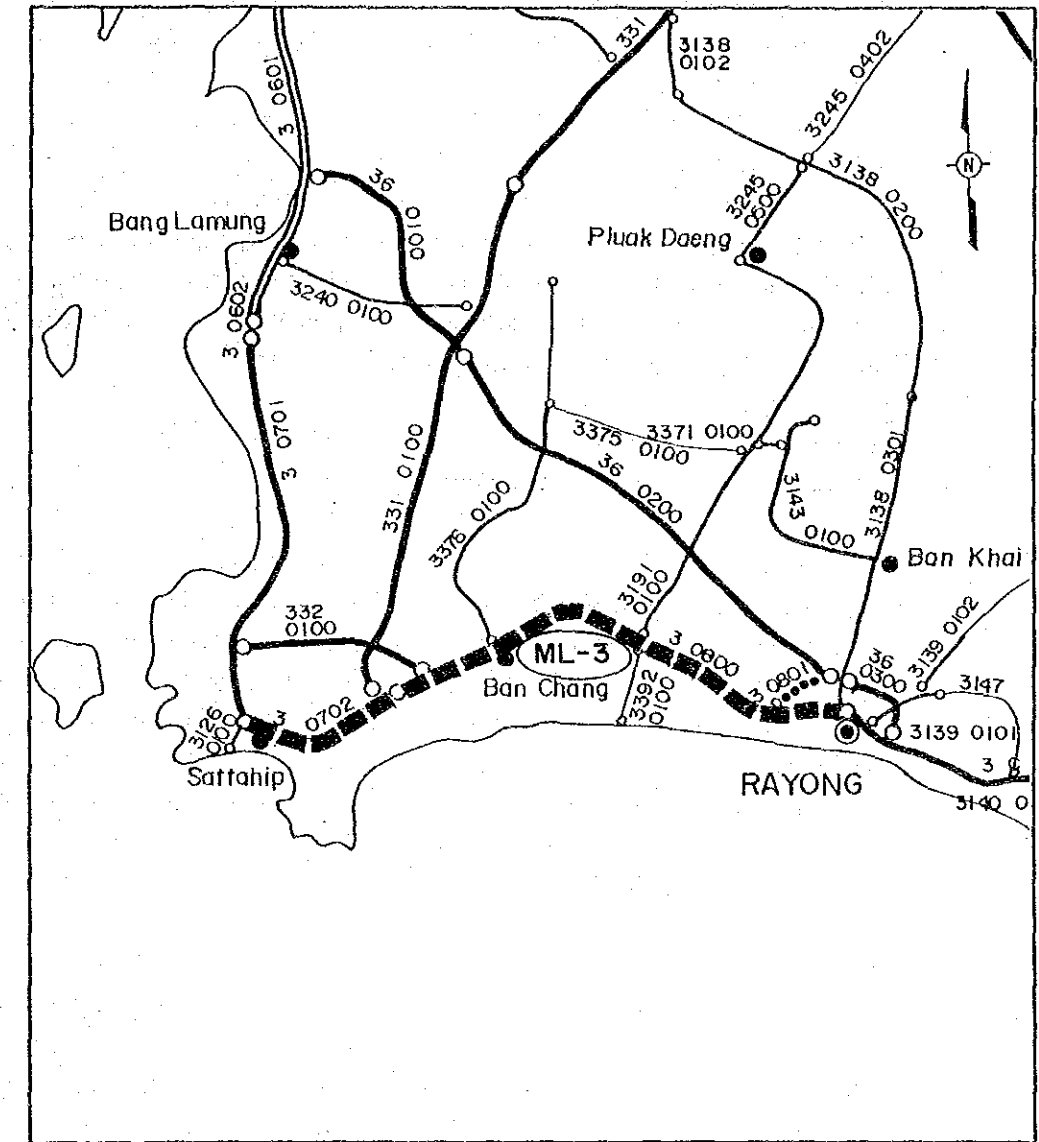
Length : 44.6 km

SUMMARY

PROJECT ML-3


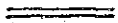

ITEM	DESCRIPTION
Changwat	Chon Buri/Rayong
Origin	A. Sattahip
Destination	C. Rayong
Route No.	Rt. 3
Project Length	49.60 km
Standard	
- Existing	P1
- Proposed	PD
Traffic	
- Base	4,388 ~ 5,809
- 2000	9,300 ~ 12,200
- 2008	14,000 ~ 18,300
Pavement Type	
- Existing	AC pavement
- Proposed	PM/AC pavement (t = 10)
Bridges	
- New Construction	5 sites, 98 m
- Replacement	—
Intersections	
- Channelization	1 each
Construction Costs	
- Financial	417,200,000 Baht
- Economic	373,297,000 Baht
Economic Evaluation	
- IRR	25.6%
- B/C	2.60

LOCATION OF PROJECT ROUTE



SCALE
5 0 10 Km.

LEGEND :

	PROJECT ROUTE		PROVINCIAL HIGHWAYS
	DIVIDED HIGHWAYS		PROVINCIAL HIGHWAYS (Unpaved)
	NATIONAL HIGHWAYS		CHANGWAT, AMPHOE

1. GENERAL

The route proposed to be widened is a part of Route 3 from Amphoe Sattahip to Changwat Rayong with a total length of 44.6 km. The route lies in Changwat Rayong for its entire length.

The terrain is mildly rolling except for short sections at both ends. Present land use along the road is mostly dry land crops such as coconut, cassava, fruits, sugarcane and rubber. Roadside development is heavy at several places. At Km 34 the Map Ta Phut Industrial Complex is under construction, with a large-scale gas separation plant already in operation.

The existing two-lane asphalt road is already carrying relatively heavy traffic. Its surface condition is often poor.

The city of Rayong and its environs have been growing rapidly in recent years due to industrial development and growth in the fishery and tourism industries, as well as the successful development of cash crops. Together with the development of the Map Ta Phut Complex, Changwat Rayong will generate a high demand for road traffic.

There are seven permanent bridges with a total length of 152 m. There are a number of places where horizontal or vertical alignment is poor.

One of the adopted design principles was, as in ML-4, to contain the expanded road within the existing right-of-way width of 40 m in built-up areas so that land acquisition can be avoided as shown in the standard cross section drawing. Sections this principle was applied to are: from the origin (STA 175+049) to STA 178+500 (approx. 3.5 km), from STA 185+000 to STA 185+500 (approx. 0.5 km), from STA 193+000 to STA 193+300 (approx. 2.5 km), from STA 196+500 to STA 198+500 (approx. 2.0 km), from STA 208+000 to STA 209+000 (approx. 1.0 km), and from STA 215+000 to the end point (STA 219+750) (approx. 4.75 km). In all, six sections with a total length of 14.25 km had this principle applied, which is 32% of the total road length of 44.7 km.

Right-of-way widening was considered possible for other sections for an extra width of 15 m. The section from STA 177+500 to STA 185+000 was decided to be widened on the sea side considering the present conditions of strip development along the existing road, ease of land acquisition, existing cross-road structure (a railway bridge at STA 184+500 for the Chachoengsao-Sattahip Railway was built with clearance on the sea side), and so forth.

In the 9 km section from STA 199+000 to STA 208+000, there are two opposing T-junctions, which will primarily serve the Map Ta Phut Industrial Complex and Map Ta Phut Waterworks Division. Horizontal alignment around STA 201+000 is curved and weaving movements of vehicles using the T-junctions will have to be accommodated in this curved section. It was therefore decided that additional lanes were necessary in this section requiring widening on the mountain side.

The section from STA 209+000 to STA 215+000 was decided to be widened on the sea side considering the existence of a school, the shape of the horizontal alignment around STA 214+800, and the shape of the Rayong Bypass Intersection already expanded on the sea side to a four-lane intersection. (No cost estimates were made in this study.)

Vertical alignment of the proposed road was designed to follow the existing road as much as possible, but wherever changes in curvature were found frequent, an attempt was made to make it as smooth as possible.

Among bridges, those at STA 179+600, STA 207+700 and STA 211+700 were found to be substandard and were decided to be replaced.

2. TRAFFIC FORECAST

Base Traffic Volume

(Unit: Vehicles/Day)

Project Code	Section	Year	Traffic Volume							ADT
			MC	PC	LB	HB	LT	MT	HT	
ML-3	3-0702	1988	4128	1473	721	47	293	2398	74	5006
	3-0800-W	1988	1370	696	779	237	2122	220	334	4388
	3-0800-E	1988	1895	806	668	249	3180	349	557	5809

Traffic Growth Rate

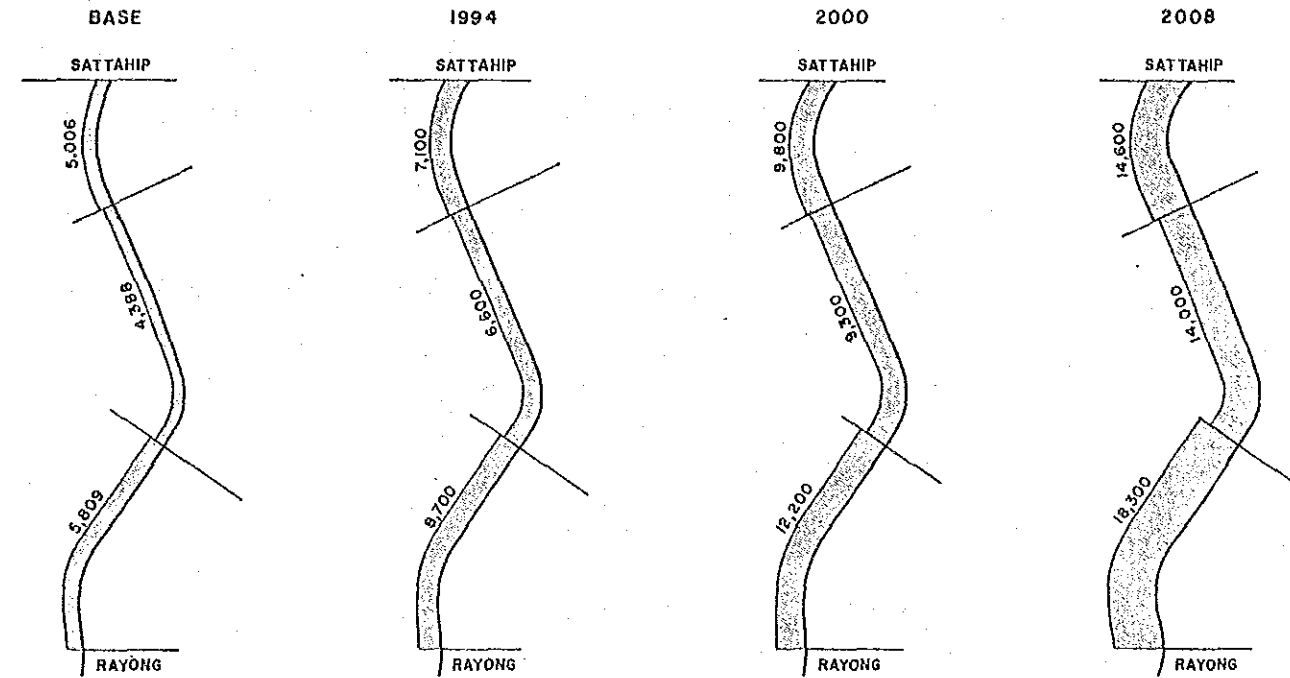
(Unit: Percent)

Project	Section	Period	Traffic Growth Rate							ADT
			MC	PC	LB	HB	LT	MT	HT	
ML-3	3-0702	-1993	7.42	7.16	8.52	5.72	7.73	4.73	4.95	
		1994 -2000	5.89	6.42	5.89	5.08	5.94	4.55	4.96	
		2000 -2008	5.27	6.08	5.18	5.10	5.17	4.27	4.38	
	3-0800-W	-1993	7.42	7.16	8.52	5.72	7.73	4.73	4.95	
		1994 -2000	5.89	6.42	5.89	5.08	5.94	4.55	4.96	
		2000 -2008	5.27	6.08	5.18	5.10	5.17	4.27	4.38	
	3-0800-E	-1993	7.42	7.16	8.52	5.72	7.73	4.73	4.95	
		1994 -2000	5.89	6.42	5.89	5.08	5.94	4.55	4.96	
		2000 -2008	5.27	6.08	5.18	5.10	5.17	4.27	4.38	

Future Traffic Volume

(Unit: Vehicles/Day)

Project	Section	Year	Future Traffic Volume							ADT
			MC	PC	LB	HB	LT	MT	HT	
ML-3	3-0702	1994	6252	2215	1149	65	450	3158	99	7136
		2000	8813	3217	1620	88	637	4125	132	9819
		2008	13291	5158	2427	131	953	5764	186	14619
	3-0800-W	1994	2075	1046	1241	329	3262	290	446	6614
		2000	2926	1520	1749	443	4611	378	596	9297
		2008	4413	2437	2620	660	6901	528	840	13986
	3-0800-E	1994	2870	1212	1064	346	4888	460	744	8714
		2000	4045	1761	1500	465	6910	601	995	12232
		2008	6100	2824	2247	692	10342	840	1402	18347



PROJECT ML - 3

UNIT : VEHICLE / DAY

3. ENGINEERING

3.1 Materials and Boring Results

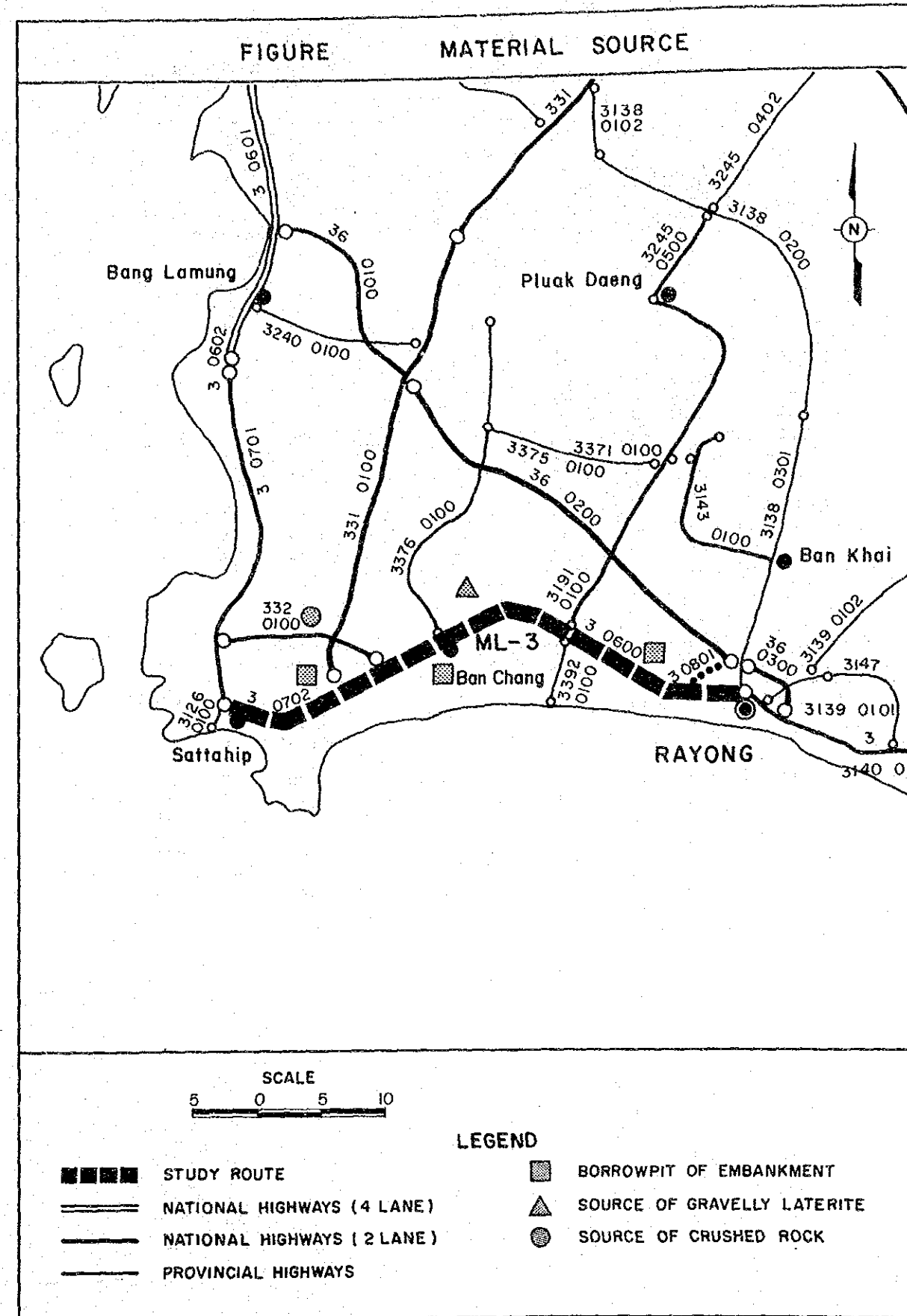
(1) Materials

DESCRIPTION OF MATERIAL SOURCES

Material	Source	Description of Sample	Estimated Quantity cu.m.	Hauling Distance (km)
Soil	Route 3 Km 193+800 Right Side 0.6 Km	Silty Fine & Medium Sand	Plentiful	10
Laterite	Route 3 Km 194+700 Left Side 3 Km	Gravelly Laterite	85,000	15
Crushed Rock	Route 332 Km 99+000 Right Side 5.0 Km	Lime Stone	Plentiful	17

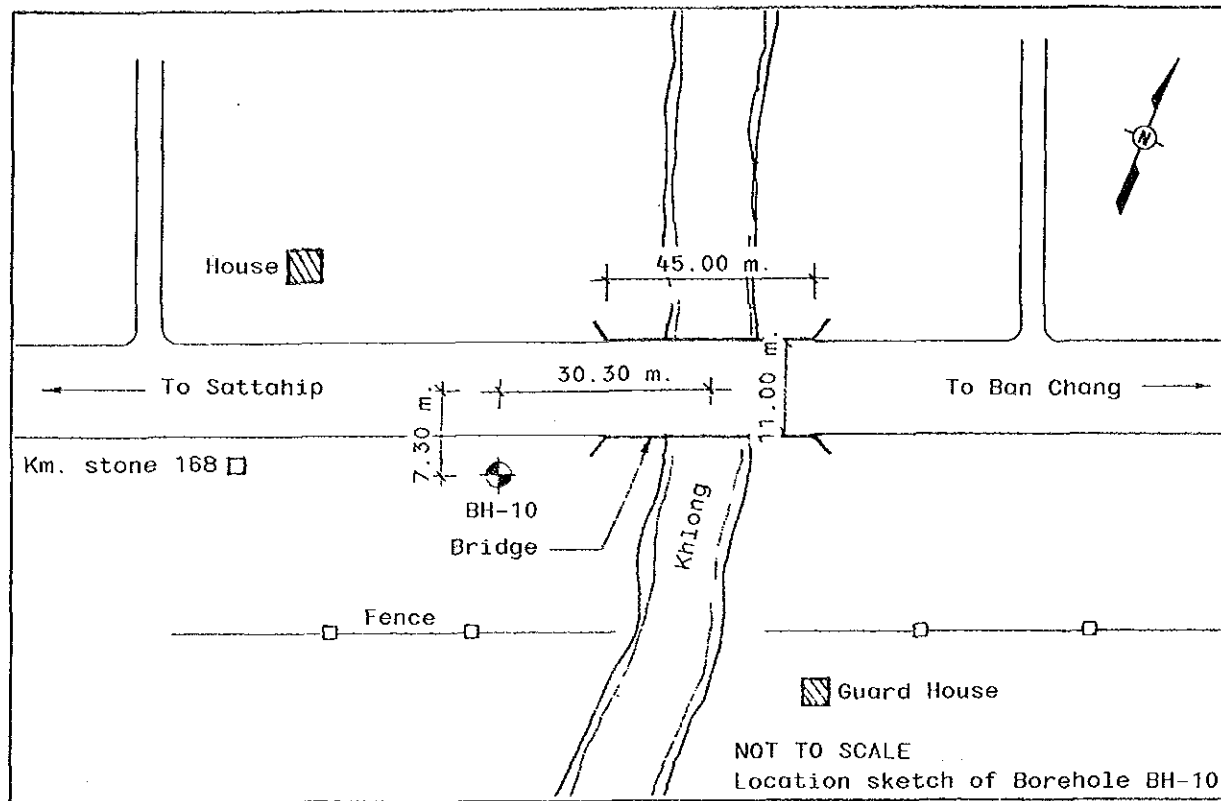
RESULTS OF LABORATORY TESTS

	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	93	57	18	-	NP	11.0	1.85	7.5	-0.1
Laterite	100	93	77	51	30	17	14	24.8	8.8	7.4	2.13	37	-	
Crushed Rock													>80	



(2) Boring Results

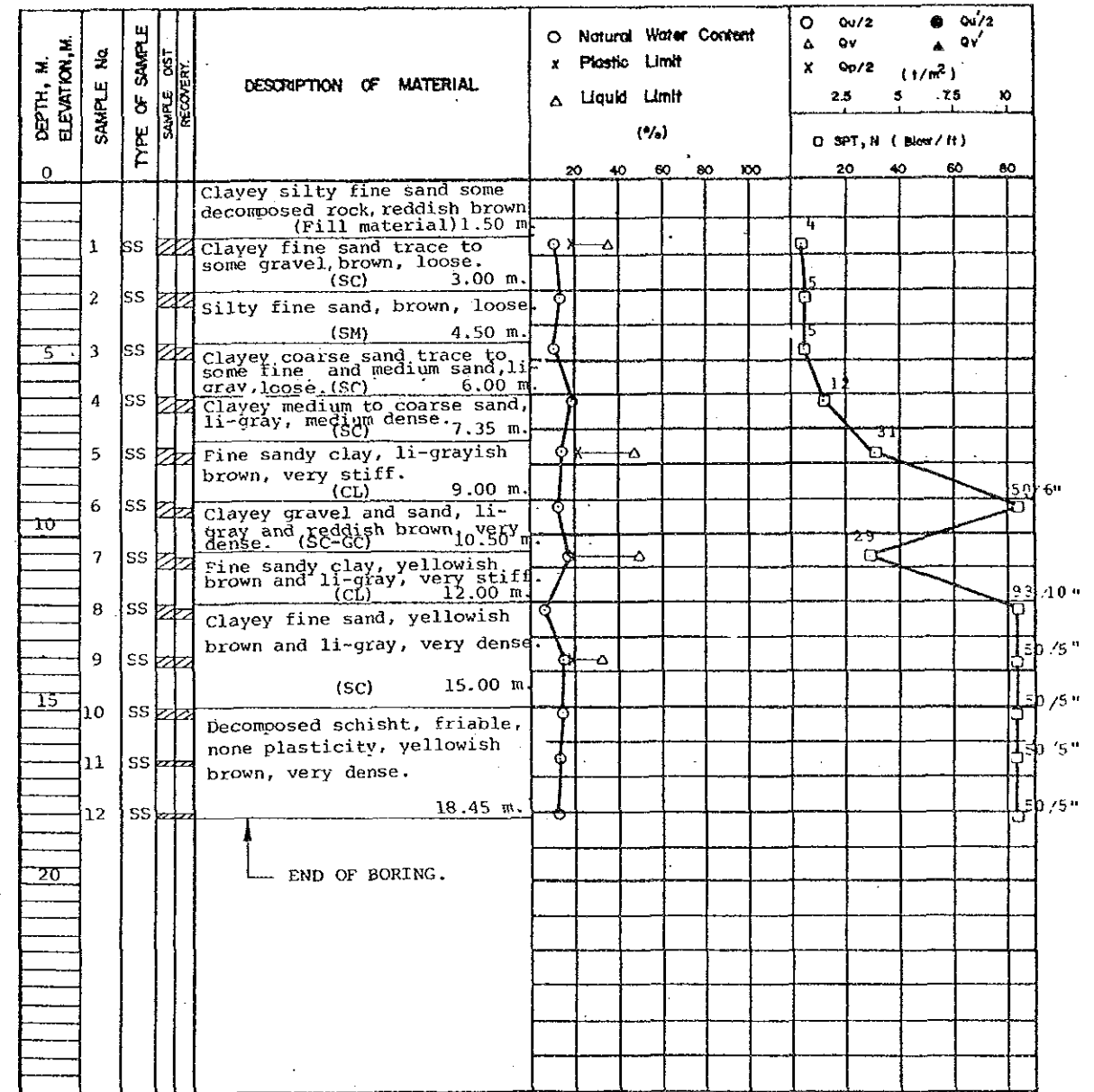
BOREHOLE LOCATION



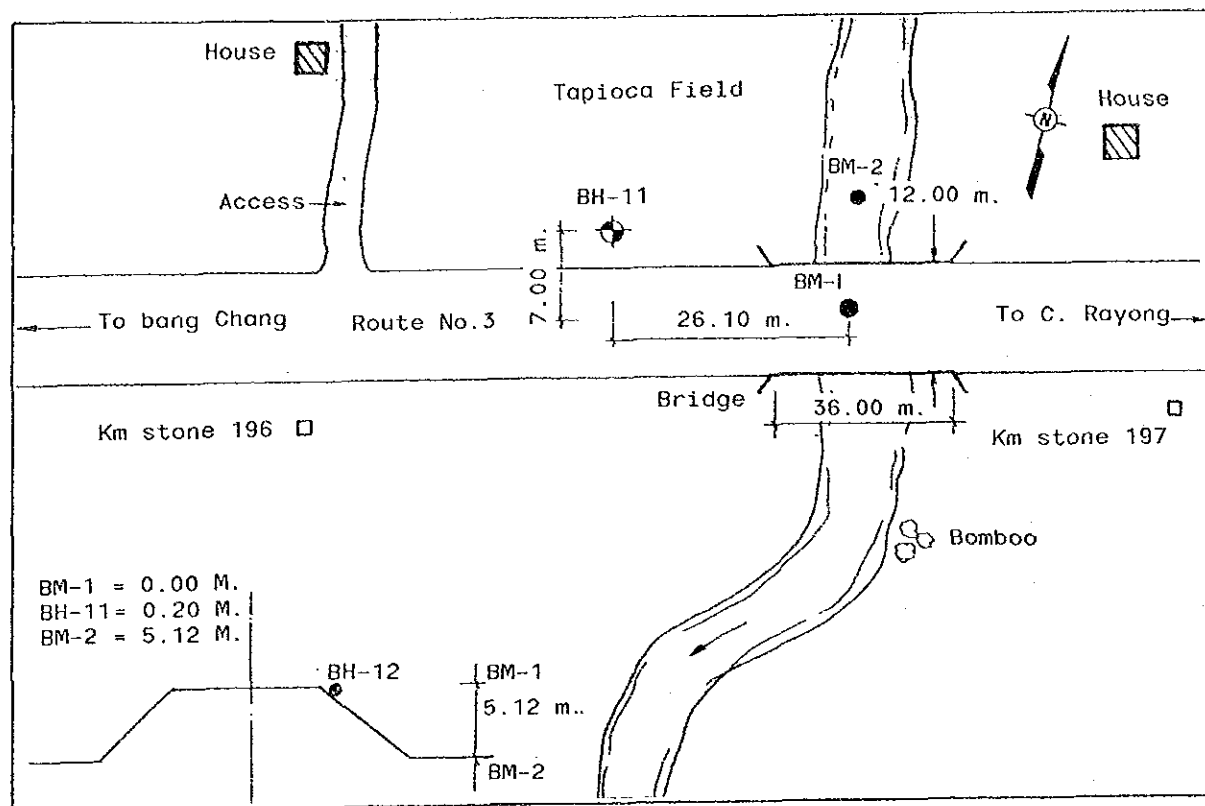
SUMMARY OF TEST RESULTS

SAMPLE No.	DEPTH M.		WATER CONTENT %	ATTERBERG LIMIT %			WET UNIT WEIGHT γ_{m^3}	SIEVE ANALYSIS % FINER					CLASSIFICATION	UNDRAINED SHEAR STRENGTH γ_{m^2}				STANDARD PENETRATION (N)
	FROM	TO		LL	PL	PI		% FINER						UNCONFINED SHEAR		FIELD VANE SHEAR		
								No. 1/8"	No. 4	No. 10	No. 40	No. 200		$Q_u/2$	$Q_u'/2$	Q_v	Q_v'	
SS-1	1.50	1.95	10.0	34.8	18.9	15.9	1.85	93	89	84	67	30	SC					4
SS-2	3.00	3.45	11.5										SM					5
SS-3	4.50	4.95	9.8					100	90	51	36	16	SC					5
SS-4	6.00	6.45	18.7										SC					12
SS-5	7.50	7.95	13.9	48.3	20.5	27.8	2.19	100	98	94	83	62	CL	24.8				31
SS-6	9.00	9.30	11.7					74	63	50	40	29	SC-GC					50/6"
SS-7	10.50	10.95	17.7	50.2	19.1	31.1	2.11						CL	13.7				29
SS-8	12.00	12.40	14.2							100	88	35	SC					93/10
SS-9	13.50	13.78	13.7	32.0	18.2	13.8	2.18						SC	11.4				50/5"
SS-10	15.00	15.28	13.4				2.19						Decomposed Schist					50/5"
SS-11	16.50	16.63	12.0						100	99	91	35	Decomposed Schist					50/5"
SS-12	18.00	18.13	10.7										Decomposed Schist					50/5"

BORING LOG



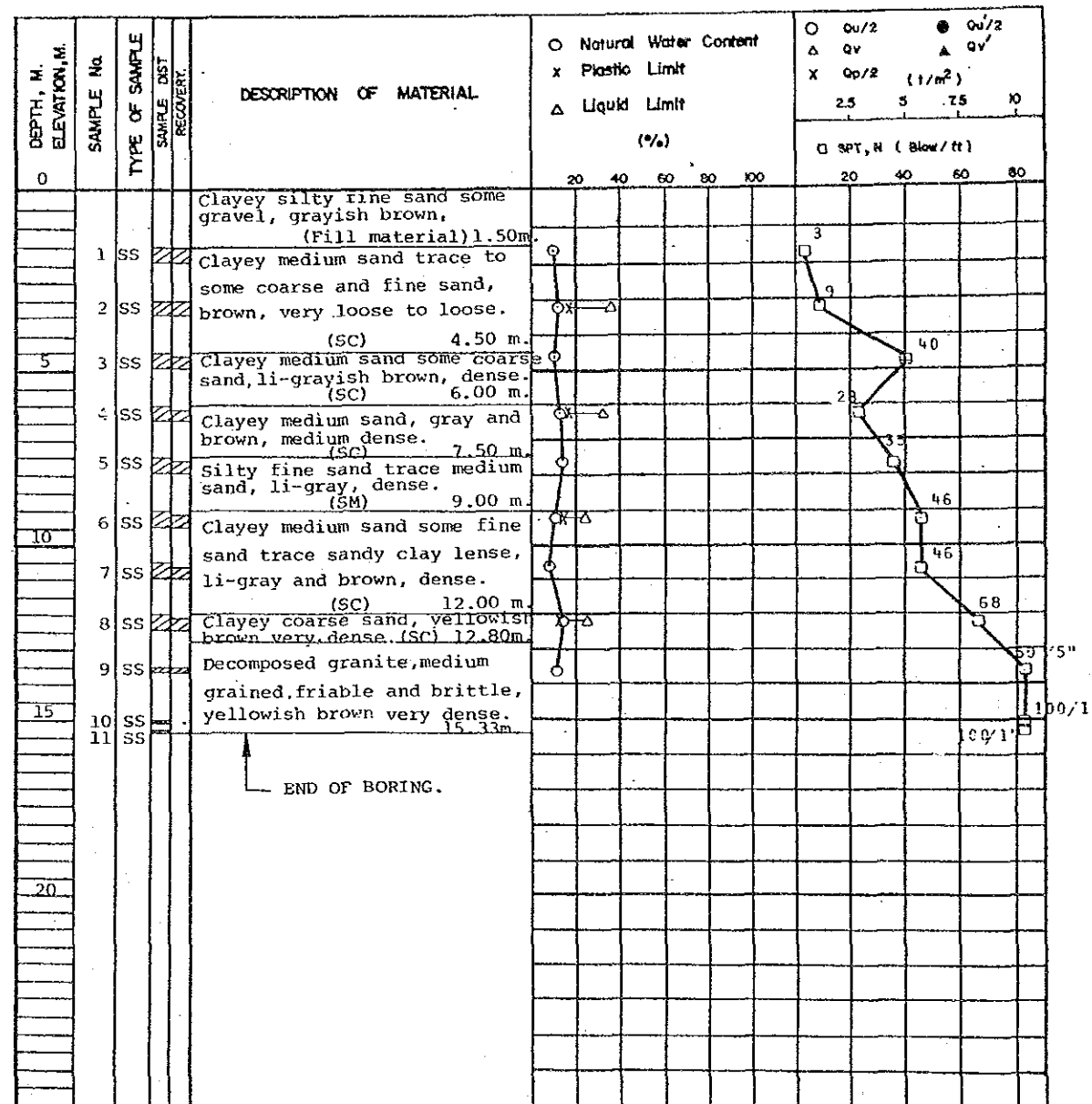
BOREHOLE LOCATION



SUMMARY OF TEST RESULTS

SAMPLE No.	DEPTH M.		WATER CONTENT %	ATTERBERG LIMIT %			WET UNIT WEIGHT γ_{m^3}	SIEVE ANALYSIS % FINER					CLASSIFICATION	UNDRAINED SHEAR STRENGTH γ_{m^2}				STANDARD PENETRATION (N)
	FROM	TO		LL.	PL.	PI.								UNCONFINED SHEAR		FIELD VANE SHEAR		
								No. 1/8"	No. 4	No. 10	No. 40	No. 100		Q _{u/2}	Q _{v/2}	Q _v	Q _{v'}	
SS-1	1.50	1.95	9.8				2.1	100	98	84	43	29	SC					3
SS-2	3.00	3.45	10.6	35.9	15.0	20.9							SC					9
SS-3	4.50	4.95	9.7					100	99	79	39	26	SC					40
SS-4	6.00	6.45	11.7	30.8	15.6	15.2	2.0						SC					23
SS-5	7.50	7.95	12.8			-NP-			100	91	24		SM					35
SS-6	9.00	9.45	9.9	23.8	12.4	11.4	2.1						SC					46
SS-7	10.50	10.95	8.1						100	91	55	28	Cl _c SC					46
SS-8	12.00	12.45	13.6	24.6	12.6	12.0	2.1	100	95	63	49	42	SC					68
SS-9	13.50	13.65	11.3				2.0	100	98	81	41	21	Decomposed granite					50/5"
SS-10	15.00	15.03		-No recovery-									Decomposed granite					100/1"
SS-11	15.30	15.33		-No recovery-									Decomposed granite					100/1"

BORING LOG

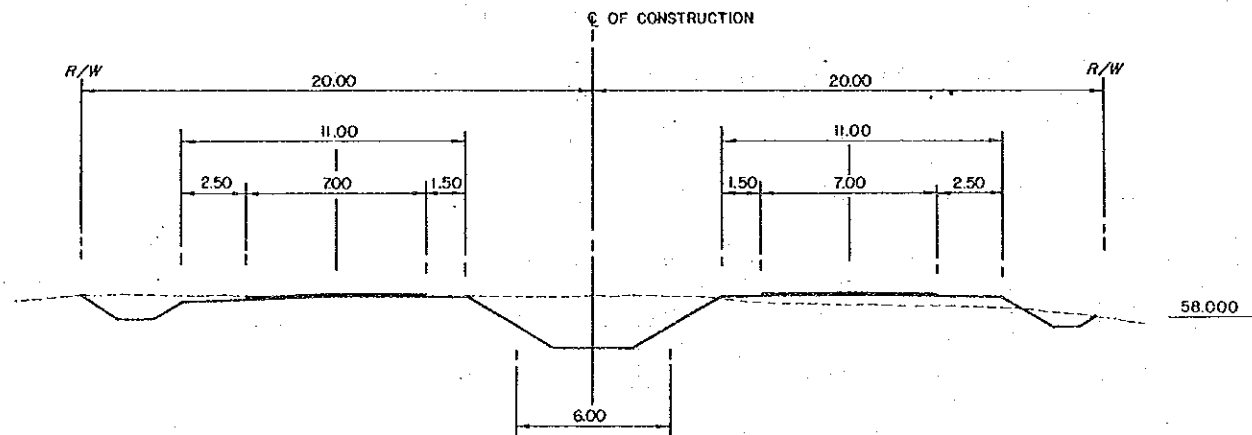


3.2 Preliminary Design

(1) Geometric Design Criteria

Design Standard : PD
 Design Speed : 80-100 km/h
 Geometric Design Criteria

Description	Design Speed (km/h)		
	80	90	100
Minimum Radius & Curvature (m)	210	280	360
Minimum Stopping Sight Distance (m)	115	140	160
Maximum Gradient (%)	8	7	6



BUILT-UP SECTION
 TYPICAL CROSS SECTION
 ML-3 ROAD CLASS PD

(2) Pavement Design

Pavement for New Construction Lane

Design CBR of Subgrade	Cumulative No. of ESA W18 x 10 (10 years)	Thickness of Pavement Structure (cm)
4.0	4,910	Surface 10 Base 20 Subbase 20

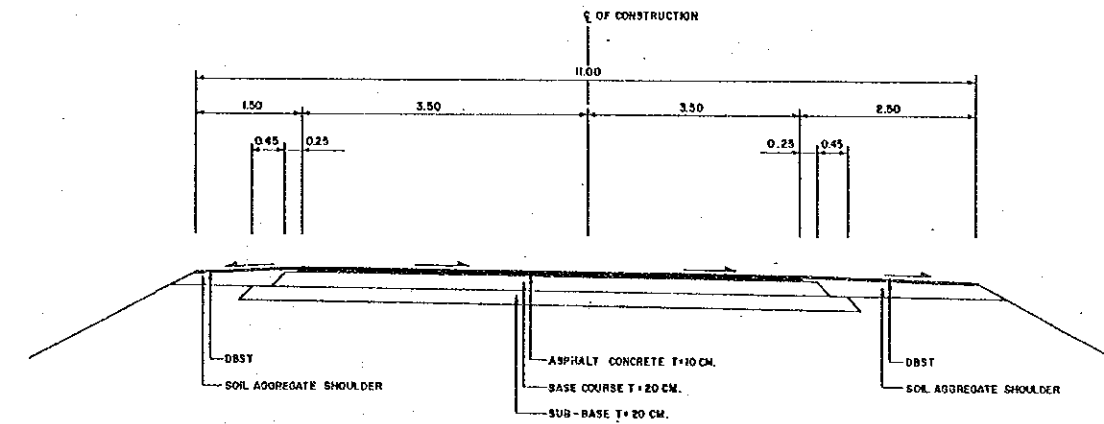
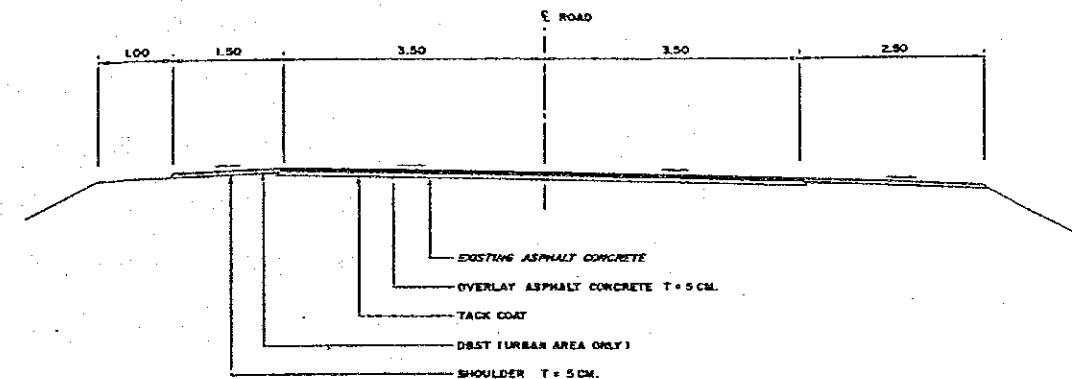


FIGURE TYPICAL PAVEMENT STRUCTURE FOR FLEXIBLE PAVEMENT ML-3

Initial Overlay for Existing Lane

Type of Overlay	Design CBR	Cumulative of ESA W18 x 10 (10 years)	Required D or SN	FRL * D _{xeff} or SN _{xeff}	Overlay Dol or SNol	Thickness (cm)
AC	6.0	4,910	3.60	1.43	2.17	12.2 (5.0)



(3) Culverts

NO.	CHAINAGE	EXISTING CULVERT	NEW CULVERT	
			LT ROADWAY	RT ROADWAY
1	175+075	RCP 2-Dia 0.60x14.50	RCP 2-Dia 1.00x17.00	RCP 2-Dia 1.00x17.00
2	175+494	RCP 3-Dia 0.60x13.00	RCP 2-Dia 1.00x15.00	RCP 2-Dia 1.00x15.00
3	176+335	RCP 1-Dia 0.80x12.00	EXTEND 1-Dia 0.80x7.00	RCP 1-Dia 0.80x19.00
4	176+656	RCP 1-Dia 0.60x12.00	RCP 1-Dia 1.00x15.00	RCP 1-Dia 1.00x15.00
5	178+975	RCP 1-Dia 0.60x12.00	RCP 1-Dia 1.00x15.00	RCP 1-Dia 1.00x15.00
6	179+997	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x 4.00	RCP 1-Dia 0.60x16.00
7	180+565	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x 4.00	RCP 1-Dia 0.60x16.00
8	180+693	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x 4.00	RCP 1-Dia 0.60x16.00
9	180+902	RCP 1-Dia 0.80x12.00	EXTEND 1-Dia 0.80x 2.00	RCP 1-Dia 0.80x14.00
10	181+589	RCP 1-Dia 0.80x12.00	EXTEND 1-Dia 0.80x18.00	RCP 1-Dia 0.80x30.00
11	182+077	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x 4.00	RCP 1-Dia 0.60x16.00
12	182+375	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x 4.00	RCP 1-Dia 0.60x16.00
13	182+625	RCP 1-Dia 0.80x13.00	EXTEND 1-Dia 0.80x 2.00	RCP 1-Dia 0.80x15.00
14	183+226	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x 4.00	RCP 1-Dia 0.60x16.00
15	183+646	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x 8.00	RCP 1-Dia 0.60x20.00
16	184+429	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x 2.00	RCP 1-Dia 0.60x14.00
17	184+658	RCP 1-Dia 0.60x12.00	EXTEND 1-Dia 0.60x 2.00	RCP 1-Dia 0.60x14.00
18	184+866	RCP 1-Dia 0.80x12.00	EXTEND 1-Dia 0.80x 4.00	RCP 1-Dia 0.80x16.00
19	186+517	RCP 1-Dia 0.60x13.00	EXTEND 1-Dia 0.60x 6.00	RCP 1-Dia 0.60x19.00
20	186+650	RCP 1-Dia 1.00x17.00	REMAIN	RCP 1-Dia 1.00x17.00
21	186+843	RCP 1-Dia 0.60x16.00	REMAIN	RCP 1-Dia 0.60x16.00

NO.	CHAINAGE	EXISTING CULVERT	NEW CULVERT	
			LT ROADWAY	RT ROADWAY
22	188+710	RCP 1-Dia 0.80x15.00	EXTEND 1-Dia 0.80x 2.00	RCP 1-Dia 0.80x17.00
23	189+683	RCP 1-Dia 0.80x17.00	EXTEND 1-Dia 0.80x 4.00	RCP 1-Dia 0.80x21.00
24	191+698	RCP 1-Dia 1.00x13.00	EXTEND 1-Dia 1.00x 6.00	RCP 1-Dia 1.00x19.00
25	192+230	RCP 1-Dia 1.00x16.00	RCP 1-Dia 1.00x17.00	RCP 1-Dia 1.00x17.00
26	192+347	RCP 2-Dia 1.00x16.00	REMAIN	RCP 2-Dia 1.00x16.00
27	192+862	RCP 1-Dia 1.00x18.00	REMAIN	RCP 1-Dia 1.00x18.00
28	194+805	BOX 2-1.20x2.00x18.00	BOX 1-2.00x2.50x15.00	BOX 1-2.00x2.50x15.00
29	197+321	RCP 1-Dia 0.80x17.00	RCP 1-Dia 0.80x17.00	REMAIN
30	197+900	-	RCP 1-Dia 1.00x15.00	RCP 1-Dia 1.00x15.00
31	198+426	RCP 1-Dia 1.00x13.00	RCP 1-Dia 1.00x17.00	EXTEND 1-Dia 1.00x 4.00
32	198+871	RCP 1-Dia 1.00x16.00	RCP 1-Dia 1.00x16.00	REMAIN
33	199+234	RCP 1-Dia 1.00x15.00	RCP 2-Dia 1.00x17.00	EXTEND 1-Dia 1.00x2.00 RCP 1-Dia 1.00x17.00
34	199+551	RCP 1-Dia 1.00x15.00	RCP 1-Dia 1.00x17.00	EXTEND 1-Dia 1.00x2.00
35	201+053	RCP 3-Dia 1.00x18.00	RCP 3-Dia 1.00x18.00	REMAIN
36	201+420	RCP 1-Dia 1.00x15.00	RCP 1-Dia 1.00x17.00	EXTEND 1-Dia 1.00x2.00
37	202+110	RCP 1-Dia 1.00x18.00	RCP 1-Dia 1.00x18.00	REMAIN
38	205+833	RCP 4-Dia 1.00x15.00	RCP 4-Dia 1.00x17.00	EXTEND 4-Dia 1.00x2.00
39	213+183	RCP 2-Dia 0.60x34.80	REMAIN	REMAIN
40	213+327	RCP 1-Dia 0.60x34.80	REMAIN	REMAIN
41	213+436	RCP 1-Dia 0.60x34.50	REMAIN	REMAIN
			TOTAL	

(4) Bridges

NO	CHAINAGE	EXISTING BRIDGE	PROPOSED BRIDGE	
			LT ROADWAY	RT ROADWAY
1	179+660	7x 8 SLAB TYPE	12x 8 SLAB TYPE	12x 8 SLAB TYPE
2	186+071	9x45 SLAB TYPE	REMAIN	12x45 SLAB TYPE
3	196+372	9x35 SLAB TYPE	12x35 SLAB TYPE	REMAIN SLAB TYPE
4	207+736	7x15 SLAB TYPE	12x15 SLAB TYPE	12x15 SLAB TYPE
5	209+265	12x24 SLAB TYPE	12x24 SLAB TYPE	REMAIN SLAB TYPE
6	211+787	7x12 SLAB TYPE	12x12 SLAB TYPE	12x12 SLAB TYPE
7	214+097	7x18 SLAB TYPE	12x18 SLAB TYPE	12x18 SLAB TYPE

3.3 Quantities and Construction and Road Maintenance Costs

(1) CONSTRUCTION QUANTITIES AND COSTS

(Project ML-3 Length = 44.6 km)

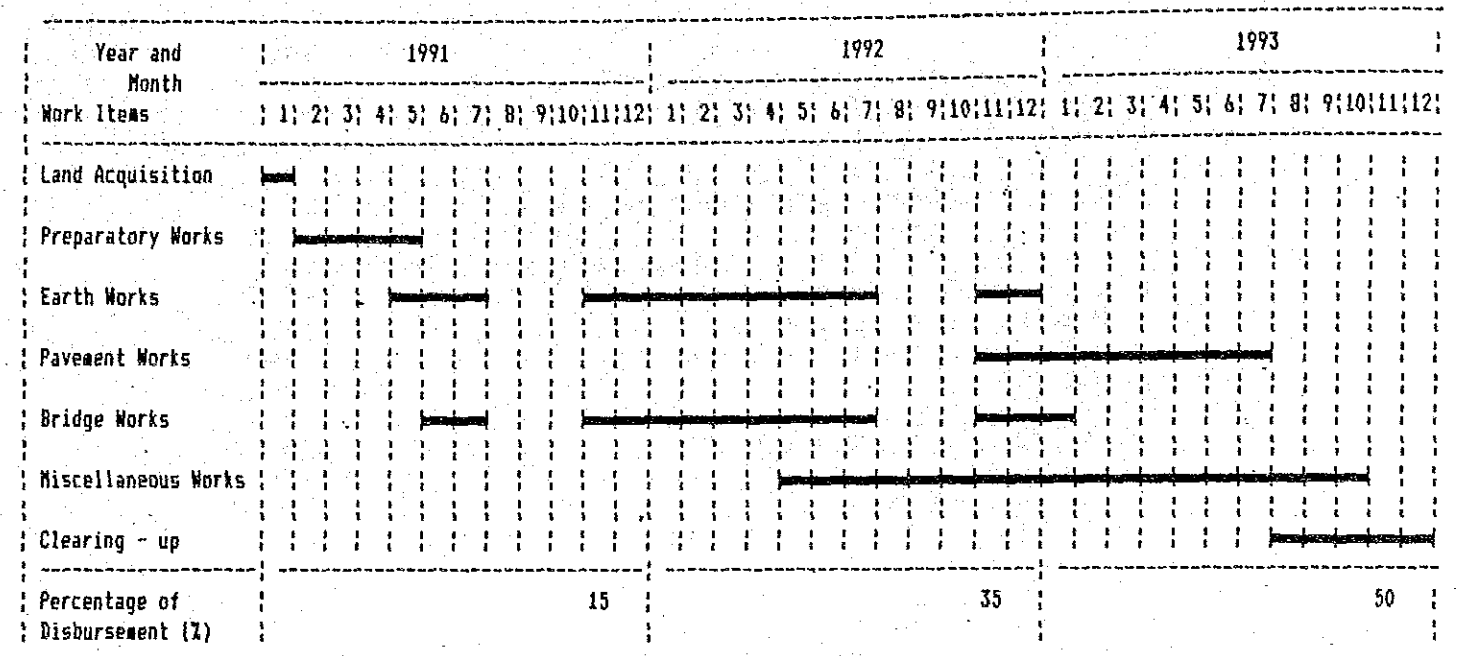
Item	Unit	Financial Unit Rate Baht	Quantity	Financial Total Cost 1000 Baht	Economic Cost		Residual Value		
					%	1000 Baht	%	1000 Baht	
EARTHWORK									
Clearing & Grubbing	ha	10,000	169	1,690	85	1,437	90	1,293	
Roadway Excavation (Unclassified)	m ³	18	320,300	5,765	84	4,843	90	4,359	
Roadway Excavation (Classified Unsuitable Material below Grade)	m ³	38	-	-	84	-	90	-	
Embankment (Common)	m ³	33	-	-	86	-	90	-	
Embankment (Borrow)	m ³	82	690,000	56,580	86	48,659	90	43,793	
Removal of Existing Structure	each	60,000	-	-	84	-	90	-	
Sub Total				64,035		54,939		49,445	
SUBBASE and BASE COURSES									
Subbase	m ³	145	102,400	14,848	83	12,324	50	6,162	
Aggregate base	m ³	272	146,100	39,739	84	33,381	50	16,691	
Shoulder (Soil Aggregate)	m ³	170	58,500	9,945	83	8,254	50	4,127	
Sub Total				64,532		53,959		26,980	
SURFACE COURSES									
Asphaltic Prime Coat	m ²	11	552,400	6,076	93	5,651	50	2,826	
Asphaltic Tack Coat	m ²	5	789,600	3,948	93	3,672	50	1,836	
Double Bituminous Surface Treatment	m ²	32	356,000	11,392	91	10,367	50	5,184	
Asphalt Concrete Surfacing	ton	905	147,400	133,397	90	120,057	50	60,029	
Portland Cement Concrete Pavement	m ³	1,628	2,100	3,419	90	3,077	50	1,539	
Sub Total				158,232		142,824		71,414	
STRUCTURES (Equivalent)									
RC Pipe Culvert (D=1.00 m)	m	1,800	880	1,584	88	1,394	50	697	
RC Box Culvert (2-2.40x 2.40 m)	m	9,000	13	117	90	105	50	53	
RC Bridge (W=12.0 m)	m	68,700	210	14,427	87	12,551	50	6,276	
PC Bridge (W=12.0 m)	m	93,800	-	-	87	-	50	-	
Bearing Unit	m ²	1,600	-	-	87	-	50	-	
Sub Total				16,128		14,050		7,026	
Total (a)				302,927		265,772		154,865	
Miscellaneous Work ((a) x 7%)				1s	21,205	87	18,448	0	0
CONTRACT AMOUNT (b)					324,132		284,220		154,865
PHYSICAL CONTINGENCIES ((b) x 10%) (c)				1s	32,413		28,422		15,487
ENGINEERING AND SUPERVISION (((b) + (c)) x 10%) (d)				1s	35,655	100	35,655	0	0
LAND ACQUISITION									
Developed Land	ha	1,250,000	-	-					
Less Developed Land	ha	625,000	40	25,000					
Total (e)				25,000	100	25,000	100	25,000	
PROJECT COST ((b) + (c) + (d) + (e))					417,200		373,297		195,352
AVERAGE COST PER KM					9,354				

(2) Road Maintenance Costs

(Unit : Baht/Year)

	Without Project	With Project
1994	1,020,103	714,119
2004	1,221,213	1,163,683

3.4 Construction Schedule



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						
3-0702	10.2	-	-	1.2	9.0	-	-	-	-	10.2	10.2	-	-
3-0800-W	20.2	-	4.5	9.7	6.0	-	-	-	-	20.2	20.2	-	-
3-0800-E	14.2	-	5.5	8.7	-	-	-	-	-	14.2	14.2	-	-

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	74,226	-	74,226	35,593	-	35,593	109,819	-	109,819
2000	109,363	-	109,363	56,855	-	56,855	166,218	-	166,218
2008	182,535	-	182,535	107,074	-	107,074	289,609	-	289,609

5. ECONOMIC EVALUATION

COST AND BENEFIT STATEMENT







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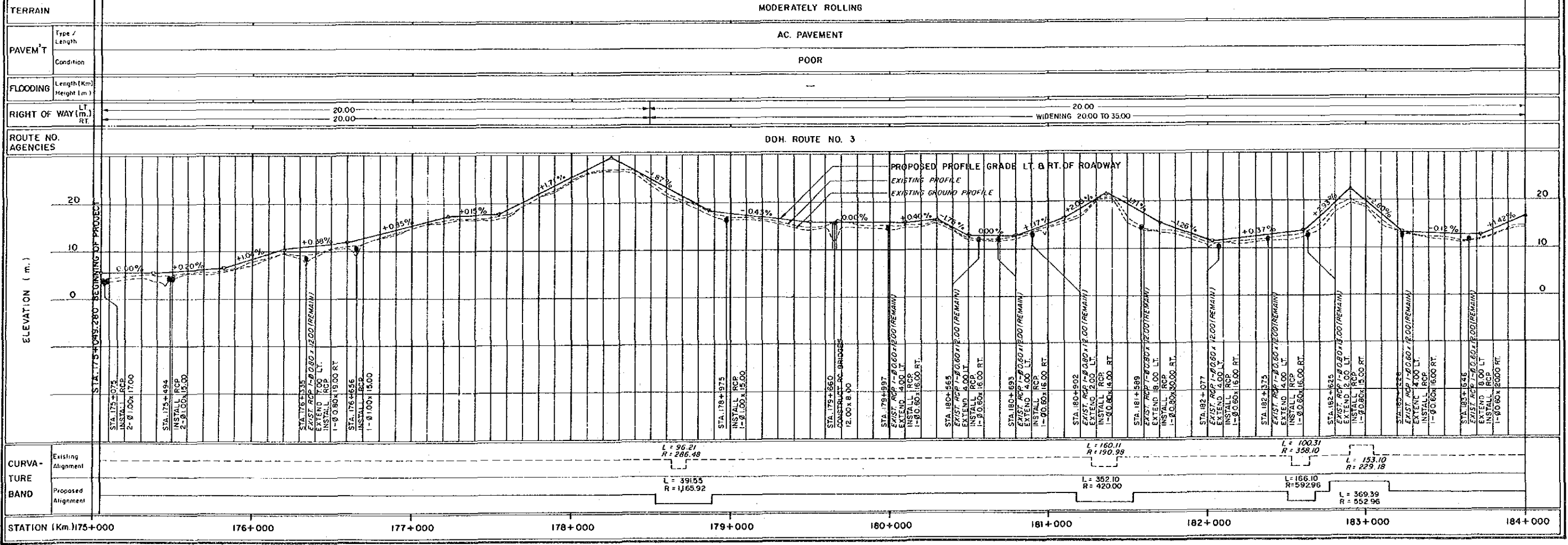
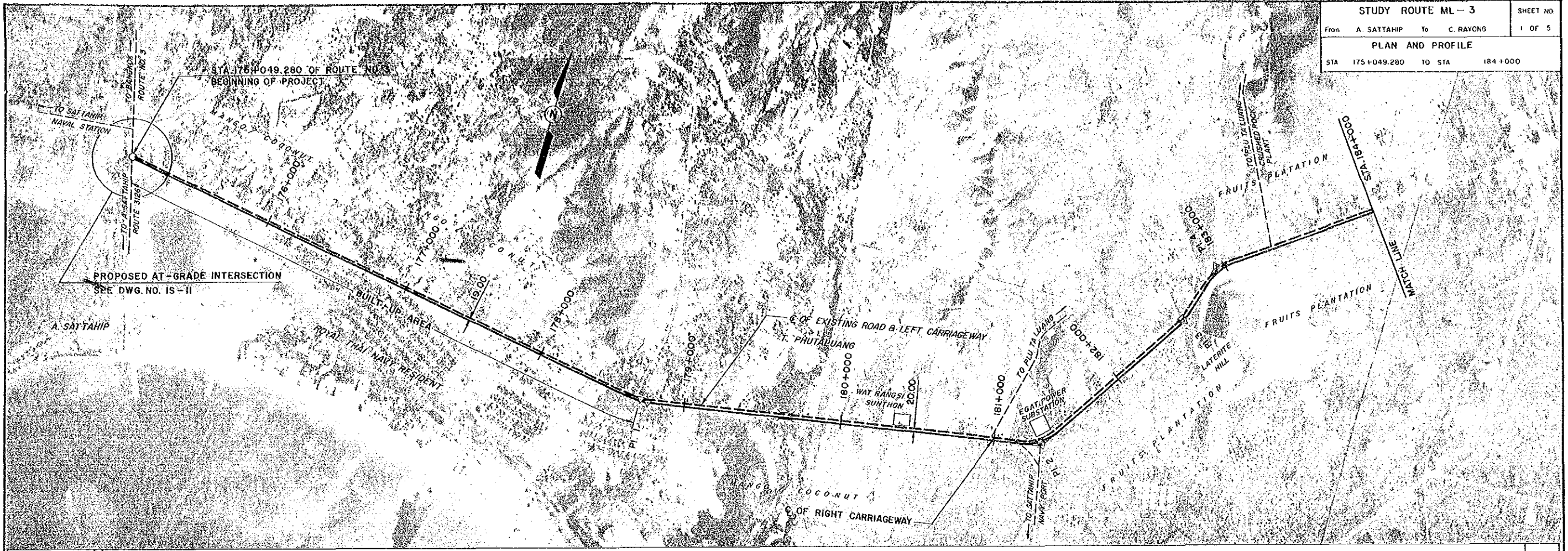
YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	VOC SAVING	TIME SAVING	MAINT. SAVING	TOTAL	COST	BENEFIT
1991	55,995				0	78,669	0
1992	130,654				0	163,892	0
1993	186,649				0	209,047	0
1994		74,226	35,595	405	110,226	0	98,416
1995		80,082	39,139	359	119,580	0	95,328
1996		85,938	42,682	313	128,933	0	91,772
1997		91,795	46,225	267	138,287	0	87,884
1998		97,651	49,769	220	147,640	0	83,775
1999		103,507	53,312	173	156,992	0	79,537
2000		109,363	56,855	126	166,344	0	75,246
2001		118,509	63,132	79	181,720	0	73,394
2002		127,656	69,410	32	197,098	0	71,076
2003		136,803	75,687	-15	212,475	0	68,411
2004	61,748	145,949	81,965	-62	227,852	19,881	65,502
2005		155,096	88,242	-109	243,229	0	62,431
2006		164,242	94,519	-156	258,605	0	59,266
2007		173,389	100,797	-203	273,983	0	56,062
2008	(195,352)	182,535	107,074	-242	289,367	(39,973)	52,866
TOTAL	239,694	1,846,741	1,004,403	1,187	2,852,331	431,516	1,120,966

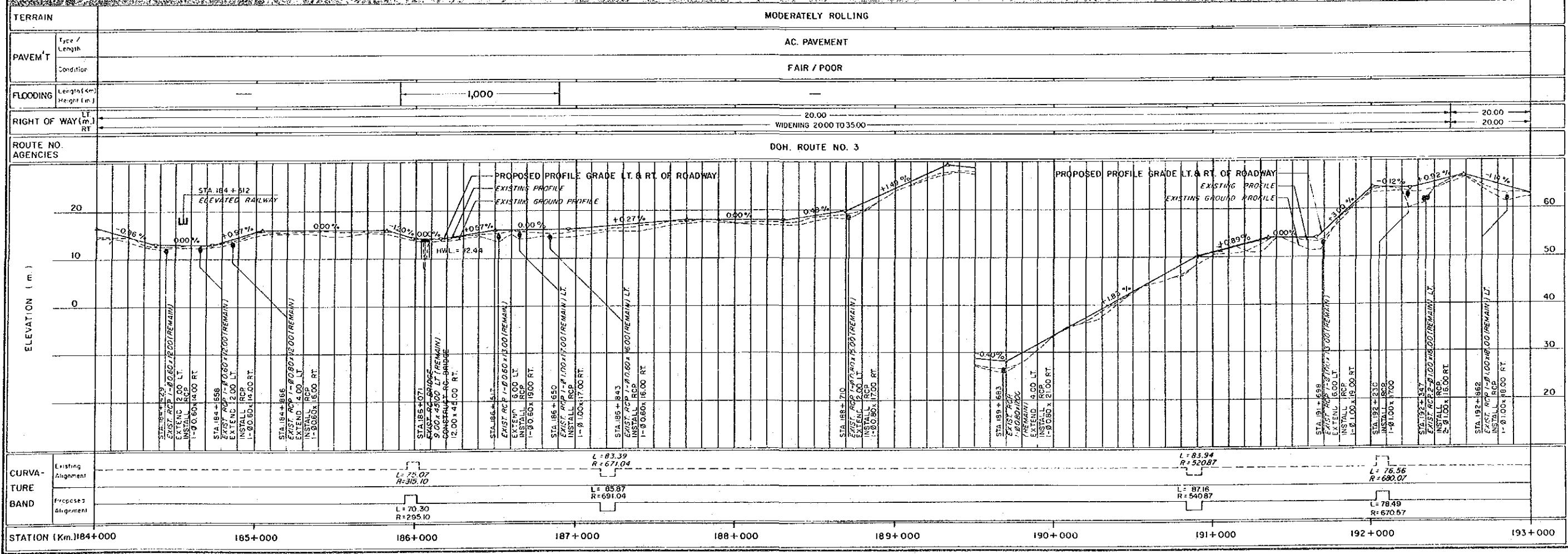
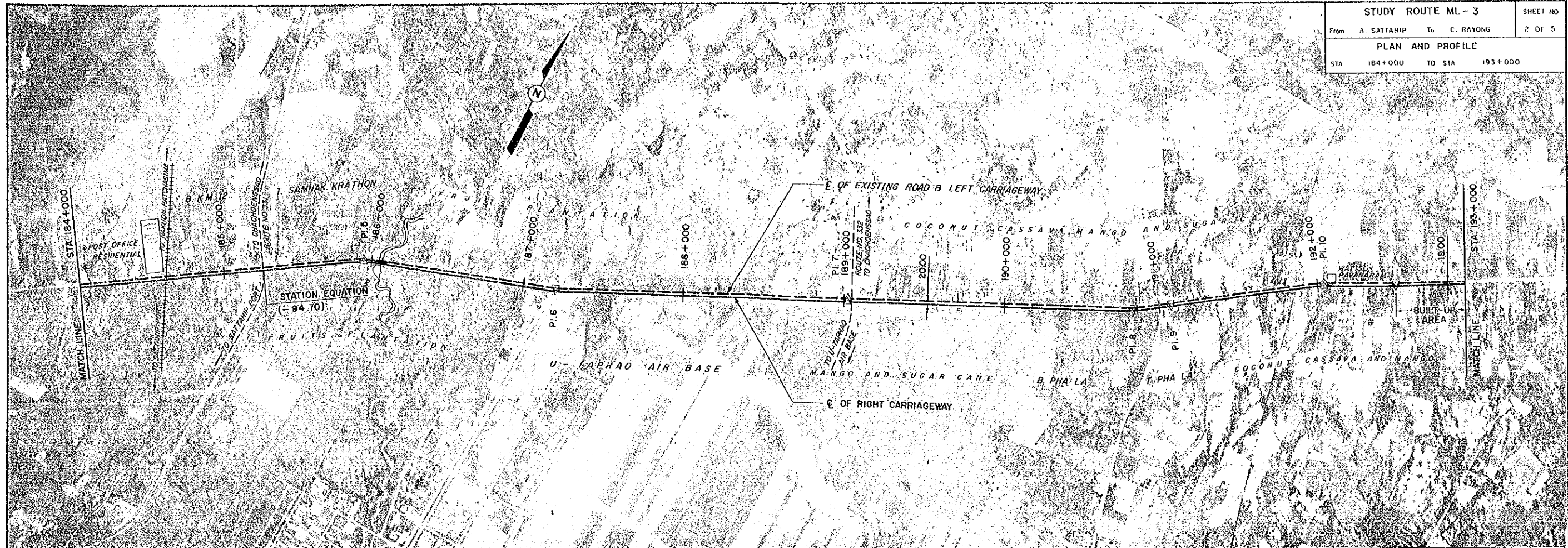
NET PRESENT VALUE : 689,450
 BENEFIT COST RATIO : 2.60
 INTERNAL RATE OF RETURN : 25.6%
 FIRST YEAR RATE OF RETURN : 21.8%

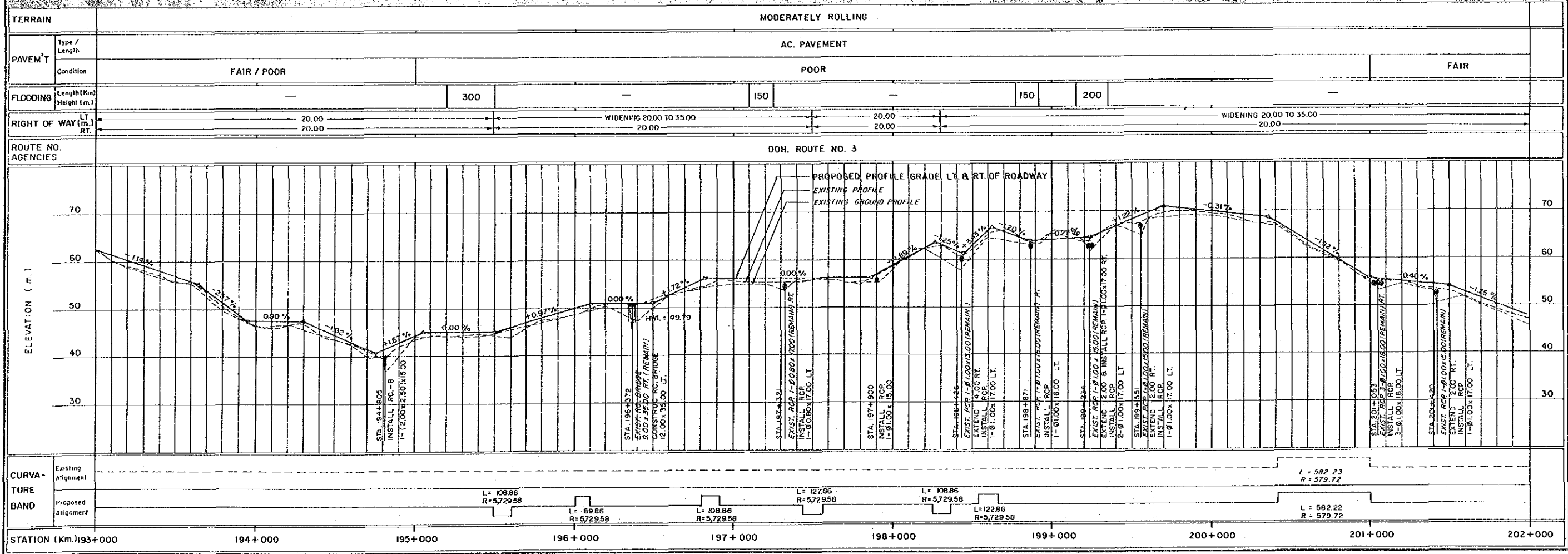
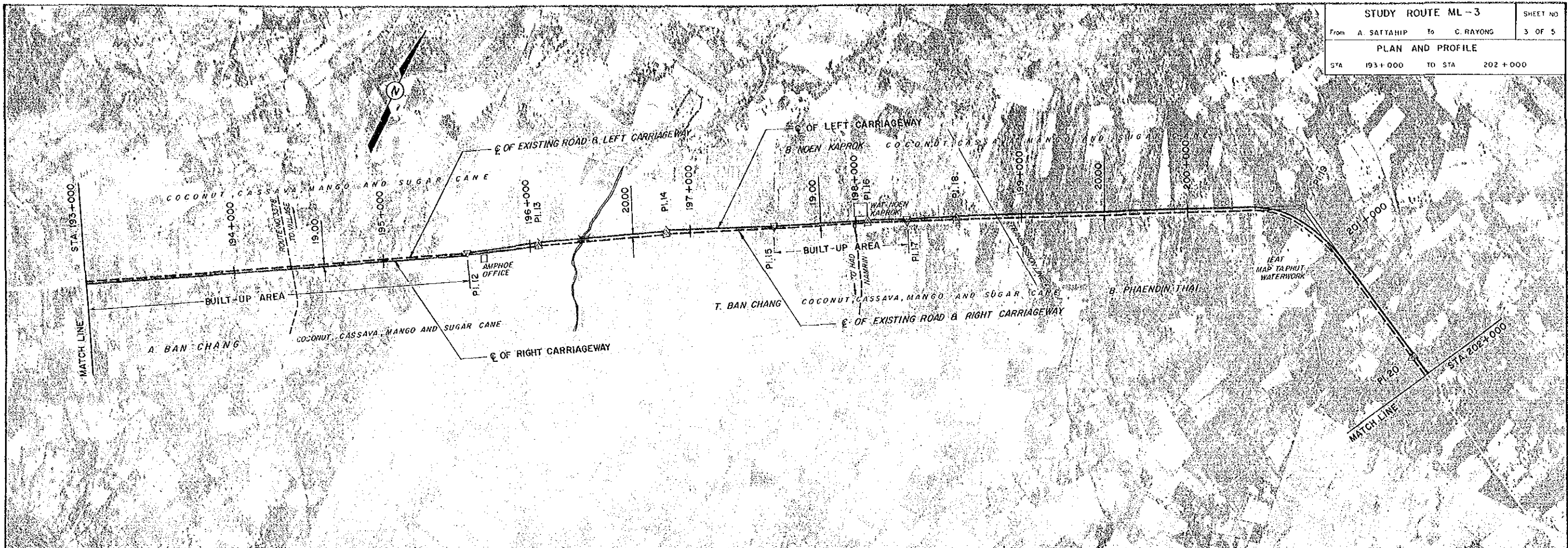
6. DRAWINGS

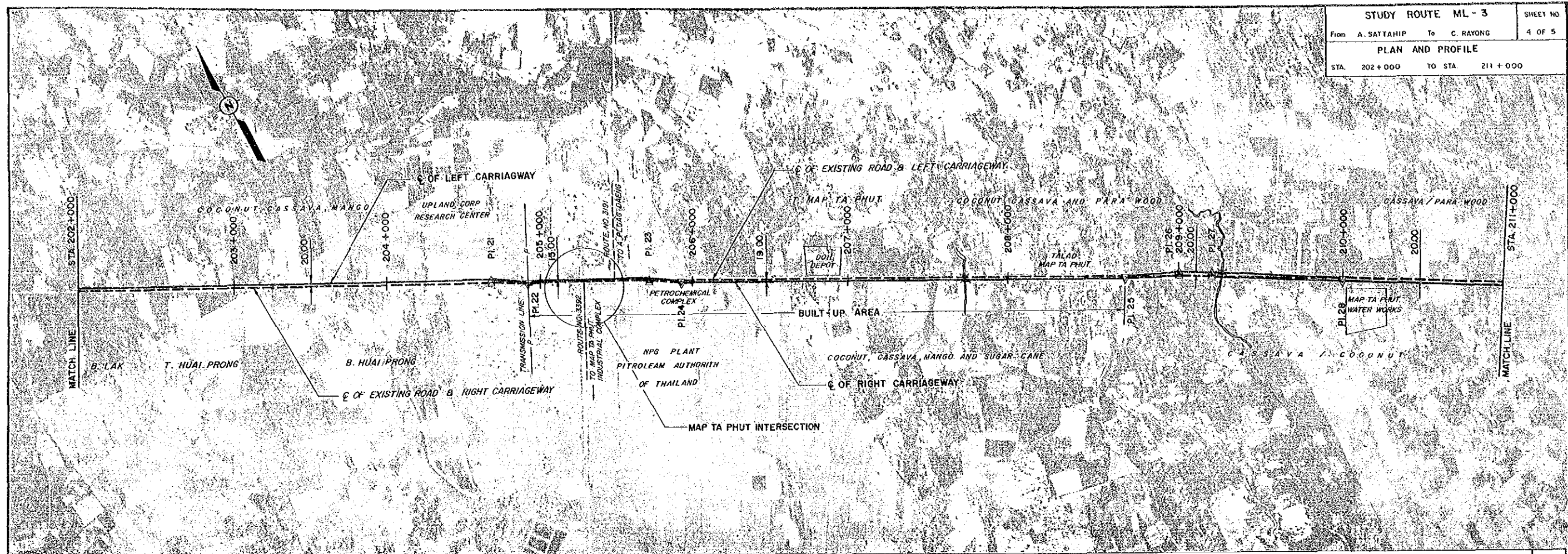
ABBREVIATIONS and SYMBOLS for PLAN and PROFILE

	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
Δ	DEFLECTION ANGLE
R	RADIUS OF CURVATURE
T	TANGENT LENGTH
L	LENGTH OF CURVE
RT	RIGHT
LT	LEFT
EXIST.	EXISTING
EXTD.	EXTEND
RC-P-n- ϕ a x l	PIPE CULVERT, n (ROW), ϕ 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)

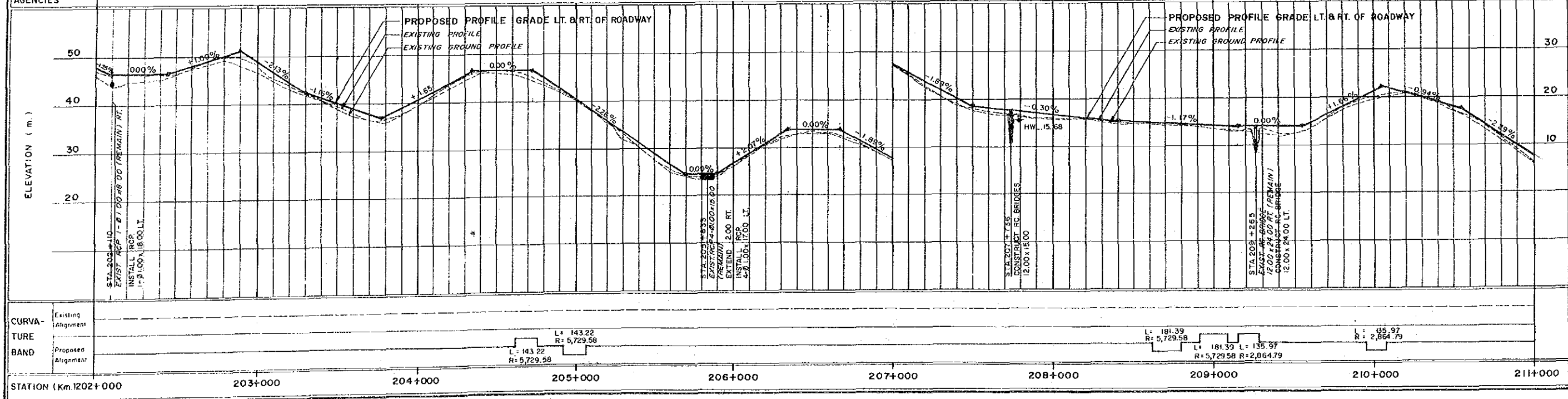




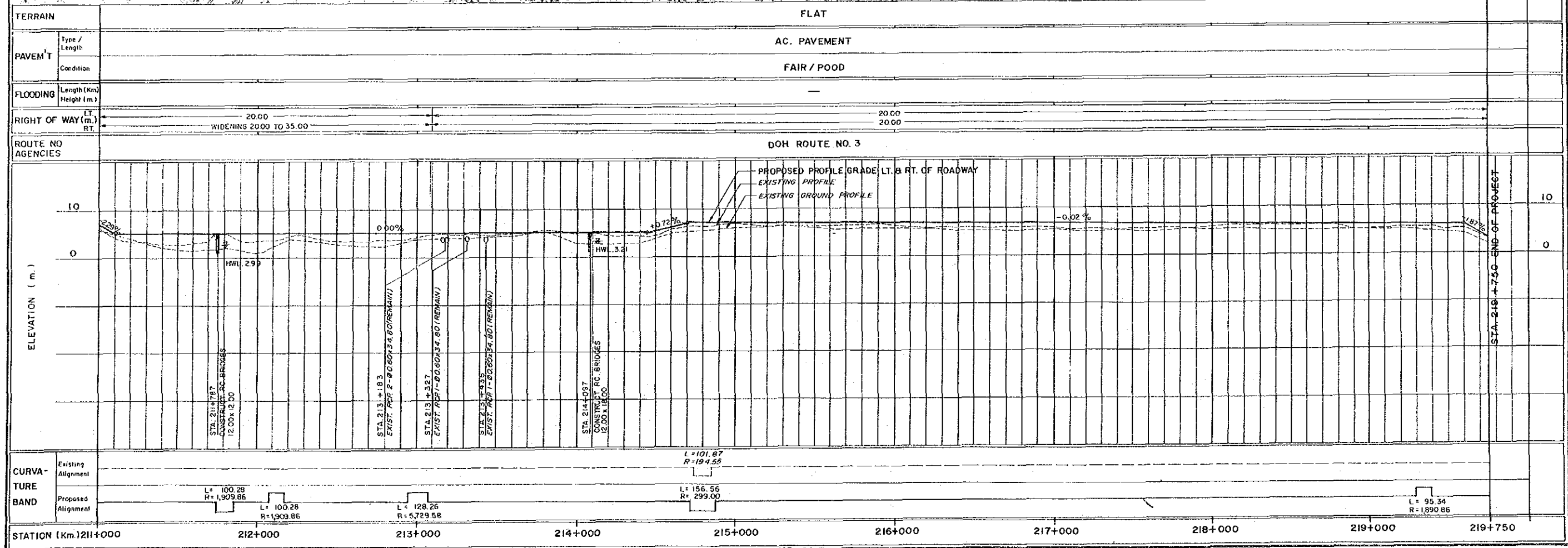
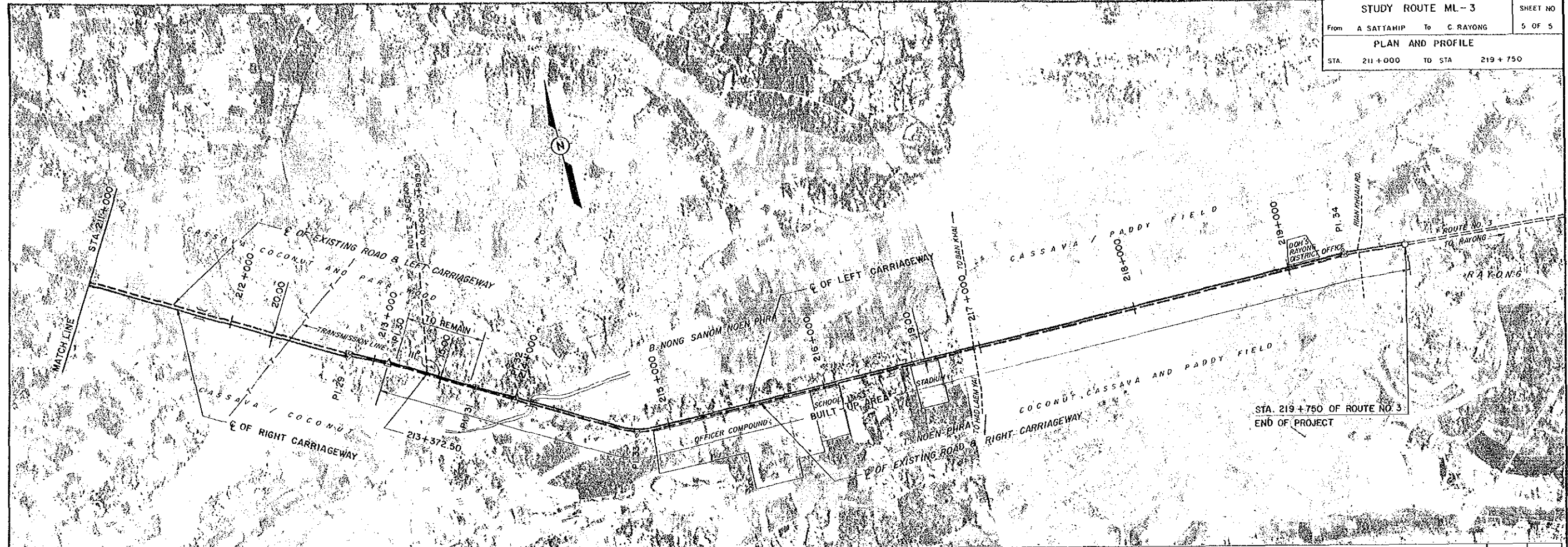


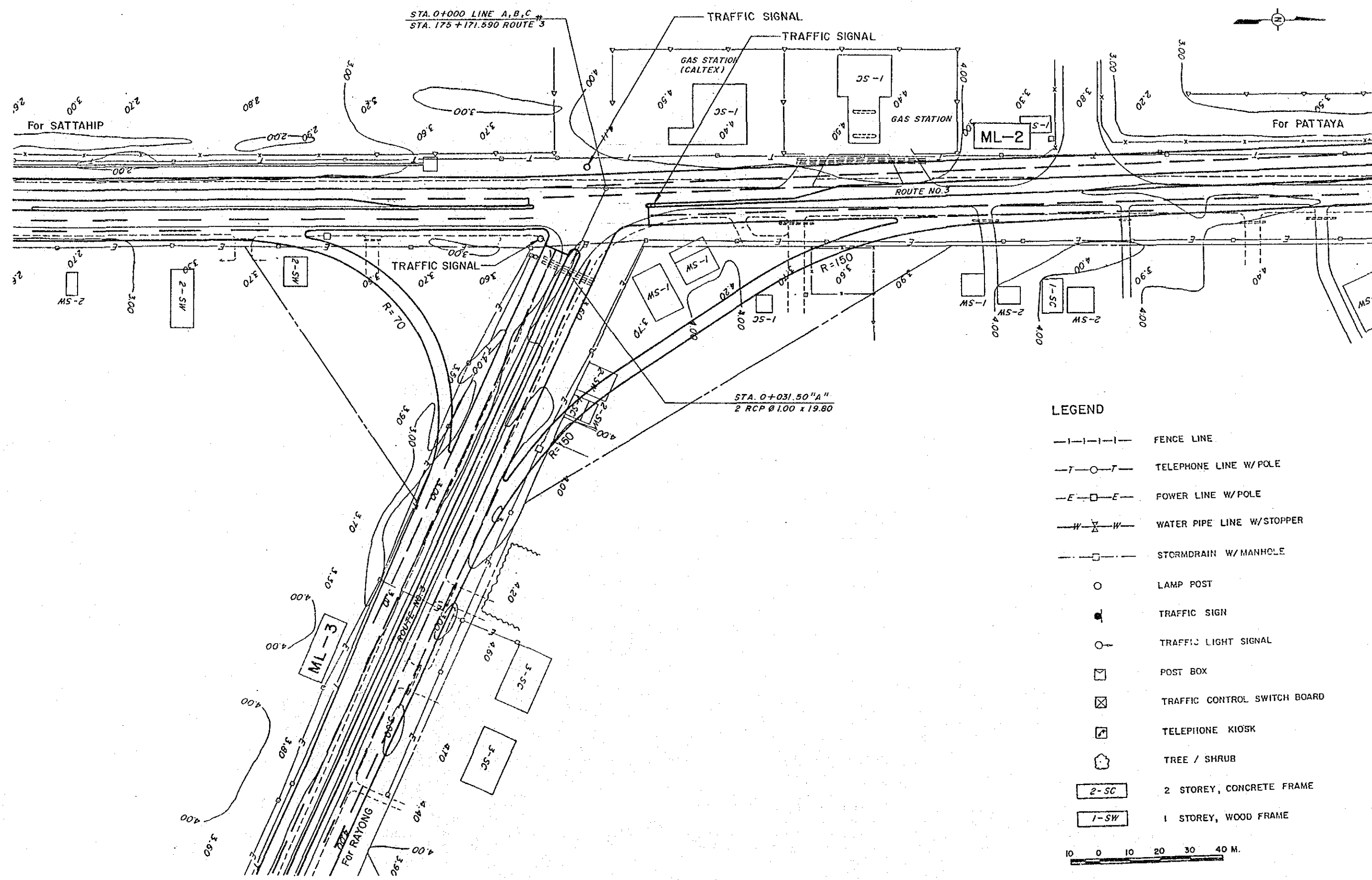


TERRAIN	Moderately Rolling	
PAVEM'T	Type / Length	AC. PAVEMENT
	Condition	FAIR
FLOODING	Length (Km) Height (m)	—
RIGHT OF WAY (m.)	LT RT	WIDENING 20.00 TO 35.00 20.00
ROUTE NO.		DOH ROUTE NO. 3
AGENCIES		



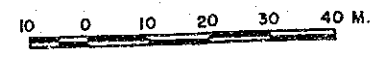
CURVA-TURE BAND	Existing Alignment	
	Proposed Alignment	<p>L = 143.22 R = 5,729.58</p> <p>L = 181.39 R = 5,729.58</p> <p>L = 135.97 R = 2,864.79</p>
STATION (Km)		202+000 203+000 204+000 205+000 206+000 207+000 208+000 209+000 210+000 211+000





LEGEND

- |—|—|—|— FENCE LINE
- T—O—T— TELEPHONE LINE W/POLE
- E—□—E— POWER LINE W/POLE
- W—∇—W— WATER PIPE LINE W/STOPPER
- STORMDRAIN W/MANHOLE
- LAMP POST
- TRAFFIC SIGN
- TRAFFIC LIGHT SIGNAL
- POST BOX
- ⊠ TRAFFIC CONTROL SWITCH BOARD
- ⊡ TELEPHONE KIOSK
- ⊕ TREE / SHRUB
- 2-SC 2 STOREY, CONCRETE FRAME
- 1-SW 1 STOREY, WOOD FRAME



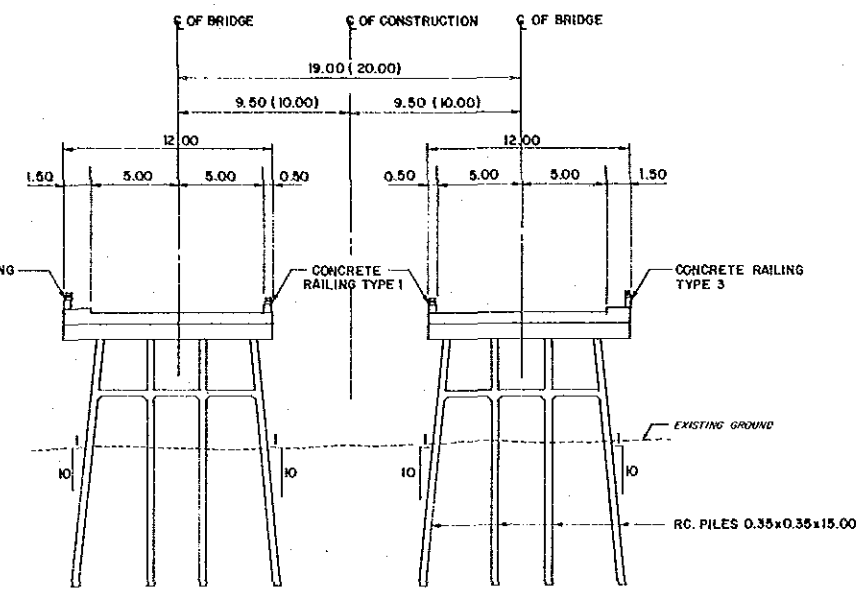
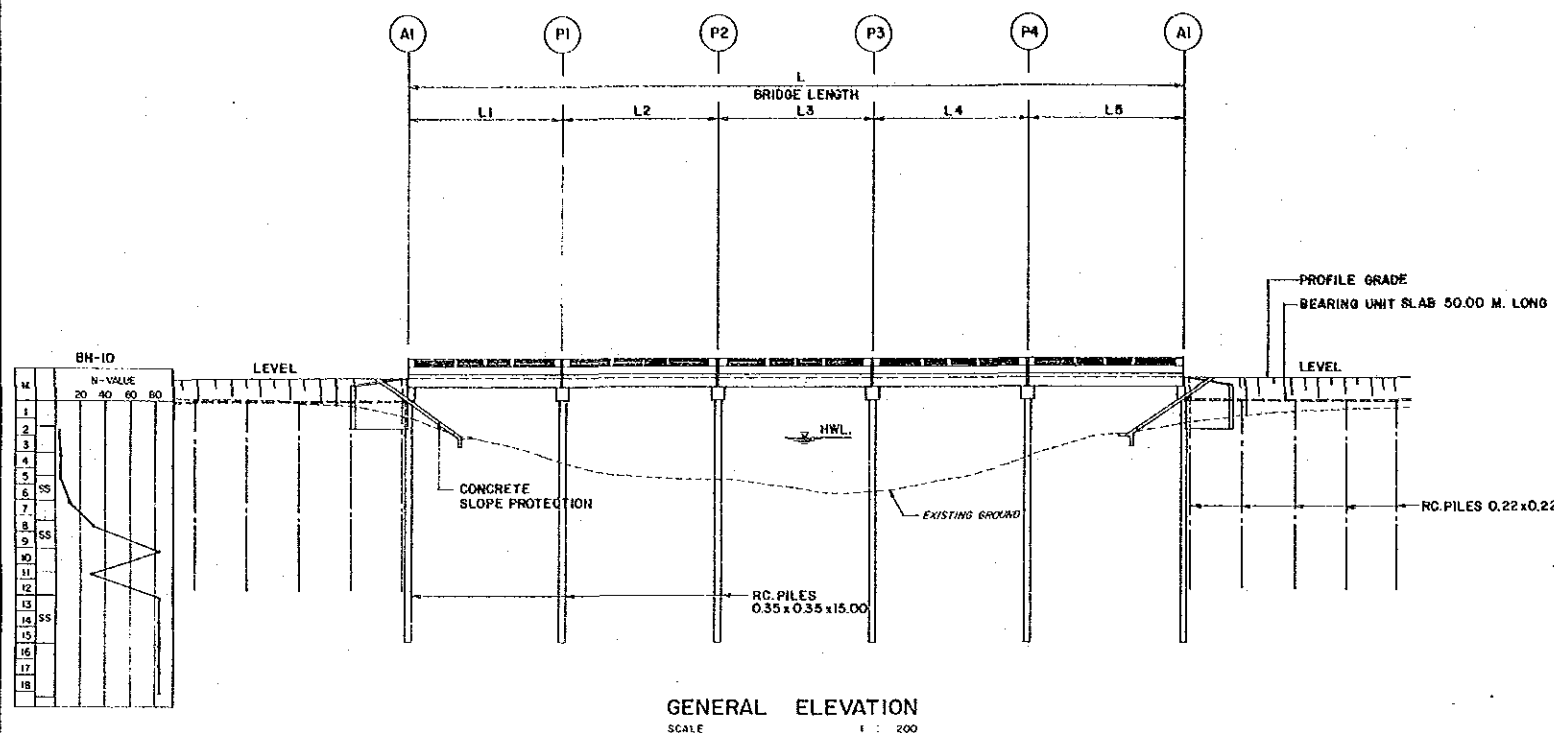
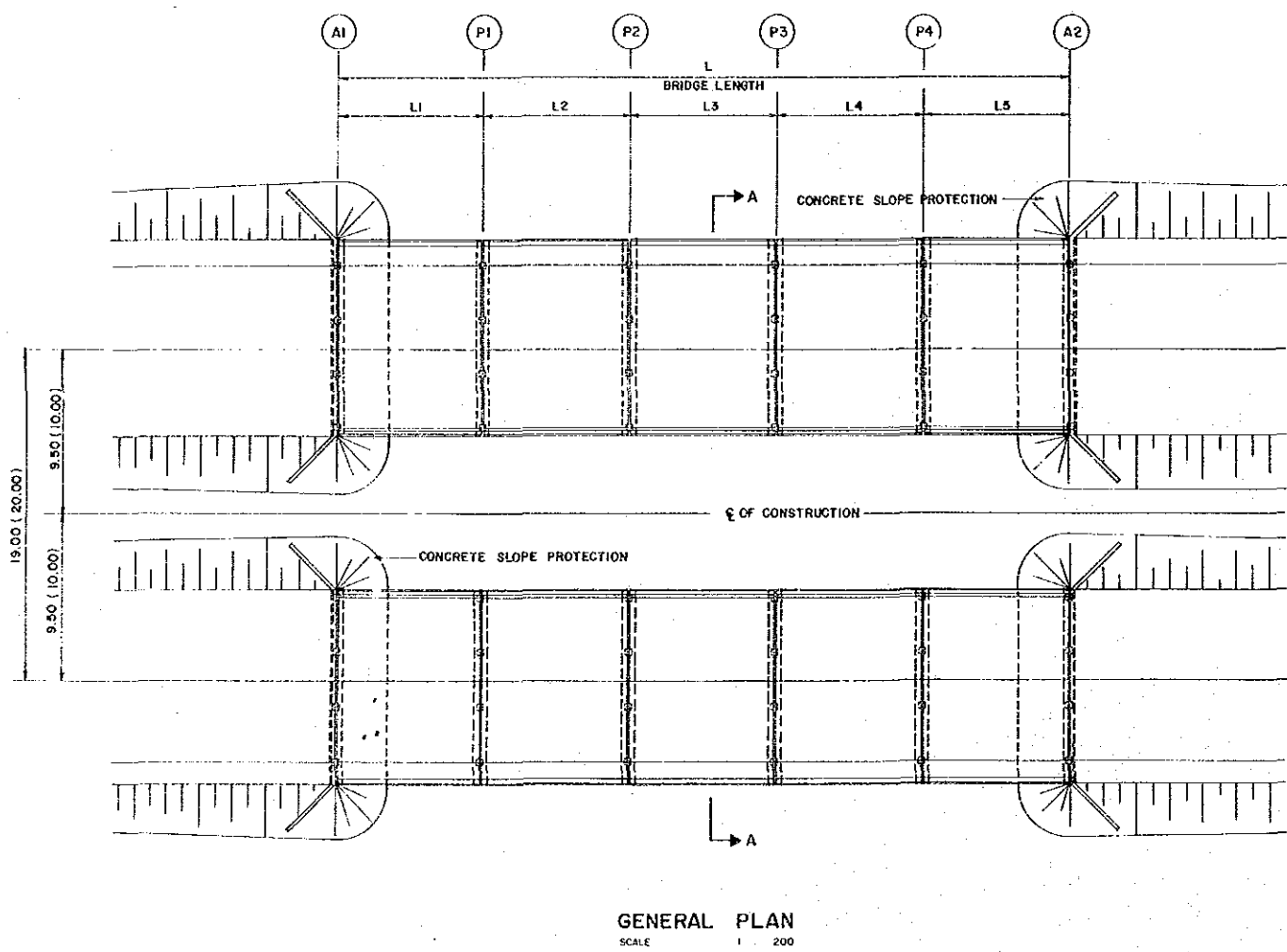


TABLE OF SUPERSTRUCTURE

STA. NO.	BRIDGE LENGTH	SPAN LENGTH					THICKNESS					TYPE	ELEV.	HWL.
		L1	L2	L3	L4	L5	L1	L2	L3	L4	L5			
179+660 LT & RT	8.00	-	-	8.00	-	-	-	0.43	-	-	-	RC SLAB	15.70	-
186+071 RT	45.00	9.00	9.00	9.00	9.00	9.00	0.47	0.47	0.47	0.47	0.47	RC SLAB	14.00	12.50
196+372 LT	35.00	7.00	7.00	7.00	7.00	7.00	0.39	0.39	0.39	0.39	0.39	RC SLAB	50.80	49.80
207+736 LT & RT	15.00	5.00	-	5.00	-	5.00	0.32	-	0.32	-	0.32	RC SLAB	17.49	15.70
209+265 LT	24.00	8.00	-	8.00	-	8.00	0.43	-	0.43	-	0.43	RC SLAB	14.20	-
211+787 LT & RT	12.00	6.00	-	-	-	6.00	0.36	-	-	-	0.36	RC SLAB	5.20	3.00
214+097 LT & RT	18.00	9.00	-	-	-	9.00	0.47	-	-	-	0.47	RC SLAB	5.20	3.20

LIST OF EXISTING BRIDGES

STA. NO.	WIDTH x LENGTH	WITHDRAW (M ³)
179+660	7.00 x 8.00	24
186+071	9.00 x 45.00	190
196+372	9.00 x 35.00	123
207+736	7.00 x 15.00	34
209+265	12.00 x 24.00	124
211+787	7.00 x 12.00	30
214+097	7.00 x 18.00	59
TOTAL		584



ITEM	UNIT	QUANTITY							TOTAL
		STA. 179+660 LT & RT	STA. 186+071 RT	STA. 196+372 LT	STA. 207+736 LT & RT	STA. 209+265 LT	STA. 211+787 LT & RT	STA. 214+097 LT & RT	
1. CONCRETE CLASS B (1/2) FOR BRIDGE DECK	M ³	83	254	164	115	124	104	203	1,047
CLASS B (1/2) FOR PILE BENT PIER & ABUTMENT	M ³	76	73	73	109	55	91	91	568
CLASS SPECIAL B (1/2) FOR BEARING UNIT SLAB	M ³	600	300	300	600	300	600	600	3,300
2. STEEL REINFORCEMENT	T	60	50	43	65	38	63	71	390
3. RC.PILE 0.22 x 0.22 M.	LM	5,328	2,664	2,664	5,328	2,664	5,328	5,328	29,304
4. RC.PILE 0.35 x 0.35 M.	LM	240	360	360	480	240	360	360	2,400
5. CONCRETE RAILING TYPE-1	LM	16	45	35	30	24	24	36	210
TYPE-3	LM	16	45	35	30	24	24	36	210
6. CONCRETE SLOPE PROTECTION	M ²	260	130	130	260	130	260	260	1,430

PROJECT ML - 9

**Changwat : Bangkok, Chachoengsao
& Chon Buri**

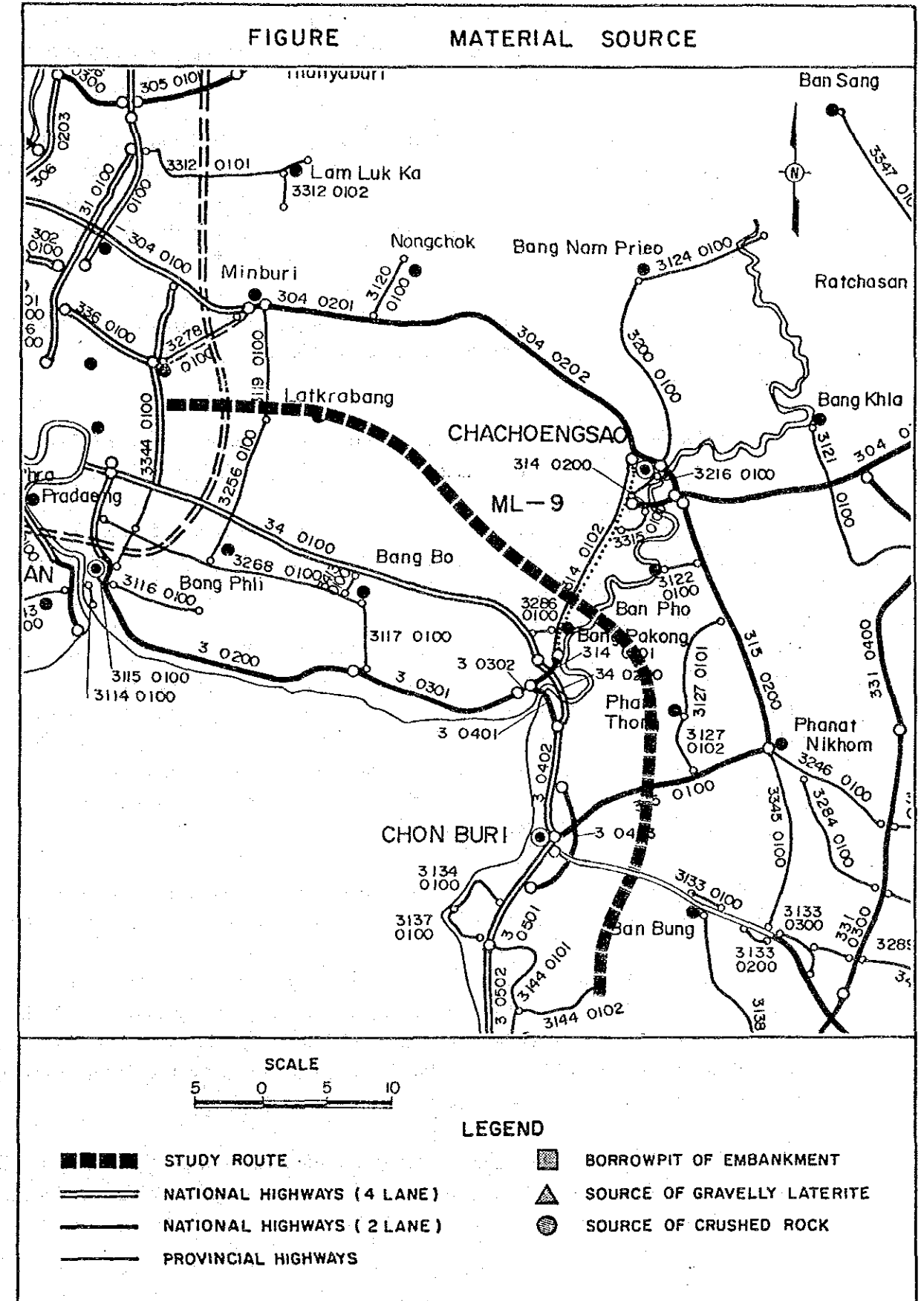
**J.R. 3344 (Bangkok) - Chon Buri -
Pattaya New Highway**

Length : 81.70 km

SUMMARY

PROJECT ML-9

ITEM	DESCRIPTION
Changwat	Bangkok, Chachoengsao & Chon Buri
Origin	J.R. 3344 (Bangkok)
Destination	Chon Buri - Pattaya New Highway
Route No.	Bangkok - Chon Buri New Highway
Project Length	81.70 km
Standard	
- Existing	—
- Proposed	—
Traffic	
- Base	—
- 2000	16,500~39,700
- 2008	25,800~61,300
Pavement Type	
- Proposed	AC pavement (t = 10-12.5 cm) STA 66+000 to 82+524 (16.5 km) PCC pavement (t = 28 cm) STA 0+774 to 66+000 (65.3 km)
Bridges	
- New Construction	42 sites, 6,522 m 3,261 m (one way) × 2 = 6,522 m
Intersections	
- Diamond Type	4 interchanges
- Junction	Directional with a loop
Construction Costs	
- Financial	3,569,696,000 Baht
- Economic	3,214,898,000 Baht
Economic Evaluation	
- IRR	39.6%
- B/C	7.20



1. GENERAL

Project ML-9 is an entirely new four-lane highway linking Bangkok with Chon Buri with a total length of 81.7 km. It extends from Bangkok through three Changwats: Samut Prakhon, Chachoengsao and Chon Buri.

The Bangkok - Chon Buri New Highway (ML-9) linking up with the Chon Buri - Pattaya New Highway (ML-5) at the south of the Chon Buri municipal area will play a vital role as an arterial highway between Bangkok and Rayong by way of existing Route 36, serving primarily the Eastern Seaboard. These two highways, ML-9 and ML-5, may be classified as a primary highway with the route name of Rt. 36.

Considering the rapid industrial and tourism development in the Bangkok - Chachoengsao - Chon Buri - Rayong corridor in recent years, this highway is of vital importance to support the corridor's continued growth.

Upon completion, much traffic is expected to divert to the new highway from Rt. 34 on which traffic volume is approaching its capacity.

The terrain is generally flat, but there is a 10 km stretch of rolling or gentle hill sections toward the end. Land along the proposed highway is used mostly for paddy fields but cassava and sugarcane fields are dominant in the hilly terrain.

The planned route originates at the junction with Srinakarin Road (Rt. 3344) and runs eastward generally parallel to the Bangkok - Chachoengsao railway up to Amphoe Lat Krabang. Then it goes due southeast heading toward Amphoe Bang Pakong through widespread paddy fields. At around Amphoe Bang Pakong, the new highway crosses the Bang Pakong River at a right angle. Then, the highway turns again to the right to go due south detouring the EGAT power station site. The route passes 3 to 4 km east of the Chon Buri Bypass and finally comes to ML-5 at the south of Chon Buri.

The highway crosses one river and natural or artificial irrigation canals which will require bridges to pass. The Bang Pakong River with a width of about 350 m is the biggest among them.

The new highway also intersects a number of major roads such as the proposed Outer Ring Road, Lat Krabang - Min Buri Road (Rt. 3119), Lat Krabang - Nong Chok, Lat Krabang - Chachoengsao (IM-17), Chachoengsao - Bang Pakong (Rt. 314), Chon Buri - Phanat Nikhom (Rt. 315) and Chon Buri - Klaeng (Rt. 344). Grade-separation control is planned to control traffic flows for some of these intersections.

It is anticipated that the ground condition along the route will be rather soft due to its close location to the sea and also its ill-drained flat terrain. Some countermeasures for ground settlement due to embankment construction are required.

Route alignment was determined taking into account the major physical matters such as large-scale industrial estates, new airport site, location of major road intersections, temples, graveyards and schools, river and canal crossings and densely populated areas. However, demolition of several houses is unavoidable at built-up areas around the Rt. 315 and 344 crossings.

Horizontal and vertical alignments of ML-9 were designed for a design speed of 120 km/h taking controlled access operation in future into account.

2. TRAFFIC FORECAST

Base Traffic Volume

(Unit: Vehicles/Day)

Project Code	Section	Year	Traffic Volume							ADT
			MC	PC	LB	HB	LT	MT	HT	
ML-9	34-0100-E	1987	1457	10126	875	1740	7306	2777	4750	27574
		3-0402&3 1987	3475	7380	741	2525	12673	2159	9707	35185

Traffic Growth Rate

(Unit: Percent)

Project	Section	Period	MC	PC	LB	HB	LT	MT	HT
		1994-2000	6.18	6.42	6.63	5.48	5.57	5.88	6.03
		2000-2008	5.65	6.14	6.68	4.95	4.97	4.92	4.65
	3-0402&3	-1993	7.83	8.65	7.95	7.31	7.07	6.91	6.02
		1994-2000	6.82	6.97	7.90	6.75	5.73	6.16	5.95
		2000-2008	6.21	6.59	7.00	5.76	5.10	5.08	4.94

Note. E: East section.

Additional Diverted Traffic Directed to Bangkok

(Unit: Vehicles/Day)

Project	Zone	Year	MC	PC	LB	HB	LT	MT	HT	Total
		2000	2006	2742	0	0	150	2319	53	5264
		2008	3186	4444	0	0	285	3426	112	8267
	SamutPrakarn	1994	1018	2307	222	514	1010	779	563	5395
		2000	1469	3365	325	709	1408	1098	811	7716
		2008	2296	5402	546	1043	2089	1612	1172	11864
	Minburi	1994	353	132	0	19	49	529	30	759
	Nong Chok	2000	506	192	0	26	68	745	43	1074
		2008	785	309	0	38	101	1094	62	1604
	Outer Ring North	1994	1795	3415	27	197	756	65	171	4631
		2000	2592	4984	40	272	1054	93	244	6687
		2008	4058	8000	65	402	1562	132	356	10517
	Outer Ring South	1994	1018	2307	222	514	1010	779	563	5395
		2000	1469	3365	325	709	1408	1098	811	7716
		2008	2296	5402	546	1043	2089	1612	1172	11864

Traffic Volumes Generated from Industrial Estates

(Unit: Vehicles/Day)

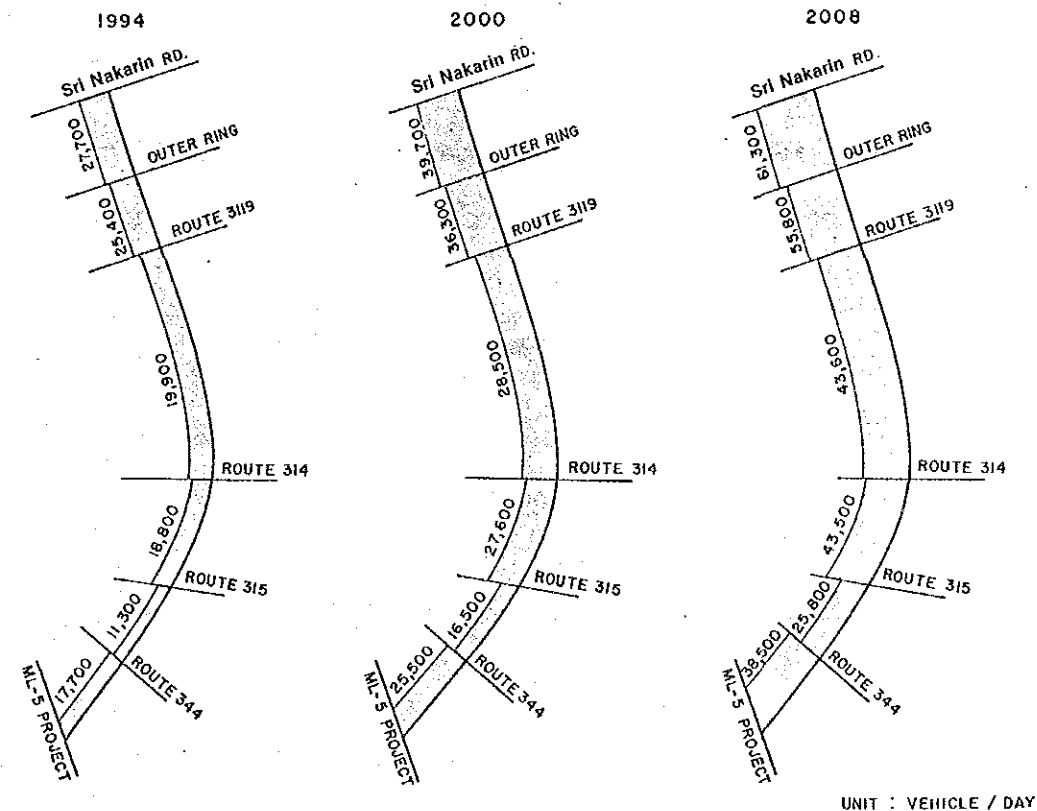
Project Name	Year	MC	PC	LB	HB	LT	MT	HT	CT	Total
	2000		786				120	126	276	1308
	2008		1157				164	172	406	1899
MAP TA PHUT	1994		0				107	112		219
	2000		0				152	159		311
	2008		0				198	207		405

Note. CT: Container Truck

Future Traffic Volume

(Unit: Vehicles/Day)

Project	Section	Year	MC	PC	LB	HB	LT	MT	HT	ADT	
ML-9	1	1994	6478	13524	967	2390	4910	3563	2358	27712	
		Sri Nakarin	2000	9346	19727	1421	3292	6844	5030	3394	39708
		- Outer Ring	2008	14607	31673	2380	4846	10156	7368	4902	61325
	2	1994	5143	10973	1020	2399	4643	4024	2408	25367	
		Outer Ring	2000	7417	16003	1499	3302	6334	5682	3468	36288
		- R.3119	2008	11582	25698	2512	4859	9401	8328	5003	55801
	3	1994	3108	8551	934	2275	4190	1633	2364	19947	
		R.3119	2000	4464	12469	1373	3133	5800	2299	3379	28453
		- R.314	2008	6914	19976	2303	4611	8550	3339	4839	43618
	4	1994	3066	8733	584	1983	4302	883	2354	18839	
		R.314	2000	4146	13109	922	2934	6010	1258	3351	27584
		- R.314	2008	6124	21691	1584	4593	8947	1828	4889	43532
	5	1994	2028	4558	519	1784	2899	553	1014	11327	
		R.311	2000	2728	6812	816	2607	4042	784	1432	16493
		- R.344	2008	3985	11127	1409	4050	6014	1123	2039	25762
	6	1994	1700	4522	1143	2115	4202	1699	4025	17706	
		R.344	2000	2487	6750	1795	3063	5827	2389	5686	25510
		- ML-5	2008	3991	10901	3100	4730	8655	3320	7783	38489
Average		1994	3587	8477	861	2158	4174	2059	2421	20150	
		2000	5096	12478	1304	3055	5810	2907	3452	29006	
		2008	7867	20178	2215	4615	8621	4218	4909	44755	



PROJECT ML-9

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	Along the Route 344 Near Km 10+000 Both Sides 0.3 km	Silty Sand	Plentiful	95 - 15
Laterite	Along the Route 315 Near Km 20+000 Both Sides 5.0 km	Gravelly Laterite	Plentiful	83 - 15
Crushed Rock	Route 3 Km 99+150 Right Side 1.2 Km	Lime Stone	Plentiful	78 - 15

RESULTS OF LABORATORY TESTS

	Sieve Analysis % Passing								Plasticity		Comp. DH-T Stand.		Lab. C.B.R.	
	50.0	25.0	19.0	7.5	#4	#10	#40	#200	LL	PI	Opt. 95%	gn/cc	CBR 95%	Swell %
Soil	100	79	59	36	32	28	34.3	14.2	7.5	2.19	14	0.4		
Laterite	100	96	93	77	51	26	29.8	8.8	7.4	2.21	37	-		
Crushed Rock											>80	-		

