KINGDOM OF THAILAND
MINISTRY OF COMMUNICATIONS
DEPARTMENT OF HIGHWAYS

ROAD DEVELOPMENT STUDY IN THE NORTHEASTERN REGION (PHASE II)

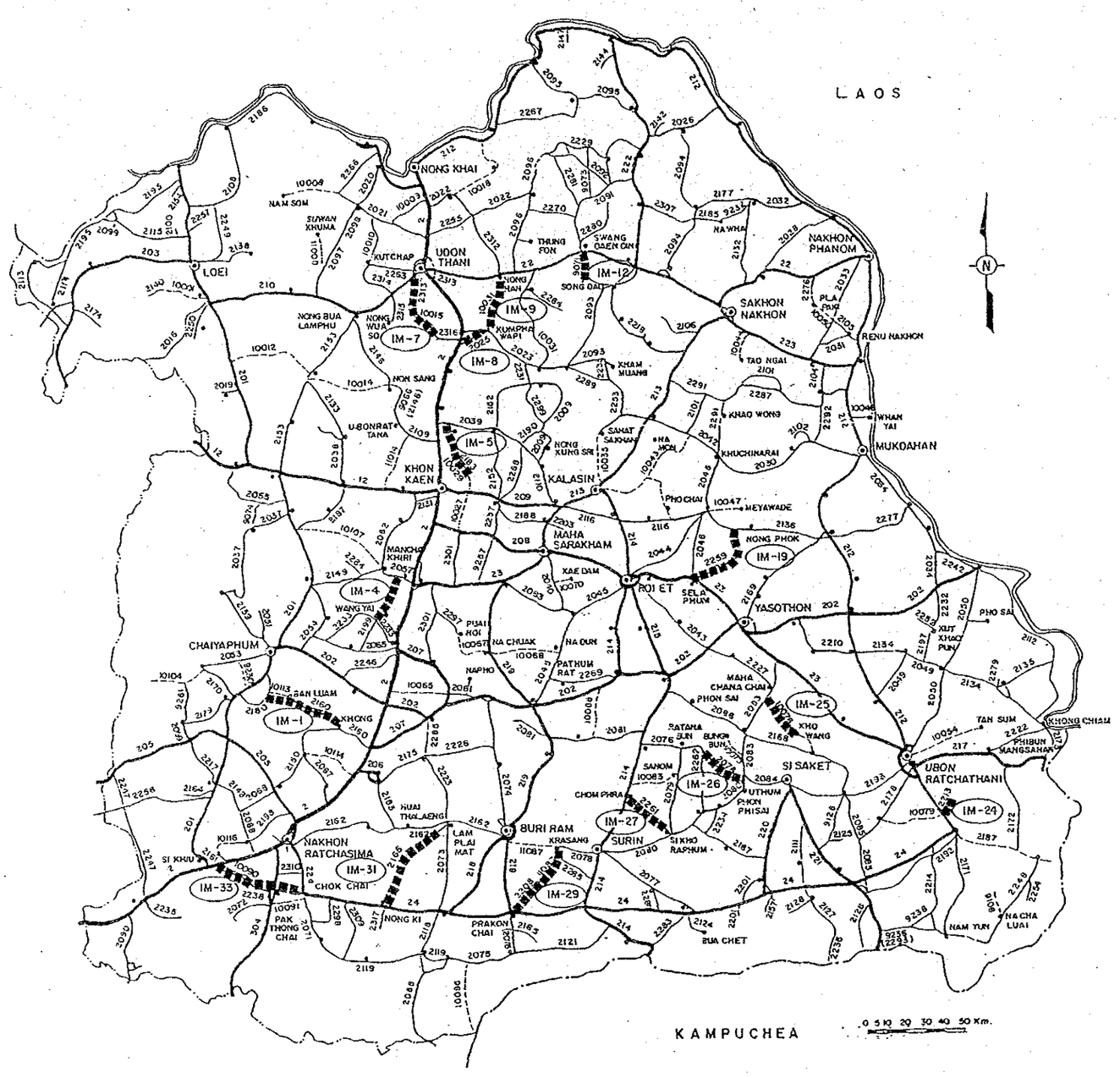
FINAL REPORT
ROUTES
(VOLUME 3)

KINGDOM OF THAILAND
MINISTRY OF COMMUNICATIONS
DEPARTMENT OF HIGHWAYS

ROAD DEVELOPMENT STUDY IN THE NORTHEASTERN REGION (PHASE II)

FINAL REPORT
ROUTES
(VOLUME 3)

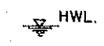
JULY, 1985
JAPAN INTERNATIONAL COOPERATION AGENCY



STUDY ROUTES

ROUTE NO.	CHANGWAT	ORIGIN	DESTINATION	PAGE	DRAWING NO.
IM- 1	Nakhon Ratchasima/ Chaiyaphum	A. Khong	-J.R. 2180	1-1/ 1-33	1-1/ 1-6
IM- 4	Khon Kaen	A. Chonnabot	-B. Don Han	4-1/ 4-27	4-1/ 4-3
IM- 5	Khon Kaen	A. Nam Phong	-B. Nong Tum	5-1/ 5-29	5-1/ 5-4
IM- 7	Udon Thani	B. Lao (J.R. 210)	-B. Tha Yom	7-1/ 7-31	7-1/ 7-5
IM- 8	Udon Thani	B. Huai Koeng	-A. Kumphawapi	8-1/ 8-25	8-1/ 8-2
IM- 9	Udon Thani	A. Nong Han	-A. Kumphawapi	9-1/ 9-29	9-1/ 9-4
IM-12	Sakon Nakhon	A. Sawang Daen Din	-A. Song Dao	12-1/12-27	12-1/12-3
IM-19	Roi Et	A. Selaphum	-B. Kham Phon Sung	19-1/19-35	19-1/19-6
IM-24	Ubon Ratchathani	B. Na Suang	-B. Na Yia	24-1/24-25	24-1/24-2
IM-25	Yasothon	A. Maha Chana Chai	-A. Kho Wang	25-1/25-27	25-1/25-3
IM-26	Surin/Si Sa Ket	B. Som Poi Noi	-B. Muang Mak	26-1/26-29	26-1/26-4
IM-27	Surin/Buri Ram	A. Chom Phra	-B. Nong Khawao	27-1/27-29	27-1/27-4
IM-29	Buri Ram/Surin	A. Prakhon Chai	-A. Krasang	29-1/29-33	29-1/29-6
IM-31	Buri Ram	B. Nong Pha Ong	-A. Nong Ki	31-1/31-33	31-1/31-6
IM-33	Nakhon Ratchasima	A. Si Khiu (J.R. 2)	-A. Chok Chai	33-1/33-33	33-1/33-6

ABBREVIATIONS and SYMBOLS for PLAN and PROFILE

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

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

RC-P-n-ϕa×1	PIPE CULVERT, n (ROW), ϕa (DIAMETER, m), 1 (LENGTH, m)
RC-B-n-a×b×1	BOX CULVERT, n (NO. OF CELLS), a×b×1 (CLEAR SPAN × DEPTH × LENGTH, m)
BR-T-a×1−n	TIMBER BRIDGE, a×1 (WIDTH × LENGTH, m), n (NO. OF SPANS)
BR-RC-a×1−n	CONCRETE BRIDGE, a×1 (ROADWAY WIDTH × LENGTH, m) n (NO. OF SPANS)

STUDY ROUTE NO. IM-1

Changwat : Nakhon Ratchasima / Chaiyaphum

A. Khong – J.R. 2180

Length : 46.8 KM.

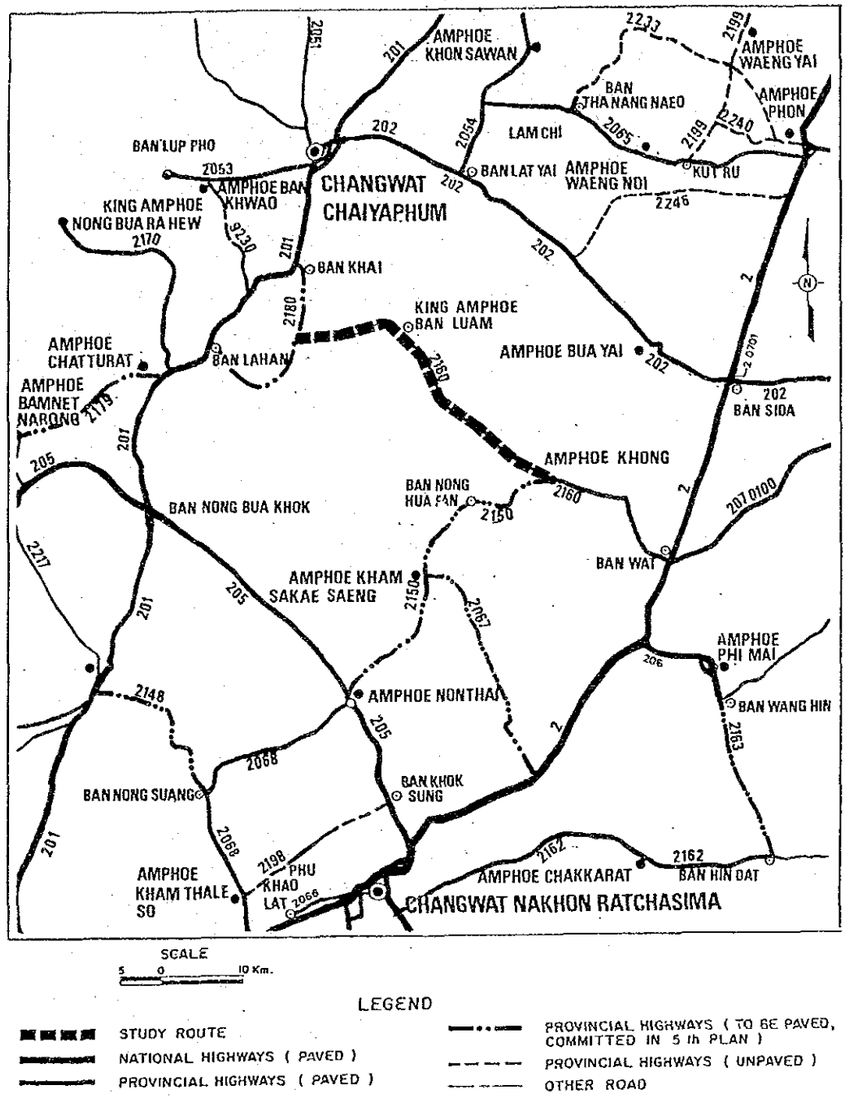
TABLE OF CONTENTS

SUMMARY

STUDY ROUTE IM-1

General		
Changwat	:	Nakhon Ratchasima/Chaiyaphum
Origin and Destination	:	A. Khong—J.R. 2180
Connected Road Network	:	2150 & 2160—2180
Amphoe on Route	:	K.A. Ban Luam
Number of Related Villages	:	9
Influence Area		
Area	:	348 km^2
Cultivated Area Ratio to Total Land Area in %	:	76
Population in 1983	:	33,300
Main Crops	:	Paddy & Cassava
Number of Public Activities		
Public Health Service Centers	:	-
Hospitals Changwat Level	:	-
Amphoe Level	:	1
Schools Primary	:	18
Secondary	:	2
Traffic (ADT)	:	1984—122 1988—294 1994—384 2002—560
Nomenclature of Study Route		
Total Length	:	46.8 km
Improvement Section	:	40.0 km
DOH Road	:	32.4 km
ARD Road	:	3.6 km
Other Road	:	4.0 km
New Construction Section	:	6.8 km
Design Standard Employed	:	F4
Construction Cost in Baht		
Financial	:	90,643,000
Economic	:	76,022,000
Economic Indicators		
IRR	:	14.1% Ranking: 9
Social Impact		
Social B/C Ratio	:	0.164 Ranking: 12
Recommendations		
Opening Year	:	1988 Overall Ranking: 9

LOCATION OF STUDY ROUTE



1.1 TRAFFIC

1.1.1 Method Employed in Traffic Forecasting

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

1.1.2 Traffic Zones and Road Links

These are shown in Figure 1.1 and Tables 1.1.1 and 1.1.2.

FIGURE 1.1 TRAFFIC ZONES AND LINKS

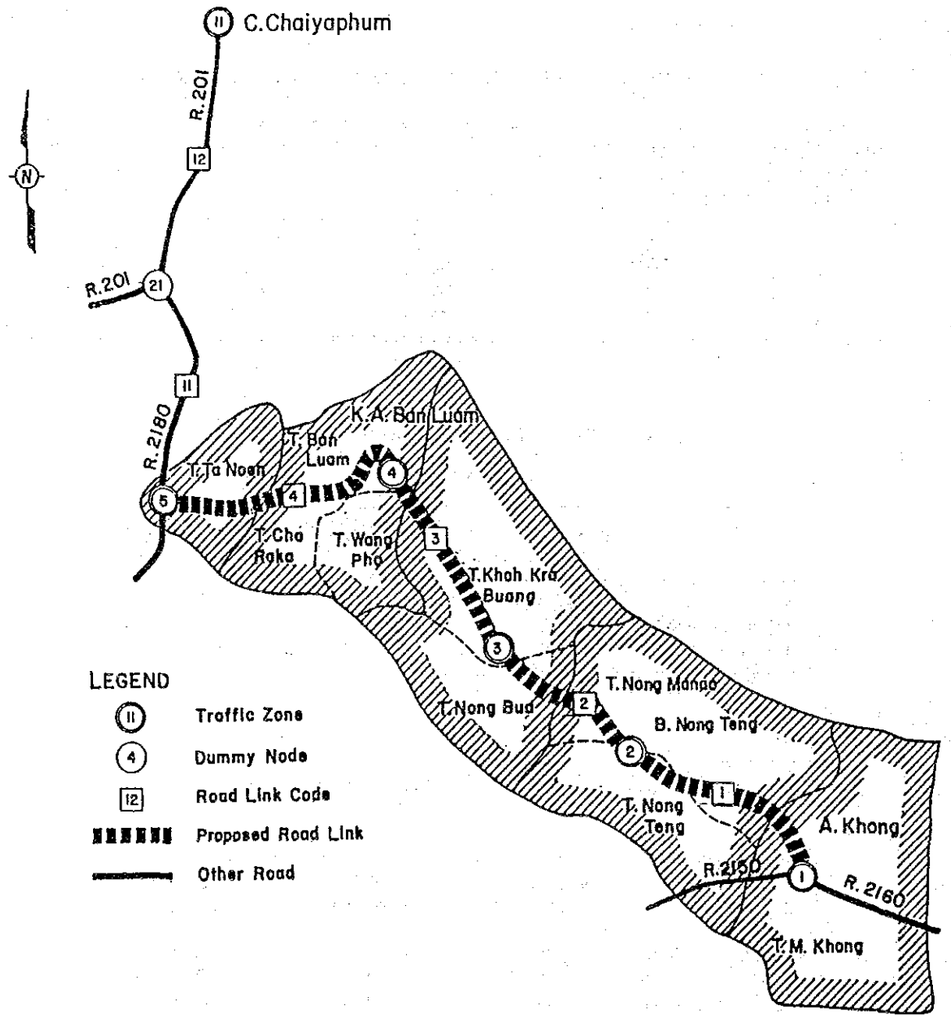


TABLE 1.1.1 TRAFFIC LINKS

Link Code	Node Pair				Length		Grade		Remarks
	Start Node		End Node		$\bar{W}$	W	$\bar{W}$	W	
1	1	A. Khong	2	B. Nong Teng	11.9	11.9	9	4	R. 2160
2	2	B. Nong Teng	3	J. ARD	8.9	8.9	9	4	R. 2160
3	3	J. ARD	4	K.A. Ban Luam	10.2	10.2	9	4	R. 2160
4	4	K.A. Ban Luam	5	J.R. 2180	15.8	15.8	11	4	ARD. Rural
11	5	J.R. 2180	21	J.R. 201	11.0	11.0	4	4	R. 2180
12	21	J.R. 201	11	C. Chaiyaphum	15.0	15.0	3	3	R. 201

TABLE 1.1.2 TRAFFIC ZONES

ZONE	Administrative Division						Population (1000 Persons)			
	Changwat		Amphoe		Tambon		Tambon	%	Zone	Attraction
1	13	Nakhon Ratchasima	04	Khong	01	N. Khong	18,446	100	18.4	75.0
2	13	Nakhon Ratchasima	04	Khong	06	Nong Manao	6,141	80	4.9	
					08	Nong Teng	5,061	70	3.5	
						Total			8.4	
3	13	Nakhon Ratchasima	03	Ban Luam	03	Khoh Kra Buang	5,640	70	3.9	
			04	Khong	07	Nong Bua	5,012	60	3.0	
						Total			6.9	
4	13	Nakhon Ratchasima	03	Ban Luam	01	Ban Luam	6,417	100	6.4	
					04	Cho Raka	4,652	40	1.9	
						Total			8.3	20.4
5	12	Chaiyaphum	13	Chatturat	08	Ta Noen	8,563	20	1.7	
					09	Kahad	4,681	30	1.4	
						Total			3.1	
11	12	Chaiyaphum	01	Muang	01	M. Chaiyaphum	-	-	-	164.5

1.1.3 Traffic Forecast

1) Items necessary for forecasting traffic were:
   - Passenger O/D table (1984)
   - 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

PASSENGER O/D TABLE (1984)

Zone	1	2	3	4	5	11
1	0	517	304	273	73	392
2	0	0	216	382	52	254
3	0	0	0	313	65	246
4	0	0	0	0	127[1/]	369
5	0	0	0	0	0	0
11	0	0	0	0	0	0

Note: 1/ 14 railway passengers per day at present were subtracted from the total passengers per day between Zone 4 and 5 by applying the modal split model.

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	5	12	36	2	54	10	22	8	148	224	372
2	5	12	36	2	54	10	22	8	147	224	371
3	5	11	34	2	51	10	21	7	141	218	359
4	3	6	19	1	28	5	10	4	75	127	202
AVE.	4	10	30	1	45	8	18	6	122	190	311

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	1153	60.3	57.7	118.1
2	1149	60.1	57.5	117.6
3	1106	57.4	54.9	112.2
4	619	27.9	26.7	54.6

GROWTH RATE OF PASSENGER MOVEMENT

(UNIT : % P.A.)

YEAR	PER CAPITA INCOME	POPULATION	PASSENGER MOVEMENT
1984 - 1988	3.1	0.2	4.7
1988 - 1994	3.1	0.2	4.6
1994 - 2002	3.1	0.1	4.6

GROWTH RATE OF FREIGHT MOVEMENT

(UNIT : % P.A.)

YEAR	NON-AGRI. FREIGHT	AGRI. FREIGHT	FREIGHT MOVEMENT
1984 - 1988	5.8	0.1	3.1
1988 - 1994	5.7	0.1	3.5
1994 - 2002	5.7	0.1	3.9

RATE OF INDUCED AND DEVELOPED MOVEMENT

(UNIT : %)

YEAR	INDUCED LINK 1	2	3	4	DEVELOPED PASSENGER MOVEMENT	NON-AGRI. FREIGHT MOVEMENT	AGRI. FREIGHT MOVEMENT
1988	35.3	69.3	85.3	155.0	0.0	0.0	0.4
1994	35.3	69.3	85.3	155.0	0.0	0.0	3.2
2002	35.3	69.3	85.3	155.0	0.0	0.0	7.0

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
	1984	6.4	54.4	9.3	28.6	1.3	22.9	19.4	42.8	14.9
4	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	29	17	54	6	126	14	35	14	294	323	617
1994	73	17	59	13	150	13	41	18	384	362	746
2002	178	14	59	32	187	12	53	27	560	417	977

TRAFFIC VOLUME ON ROUTE IM- 1 LINK COUNT= 4

	YEAR	1988					1994					2002				
	LINK	1	2	3	4	AVR.	1	2	3	4	AVR.	1	2	3	4	AVR.
P/C	N+D	19	19	19	10	16	48	48	46	26	40	117	117	112	63	98
	I	7	13	16	16	13	17	33	39	40	33	41	81	96	98	80
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	26	33	35	27	29	65	81	86	66	73	159	198	209	160	178
L/B	N+D	11	11	11	6	9	11	11	11	6	9	9	9	9	5	8
	I	4	8	9	9	8	4	8	9	9	8	3	6	7	8	6
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	15	19	20	15	17	15	19	20	16	17	12	15	16	12	14
M/B	N+D	36	36	34	19	30	39	39	38	21	33	39	39	37	21	33
	I	13	25	29	30	24	14	27	32	33	27	14	27	32	33	27
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	49	61	64	49	54	53	66	70	54	59	53	66	70	53	59
H/B	N+D	4	4	4	2	3	9	9	8	5	7	21	21	20	11	18
	I	1	3	3	3	2	3	6	7	7	6	7	15	17	18	14
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	5	6	7	5	6	12	15	16	12	13	28	36	37	29	32
P/P&T	N+D	84	83	80	44	70	99	99	95	53	83	124	123	118	66	103
	I	29	57	68	69	56	34	68	81	82	67	43	85	101	102	84
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	112	141	148	113	126	134	167	176	135	150	167	208	220	168	187
4/T	N+D	9	9	9	4	8	9	9	8	4	7	8	8	8	4	6
	I	3	6	7	8	6	2	6	7	7	6	2	5	6	6	5
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	12	15	16	12	14	11	15	15	11	13	10	13	14	10	12
6/T	N+D	24	24	23	11	19	28	28	27	13	23	36	36	34	17	29
	I	7	15	19	19	15	8	18	22	22	18	10	23	28	29	23
	DV	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1
	TOTAL	31	39	42	30	35	36	46	49	36	41	47	60	63	46	53
10/T	N+D	9	9	9	4	8	13	13	12	6	10	19	19	18	9	15
	I	3	6	7	7	6	3	8	10	10	8	5	12	15	15	12
	DV	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	TOTAL	12	15	16	12	14	16	21	22	16	18	24	31	33	24	27
ADT	N+D	197	196	188	102	163	256	255	245	133	212	372	371	357	195	309
	I	65	133	159	162	131	86	173	207	211	171	126	253	302	307	250
	DV	0	0	0	0	0	1	1	1	1	1	2	2	2	2	2
	TOTAL	262	329	348	264	294	343	430	454	345	384	500	626	661	504	560
M/C	N+D	266	265	260	170	232	304	304	298	209	271	358	358	352	264	325
	I	41	75	89	138	91	42	75	89	138	91	42	75	89	137	91
	DV	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	TOTAL	308	341	348	308	323	346	379	387	347	362	401	434	442	402	417
TOTAL	N+D	463	462	448	272	395	560	559	543	342	483	731	729	709	459	634
	I	107	208	248	300	222	128	249	296	349	262	168	328	391	445	341
	DV	0	0	0	0	0	1	1	2	1	1	2	3	3	2	2
	TOTAL	570	670	696	572	617	689	809	841	692	746	901	1060	1103	906	977

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

1.2 AGRICULTURAL DEVELOPMENT

1.2.1 Present Condition

Sixty-seven percent of the cultivated land in the influence area is covered by paddy fields. Many old paddy fields are affected by salinity and the average yield of rice is comparatively low. Among the major crops planted in upland fields in the 1983 crop year, cassava ranks first followed by castor beans, kenaf, cotton, maize and beans. Cassava roots are shipped to pellet or flour factories on Route 2 via drying places along Routes 2150 or 2160.

Land use and capability conditions in the area are shown in Table 1.2.1 and Figure 1.2.1. A typical cropping calendar in the area is shown in Figure 1.2.2.

1.2.2 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 1.2.2.

Based on the above projected production amount, farmgate prices and production costs estimated separately, net production value (NPV) was obtained as shown in Table 1.2.3. The difference in NPV between the two cases is deemed to be the development benefit of the study route.

FIGURE 1.2.1 LAND USE AND CAPABILITY OF INFLUENCE AREA

STUDY ROUTE NO.

FIGURE 1.2.1 LAND USE AND CAPABILITY OF INFLUENCE AREA

STUDY ROUTE NO. IM-1

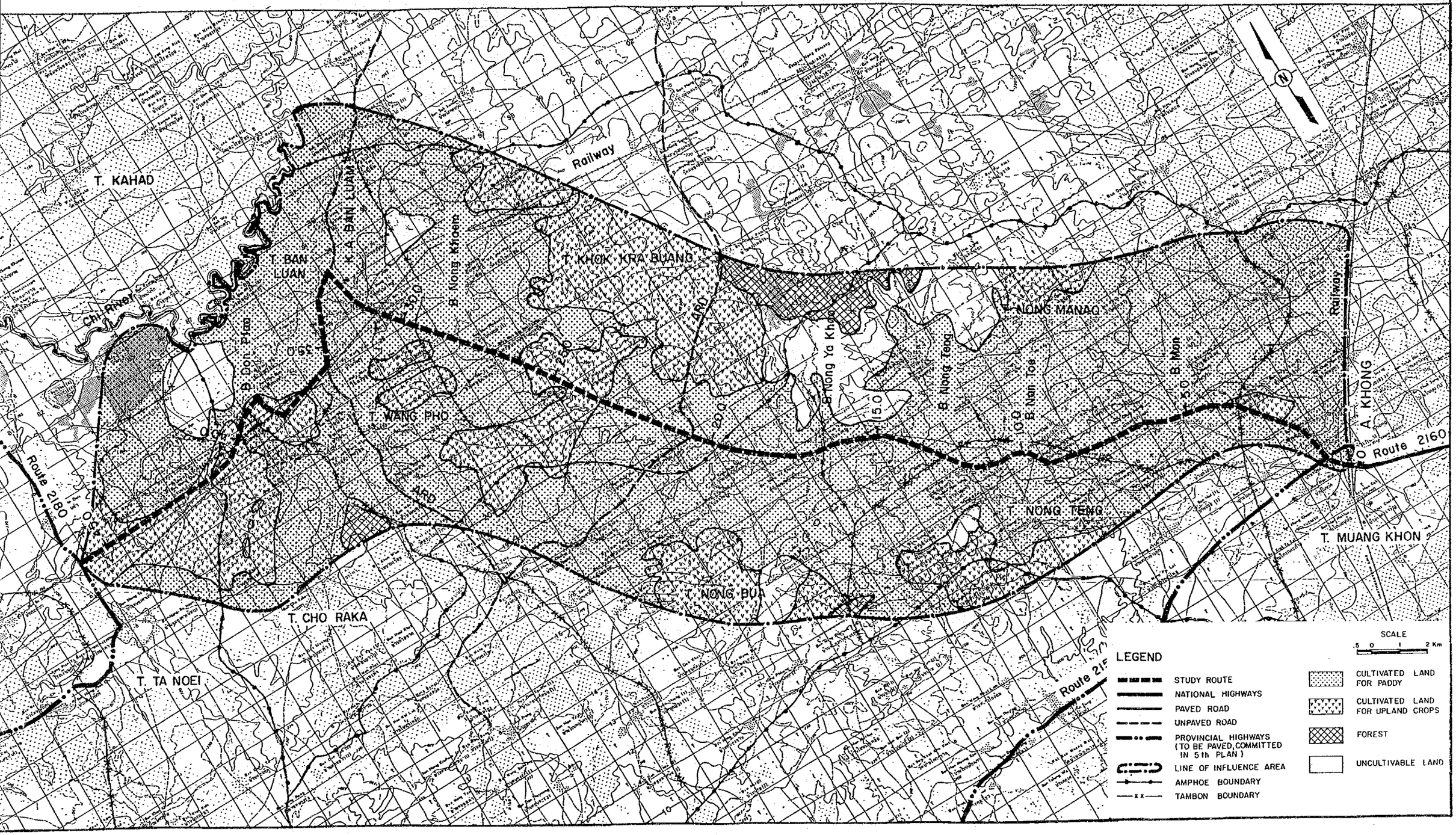
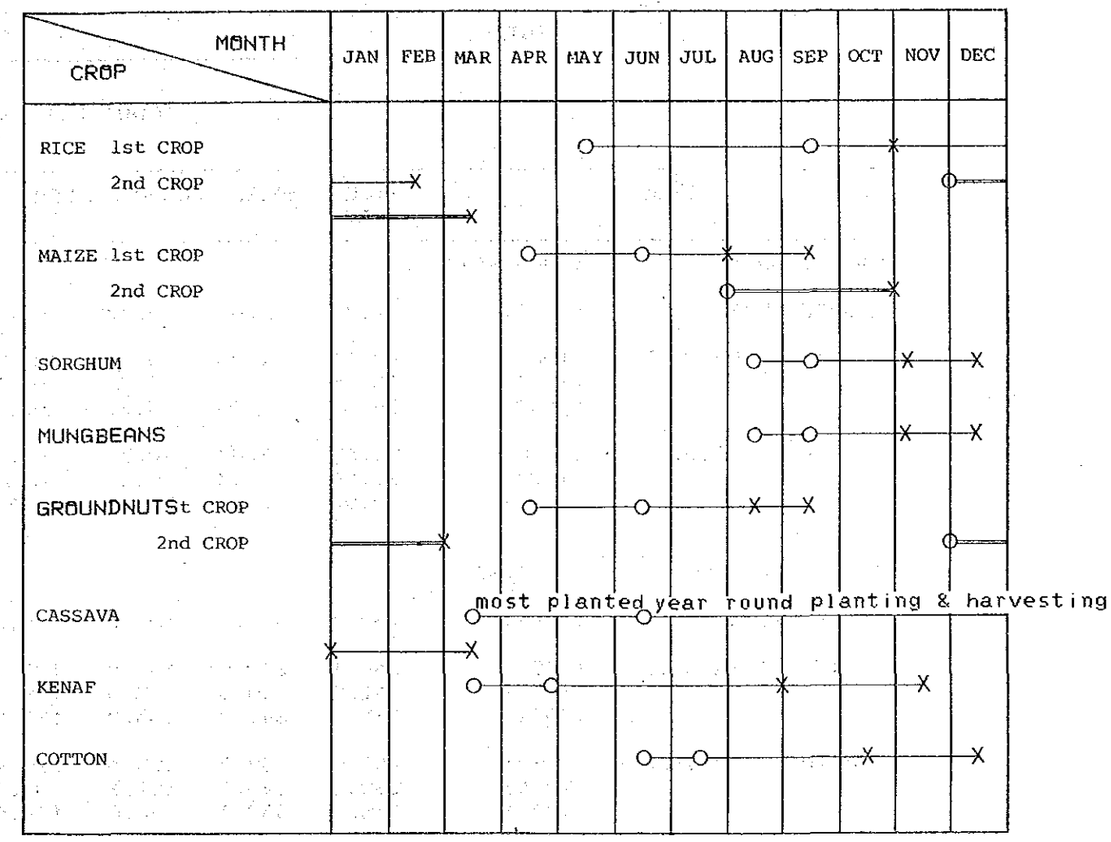


FIGURE 1.2.2 CROPPING CALENDAR

ROUTE IM-1

Related Amphoes: 1213 Chatturat
1303 Ban Luam
1304 Khong



Note:

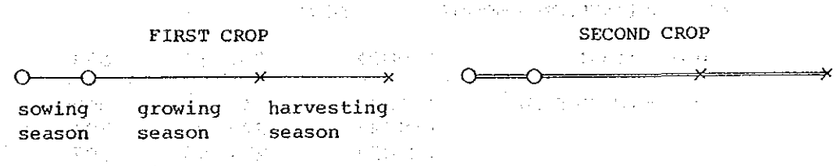


TABLE 1.2.1 CULTIVATED LAND

[UNIT : 1000 RAI (KM2)]

CHANGWAT NAME	AMPHOE NAME	CULTIVATED LAND PADDY FIELD	UPLAND FIELD	TOTAL
CHAIYAPHUM	CHATTURAT	4.82 (7.71)	4.69 (7.50)	9.51 (15.22)
NAKHON RATCHASIMA	BAN LUAM	59.44 (95.10)	34.12 (54.59)	93.56 (149.70)
	KHONG	46.94 (75.10)	16.21 (25.94)	63.15 (101.04)
TOTAL		111.20 (177.92)	55.02 (88.03)	166.22 (265.95)

TABLE 1.2.2 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)	92.74	2.06	0.77	0.27	0.05	13.29	9.92	-	5.33	10.67	42.36	135.10
WITHOUT PROJECT	(1988)	93.20	2.06	0.77	0.27	0.05	13.29	9.92	-	5.33	10.67	42.36	135.56
	(1994)	93.75	2.06	0.77	0.27	0.05	13.29	9.92	-	5.33	10.67	42.36	136.11
	(2002)	94.50	2.06	0.77	0.27	0.05	13.29	9.92	-	5.33	10.67	42.36	136.86
WITH PROJECT	(1988)	93.55	2.07	0.78	0.27	0.05	13.31	9.95	-	5.34	10.70	42.47	136.02
	(1994)	96.26	2.10	0.87	0.30	0.05	13.41	10.10	-	5.43	10.86	43.12	139.38
	(2002)	100.00	2.14	0.99	0.35	0.05	13.55	10.31	-	5.54	11.09	44.02	144.02
CROP YIELD	(KG/RAI)												
BASE YEAR	(1983)	258.4	336.8	185.0	128.5	205.0	1967.4	211.8	-	218.1	120.0		
WITHOUT PROJECT	(1988)	260.1	338.5	185.0	129.1	205.0	1967.4	211.8	-	218.1	120.0		
	(1994)	262.2	340.5	185.0	129.9	205.0	1967.4	211.8	-	218.1	120.0		
	(2002)	265.0	343.3	185.0	131.0	205.0	1967.4	211.8	-	218.1	120.0		
WITH PROJECT	(1988)	261.0	339.2	185.4	129.4	205.2	1969.4	212.0	-	218.1	120.0		
	(1994)	268.1	345.3	187.6	131.7	206.4	1981.2	213.3	-	218.1	120.0		
	(2002)	278.0	353.7	190.6	134.9	208.1	1997.1	215.0	-	218.1	120.0		
CROP PRODUCTION AMOUNT	(TON)												
BASE YEAR	(1983)	23,964	694	142	35	10	26,147	2,101	-	1,162	1,280	31,572	55,536
WITHOUT PROJECT	(1988)	24,243	697	142	35	10	26,147	2,101	-	1,162	1,280	31,576	55,819
	(1994)	24,583	701	142	35	10	26,147	2,101	-	1,162	1,280	31,580	56,163
	(2002)	25,043	707	142	35	10	26,147	2,101	-	1,162	1,280	31,586	56,628
WITH PROJECT	(1988)	24,413	700	145	36	10	26,207	2,109	-	1,165	1,284	31,656	56,068
	(1994)	25,811	724	163	40	11	26,569	2,154	-	1,183	1,304	32,148	57,958
	(2002)	27,800	757	190	47	11	27,060	2,216	-	1,208	1,330	32,819	60,619

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE

TABLE 1.2.3 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)	3,681	2,596	2,287	5,296	8,003	821	4,830	-	10,970	5,408		
WITH PROJECT	(1988 - 2002)	3,705	2,620	2,311	5,320	8,027	837	4,878	-	11,067	5,432		
CROP PRODUCTION COST	(BAHT/RAI)												
BASE YEAR	(1983)	712	582	319	515	1,005	869	690	-	1,781	463		
WITHOUT PROJECT	(1988)	716	584	319	515	1,005	869	690	-	1,781	463		
	(1994)	720	586	319	515	1,005	869	690	-	1,781	463		
	(2002)	726	589	319	515	1,005	869	690	-	1,781	463		
WITH PROJECT	(1988)	717	584	319	515	1,005	869	690	-	1,781	463		
	(1994)	731	590	319	515	1,005	871	690	-	1,781	463		
	(2002)	749	597	319	520	1,005	874	690	-	1,781	463		
NET PRODUCTION VALUE	(1000 BAHT)												
WITHOUT PROJECT	(1988)	22,508	607	80	46	32	9,917	3,303	-	3,259	1,984	19,228	41,736
	(1994)	22,986	614	80	47	32	9,917	3,303	-	3,259	1,984	19,236	42,222
	(2002)	23,575	623	80	48	32	9,917	3,303	-	3,259	1,984	19,246	42,821
WITH PROJECT	(1988)	23,372	629	86	48	33	10,371	3,423	-	3,381	2,020	19,991	43,363
	(1994)	25,261	660	99	56	33	10,557	3,539	-	3,433	2,052	20,429	45,690
	(2002)	28,099	706	121	68	35	10,807	3,698	-	3,504	2,094	21,033	49,132
NET VALUE ADDED	(1000 BAHT)												
1988		864	22	6	2	1	454	120	-	122	36	763	1,627
1994		2,275	46	19	9	1	640	236	-	174	68	1,193	3,468
2002		4,524	83	41	20	3	890	395	-	245	110	1,787	6,311

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

1.3 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 1.3.1. Data for additional VOCs are shown in Table 1.3.2.

VOC savings, obtained as the balance of total link VOCs between the two cases, were calculated as shown in Table 1.3.3.

TABLE 1.3.1 ROAD LENGTH BY ROAD CLASS

(UNIT : KM)

LINK NO.	WITHOUT PROJECT CASE						WITH PROJECT CASE
	PAVED	LATERITE			EARTH	TOTAL	PAVED
		GOOD	FAIR	POOR			
1	-	-	9.0	2.9	-	11.9	11.9
2	-	-	1.5	7.4	-	8.9	8.9
3	-	-	1.0	9.2	-	10.2	10.2
4	-	-	-	-	15.8	15.8	15.8
11	11.0	-	-	-	-	11.0	11.0
12	15.0	-	-	-	-	15.0	15.0

TABLE 1.3.2 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	140	351	182	209	259	544	845	428	210	2800	-	-	-	-	4	1600	2	1	-	-
	WITH	90	497	182	209	259	544	845	428	210	3250	-	-	-	-	4	1600	-	-	-	1
2	WITHOUT	137	122	-	294	-	263	187	418	244	3700	800	200	-	-	2	600	1	-	-	-
	WITH	137	122	-	294	-	263	187	418	244	2900	1300	-	100	-	2	600	-	-	-	-
3	WITHOUT	-	-	116	-	105	54	161	-	360	3200	300	-	-	-	1	400	1	-	-	-
	WITH	-	-	116	-	-	54	161	-	532	3800	100	-	-	-	1	400	-	-	-	-
4	WITHOUT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WITH	-	349	172	-	-	51	1189	288	-	2700	300	-	-	-	2	400	-	-	-	3

TABLE 1.3.3 VEHICLE OPERATING COST SAVING

(UNIT : 1000 BAHT)

LINK NO.	1988			1994			2002		
	WITHOUT	WITH	SAVING	WITHOUT	WITH	SAVING	WITHOUT	WITH	SAVING
1	5,058	4,172	886	6,508	5,330	1,177	9,279	7,561	1,718
2	4,051	2,947	1,104	5,217	3,753	1,464	7,454	5,305	2,149
3	4,511	3,058	1,453	5,812	3,882	1,931	8,312	5,463	2,849
4	9,612	3,236	6,377	12,538	4,127	8,411	18,158	5,814	12,344
11	1,674	1,776	-101	2,182	2,270	-87	3,132	3,193	-61
12	2,273	2,418	-145	2,963	3,092	-129	4,252	4,351	-99
TOTAL	27,179	17,606	9,573	35,220	22,453	12,766	50,587	31,687	18,900

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

1.4 ENGINEERING

1.4.1 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 1.4.1 and Table 1.4.1, respectively.

Rock aggregate sources were assumed as shown below:

No.	Source	Description of Sample	Est. Quantity m^3
I/CS-1	KM. 264+000 Rt close to Chai Badan – Nong Bour Lok (Sila Niyom Chai Quarry)	Limestone	Plentiful

FIGURE 1.4.1 SOIL AND MATERIAL SOURCES

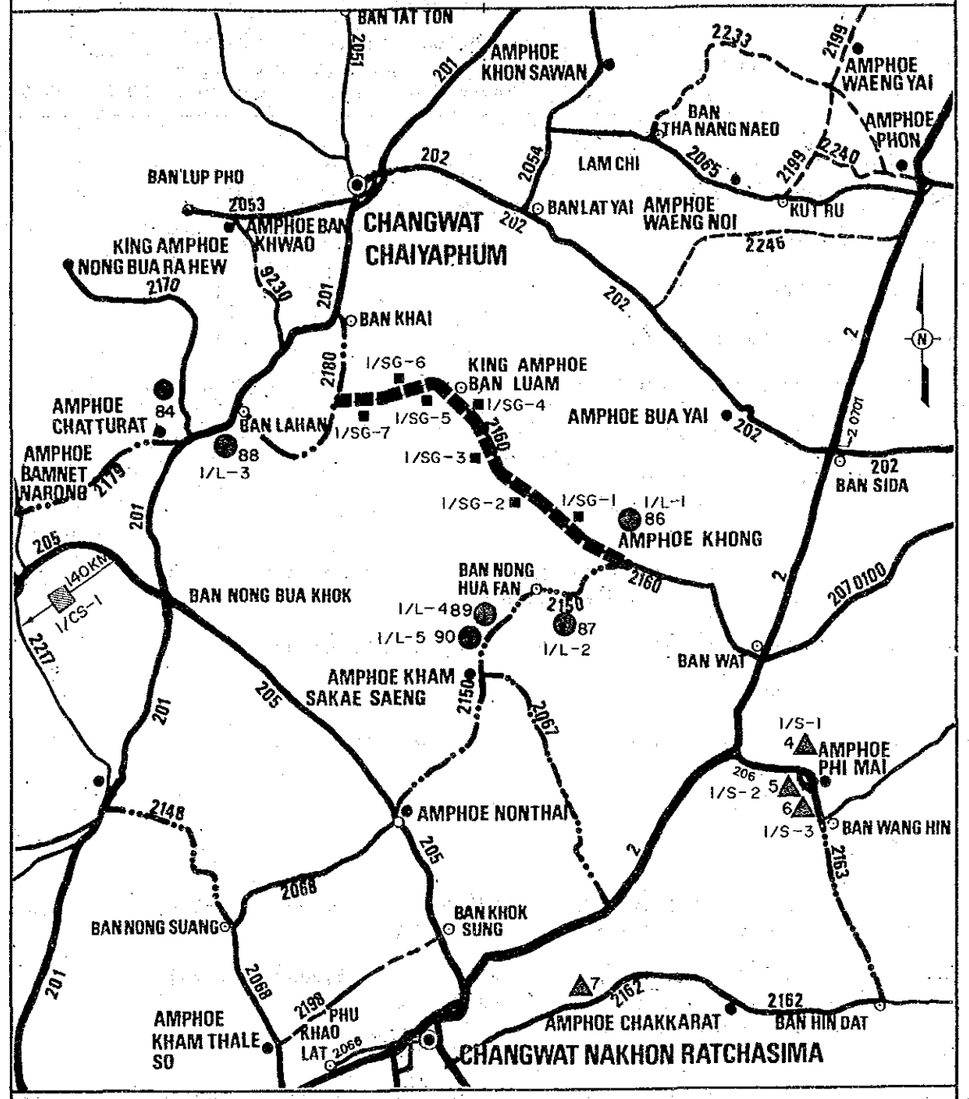


TABLE 1.4.1 PHYSICAL CHARACTERISTICS OF MATERIALS

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																			
1/SG - 1.	KM/ 8+000 Rt 15 M.			A-4				100.0	99.4	98.6	89.8	63.6	N-P		11.0	1.893	8.0	0.20		
1/SG - 2.	KM/ 16+000 Lt 15 M.			A-4						100.0	98.6	52.0	N-P		12.4	1.810	5.7	1.51		
1/SG - 3.	KM/ 22+000 Lt 12 M.			A-4					100.0	97.4	95.2	87.4	N-P		15.2	1.729	4.8	1.70		
1/SG - 4.	KM/ 28+000 Rt 10 M.			A-4					100.0	99.0	97.0	73.8	N-P		11.9	1.875	7.5	2.09		
1/SG - 5.	KM/ 34+000 Lt 15 M.			A-7-6					100.0	99.3	98.5	93.3	42.70	17.58	15.0	1.770	2.0	2.80		
1/SG - 6.	KM/ 38+000 Rt 14 M.			A-4						100.0	98.2	45.4	N-P		9.4	1.896	18.1	-		
1/SG - 7.	KM/ 45+000 Lt 17 M.			A-4						100.0	97.4	46.4	N-P		11.5	1.860	16.0	0.44		
	SAND																			
1/S - 1.	KM/ 57+000 Route No.206 B. Talad Kae - Phi Mai	Mun River sand	Plentiful																Same as standard color	
1/S - 2.	KM/ 7+650 Rt 900 M. Route Talad Kae - Phi Mai	River sand	Plentiful					100	97	89	29	3	N.P.							
1/S - 3.	KM/ 9+500 Rt Closed to Route Talad Kae - Phi Mai	River sand	Plentiful					100	98	91	33	2	N.P.							
	LATERITE																			
1/L - 1	KM. 20+000 Rt 1 KM. A. Khong - B. Luam	White laterite	13,000	A-2-4	-	100	-	77.0	-	40.5	28.2	21.9	28.5	7.1	8.3	2.134	26.5	0.56		
1/L - 2	KM. 46+000 close to Non Thai - Kham Sakae Saeng - A. Khong	Brown laterite	5,000	A-2-4		100	-	72.0	-	43.0	22.0	16.0	32.1	9.0	8.0	2.146	20.1	0.64		
1/L - 3	KM. 89+000 Rt 4 KM. Nong Bour Khok- Chaiyaphum	Brown laterite	70,000	A-2-4		100	-	69.2	-	36.4	20.1	12.1	20.3	6.9	6.8	2.203	33.5	0.36		
1/L - 4	KM. 32+000 Lt 6 KM. Non Thai- Kham Sakae Saeng - A. Khong	White laterite	30,000	A-2-4		100	-	58.0	-	28.0	25.0	18.1	28.0	8.0	7.0	2.205	15.0	0.50		
1/L - 5	KM. 28+500 Lt 500 M. Non Thai - Kham Sakae Saeng - A. Khong	Brown laterite	40,000	A-2-4		100	-	60.1	-	29.2	24.4	19.6	27.7	7.3	6.8	2.195	16.5	0.40		

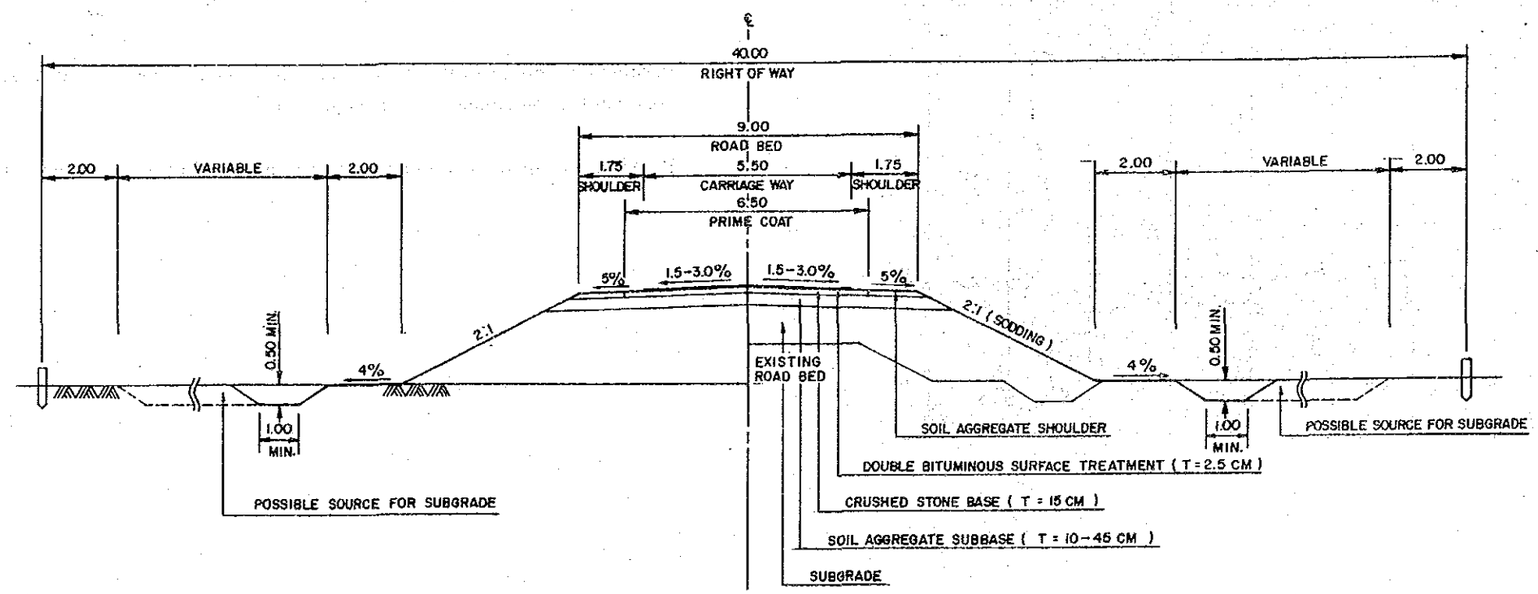
1.4.2 Preliminary Design

1.4.2.1 Design Criteria

Design Standard	:	F4
Geometric Design Criteria	:	DOH (Provincial Highway)
Typical Cross Section	:	as shown in Figure 1.4.2
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 1-1/1-6.

FIGURE 1.4.2 TYPICAL CROSS SECTION



PROVINCIAL HIGHWAY (CLASS F4)

1.4.2.2 Special Conditions in Designing

Alternative Routes

The following two alternative routes shown in the Figure illustrated below were studied:

Alternative (A):

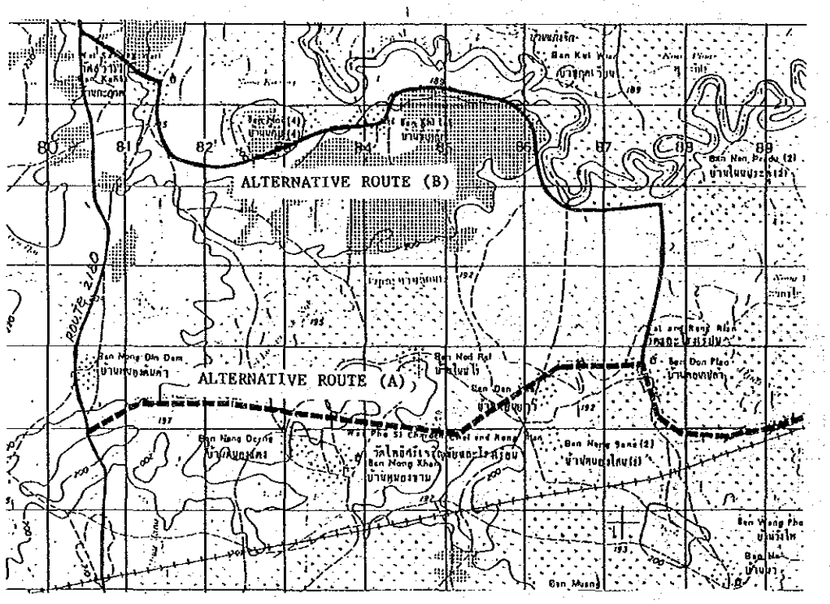
Proposed new route which was already surveyed by DOH

Alternative (B):

Improvement of existing road

The above alternatives were compared in the following aspects:

- Function as a daily use road (road user benefit)
- Physical conditions (construction costs)



1) Function as a daily use road

ALTERNATIVE ROUTE (A)		ALTERNATIVE ROUTE (B)	
Name of Village	No. of Households	Name of Village	No. of Households
Ban Nong Sans	432	Ban Kahat	559
Ban Nong Rai	273	Ban Noi (4)	268
Ban Nong Kham	654	Ban Khi Leg	814
Ban Nong Daeng	75		
Total	1,434	Total	1,641
Route Length (km)	7.4	Route Length (km)	11.5
Average Households per km	194	Average Households per km	143

As shown in the above Table, Alternative (A) has a much greater function as a daily use road compared to (B) because of the greater number of villages and households within its influence area.

2) Physical conditions of the route

The required road length of (A) is shorter than (B) by 30% and a large river which may cause flooding, runs along (B) on its north side. As a result, in (B) a high embankment will be required to keep the traffic free from flooding. Since (B) is between 185–189 m above sea level compared to (A), which is between 192–197m above sea level. The construction of such a high embankment is practically impossible because the route passes through three villages. Consequently, higher construction costs are required for (B) than for (A).

In summary, this area will gain more benefits by employing Alternative (A), because the influence area will become about twice as large.

Based on this qualitative judgement, Alternative (A) was employed in this study.

1.4.2.3 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	5	6	7	5	12	15	16	12
Medium truck	31	39	42	30	36	46	49	36
Heavy truck	12	15	16	12	16	21	22	16

- Cumulative number of ESA in one direction by road link

Road link	1	2	3	4
7 years (10^6)	0.060	0.076	0.080	0.059

2) Design CBR values

Road link	1	2	3	4
Design CBR (%)	5.8	4.8	7.5	7.0

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	20 cm	15 cm	15 cm

4) Overlay required in 7 years

DBST resurfacing

1.4.2.4 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 + 200	Timber Bridge	4.5 x 12.9	RC Bridge	9.0 x 15.0
37 + 205	Pipe Culvert	1-0.8 x 10.5	Box Culvert	2-2.4 x 2.4 x 20.0
37 + 400	Timber Bridge	4.0 x 20.0	RC Bridge	9.0 x 30.0
38 + 000	-	-	Box Culvert	2-2.4 x 2.4 x 18.0
38 + 968	Pipe Culvert	1-0.6 x 10.3	Box Culvert	2-2.4 x 2.4 x 18.0
44 + 515	-	-	Box Culvert	2-2.4 x 2.4 x 20.0
44 + 816	-	-	RC Bridge	9.0 x 10.0

1.4.3 Quantities and Construction and Road Maintenance Costs

The required construction costs were estimated based on the results of preliminary design as shown in Table 1.4.2. Financial costs with breakdown into local and foreign currency portions, economic costs and residual values were estimated as follows and in 1.4.4:

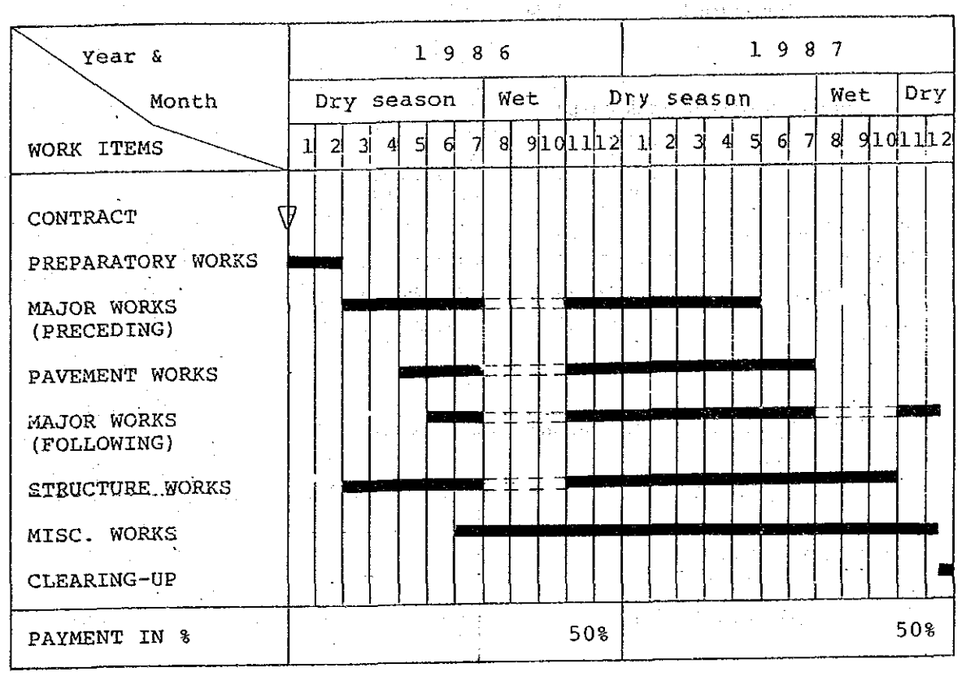
			(baht)
IM—1	L = 46.8 km		
	Financial cost	:	90,643,000
	Economic cost	:	76,022,000
	Residual value	:	32,850,000

The required road maintenance cost savings are shown in Table 1.4.3.

1.4.4 Construction and Disbursement Schedules

IM—1 **Length = 46.8 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 - 1)

(Unit : Million Baht)

	1986			1987			Total		
	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total
Construction Cost	23.0	22.3	45.3	23.0	22.3	45.3	46.0	44.6	90.6
Price Contingency	4.8	3.0	7.8	7.6	4.6	12.2	12.4	7.6	20.0
Total	27.8	25.3	53.1	30.6	26.9	57.5	58.4	52.2	110.6
	(1.03)	(0.94)	(1.97)	(1.13)	(1.00)	(2.13)	(2.16)	(1.93)	(4.10)

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

1.4.2 CONSTRUCTION QUANTITIES AND COSTS
(ROUTE IM—1 Length = 46.8 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	115	1,150						
Roadway Excavation, Unclassified	m3	19	0	0						
Embankment, Common Soil	m3	38	397,000	15,086						
Embankment, Selected Material	m3	70	0	0						
Replacement of Soft Spot	m3	88	3,500	308						
Sub Total				16,544	8,437	8,107		13,732		12,358
SUBBASE & BASE COURSES							83		50	
Subbase, Soil Aggregate	m3	112	70,200	7,862						
Aggregate Base*	m3	429	45,600	19,562						
Cement Stabilized Base	m3	390	0	0						
Shoulder, Soil Aggregate	m3	120	17,500	2,100						
Sub Total				29,525	15,943	13,581		24,506		12,253
SURFACE COURSES							85		50**	
Asphaltic Prime/Tack Coat	m2	12	304,300	3,652						
Double Bituminous Surface Treatment*	m2	40	257,500	10,300						
Asphaltic Concrete Surfacing**	t	750	0	0						
Sub Total				13,952	6,139	7,813		11,859		0
STRUCTURES							83		50	
RC Pipe Culvert (D 1.0m Equivalent)	m	2,000	2,088	4,176						
RC Box Culvert (2.4mx2.4m Equivalent)	m	18,800	96	1,805						
RC Bridg (W=9.0m L=10m Equivalent)	m	46,500	55	2,558						
Sub Total				8,538	4,269	4,269		7,087		3,543
Total (a)				68,559	34,789	33,770		57,183		28,155
INCIDENTALS							83		0	
Miscellaneous Work ((a)x7%)	ls			4,799	2,400	2,400		3,983		0
CONTRACT AMOUNT (b)				73,358	37,188	36,170		61,166		28,155
PHYSICAL CONTINGENCIES ((b)x10%) (c)	ls			7,336	3,719	3,617		6,117		2,815
ENGINEERING AND SUPERVISION							85		0	
(((b)+(c))x10%) (d)	ls			8,069	3,228	4,842		6,859		0
LAND ACQUISITION							100		100	
Highly Developed Land	ha	50,000	37	1,850						
Less Developed Land	ha	15,000	2	30						
Sub Total (e)	ls			1,880	1,880	0		1,880		1,880
PROJECT COST ((b)+(c)+(d)+(e))				90,643	46,015	44,628		76,022		32,850
AVERAGE COST PER KM				1,937						

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

TABLE 1.4.3 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	208.9	11.9	0.32	1.42	14,913	177	229.5	11.9	0.00	1.19	13,354	159	19
1	1994	284.3	11.9	0.50	1.54	16,202	193	298.9	11.9	0.00	1.19	13,354	159	34
	2002	438.6	11.9	0.85	1.79	18,843	224	435.3	11.9	0.00	1.19	13,354	159	65
	1988	239.2	8.9	0.39	1.46	15,431	137	262.6	8.9	0.00	1.19	13,354	119	18
2	1994	325.4	8.9	0.59	1.60	16,906	150	341.9	8.9	0.00	1.19	13,354	119	32
	2002	501.9	8.9	0.95	1.86	19,547	174	497.7	8.9	0.00	1.19	13,354	119	55
	1988	244.2	10.2	0.40	1.47	15,516	158	268.0	10.2	0.00	1.19	13,354	136	22
3	1994	332.1	10.2	0.61	1.62	17,020	174	348.9	10.2	0.00	1.19	13,354	136	37
	2002	512.2	10.2	0.95	1.86	19,547	199	507.9	10.2	0.00	1.19	13,354	136	63
	1988	165.7	15.8	0.22	1.34	14,172	224	182.6	15.8	0.00	1.19	13,354	211	13
4	1994	225.9	15.8	0.36	1.44	15,203	240	238.5	15.8	0.00	1.19	13,354	211	29
	2002	349.4	15.8	0.65	1.64	17,316	274	348.2	15.8	0.00	1.19	13,354	211	63
	1988	133.9	11.0	0.00	1.19	13,354	147	148.0	11.0	0.00	1.19	13,354	147	0
11	1994	182.9	11.0	0.00	1.19	13,354	147	193.7	11.0	0.00	1.19	13,354	147	0
	2002	283.4	11.0	0.00	1.19	13,354	147	283.3	11.0	0.00	1.19	13,354	147	0
	1988	133.9	15.0	0.00	1.19	13,354	200	148.0	15.0	0.00	1.19	13,354	200	0
12	1994	182.9	15.0	0.00	1.19	13,354	200	193.7	15.0	0.00	1.19	13,354	200	0
	2002	283.4	15.0	0.00	1.19	13,354	200	283.3	15.0	0.00	1.19	13,354	200	0
	1988	181.4	72.8			14,343	1,044	199.6	72.8			13,354	972	72
TOTAL	1994	247.1	72.8			15,169	1,104	260.5	72.8			13,354	972	132
	2002	381.8	72.8			16,736	1,218	379.9	72.8			13,354	972	246

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 = 1.19 + 0.70 * A1
WITH PROJECT CASE KB = 1.19 + 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

1.5 EVALUATION

1.5.1 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.

COST AND BENEFIT STATEMENT OF ROUTE IM - 1

(1000 BAHT)

YEAR	COST	BENEFITS				DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	TOTAL COST	TOTAL BENEFIT
1986	38,011	0	0	0	0	47,681	0
1987	38,011	0	0	0	0	42,572	0
1988	0	1,627	9,573	72	11,272	0	10,064
1989	0	1,934	10,105	82	12,121	0	9,663
1990	0	2,241	10,637	92	12,970	0	9,232
1991	0	2,548	11,170	102	13,819	0	8,782
1992	0	2,854	11,702	112	14,668	0	8,323
1993	0	3,161	12,234	122	15,517	0	7,862
1994	0	3,468	12,766	132	16,366	0	7,403
1995	17,065	3,823	13,533	146	17,503	7,719	7,069
1996	0	4,179	14,300	161	18,639	0	6,721
1997	0	4,534	15,066	175	19,775	0	6,367
1998	0	4,890	15,833	189	20,912	0	6,012
1999	0	5,245	16,600	203	22,048	0	5,659
2000	0	5,600	17,366	218	23,184	0	5,313
2001	0	5,956	18,133	232	24,321	0	4,977
2002	-32,850	6,311	18,900	246	25,457	-6,002	4,651
TOTAL	60,237	58,370	207,918	2,285	268,573	91,971	108,098
DISCOUNTED	91,971	21,916	85,315	868	108,098		

NET PRESENT VALUE	:	16,127
BENEFIT/COST RATIO	:	1.18
INTERNAL RATE OF RETURN	:	14.1 %
FIRST YEAR RATE OF RETURN	:	11.2 %
OPTIMUM OPENING YEAR	:	1988

SENSITIVITY TESTS

ITEM	CASE		
	BASE	1	2
NET PRESENT VALUE	16,127	2,332	-87
BENEFIT/COST RATIO	1.18	1.02	1.00
INTERNAL RATE OF RETURN	14.1 %	12.3 %	12.0 %
FIRST YEAR RATE OF RETURN	11.2 %	9.7 %	9.5 %
COSTS	BASE	+15%	BASE
BENEFITS	BASE	BASE	-15%

1.5.2 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)	:	76.0
1) General Accessibility Benefit (million baht)	:	9.38
2) Education Benefit (million baht)	:	1.36
3) Medical Care Benefit (million baht)	:	0.125
4) Total Social Benefits (million baht (1+2+3))	:	10.96
5) Social Benefit/Cost Ratio ($\times 10^{-2}$)	:	11.65
6) Ranking by Social Benefit	:	9
7) Weighted Production Value Gain/Cost ($\times 10^{-2}$)	:	4.72
8) Ranking by 7	:	10
9) Combined Ratio ($\times 10^{-2}$)	:	16.37
Overall Ranking	:	12

1.5.3 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.