24.3 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 24.3.1. Data for additional VOCs are shown in Table 24.3.2.

VOC savings, obtained as the balance of total link VOCs between the two cases, were calculated as shown in Table 24.3.3.

TABLE 24.3.1 ROAD LENGTH BY ROAD CLASS

(UNIT : KM)

LINK NO.	WITHOUT PROJECT CASE						WITH PROJECT CASE
	PAVED	LATERITE			EARTH	TOTAL	PAVED
		GOOD	FAIR	POOR			
1	-	-	13.3	0.3	-	13.6	13.6

TABLE 24.3.2 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	-	-	91	-	-	92	302	-	209	7100	250	-	-	-	3	1311	2	2	-	-
	WITH	-	-	91	-	-	92	302	-	209	7050	-	50	-	-	3	1311	-	-	-	-

TABLE 24.3.3 VEHICLE OPERATING COST SAVING

(UNIT : 1000 BAHT)

LINK NO.	1988			1994			2002		
	WITHOUT	WITH	SAVING	WITHOUT	WITH	SAVING	WITHOUT	WITH	SAVING
1	6,961	4,827	2,133	10,520	7,111	3,409	18,121	11,846	6,275
TOTAL	6,961	4,827	2,133	10,520	7,111	3,409	18,121	11,846	6,275

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

24.4 ENGINEERING

24.4.1 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 24.4.1 and Table 24.4.1, respectively.

Rock aggregate sources were assumed as shown below:

No.	Source	Description of Sample	Est. Quantity m^3
24/CS-1	KM. 44+450 Rt 4.8 KM. Srisaket-Kantharalak	Basalt	Plentiful
24/CS-2	KM. 44+700 Rt 5 KM. Srisaket-Kantharalak	Basalt	Plentiful

FIGURE 24.4.1 SOIL AND MATERIAL SOURCES

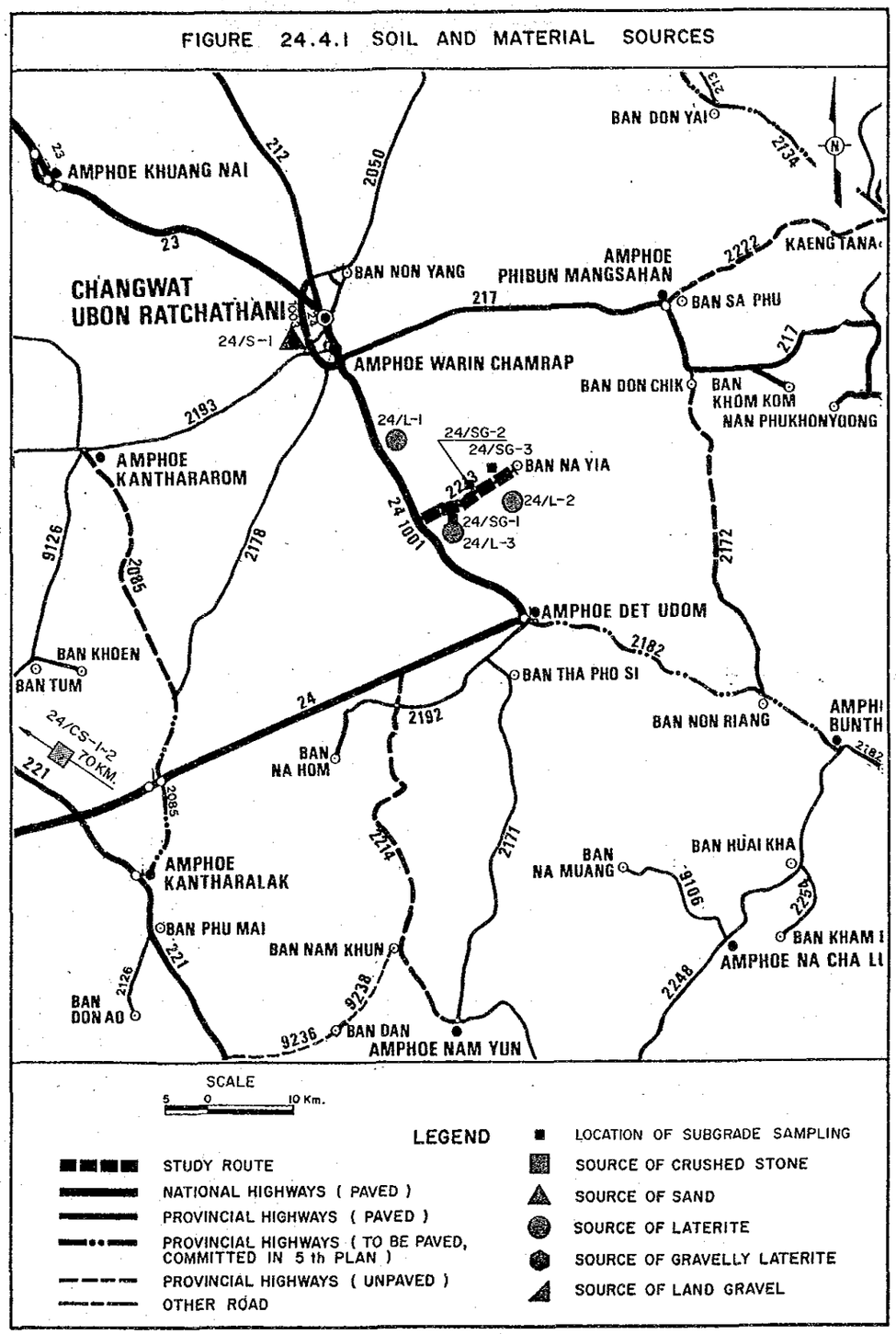


TABLE 24.4.1 PHYSICAL CHARACTERISTICS OF MATERIALS

No.	Source	Description of Sample	Est. Quantity m^3	AASHTO Classification	Sieve Analysis % Passing 50.0	25.0	19.0	9.5	#4	#10	#40	#200	Plasticity LL	PT	Comp. DH-T Stand. Opt. 95%	gm/cc	Lab. C.B.R. CBR 95%	Swell %	Durability Abr.	Dur.
SUBGRADE																				
24/SG-1.	KM. 5+100 Rt 15 M.			A-6				100	97.0	94.8	93.9	53.8	30.0	10.5	12.6	1.814	6.5	-		
24/SG-2.	KM. 10+000 Lt 12 M.			A-4					100	98.2	97.8	52.0		N-P	11.4	1.880	3.8	-		
24/SG-3.	KM. 12+500 Lt 12 M.			A-4					100	99.5	98.9	68.4		N-P	14.3	1.754	24.3	-		
SAND																				
24/S-1	C.Ubon Ratchathani	Mun River sand	Plentiful	A-3				100	99	97	94	64	0	N.P.						
LATERITE																				
24/L-1	KM. 18+000 Lt 1.5 KM. Warin - Det Udom	Laterite	10,000	A-2-4	100	96.5	84.9	68.2	43.6	30.2	21.0	14.1	25.0	2.6	9.2	2.235	40.0	0.175		
24/L-2	KM. 12+000 Rt 1.0 KM. Na Suang - Na Yia	Laterite	50,000	A-1-a	100	97.4	92,6	59.4	42,5	30.5	24.3	12.6	28.3	6.5						
24/L-3	KM. 2+800 Rt 1.2 KM. Na Suang - Na Yia	Laterite	30,000	A-1-b	100	97.7	92.8	70.5	43.0	34.0	28.8	19.6	25.1	4.7	9.0	2.235	40.0	0.861		
				A-1-b	100	98.2	93.5	65.7	39.1	29.6	25.2	18.8	25.0	4.6						

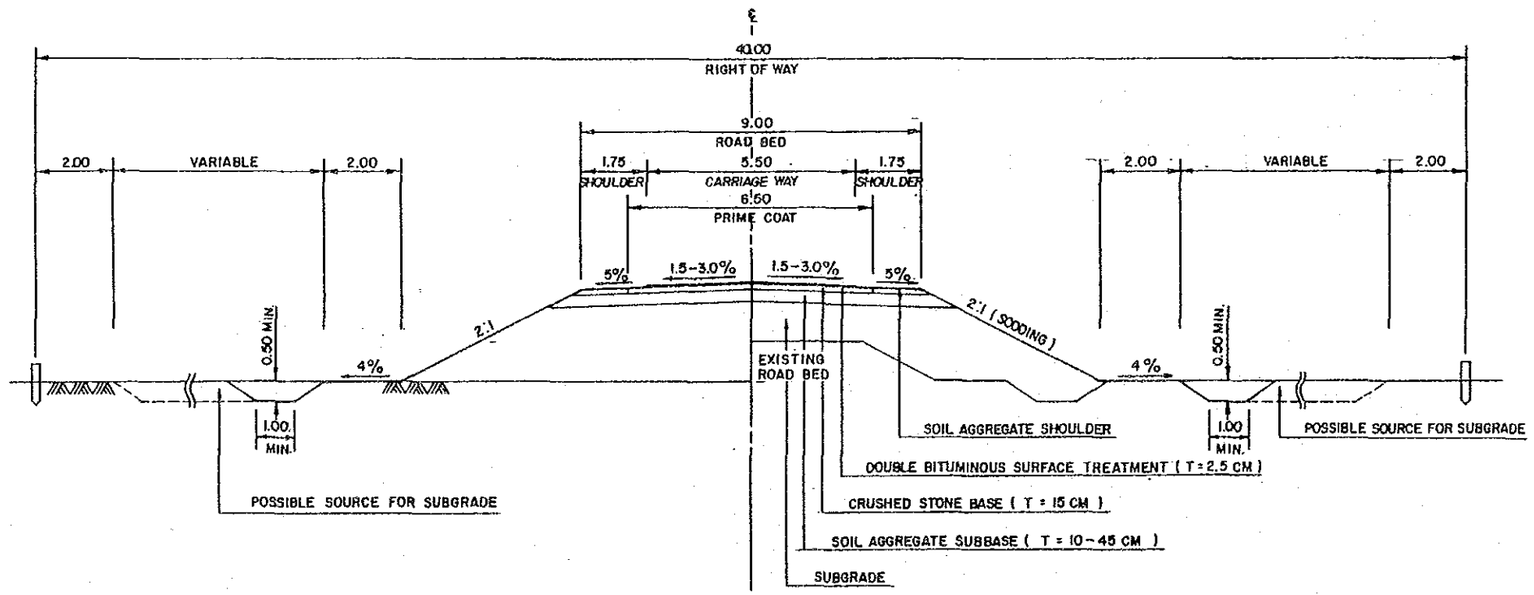
24.4.2 Preliminary Design

24.4.2.1 *Design Criteria*

Design Standard	:	F4
Geometric Design Criteria	:	DOH (Provincial Highway)
Typical Cross Section	:	as shown in Figure 24.4.2
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 24-1/24-2.

FIGURE 24.4.2 TYPICAL CROSS SECTION



PROVINCIAL HIGHWAY (CLASS F4)

24.4.2.3 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	15	—	—	—	22	—	—	—
Medium truck	41	—	—	—	70	—	—	—
Heavy truck	24	—	—	—	39	—	—	—

- Cumulative number of ESA in one direction by road link

Road link	1	2	3	4
7 years (10^6)	0.108	-	-	-

2) Design CBR values

Road link	1	2	3	4
Design CBR (%)	5.2	-	-	-

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
	25 cm	-	-	-

4) Overlay required in 7 years

DBST resurfacing

24.4.2.4 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
1 + 628	Timber Bridge	4.0 x 25.0	RC Bridge	9.0 x 30.0
12 + 050	" "	4.0 x 10.7	" "	9.0 x 20.0

24.4.3 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 24.4.2. Financial costs with breakdown into local and foreign currency portions, economic costs and residual values were estimated as follows and in 24.4.4:

IM—24	L = 13.6 km		(baht)
	Financial cost	:	26,580,000
	Economic cost	:	22,196,000
	Residual value	:	9,288,000

The required road maintenance cost savings are shown in Table 24.4.3.

24.4.4 Construction and Disbursement Schedules

IM—24 **Length = 13.6 km**

Construction Schedule
Assumption: Completion date December 31, 1987

Year & Month / WORK ITEMS	1986												1987											
	Dry season							Wet					Dry season							Wet				Dry	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
CONTRACT												▽												
PREPARATORY WORKS													▬	▬										
MAJOR WORKS (PRECEDING)															▬	▬	▬							
PAVEMENT WORKS																	▬	▬	▬	▬				
MAJOR WORKS (FOLLOWING)																		▬	▬	▬	▬	▬	▬	
STRUCTURE WORKS															▬	▬	▬	▬	▬	▬	▬	▬	▬	
MISC. WORKS																		▬	▬	▬	▬	▬	▬	
CLEARING-UP																								▬
PAYMENT IN %	0 %												100%											

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 - 24)

(Unit : Million Baht)

	1986			1987			Total		
	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total
Construction Cost	0.0	0.0	0.0	13.2	13.4	26.6	13.2	13.4	26.6
Price Continsency	0.0	0.0	0.0	4.4	2.8	7.2	4.4	2.8	7.2
Total	0.0	0.0	0.0	17.6	16.2	33.8	17.6	16.2	33.8
	(0.00)	(0.00)	(0.00)	(0.65)	(0.60)	(1.25)	(0.65)	(0.60)	(1.25)

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

TABLE 24.4.2 CONSTRUCTION QUANTITIES AND COSTS
(ROUTE IM—24 Length = 13.6 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	32	320						
Roadway Excavation, Unclassified	m3	19	0	0						
Embankment, Common Soil	m3	38	111,400	4,233						
Embankment, Selected Material	m3	70	0	0						
Replacement of Soft Spot	m3	88	1,100	97						
Sub Total				4,650	2,372	2,279		3,860		3,474
SUBBASE & BASE COURSES							83		50	
Subbase, Soil Aggregate	m3	112	32,000	3,584						
Aggregate Base*	m3	320	13,300	4,256						
Cement Stabilized Base	m3	390	0	0						
Shoulder, Soil Aggregate	m3	120	5,100	612						
Sub Total				8,452	4,564	3,888		7,015		3,508
SURFACE COURSES							85		50**	
Asphaltic Prime/Tack Coat	m2	12	88,400	1,061						
Double Bituminous Surface Treatment*	m2	38	74,800	2,842						
Asphaltic Concrete Surfacing**	t	750	0	0						
Sub Total				3,903	1,717	2,186		3,318		0
STRUCTURES							83		50	
RC Pipe Culvert (D 1.0m Equivalent)	m	2,000	600	1,200						
RC Box Culvert (2.4mx2.4m Equivalent)	m	18,800	0	0						
RC Bridge (W = 9.0m L = 10m	m	46,500	50	2,325						
Sub Total				3,525	1,763	1,763		2,926		1,463
Total (a)				20,530	10,415	10,115		17,118		8,444
INCIDENTALS							83		0	
Miscellaneous Work ((a)x7%)	ls			1,437	719	719		1,193		0
CONTRACT AMOUNT (b)				21,967	11,134	10,833		18,311		8,444
PHYSICAL CONTINGENCIES ((b)x10%) (c)	ls			2,197	1,113	1,083		1,831		844
ENGINEERING AND SUPERVISION							85		0	
(((b)+(c))x10%) (d)	ls			2,416	967	1,450		2,054		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))				26,580	13,214	13,366		22,196		9,288
AVERAGE COST PER KM				1,954						

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

TABLE 24.4.3 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	246.0	13.6	0.41	1.60	16,812	229	268.5	13.6	0.00	1.22	13,690	186	42
1	1994	400.3	13.6	0.77	1.85	19,451	265	416.1	13.6	0.00	1.22	13,690	186	78
	2002	760.2	13.6	0.95	1.98	20,811	283	736.6	13.6	0.00	1.22	13,690	186	97
	1988	246.0	13.6			16,812	229	268.5	13.6			13,690	186	42
TOTAL	1994	400.3	13.6			19,451	265	416.1	13.6			13,690	186	78
	2002	760.2	13.6			20,811	283	736.6	13.6			13,690	186	97

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

(2) UNIT MAINTENANCE COST $U = M * (KA \text{ or } KB) * FA * (1 + FR) * FE$

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 $KA = 1.31 + 0.70 * A1$
WITH PROJECT CASE $KB = 1.22 + 0.05 * X3$

(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

24.5 EVALUATION

24.5.1 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 - 24

(1000 BAHT)

YEAR	COST	BENEFITS				DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	TOTAL COST	TOTAL BENEFIT
1986	0	0	0	0	0	0	0
1987	22,196	0	0	0	0	24,860	0
1988	0	311	2,133	42	2,487	0	2,220
1989	0	438	2,346	48	2,833	0	2,258
1990	0	566	2,559	54	3,179	0	2,263
1991	0	693	2,771	60	3,525	0	2,240
1992	0	820	2,984	66	3,871	0	2,196
1993	0	948	3,197	72	4,217	0	2,136
1994	0	1,075	3,409	78	4,562	0	2,064
1995	4,832	1,198	3,767	81	5,046	2,186	2,038
1996	0	1,321	4,126	83	5,529	0	1,994
1997	0	1,443	4,484	85	6,012	0	1,936
1998	0	1,566	4,842	88	6,496	0	1,867
1999	0	1,689	5,200	90	6,979	0	1,791
2000	0	1,812	5,559	92	7,462	0	1,710
2001	0	1,934	5,917	95	7,946	0	1,626
2002	-9,288	2,057	6,275	97	8,429	-1,697	1,540
TOTAL	17,740	17,870	59,569	1,133	78,572	25,348	29,880
DISCOUNTED	25,348	6,397	23,023	460	29,880		

NET PRESENT VALUE : 4,531

BENEFIT/COST RATIO : 1.18

INTERNAL RATE OF RETURN : 14.2 %

FIRST YEAR RATE OF RETURN : 8.9 %

OPTIMUM OPENING YEAR : 1988

SENSITIVITY TESTS

ITEM	CASE		
	BASE	1	2
NET PRESENT VALUE	4,531	729	49
BENEFIT/COST RATIO	1.18	1.03	1.00
INTERNAL RATE OF RETURN	14.2 %	12.3 %	12.0 %
FIRST YEAR RATE OF RETURN	8.9 %	7.8 %	7.6 %
COSTS	BASE	+15%	BASE
BENEFITS	BASE	BASE	-15%

24.5.2 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) : 22.2

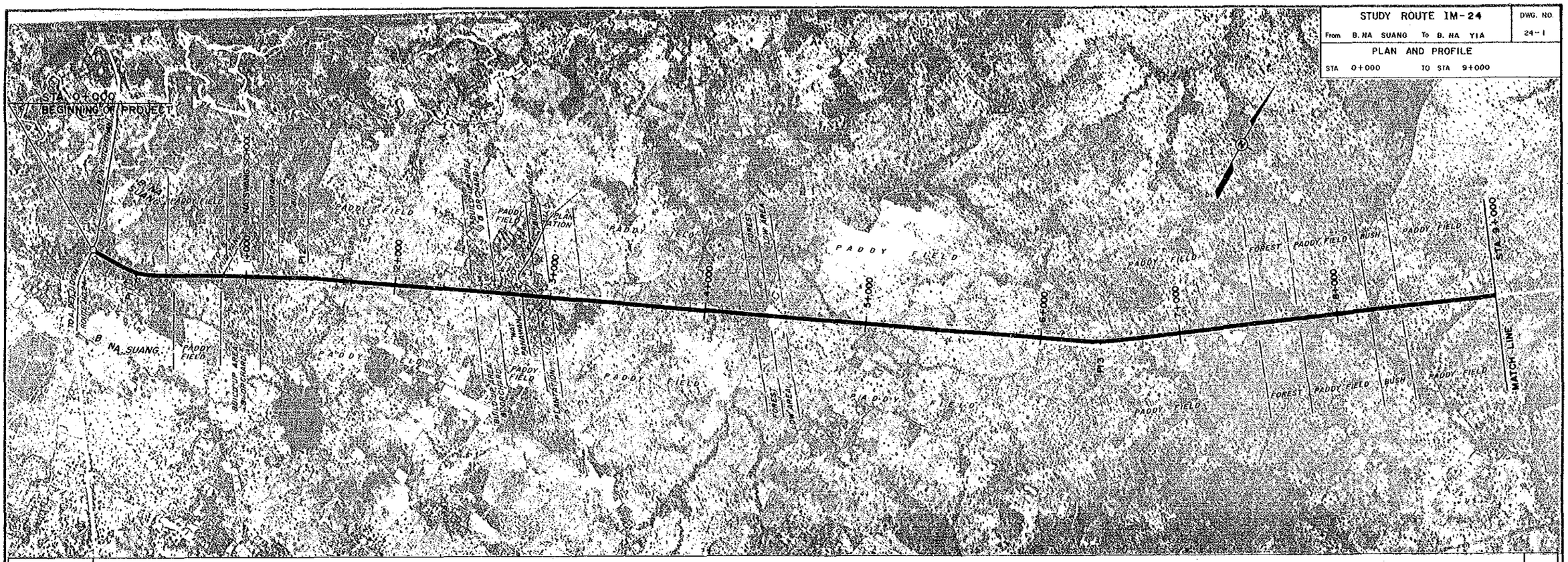
1) General Accessibility Benefit (million baht) : 1.08
2) Education Benefit (million baht) : 0.27
3) Medical Care Benefit (million baht) : 0.025
4) Total Social Benefits (million baht) (1 + 2 + 3) : 1.38
5) Social Benefit/Cost Ratio ($\times 10^{-2}$) : 6.22
6) Ranking by Social Benefits : 13
7) Weighted Production Value Gain/Cost ($\times 10^{-2}$) : 5.71
8) Ranking by 7 : 11
9) Combined Ratio ($\times 10^{-2}$) : 11.93

Overall Ranking : 14

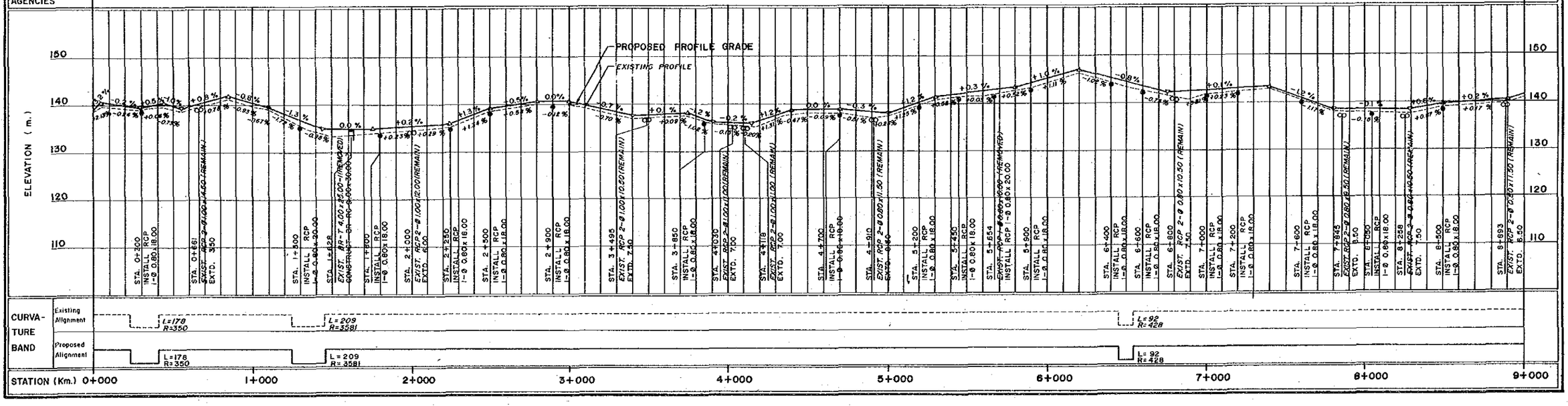
24.5.3 Overall Evaluation

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.

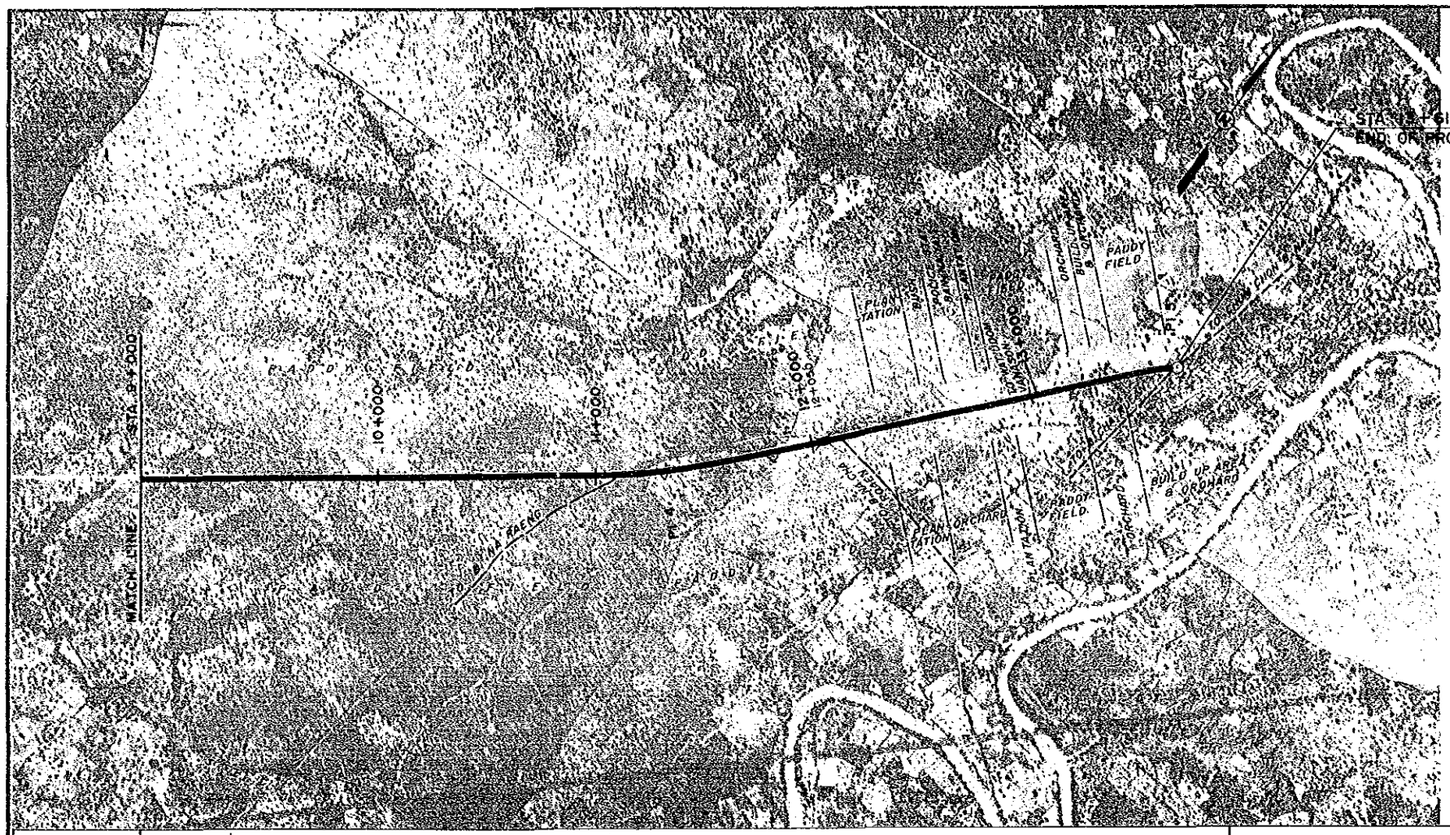
STUDY ROUTE IM-24	DWG. NO.
From B. NA SUANG To B. NA YIA	24-1
PLAN AND PROFILE	
STA 0+000 TO STA 9+000	



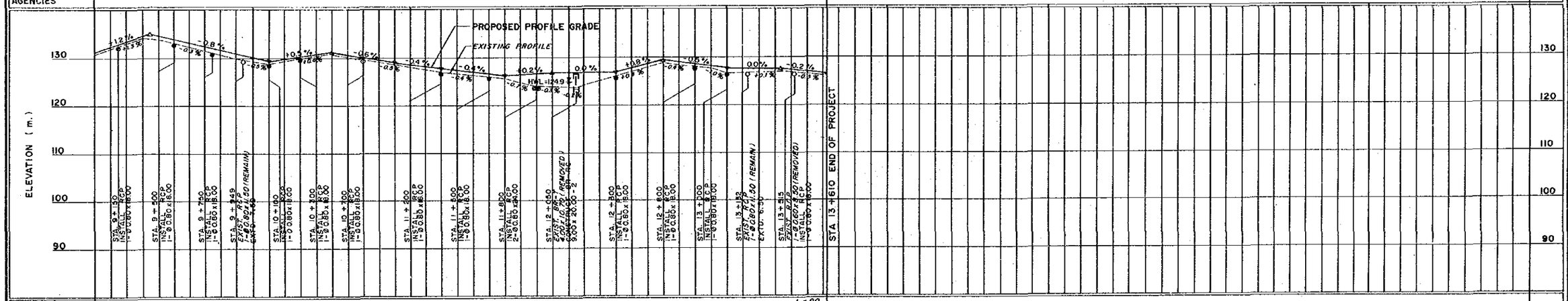
TERRAIN		FLAT	
PAVEM'T	Type	ST	LATERITE
	Condition	FAIR	
FLOODING	Length (m.) / Height (m.)		
RIGHT OF WAY (m.)	5.00 / 4.00	8.50	17.50
ROUTE NO. AGENCIES		DOH ROUTE NO. 2213	



STUDY ROUTE IM-24	DWG. NO.
From B. NA SUANG To B. NA YIA	24-2
PLAN AND PROFILE	
STA 9 + 000 TO STA. 13 + 610	



TERRAIN		FLAT				
PAVEMENT	Type	LATERITE				
	Condition	FAIR	POOR	FAIR		
FLOODING	Length (m.)		500			
	Height (m.)		1.00			
RIGHT OF WAY (m.)		17.50	11.00	9.00 11.00	5.00	
ROUTE NO. AGENCIES		DOH ROUTE NO. 2213				



CURVATURE BAND	Existing Alignment		L = 124 R = 585		L = 90 R = 194	
	Proposed Alignment		L = 124 R = 585		L = 90 R = 194	
STATION (Km.)		9+000	10+000	11+000	12+000	13+000

STUDY ROUTE NO. IM – 25

Changwat : Yasothon

A. Maha Chana Chai (J.R. 2083) – A. Khowang

Length : 24.5 KM.

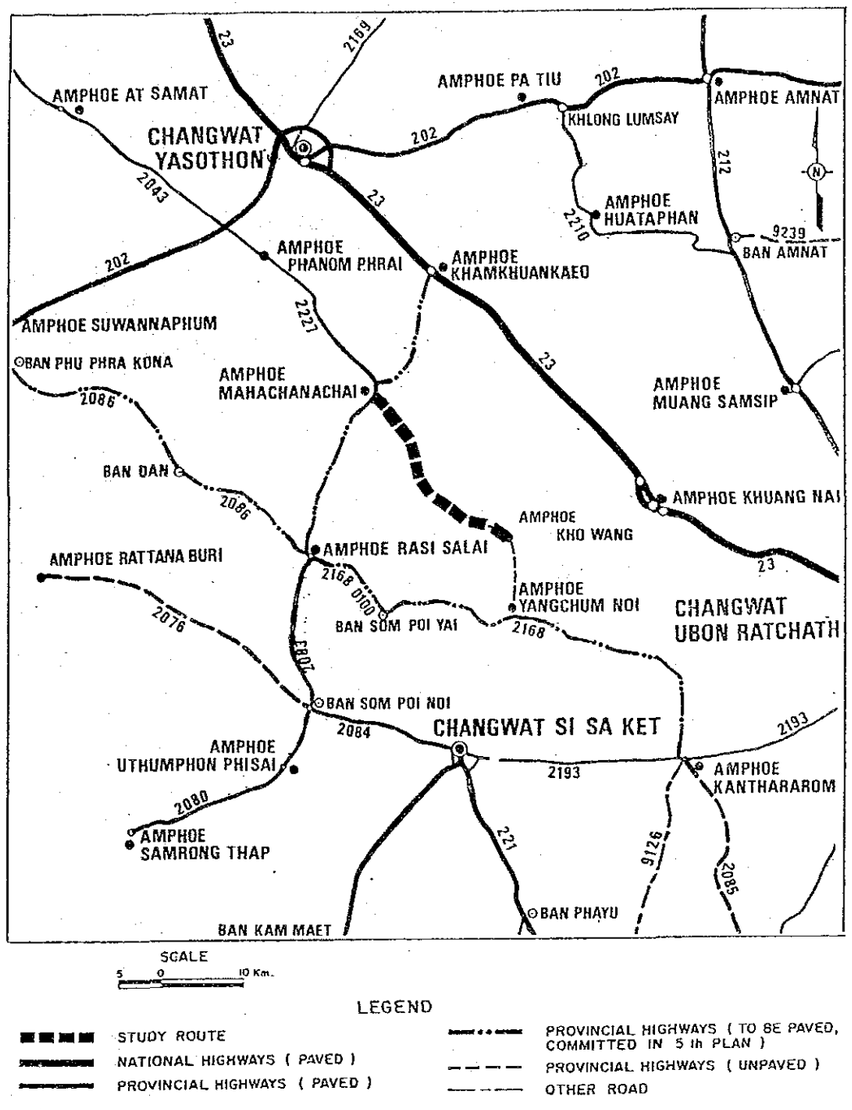
TABLE OF CONTENTS

SUMMARY

STUDY ROUTE IM-25

General		
Changwat	:	Yasothon/Si Saket
Origin and Destination	:	A. Maha Chana Chai—B. Kho Wang
Connected Road Network	:	2083
Amphoe on Route	:	-
Number of Related Villages	:	7
Influence Area		
Area	:	218 km^2
Cultivated Area Ratio to Total Land Area in %	:	79
Population in 1983	:	29,500
Main Crops	:	Paddy & Kenaf
Number of Public Activities		
Public Health Service Centers	:	-
Hospitals Changwat Level	:	-
Amphoe Level	:	3
Schools Primary	:	8
Secondary	:	1
Traffic (ADT)	:	1984—101 1988—167 1994—256 2002—473
Nomenclature of Study Route		
Total Length	:	24.5 km
Improvement Section	:	24.5 km
DOH Road	:	-
ARD Road	:	15.7 km
Other Road	:	8.8 km
New Construction Section	:	-
Design Standard Employed	:	F4
Construction Cost in Baht		
Financial	:	46,933,000
Economic	:	39,497,000
Economic Indicators		
IRR	:	11.0% Ranking: 14
Social Impact		
Social B/C Ratio	:	0.171 Ranking: 10
Recommendations		
Opening Year	:	1989 Overall Ranking: 14

LOCATION OF STUDY ROUTE

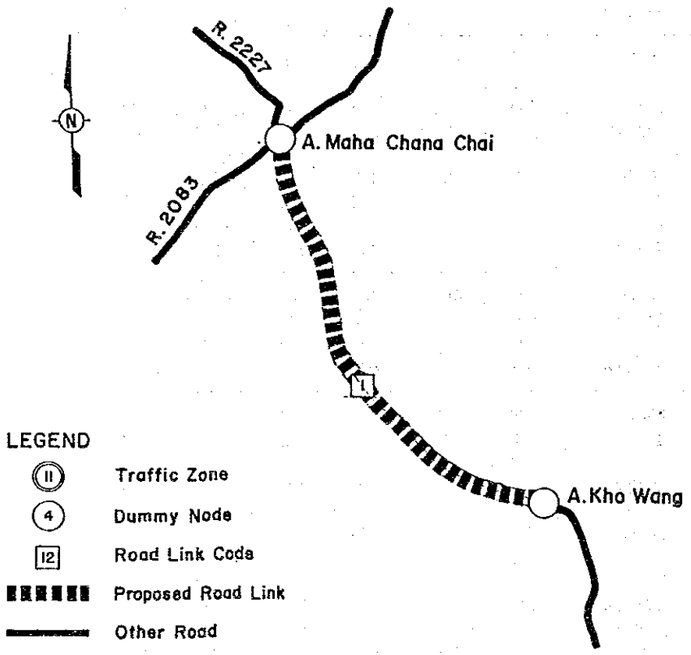


25.1 TRAFFIC

25.1.1 Method Employed in Traffic Forecasting

The growth rate method was employed in forecasting traffic because no diverted traffic after improvement was expected on this study route.

25.1.2 Assumed Road Link



25.1.3 Traffic Forecast

1) Items necessary for forecasting traffic were:
   - Traffic volume in base year
   - Passenger and freight movement in base year
   - Growth rates of passenger and freight movement
   - Rate of induced and developed movement
   - Traffic composition

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	3	0	15	8	21	6	17	31	101	60	161

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	736	166.9	93.6	260.5

GROWTH RATE OF PASSENGER MOVEMENT

(UNIT : % P.A.)

YEAR	PER CAPITA INCOME	POPULATION	PASSENGER MOVEMENT
1984 - 1988	3.1	0.9	5.4
1988 - 1994	3.1	0.8	5.2
1994 - 2002	3.1	0.7	5.1

GROWTH RATE OF FREIGHT MOVEMENT

(UNIT : % P.A.)

YEAR	NON-AGRI. FREIGHT	AGRI. FREIGHT	FREIGHT MOVEMENT
1984 - 1988	6.7	0.0	4.4
1988 - 1994	6.5	0.0	4.7
1994 - 2002	6.4	0.0	5.1

RATE OF INDUCED AND DEVELOPED MOVEMENT

(UNIT : %)

YEAR	INDUCED	DEVELOPED		
	LINK 1	PASSENGER MOVEMENT	NON-AGRI. FREIGHT MOVEMENT	AGRI. FREIGHT MOVEMENT
1988	15.0	0.0	0.0	0.1
1994	15.0	0.0	0.0	0.7
2002	15.0	0.0	0.0	1.6

TRAFFIC COMPOSITION

(UNIT : %)

LINK NO.	YEAR	PASSENGER					FREIGHT			
		P/C	P/P	L/B	M/B	H/B	P/T	4/T	6/T	10/T
1	1984	8.5	51.2	0.0	26.3	14.0	5.3	10.5	29.8	54.4
	1988	15.3	48.3	0.7	23.3	12.5	7.0	10.6	34.3	48.1
	1994	25.5	43.9	1.7	18.9	10.1	9.6	10.8	41.0	38.6
	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								ADT	M/C	TOTAL
	P/C	L/B	M/B	H/B	P/P&T	4/T	6/T	10/T			
1988	13	1	19	10	46	9	29	40	167	242	409
1994	33	2	25	13	69	14	52	48	256	304	560
2002	96	7	32	17	123	25	114	59	473	393	866

TRAFFIC VOLUME ON ROUTE IM- 25 LINK COUNT= 1

	YEAR	1988		1994		2002	
	LINK	1	AVR.	1	AVR.	1	AVR.
P/C	N+D	11	11	29	29	83	83
	I	2	2	4	4	12	12
	DV	0	0	0	0	0	0
	TOTAL	13	13	33	33	96	96
L/B	N+D	0	0	2	2	6	6
	I	0	0	0	0	1	1
	DV	0	0	0	0	0	0
	TOTAL	1	1	2	2	7	7
M/B	N+D	17	17	21	21	28	28
	I	3	3	3	3	4	4
	DV	0	0	0	0	0	0
	TOTAL	19	19	25	25	32	32
H/B	N+D	9	9	11	11	15	15
	I	1	1	2	2	2	2
	DV	0	0	0	0	0	0
	TOTAL	10	10	13	13	17	17
P/P&T	N+D	40	40	60	60	107	107
	I	6	6	9	9	16	16
	DV	0	0	0	0	0	0
	TOTAL	46	46	69	69	123	123
4/T	N+D	8	8	12	12	22	22
	I	1	1	2	2	3	3
	DV	0	0	0	0	0	0
	TOTAL	9	9	14	14	25	25
6/T	N+D	25	25	45	45	99	99
	I	4	4	7	7	15	15
	DV	0	0	0	0	0	0
	TOTAL	29	29	52	52	114	114
10/T	N+D	35	35	42	42	51	51
	I	5	5	6	6	8	8
	DV	0	0	0	0	0	0
	TOTAL	40	40	48	48	59	59
ADT	N+D	145	145	223	223	411	411
	I	22	22	33	33	62	62
	DV	0	0	0	0	1	1
	TOTAL	167	167	256	256	473	473
M/C	N+D	222	222	284	284	373	373
	I	20	20	20	20	20	20
	DV	0	0	0	0	0	0
	TOTAL	242	242	304	304	393	393
TOTAL	N+D	367	367	506	506	783	783
	I	42	42	54	54	82	82
	DV	0	0	0	0	1	1
	TOTAL	409	409	560	560	866	866

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

25.2 AGRICULTURAL DEVELOPMENT

25.2.1 Present Condition

Ninety-one percent of the cultivated land in the influence area is covered by paddy fields. Many old paddy fields are affected by salinity. Kenaf was the only main crop planted in upland fields in the 1983 crop year.

Land use and capability conditions in the area are shown in Table 25.2.1 and Figure 25.2.1. A typical cropping calendar in the area is shown in Figure 25.2.2.

25.2.2 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 25.2.2.

Based on the above projected production amount, farmgate prices and production costs estimated separately, net production value (NPV) was obtained as shown in Table 25.2.3. The difference in NPV between the two cases is deemed to be the development benefit of the study route.

FIGURE 25.2.1 LAND USE AND CAPABILITY OF INFLUENCE AREA STUDY ROUTE NO. IM-25

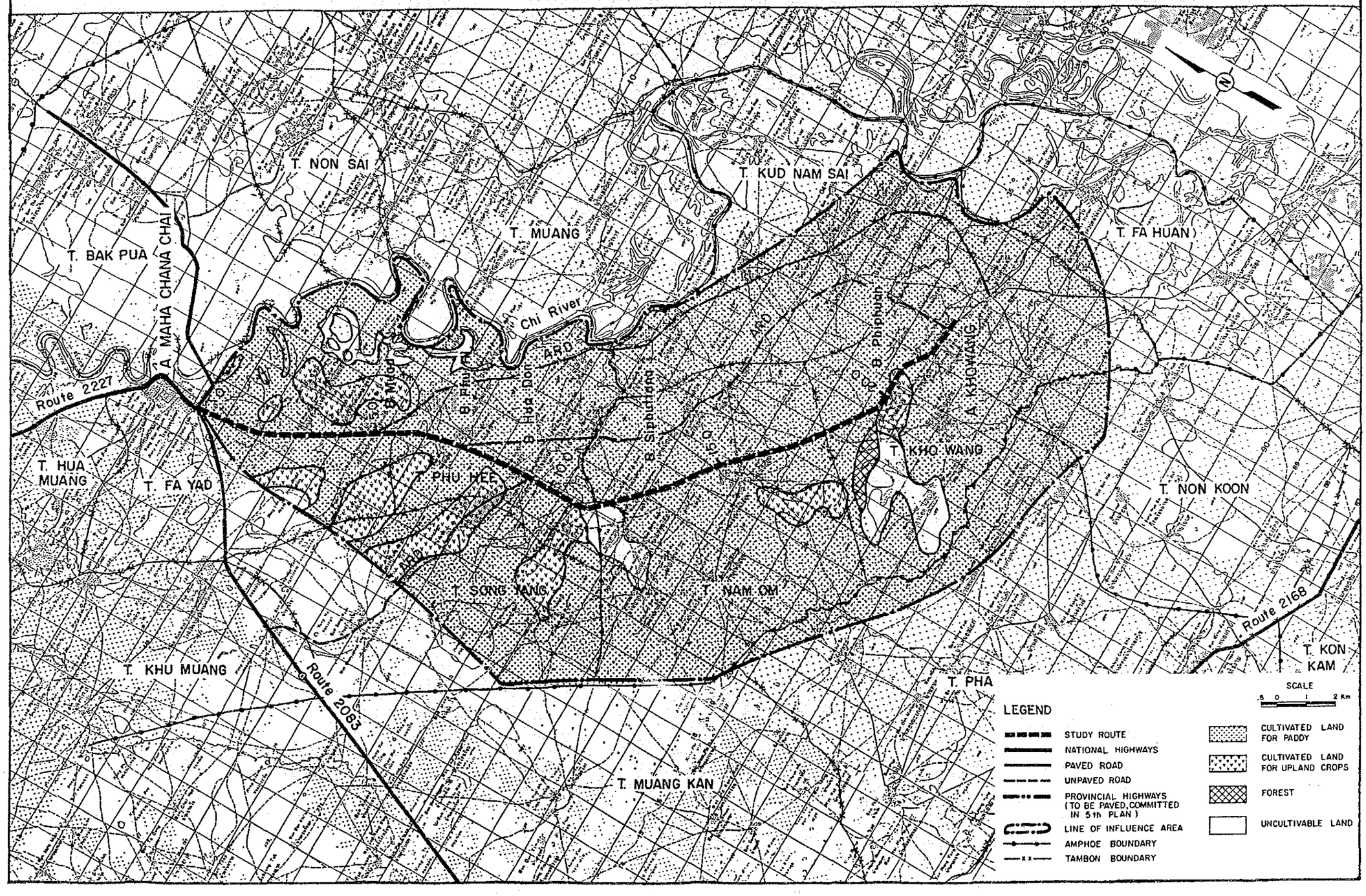
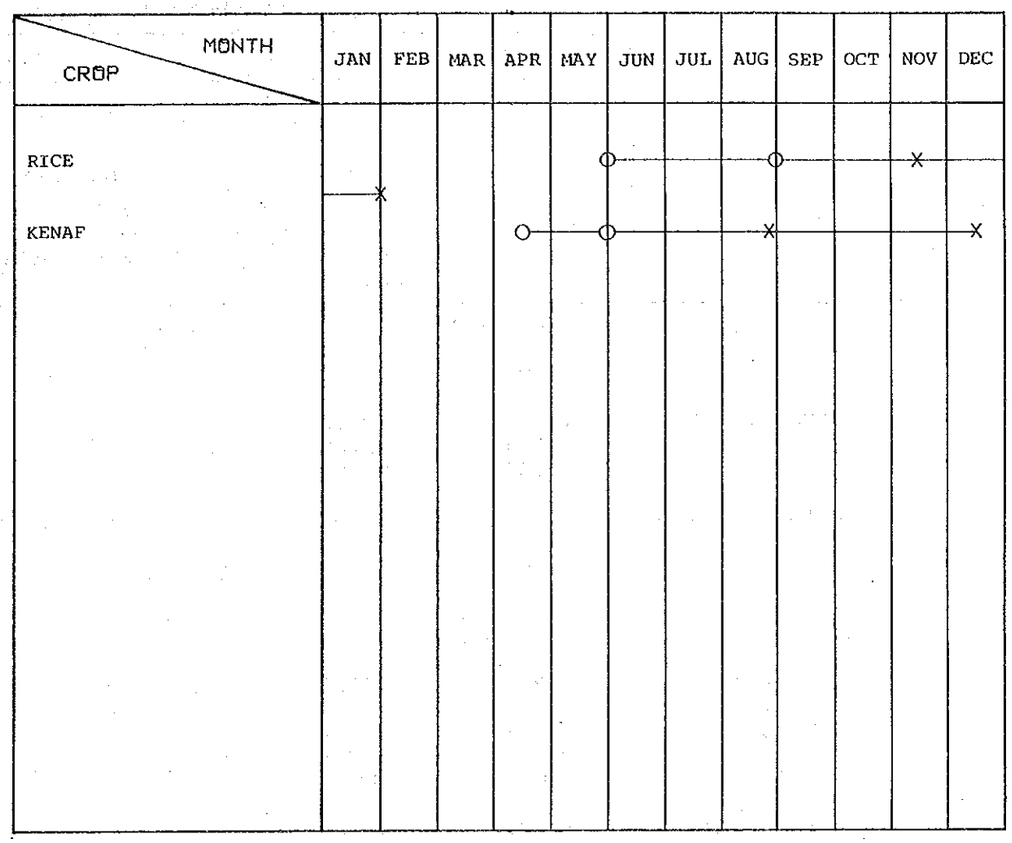


FIGURE 25.2.2 CROPPING CALENDAR

ROUTE IM-25

Related Amphoes: 1007 Maha Chana Chai
1008 Kho Wang
1602 Rasi Salai
1603 Yang Chum Noi



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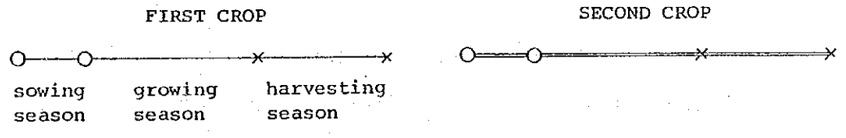


TABLE 25.2.1 CULTIVATED LAND

[UNIT : 1000 RAI (KM2)]

CHANGWAT NAME	AMPHOE NAME	CULTIVATED LAND PADDY FIELD	UPLAND FIELD	TOTAL
YASOTHON	MAHA CHANA CHAI	33.13 (53.01)	4.86 (7.78)	37.99 (60.78)
	KHO WANG	57.69 (92.30)	5.06 (8.10)	62.75 (100.40)
SI SA KET	RASI SALAI	4.00 (6.40)	0.00 (0.00)	4.00 (6.40)
	YANG CHUM NOI	1.93 (3.09)	0.00 (0.00)	1.93 (3.09)
TOTAL		96.75 (154.80)	9.92 (15.87)	106.67 (170.67)

TABLE 25.2.2 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)	92.02	-	-	-	-	-	8.52	-	-	-	8.52	100.54
WITHOUT PROJECT	(1988)	92.02	-	-	-	-	-	8.52	-	-	-	8.52	100.54
	(1994)	92.02	-	-	-	-	-	8.52	-	-	-	8.52	100.54
	(2002)	92.02	-	-	-	-	-	8.52	-	-	-	8.52	100.54
WITH PROJECT	(1988)	92.02	-	-	-	-	-	8.55	-	-	-	8.55	100.57
	(1994)	92.02	-	-	-	-	-	8.71	-	-	-	8.71	100.73
	(2002)	92.02	-	-	-	-	-	8.93	-	-	-	8.93	100.95
CROP YIELD	(KG/RAI)												
BASE YEAR	(1983)	289.1	-	-	-	-	-	200.0	-	-	-		
WITHOUT PROJECT	(1988)	289.1	-	-	-	-	-	200.0	-	-	-		
	(1994)	289.1	-	-	-	-	-	200.0	-	-	-		
	(2002)	289.1	-	-	-	-	-	200.0	-	-	-		
WITH PROJECT	(1988)	289.4	-	-	-	-	-	200.0	-	-	-		
	(1994)	290.9	-	-	-	-	-	200.0	-	-	-		
	(2002)	293.0	-	-	-	-	-	200.0	-	-	-		
CROP PRODUCTION AMOUNT	(TON)												
BASE YEAR	(1983)	26,603	-	-	-	-	-	1,704	-	-	-	1,704	28,307
WITHOUT PROJECT	(1988)	26,603	-	-	-	-	-	1,704	-	-	-	1,704	28,307
	(1994)	26,603	-	-	-	-	-	1,704	-	-	-	1,704	28,307
	(2002)	26,603	-	-	-	-	-	1,704	-	-	-	1,704	28,307
WITH PROJECT	(1988)	26,627	-	-	-	-	-	1,709	-	-	-	1,709	28,336
	(1994)	26,770	-	-	-	-	-	1,742	-	-	-	1,742	28,512
	(2002)	26,962	-	-	-	-	-	1,786	-	-	-	1,786	28,748

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE

TABLE 25.2.3 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)		3,994	-	-	-	-	-	4,172	-	-	-		
WITH PROJECT	(1988 - 2002)		4,019	-	-	-	-	-	4,223	-	-	-		
CROP PRODUCTION COST	(BAHT/RAI)													
BASE YEAR		(1983)	665	-	-	-	-	-	810	-	-	-		
WITHOUT PROJECT		(1988)	665	-	-	-	-	-	810	-	-	-		
		(1994)	665	-	-	-	-	-	810	-	-	-		
		(2002)	665	-	-	-	-	-	810	-	-	-		
WITH PROJECT		(1988)	665	-	-	-	-	-	810	-	-	-		
		(1994)	668	-	-	-	-	-	810	-	-	-		
		(2002)	672	-	-	-	-	-	810	-	-	-		
NET PRODUCTION VALUE	(1000 BAHT)													
WITHOUT PROJECT		(1988)	45,059	-	-	-	-	-	208	-	-	-	208	45,267
		(1994)	45,059	-	-	-	-	-	208	-	-	-	208	45,267
		(2002)	45,059	-	-	-	-	-	208	-	-	-	208	45,267
WITH PROJECT		(1988)	45,820	-	-	-	-	-	296	-	-	-	296	46,116
		(1994)	46,119	-	-	-	-	-	302	-	-	-	302	46,421
		(2002)	46,523	-	-	-	-	-	309	-	-	-	309	46,832
NET VALUE ADDED	(1000 BAHT)													
		1988	761	-	-	-	-	-	88	-	-	-	88	849
		1994	1,060	-	-	-	-	-	94	-	-	-	94	1,154
		2002	1,464	-	-	-	-	-	101	-	-	-	101	1,565

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE

25.3 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 25.3.1. Data for additional VOCs are shown in Table 25.3.2.

VOC savings, obtained as the balance of total link VOCs between the two cases, were calculated as shown in Table 25.3.3.

TABLE 25.3.1 ROAD LENGTH BY ROAD CLASS

(UNIT : KM)

LINK NO.	WITHOUT PROJECT CASE						WITH PROJECT CASE
	PAVED	LATERITE			EARTH	TOTAL	PAVED
		GOOD	FAIR	POOR			
1	-	-	-	16.5	8.0	24.5	24.5

TABLE 25.3.2 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	45	380	205	104	462	528	651	454	1103	2719	-	200	-	-	5	1560	6	-	-	-
	WITH	340	380	205	104	462	528	651	454	1103	2200	119	250	-	-	5	1560	-	-	-	-

TABLE 25.3.3 VEHICLE OPERATING COST SAVING

(UNIT : 1000 BAHT)

LINK NO.	1988			1994			2002		
	WITHOUT	WITH	SAVING	WITHOUT	WITH	SAVING	WITHOUT	WITH	SAVING
1	11,754	7,551	4,203	15,869	10,526	5,343	24,355	16,911	7,444
TOTAL	11,754	7,551	4,203	15,869	10,526	5,343	24,355	16,911	7,444

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

25.4 ENGINEERING

25.4.1 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 25.4.1 and Table 25.4.1, respectively.

Rock aggregate sources were assumed as shown below:

No.	Source	Description of Sample	Est. Quantity m^3
25/CS-1	KM. 13+400 Rt 2 KM. Surin-Prasat	Basalt	Plentiful
	KM. 14+450 Rt 2 KM. Surin-Prasat	Basalt	Plentiful
25/CS-2	KM. 14+450 Rt 2 KM. Surin-Prasat (Sirathanakit Quarry)	Basalt	Plentiful
25/CS-3	KM. 14+450 Rt 2.0 KM. Surin-Prasat	Basalt	Plentiful

FIGURE 25.4.1 SOIL AND MATERIAL SOURCES

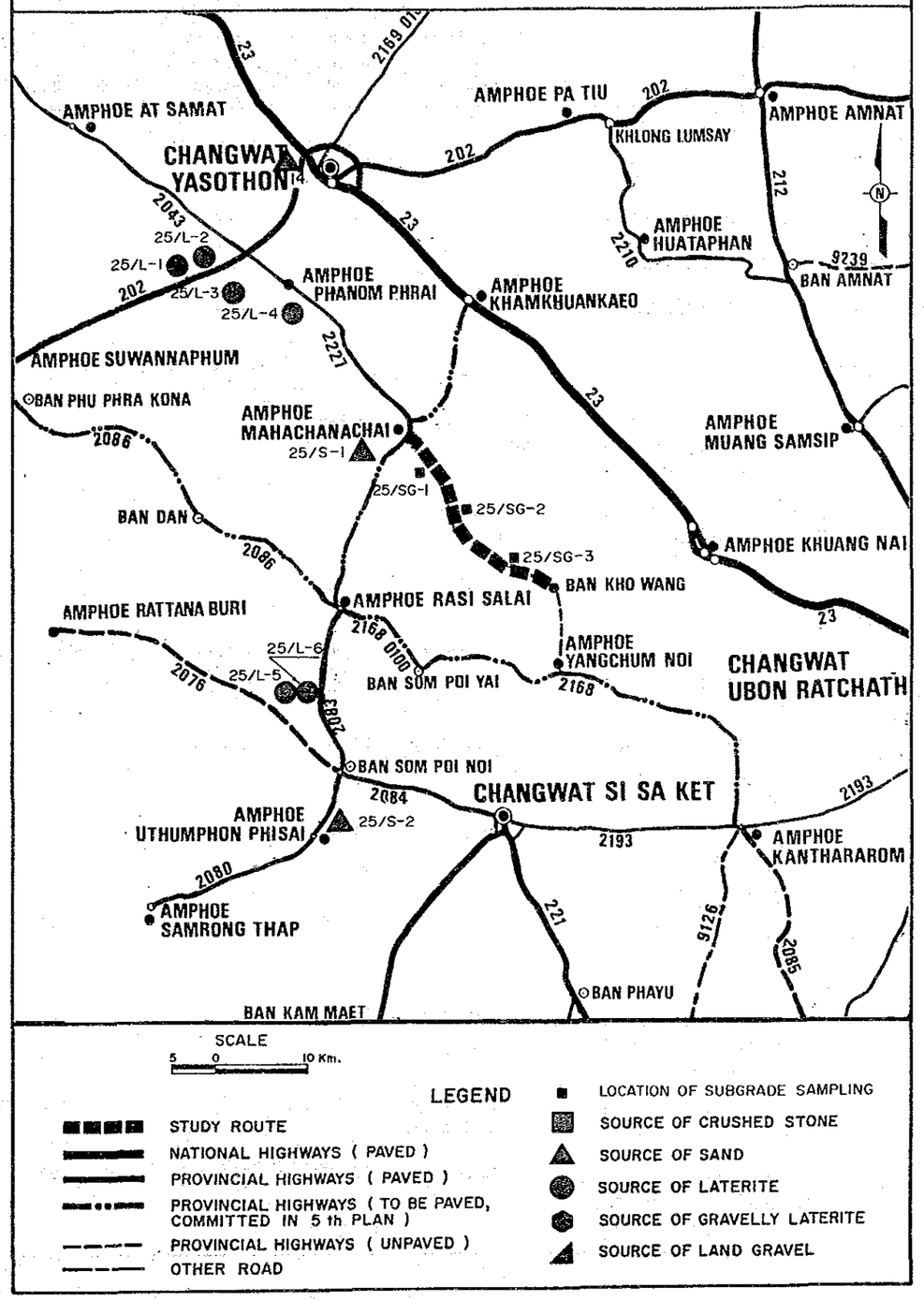


TABLE 25.4.1 PHYSICAL CHARACTERISTICS OF MATERIALS

No.	Source	Description of Sample	Est. Quantity m^3	AASHTO Classification	Sieve Analysis % Passing 50.0	25.0	19.0	9.5	#4	#10	#40	#200	Plasticity LL	PT	Comp. DH-T Stand. Opt. 95%	gm/cc	Lab. CBR 95%	C.B.R. Swell %	Durability Abr.	Dur.
SUBGRADE																				
25/SG-1.	KM. 6+100 Rt 12 M.			A-4						100	88.4	36.8		N-P	12.2	1.793	12.3	-		
25/SG-2.	KM. 13+100 Lt 12 M.			A-4					100	98.0	96.2	39.8		N-P	11.3	1.740	8.1	-		
25/SG-3.	KM. 20+500 Lt 15 M.			A-2-4					100	99.6	85.2	14.4		N-P	14.2	1.687	16.7	-		
SAND																				
25/S-1	KM. 51+100 Lt 700 M. Uthumphon Phisai - Kam Kern Kaew	Chi River sand	Plentiful							100	59	2		N.P.	Less color than standard					
25/S-2	KM. 1+500 Rt 100 M. Uthumphon Phisai - Kam Kern Kaew	Mun River sand								100	54	1		N.P.	Same as standard color					
LATERITE																				
25/L-1	KM. 21+900 Rt, Lt Suwan Na Phum - Yasothorn	Laterite	10,000	A-1-a		100	97.4	81.1	49.2	25.9	23.2	9.4		N.P.	8.5	2.420	60.0	0		
25/L-2	KM. 7+250 Rt 200 M. B. Nong Muan Tan - B. Nong Pug Sa	Laterite	10,000	A-2-A		100	78.1	47.8	33.6	28.9	19.7	28.1	8.4							
25/L-3	KM. 13+500 Rt 350 M. Pra Nom Phi - Suwan Na Phum	Laterite	20,000	A-1-6		100	87.0	51.8	31.8	24.0	15.1	24.8	5.8	8.5	2.252	39.0	0		
25/L-4	KM. 2+200 Lt 100 M. Pranom Phi - Suwan Na Phum	Laterite	5,000	A-2-4		100	96.7	80.1	48.9	30.6	24.5	18.1	19.6	4.7	8.7	2.168	37.0	0		
~~170~~	KM. 16+800 Lt 16 KM. Uthumphon Phisai - Kam Kern Kaew	Laterite	30,000			100	98.0	88.0	57.0	39.0	34.0	28.0	29.6	17.1					65.2	29.5
	L3:S1 = 3:2 by weight	Laterite and sand				100	99.0	91.0	69.0	56.0	39.0	19.0	17.0	10.0	10.4	2.124	63.9	-		
25/L-6	KM. 16+800 Lt 7.5 KM. Uthumphon Phisai - Kam Kern Kaew	Laterite	52,200	A-2-b	100	96	90.0	76.0	66.0	61.0	43.0	19.0	23.2	11.0	7.6	2.218	12.0	0.10	34.0	28.8

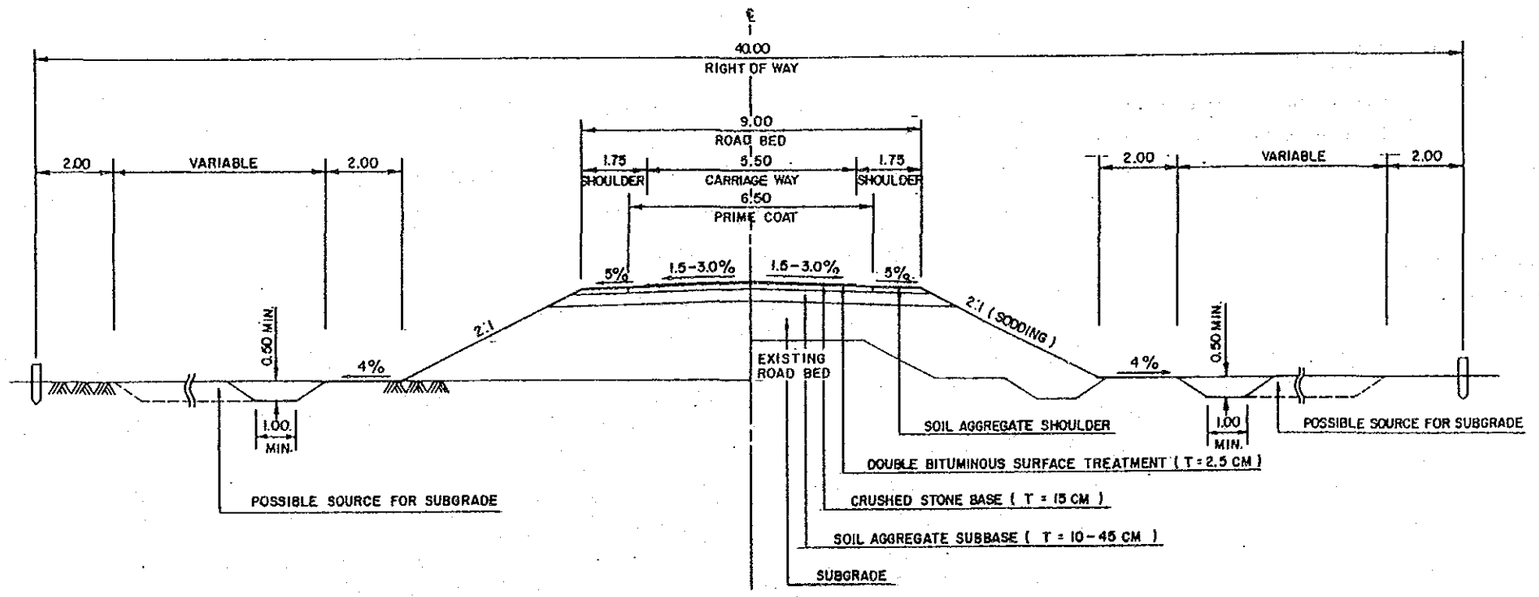
25.4.2 Preliminary Design

25.4.2.1 Design Criteria

Design Standard	:	F4
Geometric Design Criteria	:	DOH (Provincial Highway)
Typical Cross Section	:	as shown in Figure 25.4.2
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 25-1/25-3.

FIGURE 25.4.2 TYPICAL CROSS SECTION



PROVINCIAL HIGHWAY (CLASS F4)

25.4.2.3 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	10	—	—	—	13	—	—	—
Medium truck	29	—	—	—	52	—	—	—
Heavy truck	40	—	—	—	48	—	—	—

- Cumulative number of ESA in one direction by road link

Road link	1	2	3	4
7 years (10^6)	0.116	-	-	-

2) Design CBR values

Road link	1	2	3	4
Design CBR (%)	7.9	-	-	-

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
	10 cm	-	-	-

4) Overlay required in 7 years

DBST resurfacing

25.4.2.4 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
10 + 194	RC Bridge	7.0 x 30.0	-	-

25.4.3 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 25.4.2. Financial costs with breakdown into local and foreign currency portions, economic costs and residual values were estimated as follows and in 25.4.4:

IM—25 L = 24.5 km (baht)

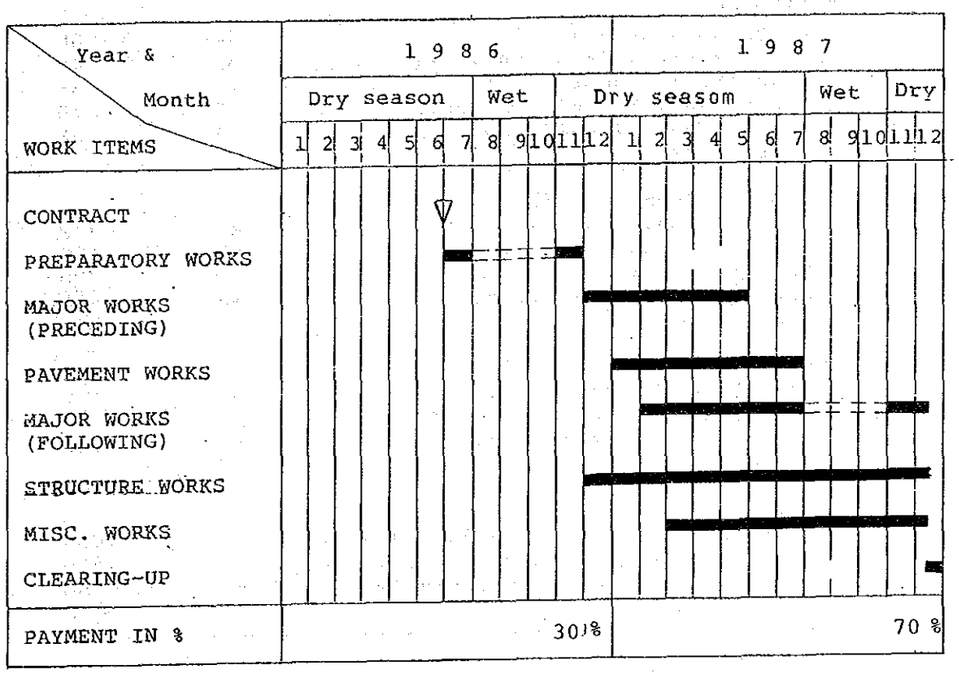
Financial cost	:	46,933,000
Economic cost	:	39,497,000
Residual value	:	17,963,000

The required road maintenance cost savings are shown in Table 25.4.3.

25.4.4 Construction and Disbursement Schedules

IM—25 **Length = 24.5 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 - 25)

(Unit : Million Baht)

	1986			1987			Total		
	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total
Construction Cost	7.2	6.8	14.0	17.0	16.0	33.0	24.2	22.8	47.0
Price Continsency	1.5	0.9	2.4	5.6	3.3	8.9	7.1	4.2	11.3
Total	8.7	7.7	16.4	22.6	19.3	41.9	31.3	27.0	58.3
	(0.32)	(0.29)	(0.61)	(0.84)	(0.71)	(1.55)	(1.16)	(1.00)	(2.16)

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

TABLE 25.4.2 CONSTRUCTION QUANTITIES AND COSTS
(ROUTE IM—25 Length = 24.5 km)

DBST

Item	Unit	Financial Unit Rate B	Quantity	Financial Cost 1000 B Total	Local	Foreign	Economic Cost %	Economic Cost 1000 B	Residual Value %	Residual Value 1000 B
EARTHWORK							83		90	
Clearing & Grubbing	ha	10,000	82	820						
Roadway Excavation, Unclassified	m3	19	800	15						
Embankment, Common Soil	m3	38	230,900	8,774						
Embankment, Selected Material	m3	70	0	0						
Replacement of Soft Spot	m3	88	3,100	273						
Sub Total				9,882	5,040	4,842		8,202		7,382
SUBBASE & BASE COURSES							83		50	
Subbase, Soil Aggregate	m3	112	23,000	2,576						
Aggregate Base*	m3	429	23,900	10,253						
Cement Stabilized Base	m3	390	0	0						
Shoulder, Soil Aggregate	m3	120	9,200	1,104						
Sub Total				13,933	7,524	6,409		11,564		5,782
SURFACE COURSES							85		50**	
Asphaltic Prime/Tack Coat	m2	12	159,300	1,912						
Double Bituminous Surface Treatment*	m2	40	134,800	5,392						
Asphaltic Concrete Surfacing**	t	750	0	0						
Sub Total				7,304	3,214	4,090		6,208		0
STRUCTURES							83		50	
RC Pipe Culvert (D 1.0m Equivalent)	m	2,000	1,886	3,772						
RC Box Culvert (2.4mx2.4m Equivalent)	m	18,800	0	0						
RC Bridge(W=9.0m L=10m Equivalent)	m	46,500	0	0						
Sub Total				3,772	1,886	1,886		3,131		1,565
Total (a)				34,891	17,663	17,228		29,106		14,730
INCIDENTALS							83		0	
Miscellaneous Work ((a)x7%)	ls			2,442	1,221	1,221		2,027		0
CONTRACT AMOUNT (b)				37,333	18,885	18,449		31,133		14,730
PHYSICAL CONTINGENCIES ((b)x10%) (c)	ls			3,733	1,888	1,845		3,113		1,473
ENGINEERING AND SUPERVISION							85		0	
(((b)+(c))x10%) (d)	ls			4,107	1,643	2,464		3,491		0
LAND ACQUISITION							100		100	
Highly Developed Land	ha	50,000	34	1,700						
Less Developed Land	ha	15,000	4	60						
Sub Total (e)	ls			1,760	1,760	0		1,760		1,760
PROJECT COST ((b)+(c)+(d)+(e))				46,933	24,176	22,758		39,497		17,963
AVERAGE COST PER KM				1,916						

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

TABLE 25.4.3 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	137.5	24.5	0.16	1.13	11,900	292	156.2	24.5	0.00	1.14	12,793	313	-22
	1994	201.4	24.5	0.30	1.23	12,992	318	239.2	24.5	0.00	1.14	12,793	313	5
	2002	356.7	24.5	0.66	1.49	15,650	383	441.6	24.5	0.00	1.14	12,793	313	70
TOTAL	1988	137.5	24.5			11,900	292	156.2	24.5			12,793	313	-22
	1994	201.4	24.5			12,992	318	239.2	24.5			12,793	313	5
	2002	356.7	24.5			15,650	383	441.6	24.5			12,793	313	70

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 = 1.02 + 0.70 * A1
WITH PROJECT CASE KB = 1.14 + 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

25.5 EVALUATION

25.5.1 Economic Evaluation

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

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

COST AND BENEFIT STATEMENT OF ROUTE IM - 25

(1000 BAHT)

YEAR	COST	BENEFITS				DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	TOTAL COST	TOTAL BENEFIT
1986	11,849	0	0	0	0	14,863	0
1987	27,648	0	0	0	0	30,966	0
1988	0	849	4,203	-22	5,030	0	4,491
1989	0	900	4,393	-17	5,275	0	4,205
1990	0	951	4,583	-13	5,521	0	3,929
1991	0	1,001	4,773	-8	5,766	0	3,664
1992	0	1,052	4,963	-4	6,011	0	3,411
1993	0	1,103	5,153	0	6,256	0	3,170
1994	0	1,154	5,343	5	6,502	0	2,941
1995	8,934	1,205	5,605	13	6,824	4,041	2,756
1996	0	1,257	5,868	21	7,146	0	2,577
1997	0	1,308	6,131	29	7,468	0	2,405
1998	0	1,360	6,393	37	7,790	0	2,240
1999	0	1,411	6,656	46	8,112	0	2,082
2000	0	1,462	6,919	54	8,435	0	1,933
2001	0	1,514	7,181	62	8,757	0	1,792
2002	-17,963	1,565	7,444	70	9,079	-3,282	1,659
TOTAL	30,468	18,092	85,607	273	103,971	46,589	43,255
DISCOUNTED	46,589	7,511	35,708	35	43,255		

NET PRESENT VALUE : -3,334

BENEFIT/COST RATIO : 0.93

INTERNAL RATE OF RETURN : 11.0 %

FIRST YEAR RATE OF RETURN : 9.8 %

OPTIMUM OPENING YEAR : 1989

SENSITIVITY TESTS

ITEM	CASE		
	BASE	1	2
NET PRESENT VALUE	-3,334	-10,322	-9,822
BENEFIT/COST RATIO	0.93	0.81	0.79
INTERNAL RATE OF RETURN	11.0 %	9.3 %	9.1 %
FIRST YEAR RATE OF RETURN	9.8 %	8.5 %	8.3 %
COSTS	BASE	+15%	BASE
BENEFITS	BASE	BASE	-15%

25.5.2 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) : 39.5

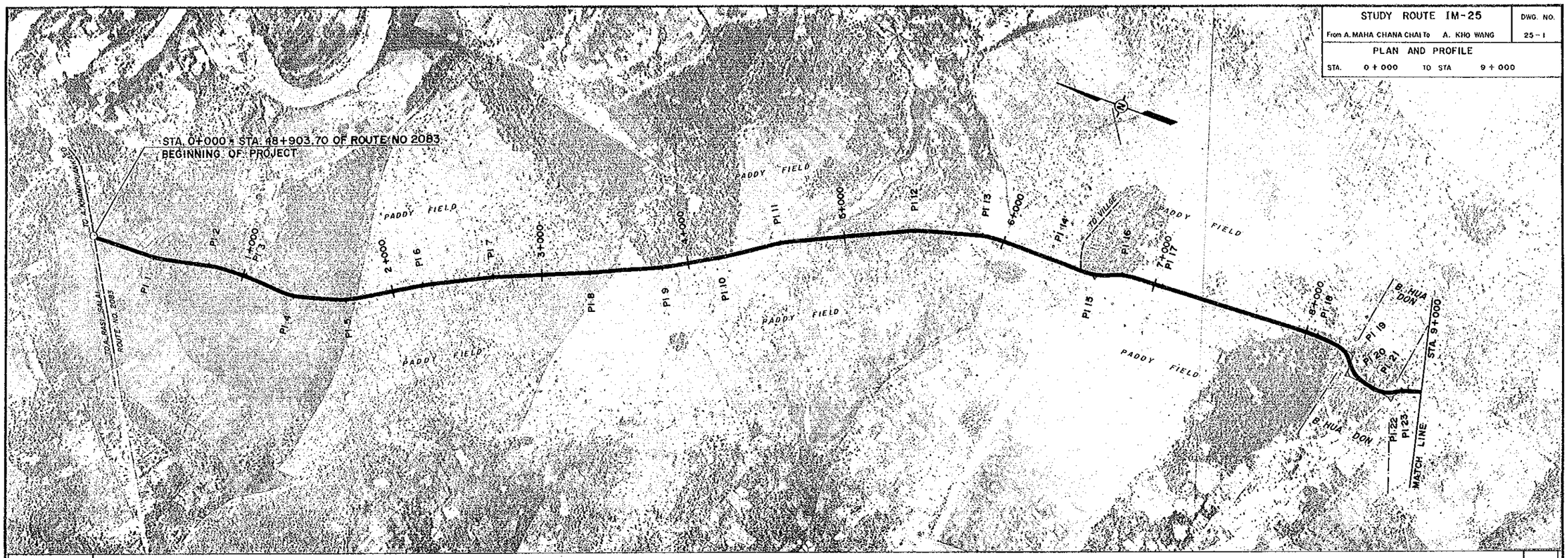
1) General Accessibility Benefit (million baht) : 2.42
2) Education Benefit (million baht) : 3.04
3) Medical Care Benefit (million baht) : 0.055
4) Total Social Benefits (million baht) (1+2+3) : 5.52
5) Social Benefit/Cost Ratio ($\times 10^{-2}$) : 13.97
6) Ranking by Social Benefit : 7
7) Weighted Production Value Gain/Cost ($\times 10^{-2}$) : 3.11
8) Ranking by 7 : 14
9) Combined Ratio ($\times 10^{-2}$) : 17.08

Overall Ranking : 10

25.5.3 Overall Evaluation

It is concluded that, considering the overall ranking and possible schedule of the improvement of the study routes with due consideration to the prevailing opportunity cost of capital, the improvement of this study route with the opening year 1989 is recommended.

STUDY ROUTE IM-25	DWG. NO.
From A. MAHA CHANA CHAI To A. KHO WANG	25 - 1
PLAN AND PROFILE	
STA. 0 + 000 TO STA 9 + 000	

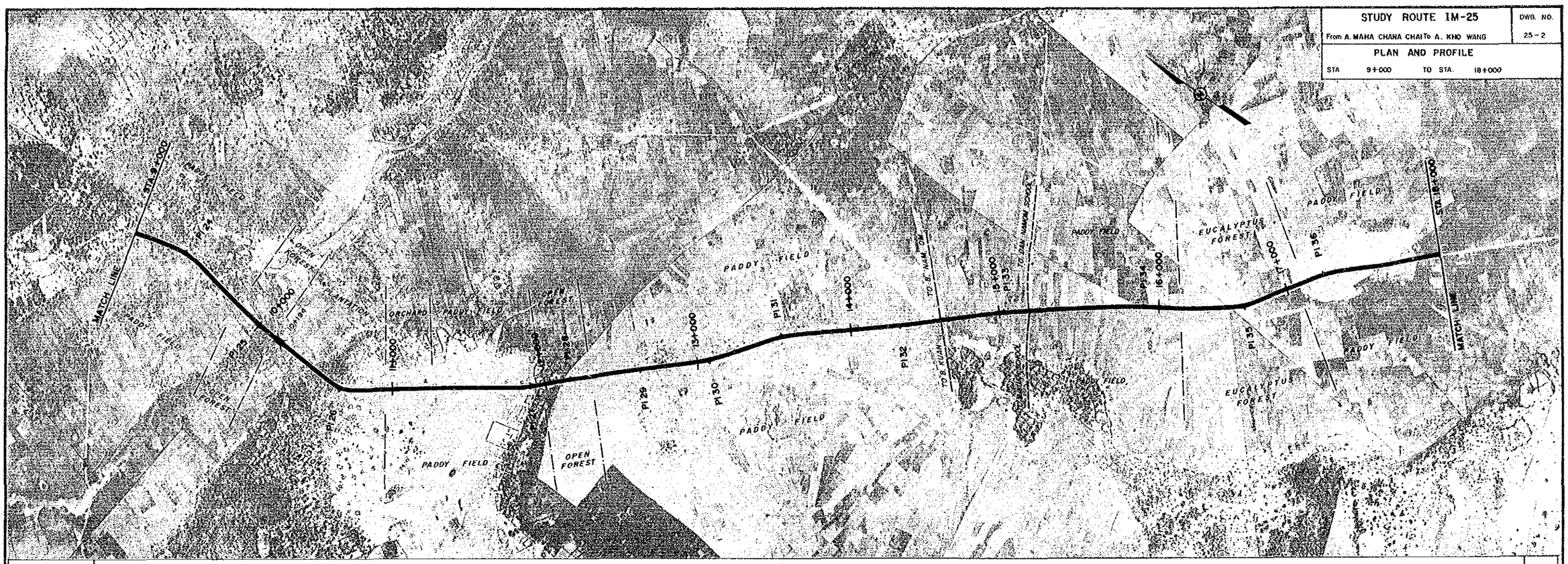


TERRAIN		FLAT
PAVEMENT	Type	LATERITE
	Condition	POOR
FLOODING	Length (m.)	8,200
	Height (m.)	0.10 ~ 1.30
RIGHT OF WAY (m.)		
ROUTE NO. AGENCIES		A R D

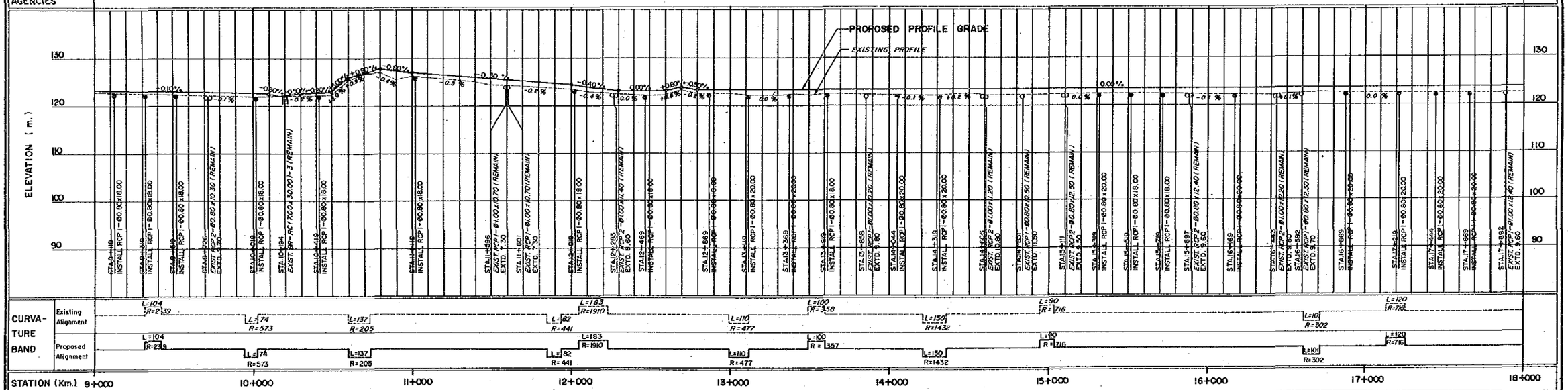
ELEVATION (m.): 130, 120, 110, 100, 90

CURVATURE BAND		STATION (Km.) 0 + 000	1 + 000	2 + 000	3 + 000	4 + 000	5 + 000	6 + 000	7 + 000	8 + 000	9 + 000
	Existing Alignment		L = 131 R = 716	L = 75 R = 573	L = 66 R = 573	L = 98 R = 286	L = 152 R = 573	L = 142 R = 1910	L = 102 R = 1146	L = 133 R = 1432	L = 119 R = 1910	L = 59 R = 409	L = 113 R = 716	L = 96 R = 358	L = 73 R = 159	L = 68 R = 191	X RA = 90° L = 45 R = 35	L = 122 R = 151
	Proposed Alignment		L = 131 R = 716	L = 75 R = 573	L = 66 R = 573	L = 98 R = 286	L = 152 R = 573	L = 142 R = 1910	L = 102 R = 1146	L = 133 R = 1432	L = 119 R = 1910	L = 59 R = 409	L = 113 R = 716	L = 96 R = 358	L = 73 R = 159	L = 68 R = 191	L = 160 R = 100	L = 135 R = 100	L = 122 R = 151

STUDY ROUTE IM-25	DWG. NO.
From A. MAHA CHANA CHAITo A. KHO WANG	25 - 2
PLAN AND PROFILE	
STA 9+000 TO STA. 18+000	

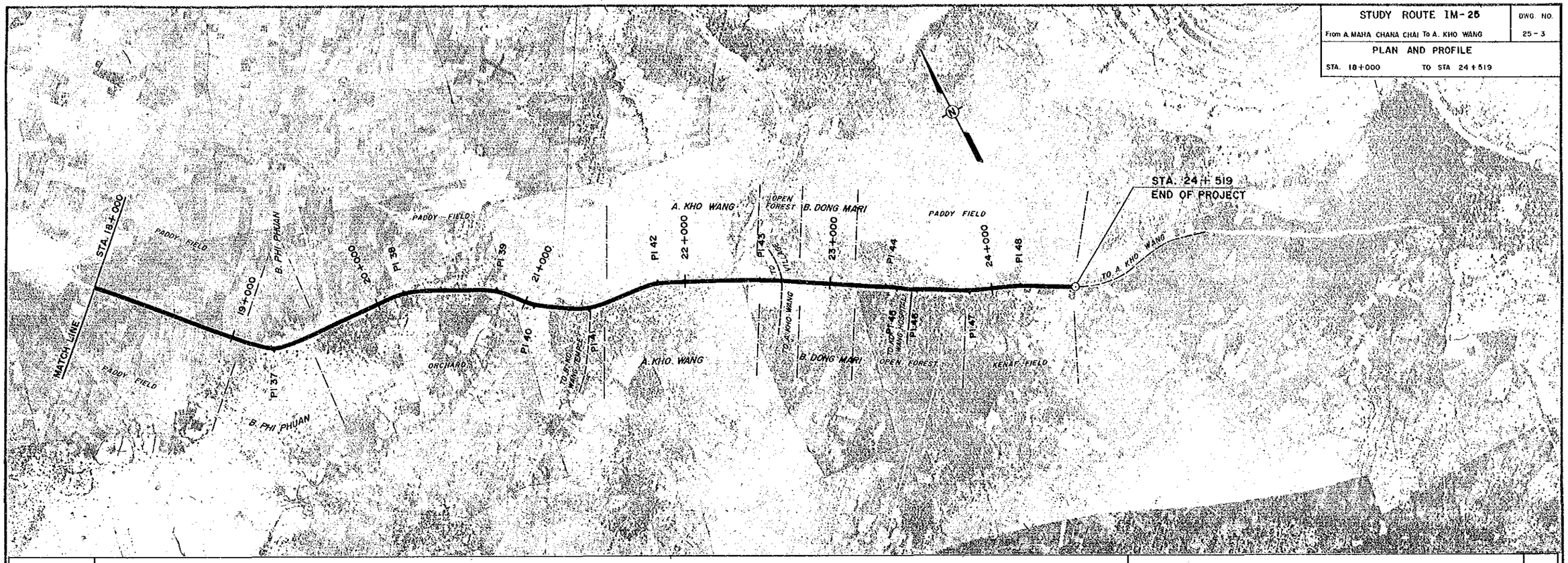


TERRAIN		FLAT
PAVEMENT	Type	LATERITE
	Condition	POOR
FLOODING	Length (m)	
	Height (m)	
RIGHT OF WAY (m.)		
ROUTE NO. AGENCIES		ARD

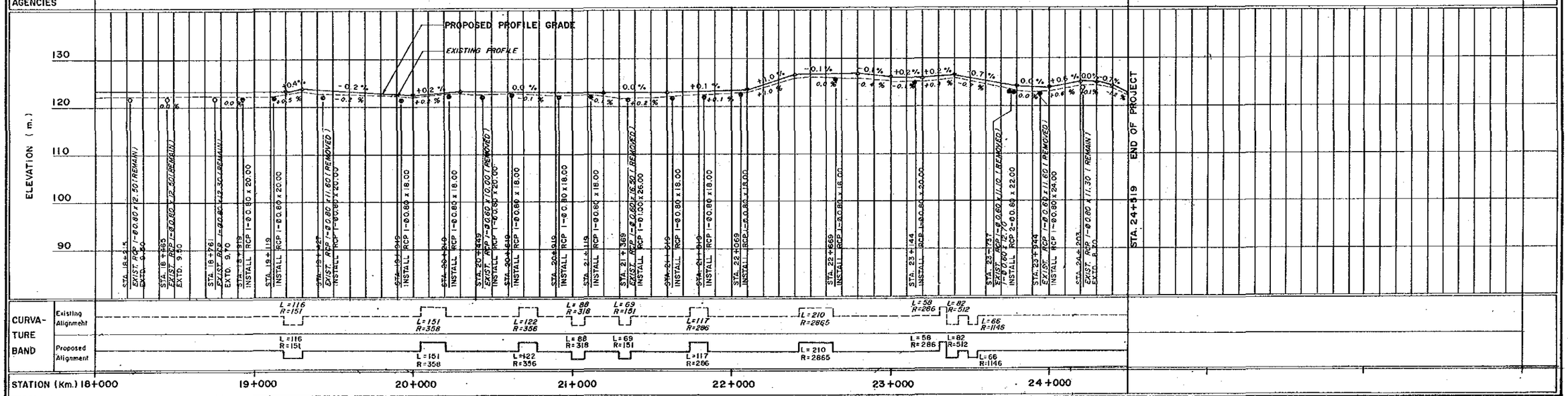


CURVATURE BAND	Existing Alignment	L=104 R=239; L=74 R=573; L=137 R=205; L=183 R=1910; L=82 R=441; L=110 R=477; L=100 R=358; L=150 R=1432; L=90 R=716; L=101 R=302; L=120 R=716
	Proposed Alignment	L=104 R=239; L=74 R=573; L=137 R=205; L=183 R=1910; L=82 R=441; L=110 R=477; L=100 R=357; L=150 R=1432; L=90 R=716; L=101 R=302; L=120 R=716
STATION (Km.)		9+000 10+000 11+000 12+000 13+000 14+000 15+000 16+000 17+000 18+000

STUDY ROUTE IM-25	DWG. NO.
From A. MAHA CHANA CHAI To A. KHO WANG	25 - 3
PLAN AND PROFILE	
STA. 18+000 TO STA 24+519	



TERRAIN		FLAT
PAVEMENT	Type	LATERITE
	Condition	POOR
FLOODING	Length (m) / Height (m)	
RIGHT OF WAY (m.)		
ROUTE NO. AGENCIES		A R D



CURVATURE BAND	Existing Alignment	L=116 R=151; L=151 R=358; L=122 R=356; L=88 R=318; L=69 R=151; L=117 R=286; L=210 R=2865; L=58 R=286; L=82 R=512; L=66 R=1146
	Proposed Alignment	L=116 R=151; L=151 R=358; L=122 R=356; L=88 R=318; L=69 R=151; L=117 R=286; L=210 R=2865; L=58 R=286; L=82 R=512; L=66 R=1146
STATION (Km.)		18+000 19+000 20+000 21+000 22+000 23+000 24+000

STUDY ROUTE NO. IM - 26

Changwat : Surin / Si Sa Ket

B. Som Poi Noi (J.R.2080, 2083, 2084) - B. Muang Mak

Length : 28.4 KM.

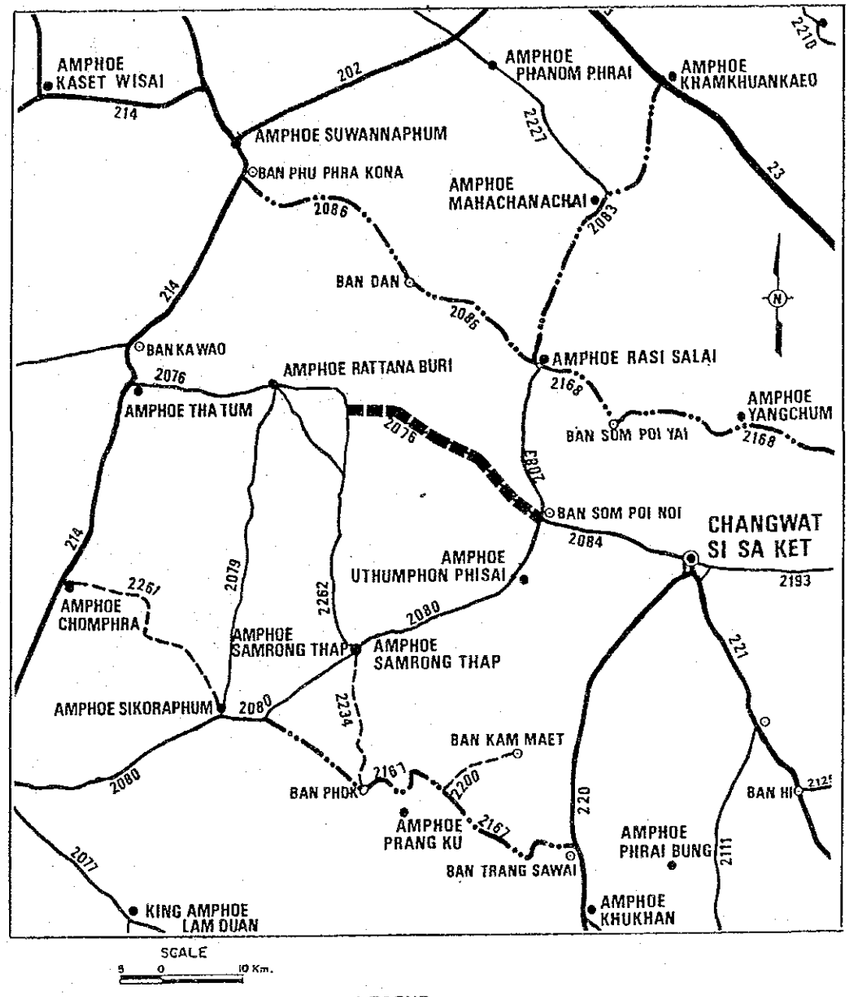
TABLE OF CONTENTS

SUMMARY

STUDY ROUTE IM-26

General		
Changwat	:	Surin/Si Saket
Origin and Destination	:	B. Som Poi Noi—B. Muang Mak
Connected Road Network	:	2080, 2083, 2084 & 2262
Amphoe on Route	:	-
Number of Related Villages	:	6
Influence Area		
Area	:	232 km^2
Cultivated Area Ratio to		
Total Land Area in %	:	79
Population in 1983	:	37,300
Main Crops	:	Paddy & Kenaf
Number of Public Activities		
Public Health Service Centers	:	-
Hospitals Changwat Level	:	-
Amphoe Level	:	1
Schools Primary	:	8
Secondary	:	1
Traffic (ADT)	:	1984—128 1988—219
		1994—308 2002—497
Nomenclature of Study Route		
Total Length	:	28.4 km
Improvement Section	:	28.4 km
DOH Road	:	28.4 km
ARD Road	:	-
Other Road	:	-
New Construction Section	:	-
Design Standard Employed	:	F4
Construction Cost in Baht		
Financial	:	47,336,000
Economic	:	39,558,000
Economic Indicators		
IRR	:	11.6% Ranking: 12
Social Impact		
Social B/C Ratio	:	0.224 Ranking: 8
Recommendations		
Opening Year	:	1990 Overall Ranking: 12

LOCATION OF STUDY ROUTE

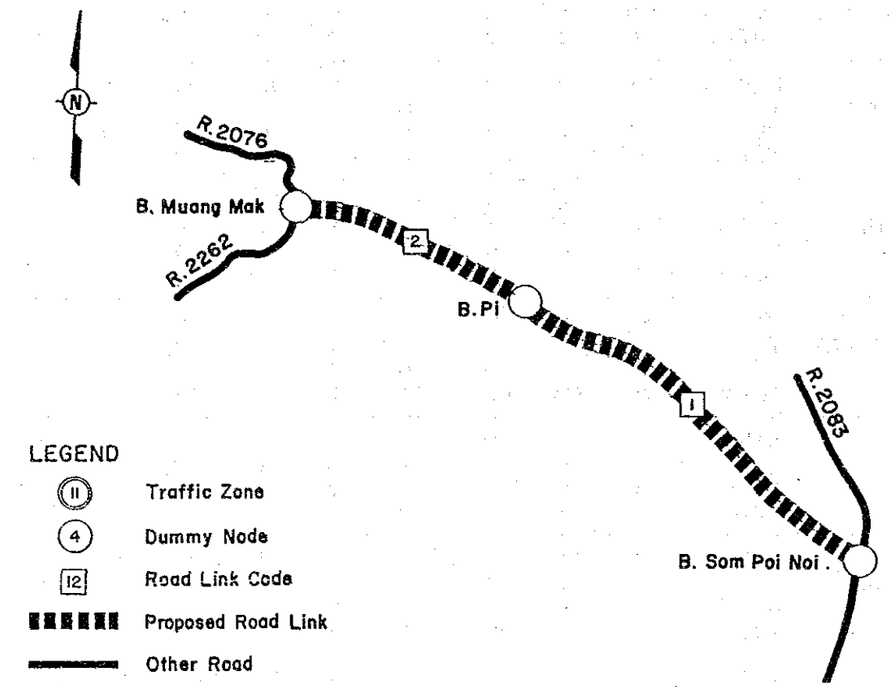


26.1 TRAFFIC

26.1.1 Method Employed in Traffic Forecasting

The growth rate method was employed in forecasting traffic because no diverted traffic after improvement was expected on this study route.

26.1.2 Assumed Road Link



26.1.3 Traffic Forecast

1) Items necessary for forecasting traffic were:
   - Traffic volume in base year
   - Passenger and freight movement in base year
   - Growth rates of passenger and freight movement
   - Rate of induced and developed movement
   - Traffic composition

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	24	8	49	2	31	3	25	22	164	107	271
2	18	0	3	5	23	0	9	6	64	95	159
AVE.	22	5	32	3	28	2	19	16	128	103	230

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	1439	154.0	60.0	213.9
2	393	45.6	17.8	63.4

GROWTH RATE OF PASSENGER MOVEMENT

(UNIT : % P.A.)

YEAR	PER CAPITA INCOME	POPULATION	PASSENGER MOVEMENT
1984 - 1988	3.1	0.9	5.3
1988 - 1994	3.1	0.7	5.2
1994 - 2002	3.1	0.6	5.1

GROWTH RATE OF FREIGHT MOVEMENT

(UNIT : % P.A.)

YEAR	NON-AGRI. FREIGHT	AGRI. FREIGHT	FREIGHT MOVEMENT
1984 - 1988	6.6	0.0	4.9
1988 - 1994	6.4	0.0	5.1
1994 - 2002	6.3	0.0	5.4

RATE OF INDUCED AND DEVELOPED MOVEMENT

(UNIT : %)

YEAR	INDUCED LINK 1	INDUCED LINK 2	DEVELOPED PASSENGER MOVEMENT	DEVELOPED NON-AGRI. FREIGHT MOVEMENT	DEVELOPED AGRI. FREIGHT MOVEMENT
1988	15.0	15.0	0.0	0.0	0.3
1994	15.0	15.0	0.0	0.0	1.8
2002	15.0	15.0	0.0	0.0	3.9

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	27.8	30.1	5.7	35.0	1.4	9.1	5.5	45.5	40.0
1	1988	30.3	31.9	5.1	30.1	2.7	10.0	6.7	46.5	36.9
	1994	34.0	34.5	4.2	22.8	4.5	11.3	8.5	48.0	32.2
	2002	39.0	38.0	3.0	13.0	7.0	13.0	11.0	50.0	26.0
	1984	45.8	48.4	0.0	2.2	3.6	21.1	0.0	47.4	31.6
2	1988	44.3	46.1	0.7	4.6	4.4	19.3	2.4	48.0	30.3
	1994	42.0	42.6	1.7	8.2	5.5	16.6	6.1	48.8	28.5
	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	53	7	39	5	62	4	28	22	219	271	490
1994	78	8	44	10	90	7	42	28	308	315	623
2002	137	11	46	25	152	16	74	38	497	377	875

TRAFFIC VOLUME ON ROUTE IM- 26 LINK COUNT= 2

	YEAR	1988 1	1988 2	1988 AVR.	1994 1	1994 2	1994 AVR.	2002 1	2002 2	2002 AVR.
	LINK									
P/C	N+D	51	37	46	84	39	68	161	44	119
	I	8	5	7	13	6	10	24	7	18
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	59	42	53	97	45	78	185	51	137
L/B	N+D	9	1	6	10	2	7	12	3	9
	I	1	0	1	2	0	1	2	1	1
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	10	1	7	12	2	8	14	4	11
M/B	N+D	51	4	34	56	8	39	54	15	40
	I	8	1	5	8	1	6	8	2	6
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	58	4	39	65	9	44	62	17	46
H/B	N+D	5	4	4	11	5	9	29	8	21
	I	1	1	1	2	1	1	4	1	3
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	5	4	5	13	6	10	33	9	25
P/P&T	N+D	61	42	54	97	45	78	179	49	132
	I	9	6	8	15	7	12	27	7	20
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	70	49	62	111	52	90	206	57	152
4/T	N+D	5	1	3	9	2	6	19	6	14
	I	1	0	0	1	0	1	3	1	2
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	5	1	4	10	2	7	22	6	16
6/T	N+D	32	11	25	48	16	37	86	25	64
	I	5	2	4	7	2	5	13	4	10
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	37	13	28	56	18	42	99	29	74
10/T	N+D	26	7	19	33	9	24	45	13	33
	I	4	1	3	5	1	4	7	2	5
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	30	8	22	38	11	28	51	15	38
ADT	N+D	239	106	190	349	125	268	585	164	432
	I	36	16	29	52	19	40	88	25	65
	DV	0	0	0	0	0	0	1	0	1
	TOTAL	274	122	219	401	144	308	673	188	497
M/C	N+D	294	176	251	349	200	295	424	239	357
	I	20	20	20	20	20	20	20	20	20
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	314	196	271	369	221	315	444	260	377
TOTAL	N+D	532	282	441	697	325	562	1009	403	789
	I	56	36	49	73	39	60	108	45	85
	DV	0	0	0	0	0	0	1	0	1
	TOTAL	588	318	490	770	365	623	1118	448	875

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