PROPOSED ROUTE NO. IM - 4

Changwat : Khon Kaen

A. Chonnabot (J.R 2057) - B Kut Ru (J.R.2065)

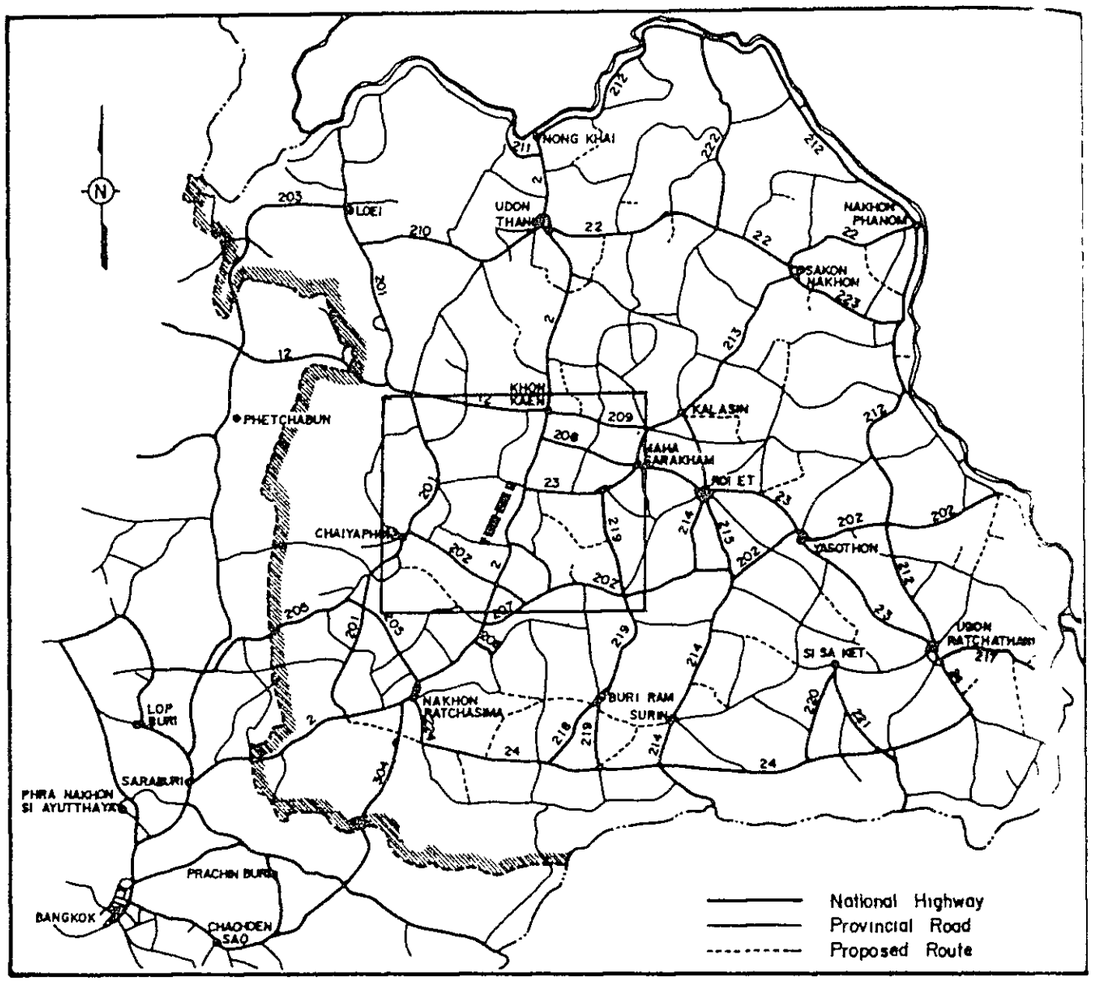
Length : 35.3 KM

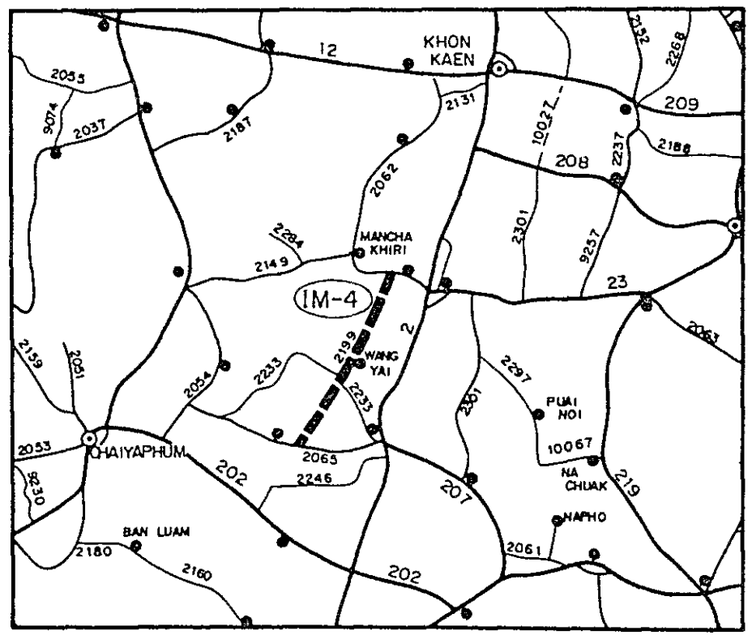
SUMMARY

PROPOSED ROUTE IM-4

Item	Description	
Changwat	Khon Kaen	
Origin	A. Chonnabot (J.R. 2057)	
Destination	B. Kut Ru (J.R. 2065)	
Length		
Total		35.3 km
Improvement Section		35.3 km
DOH Road	R. 2199	35.3 km
ARD Road		0 km
Others		0 km
New Alignment Section		0 km
Surface Type and Condition	Soil Aggregate, Good Poor	
Terrain	Flat	
Influence Area		
Area		263 km^2
Population (1982)		25,500
Principal Crops		Paddy
Traffic (ADT)		
Existing		98
1993		382
2001		507
Proposed Standard	F4 (DBST)	
Construction Cost		
Financial		60,602 . 10^3 ฿
Economic		56,439 . 10^3 ฿
IRR		6.2 %
B/C		0.58
Recommendation	For further consideration	

LOCATION OF PROPOSED ROUTE





1. 概　要

1.1　計画路線の概要

本路線は，Khon Kaen 県の南部に位置する。Chonnabot 郡に起点をもつルートは北へ走り，Mai Ne Phiang村，Waeng Yai 準郡，Don Hai 村を経て，県道2065号線にあるKut Pue 村で終っている。その総延長は35.3kmである。（Figure4.5.2参照）

沿道の地形は，ほぼ平坦である。影響圏内には，いくつかの村があり，その総人口は25,200人である。

沿道には医療センター4ケ所あるが病院はない。教育施設と中学校が1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2057号線と県道2065号線さらにWaeng Yai 準郡とを結ぶ重要な道路網の形成を目途と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 4.1.1に要約し，その詳細はTable 4.1.2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

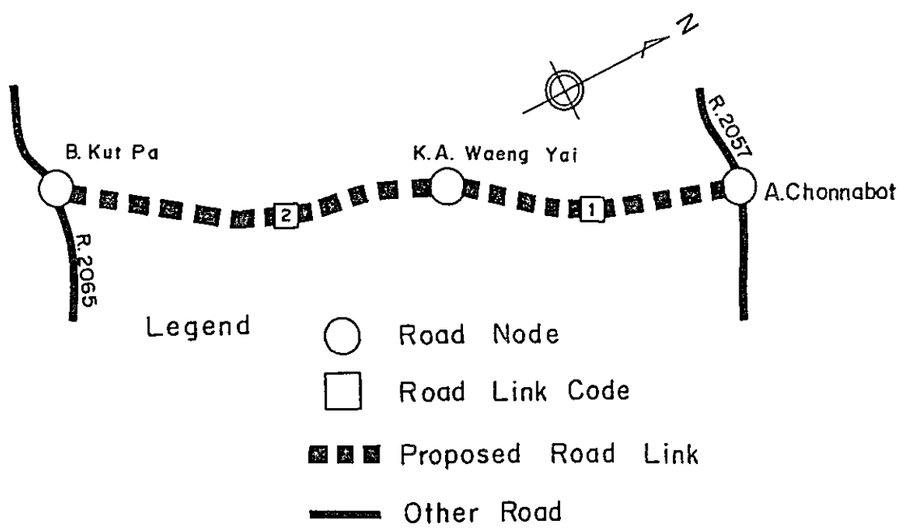
計画対象路線に関し道路改良後の転換交通はほとんど無視し得るので，交通量予測には「伸び率方式」を適用することとした。

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。

manual classified counts as shown below:

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	10	42	5	69	1	5	10	32	1	175
	2	-	14	3	3	-	2	-	1	3	26

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	1722
2	159

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	44	45	88
2	14	15	29

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	1.0
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.	7.0	7.1	7.3
AGRICULTURE	0.1	0.2	0.2
FREIGHT	3.5	3.6	3.7

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 P/C	P/P	L/B	M/B	H/B	FREIGHT P/T	4/T	6/T	10/T
1	1982	7.9	33.1	3.9	54.3	0.8	10.4	20.8	66.7	2.1
	1987	8.5	32.5	8.5	46.9	3.6	12.1	19.6	58.3	10.0
	1993	9.2	31.7	14.0	38.1	7.0	14.2	18.0	48.3	19.4
	2001	10.2	30.8	21.3	26.2	11.5	17.0	16.0	35.0	32.0
2	1982	0.0	70.0	15.0	15.0	0.0	33.3	0.0	16.7	50.0
	1987	4.6	65.4	13.9	14.6	1.5	29.0	4.2	21.5	45.3
	1993	10.1	59.9	12.6	14.0	3.4	23.9	9.3	27.3	39.6
	2001	17.5	52.5	10.8	13.3	5.8	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 4.2.1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	10	44	3	43	5	15	5	134	179	314
1993	13	20	49	9	56	5	14	7	173	210	382
2001	24	43	53	23	78	6	12	11	250	258	507

3　農業開発

3.1.　現況

影響圏内の農耕地は殆ど，水田であるが，未開発可耕地は，水田も畑作適地も殆ど残っていない。畑作では，キャッサバが一番多く，ケナフがこれに次いでいる。

圏内の土地利用及び土地適応性の状況はTable 4.3.1.とFigure 4.3.1.に示し，また，Khon Kaen 県地域の作物暦はFigure 4.3.2.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 4.3.2.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 4.3.3.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 4.3.4.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)	Road/1 class	Nos. of wooden Bridge	Nos. of Narrow C.Bridge	With Project: Length (km)	Road Class/1 case 1	case 2	case 3	case 4	Nos. of Wooden Narrow Bridge
1	Flat	17.0	2B	1	0	17.0	1	1	1	2A	0
2	Flat	18.3	3	0	0	18.3	(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)	2,662	4,012	6,679
1+2A (F4+F5)	2,466	3,754	6,303
1 (F4: only Link 1)	2,206	3,416	5,819
2A (F5)	1,-23	1,973	3,883

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, P5)

Geometric Design : AASHTO (Rural Highways)

Typical Cross Section : as shown in Figure 4.5.1

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 4.5.2

ルートの線形は，Figure 4.5.2 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 4.5.1 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 ₱) Financial Cost	Economic Cost	Remark
F4 (DBST)	35.3	60,602	56,439	
F5 (Soil Aggregate)	35.3	33,707	30,383	
F4 + F5	35.3	46,489	42,012	Adopted to link ≥300 in ADT
F4	17.0	30,939	27,999	Adopted to link ≥300 in ADT
F5	18.3	15,552	14,014	

6　経済評価

年次別経済費用と便益及び評価結果はTable 4.6.1，4.6.2，4.6.3及び4.6.4に示す通りてある。

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は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 4.7.1に示す通りである。

Table 4.1.1 SUMMARY OF ROAD INVENTORY

Item	Description		
Origin	A. Chonnabot (J.R. 2057)		
Destination	B. Kut!.Ru (J.R. 2065)		
Length			
Total		35.3 km	
Improvement Section		35.3 km	
DOH Road	R. 2199	35.3 km	
ARD Road		0 km	
Others		0 km	
New Alignment Section		0 km	
Terrain	Flat		
Alignment (Hori./Vert.)	Fair / Fair		
Formation Width	5.0 m - 9.0 m, 6.5 m (Weighted average)		
Embankment Section			
Length		35.3 km	
Height	0.2 m - 0.75 m		
Cut Section			
Length		0 km	
Depth	m - m		
Surface Type and Condition			
SBST or DBST	Good - Poor	2.7 km	
Soil Aggregate	Good - Poor	32.6 km	
Earth		0 km	
Pipe Culvert	49 each		
Box Culvert	0 each	0 m	
Bridge			
Permanent Bridge	0 each	0 m	
Narrow Concrete Bridge	0 each	0 m	(4m)
Wooden Bridge	1 each	14.2 m	
Overflow Section	3 places	4.0 km	

Table 4.1.2 ROAD INVENTORY (1)

PROPOSED ROUTE NO. IM-4   ROUTE NO. 2199   A. CHONNABOT (J.R. 2057) ∿ B. KUT RU (J.R. 2065)   L = 35.3

KHON KAEN

Item	Sub-item	Entries (left to right along station)
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. CHONNABOT H = 600 P = 4800; B. NA DOK MAI H = 75 P = 825; B. HUAI KAE H = 145 P = 1263; K.A. WAENG YAI H = 685 P = 4209; B. DON CHIM H = 230 P = 2540; B. MAINA PHIANG H = 210 P = 1200; B. NON SALA H = 38 P = 476
TERRAIN		Flat
CROSS SECTION	Formation Width (m)	9.00; 6.50; 7.00; 5.50; 6.50; 7.50; 6.00; 6.50
	Embankment Height (m)	0.45; 0.30; 0.20; 0.30; 0.75; 0.60
	Cutting Depth (m)	
PAVEMENT	Type/Length	DT; Laterite; DT; Laterite; DT; Laterite; DT; Laterite
	Condition	Bad; Good; Poor
FLOODING	Overflow Length(Km)/Height(m)	L=1.0 H=0.3; L=2.0 H=0.4
LAND USE	Left	Paddy; Bush; Paddy
	Right	Paddy; Bush; Paddy
PIPE CULVERT	Total Number	49 Pipes
BOX CULVERT & BRIDGE	Station (Km)	15.9
	Dimension	W-Br. 4.00 x 14.20
RIGHT OF WAY (m)		
ALIGNMENT	Horizontal	Fair
	Vertical	Fair
ROUTE NO., AGENCIES		DOH 2199

ROAD INVENTORY (2)

PROPOSED ROUTE NO. IM-4 ROUTE NO. 2199 A. CHANNABOT (J.R. 2057) ∿ B. KUT RU (J.R. 2065) (Cont'd) L = 35.3 Km.

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. KUT RU													
TERRAIN																	
CROSS SECTION	Formation Width (m)		5.50	5.00													
	Embankment Height (m)		0.25	0.30													
	Cutting Depth (m)																
PAVEMENT	Type/Length		Laterite														
	Condition		Poor														
FLOODING	Overflow Length(Km)/Height(m)			L=1.0 H=0.4													
LAND USE	Left		Paddy														
	Right		Paddy														
PIPE CULVERT	Total Number																
BOX CULVERT & BRIDGE	Station (Km)																
	Dimension																
RIGHT OF WAY (m)																	
ALIGNMENT	Horizontal		Fair														
	Vertical		Fair														
ROUTE NO., AGENCIES			DOH 2199														

Table 4.2.1 TRAFFIC VOLUME ON ROUTE IM - 4

YEAR		1987			1993			2001		
LINK		1	2	AVR.	1	2	AVR.	1	2	AVR.
P/C	N+D	14	1	7	20	3	12	34	9	21
	I	2	0	1	3	1	2	5	1	3
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	16	1	8	23	4	13	39	10	24
L/B	N+D	14	3	8	31	4	17	71	5	37
	I	2	1	1	5	1	3	11	1	6
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	16	4	10	36	5	20	82	6	43
M/B	N+D	76	4	39	84	5	43	88	7	46
	I	11	1	6	13	1	6	13	1	7
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	88	4	44	97	5	49	101	7	53
H/B	N+D	6	0	3	15	1	8	38	3	20
	I	1	0	0	2	0	1	6	0	3
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	7	0	3	18	1	9	44	3	23
P/P&T	N+D	58	19	38	76	22	48	111	28	68
	I	9	3	6	11	3	7	17	4	10
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	67	21	43	88	26	56	128	32	78
4/T	N+D	9	0	4	8	1	4	7	2	5
	I	1	0	1	1	0	1	1	0	1
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	10	0	5	9	1	5	9	3	6
6/T	N+D	26	2	13	21	3	12	16	5	11
	I	4	0	2	3	0	2	2	1	2
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	30	2	15	25	3	14	19	6	12
10/T	N+D	4	3	4	9	4	6	15	5	10
	I	1	1	1	1	1	1	2	1	1
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	5	4	5	10	5	7	17	6	11
ADT	N+D	208	33	117	265	43	150	381	64	217
	I	31	5	18	40	7	23	57	10	33
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	239	38	134	305	50	173	439	74	250
M/C	N+D	265	70	164	306	87	193	372	116	239
	I	23	8	15	25	10	17	26	12	19
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	288	78	179	331	97	210	397	128	258
TOTAL	N+D	472	103	281	571	130	343	753	180	456
	I	55	13	33	65	16	40	83	22	51
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	527	116	314	636	146	382	836	202	507

NOTE

N : NORMAL TRAFFIC D : DIVERTED TRAFFIC

DV : DEVELOPED TRAFFIC I : INDUCED TRAFFIC

Figure 4.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM – 4

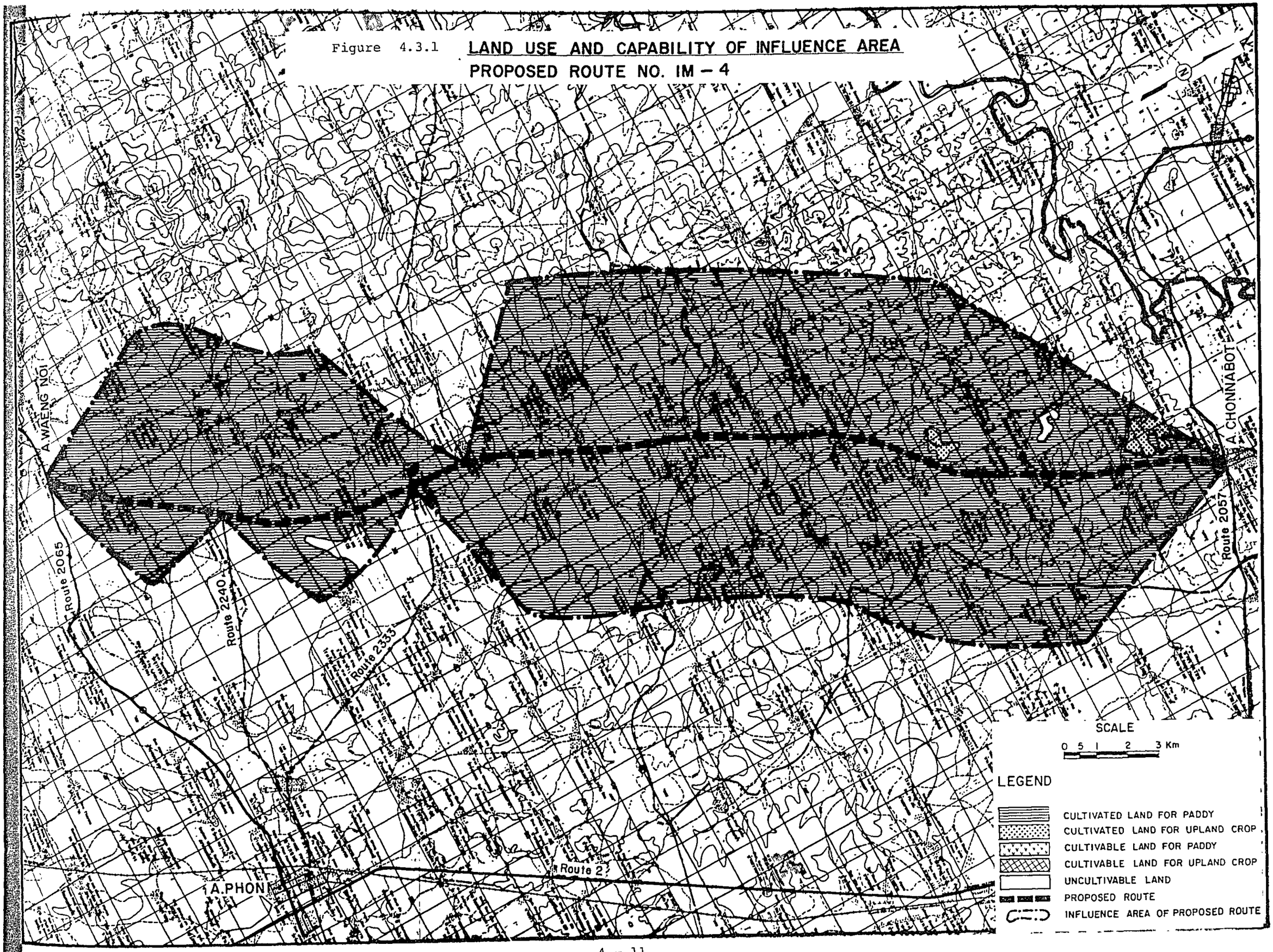


Figure 4.3.2 CROPPING CALENDAR

0600 CHANGWAT KHON KAEN

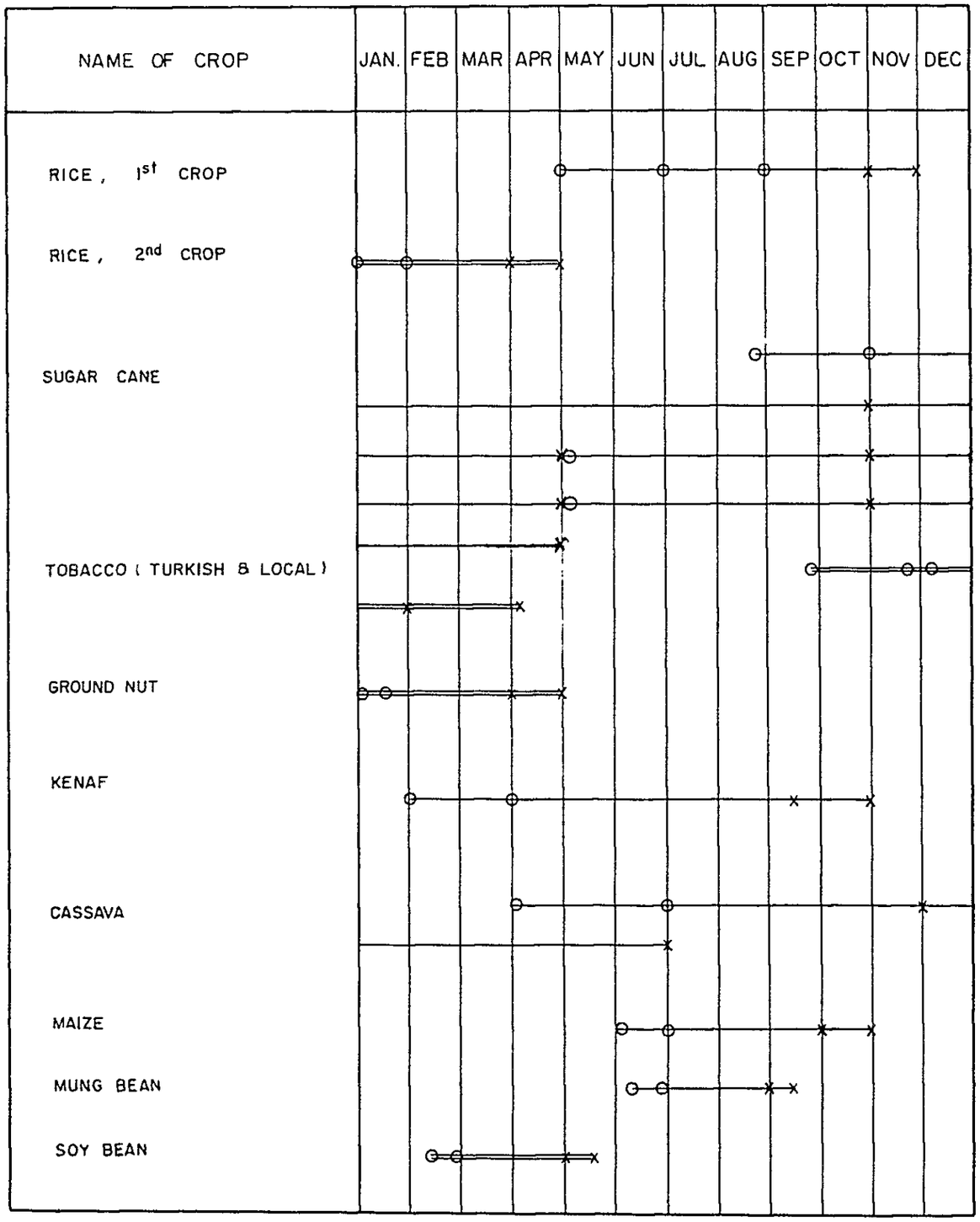


TABLE 4.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		156.250 (250.0)	0.625 (1.0)	156.875 (251.0)	-	-	-
0613	BAN PHAI	8.125 (13.0)	-	8.125 (13.0)	-	-	-
0614	CHONNABOT	71.250 (114.0)	0.625 (1.0)	71.875 (115.0)	-	-	-
0615	WAENG YAI	41.250 (66.0)	-	41.250 (66.0)	-	-	-
0616	WAENG NOI	35.625 (57.0)	-	35.625 (57.0)	-	-	-

TABLE 4.3.2 CROP PRODUCTION

ITEM			PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)												
1981			126.70	-	-	-	0.37	-	0.24	-	0.63	127.33
1987			126.70	-	-	-	0.42	-	0.24	-	0.67	127.37
1993	WITHOUT	PROJECT	126.70	-	-	-	0.47	-	0.24	-	0.72	127.43
	WITH	PROJECT	126.70	-	-	-	0.50	-	0.24	-	0.75	127.46
2001	WITHOUT	PROJECT	126.70	-	-	-	0.55	-	0.24	-	0.81	127.51
	WITH	PROJECT	126.70	-	-	-	0.58	-	0.24	-	0.84	127.54
CROP YIELD (KG/RAI)												
1981			246.1	-	-	-	2000.0	-	252.0	-		
1987			247.6	-	-	-	2000.0	-	252.0	-		
1993	WITHOUT	PROJECT	249.1	-	-	-	2000.0	-	252.0	-		
	WITH	PROJECT	253.6	-	-	-	2012.0	-	252.0	-		
2001	WITHOUT	PROJECT	251.1	-	-	-	2000.0	-	252.0	-		
	WITH	PROJECT	261.8	-	-	-	2028.2	-	252.0	-		
CROP PRODUCTION (TON)												
1981			31,183	-	-	-	741	-	60	-	803	31,986
1987			31,370	-	-	-	835	-	60	-	897	32,267
1993	WITHOUT	PROJECT	31,559	-	-	-	940	-	60	-	1,002	32,561
	WITH	PROJECT	32,131	-	-	-	1,003	-	60	-	1,065	33,195
2001	WITHOUT	PROJECT	31,812	-	-	-	1,101	-	60	-	1,163	32,976
	WITH	PROJECT	33,173	-	-	-	1,184	-	60	-	1,246	34,420

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 4.3.3 FARMGATE PRICE AND PRODUCTION COST

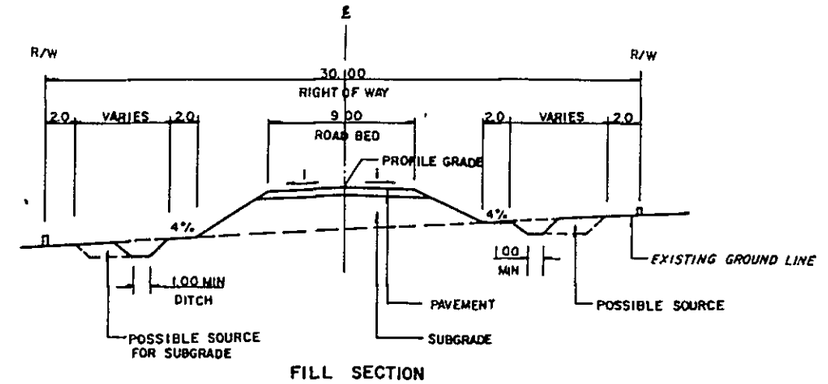
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,587	-	-	-	608	-	4,625	-
WITH PROJECT (1987 - 2001)	3,677	-	-	-	623	-	4,741	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	599	-	-	-	724	-	845	-
WITH PROJECT (1987 - 2001)	619	-	-	-	744	-	845	-

TABLE 4.3.4 NET PRODUCTION VALUE

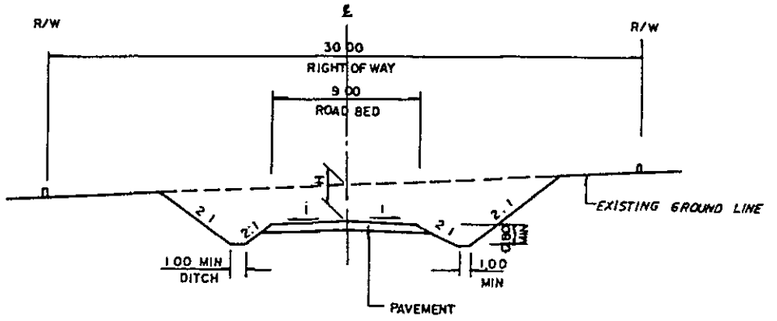
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	36,631	288	36,919	36,920	298	37,218
1993	37,308	314	37,622	39,716	343	40,059
2001	38,216	353	38,569	43,550	393	43,943

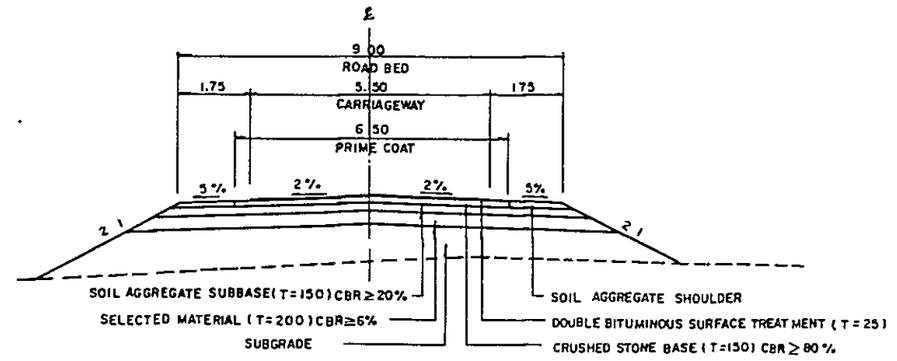
Figure 4.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



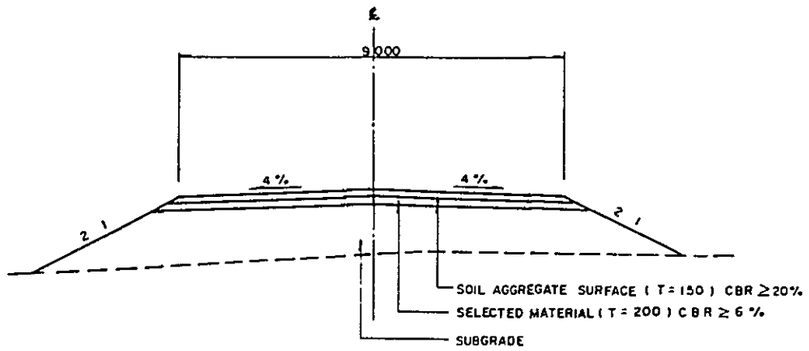
FILL SECTION



CUT SECTION



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

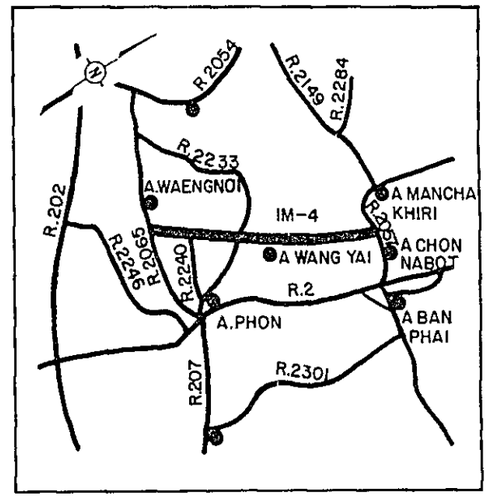


SOIL AGGREGATE SURFACED ROAD (Class F5)

Figure 4.5.2 PROPOSED ROUTE NO. IM-4 C. KHON KAEN A. CHONNABOT (J.R. 2057) — B. KUT RU (J.R. 2065)
ROUTE NO. 2199 L = 35.3 Km.

M-4 C. KHON KAEN A. CHONNABOT (J.R. 2057) – B. KUT RU (J.R. 2065)
ROUTE NO. 2199 L = 35.3 Km.

LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	15 9	C-700 x 16 00	W-4 00 x 14 20

LEGEND

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

Table 4.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-4 (35.3 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	83	1,245	1,132	83	1,245	1,132
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	120,600	5,427	4,938	120,600	5,427	4,938
Selected Material	m^3	80	74,800	5,984	5,325	74,800	5,984	5,325
Soil Aggregate Surface or Subbase	m^3	105	52,400	5,502	4,896	52,400	5,502	4,896
Crushed Stone Base	m^3	370	34,400	12,728	11,709	4,900	1,813	1,667
Soil Aggregate Shoulder	m^3	105	14,800	1,554	1,383	2,100	220	196
Prime Coat and DBST	m^2	55	194,200	10,681	9,613	27,500	1,513	1,361
Pipe Culvert	m	2,100	1,360	2,856	2,627	1,360	2,856	2,627
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	16	640	569	16	640	569
Sub Total (a)				46,617	42,197		25,201	22,716
Miscellaneous Works (a) x 7%				1,865	2,954		1,764	1,590
Total (b)				48,482	45,151		26,965	24,306
PHYSICAL CONTENGENCY (b) x 15%				7,272	6,773		4,045	3,646
ENGINEERING AND ADMINISTRATION (b) x 10%				4,848	4,515		2,697	2,431
Sub Total				12,120	11,288		6,742	6,077
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				60,602	56,439		33,707	30,383

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

Items	Unit of Q'ty	Financial Unit Rate ฿	Proposed Route Number: IM-4 (1-2) (17.0 km) 1/ Q'ty	IM-4 (1-2) Financial Cost (10^3฿)	IM-4 (1-2) Economic Cost (10^3฿)	IM-4 (2-3) (18.3 km) 2/ Q'ty	IM-4 (2-3) Financial Cost (10^3฿)	IM-4 (2-3) Economic Cost (10^3฿)	IM-4 (T) (35.3 km) 3/ Q'ty	IM-4 (T) Financial Cost (10^3฿)	IM-4 (T) Economic Cost (10^3฿)
DIRECT CONSTRUCTION COST											
Clearing and Grubbing	ha	15,000	39	585	532	44	660	600	83	1,245	1,132
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	69, 00	3,132	2,850	51,000	2,295	2,088	120,600	5,427	4,938
Selected Material	m^3	80	36,000	2,880	2,563	38,800	3,104	2,762	74,800	5,984	5,325
Soil Aggregate Surface or Subbase	m^3	105	25,200	2,646	2,354	27,200	2,856	2,541	52,400	5,502	4,896
Crushed Stone Base	m^3	370	16,600	6,142	5,650	1,500	555	510	18,100	6,697	6,161
Soil Aggregate Shoulder	m^3	105	7,100	745	663	600	63	56	7,700	808	719
Prime Coat and DBST	m^2	55	93,500	5,143	4,629	8,300	457	411	101,800	5,599	5,039
Pipe Culvert	m	2,100	580	1,218	1,120	780	1,638	1,506	1,360	2,856	2,627
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	16	640	569	0	0	0	16	640	569
Sub Total (a)				23,132	20,934		11,628	10,478		34,758	31,411
Miscellaneous Works (a) x 7%				1,619	1,465		814	733		2,433	2,199
Total (b)				24,751	22,399		12,442	11,211		37,191	33,610
PHYSICAL CONTENGENCY (b) x 15%				3,713	3,360		1,866	1,682		5,579	5,041
ENGINEERING AND ADMINISTRATION (b) x 10%				2,475	2,249		1,244	1,121		3,719	3,361
Sub Total				6,188	5,600		3,110	2,803		9,298	8,402
LAND ACQUISITION											
Highly Developed Land	ha	50,000	0	0	0	0	0	0	0	0	0
Less Developed Land	ha	15,000	0	0	0	0	0	0	0	0	0
Sub Total				0	0		0	0		0	0
GRAND TOTAL				30,939	27,999		15,552	14,014		46,489	42,012

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

Table 4.6.1 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	22,574	0	0	0	0	28,317	0
1986	33,863	0	0	0	0	37,927	0
1987	0	299	2,662	-194	2,767	0	2,471
1988	0	655	2,887	-187	3,354	0	2,674
1989	0	1,010	3,112	-181	3,942	0	2,806
1990	0	1,366	3,337	-174	4,529	0	2,878
1991	0	1,721	3,562	-167	5,116	0	2,903
1992	0	2,077	3,787	-160	5,704	0	2,890
1993	0	2,433	4,012	-153	6,291	0	2,846
1994	17,085	2,800	4,345	-143	7,002	7,728	2,828
1995	0	3,168	4,679	-133	7,713	0	2,781
1996	0	3,535	5,012	-123	8,424	0	2,712
1997	0	3,903	5,346	-113	9,135	0	2,626
1998	0	4,271	5,679	-103	9,846	0	2,527
1999	0	4,638	6,013	-93	10,557	0	2,419
2000	0	5,006	6,346	-84	11,268	0	2,306
2001	-25,962	5,373	6,679	-74	11,979	-4,743	2,189
TOTAL	47,560	42,254	67,459	-2,084	107,629	69,229	39,856

DISCOUNTED ECONOMIC COSTS :	69,229
DISCOUNTED ECONOMIC BENEFITS :	39,856
AGRICULTURAL DEVELOPMENT BENEFIT	14,204
VOC SAVING	26,716
RMC SAVING	-1,064
NET PRESENT VALUE :	-29,372
BENEFIT COST RATIO :	0.58
INTERNAL RATE OF RETURN :	6.2 %

Table 4.6.2 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	0	0	0	0	0	0	0
1985	16,804	0	0	0	0	21,079	0
1986	25,208	0	0	0	0	28,233	0
1987	0	299	2,466	-97	2,668	0	2,382
1988	0	655	2,681	-91	3,244	0	2,586
1989	0	1,010	2,895	-85	3,821	0	2,720
1990	0	1,366	3,110	-79	4,397	0	2,795
1991	0	1,721	3,325	-72	4,974	0	2,822
1992	0	2,077	3,539	-66	5,550	0	2,812
1993	0	2,433	3,754	-60	6,127	0	2,771
1994	9,680	2,800	4,073	-51	6,822	4,379	2,755
1995	0	3,168	4,391	-42	7,517	0	2,711
1996	0	3,535	4,710	-33	8,212	0	2,644
1997	0	3,903	5,029	-24	8,907	0	2,561
1998	0	4,271	5,347	-15	9,603	0	2,465
1999	0	4,638	5,666	-6	10,298	0	2,360
2000	0	5,006	5,984	3	10,993	0	2,249
2001	-19,326	5,373	6,303	12	11,688	-3,531	2,135
TOTAL	32,366	42,254	63,273	-706	104,822	50,160	38,768

DISCOUNTED ECONOMIC COSTS :	50,160
DISCOUNTED ECONOMIC BENEFITS :	38,768
AGRICULTURAL DEVELOPMENT BENEFIT	14,204
VOC SAVING	24,991
RMC SAVING	-427
NET PRESENT VALUE :	-11,391
BENEFIT COST RATIO :	0.77
INTERNAL RATE OF RETURN :	9.2 %

Table 4.6.3 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	11,199	0	0	0	0	14,048	0
1986	16,800	0	0	0	0	18,816	0
1987	0	144	2,206	-22	2,328	0	2,079
1988	0	315	2,408	-17	2,706	0	2,157
1989	0	487	2,609	-12	3,084	0	2,195
1990	0	658	2,811	-7	3,463	0	2,200
1991	0	829	3,013	-1	3,841	0	2,179
1992	0	1,001	3,214	4	4,219	0	2,137
1993	0	1,172	3,416	9	4,597	0	2,079
1994	8,228	1,349	3,716	16	5,082	3,722	2,052
1995	0	1,526	4,017	24	5,567	0	2,007
1996	0	1,703	4,317	31	6,051	0	1,948
1997	0	1,880	4,618	39	6,536	0	1,879
1998	0	2,057	4,918	46	7,021	0	1,802
1999	0	2,234	5,218	53	7,506	0	1,720
2000	0	2,411	5,519	61	7,990	0	1,635
2001	-12,879	2,588	5,819	68	8,475	-2,353	1,548
TOTAL	23,348	20,354	57,819	292	78,465	34,233	29,620

DISCOUNTED ECONOMIC COSTS : 34,233

DISCOUNTED ECONOMIC BENEFITS : 29,620

- AGRICULTURAL DEVELOPMENT BENEFIT 6,842
- VOC SAVING 22,733
- RMC SAVING 45

NET PRESENT VALUE : -4,613

BENEFIT COST RATIO : 0.87

INTERNAL RATE OF RETURN : 10.3 %

Table 4.6.4 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	12,153	0	0	0	0	15,245	0
1986	18,230	0	0	0	0	20,418	0
1987	0	299	1,023	-67	1,255	0	1,121
1988	0	655	1,181	-64	1,772	0	1,413
1989	0	1,010	1,340	-61	2,289	0	1,629
1990	0	1,366	1,498	-58	2,806	0	1,783
1991	0	1,721	1,657	-55	3,322	0	1,885
1992	0	2,077	1,815	-53	3,839	0	1,945
1993	0	2,433	1,973	-50	4,356	0	1,970
1994	1,210	2,800	2,212	-46	4,966	547	2,006
1995	0	3,168	2,451	-42	5,577	0	2,011
1996	0	3,535	2,690	-38	6,187	0	1,992
1997	0	3,903	2,928	-34	6,797	0	1,954
1998	0	4,271	3,167	-30	7,408	0	1,901
1999	0	4,638	3,406	-26	8,018	0	1,838
2000	0	5,006	3,645	-22	8,628	0	1,764
2001	-13,976	5,373	3,883	-18	9,239	-2,553	1,688
TOTAL	17,617	42,254	34,869	-663	76,460	33,656	26,902

DISCOUNTED ECONOMIC COSTS : 33,656

DISCOUNTED ECONOMIC BENEFITS : 26,902

- AGRICULTURAL DEVELOPMENT BENEFIT 14,204
- VOC SAVING 13,047
- RMC SAVING -349

NET PRESENT VALUE : -6,755

BENEFIT COST RATIO : 0.80

INTERNAL RATE OF RETURN : 9.8 %

Table 4.7.1 SOCIAL INDICATORS

(Proposed Route IM-4)

Population (1,000)		
1982	:	25.5
1993	:	29.3
Average travelling speed, without (kph)	:	44
Isolation		
Access to Amphoe		
Average distance to Amphoe (km) 1/	:	6.5
Per capita time savings (10^{-4})	:	0.020
Score	:	59
Access to Artery Highway		
Average distance to highway (km) 1/	:	17
Per capita time savings (10^{-4})	:	0.051
Score	:	111
Impassability		
Impassable week a year	:	2
Impassability per year	:	0.038
Impassability per capita (10^{-4})	:	0.013
Score	:	108
Health		
Access to Hospital		
Average distance to Hospital (km) 1/	:	18.0
Per capita time savings (10^{-4})	:	0.054
Score	:	126
Access to Medical Facilities		
Average distance to facilities (km) 1/	:	3.6
Per capita time savings (10^{-4})	:	0.011
Score	:	44
Education		
Access to Secondary School		
Number of Student in 1993 (1,000) 2/	:	5.3
Average distance to school (km)	:	12.5
Per capita time savings (10^{-4})	:	0.208
Score	:	112
Teacher Intensity		
Number of teachers 3/		
University graduate	:	-
Total	:	8
Number of Student	:	183
Indicators		
E1 4/	:	-
E2 5/	:	43.7
E 6/	:	43.7
Degree of Improvement 7/	:	1.57
Score	:	100
Disparity		
G.P.V. in 1993 (Mn B) 8/		
With project	:	119.1
Without project	:	114.1
Per capita G.P.V. in 1993 (B)		
With project (W)	:	4,065
Without project (w)	:	3,894
Degree of Disparity		
(A/W) - (A/w) 9/	:	0
Score	:	0
Total Score	:	660

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-5

Changwat : Khon Kaen

A. Nam Phong (J.R 2039) -J.R. 209

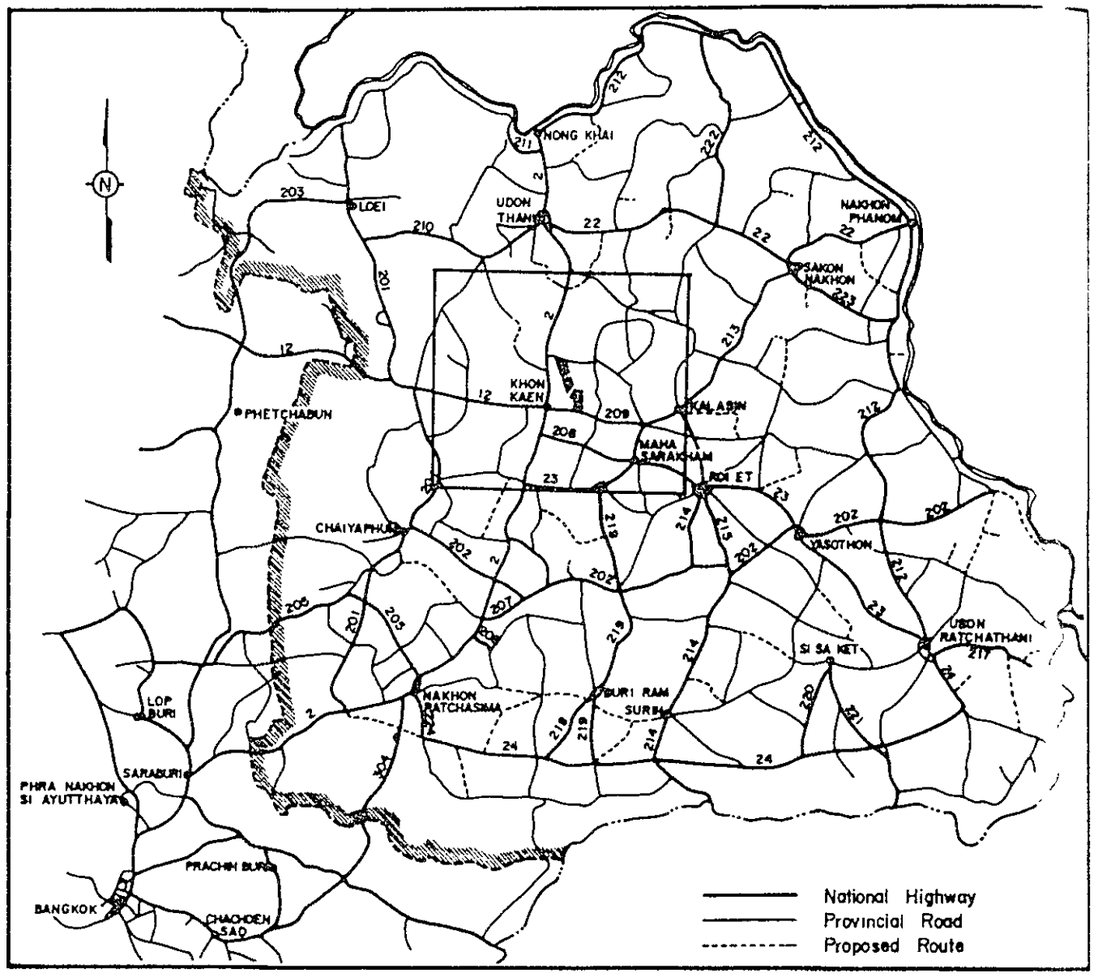
Length : 29.1 KM.

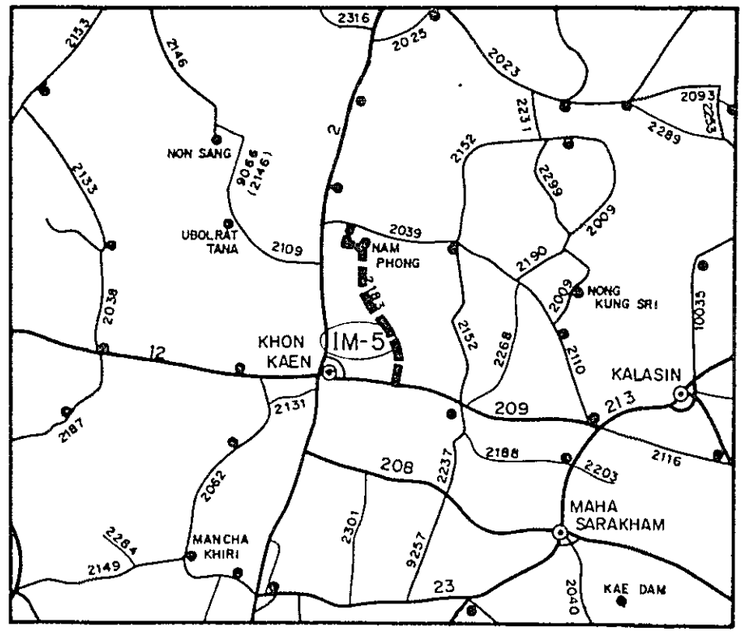
SUMMARY

PROPOSED ROUTE IM- 5

Item	Description	
Changwat	Khon Kaen	
Origin	A Nam Phong (J.R. 2039)	
Destination	J.R. 203	
Length		
Total		29.1 km
Improvement Section		29.1 km
DOH Road	R.2183	23.1 km
ARD Road		6.0 km
Others		0 km
New Alignment Section		0 km
Surface Type and Condition	Soil Aggregate, Good	
Terrain	Flat and Rolling	
Influence Area		
Area		173 km^2
Population (1982)		27,200
Principal Crops		Paddy
Traffic (ADT)		
Existing		299
1993		1,055
2001		1,426
Proposed Standard	F4 (DBST)	
Construction Cost		
Financial		61,472 . 10^3 ฿
Economic		55,565 . 10^3 ฿
IRR		20.0 %
B/C		1.76
Recommendation	For further consideration	

LOCATION OF PROPOSED ROUTE





1. 概　要

1.1　計画路線の概要

本路線は，Khon Kaen 県の北部に位置する。ルートは県道2039号線のNam Phong 郡を起点とし北に走りHong Saeng村，Bung Pnng 村，Non Tum 村を経て，県道 209号線に交差して終る。その総延長は，29.1kmである。（Figure5.5.2参照）

沿道の地形はほぼ平坦であり，一部丘陵地もある。影響圏内には，いくつかの村があり，その総人口は27,200人である。

沿道には医療センターが2ケ所あるが病院はない。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2039号線と国道209号線を結ぶため　Phong 河の右岸に沿って重要な道路網を形成することを目途として計画された。

1.2　現道の状況

計画路線に利用した現道の状況は，Table 5.1.1に要約し，その詳細はTable 5.1.2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

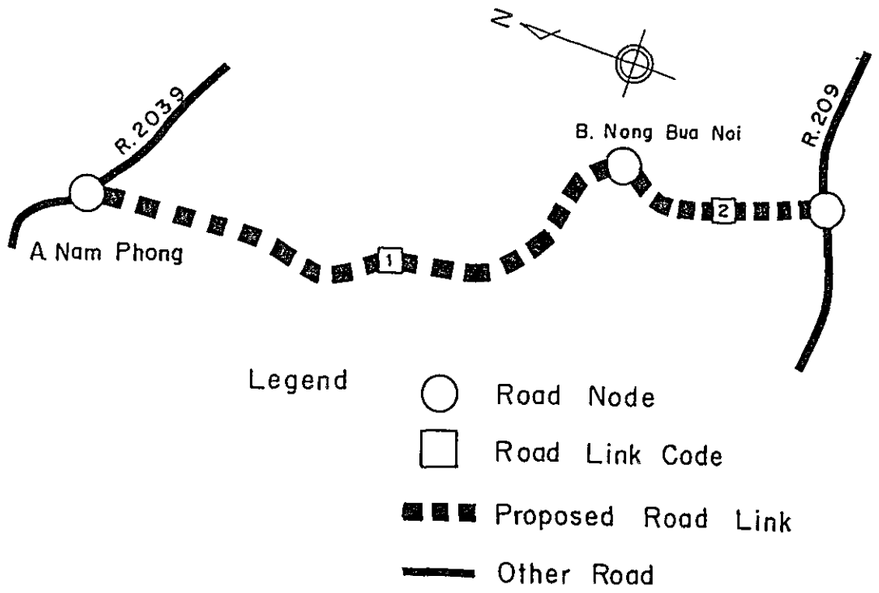
計画対象路線に関し道路改良後の転換交通はほとんど無視し得るので，交通量予測には「伸び率方式」を適用することとした。

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。

to the DOHs traffic records and manual classified count as shown below:

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
DOH (1981)	1 /1	25	46	25	30	9	8	22	61	22	248
	2	N.A.									
Manual Counts (1982)	1	N.A.									
	2	17	139	20	123	1	16	93	77	8	494
Estimated	1	25	46	25	30	9	8	22	61	22	248
	2	17	139	20	123	1	16	93	77	8	494

Note: /1 Route 2183, Station 0100, Station km 24 + 200

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	1661
2	3442

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	277	88	365
2	239	76	314

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	2.4	2.0	1.7
PASSENGER MOVEMENT	6.4	6.4	6.3

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.) 1981－1987	1987－1993	1993－2001
NON-AGRI.	8.2	8.2	8.2
AGRICULTURE	0.5	0.1	0.1
FREIGHT	6.4	6.2	6.2

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	18.5	34.1	18.5	22.2	6.7	7.1	19.5	54.0	19.5
	1987	16.9	35.7	18.1	21.9	7.4	10.1	18.4	48.3	23.2
	1993	15.3	37.3	17.7	21.5	8.2	13.0	17.4	42.6	27.0
	2001	13.1	39.4	17.1	21.1	9.2	17.0	16.0	35.0	32.0
2	1982	5.7	46.3	6.7	41.0	0.3	8.2	47.9	39.7	4.1
	1987	7.6	44.4	9.5	35.8	2.7	10.6	39.5	38.5	11.5
	1993	9.9	42.1	12.8	29.6	5.5	13.3	29.4	37.0	20.3
	2001	13.0	39.0	17.3	21.3	9.3	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 5.2.1 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	37	41	72	16	123	44	85	38	455	384	840
1993	51	61	93	28	180	48	99	61	622	432	1055
2001	80	105	129	57	299	55	121	111	957	469	1426

3. 農業開発

3.1. 現況

影響圏は，Chi 河沿岸に伸びているため，農耕地の殆どは，水田であり，畑地は極めて少い。圏内は殆ど開発されており，未開発可耕地は殆ど残っていない。

Nam Phong 郡に，１日当り8000トンの処理能力のある大規模な精糖工場があり，年間約140万トンの砂糖きびが最も多く，キャツサバ，ケナフ，豆類および落花生が，これに次いでいる。

圏内の土地利用及び土地適応性の状況は，Table 5.3.1 とFigure5.3.1に示し，また，Khon Kaen 県地域の作物暦はFigure5.3.2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 1.3.2.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 1.3.3.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 1.3.4.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 Road Class	With Project /1 Class	With Project Nos. of Wooden Narrow	With Project Nos. of Bridge
1	Flat	23.1	2B	8	2	23.1	1 (F4)		0	
2	Flat	6.0	2B	0	1	6.0			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)	10,487	16,188	28,131

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 5.5.1

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 5.5.2.

ルートの線形は，Figure5.5.2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 5.5.1に示す。

道路規程Ｆ４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 = 29.1 km
Financial Cost	61,472 . 10^3 ¥
Economic Cost	55,565 . 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 5.6.1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 5.7.1に示す通りである。

Table 5.1.1 SUMMARY OF ROAD INVENTORY

Item	Description			
Origin	A. Nam Phong (J.R. 2039)			
Destination	J.R. 209			
Length				
Total			29.1	km
Improvement Section			29.1	km
DOH Road			23.1	km
ARD Road			6.0	km
Others			0	km
New Alignment Section			0	km
Terrain	Flat and Rolling			
Alignment (Hori./Vert.)	Fair / Fair			
Formation Width	6.0 m - 10.0m, 6.9 m (Weighted average)			
Embankment Section				
Length			29.1	km
Height	0.2 m -	m		
Cut Section				
Length			0	km
Depth	m -	m		
Surface Type and Condition				
SBST or DBST	Good		4.1	km
Soil Aggregate	Good		25.0	km
Earth			0	km
Pipe Culvert	36 each			
Box Culvert	2 each		31.5	m
Bridge				
Permanent Bridge	1 each		30.0	m
Narrow Concrete Bridge	1 each		22.0	m (4m)
Wooden Bridge	10 each		109.0	m
Overflow Section	0 place		0	km

Table 5.1.2 ROAD INVENTORY

PROPOSED ROUTE NO. IM-5 ROUTE NO. 2183 ARD A. NAM PHONG (J.R. 2039) ∿ J.R. 209 KHON KAEN L = 29.1

Item		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. NONG NOK KUIEN H = 82 P = 240; B. NA YOM H = 40 P = 350; B. NONG SAENG H = 88 P = 700; B. THA KRA SOEM H = 200 P = 2000; B. KUT PHANG KHUT H = 120 P = 960; B. THA MADUA H = 239 P = 1307; B. KHOK THA H = 174 P = 870; B. NONG TUM H = 280 P = 2800; B. NONG NGU LUAM H = 160 P = 960; B. NONG BUA NOI H = 216 P = 2200; B. KHOK SI H = 280 P = 1400
TERRAIN		Folling; Flat; Rolling; Flat; Rolling
CROSS SECTION	Formation Width (m)	6.50; 6.00; 6.50; 7.00; 6.00; 5.50; 6.00; 7.00; 6.00; 8.00; 10.00; 6.00; 10.00; 8.60
	Embankment Height (m)	0.20
	Cutting Depth (m)	
PAVEMENT	Type/Length	DT; Laterite; DT; Laterite; DT; Laterite; DT; Laterite
	Condition	Good
FLOODING	Overflow Length(Km)/Height(m)	
LAND USE	Left	Bush; Paddy
	Right	Bush; Paddy
PIPE CULVERT	Total Number	36 Pipes
BOX CULVERT & BRIDGE	Station (Km)	3.8; 4.1; 4.6; 6.4; 7.2; 9.8; 11.0; 11.8; 13.0; 17.3; 17.9; 20.7; 23.2; 29.0
	Dimension	C-Br. 8.50 x 30.00; W-Br. 4.50 x 10.00; C-Box 2.50 x 2.00 x 12.50; W-Br. 4.50 x 10.00; W-Br. 4.50 x 10.00; W-Br. 4.50 x 10.00; W-Br. 4.00 x 9.00; W-Br. 4.50 x 6.50; C-Box 3-3.30 x 3.00 x 19.00; W-Br. 4.00 x 15.50; W-Br. 4.00 x 30.00; W-Br. 4.00 x 4.00; W-Br. 4.00 x 4.00; C-Br. 3.50 x 22.00
RIGHT OF WAY (m)		; 20.0
ALIGNMENT	Horizontal	Fair
	Vertical	Fair
ROUTE NO., AGENCIES		DOH 2183; ARD

Table 5.2.1 TRAFFIC VOLUME ON ROUTE IM - 5

YEAR		1987			1993			2001		
LINK		1	2	AVR.	1	2	AVR.	1	2	AVR.
P/C	N+D	32	30	32	42	56	45	57	117	70
	I	5	5	5	6	8	7	9	17	10
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	37	35	37	48	64	51	66	134	80
L/B	N+D	35	38	35	48	73	53	75	155	91
	I	5	6	5	7	11	8	11	23	14
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	40	44	41	55	84	61	86	179	105
M/B	N+D	42	143	63	59	168	81	92	191	112
	I	6	22	9	9	25	12	14	29	17
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	48	165	72	67	193	93	106	220	129
H/B	N+D	14	11	13	22	31	24	40	84	49
	I	2	2	2	3	5	4	6	13	7
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	16	12	16	26	36	28	46	96	57
P/P&T	N+D	83	199	107	128	267	157	225	395	260
	I	13	30	16	19	40	24	34	59	39
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	96	228	123	148	307	180	259	454	299
4/T	N+D	28	78	38	36	64	42	50	43	48
	I	4	12	6	5	10	6	7	6	7
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	32	89	44	41	73	48	57	49	55
6/T	N+D	74	76	74	88	80	86	108	94	105
	I	11	11	11	13	12	13	16	14	16
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	85	87	85	101	92	99	125	108	121
10/T	N+D	36	23	33	56	44	53	99	85	96
	I	5	3	5	8	7	8	15	13	14
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	41	26	38	64	50	61	114	98	111
ADT	N+D	344	597	396	479	782	541	746	1163	832
	I	52	90	59	72	117	81	112	175	125
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	395	686	455	550	899	622	858	1338	957
M/C	N+D	341	439	361	397	472	413	457	474	461
	I	24	19	23	22	9	19	10	0	8
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	365	458	384	419	482	432	467	474	469
TOTAL	N+D	685	1036	757	876	1254	954	1204	1638	1293
	I	76	108	82	94	127	100	122	175	133
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	760	1144	840	970	1381	1055	1325	1812	1426

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

Figure 5.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM – 5

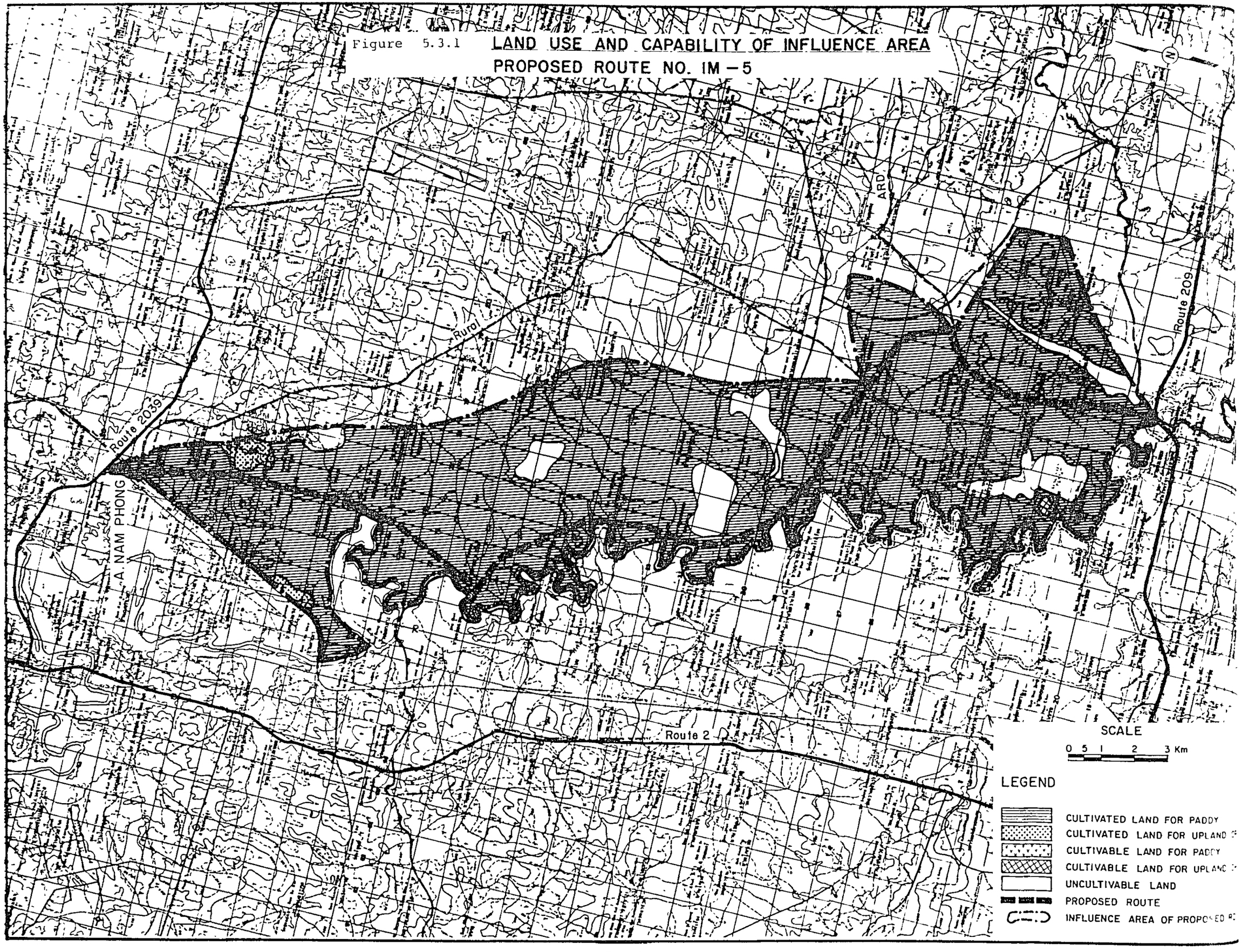
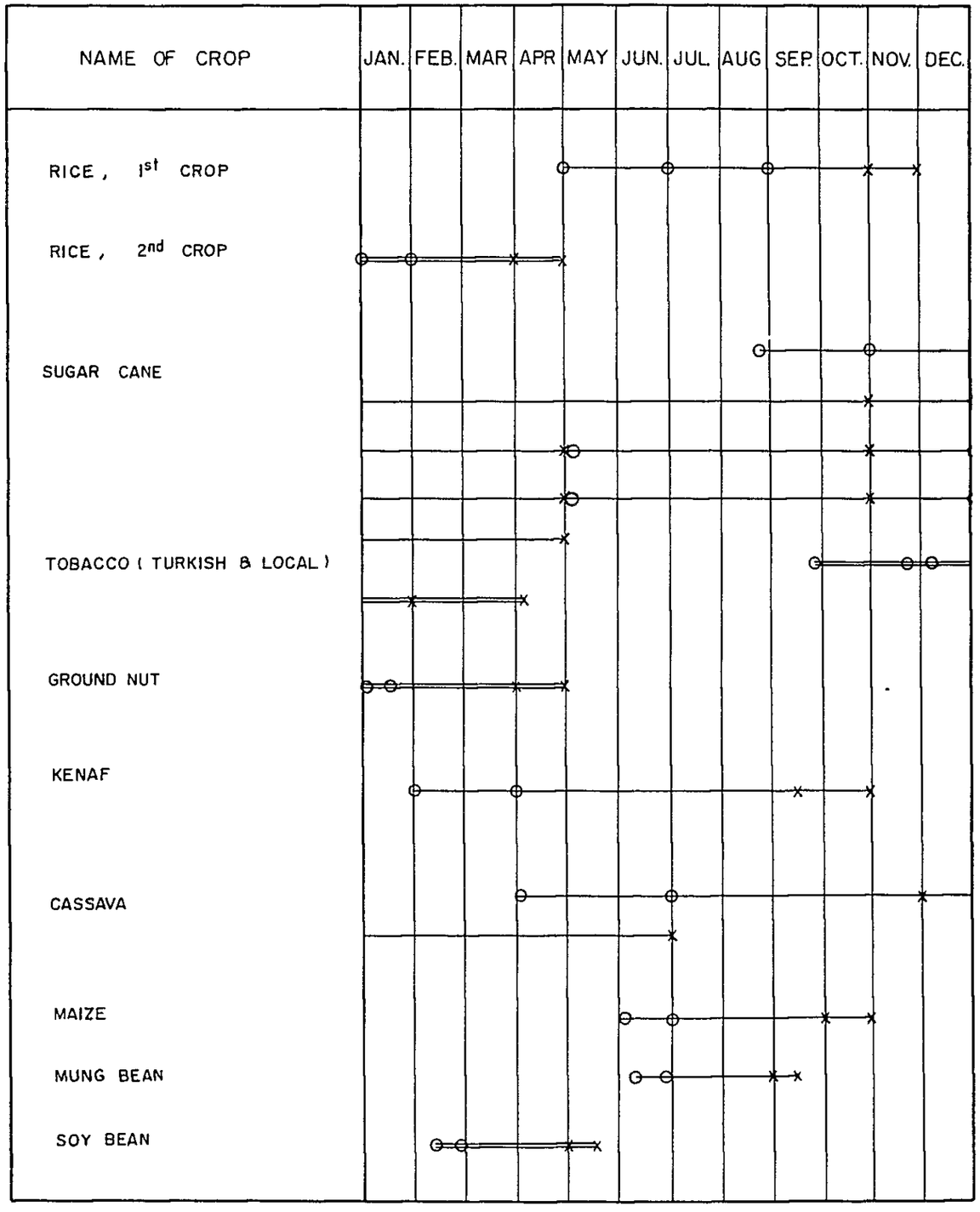


Figure 5.3.2 CROPPING CALENDAR

0600 CHANGWAT KHON KAEN



Note .

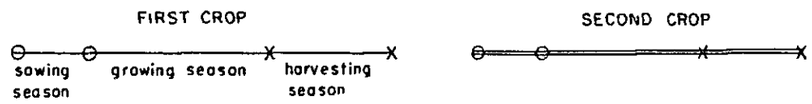


TABLE 5.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND PADDY	CULTIVATED LAND UPLAND	CULTIVATED LAND TOTAL	UNUSED CULTIVABLE LAND PADDY	UNUSED CULTIVABLE LAND UPLAND	UNUSED CULTIVABLE LAND TOTAL
		98.750 (158.0)	0.938 (1.5)	99.688 (159.5)	0.250 (0.4)	-	0.250 (0.4)
0601	M. KHON KAEN	40.000 (64.0)	-	40.000 (64.0)	0.250 (0.4)	-	0.250 (0.4)
0609	NAM PHONG	56.250 (90.0)	0.938 (1.5)	57.188 (91.5)	-	-	-
0610	KRANUAN	2.500 (4.0)	-	2.500 (4.0)	-	-	-

TABLE 5.3.2 CROP PRODUCTION

ITEM			PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)												
1981			77.47	-	-	-	0.38	0.48	0.07	-	0.94	78.41
1987			79.44	-	-	-	0.40	0.46	0.06	-	0.94	80.37
1993	WITHOUT	PROJECT	79.44	-	-	-	0.43	0.44	0.06	-	0.94	80.37
	WITH	PROJECT	79.44	-	-	-	0.42	0.45	0.06	-	0.94	80.37
2001	WITHOUT	PROJECT	79.44	-	-	-	0.46	0.42	0.06	-	0.94	80.37
	WITH	PROJECT	79.44	-	-	-	0.45	0.43	0.05	-	0.94	80.37
CROP YIELD (KG/RAI)												
1981			266.3	-	-	-	2000.0	7117.5	176.0	-		
1987			269.5	-	-	-	2000.0	7160.3	176.0	-		
1993	WITHOUT	PROJECT	272.8	-	-	-	2000.0	7203.4	176.0	-		
	WITH	PROJECT	276.1	-	-	-	2012.0	7246.7	176.0	-		
2001	WITHOUT	PROJECT	277.2	-	-	-	2000.0	7261.2	176.0	-		
	WITH	PROJECT	285.0	-	-	-	2028.2	7363.4	176.0	-		
CROP PRODUCTION (TON)												
1981			20,630	-	-	-	757	3,415	12	-	4,185	24,816
1987			21,410	-	-	-	805	3,300	11	-	4,118	25,528
1993	WITHOUT	PROJECT	21,668	-	-	-	852	3,180	11	-	4,045	25,712
	WITH	PROJECT	21,929	-	-	-	844	3,284	10	-	4,140	26,068
2001	WITHOUT	PROJECT	22,017	-	-	-	917	3,014	10	-	3,942	25,959
	WITH	PROJECT	22,640	-	-	-	916	3,140	9	-	4,066	26,707

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 5.3.3 FARMGATE PRICE AND PRODUCTION COST

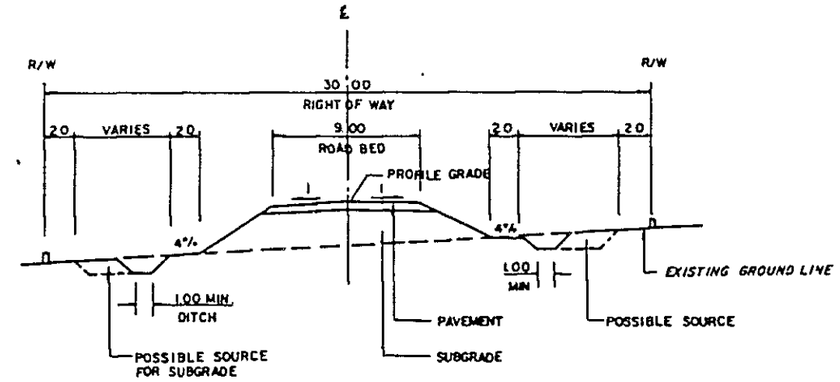
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,587	-	-	-	608	652	4,625	-
WITH PROJECT (1987 - 2001)	3,677	-	-	-	623	652	4,741	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	599	-	-	-	724	2,879	745	-
WITH PROJECT (1987 - 2001)	619	-	-	-	744	2,904	745	-

TABLE 5.3.4 NET PRODUCTION VALUE

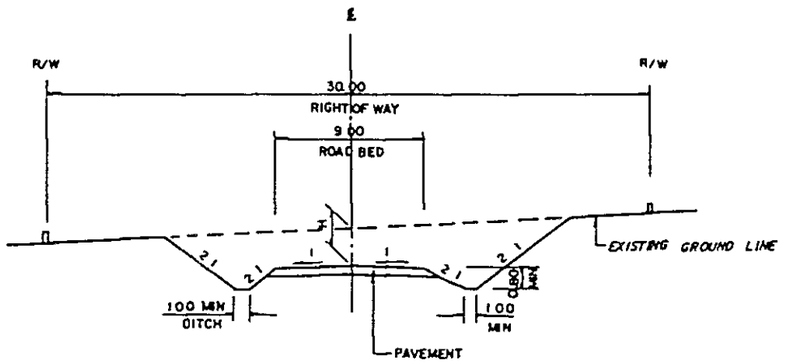
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	29,214	1,030	30,244	29,551	1,024	30,575
1993	30,140	1,019	31,159	31,460	1,047	32,507
2001	31,392	1,002	32,394	34,076	1,051	35,127

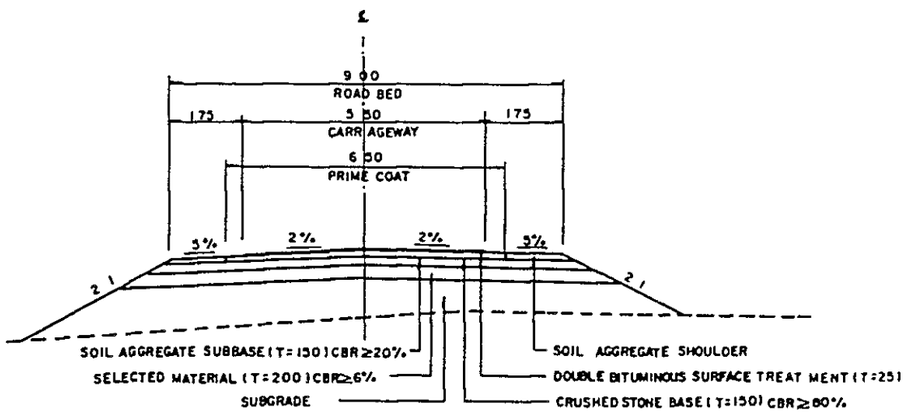
Figure 5. 5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



FILL SECTION

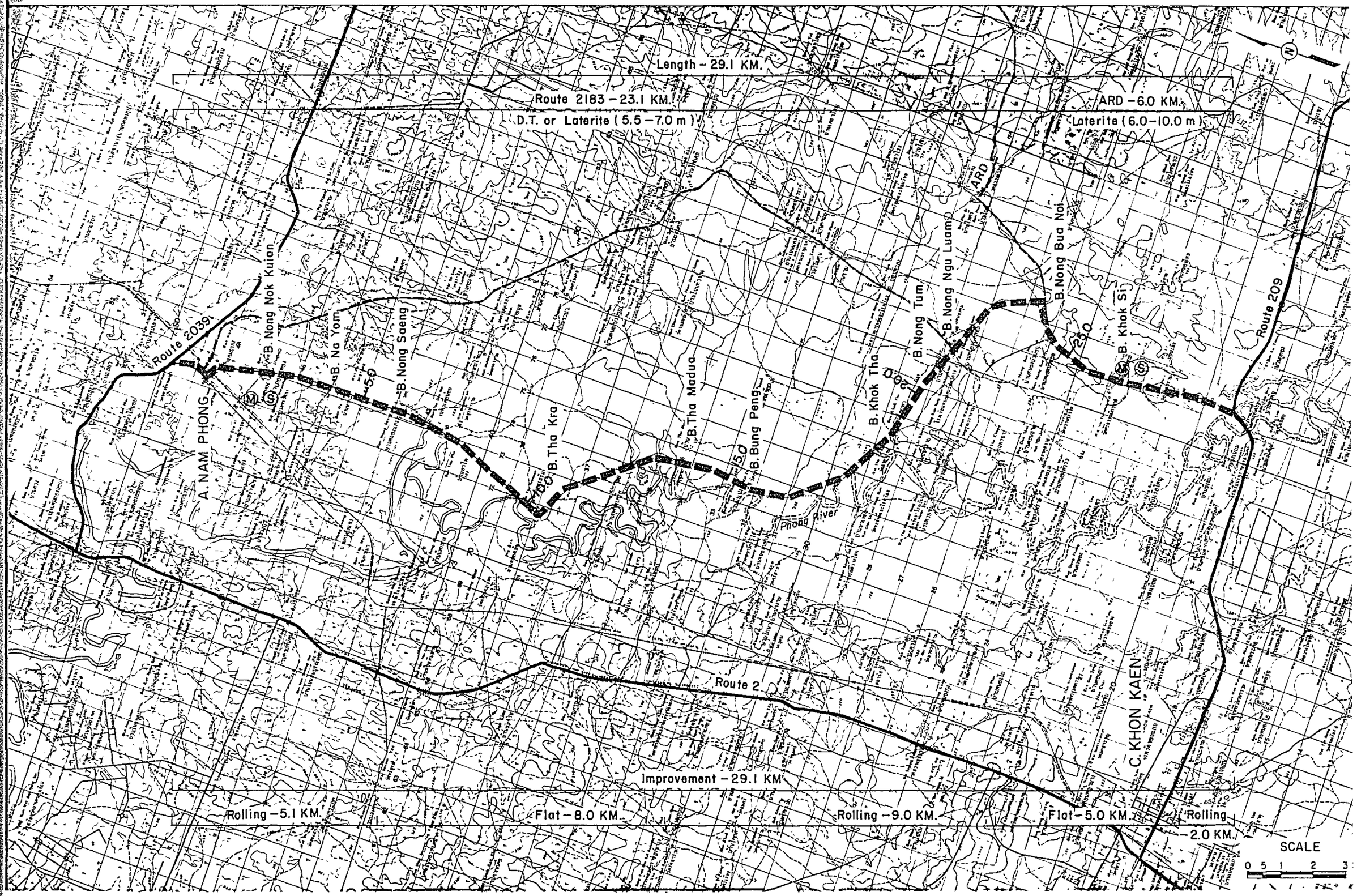


CUT SECTION



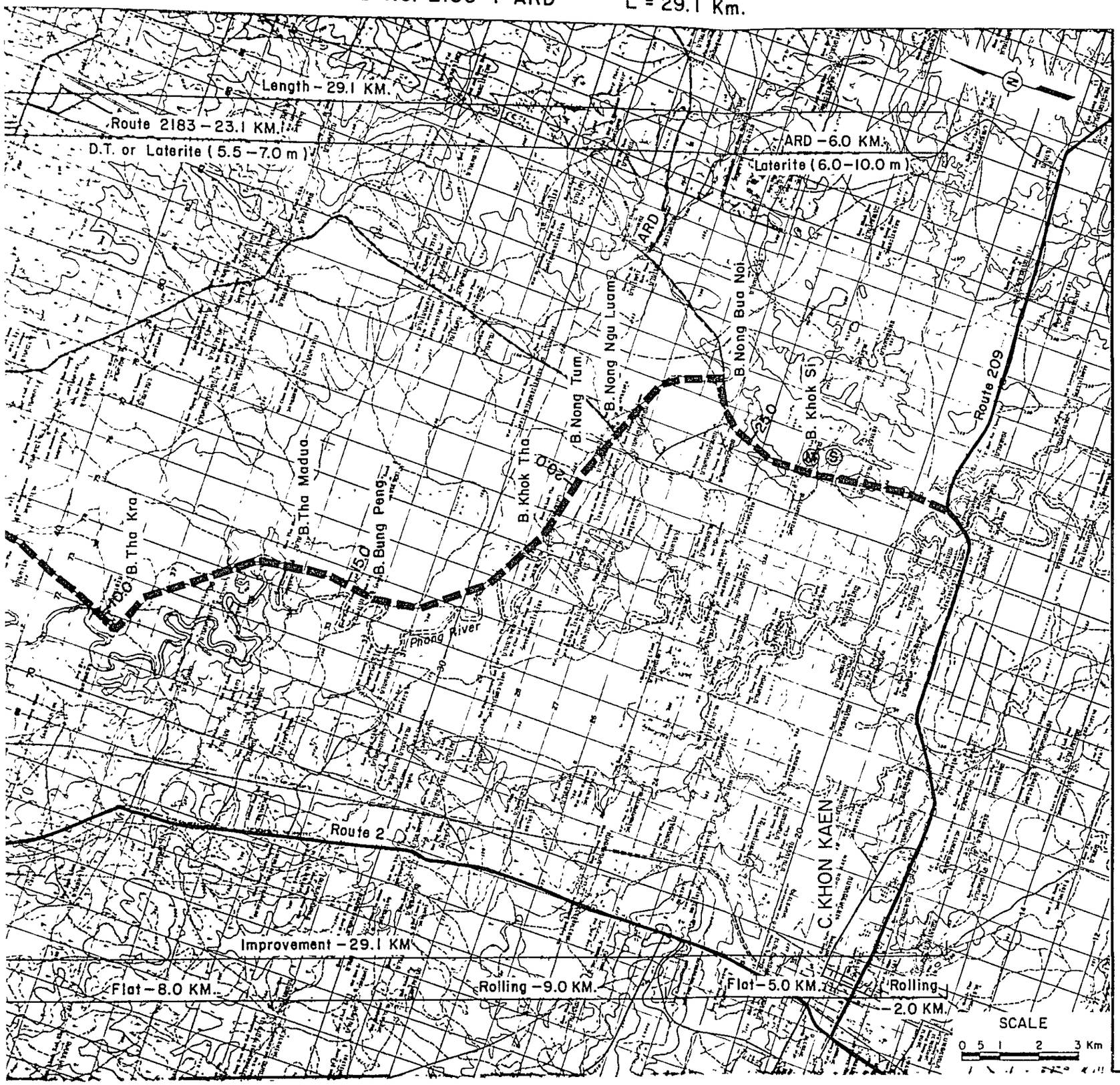
DOUBLE BITUMINOUS SURFACE TREATMENT (DBST) ROAD (Class F4)

Figure 5.5.2 PROPOSED ROUTE NO. IM – 5 C.KHON KAEN A.NAM PHONG (J.R.2039) – J.R.209
ROUTE NO. 2183 + ARD L = 29.1 Km.

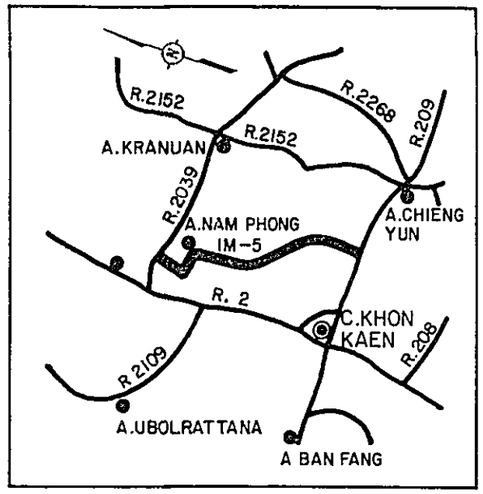


IM – 5 C.KHON KAEN A.NAM PHONG (J.R. 2039) – J.R. 209

ROUTE NO. 2183 + ARD L = 29.1 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	3.8	–	C–8.50 x 30.00
2	4 1	C–7.00 x 12.00	W–4 50 x 10 00
3	6.4	C–7.00 x 12 00	W–4 50 x 10 00
4	7.2	C–7 00 x 12 00	W–4 50 x 10.00
5	9.8	C–7 00 x 12.00	W–4 50 x 10.00
6	11.0	C–7 00 x 12 00	W–4 00 x 9.00
7	11.8	C–7.00 x 9.00	W–4 50 x 6.50
8	17.3	C–7.00 x 18.00	W–4 00 x 15.50
9	17.9	C–7 00 x 32.00	W–4 00 x 30.00
10	20 7	(BOX CULVERT)	W–4 00 x 4.00
11	23 2	(BOX CULVERT)	W–4.00 x 4.00
12	29.0	C–7.00 x 22 00	C–3 50 x 22 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 5.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-5 (29.1 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	67	1,005	914
Excavation - Soil	m^3	20	0	0	0
Excavation - Hard Rock	m^3	160	0	0	0
Embankment	m^3	45	132,140	5,946	5,411
Selected Material	m^3	80	61,700	4,936	4,393
Soil Aggregate Surface or Subbase	m^3	105	43,200	4,536	4,037
Crushed Stone Base	m^3	370	28,400	10,508	9,667
Soil Aggregate Shoulder	m^3	105	12,200	1,281	1,140
Prime Coat and DBST	m^2	55	160,000	8,800	7,920
Pipe Culvert	m	2,100	1,090	2,289	2,105
Box Culvert	m	16,000	0	0	0
Long Span Bridge	m	80,000	0	0	0
Short Span Bridge	m	40,000	141	5,640	5,019
Sub Total (a)				45,773	41,357
Miscellaneous Works (a) x 7%				3,204	2,895
Total (b)				48,977	44,252
PHYSICAL CONTENGENCY (b) x 15%				7,347	6,638
ENGINEERING AND ADMINISTRATION (b) x 10%				4,898	4,425
Sub Total				12,245	11,063
LAND ACQUISITION					
Highly Developed Land	ha	50,000	5	250	250
Less Developed Land	ha	15,000	0	0	0
Sub Total				250	250
GRAND TOTAL				61,472	55,565

Table 5.6.1 COST AND BENEFITS

(F4 STANDARD)

(1000 BAHT)

	COST	BENEFITS				DISCOUNTED(12%)	
YEAR	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	0	0	0	0	0	0	0
1985	22,226	0	0	0	0	27,880	0
1986	33,339	0	0	0	0	37,340	0
1987	0	331	10,487	85	10,903	0	9,735
1988	0	501	11,437	106	12,044	0	9,601
1989	0	670	12,387	127	13,185	0	9,385
1990	0	840	13,337	148	14,325	0	9,104
1991	0	1,009	14,288	169	15,466	0	8,776
1992	0	1,179	15,238	190	16,607	0	8,413
1993	0	1,348	16,188	211	17,747	0	8,028
1994	14,084	1,521	17,681	244	19,446	6,371	7,854
1995	0	1,694	19,174	276	21,144	0	7,625
1996	0	1,867	20,667	309	22,843	0	7,355
1997	0	2,041	22,159	341	24,541	0	7,055
1998	0	2,214	23,652	374	26,240	0	6,735
1999	0	2,387	25,145	406	27,938	0	6,403
2000	0	2,560	26,638	439	29,636	0	6,064
2001	-25,695	2,733	28,131	471	31,335	-4,694	5,725
TOTAL	43,954	22,893	276,609	3,898	303,400	66,896	117,857

DISCOUNTED ECONOMIC COSTS : 66,896

DISCOUNTED ECONOMIC BENEFITS : 117,857

AGRICULTURAL DEVELOPMENT BENEFIT	8,036
VOC SAVING	108,427
RMC SAVING	1,394

NET PRESENT VALUE : 50,961

BENEFIT COST RATIO : 1.76

INTERNAL RATE OF RETURN : 20.0 %

Table 5.7.1 SOCIAL INDICATORS

(Proposed Route IM-5)

Population (1,000)		
1982	:	27.2
1993	:	34.3
Average travelling speed, without (kph)	:	48
Isolation		
Access to Amphoe		
Average distance to Amphoe (km) 1/	:	7.9
Per capita time savings (10^{-4})	:	0.016
Score	:	47
Access to Artery Highway		
Average distance to highway (km) 1/	:	0
Per capita time savings (10^{-4})	:	0
Score	:	0
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/	:	10.0
Per capita time savings (10^{-4})	:	0.020
Score	:	47
Access to Medical Facilities		
Average distance to facilities (km) 1/	:	3.8
Per capita time savings (10^{-4})	:	0.008
Score	:	32
Education		
Access to Secondary School		
Number of Student in 1993 (1,000) 2/	:	6.2
Average distance to school (km)	:	5.4
Per capita time savings (10^{-4})	:	0.060
Score	:	32
Teacher Intensity		
Number of teachers 3/		
University graduate	:	4
Total	:	15
Number of Student	:	365
Indicators		
E1 4/	:	11.0
E2 5/	:	41.1
E 6/	:	52.1
Degree of Improvement 7/	:	1.31
Score	:	84
Disparity		
G.P.V. in 1993 (Mn B) 8/		
With project	:	83.4
Without project	:	80.4
Per capita G.P.V. in 1993 (B)		
With project (W)	:	2,431
Without project (w)	:	2,344
Degree of Disparity		
(A/W) - (A/w) 9/	:	0.05
Score	:	89
Total Score	:	331

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-6

Changwat : Udon Thani / Khon Kaen

B. Sok Chan (J.R.2146)-Ubolrattana Dam(JR2109)

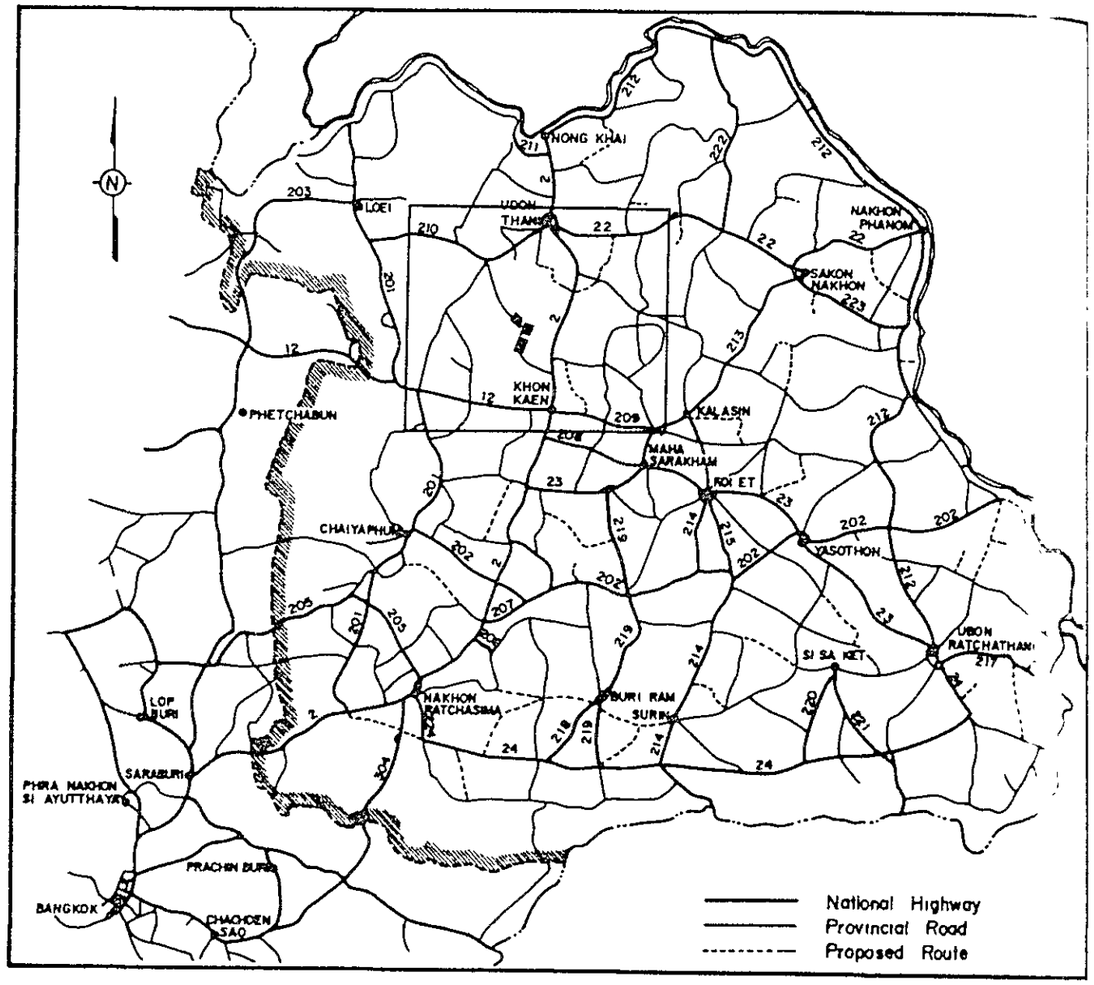
Length : 203 KM.

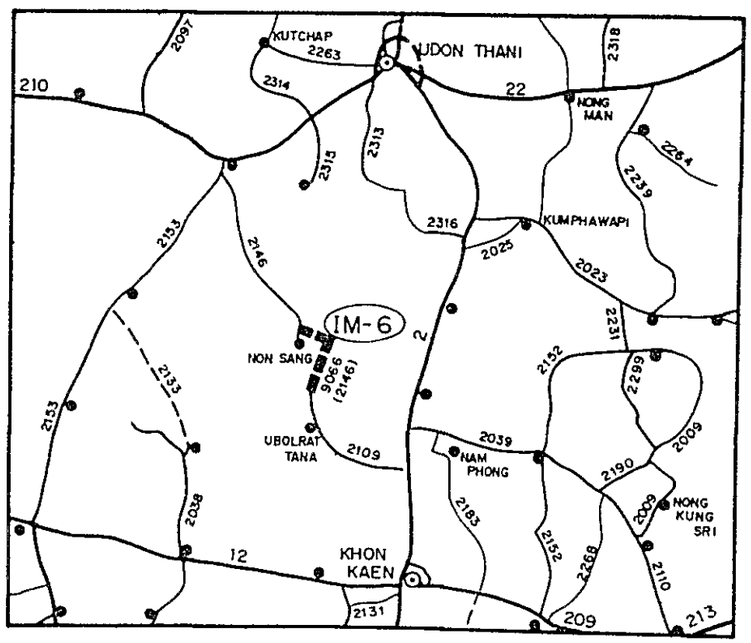
SUMMARY

PROPOSED ROUTE IM-6

Item	Description
Changwat	Udon Thani/Khon Kaen
Origin	B. Sok Chan (J.R. 2146)
Destination	Ubolrattana Dam (J.R. 2109)
Length	
Total	20.3 km
Improvement Section	20.3 km
DOH Road	R.2146 20.3 km
ARD Road	0 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Poor
Terrain	Flat, Rolling and Mountainous
Influence Area	
Area	67 km^2
Population (1982)	4900
Principal Crops	Paddy
Traffic (ADT)	
Existing	102
1993	405
2001	543
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	52,407 . 10^3 ฿
Economic	47,423 . 10^3 ฿
IRR	4.0 %
B/C	0.44
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 およびKhon Kaen 両県にまたがる。ルートは県道2146号線にあるSok Chan村を起点とし，南に走り，Tha Sila村，Pa Kung 村，Kho 村を経て県道2109号線の終点にあるUbolrattava Damで終る。その総延長は20.3kmである。（Figure 6.5.2 参照）

沿道の地形はほとんど平坦，丘陵地であるが，一部急峻な山地部もある。影響圏内には，いくつかの村が存在しその総人口は，4,900人である。

沿道には，ただ1ケ所の医療センターがある。本格線の近くのNang Sang 郡とUbolrattanaには，教育施設として中学校が2ケ所あり医療センター，病院それぞれ1ケ所ずつある。

本路線は，急峻な山地部によって孤立した2つの農業的に開発の進んだ地域を結ぶ重要な道路網の形成と目途として計画された。

1.2 現道の状況

計画路線に利用した現道の状況は，Table 6.1.1 に要約し，その詳細はTable 6.1.2 のインベントリー調査の結果に示した。

2. 交通

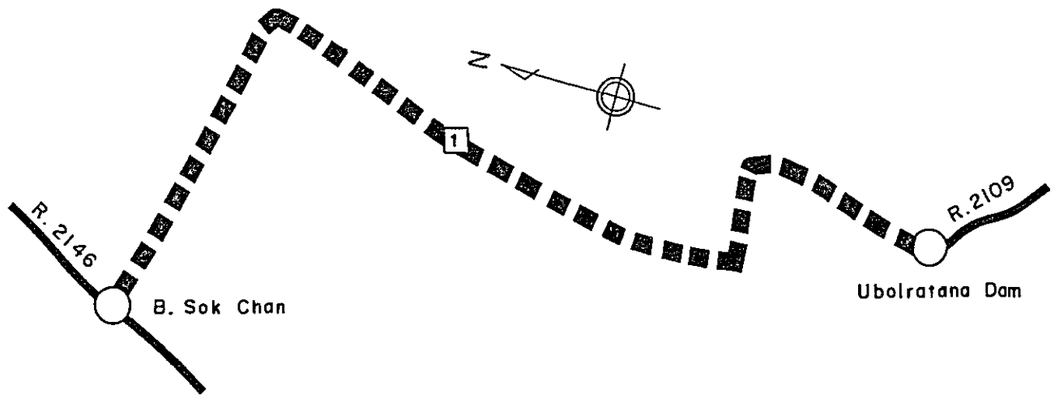
2.1 予測手法

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 [1]	Vehicle Type									
		P/C	P/P	L/B	M/B	H/B	P/T	4/T	6/T	10/T	ADT
DOH (1981)	1	14	19	9	11	2	3	9	-	-	67
Manual Counts (1982)	1	1	69	10	14	-	8	24	3	2	131
Estimated	1	8	44	10	13	1	6	17	2	1	102

Note: [1] Route 2146, Section 0200, Station km 3 + 000

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	643

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	20	9	29

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	1.6	1.4	1.3
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.	7.3	7.5	7.6
AGRICULTURE	0.0	0.0	0.0
FREIGHT	5.1	5.2	5.3

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	10.5	57.9	13.2	17.1	1.3	23.1	65.4	7.7	3.8
	1987	12.3	56.2	12.7	16.3	2.6	21.5	52.4	14.9	11.3
	1993	14.3	54.1	12.1	15.3	4.1	19.6	36.8	23.5	20.1
	2001	17.1	51.3	11.4	14.0	6.1	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 6.2.1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	14	14	18	3	68	12	4	3	136	197	332
1993	22	18	23	6	86	8	5	4	174	231	405
2001	39	26	32	14	122	4	8	8	254	290	543

3. 農業開発

3.1. 現況

影響圏は，急傾斜の丘陵地帯と，Nam Phong 貯水池があるため限出されて小さい。圏内は，Nam Phong 郡側と，Sang郡側は，殆ど 100%，またUbolratana郡側は，約80%が水田である。未開発可耕地は，残っていない。畑地では，キャツサバが最も多く，砂糖きび及びケナフがこれに次いでいる。これ等の商品作物は，2109号路線を径て，Nam Phong 郡又はKhon Kaen 付近の国道２号路線上にある関連加工工場に出荷されている。

圏内の土地利用及び土地適応性の状況は，Table 6.3.1とFigure6.3.1に示し，また，Udon Thani及びKhon Kaen 両県地域の作物暦は，Figure6.3.2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 6.3.2.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 6.3.3.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 6.3.4.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)	Road Class[1]	Nos. of Wooden Bridge	Nos. of Narrow C.Bridge	With Project: Length (km)	Road Class[1] Case 1	Case 2	Nos. of Wooden Narrow Bridge
1	Flat, Rolling & Mount-anious	20.3	3	3	0	20.3	1(F4)	2A(F5)	0

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)	2,353	3,462	5,623
2A (F5)	1,738	2,670	4,470

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 6.5.1

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 6.5.2

ルートの線形は，Figure6.5.2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 6.5.1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 ¥) Financial Cost	Economic Cost	Remark
F4 (DBST)	20.3	52,407	47,423	
F5 (Soil Aggregate)	20.3	24,199	21,903	

6. 経済評価

年次別経済費用と便益及び評価結果はTable 6.6.1，及び6.6.2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 6.7.1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 6.1.1 SUMMARY OF ROAD INVENTORY

Item	Description		
Origin	B. Sok Chan (J.R. 2146)		
Destination	Ubolrattana Dam (J.R. 2109)		
Length			
Total			20.3 km
Improvement Section			20.3 km
DOH Road	R. 2146		20.3 km
ARD Road			0 km
Others			0 km
New Alignment Section			0 km
Terrain	Flat, Rolling and Mountainous		
Alignment (Hori./Vert.)	Poor		
Formation Width	6.0 m - 7.0 m, 6.5 m (Weighted average)		
Embankment Section			
Length			19.3 km
Height	0.3 m - 1.0 m		
Cut Section			
Length			1.0 km
Depth	1.5 m - m		
Surface Type and Condition			
SBST or DBST	Poor		1.0 km
Soil Aggregate	Poor		19.3 km
Earth			0 km
Pipe Culvert	23 each		
Box Culvert	0 each		0 m
Bridge			
Permanent Bridge	0 each		0 m
Narrow Concrete Bridge	0 each		0 m (4m)
Wooden Bridge	3 each		59.0 m
Overflow Section	0 place		0 km

Table 6.1.2 ROAD INVENTORY

PROPOSED ROUTE NO. IM-6 ROUTE NO. 9066 (2146) B. SOK CHAN (J.R. 2146) ∿ UBOLRATANA DAM (J.R. 2109) L = 20.3

UDON THANI/KHON KAEN

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. SOK CHAN H = 220 P = 880; B. PA KUNG H = 70 P = 350; B. THA SIA H = 32 P = 200; B. NONG KUNG H = 1500 P = 12000
TERRAIN		Flat | Rolling | Mountainous | Rolling
CROSS SECTION	Formation Width (m)	7.00 | 6.00 | 7.50 | 4.00 | 6.00 | 7.00
	Embankment Height (m)	0.50 | 0.30 | 1.00 | 0.50 | 0.40 | 0.20
	Cutting Depth (m)	1.50
PAVEMENT	Type/Length	DT | Laterite
	Condition	Poor
FLOODING	Overflow Length(Km)/Height(m)	
LAND USE	Left	Paddy | Bush | Forest
	Right	Paddy | Bush | Forest
PIPE CULVERT	Total Number	23 Pipes
BOX CULVERT & BRIDGE	Station (Km)	0.7; 1.7; 2.2
	Dimension	W-Br. 4.00 x 10.50; W-Br. 4.00 x 28.50; W-Br. 4.50 x 20.00
RIGHT OF WAY (m)		18.0
ALIGNMENT	Horizontal	Fair | Poor | Fair
	Vertical	Fair | Poor | Fair
ROUTE NO., AGENCIES		DOH 9066 (2146)

Table 6.2.1 TRAFFIC VOLUME ON ROUTE IM - 6

YEAR		1987		1993		2001	
LINK		1	AVR.	1	AVR.	1	AVR.
P/C	N+D	12	12	19	19	34	34
	I	2	2	3	3	5	5
	DV	0	0	0	0	0	0
	TOTAL	14	14	22	22	39	39
L/B	N+D	12	12	16	16	23	23
	I	2	2	2	2	3	3
	DV	0	0	0	0	0	0
	TOTAL	14	14	18	18	26	26
M/B	N+D	16	16	20	20	28	28
	I	2	2	3	3	4	4
	DV	0	0	0	0	0	0
	TOTAL	18	18	23	23	32	32
H/B	N+D	3	3	5	5	12	12
	I	0	0	1	1	2	2
	DV	0	0	0	0	0	0
	TOTAL	3	3	6	6	14	14
P/P&T	N+D	59	59	75	75	106	106
	I	9	9	11	11	16	16
	DV	0	0	0	0	0	0
	TOTAL	68	68	86	86	122	122
4/T	N+D	11	11	7	7	3	3
	I	2	2	1	1	0	0
	DV	0	0	0	0	0	0
	TOTAL	12	12	8	8	4	4
6/T	N+D	3	3	5	5	7	7
	I	0	0	1	1	1	1
	DV	0	0	0	0	0	0
	TOTAL	4	4	5	5	8	8
10/T	N+D	2	2	4	4	7	7
	I	0	0	1	1	1	1
	DV	0	0	0	0	0	0
	TOTAL	3	3	4	4	8	8
ADT	N+D	118	118	151	151	220	220
	I	18	18	23	23	33	33
	DV	0	0	0	0	0	0
	TOTAL	136	136	174	174	254	254
M/C	N+D	179	179	211	211	267	267
	I	18	18	20	20	23	23
	DV	0	0	0	0	0	0
	TOTAL	197	197	231	231	290	290
TOTAL	N+D	297	297	363	363	488	488
	I	35	35	42	42	56	56
	DV	0	0	0	0	0	0
	TOTAL	332	332	405	405	543	543

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

Figure 6.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM - 6

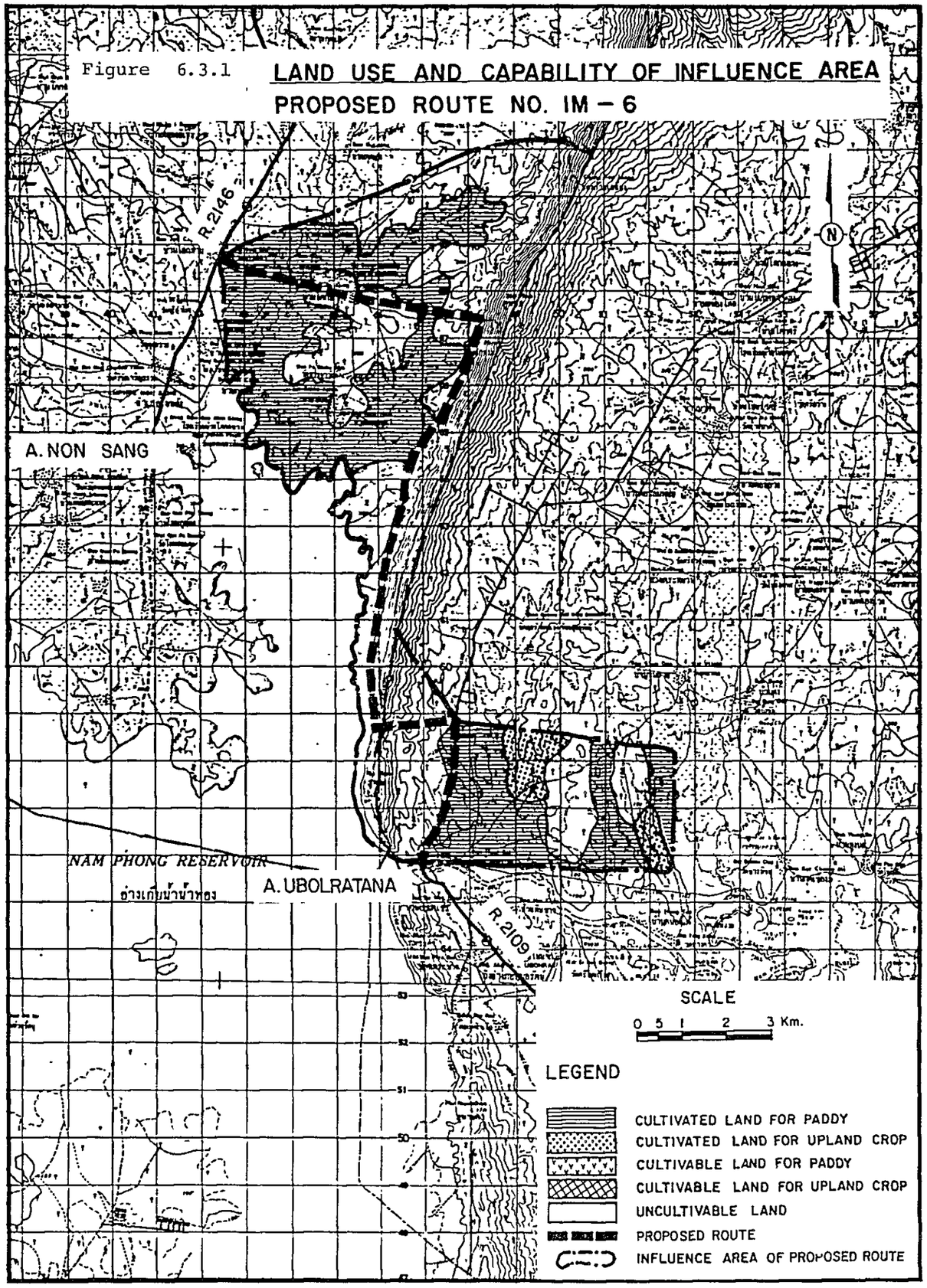
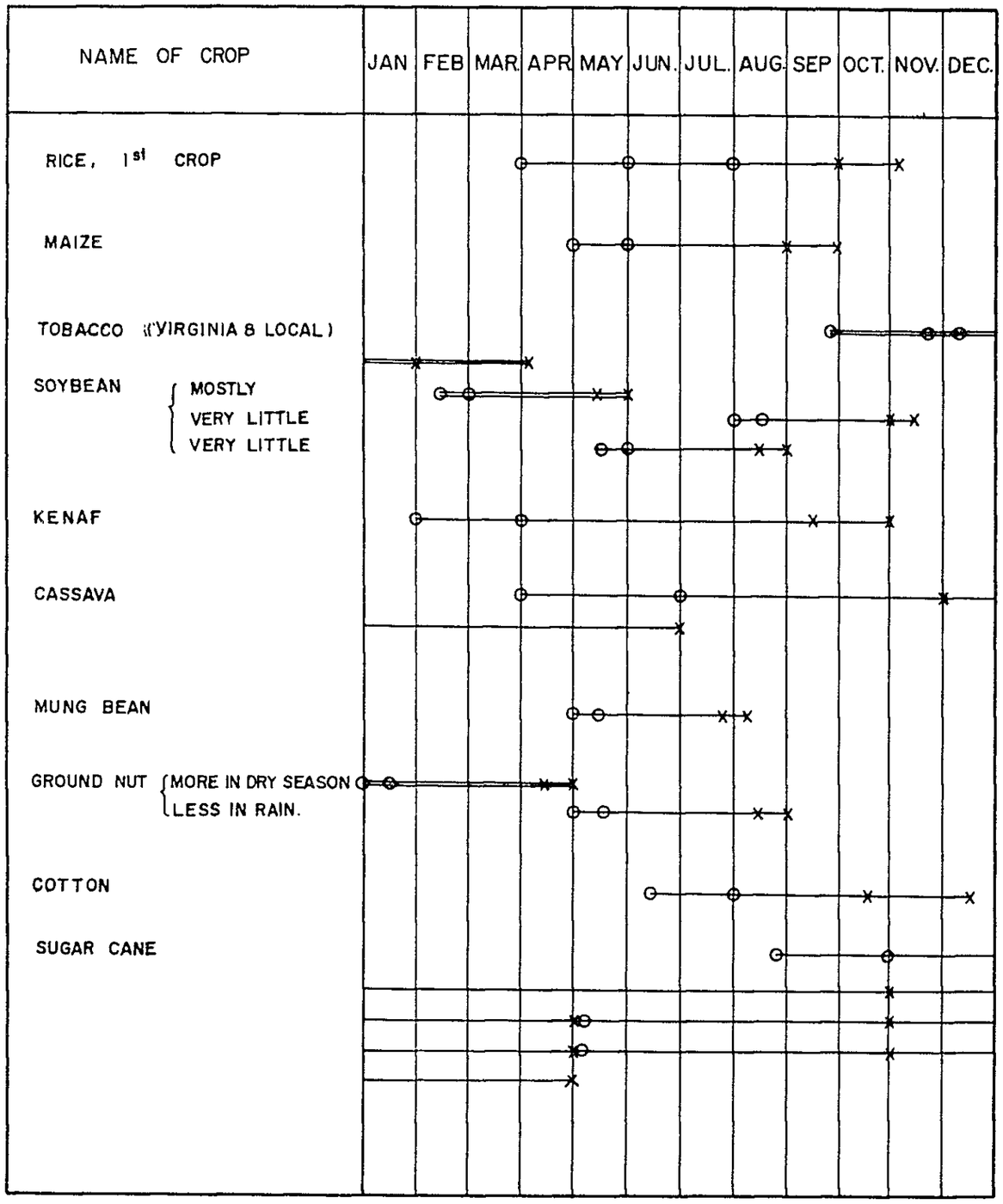


Figure 6.3.2 CROPPING CALENDAR (1)

0200 CHANGWAT UDON THANI



CROPPING CALENDAR (2)

0600 CHANGWAT KHON KAEN

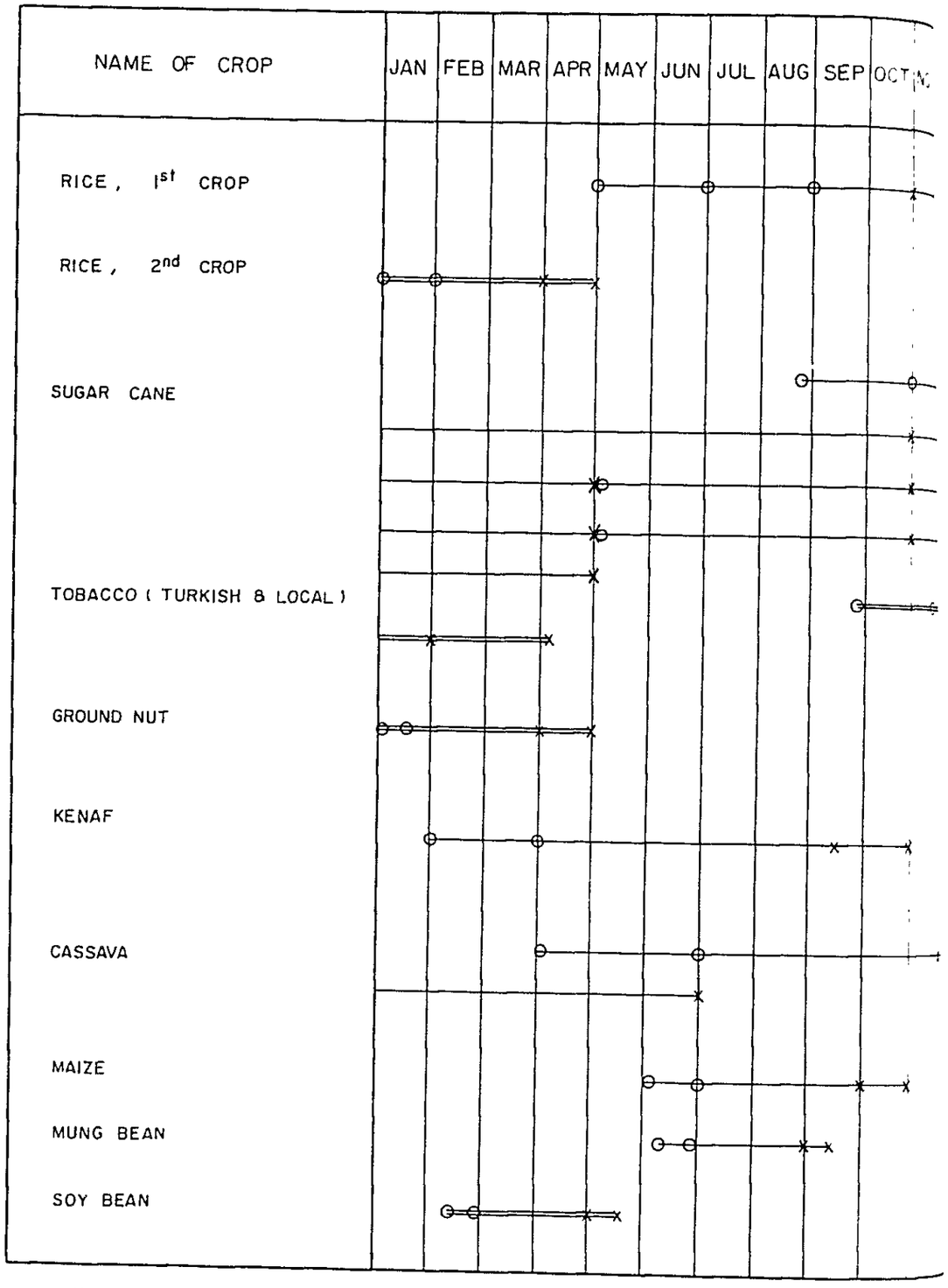


TABLE 6.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		14.375 (23.0)	1.250 (2.0)	15.625 (25.0)	-	-	-
0213	NON SANG	10.000 (16.0)	-	10.000 (16.0)	-	-	-
0607	UBOLRATANA	4.375 (7.0)	1.250 (2.0)	5.625 (9.0)	-	-	-

TABLE 6.3.2 CROP PRODUCTION

ITEM			PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)												
1981			16.45	-	-	-	0.80	0.18	0.24	-	1.25	17.70
1987			16.45	-	-	-	0.83	0.17	0.22	-	1.25	17.70
1993	WITHOUT	PROJECT	16.45	-	-	-	0.86	0.16	0.20	-	1.25	17.70
	WITH	PROJECT	16.45	-	-	-	0.86	0.17	0.19	-	1.25	17.70
2001	WITHOUT	PROJECT	16.45	-	-	-	0.90	0.14	0.18	-	1.25	17.70
	WITH	PROJECT	16.45	-	-	-	0.90	0.15	0.17	-	1.25	17.70
CROP YIELD (KG/RAI)												
1981			261.7	-	-	-	2200.0	7117.5	294.0	-		
1987			263.3	-	-	-	2200.0	7160.3	294.0	-		
1993	WITHOUT	PROJECT	264.9	-	-	-	2200.0	7203.4	294.0	-		
	WITH	PROJECT	268.1	-	-	-	2213.2	7246.7	294.0	-		
2001	WITHOUT	PROJECT	267.0	-	-	-	2200.0	7261.2	294.0	-		
	WITH	PROJECT	274.6	-	-	-	2231.0	7363.4	294.0	-		
CROP PRODUCTION (TON)												
1981			4,304	-	-	-	1,755	1,277	69	-	3,107	7,411
1987			4,330	-	-	-	1,825	1,208	64	-	3,102	7,433
1993	WITHOUT	PROJECT	4,356	-	-	-	1,892	1,139	59	-	3,095	7,451
	WITH	PROJECT	4,409	-	-	-	1,913	1,201	56	-	3,175	7,584
2001	WITHOUT	PROJECT	4,391	-	-	-	1,977	1,049	53	-	3,083	7,475
	WITH	PROJECT	4,516	-	-	-	2,014	1,114	50	-	3,183	7,698

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 6.3.3 FARMGATE PRICE AND PRODUCTION COST

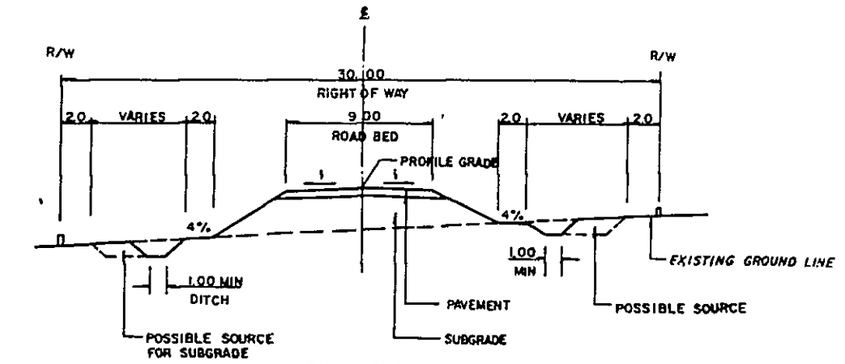
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,799	-	-	-	608	652	4,625	-
WITH PROJECT (1987 - 2001)	3,894	-	-	-	623	652	4,741	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	608	-	-	-	724	2,879	845	-
WITH PROJECT (1987 - 2001)	628	-	-	-	744	2,929	845	-

TABLE 6.3.4 NET PRODUCTION VALUE

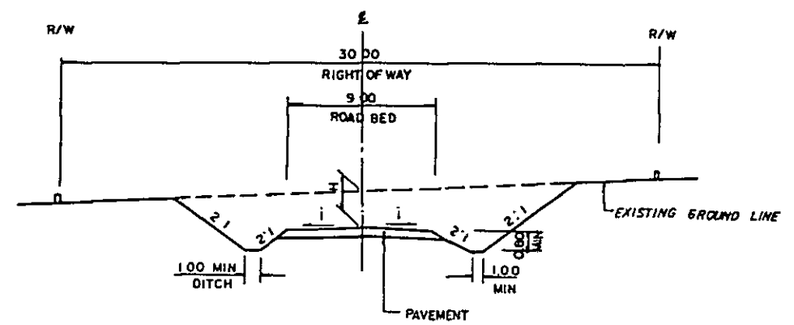
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	6,448	926	7,374	6,530	936	7,466
1993	6,547	924	7,471	6,836	955	7,791
2001	6,680	916	7,596	7,253	965	8,218

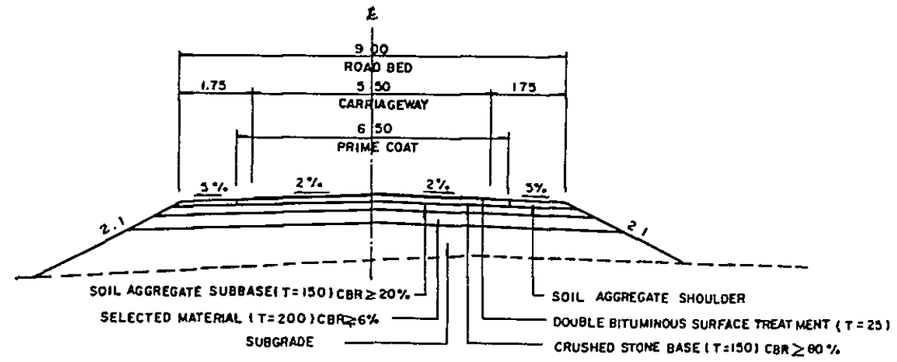
Figure 6. 5. 1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



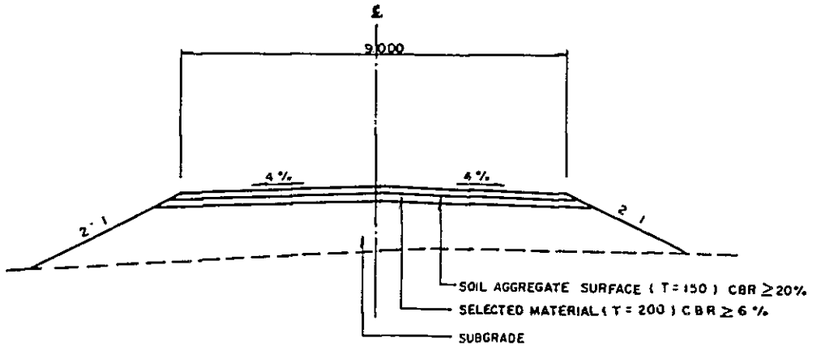
FILL SECTION



CUT SECTION



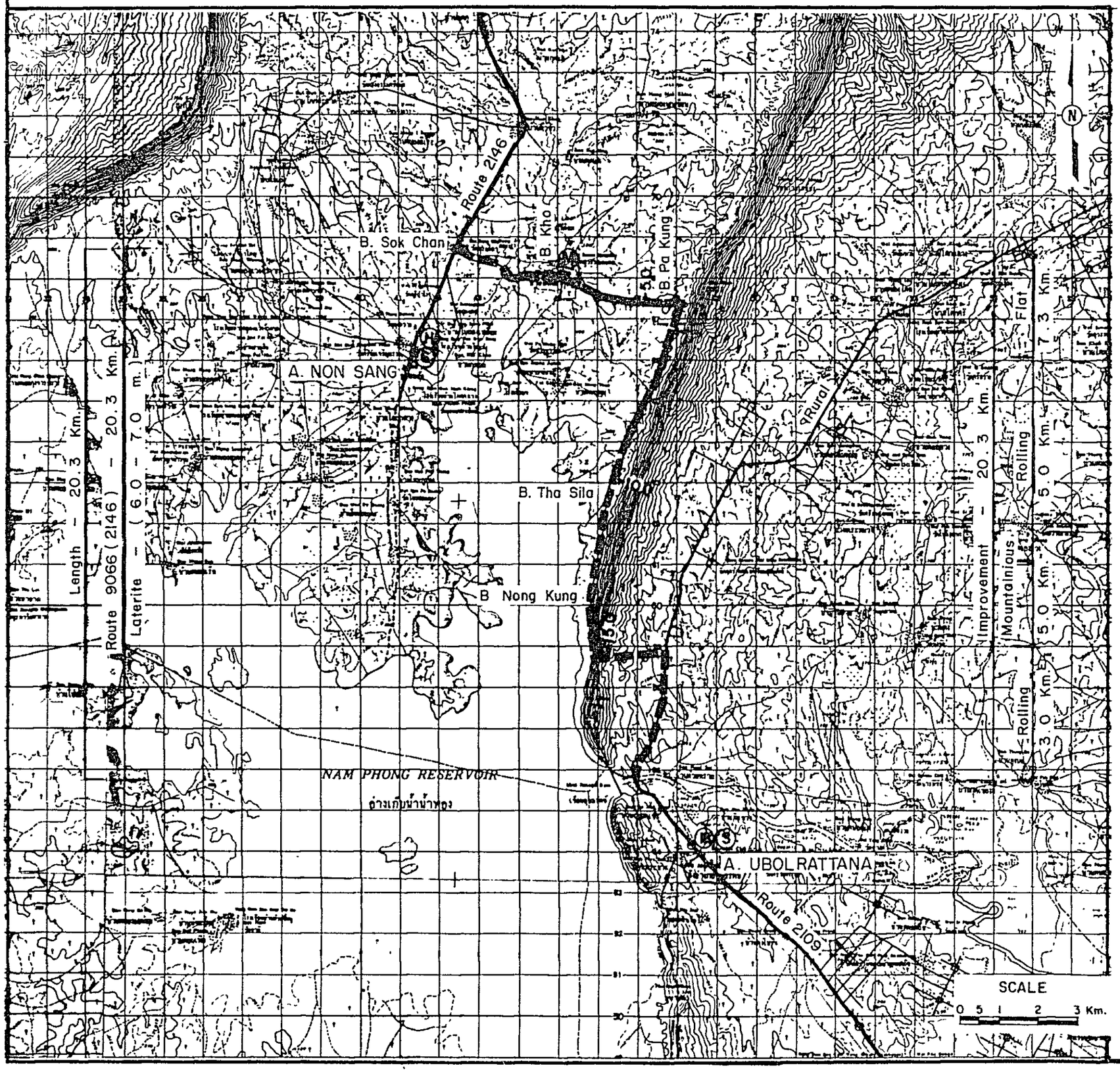
DOUBLE BITUMINOUS SURFACE TREATMENT (DBST) ROAD (Class F4)



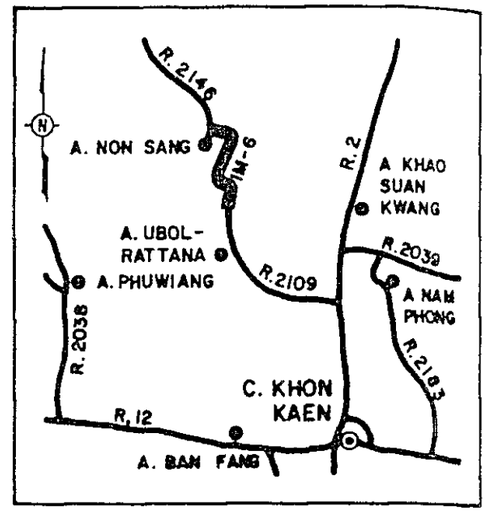
SOIL AGGREGATE SURFACED ROAD (Class F5)

Figure 6.5.2

PROPOSED ROUTE NO. IM-6 C. UDON THANI KHON KAEN B. SOK CHAN (J.R. 2146) - UBOL RATTANA DAM (J.R. 2109) ROUTE NO. 9066 (2146) L = 20.3 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	0.7	C-7.00 x 14.00	W-4.00x10.50
2	1.7	C-7.00 x 30.00	W-4.00x28.50
3	2.2	C-7.00 x 21.00	W-4.50x20.00

LEGEND

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

Table 6.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-6 (20.3 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	48	720	655	48	720	655
Excavation - Soil	m^3	20	27,900	558	502	27,900	558	502
Excavation - Hard Rock	m^3	160	65,200	10,432	9,388	65,200	10,432	9,388
Embankment	m^3	45	62,200	2,799	2,547	62,200	2,799	2,547
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	2,400	888	816
Soil Aggregate Shoulder	m^3	105	8,300	871	775	1,100	115	102
Prime Coat and DBST	m^2	55	108,900	5,990	5,391	13,800	759	683
Pipe Culvert	m	2,100	520	1,092	1,004	520	1,092	1,004
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	65	2,600	2,314	65	2,600	2,314
Sub Total (a)				38,651	34,886		26,410	23,753
Miscellaneous Works (a) x 7%				2,706	4,884		1,849	1,663
Total (b)				41,357	39,770		28,259	25,416
PHYSICAL CONTENGENCY (b) x 15%				6,204	5,966		4,239	3,812
ENGINEERING AND ADMINISTRATION (b) x 10%				4,136	3,977		2,826	2,542
Sub Total				10,340	9,943		7,065	6,354
LAND ACQUISITION								
Highly Developed Land	ha	50,000	10	500	500	10	500	500
Less Developed Land	ha	15,000	14	210	210	14	210	210
Sub Total				710	710		710	710
GRAND TOTAL				52,407	47,423		36,034	32,480

Table 6.6.1 COST AND BENEFITS

(F4 STANDARD)

(1000 BAHT)

	COST	BENEFITS				DISCOUNTED(12%)	
YEAR	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	0	0	0	0	0	0	0
1985	18,969	0	0	0	0	23,795	0
1986	28,454	0	0	0	0	31,868	0
1987	0	92	2,353	-91	2,354	0	2,101
1988	0	130	2,538	-82	2,586	0	2,061
1989	0	168	2,723	-73	2,817	0	2,005
1990	0	206	2,907	-64	3,049	0	1,938
1991	0	244	3,092	-55	3,281	0	1,862
1992	0	282	3,277	-46	3,513	0	1,780
1993	0	320	3,462	-37	3,745	0	1,694
1994	9,825	358	3,732	-23	4,067	4,444	1,642
1995	0	396	4,002	-9	4,388	0	1,582
1996	0	433	4,272	4	4,710	0	1,516
1997	0	471	4,543	18	5,031	0	1,446
1998	0	509	4,813	32	5,353	0	1,374
1999	0	547	5,083	45	5,675	0	1,300
2000	0	584	5,353	59	5,996	0	1,227
2001	-23,578	622	5,623	72	6,318	-4,308	1,154
TOTAL	33,670	5,361	57,773	-251	62,883	55,800	24,685

DISCOUNTED ECONOMIC COSTS : 55,800

DISCOUNTED ECONOMIC BENEFITS : 24,685

AGRICULTURAL DEVELOPMENT BENEFIT	1,913
VOC SAVING	23,045
RMC SAVING	-274

NET PRESENT VALUE : -31,115

BENEFIT COST RATIO : 0.44

INTERNAL RATE OF RETURN : 4.0 %

Table 6.6.2 COST AND BENEFITS

(F5 STANDARD)

(1000 BAHT)

	COST	BENEFITS				DISCOUNTED(12%)	
YEAR	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	0	0	0	0	0	0	0
1985	12,992	0	0	0	0	16,297	0
1986	19,488	0	0	0	0	21,827	0
1987	0	92	1,738	-19	1,811	0	1,617
1988	0	130	1,893	-12	2,012	0	1,604
1989	0	168	2,049	-5	2,212	0	1,574
1990	0	206	2,204	2	2,412	0	1,533
1991	0	244	2,359	9	2,612	0	1,482
1992	0	282	2,515	16	2,812	0	1,425
1993	0	320	2,670	22	3,012	0	1,363
1994	1,210	358	2,895	32	3,285	547	1,327
1995	0	396	3,120	42	3,558	0	1,283
1996	0	433	3,345	53	3,831	0	1,233
1997	0	471	3,570	63	4,104	0	1,180
1998	0	509	3,795	73	4,376	0	1,123
1999	0	547	4,020	83	4,649	0	1,066
2000	0	584	4,245	93	4,922	0	1,007
2001	-15,324	622	4,470	103	5,195	-2,800	949
TOTAL	18,366	5,361	44,888	554	50,803	35,871	19,765

DISCOUNTED ECONOMIC COSTS : 35,871

DISCOUNTED ECONOMIC BENEFITS : 19,765

AGRICULTURAL DEVELOPMENT BENEFIT	1,913
VOC SAVING	17,719
RMC SAVING	133

NET PRESENT VALUE : -16,106

BENEFIT COST RATIO : 0.55

INTERNAL RATE OF RETURN : 6.2 %

Table 6.7.1 SOCIAL INDICATORS

(Proposed Route IM-6)

Population (1,000)		
1982	:	4.9
1993	:	5.8
Average travelling speed, without (kph)	:	40
Isolation		
Access to Amphoe		
Average distance to Amphoe (km) 1/	:	4.2
Per capita time savings (10^{-4})	:	0.0086
Score	:	253
Access to Artery Highway		
Average distance to highway (km) 1/	:	0
Per capita time savings (10^{-4})	:	0
Score	:	0
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/	:	4.2
Per capita time savings (10^{-4})	:	0.086
Score	:	200
Access to Medical Facilities		
Average distance to facilities (km) 1/	:	4.2
Per capita time savings (10^{-4})	:	0.086
Score	:	344
Education		
Access to Secondary School		
Number of Student in 1993 (1,000) 2/	:	1.0
Average distance to school (km)	:	4.2
Per capita time savings (10^{-4})	:	0.467
Score	:	252
Teacher Intensity		
Number of teachers 3/		
University graduate	:	-
Total	:	10
Number of Student	:	152
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	:	19.4
Without project	:	18.7
Per capita G.P.V. in 1993 (B)		
With project (W)	:	3,345
Without project (w)	:	3,224
Degree of Disparity		
(A/W) - (A/w) 9/	:	0
Score	:	0
Total Score	:	1,134

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.