31.3 VOC SAVINGS

In accordance with the concept and data given in Section 3.4 of the Text Report, VOCs on the road link concerned were calculated in the two cases of "with and without project".

Road length by road class is shown in Table 31.3.1. Data for additional VOCs are shown in Table 31.3.2.

VOC savings, obtained as the balance of total link VOCs between the two cases, were calculated as shown in Table 31.3.3.

TABLE 31.3.1 ROAD LENGTH BY ROAD CLASS

(UNIT : KM)

LINK NO.	WITHOUT PROJECT CASE						WITH PROJECT CASE
	PAVED	LATERITE			EARTH	TOTAL	PAVED
		GOOD	FAIR	POOR			
1	-	-	24.5	-	-	24.5	24.5
2	-	-	24.9	3.2	-	28.1	28.1

TABLE 31.3.2 DATA FOR ADDITIONAL VOC COST

(UNIT OF LENGTH : M)

LINK NO.	CASE	CURVE									GRADE					VILLAGE		NO. OF INTER-SECTION	NO. OF TIMBER BRIDGE	NO. OF NARROW BRIDGE	NO. OF CORNER
		100	150	200	250	300	375	500	750	1500	1	2	3	4	5	NO.	LENGTH				
1	WITHOUT	100	-	249	124	-	544	394	1065	3315	5300	100	-	-	-	4	1500	-	3	-	-
	WITH	100	-	249	124	-	544	394	1065	3315	4750	300	-	-	-	4	1500	-	-	-	-
2	WITHOUT	277	157	428	136	437	254	883	-	2944	6900	200	46	-	-	6	4500	12	1	-	-
	WITH	277	157	428	136	437	254	883	-	2009	7100	500	46	-	-	6	4500	-	-	-	-

TABLE 31.3.3 VEHICLE OPERATING COST SAVING

(UNIT : 1000 BAHT)

LINK NO.	1988			1994			2002		
	WITHOUT	WITH	SAVING	WITHOUT	WITH	SAVING	WITHOUT	WITH	SAVING
1	14,936	12,008	2,928	21,439	17,277	4,161	35,073	28,262	6,810
2	17,608	10,634	6,975	25,178	15,076	10,102	40,794	24,385	16,409
TOTAL	32,545	22,642	9,903	46,617	32,354	14,263	75,867	52,647	23,219

N O T E
(1) WITHOUT : WITHOUT PROJECT CASE
(2) WITH : WITH PROJECT CASE
(3) SAVING : VEHICLE OPERATING COST SAVING
(4) LINK NO. = 1 - 9 : PROPOSED LINK
(5) LINK NO. = 11 - 19 : SURROUNDING LINK

31.4 ENGINEERING

31.4.1 Soil and Materials

Existing subgrade soil and material sources in the vicinity of the study route investigated by DOH and their physical characteristics are shown in Figure 31.4.1 and Table 31.4.1, respectively.

Rock aggregate sources were assumed as shown below:

No.	Source	Description of Sample	Est. Quantity m^3
31/CS-1	KM. 2+600 Lt close to Buri Ram-Prakhon Chai (Sila Pet Quarry)	Basalt	Plentiful
31/CS-2	KM. 3+000 Lt close to Buri Ram-Prakhon Chai (Sila Chai Quarry)	Basalt	Plentiful
31/CS-3	KM. 3+500 Lt close to Buri Ram-Prakhon Chai (Nisit Sawat quarry)	Basalt	Plentiful

FIGURE 31.4.1 SOIL AND MATERIAL SOURCES

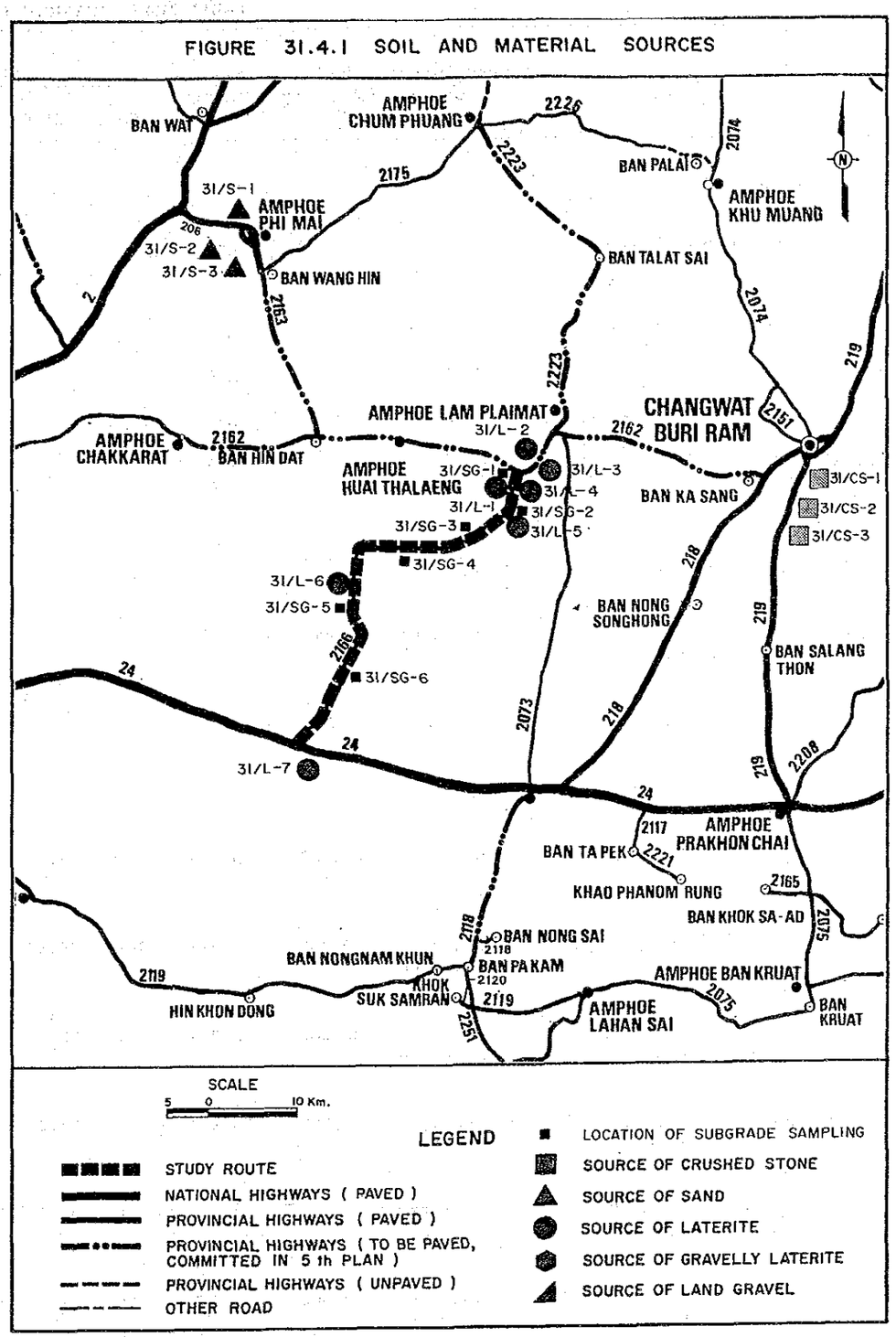


TABLE 31.4.1 PHYSICAL CHARACTERISTICS OF MATERIALS

No.	Source	Description of Sample	Est. Quantity m^3	AASHTO Classification	Sieve Analysis % Passing								Plasticity		Comp. DH-T Stand. Opt. 95%	Comp. DH-T Stand. gm/cc	Lab. C.B.R. CBR 95%	Lab. C.B.R. Swell %	Durability Abr.	Durability Dur.
					50.0	25.0	19.0	9.5	#4	#10	#40	#200	LL	PT						
SUBGRADE																				
31/SG-1.	KM. 1+800 Rt 15 M.			A-4						100	99.0	48.8	N-P		10.1	1.888	25.4	-		
31/SG-2.	KM. 8+300 Lt 13 M.			A-6					100	99.8	99.4	66.0	33.3	12.9	13.6	1.755	5.9	-		
31/SG-3.	KM. 16+100 Rt 13 M.			A-6					100	99.6	98.0	88.6	29.5	10.8	15.1	1.845	7.4	0.5		
31/SG-4.	KM. 22+300 Lt 15 M.			A-6					100	99.4	98.0	91.8	31.9	11.9	16.6	1.709	3.8	1.6		
31/SG-5.	KM. 30+400 Rt 13 M.			A-6					100	99.4	98.8	86.8	34.8	13.4	13.9	1.832	12.0	0.7		
31/SG-6.	KM. 37+800 Lt 15 M.			A-4					100	99.4	98.6	74.2	23.3	5.3	11.5	1.927	15.5	-		
SAND																				
31/S-1	KM. 57+000 Route No.206 B. Talad Kae - Phi Mai	Mun River sand	Plentiful																The same as standard Color	
31/S-2	KM. 7+650 Rt 900 M. Route Talad Kae - Phi Mai	River sand	Plentiful					100	97	89	29	3	N.P.							
31/S-3	KM. 9+500 Rt close to Talad Kae - Phi Mai	River sand	Plentiful					100	98	91	33	2	N.P.							
LATERITE																				
31/L-1	KM. 24+000 Rt 3,500 M. Lam Plai Mat - Nong Ki	White laterite	20,000	A-2-6	100	92.3	-	52.5	-	28.2	24.1	17.2	35.8	12.1	8.2	2.120	25.8	0.88		
31/L-2	KM. 7+000 Rt 2,000 M. Lam Plai Mat - Nong Ki	White laterite	20,000	A-2-4	100	85.6	-	56.2	-	29.4	22.3	17.6	31.2	8.9	8.4	2.115	26.3	1.14		
31/L-3	KM. 20+000 Lt 4,000 M. Lam Plai Mat - Nong Ki	White laterite	20,000	A-2-4	100	86.3	-	60.0	-	37.4	32.1	4.8	27.8	7.8	9.0	1.979	33.0	0.46		
31/L-4	KM. 18+000 Lt 3,000 M. Lam Plai Mat - Nong Ki	White laterite	20,000	A-2-4	100	97.0	-	60.6	-	24.3	21.5	18.3	34.4	10.1						
31/L-5	KM. 9+700 Rt 1 KM. Huai Thalaeng - Buri Ram	Laterite			100	92.0	86	50.0	32	25.0	22.0	19.0	N.P.		7.8	2.176	28.0		35	73
31/L-6	KM. 42+000 Rt 2,000 M. Lam Plai Mat - Nong Ki	White laterite	20,000	A-2-6	100	91.0	-	56.3	-	35.7	25.3	16.4	35.5	11.9	8.6	2.121	25.7	0.92		

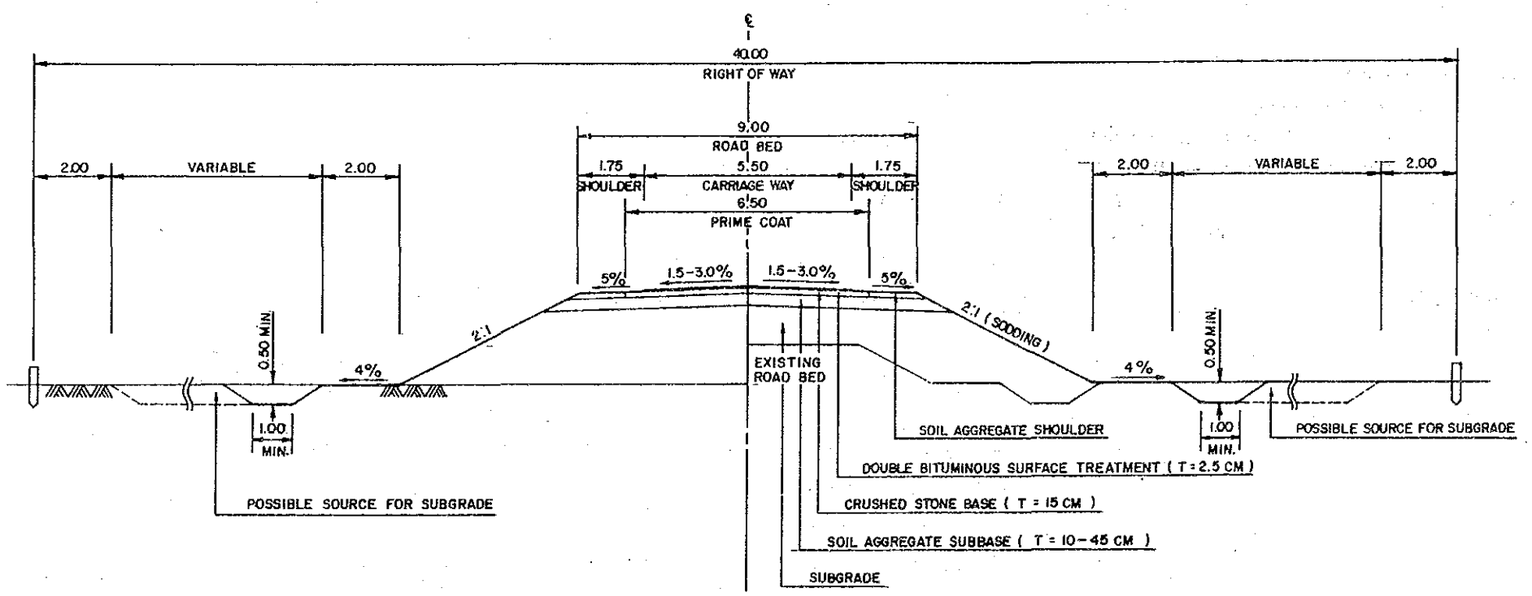
31.4.2 Preliminary Design

31.4.2.1 Design Criteria

Design Standard	:	F4
Geometric Design Criteria	:	DOH (Provincial Highway)
Typical Cross Section	:	as shown in Figure 31.4.2
Minimum Height of Embankment in Flooding Section	:	0.7 m above flood level
Pavement Structure		
DBST	:	2.5 cm
Crushed Aggregate Base CBR ≥ 80%	:	15.0 cm
Soil Aggregate Subbase CBR ≥ 25%	:	10.0 cm (minimum requirement)
Selected Materials CBR ≥ 6%	:	as required
Pipe Culvert		
Standardized type	:	80, 100, 120 & 150 cm in diameter
Location	:	as required
Standard intervals		
Paddy area	:	200 m
Others	:	500 m
Box Culvert		
Standard size	:	1.5×1.5, 2.4×2.4 & 3.0×3.0 m
Location	:	as required
Bridge		
Reinforced concrete standard type	:	Width 9.0 m
Substructure	:	Pile-bent type

The existing and designed plan and profile are shown in Drawings 31-1/31-6.

FIGURE 31.4.2 TYPICAL CROSS SECTION



PROVINCIAL HIGHWAY (CLASS F4)

31.4.2.3 Pavement Design

1) Cumulative number of ESA in one direction

- ESA conversion factors

Heavy bus	:	0.50
Medium truck	:	0.76
Heavy truck	:	1.24

- Forecasted ADT by vehicle type

Year	1988				1994			
Traffic/road link	1	2	3	4	1	2	3	4
Heavy bus	6	3	—	—	20	12	—	—
Medium truck	25	20	—	—	41	25	—	—
Heavy truck	19	5	—	—	26	9	—	—

- Cumulative number of ESA in one direction by road link

Road link	1	2	3	4
7 years (10^6)	0.082	0.037	-	-

2) Design CBR values

Road link	1	2	3	4
Design CBR (%)	6.8	6.8	-	-

3) Required thickness of pavement

Surfacing	:	DBST (2.5 cm)
Aggregate base	:	15 cm (CBR not less than 25%)
Subbase	:	Minimum requirement 10 cm

Road link	1	2	3	4
	15 cm	15 cm	-	-

4) Overlay required in 7 years

DBST resurfacing

31.4.2.4 Drainage and Structures

The locations of existing and designed RC box culverts and RC bridges and their dimensions are shown below:

STATION	EXISTING STRUCTURES		PROPOSED STRUCTURES	
	TYPE	SIZE	TYPE	SIZE
4 + 563	Timber Bridge	5.6 x 11.3	RC Bridge	9.0 x 24.0
16 + 993	" "	4.6 x 12.4	" "	9.0 x 18.0
50 + 162	Weir	100	Box Culvert	4-2.4 x 2.1 x 18.0

31.4.3 Quantities and Construction and Road Maintenance Costs

The required construction costs were estimated based on the results of the preliminary design as shown in Table 31.4.2. Financial costs with breakdown into local and foreign currency portions, economic costs and residual values were estimated as follows and in 31.4.4:

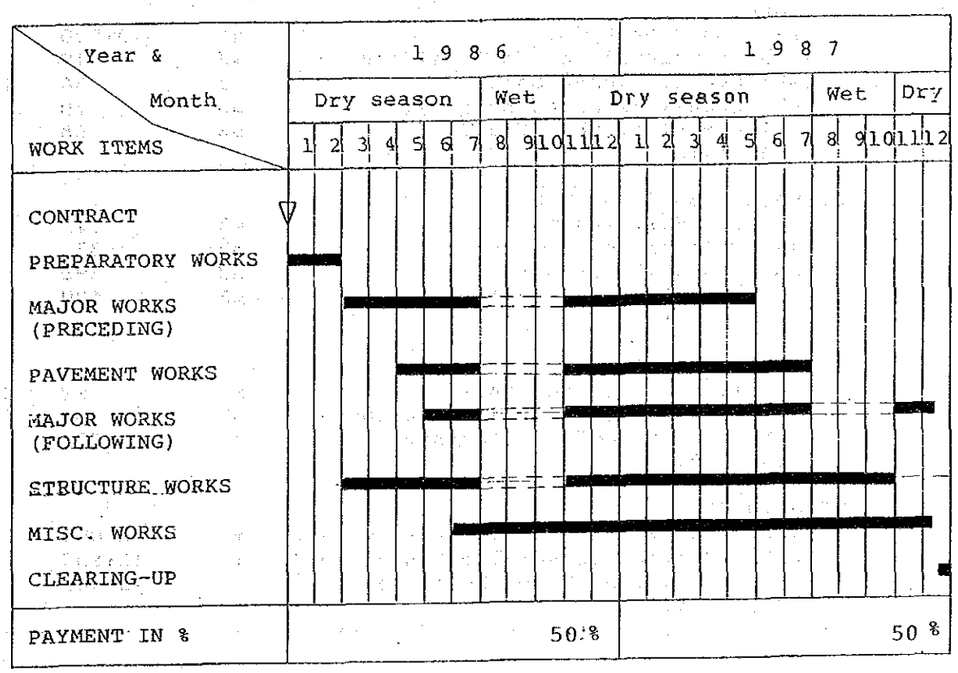
IM—31	L = 52.6 km		(baht)
	Financial cost	:	79,741,000
	Economic cost	:	66,668,000
	Residual value	:	23,427,000

The required road maintenance cost savings are shown in Table 31.4.3.

31.4.4 Construction and Disbursement Schedules

IM—31 **Length = 52.6 km**

Construction Schedule
Assumption: Completion date December 31, 1987



Yearly Disbursement Schedule
Assumption: Annual rise in prices

Year / Currency	Base year 1984	(1985)	1986	1987
Local	100	110.0	121.0	133.1
Foreign	100	106.5	113.4	120.8

LOCAL AND FOREIGN COMPONENTS OF CONSTRUCTION COST

(Route IM - 31)

(Unit : Million Baht)

	1986			1987			Total		
	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total
Construction Cost	19.7	20.1	39.8	19.8	20.1	39.9	39.5	40.2	79.7
Price Continsency	4.1	2.7	6.8	6.6	4.2	10.8	10.7	6.9	17.6
Total	23.8	22.8	46.6	26.4	24.3	50.7	50.2	47.1	97.3
	(0.88)	(0.84)	(1.73)	(0.98)	(0.90)	(1.88)	(1.86)	(1.74)	(3.60)

Remarks : L/C : Local Currency Portion
F/C : Foreign Currency Portion
( ) : US$ Equivalent (US$ 1 = 27 Baht)

TABLE 31.4.2 CONSTRUCTION QUANTITIES AND COSTS
(ROUTE IM—31 Length = 52.6 km)

DBST

Item	Unit	Financial Unit Rate B	Quantity	Financial Cost 1000 B			Economic Cost		Residual Value	
				Total	Local	Foreign	%	1000 B	%	1000 B
EARTHWORK							83		90	
Clearing & Grubbing	ha	10,000	120	1,200						
Roadway Excavation, Unclassified	m3	19	22,600	429						
Embankment, Common Soil	m3	38	115,300	4,381						
Embankment, Selected Material	m3	70	0	0						
Replacement of Soft Spot	m3	88	4,400	387						
Sub Total				6,398	3,263	3,135		5,310		4,779
SUBBASE & BASE COURSES							83		50	
Subbase, Soil Aggregate	m3	112	74,100	8,299						
Aggregate Base*	m3	372	51,300	19,084						
Cement Stabilized Base	m3	390	0	0						
Shoulder, Soil Aggregate	m3	120	19,700	2,364						
Sub Total				29,747	16,063	13,684		24,690		12,345
SURFACE COURSES							85		50**	
Asphaltic Prime/Tack Coat	m2	12	342,000	4,104						
Double Bituminous Surface Treatment*	m2	39	289,400	11,287						
Asphaltic Concrete Surfacing**	t	750	0	0						
Sub Total				15,391	6,772	8,619		13,082		0
STRUCTURES							83		50	
RC Pipe Culvert (D 1.0m Equivalent)	m	2,000	3,374	6,748						
RC Box Culvert (2.4mx2.4m Equivalent)	m	18,800	72	1,354						
RC Bridge(W=9.0m L=10m Equivalent)	m	46,500	42	1,953						
Sub Total				10,055	5,027	5,027		8,345		4,173
Total (a)				61,590	31,125	30,465		51,428		21,297
INCIDENTALS							83		0	
Miscellaneous Work ((a)x7%)	ls			4,311	2,156	2,156		3,578		0
CONTRACT AMOUNT (b)				65,901	33,281	32,620		55,006		21,297
PHYSICAL CONTINGENCIES ((b)x10%) (c)	ls			6,590	3,328	3,262		5,501		2,130
ENGINEERING AND SUPERVISION							85		0	
(((b)+(c))x10%) (d)	ls			7,249	2,900	4,349		6,162		0
LAND ACQUISITION							100		100	
Highly Developed Land	ha	50,000	0	0						
Less Developed Land	ha	15,000	0	0						
Sub Total (e)	ls			0	0	0		0		0
PROJECT COST ((b)+(c)+(d)+(e))				79,741	39,509	40,232		66,668		23,427
AVERAGE COST PER KM				1,516						

Note : * The unit prices are modified by aggregate haulage distance
** Rate is applied only for Asphaltic Concrete Surfacing

TABLE 31.4.3 ROAD MAINTENANCE COST SAVING

LINK NO.	YEAR	WITHOUT PROJECT CASE: AVERAGE DAILY TRAFFIC <ADT> (VEHICLE)	LENGTH OF LINK <L> (KM)	FACTOR FOR ADT <A1>	ROAD CHARA. FACTOR <KA>	UNIT MAINTE. COST <U> (BAHT/KM)	TOTAL MAINTE. COST <T> (1000 BAHT)	WITH PROJECT CASE: AVERAGE DAILY TRAFFIC <ADT> (VEHICLE)	LENGTH OF LINK <L> (KM)	FACTOR FOR ADT <X3>	ROAD CHARA. FACTOR <KB>	UNIT MAINTE. COST <U> (BAHT/KM)	TOTAL MAINTE. COST <T> (1000 BAHT)	ROAD MAINTE. COST SAVING (1000 BAHT)
1	1988	321.6	24.5	0.58	1.63	17,157	420	367.7	24.5	0.00	1.17	13,129	322	99
	1994	499.6	24.5	0.95	1.89	19,863	487	556.0	24.5	0.00	1.17	13,129	322	165
	2002	905.5	24.5	0.95	1.89	19,863	487	961.3	24.5	0.00	1.17	13,129	322	165
2	1988	212.2	28.1	0.33	1.45	15,286	430	233.7	28.1	0.00	1.17	13,129	369	61
	1994	327.4	28.1	0.60	1.64	17,255	485	339.9	28.1	0.00	1.17	13,129	369	116
	2002	588.4	28.1	0.95	1.89	19,863	558	568.8	28.1	0.00	1.17	13,129	369	189
TOTAL	1988	263.2	52.6			16,157	850	296.1	52.6			13,129	691	159
	1994	407.6	52.6			18,470	972	440.5	52.6			13,129	691	281
	2002	736.1	52.6			19,863	1,045	751.6	52.6			13,129	691	354

NOTE (1) TOTAL MAINTENANCE COST T = U * L

(2) UNIT MAINTENANCE COST U = M * (KA or KB) * FA * (1 + FR) * FE

M ; SPECIFIED MAINTENANCE COST
WITHOUT PROJECT CASE M = 7,700 BAHT/KM
WITH PROJECT CASE M = 8,200 BAHT/KM

FA = 1.40 ADMINISTRATION FACTOR FOR DIRECT LABOUR OPERATION BY DOH
FR = 0.15 EMERGENCY REHABILITATION COST FACTOR
FE = 0.85 ECONOMIC MAINTENANCE COST FACTOR TO FINANCIAL MAINTENANCE COST

(3) ROAD CHARACTERISTIC FACTOR
WITHOUT PROJECT CASE KA = 1.22 + 0.70 * A1
WITH PROJECT CASE KB = 1.17 + 0.05 * X3

(4) FACTOR FOR ADT
WITHOUT PROJECT CASE A1 = -0.1630 + 0.002320 * ADT
WITH PROJECT CASE X3 = -0.2034 + 0.000409 * (ADT / LANE) ; LANE = 2

31.5 EVALUATION

31.5.1 Economic Evaluation

The yearly distribution of the economic costs and benefits and the calculated economic indicators for evaluation are given in the table below.

The results indicate that the improvement of this study route is feasible by employing the F4 standard with DBST surfacing.

COSTS AND BENEFITS STATEMENT OF ROUTE IM - 31

(1000 BAHT)

YEAR	COST	BENEFITS				DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	TOTAL COST	TOTAL BENEFIT
1986	33,334	0	0	0	0	41,814	0
1987	33,334	0	0	0	0	37,334	0
1988	0	2,683	9,903	159	12,745	0	11,380
1989	0	3,369	10,630	180	14,178	0	11,302
1990	0	4,054	11,356	200	15,610	0	11,111
1991	0	4,740	12,083	220	17,043	0	10,831
1992	0	5,425	12,810	240	18,475	0	10,483
1993	0	6,111	13,536	261	19,907	0	10,086
1994	0	6,796	14,263	281	21,340	0	9,653
1995	18,935	7,462	15,383	290	23,134	8,565	9,344
1996	0	8,128	16,502	299	24,929	0	8,990
1997	0	8,793	17,622	308	26,723	0	8,604
1998	0	9,459	18,741	318	28,518	0	8,198
1999	0	10,125	19,861	327	30,312	0	7,780
2000	0	10,791	20,980	336	32,107	0	7,358
2001	0	11,456	22,100	345	33,901	0	6,937
2002	-23,427	12,122	23,219	354	35,696	-4,280	6,521
TOTAL	62,176	111,512	238,988	4,118	354,617	83,433	138,578
DISCOUNTED	83,433	41,352	95,551	1,675	138,578		

NET PRESENT VALUE	:	55,144
BENEFIT/COST RATIO	:	1.66
INTERNAL RATE OF RETURN	:	19.2 %
FIRST YEAR RATE OF RETURN	:	14.4 %
OPTIMUM OPENING YEAR	:	1988

SENSITIVITY TESTS

ITEM	CASE		
	BASE	1	2
NET PRESENT VALUE	55,144	42,629	34,358
BENEFIT/COST RATIO	1.66	1.44	1.41
INTERNAL RATE OF RETURN	19.2 %	17.1 %	16.7 %
FIRST YEAR RATE OF RETURN	14.4 %	12.5 %	12.2 %
COSTS	BASE	+15%	BASE
BENEFITS	BASE	BASE	-15%

31.5.2 Social Impact

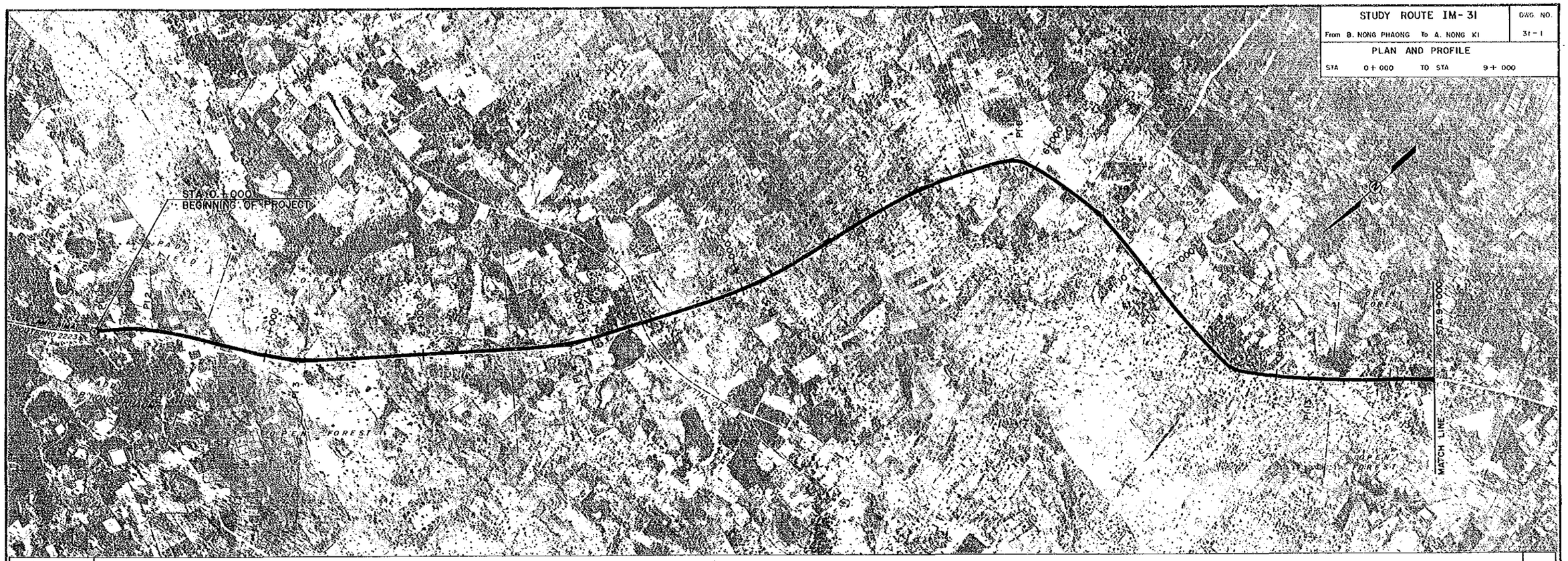
The social impact brought about by the improvement of the study route is shown in the following social benefit indicators:

Construction Cost (million baht)	:	66.7
1) General Accessibility Benefit (million baht)	:	4.73
2) Education Benefit (million baht)	:	5.01
3) Medical Care Benefit (million baht)	:	0.108
4) Total Social Benefits (million baht) (1+2+3)	:	9.85
5) Social Benefit/Cost Ratio ($\times 10^{-2}$)	:	14.77
6) Ranking by Social Benefits	:	6
7) Weighted Production Value Gain/Cost ($\times 10^{-2}$)	:	11.35
8) Ranking by 7	:	4
9) Combined Ratio ($\times 10^{-2}$)	:	26.12
Overall Ranking	:	6

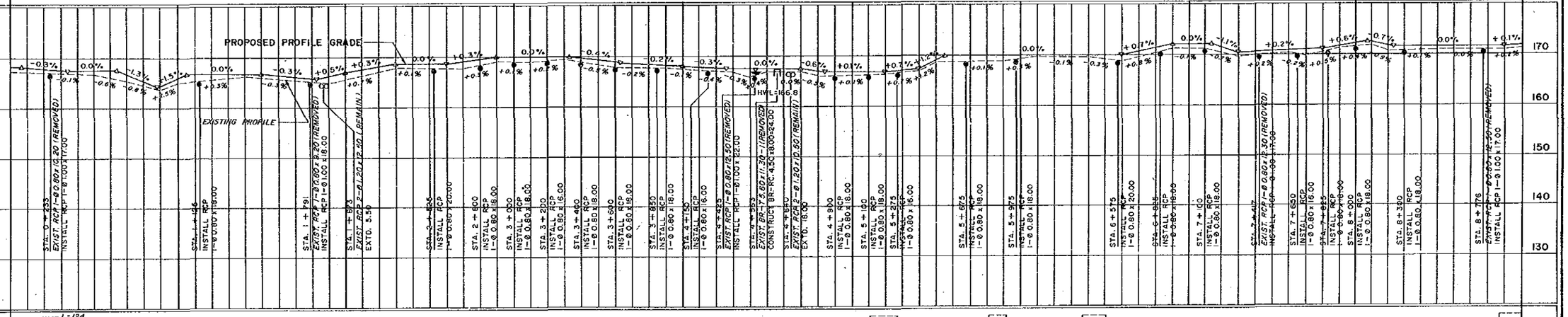
31.5.3 Overall Evaluation

It is concluded and recommended that, considering the overall ranking and possible schedule of the improvement and/or new construction of the study routes, this study route should be improved with the opening year 1988.

STUDY ROUTE IM-31	DWG. NO.
From B. NONG PHAONG To A. NONG KI	31-1
PLAN AND PROFILE	
STA 0+000 TO STA 9+000	



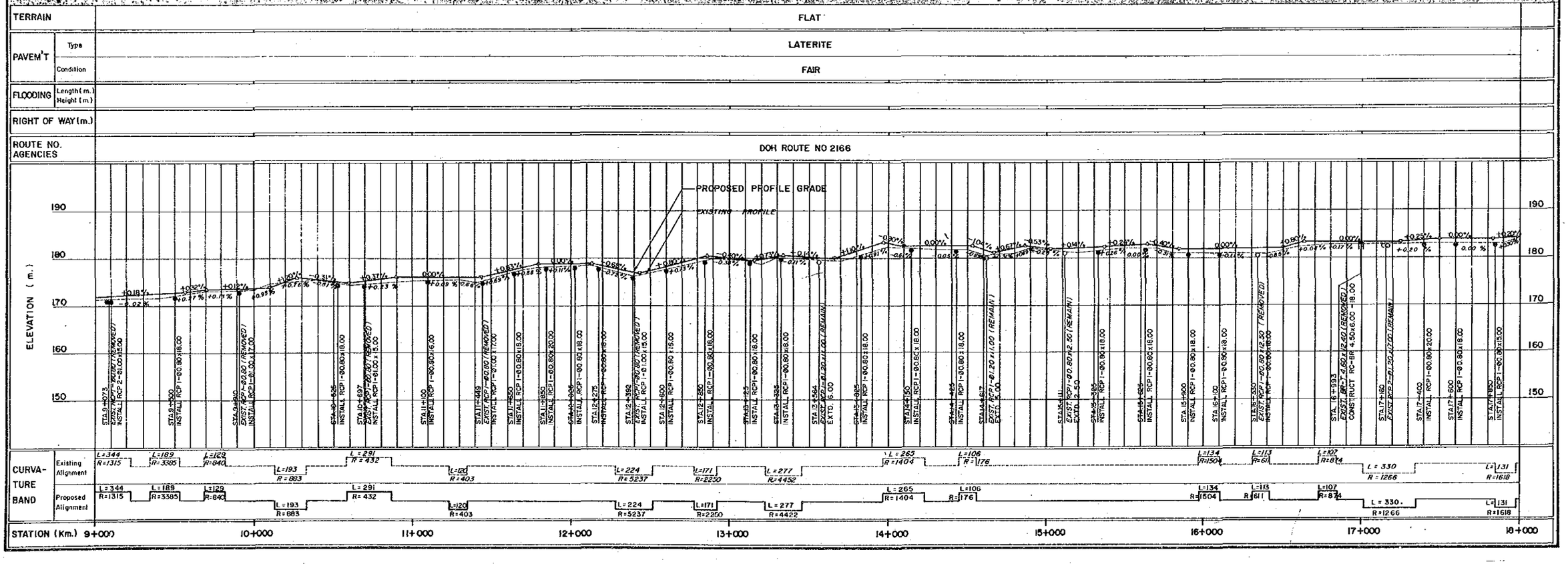
TERRAIN		FLAT
PAVEMENT	Type	LATERITE
	Condition	FAIR
FLOODING	Length (m.) / Height (m.)	
RIGHT OF WAY (m.)		
ROUTE NO. AGENCIES		DOH ROUTE NO. 2166



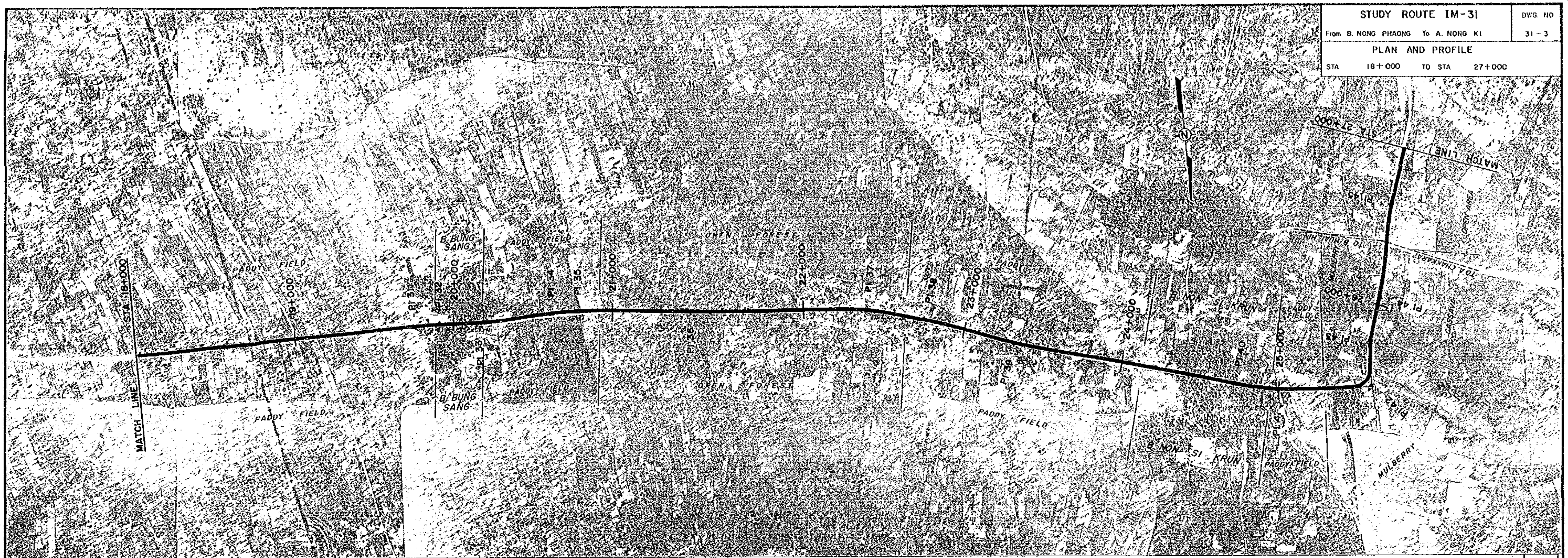
CURVATURE BAND	Existing Alignment	L=93 R=341 · L=124 R=251 · L=155 R=520 · L=207 R=853 · L=161 R=759 · L=177 R=671 · L=100 R=112 · L=133 R=433 · L=166 R=1919 · L=143 R=207 · L=194 R=1571 · L=344 R=1315
	Proposed Alignment	L=93 R=341 · L=124 R=251 · L=155 R=520 · L=207 R=853 · L=161 R=759 · L=177 R=671 · L=100 R=112 · L=133 R=433 · L=166 R=1919 · L=143 R=207 · L=194 R=1571 · L=344 R=1315
STATION (Km.)		0+000 · 1+000 · 2+000 · 3+000 · 4+000 · 5+000 · 6+000 · 7+000 · 8+000 · 9+000

STUDY ROUTE IM-31	DWG NO.
From B. NONG PHAONG To A. NONG KI	31 – 2
PLAN AND PROFILE	
STA. 9+000 TO STA. 18+000	

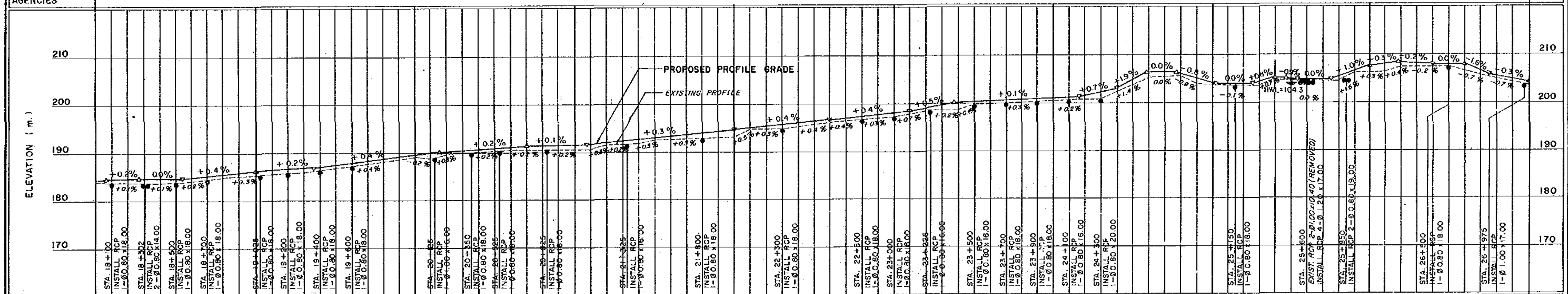
TERRAIN		FLAT
PAVEM'T	Type	LATERITE
	Condition	FAIR
FLOODING	Length (m.) / Height (m.)	
RIGHT OF WAY (m.)		
ROUTE NO. AGENCIES		DOH ROUTE NO 2166



STUDY ROUTE IM-31	DWG. NO
From B. NONG PHAONG To A. NONG KI	31 - 3
PLAN AND PROFILE	
STA 18+000 TO STA 27+000	



TERRAIN		FLAT			
PAVEM'T	Type	LATERITE	DT	LATERITE	
	Condition	FAIR	POOR	FAIR	
FLOODING	Length (m.) Height (m.)				
RIGHT OF WAY (m.)					
ROUTE NO. AGENCIES		DOH ROUTE NO 2166			



CURVATURE BAND													
Existing Alignment	L=91 R=805	L=111 R=1203	L=169 R=2017	L=256 R=5465	L=126 R=623	L=146 R=1586	L=208 R=2698	L=106 R=455	L=110 R=72	L=91 R=261	L=92 R=573	L=157 R=1146
Proposed Alignment	L=91 R=805	L=111 R=1203	L=169 R=2017	L=256 R=5465	L=126 R=623	L=146 R=1586	L=208 R=2698	L=106 R=455	L=110 R=72	L=91 R=261	L=92 R=573	L=157 R=1146

STATION (Km.) 18+000 | 19+000 | 20+000 | 21+000 | 22+000 | 23+000 | 24+000 | 25+000 | 26+000 | 27+000

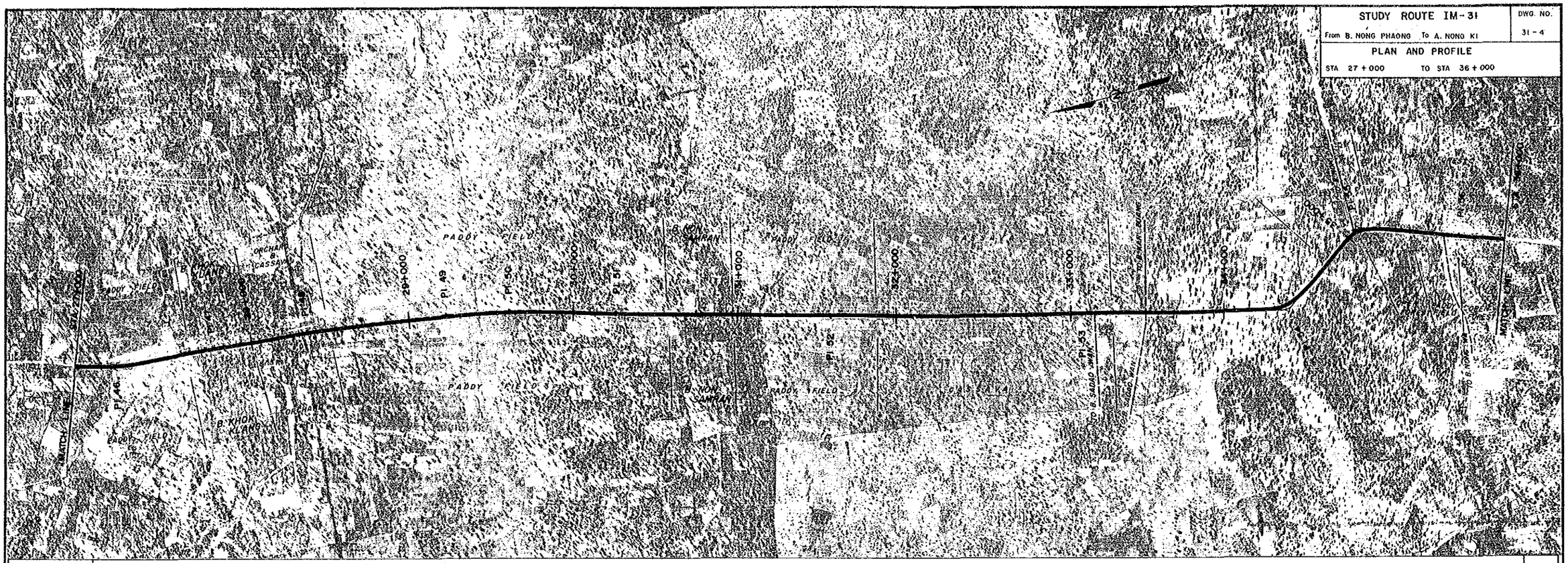
STUDY ROUTE IM-31

From B. NONG PHAONG To A. NONG KI

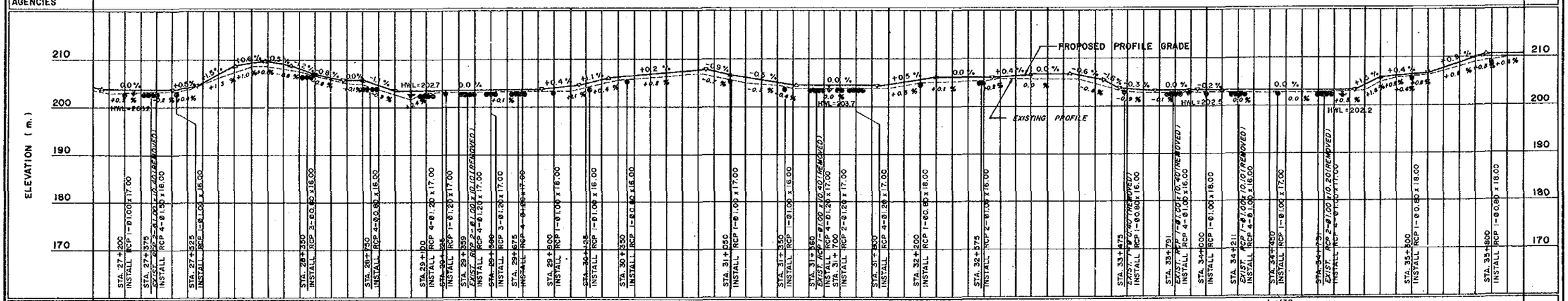
DWG. NO. 31-4

PLAN AND PROFILE

STA 27+000 TO STA 36+000



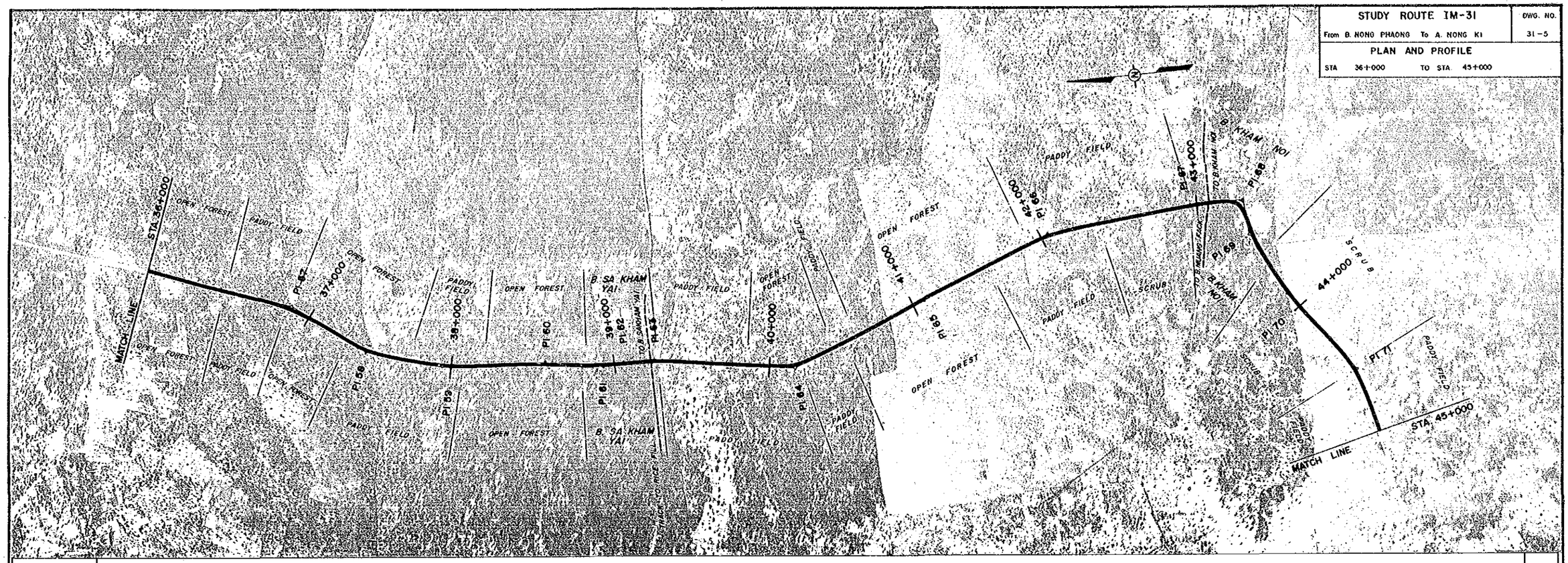
TERRAIN		FLAT	
PAVEM'T	Type	DT	LATERITE
	Condition	POOR	FAIR
FLOODING	Length (m.) / Height (m.)		
RIGHT OF WAY (m.)			
ROUTE NO. AGENCIES		DOH ROUTE NO. 2116	



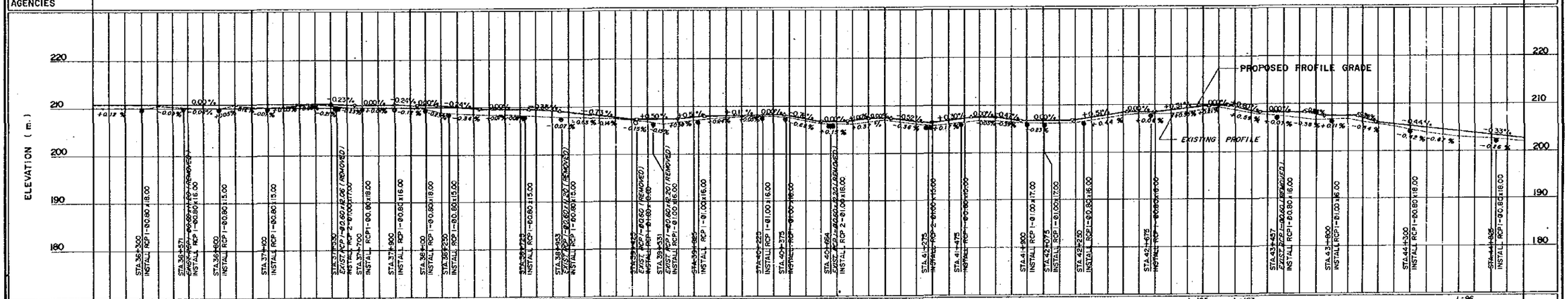
CURVATURE BAND	Existing Alignment	L=131 R=573; L=31 R=1146; L=317 R=5730; L=175 R=2865; L=150 R=5730; L=132 R=155; L=211 R=220
	Proposed Alignment	L=131 R=573; L=31 R=1146; L=317 R=5730; L=175 R=2865; L=150 R=5730; L=132 R=155; L=211 R=220

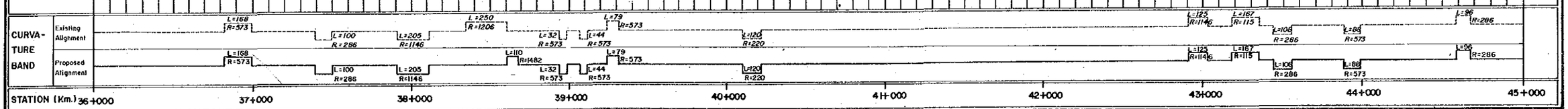
STATION (Km.) 27+000 28+000 29+000 30+000 31+000 32+000 33+000 34+000 35+000 36+000

STUDY ROUTE IM-31	DWG. NO.
From B. NONG PHAONG To A. NONG KI	31 – 5
PLAN AND PROFILE	
STA 36+000 TO STA 45+000	

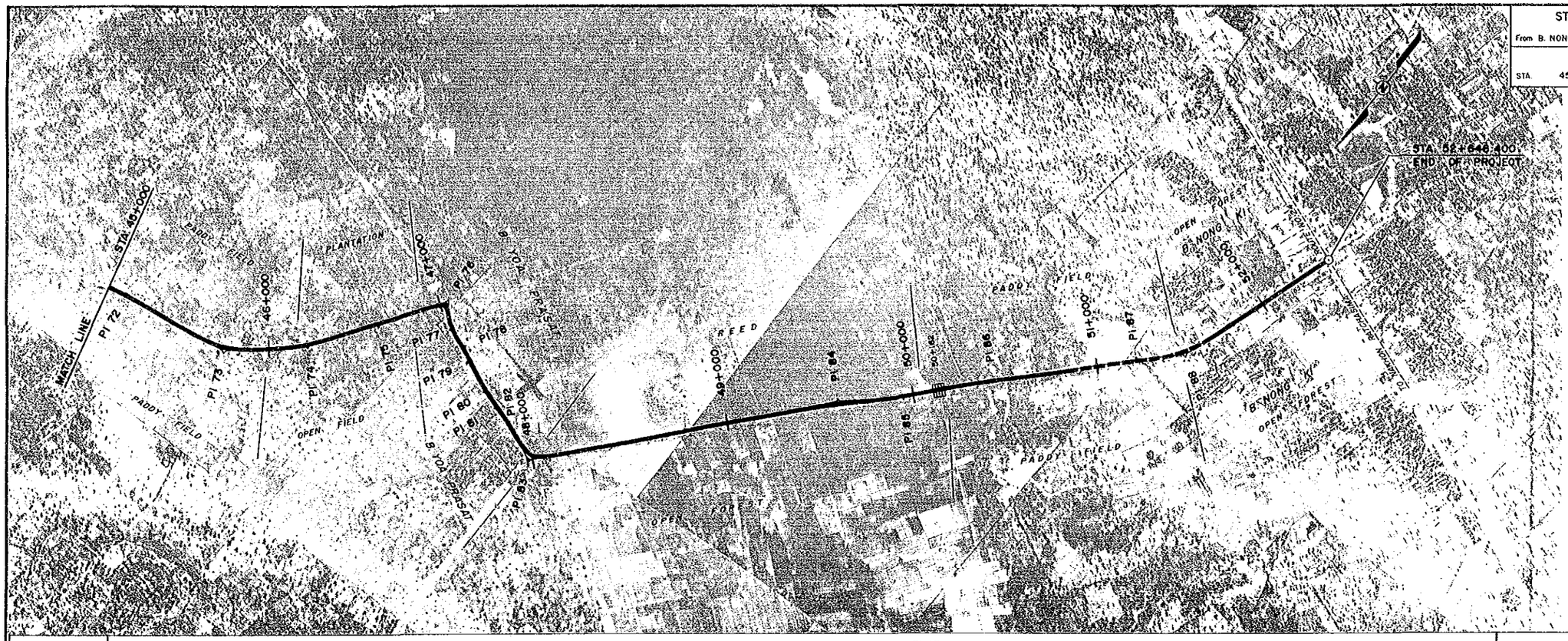


TERRAIN		FLAT
PAVEMENT	Type	LATERITE
	Condition	FAIR
FLOODING	Length (m.) / Height (m.)	
RIGHT OF WAY (m.)		
ROUTE NO. AGENCIES		DOH ROUTE NO 2166

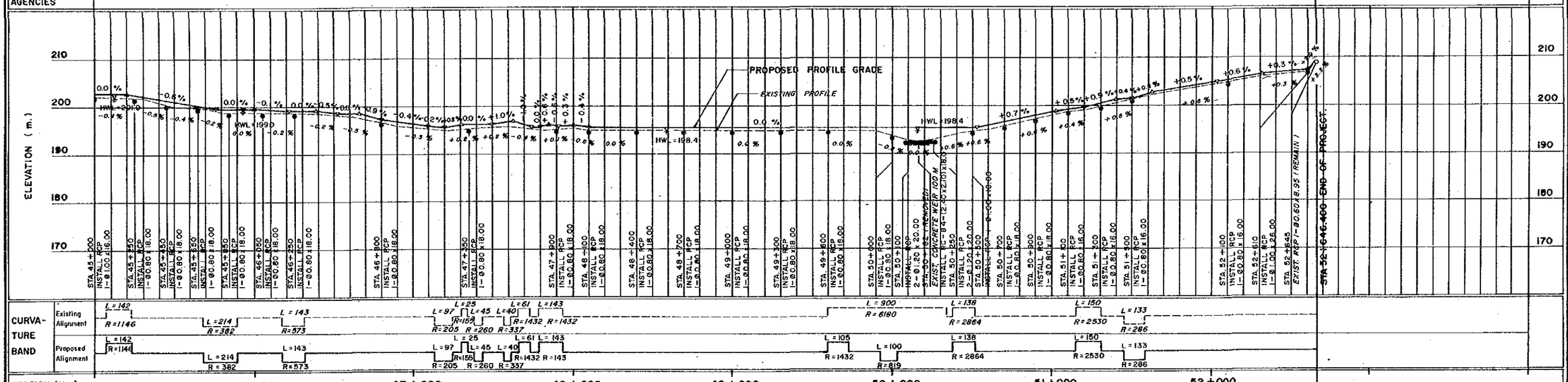




STUDY ROUTE IM-31	DWG NO.
From B. NONG PHAONG To A. NONG KI	31-6
PLAN AND PROFILE	
STA 45 + 000 TO STA 52 + 646.4	



TERRAIN		FLAT					
PAVEMENT	Type	LATERITE	DT	LATERITE	DT		
	Condition	FAIR	POOR	FAIR	POOR		
FLOODING	Length (m.) / Height (m.)						
RIGHT OF WAY (m.)							
ROUTE NO. AGENCIES		DOH ROUTE NO 2166					



STUDY ROUTE NO. IM-33

Changwat : Nakhon Ratchasima

A. Si Khui (J.R.2) – A. Chok Chai (J.R.24)

Length : 51.4 KM.

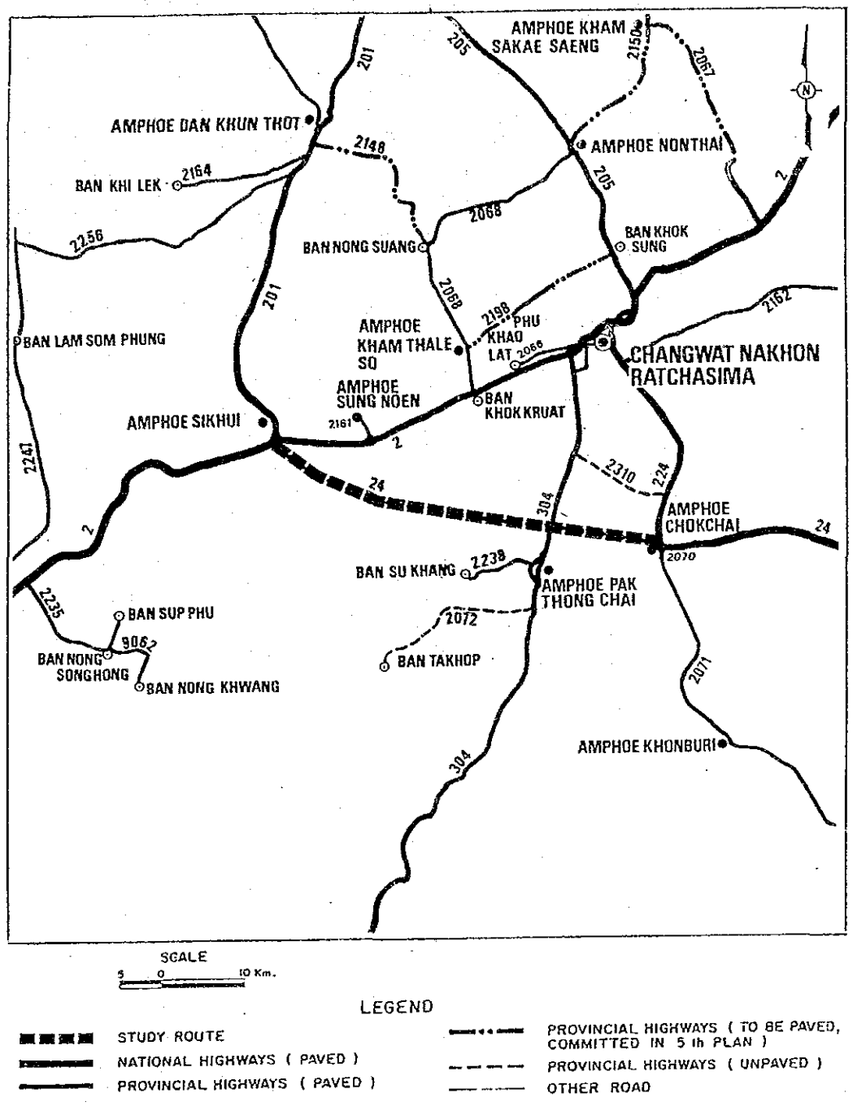
TABLE OF CONTENTS

SUMMARY

STUDY ROUTE IM-33

General		
Changwat	:	Nakhon Ratchasima
Origin and Destination	:	A. Si Khiu—A. Chok Chai
Connected Road Network	:	2—24
Amphoe on Route	:	-
Number of Related Villages	:	6
Influence Area		
Area	:	372 km^2
Cultivated Area Ratio to Total Land Area in %	:	46
Population in 1983	:	26,200
Main Crops	:	Cassava & Paddy
Number of Public Activities		
Public Health Service Centers	:	-
Hospitals Changwat Level	:	-
Amphoe Level	:	3
Schools Primary	:	6
Secondary	:	3
Traffic (ADT)	:	1984— 64 1988—1,434 1994—1,924 2002—2,785
Nomenclature of Study Route		
Total Length	:	51.4 km
Improvement Section	:	-
DOH Road	:	-
ARD Road	:	-
Other Road	:	-
New Construction Section	:	51.4 km
Design Standard Employed	:	P2
Construction Cost in Baht		
Financial	:	176,345,000
Economic	:	150,063,000
Economic Indicators		
IRR	:	19.7% Ranking: 2
Social Impact		
Social B/C Ratio	:	0.172 Ranking: 9
Recommendations		
Opening Year	:	1988 Overall Ranking: 3

LOCATION OF STUDY ROUTE



33.1 TRAFFIC

33.1.1 Method Employed in Traffic Forecasting

The assignment method was employed in forecasting because the study route was to be newly constructed.

33.1.2 Traffic Zones and Road Links

These are shown in Figure 33.1 and Tables 33.1.1 and 33.1.2.

FIGURE 33.1 TRAFFIC ZONES AND LINKS

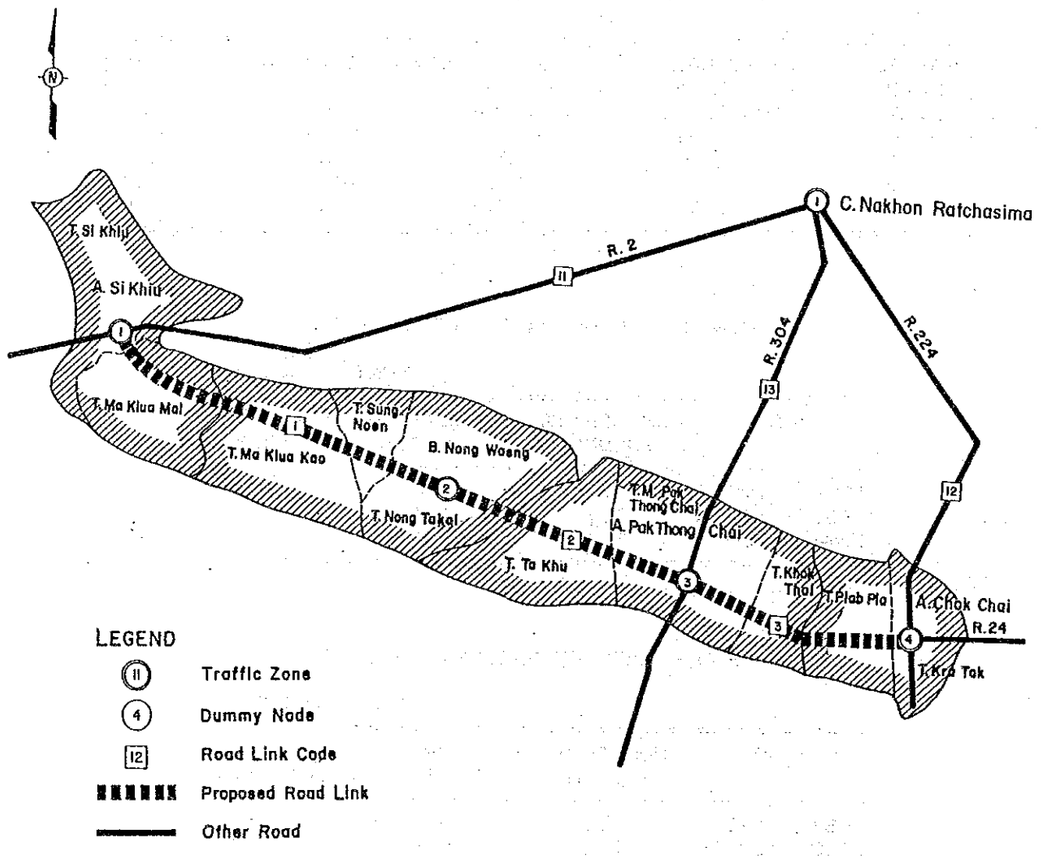


TABLE 33.1.1 TRAFFIC LINKS

Link Code	Node Pair			Length		Grade		Remarks
	Start Node		End Node	$\bar{W}$.	W	$\bar{W}$	W	
1	1	A. Si Khiu	B. Nong Waeng	18.0	20.5	10	1	Rural
2	2	B. Nong Waeng	A. Pak Thong Chai	17.2	16.7	9	1	Rural
3	3	A. Pak Thong Chai	A. Chok Chai	26.9	14.2	6	1	ARD
11	1	A. Si Khiu	C. Nakhon Ratchasima	38.0	38.0	2	2	R 2
12	4	A. Chok Chai	C. Nakhon Ratchasima	35.0	35.0	2	2	R 224
13	3	A. Pak Thong Chai	C. Nakhon Ratchasima	23.0	23.0	3	3	R 304

TABLE 33.1.2 TRAFFIC ZONES

ZONE	Administrative Division						Population (1000 persons)			
	Changwat		Amphoe		Tambon		Tambon	%	Zone	Attraction
1	13	Nakhon Ratchasima	15	Sung Noen	07	Ma klua Mai	4,670	40	1.9	
			16	Si Khiu	01	Si Khiu	33,499	100	33.5	
						Total			35.4	99.3
2	13	Nakhon Ratchasima	15	Sung Noen	01	Sung Noen	8,404	10	0.8	
					08	Ma Klua Kao	7,675	30	2.3	
					10	Nong Takai	4,160	70	2.9	
						Total			6.0	
3	13	Nakhon Ratchasima	18	Pak Thong Chai	01	M. Pak Thong Chai	18,475	30	5.5	
					02	Ta Khu	10,080	50	5.0	
					03	Khok Thai	3,961	50	2.0	
						Total			12.5	116.9
4	13	Nakhon Ratchasima	19	Chok Chai	01	Kratok	12,789	50	6.4	
					02	Plab Pla	7,409	60	4.4	
						Total			10.8	56.6
5	13	Nakhon Ratchasima	01	M. Nakhon Ratchsima	01	Muang	-	-	-	359.7

33.1.3 Traffic Forecast

1) Items necessary for forecasting traffic were:
   - Passenger O/D Table (1984)
   - Traffic volume in base year
   - Passenger movements in base year
   - Passenger and freight movement
   - Growth rates of passenger and freight movement
   - Rate of induced and developed movement
   - Traffic composition

Passenger O/D Table (1984)

Zone	1	2	3	4	11
1	0	531	1829	345	0
2	0	0	568	253	388
3	0	0	0	1023	0
4	0	0	0	0	0
11	0	0	0	0	0

Grand Total = 4936

TRAFFIC VOLUME IN BASE YEAR

LINK	TYPE OF VEHICLE								ADT	M/C	TOTAL
	P/C	L/B	M/B	H/B	P/P&T	4/T	6/T	10/T			
1	1	1	4	0	6	1	2	1	16	0	16
2	3	7	20	1	31	6	14	5	86	146	233
3	3	6	20	1	30	6	13	4	82	139	221
AVE.	2	5	15	1	23	4	10	3	64	101	165

PASSENGER AND FREIGHT MOVEMENT IN BASE YEAR

PROPOSED ROAD LINK	PASSENGER MOVEMENT (TRIPS PER DAY)	FREIGHT MOVEMENT (TONNAGE PER DAY)		
		NON-AGRI.	AGRI.	TOTAL
1	140	3.9	6.7	10.6
2	658	26.3	45.9	72.3
3	627	24.8	43.2	68.0

GROWTH RATE OF PASSENGER MOVEMENT

(UNIT : % P.A.)

YEAR	PER CAPITA INCOME	POPULATION	PASSENGER MOVEMENT
1984 - 1988	3.1	1.6	6.1
1988 - 1994	3.1	1.4	5.8
1994 - 2002	3.1	1.2	5.7

GROWTH RATE OF FREIGHT MOVEMENT

(UNIT : % P.A.)

YEAR	NON-AGRI. FREIGHT	AGRI. FREIGHT	FREIGHT MOVEMENT
1984 - 1988	7.5	0.6	3.3
1988 - 1994	7.2	0.6	3.7
1994 - 2002	7.0	0.6	4.3

RATE OF INDUCED AND DEVELOPED MOVEMENT

(UNIT : %)

YEAR	INDUCED LINK 1	INDUCED LINK 2	INDUCED LINK 3	DEVELOPED PASSENGER MOVEMENT	DEVELOPED NON-AGRI. FREIGHT MOVEMENT	DEVELOPED AGRI. FREIGHT MOVEMENT
1988	118.3	92.5	91.6	1.7	1.7	0.7
1994	118.3	92.5	91.6	11.7	11.7	5.7
2002	118.3	92.5	91.6	4.2	4.2	8.1

TRAFFIC COMPOSITION

(UNIT : %)

LINK NO.	YEAR	PASSENGER P/C	P/P	L/B	M/B	H/B	FREIGHT P/T	4/T	6/T	10/T
	1984	6.4	54.4	9.3	28.6	1.3	22.9	19.4	42.8	14.9
1	1988	13.6	50.8	7.9	25.2	2.6	20.7	17.5	44.4	17.4
	1994	24.5	45.3	5.8	19.9	4.5	17.4	14.7	46.8	21.1
	2002	39.0	38.0	3.0	13.0	7.0	13.0	11.0	50.0	26.0
	1984	6.4	54.4	9.3	28.6	1.3	22.9	19.4	42.8	14.9
2	1988	13.6	50.8	7.9	25.2	2.6	20.7	17.5	44.4	17.4
	1994	24.5	45.3	5.8	19.9	4.5	17.4	14.7	46.8	21.1
	2002	39.0	38.0	3.0	13.0	7.0	13.0	11.0	50.0	26.0
	1984	6.4	54.4	9.3	28.6	1.3	22.9	19.4	42.8	14.9
3	1988	13.6	50.8	7.9	25.2	2.6	20.7	17.5	44.4	17.4
	1994	24.5	45.3	5.8	19.9	4.5	17.4	14.7	46.8	21.1
	2002	39.0	38.0	3.0	13.0	7.0	13.0	11.0	50.0	26.0

2) The following were output:
- Forecasted ADT
- Traffic volumes

AVERAGE FUTURE TRAFFIC ON PROPOSED ROUTE

YEAR	TYPE OF VEHICLE P/C	L/B	M/B	H/B	P/P&T	4/T	6/T	10/T	ADT	M/C	TOTAL
1988	299	27	95	111	486	34	169	233	1453	404	1856
1994	453	33	122	153	633	35	213	299	1940	460	2401
2002	766	26	126	233	824	32	281	409	2696	515	3211

TRAFFIC VOLUME ON ROUTE IM- 33 LINK COUNT= 3

	YEAR	1988				1994				2002			
	LINK	1	2	3	AVR.	1	2	3	AVR.	1	2	3	AVR.
P/C	N+D	280	289	249	274	381	406	333	376	590	654	501	586
	I	26	29	14	24	69	77	37	63	183	203	97	166
	DV	1	1	0	1	15	19	9	15	14	18	9	14
	TOTAL	307	319	263	299	466	501	378	453	787	875	606	766
L/B	N+D	13	18	9	13	14	20	9	14	12	17	8	12
	I	15	17	8	14	16	18	9	15	14	16	7	13
	DV	0	1	0	0	4	4	2	3	1	1	1	1
	TOTAL	28	35	17	27	34	42	20	33	27	34	16	26
M/B	N+D	48	65	35	50	57	77	42	59	64	85	47	66
	I	48	53	25	44	56	62	30	51	61	68	32	55
	DV	1	2	1	1	12	15	7	12	5	6	3	5
	TOTAL	97	120	61	95	125	154	79	122	129	159	82	126
H/B	N+D	106	108	105	106	139	143	135	139	200	211	191	201
	I	5	5	3	4	13	14	7	11	33	36	17	30
	DV	0	0	0	0	3	3	2	3	3	3	2	2
	TOTAL	111	114	108	111	154	161	144	153	235	251	210	233
P/P&T	N+D	379	423	313	375	474	529	391	469	638	709	526	630
	I	119	132	61	107	148	165	77	134	197	219	103	178
	DV	3	4	2	3	31	39	18	30	16	20	9	15
	TOTAL	501	560	376	486	653	732	486	633	851	948	638	824
4/T	N+D	17	25	9	17	17	24	9	17	17	24	8	17
	I	18	21	8	16	17	19	8	15	16	18	7	14
	DV	0	0	0	0	3	4	1	3	2	2	1	2
	TOTAL	35	46	17	34	37	47	18	35	34	44	16	32
6/T	N+D	126	146	105	127	156	180	130	156	209	240	175	210
	I	46	52	21	41	54	61	24	48	71	81	32	64
	DV	1	1	0	1	9	11	5	8	7	10	4	7
	TOTAL	173	199	126	169	218	252	159	213	288	331	211	281
10/T	N+D	240	247	148	217	302	312	186	273	410	426	253	372
	I	18	20	8	16	24	28	11	22	37	42	17	33
	DV	0	0	0	0	4	5	2	4	4	5	2	4
	TOTAL	258	268	156	233	330	345	199	299	451	474	272	409
ADT	N+D	1208	1321	973	1180	1539	1690	1235	1504	2139	2367	1709	2094
	I	294	329	148	265	398	444	202	359	612	683	313	552
	DV	8	10	5	8	80	101	46	77	51	65	30	50
	TOTAL	1511	1661	1125	1453	2017	2235	1483	1940	2802	3115	2052	2696
M/C	N+D	298	353	238	299	342	396	283	343	405	458	346	406
	I	114	95	94	102	114	95	94	102	114	95	94	102
	DV	2	2	2	2	15	15	15	15	6	6	6	6
	TOTAL	414	449	334	404	471	506	392	460	525	559	447	515
TOTAL	N+D	1506	1674	1211	1479	1881	2086	1518	1847	2543	2826	2056	2500
	I	409	424	242	367	512	539	295	461	726	777	407	655
	DV	10	12	7	10	95	116	62	92	58	72	36	56
	TOTAL	1925	2110	1459	1856	2488	2741	1875	2401	3327	3675	2498	3211

NOTE
N : NORMAL TRAFFIC D : DIVERTED TRAFFIC
DV : DEVELOPED TRAFFIC I : INDUCED TRAFFIC