33.2 AGRICULTURAL DEVELOPMENT

33.2.1 Present Condition

The influence area is divided into two parts between Amphoes Si Khiu and Chok Chai. Paddy and upland fields are mixed in the influence area, and 65% of the cultivated land is covered by upland fields. Cassava ranks first in the upland fields followed by maize, ground nuts, beans and cotton.

Large areas of unused cultivable land for upland fields still remain in the area.

Land use and capability conditions in the area are shown in Table 33.2.1 and Figure 33.2.1. A typical cropping calendar in the area is shown in Figure 33.2.2.

33.2.2 Development Projection

Future agricultural development in the area of influence was projected for the two cases of "with and without project". The projected planted area, unit yields by crop, and the consequent production amount are shown in Table 33.2.2.

Based on the above projected production amount, farmgate prices and production costs estimated separately, net production value (NPV) was obtained as shown in Table 33.2.3. The difference in NPV between the two cases is deemed to be the development benefit of the study route.

FIGURE 33.2.1 LAND USE AND CAPABILITY OF INFLUENCE AREA

FIGURE 33.2.1 LAND USE AND CAPABILITY OF INFLUENCE AREA

STUDY ROUTE NO. IM-33

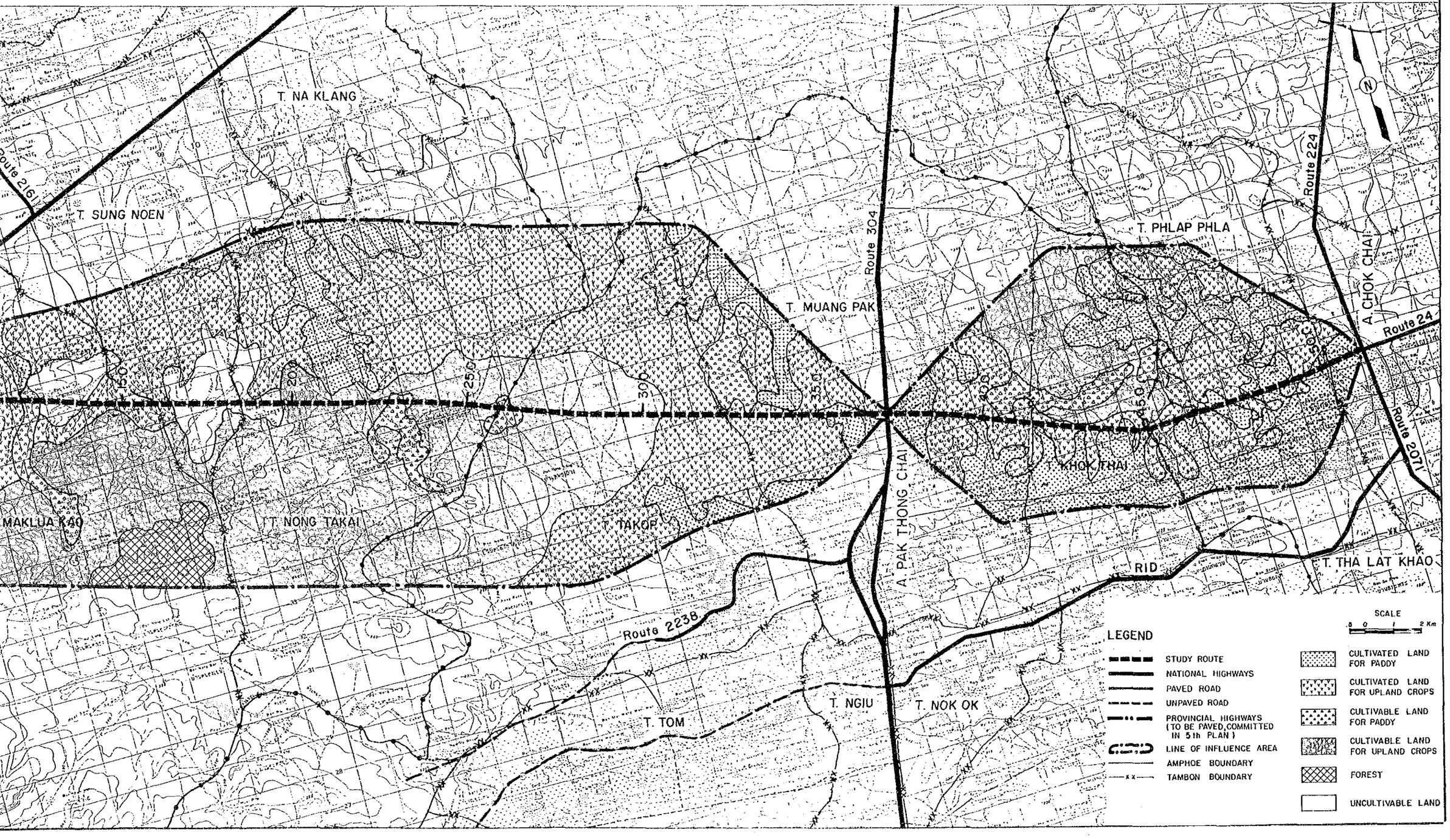
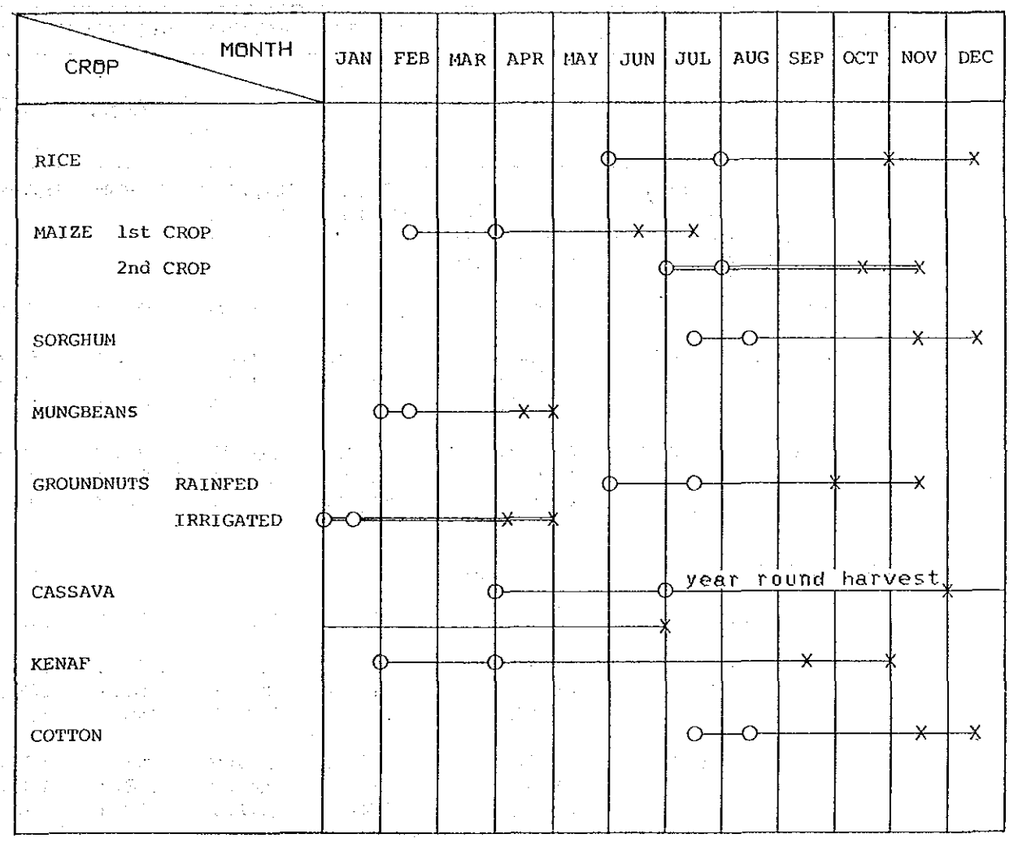


FIGURE 33.2.2 CROPPING CALENDAR

ROUTE IM- 33

Related Amphoes: 1315 Sung Noen
1318 Pak Thong Chai
1319 Chok Chai



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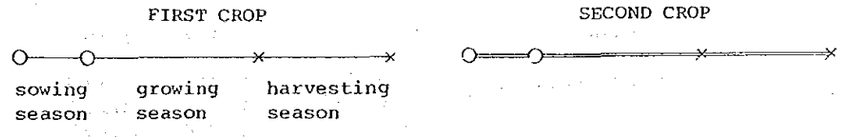


TABLE 33.2.1 CULTIVATED & UNUSED CULTIVABLE LAND

[UNIT : 1000 RAI (KM2)]

CHANGWAT NAME	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE AREA		
		PADDY FIELD	UPLAND FIELD	TOTAL	PADDY FIELD	UPLAND FIELD	TOTAL
NAKHON RATCHASIMA	SUNG NOEN	24.46 (39.14)	39.60 (63.36)	64.06 (102.50)	8.70 (13.92)	58.42 (93.47)	67.12 (107.39)
	PAK THONG CHAI	8.54 (13.66)	25.48 (40.77)	34.02 (54.43)	4.22 (6.75)	19.25 (30.80)	23.47 (37.55)
	CHOK CHAI	4.87 (7.79)	4.39 (7.02)	9.26 (14.82)	0.25 (0.40)	0.63 (1.01)	0.88 (1.41)
TOTAL		37.87 (60.59)	69.47 (111.15)	107.34 (171.74)	13.17 (21.07)	78.30 (125.28)	91.47 (146.35)

TABLE 33.2.2 CROP PRODUCTION

ITEM		RICE (PADDY)	MAIZE	SORGHUM	BEANS	GROUND NUTS	CASSAVA	KENAF	SUGAR CANE	COTTON	CASTOR BEANS	UPLAND TOTAL	TOTAL
PLANTED AREA	(1000 RAI)												
BASE YEAR	(1983)	27.19	9.28	0.22	0.67	1.06	26.18	0.13	-	0.51	0.76	38.82	66.02
WITHOUT PROJECT	(1988)	27.98	9.65	0.27	0.71	1.11	26.97	0.14	-	0.53	0.79	40.15	68.13
	(1994)	28.95	10.11	0.33	0.75	1.16	27.95	0.14	-	0.55	0.83	41.82	70.77
	(2002)	30.30	10.76	0.44	0.81	1.23	29.31	0.15	-	0.59	0.89	44.17	74.47
WITH PROJECT	(1988)	28.20	10.33	0.28	0.75	1.18	26.99	0.14	-	0.56	0.81	41.07	69.27
	(1994)	30.58	16.36	0.47	1.17	1.87	28.11	0.23	-	0.89	0.98	50.09	80.67
	(2002)	34.08	17.41	0.63	1.26	1.99	29.48	0.24	-	0.95	1.04	53.02	87.10
CROP YIELD	(KG/RAI)												
BASE YEAR	(1983)	275.7	322.9	258.1	123.4	227.1	2118.6	280.5	-	218.1	133.0		
WITHOUT PROJECT	(1988)	275.7	322.9	258.1	126.5	227.1	2118.6	280.5	-	218.1	133.0		
	(1994)	275.7	322.9	258.1	130.4	227.1	2118.6	280.5	-	218.1	133.0		
	(2002)	275.7	322.9	258.1	135.7	227.1	2118.6	280.5	-	218.1	133.0		
WITH PROJECT	(1988)	277.3	323.9	258.1	127.1	227.1	2120.7	280.5	-	218.5	133.0		
	(1994)	286.8	329.7	258.1	135.0	227.1	2133.5	280.5	-	221.2	133.0		
	(2002)	300.0	337.7	258.1	146.2	227.1	2150.6	280.5	-	224.7	133.0		
CROP PRODUCTION AMOUNT	(TON)												
BASE YEAR	(1983)	7,497	2,997	57	83	241	55,471	36	-	111	102	59,098	66,595
WITHOUT PROJECT	(1988)	7,713	3,115	69	90	251	57,142	38	-	115	106	60,924	68,638
	(1994)	7,982	3,264	85	98	263	59,212	40	-	120	111	63,193	71,175
	(2002)	8,354	3,473	114	110	280	62,091	42	-	128	118	66,356	74,710
WITH PROJECT	(1988)	7,818	3,347	72	96	269	57,247	41	-	123	108	61,303	69,121
	(1994)	8,771	5,394	122	158	426	59,979	64	-	198	130	66,470	75,241
	(2002)	10,224	5,880	163	185	453	63,405	68	-	214	138	70,505	80,729

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE

TABLE 33.2.3 NET PRODUCTION VALUE

ITEM			RICE (PADDY)	MAIZE	SORGHUM	BEANS	GROUND NUTS	CASSAVA	KENAF	SUGAR CANE	COTTON	CASTOR BEANS	UPLAND TOTAL	TOTAL
FARMGATE PRICE	(BAHT/TON)													
WITHOUT PROJECT	(1983 - 2002)		3,679	2,596	2,287	5,212	8,003	814	4,872	-	10,970	5,408		
WITH PROJECT	(1988 - 2002)		3,732	2,648	2,339	5,264	8,056	849	4,977	-	11,180	5,460		
CROP PRODUCTION COST	(BAHT/RAI)													
BASE YEAR		(1983)	712	582	319	515	1,005	869	690	-	1,781	463		
WITHOUT PROJECT		(1988)	712	582	319	515	1,005	869	690	-	1,781	463		
		(1994)	712	582	319	520	1,005	869	690	-	1,781	463		
		(2002)	712	582	319	525	1,005	869	690	-	1,781	463		
WITH PROJECT		(1988)	715	583	319	515	1,005	869	690	-	1,781	463		
		(1994)	733	588	319	525	1,005	872	690	-	1,781	463		
		(2002)	758	595	319	525	1,005	875	690	-	1,781	463		
NET PRODUCTION VALUE	(1000 BAHT)													
WITHOUT PROJECT		(1988)	8,458	2,471	72	103	898	23,058	92	-	322	203	27,219	35,677
		(1994)	8,751	2,589	89	120	940	23,893	96	-	337	214	28,278	37,029
		(2002)	9,159	2,755	120	148	1,001	25,055	102	-	359	227	29,767	38,926
WITH PROJECT		(1988)	9,016	2,838	80	117	976	25,144	102	-	373	214	29,844	38,860
		(1994)	10,315	4,664	134	217	1,545	26,407	162	-	618	257	34,004	44,319
		(2002)	12,323	5,211	180	309	1,644	28,033	172	-	696	274	36,519	48,842
NET VALUE ADDED	(1000 BAHT)													
1988			558	367	8	14	78	2,086	10	-	51	11	2,625	3,183
1994			1,564	2,075	45	97	605	2,514	66	-	281	43	5,726	7,290
2002			3,164	2,456	60	161	643	2,978	70	-	337	47	6,752	9,916

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE

LAND PREPARATION COST IN NEWLY OPENED LAND

(UNIT : 1000 BAHT)

YEAR	PADDY FIELD	UPLAND FIELD	TOTAL
1988	198	828	1,026
1994	188	982	1,170
2002	215	197	412

NOTE : LAND PRPARATION COST = 900 BAHT/RAI

NET VALUE ADDED AFTER REDUCTION OF LAND PREPARATION COST

(UNIT : 1000 BAHT)

YEAR	RICE (PADDY)	UPLAND CROPS	TOTAL
1988	360	1,797	2,157
1994	1,377	4,744	6,120
2002	2,949	6,555	9,504

33.3 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 33.3.1. Data for additional VOCs are shown in Table 33.3.2.

VOC savings, obtained as the balance of total link VOCs between the two cases, were calculated as shown in Table 33.3.3.

TABLE 33.3.1 ROAD LENGTH BY ROAD CLASS

(UNIT : KM)

LINK NO.	WITHOUT PROJECT CASE						WITH PROJECT CASE
	PAVED	LATERITE			EARTH	TOTAL	PAVED
		GOOD	FAIR	POOR			
1	-	-	-	-	26.9	26.9	20.5
2	-	-	-	-	17.2	17.2	16.7
3	-	-	-	-	29.3	29.3	14.2
11	38.0	-	-	-	-	38.0	38.0
12	35.0	-	-	-	-	35.0	35.0
13	23.0	-	-	-	-	23.0	23.0

TABLE 33.3.2 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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WITH	-	-	-	-	-	-	591	-	-	5700	4900	2650	1100	-	-	-	-	-	-	-
2	WITHOUT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WITH	-	-	-	-	-	-	-	-	241	1450	-	350	-	-	-	-	-	-	-	-
3	WITHOUT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WITH	-	-	-	-	-	-	284	-	240	3850	1500	-	200	-	-	-	1	-	-	-

TABLE 33.3.3 VEHICLE OPERATING COST SAVING

(UNIT : 1000 BAHT)

LINK NO.	1988			1994			2002		
	WITHOUT	WITH	SAVING	WITHOUT	WITH	SAVING	WITHOUT	WITH	SAVING
1	4,868	8,248	-3,380	6,822	10,795	-3,973	11,042	15,952	-4,911
2	9,100	8,783	317	12,477	11,483	994	19,267	16,977	2,290
3	16,413	3,683	12,730	22,513	4,828	17,686	34,796	7,109	27,687
11	11,965	0	11,965	16,138	0	16,138	24,574	0	24,574
12	1,614	0	1,614	2,566	0	2,566	4,267	0	4,267
13	7,687	1,456	6,231	10,373	2,089	8,284	15,810	3,246	12,565
TOTAL	51,646	22,169	29,476	70,888	29,194	41,694	109,757	43,284	66,473

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

33.4 ENGINEERING

33.4.1 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 33.4.1 and Table 33.4.1, respectively.

Rock aggregate sources were assumed as shown below:

No.	Source	Description of Sample	Est. Quantity m^3
33/CS-1	KM. 153+000 Rt close to Saraburi-Nakhon Ratchasima (Lan A Sok Quarry)	Limestone	Plentiful
33/CS-2	KM. 157+000 Rt close to Saraburi-Nakhon Ratchasima (Porn Piroon Quarry)	Limestone	Plentiful
33/CS-3	KM. 160+000 Rt close to Saraburi-Nakhon Ratchasima (Sakhon Pattana Quarry)	Limestone	Plentiful
33/CS-4	KM. 12+000 Rt 1 KM. Route No. 2- Kout Yai (Kea Rin Quarry)	Limestone	Plentiful
33/CS-5	KM. 15+000 Rt 1 KM. Route No. 2-Kout Yai (Prakay Pet Quarry)	Limestone	Plentiful

Figure 33.4.1 SOIL AND MATERIAL SOURCES

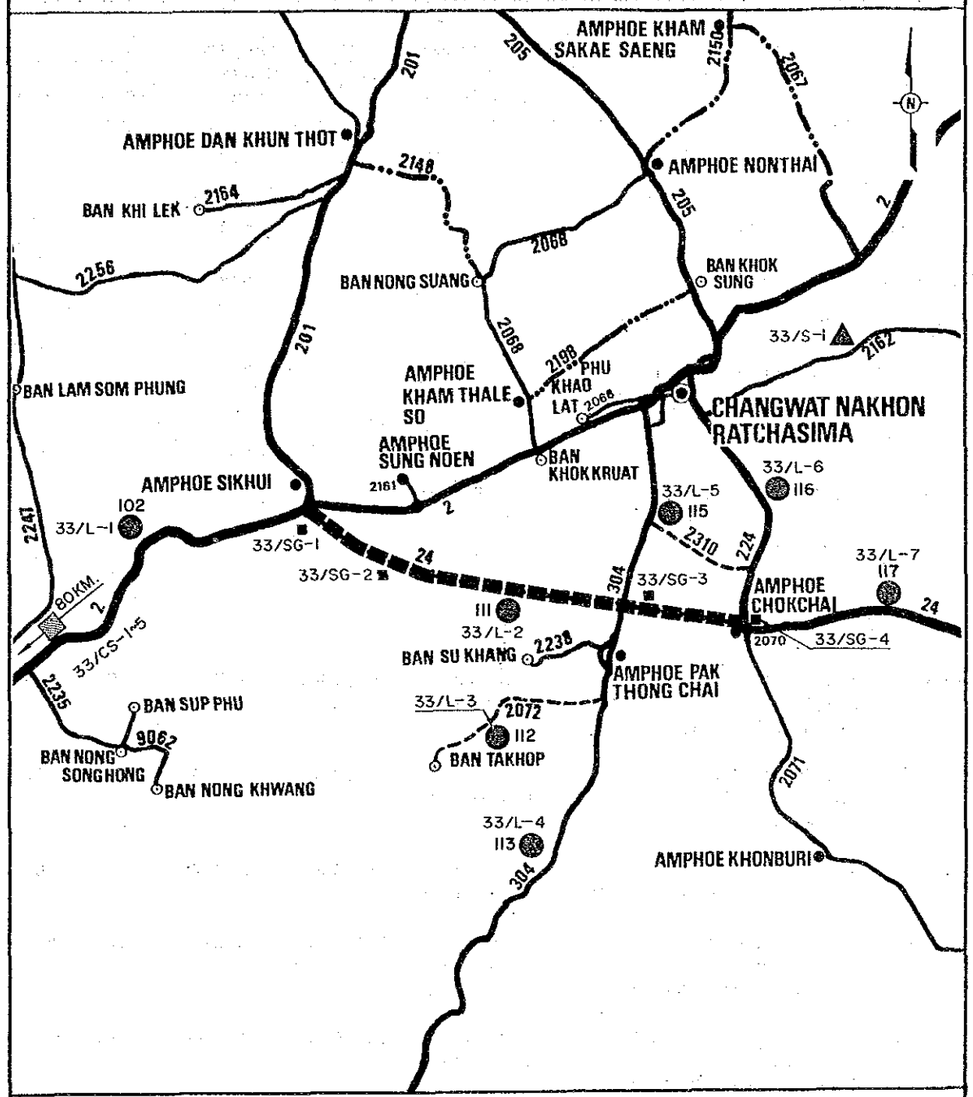


TABLE 33.4.1 PHYSICAL CHARACTERISTICS OF MATERIALS

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																				
33/SG-1	KM. 0+075			A-4					100	99.4	96.4	48.0	N-P		12.6	1.848	18.0	0.2		
33/SG-2	KM. 7+000			A-4						100	99.4	55.8	19.5	6.2	15.2	1.775	5.3	0.2		
33/SG-3	KM. 37+200			A-6					100	97.2	93.8	90.6	37.2	12.1	16.2	1.753	3.2	1.7		
33/SG-4	KM. 51+300 Lt 18 M.			A-4						100	94.2	73.2	20.0	4.3	11.3	1.892	6.0	0.2		
SAND																				
33/S - 1	KM. 18+300 Lt 5 KM. Route No. 224 - Chak Ka Rat	Mun River sand							100	84	41	3	N-P							
LATERITE																				
33/L-1	KM. 195+000 Lt 5 KM. Saraburi - Nakhon Ratchasima	Brown laterite	90,000	A-2-4	100	95.4	-	62.1	-	38.6	14.1	6.5	30.6	7.9	6.9	2.172	25.0	0.40		
33/L-2	KM. 9+400 Rt 7 KM. Pak Thong Chai - Su Khang	Brown laterite	80,000	A-2-4		100	-	76.5	-	49.2	23.7	10.2	28.4	6.3	8.0	2.046	21.0	0.84		
33/L-3	KM. 16+850 Lt 7 KM. Route No. 304 - B.Ta Kob	Brown laterite	50,000	A-2-4		100	-	68.7	-	36.8	28.4	18.6	27.8	9.4	6.7	2.148	40.0	0.46		
33/L-4	KM. 82+200 Lt 1.5 KM. Kabinburi - Nakhon Ratchasima	Brown laterite	100,000	A-2-4	100	96.0	-	49.4	-	25.5	23.5	16.4	29.6	9.0	6.8	2.214	29.4	0.26		
33/L-5	KM. 120+000 Rt 7 KM. Kabinburi - Nakhon Ratchasima	Brown laterite	100,000	A-2-4	100	98.6	-	83.9	-	45.0	35.0	15.3	25.1	5.6	6.5	2.187	17.0	0.62		
33/L-6	KM. 11+000 Lt 500 KM. Nakhon Ratchasima - Chok Chai	Brown laterite	100,000	A-2-4	100	97.5	-	88.6	-	56.6	41.8	24.8	28.4	6.2	8.6	2.174	6.8	1.14		
33/L-7	KM. 11+500 Lt 2 KM. Chok Chai - Det Udom	Brown laterite	100,000	A-2-4		100	-	83.3	-	39.2	28.7	22.1	35.1	8.4	6.1	2.167	15.3	0.64		

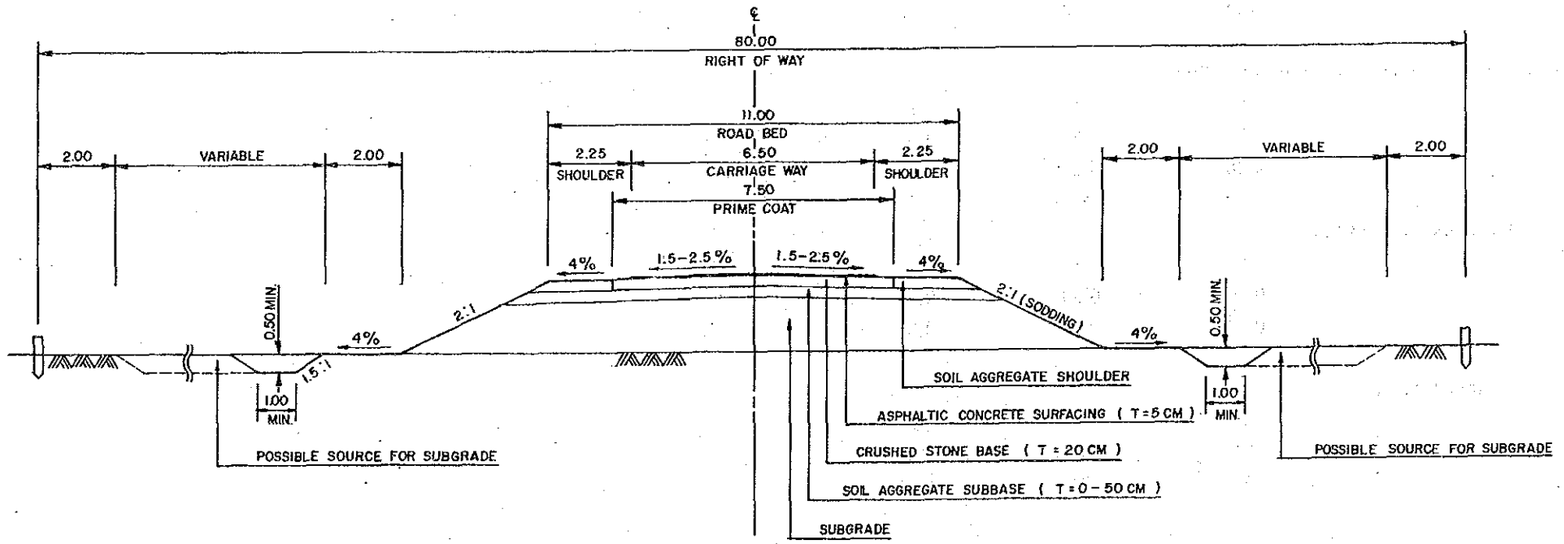
33.4.2 Preliminary Design

33.4.2.1 Design Criteria

Design Standard	:	P2
Geometric Design Criteria	:	DOH (Primary Highway)
Typical Cross Section	:	as shown in Figure 33.4.2
Minimum Height of Embankment in Flooding Section	:	0.7 m above flood level
Pavement Structure		
Asphaltic Concrete	:	5 cm
Crushed Aggregate Base CBR ≥ 80%	:	15.0 cm
Soil Aggregate Subbase CBR ≥ 25%	:	as required
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 11.0 m
Substructure	:	Pile-bent type

The existing and designed plan and profile are shown in Drawings 33-1/33-6.

FIGURE 33.4.2 TYPICAL CROSS SECTION



PRIMARY HIGHWAY (CLASS P2)

33.4.2.2 Special Conditions in Designing

Employment of P2 Standard

The study route will be incorporated into National Highway Route 24 after completion. Since the projected average ADT of the study route 15 years after opening is 2,785, the P2 standard was employed in the design.

33.4.2.3 Pavement Design

1) Traffic data

- Average daily number of heavy vehicles on design lane in 1988 (NHT) by road link.

1	2	3
271	291	195

- Average gross weight of heavy vehicles by road link in kg

1	2	3
11,500	11,500	11,200

- Single axle load limit: 8,200 kg

- Initial traffic number by road link

1	2	3
100	100	70

- Annual growth rate of heavy vehicles by road link

	1	2	3
7 years	3.76	3.87	3.67
14 years	4.28	4.32	4.19

- ITN adjustment factors by road link

	1	2	3
7 years	0.39	0.39	0.39
14 years	0.93	0.93	0.93

- Design traffic number (DTN)

	1	2	3
7 years	39	39	27.3
14 years	93	93	65.1

2) Subgrade CRB values by road link

1	2	3
0.8	2.4	12.7

3) Pavement thickness

- Total pavement thickness by road link

	1	2	3
7 years	20 cm	29 cm	14 cm
14 years	22 cm	30.5 cm	16 cm

- Designed pavement thickness by road link

	1	2	3
Asphaltic concrete	5 cm	5 cm	5 cm
Aggregate base	20 cm	20 cm	20 cm
Subbase	17 cm	47 cm	-
Overlay in 7 years	4.5 cm	4.0 cm	3.5 cm

33.4.2.4 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
0 + 234	-	-	Box Culvert	1-2.4 x 2.4 x 18.0
+ 600	-	-	" "	1-2.4 x 2.4 x 24.0
+ 919	-	-	RC Bridge	11.0 x 20.0
1 + 196	-	-	Box Culvert	2-2.4 x 2.4 x 26.0
2 + 575	-	-	" "	1-2.4 x 2.4 x 22.0
3 + 175	-	-	" "	2-2.4 x 2.4 x 20.0
5 + 200	-	-	" "	1-2.4 x 2.4 x 20.0
6 + 815	-	-	" "	2-2.4 x 2.4 x 22.0
7 + 737	-	-	" "	3-2.4 x 2.4 x 20.0
10 + 000	-	-	" "	2-2.4 x 2.4 x 22.0
11 + 990	-	-	" "	1-2.4 x 2.4 x 24.0
12 + 175	-	-	" "	1-2.4 x 2.4 x 22.0
13 + 807	-	-	" "	2-2.4 x 2.4 x 28.0
15 + 000	-	-	RC Bridge	11.0 x 16.0
18 + 690	-	-	Box Culvert	2-2.4 x 2.4 x 24.0
20 + 335	-	-	" "	1-2.4 x 2.4 x 20.0
29 + 850	-	-	" "	1-2.4 x 2.4 x 20.0
30 + 325	-	-	" "	1-2.4 x 2.4 x 26.0
30 + 595	-	-	" "	2-2.4 x 2.4 x 22.0
35 + 162	-	-	" "	1-2.4 x 2.4 x 20.0
37 + 844	-	-	" "	1-2.4 x 2.4 x 22.0
38 + 230	-	-	RC Bridge	11.0 x 16.0

33.4.3 Quantities and Construction and Road Maintenance Costs

The required construction costs were estimated based on the results of preliminary design as shown in Table 33.4.2. Financial costs with breakdown into local and foreign currency portions, economic costs and residual values were estimated as follows and in 33.4.4:

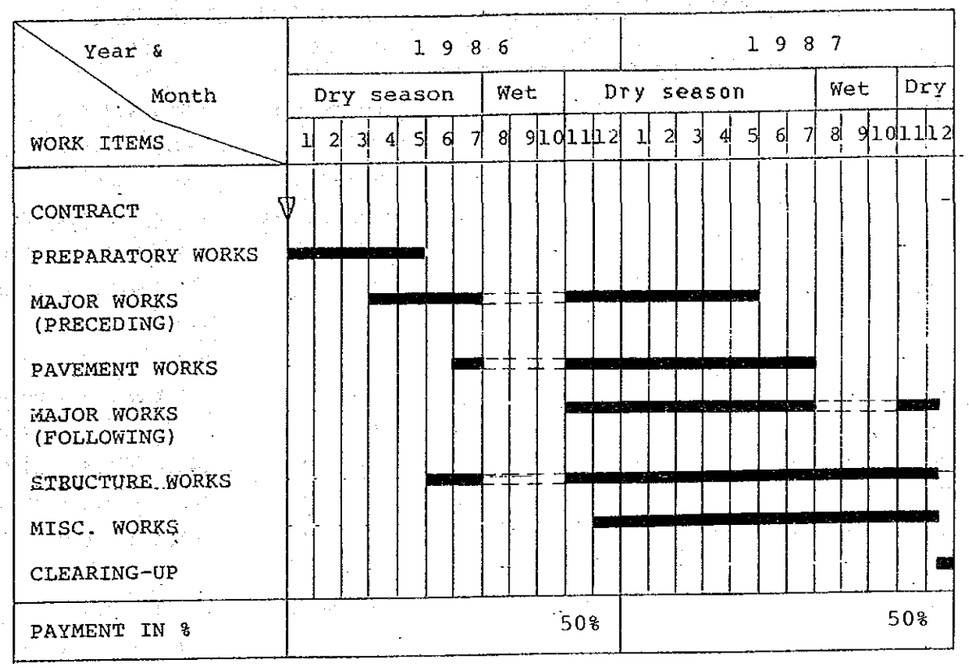
			(baht)
IM—33	L = 51.4 km		
	Financial cost	:	176,345,000
	Economic cost	:	150,063,000
	Residual value	:	178,842,000

The required road maintenance costs are shown in Table 33.4.3.

33.4.4 Construction and Disbursement Schedules

IM—33 **Length = 51.4 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 - 33)

(Unit : Million Baht)

	1986			1987			Total		
	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total
Construction Cost	47.3	40.8	88.1	47.3	40.9	88.2	94.6	81.7	176.3
Price Continsency	9.9	5.5	15.4	15.7	8.5	24.2	25.6	14.0	39.6
Total	57.2	46.3	103.5	63.0	49.4	112.4	120.2	95.7	215.9
	(2.12)	(1.71)	(3.83)	(2.33)	(1.83)	(4.16)	(4.45)	(3.54)	(8.00)

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

TABLE 33.4.2 CONSTRUCTION QUANTITIES AND COSTS
(ROUTE IM--33 Length = 51.4 km)

A.C.

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	154	1,540						
Roadway Excavation, Unclassified	m3	19	0	0						
Embankment, Common Soil	m3	38	560,700	21,307						
Embankment, Selected Material	m3	70	0	0						
Replacement of Soft Spot	m3	88	0	0						
Sub Total				22,847	11,652	11,195		18,963		17,066
SUBBASE & BASE COURSES							83		50	
Subbase, Soil Aggregate	m3	112	137,200	15,366						
Aggregate Base*	m3	372	77,200	28,718						
Cement Stabilized Base	m3	390	0	0						
Shoulder, Soil Aggregate	m3	120	36,000	4,320						
Sub Total				48,405	26,139	22,266		40,176		20,088
SURFACE COURSES							85		50**	
Asphaltic Prime/Tack Coat	m2	12	385,600	4,627						
Double Bituminous Surface Treatment*	m2	39	0	0						
Asphaltic Concrete Surfacing**	t	750	39,300	29,475						
Sub Total				34,102	15,005	19,097		28,987		12,527
STRUCTURES							83		50	
RC Pipe Culvert (D 1.0m Equivalent)	m	2,000	2,302	4,604						
RC Box Culvert (2.4mx2.4m Equivalent)	m	18,800	626	11,769						
RC Bridge(W=9.0m L=10m Equivalent)	m	46,500	52	2,418						
Sub Total				18,791	9,395	9,395		15,596		7,798
Total (a)				124,144	62,191	61,954		103,722		57,479
INCIDENTALS							83		0	
Miscellaneous Work ((a)x7%)	ls			8,690	4,345	4,345		7,213		0
CONTRACT AMOUNT (b)				132,835	66,536	66,299		110,935		57,479
PHYSICAL CONTINGENCIES ((b)x10%) (c)	ls			13,283	6,654	6,630		11,093		5,748
ENGINEERING AND SUPERVISION							85		0	
(((b)+(c))x10%) (d)	ls			14,612	5,845	8,767		12,420		0
LAND ACQUISITION							100		100	
Highly Developed Land	ha	50,000	270	13,500						
Less Developed Land	ha	15,000	141	2,115						
Sub Total (e)	ls			15,615	15,615	0		15,615		15,615
PROJECT COST ((b)+(c)+(d)+(e))				176,345	94,649	81,696		150,063		78,842
AVERAGE COST PER KM				3,431						

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

TABLE 33.4.3 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)
	1988	52.0	26.9	0.00	0.00	0	0	392.5	20.5	0.00	1.21	13,578	278	-278
1	1994	75.6	26.9	0.00	0.00	0	0	531.1	20.5	0.00	1.21	13,578	278	-278
	2002	126.7	26.9	0.00	0.00	0	0	818.5	20.5	0.00	1.21	13,578	278	-278
	1988	154.6	17.2	0.00	0.00	0	0	523.0	16.7	0.00	1.21	13,578	227	-227
2	1994	222.9	17.2	0.00	0.00	0	0	705.1	16.7	0.00	1.21	13,578	227	-227
	2002	370.4	17.2	0.00	0.00	0	0	1082.8	16.7	0.02	1.21	13,588	227	-227
	1988	157.6	29.3	0.00	0.00	0	0	236.5	14.2	0.00	1.21	13,578	193	-193
3	1994	227.3	29.3	0.00	0.00	0	0	322.1	14.2	0.00	1.21	13,578	193	-193
	2002	377.7	29.3	0.00	0.00	0	0	499.4	14.2	0.00	1.21	13,578	193	-193
	1988	283.8	38.0	0.00	1.21	13,578	516	0.0	38.0	0.00	1.21	13,578	516	0
11	1994	406.9	38.0	0.00	1.21	13,578	516	0.0	38.0	0.00	1.21	13,578	516	0
	2002	672.7	38.0	0.00	1.21	13,578	516	0.0	38.0	0.00	1.21	13,578	516	0
	1988	43.0	35.0	0.00	1.21	13,578	475	0.0	35.0	0.00	1.21	13,578	475	0
12	1994	62.6	35.0	0.00	1.21	13,578	475	0.0	35.0	0.00	1.21	13,578	475	0
	2002	105.1	35.0	0.00	1.21	13,578	475	0.0	35.0	0.00	1.21	13,578	475	0
	1988	291.3	23.0	0.00	1.21	13,578	312	56.6	23.0	0.00	1.21	13,578	312	0
13	1994	417.7	23.0	0.00	1.21	13,578	312	78.3	23.0	0.00	1.21	13,578	312	0
	2002	690.4	23.0	0.00	1.21	13,578	312	123.3	23.0	0.00	1.21	13,578	312	0
	1988	163.3	169.4			7,695	1,304	145.4	147.4			13,578	2,001	-698
TOTAL	1994	234.9	169.4			7,695	1,304	197.0	147.4			13,578	2,001	-698
	2002	389.4	169.4			7,695	1,304	303.9	147.4			13,579	2,002	-698

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 = 0.00 + 0.00 * A1
WITH PROJECT CASE KB = 1.21 + 0.05 * X3

(4) FACTOR FOR ADT
WITHOUT PROJECT CASE A1 = 0.0
WITH PROJECT CASE X3 = -0.2034 + 0.000409 * (ADT / LANE) ; LANE = 2

33.5 EVALUATION

33.5.1 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 P2 standard with asphaltic concrete surfacing.

COSTS AND BENEFITS STATEMENT OF ROUTE IM - 33

(1000 BAHT)

YEAR	COST	BENEFITS				DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	TOTAL COST	TOTAL BENEFIT
1986	75,032	0	0	0	0	94,120	0
1987	75,031	0	0	0	0	84,035	0
1988	0	2,157	29,476	-698	30,935	0	27,621
1989	0	2,818	31,513	-698	33,632	0	26,811
1990	0	3,478	33,549	-698	36,329	0	25,858
1991	0	4,139	35,585	-698	39,026	0	24,801
1992	0	4,799	37,621	-698	41,722	0	23,674
1993	0	5,460	39,657	-698	44,419	0	22,504
1994	0	6,120	41,694	-698	47,116	0	21,313
1995	31,949	6,543	44,791	-698	50,636	14,452	20,451
1996	0	6,966	47,888	-698	54,157	0	19,529
1997	0	7,389	50,986	-698	57,677	0	18,570
1998	0	7,812	54,083	-698	61,198	0	17,593
1999	0	8,235	57,181	-698	64,718	0	16,612
2000	0	8,658	60,278	-698	68,238	0	15,639
2001	0	9,081	63,376	-698	71,759	0	14,683
2002	-78,842	9,504	66,473	-698	75,279	-14,404	13,753
TOTAL	103,170	93,159	694,151	-10,469	776,841	178,203	309,414
DISCOUNTED	178,203	35,007	279,160	-4,753	309,414		

NET PRESENT VALUE : 131,211

BENEFIT/COST RATIO : 1.74

INTERNAL RATE OF RETURN : 19.7 %

FIRST YEAR RATE OF RETURN : 15.5 %

OPTIMUM OPENING YEAR : 1988

SENSITIVITY TESTS

ITEM	CASE		
	BASE	1	2
NET PRESENT VALUE	131,211	104,480	84,799
BENEFIT/COST RATIO	1.74	1.51	1.48
INTERNAL RATE OF RETURN	19.7 %	17.5 %	17.2 %
FIRST YEAR RATE OF RETURN	15.5 %	13.5 %	13.2 %
COSTS	BASE	+15%	BASE
BENEFITS	BASE	BASE	-15%

33.5.2 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) : 150.1

1) General Accessibility Benefit (million baht) : 8.95
2) Education Benefit (million baht) : 3.02
3) Medical Care Benefit (million baht) : 0.205
4) Total Social Benefits (million baht) (1+2+3) : 12.18
5) Social Benefit/Cost Ratio ($\times 10^{-2}$) : 8.11
6) Ranking by Social Benefits : 12
7) Weighted Production Value Gain/Cost ($\times 10^{-2}$) : 9.11
8) Ranking by 7 : 9
9) Combined Ratio ($\times 10^{-2}$) : 17.22

Overall Ranking : 9

33.5.3 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 constructed with the opening year 1988.

STUDY ROUTE IM-33 | DWG NO. 33-1

From A. SIKHIU to A. CHOK CHAI

PLAN AND PROFILE

STA. 0+000 TO STA 9+000

STA.0+000 = STA 210+460.60 OF ROUTE NO.2
BEGINNING OF PROJECT

TO SARA BURI

ROUTE NO.2

TO NAKHON RATCHASIMA

CONCRETE

0+234

0+500

0+918

1+000

1+196

PADDY FIELD

CASSAVA

PADDY FIELD

CASSAVA

PADDY FIELD

OPEN FOREST & BAMBOO

CASSAVA

PADDY FIELD

TO BAN NANGTHIM

TOBACCO

CASSAVA

OPEN FOREST

CASSAVA

OPEN FOREST

CASSAVA

STA.9+000

MATCH LINE

PADDY FIELD

CASSAVA

PADDY FIELD

OPEN FOREST & BAMBOO

BAMBOO

CASSAVA

PADDY FIELD

CASSAVA

OPEN FOREST

CASSAVA

OPEN FOREST

CASSAVA

2+000

2+575

3+000

3+175

4+000

5+000

5+200

6+000

6+585

7+000

7+737

8+000

TERRAIN		ROLLING
PAVEMENT	Type	—
	Condition	—
FLOODING	Length (m.)	—
	Height (m.)	—
RIGHT OF WAY (m.)		—
ROUTE NO. AGENCIES		—

ELEVATION (m.)

250
240
230
220
210

PROPOSED PROFILE GRADE

GROUND PROFILE

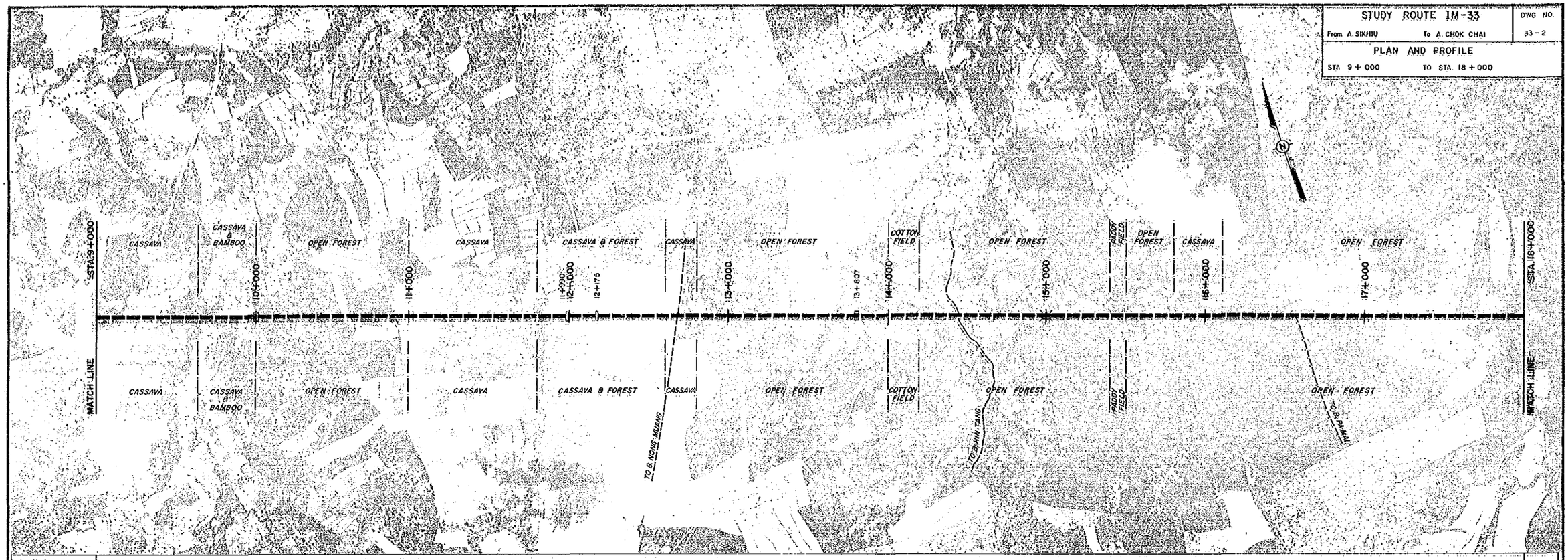
HWL=236.2
HWL=227.5
HWL=236.5
HWL=241.5
HWL=239.0

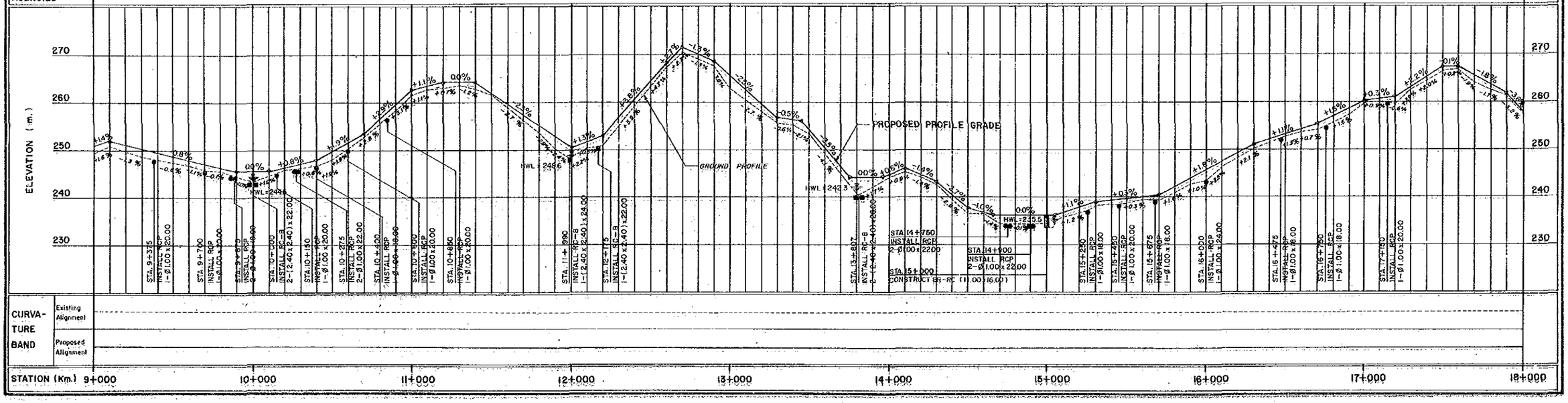
STA. 0+000 INSTALL RCP =Ø1.00x16.00
STA. 0+154 INSTALL RC-B 1-(2.40x2.40)x4.00
STA. 0+600 INSTALL RC-B 1-(2.40x2.40)x24.00
STA. 0+750 INSTALL RCP =Ø1.00x22.00
STA. 0+900 INSTALL RCP =Ø1.00x22.00
STA. 0+919 INSTALL BR-RC 11.00x2000
STA. 1+175 INSTALL RCP 1-Ø1.00x26.00
STA. 1+196 INSTALL RC-B 2-(2.40x2.40)x26.00
STA. 1+600 INSTALL RCP 1-Ø1.00x22.00
STA. 2+575 INSTALL RC-B 1-(2.40x2.40)x22.00
STA. 2+660 INSTALL RCP 1-Ø1.00x24.00
STA. 2+950 INSTALL RCP 1-Ø1.00x20.00
STA. 3+175 INSTALL RC-B 2-(2.40x2.40)x20.00
STA. 3+375 INSTALL RCP 1-Ø1.00x19.00
STA. 4+325 INSTALL RCP 1-Ø1.00x32.00
STA. 5+200 INSTALL RC-B 1-(2.40x2.40)x20.00
STA. 6+010 INSTALL RCP 1-Ø1.00x32.00
STA. 6+675 INSTALL RCP 1-Ø1.00x18.00
STA. 6+815 INSTALL RC-B 2-(2.40x2.40)x22.00
STA. 6+900 INSTALL RCP 1-Ø1.00x18.00
STA. 7+150 INSTALL RCP 1-Ø1.00x22.00
STA. 7+640 INSTALL RCP 1-Ø1.00x24.00
STA. 7+737 INSTALL RC-B 3-(2.40x2.40)x20.00
STA. 7+915 INSTALL RCP 1-Ø1.00x18.00
STA. 8+325 INSTALL RCP =Ø1.00x18.00
STA. 8+500 INSTALL RCP =Ø1.00x16.00
STA. 8+715 INSTALL RCP 1-Ø1.00x18.00

CURVATURE BAND	Existing Alignment	—
	Proposed Alignment	L = 691 R = 573

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-33	DWG NO.
From A. SIKHIU To A. CHOK CHAI	33 - 2
PLAN AND PROFILE	
STA 9 + 000 TO STA 18 + 000	





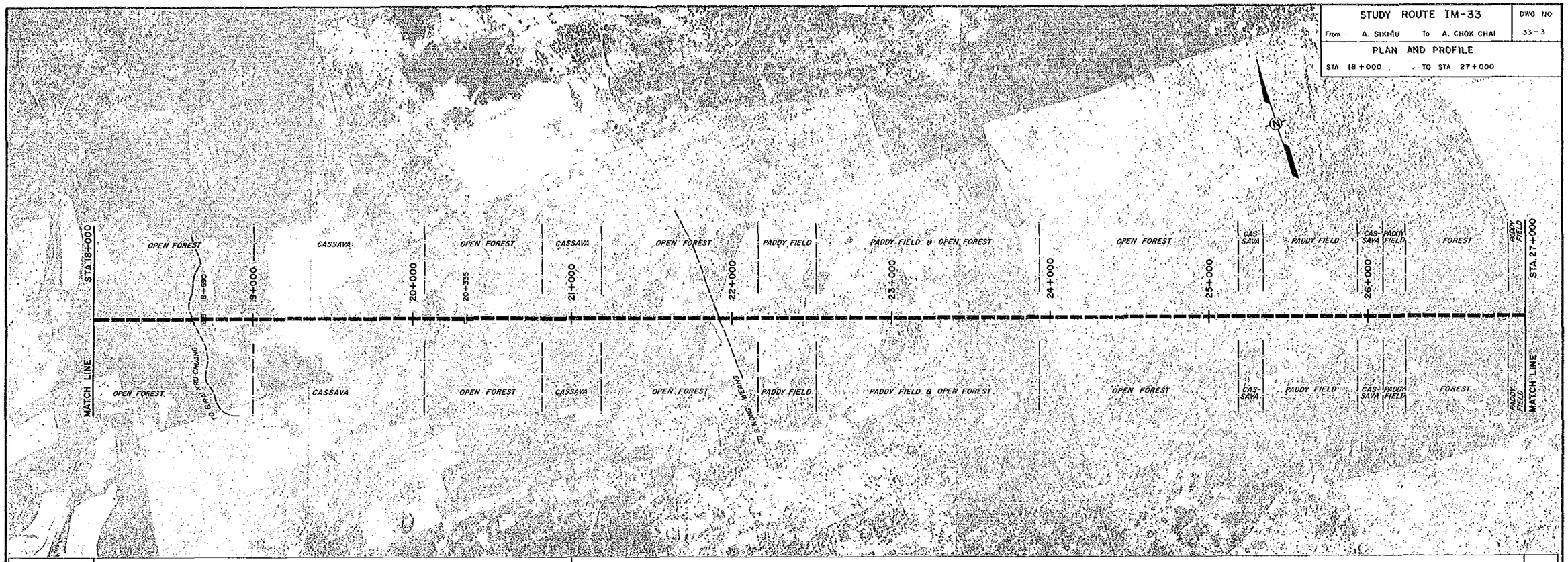
STUDY ROUTE IM-33

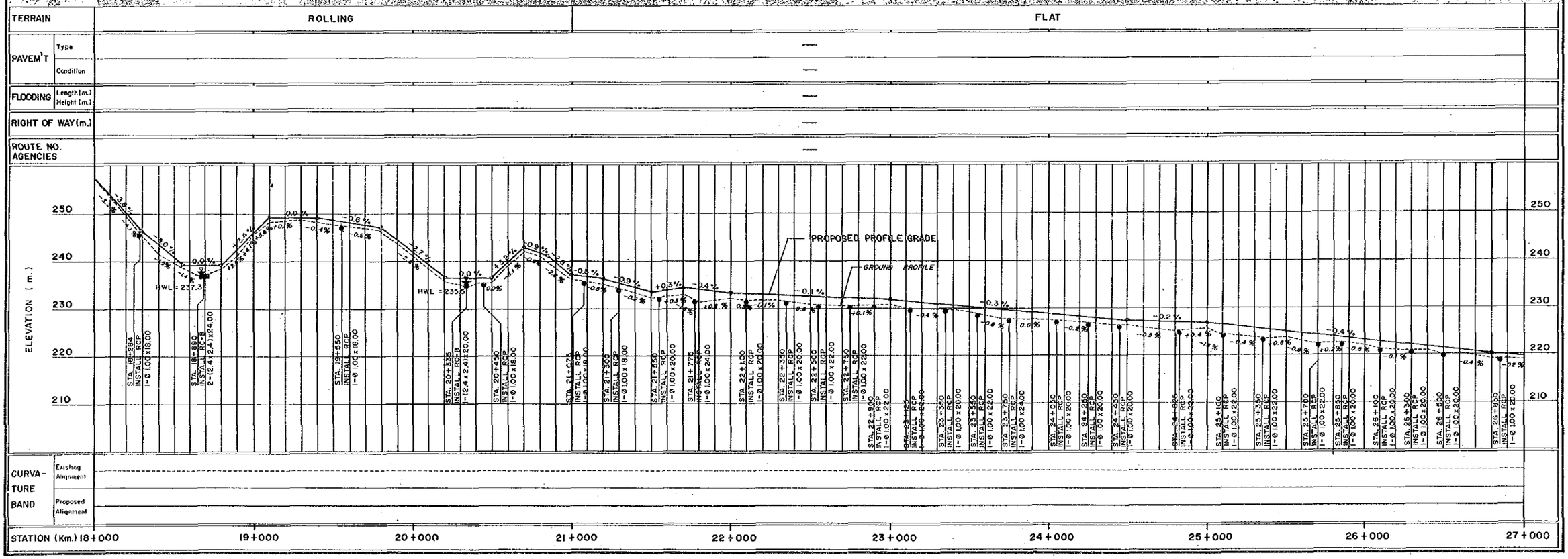
From A. SIKHIU To A. CHOK CHAI

DWG NO 33-3

PLAN AND PROFILE

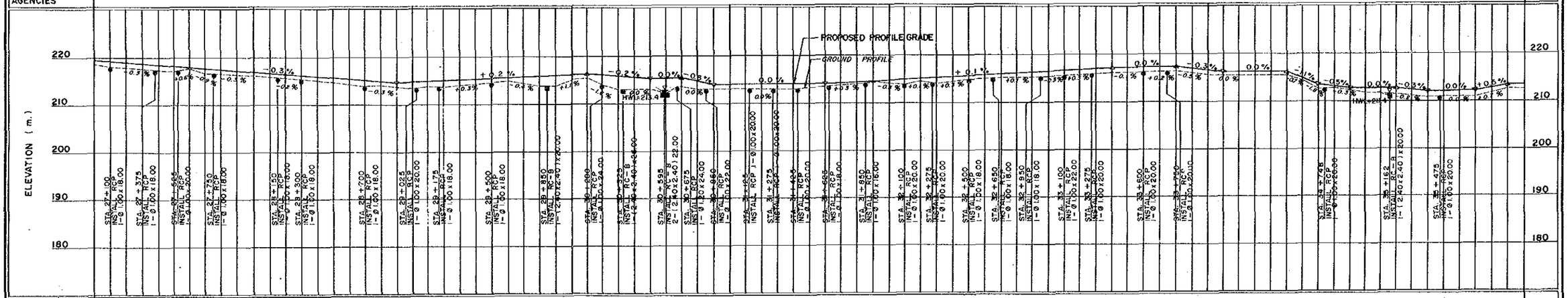
STA 18+000 TO STA 27+000





STUDY ROUTE IM-33	DWG. NO.
From A. SIKHIU To A. CHOK CHAI	33-4
PLAN AND PROFILE	
STA 27+000 TO STA 36+000	

TERRAIN		FLAT
PAVEMENT	Type	—
	Condition	—
FLOODING	Length (m.)	—
	Height (m.)	—
RIGHT OF WAY (m.)		—
ROUTE NO. AGENCIES		—

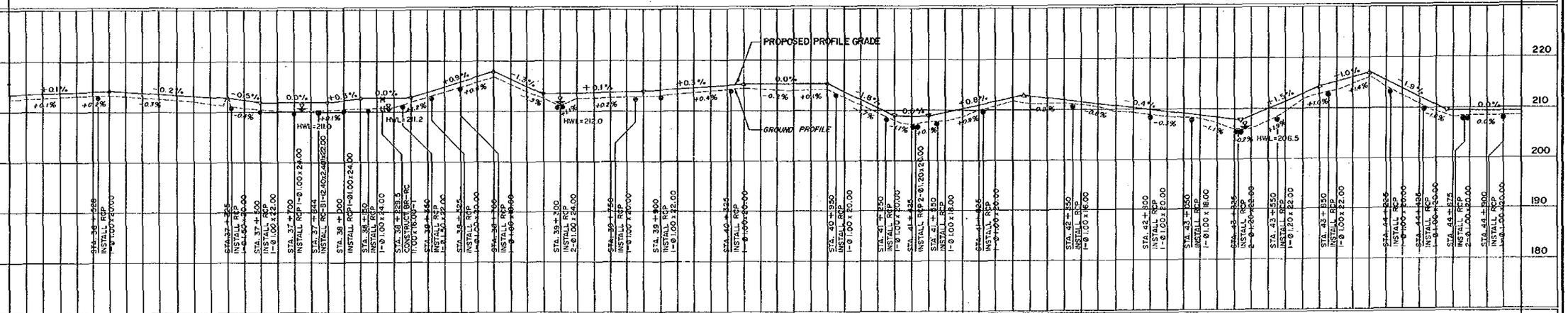


CURVATURE BAND	Existing Alignment	—
	Proposed Alignment	—

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-33			DWG. NO.
From A. SIKHIU	To A. CHOK CHAI		33-5
PLAN AND PROFILE			
STA. 36+000	TO STA 45+000		

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



CURVATURE BAND	Existing Alignment	—
	Proposed Alignment	L=240 R=1146 ; L=284 R=553
STATION (Km.)		36+000 37+000 38+000 39+000 40+000 41+000 42+000 43+000 44+000 45+000

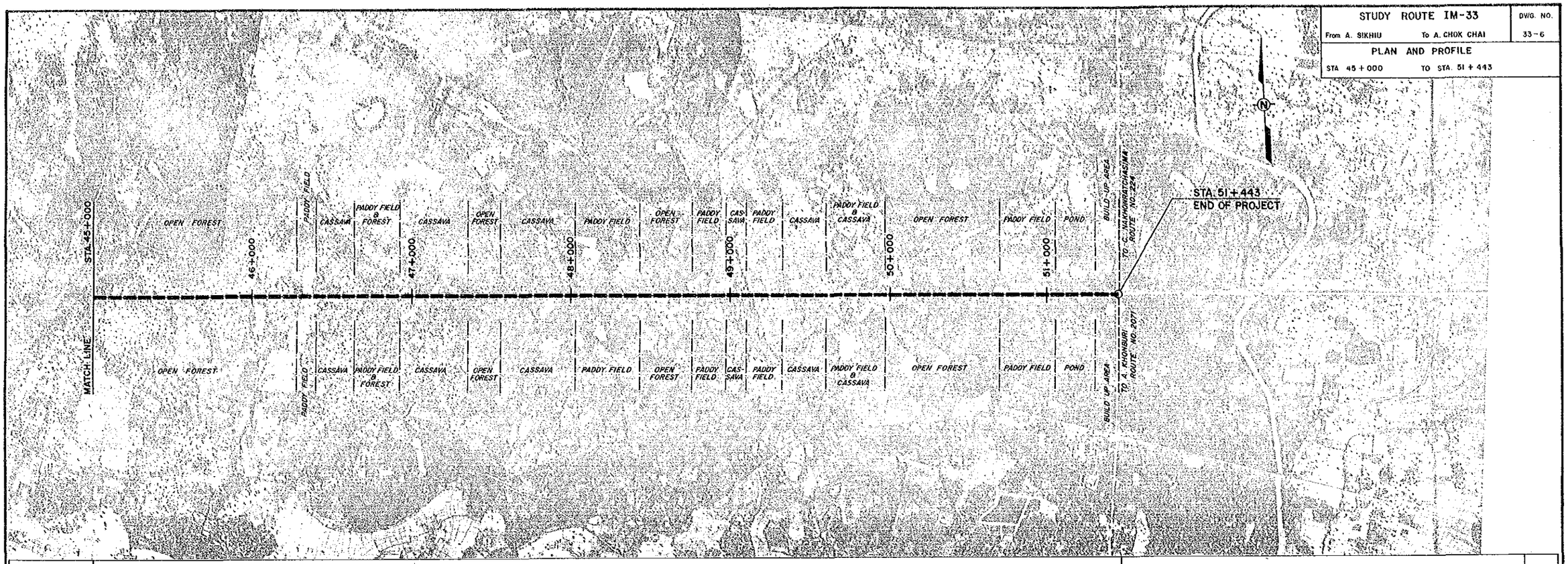
STUDY ROUTE IM-33

From A. SIKHIU To A. CHOK CHAI

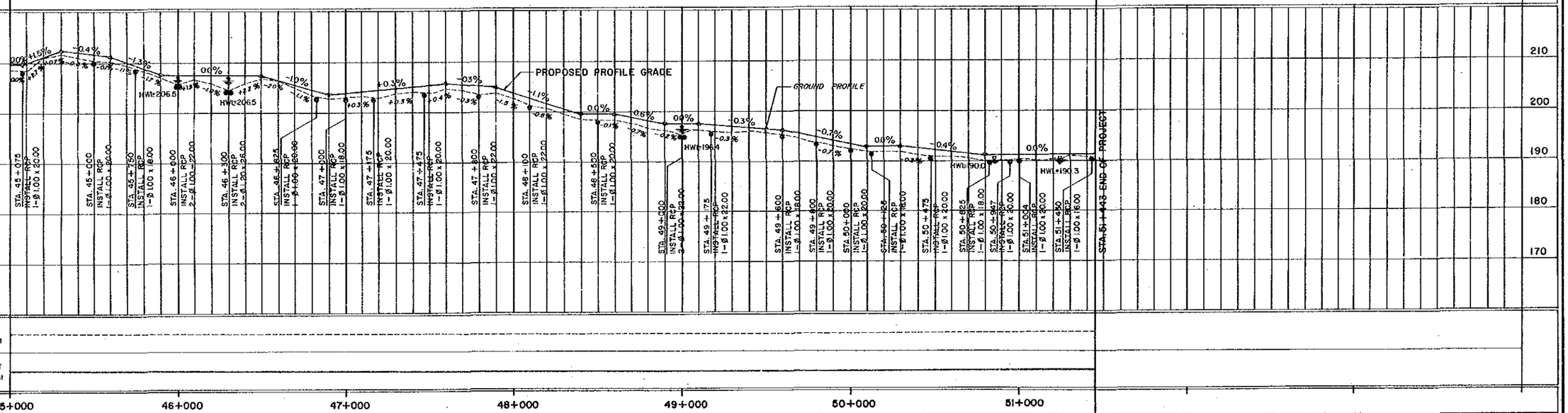
DWG. NO. 33-6

PLAN AND PROFILE

STA 45+000 TO STA. 51+443



TERRAIN		FLAT
PAVEMENT	Type	—
	Condition	—
FLOODING	Length (m.)	—
	Height (m.)	—
RIGHT OF WAY (m.)		—
ROUTE NO. AGENCIES		—



CURVATURE BAND	Existing Alignment	—
	Proposed Alignment	—

STATION (Km.) 45+000 46+000 47+000 48+000 49+000 50+000 51+000