

PROPOSED ROUTE NO. IM - 18

Changwat : Kalasin / Roi Et

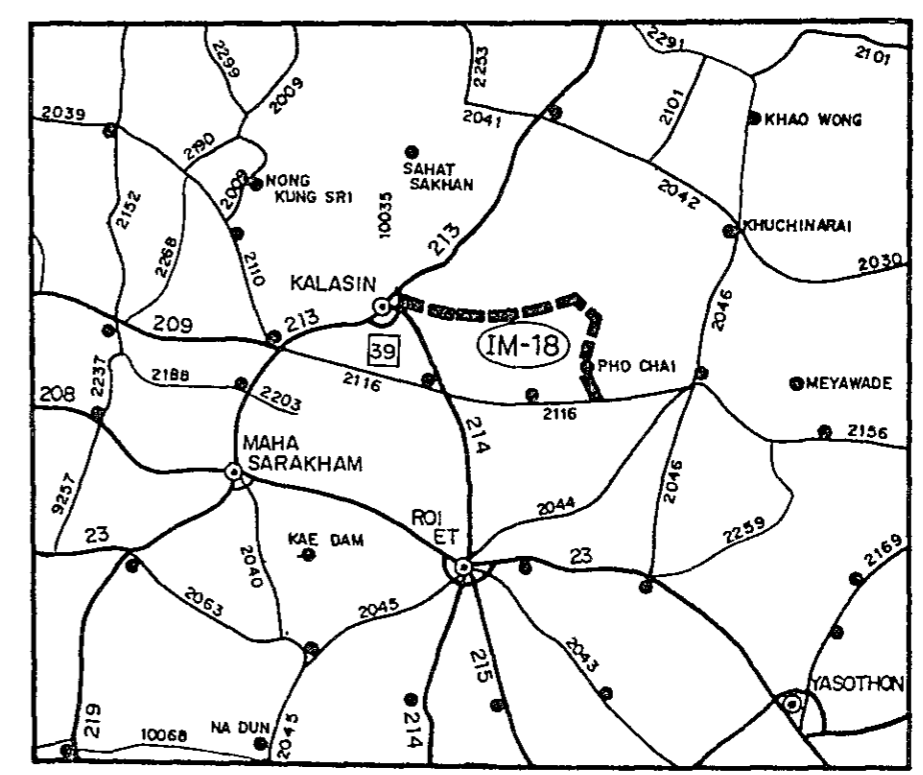
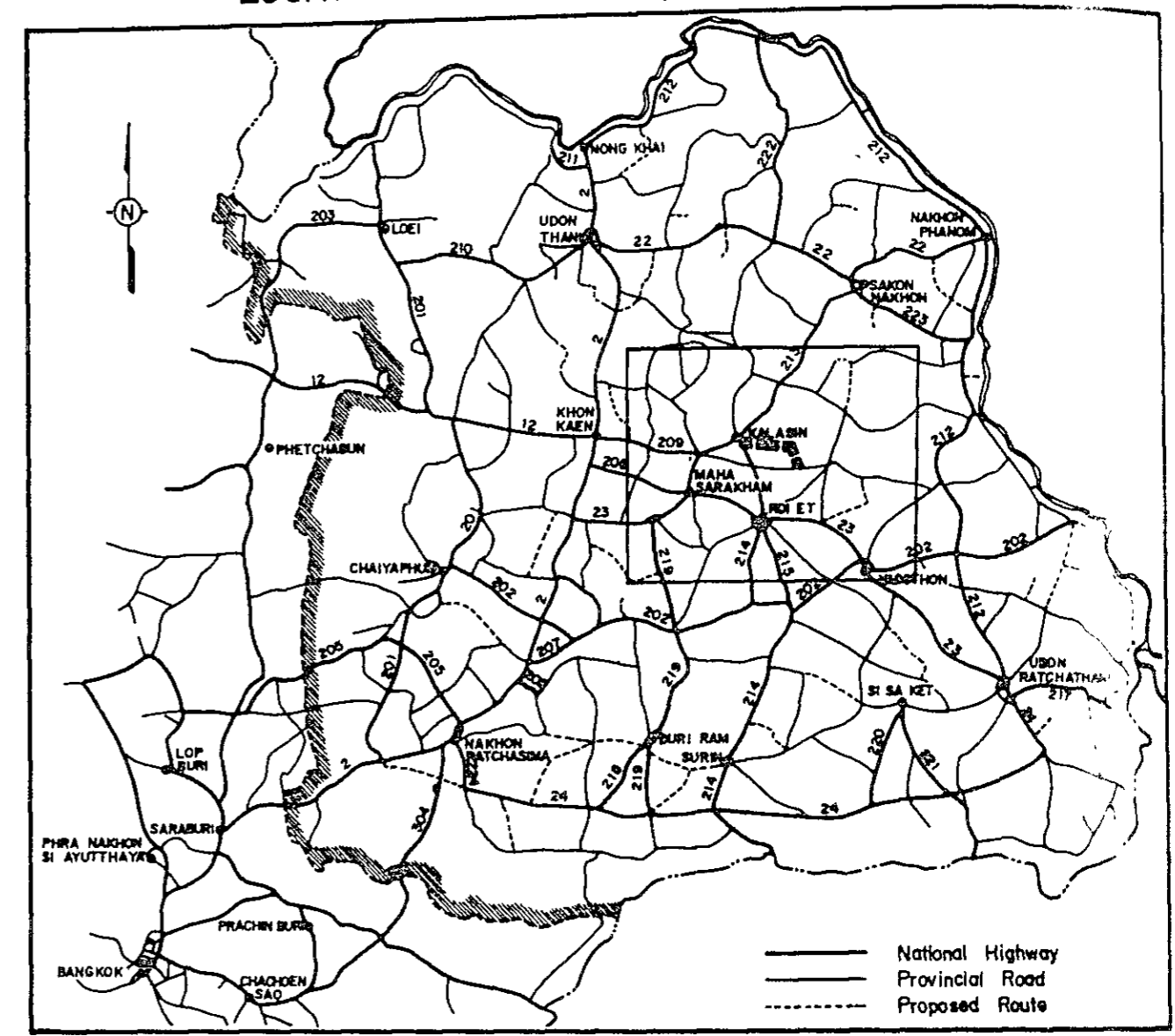
C. Kalasin - B. Khok Nong Bua (J.R.2116)

Length : 50.7 KM.

SUMMARY
PROPOSED ROUTE IM-18

Item	Description
Changwat	Kalasin/Roi Et
Origin	C. Kalasin
Destination	B. Khok Nong Bua (J.R.2116)
Length	
Total	50.7 km
Improvement Section	50.7 km
DOH Road	0 km
ARD Road	50.7 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Good ~ Poor
Terrain	Flat and Partially Rolling
Influence Area	
Area	366 km ²
Population (1982)	52,500
Principal Crops	Paddy
Traffic (ADT)	
Existing	117
1993	431
2001	557
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	98,245 . 10 ³ ฿
Economic	89,203 . 10 ³ ฿
IRR	7.5 %
B/C	0.65
Recommendation	For further consideration

LOCATION OF PROPOSED ROUTE



1. 概要

1.1 計画路線の概要

本路線は、Kalasin および Roi Et の両県にまたがる。ルートは、Kalasin 県を起点とし、南東に走り、Kae Pae 村、Nong Pok 村、Pho Chai 郡を経て、県道2116号線のKhok Nong Bua 村で終わる。その総延長は、50.7kmである。(Figure 18.5.2 参照)

沿道の地形は、ほとんど平坦であるが、一部に丘陵地を含む。影響圏内には、いくつかの村があり、その総人口は、52,500人である。沿道には、医療センターが1ヶ所、病院が1ヶ所あり、教育施設として中学校が2ヶ所ある。

本路線は、Kalasin 県と農業的に開発の進んだ地域を結ぶ重要な道路網の形成を目的に計画され、又幹線道路とPho Chai 郡とを結ぶ重要な路線である。

1.2 現道の状況

計画路線に利用した現道の状況はTable 18.1.1 に要約し、その詳細はTable 18.1.2 のイベントリー調査の結果に示した。

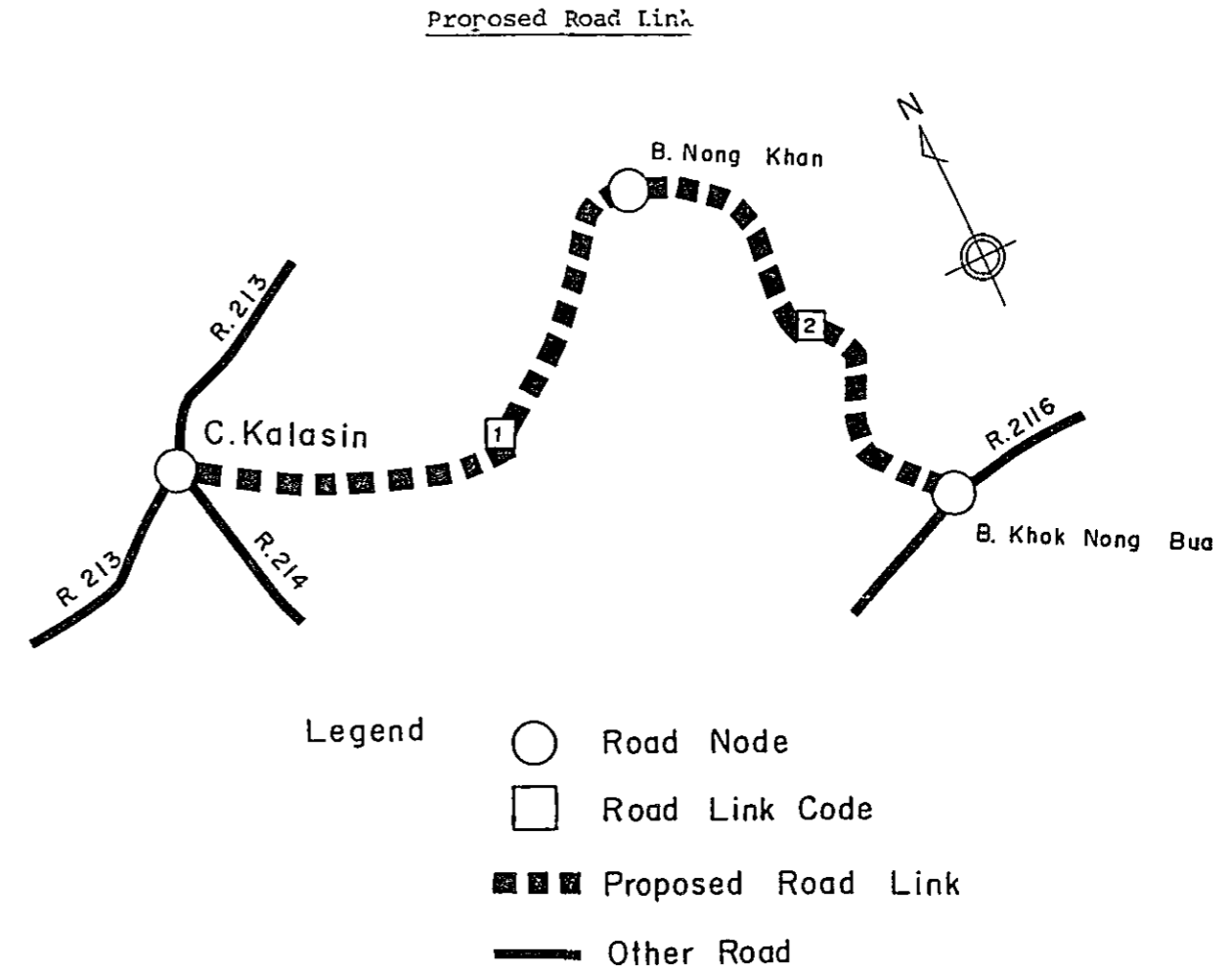
2. 交通

2.1 予測手法

計画対象路線に関し道路改良後の転換交通はほとんど無視し得るので、交通量予測には「伸び率方式」を適用することとした。

2.2 基準年交通量

道路リンク別車種別の基準年交通量は、本調査で実施したマニュアルカウンティングのデータを基として次のように推定した。



Traffic Volume in Base Year

Source (base year)	Link No.	Vehicle Type									
		P/C	P/P	L/B	M/B	H/B	P/T	4/T	6/T	10/T	ADT
Manual Counts (1982)	1	-	16	35	21	-	2	24	42	-	140
	2	6	54	6	2	-	6	5	11	3	93

2.3 交通需要

計画路線上の旅客交通需要（トリップ/日）および貨物交通需要（トン/日）は、先に求めた基準年の交通量に路側インタビューによって得られる平均乗車人員もしくは平均貨物積載量をかけることによって推定した。推定結果は以下のとおりである。

PASSENGER MOVEMENT (1982)

PROPOSED ROAD LINK	TRIPS PER DAY
1	1001
2	351

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	21	89	110
2	11	46	57

2.4 交通需要の将来伸び率

1981-1987, 1987-1993, 1993-2001の各期間における旅客および貨物の交通需要の将来伸び率は、メインレポートの7.3.3の1)で述べた予測式に従って求めた。予測の前提および得られた将来伸び率は以下の通りである。

GROWTH RATE OF PASSENGER MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981-1987	1987-1993	1993-2001
PER CAPITA INCOME	4.2	4.5	4.7
TRANS. PRICE INCREASE	4.5	4.5	4.5
POPULATION	1.5	1.3	1.2
PASSENGER MOVEMENT	5.5	5.7	5.8

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981-1987	1987-1993	1993-2001
NON-AGRI. AGRICULTURE	7.1	7.4	7.5
FREIGHT	1.9	1.9	1.9

2.5 誘発および開発交通量

メインレポートの7.3.3の3)で述べた方式を基に誘発および開発交通量の通常交通量に対する比率を求めた。

RATE OF INDUCED AND DEVELOPED TRAFFIC

ITEM	YEAR		
	1987	1993	2001
INDUCED	15.0	15.0	15.0
DEVELOPED	0.0	3.4	3.4

2.6 将来交通量

1) 車種構成

計画路線上の旅客・貨物に関する将来交通需要を、以下の車種構成比によって車種別交通量に変換した。

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	1982	0.0	22.2	48.6	29.2	0.0	2.9	35.3	61.8	0.0
	1987	2.7	24.5	41.4	28.4	3.0	6.6	30.2	54.7	8.4
	1993	5.9	27.2	32.8	27.5	6.6	11.1	24.1	46.3	18.5
	2001	10.2	30.8	21.3	26.2	11.5	17.0	16.0	35.0	32.0
2	1982	8.8	79.4	8.8	2.9	0.0	24.0	20.0	44.0	12.0
	1987	12.3	75.9	7.6	3.5	0.6	22.2	18.9	41.6	17.3
	1993	16.5	71.7	6.2	4.3	1.3	19.9	17.7	38.8	23.6
	2001	22.1	66.2	4.2	5.2	2.3	17.0	16.0	35.0	32.0

2) 将来ADT

計画路線上のリンク加重平均将来交通量は以下に示すとおりであり、またその道路リンク別交通タイプ別の詳細はTable 18.2.1に示す。

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			
1987	8	26	17	2	56	12	23	5	149	210	359
1993	16	30	24	6	76	9	18	8	188	243	431
2001	35	30	37	16	11	6	13	12	262	295	557

3. 農業開発

3.1. 現況

影響圏の農耕地の約80%が、水田であり、畑地では、キャッサバが最も多く、落花生及びケナフがこれに次いでいる。未開発可耕地は、主として畑地がPho Chai郡の地域に残っている。

図内の土地利用及び土地適応性の状況はTable 18.3.1とFigure 18.3.1に示し、また、Kalasin 及び Roi Et 両県地域の代表的作物は、Figure 18.3.2のとおりである。

3.2. 開発予測

影響圏内の将来の農業開発状況を、With ProjectとWithout Projectの双方について予測した。予測した作付面積、単位当り収量及び生産量はTable 18.3.2のとおりである。代表的作物の農家庭先価格と農業生産費とは、各県の資料及び現地調査の結果を参考にし、Table 18.3.3.のように見積った。

上記のごとく各作物ごとに予測された生産量と庭先価格により、生産価値を計算し、これから農業生産費及び別途見積られた開墾費を差引き、純生産価値(N.P.V)をTable 18.3.4.のように算出した。

このN.P.VのWith Projectの場合と、Without Projectの場合の差が、この道路の開発便益である。

4. 走行費の節減

本報告書、第1巻、第7章で述べた概念と基礎データにもとづき関連する各道路リンクの走行費(以下"VOC"という)をWith ProjectとWithout Projectの両ケースについて計算した。

各リンクにおけるVOCのコスト増に影響を与える道路状況は以下に示すとおりである。

Road Condition

Link	Without Project				With Project			
	No. Terrain	Length (Km)	^{/1}	Nos. of Wooden Bridge	Nos. of Narrow C. Bridge	Length (Km)	^{/1} Road Class	
Road Class			Case 1				Case 2	
1 Flat	25.5	2B	4	0	25.5	1 (F4)	2A (F5)	0
2 Flat & Rolling	25.2	3	2	2	25.2			0

^{/1}

- Road 1 : Paved Road
- Road 2A : Laterite Road with good surface condition and alignment
- Road 2B : Laterite Road with good surface condition but poor alignment
- Road 3 : Laterite Road with poor surface condition and alignment
- Road 4 : Earth Road

VOC 節減は、With Project の全リンクの VOC と Without Project の際の VOC との差で、当道路における VOC の節減は次に示すとおりである。

Vehicle Operating Cost Saving

(Unit: 1,000 Baht)

Road Class	1987	1993	2001
1 (F4)	4,693	6,458	9,515
2A (F5)	2,576	3,904	5,996

5. エンジニアリング

5.1 予備設計

予備設計は、次に示す設計規準を基本に行った。

Design Standard	: F4 (if not feasible, F5)
Geometric Design	: AASHTO (Rural Highways)
Typical Cross Section	: as shown in Figure 18.5.1
Minimum Height of Embankment	
Ordinary Section	: 1.0m
Approach of Bridge in Flat Area	: 2.0m
Flood Section	: 0.7m (above flood level)

Pavement Structure

In case of F4 Standard

DBST	: 2.5cm
Crushed Stone Base CBR _{>} 80%	: 15.0cm
Soil Aggregate Subbase CBR _{>} 20%	: 15.0cm
Selected Material CBR _{>} 6%	: 20.0cm

In case of F5 Standard

Soil Aggregate Surface CBR _{>} 20%	: 15.0cm
Selected Material CBR _{>} 6%	: 20.0cm

Pipe Culvert

Standard Size	: φ 100cm
Standard Interval	
Paddy Area	: 200 m
Others	: 500 m

Box Culvert

Standard Size : 2.4m x 2.4m
Location : as required

Bridge

Standard Type (width 7.0m)
Short Span Bridge : RC - Slab
Long Span Bridge : PC - Girder
Location : as shown in Bridge List in Figure 18.5.2

ルートの線形は、Figure 18.5.2 示す。

5.2 工事数量および建設費

予備設計による工事数量は建設費は、各工事ごとに単価を付してTable 18.5.1 に示す。
道路規格別の建設費を財務費用および経済費用に分けて集計すると、下表に示すとおりとなる。

Total Financial and Economic Construction Cost

Road Class	Length (Km)	Construction Cost (10 ³ B)		Remark
		Financial Cost	Economic Cost	
F4 (DBST)	50.7	98,245	89,203	
F5 (Laterite)	50.7	59,599	54,020	

6. 経済価格

年次別経済費用と便益及び評価結果はTable 18.6.1 及び 18.6.2 に示す通りである。
このルートはF4規格ではフィージブルでないがF5規格ではフィージブルである。

7. 社会インパクト

社会インパクトを示すデータ及び評価結果はTable 18.7.1 に示す通りである。

Table 18.1.1 SUMMARY OF ROAD INVENTORY

Item	Description	
Origin	C. Kalasin	
Destination	B. Khok Nong Bua (J.R. 2116)	
Length		
Total		50.7 km
Improvement Section		50.7 km
DOH Road		0 km
ARD Road		50.7 km
Others		0 km
New Alignment Section		0 km
Terrain	Flat and Partially Rolling	
Alignment (Hori./Vert.)	Fair / Fair	
Formation Width	5.5 m - 7.0 m, 6.6m (Weighted average)	
Embankment Section		
Length		50.7 km
Height	0.2 m - 1.0 m	
Cut Section		
Length		0 km
Depth	m - m	
Surface Type and Condition		
SBST or DBST	Good	0.7 km
Soil Aggregate	Good - Poor	50.0 km
Earth		0 km
Pipe Culvert	47 each	
Box Culvert	1 each	6.0 m
Bridge		
Permanent Bridge	3 each	114.0 m
Narrow Concrete Bridge	2 each	34.0 m (4m)
Wooden Bridge	6 each	116.7 m
Overflow Section	2 places	2.0 km

Table 18.1.2 ROAD INVENTORY (1)

PROPOSED ROUTE NO. IM-18

ROUTE NO. ARD

C. KALASIN ~ B. KHOK NONG BUA (J.R. 2116)

L = 50.7 Km

KALASIN/ROI ET

STATION (Km)		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	
VILLAGE																		
- Name																		
- Household (H)																		
- Population (P)																		
TERRAIN		Flat																
CROSS SECTION	Formation Width (m)	7.00	8.00	7.00	6.50	6.00	6.50		6.00		7.00	6.50	6.00		5.50			
	Embankment Height (m)	0.20	0.30	0.50	1.00	0.50	0.50	0.30	0.40	0.20	0.60		0.40		0.30	0.80	0.30	
	Cutting Depth (m)																	
PAVEMENT	Type/Length	DT																
	Condition							Good			Laterite						Poor	
FLOODING	Overflow Length(Km)/Height(m)																	
LAND USE	Left																	
	Right								Paddy									
PIPE CULVERT	Total Number									47								
BOX CULVERT & BRIDGE	Station (Km)			3.2	4.7	5.8				13.7		16.4				27.1	29.3	
	Dimension			W-Br. 4.30 x 25.00	W-Br. 4.50 x 12.00	C-Br. 7.00 x 27.00				W-Br. 4.00 x 60.00		W-Br. 4.50 x 6.20				W-Br. 4.00 x 5.00	C-Br. 4.50 x 18.00	
RIGHT OF WAY (m)											15.0							
ALIGNMENT	Horizontal																	
	Vertical																	
ROUTE NO., AGENCIES																	ARD	

ROAD INVENTORY (2)

PROPOSED ROUTE NO. IM-18

ROUTE No. ARD

C. KALASIN ~ B. KHOK NONG BUA (J.R. 2116) (Cont'd)

L = 50.7 Km.

KALASIN/ROI ET

STATION (Km)		30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	
VILLAGE			B. SA AT CHAI SI H = 120 P = 900		B. NA LAO H = 200 P = 1800			B. NONG NATHO H = 40 P = 300		B. PHO CHAI H = 500 P = 4000		B. KHOK KUNG H = 50 P = 400						
TERRAIN			Flat						Rolling									
CROSS SECTION	Formation Width (m)	7.30	7.00	6.00	7.00	6.00	6.50		6.00									
	Embankment Height (m)	0.50	1.00		0.60	0.4	0.60	0.80	1.00		0.80		0.30					
	Cutting Depth (m)																	
PAVEMENT	Type/Length	Laterite																
	Condition	Poor																
FLOODING	Overflow Length(Km)/Height(m)		L=1.0 H=0.2															
LAND USE	Left		Paddy						Bush		Paddy		Cassava					
	Right		Paddy						Cassava		Paddy		Cassava					
PIPE CULVERT	Total Number																	
BOX CULVERT & BRIDGE	Station (Km)		33.2		36.5					46.3		48.5						
	Dimension		C-Box 7.50 x 6.00		C-Br. 4.50 x 16.00					C-Br. 8.30 x 81.00		W-Br. 4.50 x 8.50						
RIGHT OF WAY (m)		15.0																
ALIGNMENT	Horizontal	Fair																
	Vertical	Fair																
ROUTE NO., AGENCIES		ARD																

Table 18.2.1 TRAFFIC VOLUME ON ROUTE IM -18

YEAR	1987			1993			2001			
LINK	1	2	AVR.	1	2	AVR.	1	2	AVR.	
P/C	N+D	3	11	7	8	19	13	20	39	30
	I	0	2	1	1	3	2	3	6	4
	DV	0	0	0	0	1	1	1	2	1
	TOTAL	3	12	8	9	23	16	24	46	35
L/B	N+D	39	7	23	42	7	25	43	7	25
	I	6	1	3	6	1	4	6	1	4
	DV	0	0	0	2	0	1	2	0	1
	TOTAL	44	8	26	50	9	30	51	9	30
M/B	N+D	27	3	15	35	5	20	52	9	31
	I	4	0	2	5	1	3	8	1	5
	DV	0	0	0	1	0	1	2	0	1
	TOTAL	30	4	17	42	6	24	62	11	37
H/B	N+D	3	1	2	9	2	5	23	4	14
	I	0	0	0	1	0	1	3	1	2
	DV	0	0	0	0	0	0	1	0	1
	TOTAL	3	1	2	10	2	6	27	5	16
P/P&T	N+D	27	71	49	40	88	64	69	120	94
	I	4	11	7	6	13	10	10	18	14
	DV	0	0	0	2	3	3	3	5	4
	TOTAL	31	81	56	48	105	76	82	143	112
4/T	N+D	17	4	11	11	4	8	7	3	5
	I	3	1	2	2	1	1	1	1	1
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	19	5	12	14	5	9	8	4	6
6/T	N+D	30	10	20	22	9	15	15	8	11
	I	5	1	3	3	1	2	2	1	2
	DV	0	0	0	1	0	1	1	0	0
	TOTAL	35	11	23	26	10	18	18	9	13
10/T	N+D	5	4	4	9	5	7	13	7	10
	I	1	1	1	1	1	1	2	1	2
	DV	0	0	0	0	0	0	1	0	0
	TOTAL	5	5	5	10	6	8	16	8	12
ADT	N+D	149	110	129	177	139	158	242	198	220
	I	22	16	19	26	21	24	36	30	33
	DV	0	0	0	7	5	6	10	8	9
	TOTAL	171	126	149	210	166	188	288	235	262
M/C	N+D	214	168	191	239	197	218	289	245	267
	I	20	17	18	22	19	20	24	21	23
	DV	0	0	0	5	5	5	6	5	6
	TOTAL	235	185	210	267	220	243	319	272	295
TOTAL	N+D	363	278	321	416	336	376	531	443	487
	I	43	33	38	48	39	44	61	51	56
	DV	0	0	0	12	10	11	16	13	14
	TOTAL	406	311	359	477	385	431	607	507	557

NOTE

N : NORMAL TRAFFIC
 DV : DEVELOPED TRAFFIC

D : DIVERTED TRAFFIC
 I : INDUCED TRAFFIC

Figure 18.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM - 18

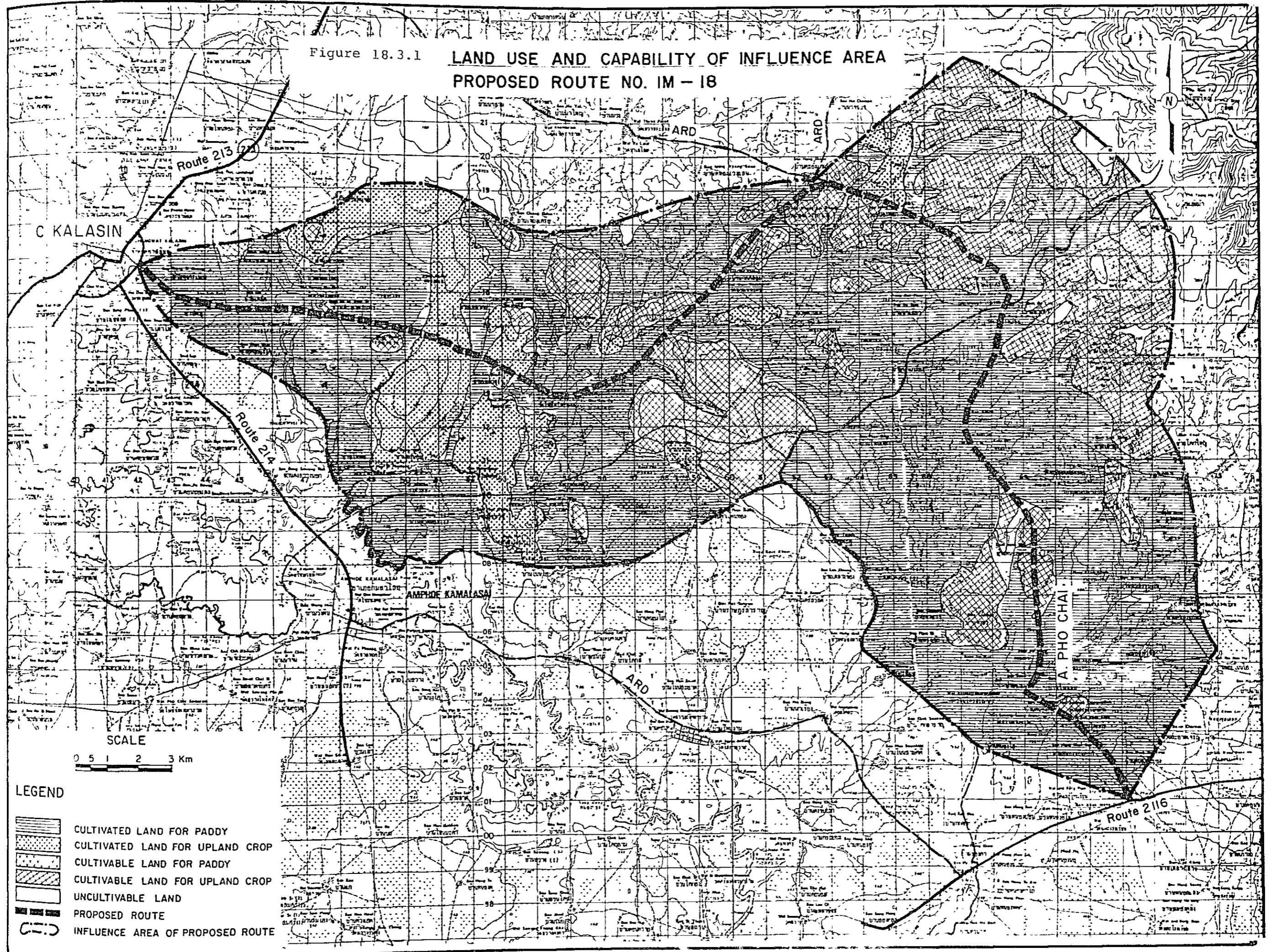
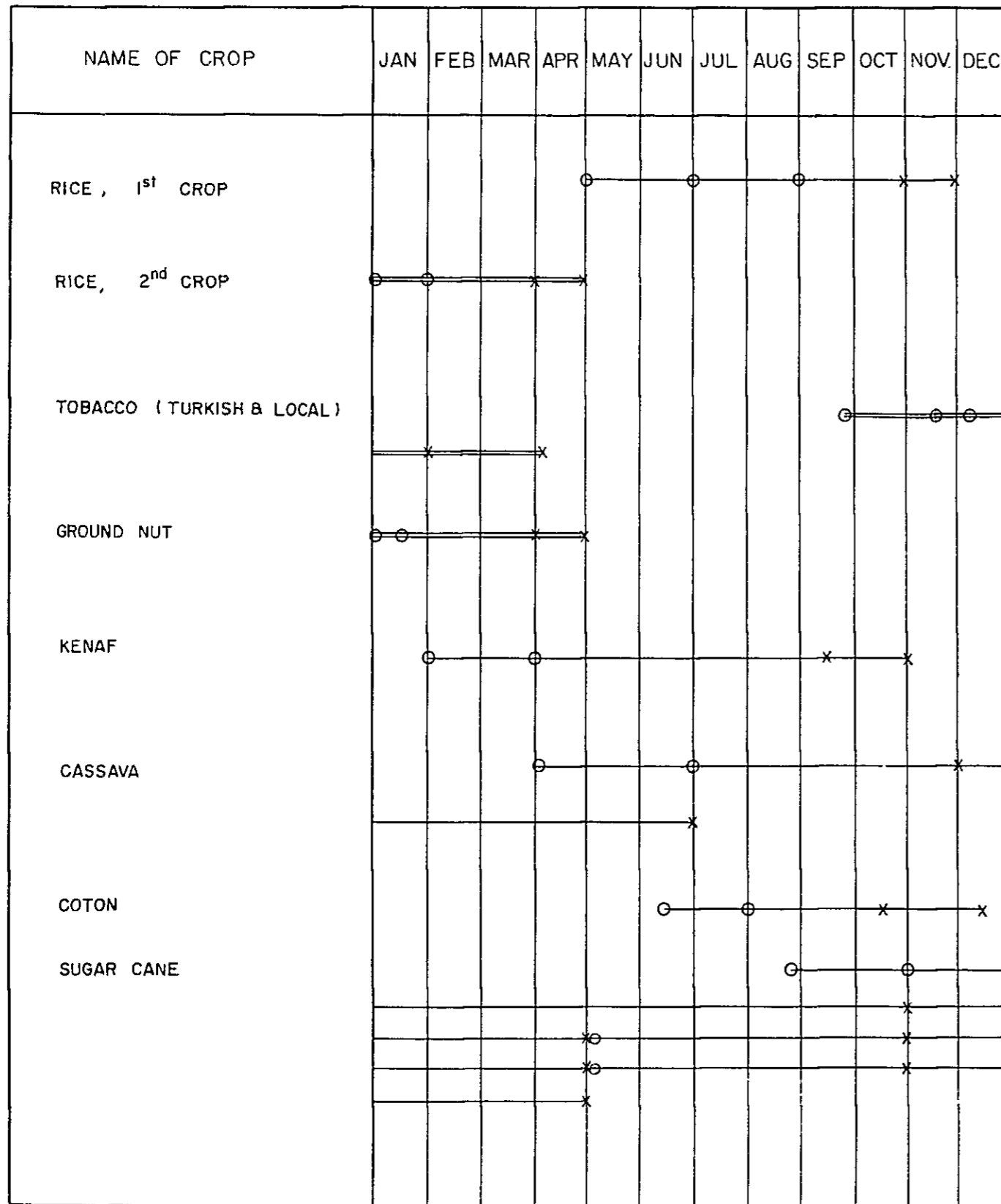


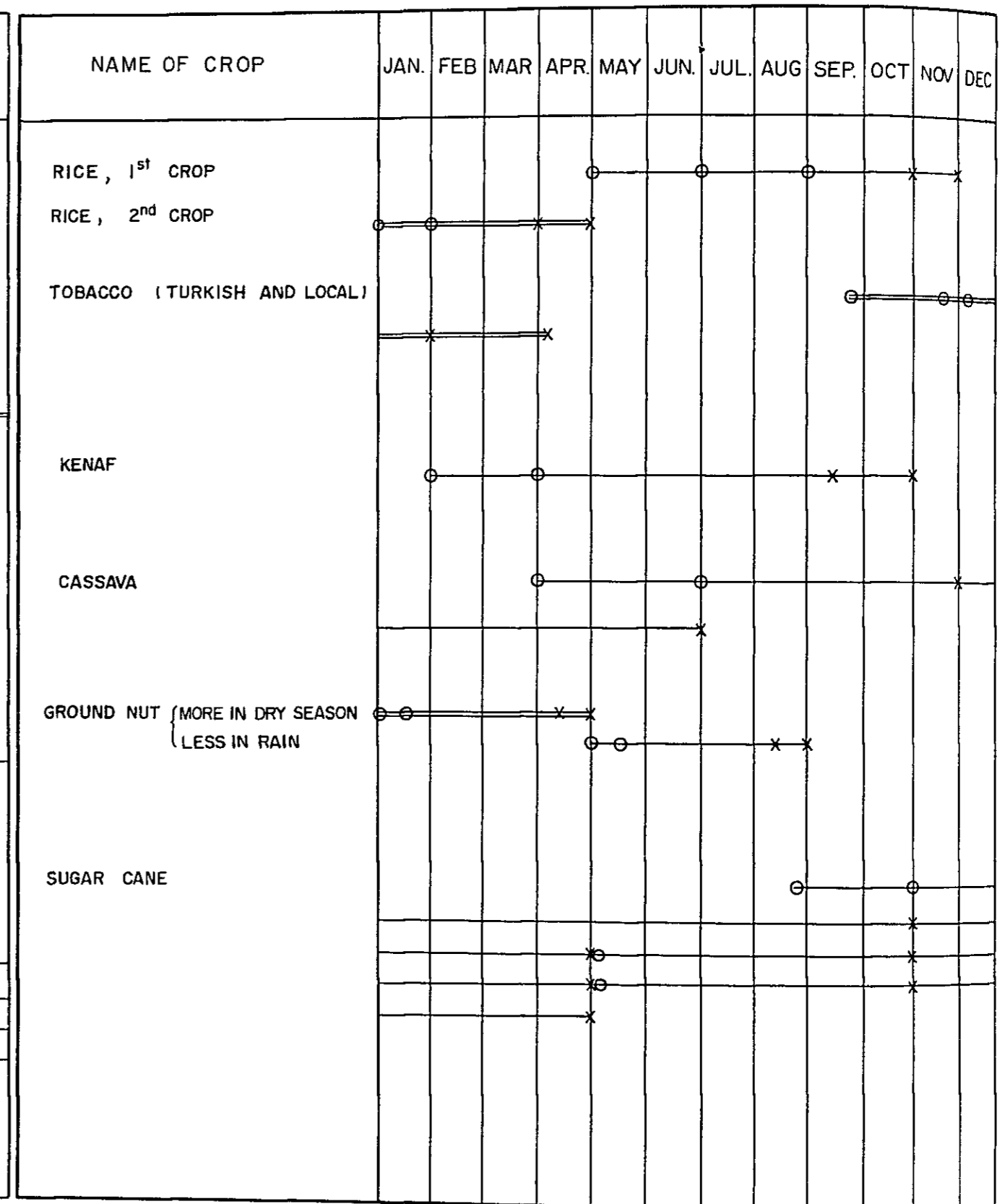
Figure 18.3.2 CROPPING CALENDAR(1)

0800 CHANGWAT KALASIN



CROPPING CALENDAR(2)

0900 CHANGWAT ROIET



Note :

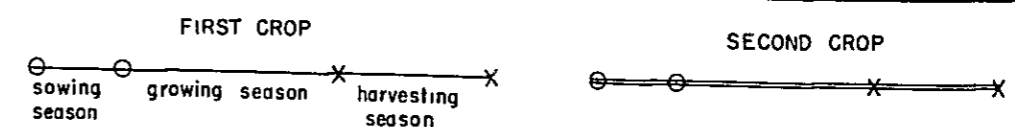


TABLE 18.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM²)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		153.125 (245.0)	21.125 (33.8)	174.250 (278.8)	0.750 (1.2)	49.375 (79.0)	50.125 (80.2)
0801	M. KALASIN	71.250 (114.0)	20.000 (32.0)	91.250 (146.0)	-	28.125 (45.0)	28.125 (45.0)
0812	KAMALASAI	13.750 (22.0)	1.125 (1.8)	14.875 (23.8)	-	3.750 (6.0)	3.750 (6.0)
0902	PHO CHAI	68.125 (109.0)	-	68.125 (109.0)	0.750 (1.2)	17.500 (28.0)	18.250 (29.2)

TABLE 18.3.2 CROP PRODUCTION

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)										
1981	153.03	-	-	1.94	19.34	-	0.17	-	21.45	174.48
1987	157.68	-	-	1.94	20.05	-	0.17	-	22.16	179.84
1993	WITHOUT PROJECT	-	-	1.94	20.78	-	0.17	-	22.89	185.36
	WITH PROJECT	-	-	2.18	23.94	-	0.17	-	26.30	191.70
2001	WITHOUT PROJECT	-	-	1.94	21.80	-	0.17	-	23.91	192.99
	WITH PROJECT	-	-	2.18	25.11	-	0.17	-	27.47	199.61
CROP YIELD (KG/RAI)										
1981	209.4	-	-	185.9	2669.5	-	189.6	-	-	-
1987	212.0	-	-	185.9	2669.5	-	189.6	-	-	-
1993	WITHOUT PROJECT	-	-	185.9	2669.5	-	189.6	-	-	-
	WITH PROJECT	-	-	187.0	2685.6	-	189.6	-	-	-
2001	WITHOUT PROJECT	-	-	185.9	2669.5	-	189.6	-	-	-
	WITH PROJECT	-	-	188.5	2707.1	-	189.6	-	-	-
CROP PRODUCTION (TON)										
1981	32,049	-	-	360	51,633	-	32	-	52,035	84,084
1987	33,420	-	-	360	53,520	-	32	-	53,922	87,343
1993	WITHOUT PROJECT	-	-	360	55,475	-	32	-	55,878	90,729
	WITH PROJECT	-	-	408	64,290	-	33	-	64,742	100,863
2001	WITHOUT PROJECT	-	-	360	58,195	-	32	-	58,598	95,452
	WITH PROJECT	-	-	411	67,982	-	33	-	68,438	107,561

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 18.3.3 FARMGATE PRICE AND PRODUCTION COST

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,505	-	-	6,276	679	-	4,069	-
WITH PROJECT (1987 - 2001)	3,593	-	-	6,276	696	-	4,171	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	507	-	-	1,019	724	-	725	-
WITH PROJECT (1987 - 2001)	527	-	-	1,039	744	-	725	-

TABLE 18.3.4 NET PRODUCTION VALUE

YEAR	(1000 BAHT)					
	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	37,160	22,119	59,279	36,948	22,593	59,541
1993	39,745	22,917	62,662	42,583	27,242	69,825
2001	43,410	24,026	67,436	49,815	28,959	78,774

Figure 18.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE

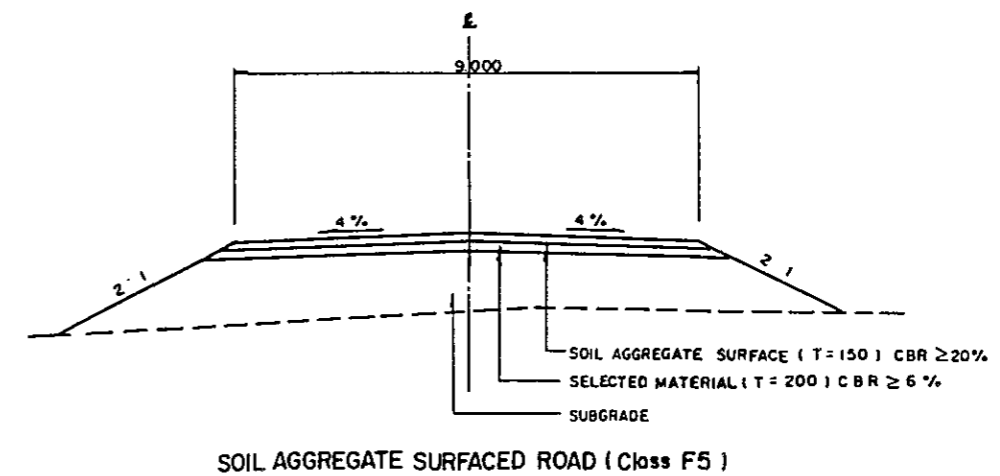
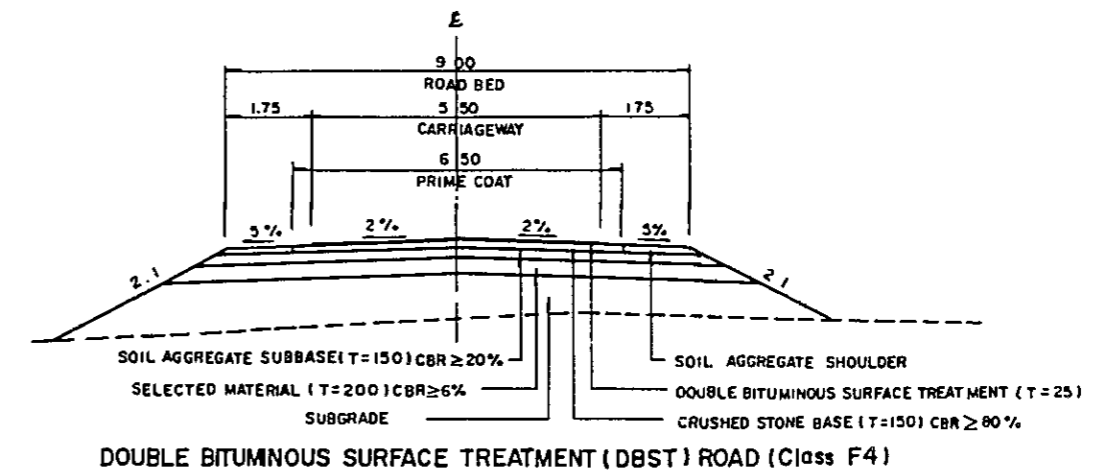
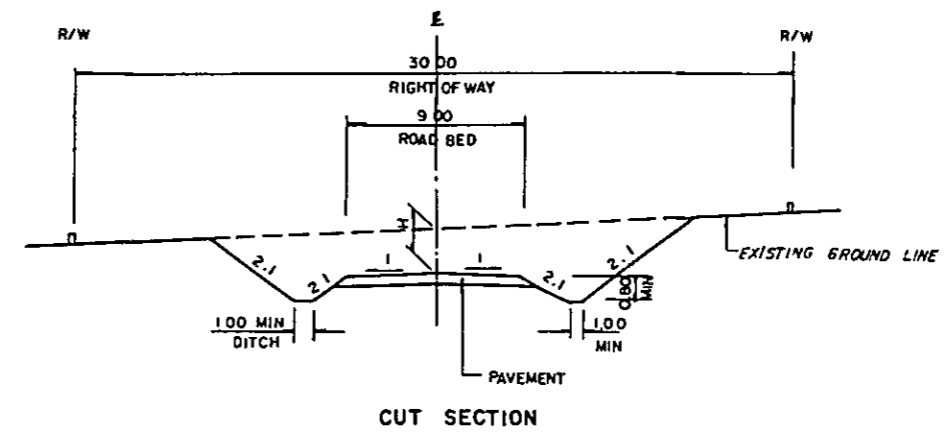
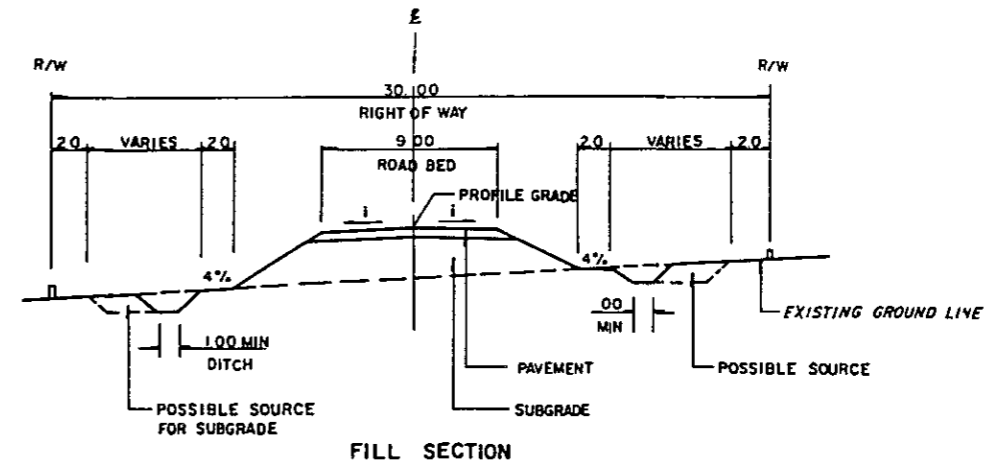
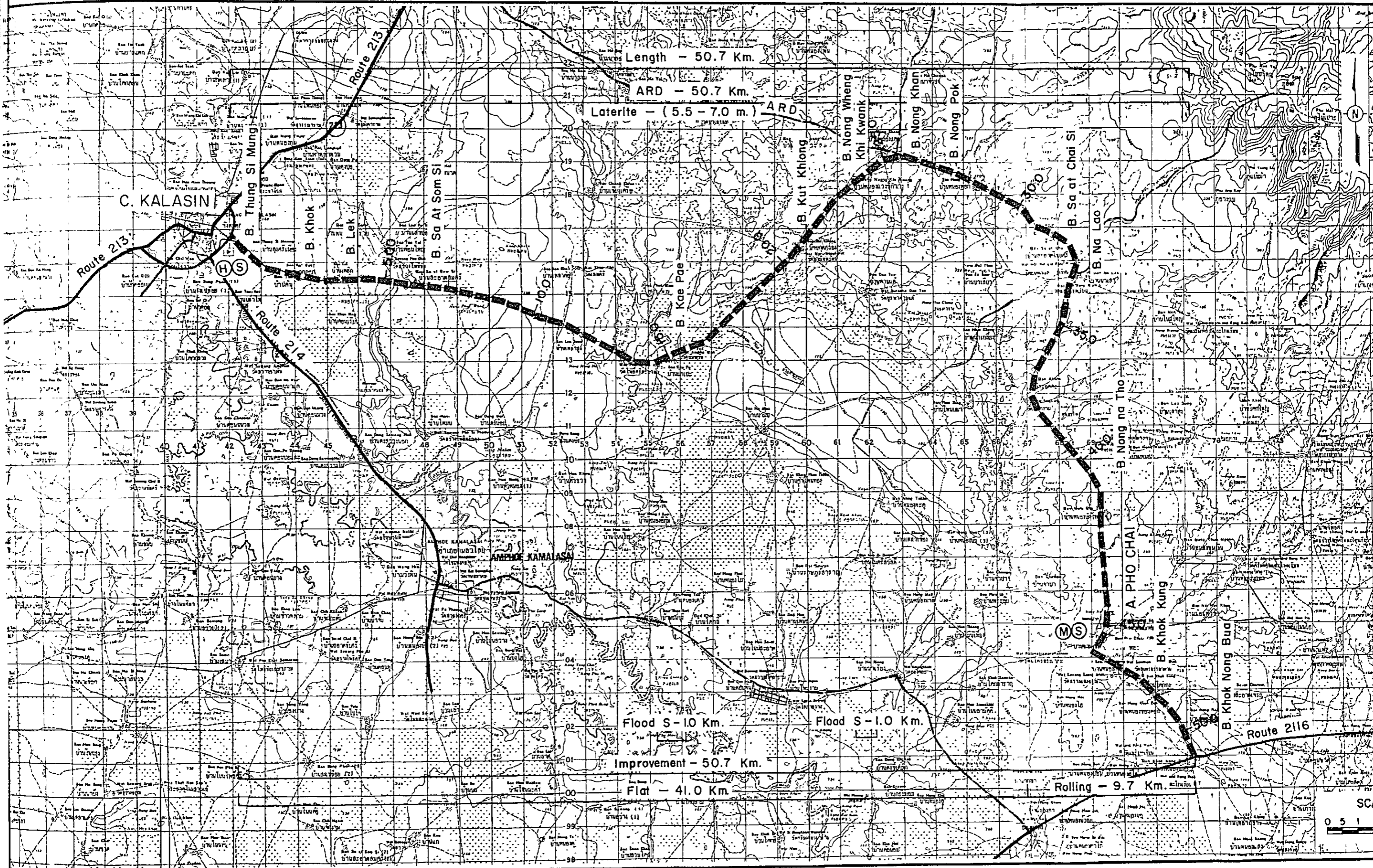
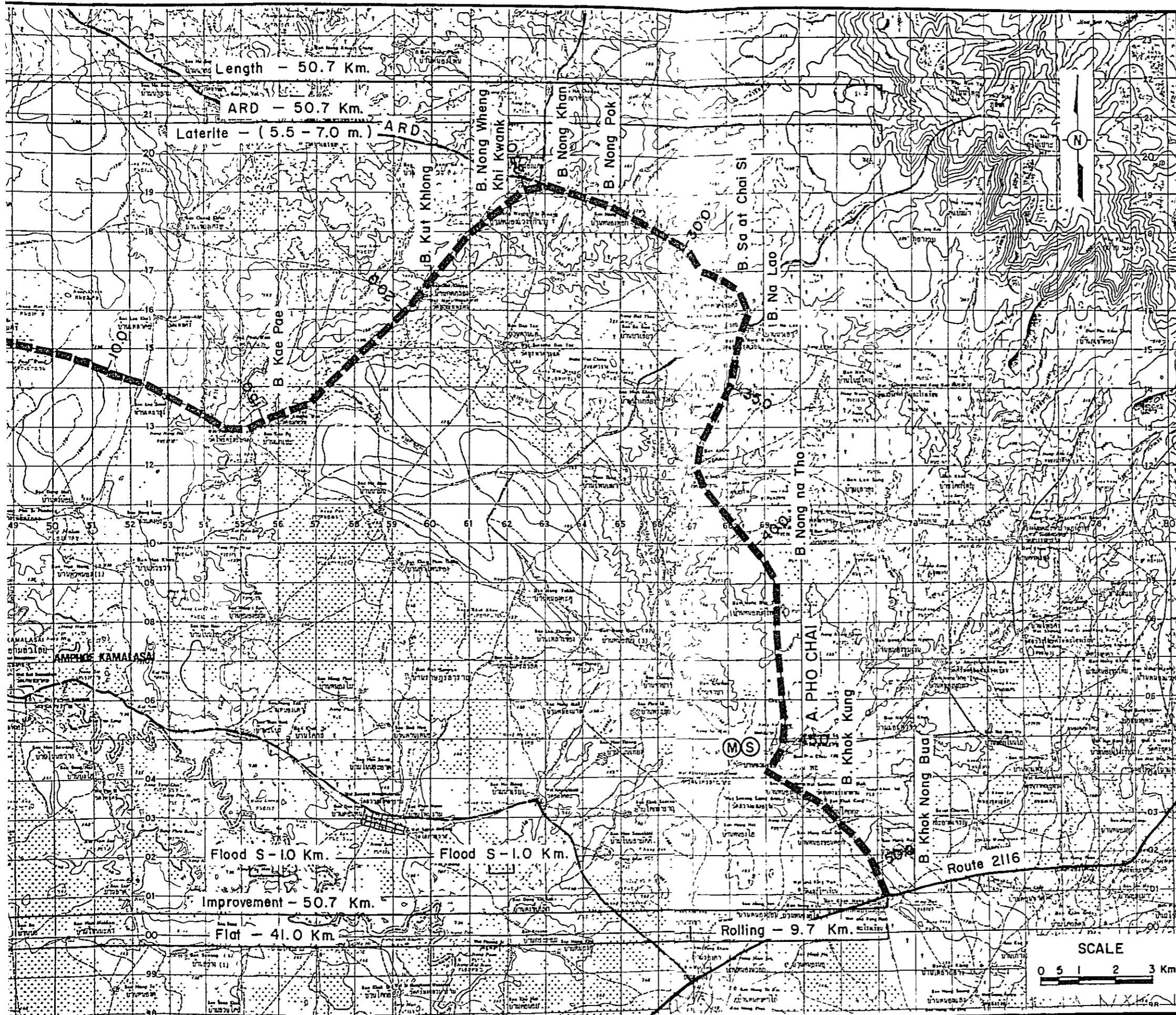


Figure 18.5.2 PROPOSED ROUTE NO. IM - 18

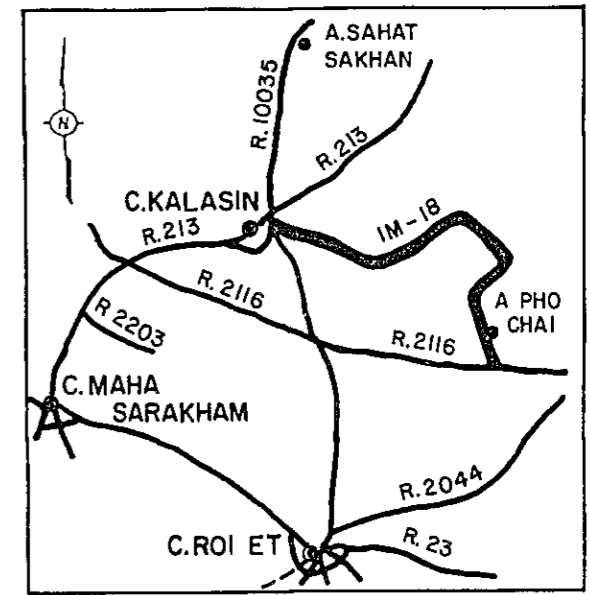
C. KALASIN
ROI ET

C. KALASIN - B. KHOK NONG BUA (J.R. 2116)
ROUTE NO. ARD
L = 50.7 Km.





LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	3.2	C - 7 00 x 27.00	W - 4 30 x 25 00
2	4.7	C - 7 00 x 14 00	W - 4 50 x 12.00
3	5.8	—	C - 7 00 x 27.00
4	13.7	C - 7 00 x 62.00	W - 4 00 x 60.00
5	16.4	C - 7 00 x 9.00	W - 4 50 x 620
6	27.1	C - 7 00 x 7 00	W - 4 00 x 5 00
7	29.3	C - 7 00 x 18.00	C - 4 00 x 18.00
8	33.2	—	C - 7 50 x 6 00
9	36.5	C - 7 00 x 16 00	C - 4 50 x 16.00
10	46.3	—	C - 8 50 x 8 100
11	48.5	C - 7.00 x 12.00	W - 4.50 x 8.50

LEGEND

- PROPOSED ROUTE (IMPROVEMENT)
- PROPOSED ROUTE (NEW CONSTRUCTION)
- PAVED ROUTE
- UNPAVED ROUTE
- INVENTORY SURVEY ROUTE
- HOSPITAL
- MEDICAL CENTER
- SECONDARY SCHOOL

Table 18.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-18 (50.7 km)

Items	Unit of Q'ty	Financial Unit Rate ₪	(DBST)			(Soil Aggregate Surface)		
			Q'ty	Financial Cost (10 ³ ₪)	Economic Cost (10 ³ ₪)	Q'ty	Financial Cost (10 ³ ₪)	Economic Cost (10 ³ ₪)
DIRECT CONSTRUCTION COST								
Clearing and Grubbing	ha	15,000	119	1,785	1,624	119	1,785	1,624
Excavation - Soil	m ³	20	0	0	0	0	0	0
Excavation - Hard Rock	m ³	160	0	0	0	0	0	0
Embankment	m ³	45	163,800	7,371	6,707	163,800	7,371	6,707
Selected Material	m ³	80	106,000	8,480	7,547	106,000	8,480	7,547
Soil Aggregate Surface or Subbase	m ³	105	74,300	7,801	6,943	74,300	7,801	6,943
Crushed Stone Base	m ³	370	48,800	18,056	16,611	7,300	2,701	2,484
Soil Aggregate Shoulder	m ³	105	21,000	2,205	1,962	3,200	336	299
Prime Coat and DBST	m ²	55	275,000	15,125	13,613	41,000	2,255	2,030
Pipe Culvert	m	2,100	2,060	4,326	3,979	2,060	4,326	3,979
Box Culvert	m	16,000	4	64	57	4	64	57
Long Span Bridge	m	80,000	0	0	0	0	0	0
Short Span Bridge	m	40,000	135	5,400	4,806	165	6,600	5,874
Sub Total (a)				70,613	63,853		41,719	37,548
Miscellaneous Works (a) x 7%				4,943	4,470		2,920	2,628
Total (b)				75,556	68,323		44,639	40,176
PHYSICAL CONTINGENCY (b) x 15%				11,333	10,248		6,696	6,026
ENGINEERING AND ADMINISTRATION (b) x 10%				7,556	6,832		4,464	4,018
Sub Total				18,889	17,080		11,160	10,044
LAND ACQUISITION								
Highly Developed Land	ha	50,000	76	3,800	3,800	76	3,800	3,800
Less Developed Land	ha	15,000	0	0	0	0	0	0
Sub Total				3,800	3,800		3,800	3,800
GRAND TOTAL				98,245	89,203		59,599	54,020

Table 18.6.1 COST AND BENEFITS
(F4 STANDARD)

YEAR	COST					BENEFITS			DISCOUNTED(12%)	
	CONST.	AGRI.	VOC	RMC	TOTAL	COST	BENEFIT			
	COST	BENEFIT	SAVING	SAVING						
1984	17,841	0	0	0	0	25,065	0			
1985	44,601	0	0	0	0	55,947	0			
1986	26,761	0	0	0	0	29,972	0			
1987	0	262	4,693	-192	4,763	0	4,253			
1988	0	1,245	4,987	-177	6,055	0	4,827			
1989	0	2,228	5,281	-163	7,346	0	5,229			
1990	0	3,211	5,575	-148	8,638	0	5,490			
1991	0	4,194	5,870	-134	9,930	0	5,634			
1992	0	5,176	6,164	-119	11,221	0	5,685			
1993	0	6,159	6,458	-105	12,513	0	5,660			
1994	24,539	6,803	6,840	-83	13,560	11,100	5,477			
1995	0	7,446	7,223	-61	14,607	0	5,268			
1996	0	8,089	7,605	-39	15,654	0	5,040			
1997	0	8,732	7,987	-18	16,702	0	4,801			
1998	0	9,376	8,369	4	17,749	0	4,556			
1999	0	10,019	8,751	26	18,796	0	4,308			
2000	0	10,662	9,133	48	19,843	0	4,060			
2001	-43,086	11,305	9,515	69	20,890	-7,872	3,817			
TOTAL	70,656	94,907	104,450	-1,090	198,267	114,214	74,103			

DISCOUNTED ECONOMIC COSTS :	114,214
DISCOUNTED ECONOMIC BENEFITS :	74,103
AGRICULTURAL DEVELOPMENT BENEFIT	32,138
VOC SAVING	42,715
RMC SAVING	-749
NET PRESENT VALUE :	-40,110
BENEFIT COST RATIO :	0.65
INTERNAL RATE OF RETURN :	7.5 %

Table 18.6.2 COST AND BENEFITS
(F5 STANDARD)

YEAR	COST					BENEFITS			DISCOUNTED(12%)	
	CONST.	AGRI.	VOC	RMC	TOTAL	COST	BENEFIT			
	COST	BENEFIT	SAVING	SAVING						
1984	0	0	0	0	0	0	0			
1985	21,608	0	0	0	0	27,105	0			
1986	32,412	0	0	0	0	36,301	0			
1987	0	262	2,576	-22	2,816	0	2,514			
1988	0	1,245	2,797	-12	4,030	0	3,213			
1989	0	2,228	3,018	-2	5,244	0	3,732			
1990	0	3,211	3,240	7	6,458	0	4,104			
1991	0	4,194	3,461	17	7,672	0	4,353			
1992	0	5,176	3,683	26	8,886	0	4,502			
1993	0	6,159	3,904	36	10,100	0	4,569			
1994	3,630	6,803	4,166	50	11,018	1,642	4,450			
1995	0	7,446	4,427	64	11,937	0	4,304			
1996	0	8,089	4,689	77	12,855	0	4,139			
1997	0	8,732	4,950	91	13,773	0	3,960			
1998	0	9,376	5,211	105	14,692	0	3,771			
1999	0	10,019	5,473	118	15,610	0	3,577			
2000	0	10,662	5,734	132	16,528	0	3,382			
2001	-26,901	11,305	5,996	146	17,447	-4,915	3,187			
TOTAL	30,749	94,907	63,325	833	159,065	60,134	57,758			

DISCOUNTED ECONOMIC COSTS :	60,134
DISCOUNTED ECONOMIC BENEFITS :	57,758
AGRICULTURAL DEVELOPMENT BENEFIT	32,138
VOC SAVING	25,405
RMC SAVING	215
NET PRESENT VALUE :	-2,376
BENEFIT COST RATIO :	0.96
INTERNAL RATE OF RETURN :	11.6 %

Table 18.7.1 SOCIAL INDICATORS
(Proposed Route IM-18)

Population (1,000)		Education	
1982	: 52.5	Access to Secondary School	
1993	: 61.3	Number of Student in 1993 (1,000) ^{2/}	: 13.5
Average travelling speed, without (kph)	: 44	Average distance to school (km)	: 10.3
Isolation		Per capita time savings (10 ⁻⁴)	: 0.067
Access to Amphoe		Score	: 36
Average distance to Amphoe (km) ^{1/}	: 13.9	Teacher Intensity	
Per capita time savings (10 ⁻⁴)	: 0.020	Number of teachers ^{3/}	
Score	: 59	University graduate	: -
Access to Artery Highway		Total	: 6
Average distance to highway (km) ^{1/}	: 5	Number of Student	: 140
Per capita time savings (10 ⁻⁴)	: 0.007	Indicators	
Score	: 15	E1 ^{4/}	: -
Impassability		E2 ^{5/}	: 42.9
Impassable week a year	: 4	E ^{6/}	: 42.9
Impassability per year	: 0.077	Degree of Improvement ^{7/}	: 1.59
Impassability per capita (10 ⁻⁴)	: 0.013	Score	: 102
Score	: 108	Disparity	
Health		G.P.V. in 1993 (Mn B) ^{8/}	
Access to Hospital		With project	: 177.2
Average distance to Hospital (km) ^{1/}	: 15.0	Without project	: 162.2
Per capita time savings (10 ⁻⁴)	: 0.022	Per capita G.P.V. in 1993 (B)	
Score	: 51	With project (W)	: 2,891
Access to Medical Facilities		Without project (w)	: 2,646
Average distance to facilities (km) ^{1/}	: 10.5	Degree of Disparity	
Per capita time savings (10 ⁻⁴)	: 0.015	(A/W) - (A/w) ^{9/}	: 0.10
Score	: 60	Score	: 179
		Total Score	: 610

Note:

- ^{1/} () shows the length or distance in without project case. Unless otherwise, lengths are same both in with project case and without project case.
- ^{2/} Number of secondary school student estimated based on the projected population of the areas of influence applying ratios of secondary school students to the total population in the sample area.
- ^{3/} Numbers of the sample areas
- ^{4/} (Number of University Graduate Teachers)/(Total Number of Student) x 1,000
- ^{5/} (Total of Teachers)/(Total Number of Student) x 1,000
- ^{6/} Sum of ^{4/} and ^{5/}
- ^{7/} Ratio of E value of each route to an average value of the same indicator E in case of the sample areas, 33 in number, along paved road near the proposed routes.
The average value of E in case of paved roads were calculated at 68.4 from the following data:
Number of university graduate teachers 438
Number of Teachers 1,285
Number of student 25,196
- ^{8/} Estimated gross value of crop production in the areas of influence
- ^{9/} "A" indicates an average per capita value of crop production in the Northeastern Region, which is estimated assuming that:
- GRP per capita of the Northeast is estimated at 11,897 Baht in 1993,
- Agricultural sector shares 40% of GRP, and
- Crop production shares 80% of agricultural production.

PROPOSED ROUTE NO. IM - 19

Changwat : Roi Et

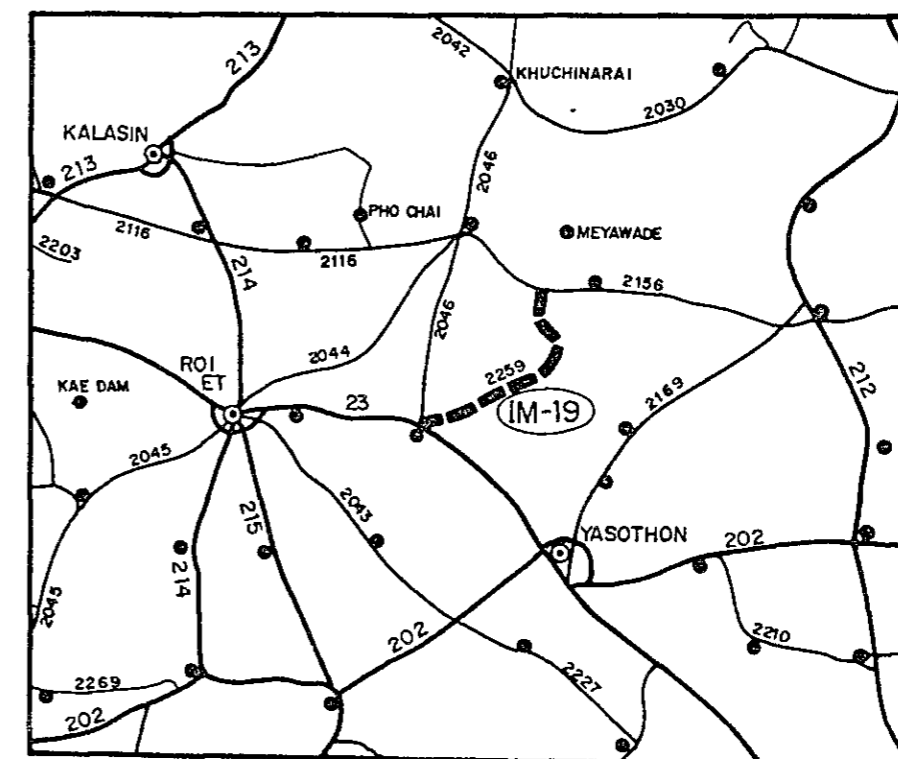
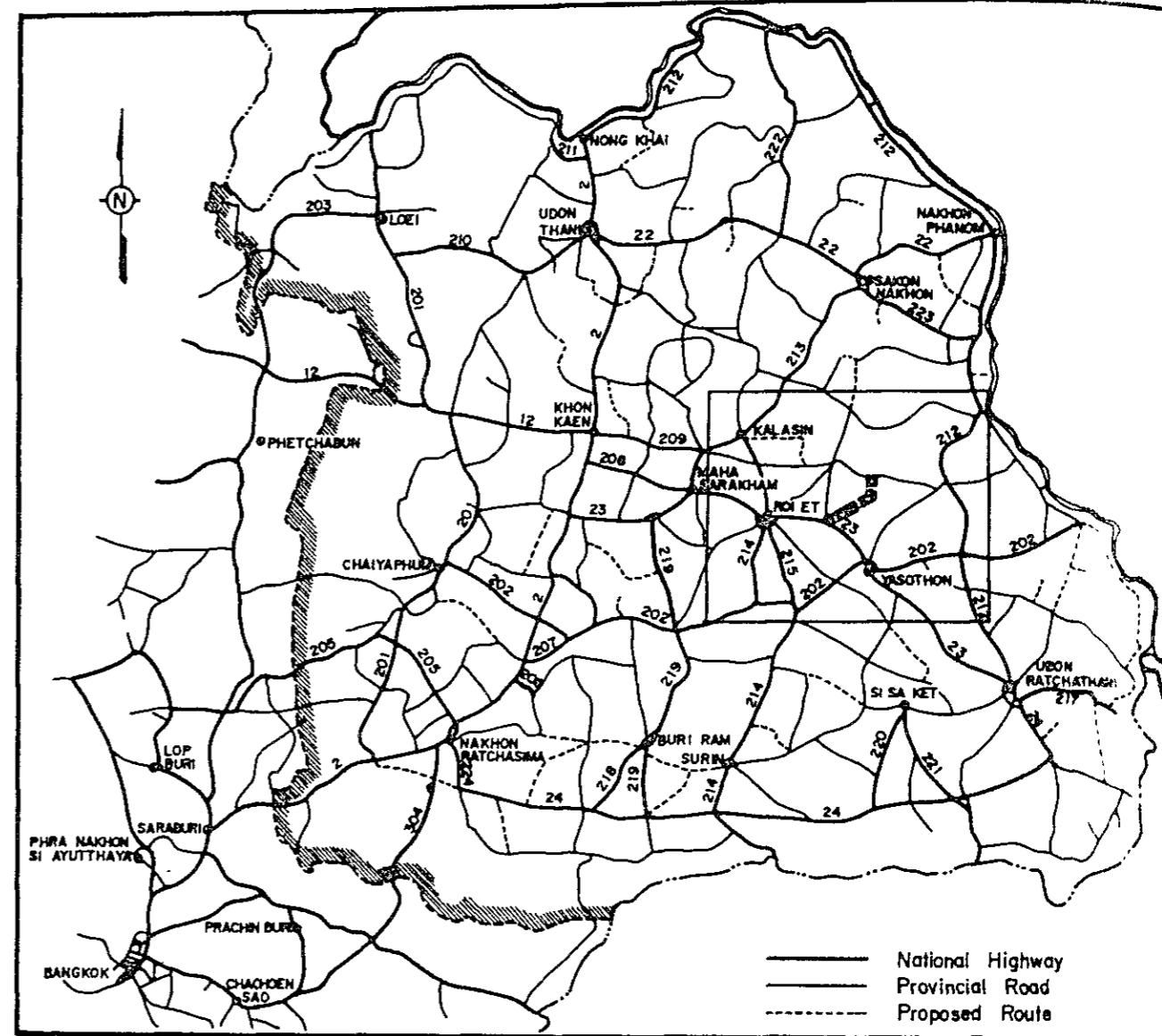
A. Selaphum (J.R 23) - B. Kham Phon Sung (J.R.2136)

Length : 46.0 K M.

SUMMARY
PROPOSED ROUTE IM-19

Item	Description
Changwat	ROI ET
Origin	A. selaphum (J.R.23)
Destination	B. Kham Phon Sung (J.R.2136)
Length	
Total	46.0 km
Improvement Section	46.0 km
DOH Road	R.2259 46.0 km
ARD Road	0 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Good - Poor
Terrain	Flat and Rolling
Influence Area	
Area	340 km ²
Population (1982)	37,600
Principal Crops	Paddy
Traffic (ADT)	
Existing	283
1993	896
2001	1,132
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	95,310 . 10 ³ ฿
Economic	86,000 . 10 ³ ฿
IRR	17.1 %
B/C	1.48
Recommendation	For further consideration

LOCATION OF PROPOSED ROUTE



1. 概要

1.1 計画路線の概要

本路線は、 Roi Et 県の東部に位置している。ルートは、 県道23号線の Salaphum 郡を起点とし北東に走り、 Na Thom 村、 Na Pho 村、 DongBung 村を経て、 県道2136号線の Kham Phon Sung 村で終わる。その総延長は、 46.0km である。(Figure 19.5.2 参照)

沿道の地形は、 ほぼ平坦であるが、 一部に丘陵も含む。影響圏内には、 いくつかの村があり、 その総人口は、 37,600 人である。沿道には、 医療センターが 3ヶ所、 病院が 1ヶ所あり、 教育施設として中学校が 1ヶ所ある。本路線の終着点近くの Nong Phok 郡には、 病院が 1ヶ所あり、 教育施設として中学校が 1ヶ所ある。

本路線は農業的に開発の進んだ地域における 2つの幹線道路、 県道23号線、 県道2136号線を結ぶ重要な道路網の形成を目的として計画されたものである。

1.2 現道の状況

計画路線に利用した現道の状況は Table 19.1.1 に要約し、 その詳細は Table 19.1.2 のイベントリー調査の結果に示した。

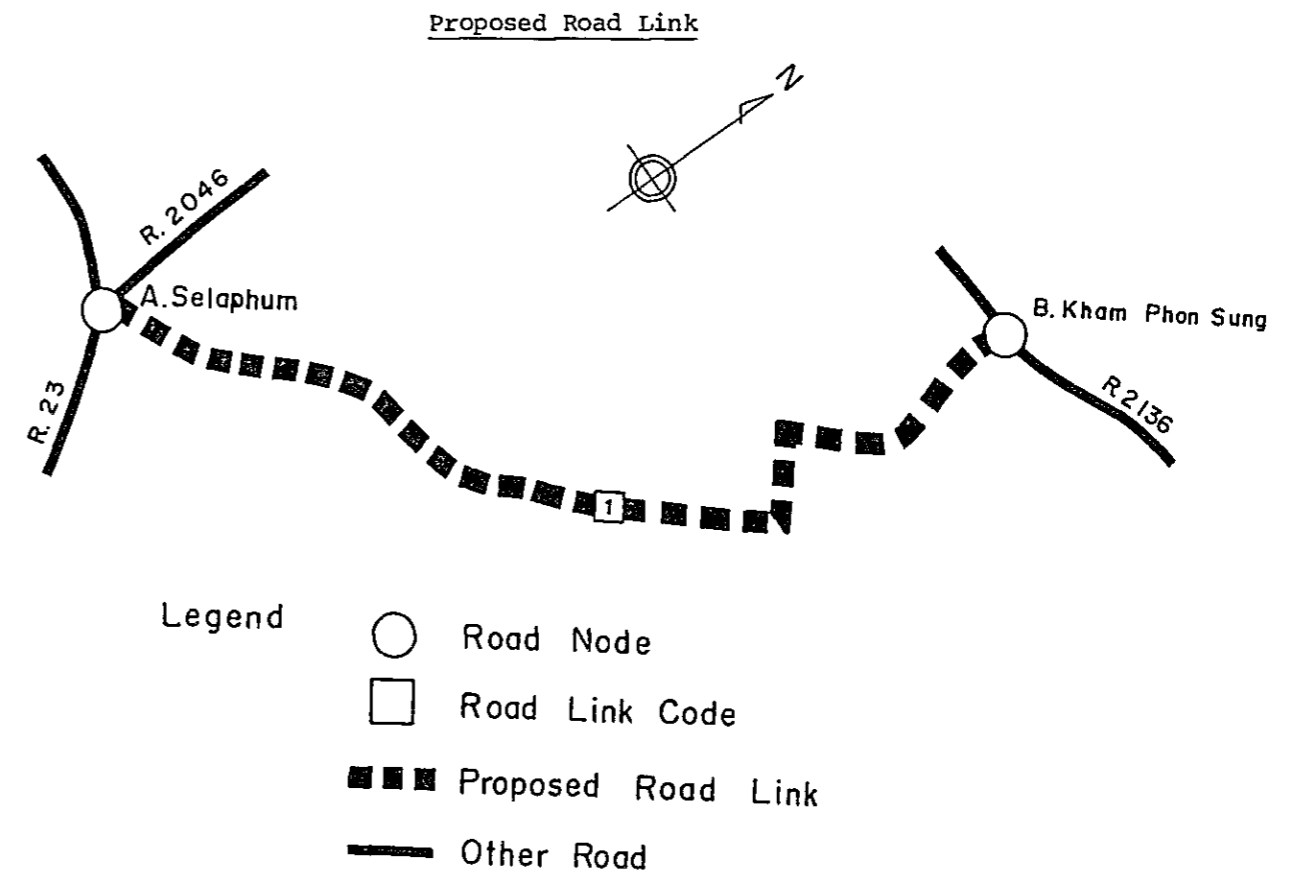
2. 交通

2.1 予測手法

計画対象路線に関し道路改良後の転換交通はほとんど無視し得るので、 交通量予測には「伸び率方式」を適用することとした。

2.2 基準年交通量

道路リンク別車種別の基準年交通量は、 本調査で実施したマニュアルカウンティングのデータを基として次のように推定した。



Traffic Volume in Base Year

Source (base year)	Link No.	Vehicle Type									
		P/C	P/P	L/B	M/B	H/B	P/T	4/T	6/T	10/T	ADT
Manual Counts (1982)	1	17	91	77	31	-	10	10	40	7	283

2.3 交通需要

計画路線上の旅客交通需要（トリップ/日）および貨物交通需要（トン/日）は、先に求めた基準年の交通量に路側インタビューによって得られる平均乗車人員もしくは平均貨物積載量をかけることによって推定した。推定結果は以下のとおりである。

PASSENGER MOVEMENT (1982)

PROPOSED ROAD LINK	TRIPS PER DAY
1	2152

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	113	47	160

2.4 交通需要の将来伸び率

1981-1987, 1987-1993, 1993-2001の各期間における旅客および貨物の交通需要の将来伸び率は、メインレポートの7.3.3の1)で述べた予測式に従って求めた。予測の前提および得られた将来伸び率は以下の通りである。

GROWTH RATE OF PASSENGER MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981-1987	1987-1993	1993-2001
PER CAPITA INCOME	4.2	4.5	4.7
TRANS. PRICE INCREASE	4.5	4.5	4.5
POPULATION	1.4	1.2	1.1
PASSENGER MOVEMENT	5.4	5.6	5.7

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981-1987	1987-1993	1993-2001
NON-AGRI. AGRICULTURE	7.0	7.2	7.4
FREIGHT	5.0	5.1	5.2

2.5 誘発および開発交通量

メインレポートの7.3.3の3)で述べた方式を基に誘発および開発交通量の通常交通量に対する比率を求めた。

RATE OF INDUCED AND DEVELOPED TRAFFIC

ITEM	YEAR (%)		
	1987	1993	2001
INDUCED	15.0	15.0	15.0
DEVELOPED	0.0	0.0	0.0

2.6 将来交通量

1) 車種構成

計画路線上の旅客・貨物に関する将来交通需要を、以下の車種構成比によって車種別交通量に変換した。

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	1982	7.9	42.1	35.6	14.4	0.0	14.9	14.9	59.7	10.4
	1987	9.1	40.9	31.0	16.4	2.6	15.5	15.2	53.2	16.1
	1993	10.6	39.4	25.5	18.9	5.6	16.1	15.5	45.4	22.9
	2001	12.5	37.5	18.1	22.2	9.7	17.0	16.0	35.0	32.0

2) 将来ADT

計画路線上のリンク加重平均将来交通量は以下に示すとおりであり、またその道路リンク別交通タイプ別の詳細はTable 19.2.1に示す。

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			
1987	27	93	49	8	136	13	46	14	387	371	758
1993	41	98	73	22	168	16	45	23	486	410	896
2001	68	99	121	53	227	20	45	41	674	458	1132

3. 農業開発

3.1. 現況

影響圏の農耕地の殆どが、水田であり、畑地には、僅かであるが、落花生、メイズ及び豆類が栽培されている。圏内の未開発可耕地は、水田、畑地の適地が広い範囲に残っている。

圏内の土地利用及び土地適応性の状況はTable 19.3.1とFigure 19.3.1に示し、また、P01 Et県地域の代表的作物暦は、Figure 19.3.2のとおりである。

3.2. 開発予測

影響圏内の将来の農業開発状況を、With ProjectとWithout Projectの双方について予測した。予測した作付面積、単位当たり収量及び生産量はTable 19.3.2のとおりである。代表的作物の農家庭先価格と農業生産費とは、各県の資料及び現地調査の結果を参考にTable 19.3.3のように見積った。

上記のごとく各作物ごとに予測された生産量と庭先価格により、生産価値を計算し、これから農業生産費及び別途見積られた開墾費を差引き、純生産価値(N.P.V)をTable 19.3.4のように算出した。

このN.P.VのWith Projectの場合と、Without Projectの場合の差が、この道路の開発便益である。

4. 走行費の節減

本報告書、第1巻、第7章で述べた概念と基礎データにもとづき関連する各道路リンクの走行費(以下"VOC"という)をWith ProjectとWithout Projectの両ケースについて計算した。

各リンクにおけるVOCのコスト増に影響を与える道路状況は以下に示すとおりである。

Road Condition

Link	Without Project				With Project		
	Length (Km)	^{/1} Road Class	Nos. of Wooden Bridge	Nos. of Narrow C. Bridge	Length (Km)	^{/1} Road Class	Nos. of Wooden Narrow Bridge
1 Flat & Rolling	46.0	3	0	16	46.0	1 (F4)	0

^{/1} Road 1 : Paved Road

Road 2A : Laterite Road with good surface condition and alignment

Road 2B : Laterite Road with good surface condition and poor alignment

Road 3 : Laterite Road with poor surface condition and alignment

Road 4 : Earth Road

VOC 節減は、With Projectの全リンクのVOCとWithout Projectの際のVOCとの差で、当道路におけるVOCの節減は次に示すとおりである。

Vehicle Operating Cost Saving

(Unit: 1,000 Baht)

Road Class	1987	1993	2001
1 (F4)	14,873	21,203	33,806

5. エンジニアリング

5.1 予備設計

予備設計は、次に示す設計規準を基本に行った。

Design Standard : F4 (feasible)
 Geometric Design : AASHTO (Rural Highways)
 Typical Cross Section : as shown in Figure 19.5.1
 Minimum Height of Embankment
 Ordinary Section : 1.0m
 Approach of Bridge in Flat Area : 2.0m
 Flood Section : 0.7m (above flood level)

Pavement Structure

In case of F4 Standard

DBST : 2.5cm
 Crushed Stone Base CBR_≥80% : 15.0cm
 Soil Aggregate Subbase CBR_≥20% : 15.0cm
 Selected Material CBR_≥6% : 20.0cm

Pipe Culvert

Standard Size : φ 100cm
 Standard Interval
 Paddy Area : 200 m
 Others : 500 m

Box Culvert

Standard Size : 2.4m x 2.4m
 Location : as required

Bridge

Standard Type (width 7.0m)

Short Span Bridge : RC - Slab
 Long Span Bridge : PC - Girder

Location : as shown in Bridge List in Figure 19.5.2

ルートの線形は、Figure 19.5.2 示す。

5.2 工事数量および建設費

予備設計による工事数量は建設費は、各工事ごとに単価を付してTable 19.5.1に示す。

道路規格別の建設費を財務費用および経済費用に分けて集計すると、下表に示すとおりとなる。

F4 Standard (DBST)	L = 46.0 Km
Financial Cost	95,310 . 10 ³ ¥
Economic Cost	86,000 . 10 ³ ¥

6. 経済評価

年次別経済費用と便益及び評価結果はTable 19.6.1に示す通りである。

このルートはF4規格でフィージブルである。

7. 社会インパクト

社会インパクトを示すデータ及び評価結果はTable 19.7.1に示す通りである。このルートの社会的インパクトはかなり高い。

Table 19.1.1 SUMMARY OF ROAD INVENTORY

Item	Description	
Origin	A. Selaphum (J.R. 23)	
Destination	B. Khan Phon Sung (J.R. 2136)	
Length		
Total		46.0 km
Improvement Section		46.0 km
DOH Road	R. 2259	46.0 km
ARD Road		0 km
Others		0 km
New Alignment Section		0 km
Terrain	Flat and Rolling	
Alignment (Hori./Vert.)	Fair / Fair	
Formation Width	6.0 m - 7.5 m, 7.0 m (Weighted average)	
Embankment Section		
Length		46.0 km
Height	0.2 m - 2.5 m	
Cut Section		
Length		0 km
Depth	m - m	
Surface Type and Condition		
SBST or DBST	Good	1.5 km
Soil Aggregate	Good - Poor	44.5 km
Earth		0 km
Pipe Culvert	47 each	
Box Culvert	0 each	0 m
Bridge		
Permanent Bridge	1 each	60.5 m
Narrow Concrete Bridge	16 each	353.2 m (4m)
Wooden Bridge	each	m
Overflow Section	1 place	1.0 km

Table 19.1.2 ROAD INVENTORY(1)

PROPOSED ROUTE NO. IM-19

ROUTE NO. 2259

A. SELAPHUM (J.R.23) ~ B. KHAM PHON SUNG (J.R.2136)

L = 46.0

ROI ET

STATION (Km)		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	
VILLAGE																		
- Name																		
- Household (H)																		
- Population (P)																		
TERRAIN																		
CROSS SECTION	Formation Width (m)																	
	Embankment Height (m)																	
	Cutting Depth (m)																	
PAVEMENT	Type/Length																	
	Condition																	
FLOODING	Overflow Length(m)/Height(m)																	
LAND USE	Left																	
	Right																	
PIPE CULVERT	Total Number																	
BOX CULVERT & BRIDGE	Station (Km)																	
	Dimension																	
RIGHT OF WAY (m)																		
ALIGNMENT	Horizontal																	
	Vertical																	
ROUTE NO., AGENCIES																		

ROAD INVENTORY (2)

L = 46.0 Km.

A. SELAPHUM (J.R. 23) B. KHAM PHON SUNG (J.R. 2136) (Cont'd)

PROPOSED ROUTE NO. IM-19

ROUTE NO. 56

UDON THANI

Table 19.2.1 TRAFFIC VOLUME ON ROUTE IM - 19

STATION (Km)		30	32	34	36	38	40	42	44	46
VILLAGE										
- Name										
- Household (H)										
- Population (P)										
TERRAIN		Flat								
CROSS SECTION	Formation Width (m)	6.50	7.00	6.50	6.00	6.50	7.00	6.50		
	Embankment Height (m)	0.20	0.50	0.30	0.30	1.00	0.30	1.00		
	Cutting Depth (m)									
PAVEMENT	Type/Length	Laterite								
	Condition	Fair	Poor	Fair		Poor				
FLOODING	Overflow Length(Km)/Height(m)									
LAND USE	Left	Paddy	Kenaf	Bush	Paddy	Kenaf	Paddy		Bush	
	Right	Paddy	Bush	Paddy	Bush	Paddy	Sugar Cane		Bush	
PIPE CULVERT	Total Number									
BOX CULVERT & BRIDGE	Station (Km)		32.9	34.5	35.6	36.8	38.2	40.9		
	Dimension		C-Br. 4.40 x 30.00	C-Br. 4.30 x 24.00	C-Br. 4.40 x 20.50	C-Br. 4.30 x 12.00	C-Br. 4.4 x 14.00	C-Br. 4.20 x 24.4		
RIGHT OF WAY (m)										
ALIGNMENT	Horizontal		Fair			Poor		Fair		
	Vertical					Fair				
ROUTE NO., AGENCIES						DOH	2259			

YEAR	1987		1993		2001		
LINK	1 AVR.		1 AVR.		1 AVR.		
P/C	N+D	24	24	35	35	59	59
	I	4	4	5	5	9	9
	DV	0	0	0	0	0	0
	TOTAL	27	27	41	41	68	68
L/B	N+D	81	81	85	85	86	86
	I	12	12	13	13	13	13
	DV	0	0	0	0	0	0
	TOTAL	93	93	98	98	99	99
M/B	N+D	43	43	63	63	106	106
	I	6	6	10	10	16	16
	DV	0	0	0	0	0	0
	TOTAL	49	49	73	73	121	121
H/B	N+D	7	7	19	19	46	46
	I	1	1	3	3	7	7
	DV	0	0	0	0	0	0
	TOTAL	8	8	22	22	53	53
P/P&T	N+D	119	119	146	146	197	197
	I	18	18	22	22	30	30
	DV	0	0	0	0	0	0
	TOTAL	136	136	168	168	227	227
4/T	N+D	11	11	14	14	18	18
	I	2	2	2	2	3	3
	DV	0	0	0	0	0	0
	TOTAL	13	13	16	16	20	20
6/T	N+D	40	40	39	39	39	39
	I	6	6	6	6	6	6
	DV	0	0	0	0	0	0
	TOTAL	46	46	45	45	45	45
10/T	N+D	12	12	20	20	35	35
	I	2	2	3	3	5	5
	DV	0	0	0	0	0	0
	TOTAL	14	14	23	23	41	41
ADT	N+D	336	336	422	422	586	586
	I	50	50	63	63	88	88
	DV	0	0	0	0	0	0
	TOTAL	387	387	486	486	674	674
M/C	N+D	346	346	386	386	439	439
	I	25	25	25	25	20	20
	DV	0	0	0	0	0	0
	TOTAL	371	371	410	410	458	458
TOTAL	N+D	682	682	808	808	1024	1024
	I	76	76	88	88	108	108
	DV	0	0	0	0	0	0
	TOTAL	758	758	896	896	1132	1132

NOTE

N : NORMAL TRAFFIC

D : DIVERTED TRAFFIC

DV : DEVELOPED TRAFFIC

I : INDUCED TRAFFIC

Figure 19.3.1 **LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM - 19**

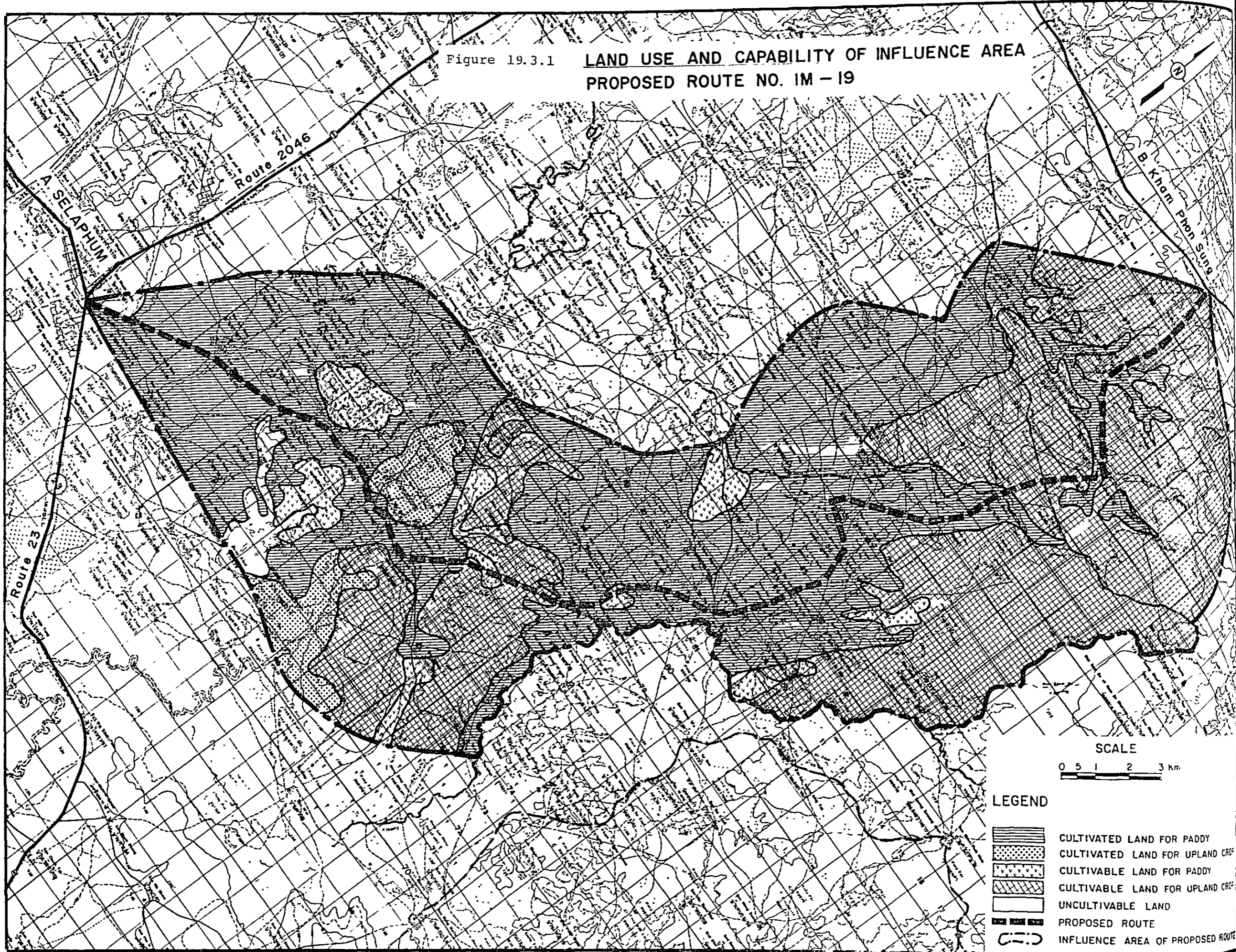
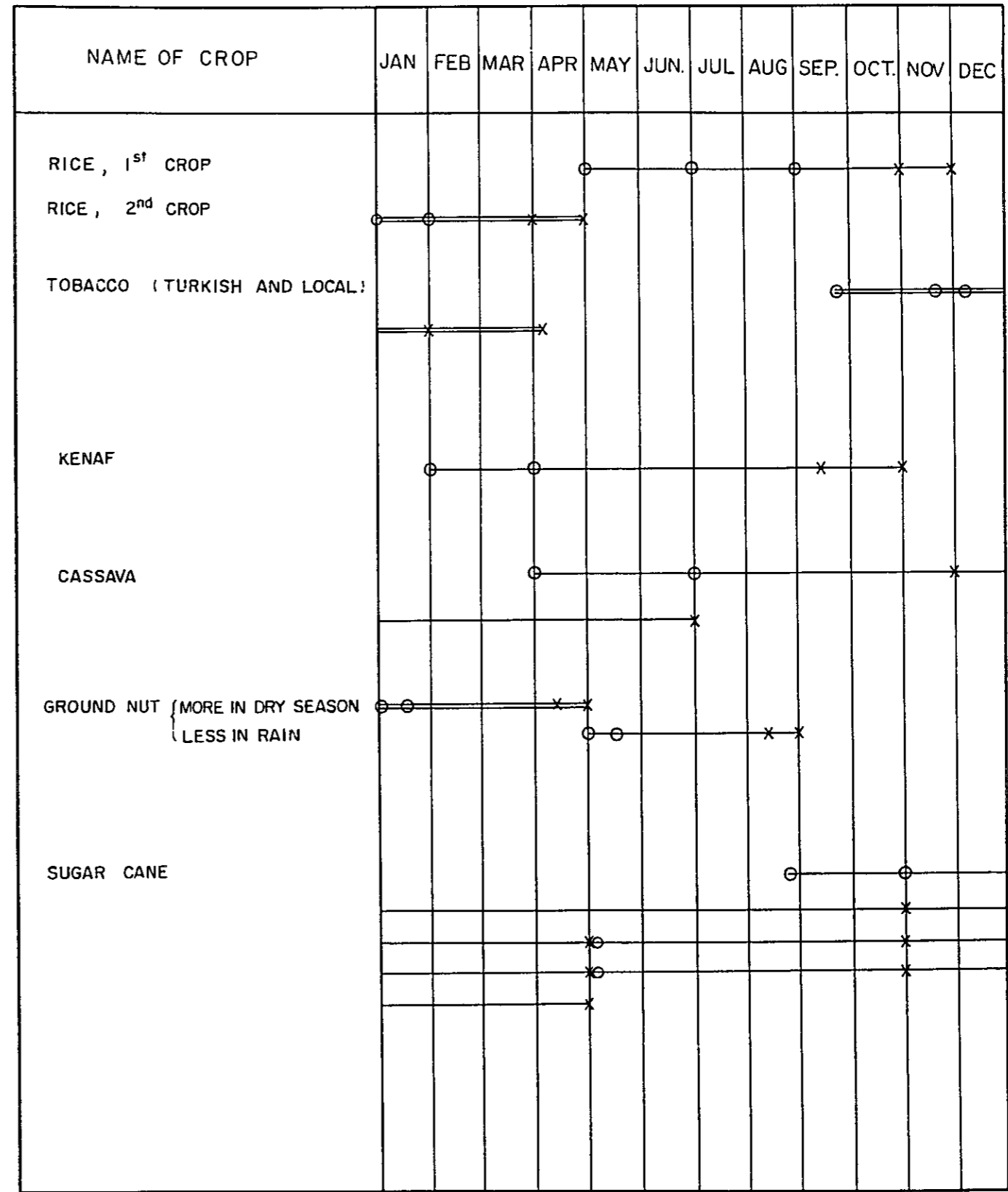


Figure 19.3.2 CROPPING CALENDAR

0900 CHANGWAT — ROI ET



Note

⊕ — ⊕ FIRST CROP
 ⊕ — ⊕ SECOND CROP

⊕ — ⊕ sowing season ⊕ — ⊕ growing season × — × harvesting season

TABLE 19.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

L UNIT : 1000 RAI (RM²)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		127.375 (203.8)	3.750 (6.0)	131.125 (209.8)	11.250 (18.0)	69.375 (111.0)	80.625 (129.0)
0903	PHON THONG	18.750 (30.0)	-	18.750 (30.0)	-	7.500 (12.0)	7.500 (12.0)
0905	NONG PHOK	11.125 (17.8)	-	11.125 (17.8)	-	25.000 (40.0)	25.000 (40.0)
0907	SELAPHUM	97.500 (156.0)	3.750 (6.0)	101.250 (162.0)	11.250 (18.0)	36.875 (59.0)	48.125 (77.0)

TABLE 19.3.2 CROP PRODUCTION

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)										
1981	118.12	0.25	0.06	0.37	3.32	-	-	-	4.00	122.12
1987	118.12	0.25	0.07	0.37	3.46	-	-	-	4.15	122.27
1993	WITHOUT PROJECT	118.12	0.25	0.08	0.37	3.60	-	-	4.30	122.43
	WITH PROJECT	118.12	0.22	0.07	0.35	3.67	-	-	4.30	122.43
2001	WITHOUT PROJECT	118.12	0.24	0.10	0.35	3.62	-	-	4.30	122.43
	WITH PROJECT	118.12	0.21	0.08	0.33	3.68	-	-	4.30	122.43
CROP YIELD (KG/RAI)										
1981	232.1	180.0	115.0	161.9	2100.0	-	-	-		
1987	232.1	181.1	116.4	161.9	2100.0	-	-	-		
1993	WITHOUT PROJECT	232.1	182.2	117.8	161.9	2100.0	-	-		
	WITH PROJECT	236.3	185.5	119.2	162.9	2112.7	-	-		
2001	WITHOUT PROJECT	232.1	183.6	119.7	161.9	2100.0	-	-		
	WITH PROJECT	242.0	191.5	123.1	164.2	2129.6	-	-		
CROP PRODUCTION (TON)										
1981	27,413	45	7	59	6,969	-	-	-	7,095	34,508
1987	27,413	45	8	59	7,267	-	-	-	7,394	34,807
1993	WITHOUT PROJECT	27,413	45	10	59	7,569	-	-	7,698	35,111
	WITH PROJECT	27,910	41	8	56	7,745	-	-	7,863	35,773
2001	WITHOUT PROJECT	27,413	43	12	56	7,605	-	-	7,730	35,143
	WITH PROJECT	28,587	40	10	54	7,843	-	-	7,959	36,546

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 19.3.3 FARMGATE PRICE AND PRODUCTION COST

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,451	2,060	6,695	7,128	587	-	-	-
WITH PROJECT (1987 - 2001)	3,537	2,112	6,695	7,128	602	-	-	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	540	359	558	989	724	-	-	-
WITH PROJECT (1987 - 2001)	553	379	578	1,009	744	-	-	-

TABLE 19.3.4 NET PRODUCTION VALUE

(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	30,755	1,843	32,598	31,632	1,873	33,505
1993	30,755	1,921	32,676	33,390	2,009	35,399
2001	30,755	1,931	32,686	35,785	2,063	37,848

Figure 19.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE

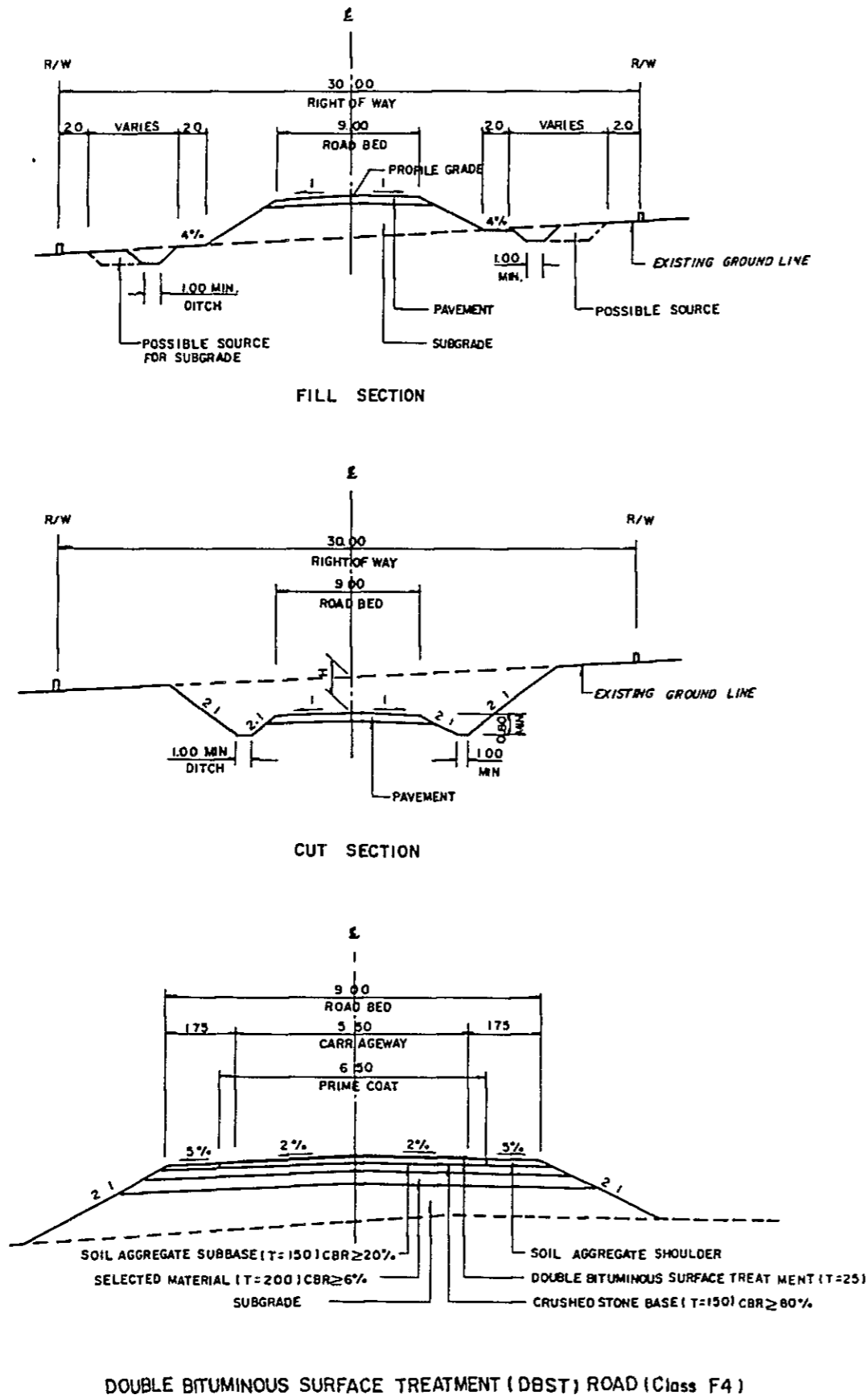


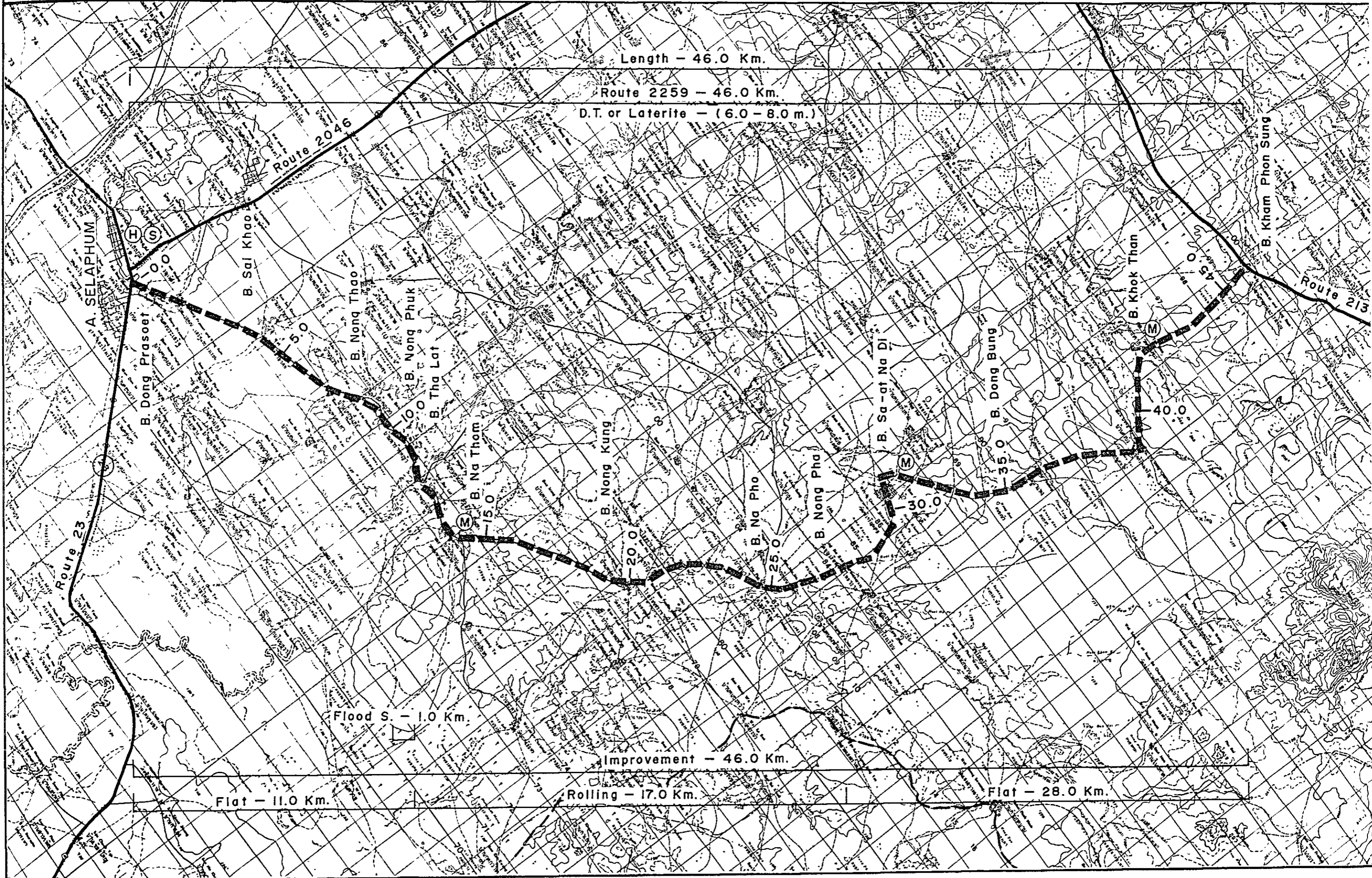
Figure 19.5.2 PROPOSED ROUTE NO. IM - 19

C. ROI ET

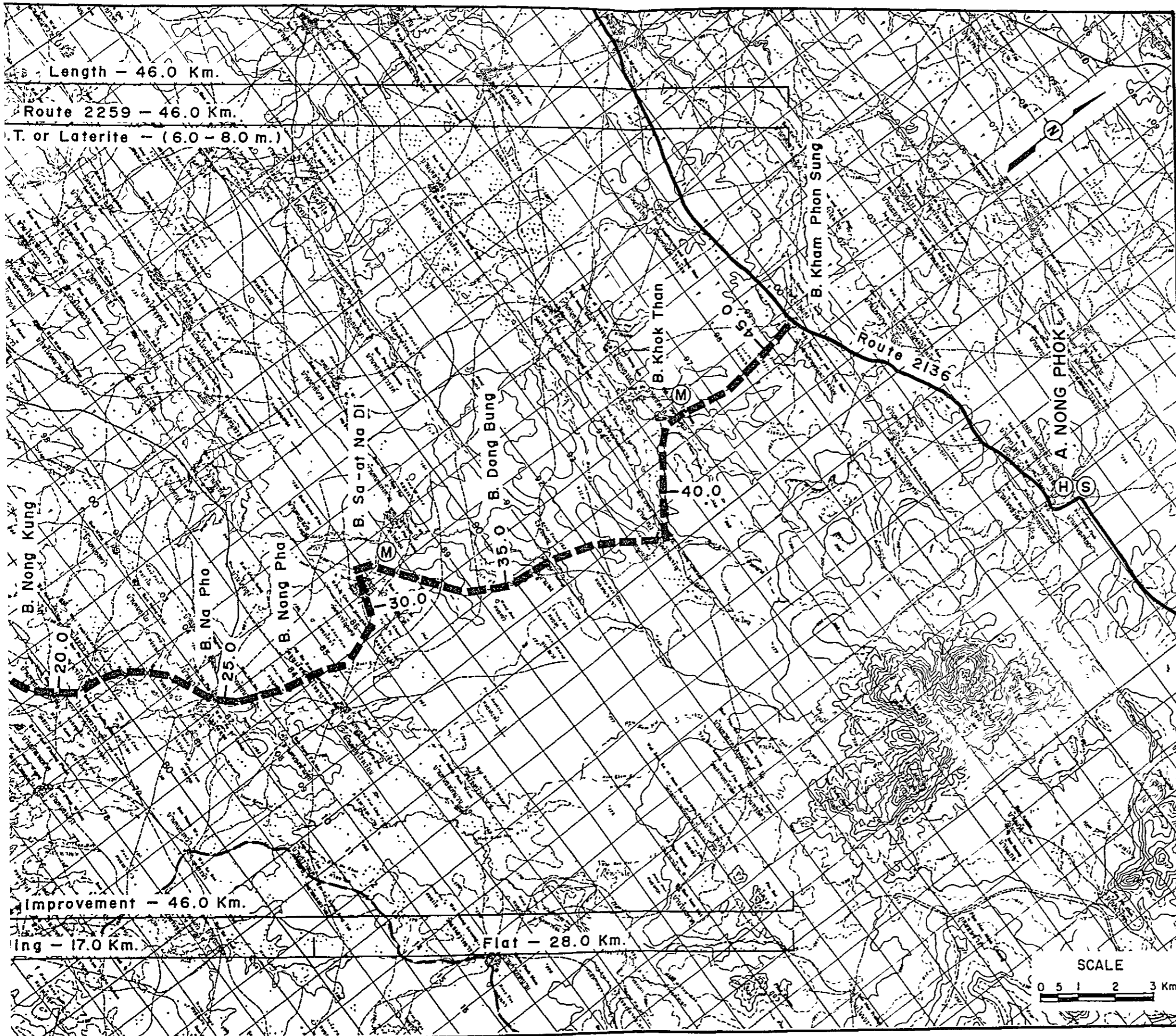
A. SELAPHUM (J.R. 23) - B. KHAM PHON SUNG (J.R. 2136)

ROUTE NO. 2259

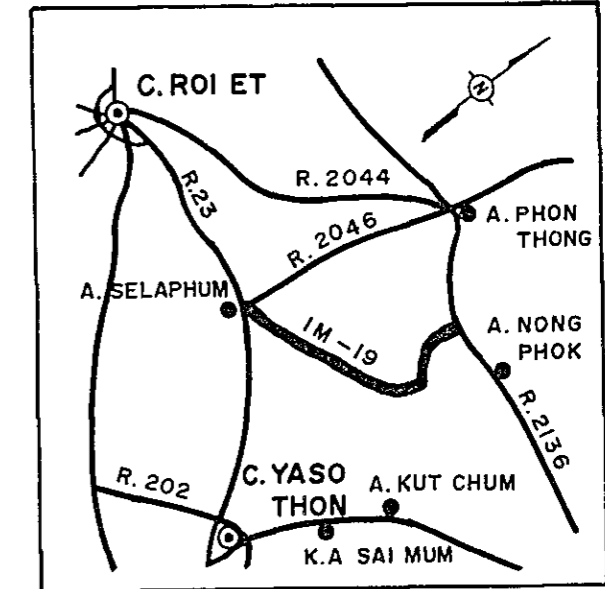
L = 46.0 Km.



ROI ET A. SELAPHUM (J.R. 23) - B. KHAM PHON SUNG (J.R. 2136)
ROUTE NO. 2259 **L = 46.0 Km.**



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	7.2	C-7.00 x 12.50	C-4.50 x 12.50
2	9.3	C-7.00 x 40.50	C-4.20 x 40.50
3	9.4	C-7.00 x 40.30	C-4.30 x 40.30
4	9.8	—	C-9.50 x 60.50
5	10.9	C-7.00 x 19.00	C-4.50 x 19.00
6	12.8	C-7.00 x 30.00	C-4.40 x 30.00
7	13.0	C-7.00 x 25.00	C-4.50 x 25.00
8	14.9	C-7.00 x 12.50	C-4.20 x 12.50
9	22.6	C-7.00 x 12.00	C-4.50 x 12.00
10	26.8	C-7.00 x 20.50	C-4.50 x 20.50
11	28.1	C-7.00 x 16.00	C-4.30 x 16.00
12	32.9	C-7.00 x 30.00	C-4.40 x 30.00
13	34.5	C-7.00 x 24.00	C-4.30 x 24.00
14	35.6	C-7.00 x 20.50	C-4.40 x 20.50
15	36.8	C-7.00 x 12.00	C-4.30 x 12.00
16	38.2	C-7.00 x 14.00	C-4.40 x 14.00
17	40.9	C-7.00 x 24.40	C-4.20 x 24.40

LEGEND

- PROPOSED ROUTE (IMPROVEMENT)
- PROPOSED ROUTE (NEW CONSTRUCTION)
- PAVED ROUTE
- UNPAVED ROUTE
- INVENTORY SURVEY ROUTE
- HOSPITAL
- MEDICAL CENTER
- SECONDARY SCHOOL

Table 19.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-19 (46.0 km)

Items	Unit of Q'ty	Financial Unit Rate ₪	(DBST)		
			Q'ty	Financial Cost (10 ³ ₪)	Economic Cost (10 ³ ₪)
DIRECT CONSTRUCTION COST					
Clearing and Grubbing	ha	15,000	106	1,590	1,446
Excavation - Soil	m ³	20	0	0	0
Excavation - Hard Rock	m ³	160	0	0	0
Embankment	m ³	45	136,300	6,133	5,581
Selected Material	m ³	80	93,900	7,512	6,685
Soil Aggregate Surface or Subbase	m ³	105	65,800	6,909	6,149
Crushed Stone Base	m ³	370	43,200	15,984	14,705
Soil Aggregate Shoulder	m ³	105	18,600	1,953	1,738
Prime Coat and DBST	m ²	55	243,700	13,404	12,064
Pipe Culvert	m	2,100	1,740	3,654	3,361
Box Culvert	m	16,000	0	0	0
Long Span Bridge	m	80,000	0	0	0
Short Span Bridge	m	40,000	353	14,120	12,566
Sub Total (a)				71,260	64,299
Miscellaneous Works (a) x 7%				4,988	4,501
Total (b)				76,248	68,800
PHYSICAL CONTINGENCY (b) x 15%				11,437	10,320
ENGINEERING AND ADMINISTRATION (b) x 10%					
ADMINISTRATION (b) x 10%				7,625	6,880
Sub Total				19,062	17,200
LAND ACQUISITION					
Highly Developed Land	ha	50,000	0	0	0
Less Developed Land	ha	15,000	0	0	0
Sub Total				0	0
GRAND TOTAL				95,310	86,000

Table 19.6.1 COST AND BENEFITS (F4 STANDARD)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	17,200	0	0	0	0	24,165	0
1985	43,000	0	0	0	0	53,939	0
1986	25,800	0	0	0	0	28,896	0
1987	0	907	14,873	308	16,088	0	14,365
1988	0	1,210	15,928	363	17,501	0	13,952
1989	0	1,512	16,983	418	18,913	0	13,462
1990	0	1,815	18,038	473	20,326	0	12,918
1991	0	2,118	19,093	528	21,739	0	12,335
1992	0	2,420	20,148	583	23,151	0	11,729
1993	0	2,723	21,203	637	24,564	0	11,111
1994	22,264	3,028	22,779	720	26,527	10,071	10,714
1995	0	3,333	24,354	803	28,490	0	10,274
1996	0	3,638	25,929	886	30,453	0	9,805
1997	0	3,943	27,505	969	32,416	0	9,319
1998	0	4,247	29,080	1,051	34,379	0	8,824
1999	0	4,552	30,655	1,134	36,342	0	8,329
2000	0	4,857	32,231	1,217	38,305	0	7,838
2001	-39,560	5,162	33,806	1,300	40,268	-7,227	7,357
TOTAL	68,704	45,465	352,607	11,389	409,461	109,844	162,330
DISCOUNTED ECONOMIC COSTS :					109,844		
DISCOUNTED ECONOMIC BENEFITS :					162,330		
AGRICULTURAL DEVELOPMENT BENEFIT					16,463		
VOC SAVING					141,661		
RMC SAVING					4,205		
NET PRESENT VALUE :					52,487		
BENEFIT COST RATIO :					1.48		
INTERNAL RATE OF RETURN :					17.1 %		

Table 19.7.1 SOCIAL INDICATORS
(Proposed Route IM-19)

Population (1,000)		Education		Note:
1982	: 37.6	Access to Secondary School		
1993	: 43.2	Number of Student in 1993 (1,000) ^{2/}	: 8.6	
Average travelling speed, without (kph)	: 40	Average distance to school (km)	: 13.0	
Isolation		Per capita time savings (10 ⁻⁴)	: 0.168	
Access to Amphoe		Score	: 91	
Average distance to Amphoe (km) ^{1/}	: 15.2	Teacher Intensity		
Per capita time savings (10 ⁻⁴)	: 0.039	Number of teachers ^{3/}		
Score	: 115	University graduate	: 1	
Access to Artery Highway		Total	: 19	
Average distance to highway (km) ^{1/}	: -	Number of Student	: 505	
Per capita time savings (10 ⁻⁴)	: -	Indicators		
Score	: 100	E1 ^{4/}	: 2.0	
Impassability		E2 ^{5/}	: 37.6	
Impassable week a year	: 1	E ^{6/}	: 39.6	
Impassability per year	: 0.019	Degree of Improvement ^{7/}	: 1.73	
Impassability per capita (10 ⁻⁴)	: 0.004	Score	: 110	
Score	: 33	Disparity		
Health		G.P.V. in 1993 (Mn B) ^{8/}		
Access to Hospital		With project	: 103.9	
Average distance to Hospital (km) ^{1/}	: 13.0	Without project	: 99.6	
Per capita time savings (10 ⁻⁴)	: 0.033	Per capita G.P.V. in 1993 (B)		
Score	: 77	With project (W)	: 2,405	
Access to Medical Facilities		Without project (w)	: 2,306	
Average distance to facilities (km) ^{1/}	: 3.7	Degree of Disparity		
Per capita time savings (10 ⁻⁴)	: 0.010	(A/W) - (A/w) ^{9/}	: 0.06	
Score	: 40	Score	: 107	
		Total Score	: 673	

- ^{1/} () shows the length or distance in without project case. Unless otherwise, lengths are same both in with project case and without project case.
- ^{2/} Number of secondary school student estimated based on the projected population of the areas of influence applying ratios of secondary school students to the total population in the sample area.
- ^{3/} Numbers of the sample areas
- ^{4/} (Number of University Graduate Teachers)/(Total Number of Student) x 1,000
- ^{5/} (Total of Teachers)/(Total Number of Student) x 1,000
- ^{6/} Sum of ^{4/} and ^{5/}
- ^{7/} Ratio of E value of each route to an average value of the same indicator E in case of the sample areas, 33 in number, along paved road near the proposed routes. The average value of E in case of paved roads were calculated at 68.4 from the following data:
 Number of university graduate teachers 438
 Number of Teachers 1,285
 Number of student 25,196
- ^{8/} Estimated gross value of crop production in the areas of influence
- ^{9/} "A" indicates an average per capita value of crop production in the Northeastern Region, which is estimated assuming that:
 - GRP per capita of the Northeast is estimated at 11,897 Baht in 1993,
 - Agricultural sector shares 40% of GRP, and
 - Crop production shares 80% of agricultural production.

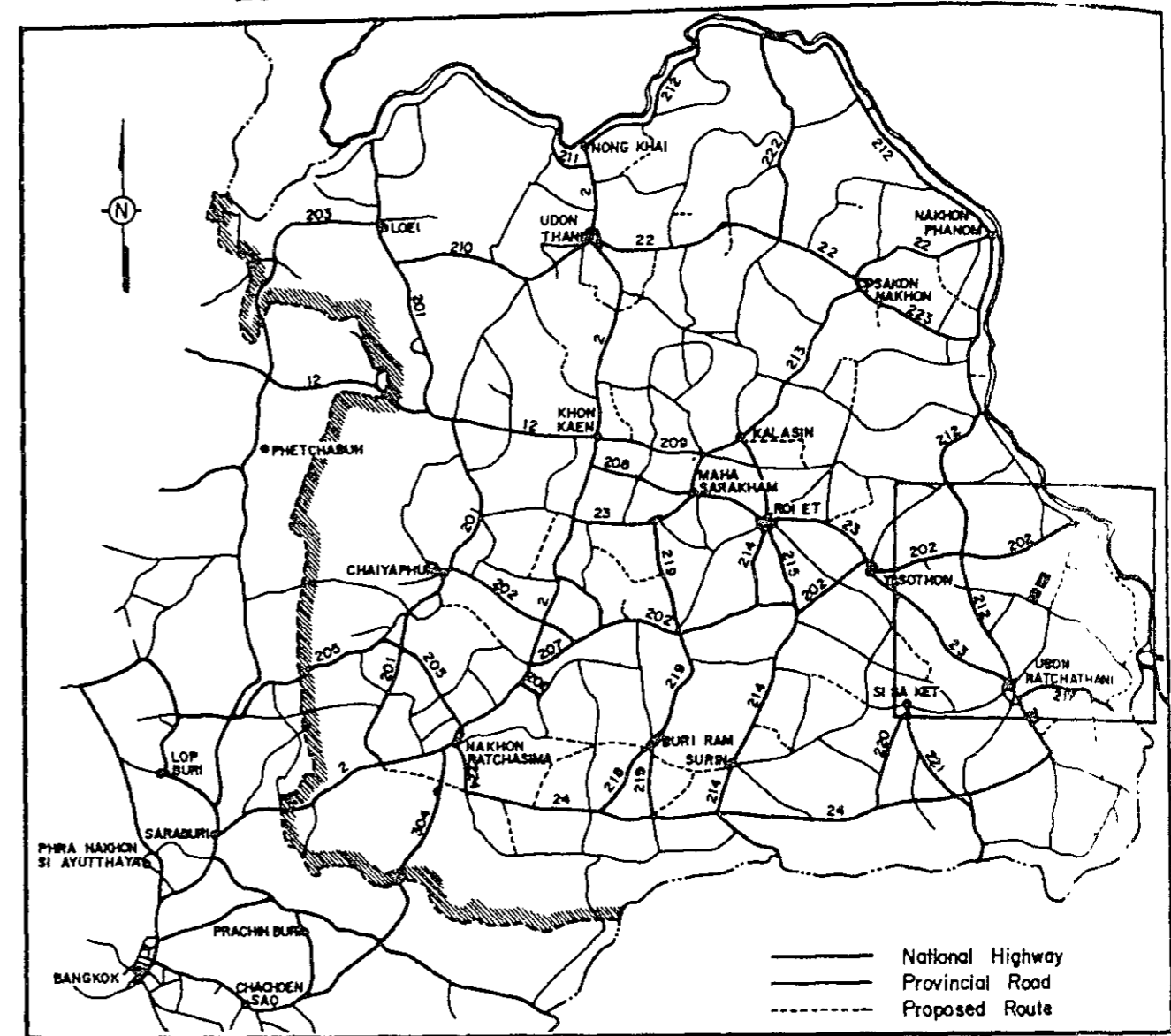
PROPOSED ROUTE NO. IM - 20

Changwat : Ubon Ratchathani

B. Na Hai (J.R.2049) - A. Kut Khao Pun

Length : 17.2 KM.

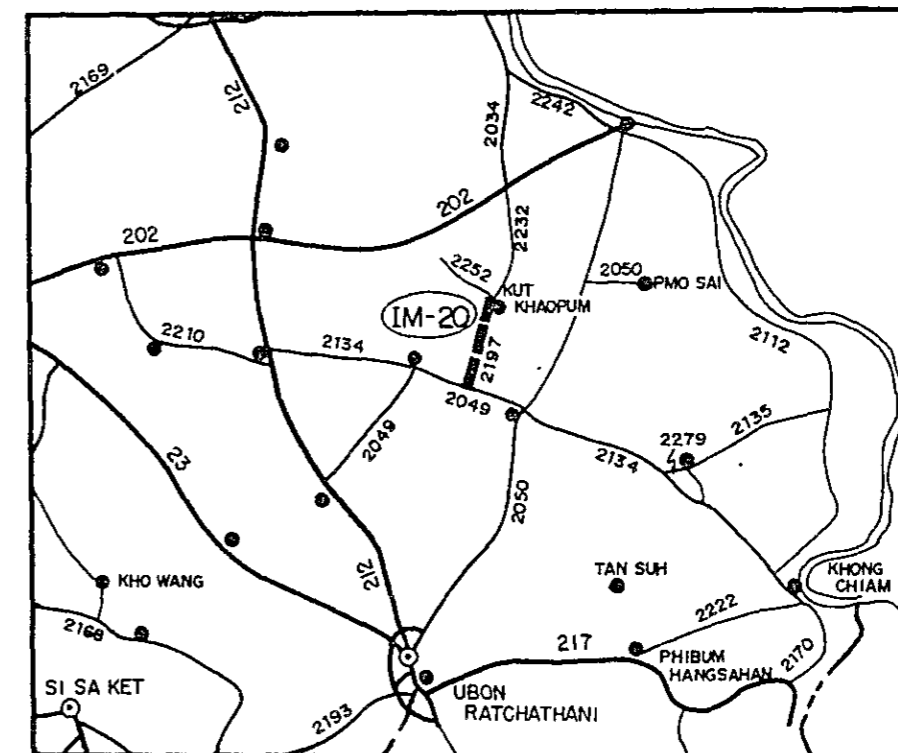
LOCATION OF PROPOSED ROUTE



SUMMARY

PROPOSED ROUTE IM- 20

Item	Description
Changwat	Ubon Ratchathani
Origin	B. Na Hai (J.R.2049)
Destination	A. Kut Khao Pun
Length	
Total	17.2 km
Improvement Section	17.2 km
DOH Road	R.2197 17.2 km
ARD Road	0 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Poor
Terrain	Flat and Rolling
Influence Area	
Area	116 km ²
Population (1982)	17,900
Principal Crops	Paddy
Traffic (ADT)	
Existing	102
1993	399
2001	517
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	32,869 . 10 ³ ฿
Economic	29,666 . 10 ³ ฿
IRR	8.4 %
B/C	0.73
Recommendation	For further consideration



1. 概要

1.1 計画路線の概要

本路線は、Ubon Ratchatani 県の北部に位置している。ルートは、県道2049号線のNa Hai村を起点とし、北に走り、Pao 村、Ka Bin村を経て、県道2232号線と2252号線の交差するKut Khaopun郡で終わる。その総延長は、17.2kmである。(Figure 20.5.2 参照)

沿道の地形は、ほとんど平坦であるが、一部に丘陵地を含む。影響圏内には、いくつかの村があり、その総人口は、17,900人である。

沿道には、医療センターが2ヶ所、病院が1ヶ所あり、教育施設として中学校が1ヶ所ある。

本路線は、県道2049号線とKut Khaopun 郡を結ぶ役割を果たすことを目途に計画されたものである。

1.2 現道の状況

計画路線に利用した現道の状況はTable 20.1.1に要約し、その詳細はTable 20.1.2のイベントリー調査の結果に示した。

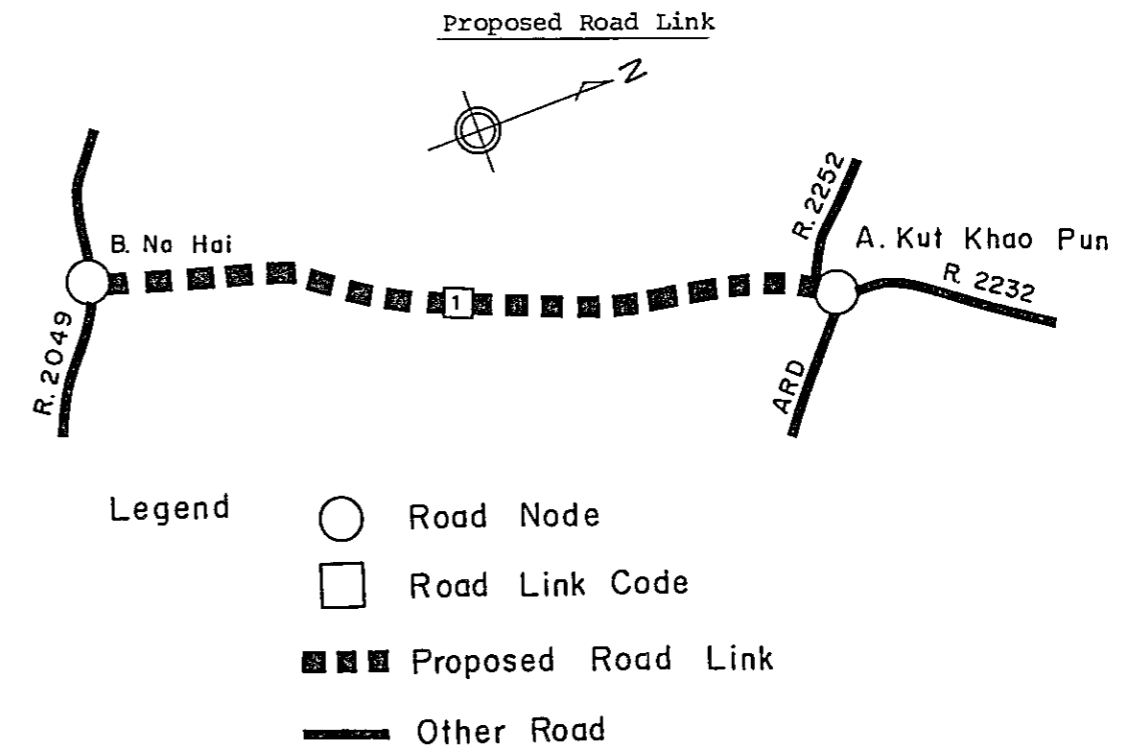
2. 交通

2.1 予測手法

計画対象路線に関し道路改良後の転換交通はほとんど無視し得るので、交通量予測には「伸び率方式」を適用することとした。

2.2 基準年交通量

道路リンク別車種別の基準年交通量は、DOH交通量調査結果および本調査で実施したマニュアルカウンティングのデータを基として次のように推定した。



Traffic Volume in Base Year

Source (base year)	Link No.	Vehicle Type									
		P/C	P/P	L/B	M/B	H/B	P/T	4/T	6/T	10/T	ADT
DOH (1981)	1 ^{1/}	45	17	13	16	6	3	8	18	2	128
Manual Counts (1982)	1	-	15	18	7	-	2	7	21	-	70
Estimated	1	23	16	16	12	3	3	8	20	1	102

Note: ^{1/} Route 2197 Section 0100 Station Km 1+300

2.3 交通需要

計画路線上の旅客交通需要（トリップ/日）および貨物交通需要（トン/日）は、先に求めた基準年の交通量に路側インタビューによって得られる平均乗車人員もしくは平均貨物積載量をかけることによって推定した。推定結果は以下のとおりである。

PASSENGER MOVEMENT (1982)

PROPOSED ROAD LINK	TRIPS PER DAY
1	725

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	38	22	60

2.4 交通需要の将来伸び率

1981-1987, 1987-1993, 1993-2001の各期間における旅客および貨物の交通需要の将来伸び率は、メインレポートの7.3.3の1)で述べた予測式に従って求めた。予測の前提および得られた将来伸び率は以下の通りである。

GROWTH RATE OF PASSENGER MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981	1987	1993
	1987	1993	2001
PER CAPITA INCOME	4.2	4.5	4.7
TRANS. PRICE INCREASE	4.5	4.5	4.5
POPULATION	1.2	1.0	0.9
PASSENGER MOVEMENT	5.2	5.4	5.6

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981	1987	1993
	1987	1993	2001
NON-AGRI. AGRICULTURE	6.7	7.0	7.2
AGRICULTURE	0.1	0.0	0.0
FREIGHT	4.3	4.5	4.6

2.5 誘発および開発交通量

メインレポートの7.3.3の3)で述べた方式を基に誘発および開発交通量の通常交通量に対する比率を求めた。

RATE OF INDUCED AND DEVELOPED TRAFFIC

ITEM	YEAR		
	1987	1993	2001
	(%)		
INDUCED	15.0	15.0	15.0
DEVELOPED	0.0	0.0	0.0

2.6 将来交通量

1) 車種構成

計画路線上の旅客・貨物に関する将来交通需要を、以下の車種構成比によって車種別交通量に変換した。

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	1982	32.9	22.9	22.9	17.1	4.3	9.4	25.0	62.5	3.1
	1987	27.9	27.8	21.1	17.8	5.4	11.4	22.6	55.3	10.7
	1993	21.9	33.8	18.9	18.6	6.8	13.8	19.8	46.6	19.8
	2001	13.9	41.8	16.0	19.7	8.6	17.0	16.0	35.0	32.0

2) 将来ADT

計画路線上のリンク加重平均将来交通量は以下に示すとおりであり、またその道路リンク別交通タイプ別の詳細はTable 20.2.1に示す。

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			
1987	28	21	18	5	32	8	20	4	136	198	335
1993	29	25	25	9	50	7	17	7	170	229	399
2001	27	31	38	17	88	7	15	14	236	281	517

3. 農業開発

3.1. 現況

影響圏の殆ど総てが、水田であり、未開発可耕地は、水田、畑地共に極めて限られている。

圏内の土地利用及び土地適応性の状況はTable 20.3.1とFigure 20.3.1に示し、また、Ubun Ratchathani県地域の代表的作物暦は、Figure 20.3.2のとおりである。

3.2. 開発予測

影響圏内の将来の農業開発状況を、With ProjectとWithout Projectの双方について予測した。予測した作付面積、単位当たり収量及び生産量はTable 20.3.2のとおりである。代表的作物の農家庭先価格と農業生産費とは、各県の資料及び現地調査の結果を参考にし、Table 20.3.3のように見積った。

上記のごとく各作物ごとに予測された生産量と庭先価格により、生産価値を計算し、これから農業生産費及び別途見積られた開墾費を差引き、純生産価値(N.P.V)をTable 20.3.4のように算出した。

このN.P.VのWith Projectの場合と、Without Projectの場合の差が、この道路の開発便益である。

4. 走行費の節減

本報告書、第1巻、第7章で述べた概念と基礎データにもとづき関連する各道路リンクの走行費（以下“VOC”という）をWith ProjectとWithout Projectの両ケースについて計算した。

各リンクにおけるVOCのコスト増に影響を与える道路状況は以下に示すとおりである。

Road Condition									
Link No.	Terrain	Without Project			With Project				
		Length (Km)	Nos. of Road Class	Nos. of Wooden Bridge	Length (Km)	Nos. of Road Class Case 1	Nos. of Road Class Case 2	Nos. of Wooden Narrow Bridge	
1	Flat & Rolling	17.2	3	5	0	17.2	1(F4)	2A(F5)	0

/1

- Road 1 : Paved Road
- Road 2A : Laterite Road with good surface condition and alignment
- Road 2B : Laterite Road with good surface condition but poor alignment
- Road 3 : Laterite Road with poor surface condition and alignment
- Road 4 : Earth Road

VOC節減は、With Projectの全リンクのVOCとWithout Projectの際のVOCとの差で、当道路におけるVOCの節減は次に示すとおりである。

Vehicle Operating Cost Saving			
(Unit: 1,000 Baht)			
Road Class	1987	1993	2001
1 (F4)	2,188	3,127	4,926
2A (F5)	1,556	2,307	3,719

5. エンジニアリング

5.1 予備設計

予備設計は、次に示す設計規準を基本に行った。

Design Standard	:	F4 (if not feasible, F5)
Geometric Design	:	AASHTO (Rural Highways)
Typical Cross Section	:	as shown in Figure 20.5.1
Minimum Height of Embankment		
Ordinary Section	:	1.0m
Approach of Bridge in Flat Area	:	2.0m
Flood Section	:	0.7m (above flood level)
Pavement Structure		
In case of F4 Standard		
DBST		2.5cm
Crushed Stone Base	CBR \geq 80%	15.0cm
Soil Aggregate Subbase	CBR \geq 20%	15.0cm
Selected Material	CBR \geq 6%	20.0cm
In case of F5 Standard		
Soil Aggregate Surface	CBR \geq 20%	15.0cm
Selected Material	CBR \geq 6%	20.0cm
Pipe Culvert		
Standard Size	:	ϕ 100cm
Standard Interval		
Paddy Area	:	200 m
Others	:	500 m

Box Culvert

Standard Size : 2.4m x 2.4m

Location : as required

Bridge

Standard Type (width 7.0m)

Short Span Bridge : RC - Slab

Long Span Bridge : PC - Girder

Location : as shown in Bridge List in
Figure 20.5.2.

ルートの線形は、Figure 20.5.2 示す。

5.2 工事数量および建設費

予備設計による工事数量は建設費は、各工事ごとに単価を付してTable 20.5.1 に示す。
道路規格別の建設費を財務費用および経済費用に分けて集計すると、下表に示すとおりとなる。

Total Financial and Economic Construction Cost

Road Class	Length (Km)	Construction Cost (10 ³ ¥)		Remark
		Financial Cost	Economic Cost	
F4 (DBST)	17.2	32,869	29,666	
F5 (Soil Aggregate)	17.2	22,284	20,038	

6. 経済価格

年次別経済費用と便益及び評価結果はTable 20.6.1 及び 20.6.2 に示す通りである。
このルートはF4規格、F5規格共に1987年を供用開始とした場合にフィージブルでない。

7. 社会インパクト

社会インパクトを示すデータ及び評価結果はTable 20.7.1 に示す通りである。

Table 20.1.1 SUMMARY OF ROAD INVENTORY

Item	Description	
Origin	B. Na Hai (J.R. 2049)	
Destination	A. Kut Khao Pun	
Length		
Total		17.2 km
Improvement Section		17.2 km
DOH Road	R. 2197	17.2 km
ARD Road		0 km
Others		0 km
New Alignment Section		0 km
Terrain	Flat and Rolling	
Alignment (Hori./Vert.)	Fair / Fair	
Formation Width	6.0m - 8.0 m, 6.8 m (Weighted average)	
Embankment Section		
Length		17.2 km
Height	0.5m - 1.35m	
Cut Section		
Length		0 km
Depth	m - m	
Surface Type and Condition		
SBST or DBST		0 km
Soil Aggregate	Poor	17.2 km
Earth		0 km
Pipe Culvert	50 each	
Box Culvert	0 each	0 m
Bridge		
Permanent Bridge	0 each	0 m
Narrow Concrete Bridge	0 each	0 m (4m)
Wooden Bridge	6 each	81.0 m
Overflow Section	0 place	0 km

Table 20.1.2 ROAD INVENTORY

PROPOSED ROUTE NO. IM-20

ROUTE NO. 2197

B. NA HAI (J.R. 2049) ~ A. KUT KHAO PUN

L = 17.2

UBON RATCHATHANI

STATION (Km)		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	
VILLAGE																		
- Name																		
- Household (H)																		
- Population (P)																		
TERRAIN																		
		Flat		Rolling		Flat		Rolling		Flat		Rolling		Flat				
CROSS SECTION	Formation Width (m)	7.00	5.50		7.00		6.50	8.00	6.00	7.00		6.50						
	Embankment Height (m)	1.00	1.35		0.80		0.50	0.75	1.00	0.50		0.85						
	Cutting Depth (m)																	
PAVEMENT	Type/Length	Laterite																
	Condition	Poor																
FLOODING	Overflow Length(Km)/Height(m)																	
LAND USE	Left	Paddy		Forest	Paddy		Forest	Paddy	Forest		Paddy							
	Right	Paddy		Forest	Paddy		Forest				Paddy							
PIPE CULVERT	Total Number	50 Pipes																
BOX CULVERT & BRIDGE	Station (Km)	0.7	0.9	1.9		5.1				11.3		14.5						
	Dimension	W-Br. 4.20 x 15.50	W-Br. 4.00 x 10.50	W-Br. 4.00 x 10.50		W-Br. 4.10 x 4.00				W-Br. 4.20 x 20.40		W-Br. 4.00 x 20.10						
RIGHT OF WAY (m)																		
ALIGNMENT	Horizontal	Fair																
	Vertical	Fair																
ROUTE NO., AGENCIES		DOH 2197																

Table 20.2.1 TRAFFIC VOLUME ON ROUTE IM - 20

YEAR	1987		1993		2001		
LINK	1 AVR.		1 AVR.		1 AVR.		
P/C	N+D	24	24	25	25	23	23
	I	4	4	4	4	4	4
	DV	0	0	0	0	0	0
	TOTAL	28	28	29	29	27	27
L/B	N+D	18	18	22	22	27	27
	I	3	3	3	3	4	4
	DV	0	0	0	0	0	0
	TOTAL	21	21	25	25	31	31
M/B	N+D	16	16	21	21	33	33
	I	2	2	3	3	5	5
	DV	0	0	0	0	0	0
	TOTAL	18	18	25	25	38	38
H/B	N+D	5	5	8	8	15	15
	I	1	1	1	1	2	2
	DV	0	0	0	0	0	0
	TOTAL	5	5	9	9	17	17
P/P&T	N+D	28	28	43	43	77	77
	I	4	4	7	7	12	12
	DV	0	0	0	0	0	0
	TOTAL	32	32	50	50	88	88
4/T	N+D	7	7	6	6	6	6
	I	1	1	1	1	1	1
	DV	0	0	0	0	0	0
	TOTAL	8	8	7	7	7	7
6/T	N+D	17	17	15	15	13	13
	I	3	3	2	2	2	2
	DV	0	0	0	0	0	0
	TOTAL	20	20	17	17	15	15
10/T	N+D	3	3	6	6	12	12
	I	1	1	1	1	2	2
	DV	0	0	0	0	0	0
	TOTAL	4	4	7	7	14	14
ADT	N+D	118	118	148	148	205	205
	I	18	18	22	22	31	31
	DV	0	0	0	0	0	0
	TOTAL	136	136	170	170	236	236
M/C	N+D	181	181	209	209	258	258
	I	18	18	20	20	23	23
	DV	0	0	0	0	0	0
	TOTAL	198	198	229	229	281	281
TOTAL	N+D	299	299	357	357	463	463
	I	36	36	42	42	53	53
	DV	0	0	0	0	0	0
	TOTAL	335	335	399	399	517	517

NOTE

N : NORMAL TRAFFIC
DV : DEVELOPED TRAFFIC

D : DIVERTED TRAFFIC
I : INDUCED TRAFFIC

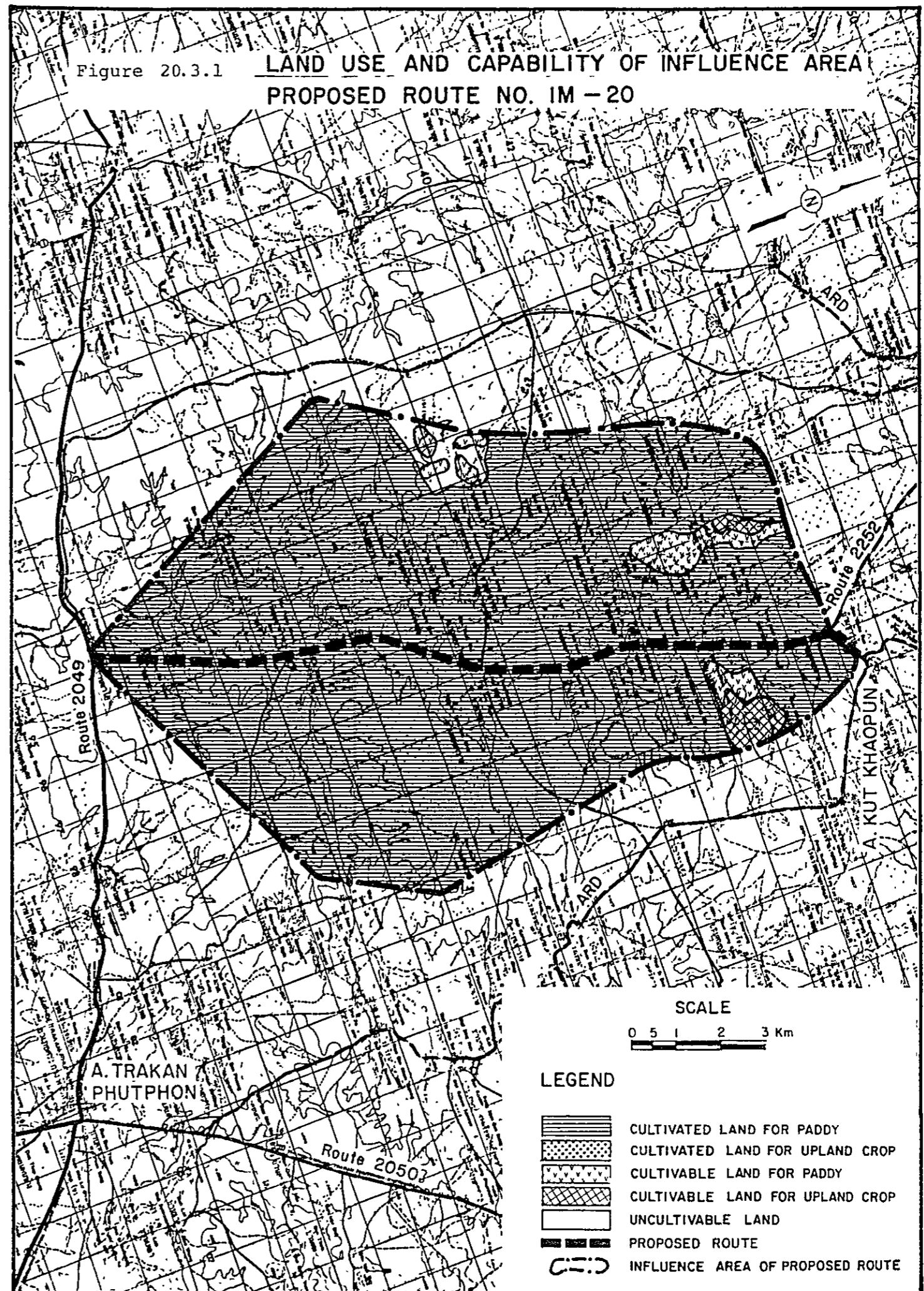
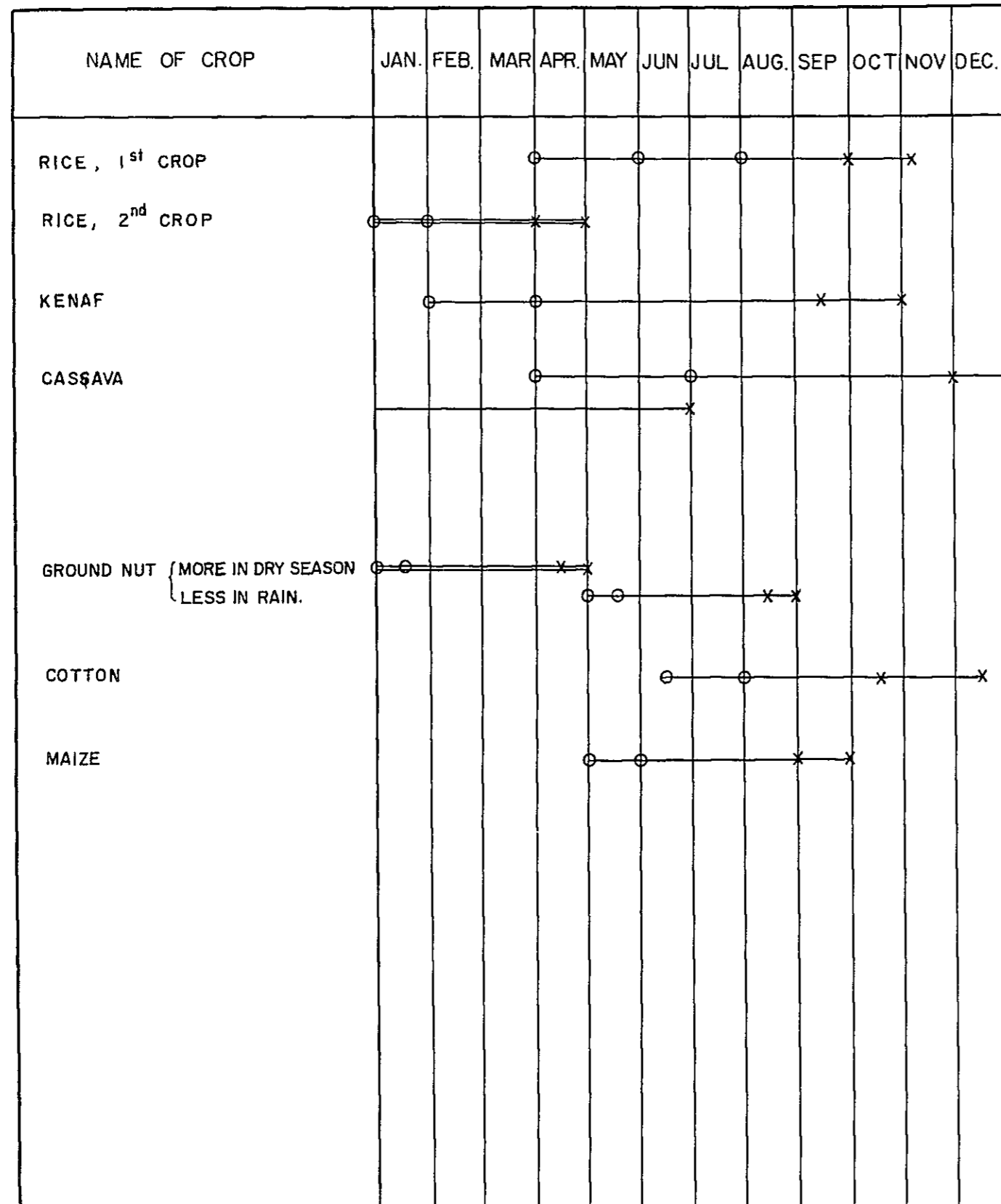


Figure 20.3.2 CROPPING CALENDAR

1100 CHANGWAT UBON RATCHATHANI



Note :

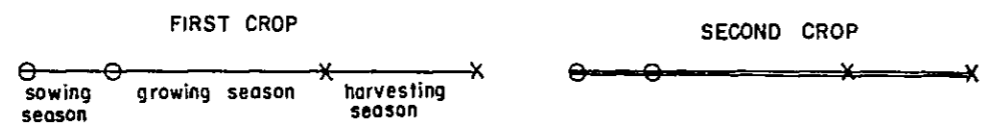


TABLE 20.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM²)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		67.500 (108.0)	-	67.500 (108.0)	2.500 (4.0)	1.250 (2.0)	3.750 (6.0)
1110	KUT KAOPUN	25.625 (41.0)	-	25.625 (41.0)	1.875 (3.0)	1.250 (2.0)	3.125 (5.0)
1111	TRAKAN PHUTPHON	41.875 (67.0)	-	41.875 (67.0)	0.625 (1.0)	-	0.625 (1.0)

TABLE 20.3.2 CROP PRODUCTION

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)										
1981	62.88	-	-	-	0.10	-	-	-	0.10	62.98
1987	63.18	-	-	-	0.10	-	-	-	0.10	63.29
1993	63.18	-	-	-	0.11	-	-	-	0.11	63.29
	63.18	-	-	-	0.12	-	-	-	0.12	63.30
2001	63.18	-	-	-	0.11	-	-	-	0.11	63.30
	63.18	-	-	-	0.12	-	-	-	0.12	63.31
CROP YIELD (KG/RAI)										
1981	179.7	-	-	-	1400.0	-	-	-	-	-
1987	179.7	-	-	-	1425.4	-	-	-	-	-
1993	179.7	-	-	-	1451.2	-	-	-	-	-
	183.0	-	-	-	1468.7	-	-	-	-	-
2001	179.7	-	-	-	1486.4	-	-	-	-	-
	187.4	-	-	-	1528.5	-	-	-	-	-
CROP PRODUCTION (TON)										
1981	11,300	-	-	-	138	-	-	-	138	11,438
1987	11,355	-	-	-	146	-	-	-	146	11,501
1993	11,355	-	-	-	155	-	-	-	155	11,510
	11,561	-	-	-	169	-	-	-	170	11,731
2001	11,355	-	-	-	168	-	-	-	168	11,523
	11,842	-	-	-	186	-	-	-	187	12,028

NOTE : SYMBOL "--" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 20.3.3 FARMGATE PRICE AND PRODUCTION COST

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,741	-	-	-	577	-	-	-
WITH PROJECT (1987 - 2001)	3,835	-	-	-	591	-	-	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	392	-	-	-	677	-	-	-
WITH PROJECT (1987 - 2001)	406	-	-	-	737	-	-	-

TABLE 20.3.4 NET PRODUCTION VALUE

(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	17,726	15	17,741	17,918	11	17,929
1993	17,726	17	17,743	18,708	15	18,723
2001	17,726	21	17,747	19,784	20	19,804

Figure 20.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE

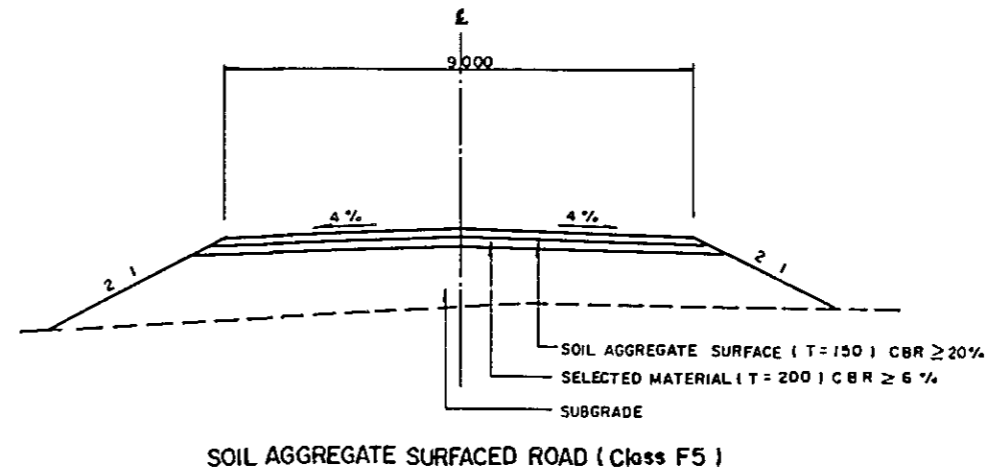
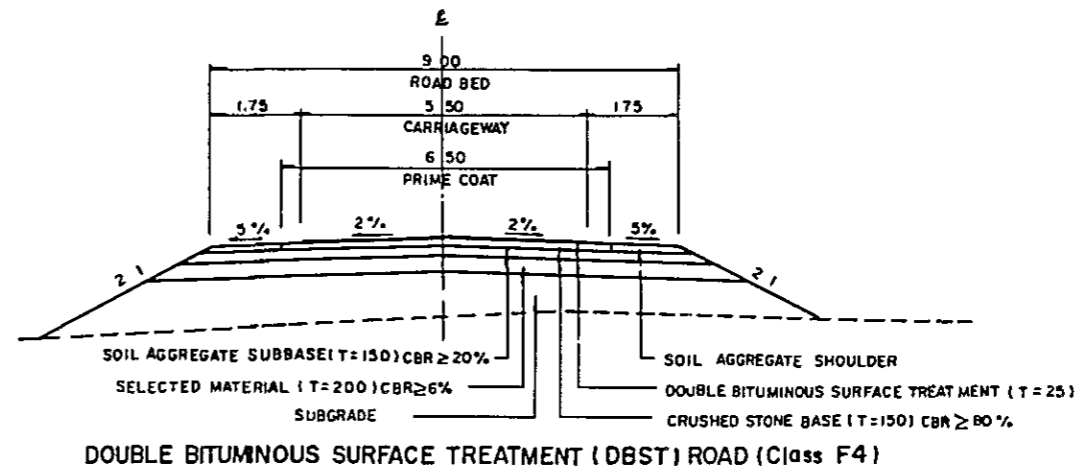
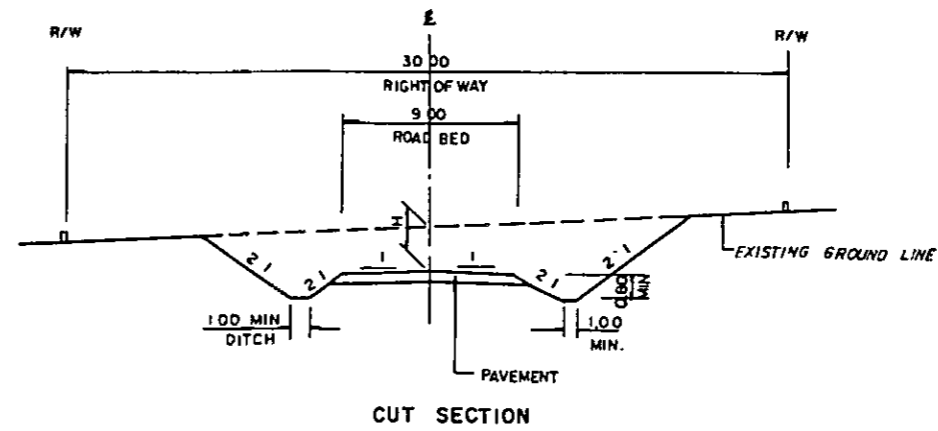
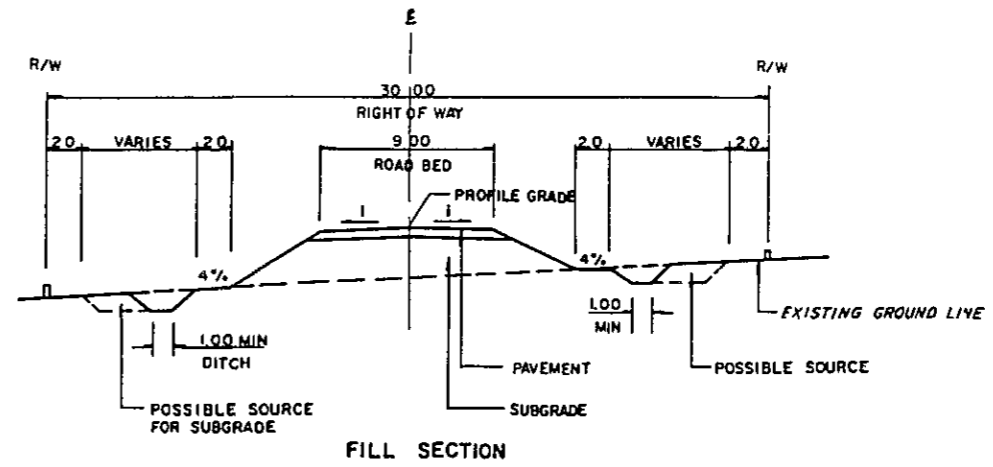
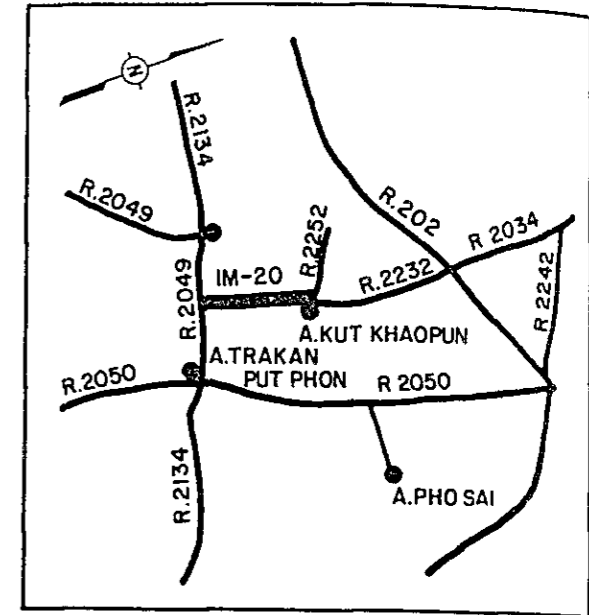


Figure 20.5.2

PROPOSED ROUTE NO. IM - 20 CUBON RATCHATHANI B.NA HAI (J.R.2049) - A.KUT KHAO PUN ROUTE NO. 2197 L = 17.2 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	0.7	C-7.00 x 18.00	W-4.20 x 15.50
2	0.9	C-7.00 x 14.00	W-4.00 x 10.50
3	1.9	C-7.00 x 14.00	W-4.00 x 10.50
4	5.1	(BOX CULVERT)	W-4.10 x 4.00
5	11.3	C-7.00 x 24.00	W-4.20 x 20.40
6	14.5	C-7.00 x 24.00	W-4.00 x 20.10

LEGEND

- PROPOSED ROUTE (IMPROVEMENT)
- PROPOSED ROUTE (NEW CONSTRUCTION)
- PAVED ROUTE
- UNPAVED ROUTE
- INVENTORY SURVEY ROUTE
- HOSPITAL
- MEDICAL CENTER
- SECONDARY SCHOOL

Table 20.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-20 (17.2 km)

Items	Unit of Q'ty	Financial Unit Rate ₪	(DBST)			(Soil Aggregate Surface)		
			Q'ty	Financial Cost (10 ³ ₪)	Economic Cost (10 ³ ₪)	Q'ty	Financial Cost (10 ³ ₪)	Economic Cost (10 ³ ₪)
DIRECT CONSTRUCTION COST								
Clearing and Grubbing	ha	15,000	40	600	546	40	600	546
Excavation - Soil	m ³	20	0	0	0	0	0	0
Excavation - Hard Rock	m ³	160	0	0	0	0	0	0
Embankment	m ³	45	34,400	1,548	1,408	34,400	1,548	1,408
Selected Material	m ³	80	36,500	2,920	2,598	36,500	2,920	2,598
Soil Aggregate Surface or Subbase	m ³	105	25,500	2,677	2,382	25,500	2,677	2,382
Crushed Stone Base	m ³	370	16,800	6,216	5,718	5,900	2,183	2,008
Soil Aggregate Shoulder	m ³	105	7,200	756	672	2,500	262	233
Prime Coat and DBST	m ²	55	94,600	5,203	4,683	33,000	1,815	1,634
Pipe Culvert	m	2,100	350	735	676	350	735	676
Box Culvert	m	16,000	20	320	288	20	320	288
Long Span Bridge	m	80,000	0	0	0	0	0	0
Short Span Bridge	m	40,000	90	3,600	3,204	90	3,600	3,204
Sub Total (a)				24,575	22,180		16,661	14,981
Miscellaneous Works (a) x 7%				1,720	1,553		1,166	1,049
Total (b)				26,295	23,733		17,827	16,030
PHYSICAL CONTINGENCY (b) x 15%				3,944	3,560		2,674	2,405
ENGINEERING AND ADMINISTRATION (b) x 10%				2,630	2,373		1,783	1,603
Sub Total				6,574	5,933		4,457	4,008
LAND ACQUISITION								
Highly Developed Land	ha	50,000	0	0	0	0	0	0
Less Developed Land	ha	15,000	0	0	0	0	0	0
Sub Total				0	0		0	0
GRAND TOTAL				32,869	29,666		22,284	20,038

Table 20.6.1 COST AND BENEFITS
(F4 STANDARD)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	0	0	0	0	0	0	0
1985	11,866	0	0	0	0	14,885	0
1986	17,799	0	0	0	0	19,935	0
1987	0	188	2,188	-81	2,295	0	2,049
1988	0	320	2,345	-75	2,590	0	2,064
1989	0	452	2,501	-68	2,884	0	2,053
1990	0	583	2,657	-61	3,179	0	2,021
1991	0	715	2,814	-55	3,474	0	1,971
1992	0	847	2,970	-48	3,769	0	1,910
1993	0	979	3,127	-41	4,064	0	1,838
1994	8,325	1,113	3,351	-31	4,434	3,766	1,791
1995	0	1,248	3,576	-21	4,803	0	1,732
1996	0	1,383	3,801	-12	5,173	0	1,665
1997	0	1,518	4,026	-2	5,542	0	1,593
1998	0	1,653	4,251	8	5,912	0	1,517
1999	0	1,787	4,476	18	6,281	0	1,440
2000	0	1,922	4,701	28	6,651	0	1,361
2001	-13,646	2,057	4,926	38	7,021	-2,493	1,283
TOTAL	24,344	16,765	51,711	-404	68,072	36,092	26,288

DISCOUNTED ECONOMIC COSTS :	36,092
DISCOUNTED ECONOMIC BENEFITS :	26,288
AGRICULTURAL DEVELOPMENT BENEFIT	5,777
VOC SAVING	20,811
RMC SAVING	-299
NET PRESENT VALUE :	-9,804
BENEFIT COST RATIO :	0.73
INTERNAL RATE OF RETURN :	8.4 %

Table 20.6.2 COST AND BENEFITS
(F5 STANDARD)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	0	0	0	0	0	0	0
1985	8,015	0	0	0	0	10,054	0
1986	12,023	0	0	0	0	13,466	0
1987	0	188	1,556	-20	1,725	0	1,540
1988	0	320	1,682	-15	1,987	0	1,584
1989	0	452	1,807	-10	2,248	0	1,600
1990	0	583	1,932	-5	2,510	0	1,595
1991	0	715	2,057	0	2,772	0	1,573
1992	0	847	2,182	5	3,034	0	1,537
1993	0	979	2,307	10	3,296	0	1,491
1994	2,904	1,113	2,484	18	3,615	1,314	1,460
1995	0	1,248	2,660	25	3,933	0	1,418
1996	0	1,383	2,837	32	4,252	0	1,369
1997	0	1,518	3,013	39	4,570	0	1,314
1998	0	1,653	3,190	47	4,889	0	1,255
1999	0	1,787	3,366	54	5,207	0	1,193
2000	0	1,922	3,543	61	5,526	0	1,131
2001	-9,217	2,057	3,719	69	5,845	-1,684	1,068
TOTAL	13,725	16,765	38,333	311	55,409	23,149	21,128

DISCOUNTED ECONOMIC COSTS :	23,149
DISCOUNTED ECONOMIC BENEFITS :	21,128
AGRICULTURAL DEVELOPMENT BENEFIT	5,777
VOC SAVING	15,296
RMC SAVING	55
NET PRESENT VALUE :	-2,021
BENEFIT COST RATIO :	0.91
INTERNAL RATE OF RETURN :	11.0 %

Table 20.7.1 SOCIAL INDICATORS
(Proposed Route IM-20)

Population (1,000)		Education		<p>Note:</p> <p><u>1/</u> () shows the length or distance in without project case. Unless otherwise, lengths are same both in with project case and without project case.</p> <p><u>2/</u> Number of secondary school student estimated based on the projected population of the areas of influence applying ratios of secondary school students to the total population in the sample area.</p> <p><u>3/</u> Numbers of the sample areas</p> <p><u>4/</u> (Number of University Graduate Teachers)/(Total Number of Student) x 1,000</p> <p><u>5/</u> (Total of Teachers)/(Total Number of Student) x 1,000</p> <p><u>6/</u> Sum of <u>4/</u> and <u>5/</u></p> <p><u>7/</u> Ratio of E value of each route to an average value of the same indicator E in case of the sample areas, 33 in number, along paved road near the proposed routes. The average value of E in case of paved roads were calculated at 68.4 from the following data: Number of university graduate teachers 438 Number of Teachers 1,285 Number of student 25,196</p> <p><u>8/</u> Estimated gross value of crop production in the areas of influence</p> <p><u>9/</u> "A" indicates an average per capita value of crop production in the Northeastern Region, which is estimated assuming that: - GRP per capita of the Northeast is estimated at 11,897 Baht in 1993, - Agricultural sector shares 40% of GRP, and - Crop production shares 80% of agricultural production.</p>
1982	: 17.9	Access to Secondary School		
1993	: 20.1	Number of Student in 1993 (1,000) <u>2/</u>	: 3.0	
Average travelling speed, without (kph)	: 40	Average distance to school (km)	: 5.0	
Isolation		Per capita time savings (10 ⁻⁴)	: 0.187	
Access to Amphoe		Score	: 101	
Average distance to Amphoe (km) <u>1/</u>	: 4.3	Teacher Intensity		
Per capita time savings (10 ⁻⁴)	: 0.024	Number of teachers <u>3/</u>		
Score	: 71	University graduate	: 3	
Access to Artery Highway		Total	: 17	
Average distance to highway (km) <u>1/</u>	: 17	Number of Student	: 416	
Per capita time savings (10 ⁻⁴)	: 0.094	Indicators		
Score	: 204	E1 <u>4/</u>	: 7.2	
Impassability		E2 <u>5/</u>	: 40.9	
Impassable week a year	: -	E <u>6/</u>	: 48.1	
Impassability per year	: 0	Degree of Improvement <u>7/</u>	: 1.42	
Impassability per capita (10 ⁻⁴)	: 0	Score	: 91	
Score	: 0	Disparity		
Health		G.P.V. in 1993 (Mn B) <u>8/</u>		
Access to Hospital		With project	: 44.9	
Average distance to Hospital (km) <u>1/</u>	: 8.5	Without project	: 42.6	
Per capita time savings (10 ⁻⁴)	: 0.047	Per capita G.P.V. in 1993 (B)		
Score	: 109	With project (W)	: 2,209	
Access to Medical Facilities		Without project (w)	: 2,119	
Average distance to facilities (km) <u>1/</u>	: 5.2	Degree of Disparity		
Per capita time savings (10 ⁻⁴)	: 0.029	(A/W) - (A/w) <u>9/</u>	: 0.05	
Score	: 116	Score	: 89	
		Total Score	: 781	