PROPOSED ROUTE NO. IM - 14

Changwat : Sakon Nakhon

J.R. 223 - K.A. Tao Ngai

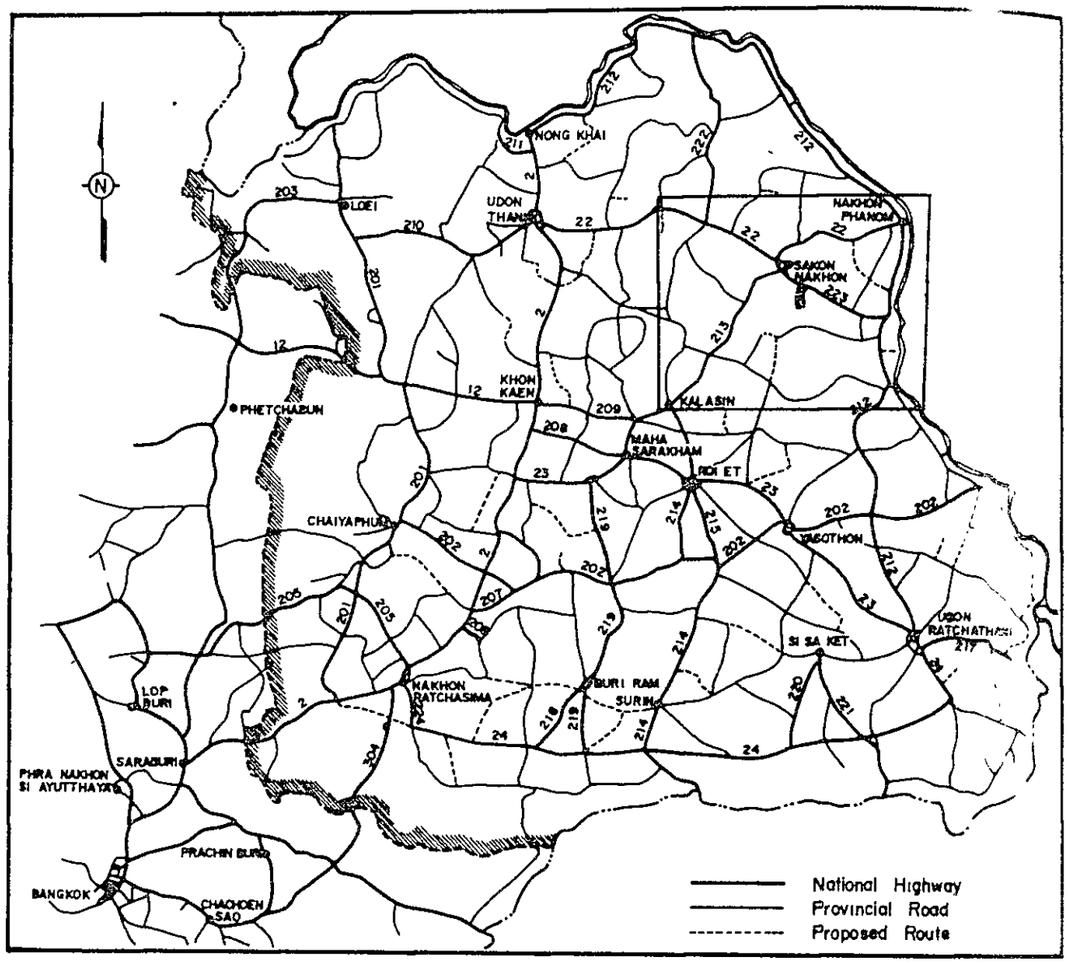
Length : 12.0 KM.

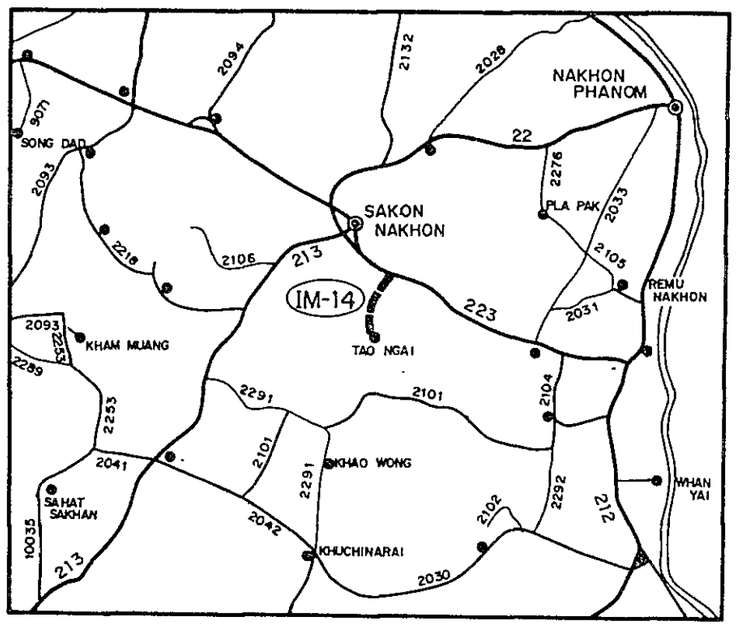
SUMMARY

PROPOSED ROUTE IM-14

Item	Description
Changwat	Sakhon Nakhon
Origin	J.R.223
Destination	K.A. Tao Ngai
Length	
Total	12.0 km
Improvement Section	12.0 km
DOH Road	0 km
ARD Road	12.0 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Poor
Terrain	Flat and Rolling
Influence Area	
Area	58 km^2
Population (1982)	6,600
Principal Crops	Paddy
Traffic (ADT)	
Existing	95
1993	384
2001	495
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	27,687 . 10^3 ฿
Economic	25,135 . 10^3 ฿
IRR	3.7 %
B/C	0.43
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,Sakon　Nakhon県の南に位置している。ルートは，県道 223号線と交差するところを起点とし，南に走り，Non Hom 村,Nong Bua 村を経て，Tao　Nagai準郡で終る。その総延長は，12.0kmである。（Figure 14.5.2 参照）

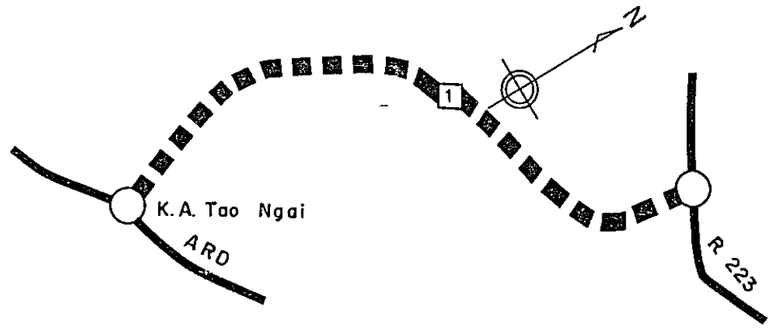
沿道の地形は，ほとんど平坦であるが一部に丘陵地も含む。影響圏内には，いくつかの村が存在し，その総人口は 6,600人である。沿道には医療センターが２ケ所あるが病院はない。教育施設として中学校が１ケ所ある。

本路線はTao Ngai準郡と幹線道路 223号線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　14.1.1 に要約し，その詳細はTable　14.1.2のインベントリー調査の結果に示した。

Proposed Road Link



Legend

○ Road Node

□ Road Link Code

■■■ Proposed Road Link

——— Other Road

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	2	19	47	1	-	2	5	19	-	95

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），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	780

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	40	6	46

2.4 交通需要の将来伸び率

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

GROWTH RATE OF PASSENGER MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981 － 1987	1987 － 1993	1993 － 2001
PER CAPITA INCOME	4.2	4.5	4.7
TRANS. PRICE INCREASE	4.5	4.5	4.5
POPULATION	1.5	1.2	1.1
PASSENGER MOVEMENT	5.5	5.6	5.7

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981 － 1987	1987 － 1993	1993 － 2001
NON-AGRI.	7.1	7.2	7.3
AGRICULTURE	0.1	0.1	0.1
FREIGHT	6.2	6.3	6.4

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	0.1	0.1

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	2.9	27.5	68.1	1.4	0.0	7.7	19.2	73.1	0.0
	1987	4.8	28.4	55.8	8.0	3.0	10.1	18.4	63.1	8.4
	1993	7.2	29.4	41.0	15.8	6.6	13.1	17.4	51.0	18.5
	2001	10.2	30.8	21.3	26.2	11.5	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 14.2.1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	5	54	8	3	31	6	20	3	128	195	323
1993	9	51	20	8	41	6	18	7	160	224	384
2001	18	38	46	20	62	7	16	15	222	273	495

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，ケナフとキヤツサバが僅かに栽培されている。未開発可耕地は，主として，畑作地方が残っている。

圏内の土地利用及び土地適応性の状況はTable 14.3.1とFigure 14.3.1に示し，また，Sakon Nakhon 県地域の代表的作物暦は，Figure 14.3.2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 14.3.2.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 14.3.3.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 14.3.4.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		Without Project				With Project			
No.	Terrain	Length (km)	Road Class /1	Nos. of Wooden Bridge	Nos. of Narrow C.Bridge	Length (km)	Road Class /1 Case 1	Case 2	Nos. of Wooden Narrow Bridge
1	Flat & Rolling	12.0	3	1	1	12.0	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)	1,122	1,676	2,825
2A(F5)	724	1,120	1,935

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 14.5.1

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 14.5.2

ルートの線形は，Figure 14.5.2 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 14.5.1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。

Financial and Economic Construction Cost

Road Class	Length (km)	Construction Cost (10^3 ₿)		Remark
		Financial Cost	Economic Cost	
F4 (DBST)	12.0	27,687	25,135	
F5 (Soil Aggregate)	12.0	18,518	16,796	

6. 経済評価

年次別経済費用と便益及び評価結果はTable 14.6.1，及び 14.6.2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 14.7.1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 14.1.1 SUMMARY OF ROAD INVENTORY

Item	Description		
Origin	J.R. 223		
Destination	K.A. Tao Ngai		
Length			
Total			12.0 km
Improvement Section			12.0 km
DOH Road			0 km
ARD Road			12.0 km
Others			0 km
New Alignment Section			0 km
Terrain	Flat and Rolling		
Alignment (Hori./Vert.)	Fair / Fair		
Formation Width	6.0 m - 8.0 m, 7.6 m (Weighted average)		
Embankment Section			
Length			12.0 km
Height	0.2 m - 0.5 m		
Cut Section			
Length			0 km
Depth	m - m		
Surface Type and Condition			
SBST or DBST	Poor		1.8 km
Soil Aggregate	Poor		10.2 km
Earth			0 km
Pipe Culvert	17 each		
Box Culvert	0 each		0 m
Bridge			
Permanent Bridge	0 each		0 m
Narrow Concrete Bridge	1 each		24.5 m (4m)
Wooden Bridge	0 each		0 m
Overflow Section	1 place		2 km

Table 14.1.2 ROAD INVENTORY

PROPOSED ROUTE NO. IM-14 ROUTE NO. ARD J.R. 223 ~ K.A. TAO NGAI SAKHON NAKHON L = 12.0 Km.

STATION (Km)		0 – 12
VILLAGE - Name - Household (H) - Population (P)		B. PHAI LOM H = 160 P = 960; B. NON HOM H = 260 P = 1560; B. NONG BUA H = 220 P = 1360; KA. TAO NGAI H = 1000 P = 6500
TERRAIN		Flat / Rolling / Flat / Rolling
CROSS SECTION	Formation Width (m)	8.00 / 6.00 / 7.50
	Embankment Height (m)	0.30 / 0.20 / 0.30 / 0.40 / 0.30 / 0.40 / 0.50
	Cutting Depth (m)	
PAVEMENT	Type/Length	La. / DT / La. / DT / La. / DT / Laterite
	Condition	Poor
FLOODING	Overflow Length(Km)/Height(m)	L=2.0 H=2.5
LAND USE	Left	Paddy / Bush / Paddy / Bush / Paddy
	Right	Paddy / Bush / Paddy / Bush / Paddy
PIPE CULVERT	Total Number	17 Pipes
BOX CULVERT & BRIDGE	Station (Km)	10.8
	Dimension	C-Br. 4.00 x 24.50
RIGHT OF WAY (m)		10.0
ALIGNMENT	Horizontal	Fair
	Vertical	Fair
ROUTE NO., AGENCIES		ARD

Table 14.2.1 TRAFFIC VOLUME ON ROUTE IM -14

YEAR		1987		1993		2001	
LINK		1	AVR.	1	AVR.	1	AVR.
P/C	N+D	4	4	8	8	16	16
	I	1	1	1	1	2	2
	DV	0	0	0	0	0	0
	TOTAL	5	5	9	9	18	18
L/B	N+D	47	47	44	44	33	33
	I	7	7	7	7	5	5
	DV	0	0	0	0	0	0
	TOTAL	54	54	51	51	38	38
M/B	N+D	7	7	17	17	40	40
	I	1	1	3	3	6	6
	DV	0	0	0	0	0	0
	TOTAL	8	8	20	20	46	46
H/B	N+D	3	3	7	7	18	18
	I	0	0	1	1	3	3
	DV	0	0	0	0	0	0
	TOTAL	3	3	8	8	20	20
P/P&T	N+D	27	27	36	36	54	54
	I	4	4	5	5	8	8
	DV	0	0	0	0	0	0
	TOTAL	31	31	41	41	62	62
4/T	N+D	5	5	5	5	6	6
	I	1	1	1	1	1	1
	DV	0	0	0	0	0	0
	TOTAL	6	6	6	6	7	7
6/T	N+D	17	17	16	16	14	14
	I	3	3	2	2	2	2
	DV	0	0	0	0	0	0
	TOTAL	20	20	18	18	16	16
10/T	N+D	2	2	6	6	13	13
	I	0	0	1	1	2	2
	DV	0	0	0	0	0	0
	TOTAL	3	3	7	7	15	15
ADT	N+D	111	111	139	139	192	192
	I	17	17	21	21	29	29
	DV	0	0	0	0	0	0
	TOTAL	128	128	160	160	222	222
M/C	N+D	177	177	205	205	251	251
	I	18	18	20	20	22	22
	DV	0	0	0	0	0	0
	TOTAL	195	195	224	224	273	273
TOTAL	N+D	288	288	343	343	443	443
	I	34	34	41	41	51	51
	DV	0	0	0	0	0	0
	TOTAL	323	323	384	384	495	495

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

Figure 14.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM – 14

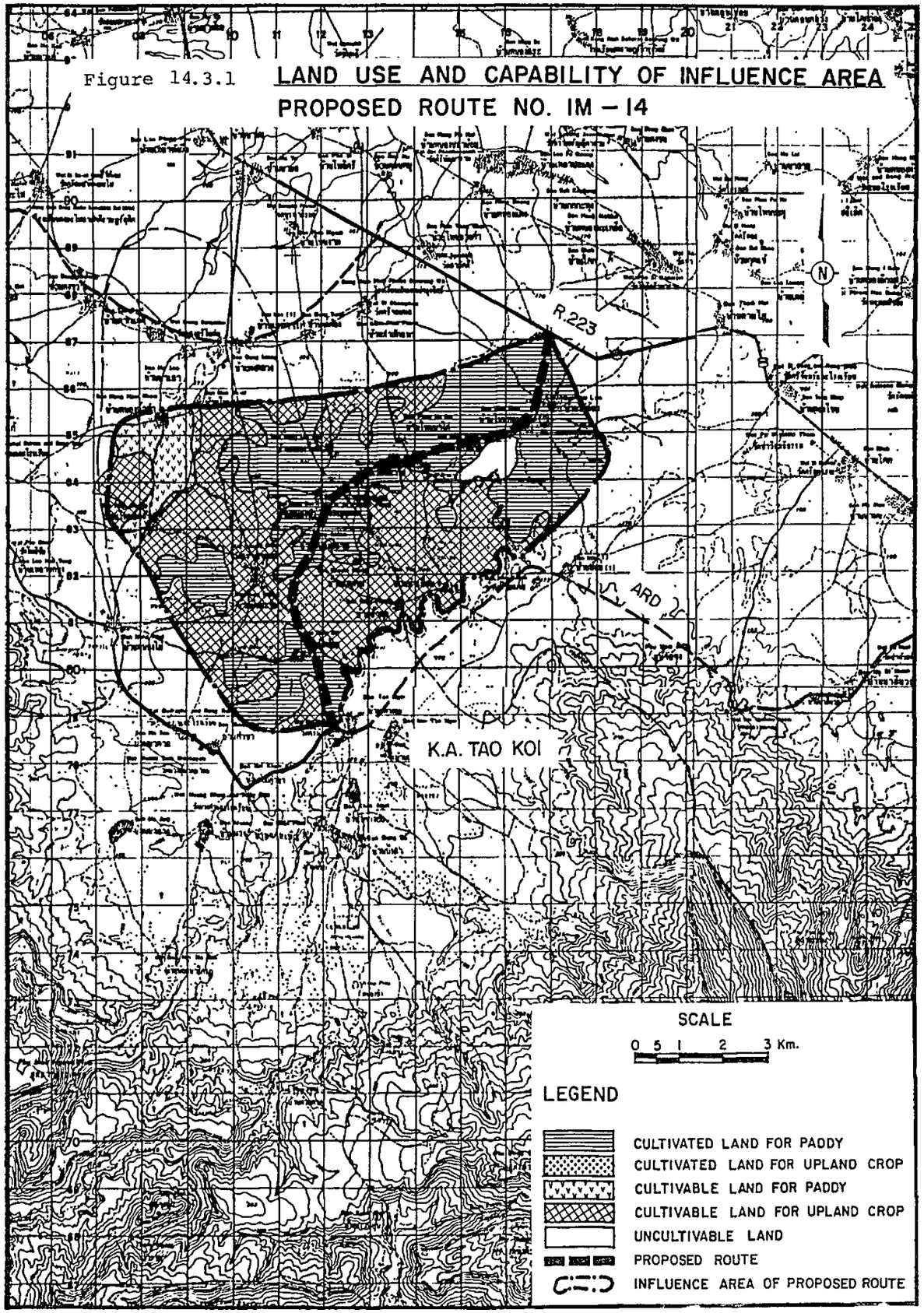


Figure 14.3.2 CROPPING CALENDAR

0400 CHANGWAT SAKON NAKHON

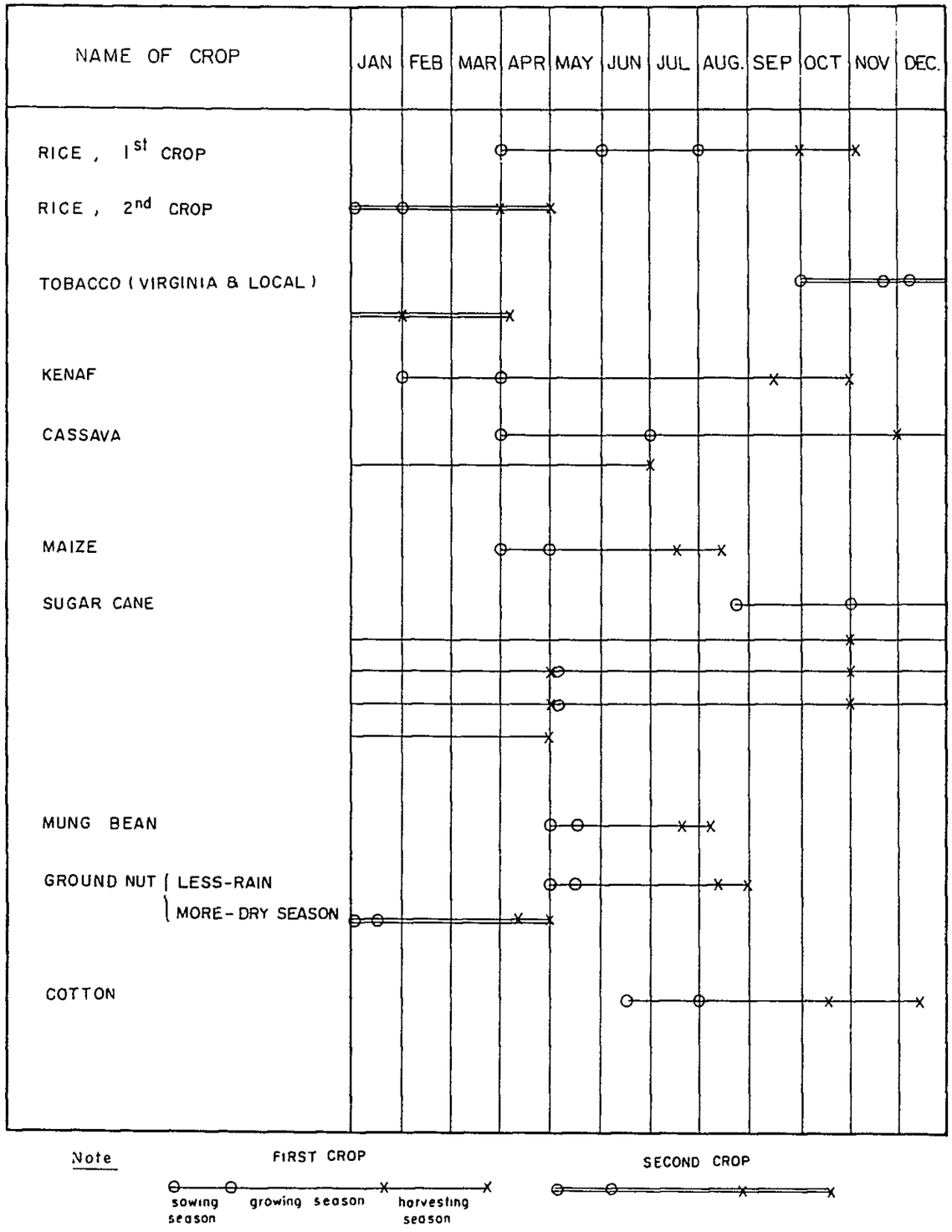


TABLE 14.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		15.625 (25.0)	-	15.625 (25.0)	1.563 (2.5)	18.125 (29.0)	19.688 (31.5)
0401	M. SAKHON NAKHON	9.375 (15.0)	-	9.375 (15.0)	-	5.625 (9.0)	5.625 (9.0)
0404	SAWANG DAEN DIN	6.250 (10.0)	-	6.250 (10.0)	1.563 (2.5)	12.500 (20.0)	14.063 (22.5)

TABLE 14.3.2 CROP PRODUCTION

ITEM			PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)												
1981			14.91	-	-	-	0.08	-	0.05	-	0.20	15.11
1987			15.00	-	-	-	0.08	-	0.05	-	0.20	15.21
1993	WITHOUT	PROJECT	15.09	-	-	-	0.08	-	0.05	-	0.21	15.30
	WITH	PROJECT	15.09	-	-	-	0.09	-	0.05	-	0.22	15.32
2001	WITHOUT	PROJECT	15.22	-	-	-	0.08	-	0.05	-	0.21	15.43
	WITH	PROJECT	15.22	-	-	-	0.10	-	0.05	-	0.23	15.45
CROP YIELD (KG/RAI)												
1981			210.2	-	-	-	2580.0	-	161.0	-		
1987			210.2	-	-	-	2580.0	-	161.0	-		
1993	WITHOUT	PROJECT	210.2	-	-	-	2580.0	-	161.0	-		
	WITH	PROJECT	214.1	-	-	-	2595.5	-	161.0	-		
2001	WITHOUT	PROJECT	210.2	-	-	-	2580.0	-	161.0	-		
	WITH	PROJECT	219.3	-	-	-	2616.4	-	161.0	-		
CROP PRODUCTION (TON)												
1981			3,136	-	-	-	201	-	8	-	282	3,417
1987			3,154	-	-	-	205	-	8	-	287	3,441
1993	WITHOUT	PROJECT	3,173	-	-	-	209	-	8	-	292	3,465
	WITH	PROJECT	3,231	-	-	-	246	-	9	-	330	3,561
2001	WITHOUT	PROJECT	3,199	-	-	-	214	-	8	-	299	3,498
	WITH	PROJECT	3,336	-	-	-	254	-	9	-	341	3,677

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 14.3.3 FARMGATE PRICE AND PRODUCTION COST

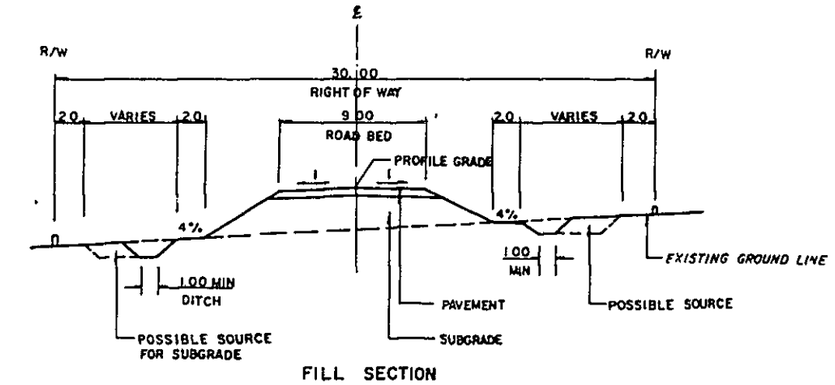
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,663	-	-	-	546	-	4,614	-
WITH PROJECT (1987 - 2001)	3,755	-	-	-	560	-	4,729	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	548	-	-	-	759	-	631	-
WITH PROJECT (1987 - 2001)	562	-	-	-	779	-	631	-

TABLE 14.3.4 NET PRODUCTION VALUE

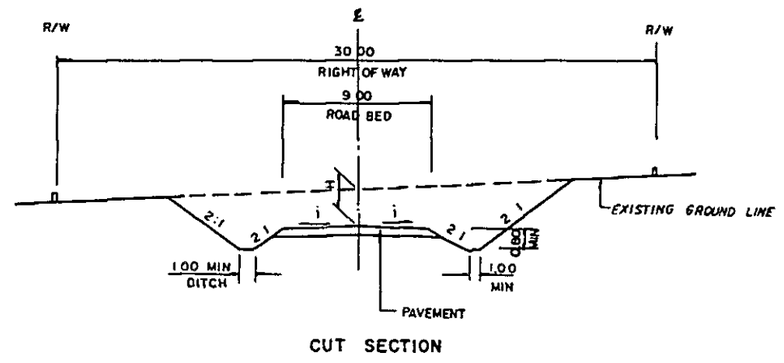
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	3,333	71	3,404	3,416	74	3,490
1993	3,353	75	3,428	3,653	88	3,741
2001	3,380	76	3,456	3,979	92	4,071

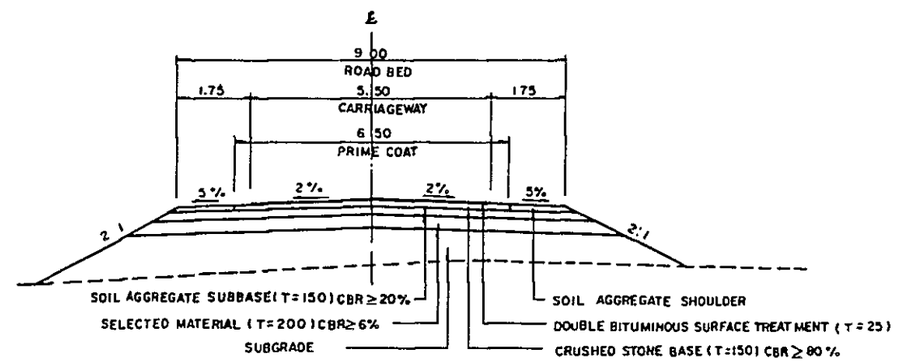
Figure 14.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



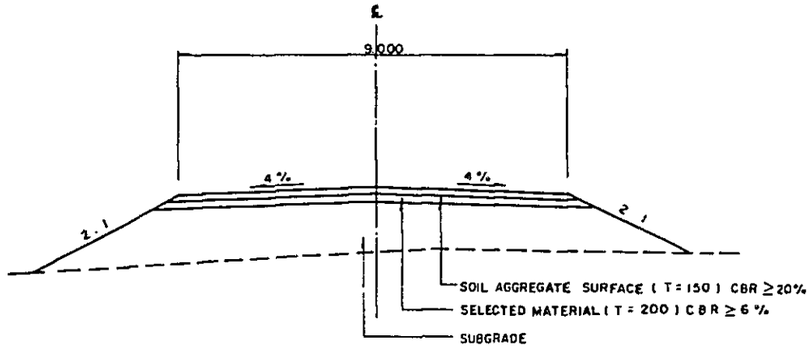
FILL SECTION



CUT SECTION



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

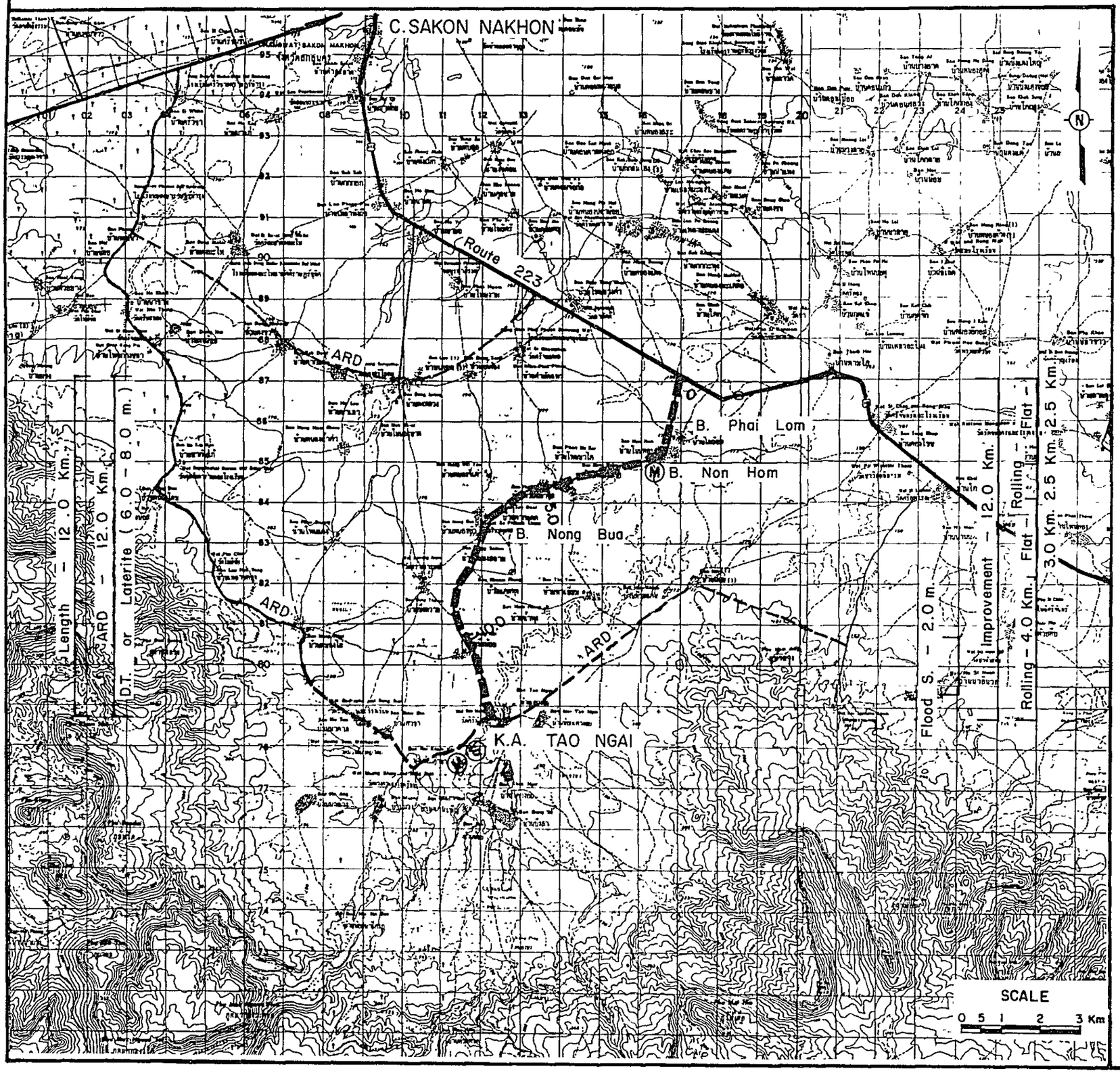


SOIL AGGREGATE SURFACED ROAD (Class F5)

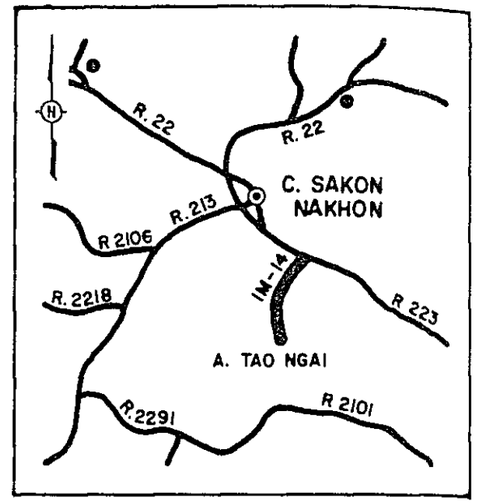
Figure 14.5.2

PROPOSED ROUTE NO. IM-14 C. SAKON NAKHON J.R. 223 - K.A. TAO NGAI

ROUTE NO. ARD L = 12.0 Km



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	10.2	C-7 00 x30 00	-
2	10 8	C-7 00 x24.50	C-4 00 x24 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 14.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-14 (12.0 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	27	405	368	27	405	368
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	136,400	6,138	5,585	136,400	6,138	5,585
Selected Material	m^3	80	21,600	1,728	1,537	21,600	1,728	1,537
Soil Aggregate Surface or Subbase	m^3	105	15,100	1,585	1,411	15,100	1,585	1,411
Crushed Stone Base	m^3	370	9,900	3,663	3,369	500	185	170
Soil Aggregate Shoulder	m^3	105	4,300	451	401	200	21	18
Prime Coat and DBST	m^2	55	56,100	3,086	2,777	2,500	138	124
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	55	2,200	1,958	55	2,200	1,958
Sub Total (a)				20,013	18,105		13,157	11,870
Miscellaneous Works (a) x 7%				1,401	1,267		921	831
Total (b)				21,414	19,372		14,078	12,701
PHYSICAL CONTENGENCY (b) x 15%				3,212	2,906		2,112	1,905
ENGINEERING AND ADMINISTRATION (b) x 10%				2,141	1,937		1,408	1,270
Sub Total				5,353	4,843		3,520	3,175
LAND ACQUISITION								
Highly Developed Land	ha	50,000	16	800	800	16	800	800
Less Developed Land	ha	15,000	8	120	120	8	120	120
Sub Total				27,687	25,135		920	920
GRAND TOTAL				27,687	25,135		18,518	16,796

Table 14.6.1 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	10,054	0	0	0	0	12,612	0
1986	15,081	0	0	0	0	16,891	0
1987	0	86	1,122	-57	1,151	0	1,028
1988	0	123	1,215	-51	1,287	0	1,026
1989	0	161	1,307	-45	1,422	0	1,012
1990	0	198	1,399	-39	1,558	0	990
1991	0	236	1,492	-33	1,694	0	961
1992	0	273	1,584	-27	1,830	0	927
1993	0	311	1,676	-22	1,965	0	889
1994	5,808	349	1,820	-12	2,156	2,627	871
1995	0	387	1,963	-3	2,347	0	846
1996	0	425	2,107	7	2,538	0	817
1997	0	463	2,251	16	2,729	0	785
1998	0	501	2,394	25	2,920	0	750
1999	0	539	2,538	35	3,111	0	713
2000	0	577	2,681	44	3,302	0	676
2001	-12,059	615	2,825	54	3,493	-2,203	638
TOTAL	18,884	5,242	28,373	-110	33,505	29,927	12,929

DISCOUNTED ECONOMIC COSTS : 29,927

DISCOUNTED ECONOMIC BENEFITS : 12,929

AGRICULTURAL DEVELOPMENT BENEFIT	1,861
VOC SAVING	11,226
RMC SAVING	-158

NET PRESENT VALUE : -16,998

BENEFIT COST RATIO : 0.43

INTERNAL RATE OF RETURN : 3.7 %

Table 14.6.2 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	6,718	0	0	0	0	8,427	0
1986	10,078	0	0	0	0	11,287	0
1987	0	86	724	-12	798	0	712
1988	0	123	790	-8	906	0	722
1989	0	161	856	-3	1,014	0	722
1990	0	198	922	2	1,122	0	713
1991	0	236	988	7	1,231	0	698
1992	0	273	1,054	12	1,339	0	678
1993	0	311	1,120	16	1,447	0	654
1994	242	349	1,222	24	1,594	109	644
1995	0	387	1,324	32	1,742	0	628
1996	0	425	1,426	40	1,890	0	608
1997	0	463	1,527	47	2,038	0	586
1998	0	501	1,629	55	2,185	0	561
1999	0	539	1,731	63	2,333	0	535
2000	0	577	1,833	71	2,481	0	508
2001	-8,223	615	1,935	78	2,628	-1,502	480
TOTAL	8,815	5,242	19,081	424	24,748	18,322	9,451

DISCOUNTED ECONOMIC COSTS : 18,322

DISCOUNTED ECONOMIC BENEFITS : 9,451

AGRICULTURAL DEVELOPMENT BENEFIT	1,861
VOC SAVING	7,486
RMC SAVING	104

NET PRESENT VALUE : -8,871

BENEFIT COST RATIO : 0.52

INTERNAL RATE OF RETURN : 5.8 %

Table 14.7.1 SOCIAL INDICATORS

(Proposed Route IM-14)

Population (1,000)		
1982	:	6.6
1993	:	7.6
Average travelling speed, without (kph)	:	40
Isolation		
Access to Amphoe		
Average distance to Amphoe (km) 1/	:	3.0
Per capita time savings (10^{-4})	:	0.044
Score	:	133
Access to Artery Highway		
Average distance to highway (km) 1/	:	12
Per capita time savings (10^{-4})	:	0.175
Score	:	350
Impassability		
Impassable week a year	:	4
Impassability per year	:	0.077
Impassability per capita (10^{-4})	:	0.060
Score	:	500
Health		
Access to Hospital		
Average distance to Hospital (km) 1/	:	6.0
Per capita time savings (10^{-4})	:	0.089
Score	:	207
Access to Medical Facilities		
Average distance to facilities (km) 1/	:	2.3
Per capita time savings (10^{-4})	:	0.034
Score	:	136
Education		
Access to Secondary School		
Number of Student in 1993 (1,000) 2/	:	1.5
Average distance to school (km)	:	6.0
Per capita time savings (10^{-4})	:	0.447
Score	:	232
Teacher Intensity		
Number of teachers 3/		
University graduate	:	-
Total	:	6
Number of Student	:	157
Indicators		
E1 4/	:	-
E2 5/	:	38.2
E 6/	:	38.2
Degree of Improvement 7/	:	1.79
Score	:	114
Disparity		
G.P.V. in 1993 (Mn B) 8/		
With project	:	12.4
Without project	:	11.9
Per capita G.P.V. in 1993 (B)		
With project (W)	:	1,697
Without project (w)	:	1,556
Degree of Disparity		
(A/W) - (A/w) 9/	:	0.15
Score	:	268
Total Score	:	1,940

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 - 15

Changwat : Nakhon Phanom

A. Renu Nakhon (J.R. 2031) - B. Ku Ru Khu (J.R. 22)

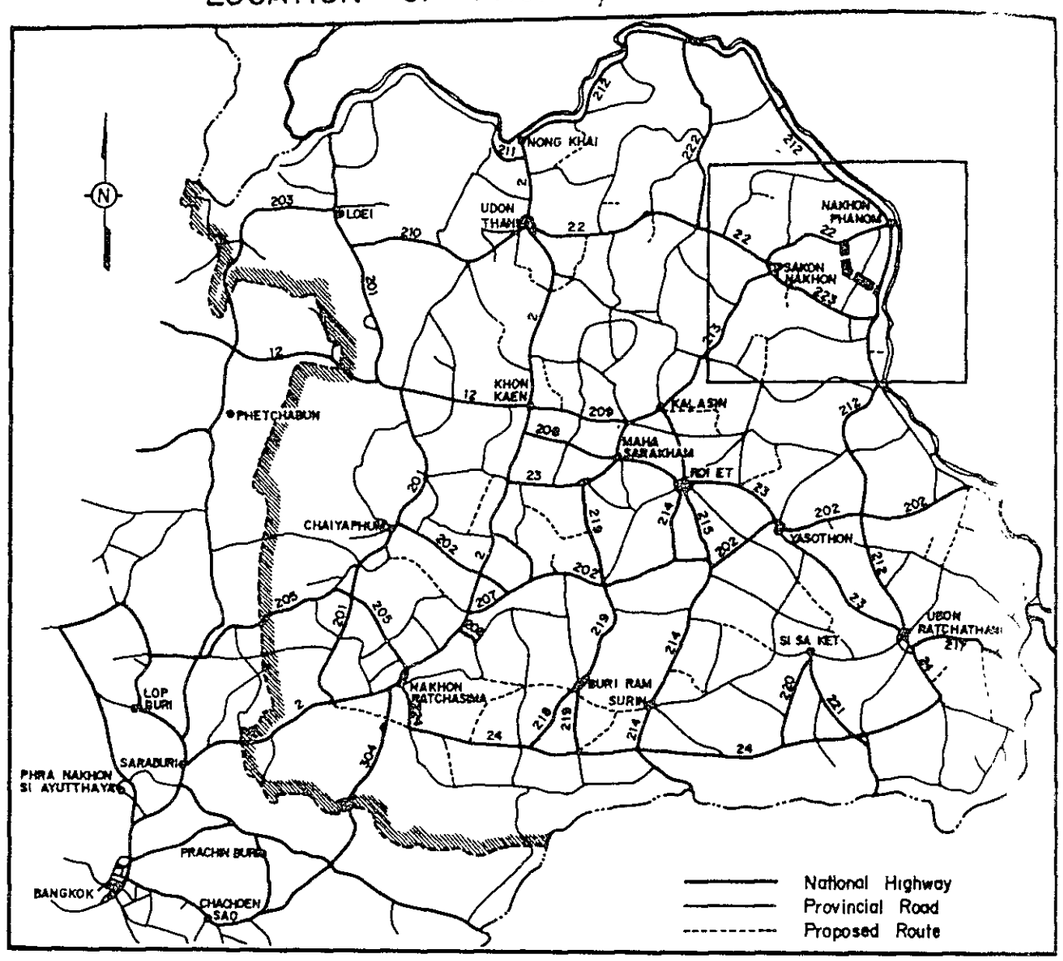
Length : 40.1 KM.

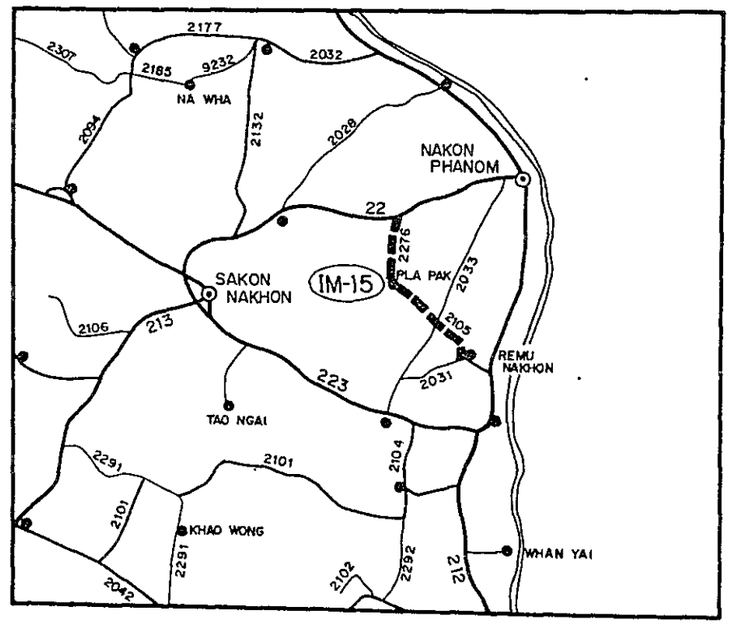
SUMMARY

PROPOSED ROUTE IM-15

Item	Description
Changwat	Nakhon Phanom
Origin	A. Renu Nakhon (J.R.2031)
Destination	B. Ku Ru Khu (J.R.22)
Length	
Total	40.1 km
Improvement Section	40.1 km
DOH Road	R.2105, R.2276 27.1 km
ARD Road	13.0 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Good ~ Poor
Terrain	Flat and Rolling
Influence Area	
Area	307 km^2
Population (1982)	32,800
Principal Crops	Paddy
Traffic (ADT)	
Existing	95
1993	400
2001	534
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	75,443 . 10^3 ฿
Economic	68,442 . 10^3 ฿
IRR	5.1 %
B/C	0.51
Recommendation	For further consideration

LOCATION OF PROPOSED ROUTE





1. 概　　要

1.1　計画路線の概要

本路線は，Nakhon Phanom の南東部に位置している。ルートは，県道2031号線のRenu Nakhon を起点とし，北に走り,Hong Hi村，Pla Pak 準郡，Khon Klang村を経て，県道22号線のKu Ru khu 村で終る。その総延長は，40.1kmである。（Figure 15.5.2 参照）

沿道の地形は，ほとんどが丘陵地であるが一部は平坦である。影響圏内には，いくつかの村があり，その総人口は32,800人である。

沿道には，医療センターが３ケ所あるが，病院はない。教育施設として中学校が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３つの幹線県道2031号線，県道2033号線及び国道22号線を結ぶ重要な道路網の形成を目途に計画され又Pla Pak 準郡とこれらの幹線道路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　15.1.1 に要約し，その詳細はTable　15.1.2のインベントリー調査の結果に示した。

2．交通

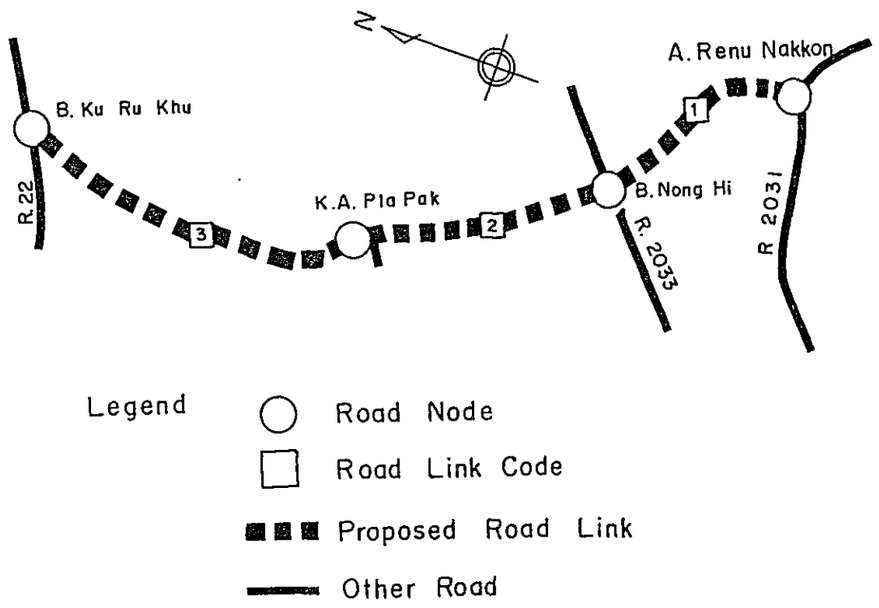
2.1　予測手法

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	H/B	P/T	4/T	6/T	10/T	ADT
DOH (1981)	1 [1/]	19	22	16	19	2	4	10	20	3	115
	2	n.a.									
	3 [2/]	7	16	24	29	2	3	7	1	-	89
Manual Counts (1982)	1	3	72	3	-	-	8	17	22	2	127
	2	1	45	2	-	-	5	8	12	3	76
	3	n.a.									
Estimated	1	11	47	10	10	1	6	14	21	3	123
	2	1	45	2	-	-	5	8	12	3	76
	3	7	16	24	29	2	3	7	1	-	89

Note: 1/ Route 2105 Station 0100 Station Km 1+000
2/ Route 2276 Station 0100 Station Km 8+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	601
2	203
3	1170

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	46	39	85
2	33	28	61
3	5	4	10

2.4 交通需要の将来伸び率

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

GROWTH RATE OF PASSENGER MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981 － 1987	1987 － 1993	1993 － 2001
PER CAPITA INCOME	4.2	4.5	4.7
TRANS. PRICE INCREASE	4.5	4.5	4.5
POPULATION	1.5	1.2	1.0
PASSENGER MOVEMENT	5.5	5.6	5.7

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981 － 1987	1987 － 1993	1993 － 2001
NON-AGRI.	7.1	7.2	7.3
AGRICULTURE	0.5	0.1	0.1
FREIGHT	4.1	3.9	4.0

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	13.9	59.5	12.7	12.7	1.3	13.6	31.8	47.7	6.8
	1987	15.1	58.3	11.9	12.4	2.3	14.5	27.7	44.4	13.4
	1993	16.5	56.9	10.9	12.2	3.5	15.6	22.7	40.4	21.4
	2001	18.4	55.1	9.6	11.8	5.2	17.0	16.0	35.0	32.0
2	1982	2.1	93.8	4.2	0.0	0.0	17.9	28.6	42.9	10.7
	1987	7.8	88.0	3.5	0.5	0.2	17.6	25.3	40.8	16.3
	1993	14.7	81.1	2.6	1.1	0.5	17.4	21.3	38.3	23.0
	2001	24.0	71.9	1.5	1.9	0.8	17.0	16.0	35.0	32.0
3	1982	9.0	20.5	30.8	37.2	2.6	27.3	63.6	9.1	0.0
	1987	9.4	23.6	27.9	33.9	5.2	24.2	49.3	16.9	9.6
	1993	9.7	26.7	25.1	30.6	7.9	21.1	35.1	24.6	19.2
	2001	10.2	30.8	21.3	26.2	11.5	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 15.2.1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	11	18	20	3	56	8	12	4	133	194	327
1993	19	22	26	7	74	7	11	6	171	229	400
2001	35	28	35	15	109	5	11	10	248	286	534

3. 農業開発

3.1. 現況

影響圏は，Pla Pak 郡側と，Renu Nakhon郡側の二つの地域に分かれている。農耕地の殆どは，水田であるが，未開発可耕地は，Renu Nakhon 郡側に，畑地が残っているだけで，新たな水田適地は，殆ど残っていない。

圏内の土地利用及び土地適応性の状況はTable 15.3.1とFigure 15.3.1に示し，また，Nakhon Phanom 県地域の代表的作物暦は，Figure 15.3.2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 15.3.2.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 15.3.3.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 15.3.4.のように算出した。

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

4. 走行費の節減

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

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

Road Condition

Link		Without Project				With Project			
No.	Terrain	Length (Km)	Road Class /1	Nos. of Wooden Bridge	Nos. of Narrow C.Bridge	Length (Km)	Road Class /1 Case 1	Case 2	Nos. of Wooden Narrow Bridge
1	Flat & Rolling	12.1	3	0	0	12.1	1(F4)	2S(F5)	0
2	Rolling	13.0	3	0	8	13.0			0
3	Rolling	15.0	2B	4	1	15.0			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)	3,815	5,407	8,443
2A (F5)	2,367	3,552	5,786

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 15.5.1
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 15.5.2

ルートの線形は，Figure 15.5.2 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 15.5.1 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 (10^3B)		Remark
		Financial Cost	Economic Cost	
F4 (DBST)	40.1	75,443	68,442	
F5 (Laterite)	40.1	45,160	40,896	

6. 経済価格

年次別経済費用と便益及び評価結果はTable 15.6.1 及び 15.6.2 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 15.7.1 に示す通りである。

Table 15.1.1 SUMMARY OF ROAD INVENTORY

Item	Description		
Origin	A. Renu Nakhon (J.R. 2031)		
Destination	B. Ku Ru Khu (J.R. 22)		
Length			
Total		40.1 km	
Improvement Section		40.1 km	
DOH Road	R.2105, R.2276	27.1 km	
ARD Road		13.0 km	
Others		0 km	
New Alignment Section		0 km	
Terrain	Flat and Rolling		
Alignment (Hori./Vert.)	Fair / Fair		
Formation Width	5.5 m - 9.0 m, 7.4 m (Weighted average)		
Embankment Section			
Length		40.1 km	
Height	0.2 m - 1.5 m		
Cut Section			
Length		0 km	
Depth	m - m		
Surface Type and Condition			
SBST or DBST	Good - Poor	5.1 km	
Soil Aggregate	Good - Poor	35.0 km	
Earth		0 km	
Pipe Culvert	28 each		
Box Culvert	1 each	12.0 m	
Bridge			
Permanent Bridge	1 each	21.0 m	
Narrow Concrete Bridge	9 each	152.3 m	(4m)
Wooden Bridge	4 each	50.8 m	
Overflow Section	0 place	0 km	

Table 15.1.2 ROAD INVENTORY (1)

PROPOSED ROUTE NO. IM-15   ROUTE NO. 2105
ARD
2276

A. RENU NAKHON (J.R. 2031) ∿ B. KU RU KHU (J.R. 22)

NAKHON PHANO

L = 40.1 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. RENU NAKHON	B. NON SAO AE H = 60 P = 420	B. NONG KHAN H = 30 P = 360			B. KHAN PRASUK H = 40 P = 240	B. NONG HI H = 420 P = 2460				B. KUNG KON H = 150 P = 1500	B. NA KHAM H = 130 P = 780	K.A. PLA PAK H = 300 P = 1800			
TERRAIN		Rolling		Flat				Rolling									
CROSS SECTION	Formation Width (m)	6.50	9.00			7.50							6.50	7.00 7.50		6.50	
	Embankment Height (m)	0.30	1.50	0.30	0.50	0.20				0.30	0.20	1.00	0.40	0.20	0.40		
	Cutting Depth (m)																
PAVEMENT	Type/Length	DT	Laterite					DT Laterite			DT	La DT	Laterite	DT Laterite			
	Condition	Poor												Good			
FLOODING	Overflow Length(Km)/Height(m)																
LAND USE	Left	Paddy													Bush		
	Right	Paddy													Bush		
PIPE CULVERT	Total Number	28 pipes															
BOX CULVERT & BRIDGE	Station (Km)		3.4				11.4		14.8		18.4	20.2 21.0 21.5	22.6 22.9 23.2	25.7			30.0
	Dimension		C-Br. 3.00 x 12.00				C-Br. 7.00 x 21.00		C-Br. 4.00 x 17.00		C-Br. 4.00 x 15.00	C-Br. 4.00 x 8.00 C-Br. 4.00 x 18.00 C-Br. 4.00 x 18.00	C-Br. 4.00 x 18.30 C-Br. 4.00 x 16.00 C-Br. 4.00 x 21.00	W-Br 4.00 x 9.00			W-Br 4.00 x 15.00
RIGHT OF WAY (m)								15.0									
ALIGNMENT	Horizontal	Fair															
	Vertical	Fair															
ROUTE NO., AGENCIES		DOH 2105						ARD						DOH 2276			

ROAD INVENTORY (2)

L = 40.1 Km.

A. RENU NAKHON (J.R. 2031) ∿ B. KU RU KHU (J.R. 22) (Cont'd)

NAKHON PHANOM

STATION (Km)		30	32	34	36	38	40
VILLAGE - Name - Household (H) - Population (P)			B. KHOK KLANG H = 115 P = 1150				B. KU RU KHU
TERRAIN		Rolling					
CROSS SECTION	Formation Width (m)	7.50		7.00	5.50	5.50	7.30
	Embankment Height (m)	0.80		0.20		0.40	0.20
	Cutting Depth (m)						
PAVEMENT	Type/Length	Laterite	DT	Laterite			
	Condition	Good					
FLOODING	Overflow Length(Km)/Height(m)						
LAND USE	Left	Bush	Paddy	Bush			Paddy
	Right	Bush	Paddy		Bush		Paddy
PIPE CULVERT	Total Number						
BOX CULVERT & BRIDGE	Station (Km)				36.5	38.2	
	Dimension				W-Br. 4.30 x 15.00	W-Br. 4.00 x 11.80	
RIGHT OF WAY (m)							
ALIGNMENT	Horizontal	Fair					
	Vertical	Fair					
ROUTE NO., AGENCIES		DOH 2276					

Table 15.2.1 TRAFFIC VOLUME ON ROUTE IM - 15

YEAR		1987				1993				2001			
LINK		1	2	3	AVR.	1	2	3	AVR.	1	2	3	AVR.
P/C	N+D	15	5	10	10	22	13	14	16	37	31	23	30
	I	2	1	2	1	3	2	2	2	6	5	4	4
	DV	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	17	6	12	11	25	14	17	19	42	36	27	35
L/B	N+D	12	2	30	16	15	2	37	19	19	2	49	25
	I	2	0	5	2	2	0	6	3	3	0	7	4
	DV	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	14	2	35	18	17	3	43	22	22	2	56	28
M/B	N+D	12	0	36	18	16	1	45	22	24	2	60	30
	I	2	0	5	3	2	0	7	3	4	0	9	5
	DV	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	14	0	42	20	19	1	52	26	27	3	69	35
H/B	N+D	2	0	6	3	5	0	12	6	10	1	26	13
	I	0	0	1	0	1	0	2	1	2	0	4	2
	DV	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	3	0	6	3	5	0	13	7	12	1	30	15
P/P&T	N+D	65	60	27	49	83	75	41	65	118	100	71	95
	I	10	9	4	7	13	11	6	10	18	15	11	14
	DV	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	75	69	31	56	96	86	47	74	136	115	82	109
4/T	N+D	12	7	3	7	10	6	2	6	8	5	1	4
	I	2	1	1	1	2	1	0	1	1	1	0	1
	DV	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	14	8	4	8	12	7	2	7	9	6	1	5
6/T	N+D	19	12	1	10	18	12	1	10	17	12	2	10
	I	3	2	0	2	3	2	0	1	3	2	0	1
	DV	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	22	13	1	12	21	13	2	11	19	14	2	11
10/T	N+D	6	5	1	4	9	7	1	6	15	11	2	9
	I	1	1	0	1	1	1	0	1	2	2	0	1
	DV	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	7	5	1	4	11	8	1	6	18	13	2	10
ADT	N+D	144	91	114	116	179	116	154	149	248	165	234	216
	I	22	14	17	17	27	17	23	22	37	25	35	32
	DV	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	165	105	132	133	205	133	177	171	285	190	269	248
M/C	N+D	203	147	182	177	233	173	221	209	284	218	286	263
	I	19	15	18	17	21	17	21	20	23	20	24	22
	DV	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	222	162	200	194	254	190	243	229	307	238	310	286
TOTAL	N+D	346	238	297	293	412	289	375	358	532	383	520	479
	I	41	28	35	35	48	34	44	42	60	44	60	55
	DV	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	387	266	332	327	459	323	420	400	592	428	579	534

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

Figure 15.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM – 15

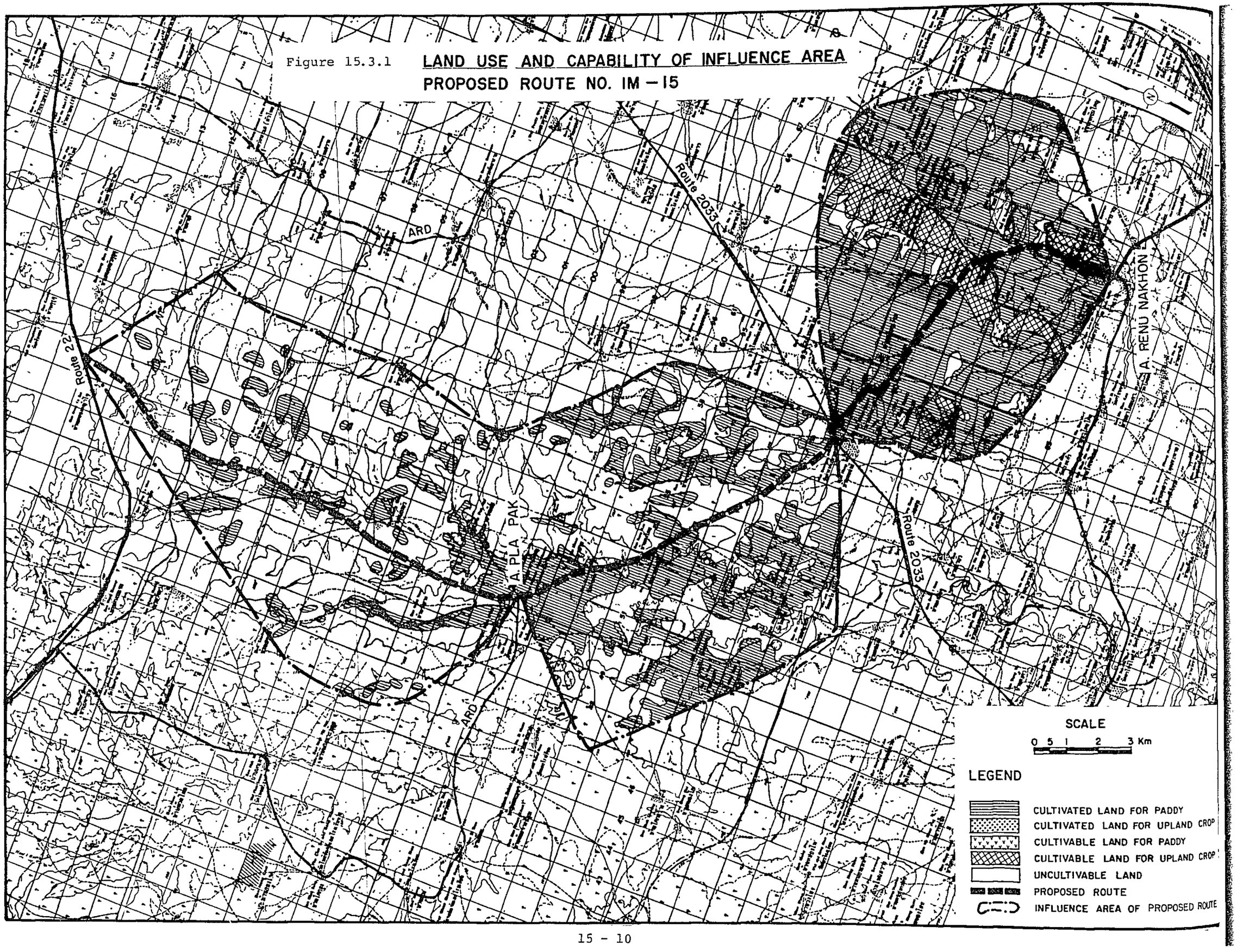


Figure 15.3.2 CROPPING CALENDAR

0500 CHANCWAT NAKHON PHANOM

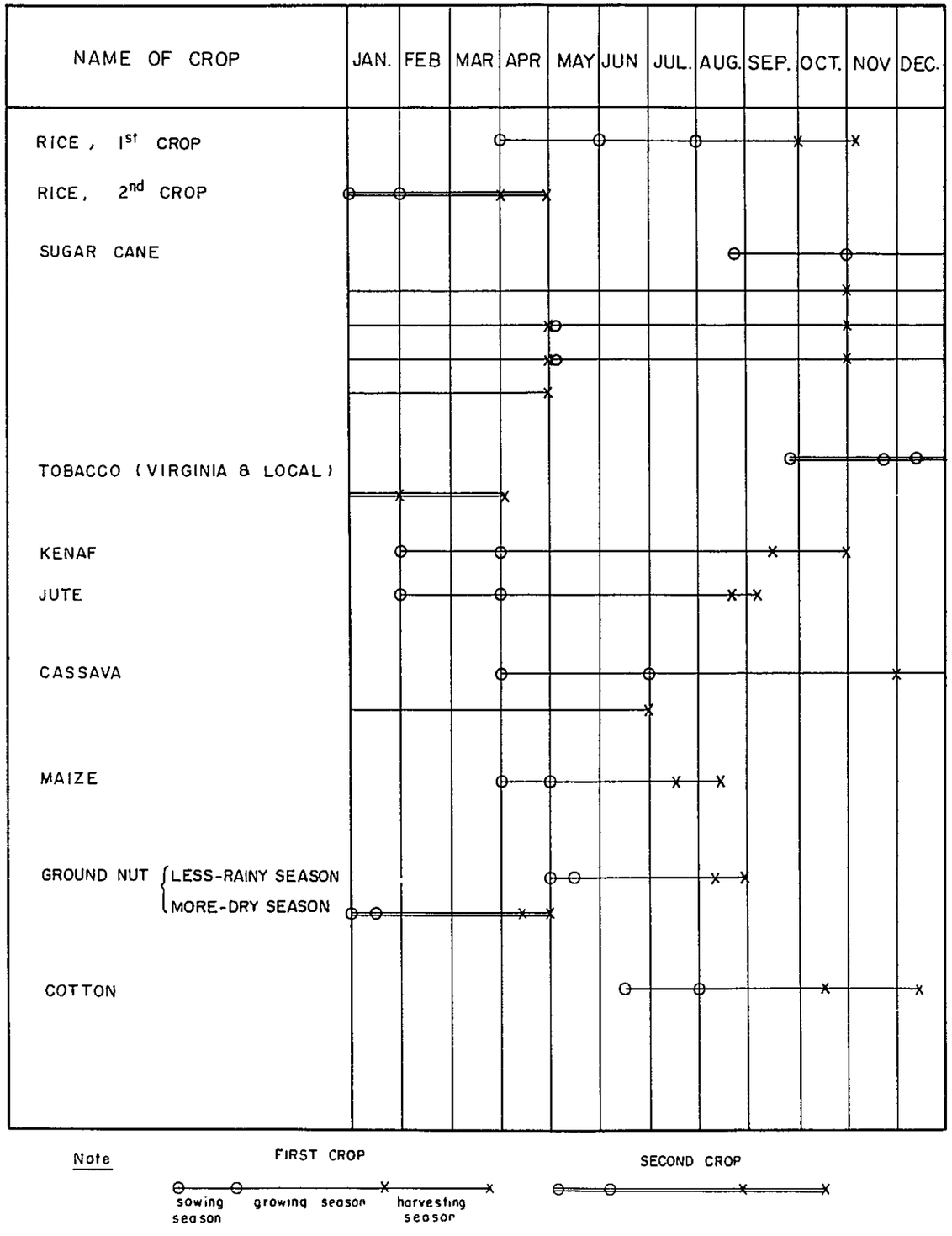


TABLE 15.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		75.813 (121.3)	-	75.813 (121.3)	1.438 (2.3)	8.313 (13.3)	9.750 (15.6)
0501	M. NAKHON PHANOM	0.188 (0.3)	-	0.188 (0.3)	-	-	-
0506	PLA PAK	30.625 (49.0)	-	30.625 (49.0)	0.938 (1.5)	0.188 (0.3)	1.125 (1.8)
0507	RENU NAKHON	45.000 (72.0)	-	45.000 (72.0)	0.500 (0.8)	8.125 (13.0)	8.625 (13.8)

TABLE 15.3.2 CROP PRODUCTION

ITEM			PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)												
1981			81.60	-	-	-	0.11	-	0.07	-	0.20	81.80
1987			83.65	-	-	-	0.12	-	0.07	-	0.21	83.87
1993	WITHOUT	PROJECT	83.65	-	-	-	0.13	-	0.07	-	0.22	83.88
	WITH	PROJECT	83.65	-	-	-	0.14	-	0.07	-	0.24	83.89
2001	WITHOUT	PROJECT	83.65	-	-	-	0.14	-	0.07	-	0.24	83.90
	WITH	PROJECT	83.65	-	-	-	0.16	-	0.07	-	0.26	83.91
CROP YIELD (KG/RAI)												
1981			205.0	-	-	-	2500.0	-	175.0	-		
1987			206.2	-	-	-	2500.0	-	175.0	-		
1993	WITHOUT	PROJECT	207.5	-	-	-	2500.0	-	175.0	-		
	WITH	PROJECT	210.0	-	-	-	2515.0	-	175.0	-		
2001	WITHOUT	PROJECT	209.1	-	-	-	2500.0	-	175.0	-		
	WITH	PROJECT	215.1	-	-	-	2535.2	-	175.0	-		
CROP PRODUCTION (TON)												
1981			16,729	-	-	-	267	-	12	-	389	17,118
1987			17,252	-	-	-	292	-	12	-	421	17,674
1993	WITHOUT	PROJECT	17,356	-	-	-	320	-	12	-	456	17,813
	WITH	PROJECT	17,565	-	-	-	351	-	12	-	489	18,054
2001	WITHOUT	PROJECT	17,495	-	-	-	360	-	12	-	508	18,004
	WITH	PROJECT	17,991	-	-	-	399	-	12	-	549	18,540

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 15.3.3 FARMGATE PRICE AND PRODUCTION COST

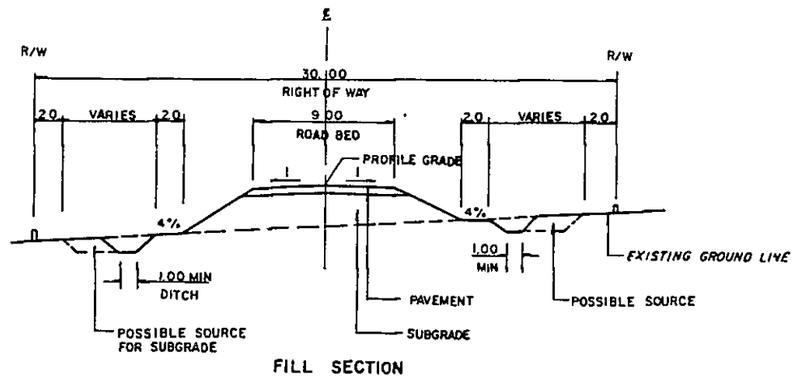
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,630	-	-	-	515	-	3,430	-
WITH PROJECT (1987 - 2001)	3,721	-	-	-	528	-	3,516	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	530	-	-	-	759	-	511	-
WITH PROJECT (1987 - 2001)	540	-	-	-	779	-	511	-

TABLE 15.3.4 NET PRODUCTION VALUE

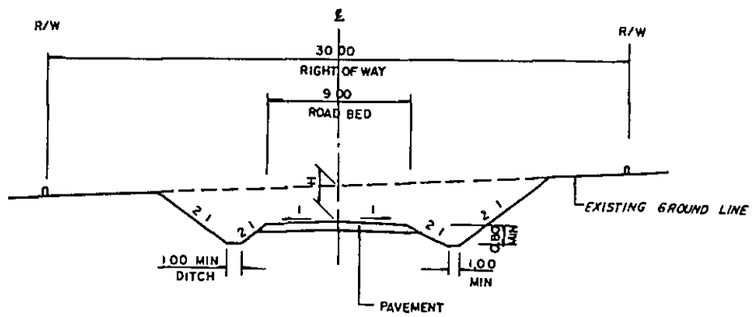
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	18,289	111	18,400	19,020	112	19,132
1993	18,666	119	18,785	20,184	129	20,313
2001	19,172	131	19,303	21,770	146	21,916

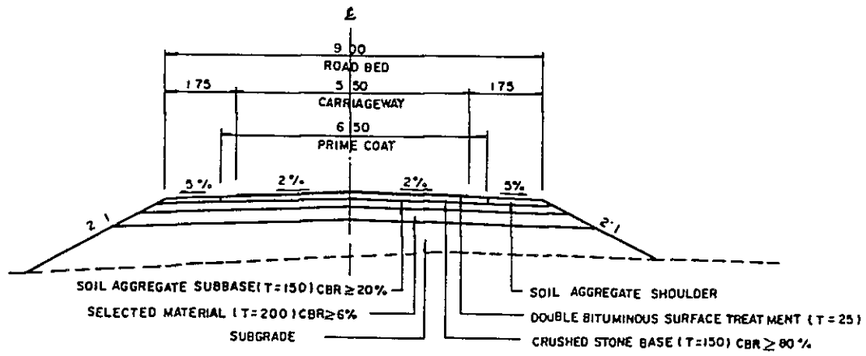
Figure 15. 5. 1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



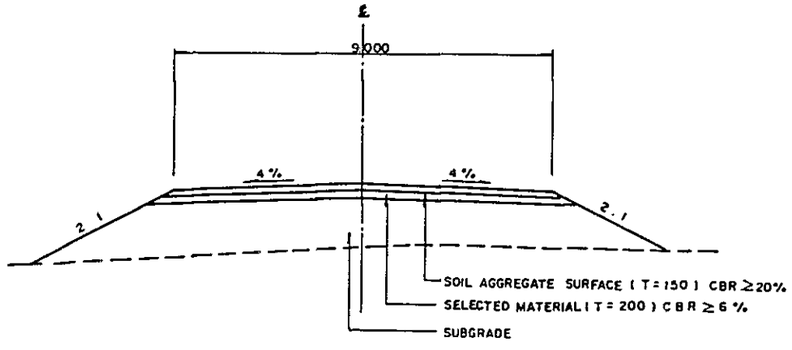
FILL SECTION



CUT SECTION

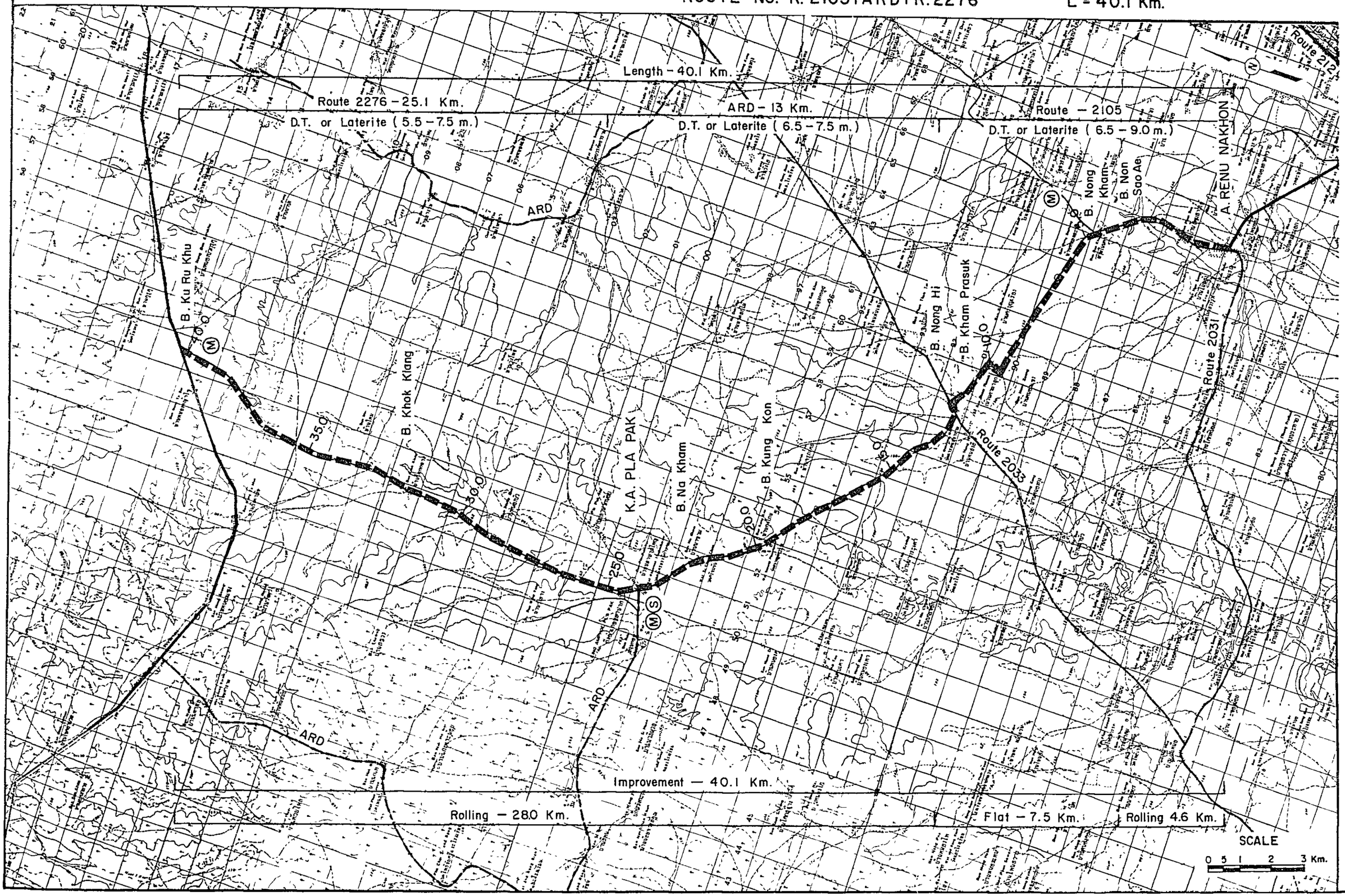


DOUBLE BITUMINOUS SURFACE TREATMENT (DBST) ROAD (Class F4)



SOIL AGGREGATE SURFACED ROAD (Class F5)

Figure 15.5.2 PROPOSED ROUTE NO. 1M – 15 C. NAKHON PHANOM A. RENU NAKHON (J.R. 2031) — B. KU RU KHU (J.R. 22)
ROUTE NO. R. 2105+ARD+R. 2276 L = 40.1 Km.



No.	S
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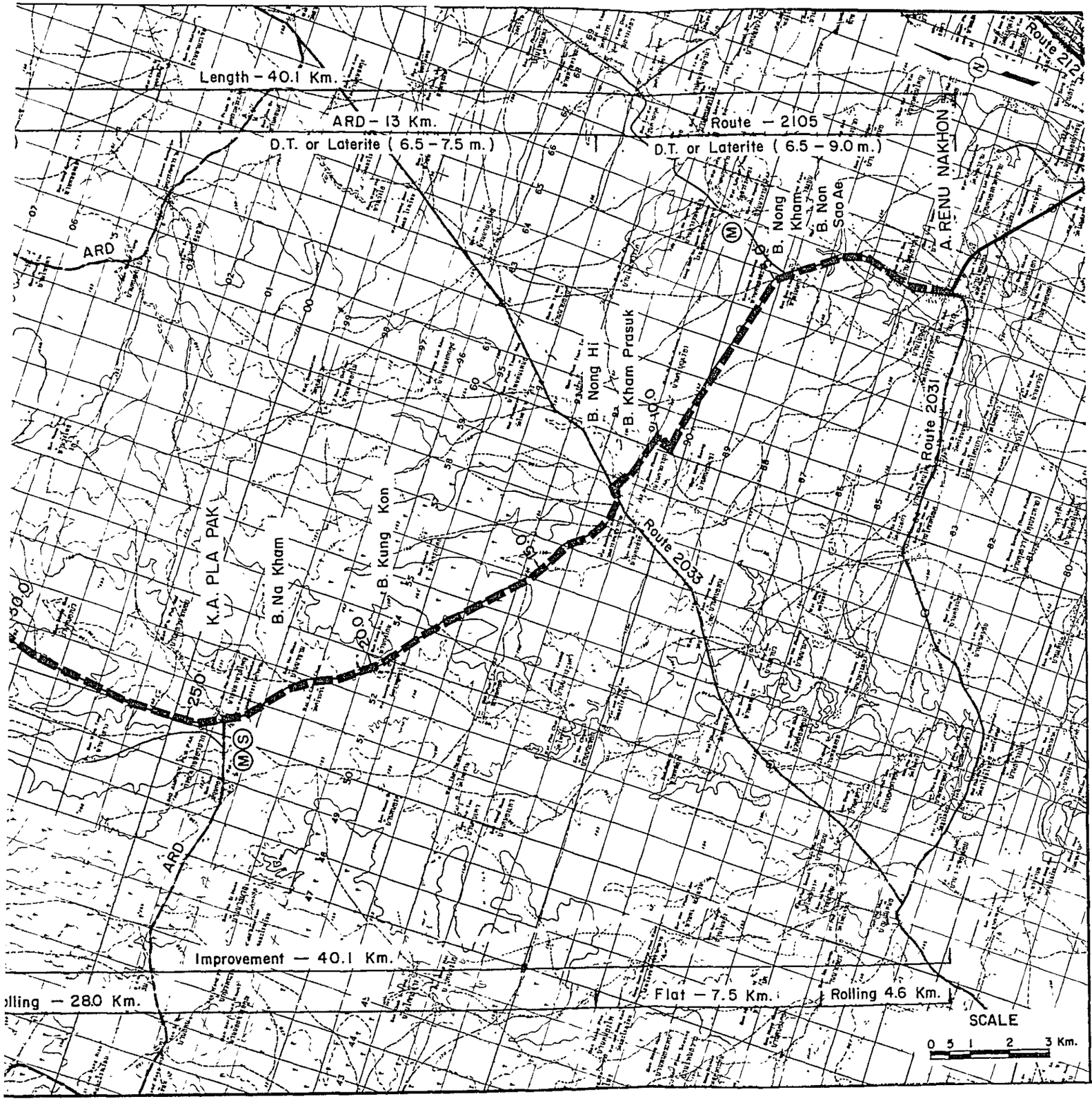
15	

LEG

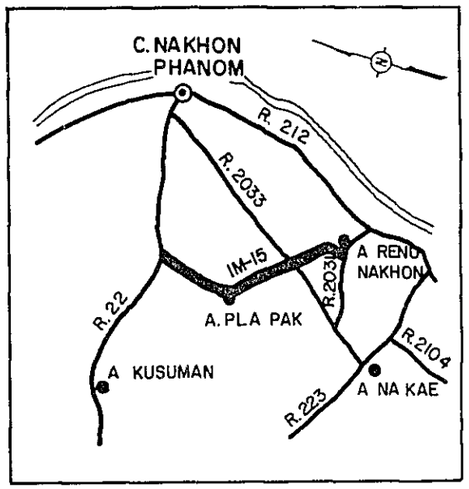
C. NAKHON PHANOM

A. RENU NAKHON (J.R. 2031) — B. KU RU KHU (J.R. 22)

ROUTE NO. R. 2105+ARD+R.2276 L = 40.1 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	3.4	—	C — 3.00 x 12 00
2	11.4	—	C — 7.00 x 21 00
3	14.8	C — 7.00 x 17 00	C — 4 00 x 17.00
4	18.4	C — 7 00 x 15 00	C — 4 00 x 15 00
5	20.2	C — 7.00 x 8 00	C — 4.00 x 8 00
6	21 0	C — 7 00 x 18.00	C — 4 00 x 18 00
7	21.5	C — 7 00 x 18 00	C — 4 00 x 18.00
8	22.6	C — 7 00 x 18.30	C — 4 00 x 18 30
9	22 9	C — 7.00 x 16.00	C — 4.00 x 16 00
10	23.2	C — 7 00 x 21 00	C — 4 00 x 21 00
11	25.7	C — 7.00 x 21 00	C — 4 00 x 21 00
12	26.7	C — 7 00 x 12.00	W — 4 00 x 9.00
13	30 0	C — 7 00 x 18.00	W — 4 00 x 15 00
14	36.5	C — 7 00 x 18 00	W — 4 30 x 15 00
15	38.2	C — 7.00 x 14 00	W — 4 00 x 11.80

LEGEND

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

Table 15.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-15 (40.1 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	91	1,365	1,242	91	1,365	1,242
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	126,900	5,710	5,196	126,900	5,710	5,196
Selected Material	m^3	80	72,100	5,768	5,133	72,100	5,768	5,133
Soil Aggregate Surface or Subbase	m^3	105	50,500	5,302	4,719	50,500	5,302	4,719
Crushed Stone Base	m^3	370	33,200	12,284	11,301	2,000	740	680
Soil Aggregate Shoulder	m^3	105	14,300	1,501	1,336	800	84	74
Prime Coat and DBST	m^2	55	187,000	10,285	9,257	11,000	605	545
Pipe Culvert	m	2,100	1,570	3,297	3,033	1,570	3,297	3,033
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	214	8,560	7,618	214	8,560	7,618
Sub Total (a)				54,073	48,838		31,432	28,244
Miscellaneous Works (a) x 7%				3,785	3,419		2,200	1,977
Total (b)				57,858	52,257		33,632	30,221
PHYSICAL CONTENGENCY (b) x 15%				8,679	7,839		5,045	4,533
ENGINEERING AND ADMINISTRATION (b) x 10%				5,786	5,226		3,363	3,022
Sub Total				14,465	13,065		8,408	7,555
LAND ACQUISITION								
Highly Developed Land	ha	50,000	60	3,000	3,000	60	3,000	3,000
Less Developed Land	ha	15,000	8	120	120	8	120	120
Sub Total				75,443	68,442		3,120	3,120
GRAND TOTAL				75,443	68,442		45,160	40,896

Table 15.6.1 COST AND BENEFITS

(F4 STANDARD)

(1000 BAHT)

YEAR	COST	BENEFITS				DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	13,688	0	0	0	0	19,231	0
1985	34,221	0	0	0	0	42,927	0
1986	20,533	0	0	0	0	22,997	0
1987	0	732	3,815	-163	4,383	0	3,914
1988	0	864	4,080	-154	4,790	0	3,819
1989	0	997	4,346	-145	5,198	0	3,700
1990	0	1,129	4,611	-135	5,605	0	3,562
1991	0	1,261	4,876	-126	6,012	0	3,411
1992	0	1,394	5,142	-117	6,419	0	3,252
1993	0	1,526	5,407	-107	6,826	0	3,088
1994	19,408	1,662	5,787	-93	7,355	8,779	2,971
1995	0	1,798	6,166	-79	7,885	0	2,843
1996	0	1,934	6,546	-65	8,414	0	2,709
1997	0	2,069	6,925	-52	8,943	0	2,571
1998	0	2,205	7,304	-38	9,472	0	2,431
1999	0	2,341	7,684	-24	10,001	0	2,292
2000	0	2,477	8,063	-10	10,530	0	2,155
2001	-33,168	2,613	8,443	4	11,060	-6,060	2,021
TOTAL	54,682	25,003	89,194	-1,304	112,893	87,874	44,738

DISCOUNTED ECONOMIC COSTS : 87,874

DISCOUNTED ECONOMIC BENEFITS : 44,738

AGRICULTURAL DEVELOPMENT BENEFIT	9,506
VOC SAVING	35,987
RMC SAVING	-755

NET PRESENT VALUE : -43,136

BENEFIT COST RATIO : 0.51

INTERNAL RATE OF RETURN : 5.1 %

Table 15.6.2 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	16,358	0	0	0	0	20,519	0
1986	24,538	0	0	0	0	27,483	0
1987	0	732	2,367	-18	3,081	0	2,751
1988	0	864	2,564	-13	3,416	0	2,723
1989	0	997	2,762	-8	3,751	0	2,670
1990	0	1,129	2,959	-3	4,085	0	2,596
1991	0	1,261	3,157	2	4,420	0	2,508
1992	0	1,394	3,355	7	4,755	0	2,409
1993	0	1,526	3,552	11	5,090	0	2,302
1994	968	1,662	3,831	18	5,512	438	2,226
1995	0	1,798	4,110	25	5,934	0	2,140
1996	0	1,934	4,390	33	6,356	0	2,046
1997	0	2,069	4,669	40	6,778	0	1,949
1998	0	2,205	4,948	47	7,200	0	1,848
1999	0	2,341	5,227	54	7,622	0	1,747
2000	0	2,477	5,507	61	8,044	0	1,646
2001	-20,497	2,613	5,786	68	8,466	-3,745	1,547
TOTAL	21,367	25,003	59,184	323	84,510	44,695	33,108

DISCOUNTED ECONOMIC COSTS : 44,695

DISCOUNTED ECONOMIC BENEFITS : 33,108

AGRICULTURAL DEVELOPMENT BENEFIT	9,506
VOC SAVING	23,539
RMC SAVING	64

NET PRESENT VALUE : -11,587

BENEFIT COST RATIO : 0.74

INTERNAL RATE OF RETURN : 8.9 %

Table 15.7.1 SOCIAL INDICATORS
(Proposed Route IM-15)

Population (1,000)		
1982	:	32.8
1993	:	37.9
Average travelling speed, without (kph)	:	45
Isolation		
Access to Amphoe		
Average distance to Amphoe (km) 1/	:	9.4
Per capita time savings (10^{-4})	:	0.020
Score	:	61
Access to Artery Highway		
Average distance to highway (km) 1/	:	15
Per capita time savings (10^{-4})	:	0.032
Score	:	64
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/	:	20.0
Per capita time savings (10^{-4})	:	0.044
Score	:	102
Access to Medical Facilities		
Average distance to facilities (km) 1/	:	4.8
Per capita time savings (10^{-4})	:	0.010
Score	:	40
Education		
Access to Secondary School		
Number of Student in 1993 (1,000) 2/	:	4.5
Average distance to school (km)	:	6.7
Per capita time savings (10^{-4})	:	0.124
Score	:	64
Teacher Intensity		
Number of teachers 3/		
University graduate	:	2
Total	:	16
Number of Student	:	290
Indicators		
E1 4/	:	6.9
E2 5/	:	(51.0)
E 6/	:	57.9
Degree of Improvement 7/	:	1.18
Score	:	75
Disparity		
G.P.V. in 1993 (Mn B) 8/		
With project	:	65.7
Without project	:	63.3
Per capita G.P.V. in 1993 (B)		
With project (W)	:	1,734
Without project (w)	:	1,670
Degree of Disparity		
(A/W) - (A/w) 9/	:	0.07
Score	:	125
Total Score	:	531

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 - 16

Changwat : Nakhon Phanom

J.R. 212 - K.A. Whan Yai

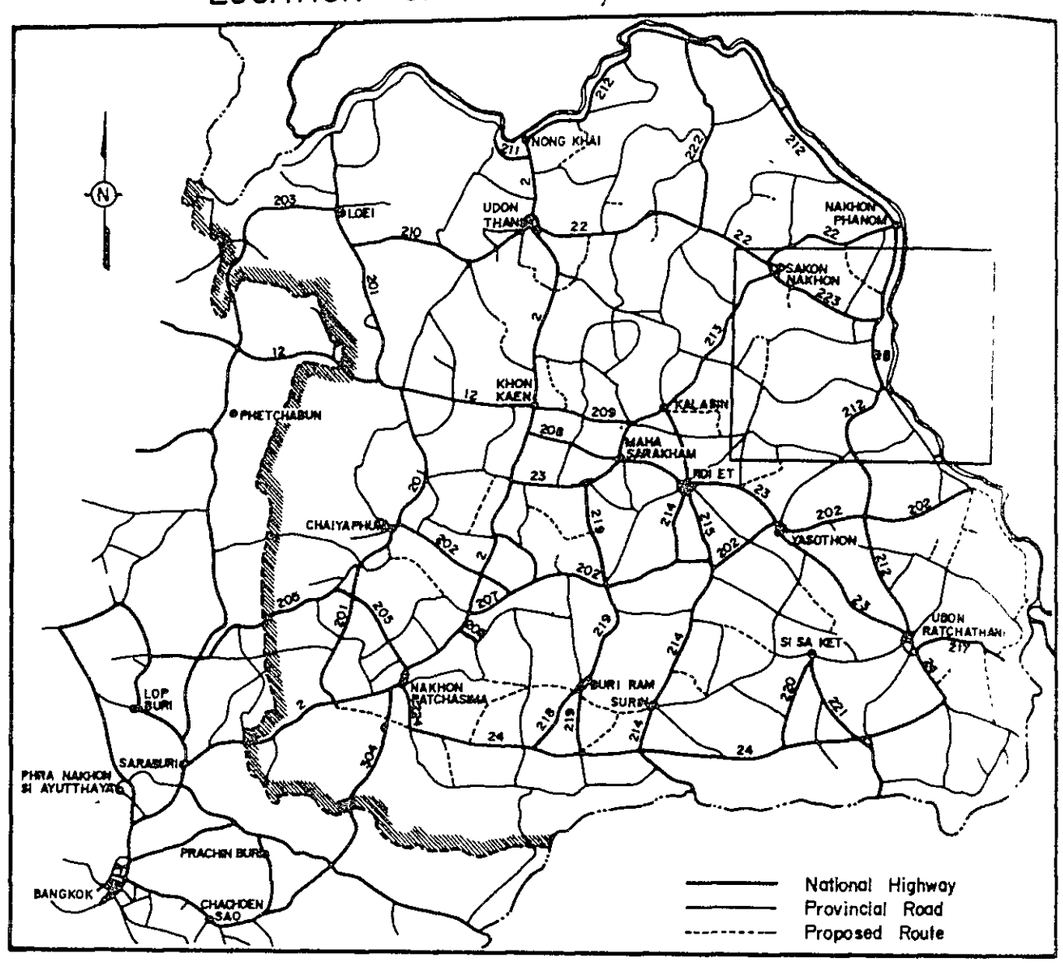
Length : 9.1 KM.

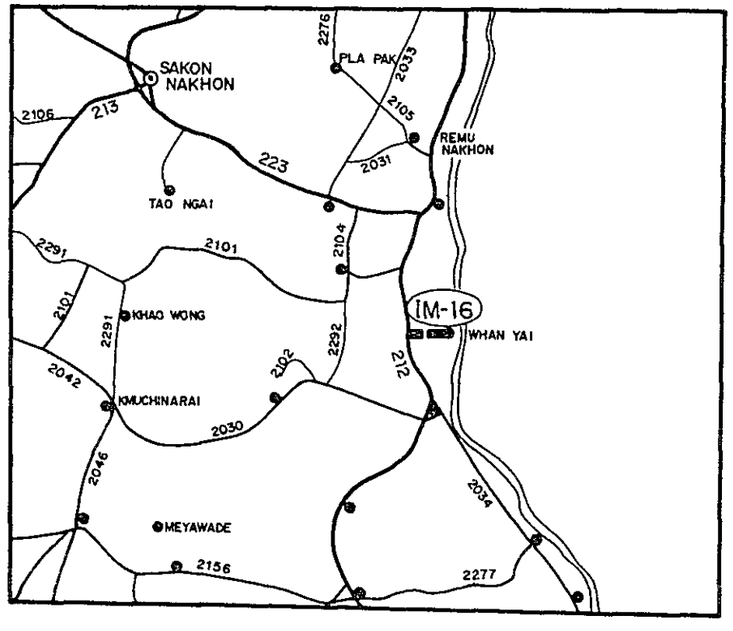
SUMMARY

PROPOSED ROUTE IM-16

Item	Description
Changwat	Nakhon Phanom
Origin	J.R.212
Destination	K.A. Whan Yai
Length	
Total	9.1 km
Improvement Section	9.1 km
DOH Road	0 km
ARD Road	0 km
Others	9.1 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Poor
Terrain	Rolling
Influence Area	
Area	70 km^2
Population (1982)	9,500
Principal Crops	Paddy
Traffic (ADT)	
Existing	67
1993	272
2001	347
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	15,224 . 10^3 ฿
Economic	13,835 . 10^3 ฿
IRR	3.0 %
B/C	0.40
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，Nakhon Phanom 県の南部に位置する。ルートは，県道 212号線と交差する所を起点とし，東に走り，Whan Yai郡で終わる。その総延長は，9.1kmである。(Figure 16.5.2参照)

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，9,500人である。沿道には，医療センターが１ヶ所あるが病院はない。教育施設として中学校が１ヶ所ある。

本路線は，Mekong河岸の Whan Yai 準郡と，幹線道路県道 212号線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 16.1.1 に要約し，その詳細はTable 16.1.2 のイベントリー調査の結果に示した。

2. 交通

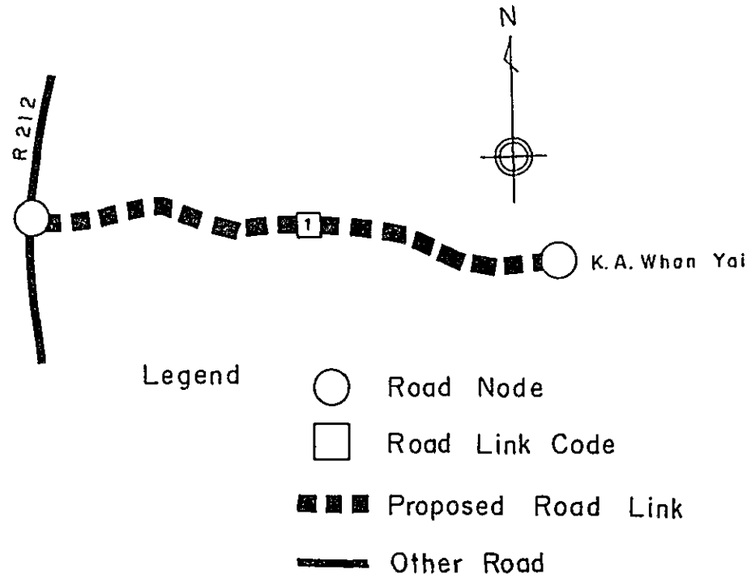
2.1　予測手法

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

2.2　基準年交通量

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

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	19	47	1	-	2	5	19	-	95

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	428

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	11	8	19

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	1.3	1.1
PASSENGER MOVEMENT	5.6	5.7	5.8

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981 － 1987	1987 － 1993	1993 － 2001
NON-AGRI.	7.2	7.3	7.4
AGRICULTURE	0.4	0.5	0.5
FREIGHT	4.4	4.5	4.5

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	0.4	0.5

2.6　将来交通量

1）車種構成

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

TRAFFIC COMPOSITION

(UNIT : %)

LINK NO.	YEAR	PASSENGER					FREIGHT			
		P/C	P/P	L/B	M/B	H/B	P/T	4/T	6/T	10/T
1	1982	0.0	59.6	38.5	1.9	0.0	26.7	33.3	40.0	0.0
	1987	3.9	55.7	32.2	6.1	2.1	24.1	28.8	38.7	8.4
	1993	8.6	51.0	24.6	11.2	4.5	21.1	23.3	37.1	18.5
	2001	14.9	44.7	14.6	17.9	7.9	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 16.2.1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	23	4	1	44	4	5	1	86	145	232
1993	8	23	10	4	50	3	5	2	105	167	272
2001	19	19	23	10	60	2	5	4	142	205	347

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，畑地は少く，モヤツサバ，ケナフ砂糖きびが，僅かに栽培されているが，未開発可耕地は水田，畑地共に，未だ残存している。

圏内の土地利用及び土地適応性の状況はTable 16.3.1とFigure 16.3.1に示し，また，Nakhon Phanom 県地域の代表的作物暦は，Figure 16.3.2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 16.3.2.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 16.3.3.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 16.3.4.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。

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。

Road Condition

Link		Without Project				With Project			
No.	Terrain	Length (Km)	Road Class /1	Nos. of Wooden Bridge	Nos. of Narrow C.Bridge	Length (Km)	Road Class /1 Case 1	Case 2	Nos. of Wooden Narrow Bridge
1	Rolling	9.1	3	0	0	9.1	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)	472	669	1,030
2A (F5)	296	437	682

5. エンジニアリング

5.1 予備設計

予備設計は，次に示す設計規準を基本に行った。

Design Standard : F4 (if not feasible, F5)

Geometric Design : AASHTO (Rural Highways)

Typical Cross Section : as shown in Figure 16.5.1

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 16.5.2

ルートの線形は，Figure 16.5.2示す。

5.2 工事数量および建設費

予備設計による工事数量は建設費は，各工事ごとに単価を付してTable 16.5.1に示す。

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

Total Financial and Economic Construction Cost

Road Class	Length (Km)	Construction Cost (10^3B)		Remark
		Financial Cost	Economic Cost	
F4 (DBST)	9.1	15,224	13,835	
F5 (Laterite)	9.1	7,555	6,862	

6. 経済評価

年次別経済費用と便益及び評価結果はTable 16.6.1，及び 16.6.2 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 16.7.1 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 16.1.1 SUMMARY OF ROAD INVENTORY

Item	Description		
Origin	J.R. 212		
Destination	K.A. Whan Yai		
Length			
Total			9.1 km
Improvement Section			9.1 km
DOH Road			0 km
ARD Road			0 km
Others			9.1 km
New Alignment Section			0 km
Terrain	Rolling		
Alignment (Hori./Vert.)	Fair / Fair		
Formation Width	7.5 m - 9.0 m, 7.9 m (Weighted average)		
Embankment Section			
Length			9.1 km
Height	0.5 m - 1.0 m		
Cut Section			
Length			0 km
Depth	m - m		
Surface Type and Condition			
SBST or DBST			0 km
Soil Aggregate	Poor		9.1 km
Earth			0 km
Pipe Culvert	3 each		
Box Culvert	1 each		9.0 m
Bridge			
Permanent Bridge	1 each		4.0 m
Narrow Concrete Bridge	0 each		0 m (4m)
Wooden Bridge	0 each		0 m
Overflow Section	0 place		0 km

Table 16.1.2 ROAD INVENTORY L = 9.1 Km.

PROPOSED ROUTE NO. IM-16

J.R. 212 ∿ K.A. WHAN YAI
NAKHON PHANOM

STATION (Km)		0	2	4	6	8	10
VILLAGE - Name - Household (H) - Population (P)						K.A. WHAN YAI	
TERRAIN		Rolling					
CROSS SECTION	Formation Width (m)	7.50	8.00	7.50	9.00	8.00	7.50
	Embankment Height (m)	0.50	0.50	0.50	0.50	0.80 1.00	0.40
	Cutting Depth (m)						
PAVEMENT	Type/Length	Laterite					
	Condition	Poor					
FLOODING	Overflow Length(Km)/Height(m)						
LAND USE	Left	Bush	Paddy				
	Right	Bush	Paddy				
PIPE CULVERT	Total Number	3 Pipes					
BOX CULVERT & BRIDGE	Station (Km)					6.9	8.8
	Dimension					C-Br. 7.50 x 4.00	C-Box 1.00 x 0.50 x 9.00
RIGHT OF WAY (m)		15.0					
ALIGNMENT	Horizontal	Fair					
	Vertical	Fair					
ROUTE NO., AGENCIES		Rural					

Table 16.2.1 TRAFFIC VOLUME ON ROUTE IM - 16

YEAR		1987		1993		2001	
LINK		1	AVR.	1	AVR.	1	AVR.
P/C	N+D	2	2	7	7	17	17
	I	0	0	1	1	2	2
	DV	0	0	0	0	0	0
	TOTAL	3	3	8	8	19	- 19
L/B	N+D	20	20	20	20	16	16
	I	3	3	3	3	2	2
	DV	0	0	0	0	0	0
	TOTAL	23	23	23	23	19	19
M/B	N+D	4	4	9	9	20	20
	I	1	1	1	1	3	3
	DV	0	0	0	0	0	0
	TOTAL	4	4	10	10	23	23
H/B	N+D	1	1	4	4	9	9
	I	0	0	1	1	1	1
	DV	0	0	0	0	0	0
	TOTAL	1	1	4	4	10	10
P/P&T	N+D	38	38	43	43	52	52
	I	6	6	6	6	8	8
	DV	0	0	0	0	0	0
	TOTAL	44	44	50	50	60	60
4/T	N+D	4	4	3	3	2	2
	I	1	1	0	0	0	0
	DV	0	0	0	0	0	0
	TOTAL	4	4	3	3	2	2
6/T	N+D	5	5	4	4	4	4
	I	1	1	1	1	1	1
	DV	0	0	0	0	0	0
	TOTAL	5	5	5	5	5	5
10/T	N+D	1	1	2	2	4	4
	I	0	0	0	0	1	1
	DV	0	0	0	0	0	0
	TOTAL	1	1	2	2	4	4
ADT	N+D	75	75	91	91	123	123
	I	11	11	14	14	18	18
	DV	0	0	0	0	1	1
	TOTAL	86	86	105	105	142	142
M/C	N+D	132	132	151	151	186	186
	I	14	14	15	15	18	18
	DV	0	0	0	0	1	1
	TOTAL	145	145	167	167	205	205
TOTAL	N+D	207	207	242	242	309	309
	I	25	25	29	29	37	37
	DV	0	0	1	1	1	1
	TOTAL	232	232	272	272	347	347

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

Figure 16.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM – 16

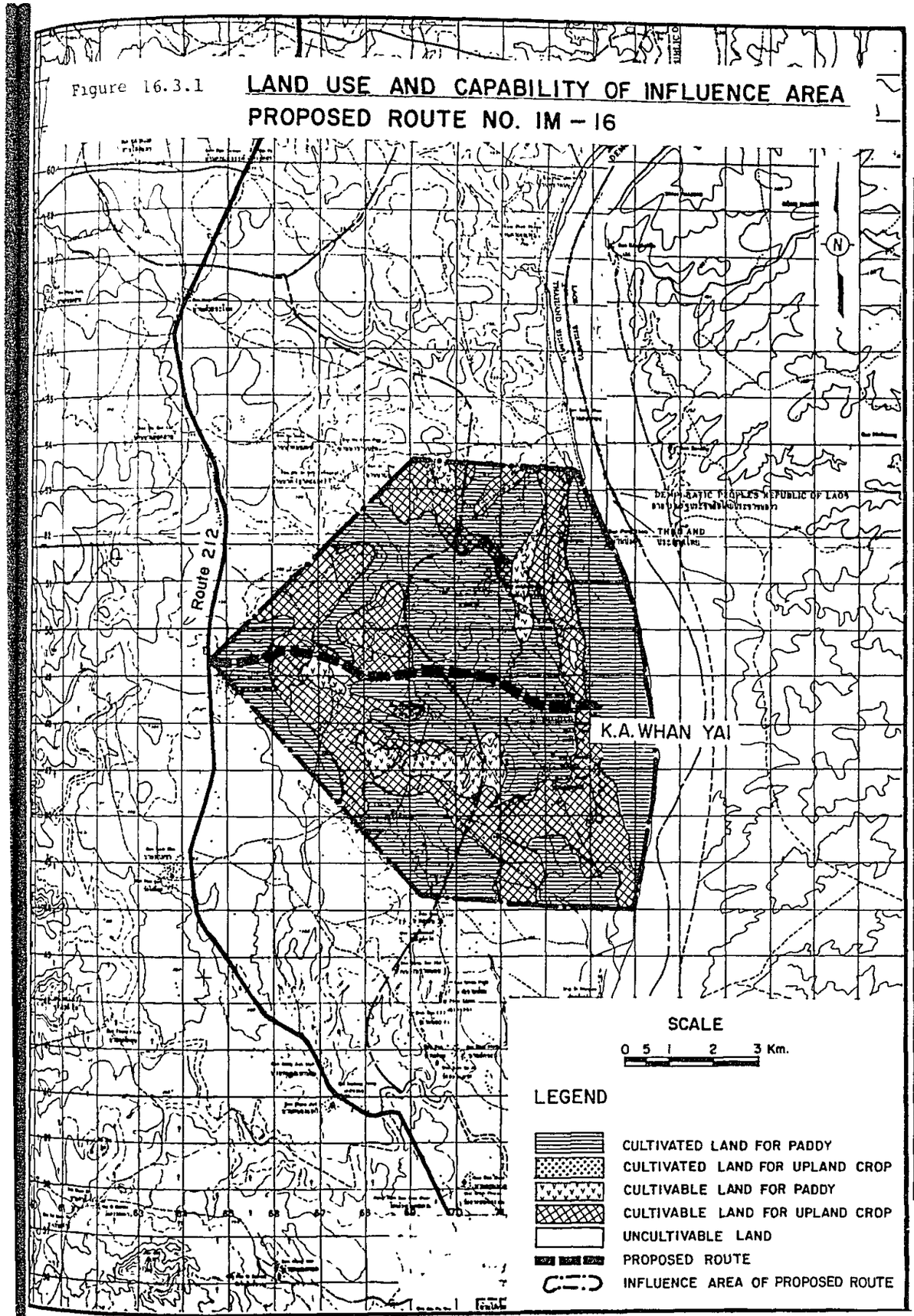


Figure 16.3.2 CROPPING CALENDAR

0500 CHANCWAT NAKHON PHANOM

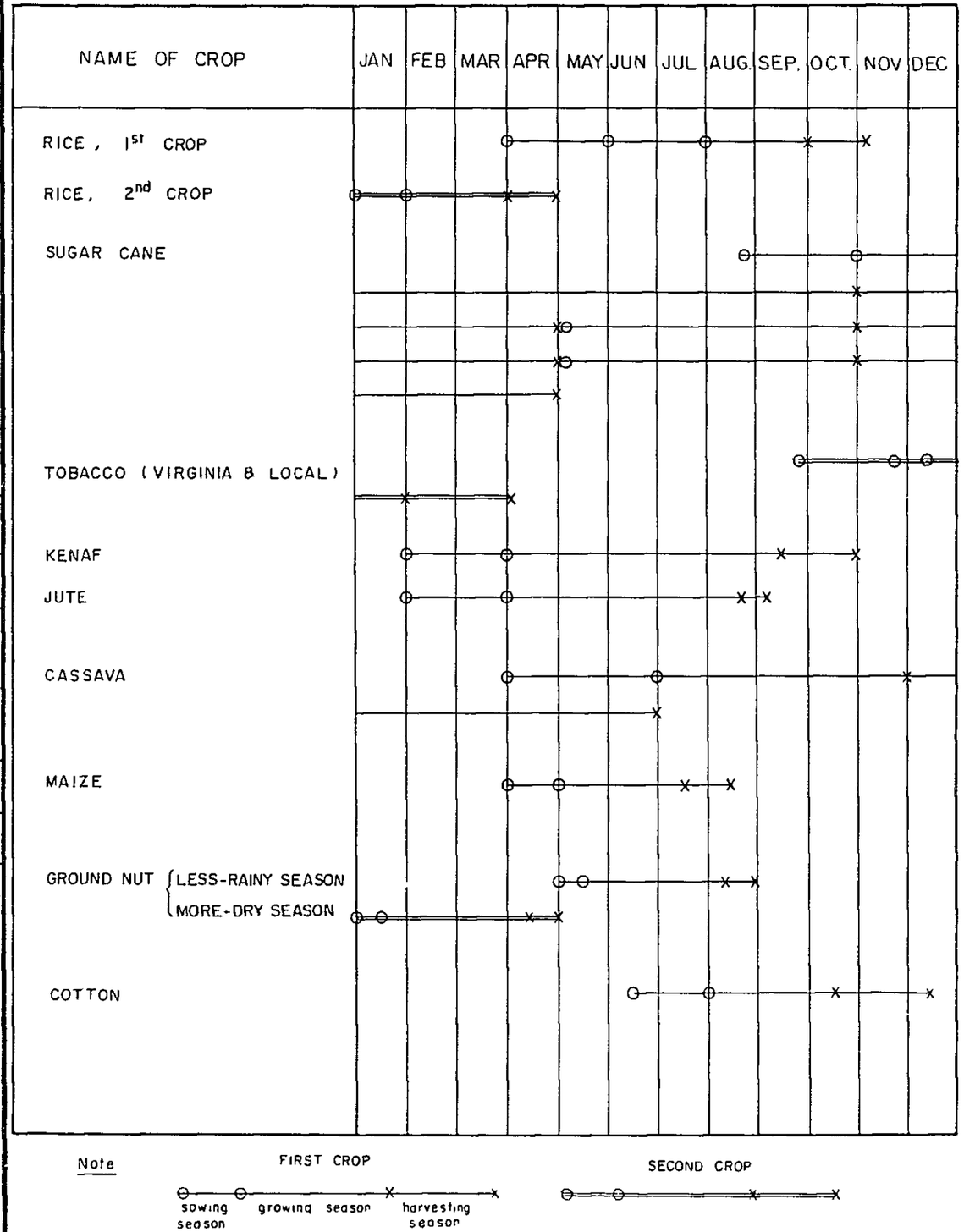


TABLE 16.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		24.375 (39.0)	-	24.375 (39.0)	3.125 (5.0)	16.250 (26.0)	19.375 (31.0)
0512	MUKDAHAN	8.125 (13.0)	-	8.125 (13.0)	1.875 (3.0)	8.750 (14.0)	10.625 (17.0)
0513	WAN YAI	16.250 (26.0)	-	16.250 (26.0)	1.250 (2.0)	7.500 (12.0)	8.750 (14.0)

TABLE 16.3.2 CROP PRODUCTION

ITEM			PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)												
1981			23.36	-	-	-	0.45	0.14	0.33	-	1.00	24.36
1987			23.36	-	-	-	0.49	0.15	0.34	-	1.05	24.41
1993	WITHOUT	PROJECT	23.36	-	-	-	0.53	0.16	0.34	-	1.11	24.47
	WITH	PROJECT	23.36	-	-	-	0.62	0.17	0.35	-	1.21	24.57
2001	WITHOUT	PROJECT	23.36	-	-	-	0.60	0.17	0.35	-	1.20	24.55
	WITH	PROJECT	23.36	-	-	-	0.69	0.18	0.35	-	1.31	24.67
CROP YIELD (KG/RAI)												
1981			225.6	-	-	-	2500.0	6828.7	175.0	-		
1987			227.0	-	-	-	2500.0	6869.8	175.0	-		
1993	WITHOUT	PROJECT	228.4	-	-	-	2500.0	6911.1	175.0	-		
	WITH	PROJECT	232.5	-	-	-	2515.0	6952.7	175.0	-		
2001	WITHOUT	PROJECT	230.2	-	-	-	2500.0	6966.6	175.0	-		
	WITH	PROJECT	240.0	-	-	-	2535.2	7064.7	175.0	-		
CROP PRODUCTION (TON)												
1981			5,270	-	-	-	1,113	970	58	-	2,154	7,424
1987			5,302	-	-	-	1,216	1,036	59	-	2,324	7,626
1993	WITHOUT	PROJECT	5,334	-	-	-	1,330	1,106	60	-	2,509	7,843
	WITH	PROJECT	5,431	-	-	-	1,548	1,180	61	-	2,803	8,234
2001	WITHOUT	PROJECT	5,377	-	-	-	1,498	1,207	61	-	2,780	8,156
	WITH	PROJECT	5,607	-	-	-	1,758	1,299	62	-	3,132	8,739

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 16.3.3 FARMGATE PRICE AND PRODUCTION COST

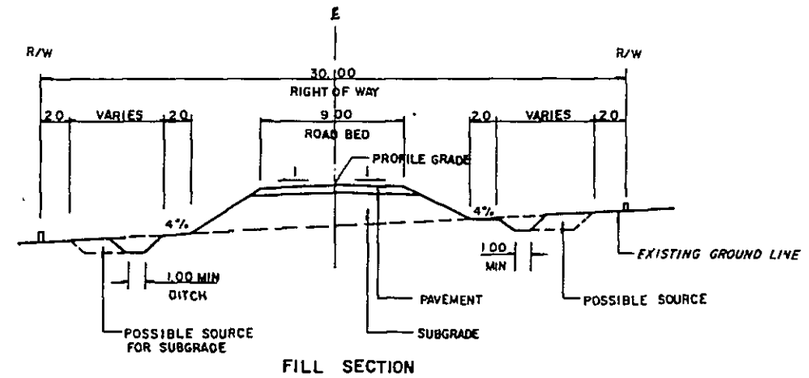
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,630	-	-	-	515	702	3,430	-
WITH PROJECT (1987 - 2001)	3,721	-	-	-	528	702	3,516	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	560	-	-	-	759	2,506	511	-
WITH PROJECT (1987 - 2001)	580	-	-	-	779	2,544	511	-

TABLE 16.3.4 NET PRODUCTION VALUE

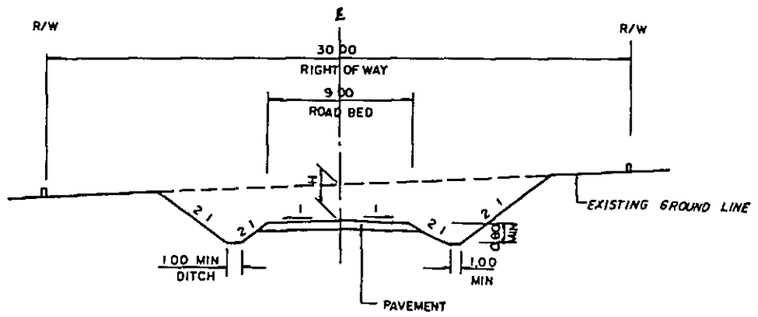
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	6,166	670	6,836	6,181	675	6,856
1993	6,282	721	7,003	6,660	805	7,465
2001	6,437	796	7,233	7,315	903	8,218

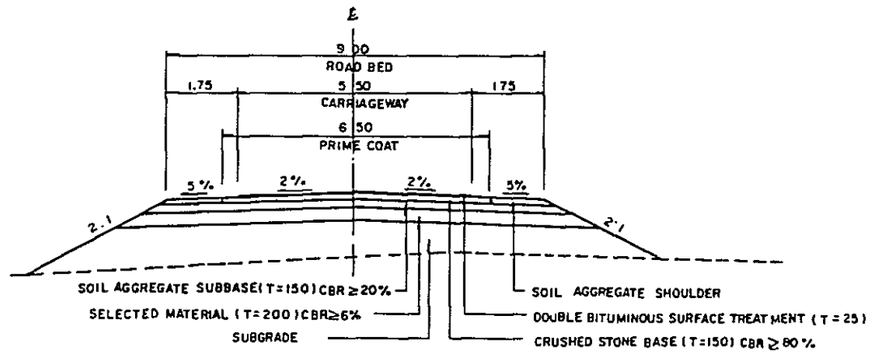
Figure 16.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



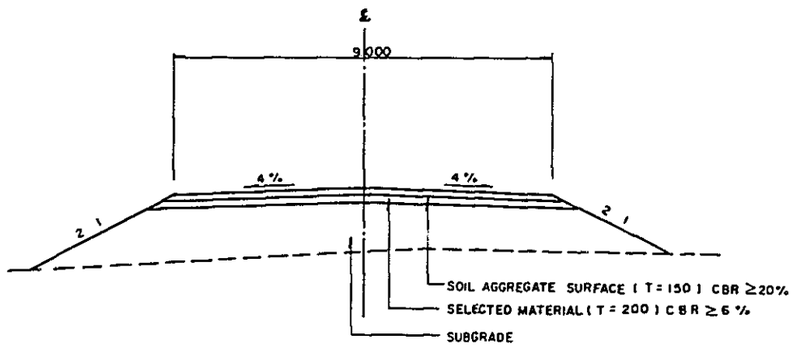
FILL SECTION



CUT SECTION



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

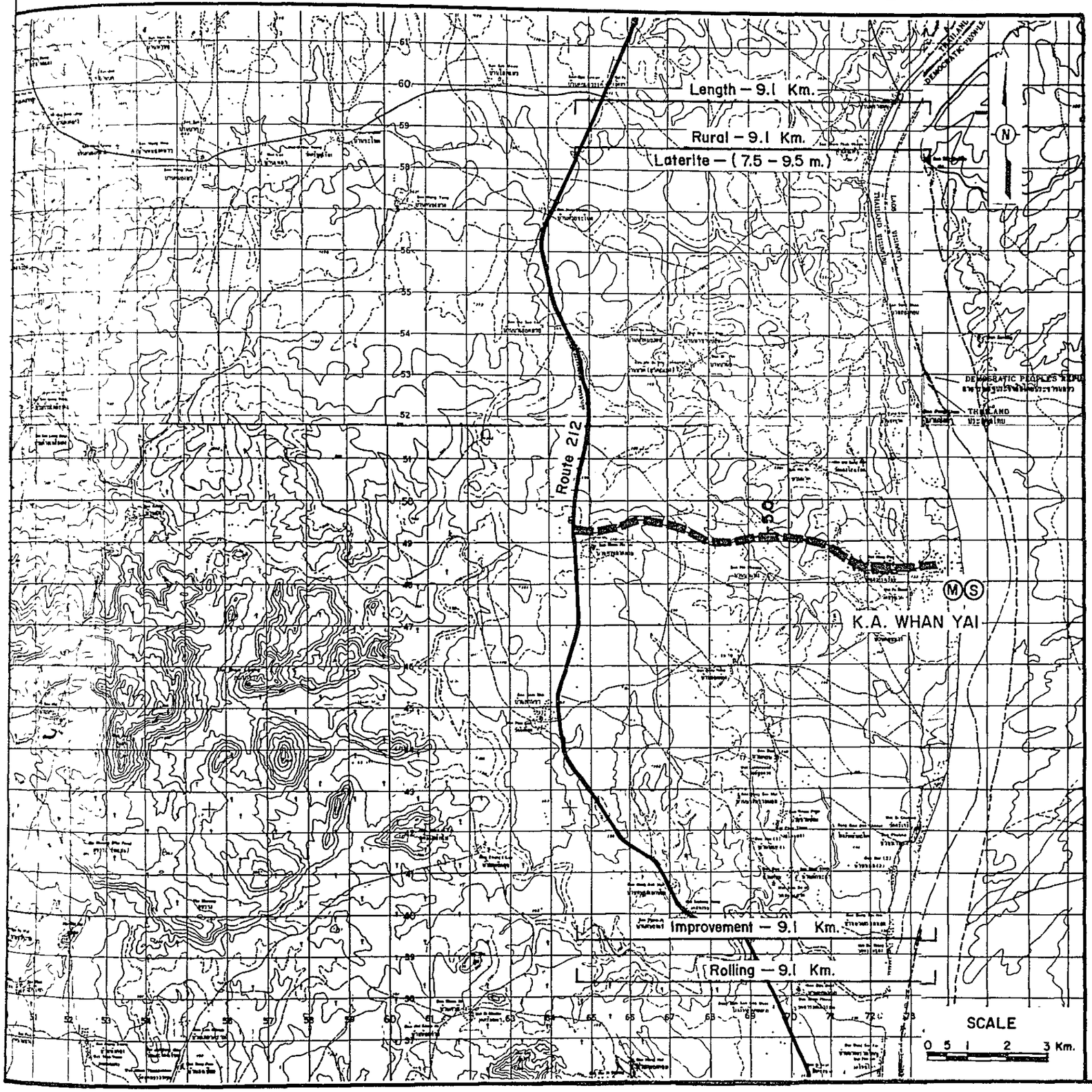


SOIL AGGREGATE SURFACED ROAD (Class F5)

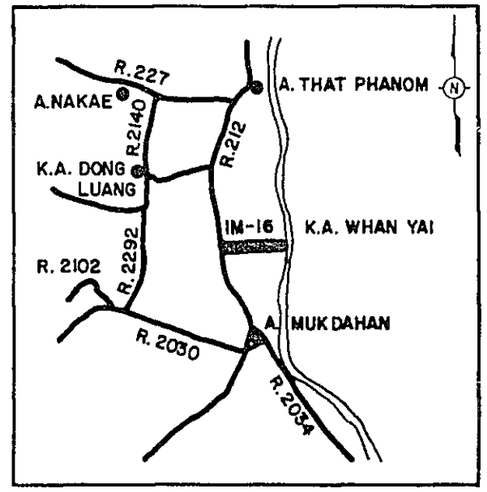
Figure 16.5.2

PROPOSED ROUTE NO. IM-16 C. NAKHON PHANOM J.R. 212 - K.A. WHAN YAI

ROUTE NO. Rural L = 9.1 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	6.9	—	C – 7.50 x 4.00

LEGEND

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

Table 16.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-16 (9.1 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	20	300	273	20	300	273
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	10,700	481	438	10,700	481	438
Selected Material	m^3	80	19,300	1,544	1,374	19,300	1,544	1,374
Soil Aggregate Surface or Subbase	m^3	105	13,500	1,417	1,261	13,500	1,417	1,261
Crushed Stone Base	m^3	370	8,900	3,293	3,029	1,000	370	340
Soil Aggregate Shoulder	m^3	105	3,800	399	355	400	42	37
Prime Coat and DBST	m^2	55	50,100	2,756	2,480	5,500	303	273
Pipe Culvert	m	2,100	320	672	618	320	672	618
Box Culvert	m	16,000	3	48	43	3	48	43
Long Span Bridge	m	80,000	0	0	0	0	0	0
Short Span Bridge	m	40,000	0	0	0	0	0	0
Sub Total (a)				10,911	9,873		5,178	4,659
Miscellaneous Works (a) x 7%				764	691		362	326
Total (b)				11,675	10,564		5,540	4,985
PHYSICAL CONTENGENCY (b) x 15%				1,751	1,585		831	748
ENGINEERING AND ADMINISTRATION (b) x 10%				1,168	1,056		554	499
Sub Total				2,919	2,641		1,385	1,247
LAND ACQUISITION								
Highly Developed Land	ha	50,000	12	600	600	12	600	600
Less Developed Land	ha	15,000	2	30	30	2	30	30
Sub Total				630	630		630	630
GRAND TOTAL				15,224	13,835		7,555	6,862

Table 16.6.1 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	2,767	0	0	0	0	3,471	0
1986	11,068	0	0	0	0	12,396	0
1987	0	20	472	-61	431	0	385
1988	0	91	505	-59	537	0	428
1989	0	162	538	-56	644	0	458
1990	0	233	571	-54	750	0	477
1991	0	304	603	-51	857	0	486
1992	0	375	636	-48	963	0	488
1993	0	446	669	-46	1,070	0	484
1994	4,404	513	714	-42	1,186	1,992	479
1995	0	581	759	-38	1,302	0	469
1996	0	648	804	-34	1,418	0	457
1997	0	715	850	-30	1,534	0	441
1998	0	782	895	-26	1,650	0	424
1999	0	849	940	-23	1,767	0	405
2000	0	916	985	-19	1,883	0	385
2001	-6,704	984	1,030	-15	1,999	-1,225	365
TOTAL	11,535	7,620	10,972	-602	17,990	16,634	6,631

DISCOUNTED ECONOMIC COSTS : 16,634

DISCOUNTED ECONOMIC BENEFITS : 6,631

AGRICULTURAL DEVELOPMENT BENEFIT	2,512
VOC SAVING	4,438
RMC SAVING	-319

NET PRESENT VALUE : -10,004

BENEFIT COST RATIO : 0.40

INTERNAL RATE OF RETURN : 3.0 %

Table 16.6.2 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	1,372	0	0	0	0	1,721	0
1986	5,490	0	0	0	0	6,149	0
1987	0	20	296	-21	295	0	263
1988	0	91	319	-19	392	0	312
1989	0	162	343	-17	488	0	348
1990	0	233	366	-14	585	0	372
1991	0	304	390	-12	682	0	387
1992	0	375	413	-10	778	0	394
1993	0	446	437	-8	875	0	396
1994	484	513	468	-5	976	219	394
1995	0	581	498	-2	1,077	0	388
1996	0	648	529	1	1,178	0	379
1997	0	715	560	4	1,279	0	368
1998	0	782	590	8	1,380	0	354
1999	0	849	621	11	1,481	0	339
2000	0	916	652	14	1,582	0	324
2001	-3,496	984	682	17	1,683	-639	307
TOTAL	3,850	7,620	7,164	-53	14,731	7,450	5,326

DISCOUNTED ECONOMIC COSTS : 7,450

DISCOUNTED ECONOMIC BENEFITS : 5,326

AGRICULTURAL DEVELOPMENT BENEFIT	2,512
VOC SAVING	2,875
RMC SAVING	-61

NET PRESENT VALUE : -2,124

BENEFIT COST RATIO : 0.71

INTERNAL RATE OF RETURN : 8.6 %

Table 16.7.1 SOCIAL INDICATORS
(Proposed Route IM-16)

Population (1,000)		
1982	:	9.5
1993	:	11.1
Average travelling speed, without (kph)	:	40
Isolation		
Access to Amphoe		
Average distance to Amphoe (km) 1/	:	2.3
Per capita time savings (10^{-4})	:	0.023
Score	:	68
Access to Artery Highway		
Average distance to highway (km) 1/	:	9
Per capita time savings (10^{-4})	:	0.090
Score	:	196
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/	:	4.5
Per capita time savings (10^{-4})	:	0.045
Score	:	105
Access to Medical Facilities		
Average distance to facilities (km) 1/	:	4.5
Per capita time savings (10^{-4})	:	0.045
Score	:	180
Education		
Access to Secondary School		
Number of Student in 1993 (1,000) 2/	:	1.8
Average distance to school (km)	:	4.5
Per capita time savings (10^{-4})	:	0.278
Score	:	150
Teacher Intensity		
Number of teachers 3/		
University graduate	:	-
Total	:	13
Number of Student	:	339
Indicators		
E1 4/	:	-
E2 5/	:	38.3
E 6/	:	38.3
Degree of Improvement 7/	:	1.79
Score	:	114
Disparity		
G.P.V. in 1993 (Mn B) 8/		
With project	:	22.2
Without project	:	21.1
Per capita G.P.V. in 1993 (B)		
With project (W)	:	2,000
Without project (w)	:	1,901
Degree of Disparity		
(A/W) - (A/w) 9/	:	0.08
Score	:	143
Total Score	:	956

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 - 17

Changwat : Kalasin

A. Kuchinarai (J.R.2042, 2030) - B. Na Khu

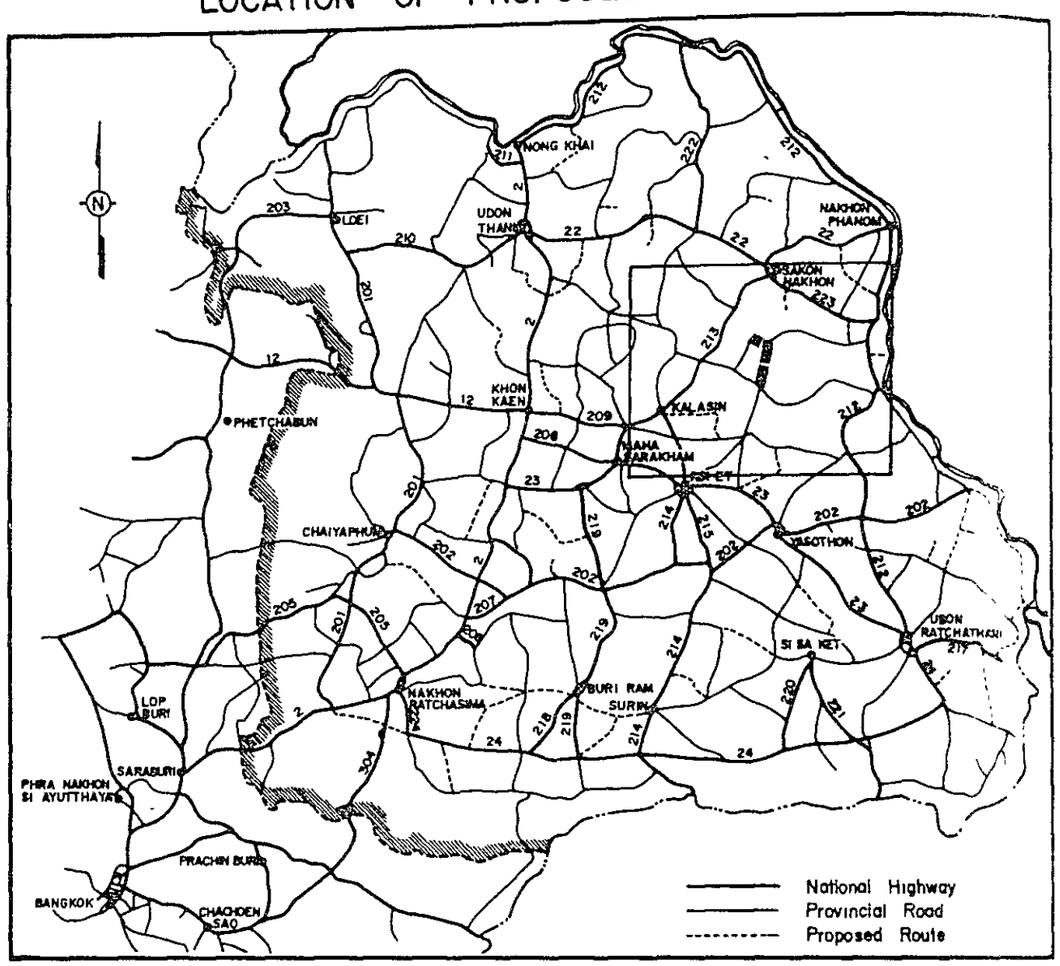
Length : 30.4 KM.

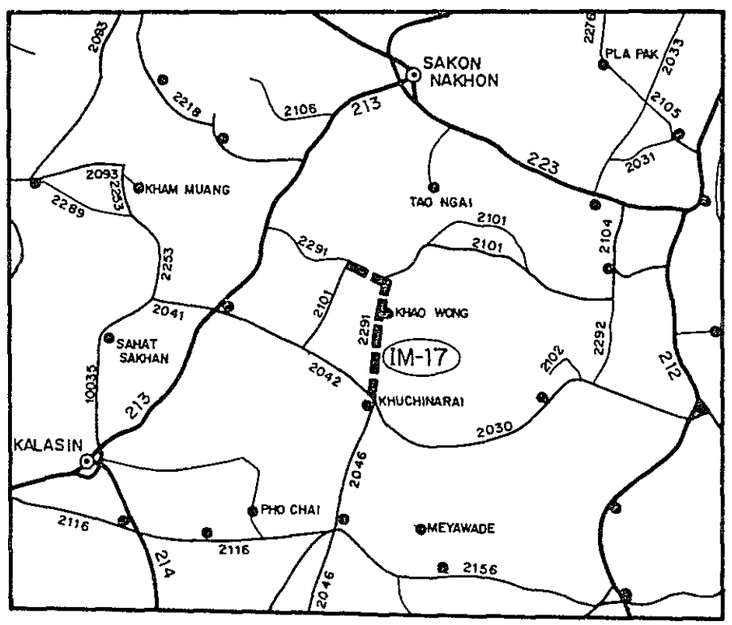
SUMMARY

PROPOSED ROUTE IM-17

Item	Description
Changwat	Kalasin
Origin	A. Kuchinarai (J.R.2042, 2030)
Destination	B. Na Khu
Length	
Total	30.4 km
Improvement Section	30.4 km
DOH Road	R.2291 30.4 km
ARD Road	0 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Poor
Terrain	Flat and Rolling
Influence Area	
Area	175 km^2
Population (1982)	25,300
Principal Crops	Paddy
Traffic (ADT)	
Existing	124
1993	469
2001	611
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	66,060 . 10^3 ฿
Economic	59,650 . 10^3 ฿
IRR	8.7 %
B/C	0.75
Recommendation	For further consideration

LOCATION OF PROPOSED ROUTE





1. 概　要

1.1　計画路線の概要

本路線は，Kalasin 県の南部に位置する。ルートは，県道2042号線と県道2046号線とが交差するKuchinarai郡を起点とし，北に走り，Na Khu村，Khao Wong 郡　Nong Phu村を経て，県道2101号線のNakhu 村で終わる。その総延長は，30.4kmである。（Figure 17.5.2 参照）

沿道の地形は，ほぼ平坦である。一部に丘陵も含む。影響圏内には，いくつかの村が存在し，その総人口は，25,300人である。沿道には，医療センターが２ヶ所，病院が１ヶ所あり，教育施設として中学校が３ヶ所ある。

本路線は農業的に開発の進んだ地域における３つの幹線道路，県道2042号線，県道2046号線と県道2101号線を結ぶ重要な道路網の形成を目途として計画され，又Khao Wong 郡をも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　17.1.1 に要約し，その詳細はTable　17.1.2 のイベントリー調査の結果に示した。

2. 交通

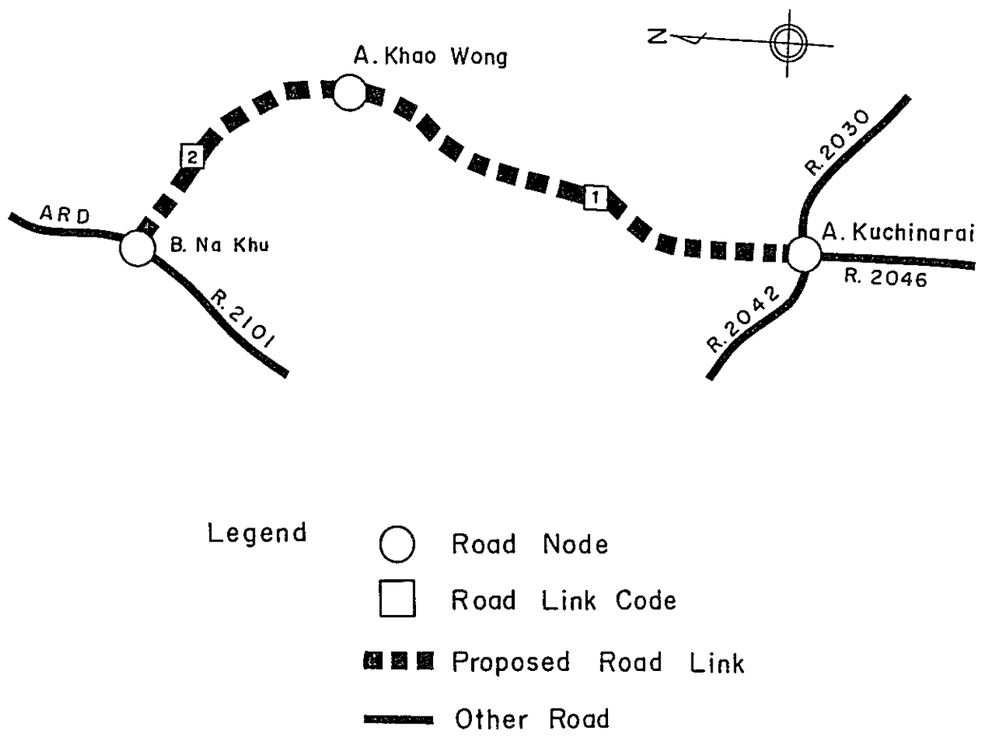
2.1　予測手法

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

2.2　基準年交通量

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

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/	26	21	17	20	5	4	10	25	8	136
	2	n.a.									
Manual Counts (1982)	1	n.a.									
	2	-	21	21	4	-	2	30	8	-	86
Estimated	1	26	21	17	20	5	4	10	25	8	136
	2	-	21	21	4	-	2	30	8	-	86

Note: 1/ Route 2291 Section 0100 Station Km 48+274

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	1010
2	467

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	61	72	133
2	19	22	41

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	1.3	1.1
PASSENGER MOVEMENT	5.6	5.7	5.8

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981 - 1987	1987 - 1993	1993 - 2001
NON-AGRI.	7.2	7.3	7.4
AGRICULTURE	0.4	0.1	0.1
FREIGHT	3.5	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	29.2	23.6	19.1	22.5	5.6	8.5	21.3	53.2	17.0
	1987	24.4	28.4	18.5	22.0	6.7	11.1	19.7	47.7	21.5
	1993	19.6	33.2	17.9	21.6	7.8	13.6	18.1	42.3	26.0
	2001	13.2	39.6	17.0	21.0	9.2	17.0	16.0	35.0	32.0
2	1982	0.0	45.7	45.7	8.7	0.0	5.0	75.0	20.0	0.0
	1987	3.0	42.6	38.8	12.8	2.8	8.2	59.5	23.9	8.4
	1993	6.6	39.0	30.6	17.6	6.1	11.9	40.8	28.7	18.5
	2001	11.4	34.2	19.6	24.2	10.6	17.0	16.0	35.0	32.0

2）将来ＡＤＴ

計画路線上のリンク加重平均将来交通量は以下に示すとおりであり，またその道路リンク別交通タイプ別の詳細はTable 17.2.1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	25	24	24	7	40	13	23	10	167	224	391
1993	28	30	33	12	60	12	23	14	211	258	469
2001	30	40	50	22	102	10	23	21	298	313	611

3.　農業開発

3.1.　現況

影響圏の農耕地の約93％が，水田であり，畑地には，キャツサバ，ケナフ及び落花生が栽培されている。未開発可耕地は，主に畑地が残されている。

圏内の土地利用及び土地適応性の状況はTable 17.3.1とFigure 17.3.1に示し，また，Kalasin 県地域の代表的作物暦は，Figure 17.3.2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 17.3.2.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 17.3.3.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 17.3.4.のように算出した。

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

4. 走行費の節減

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

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

Road Condition

Link		Without Project				With Project			
No.	Terrain	Length (Km)	Road Class /1	Nos. of Wooden Bridge	Nos. of Narrow C.Bridge	Length (Km)	Road Class /1 Case 1	Road Class /1 Case 2	Nos. of Wooden Narrow Bridge
1	Flat & Rolling	23.0	3	4	1	23.0	1(F4)	2A(F5)	0
2	Rolling	7.4	2B	4	2	7.4			0

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

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

Vehicle Operating Cost Saving

(unit: 1,000 Baht)

Road Class	1987	1993	2001
1 (F4)	4,928	6,747	10,171
2A (F5)	3,400	4,782	7,335

5. エンジニアリング

5.1 予備設計

予備設計は，次に示す設計規準を基本に行った。

Design Standard	:	F4 (if not feasible, F5)
Geometric Design	:	AASHTO (Rural Highways)
Typical Cross Section	:	as shown in Figure 17.5.1
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 17.5.2

ルートの線形は，Figure 17.5.2 示す。

5.2 工事数量および建設費

予備設計による工事数量は建設費は，各工事ごとに単価を付してTable 17.5.1 に示す。

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

Total Financial and Economic Construction Cost

Road Class	Length (Km)	Construction Cost (10^3B)		Remark
		Financial Cost	Economic Cost	
F4 (DBST)	30.4	66,060	59,650	
F5 (Laterite)	30.4	40,628	36,519	

6. 経済価格

年次別経済費用と便益及び評価結果はTable 17.6.1 及び 17.6.2 に示す通りである。

このルートはＦ４規格ではフィージブルでないがＦ５規格ではフィージブルである。

7. 社会インパクト

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

Table 17.1.1 SUMMARY OF ROAD INVENTORY

Item	Description		
Origin	A. Kuchinarai (J.R. 2042, 2030)		
Destination	B. Na Khu		
Length			
Total		30.4 km	
Improvement Section		30.4 km	
DOH Road	R.2291	30.4 km	
ARD Road		0 km	
Others		0 km	
New Alignment Section		0 km	
Terrain	Flat and Rolling		
Alignment (Hori./Vert.)	Fair / Fair		
Formation Width	5.5 m - 8.5 m, 7.0 m (Weighted average)		
Embankment Section			
Length		30.4 km	
Height	0.1 m - 1.0 m		
Cut Section			
Length		0 km	
Depth	m - m		
Surface Type and Condition			
SBST or DBST	Poor	7.6 km	
Soil Aggregate	Poor	22.8 km	
Earth		0 km	
Pipe Culvert	24 each		
Box Culvert	0 each	0 m	
Bridge			
Permanent Bridge	1 each	80.0 m	
Narrow Concrete Bridge	3 each	56.1 m	(4m)
Wooden Bridge	8 each	135.5 m	
Overflow Section	2 places	0.9 km	

Table 17.1.2 ROAD INVENTORY

PROPOSED ROUTE NO. IM-17 ROUTE NO. 2291 A. KUCHINARAI (J.R. 2042, 2030) ∿ B. NA KHU L = 30.4 Km.

KALASIN

Item		Entries (left to right along station, 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. KUCHINARAI; B. NA KO H = 1050 P = 5000; B. KUT CHIM H = 150 P = 900; A. KHAO WONG; B. KUT PLA KHAO H = 190 P = 1900; B. NONG PHU H = 400 P = 2400; B. NA KUT CHIM H = 150 P = 900; B. NA KHO H = 250 P = 1500
TERRAIN		Rolling; Flat; Rolling
CROSS SECTION	Formation Width (m)	7,50; 5.50; 8.00; 8.50; 6.50; 8.50; 8.00; 6.00; 7.00
	Embankment Height (m)	0.40; 0.20; 0.10; 0.50; 1.00; 0.30; 0.50; 0.20; 0.80; 1.00; 0.20; 0.40; 0.30; 0.20
	Cutting Depth (m)	
PAVEMENT	Type/Length	DT; Laterite; DT; Laterite; DT; Laterite
	Condition	Poor
FLOODING	Overflow Length(Km)/Height(m)	L=0.3 H=0.8; L=0.6 H=0.6
LAND USE	Left	Paddy; Bush; Paddy
	Right	Paddy; Bush; Paddy
PIPE CULVERT	Total Number	24 Pipes
BOX CULVERT & BRIDGE	Station (Km)	9.4; 10.6; 17.7; 18.2; 20.8; 22.1; 24.2; 24.3; 25.5; 27.2; 28.7; 28.9
	Dimension	C-Br. 4.00 x 20.50; W-Br. 4.50 x 12.00; C-Br. 8.50 x 80.00; W-Br. 4.50 x 15.50; W-Br. 4.50 x 5.00; W-Br. 4.50 x 20.00; C-Br. 4.00 x 7.60; C-Br. 4.00 x 28.00; W-Br. 4.00 x 15.00; W-Br. 4.00 x 15.50; W-Br. 4.00 x 34.00; W-Br. 4.00 x 18.50
RIGHT OF WAY (m)		
ALIGNMENT	Horizontal	Fair
	Vertical	Fair
ROUTE NO., AGENCIES		DOH 2291

Table 17.2.1 TRAFFIC VOLUME ON ROUTE IM - 17

YEAR		1987			1993			2001		
LINK		1	2	AVR.	1	2	AVR.	1	2	AVR.
P/C	N+D	28	2	21	30	5	24	31	11	26
	I	4	0	3	5	1	4	5	2	4
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	32	2	25	35	5	28	36	13	30
L/B	N+D	21	22	21	28	22	26	40	19	35
	I	3	3	3	4	3	4	6	3	5
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	24	25	24	32	25	30	46	22	40
M/B	N+D	25	7	21	34	12	28	50	24	43
	I	4	1	3	5	2	4	7	4	6
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	29	8	24	39	14	33	57	27	50
H/B	N+D	8	2	6	12	4	10	22	10	19
	I	1	0	1	2	1	2	3	2	3
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	9	2	7	14	5	12	25	12	22
P/P&T	N+D	38	26	35	59	30	52	105	37	89
	I	6	4	5	9	5	8	16	6	13
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	44	30	40	68	35	60	121	43	102
4/T	N+D	10	17	12	10	9	10	11	3	9
	I	2	2	2	2	1	2	2	1	1
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	12	19	13	12	11	12	13	4	10
6/T	N+D	24	7	20	24	7	20	24	7	20
	I	4	1	3	4	1	3	4	1	3
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	28	8	23	28	8	23	27	8	23
10/T	N+D	11	2	9	15	4	12	22	7	18
	I	2	0	1	2	1	2	3	1	3
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	13	3	10	17	5	14	25	8	21
ADT	N+D	165	83	145	213	93	184	304	119	259
	I	25	13	22	32	14	28	46	18	39
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	190	96	167	245	107	211	350	137	298
M/C	N+D	225	142	205	263	154	237	324	183	290
	I	21	15	19	23	16	21	25	18	23
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	245	157	224	286	170	258	348	201	313
TOTAL	N+D	390	226	350	476	248	421	628	303	549
	I	45	27	41	55	30	49	70	36	62
	DV	0	0	0	0	0	0	0	0	0
	TOTAL	435	253	391	531	278	469	698	339	611

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

Figure 17.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM – 17

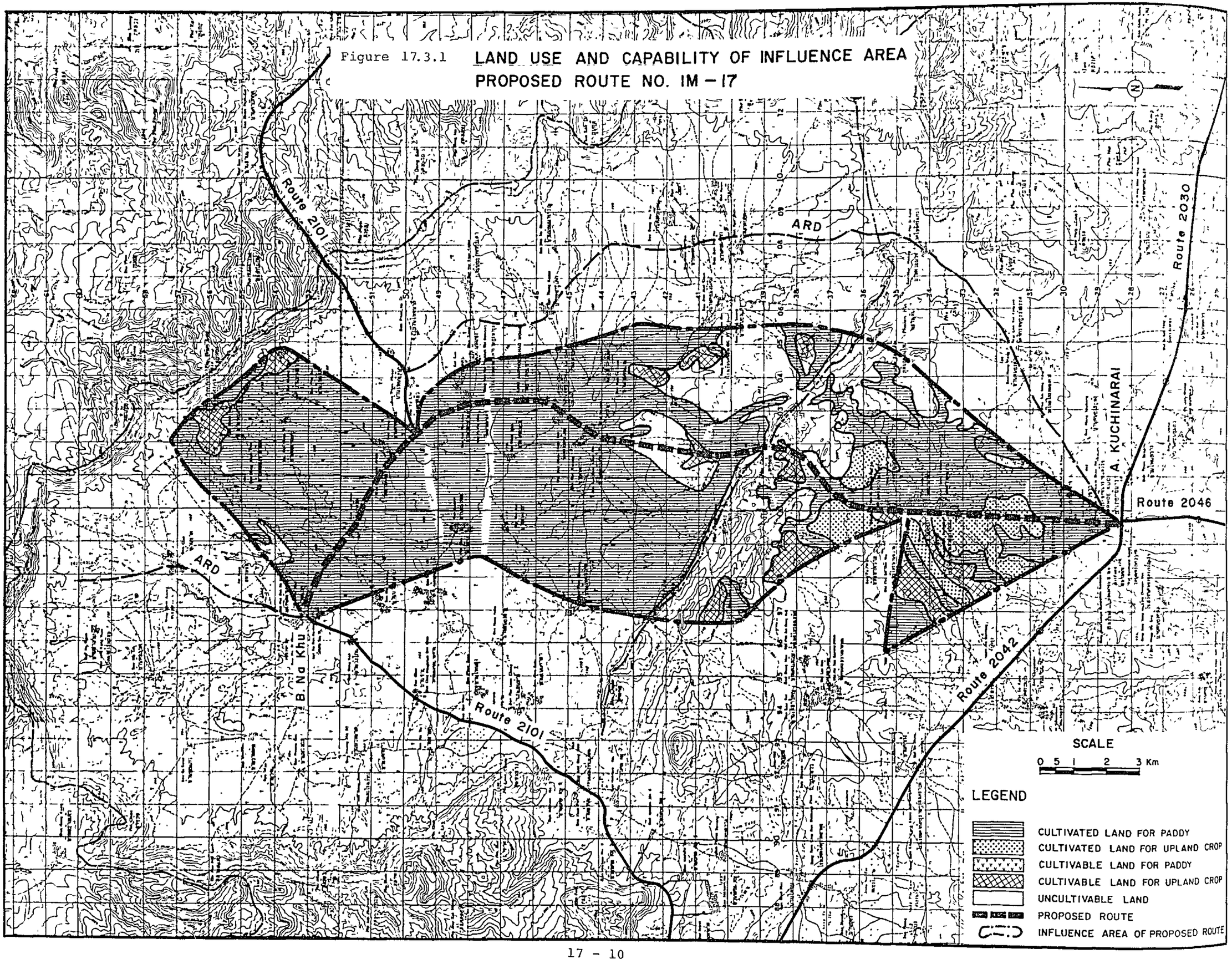


Figure 17.3.2 CROPPING CALENDAR

0800 CHANGWAT KALASIN

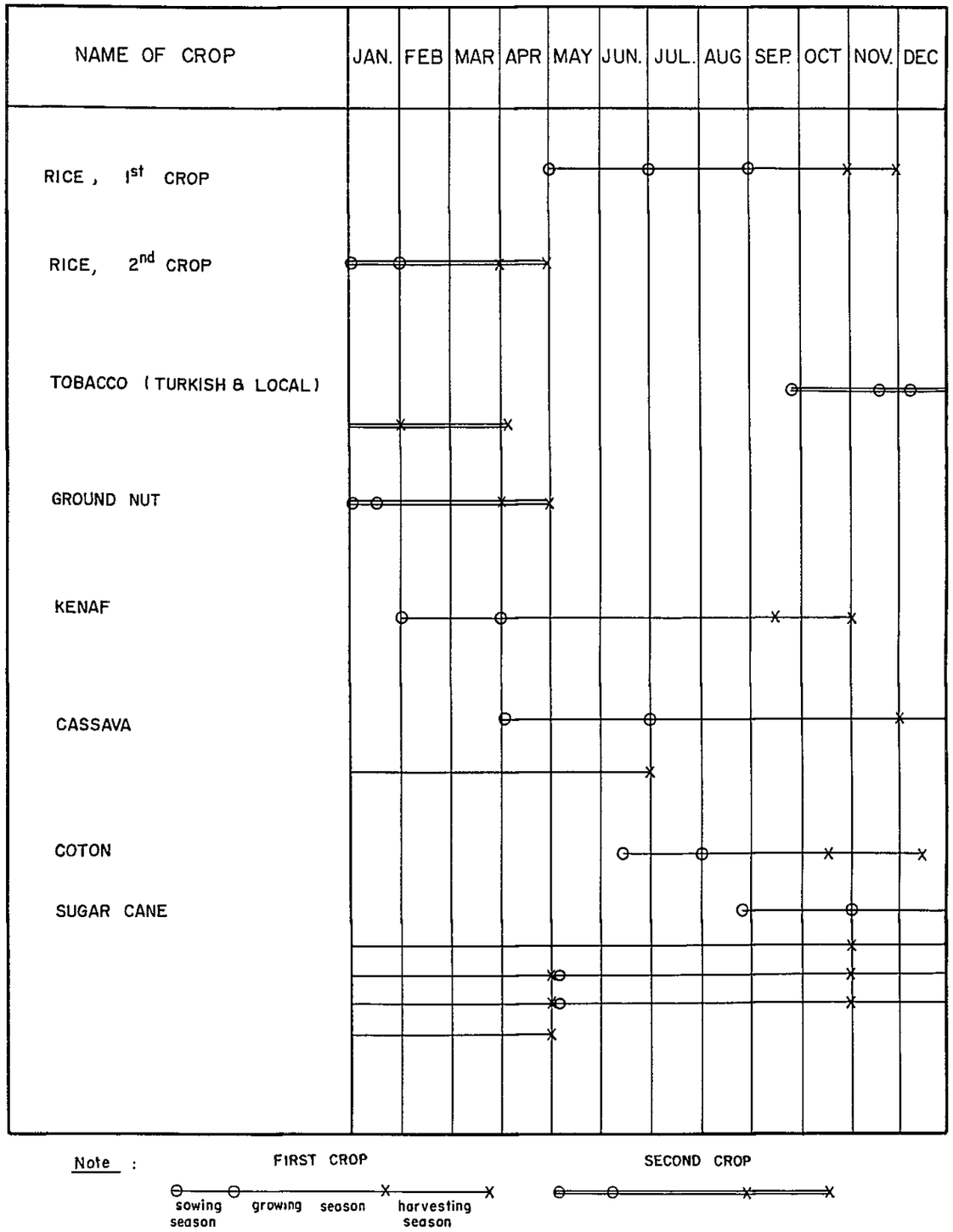


TABLE 17.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		78.125 (125.0)	5.188 (8.3)	83.313 (133.3)	0.250 (0.4)	6.250 (10.0)	6.500 (10.4)
0808	KHAO WONG	63.125 (101.0)	-	63.125 (101.0)	-	2.500 (4.0)	2.500 (4.0)
0809	KUCHINARAI	15.000 (24.0)	5.188 (8.3)	20.188 (32.3)	0.250 (0.4)	3.750 (6.0)	4.000 (6.4)

TABLE 17.3.2 CROP PRODUCTION

ITEM			PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)												
1981			77.22	-	-	0.06	4.01	-	1.22	-	5.33	82.55
1987			79.30	-	-	0.06	4.04	-	1.19	-	5.33	84.64
1993	WITHOUT	PROJECT	79.30	-	-	0.05	4.08	-	1.16	-	5.33	84.64
	WITH	PROJECT	79.30	-	-	0.05	4.15	-	1.09	-	5.33	84.64
2001	WITHOUT	PROJECT	79.30	-	-	0.05	4.12	-	1.12	-	5.33	84.64
	WITH	PROJECT	79.30	-	-	0.05	4.20	-	1.05	-	5.33	84.64
CROP YIELD (KG/RAI)												
1981			258.1	-	-	189.7	2610.6	-	213.4	-		
1987			259.6	-	-	189.7	2610.6	-	213.4	-		
1993	WITHOUT	PROJECT	261.2	-	-	189.7	2610.6	-	213.4	-		
	WITH	PROJECT	264.3	-	-	190.8	2626.4	-	213.4	-		
2001	WITHOUT	PROJECT	263.3	-	-	189.7	2610.6	-	213.4	-		
	WITH	PROJECT	270.7	-	-	192.3	2647.4	-	213.4	-		
CROP PRODUCTION (TON)												
1981			19,927	-	-	11	10,461	-	261	-	10,970	30,896
1987			20,589	-	-	11	10,553	-	254	-	11,051	31,640
1993	WITHOUT	PROJECT	20,712	-	-	10	10,644	-	247	-	11,132	31,844
	WITH	PROJECT	20,962	-	-	10	10,907	-	232	-	11,365	32,327
2001	WITHOUT	PROJECT	20,879	-	-	10	10,763	-	238	-	11,236	32,115
	WITH	PROJECT	21,470	-	-	10	11,109	-	223	-	11,556	33,026

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 17.3.3 FARMGATE PRICE AND PRODUCTION COST

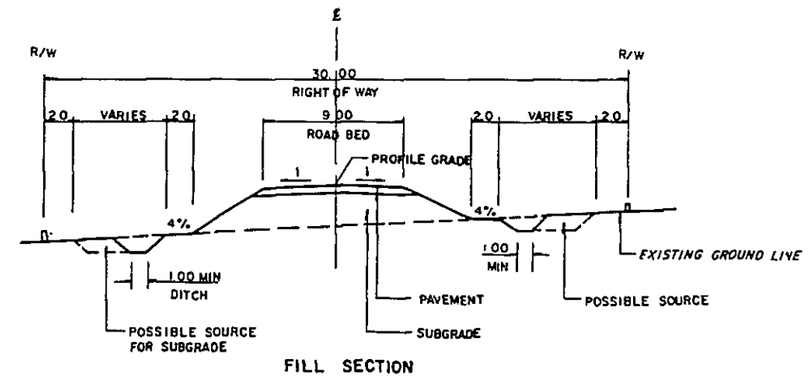
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,550	-	-	6,273	680	-	4,069	-
WITH PROJECT (1987 - 2001)	3,639	-	-	6,273	697	-	4,171	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	599	-	-	1,019	724	-	795	-
WITH PROJECT (1987 - 2001)	617	-	-	1,039	744	-	795	-

TABLE 17.3.4 NET PRODUCTION VALUE

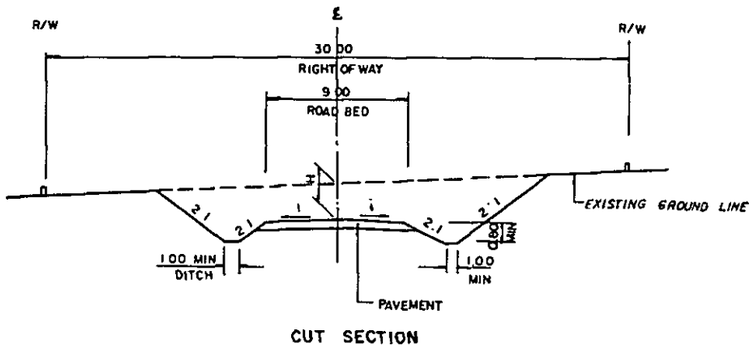
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	25,587	4,378	29,965	25,981	4,500	30,481
1993	26,026	4,414	30,440	27,340	4,655	31,995
2001	26,616	4,461	31,077	29,190	4,764	33,954

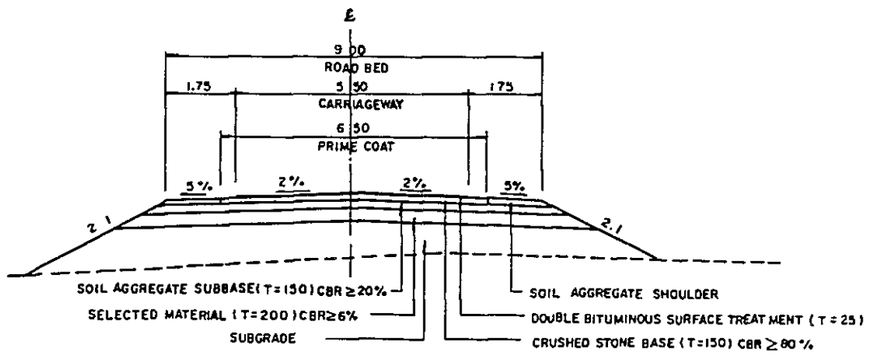
Figure 17. 5. 1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



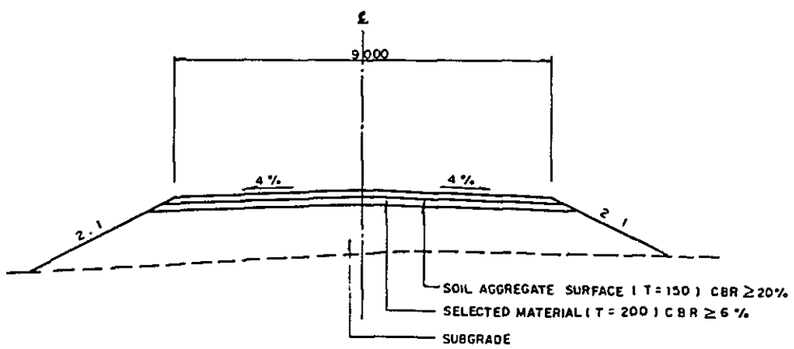
FILL SECTION



CUT SECTION

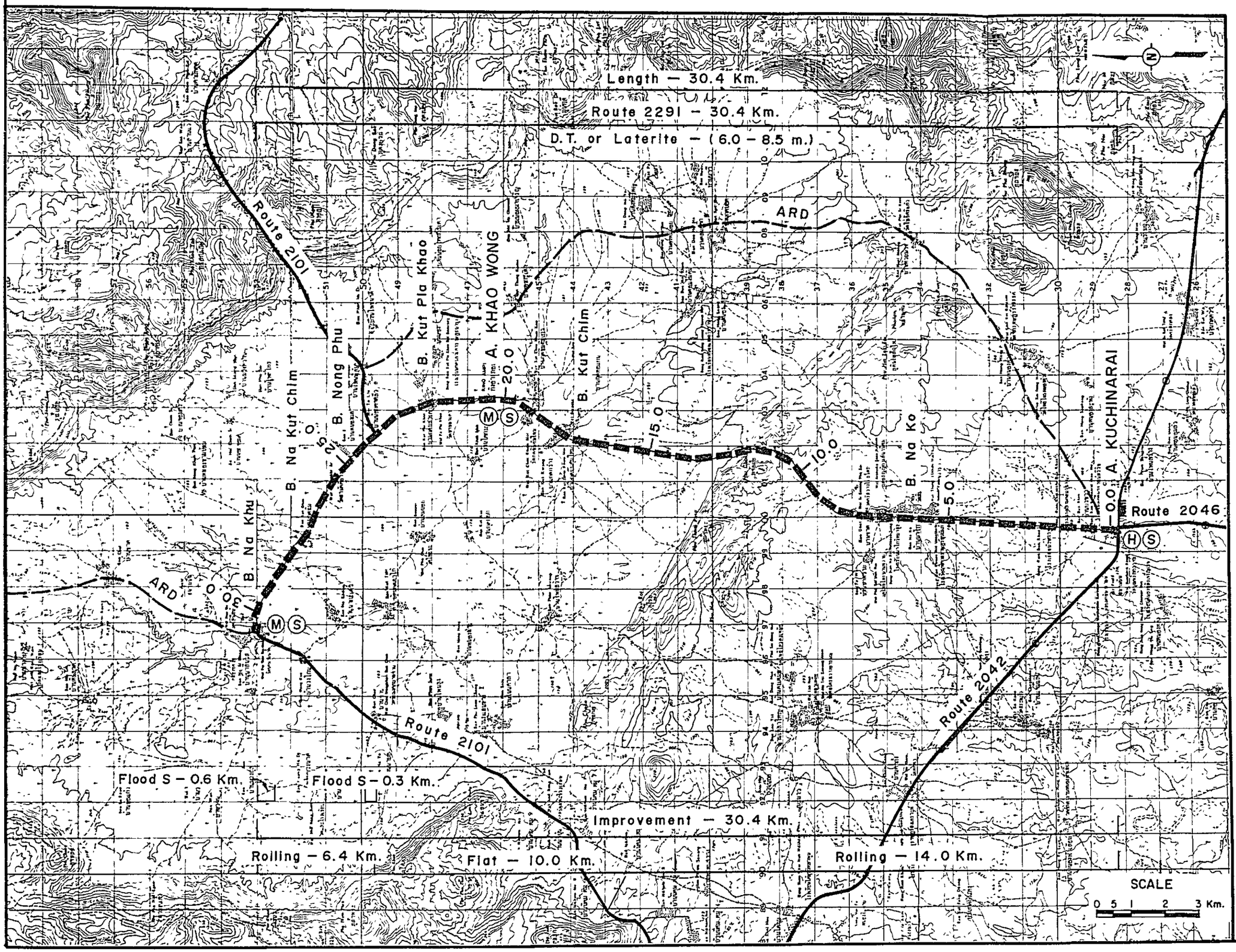


DOUBLE BITUMINOUS SURFACE TREATMENT (DBST) ROAD (Class F4)



SOIL AGGREGATE SURFACED ROAD (Class F5)

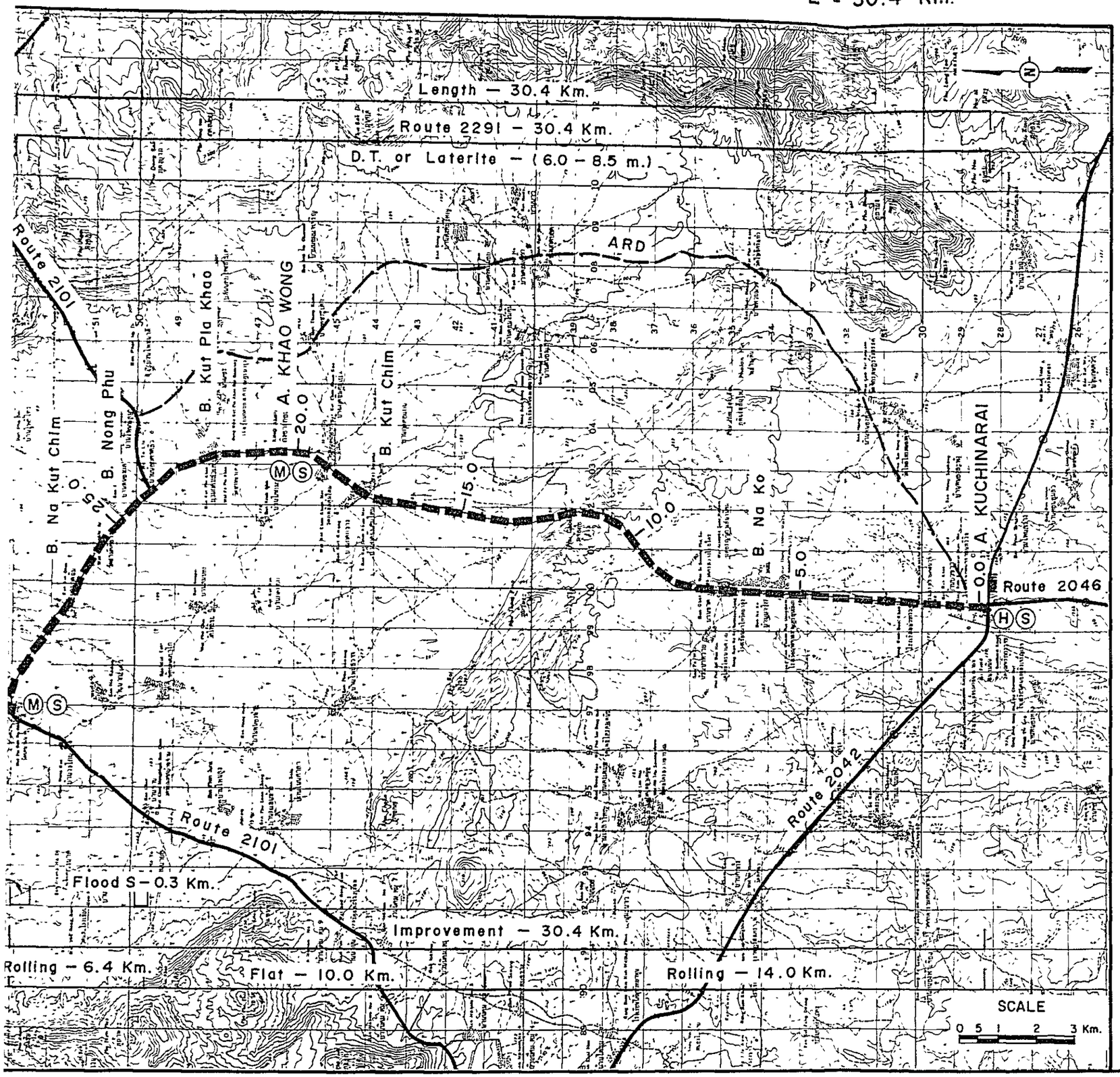
Figure 17.5.2 **PROPOSED ROUTE NO. IM - 17** **C. KALASIN** **A. KUCHINARAI (J.R.2042, 2030) - B. NA KHU**
ROUTE NO. 2291 **L = 30.4 Km.**



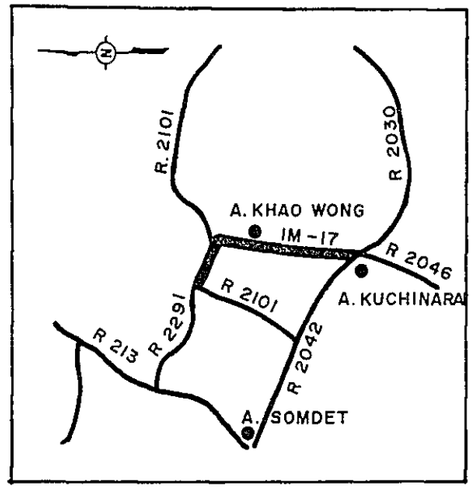
No.	Station Km.
1	9.4
2	10.6
3	17.7
4	18.2
5	20.8
6	22.1
7	24 2
8	24.3
9	25.5
10	27.2
11	28.7
12	28.9

LEGEND

ROUTE NO. IM - 17 C. KALASIN A. KUCHINARAI (J.R.2042, 2030) - B. NA KHU
ROUTE NO. 2291 L = 30.4 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	9.4	C - 7.00x 20.50	C - 4 00 x 20 50
2	10 6	C - 7.00 x 14.00	W - 4 50 x 12.00
3	17 7	-	C - 8 50 x 80 00
4	18.2	C - 7 00 x 18 00	W - 4 50 x 15 50
5	20.8	C - 7 00 x 7 00	W - 4 50 x 5 00
6	22 1	C - 7 00 x 22.00	W - 4.50 x 2000
7	24 2	C - 7 00 x 7.60	C - 4 00 x 7.60
8	24 3	C - 7.00 x 28.00	C - 4 00 x 28 00
9	25 5	C - 7.00 x 18.00	W - 4.00 x 15 00
10	27.2	C - 7.00 x 18 00	W - 4 00 x 15.50
11	28 7	C - 7 00 x 36 00	W - 4 00 x 34 00
12	28.9	C - 7 00 x 21 00	W - 4 00 x 18 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 17.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-17 (30.4 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	70	1,050	955	70	1,050	955
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	126,900	5,710	5,196	126,900	5,710	5,196
Selected Material	m^3	80	64,500	5,160	4,592	64,500	5,160	4,592
Soil Aggregate Surface or Subbase	m^3	105	45,200	4,746	4,223	45,200	4,746	4,223
Crushed Stone Base	m^3	370	29,600	10,952	10,075	3,400	1,258	1,157
Soil Aggregate Shoulder	m^3	105	12,800	1,344	1,196	1,500	157	140
Prime Coat and DBST	m^2	55	167,200	9,196	8,276	19,300	1,062	956
Pipe Culvert	m	2,100	1,330	2,793	2,569	1,330	2,793	2,569
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	211	8,440	7,511	211	8,440	7,511
Sub Total (a)				49,391	44,598		30,377	27,304
Miscellaneous Works (a) x 7%				3,457	3,122		2,126	1,911
Total (b)				52,848	47,720		32,503	29,215
PHYSICAL CONTENGENCY (b) x 15%				7,927	7,158		4,875	4,382
ENGINEERING AND ADMINISTRATION (b) x 10%				5,285	4,772		3,250	2,922
Sub Total				13,212	11,930		8,125	7,304
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				66,060	59,650		40,628	36,519

Table 17.6.1 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	23,860	0	0	0	0	29,930	0
1986	35,790	0	0	0	0	40,085	0
1987	0	516	4,928	-105	5,339	0	4,767
1988	0	689	5,231	-91	5,829	0	4,647
1989	0	862	5,534	-78	6,319	0	4,498
1990	0	1,036	5,838	-64	6,809	0	4,327
1991	0	1,209	6,141	-51	7,299	0	4,141
1992	0	1,382	6,444	-37	7,788	0	3,946
1993	0	1,555	6,747	-24	8,278	0	3,745
1994	14,713	1,720	7,175	-4	8,891	6,655	3,591
1995	0	1,886	7,603	15	9,504	0	3,427
1996	0	2,051	8,031	35	10,116	0	3,257
1997	0	2,216	8,459	54	10,729	0	3,084
1998	0	2,381	8,887	74	11,342	0	2,911
1999	0	2,547	9,315	93	11,955	0	2,740
2000	0	2,712	9,743	113	12,567	0	2,572
2001	-27,439	2,877	10,171	132	13,180	-5,013	2,408
TOTAL	46,924	25,638	110,246	62	135,945	71,657	54,061

DISCOUNTED ECONOMIC COSTS :	71,657
DISCOUNTED ECONOMIC BENEFITS :	54,061
AGRICULTURAL DEVELOPMENT BENEFIT	9,319
VOC SAVING	44,945
RMC SAVING	-203
NET PRESENT VALUE :	-17,596
BENEFIT COST RATIO :	0.75
INTERNAL RATE OF RETURN :	8.7 %

Table 17.6.2 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	14,607	0	0	0	0	18,323	0
1986	21,912	0	0	0	0	24,541	0
1987	0	516	3,400	-12	3,904	0	3,486
1988	0	689	3,631	-3	4,317	0	3,441
1989	0	862	3,861	7	4,730	0	3,367
1990	0	1,036	4,091	16	5,143	0	3,268
1991	0	1,209	4,321	26	5,556	0	3,152
1992	0	1,382	4,551	35	5,968	0	3,024
1993	0	1,555	4,782	45	6,381	0	2,887
1994	1,694	1,720	5,101	58	6,879	766	2,778
1995	0	1,886	5,420	72	7,377	0	2,660
1996	0	2,051	5,739	85	7,875	0	2,536
1997	0	2,216	6,058	99	8,374	0	2,407
1998	0	2,381	6,378	113	8,872	0	2,277
1999	0	2,547	6,697	126	9,370	0	2,147
2000	0	2,712	7,016	140	9,868	0	2,019
2001	-16,799	2,877	7,335	154	10,366	-3,069	1,894
TOTAL	21,414	25,638	78,382	960	104,979	40,562	41,344

DISCOUNTED ECONOMIC COSTS :	40,562
DISCOUNTED ECONOMIC BENEFITS :	41,344
AGRICULTURAL DEVELOPMENT BENEFIT	9,319
VOC SAVING	31,751
RMC SAVING	274
NET PRESENT VALUE :	782
BENEFIT COST RATIO :	1.02
INTERNAL RATE OF RETURN :	12.2 %

Table 17.7.1 SOCIAL INDICATORS

(Proposed Route IM-17)

Population (1,000)		
1982	:	25.3
1993	:	29.5
Average travelling speed, without (kph)	:	40
Isolation		
Access to Amphoe		
Average distance to Amphoe (km) 1/	:	5.2
Per capita time savings (10^{-4})	:	0.020
Score	:	59
Access to Artery Highway		
Average distance to highway (km) 1/	:	23
Per capita time savings (10^{-4})	:	0.087
Score	:	189
Impassability		
Impassable week a year	:	2
Impassability per year	:	0.038
Impassability per capita (10^{-4})	:	0
Score	:	0
Health		
Access to Hospital		
Average distance to Hospital (km) 1/	:	15.0
Per capita time savings (10^{-4})	:	0.057
Score	:	133
Access to Medical Facilities		
Average distance to facilities (km) 1/	:	5.5
Per capita time savings (10^{-4})	:	0.021
Score	:	84
Education		
Access to Secondary School		
Number of Student in 1993 (1,000) 2/	:	4.4
Average distance to school (km)	:	5.2
Per capita time savings (10^{-4})	:	0.131
Score	:	71
Teacher Intensity		
Number of teachers 3/		
University graduate	:	2
Total	:	9
Number of Student	:	188
Indicators		
E1 4/	:	10.6
E2 5/	:	47.9
E 6/	:	58.5
Degree of Improvement 7/	:	1.17
Score	:	74
Disparity		
G.P.V. in 1993 (Mn B) 8/		
With project	:	85.1
Without project	:	82.0
Per capita G.P.V. in 1993 (B)		
With project (W)	:	2,885
Without project (w)	:	2,780
Degree of Disparity		
(A/W) - (A/w) 9/	:	0.04
Score	:	71
Total Score	:	681

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.