PROPOSED ROUTE NO. IM - 10

Changwat : Udon Thani / Nong Khai

A. Phen (J.R. 2022) - J.R. 212

Length : 48.1 KM.

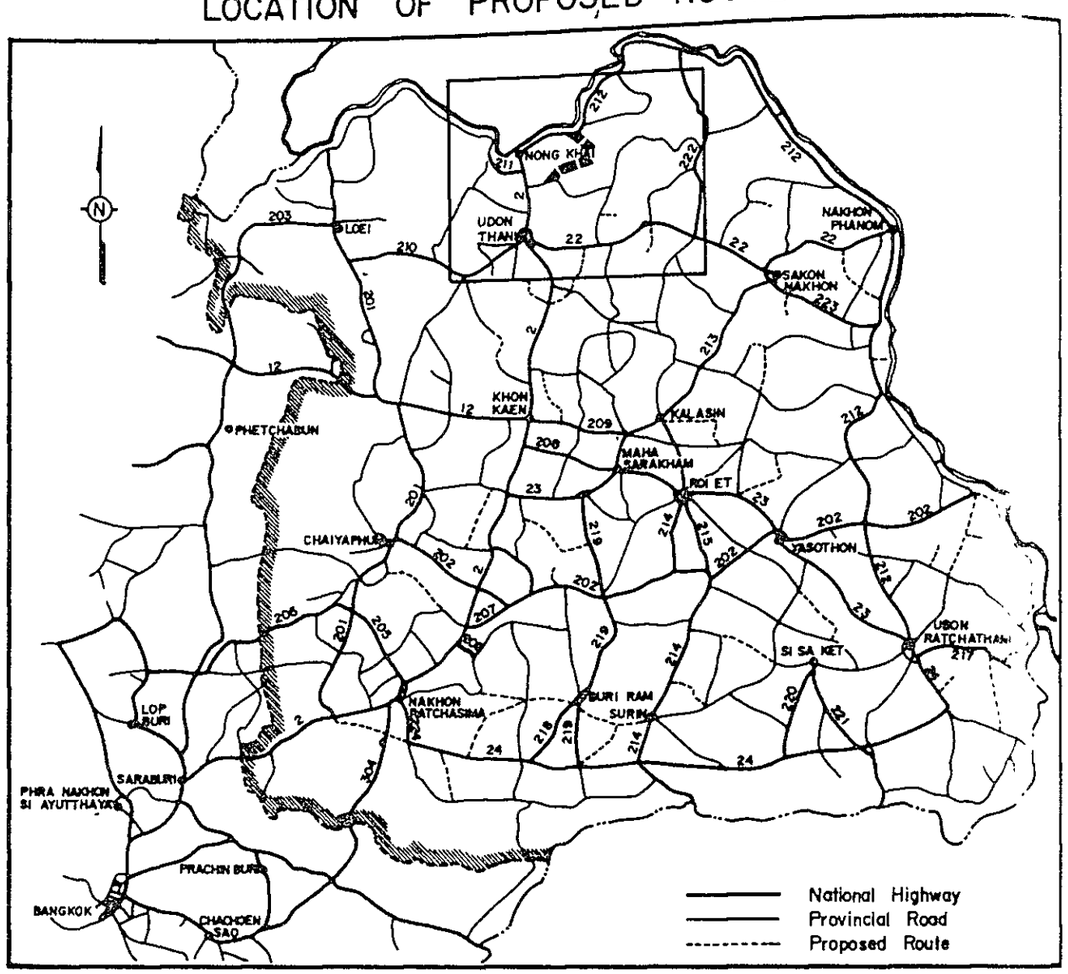
SUMMARY

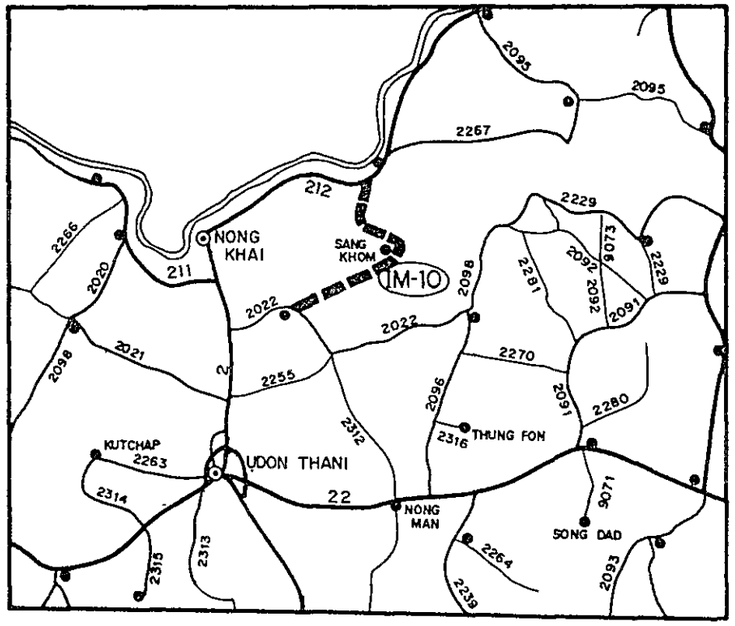
PROPOSED ROUTE IM-10

Item	Description
Changwat	Udon Tani/Nong Khai
Origin	A. Phen (J.R.2022)
Destination	J.R.212
Length	
Total	48.1 km
Improvement Section	48.1 km
DOH Road	0 km
ARD Road	48.1 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Good ~ Poor
Terrain	Flat and Rolling
Influence Area	
Area	411 km^2
Population (1982)	32,200
Principal Crops	Paddy
Traffic (ADT)	
Existing	157
1993	485
2001	615
Proposed Standard	F4 (DBST)
Total Section	
Construction Cost	
Financial	87,680 . 10^3 ₿
Economic	79,533 . 10^3 ₿
IRR	7.7 %
B/C	0.68
Section 1 (26 km)[1/]	
Construction Cost	
Financial	45,614
Economic	41,344
IRR	12.4 %
B/C	1.03
Recommendation	For immediate implementation of Section 1

1/ A section which has ADT of more than 300 in 7th year after opening.

LOCATION OF PROPOSED ROUTE





1 概　要

1.1 計画路線の概要

本路線はUdon ThaniおよびNong Khai の両県にまたがっている。県道2022号線のPhen郡を起点とし，ルートは，東北に走りNam Chum村，Sang Khom準郡，Chaeng Dan村を経て県道212号線との交点で終る。（Figure 10.5.2参照）

沿道の地形はほぼ平坦であるが一部に丘陵地も含む。影響圏内にはいくつかの村が存在し，その総人口は，32,200人である。沿道には，医療センターが3ケ所，病院1ケ所があり，教育施設として中学校が2ケ所ある。

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2022号線と国道212号線を結ぶ重要な道路網の形成を目途に計画されたものであり，又Sang Khom 準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 10.1.1に要約し，その詳細はTable 10.1.2のインベントリー調査の結果に示した。

2. 交通

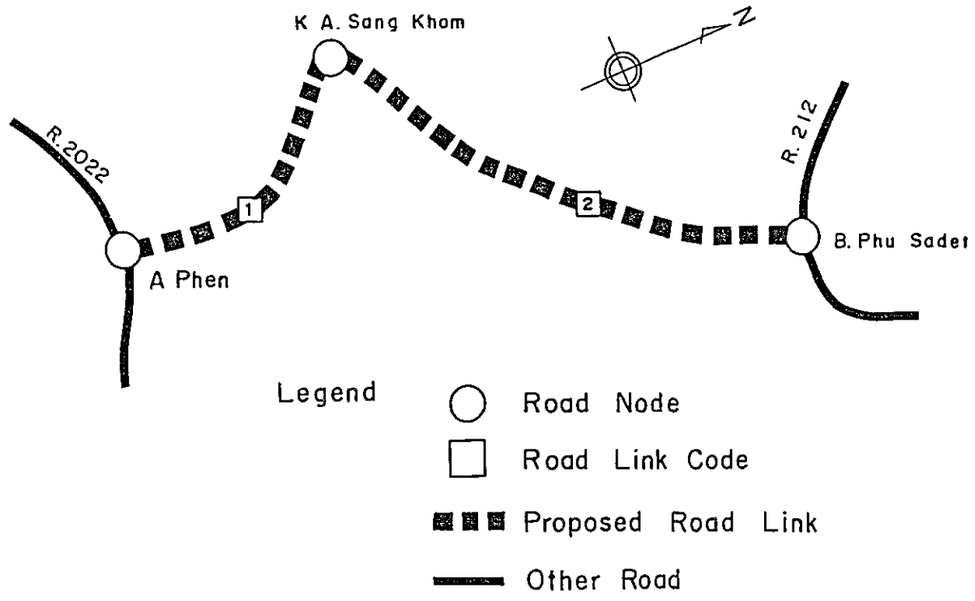
2.1 予測手法

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。

Proposed Road Link



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	2	37	5	5	5	4	32	142	-	234
	2	-	44	1	4	1	5	3	8	-	66

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	557
2	303

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	100	234	334
2	7	16	23

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	2.1	1.7	1.5
PASSENGER MOVEMENT	6.1	6.1	6.1

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981 － 1987	1987 － 1993	1993 － 2001
NON-AGRI.	7.9	7.9	7.9
AGRICULTURE	0.4	0.4	0.4
FREIGHT	2.6	2.6	2.6

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	2.8	2.9

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	3.6	66.1	8.9	12.5	8.9	2.2	18.0	79.8	0.0
	1987	7.2	62.4	9.5	12.8	8.1	6.1	17.5	68.0	8.4
	1993	11.6	58.1	10.1	13.1	7.2	10.8	16.8	53.9	18.5
	2001	17.4	52.2	11.0	13.5	5.9	17.0	16.0	35.0	32.0
2	1982	0.0	88.0	2.0	8.0	2.0	31.3	18.8	50.0	0.0
	1987	5.8	82.2	2.6	7.3	2.1	27.5	18.0	46.1	8.4
	1993	12.7	75.3	3.4	6.5	2.2	23.0	17.2	41.3	18.5
	2001	22.0	66.0	4.3	5.3	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 10.2.1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	6	5	9	5	67	19	71	9	190	228	419
1993	15	9	13	6	94	17	54	19	228	258	485
2001	40	17	21	9	137	16	35	32	307	309	615

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，畑地はキヤツサバが最も多く，ケナフ，落花生，豆類および砂糖きびがこれに次いでいる。圏内には，未だ方々に，水田及び畑地の未開発可耕地が残っている。

圏内の土地利用及び土地適応性の状況は，Table 10.3.1とFigure 10.3.1に示し，また，Udon ThaniとNong Khai 両県地域の代表的作物暦はFigure 10.3.2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 10.3.2.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てTable 10.3.3.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 10.3.4.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: Length (km)	Without Project: 1) Road Class	Without Project: Nos. of Wooden Bridge	Without Project: Nos. of Narrow C.Bridge	With Project: Length (km)	With Project: Load Class 1) Case 1	Case 2	Case 3	Case 4	With Project: Nos. of Wooden Narrow Bridge
1	Rolling	26.0	2B	2	0	26.0	1 (F4)	1 2A	1 -	2A (F5)	0
2	Flat & Rolling	22.1	3	1	0	22.1					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)	5,921	8,434	12,204
1+2A (F4+F5)	5,468	7,860	11,388
1 (F4: only Link 1)	4,708	6,760	9,713
2A (F5)	3,013	5,177	8,137

5. エンジニアリング

5.1 予備設計

予備設計は，次に示す設計基準を基本に行った。

Design Standard : F4 (if not feasible, F5)

Geometric Design : AASHTO (Rural Highways)

Typical Cross Section : as shown in Figure 10.5.1

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 : ø 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 10.5.2

ルートの線形は，Figure 10.5.2 に示す。

5.2 工事数量および建設費

予備設計による工事数量と建設費は，各工種ごとに単価を付してTable 10.5.1 に示す。

道路規程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。

Financial and Economic Construction Cost

Road Closs	Length (Km)	Construction Cost (10^3 ₱) Financial Cost	Economic Cost	Remark
F4 (DBST)	48.1	87,680	79,533	
F5 (Laterite)	48.1	53,516	48,457	
F4 + F5	48.1	69,147	62,674	
F4		45,614	41,344	Adopted to link ≧300 in ADT
F5		23,532	21,328	Adopted to link <300 in ADT

6. 経済評価

年次別経済費用と便益及び評価結果はTable 10.6.1， 10.6.2， 10.6.3.及び 10.6.4 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ＡＤＴの多い一部区間では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 10.7.1 に示す通りである。

Table 10.1.1 SUMMARY OF ROAD INVENTORY

Item	Description		
Origin	A. Phen (J.R. 2022)		
Destination	J.R. 212		
Length			
Total			48.1 km
Improvement Section			48.1 km
DOH Road			0 km
ARD Road			48.1 km
Others			0 km
New Alignment Section			0 km
Terrain	Flat and Rolling		
Alignment (Hori./Vert.)	Fair / Fair		
Formation Width	5.0 m - 8.0 m, 6.5 m (Weighted average)		
Embankment Section			
Length			48.1 km
Height	0.2 m - 1.5 m		
Cut Section			
Length			0 km
Depth	m - m		
Surface Type and Condition			
SBST or DBST	Good		1.0 km
Soil Aggregate	Good - Poor		47.1 km
Earth			0 km
Pipe Culvert	2 each		
Box Culvert	0 each	0 m	
Bridge			
Permanent Bridge	1 each	40.0 m	
Narrow Concrete Bridge	0 each	0 m	(4m)
Wooden Bridge	3 each	75.5 m	
Overflow Section	0 place	0 km	

Table 10.1.2 ROAD INVENTORY (1)

PROPOSED ROUTE NO. IM-10 ROUTE NO. ARD A. PHEN (J.R. 2022) ∿ J.R. 212 L = 48.1 Km.

UDON THANI / NONG KHAI

Item	Sub-item	Data (in order along route)
STATION (Km)		0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30
VILLAGE - Name - Household (H) - Population (P)		B. DON SAENG H = 35 P = 210; B. NAM CHUM H = 270 P = 2150; B. KHOK H = 208 P = 1646; B. DON DUA H = 50 P = 300; B. KHOK SAWANG H = 30 P = 300; B. SANG KHON H = 350 P = 2700
TERRAIN		Rolling; Flat
CROSS SECTION	Formation Width (m)	5.50; 7.00; 8.00; 6.00; 8.00; 6.50; 6.00; 7.00
	Embankment Height (m)	0.20; 0.70; 1.00; 0.40; 0.20; 1.00; 0.20; 0.50; 1.50; 0.30; 0.50; 0.20; 0.20; 0.40
	Cutting Depth (m)	
PAVEMENT	Type/Length	D.T.; Laterite
	Condition	Good; Poor
FLOODING	Overflow Length(Km)/Height(m)	
LAND USE	Left	Bush; Paddy; Bush; Swamp
	Right	Paddy; Bush; Swamp
PIPE CULVERT	Total Number	43 Pipes
BOX CULVERT & BRIDGE	Station (Km)	1.0; 16.0; 18.6; 29.2
	Dimension	C-Br. 7.00 x 40.00; W-Br. 4.00 x 28.50; W-Br. 4.00 x 23.00; W-Br. 4.80 x 24.00
RIGHT OF WAY (m)		15.0
ALIGNMENT	Horizontal	Poor; Fair
	Vertical	Poor; Fair
ROUTE NO., AGENCIES		ARD

ROAD INVENTORY

PROPOSED ROUTE NO. IM-10 ROUTE NO. ARD A. PHEN (J.R. 2022)∿ B.PAK BUAI (J.R. 212) (Cont'd) L = 48.1 Km.

UDON THNAI / KHON KAEN

STATION (Km)		30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
VILLAGE - Name - Household (H) - Population (P)			B. SOM PHON H = 20 P = 100	B. CHAENG DA H = 98 P = 980		B. SNAG NANG KHAO H = 80 P = 640											
TERRAIN		Flat		Rolling													
CROSS SECTION	Formation Width (m)	5.00	5.50	6.00	5.00		6.00		7.00	5.50							
	Embankment Height (m)	0.60	0.50	0.20	0.30	0.60	0.30	0.40	0.60	0.50							
	Cutting Depth (m)																
PAVEMENT	Type/Length	Laterite															
	Condition	Poor															
FLOODING	Overflow Length(Km)/Height(m)																
LAND USE	Left	Paddy	Bush		Paddy												
	Right	Paddy	Bush		Paddy												
PIPE CULVERT	Total Number																
BOX CULVERT & BRIDGE	Station (Km)																
	Dimension																
RIGHT OF WAY (m)		15.0															
ALIGNMENT	Horizontal	Fair		Poor													
	Vertical	Fair		Poor													
ROUTE NO., AGENCIES		ARD															

Table 10.2.1 TRAFFIC VOLUME ON ROUTE IM - 10

YEAR		1987			1993			2001		
LINK		1	2	AVR.	1	2	AVR.	1	2	AVR.
P/C	N+D	6	4	5	13	13	13	33	35	34
	I	1	1	1	2	2	2	5	5	5
	DV	0	0	0	0	0	0	1	1	1
	TOTAL	6	5	6	15	15	15	39	42	40
L/B	N+D	7	2	5	11	3	8	21	7	14
	I	1	0	1	2	0	1	3	1	2
	DV	0	0	0	0	0	0	1	0	0
	TOTAL	8	2	5	13	4	9	24	8	17
M/B	N+D	10	5	8	15	6	11	25	9	18
	I	1	1	1	2	1	2	4	1	3
	DV	0	0	0	0	0	0	1	0	1
	TOTAL	11	6	9	17	8	13	30	10	21
H/B	N+D	6	1	4	8	2	5	11	4	8
	I	1	0	1	1	0	1	2	1	1
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	7	2	5	10	3	6	13	4	9
P/P&T	N+D	58	59	59	82	77	79	123	108	116
	I	9	9	9	12	11	12	18	16	17
	DV	0	0	0	3	2	3	4	4	4
	TOTAL	67	68	67	97	91	94	145	128	137
4/T	N+D	28	2	16	25	2	15	23	2	13
	I	4	0	2	4	0	2	4	0	2
	DV	0	0	0	1	0	0	1	0	0
	TOTAL	32	3	19	30	2	17	28	2	16
6/T	N+D	109	6	62	81	5	46	51	3	29
	I	16	1	9	12	1	7	8	1	4
	DV	0	0	0	3	0	1	2	0	1
	TOTAL	126	7	71	96	5	54	61	4	35
10/T	N+D	14	1	8	28	2	16	47	3	27
	I	2	0	1	4	0	2	7	0	4
	DV	0	0	0	1	0	1	2	0	1
	TOTAL	16	1	9	33	2	19	55	4	32
ADT	N+D	238	81	166	263	109	192	334	171	259
	I	36	12	25	39	16	29	50	26	39
	DV	0	0	0	9	4	6	11	6	9
	TOTAL	273	93	190	311	129	228	395	202	307
M/C	N+D	273	136	210	290	167	234	331	224	282
	I	22	14	18	23	17	20	23	20	22
	DV	0	0	0	5	3	4	5	4	4
	TOTAL	295	150	228	318	187	258	360	249	309
TOTAL	N+D	511	216	375	553	277	426	666	395	541
	I	58	26	43	62	33	49	74	46	61
	DV	0	0	0	13	7	10	16	10	13
	TOTAL	569	242	419	629	317	485	755	451	615

NOTE

N : NORMAL TRAFFIC D : DIVERTED TRAFFIC

DV : DEVELOPED TRAFFIC I : INDUCED TRAFFIC

Figure 10.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM – 10

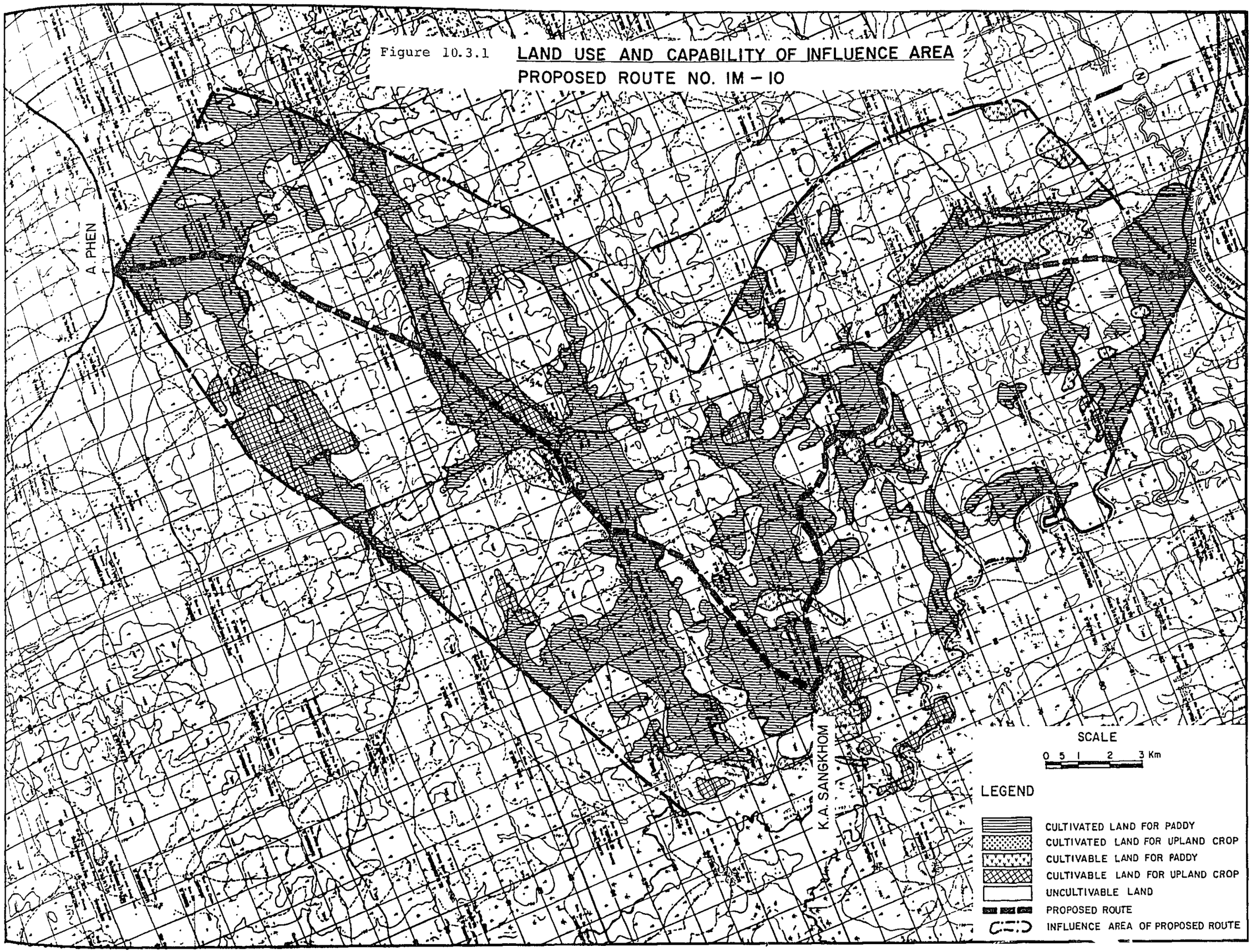
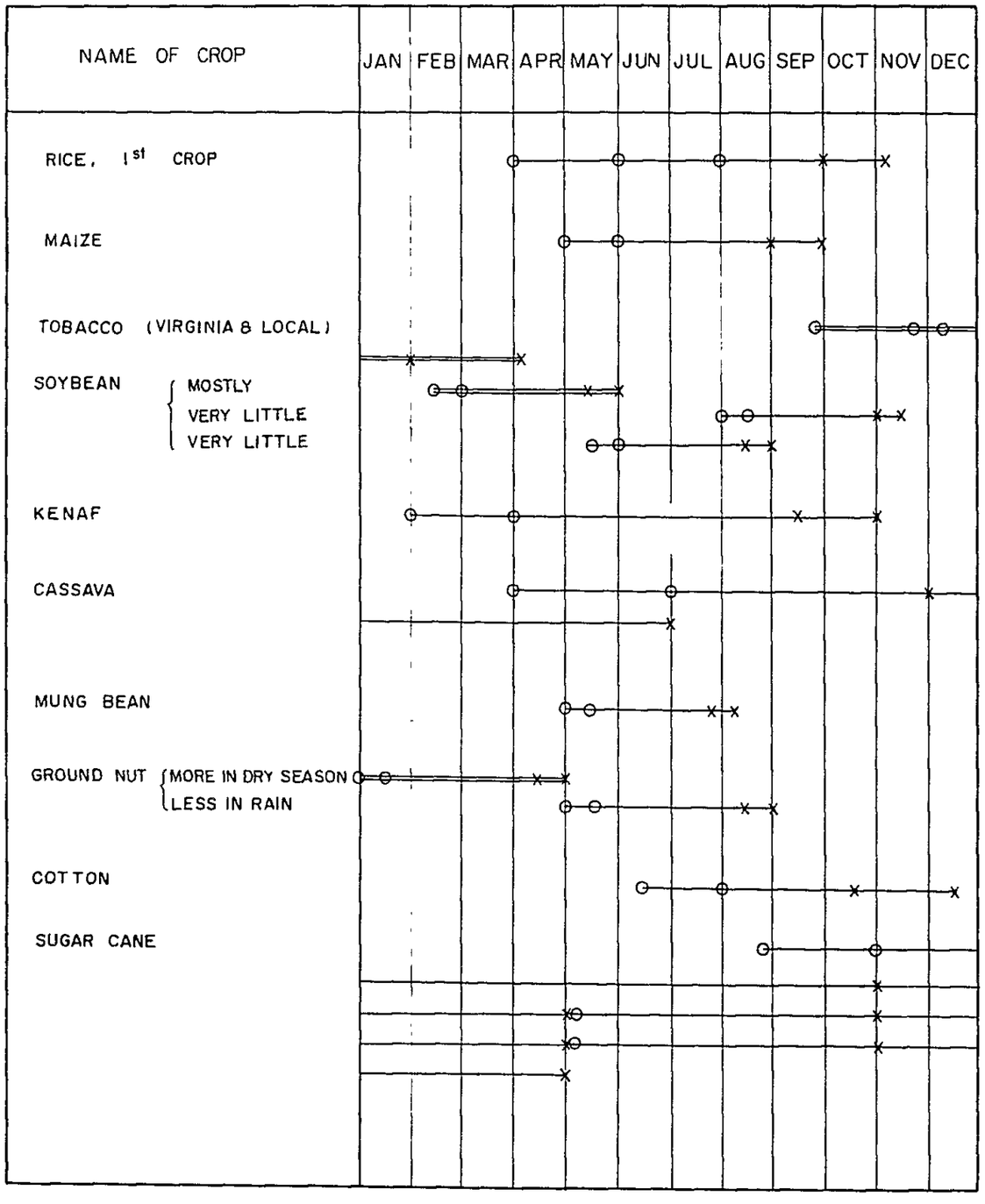


Figure 10.3.2 CROPPING CALENDAR(1)

0200 CHANGWAT UDON THANI



CROPPING CALENDAR(2)

0300 CHANGWAT NONGKHAI

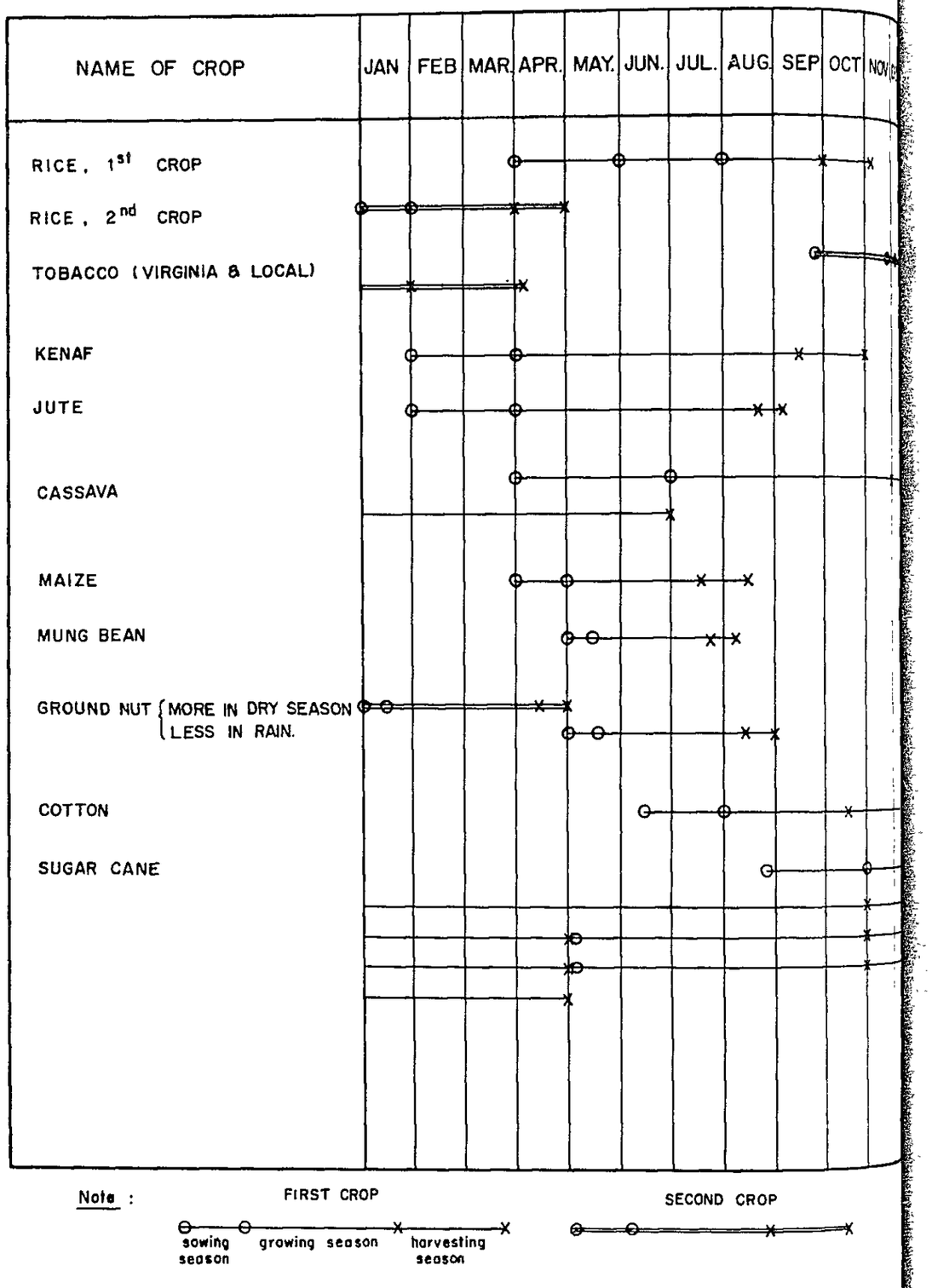


TABLE 10.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		60.000 (96.0)	0.125 (0.2)	60.125 (96.2)	9.500 (15.2)	8.125 (13.0)	17.625 (28.2)
0206	PHEN	21.250 (34.0)	0.125 (0.2)	21.375 (34.2)	0.125 (0.2)	5.000 (8.0)	5.125 (8.2)
0207	SANG KHOM	25.625 (41.0)	-	25.625 (41.0)	3.750 (6.0)	3.125 (5.0)	6.875 (11.0)
0305	PHON PHISAI	13.125 (21.0)	-	13.125 (21.0)	5.625 (9.0)	-	5.625 (9.0)

TABLE 10.3.2 CROP PRODUCTION

ITEM			PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)												
1981			65.66	-	0.22	0.89	3.28	0.11	1.65	-	6.20	71.86
1987			66.06	-	0.22	0.89	3.48	0.12	1.65	-	6.36	72.41
1993	WITHOUT	PROJECT	66.45	-	0.22	0.89	3.70	0.13	1.65	-	6.58	73.03
	WITH	PROJECT	68.06	-	0.22	0.89	4.16	0.13	1.65	-	7.04	75.10
2001	WITHOUT	PROJECT	66.99	-	0.22	0.89	4.00	0.14	1.65	-	6.89	73.88
	WITH	PROJECT	68.61	-	0.22	0.89	4.50	0.14	1.65	-	7.39	76.00
CROP YIELD (KG/RAI)												
1981			260.7	-	180.0	121.9	2232.1	6000.0	122.3	-		
1987			260.7	-	180.0	122.6	2232.1	6036.1	122.3	-		
1993	WITHOUT	PROJECT	260.7	-	180.0	123.3	2232.1	6072.4	122.3	-		
	WITH	PROJECT	265.5	-	182.2	124.8	2245.5	6108.9	122.3	-		
2001	WITHOUT	PROJECT	260.7	-	180.0	124.3	2232.1	6121.1	122.3	-		
	WITH	PROJECT	271.9	-	185.1	127.9	2263.5	6207.3	122.3	-		
CROP PRODUCTION (TON)												
1981			17,120	-	39	108	7,321	684	201	-	8,354	25,474
1987			17,223	-	39	109	7,772	730	201	-	8,851	26,075
1993	WITHOUT	PROJECT	17,327	-	39	110	8,250	780	201	-	9,380	26,707
	WITH	PROJECT	18,068	-	39	111	9,335	785	201	-	10,472	28,540
2001	WITHOUT	PROJECT	17,466	-	39	111	8,933	851	201	-	10,136	27,602
	WITH	PROJECT	18,655	-	40	114	10,190	863	201	-	11,409	30,064

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 10.3.3 FARMGATE PRICE AND PRODUCTION COST

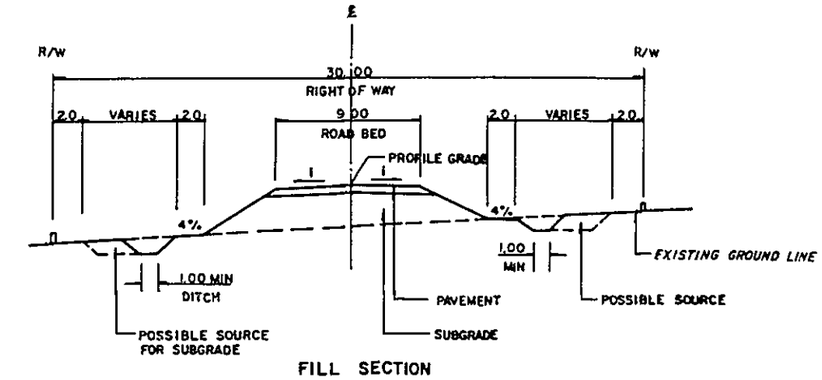
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,861	-	7,313	9,641	597	671	4,511	-
WITH PROJECT (1987 - 2001)	3,958	-	7,313	9,641	612	671	4,624	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	603	-	667	1,010	759	2,506	479	-
WITH PROJECT (1987 - 2001)	619	-	687	1,030	779	2,531	479	-

TABLE 10.3.4 NET PRODUCTION VALUE

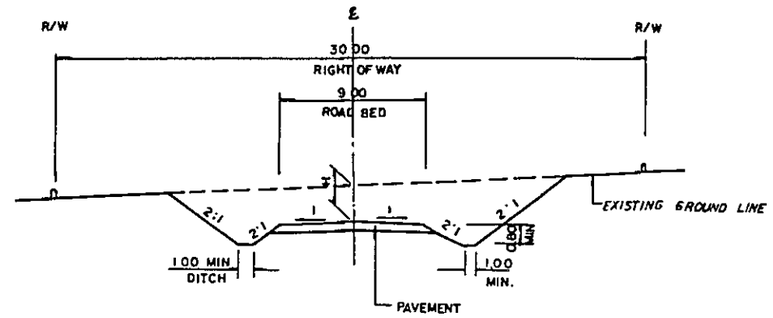
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	26,687	2,597	29,284	27,281	2,641	29,922
1993	26,847	2,740	29,587	29,382	3,112	32,494
2001	27,063	2,945	30,008	31,367	3,422	34,789

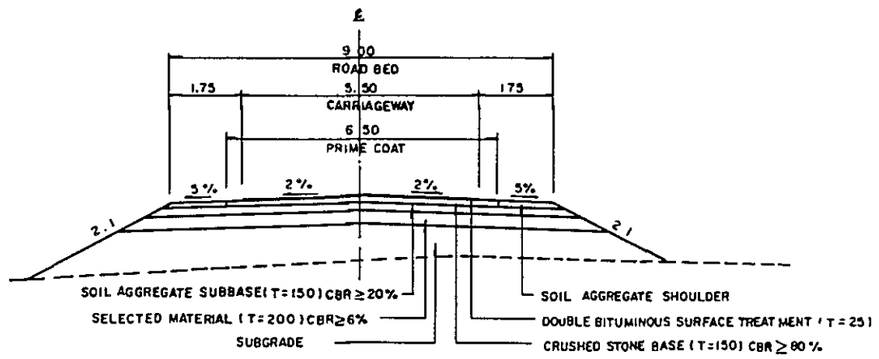
Figure 10.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



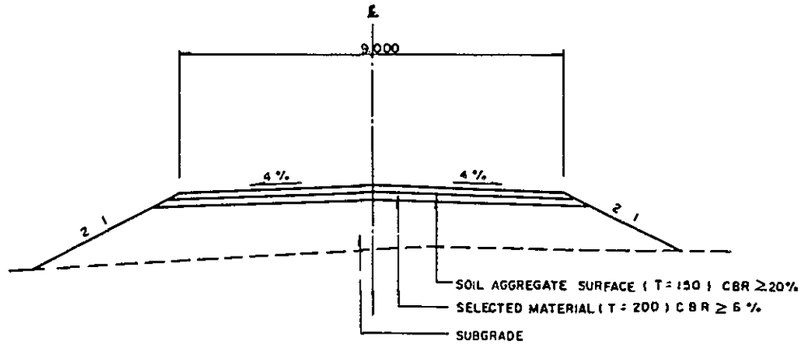
FILL SECTION



CUT SECTION

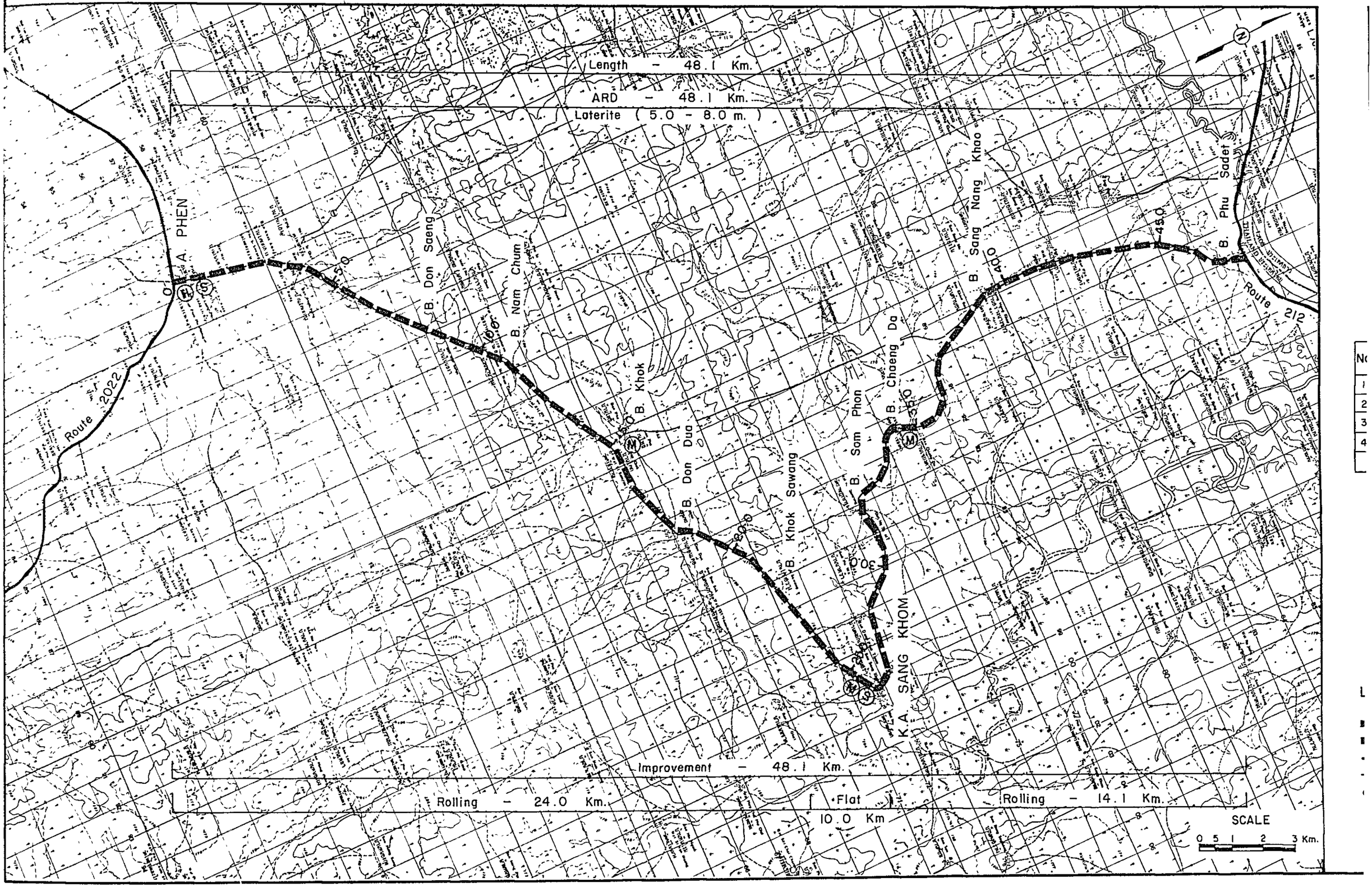


DOUBLE BITUMINOUS SURFACE TREATMENT (DBST) ROAD (Class F4)



SOIL AGGREGATE SURFACED ROAD (Class F5)

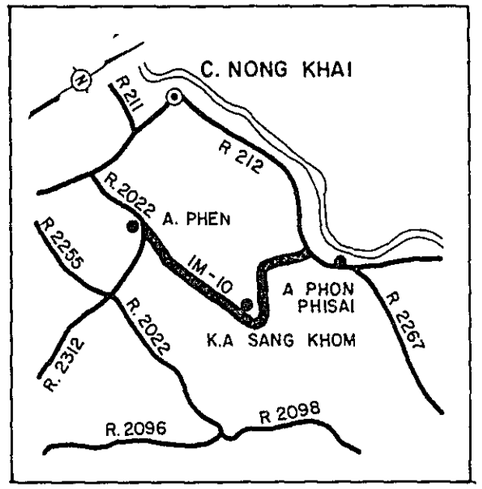
Figure 10.5.2 **PROPOSED ROUTE NO. IM-10** C. UDON THANI NONG KHAI — A. PHEN (J.R. 2022) - J.R. 212 ROUTE NO. ARD L = 48.1 Km.



C. UDON THANI
NONG KHAI

A. PHEN (J.R. 2022) - J.R. 212
ROUTE NO. ARD L = 48.1 Km.

LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	1.0	—	C - 7 00 x 40 00
2	16 0	C-7.00 x 32 00	W - 4 00 x 28 50
3	18 6	C-7 00 x 26 00	W - 4 00 x 23 00
4	29 2	C-7 00 x 26 00	W - 4 80 x 24 00

LEGEND

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

Table 10.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-10 (48.1 km) (1)

Items	Unit of Q'ty	Financial Unit Rate ฿	(DBST) Q'ty	(DBST) Financial Cost (10^3฿)	(DBST) Economic Cost (10^3฿)	(Soil Aggregate Surface) Q'ty	(Soil Aggregate Surface) Financial Cost (10^3฿)	(Soil Aggregate Surface) Economic Cost (10^3฿)
DIRECT CONSTRUCTION COST								
Clearing and Grubbing	ha	15,000	113	1,695	1,542	113	1,695	1,542
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	151,300	6,808	6,195	151,300	6,808	6,195
Selected Material	m^3	80	99,900	7,992	7,112	99,900	7,992	7,112
Soil Aggregate Surface or Subbase	m^3	105	69,900	7,339	6,532	69,900	7,339	6,532
Crushed Stone Base	m^3	370	45,900	16,983	15,624	10,700	3,959	3,642
Soil Aggregate Shoulder	m^3	105	19,800	2,079	1,850	4,600	483	429
Prime Coat and DBST	m^2	55	259,100	14,251	12,826	60,500	3,328	2,995
Pipe Culvert	m	2,100	1,540	3,234	2,975	1,540	3,234	2,975
Box Culvert	m	16,000	0	0	0	0	0	0
Long Span Bridge	m	80,000	0	0	0	0	0	0
Short Span Bridge	m	40,000	84	3,360	2,990	84	3,360	2,990
Sub Total (a)				63,742	57,650		38,199	34,416
Miscellaneous Works (a) x 7%				4,462	4,036		2,674	2,409
Total (b)				68,204	61,686		40,873	36,825
PHYSICAL CONTENGENCY (b) x 15%				10,231	9,253		6,131	5,524
ENGINEERING AND ADMINISTRATION (b) x 10%				6,820	6,169		4,087	3,683
Sub Total				17,051	15,422		10,218	9,207
LAND ACQUISITION								
Highly Developed Land	ha	50,000	38	1,900	1,900	38	1,900	1,900
Less Developed Land	ha	15,000	35	525	525	35	525	525
Sub Total				2,425	2,425		2,425	2,425
GRAND TOTAL				87,680	79,533		53,516	48,457

CONSTRUCTION QUANTITIES AND COSTS (DBST + Soil Aggregate Surface) (2)

Items	Unit of Q'ty	Financial Unit Rate ₿	Proposed Route Number: IM-10 (1-2) (26.0 km) 1/ Q'ty	IM-10 (1-2) Financial Cost (10^3₿)	IM-10 (1-2) Economic Cost (10^3₿)	IM-10 (2-3) (22.1 km) 2/ Q'ty	IM-10 (2-3) Financial Cost (10^3₿)	IM-10 (2-3) Economic Cost (10^3₿)	IM-10 (T) (48.1 km) 3/ Q'ty	IM-10 (T) Financial Cost (10^3₿)	IM-10 (T) Economic Cost (10^3₿)
DIRECT CONSTRUCTION COST											
Clearing and Grubbing	ha	15,000	60	900	819	53	795	723	113	1,695	1,542
Excavation - Soil	m^3	20	0	0	0	0	0	0	0	0	0
Excavation - Hard Rock	m^3	160	0	0	0	0	0	0	0	0	0
Embankment	m^3	45	59,800	2,691	2,448	91,500	4,117	3,746	151,300	6,808	6,195
Selected Material	m^3	80	53,000	4,240	3,773	46,900	3,752	3,339	99,900	7,992	7,112
Soil Aggregate Surface or Subbase	m^3	105	37,100	3,895	3,466	32,800	3,444	3,065	69,900	7,339	6,532
Crushed Stone Base	m^3	370	24,400	9,028	8,305	2,400	888	816	26,800	9,916	9,122
Soil Aggregate Shoulder	m^3	105	10,500	1,102	981	1,100	115	102	11,600	1,218	1,084
Prime Coat and DEST	m^2	55	137,500	7,563	6,806	13,800	759	683	151,300	8,322	7,490
Pipe Culvert	m	2,100	700	1,470	1,352	840	1,764	1,622	1,540	3,234	2,975
Box Culvert	m	16,000	0	0	0	0	0	0	0	0	0
Long Span Bridge	m	80,000	0	0	0	0	0	0	0	0	0
Short Span Bridge	m	40,000	58	2,320	2,064	26	1,040	925	84	3,360	2,990
Sub Total (a)				33,210	30,018		16,675	15,026		49,885	45,046
Miscellaneous Works (a) x 7%				2,325	2,101		1,167	1,052		3,492	3,153
Total (b)				35,535	32,119		17,842	16,078		53,377	48,199
PHYSICAL CONTENGENCY (b) x 15%				5,330	4,818		2,676	2,412		8,007	7,23
ENGINEERING AND ADMINISTRATION (b) x 10%				3,554	3,212		1,784	1,608		5,338	4,820
Sub Total				8,884	8,030		4,460	4,020		13,345	12,050
LAND ACQUISITION											
Highly Developed Land	ha	50,000	17	850	850	21	1,050	1,050	38	1,900	1,900
Less Developed Land	ha	15,000	23	345	345	12	180	180	35	525	525
Sub Total				1,195	1,195		1,230	1,230		2,425	2,425
GRAND TOTAL				45,614	41,344		23,532	21,328		69,147	62,674

Note: 1/ = DBST Link
2/ = Soil Aggregate Surface Link
3/ = Total Link

Table 10.6.1 COST AND BENEFITS

(F4 STANDARD)

(1000 BAHT)

YEAR	COST	BENEFITS				DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	15,907	0	0	0	0	22,348	0
1985	39,767	0	0	0	0	49,884	0
1986	23,860	0	0	0	0	26,723	0
1987	0	638	5,921	-148	6,410	0	5,723
1988	0	962	6,340	-135	7,166	0	5,713
1989	0	1,285	6,759	-121	7,922	0	5,639
1990	0	1,609	7,178	-108	8,678	0	5,515
1991	0	1,932	7,596	-94	9,435	0	5,353
1992	0	2,256	8,015	-80	10,191	0	5,163
1993	0	2,579	8,434	-67	10,947	0	4,952
1994	23,280	2,854	8,906	-49	11,711	10,531	4,730
1995	0	3,128	9,377	-30	12,475	0	4,498
1996	0	3,403	9,848	-12	13,238	0	4,262
1997	0	3,677	10,319	6	14,002	0	4,025
1998	0	3,952	10,791	24	14,766	0	3,790
1999	0	4,226	11,262	42	15,530	0	3,559
2000	0	4,500	11,733	60	16,294	0	3,334
2001	-37,894	4,775	12,204	79	17,058	-6,923	3,116
TOTAL	64,920	41,774	134,682	-633	175,823	102,563	69,374

DISCOUNTED ECONOMIC COSTS :	102,563
DISCOUNTED ECONOMIC BENEFITS :	69,374
AGRICULTURAL DEVELOPMENT BENEFIT	14,888
VOC SAVING	54,995
RMC SAVING	-509
NET PRESENT VALUE :	-33,188
BENEFIT COST RATIO :	0.68
INTERNAL RATE OF RETURN :	7.7 %

Table 10.6.2 COST AND BENEFITS

(F4&F5 COMBINED)

(1000 BAHT)

YEAR	COST	BENEFITS				DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	12,535	0	0	0	0	17,611	0
1985	31,337	0	0	0	0	39,309	0
1986	18,802	0	0	0	0	21,058	0
1987	0	638	5,468	-52	6,054	0	5,405
1988	0	962	5,867	-41	6,788	0	5,411
1989	0	1,285	6,265	-29	7,521	0	5,354
1990	0	1,609	6,664	-18	8,255	0	5,246
1991	0	1,932	7,063	-6	8,989	0	5,100
1992	0	2,256	7,461	6	9,722	0	4,926
1993	0	2,579	7,860	17	10,456	0	4,730
1994	13,552	2,854	8,301	32	11,186	6,130	4,518
1995	0	3,128	8,742	46	11,916	0	4,297
1996	0	3,403	9,183	61	12,646	0	4,072
1997	0	3,677	9,624	76	13,377	0	3,845
1998	0	3,952	10,065	90	14,107	0	3,621
1999	0	4,226	10,506	105	14,837	0	3,400
2000	0	4,500	10,947	119	15,567	0	3,185
2001	-30,139	4,775	11,388	134	16,297	-5,506	2,977
TOTAL	46,087	41,774	125,404	540	167,718	78,602	66,088

DISCOUNTED ECONOMIC COSTS :	78,602
DISCOUNTED ECONOMIC BENEFITS :	66,088
AGRICULTURAL DEVELOPMENT BENEFIT	14,888
VOC SAVING	51,137
RMC SAVING	63
NET PRESENT VALUE :	-12,514
BENEFIT COST RATIO :	0.84
INTERNAL RATE OF RETURN :	10.1 %

Table 10.6.3 COST AND BENEFITS

(F4,SECTION 1)

(1000 BAHT)

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	16,537	0	0	0	0	20,744	0
1986	24,807	0	0	0	0	27,784	0
1987	0	335	4,708	4	5,047	0	4,506
1988	0	512	5,050	12	5,574	0	4,443
1989	0	688	5,392	20	6,100	0	4,342
1990	0	865	5,734	28	6,627	0	4,211
1991	0	1,041	6,076	36	7,153	0	4,059
1992	0	1,218	6,418	44	7,680	0	3,891
1993	0	1,394	6,760	52	8,206	0	3,712
1994	12,584	1,542	7,129	62	8,733	5,692	3,527
1995	0	1,691	7,498	72	9,261	0	3,340
1996	0	1,839	7,867	82	9,788	0	3,152
1997	0	1,988	8,237	92	10,316	0	2,965
1998	0	2,136	8,606	101	10,843	0	2,783
1999	0	2,284	8,975	111	11,370	0	2,606
2000	0	2,433	9,344	121	11,898	0	2,434
2001	-19,663	2,581	9,713	131	12,425	-3,592	2,270
TOTAL	34,265	22,545	107,507	968	131,019	50,628	52,241

DISCOUNTED ECONOMIC COSTS : 50,628

DISCOUNTED ECONOMIC BENEFITS : 52,241

AGRICULTURAL DEVELOPMENT BENEFIT	8,021
VOC SAVING	43,905
RMC SAVING	315

NET PRESENT VALUE : 1,613

BENEFIT COST RATIO : 1.03

INTERNAL RATE OF RETURN : 12.4 %

Table 10.6.4 COST AND BENEFITS

(F5,SECTION 2)

(1000 BAHT)

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	8,531	0	0	0	0	10,701	0
1986	12,797	0	0	0	0	14,333	0
1987	0	303	760	-56	1,007	0	899
1988	0	450	817	-53	1,214	0	968
1989	0	597	873	-49	1,421	0	1,012
1990	0	744	930	-46	1,629	0	1,035
1991	0	891	987	-42	1,836	0	1,042
1992	0	1,038	1,043	-39	2,043	0	1,035
1993	0	1,185	1,100	-35	2,250	0	1,018
1994	1,214	1,311	1,172	-30	2,453	549	991
1995	0	1,437	1,244	-26	2,656	0	958
1996	0	1,563	1,316	-21	2,858	0	920
1997	0	1,690	1,388	-16	3,061	0	880
1998	0	1,816	1,459	-11	3,264	0	838
1999	0	1,942	1,531	-7	3,467	0	794
2000	0	2,068	1,603	-2	3,669	0	751
2001	-7,608	2,194	1,675	3	3,872	-1,390	707
TOTAL	14,934	19,229	17,898	-428	36,699	24,193	13,847

DISCOUNTED ECONOMIC COSTS : 24,193

DISCOUNTED ECONOMIC BENEFITS : 13,847

AGRICULTURAL DEVELOPMENT BENEFIT	6,866
VOC SAVING	7,232
RMC SAVING	-252

NET PRESENT VALUE : -10,346

BENEFIT COST RATIO : 0.57

INTERNAL RATE OF RETURN : 6.4 %

Table 10.7.1 SOCIAL INDICATORS

(Proposed Route IM-10)

Population (1,000)		
1982	:	32.2
1993	:	39.5
Average travelling speed, without (kph)	:	44
Isolation		
Access to Amphoe		
Average distance to Amphoe (km) 1/	:	6.1
Per capita time savings (10^{-4})	:	0.014
Score	:	41
Access to Artery Highway		
Average distance to highway (km) 1/	:	22
Per capita time savings (10^{-4})	:	0.049
Score	:	107
Impassability		
Impassable week a year	:	-
Impassability per year	:	0
Impassability per capita (10^{-4})	:	0
Score	:	0
Health		
Access to Hospital		
Average distance to Hospital (km) 1/	:	14.0
Per capita time savings (10^{-4})	:	0.031
Score	:	72
Access to Medical Facilities		
Average distance to facilities (km) 1/	:	3.4
Per capita time savings (10^{-4})	:	0.008
Score	:	32
Education		
Access to Secondary School		
Number of Student in 1993 (1,000) 2/	:	8.7
Average distance to school (km)	:	6.2
Per capita time savings (10^{-4})	:	0.088
Score	:	48
Teacher Intensity		
Number of teachers 3/		
University graduate	:	1
Total	:	19
Number of Student	:	470
Indicators		
E1 4/	:	2.1
E2 5/	:	40.4
E 6/	:	42.5
Degree of Improvement 7/	:	1.61
Score	:	103
Disparity		
G.P.V. in 1993 (Mn B) 8/		
With project	:	80.0
Without project	:	74.6
Per capita G.P.V. in 1993 (B)		
With project (W)	:	2,025
Without project (w)	:	1,889
Degree of Disparity		
(A/W) - (A/w) 9/	:	0.11
Score	:	196
Total Score	:	599

Note:

1/ ( ) shows the length or distance in without project case. Unless otherwise, lengthes 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 - 11

Changwat : Udon Thani

B. Thung Yai (J.R. 2096)- K.A. Thung Fon

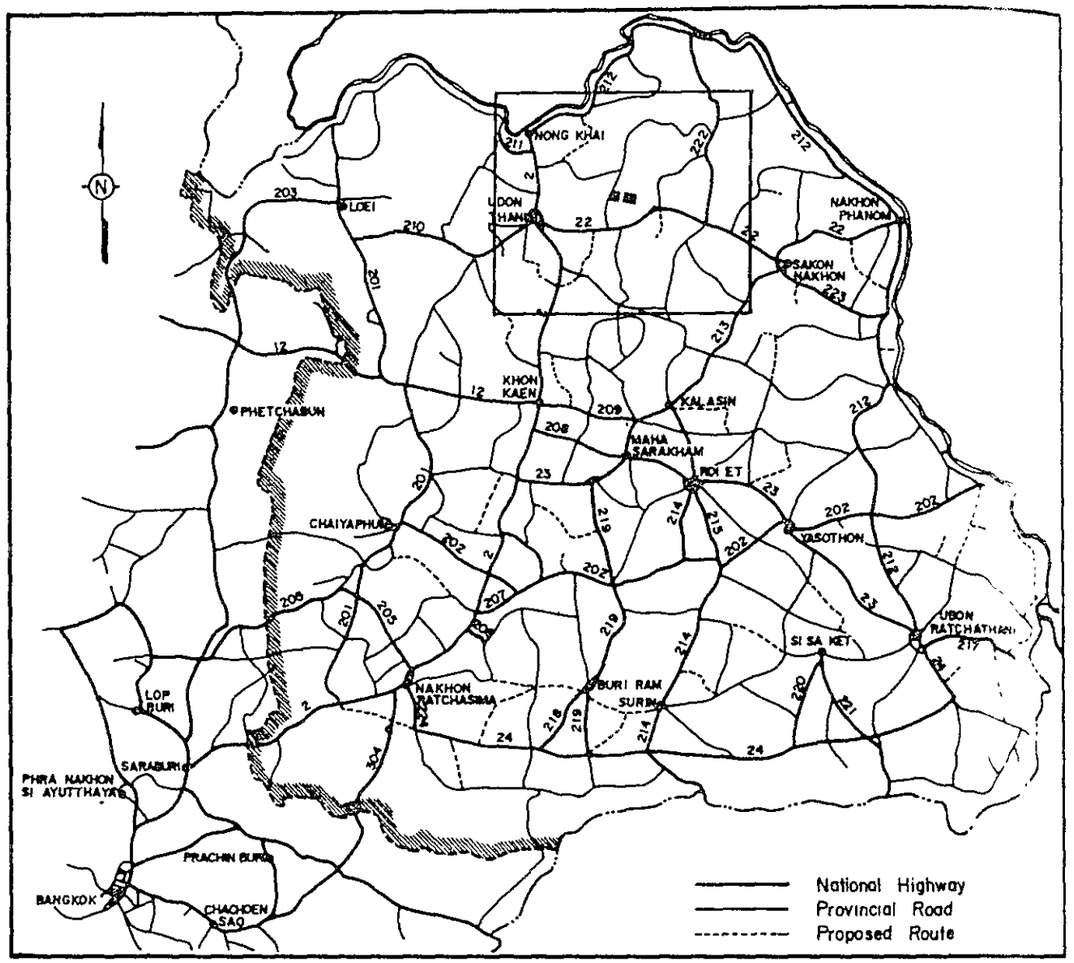
Length : 8.3 KM.

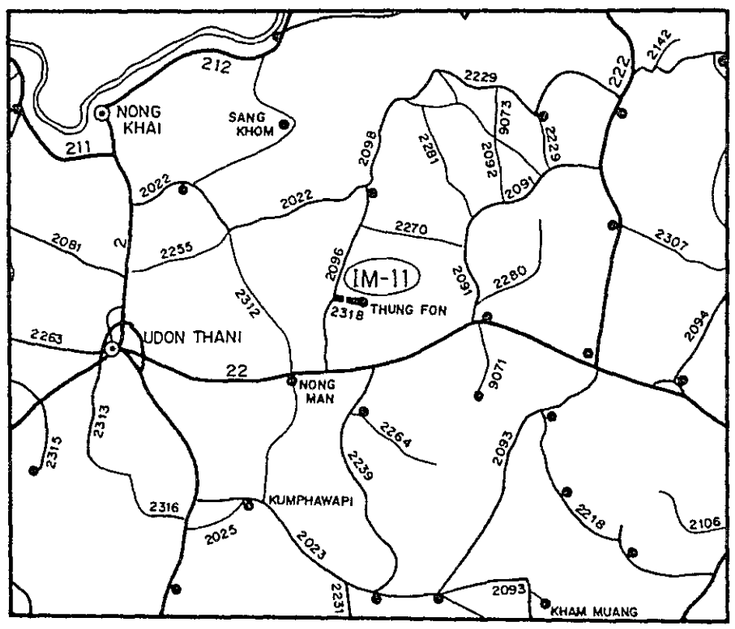
SUMMARY

PROPOSED ROUTE IM- 11

Item	Description
Changwat	Udon Thani
Origin	B. Thung Yai (J.R.2096)
Destination	K.A. Thung Fon
Length	
Total	8.3 km
Improvement Section	8.3 km
DOH Road	0 km
ARD Road	8.3 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Poor
Terrain	Rolling
Influence Area	
Area	59 km^2
Population (1982)	7,700
Principal Crops	Paddy
Traffic (ADT)	
Existing	74
1993	297
2001	392
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	18,823 . 10^3 ฿
Economic	17,001 . 10^3 ฿
IRR	5.1 %
B/C	0.51
Social Impact	High
Recommendation	For further consideration

LOCATION OF PROPOSED ROUTE





1. 概　要

1.1　計画路線の概要

本路線はUdon Thani県の東部に位置している。県道2096号線にあるThung 村を起点とし，ルートは東に走りThung　Fon準郡で終る。その総延長は 8.3kmである。(Figure 11.5.2 参照)

沿道の地形はほぼ丘陵地である。影響圏内にはいくつかの村が存在し，その総人口は，7,700人である。沿道には，医療センターが2ケ所と教育施設として中学校が1ケ所ある。

本路線は，Thung　For準郡と県道2096号線を結ぶ重要な路線となる。

1.2　現道の状況

計画路線に利用した現道の状況は，Table　11.1.1に要約し，その詳細はTable　11.1.2のインベントリー調査の結果に示した。

2. 交通

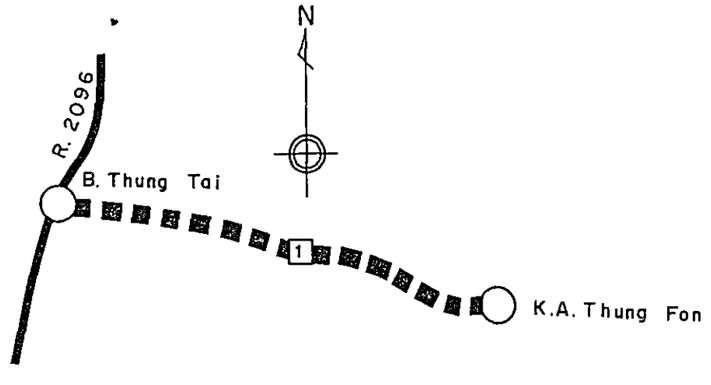
2.1　予測手法

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。

Proposed Road Link



Traffic Volume in Base Year

Source (base year)	Link No	Vehicle Type P/C	P/P	L/B	M/B	M/B	P/T	4/T	6/T	10/T	ADT
DOH (1981) /1	1	17	11	10	13	2	2	5	7	-	67
Manual Counts (1982)	1	1	41	4	5	-	5	18	5	-	79
Estimated	1	9	26	7	9	1	4	12	6	-	74

Note: /1 Route 2318　Section 0100　Section km　0 + 500

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	451

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	16	9	24

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	1.3	1.0	1.0
PASSENGER MOVEMENT	5.3	5.4	5.6

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981 － 1987	1987 － 1993	1993 － 2001
NON-AGRI.	6.9	7.0	7.2
AGRICULTURE	0.3	0.3	0.3
FREIGHT	4.5	4.6	4.7

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	17.3	50.0	13.5	17.3	1.9	18.2	54.5	27.3	0.0
	1987	17.2	50.1	13.0	16.6	3.1	17.9	44.4	29.3	8.4
	1993	17.0	50.3	12.5	15.7	4.5	17.5	32.2	31.7	18.5
	2001	16.8	50.5	11.8	14.5	6.4	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 11.2.1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	13	10	13	2	41	9	6	2	95	154	249
1993	17	13	16	5	54	6	6	3	118	179	297
2001	25	18	22	9	78	3	6	6	167	225	392

3 農業開発

3 1. 現況

影響圏の農耕地の殆どは，水田で占められているが，未開発可耕地では，圏内の2096号路線に沿って畑作地が僅かに残っている。

圏内の土地利用及び土地適応性の状況は，Table 11.3.1とFigure 11.3.1に示し，また，Udon Thani県地域の代表的作物暦は，Figure 11.3.1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 11.3.2.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てTable 11.3.3.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 11.3.4.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: Length (km)	1) Road Class	Nos. of Wooden Bridge	Nos. of Narrow C.Bridge	With Project: Length (km)	1) Road Class Case 1	Case 2	Nos. of Wooden Narrow Bridge
1	Rolling	8.3	3	4	0	8.3	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)	812	1,162	1,824
2A (F5)	618	918	1,474

5. エンジニアリング

5.1 予備設計

予備設計は，次に示す設計基準を基本に行った。

Design Standard : F4 (if not feasible, F5)

Geometric Design : AASHTO (Rural Highways)

Typical Cross Section : as shown in Figure 11.5.1

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 : ø 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 11.5.2

ルートの線形は，Figure 11.5.2 に示す。

5 2　工事数量および建設費

予備設計による工事数量と建設費は，各工種ごとに単価を付してTable　11.5.1に示す。

道路規程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。

Financial and Economic Construction Cost

Road Class	Length (km)	Construction Cost (10^3 ¥)		Remark
		Financial Cost	Economical Cost	
F4 (DBST)	8.3	18,823	17,001	
F5 (Soil Aggregate)	8.3	12,398	11,157	

6.　経済評価

年次別経済費用と便益及び評価結果はTable　11.6.1，及び 11.6.2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　11.7.1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 11.1.1 SUMMARY OF ROAD INVENTORY

Item	Description		
Origin	B. Thung Yai (J.R. 2096)		
Destination	K.A. Thung Fon		
Length			
Total			8.3 km
Improvement Section			8.3 km
DOH Road			0 km
ARD Road			8.3 km
Others			0 km
New Alignment Section			0 km
Terrain	Rolling		
Alignment (Hori./Vert.)	Fair / Fair		
Formation Width	5.5 m - 9.0 m, 7.5 m (Weighted average)		
Embankment Section			
Length			8.3 km
Height	0.2 m - 0.4 m		
Cut Section			
Length			0 km
Depth	m - m		
Surface Type and Condition			
SBST or DBST			0 km
Soil Aggregate	Poor		8.3 km
Earth			0 km
Pipe Culvert	2 each		
Box Culvert	0 each	0 m	
Bridge			
Permanent Bridge	0 each	0 m	
Narrow Concrete Bridge	0 each	0 m	(4m)
Wooden Bridge	4 each	49.0 m	
Overflow Section	1 place	0.5 km	

Table 11.1.2 ROAD INVENTORY

PRCPOSED ROUTE NO. IM-11 ROUTE NO. 2318 B.THUNG YAI (J.R. 2096) ~ K.A. THUNG FON L = 8.3 Km

UDON THANI

STATION (Km)		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
VILLAGE - Name - Household (H) - Population (P)		B. THUNG YAI H = 219 P = 1240				B. THUNG FON H = 670 P = 5000											
TERRAIN		Rolling															
CROSS SECTION	Formation Width (m)	5.50	9.00		7.00												
	Embankment Height (m)	0.30	0.20		0.40	0.20											
	Cutting Depth (m)																
PAVEMENT	Type/Length	Laterite															
	Condition	Poor															
FLOODING	Overflow Length(Km)/Height(m)				L=0.5 H=0.4												
LAND USE	Left	Bush		Paddy													
	Right	Bush		Paddy													
PIPE CULVERT	Total Number	2 Pipes															
BOX CULVERT & BRIDGE	Station (Km)			3.7		6.4 6.4 6.7											
	Dimension			W-Br. 4.00 x 8.00		W-Br. 4.50 x 13.00 W-Br. 4.50 x 12.50 W-Br. 4.50 x 15.50											
RIGHT OF WAY (m)																	
ALIGNMENT	Horizontal	Fair															
	Vertical	Fair															
ROUTE NO., AGENCIES		DOH 2318															

Table 11.2.1 TRAFFIC VOLUME ON ROUTE IM - 11

YEAR		1987		1993		2001	
LINK		1	AVR.	1	AVR.	1	AVR.
P/C	N+D	11	11	15	15	22	22
	I	2	2	2	2	3	3
	DV	0	0	0	0	0	0
	TOTAL	13	13	17	17	25	25
L/B	N+D	9	9	11	11	15	15
	I	1	1	2	2	2	2
	DV	0	0	0	0	0	0
	TOTAL	10	10	13	13	18	18
M/B	N+D	11	11	14	14	19	19
	I	2	2	2	2	3	3
	DV	0	0	0	0	0	0
	TOTAL	13	13	16	16	22	22
H/B	N+D	2	2	4	4	8	8
	I	0	0	1	1	1	1
	DV	0	0	0	0	0	0
	TOTAL	2	2	5	5	9	9
P/P&T	N+D	36	36	47	47	68	68
	I	5	5	7	7	10	10
	DV	0	0	0	0	0	0
	TOTAL	41	41	54	54	78	78
4/T	N+D	7	7	5	5	2	2
	I	1	1	1	1	0	0
	DV	0	0	0	0	0	0
	TOTAL	9	9	6	6	3	3
6/T	N+D	5	5	5	5	5	5
	I	1	1	1	1	1	1
	DV	0	0	0	0	0	0
	TOTAL	6	6	6	6	6	6
10/T	N+D	1	1	3	3	5	5
	I	0	0	0	0	1	1
	DV	0	0	0	0	0	0
	TOTAL	2	2	3	3	6	6
ADT	N+D	82	82	102	102	145	145
	I	12	12	15	15	22	22
	DV	0	0	0	0	0	0
	TOTAL	95	95	118	118	167	167
M/C	N+D	140	140	163	163	206	206
	I	14	14	16	16	19	19
	DV	0	0	0	0	0	0
	TOTAL	154	154	179	179	225	225
TOTAL	N+D	222	222	265	265	351	351
	I	27	27	32	32	41	41
	DV	0	0	0	0	0	0
	TOTAL	249	249	297	297	392	392

NOTE

N : NORMAL TRAFFIC D : DIVERTED TRAFFIC

DV : DEVELOPED TRAFFIC I : INDUCED TRAFFIC

Figure 11.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA PROPOSED ROUTE NO. IM – 11

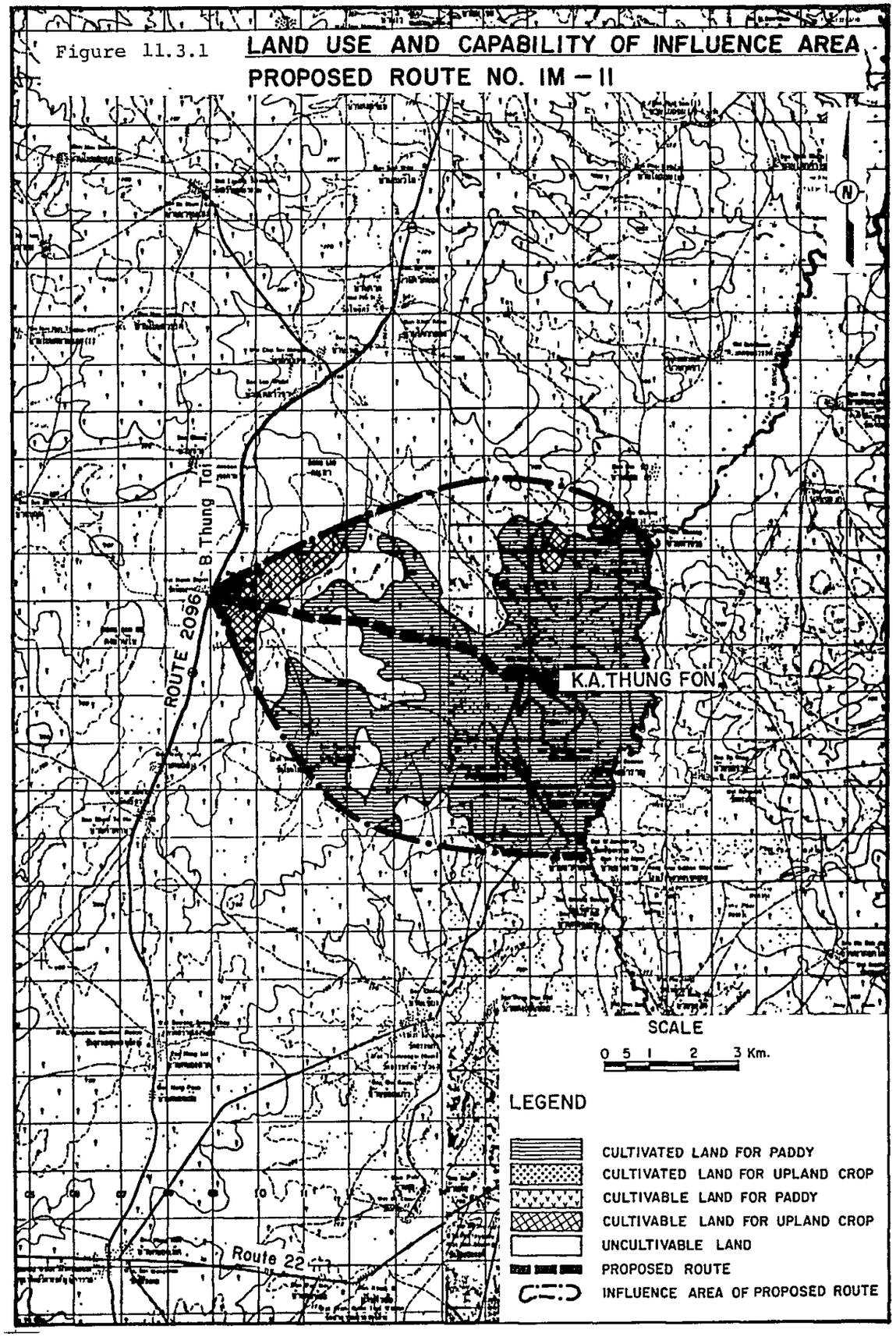


Figure 11.3.2 CROPPING CALENDAR

0200 CHANGWAT UDON THANI

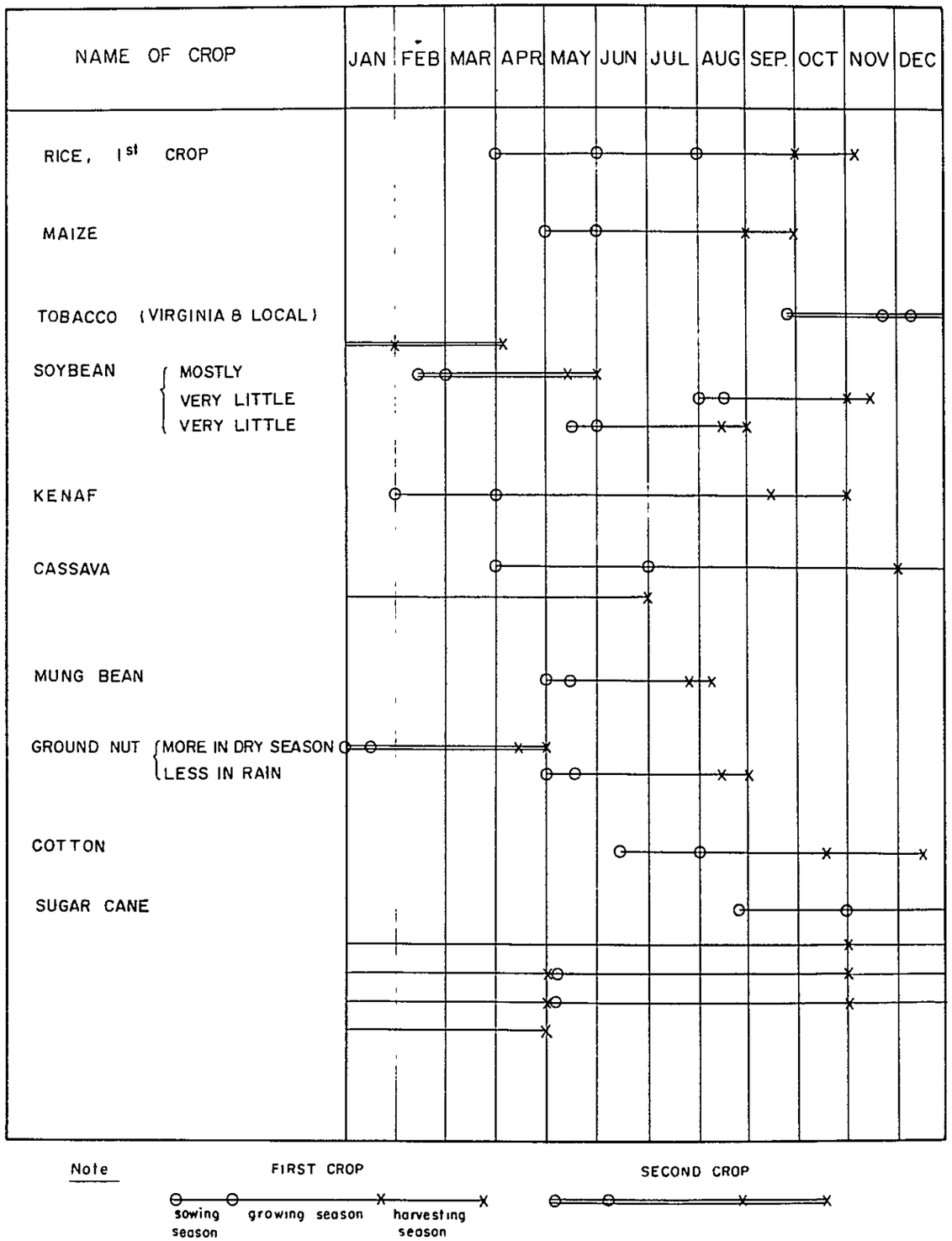


TABLE 11.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		25.000 (40.0)	-	25.000 (40.0)	-	2.188 (3.5)	2.188 (3.5)
0209	THUNG FON	25.000 (40.0)	-	25.000 (40.0)	-	2.188 (3.5)	2.188 (3.5)

TABLE 11.3.2 CROP PRODUCTION

ITEM			PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)												
1981			27.35	-	-	-	-	-	-	-	-	27.45
1987			27.68	-	-	-	-	-	-	-	-	27.78
1993	WITHOUT	PROJECT	28.01	-	-	-	-	-	-	-	-	28.11
	WITH	PROJECT	28.01	-	-	-	-	-	-	-	-	28.11
2001	WITHOUT	PROJECT	28.47	-	-	-	-	-	-	-	-	28.57
	WITH	PROJECT	28.47	-	-	-	-	-	-	-	-	28.57
CROP YIELD (KG/RAI)												
1981			220.0	-	-	-	-	-	-	-		
1987			221.3	-	-	-	-	-	-	-		
1993	WITHOUT	PROJECT	222.7	-	-	-	-	-	-	-		
	WITH	PROJECT	226.7	-	-	-	-	-	-	-		
2001	WITHOUT	PROJECT	224.4	-	-	-	-	-	-	-		
	WITH	PROJECT	234.0	-	-	-	-	-	-	-		
CROP PRODUCTION (TON)												
1981			6,017	-	-	-	-	-	-	-	-	6,242
1987			6,126	-	-	-	-	-	-	-	-	6,360
1993	WITHOUT	PROJECT	6,237	-	-	-	-	-	-	-	-	6,479
	WITH	PROJECT	6,350	-	-	-	-	-	-	-	-	6,593
2001	WITHOUT	PROJECT	6,389	-	-	-	-	-	-	-	-	6,640
	WITH	PROJECT	6,662	-	-	-	-	-	-	-	-	6,917

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 11.3.3 FARMGATE PRICE AND PRODUCTION COST

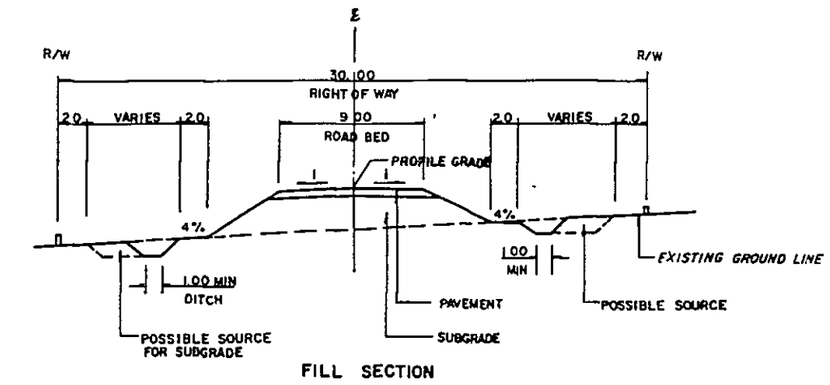
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,887	-	-	-	-	-	-	-
WITH PROJECT (1987 - 2001)	3,984	-	-	-	-	-	-	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	582	-	-	-	-	-	-	-
WITH PROJECT (1987 - 2001)	602	-	-	-	-	-	-	-

TABLE 11.3.4 NET PRODUCTION VALUE

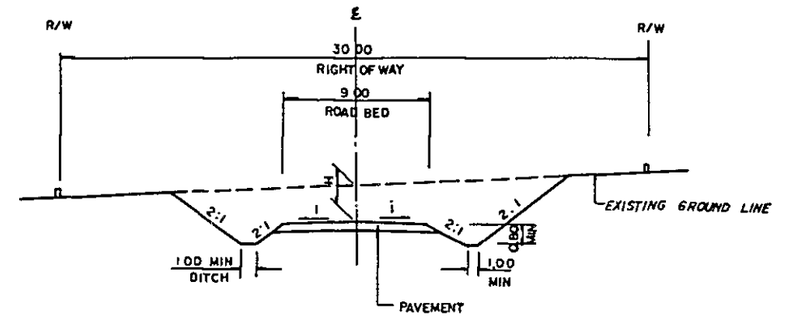
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	7,703	89	7,792	7,743	90	7,833
1993	7,941	90	8,031	8,435	93	8,528
2001	8,266	92	8,358	9,406	98	9,504

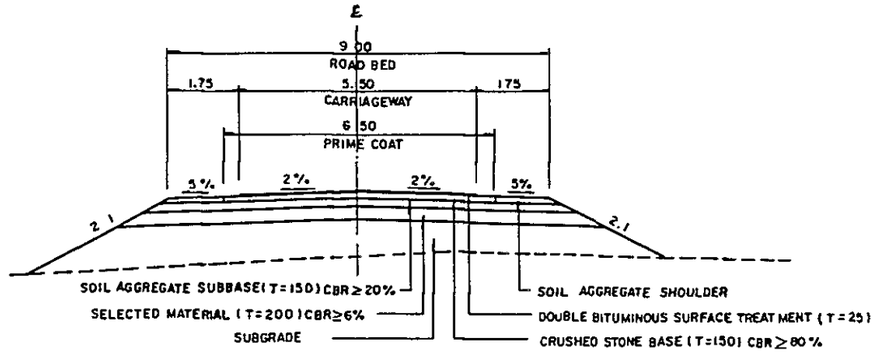
Figure 11. 5. 1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



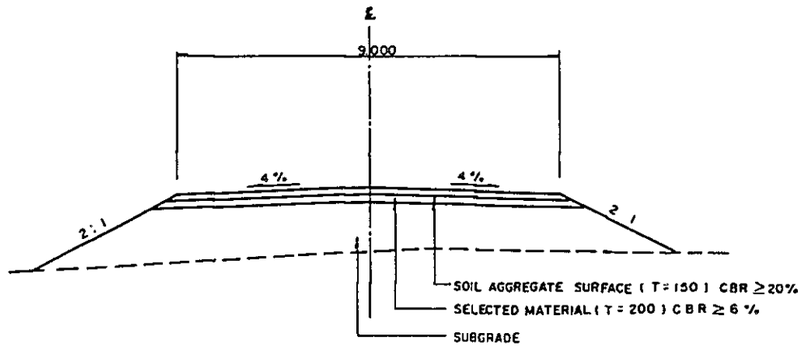
FILL SECTION



CUT SECTION



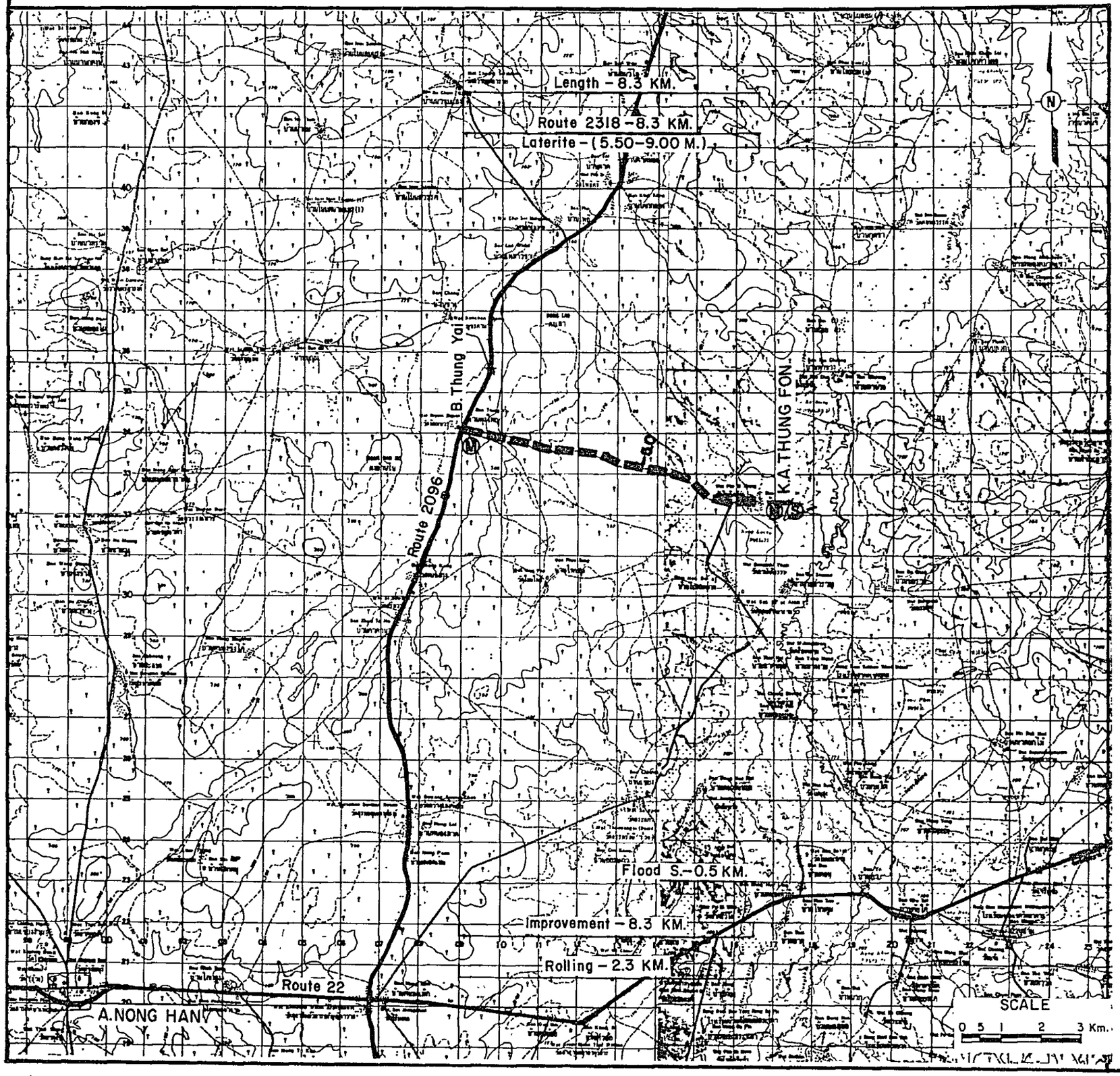
DOUBLE BITUMINOUS SURFACE TREATMENT (DBST) ROAD (Class F4)



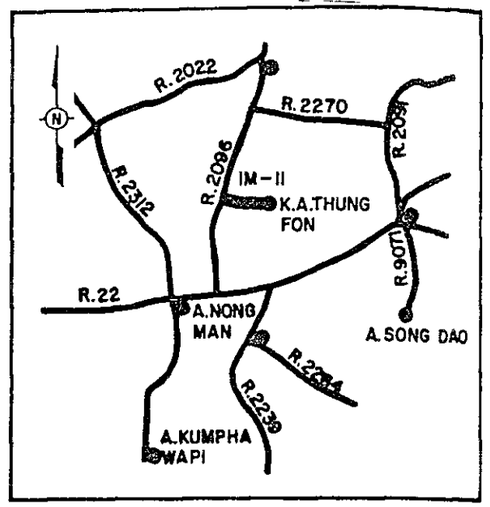
SOIL AGGREGATE SURFACED ROAD (Class F5)

Figure 11.5.2

PROPOSED ROUTE NO. IM – II C. UDON THANI B. THUNG YAI (J.R. 2096) – K.A. THUNG FON
ROUTE NO. 2318 L = 8.3 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	3.7	C–7.00 x 10.00	W–4.00 x 8 00
2	6.4	C–7.00 x 16.00	W–4.50 x 13.00
3	6.4	C–7.00 x 16.00	W–4.50 x 12 50
4	6.7	C–7.00 x 18.00	W–4.50 x 15 50

LEGEND

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

Table 11.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-11 (8.3 km)

Items	Unit of Q'ty	Financial Unit Rate ₿	(DBST) Q'ty	(DBST) Financial Cost (10^3₿)	(DBST) Economic Cost (10^3₿)	(Soil Aggregate Surface) Q'ty	(Soil Aggregate Surface) Financial Cost (10^3₿)	(Soil Aggregate Surface) Economic Cost (10^3₿)
DIRECT CONSTRUCTION COST								
Clearing and Grubbing	ha	15,000	19	285	259	19	285	259
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	46,800	2,106	1,916	46,800	2,106	1,916
Selected Material	m^3	80	17,600	1,408	1,253	17,600	1,408	1,253
Soil Aggregate Surface or Subbase	m^3	105	11,800	1,239	1,102	11,800	1,239	1,102
Crushed Stone Base	m^3	370	8,100	2,997	2,757	1,500	555	510
Soil Aggregate Shoulder	m^3	105	3,500	367	327	600	63	56
Prime Coat and DBST	m^2	55	45,700	2,514	2,263	8,300	457	411
Pipe Culvert	m	2,100	360	756	695	360	756	695
Box Culvert	m	16,000	0	0	0	0	0	0
Long Span Bridge	m	80,000	0	0	0	0	0	0
Short Span Bridge	m	40,000	60	2,400	2,136	60	2,400	2,136
Sub Total (a)				14,073	12,711		9,269	8,341
Miscellaneous Works (a) x 7%				985	890		649	584
Total (b)				15,058	13,601		9,918	8,925
PHYSICAL CONTENGENCY (b) x 15%				2,259	2,040		1,488	1,339
ENGINEERING AND ADMINISTRATION (b) x 10%				1,506	1,360		992	893
Sub Total				3,765	3,400		2,480	2,232
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				18,823	17,001		12,398	11,157

Table 11.6.1 COST AND BENEFITS

(F4 STANDARD)

(1000 BAHT)

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	6,800	0	0	0	0	8,530	0
1986	10,201	0	0	0	0	11,425	0
1987	0	41	812	-53	800	0	714
1988	0	117	870	-50	937	0	747
1989	0	193	929	-48	1,074	0	764
1990	0	269	987	-46	1,210	0	769
1991	0	345	1,045	-43	1,347	0	764
1992	0	421	1,104	-41	1,484	0	752
1993	0	497	1,162	-38	1,621	0	733
1994	4,017	578	1,245	-35	1,788	1,817	722
1995	0	659	1,327	-31	1,956	0	705
1996	0	740	1,410	-28	2,123	0	684
1997	0	822	1,493	-24	2,291	0	658
1998	0	903	1,576	-20	2,458	0	631
1999	0	984	1,659	-17	2,626	0	602
2000	0	1,065	1,741	-13	2,793	0	572
2001	-7,821	1,146	1,824	-10	2,960	-1,429	541
TOTAL	13,197	8,780	19,184	-497	27,466	20,343	10,358

DISCOUNTED ECONOMIC COSTS : 20,343

DISCOUNTED ECONOMIC BENEFITS : 10,358

AGRICULTURAL DEVELOPMENT BENEFIT 2,902
VOC SAVING 7,723
RMC SAVING -268

NET PRESENT VALUE : -9,985

BENEFIT COST RATIO : 0.51

INTERNAL RATE OF RETURN : 5.1 %

Table 11.6.2 COST AND BENEFITS

(F5 STANDARD)

(1000 BAHT)

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	2,231	0	0	0	0	2,799	0
1986	8,926	0	0	0	0	9,997	0
1987	0	41	618	-17	642	0	573
1988	0	117	668	-15	770	0	614
1989	0	193	718	-13	898	0	639
1990	0	269	768	-11	1,026	0	652
1991	0	345	818	-10	1,153	0	654
1992	0	421	868	-8	1,281	0	649
1993	0	497	918	-6	1,409	0	637
1994	726	578	987	-3	1,562	328	631
1995	0	659	1,057	-1	1,716	0	619
1996	0	740	1,126	2	1,869	0	602
1997	0	822	1,196	5	2,022	0	581
1998	0	903	1,265	7	2,175	0	558
1999	0	984	1,335	10	2,329	0	534
2000	0	1,065	1,404	13	2,482	0	508
2001	-5,132	1,146	1,474	15	2,635	-938	481
TOTAL	6,751	8,780	15,220	-31	23,969	12,186	8,933

DISCOUNTED ECONOMIC COSTS : 12,186

DISCOUNTED ECONOMIC BENEFITS : 8,933

AGRICULTURAL DEVELOPMENT BENEFIT 2,902
VOC SAVING 6,076
RMC SAVING -46

NET PRESENT VALUE : -3,254

BENEFIT COST RATIO : 0.73

INTERNAL RATE OF RETURN : 8.8 %

Table 11.7.1 SOCIAL INDICATORS

(Proposed Route IM-11)

Population (1,000)	
1982	: 7.7
1993	: 8.7
Average travelling speed, without (kph)	: 40
Isolation	
Access to Amphoe	
Average distance to Amphoe (km) 1/	: 4.0
Per capita time savings (10^{-4})	: 0.052
Score	: 153
Access to Artery Highway	
Average distance to highway (km) 1/	: 8
Per capita time savings (10^{-4})	: 0.102
Score	: 222
Impassability	
Impassable week a year	: 1
Impassability per year	: 0.019
Impassability per capita (10^{-4})	: 0
Score	: 0
Health	
Access to Hospital	
Average distance to Hospital (km) 1/	: 4.0
Per capita time savings (10^{-4})	: 0.051
Score	: 119
Access to Medical Facilities	
Average distance to facilities (km) 1/	: 2.0
Per capita time savings (10^{-4})	: 0.026
Score	: 104
Education	
Access to Secondary School	
Number of Student in 1993 (1,000) 2/	: 1.5
Average distance to school (km)	: 4.0
Per capita time savings (10^{-4})	: 0.296
Score	: 160
Teacher Intensity	
Number of teachers 3/	
University graduate	: 3
Total	: 27
Number of Student	: 597
Indicators	
E1 4/	: 5.0
E2 5/	: 45.2
E 6/	: 50.2
Degree of Improvement 7/	: 1.36
Score	: 87
Disparity	
G.P.V. in 1993 (Mn B) 8/	
With project	: 25.50
Without project	: 24.4
Per capita G.P.V. in 1993 (B)	
With project (W)	: 2,931
Without project (w)	: 2,805
Degree of Disparity	
(A/W) - (A/w) 9/	: 0.04
Score	: 71
Total Score	: 916

Note:

1/ ( ) shows the length or distance in without project case. Unless otherwise, lengthes 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-12

Changwat : Sakon Nakhon

A. Sawang Daen Din (J.R 22) - A. Song Dao

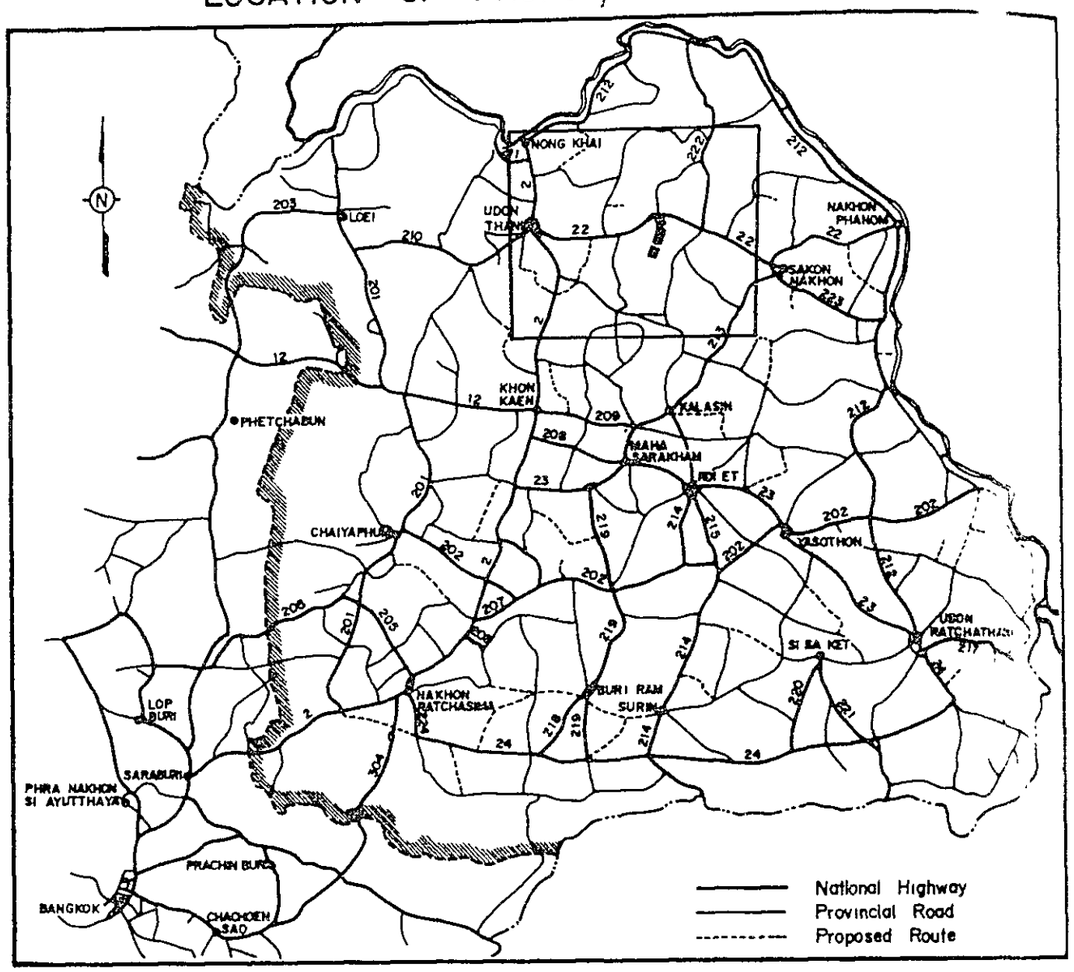
Length : 18.1 KM.

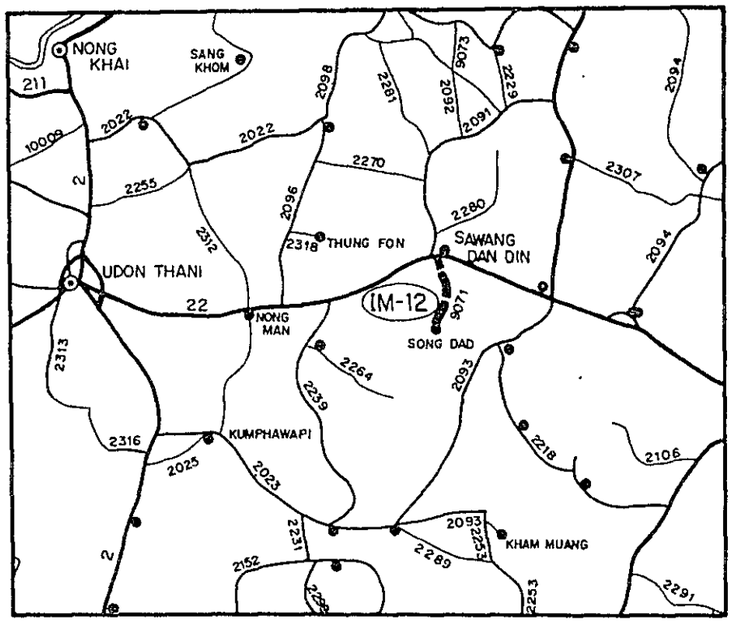
SUMMARY

PROPOSED ROUTE IM-12

Item	Description
Changwat	Sakhon Nakhon
Origin	A. Sawang Daen Din (J.R.22)
Destination	A. Song Dao
Length	
Total	18.1 km
Improvement Section	18.1 km
DOH Road	0 km
ARD Road	18.1 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Good
Terrain	Rolling
Influence Area	
Area	164 km^2
Population (1982)	11,500
Principal Crops	Paddy
Traffic (ADT)	
Existing	255
1993	861
2001	1,116
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	35,903 . 10^3 ฿
Economic	32,590 . 10^3 ฿
IRR	12.5 %
B/C	1.04
Social Impact	High
Recommendation	For immediate implementation

LOCATION OF PROPOSED ROUTE





1. 概　要

1.1 計画路線の概要

本路線は,Sakon Nakhon県の西部に位置する。ルートは，県道22号線のSawang Daen Din 郡を起点とし，南に走りPuai村,Nong Thum村，Lao Yai 村を経て Song Dao 郡で終る。その総延長は，18.1kmである。（Figure 12.5.2 参照）

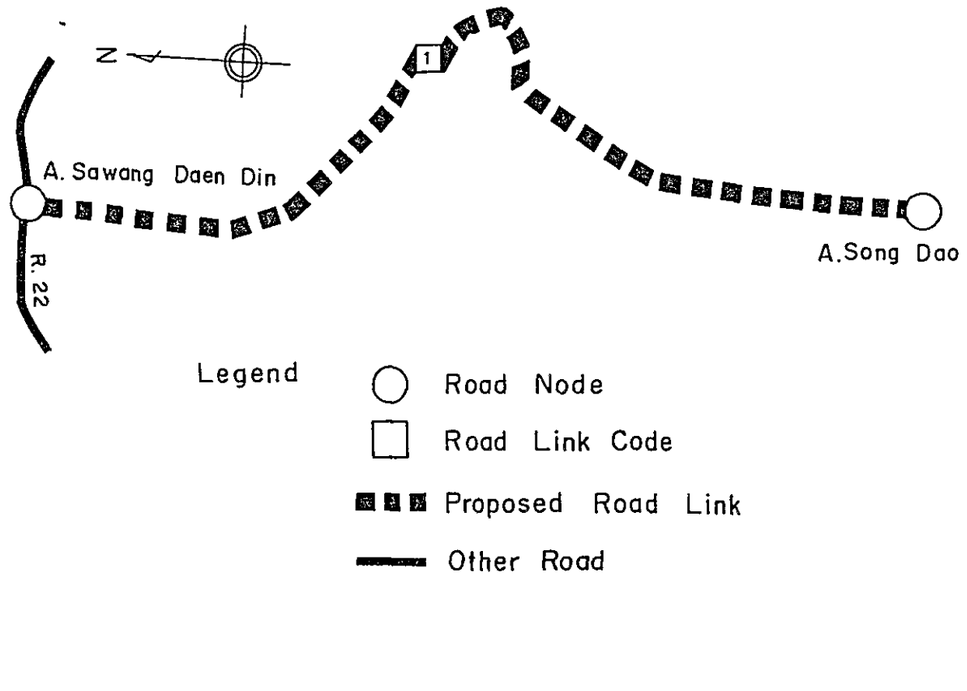
沿道の地形はほとんど丘陵地である。影響圏内にはいくつかの村が存在し，その総人口は，11,500人である。沿道には，医療センター，病院が１ケ所ずつあり，教育施設として中学校が１ケ所ある。

本路線は，Song Dao郡と幹線道路の国道22号線とを結ぶ重要な路線となる。

1.2 現道の状況

計画路線に利用した現道の状況は，Table 12.1.1 に要約し，その詳細はTable 12.1.2のインベントリー調査の結果に示した。

Proposed Road Link



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	3	75	46	27	-	8	33	37	6	255

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	1517

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	261	73	333

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	1.2	1.1	1.0
PASSENGER MOVEMENT	5.2	5.5	5.6

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981 － 1987	1987 － 1993	1993 － 2001
NON-AGRI.	6.7	7.0	7.2
AGRICULTURE	0.1	0.1	0.1
FREIGHT	5.3	5.5	5.7

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	2.0	49.7	30.5	17.9	0.0	7.7	31.7	35.6	25.0
	1987	4.9	46.8	27.0	18.8	2.5	10.1	27.6	35.4	26.8
	1993	8.3	43.3	22.9	20.0	5.4	13.1	22.6	35.2	29.1
	2001	12.9	38.7	17.5	21.5	9.4	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 12.2.1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	10	57	40	5	114	41	53	40	359	352	711
1993	22	62	54	15	143	44	69	57	466	395	861
2001	50	67	83	36	198	46	100	91	670	446	1116

3. 農業開発

3.1. 現況

影響圏の農耕地の殆どは，水田で占められている。畑作では，キャツサバが最も多く，メイズ，ケナフ，砂糖きび及び落花生がこれに次いでいる。畑地の未開発可耕地は，比較的多く残っているが，水田適地は殆ど無い。

圏内の土地利用及び土地適応性の状況は，Table 12.3.1とFigure 12.3.1に示し，また，Sakon Nakhon 県地域の代表的作物暦は，Figure 12.3.2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 12.3.2.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てTable 12.3.3.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 12.3.4.のように算出した。

このN.P.V のWith Prozectの場合と，Without Prozect 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 Length (km)	1) Road Class	Nos. of Wooden Bridge	Nos. of Narrow C.Bridge	With Project Length (km)	1) Road Class	Nos. of Wooden Narrow Bridge
1	Rolling	18.1	2B	3	1	18.1	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 but poor allignment

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 Cladd	1987	1993	2001
1 (F4)	3,879	5,583	9,102

5. エンジニアリング

5.1 予備設計

予備設計は，次に示す設計基準を基本に行った。

Design Standard : F4 (feasible)

Geometric Design : AASHTO (Rural Highways)

Typical Cross Section : as shown in Figure 12.5.1

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 : ø 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 12.5.2

ルートの線形は，Figure 12.5.2に示す。

5.2　工事数量および建設費

予備設計による工事数量と建設費は，各工種ごとに単価を付してTable　12.5.1に示す。

道路規程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 = 18.1 km

Financial Cost	35,903.10^3 ¥
Economic Cost	32,590.10^3 ¥

6.　経済評価

年次別経済費用と便益及び評価結果はTable　12.6.1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　12.7.1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 12.1.1 SUMMARY OF ROAD INVENTORY

Item	Description		
Origin	A. Sawang Daen Din (J.R. 22)		
Destination	A. Song Dao		
Length			
Total		18.1 km	
Improvement Section		18.1 km	
DOH Road		0 km	
ARD Road		18.1 km	
Others		0 km	
New Alignment Section		0 km	
Terrain	Rolling		
Alignment (Hori./Vert.)	Fair / Fair		
Formation Width	6.0 m - 9.0 m, 7.3 m (Weighted average)		
Embankment Section			
Length		18.1 km	
Height	0.3 m - 1.0 m		
Cut Section			
Length		0 km	
Depth	m - m		
Surface Type and Condition			
SBST or DBST		0 km	
Soil Aggregate	Good	18.1 km	
Earth		0 km	
Pipe Culvert	8 each		
Box Culvert	0 each	0 m	
Bridge			
Permanent Bridge	0 each	0 m	
Narrow Concrete Bridge	1 each	28.5 m	(4m)
Wooden Bridge	3 each	25.0 m	
Overflow Section	1 place	1.0 km	

Table 12.1.2 ROAD INVENTORY

PROPOSED ROUTE NO. IM-12 ROUTE ARD A.SAWANG DAEN DIN (J.R. 22) ~ A. SONG DAO SAKON NAKHON L = 18.1 Km.

STATION (Km)		0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
VILLAGE - Name - Household (H) - Population (P)		A. SAWANG DAEN DIN; B. PUAI H = 400 P = 4000; B. NONG THUM H = 500 P = 4500; B. LAO YAI H = 150 P = 900; A. SONG DAO H = 500 P = 5300
TERRAIN		Flat; Rolling
CROSS SECTION	Formation Width (m)	6.00; 9.00; 7.00; 8.00; 6.00; 7.00; 6.50
	Embankment Height (m)	1.00; 0.30; 0.50; 1.00; 0.70; 0.80; 0.30; 0.80; 0.40
	Cutting Depth (m)	
PAVEMENT	Type/Length	Laterite
	Condition	Good
FLOODING	Overflow Length(Km)/Height(m)	L=1.0 H=1.0
LAND USE	Left	Paddy; Bush; Paddy; Sugar Cane; Cassava
	Right	Paddy; Bush; Paddy; Sugar Cane; Cassava
PIPE CULVERT	Total Number	8 Pipes
BOX CULVERT & BRIDGE	Station (Km)	0.2; 1.5; 1.7; 12.7; 17.7
	Dimension	W-Br. 4.00 x 6.50; W-Br. 4.50 x 7.00; W-Br. 4.50 x 7.00; W-Br. 3.50 x 4.50; C-Br. 4.50 x 28.50
RIGHT OF WAY (m)		12.0; 10.0; 12.0
ALIGNMENT	Horizontal	Fair
	Vertical	FRir
ROUTE NO., AGENCIES		ARD

Table 12.2.1 TRAFFIC VOLUME ON ROUTE IM - 12

YEAR		1987		1993		2001	
LINK		1	AVR.	1	AVR.	1	AVR.
P/C	N+D	9	9	20	20	43	43
	I	1	1	3	3	6	6
	DV	0	0	0	0	0	0
	TOTAL	10	10	22	22	50	50
L/B	N+D	50	50	54	54	58	58
	I	7	7	8	8	9	9
	DV	0	0	0	0	0	0
	TOTAL	57	57	62	62	67	67
M/B	N+D	35	35	47	47	72	72
	I	5	5	7	7	11	11
	DV	0	0	0	0	0	0
	TOTAL	40	40	54	54	83	83
H/B	N+D	5	5	13	13	31	31
	I	1	1	2	2	5	5
	DV	0	0	0	0	0	0
	TOTAL	5	5	15	15	36	36
P/P&T	N+D	99	99	124	124	172	172
	I	15	15	19	19	26	26
	DV	0	0	0	0	0	0
	TOTAL	114	114	143	143	198	198
4/T	N+D	36	36	38	38	40	40
	I	5	5	6	6	6	6
	DV	0	0	0	0	0	0
	TOTAL	41	41	44	44	46	46
6/T	N+D	46	46	60	60	87	87
	I	7	7	9	9	13	13
	DV	0	0	0	0	0	0
	TOTAL	53	53	69	69	100	100
10/T	N+D	35	35	49	49	79	79
	I	5	5	7	7	12	12
	DV	0	0	0	0	0	0
	TOTAL	40	40	57	57	91	91
ADT	N+D	312	312	405	405	583	583
	I	47	47	61	61	87	87
	DV	0	0	0	0	0	0
	TOTAL	359	359	466	466	670	670
M/C	N+D	327	327	371	371	428	428
	I	24	24	24	24	18	18
	DV	0	0	0	0	0	0
	TOTAL	352	352	395	395	446	446
TOTAL	N+D	639	639	776	776	1010	1010
	I	71	71	85	85	106	106
	DV	0	0	0	0	0	0
	TOTAL	711	711	861	861	1116	1116

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

Figure 12.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA

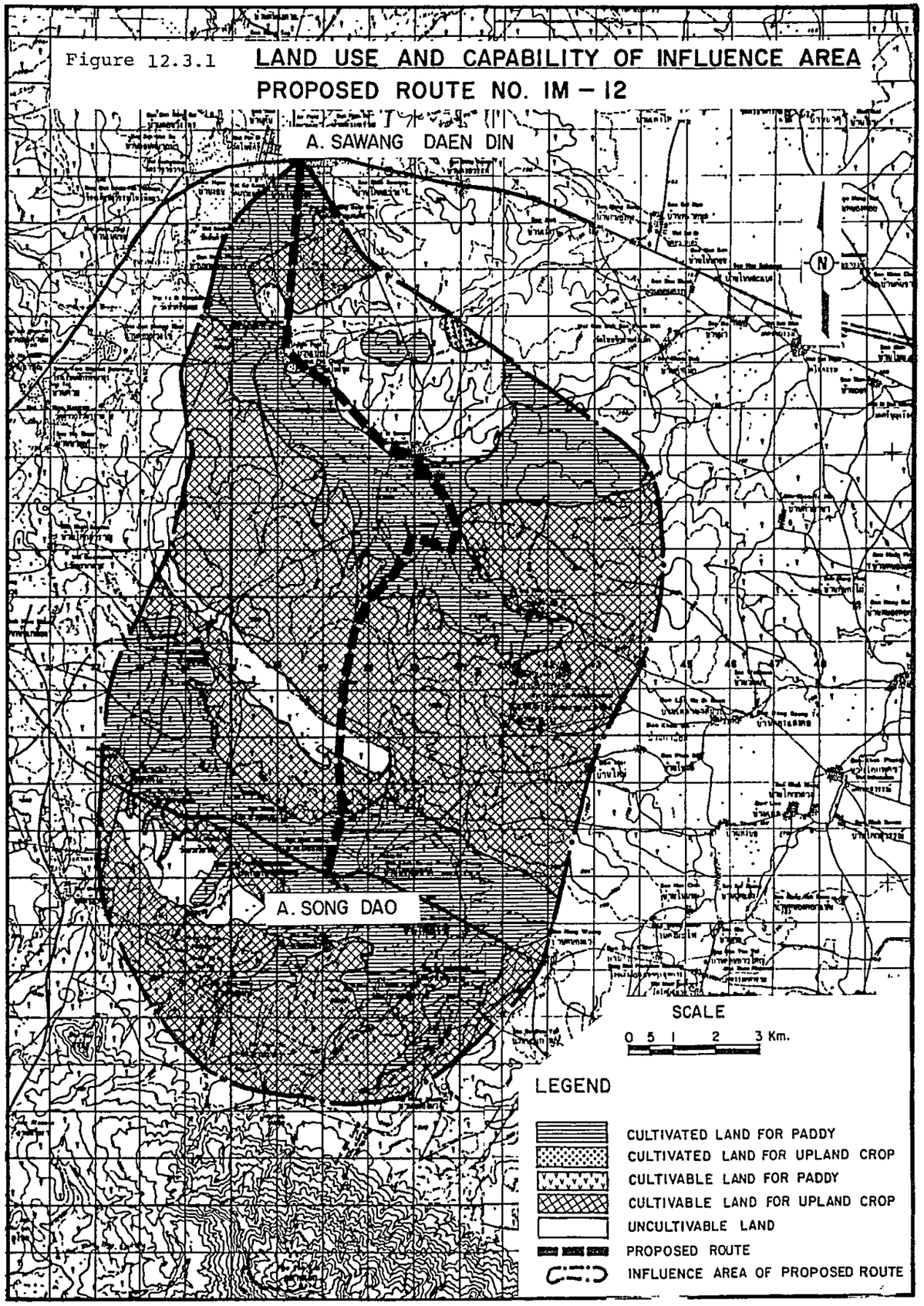


Figure 12.3.2 CROPPING CALENDAR

0400 CHANGWAT SAKON NAKHON

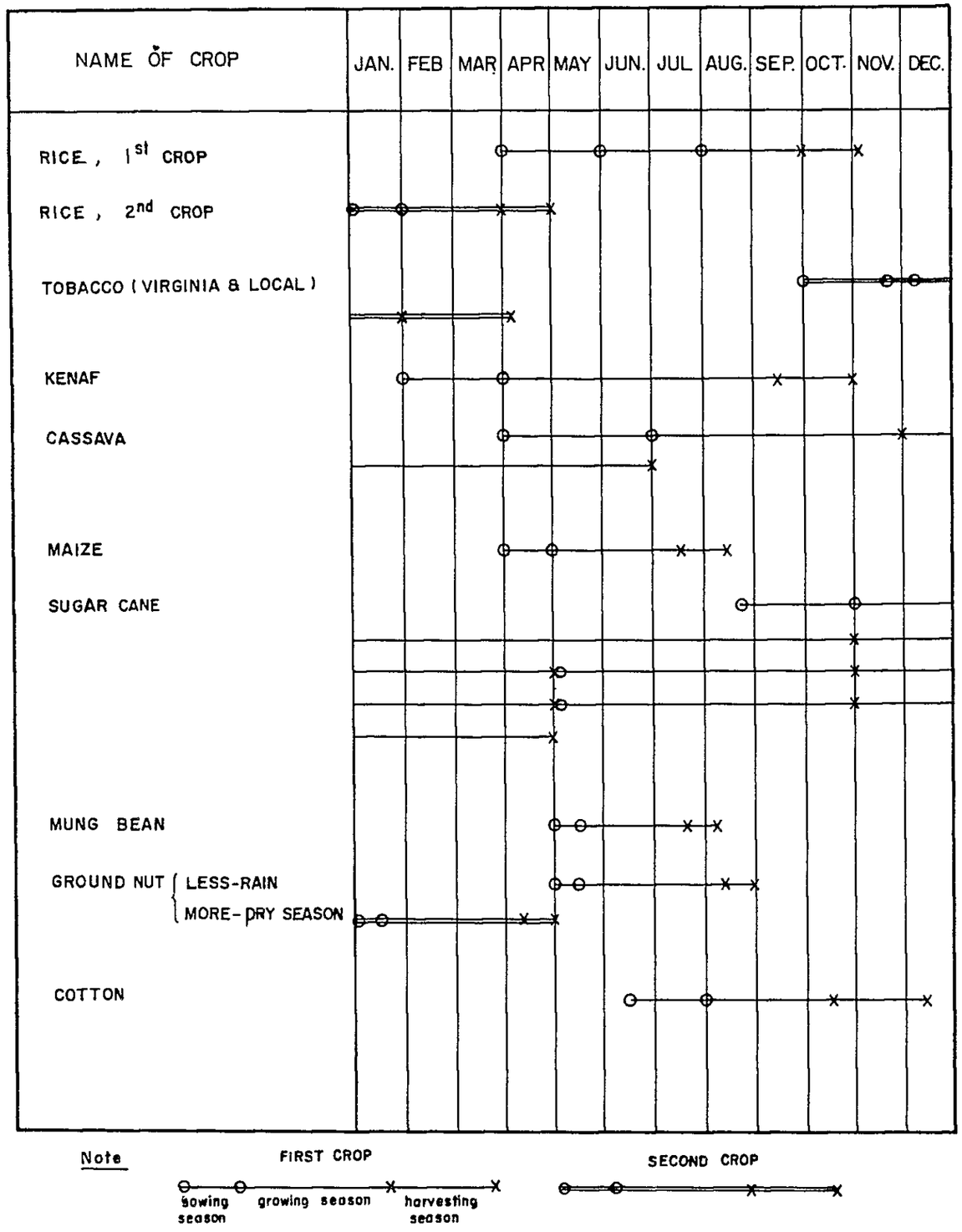


TABLE 12.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		31.875 (51.0)	0.313 (0.5)	32.188 (51.5)	-	52.500 (84.0)	52.500 (84.0)
0404	SAWANG DAEN DIN	12.500 (20.0)	0.313 (0.5)	12.813 (20.5)	-	12.500 (20.0)	12.500 (20.0)
0407	SONG DAO	19.375 (31.0)	-	19.375 (31.0)	-	40.000 (64.0)	40.000 (64.0)

TABLE 12.3.2 CROP PRODUCTION

ITEM			PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)												
1981			30.84	0.83	-	0.25	1.98	0.49	0.85	-	4.40	35.24
1987			30.84	0.83	-	0.26	1.99	0.48	0.84	-	4.40	35.24
1993	WITHOUT	PROJECT	30.84	0.82	-	0.27	2.00	0.48	0.83	-	4.40	35.24
	WITH	PROJECT	30.84	0.77	-	0.24	2.21	0.42	0.76	-	4.40	35.24
2001	WITHOUT	PROJECT	30.84	0.80	-	0.29	2.02	0.47	0.82	-	4.40	35.24
	WITH	PROJECT	30.84	0.75	-	0.26	2.23	0.42	0.74	-	4.40	35.24
CROP YIELD (KG/RAI)												
1981			233.8	260.0	-	189.0	2580.0	4000.0	161.0	-		
1987			235.2	261.6	-	189.0	2580.0	4072.5	161.0	-		
1993	WITHOUT	PROJECT	236.6	263.1	-	189.0	2580.0	4146.4	161.0	-		
	WITH	PROJECT	239.5	266.3	-	190.1	2595.5	4171.3	161.0	-		
2001	WITHOUT	PROJECT	238.5	265.2	-	189.0	2580.0	4247.0	161.0	-		
	WITH	PROJECT	245.3	272.8	-	191.7	2616.4	4306.6	161.0	-		
CROP PRODUCTION (TON)												
1981			7,210	217	-	47	5,103	1,960	136	-	7,463	14,673
1987			7,254	216	-	49	5,141	1,974	135	-	7,515	14,769
1993	WITHOUT	PROJECT	7,297	215	-	51	5,173	1,987	133	-	7,559	14,856
	WITH	PROJECT	7,385	204	-	46	5,735	1,772	122	-	7,879	15,264
2001	WITHOUT	PROJECT	7,356	213	-	55	5,214	2,003	131	-	7,615	14,971
	WITH	PROJECT	7,564	206	-	49	5,824	1,800	120	-	7,998	15,563

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 12.3.3 FARMGATE PRICE AND PRODUCTION COST

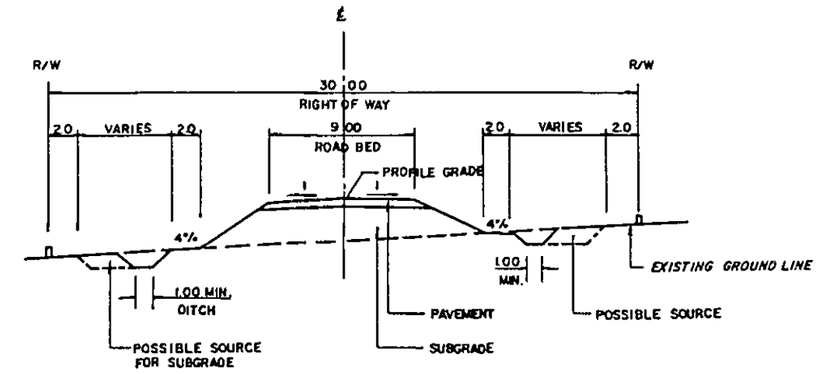
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,663	2,235	-	6,664	546	594	4,614	-
WITH PROJECT (1987 - 2001)	3,755	2,291	-	6,664	560	594	4,729	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	586	438	-	1,010	759	2,130	631	-
WITH PROJECT (1987 - 2001)	606	458	-	1,030	779	2,180	631	-

TABLE 12.3.4 NET PRODUCTION VALUE

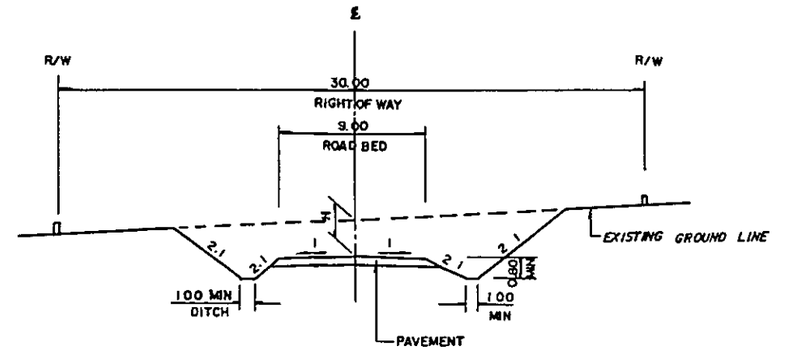
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	8,493	1,715	10,208	8,544	1,728	10,272
1993	8,653	1,744	10,397	9,038	1,889	10,927
2001	8,867	1,785	10,652	9,711	1,971	11,682

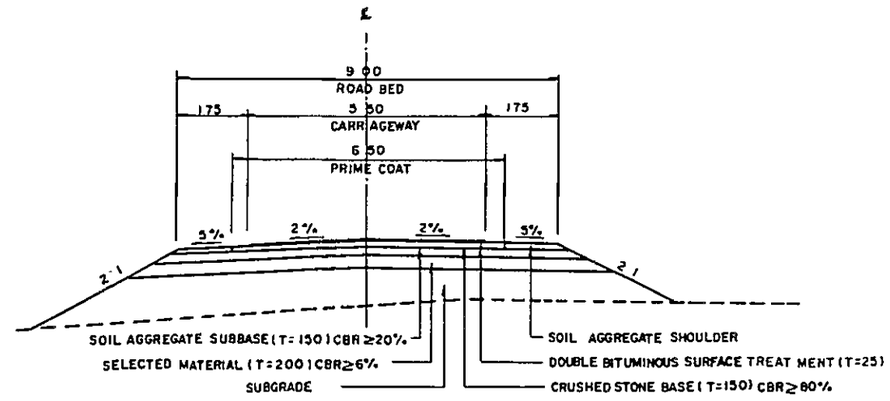
Figure 12.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



FILL SECTION



CUT SECTION

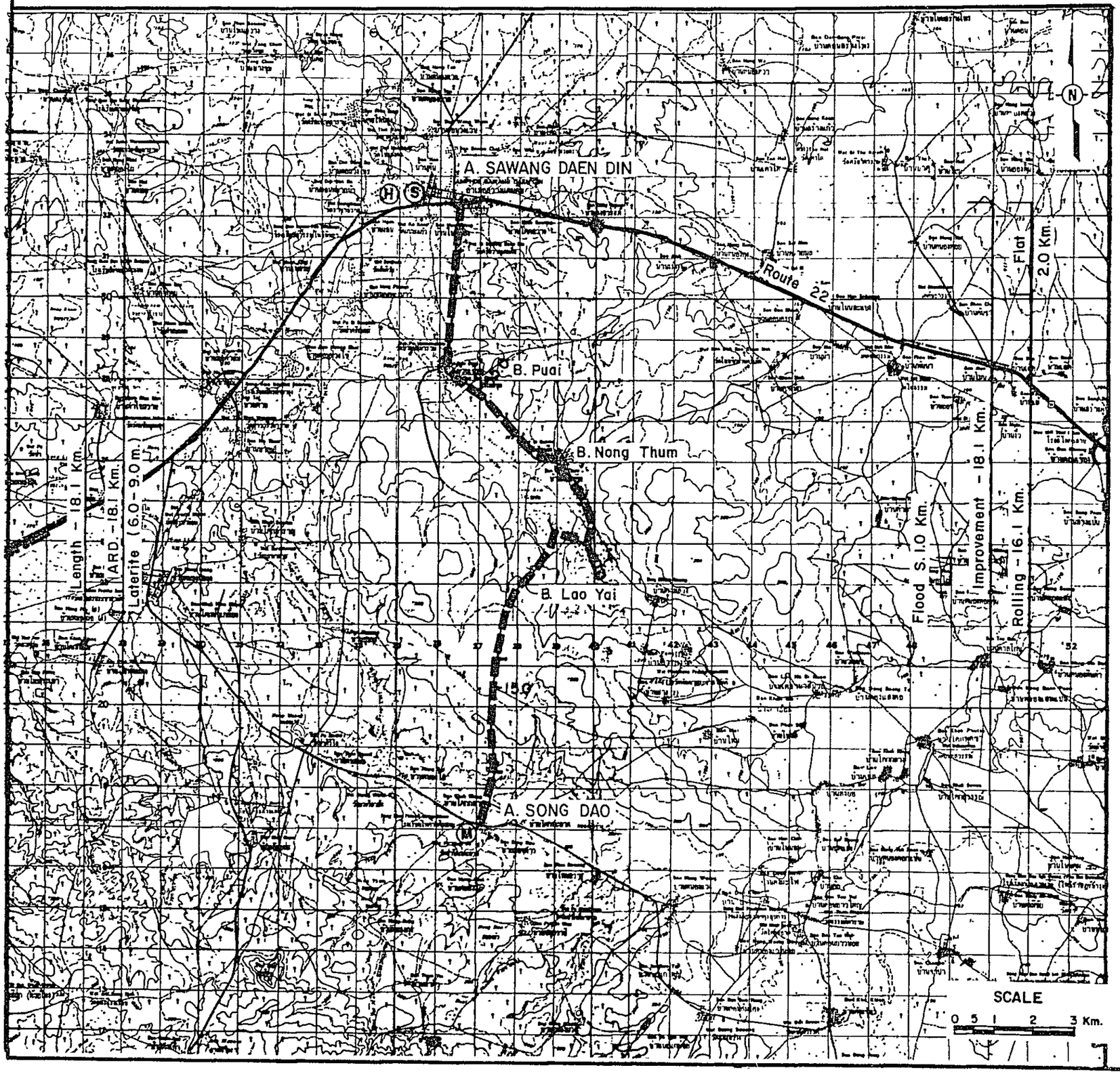


DOUBLE BITUMINOUS SURFACE TREATMENT (DBST) ROAD (Class F4)

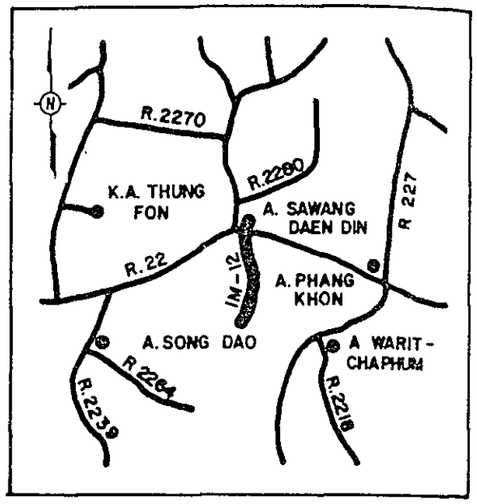
Figure 12.5.2

PROPOSED ROUTE NO. IM-12 C. SAKON NAKHON A. SAWANG DAEN DIN (J.R.22) - A. SONG DAO

ROUTE NO. ARD (9071) L= 18.1 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	0.2	C-7.00 x 9.00	W-4.00 x 6 50
2	1.5	C-7.00x 9.00	W-4 50 x 7 00
3	1.7	C-7.00x 9.00	W-4 50 x 7 00
4	12.7	(BOX CULVERT)	W-4 50 x 4 50
5	17.7	C-7.00 x 28.50	C-4 50 x 28 50

LEGEND

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

Table 12.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-13 (18.1 km)

Items	Unit of Q'ty	Financial Unit Rate ฿	(DBST) Q'ty	(DBST) Financial Cost (10^3฿)	(DBST) Economic Cost (10^3฿)
DIRECT CONSTRUCTION COST					
Clearing and Grubbing	ha	15,000	41	615	559
Excavation - Soil	m^3	20	0	0	0
Excavation - Hard Rock	m^3	160	0	0	0
Embankment	m^3	45	62,000	2,790	2,538
Selected Material	m^3	80	38,400	3,072	2,734
Soil Aggregate Surface or Subbase	m^3	105	26,900	2,824	2,513
Crusned Stone Base	m^3	370	17,600	6,512	5,991
Soil Aggregate Shoulder	m^3	105	7,600	798	710
Prime Coat and DBST	m^2	55	99,600	5,478	4,930
Pipe Culvert	m	2,100	520	1,092	1,004
Box Culvert	m	16,000	20	320	288
Long Span Bridge	m	80,000	0	0	0
Short Span Bridge	m	40,000	56	2,340	1,993
Sub Total (a)				25,741	23,264
Miscellaneous Works (a) x 7%				1,802	1,628
Total (b)				27,543	24,892
PHYSICAL CONTENGENCY (b) x 15%				4,131	3,734
ENGINEERING AND ADMINISTRATION (b) x 10%				2,754	2,489
Sub Total				6,885	6,223
LAND ACQUISITION					
Highly Developed Land	ha	50,000	28	1,400	1,400
Less Developed Land	ha	15,000	5	75	75
Sub Total				1,475	1,475
GRAND TOTAL				35,903	32,590

Table 12.6.1 COST AND BENEFITS

(F4 STANDARD)

(1000 BAHT)

YEAR	COST CONST. COST	BENEFITS AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	DISCOUNTED(12%) COST	BENEFIT
1984	0	0	0	0	0	0	0
1985	13,036	0	0	0	0	16,352	0
1986	19,554	0	0	0	0	21,900	0
1987	0	64	3,879	17	3,959	0	3,535
1988	0	142	4,163	26	4,330	0	3,452
1989	0	219	4,447	34	4,700	0	3,346
1990	0	297	4,731	43	5,071	0	3,223
1991	0	375	5,015	52	5,442	0	3,088
1992	0	452	5,299	61	5,812	0	2,945
1993	0	530	5,583	70	6,183	0	2,797
1994	8,760	593	6,023	83	6,699	3,963	2,705
1995	0	655	6,463	97	7,214	0	2,602
1996	0	718	6,903	110	7,730	0	2,489
1997	0	780	7,342	124	8,246	0	2,371
1998	0	843	7,782	137	8,762	0	2,249
1999	0	905	8,222	151	9,278	0	2,126
2000	0	968	8,662	164	9,793	0	2,004
2001	-15,788	1,030	9,102	177	10,309	-2,884	1,883
TOTAL	25,562	8,569	93,615	1,345	103,529	39,331	40,813

DISCOUNTED ECONOMIC COSTS : 39,331

DISCOUNTED ECONOMIC BENEFITS : 40,813

AGRICULTURAL DEVELOPMENT BENEFIT	2,937
VOC SAVING	37,422
RMC SAVING	454

NET PRESENT VALUE : 1,482

BENEFIT COST RATIO : 1.04

INTERNAL RATE OF RETURN : 12.5 %

Table 12.7.1 SOCIAL INDICATORS

(Proposed Route IM-12)

Population (1,000)		
1982	:	11.5
1993	:	13.0
Average travelling speed, without (kph)	:	48
Isolation		
Access to Amphoe		
Average distance to Amphoe (km) 1/	:	4.5
Per capita time savings (10^{-4})	:	0.038
Score	:	115
Access to Artery Highway		
Average distance to highway (km) 1/	:	18
Per capita time savings (10^{-4})	:	0.097
Score	:	194
Impassability		
Impassable week a year	:	1
Impassability per year	:	0.019
Impassability per capita (10^{-4})	:	0.022
Score	:	183
Health		
Access to Hospital		
Average distance to Hospital (km) 1/	:	9.0
Per capita time savings (10^{-4})	:	0.048
Score	:	112
Access to Medical Facilities		
Average distance to facilities (km) 1/	:	5.0
Per capita time savings (10^{-4})	:	0.026
Score	:	104
Education		
Access to Secondary School		
Number of Student in 1993 (1,000) 2/	:	2.5
Average distance to school (km)	:	4.5
Per capita time savings (10^{-4})	:	0.160
Score	:	83
Teacher Intensity		
Number of teachers 3/		
University graduate	:	-
Total	:	16
Number of Student	:	422
Indicators		
E1 4/	:	-
E2 5/	:	37.9
E 6/	:	37.9
Degree of Improvement 7/	:	1.80
Score	:	115
Disparity		
G.P.V. in 1993 (Mn B) 8/		
With project	:	33.3
Without project	:	32.2
Per capita G.P.V. in 1993 (B)		
With project (W)	:	2,562
Without project (w)	:	2,477
Degree of Disparity		
(A/W) - (A/w) 9/	:	0.04
Score	:	71
Total Score	:	977

Note:

1/ ( ) shows the length or distance in without project case. Unless otherwise, lengthes 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 - 13

Changwat : Sakon Nakhon / Nakhon Phanom

B. Chuam (J.R.2094) - A. Na Wha

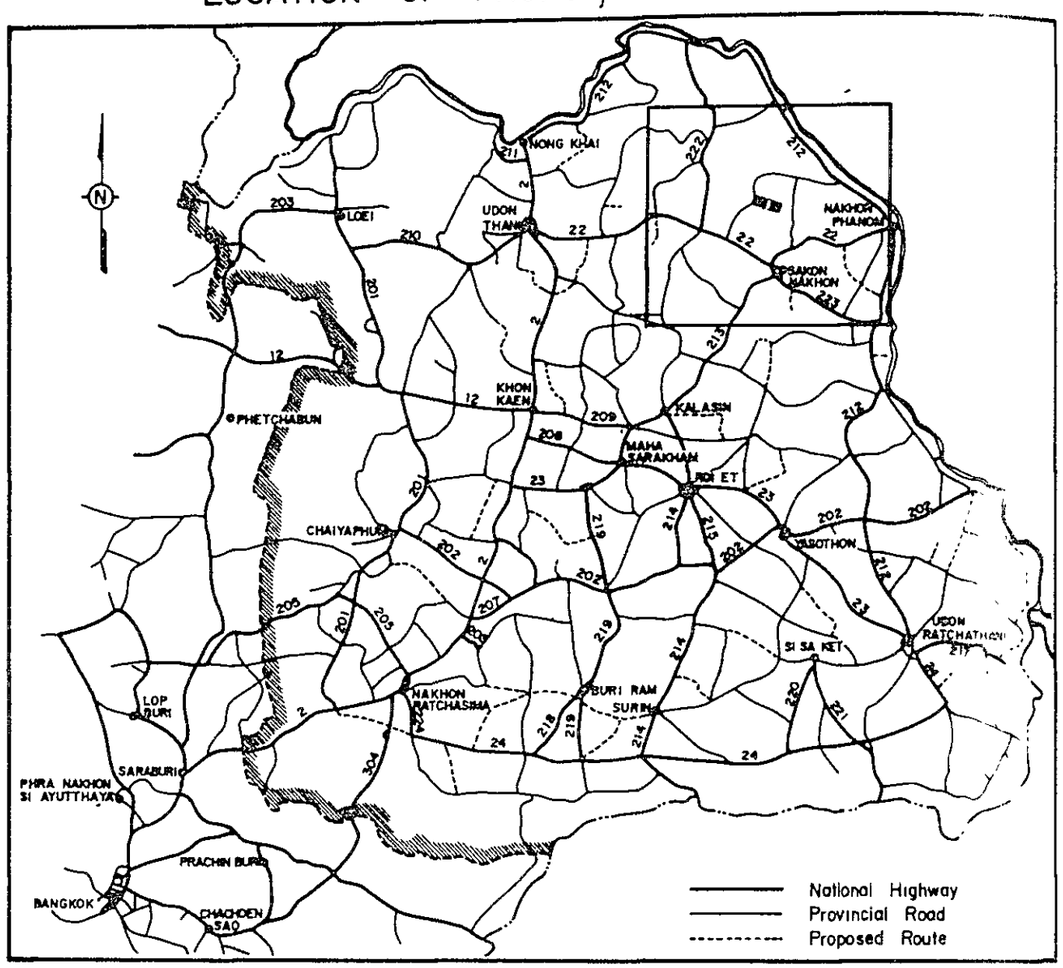
Length : 19.8 KM.

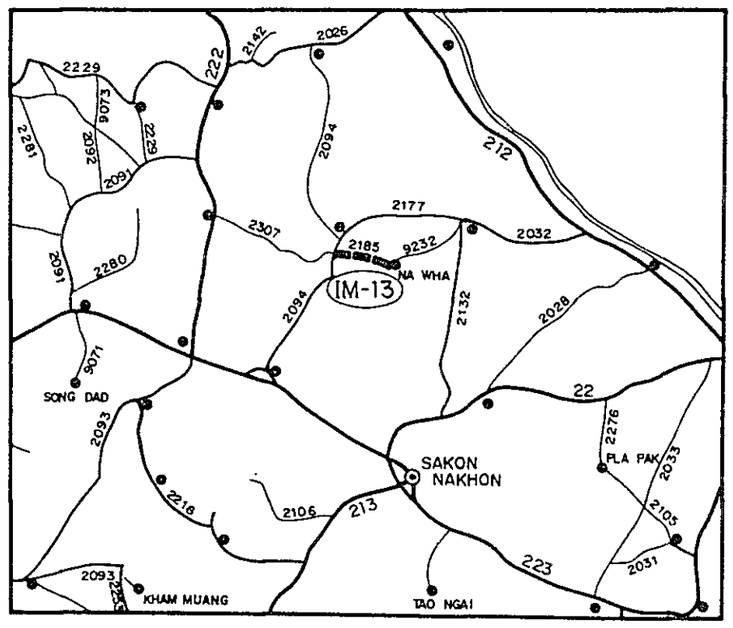
SUMMARY

PROPOSED ROUTE IM- 13

Item	Description	
Changwat	Sakhon Nakhon /Nakhon Phanom	
Origin	B. Chuam (J.R.2094)	
Destination	A. Na Wha	
Length		
Total		19.8 km
Improvement Section		19.8 km
DOH Road	R.2185	19.8 km
ARD Road		0 km
Others		0 km
New Alignment Section		0 km
Surface Type and Condition	Soil Aggregate, Poor	
Terrain	Flat	
Influence Area		
Area		140 km^2
Population (1982)		15,800
Principal Crops		Paddy
Traffic (ADT)		
Existing		69
1993		309
2001		410
Proposed Standard	F4 (DBST)	
Construction Cost		
Financial		37,519 . 10^3 ฿
Economic		33,915 . 10^3 ฿
IRR		6.6 %
B/C		0.61
Recommendation	For further consideration	

LOCATION OF PROPOSED ROUTE





1. 概　要

1.1　計画路線の概要

本路線は，Sakon NokhonおよびNokhon　Phanomの両県にまたがる。県道2094号線のChuam 村を起点とし南東に走り，Khok Sa-At 村，Soe村，Tan村を経て，Na Wha郡で終わる。その総延長は19.8kmである。（Figure 13.5.2参照）

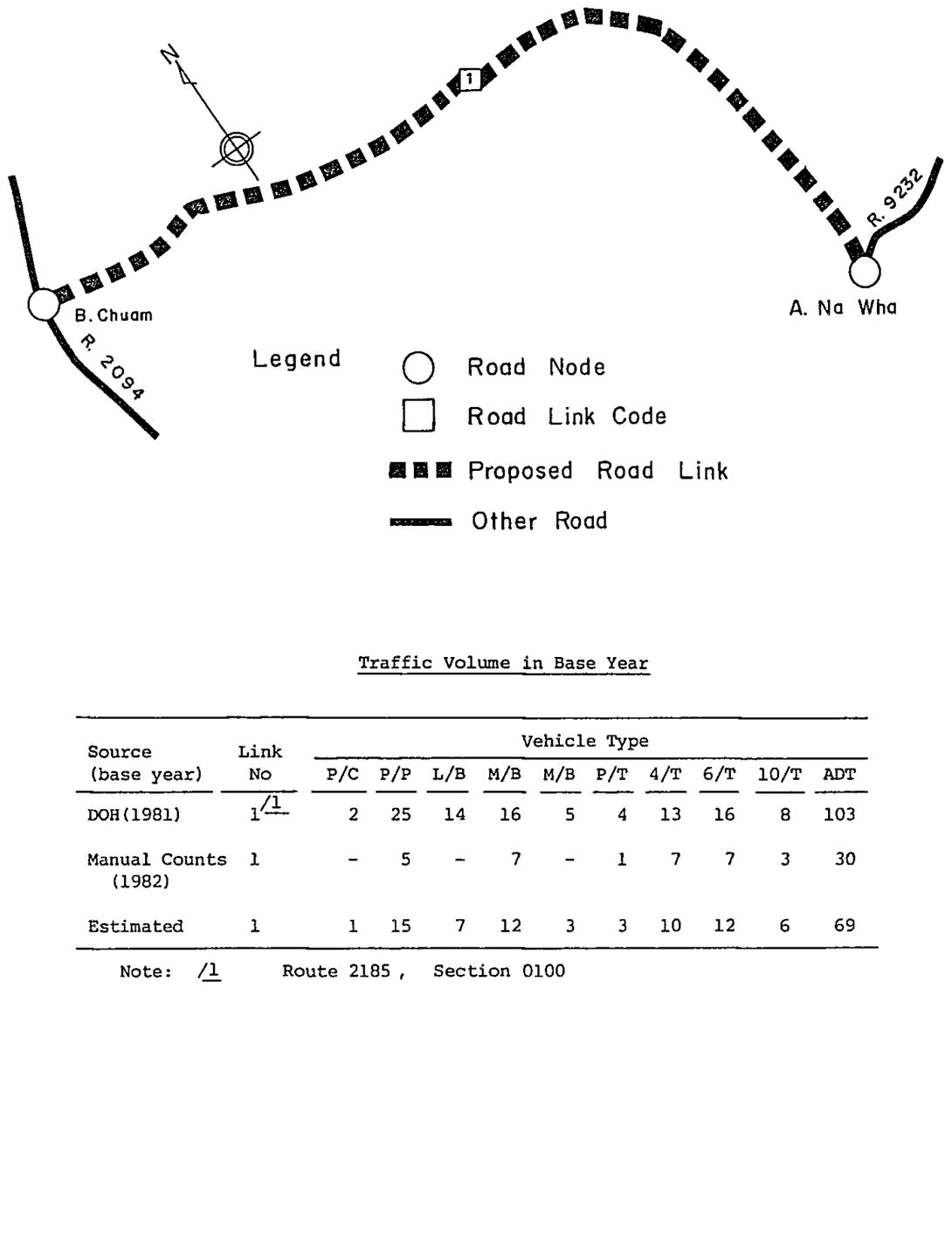
沿道の地形はほぼ平坦である。影響圏内には，いくつかの村が存在し，その総人口は，15,800人である。沿道には，医療センターはないが病院が1ケ所ある。教育施設として中学校が1ケ所ある。

本路線は，Na Wha郡と県道2094号線を結ぶ重要な路線となる。

1.2　現道の状況

計画路線に利用した現道の状況は，Table　13.1.1に要約し，その詳細はTable　13.1.2のインベントリー調査の結果に示した。

Proposed Road Link



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	M/B	P/T	4/T	6/T	10/T	ADT
DOH(1981)	1/1	2	25	14	16	5	4	13	16	8	103
Manual Counts (1982)	1	-	5	-	7	-	1	7	7	3	30
Estimated	1	1	15	7	12	3	3	10	12	6	69

Note: /1　Route 2185 , Section 0100

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	525

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	39	48	87

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	1.7	1.4	1.2
PASSENGER MOVEMENT	5.7	5.8	5.9

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.) 1981－1987	1987－1993	1993－2001
NON-AGRI.	7.4	7.5	7.6
AGRICULTURE	0.2	0.2	0.2
FREIGHT	3.4	3.4	3.5

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	2.6	39.5	18.4	31.6	7.9	9.7	32.3	38.7	19.4
	1987	4.7	37.4	19.1	30.0	8.8	11.6	28.0	37.7	22.7
	1993	7.2	34.9	19.9	28.2	9.8	13.9	22.8	36.6	26.7
	2001	10.5	31.6	20.9	25.7	11.3	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 13.2.1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	3	11	17	5	26	11	15	9	96	156	252
1993	6	16	22	8	34	10	16	12	123	186	309
2001	13	26	32	14	48	8	18	16	175	235	410

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，キャツサバ，砂糖きび及びケナフが栽培されている。

圏内の土地利用及び土地適応性の状況はTable 13.3.1とFigure 13.3.1に示し，また，えすSakon Nakhon 県地域の代表的作物暦は，Figure 13.3.2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 13.3.2.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てTable 13.3.3.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 13.3.4.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: Length (km)	Without Project: /1 Road Class	Without Project: Nos. of Wooden Bridge	Without Project: Nos. of Narrow C.Bridge	With Project: Length (km)	With Project: /1 Road Class Case 1	With Project: /1 Road Class Case 2	With Project: Nos. of Wooden Narrow Bridge
1	Flat	19.8	3	4	0	19.8	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)	2,134	2,891	4,336
2A(F5)	1,452	2,027	3,128

5. エンジニアリング

5.1 予備設計

予備設計は，次に示す設計基準を基本に行った。

Design Standard : F4 (if not feasible, F5)

Geometric Design : AASHTO (Rural Highways)

Typical Cross Section : as shown in Figure 13.5.1

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 : ø 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 13.5.2

ルートの線形は，Figure 13.5.2に示す。

5.2 工事数量および建設費

予備設計による工事数量と建設費は，各工種ごとに単価を付してTable 13.5.1に示す。

道路規程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。

Financial and Economic Construction Cost

Road Class	Length (km)	Construction Cost (10^3 ¥)		Remark
		Financial Cost	Economic Cost	
F4 (DBST)	19.8	37,519	33,915	
F5 (Soil Aggregate)	19.8	24,489	22,065	

6. 経済価格

年次別経済費用と便益及び評価結果はTable 13.6.1及び 13.6.2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 13.7.1に示す通りである。

Table 13.1.1 SUMMARY OF ROAD INVENTORY

Item	Description		
Origin	B. Chuam (J.R. 2094)		
Destination	A. Na Wha		
Length			
Total		19.8	km
Improvement Section		19.8	km
DOH Road	R. 2185	19.8	km
ARD Road		0	km
Others		0	km
New Alignment Section		0	km
Terrain	Flat		
Alignment (Hori./Vert.)	Fair / Fair		
Formation Width		8.0	m
Embankment Section			
Length		19.8	km
Height	0.3 m - 5.5 m		
Cut Section			
Length		0	km
Depth	m - m		
Surface Type and Condition			
SBST or DBST		0	km
Soil Aggregate	Poor	19.8	km
Earth		0	km
Pipe Culvert	22 each		
Box Culvert	0 each	0	m
Bridge			
Permanent Bridge	1 each	80.0	m
Narrow Concrete Bridge	0 each	0	m (4m)
Wooden Bridge	4 each	51.5	m
Overflow Section	0 place	0	km

Table 13.1.2 ROAD INVENTORY

PROPOSED ROUTE NO. IM-13 ROUTE No. 2185 B. CHUAM (J.R. 2094) ∿ A. NA WHA L = 19.8 Km.

SAKHON NAKORN/NAKHON PRANOM

STATION (Km)		0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
VILLAGE - Name - Household (H) - Population (P)		B. CHUAM H = 200 P = 1500; B. KOK SAAT H = 291 P = 2690; B SEO H = 267 P = 2610; B. TAN H = 420 P = 2000; B. NA WHA H = 800 P = 4800
TERRAIN		Flat
CROSS SECTION	Formation Width (m)	8.00
	Embankment Height (m)	1.00; 2.00; 0.40; 2.50; 5.50; 2.50; 0.30; 0.50
	Cutting Depth (m)	
PAVEMENT	Type/Length	Laterite
	Condition	Poor
FLOODING	Overflow Length(Km)/Height(m)	
LAND USE	Left	Paddy; Bush; Paddy
	Right	Paddy
PIPE CULVERT	Total Number	22 Pipes
BOX CULVERT & BRIDGE	Station (Km)	0.6; 1.1; 11.4; 13.9; 15.3
	Dimension	W-Br. 4.00 x 10.50; W-Br. 4.50 x 10.50; W-Br. 4.00 x 15.50; C-Br. 8.00 x 80.00; W-Br. 4.00 x 15.00
RIGHT OF WAY (m)		
ALIGNMENT	Horizontal	Fair
	Vertical	Fair
ROUTE NO., AGENCIES		DOH 2185

Table 13.2.1 TRAFFIC VOLUME ON ROUTE IM - 13

YEAR		1987		1993		2001	
LINK		1	AVR.	1	AVR.	1	AVR.
P/C	N+D	2	2	5	5	11	11
	I	0	0	1	1	2	2
	DV	0	0	0	0	0	0
	TOTAL	3	3	6	6	13	13
L/B	N+D	10	10	14	14	23	23
	I	1	1	2	2	3	3
	DV	0	0	0	0	0	0
	TOTAL	11	11	16	16	26	26
M/B	N+D	15	15	20	20	28	28
	I	2	2	3	3	4	4
	DV	0	0	0	0	0	0
	TOTAL	17	17	22	22	32	32
H/B	N+D	4	4	7	7	12	12
	I	1	1	1	1	2	2
	DV	0	0	0	0	0	0
	TOTAL	5	5	8	8	14	14
P/P&T	N+D	23	23	29	29	42	42
	I	3	3	4	4	6	6
	DV	0	0	0	0	0	0
	TOTAL	26	26	34	34	48	48
4/T	N+D	9	9	9	9	7	7
	I	1	1	1	1	1	1
	DV	0	0	0	0	0	0
	TOTAL	11	11	10	10	8	8
6/T	N+D	13	13	14	14	16	16
	I	2	2	2	2	2	2
	DV	0	0	0	0	0	0
	TOTAL	15	15	16	16	18	18
10/T	N+D	8	8	10	10	14	14
	I	1	1	2	2	2	2
	DV	0	0	0	0	0	0
	TOTAL	9	9	12	12	16	16
ADT	N+D	84	84	107	107	152	152
	I	13	13	16	16	23	23
	DV	0	0	0	0	0	0
	TOTAL	96	96	123	123	175	175
M/C	N+D	142	142	169	169	215	215
	I	15	15	17	17	20	20
	DV	0	0	0	0	0	0
	TOTAL	156	156	186	186	235	235
TOTAL	N+D	225	225	276	276	367	367
	I	27	27	33	33	43	43
	DV	0	0	0	0	0	0
	TOTAL	252	252	309	309	410	410

NOTE

N : NORMAL TRAFFIC D : DIVERTED TRAFFIC

DV : DEVELOPED TRAFFIC I : INDUCED TRAFFIC

Figure 13.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA PROPOSED ROUTE NO. IM - 13

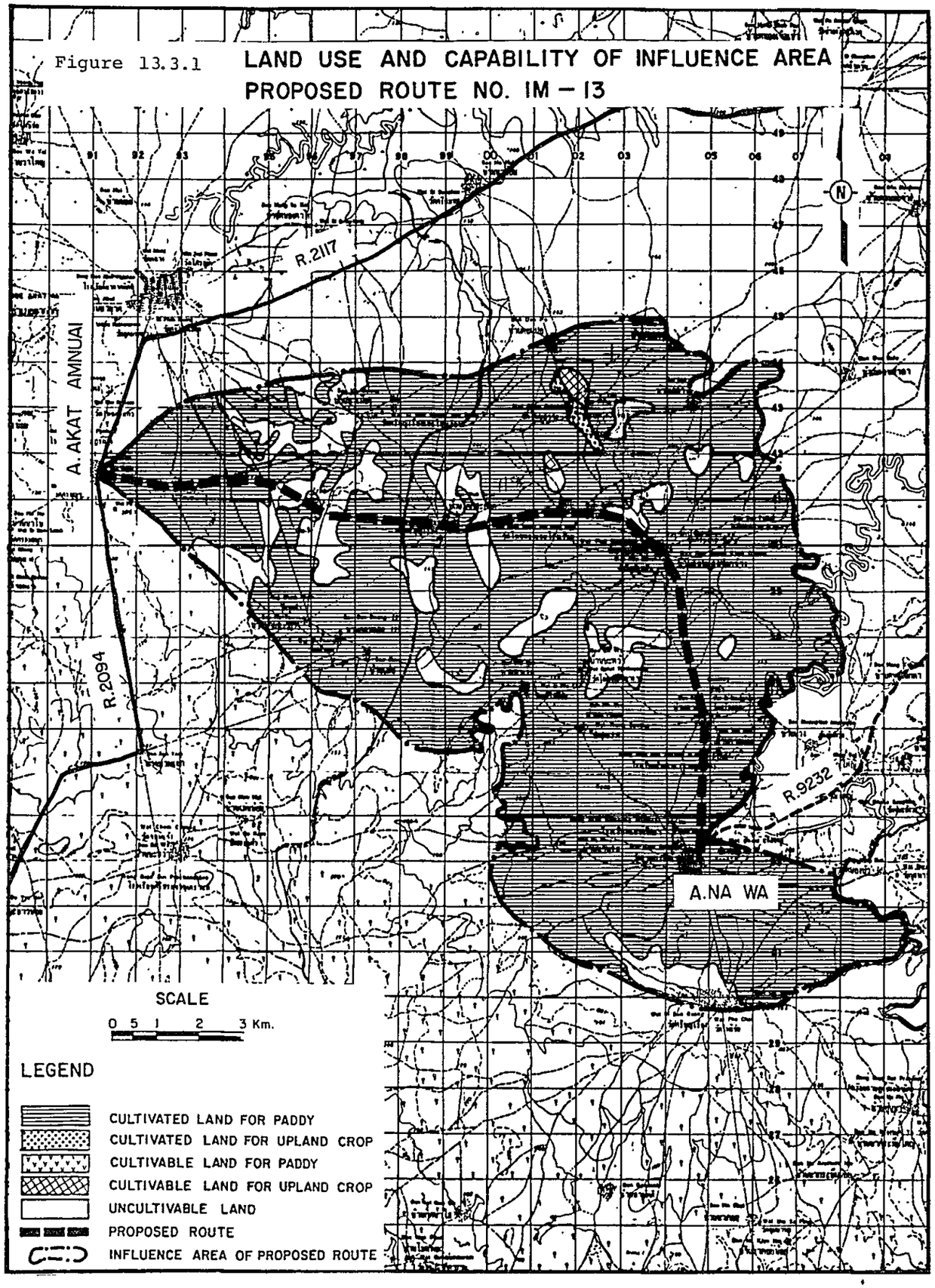
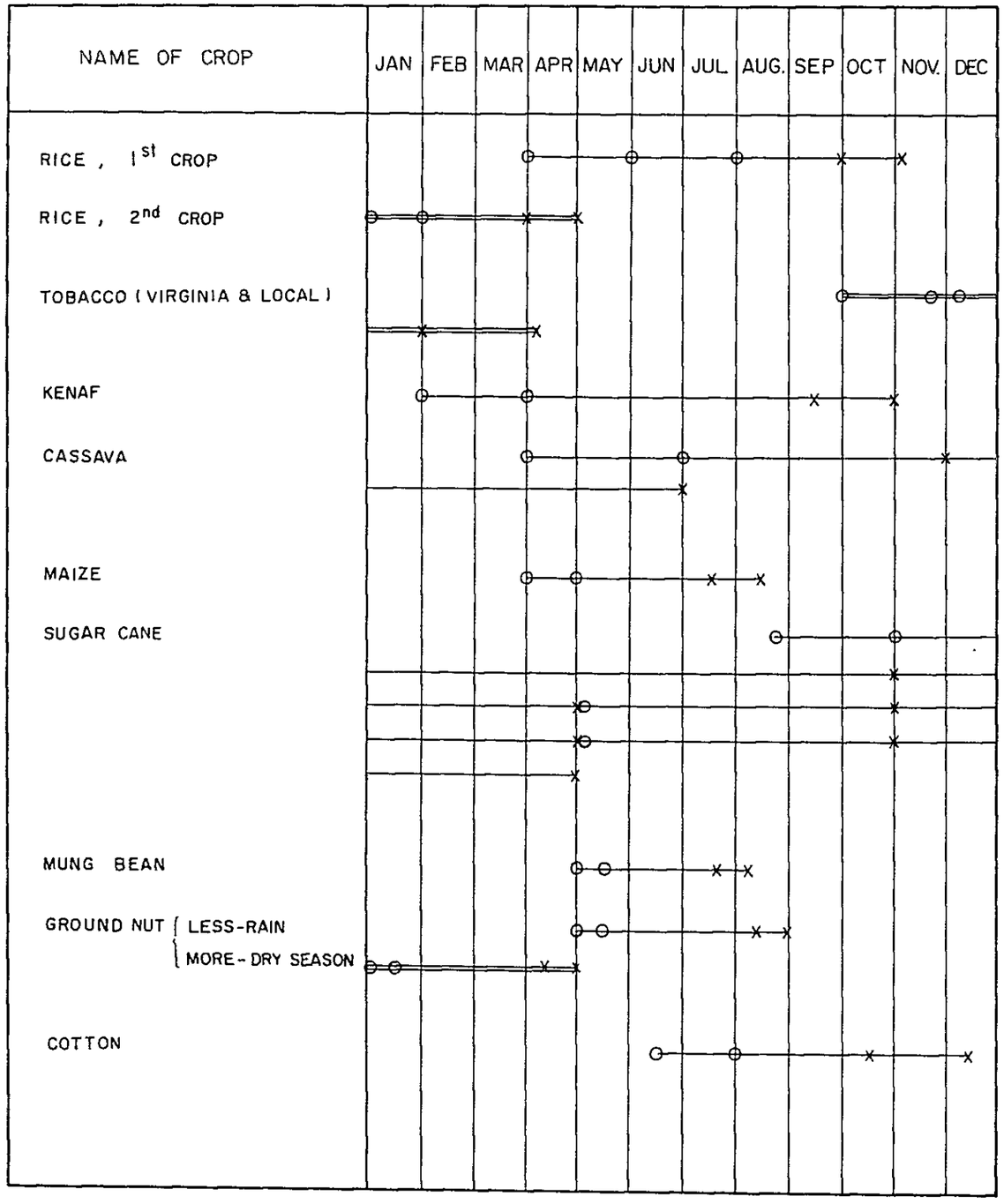


Figure 13.3.2 CROPPING CALENDAR(1)

0400 CHANGWAT SAKON NAKHON



CROPPING CALENDAR(2)

0500 CHANCWAT NAKHON PHANOM

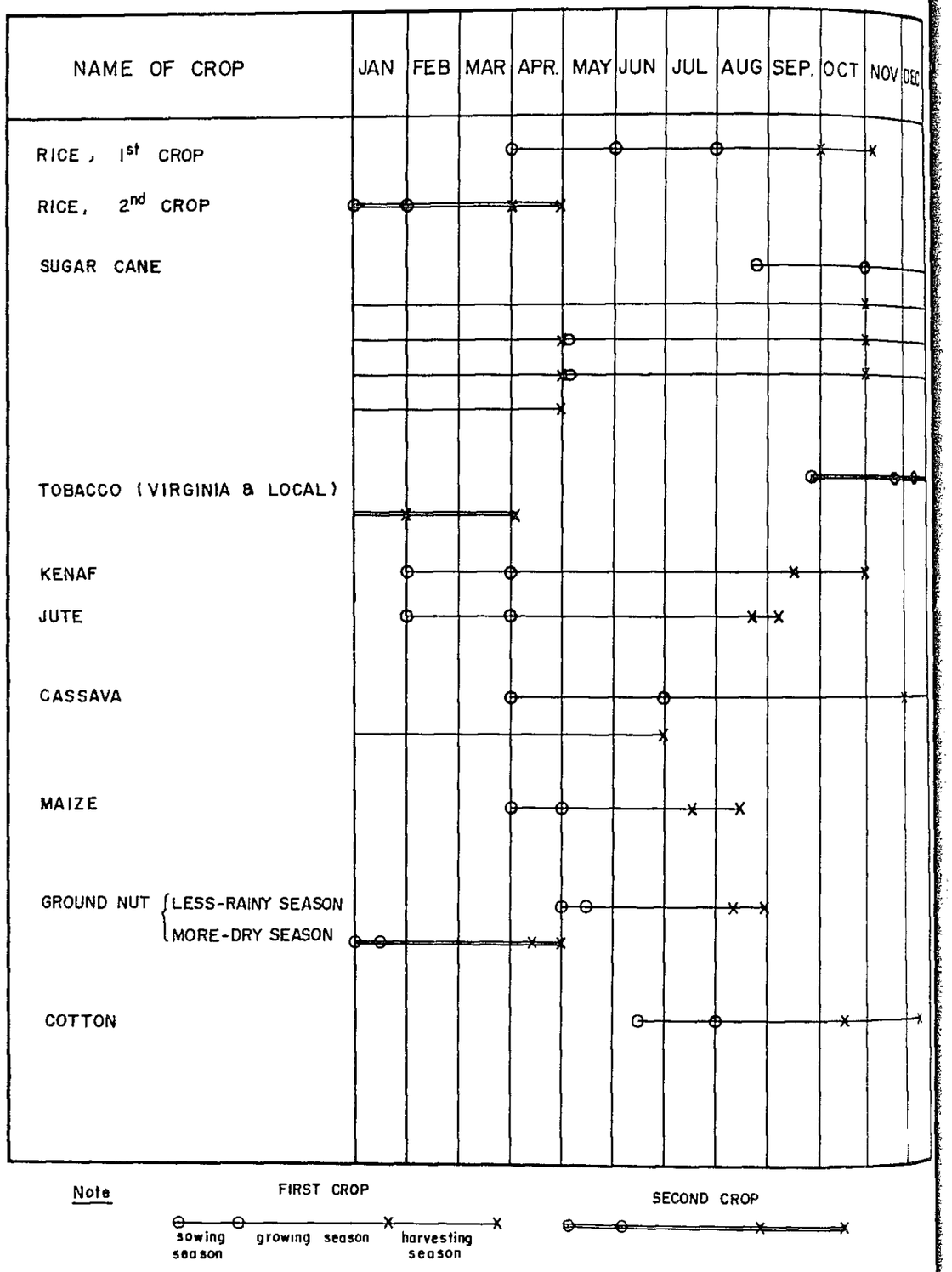


TABLE 13.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		75.000 (120.0)	0.313 (0.5)	75.313 (120.5)	-	0.313 (0.5)	0.313 (0.5)
0406	AKAT AMNUAI	13.750 (22.0)	-	13.750 (22.0)	-	-	-
0504	NA WA	61.250 (98.0)	0.313 (0.5)	61.563 (98.5)	-	0.313 (0.5)	0.313 (0.5)

TABLE 13.3.2 CROP PRODUCTION

ITEM			PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)												
1981			75.38	-	-	-	0.16	0.06	0.09	-	0.32	75.70
1987			75.38	-	-	-	0.17	0.06	0.09	-	0.34	75.72
1993	WITHOUT	PROJECT	75.38	-	-	-	0.19	0.06	0.10	-	0.36	75.74
	WITH	PROJECT	75.38	-	-	-	0.20	0.07	0.10	-	0.38	75.76
2001	WITHOUT	PROJECT	75.38	-	-	-	0.21	0.07	0.10	-	0.39	75.77
	WITH	PROJECT	75.38	-	-	-	0.23	0.07	0.10	-	0.41	75.80
CROP YIELD (KG/RAI)												
1981			208.3	-	-	-	2500.0	6500.0	175.0	-		
1987			209.5	-	-	-	2500.0	6539.1	175.0	-		
1993	WITHOUT	PROJECT	210.8	-	-	-	2500.0	6578.4	175.0	-		
	WITH	PROJECT	214.6	-	-	-	2515.0	6618.0	175.0	-		
2001	WITHOUT	PROJECT	212.5	-	-	-	2500.0	6631.2	175.0	-		
	WITH	PROJECT	221.6	-	-	-	2535.2	6724.6	175.0	-		
CROP PRODUCTION (TON)												
1981			15,700	-	-	-	391	366	16	-	775	16,474
1987			15,794	-	-	-	427	390	17	-	836	16,630
1993	WITHOUT	PROJECT	15,889	-	-	-	467	417	17	-	903	16,792
	WITH	PROJECT	16,177	-	-	-	513	445	17	-	977	17,154
2001	WITHOUT	PROJECT	16,017	-	-	-	526	455	17	-	1,000	17,017
	WITH	PROJECT	16,702	-	-	-	582	489	17	-	1,091	17,793

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 13.3.3 FARMGATE PRICE AND PRODUCTION COST

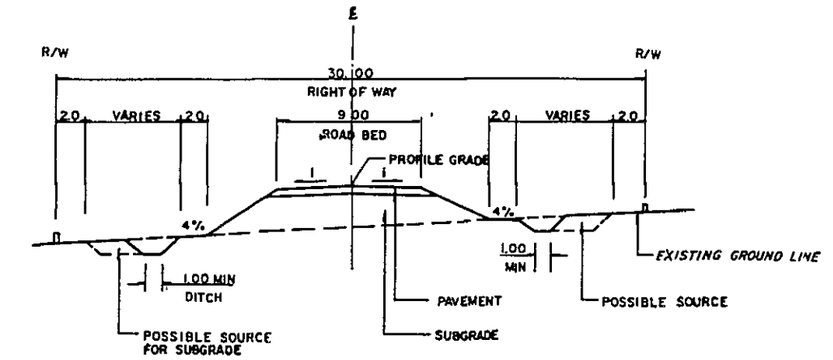
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,635	-	-	-	515	702	3,430	-
WITH PROJECT (1987 - 2001)	3,726	-	-	-	528	702	3,516	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	536	-	-	-	759	2,506	511	-
WITH PROJECT (1987 - 2001)	554	-	-	-	779	2,531	511	-

TABLE 13.3.4 NET PRODUCTION VALUE

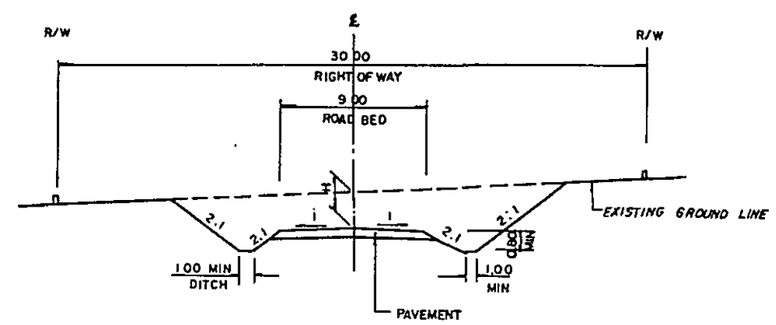
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	17,031	233	17,264	17,090	235	17,325
1993	17,377	251	17,628	18,516	274	18,790
2001	17,840	277	18,117	20,472	310	20,782

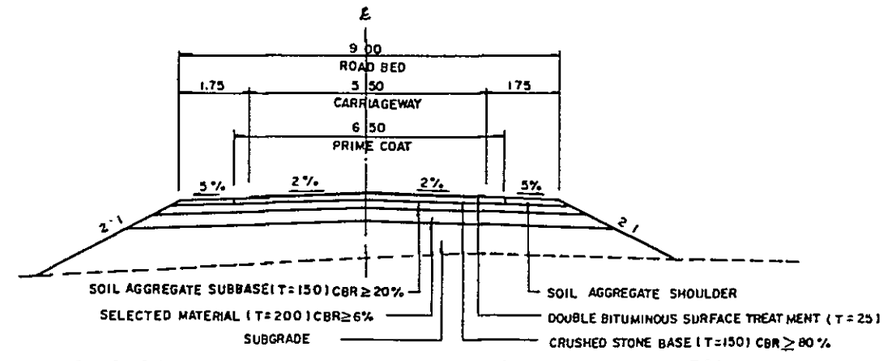
Figure 13.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



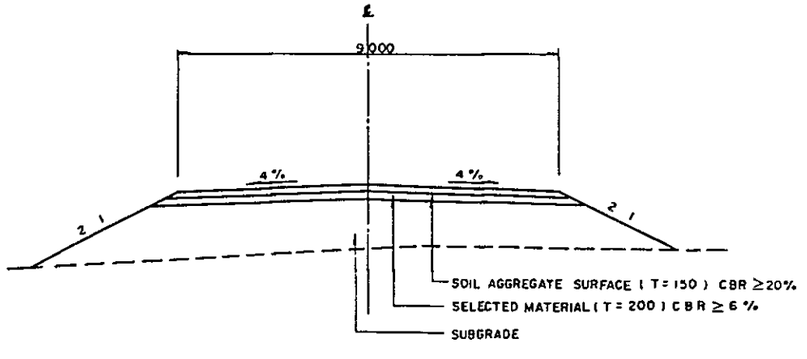
FILL SECTION



CUT SECTION



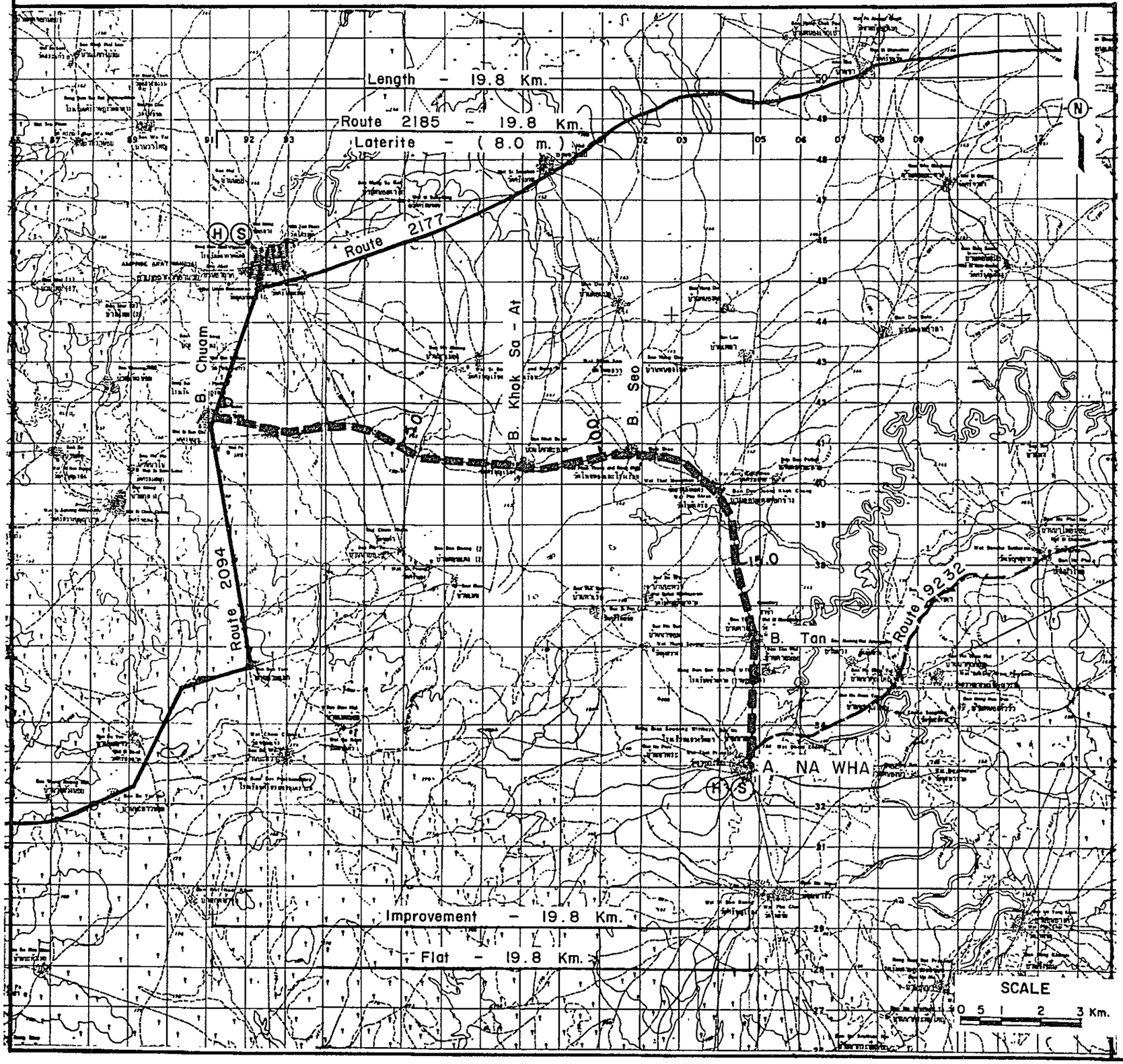
DOUBLE BITUMINOUS SURFACE TREATMENT (DBST) ROAD (Class F4)



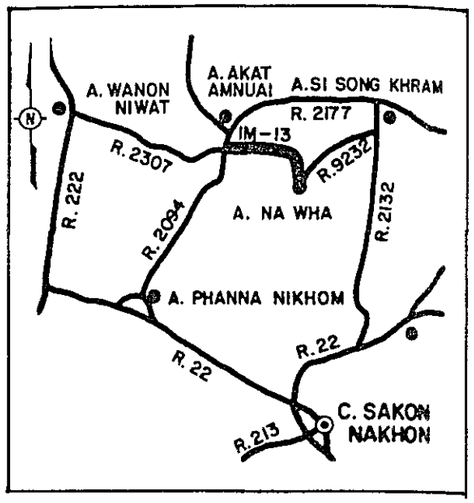
SOIL AGGREGATE SURFACED ROAD (Class F5)

Figure 13.5.2

PROPOSED ROUTE NO. IM-13 C. SAKON NAKHON NAKHON PHANOM B. CHUAM (J.R.2094) - A. NA WHA ROUTE NO. 2185 L = 19.8 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	0.6	C-7.00 x 14.00	W-4.00x10 50
2	1.1	C-7.00 x 14.00	W-4.50x10 50
3	11.4	C-7.00 x 18.00	W-4.00x15 50
4	13.9	-	C-8.00x80 00
5	15.3	C-7.00 x 18.00	W-4.00x15 00

LEGEND

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

Table 13.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-13 (19.8 km)

Items	Unit of Q'ty	Financial Unit Rate ¥	(DBST) Q'ty	(DBST) Financial Cost (10^3¥)	(DBST) Economic Cost (10^3¥)	(Soil Aggregate Surface) Q'ty	(Soil Aggregate Surface) Financial Cost (10^3¥)	(Soil Aggregate Surface) Economic Cost (10^3¥)
DIRECT CONSTRUCTION COST								
Clearing and Grubbing	ha	15,000	44	660	600	44	660	600
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	59,100	2,659	2,420	59,100	2,659	2,420
Selected Material	m^3	80	42,000	3,360	2,990	42,000	3,360	2,990
Soil Aggregate Surface or Subbase	m^3	105	29,400	3,087	2,747	29,400	3,087	2,747
Crushed Stone Base	m^3	370	19,300	7,141	6,569	5,900	2,183	2,008
Soil Aggregate Shoulder	m^3	105	8,300	871	775	2,500	262	233
Prime Coat and DBST	m^2	55	108,900	5,990	5,391	33,000	1,815	1,634
Pipe Culvert	m	2,100	820	1,722	1,584	820	1,722	1,584
Box Culvert	m	16,000	0	0	0	0	0	0
Long Span Bridge	m	80,000	0	0	0	0	0	0
Short Span Bridge	m	40,000	64	2,560	2,278	64	2,560	2,278
Sub Total (a)				28,051	25,357		18,309	16,497
Miscellaneous Works (a) x 7%				1,964	1,775		1,282	1,155
Total (b)				30,015	27,132		19,591	17,652
PHYSICAL CONTENGENCY (b) x 15%				4,502	4,070		2,939	2,648
ENGINEERING AND ADMINISTRATION (b) x 10%				3,002	2,713		1,959	1,765
Sub Total				7,504	6,783		4,898	4,413
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				37,519	33,915		24,489	22,065

Table 13.6.1 COST AND BENEFITS

(F4 STANDARD)

(1000 BAHT)

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	13,566	0	0	0	0	17,017	0
1986	20,349	0	0	0	0	22,791	0
1987	0	61	2,134	-136	2,059	0	1,839
1988	0	244	2,260	-131	2,373	0	1,892
1989	0	427	2,386	-126	2,687	0	1,912
1990	0	610	2,513	-122	3,001	0	1,907
1991	0	793	2,639	-117	3,314	0	1,881
1992	0	976	2,765	-113	3,628	0	1,838
1993	0	1,159	2,891	-108	3,942	0	1,783
1994	9,583	1,347	3,072	-101	4,317	4,335	1,744
1995	0	1,535	3,252	-94	4,693	0	1,692
1996	0	1,723	3,433	-88	5,069	0	1,632
1997	0	1,912	3,614	-81	5,444	0	1,565
1998	0	2,100	3,794	-74	5,820	0	1,494
1999	0	2,288	3,975	-68	6,195	0	1,420
2000	0	2,476	4,155	-61	6,571	0	1,345
2001	-15,601	2,665	4,336	-54	6,946	-2,850	1,269
TOTAL	27,897	20,315	47,219	-1,474	66,060	41,293	25,212

DISCOUNTED ECONOMIC COSTS : 41,293

DISCOUNTED ECONOMIC BENEFITS : 25,212

AGRICULTURAL DEVELOPMENT BENEFIT	6,668
VOC SAVING	19,294
RMC SAVING	-749

NET PRESENT VALUE : -16,080

BENEFIT COST RATIO : 0.61

INTERNAL RATE OF RETURN : 6.6 %

Table 13.6.2 COST AND BENEFITS

(F5 STANDARD)

(1000 BAHT)

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	8,826	0	0	0	0	11,071	0
1986	13,239	0	0	0	0	14,828	0
1987	0	61	1,452	-51	1,462	0	1,306
1988	0	244	1,548	-48	1,744	0	1,390
1989	0	427	1,644	-45	2,026	0	1,442
1990	0	610	1,740	-42	2,308	0	1,467
1991	0	793	1,835	-38	2,590	0	1,470
1992	0	976	1,931	-35	2,872	0	1,455
1993	0	1,159	2,027	-32	3,154	0	1,427
1994	2,904	1,347	2,165	-28	3,484	1,314	1,407
1995	0	1,535	2,302	-24	3,814	0	1,375
1996	0	1,723	2,440	-19	4,144	0	1,334
1997	0	1,912	2,577	-15	4,474	0	1,286
1998	0	2,100	2,715	-10	4,805	0	1,233
1999	0	2,288	2,852	-6	5,135	0	1,177
2000	0	2,476	2,990	-1	5,465	0	1,118
2001	-10,150	2,665	3,128	3	5,795	-1,854	1,059
TOTAL	14,819	20,315	33,346	-390	53,271	25,358	19,946

DISCOUNTED ECONOMIC COSTS : 25,358

DISCOUNTED ECONOMIC BENEFITS : 19,946

AGRICULTURAL DEVELOPMENT BENEFIT	6,668
VOC SAVING	13,508
RMC SAVING	-230

NET PRESENT VALUE : -5,412

BENEFIT COST RATIO : 0.79

INTERNAL RATE OF RETURN : 9.4 %

Table 13.7.1 SOCIAL INDICATORS

(Proposed Route IM-13)

Population (1,000)		
1982	:	15.8
1993	:	18.7
Average travelling speed, without (kph)	:	40
Isolation		
Access to Amphoe		
Average distance to Amphoe (km) 1/	:	4.5
Per capita time savings (10^{-4})	:	0.027
Score	:	79
Access to Artery Highway		
Average distance to highway (km) 1/	:	20
Per capita time savings (10^{-4})	:	0.119
Score	:	259
Impassability		
Impassable week a year	:	2
Impassability per year	:	0.038
Impassability per capita (10^{-4})	:	0.020
Score	:	167
Health		
Access to Hospital		
Average distance to Hospital (km) 1/	:	5.0
Per capita time savings (10^{-4})	:	0.030
Score	:	70
Access to Medical Facilities		
Average distance to facilities (km) 1/	:	3.0
Per capita time savings (10^{-4})	:	0.018
Score	:	72
Education		
Access to Secondary School		
Number of Student in 1993 (1,000) 2/	:	3.4
Average distance to school (km)	:	5.0
Per capita time savings (10^{-4})	:	0.163
Score	:	88
Teacher Intensity		
Number of teachers 3/		
University graduate	:	-
Total	:	15
Number of Student	:	279
Indicators		
E1 4/	:	-
E2 5/	:	(51.0)
E 6/	:	51.0
Degree of Improvement 7/	:	1.34
Score	:	85
Disparity		
G.P.V. in 1993 (Mn B) 8/		
With project	:	60.9
Without project	:	58.4
Per capita G.P.V. in 1993 (B)		
With project (W)	:	3,257
Without project (w)	:	3,123
Degree of Disparity		
(A/W) - (A/w) 9/	:	0
Score	:	0
Total Score	:	820

Note:

1/ ( ) shows the length or distance in without project case. Unless otherwise, lengthes 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.