

PROPOSED ROUTE NO. IM - 24

Changwat · Ubon Ratchathani

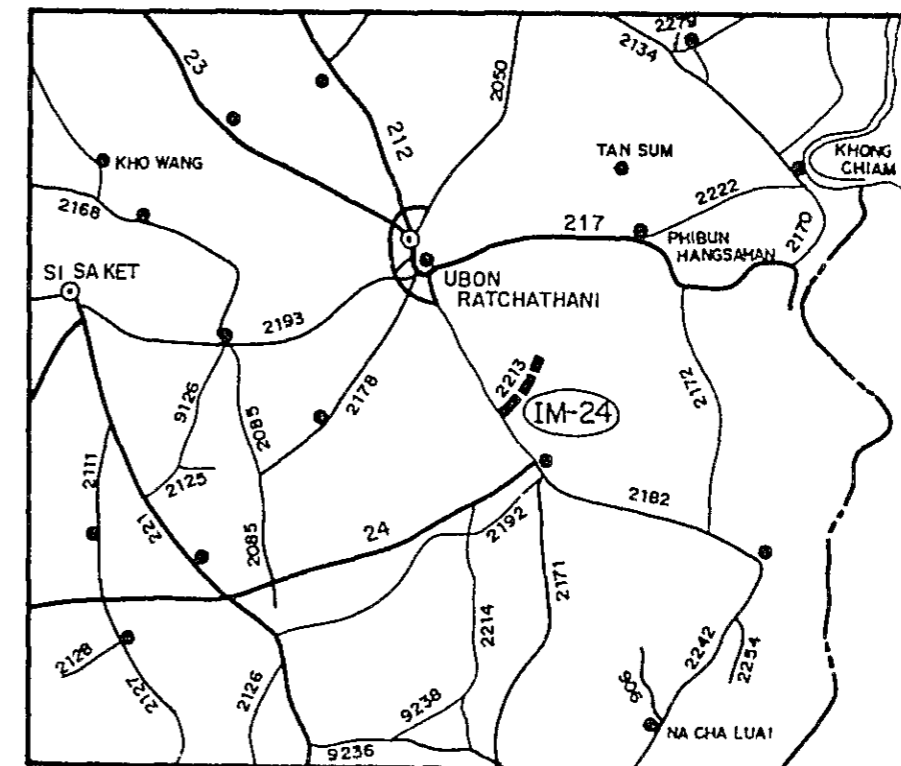
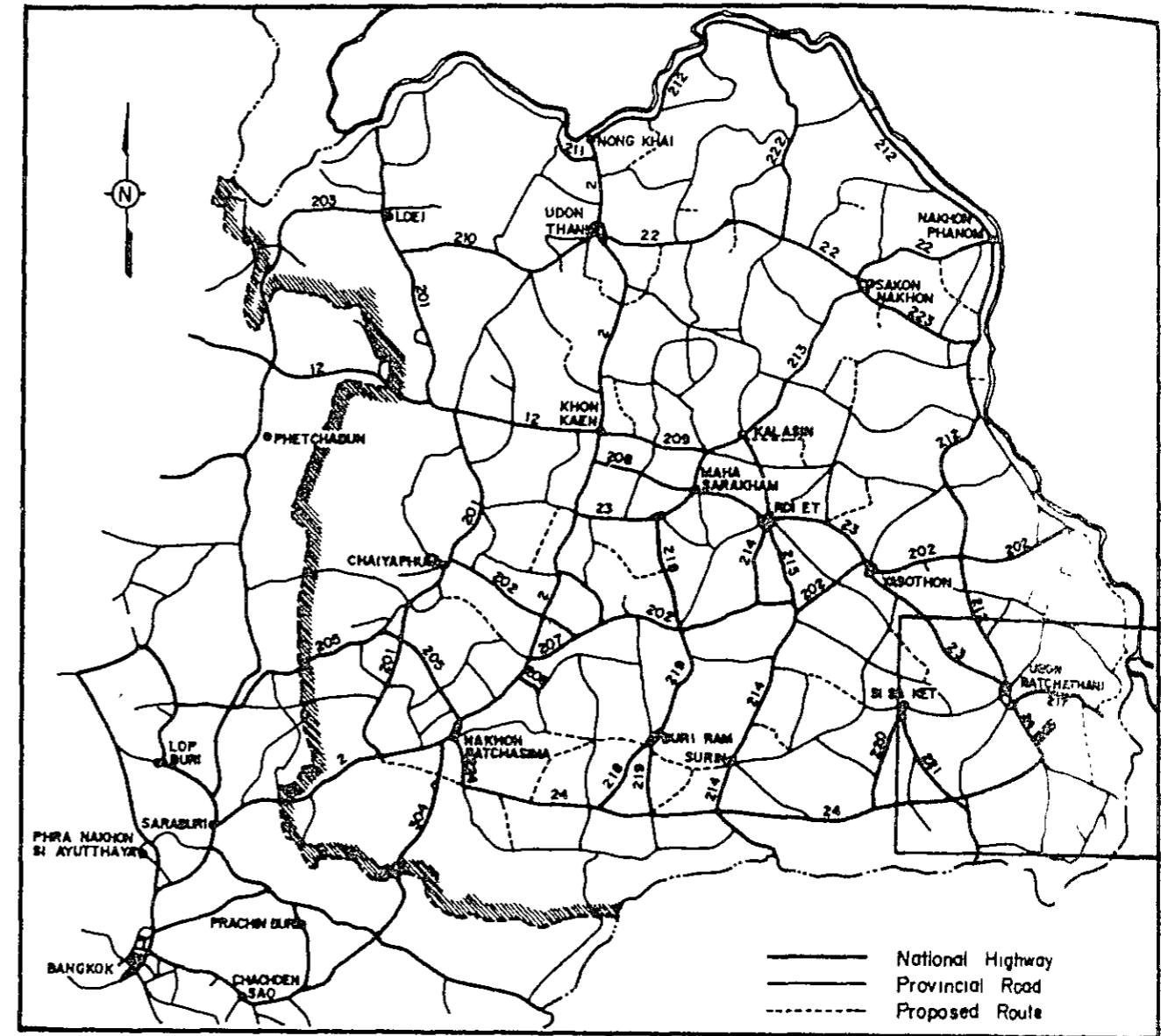
B. Na Suang (J.R.24) - B. Na Yia

Length · 14.5 KM.

SUMMARY
PROPOSED ROUTE IM-24

Item	Description
Changwat	Ubon Ratchathani
Origin	B. Na Suang (J.R.24)
Destination	B. Na Yia
Length	
Total	14.5 km
Improvement Section	14.5 km
DOH Road	R.2213 14.5 km
ARD Road	0 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Good
Terrain	Rolling
Influence Area	
Area	71 km ²
Population (1982)	6,000
Principal Crops	Paddy
Traffic (ADT)	
Existing	169
1993	727
2001	1,027
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	25,653 . 10 ³ ฿
Economic	23,184 . 10 ³ ฿
IRR	10.6 %
B/C	0.89
Social Impact	High
Recommendation	For immediate implementation

LOCATION OF PROPOSED ROUTE



1. GENERAL

1.1 Characteristics of Route

The proposed route is located in the southeast of Changwat Ubon Ratchathani.

The route, starting at the intersection with Route 24 at Ban Na Suang, runs northeastward passing through Ban Na Chik and ends at Ban Na Yia.

Its total length is 14.5 km. (Figure 24.5.2)

The terrain is rolling. In the influence area, there exists a village with total population of 6,000.

There are only one medical center, and one secondary school at the end of route.

The proposed route, upon completion, will play vital role to connect the agriculturally developed area to artery highway, Route 24.

1.2 Condition of Existing Road

Condition of existing roads to be utilized for the proposed route is summarized in Table 24.1.1.

The details are shown as the results of inventory survey in Table 24.1.2.

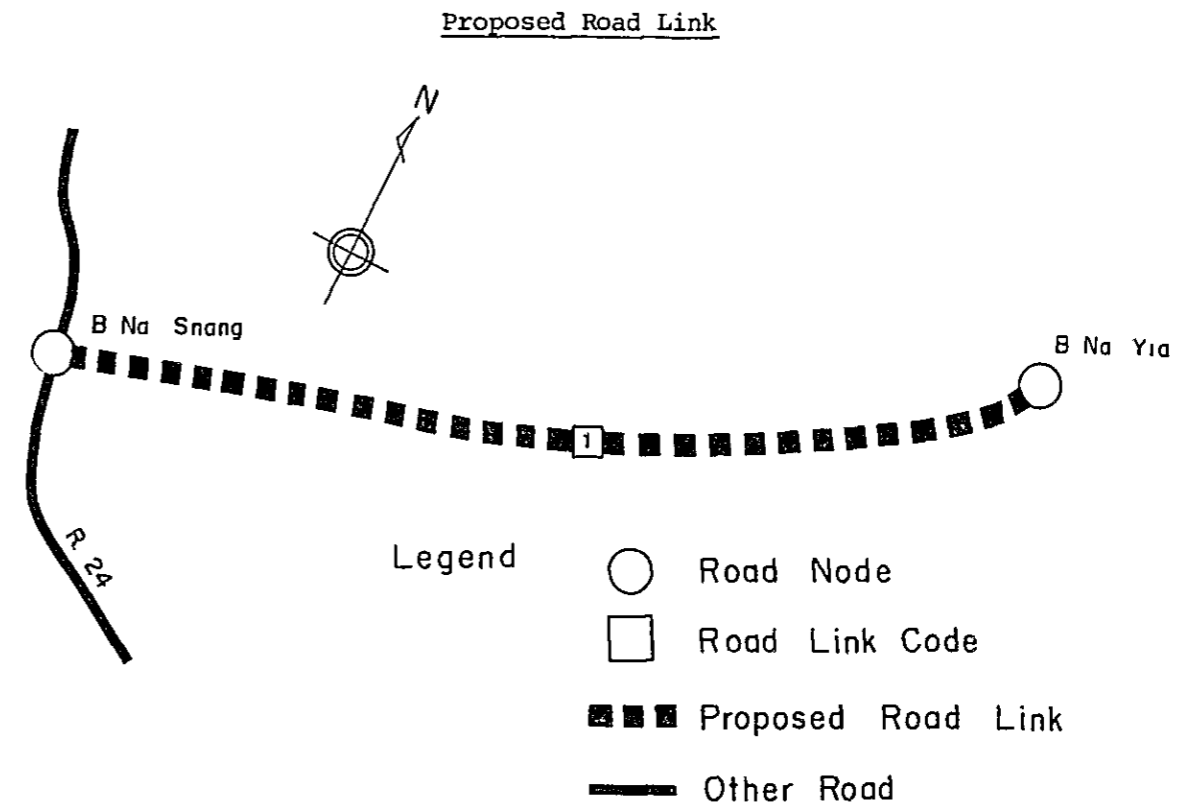
2. TRAFFIC

2.1 Method

Growth Rate Method was employed for traffic forecasting as no diverted traffic is expected after improvement of the subject road.

2.2 Base Year Traffic

The base year traffic by road link by vehicle type was estimated referring to the DOHs traffic records and manual classified counts as shown below:



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/}	4	47	34	42	16	8	24	37	25	237
Manual Counts (1982)	1	-	31	1	46	2	3	4	11	-	98
Estimated	1	2	39	18	44	9	6	14	24	13	169

Note: ^{1/} Route 2213 Section 0100 Section Km 4+000

2.3 Transport Movement

Passenger movement in terms of trips per day and freight movement in terms of tonnage per day on the proposed road link were estimated multiplying traffic volume in base year by the occupancy or average load obtained from roadside interview, as shown below:

PASSENGER MOVEMENT (1982)

PROPOSED ROAD LINK	TRIPS PER DAY
1	1670

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	159	19	178

2.4 Future Growth of Transport Movement

The growth rates of passenger and freight movements for the periods of 1981-1987, 1987-1993 and 1993-2001 were predicted by the formula described in 7.3.3-2) of the Main Report. The basis for the prediction is shown in the following tables:

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	1.8	1.5	1.3
PASSENGER MOVEMENT	5.8	5.9	6.0

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981-1987	1987-1993	1993-2001
NON-AGRI. AGRICULTURE	7.5	7.6	7.7
FREIGHT	6.7	6.8	6.9

2.5 Induced and Developed Traffic

The following ratios are used for the estimation of induced and developed traffic described in 7.3.3-3) of the Main Report:

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 Future Traffic

1) Traffic Composition

The movements of passenger and freight transport were transformed into traffic volume by vehicle type applying future traffic composition as shown in the following table:

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	1.8	34.8	16.1	39.3	8.0	10.5	24.6	42.1	22.8
	1987	4.0	33.8	17.4	35.8	8.9	12.2	22.3	40.2	25.2
	1993	6.7	32.5	19.1	31.7	10.0	14.3	19.6	38.0	28.1
	2001	10.2	30.8	21.3	26.2	11.5	17.0	16.0	35.0	32.0

2) Forecasted ADT

The average of the forecasted traffic on proposed road links is shown in the following table and details by road link by traffic type are shown in Table 24.2.1.

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	7	30	62	15	69	19	35	22	259	299	557
1993	16	47	78	25	97	24	46	34	367	360	727
2001	41	85	104	46	155	31	67	61	588	439	1027

3. AGRICULTURAL DEVELOPMENT

3.1 Present Condition

Almost all cultivated land is covered by paddy fields. Upland crops planted in the area are kenaf, cassava, maize and ground nut.

Land use and capability conditions in the area of influence are shown in Table 24.3.1 and Figure 24.3.1.

A typical cropping calendar in the Ubon Ratchathani area is shown in Figure 24.3.2.

3.2 Development Projection

Future agricultural development in the area of influence was projected for both cases of without project and with project. The projected planted area, unit yields by crop, and the consequent production volumes are shown in Table 24.3.2.

Farmgate prices and production costs of the selected crops are estimated as follows, referring to the Changwat data and field survey information as shown in Table 24.3.3.

Based on the above projected production volume, farmgate prices, production costs and land preparation cost estimated separately, net production value (NPV) was obtained as shown in Table 24.3.4. The difference between NPV of with project case and NPV of without project case is deemed to be the development benefit of the subject road.

4. VOC SAVINGS

In accordance with the concept and basic data given in Chapter 7 of Vol. 1 Main Report, VOCs on each road link concerned were calculated in both cases of with project and without project.

Elements of road condition, which affect the calculation of additional costs of VOC of each link, are shown below.

<u>Road Condition</u>									
<u>Link</u>		<u>Without Project</u>				<u>With Project</u>			
<u>No.</u>	<u>Terrain</u>	<u>Length (km)</u>	^{/1} <u>Nos. of Road Class</u>	<u>Nos. of Wooden Bridge</u>	<u>Nos. of Narrow C.Bridge</u>	<u>Length (Km)</u>	<u>Road Class</u>		^{/1} <u>Nos. of Wooden Narrow Bridge</u>
							<u>Class 1</u>	<u>Class 2</u>	
1	Rolling	14.5	2B	2	0	14.5	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 savings, obtained from the difference of total link VOCs in the cases of with project and those of without project case, were calculated as follows:

<u>Vehicle Operating Cost Saving</u>			
(Unit: 1,000 Baht)			
<u>Road Class</u>	<u>1987</u>	<u>1993</u>	<u>2001</u>
1 (F4)	2,122	3,238	5,678
2A (F5)	744	1,321	2,681

5. ENGINEERING

5.1 Preliminary Design

Preliminary design was carried out based on the following design criteria.

Design Standard	:	F4 (if not feasible, F5)
Geometric Design	:	AASHTO (Rural Highways)
Typical Cross Section	:	As shown in Figure 24.5.1
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	:	∅ 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 24.5.2

Alignment of the route is shown in Figure 24.5.2.

5.2 Work Quantity and Construction Cost

Work quantities based on the preliminary design and construction cost together with unit rate by work item are shown in Table 24.5.1.

Total financial and economic construction costs by applied road class are as given below:

Financial and Economic Construction Cost

Road Class	Length (Km)	Construction Cost (10 ³ ₪)		Remark
		Financial Cost	Economic Cost	
F4 (DBST)	14.5	25,653	23,184	
F5 (Soil Aggregate)	14.5	13,387	12,027	

6. ECONOMIC EVALUATION

Yearly distribution of the economic costs and benefits, and the calculated economic indicators for evaluation are given in Table 24.6.1 and 24.6.2.

The result indicates that the proposed project seems to be not feasible under F4 Standard and F5 Standard in case the opening year is 1987.

7. SOCIAL IMPACTS

Detailed data and results of quantification of indicators of social impacts are tabulated in Table 24.7.1. Social impacts of the proposed route are considerably high.

Table 24.1.1 SUMMARY OF ROAD INVENTORY

Item	Description	
Origin	B. Na Suang (J.R. 24)	
Destination	B. Na Yai	
Length		
Total		14.5 km
Improvement Section		14.5 km
DOH Road	R. 2213	14.5 km
ARD Road		0 km
Others		0 km
New Alignment Section		0 km
Terrain	Rolling	
Alignment (Hori./Vert.)	Fair / Fair	
Formation Width	6.0 m - 7.0 m, 6.7 m (Weighted average)	
Embankment Section		
Length		14.5 km
Height	0.3 m -	1.0 m
Cut Section		
Length		0 km
Depth	m -	m
Surface Type and Condition		
SBST or DBST		0 km
Soil Aggregate	Good	14.5 km
Earth		0 km
Pipe Culvert	22 each	
Box Culvert	0 each	0 m
Bridge		
Permanent Bridge	0 each	0 m
Narrow Concrete Bridge	0 each	0 m (4m)
Wooden Bridge	2 each	36.1 m
Overflow Section	0 place	0 km

Table 24.1.2 ROAD INVENTORY

PROPOSED ROUTE NO. IM-24

ROUTE NO. 2213

B. NA SUANG (J.R. 24) ~ B. NA YIA

L = 14.5 Km.

UBON RATCHATHANI

STATION (Km)		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	
VILLAGE																		
- Name																		
- Household (H)																		
- Population (P)																		
TERRAIN		Rolling																
CROSS SECTION	Formation Width (m)	6.00			7.00													
	Embankment Height (m)	0.30	1.00	0.30	1.00	0.80				1.00	0.70							
	Cutting Depth (m)																	
PAVEMENT	Type/Length	Laterite																
	Condition	Good																
FLOODING	Overflow Length(Km)/Height(m)																	
LAND USE	Left	Paddy																
	Right	Paddy																
PIPE CULVERT	Total Number	22 pipes																
BOX CULVERT & BRIDGE	Station (Km)	1.7			12.5													
	Dimension	W-Br. 4.50 x 25.40			W-Br. 4.00 x 10.70													
RIGHT OF WAY (m)																		
ALIGNMENT	Horizontal	Fair																
	Vertical	Fair																
ROUTE NO., AGENCIES		DOH 2213																

Table 24.2.1 TRAFFIC VOLUME ON ROUTE IM - 24

YEAR	1987		1993		2001		
LINK	1 AVR.		1 AVR.		1 AVR.		
P/C	N+D	6	6	14	14	35	35
	I	1	1	2	2	5	5
	DV	0	0	0	0	0	0
	TOTAL	7	7	16	16	41	41
L/B	N+D	26	26	41	41	73	73
	I	4	4	6	6	11	11
	DV	0	0	0	0	0	0
	TOTAL	30	30	47	47	85	85
M/B	N+D	54	54	68	68	90	90
	I	8	8	10	10	14	14
	DV	0	0	0	0	0	0
	TOTAL	62	62	78	78	104	104
H/B	N+D	13	13	21	21	40	40
	I	2	2	3	3	6	6
	DV	0	0	0	0	0	0
	TOTAL	15	15	25	25	46	46
P/P&T	N+D	60	60	84	84	134	134
	I	9	9	13	13	20	20
	DV	0	0	0	0	0	0
	TOTAL	69	69	97	97	155	155
4/T	N+D	17	17	21	21	27	27
	I	3	3	3	3	4	4
	DV	0	0	0	0	0	0
	TOTAL	19	19	24	24	31	31
6/T	N+D	30	30	40	40	58	58
	I	5	5	6	6	9	9
	DV	0	0	0	0	0	0
	TOTAL	35	35	46	46	67	67
10/T	N+D	19	19	30	30	53	53
	I	3	3	4	4	8	8
	DV	0	0	0	0	0	0
	TOTAL	22	22	34	34	61	61
ADT	N+D	225	225	319	319	511	511
	I	34	34	48	48	77	77
	DV	0	0	0	0	1	1
	TOTAL	259	259	367	367	588	588
M/C	N+D	275	275	335	335	416	416
	I	24	24	25	25	22	22
	DV	0	0	0	0	0	0
	TOTAL	299	299	360	360	439	439
TOTAL	N+D	500	500	653	653	927	927
	I	57	57	73	73	99	99
	DV	0	0	1	1	1	1
	TOTAL	557	557	727	727	1027	1027

NOTE

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

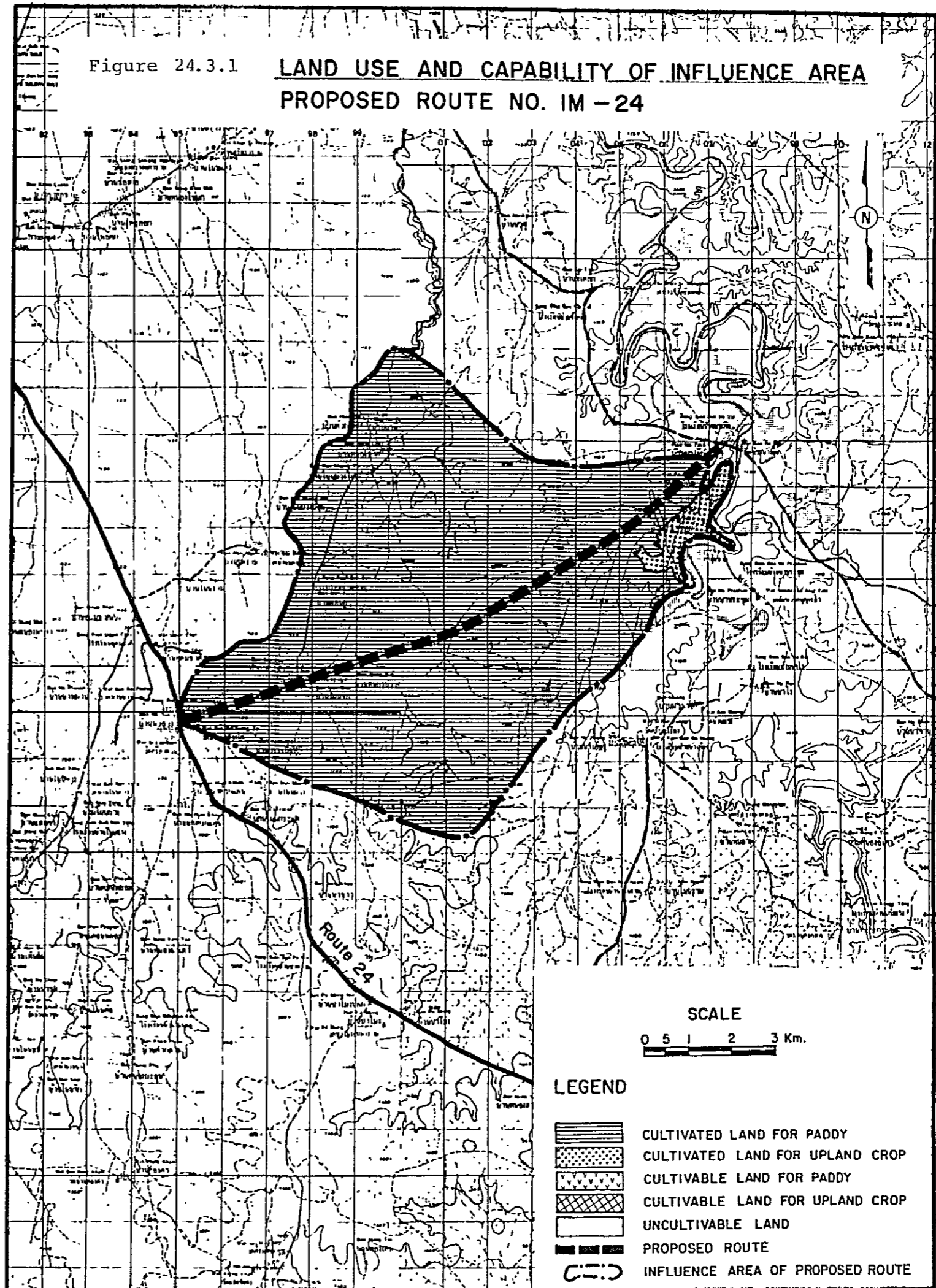
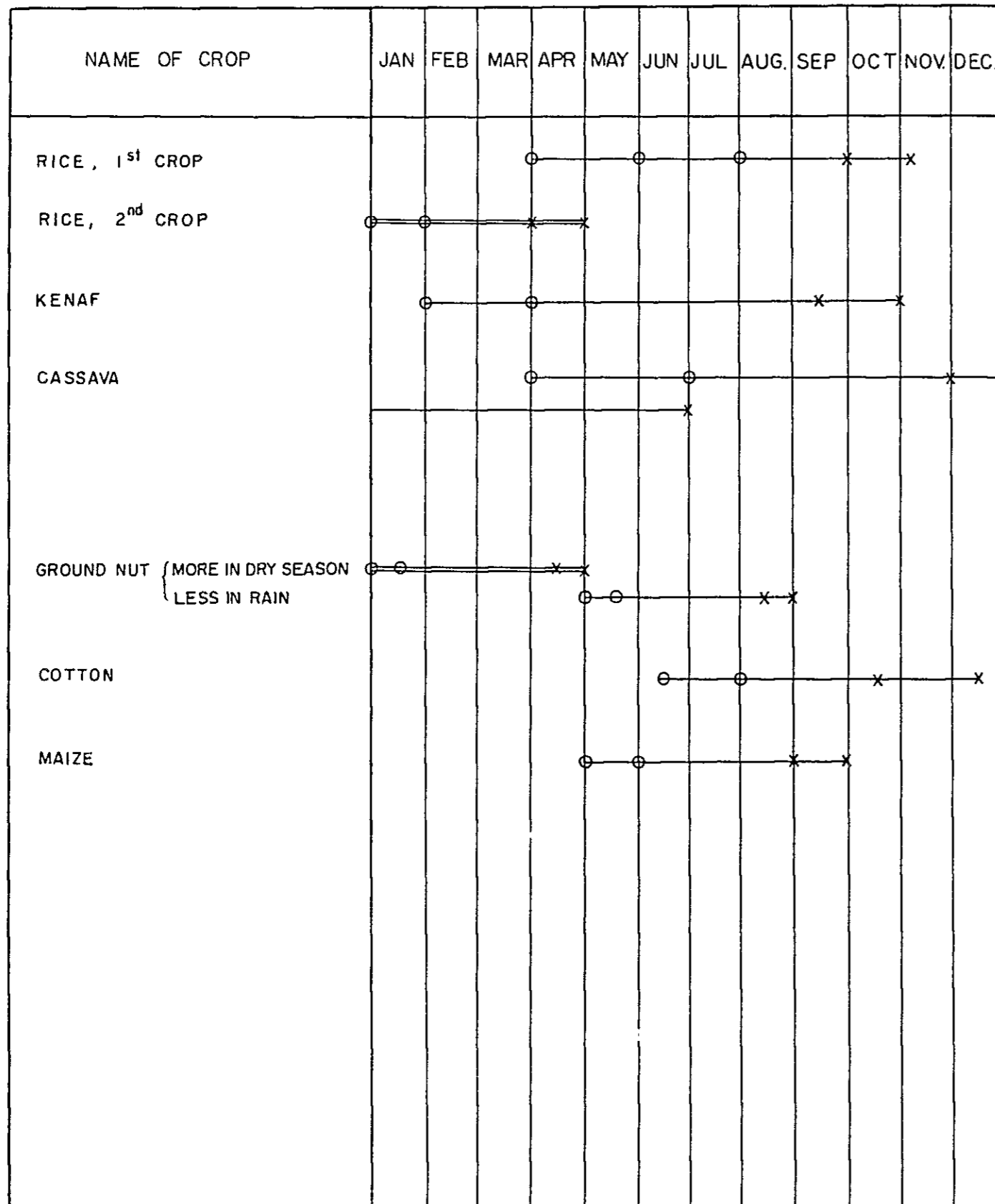


Figure 24.3.2 CROPPING CALENDAR

1100 CHANGWAT UBON RATCHATHANI



Note

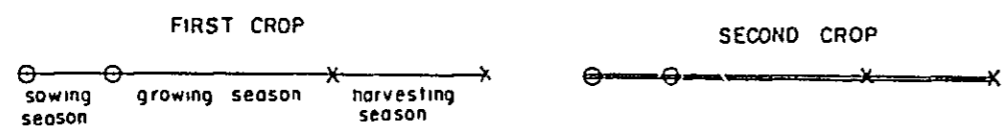


TABLE 24.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (RM²)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		43.125 (69.0)	1.250 (2.0)	44.375 (71.0)	-	-	-
1117	DET UDOM	43.125 (69.0)	1.250 (2.0)	44.375 (71.0)	-	-	-

TABLE 24.3.2 CROP PRODUCTION

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)										
1981	40.05	0.09	-	0.07	0.29	-	0.80	-	1.25	41.30
1987	40.05	0.09	-	0.07	0.30	-	0.80	-	1.26	41.31
1993	WITHOUT PROJECT	40.05	0.09	-	0.07	0.31	0.80	-	1.28	41.32
	WITH PROJECT	40.05	0.09	-	0.08	0.34	0.81	-	1.32	41.37
2001	WITHOUT PROJECT	40.05	0.09	-	0.07	0.33	0.80	-	1.30	41.34
	WITH PROJECT	40.05	0.09	-	0.08	0.36	0.81	-	1.34	41.39
CROP YIELD (KG/RAI)										
1981	162.8	240.0	-	150.0	2000.0	-	168.0	-		
1987	163.8	241.4	-	150.0	2000.0	-	168.0	-		
1993	WITHOUT PROJECT	164.8	242.9	-	150.0	2000.0	168.0	-		
	WITH PROJECT	166.8	245.8	-	150.9	2012.0	168.0	-		
2001	WITHOUT PROJECT	166.1	244.8	-	150.0	2000.0	168.0	-		
	WITH PROJECT	170.8	251.8	-	152.1	2028.2	168.0	-		
CROP PRODUCTION (TON)										
1981	6,521	21	-	10	574	-	135	-	740	7,261
1987	6,560	21	-	10	598	-	135	-	765	7,326
1993	WITHOUT PROJECT	6,600	22	-	10	624	135	-	791	7,391
	WITH PROJECT	6,679	22	-	12	678	137	-	848	7,528
2001	WITHOUT PROJECT	6,653	22	-	10	659	135	-	828	7,481
	WITH PROJECT	6,841	23	-	12	722	137	-	894	7,736

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 24.3.3 FARMGATE PRICE AND PRODUCTION COST

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,741	2,503	-	8,693	577	-	4,666	-
WITH PROJECT (1987 - 2001)	3,835	2,566	-	8,693	591	-	4,783	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	416	492	-	1,028	677	-	729	-
WITH PROJECT (1987 - 2001)	426	512	-	1,048	697	-	729	-

TABLE 24.3.4 NET PRODUCTION VALUE

(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	7,883	219	8,102	8,099	233	8,332
1993	8,031	225	8,256	8,555	258	8,813
2001	8,229	235	8,464	9,176	275	9,451

Figure 24.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE

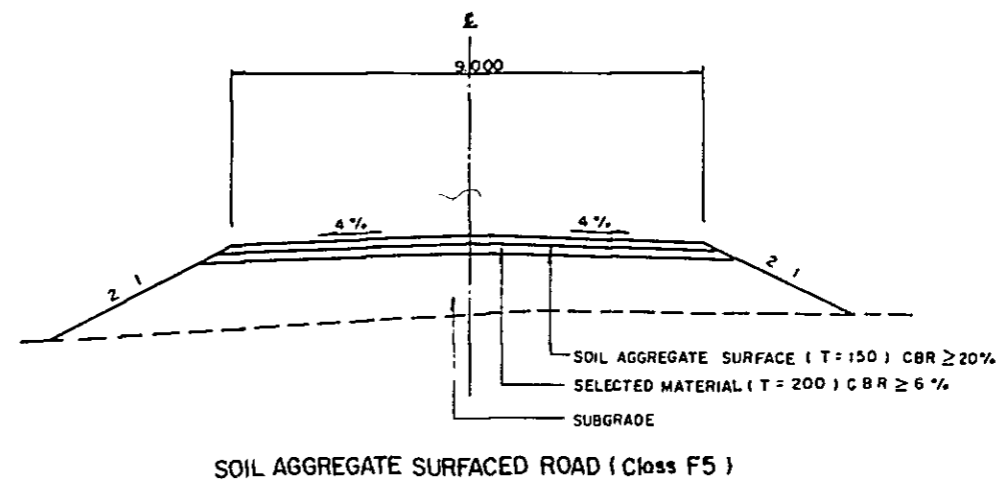
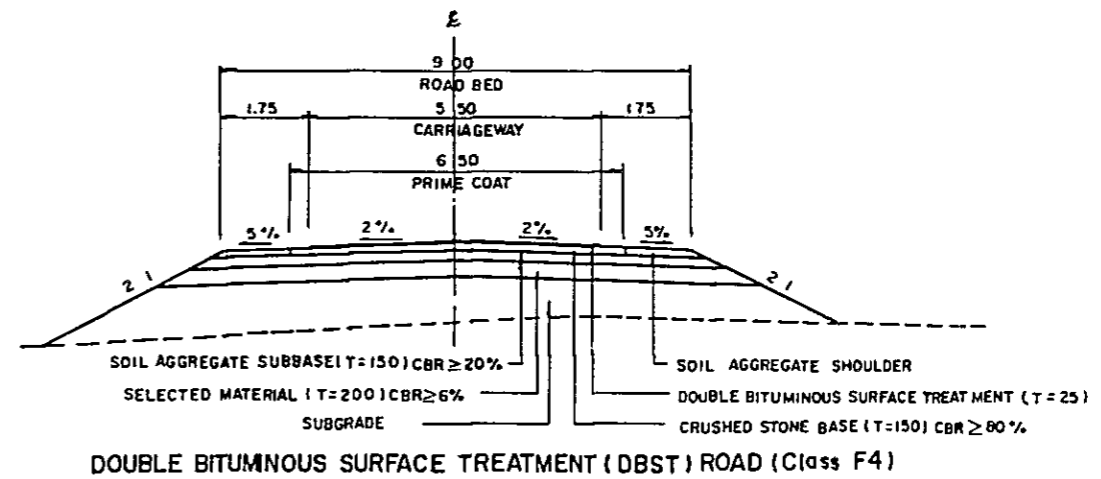
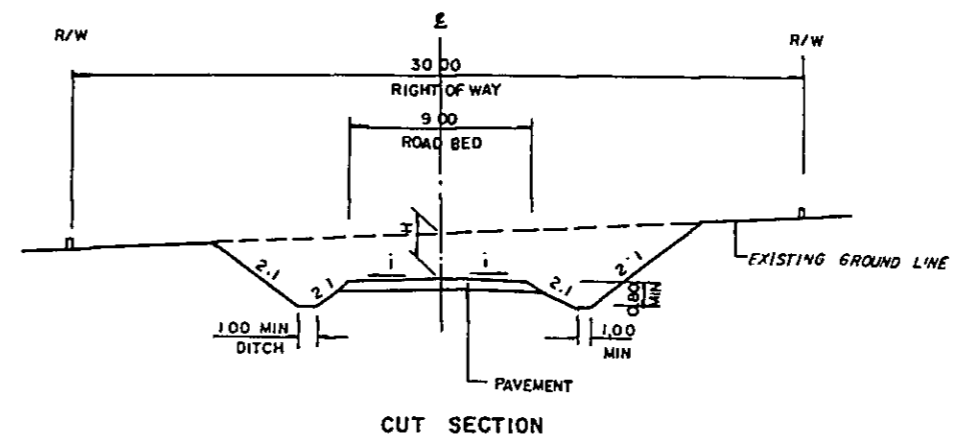
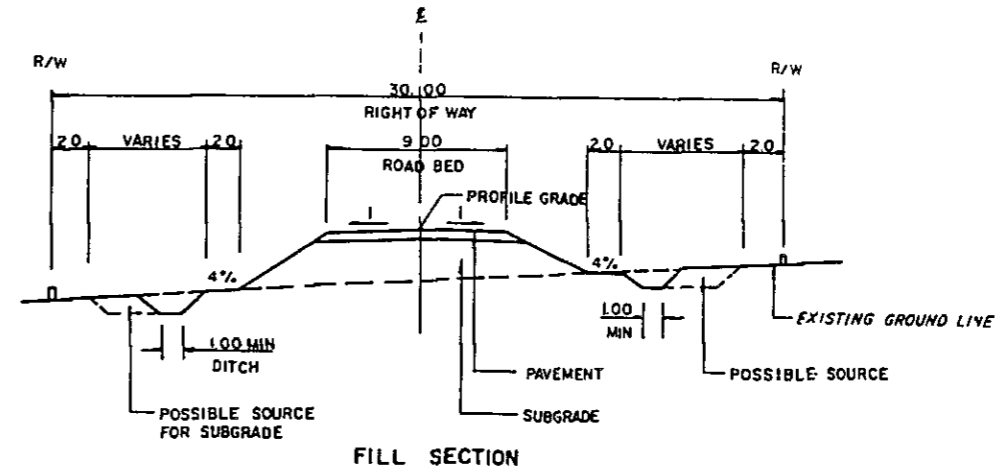
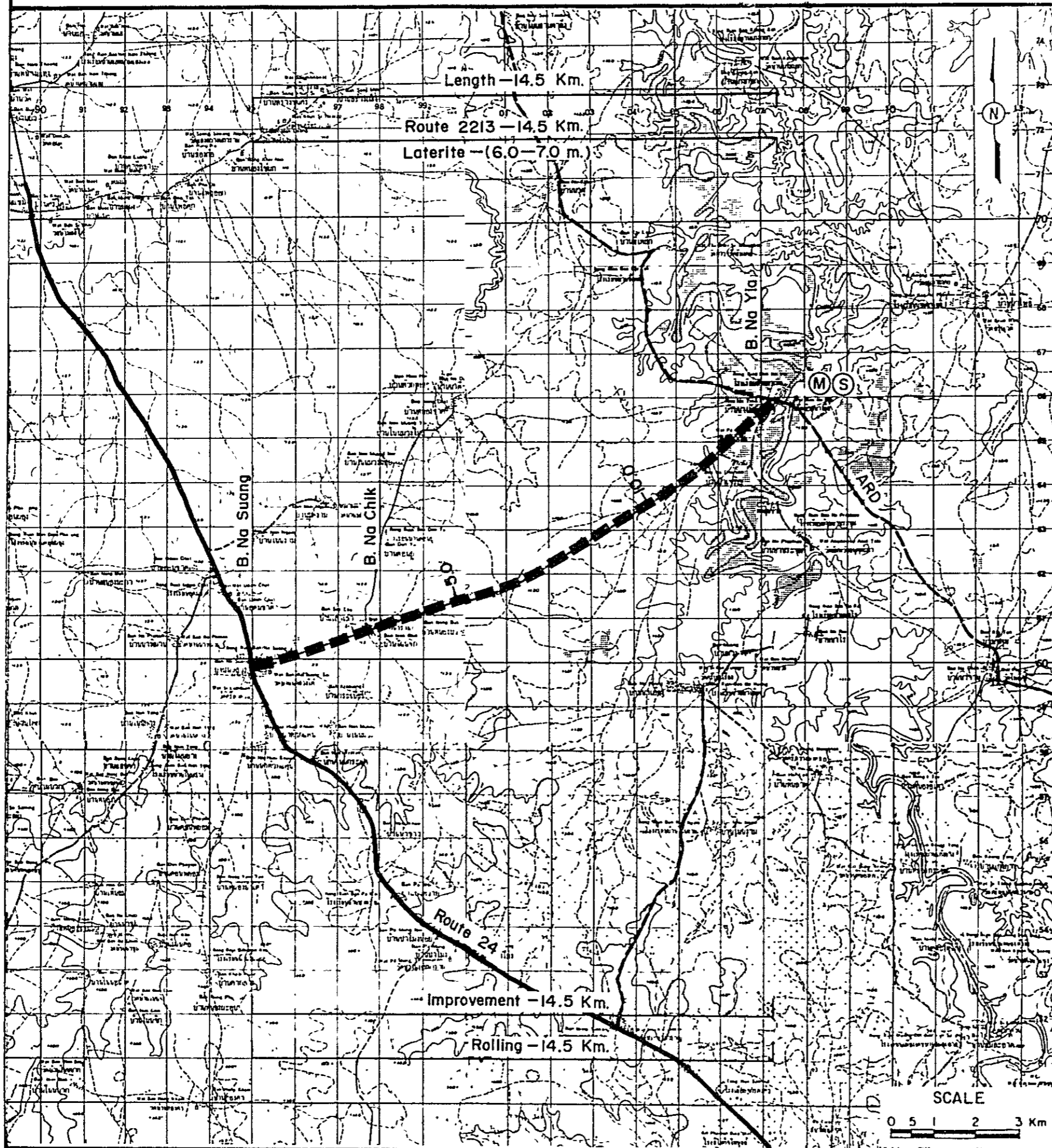
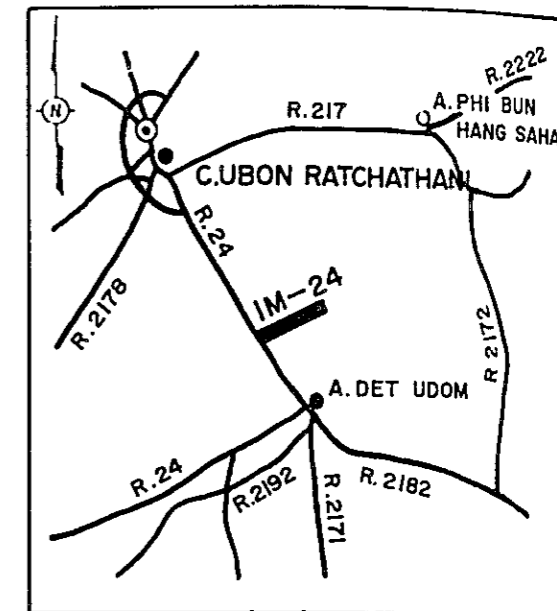


Figure 24.5.2

**PROPOSED ROUTE NO.IM-24 C.UBON RATCHATHANI B.NA SUANG(J.R.24) - B.NA YIA
ROUTE NO.2213 L = 14.5 Km.**



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1.	1.7	C-7.00 x 28.00	W-4.50 x 25.40
2.	12.5	C-7.00 x 14.00	W-4.00 x 10.70

LEGEND

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

Table 24.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-24 (14.5 km)

Items	Unit of Q'ty	Financial Unit Rate ₪	(DBST)			(Soil Aggregate Surface)		
			Q'ty	Financial Cost (10 ³ ₪)	Economic Cost (10 ³ ₪)	Q'ty	Financial Cost (10 ³ ₪)	Economic Cost (10 ³ ₪)
DIRECT CONSTRUCTION COST								
Clearing and Grubbing	ha	15,000	34	510	464	34	510	464
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	17,580	791	719	17,600	792	720
Selected Material	m ³	80	30,700	2,456	2,185	30,700	2,456	2,185
Soil Aggregate Surface or Subbase	m ³	105	21,500	2,257	2,009	21,500	2,257	2,009
Crushed Stone Base	m ³	370	14,100	5,217	4,799	1,500	555	510
Soil Aggregate Shoulder	m ³	105	6,100	640	570	600	63	56
Prime Coat and DBST	m ²	55	79,800	4,389	3,950	8,300	456	410
Pipe Culvert	m	2,100	590	1,239	1,139	590	1,239	1,139
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	42	1,680	1,495	42	1,680	1,495
Sub Total (a)				19,180	17,334		10,009	8,992
Miscellaneous Works (a) x 7%				1,343	1,213		700	629
Total (b)				20,523	18,547		10,709	9,621
PHYSICAL CONTINGENCY (b) x 15%				3,078	2,782		1,606	1,443
ENGINEERING AND ADMINISTRATION (b) x 10%				2,052	1,855		1,070	962
Sub Total				5,130	4,637		2,676	2,405
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				25,653	23,184		13,387	12,027

Table 24.6.1 COST AND BENEFITS
(F4 STANDARD)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	0	0	0	0	0	0	0
1985	9,273	0	0	0	0	11,632	0
1986	13,911	0	0	0	0	15,580	0
1987	0	230	2,122	-18	2,334	0	2,084
1988	0	283	2,308	-13	2,579	0	2,056
1989	0	337	2,494	-7	2,823	0	2,010
1990	0	390	2,680	-2	3,068	0	1,950
1991	0	443	2,866	3	3,313	0	1,880
1992	0	497	3,052	9	3,557	0	1,802
1993	0	550	3,238	14	3,802	0	1,720
1994	7,018	605	3,543	23	4,170	3,175	1,684
1995	0	659	3,848	31	4,538	0	1,637
1996	0	714	4,153	40	4,906	0	1,580
1997	0	768	4,458	48	5,275	0	1,516
1998	0	823	4,763	57	5,643	0	1,448
1999	0	878	5,068	65	6,011	0	1,378
2000	0	932	5,373	74	6,379	0	1,305
2001	-10,665	987	5,678	83	6,747	-1,948	1,233
TOTAL	19,537	9,097	55,642	407	65,145	28,438	25,282

DISCOUNTED ECONOMIC COSTS :	28,438
DISCOUNTED ECONOMIC BENEFITS :	25,282
AGRICULTURAL DEVELOPMENT BENEFIT	3,387
VOC SAVING	21,808
RMC SAVING	87
NET PRESENT VALUE :	-3,157
BENEFIT COST RATIO :	0.89
INTERNAL RATE OF RETURN :	10.6 %

Table 24.6.2 COST AND BENEFITS
(F5 STANDARD)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	0	0	0	0	0	0	0
1985	2,405	0	0	0	0	3,017	0
1986	9,622	0	0	0	0	10,777	0
1987	0	230	744	2	977	0	872
1988	0	283	840	3	1,127	0	898
1989	0	337	937	4	1,277	0	909
1990	0	390	1,033	4	1,427	0	907
1991	0	443	1,129	5	1,577	0	895
1992	0	497	1,225	6	1,727	0	875
1993	0	550	1,321	7	1,877	0	849
1994	726	605	1,491	8	2,103	328	850
1995	0	659	1,661	10	2,330	0	840
1996	0	714	1,831	11	2,556	0	823
1997	0	768	2,001	12	2,782	0	800
1998	0	823	2,171	14	3,008	0	772
1999	0	878	2,341	15	3,234	0	741
2000	0	932	2,511	17	3,460	0	708
2001	-5,532	987	2,681	18	3,686	-1,011	673
TOTAL	7,221	9,097	23,915	137	33,148	13,111	12,412

DISCOUNTED ECONOMIC COSTS :	13,111
DISCOUNTED ECONOMIC BENEFITS :	12,412
AGRICULTURAL DEVELOPMENT BENEFIT	3,387
VOC SAVING	8,979
RMC SAVING	46
NET PRESENT VALUE :	-699
BENEFIT COST RATIO :	0.95
INTERNAL RATE OF RETURN :	11.4 %

Table 24.7.1 SOCIAL INDICATORS
(Proposed Route IM-24)

Population		Education		Disparity		Note:
Population (1,000)		Access to Secondary School		G.P.V. in 1993 (Mn B) ^{8/}		
1982	: 6.0	Number of Student in 1993 (1,000) ^{2/}	: 1.0	With project	: 26.8	
1993	: 7.2	Average distance to school (km)	: 3.8	Without project	: 25.8	
Average travelling speed, without (kph)	: 48	Per capita time savings (10 ⁻⁴)	: 0.260	Per capita G.P.V. in 1993 (B)		
Isolation		Score	: 135	With project (W)	: 3,722	
Access to Amphoe		Teacher Intensity		Without project (w)	: 3,583	
Average distance to Amphoe (km) ^{1/}	: 7.5	Number of teachers ^{3/}		Degree of Disparity		
Per capita time savings (10 ⁻⁴)	: 0.072	University graduate	: 3	(A/W) - (A/w) ^{9/}	: 0	
Score	: 218	Total	: 36	Score	: 0	
Access to Artery Highway		Number of Student	: 889	Total Score	: 1,379	
Average distance to highway (km) ^{1/}	: -	Indicators				
Per capita time savings (10 ⁻⁴)	: -	E1 ^{4/}	: 3.4			
Score	: 100	E2 ^{5/}	: 40.5			
Impassability		E ^{6/}	: 43.9			
Impassable week a year	: -	Degree of Improvement ^{7/}	: 1.56			
Impassability per year	: 0	Score	: 99			
Impassability per capita (10 ⁻⁴)	: 0					
Score	: 0					
Health						
Access to Hospital						
Average distance to Hospital (km) ^{1/}	: 7.5					
Per capita time savings (10 ⁻⁴)	: 0.072					
Score	: 167					
Access to Medical Facilities						
Average distance to facilities (km) ^{1/}	: 4.4					
Per capita time savings (10 ⁻⁴)	: 0.043					
Score	: 172					

PROPOSED ROUTE NO. IM - 25

Changwat : Yasothon / Si Sa Ket

A Maha Chana Chai(JR.2083)-A Yang Chum Noi(JR.2165)

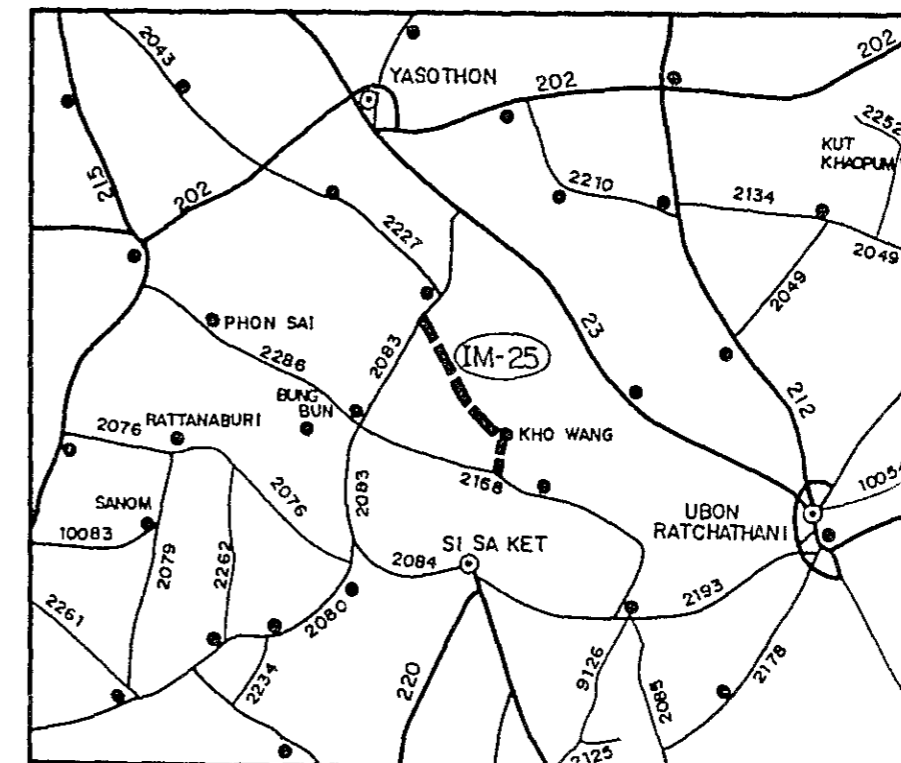
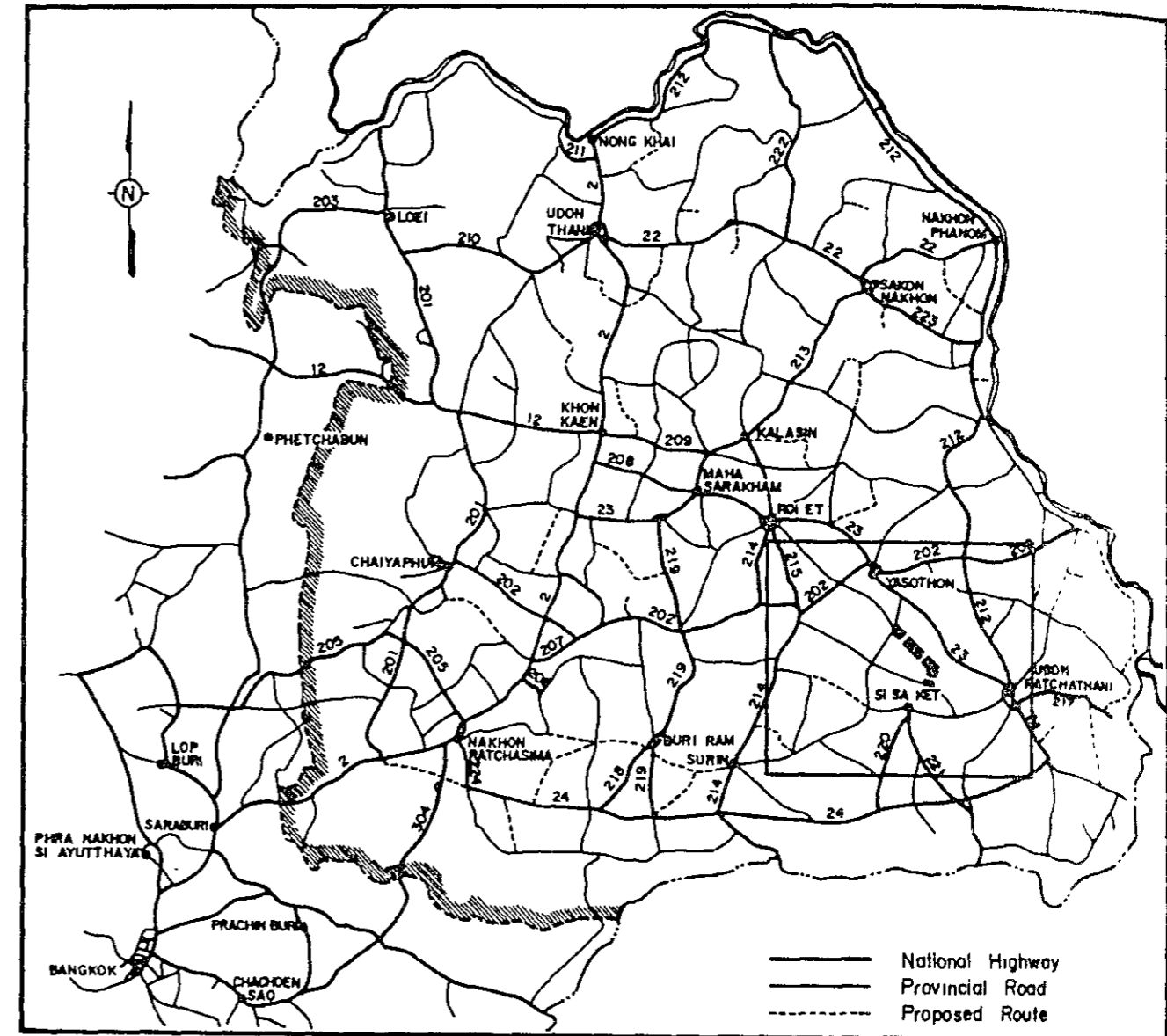
Length : 38.2 KM.

SUMMARY
PROPOSED ROUTE IM-25

Item	Description
Changwat	Yasothon/Si Sa Ket
Origin	A. Maha Chana Chai (J.R.2083)
Destination	A. Yang Chum Noi (J.R.2165)
Length	
Total	38.2 km
Improvement Section	38.2 km
DOH Road	0 km
ARD Road	18.0 km
Others	20.2 km
New Alignment Section	0 km
Surface Condition	Soil Aggregate and Earth, Good ~ Poor
Terrain	Flat
Influence Area	
Area	212 km ²
Population (1982)	38,900
Principal Crops	Paddy
Traffic (ADT)	
Existing	88
1993	573
2001	781
Proposed Standard	F4 (DBST)
Total Section	
Construction Cost	
Financial	68,025 . 10 ³ ฿
Economic	61,658 . 10 ³ ฿
IRR	8.6 %
B/C	0.74
Section 1 (23 km) ^{1/}	
Construction Cost	
Financial	39,928 . 10 ³ ฿
Economic	36,224 . 10 ³ ฿
IRR	12.6 %
B/C	1.05
Recommendation	For immediate implementation of Section 1

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

LOCATION OF PROPOSED ROUTE



1. GENERAL

1.1 Characteristics of the Route

The proposed route extends in two Changwat of Yasothon and Si Sa Ket.

The route, starting at the intersection of Route 2083, with 2227 Amphoe Maha Chana Chai, runs southeastward passing through Ban Hna Don, Amphoe Kho Wang and Ban Fa Huan and ends at the intersection with Route 2168 at Amphoe Yang Chum Noi. Its total length is 38.2 km. (Figure 25.5.2).

The terrain is flat. In the influence area, there exists several villages with total population of 38,900.

There are two medical centers, two hospitals and one secondary school along the proposed route.

The proposed route, upon completion, will form an important part of road network to connect two artery highways, Route 2083 and 2168 in the agriculturally developed area and also play vital role to connect Amphoe Kho Wang.

1.2 Condition of Existing Road

Condition of existing roads to be utilized for the proposed route is summarized in Table 25.1.1. The details are shown as the results of inventory survey in Table 25.1.2.

2. TRAFFIC

2.1 Method

Assignment Method was employed for traffic forecasting as considerable diverted and induced traffic are expected after improvement of the subject road due to time savings of transportation.

2.2 Zoning and Road Links

The related area of proposed route was divided into five traffic zones and three Amphoe of Maha Chana Chai, Kho Wang and Yang Chum were chosen as the major destinations of transport demand originated in the area. The proposed route together with surrounding roads concerned were divided into four road links, in the proposed roads.

Zoning map and characteristics of zone and links are shown in Figure 25.2.1, Table 25.2.1 and 25.2.2.

2.3 Transport Movement

1) Passenger

The transport demand in terms of trips per day by origin/destination pair in base year was estimated basing on the formula described in 7.3.3-1) of the Main Report, as shown below:

Zone	1	2	3	4	5
1	0	439	750	402	128
2	0	0	232	305	208
3	0	0	0	521	468
4	0	0	0	0	371
5	0	0	0	0	0

Grand Total = 3822.56

The transport demand which can be obtained by assigning transport demand mentioned above to road links, are estimated as shown in the following table:

PASSENGER MOVEMENT (1982)

PROPOSED ROAD LINK	TRIPS PER DAY
1	1275
2	1370
3	1181
4	259

2) Freight

The freight movement in terms of tonnage per day on proposed route was estimated in accordance with the procedure described in 7.3.3-1) of the Main Report. The basis and results of the estimation of freight movement are shown in the following tables:

Ratios of Total/Non-Agricultural Freight Movement

Year	1987	1993	2001
Ratio	1.55	1.38	1.22

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	58	43	101
2	63	48	111
3	52	40	92
4	7	6	13

2.4 Future Growth of Transport Movement

The growth rates of passenger and freight movement for the periods of 1981-1987, 1987-1993 and 1993-2001 were predicted by the formula described in 7.3.3-2) of the Main Report. The basis for the prediction is shown in the following tables:

GROWTH RATE OF PASSENGER MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981-1987	1987-1993	1993-2001
PER CAPITA INCOME	4.2	4.5	4.7
TRANS. PRICE INCREASE	4.5	4.5	4.5
POPULATION	1.3	1.1	1.0
PASSENGER MOVEMENT	5.4	5.5	5.7

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981-1987	1987-1993	1993-2001
NON-AGRI. AGRICULTURE	6.9	7.1	7.3
AGRICULTURE	0.3	0.3	0.3
FREIGHT	5.0	5.5	6.0

2.5 Induced and Developed Traffic

The following ratios are used for the estimation of induced and developed traffic described in 7.3.3-3) of the Main Report:

RATE OF INDUCED AND DEVELOPED TRAFFIC

(%)

ITEM	YEAR		
	1987	1993	2001
INDUCED	83.8	85.4	87.4
DEVELOPED	0.0	0.0	0.0

2.6 Future Traffic

1) Traffic Composition

The movement of passenger and freight transport were transformed into traffic volume by vehicle type applying future traffic composition as shown in the following table:

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
1-4	1982	22.3	20.6	25.1	30.4	1.6	6.1	18.2	39.3	36.4
	1987	19.3	23.6	23.9	29.1	4.1	9.0	17.6	38.2	35.2
	1993	15.6	27.3	22.5	27.5	7.1	12.4	16.9	36.8	33.9
	2001	10.7	32.2	20.6	25.4	11.1	17.0	16.0	35.0	32.0

2) Forecasted ADT

The average of the forecasted traffic on proposed road links is shown in the following table and details by road link by traffic type are shown in table 25.2.3.

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	32	40	49	7	43	6	13	12	202	257	459
1993	34	49	60	16	66	9	19	17	270	304	574
2001	34	66	81	36	118	14	31	28	408	373	781

3. AGRICULTURAL DEVELOPMENT

3.1 Present Condition

Almost all cultivated land in the influence area is covered by paddy fields. The average yield of paddy is comparatively low because of salinity affected soils in the old paddy fields. Kenaf is the only main crop in the upland field.

Unused cultivable land is only for upland field and limited.

Land use and capability conditions in the area of influence are shown in Table 25.3.1 and Figure 25.3.1.

Typical cropping calendars in the Yasothon and Si Sa Ket areas are shown in Figure 25.3.2.

3.2 Development Projection

Future agricultural development in the area of influence was projected for both cases of without project and with project. The project planted area, unit fields by crop, and the consequent production volumes are shown in Table 25.3.2.

Farmgate prices and production costs of the selected crops are estimated as follows, referring to the Changwat data and field survey information as shown in Table 25.3.3.

Based on the above projected production volume, farmgate prices, production costs and land preparation cost estimated separately, net production value (NPV) was obtained as shown in Table 25.3.4. The difference between NPV of with project case and NPV of without project case is deemed to be the development benefit of the subject road.

4. VOC SAVINGS

In accordance with the concept and basic data given in Chapter 7 of Vol. 1 Main Report, VOCs on each road link concerned were calculated in both cases of with project and without project.

Elements of road condition, which affect the calculation of additional costs of VOC of each link, are shown below.

Road Condition

Link No.	Terrain	Length (Km)	Without Project			Length (Km)	With Project			
			Class	Nos of Bridge	Nos of C.Bridge		Road Class			
			/1	Nos of		/1	Nos of	Wood-		
				Narrow		C.1	C.2	C.3	C.4	en Narrow
				Bridge						Bridge
1	Flat	7.0	3	0	0	7.0	1	1		0
1	Flat	2.0	4	0	0	2.0	1	1		0
2	Flat	6.0	2B	0	0	6.0	1	1	1	2A 0
3	Flat	8.0	2B	0	0	8.0	(F4) 1	1		(F5) 0
4	Flat	4.0	3	0	0	4.0	2A	-		0
4	Flat	11.2	4	1	0	11.2	2A	-		

/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 savings, obtained from the difference of total link VOCs in the cases of with project and those of without project case, were calculated as follows.

Vehicle Operating Cost Saving

Road Class	(Unit: 1,000 Baht)		
	1987	1993	2001
1 (F4)	3,974	5,698	9,331
1+2A (F4+F5)	3,553	5,112	8,404
1 (F4 from Link 1 to Link 4)	2,630	3,773	6,190
2A (F5)	1,999	2,978	5,064

5. ENGINEERING

5.1 Preliminary Design

Preliminary design was carried out based on the following design criteria.

Design Standard	: F4 (if not feasible, F5)
Geometric Design	: AASHTO (Rural Highways)
Typical Cross Section	: as shown in Figure 25.5.1
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	:	∅ 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 25.5.2

Alignment of the route is shown in Figure 25.5.2.

5.2 Work Quantity and Construction Cost

Work quantities based on the preliminary design and construction cost together with unit rate by work item are shown in Table 25.5.1.

Total financial and economic construction costs by applied road class are as given below:

Financial and Economic Construction Cost

Road Class	Length (Km)	Construction Cost (10 ³ ₪)		Remark
		Financial Cost	Economic Cost	
F4 (DBST)	38.2	68,025	61,658	
F5 (Laterite)	38.2	36,655	33,126	
F4 + F5	38.2	58,473	52,896	
Section 1 (F4)	23.0	39,928	36,224	Adopted to link _{>} 300 in ADT
Section 2 (F5)	15.2	18,548	16,678	Adopted to link _{<} 300 in AD

6. ECONOMIC EVALUATION

Yearly distribution of the economic costs and benefits, and the calculated economic indicators for evaluation are given in Table 2.6.1, 25.6.2, 25.6.3 and 25.6.4.

The result indicated that the proposed project seems to be not feasible under F4 Standard but a partial section of higher ADT will be feasible under F4 Standard.

7. SOCIAL IMPACTS

Detailed data and results of quantification of indicators of social impacts are tabulated in Table 25.7.1.

Table 25.1.1 SUMMARY OF ROAD INVENTORY

Item	Description	
Origin	A. Maha Chana Chai (J.R. 2083)	
Destination	A. Yang Chum Noi (J.R. 2165)	
Length		
Total		38.2 km
Improvement Section		38.2 km
DOH Road		0 km
ARD Road		18.0 km
Others		20.2 km
New Alignment Section		0 km
Terrain	Flat	
Alignment (Hori./Vert.)	Fair / Fair	
Formation Width		5.0 m
Embankment Section		
Length		38.2 km
Height	0.3 m -	1.0 m
Cut Section		
Length		0 km
Depth	m -	m
Surface Type and Condition		
SBST or DBST		0 km
Soil Aggregate	Good	14.0 km
Earth	Poor	14.2 km
Pipe Culvert	36 each	
Box Culvert	2 each	13.2 m
Bridge		
Permanent Bridge	1 each	30.0 m
Narrow Concrete Bridge	0 each	0 m (4m)
Wooden Bridge	2 each	10.2 m
Overflow Section	0 place	0 km

Table 25.1.2 ROAD INVENTORY (1)

PROPOSED ROUTE NO. IM-25

ROUTE NO. ARD

A. MAHA CHANA CHAI (J.R. 2083) ~ A. YANG CHUM NO. 1 (J.R. 2165)

L = 38.2 Km.

YASOTHON/SI SA KET

STATION (Km)		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30		
VILLAGE																			
- Name																			
- Household (H)																			
- Population (P)																			
TERRAIN		Flat																	
CROSS SECTION	Formation Width (m)	5.00																	
	Embankment Height (m)	0.30	1.20	0.40	0.60	1.00	0.60	1.00	1.00	1.20	0.30	1.00	0.30	0.30	1.30				
	Cutting Depth (m)																		
PAVEMENT	Type/Length	Laterite	Earth				Laterite						Earth						
	Condition	Poor				Good						Poor		Fair	Poor				
FLOODING	Overflow Length(Km)/Height(m)																		
LAND USE	Left	Paddy				Forest	Paddy				Forest	Paddy	Forest	Paddy					
	Right	Paddy						Forest				Paddy	Forest	Paddy					
PIPE CULVERT	Total Number	36 pipes																	
BOX CULVERT & BRIDGE	Station (Km)	1.3							10.4							29.1			
	Dimension	C-Box 2.00 x 2.00 x 7.00								C-Br. 9.70 x 30.00								W-Br. 3.60 x 6.10	
RIGHT OF WAY (m)		10.0						30.0											
ALIGNMENT	Horizontal	Fair																	
	Vertical	Fair																	
ROUTE NO., AGENCIES		Rural						ARD						Rural					

ROAD INVENTORY (2)

PROPOSED ROUTE NO. IM-25

ROUTE NO. ARD

A. MAHA CHANA CHAI (J.R. 2083) A. YANG CHUM NO. 1 (J.R. 2165) (Cont'd)

L = 38.2 Km.

YASOTHON/SI SA KET

STATION (Km)		30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	
VILLAGE																		
- Name																		
- Household (H)																		
- Population (P)																		
TERRAIN		Flat																
CROSS SECTION	Formation Width (m)	5.00																
	Embankment Height (m)	0.30	0.50	1.00	0.60	0.20												
	Cutting Depth (m)																	
PAVEMENT	Type/Length	Earth																
	Condition	Poor																
FLOODING	Overflow Length(Km)/Height(m)	L=1.0 H=0.3																
LAND USE	Left	Paddy																
	Right	Paddy																
PIPE CULVERT	Total Number																	
BOX CULVERT & BRIDGE	Station (Km)	30.8														37.5		
	Dimension	C-Box 3.00 x 10.20 x 6.20														W-Br. 4.00 x 4.10		
RIGHT OF WAY (m)																		
ALIGNMENT	Horizontal	Fair																
	Vertical	Fair																
ROUTE NO., AGENCIES		Rural																

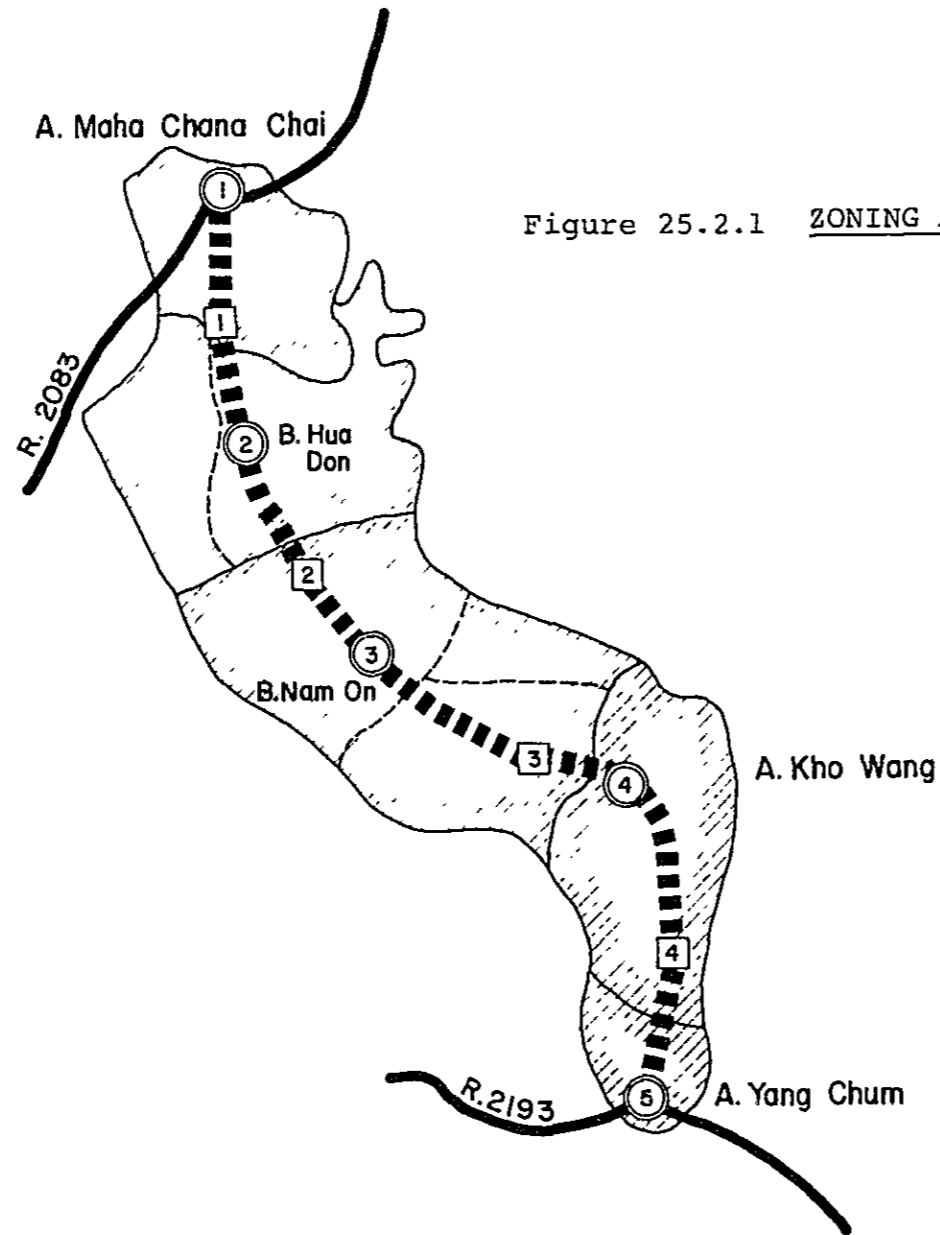


Figure 25.2.1 ZONING AND ROAD NETWORK

PROPOSED ROUTE NO. IM-25

LEGEND

- ⓪ Traffic Zone
- ⓪ Dummy Node
- ⓪ Road Link Code
- ▬▬▬▬ Proposed Road Link
- ▬▬▬▬ Other Road

Table 25.2.1 ZONE CHARACTERISTICS

Zone	Administrative Division			Population			
	Changwat	Amphoe	Tambon Code	Tambon	%	Zone	Attraction
1	Yasothon	Maha Chana Chai	1	8,139	100	8.1	52.7
2	Yasothon	Maha Chana Chai	4	3,891	100	3.9	
			9	4,040	100	4.0	
			Total			7.9	-
3	Yasothon	Kho Wang	2	8,160	30	2.4	
			3	4,767	100	4.8	
			4	6,349	100	6.3	
			Total			13.5	-
4	Yasothon	Kho Wang	1	8,835	100	8.8	24.2
5	Si Sa Ket	Yang Chum	1	10,127	50	5.1	29.3

Table 25.2.2 LINK CHARACTERISTICS

Link No	Node Pair		Length		Grade		Remark
	Start Node	End Node	\bar{W}	W	\bar{W}	W	
1.	1. A. Maha Chama Chai	2. B. Hua Don	9.0	9.0	8	4	ARD
2	2. B. Hua Don	3. B. Nam On	6.0	6.0	8	4	ARD
3	3. B. Nam On	4. A. Kho Wang	12.0	12.0	8	4	ARD
4	4. A. Kho Wang	5. A. Yang Chum Noi	11.0	11.0	11	4	ARD

Table 25.2.3 TRAFFIC VOLUME ON ROUTE IM - 25

YEAR	1987					1993					2001					
	LINK	1	2	3	4 AVR.	1	2	3	4 AVR.	1	2	3	4 AVR.			
P/C	N+D	25	27	24	5	17	27	29	25	5	18	27	29	25	5	18
	I	9	13	17	18	15	9	14	18	19	16	9	14	18	19	16
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	34	40	41	23	32	36	43	43	25	34	37	43	43	25	34
L/B	N+D	32	34	29	6	21	39	42	36	8	27	52	56	48	11	35
	I	11	16	21	23	19	14	20	26	28	23	18	27	35	37	31
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	43	50	50	29	40	53	62	62	36	49	70	83	83	48	66
M/B	N+D	38	41	36	8	26	48	51	44	10	32	64	69	59	13	44
	I	13	20	26	28	23	17	24	32	34	28	22	33	43	46	38
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	52	61	61	35	49	64	76	76	44	60	86	102	102	59	81
H/B	N+D	5	6	5	1	4	12	13	11	2	8	28	30	26	6	19
	I	2	3	4	4	3	4	6	8	9	7	10	14	19	20	16
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	7	9	9	5	7	17	20	20	11	16	38	45	45	26	36
P/P&T	N+D	34	37	31	7	23	53	57	49	10	36	93	101	86	18	63
	I	12	17	22	24	20	18	27	35	37	31	33	49	63	66	55
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	46	54	54	31	43	71	84	84	47	66	126	149	149	84	118
4/T	N+D	5	6	5	1	4	7	8	7	1	5	11	12	10	1	7
	I	2	3	3	3	3	2	4	5	4	4	4	7	8	7	7
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	7	9	8	3	6	10	12	11	5	9	16	19	19	9	14
6/T	N+D	12	13	11	2	8	16	17	14	2	10	25	27	22	3	16
	I	4	5	7	6	5	5	8	11	9	8	9	14	18	16	15
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	15	18	18	7	13	21	26	25	11	19	34	42	41	19	31
10/T	N+D	11	12	10	1	7	15	16	13	2	9	23	25	20	3	15
	I	3	5	6	5	5	5	8	10	8	8	9	13	17	14	13
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	14	17	16	7	12	20	24	23	10	17	31	38	37	17	28
ADT	N+D	163	176	151	31	110	216	234	200	41	146	323	349	298	60	217
	I	55	82	106	110	92	75	111	144	149	124	115	171	221	226	190
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	219	258	257	141	202	291	345	344	189	270	438	520	519	286	408
M/C	N+D	227	239	216	68	163	270	283	257	84	196	338	352	324	113	248
	I	46	63	85	139	94	51	69	94	165	108	55	70	98	204	126
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	273	302	301	207	257	322	352	351	250	304	393	422	422	317	373
TOTAL	N+D	390	415	366	99	273	487	517	457	125	341	661	701	622	173	465
	I	101	145	191	249	186	126	180	238	314	233	170	241	319	430	316
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	492	560	558	348	459	613	697	695	439	574	831	942	941	603	781

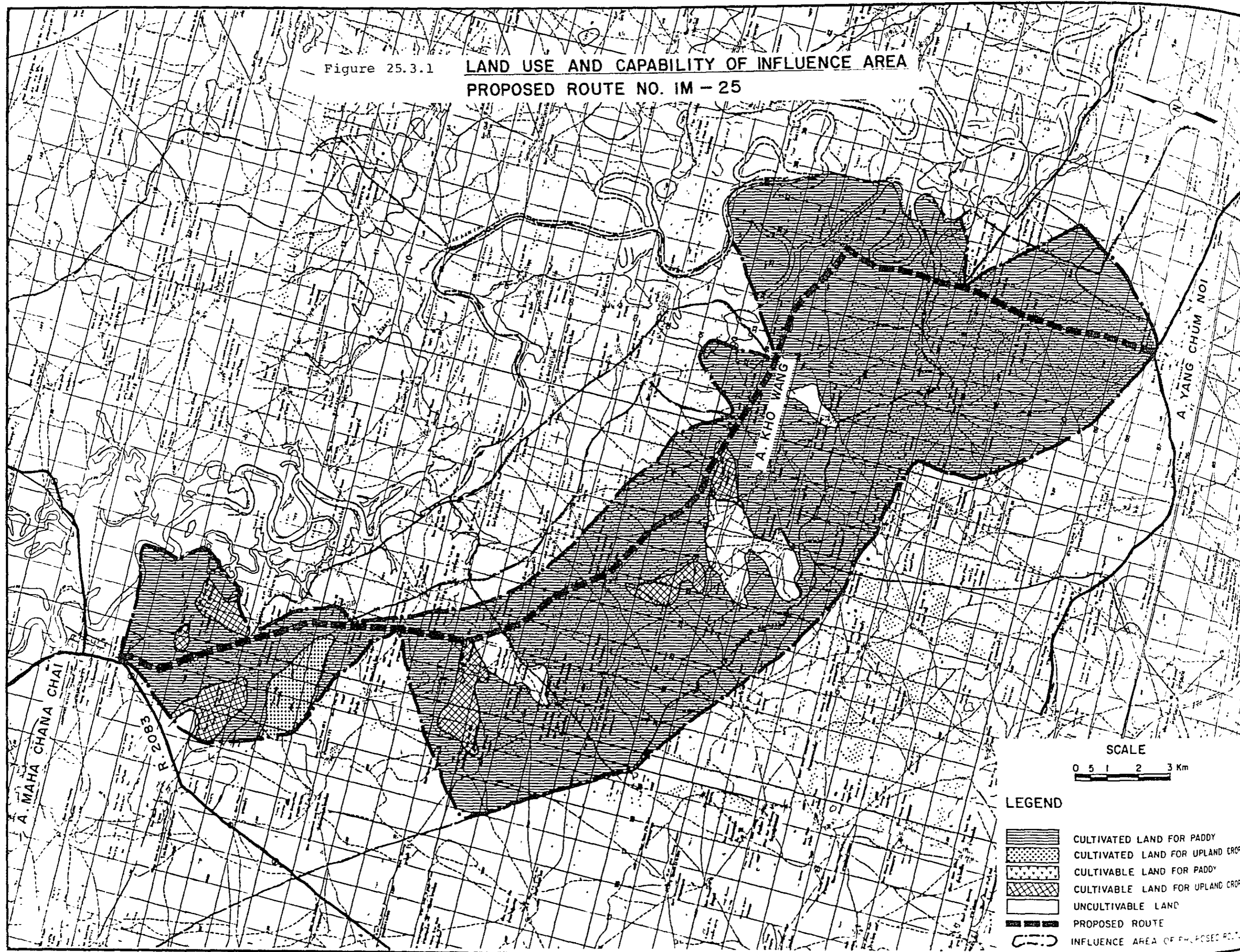
NOTE

N : NORMAL TRAFFIC
 DV : DEVELOPED TRAFFIC

D : DIVERTED TRAFFIC
 I : INDUCED TRAFFIC

Figure 25.3.1

**LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM - 25**



SCALE

0 5 1 2 3 Km

LEGEND



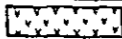



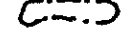
-  CULTIVATED LAND FOR PADDY
-  CULTIVATED LAND FOR UPLAND CROP
-  CULTIVABLE LAND FOR PADDY
-  CULTIVABLE LAND FOR UPLAND CROP
-  UNCULTIVABLE LAND
-  PROPOSED ROUTE
-  INFLUENCE AREA OF PROPOSED ROUTE

Figure 25.3.2 **CROPPING CALENDAR(1)**

CROPPING CALENDAR(2)

1000 CHANGWAT YASOTHON

1600 CHANGWAT SI SA KET

NAME OF CROP	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
RICE, 1 st CROP			○	○	○	○	○	○	X	X		
KENAF		○	○	○	○	○	○	○	X	X		
CASSAVA			○	○	○	○	○	○	X			X
GROUND NUT	○	○	○	○	○	○	○	○	X	X		
COTTON						○	○	○	X	X		

GROUND NUT { MORE IN DRY SEASON
LESS IN RAIN.

NAME OF CROP	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
RICE, 1 st CROP				○	○	○	○	○	X	X		
RICE, 2 nd CROP	○	○	○	○	○	○	○	○	X	X		
KENAF		○	○	○	○	○	○	○	X	X		
CASSAVA				○	○	○	○	○	X			X
MAIZE												
GROUND NUT	○	○	○	○	○	○	○	○	X	X		

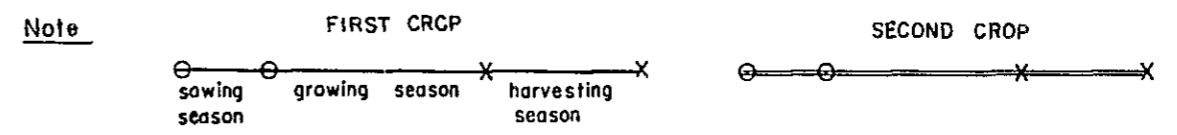


TABLE 25.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM²)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		118.750 (190.0)	1.875 (3.0)	120.625 (193.0)	-	5.625 (9.0)	5.625 (9.0)
1007	MAHA CHANA CHAI	26.250 (42.0)	1.875 (3.0)	28.125 (45.0)	-	3.750 (6.0)	3.750 (6.0)
1008	KHO WANG	55.625 (89.0)	-	55.625 (89.0)	-	1.875 (3.0)	1.875 (3.0)
1602	RASI SALAI	8.125 (13.0)	-	8.125 (13.0)	-	-	-
1603	YANG CHUM NOI	28.750 (46.0)	-	28.750 (46.0)	-	-	-

TABLE 25.3.2 CROP PRODUCTION

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)										
1981	116.41	-	-	-	-	-	1.94	-	1.98	118.39
1987	116.66	-	-	-	-	-	1.94	-	1.97	118.64
1993	WITHOUT PROJECT	116.66	-	-	-	-	1.94	-	1.97	118.64
	WITH PROJECT	116.66	-	-	-	-	1.94	-	1.97	118.64
2001	WITHOUT PROJECT	116.66	-	-	-	-	1.94	-	1.97	118.64
	WITH PROJECT	116.66	-	-	-	-	1.94	-	1.97	118.64
CROP YIELD (KG/RAI)										
1981	175.9	-	-	-	-	-	165.0	-	-	-
1987	179.1	-	-	-	-	-	165.0	-	-	-
1993	WITHOUT PROJECT	182.3	-	-	-	-	165.0	-	-	-
	WITH PROJECT	185.6	-	-	-	-	165.0	-	-	-
2001	WITHOUT PROJECT	186.7	-	-	-	-	165.0	-	-	-
	WITH PROJECT	194.7	-	-	-	-	165.0	-	-	-
CROP PRODUCTION (TON)										
1981	20,476	-	-	-	-	-	320	-	327	20,802
1987	20,892	-	-	-	-	-	320	-	327	21,218
1993	WITHOUT PROJECT	21,271	-	-	-	-	320	-	327	21,597
	WITH PROJECT	21,655	-	-	-	-	320	-	327	21,982
2001	WITHOUT PROJECT	21,786	-	-	-	-	320	-	327	22,113
	WITH PROJECT	22,717	-	-	-	-	320	-	327	23,043

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 25.3.3 FARMGATE PRICE AND PRODUCTION COST

ITEM	PADDY	MAIZE	BEANS	GRIND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	3,678	-	-	-	-	-	4,264	-
WITH PROJECT (1987 - 2001)	3,770	-	-	-	-	-	4,371	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	436	-	-	-	-	-	625	-
WITH PROJECT (1987 - 2001)	436	-	-	-	-	-	625	-

TABLE 25.3.4 NET PRODUCTION VALUE

YEAR	(1000 BAHT)					
	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	26,028	170	26,198	27,898	204	28,102
1993	27,421	170	27,591	30,776	204	30,980
2001	29,319	170	29,489	34,778	205	34,983

Figure 25.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE

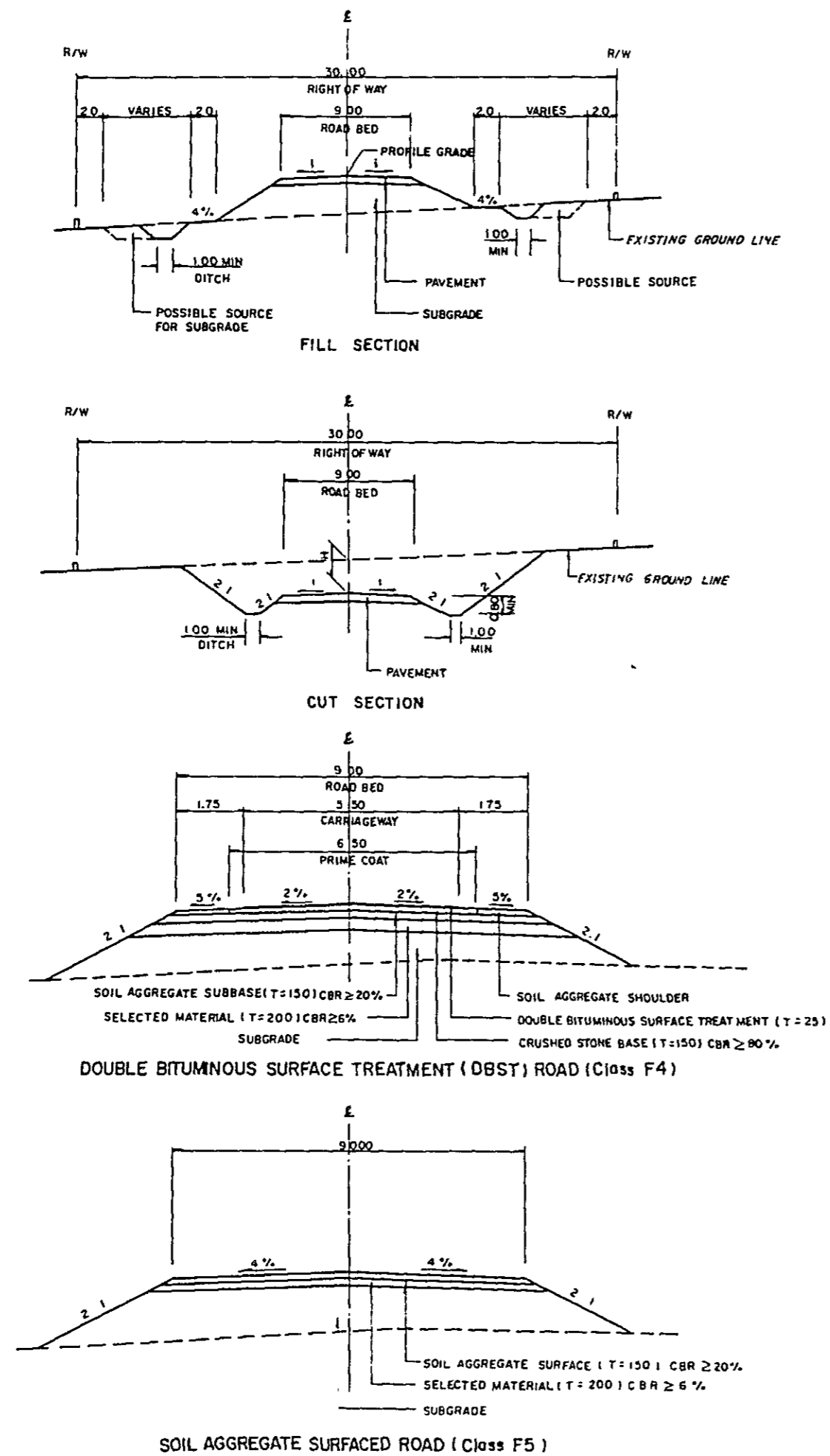
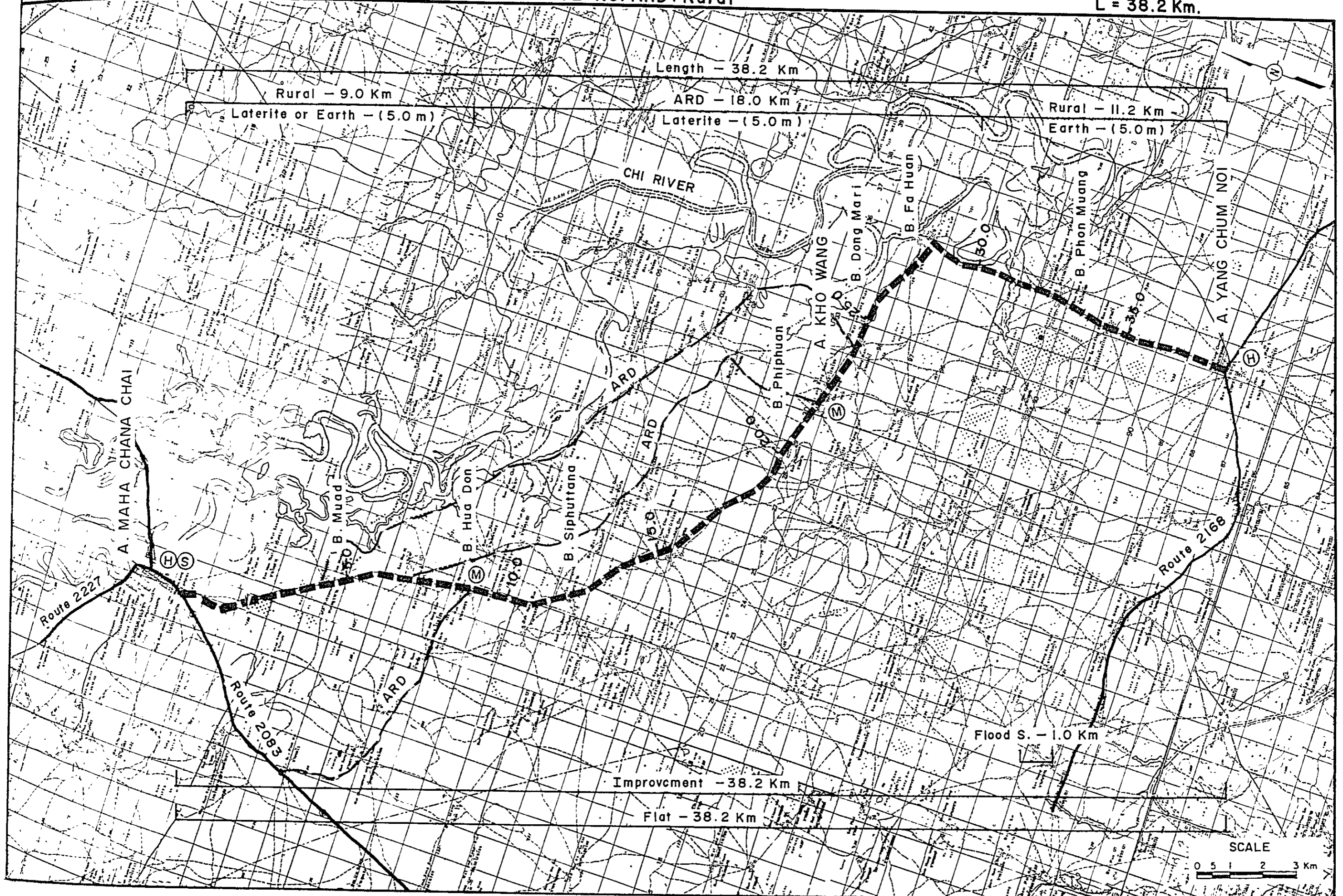


Figure 25.5.2

PROPOSED ROUTE NO. IM - 25

C. YASOTHON
SISAKET

A. MAHA CHANA CHAI (J.R. 2083) - A. YANG CHUM NOI (J.R. 2168)
ROUTE NO. ARD+Rural
L = 38.2 Km.



No.
1
2
3

LEG

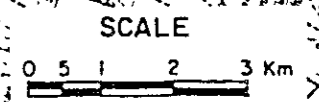
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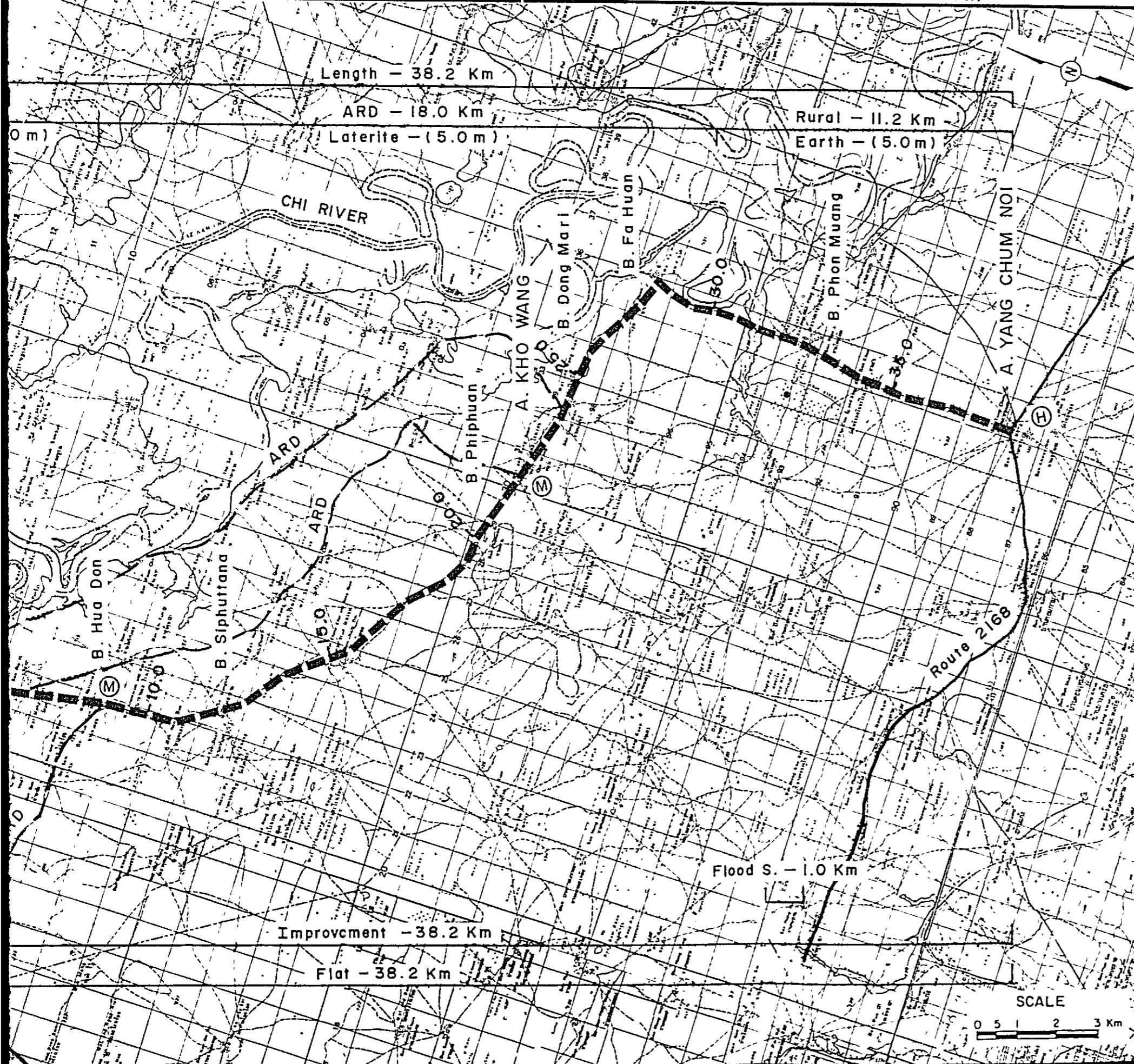
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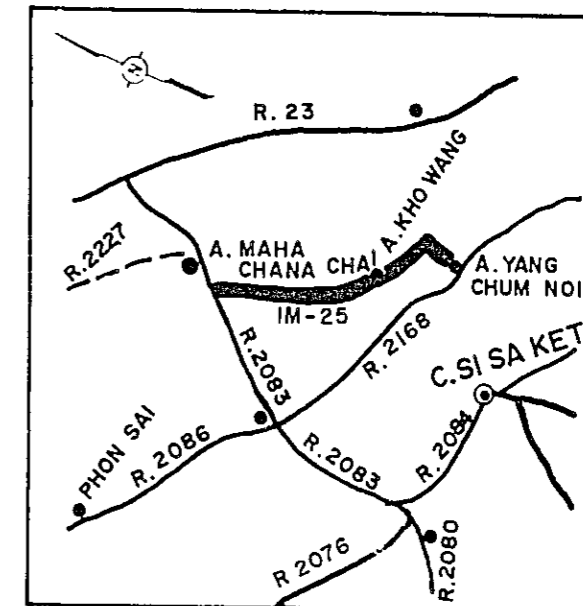
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LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	10.4	—	C - 9 70 x 30 00
2	29 1	C - 7 00 x 8 00	W - 3 60 x 6 10
3	37 5	— (BOX CULVERT)	W - 4 00 x 4 10

LEGEND

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

Table 25.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-25 (38.2 km) (1)

Items	Unit of Q'ty	Financial Unit Rate ₪	(DBST)			(Soil Aggregate Surface)		
			Q'ty	Financial Cost (10 ³ ₪)	Economic Cost (10 ³ ₪)	Q'ty	Financial Cost (10 ³ ₪)	Economic Cost (10 ³ ₪)
DIRECT CONSTRUCTION COST								
Clearing and Grubbing	ha	15,000	96	1,440	1,310	96	1,440	1,310
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	118,300	5,346	4,864	118,800	5,346	4,864
Selected Material	m ³	80	81,000	6,480	5,767	81,000	6,480	5,767
Soil Aggregate Surface or Subbase	m ³	105	56,700	5,953	5,298	56,700	5,953	5,298
Crushed Stone Base	m ³	370	37,200	13,764	12,662	4,900	1,813	1,667
Soil Aggregate Shoulder	m ³	105	16,000	1,680	1,495	2,100	220	196
Prime Coat and DBST	m ²	55	210,100	11,556	10,400	27,500	1,512	1,361
Pipe Culvert	m	2,100	1,620	3,402	3,129	1,620	3,402	3,129
Box Culvert	m	16,000	20	320	288	0	0	0
Long Span Bridge	m	80,000	0	0	0	0	0	0
Short Span Bridge	m	40,000	8	320	284	8	320	284
Sub Total (a)				50,262	45,501		26,907	24,169
Miscellaneous Works (a) x 7%				3,518	3,185		1,976	1,691
Total (b)				53,780	48,686		28,684	25,861
PHYSICAL CONTINGENCY (b) x 15%				8,067	7,303		4,302	3,879
ENGINEERING AND								
ADMINISTRATION (b) x 10%				5,378	4,869		2,968	2,586
Sub Total				13,445	12,172		7,170	6,465
LAND ACQUISITION								
Highly Developed Land	ha	50,000	16	800	800	16	800	800
Less Developed Land	ha	15,000	0	0	0	0	0	0
Sub Total				800	800		800	800
GRAND TOTAL				68,025	61,658		36,655	33,126

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

Items	Unit of Q'ty	Financial Unit Rate ₪	Route Number								
			IM-25 (1-2, 2-3, 3-4) (23.0 km)			IM-25 (4-5) (15.2 km)			IM-25 (T) (38.2 km)		
			Q'ty	Financial Cost (10 ³ ₪)	Economic Cost (10 ³ ₪)	Q'ty	Financial Cost (10 ³ ₪)	Economic Cost (10 ³ ₪)	Q'ty	Financial Cost (10 ³ ₪)	Economic Cost (10 ³ ₪)
DIRECT CONSTRUCTION COST											
Clearing and Grubbing	ha	15,000	58	870	791	38	570	518	96	1,440	1,310
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	53,400	2,403	2,186	65,400	2,943	2,678	118,800	5,346	4,864
Selected Material	m ³	80	48,800	3,904	3,474	32,200	2,576	2,292	81,000	6,480	5,767
Soil Aggregate Surface or Subbase	m ³	105	34,200	3,591	3,195	22,500	2,362	2,102	56,700	5,953	5,298
Crushed Stone Base	m ³	370	22,400	2,288	7,624	1,000	370	340	23,400	8,658	7,965
Soil Aggregate Shoulder	m ³	105	9,700	1,018	906	400	42	37	10,100	1,060	943
Prime Coat and DBST	m ²	55	126,500	6,958	6,262	5,500	303	273	132,000	7,260	6,534
Pipe Culvert	m	2,100	1,020	2,142	1,970	600	1,260	1,159	1,620	3,402	3,129
Box Culvert	m	16,000	5	80	72	15	240	216	20	320	288
Long Span Bridge	m	80,000	0	0	0	0	0	0	0	0	0
Short Span Bridge	m	40,000	0	0	0	80	3,200	2,848	80	3,200	2,848
Sub Total (a)				29,255	26,485		13,867	12,466		43,120	38,950
Miscellaneous Works (a) x 7%				2,048	1,854		971	873		3,018	2,727
Total (b)				31,303	28,339		14,838	13,339		46,138	41,677
PHYSICAL CONTEGENCY (b) x 15%				4,695	4,251		2,226	2,001		6,921	6,251
ENGINEERING AND				3,130	2,834		1,484	1,334		4,614	4,168
ADMINISTRATION (b) x 10%				3,130	2,834		1,484	1,334		4,614	4,168
Sub Total				7,825	7,085		3,710	3,335		11,535	10,419
LAND ACQUISITION											
Highly Developed Land	ha	50,000	16	800	800	0	0	0	16	800	800
Less Developed Land	ha	15,000	0	0	0	0	0	0	0	0	0
Sub Total				800	800		0	0		800	800
GRAND TOTAL				39,928	36,224		18,548	16,674		58,473	52,896

Table 25.6.1 COST AND BENEFITS
(F4 STANDARD)

(1000 BAHT)							
YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	12,332	0	0	0	0	17,326	0
1985	30,829	0	0	0	0	38,672	0
1986	18,497	0	0	0	0	20,717	0
1987	0	1,904	3,974	-178	5,700	0	5,089
1988	0	2,152	4,261	-163	6,250	0	4,982
1989	0	2,399	4,549	-148	6,799	0	4,840
1990	0	2,647	4,836	-133	7,349	0	4,670
1991	0	2,894	5,123	-118	7,899	0	4,482
1992	0	3,142	5,411	-104	8,449	0	4,280
1993	0	3,389	5,698	-89	8,998	0	4,070
1994	18,489	3,652	6,152	-66	9,738	8,363	3,933
1995	0	3,915	6,606	-43	10,479	0	3,779
1996	0	4,178	7,060	-20	11,219	0	3,612
1997	0	4,442	7,515	3	11,959	0	3,438
1998	0	4,705	7,969	26	12,699	0	3,260
1999	0	4,968	8,423	49	13,439	0	3,080
2000	0	5,231	8,877	72	14,180	0	2,901
2001	-28,794	5,494	9,331	95	14,920	-5,261	2,726
TOTAL	51,353	55,110	95,784	-818	150,077	79,817	59,143

DISCOUNTED ECONOMIC COSTS :	79,817
DISCOUNTED ECONOMIC BENEFITS :	59,143
AGRICULTURAL DEVELOPMENT BENEFIT	21,501
VOC SAVING	38,279
RMC SAVING	-636
NET PRESENT VALUE :	-20,674
BENEFIT COST RATIO :	0.74
INTERNAL RATE OF RETURN :	8.6 %

Table 25.6.2 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	21,158	0	0	0	0	26,541	0
1986	31,738	0	0	0	0	35,547	0
1987	0	1,904	3,553	-111	5,346	0	4,773
1988	0	2,152	3,813	-98	5,867	0	4,677
1989	0	2,399	4,073	-84	6,387	0	4,546
1990	0	2,647	4,333	-71	6,908	0	4,390
1991	0	2,894	4,592	-58	7,429	0	4,215
1992	0	3,142	4,852	-44	7,949	0	4,027
1993	0	3,389	5,112	-31	8,470	0	3,831
1994	11,616	3,652	5,524	-10	9,166	5,254	3,702
1995	0	3,915	5,935	11	9,861	0	3,556
1996	0	4,178	6,347	32	10,557	0	3,399
1997	0	4,442	6,758	53	11,252	0	3,235
1998	0	4,705	7,170	73	11,948	0	3,067
1999	0	4,968	7,581	94	12,643	0	2,897
2000	0	5,231	7,993	115	13,339	0	2,729
2001	-24,764	5,494	8,404	136	14,034	-4,524	2,564
TOTAL	39,748	55,110	86,038	7	141,154	62,817	55,609

DISCOUNTED ECONOMIC COSTS :	62,817
DISCOUNTED ECONOMIC BENEFITS :	55,609
AGRICULTURAL DEVELOPMENT BENEFIT	21,501
VOC SAVING	34,346
RMC SAVING	-237
NET PRESENT VALUE :	-7,208
BENEFIT COST RATIO :	0.89
INTERNAL RATE OF RETURN :	10.5 %

Table 25.6.3 COST AND BENEFITS
(F4, SECTION 1)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST.	AGRI.	VOC	RMC	TOTAL	COST	BENEFIT
	COST	BENEFIT	SAVING	SAVING			
1984	0	0	0	0	0	0	0
1985	14,489	0	0	0	0	18,175	0
1986	21,735	0	0	0	0	24,343	0
1987	0	1,605	2,630	-46	4,189	0	3,740
1988	0	1,814	2,821	-37	4,598	0	3,665
1989	0	2,022	3,011	-27	5,006	0	3,563
1990	0	2,231	3,202	-18	5,415	0	3,441
1991	0	2,440	3,392	-8	5,824	0	3,305
1992	0	2,648	3,583	2	6,232	0	3,157
1993	0	2,857	3,773	11	6,641	0	3,004
1994	11,132	3,079	4,075	26	7,180	5,036	2,900
1995	0	3,301	4,377	41	7,719	0	2,783
1996	0	3,522	4,679	56	8,257	0	2,659
1997	0	3,744	4,982	71	8,796	0	2,529
1998	0	3,966	5,284	85	9,335	0	2,396
1999	0	4,188	5,586	100	9,874	0	2,263
2000	0	4,409	5,888	115	10,412	0	2,131
2001	-14,970	4,631	6,190	130	10,951	-2,735	2,001
TOTAL	32,386	46,456	63,471	501	110,428	44,819	43,537

DISCOUNTED ECONOMIC COSTS :	44,819
DISCOUNTED ECONOMIC BENEFITS :	43,537
AGRICULTURAL DEVELOPMENT BENEFIT	18,125
VOC SAVING	25,356
RMC SAVING	56
NET PRESENT VALUE :	-1,282
BENEFIT COST RATIO :	0.97
INTERNAL RATE OF RETURN :	11.6 %

Table 25.6.4 COST AND BENEFITS
(F5, SECTION 2)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST.	AGRI.	VOC	RMC	TOTAL	COST	BENEFIT
	COST	BENEFIT	SAVING	SAVING			
1984	0	0	0	0	0	0	0
1985	6,670	0	0	0	0	8,367	0
1986	10,004	0	0	0	0	11,204	0
1987	0	299	923	-66	1,156	0	1,032
1988	0	338	992	-62	1,268	0	1,011
1989	0	377	1,062	-58	1,380	0	982
1990	0	416	1,131	-54	1,493	0	949
1991	0	454	1,200	-50	1,605	0	911
1992	0	493	1,270	-46	1,717	0	870
1993	0	532	1,339	-42	1,829	0	827
1994	484	573	1,448	-36	1,986	219	802
1995	0	615	1,558	-30	2,143	0	773
1996	0	656	1,667	-24	2,300	0	740
1997	0	698	1,777	-18	2,457	0	706
1998	0	739	1,886	-11	2,613	0	671
1999	0	780	1,995	-5	2,770	0	635
2000	0	822	2,105	1	2,927	0	599
2001	-10,322	863	2,214	7	3,084	-1,886	563
TOTAL	6,836	8,654	22,567	-494	30,727	17,904	12,071

DISCOUNTED ECONOMIC COSTS :	17,904
DISCOUNTED ECONOMIC BENEFITS :	12,071
AGRICULTURAL DEVELOPMENT BENEFIT	3,376
VOC SAVING	8,990
RMC SAVING	-295
NET PRESENT VALUE :	-5,833
BENEFIT COST RATIO :	0.67
INTERNAL RATE OF RETURN :	8.1 %

Table 25.7.1 SOCIAL INDICATORS
(Proposed Route IM-25)

Population (1,000)		Education	
1982	: 38.9	Access to Secondary School	
1993	: 44.4	Number of Student in 1993 (1,000) ^{2/}	: 9.8
Average travelling speed, without (kph)		Average distance to school (km)	: 9.5
	: 40	Per capita time savings (10 ⁻⁴)	: 0.108
Isolation		Score	: 58
Access to Amphoe		Teacher Intensity	
Average distance to Amphoe (km) ^{1/}	: 10.6	Number of teachers ^{3/}	
Per capita time savings (10 ⁻⁴)	: 0.027	University graduate	: -
Score	: 79	Total	: 11
Access to Artery Highway		Number of Student	: 218
Average distance to highway (km) ^{1/}	: 11	Indicators	
Per capita time savings (10 ⁻⁴)	: 0.028	E1 ^{4/}	: -
Score	: 61	E2 ^{5/}	: 50.5
Impassability		E ^{6/}	: 50.5
Impassable week a year	: 4	Degree of Improvement ^{7/}	: 1.35
Impassability per year	: 0.077	Score	: 86
Impassability per capita (10 ⁻⁴)	: 0.017	Disparity	
Score	: 142	G.P.V. in 1993 (Mn B) ^{8/}	
Health		With project	: 83.1
Access to Hospital		Without project	: 79.7
Average distance to Hospital (km) ^{1/}	: 9.5	Per capita G.P.V. in 1993 (B)	
Per capita time savings (10 ⁻⁴)	: 0.024	With project (W)	: 1,872
Score	: 56	Without project (w)	: 1,795
Access to Medical Facilities		Degree of Disparity	
Average distance to facilities (km) ^{1/}	: 3.9	(A/W) - (A/w) ^{9/}	: 0.07
Per capita time savings (10 ⁻⁴)	: 0.010	Score	: 125
Score	: 40	Total Score	: 647

Note:

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

PROPOSED ROUTE NO. IM - 26

Changwat : Surin / Si Sa Ket

B. Non Dang(JR.2030,2033,2034)-A.Rattana Buri

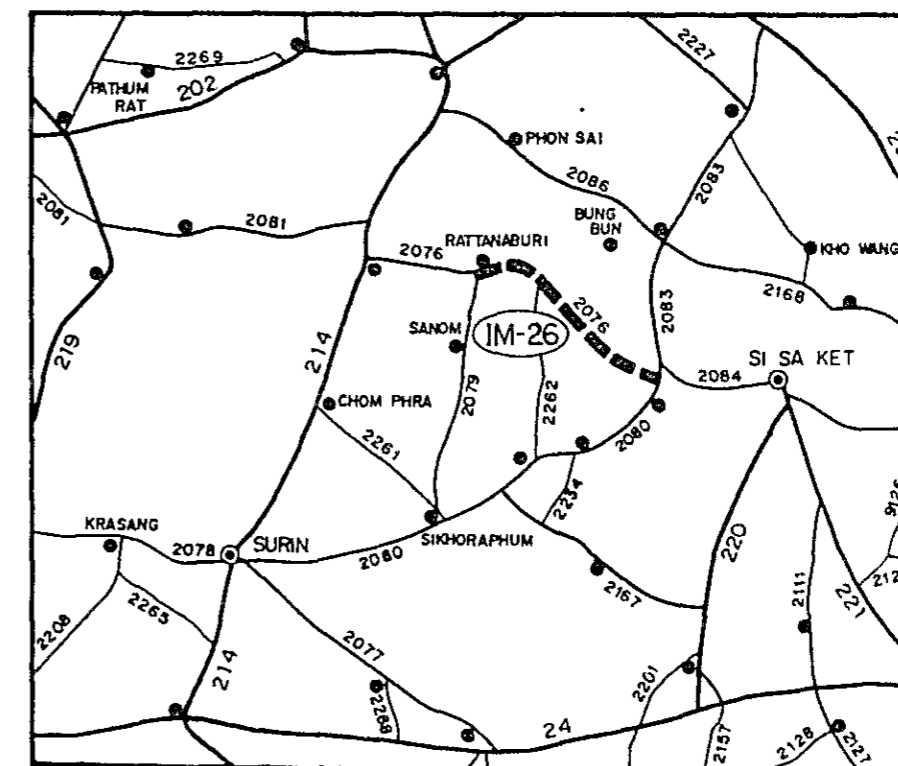
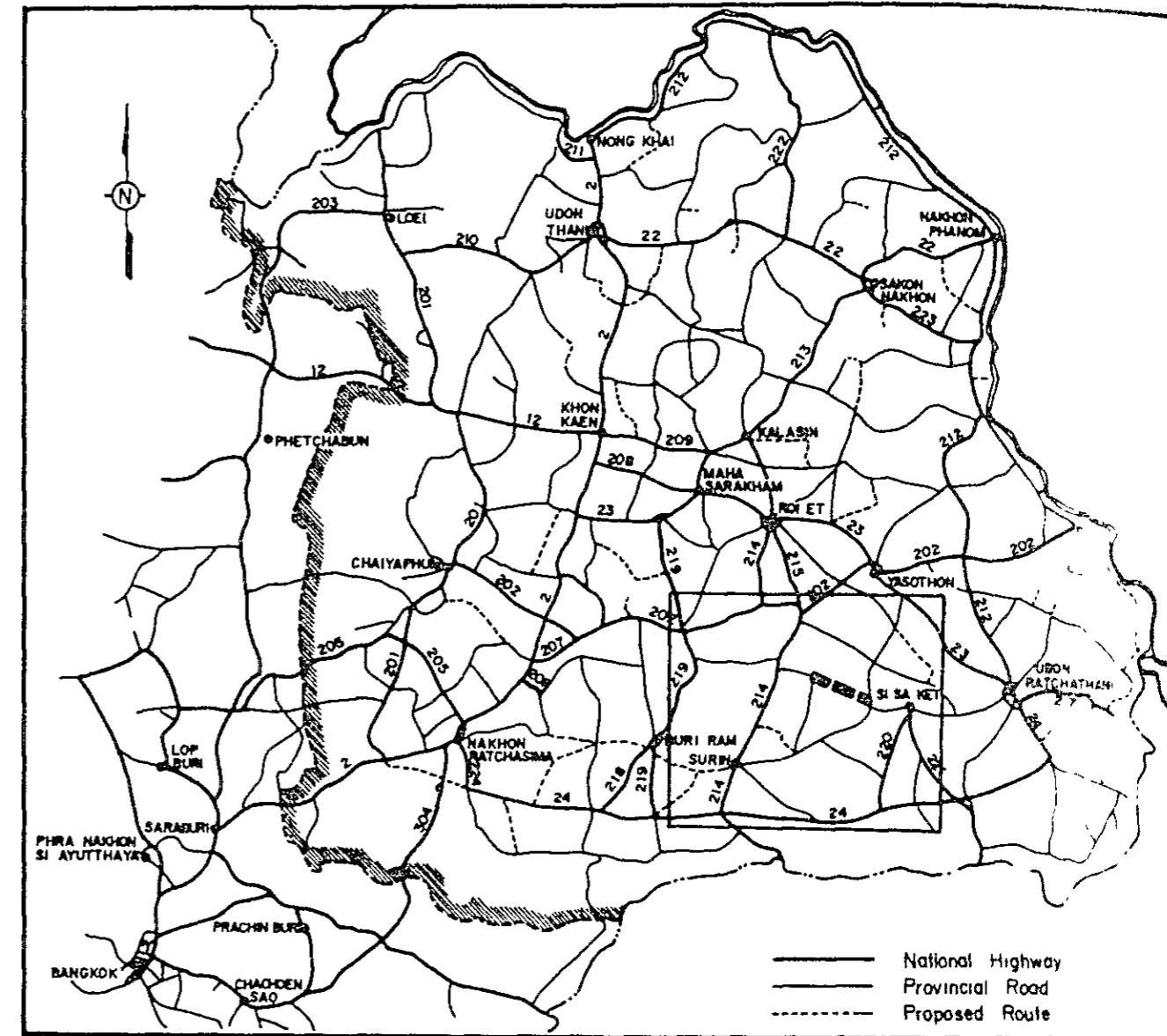
Length · 39.5 KM.

LOCATION OF PROPOSED ROUTE

SUMMARY

PROPOSED ROUTE IM-26

Item	Description
Changwat	Surin/Si Sa Ket
Origin	B. Non Dang (J.R.2030, 2033, 2034)
Destination	A. Rattane Buri
Length	
Total	39.5 km
Improvement Section	35.5 km
DOH Road	R.2076 35.5 km
ARD Road	0 km
Others	0 km
New Alignment Section	4.0 km
Surface Type and Condition	Soil Aggregate, Poor
Terrain	Flat and Rolling
Influence Area	
Area	196 km ²
Population (1982)	33,800
Principal Crops	Paddy
Traffic (ADT)	
Existing	154
1993	630
2001	857
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	74,327 . 10 ³ ฿
Economic	67,347 . 10 ³ ฿
IRR	11.8 %
B/C	0.99
Social Impact	High
Recommendation	For immediate implementation



1. GENERAL

1.1 Characteristics of the Route

The proposed route extends in two changwat of Surin and Si Sa Ket.

The route, starting of Route 2076 with 2079 at Ban Non Dang at the intersection, runs southeastward passing through Ban Muang Mak, Ban E Se and Ban Dong Ling and ends at the intersection of Route 2080 with 2083 at Amphoe Rathanaburi. Its total length is 39.5 km. (Figure 26.5.2)

The terrain is almost flat, while some sections are rolling. In the influence area, these exists several villages with total population of 33,800. There are two medical centers, one hospital and one secondary school along the proposed route.

The proposed route, upon completion, will form an important part of road network to connect two artery highways, Route 214 and 2084 in the agriculturally developed area.

1.2 Condition of Existing Road

Condition of existing roads to be utilized for the proposed route is summarized in Table 26.1.2. The details are shown as the results of inventory survey in Table 26.1.2.

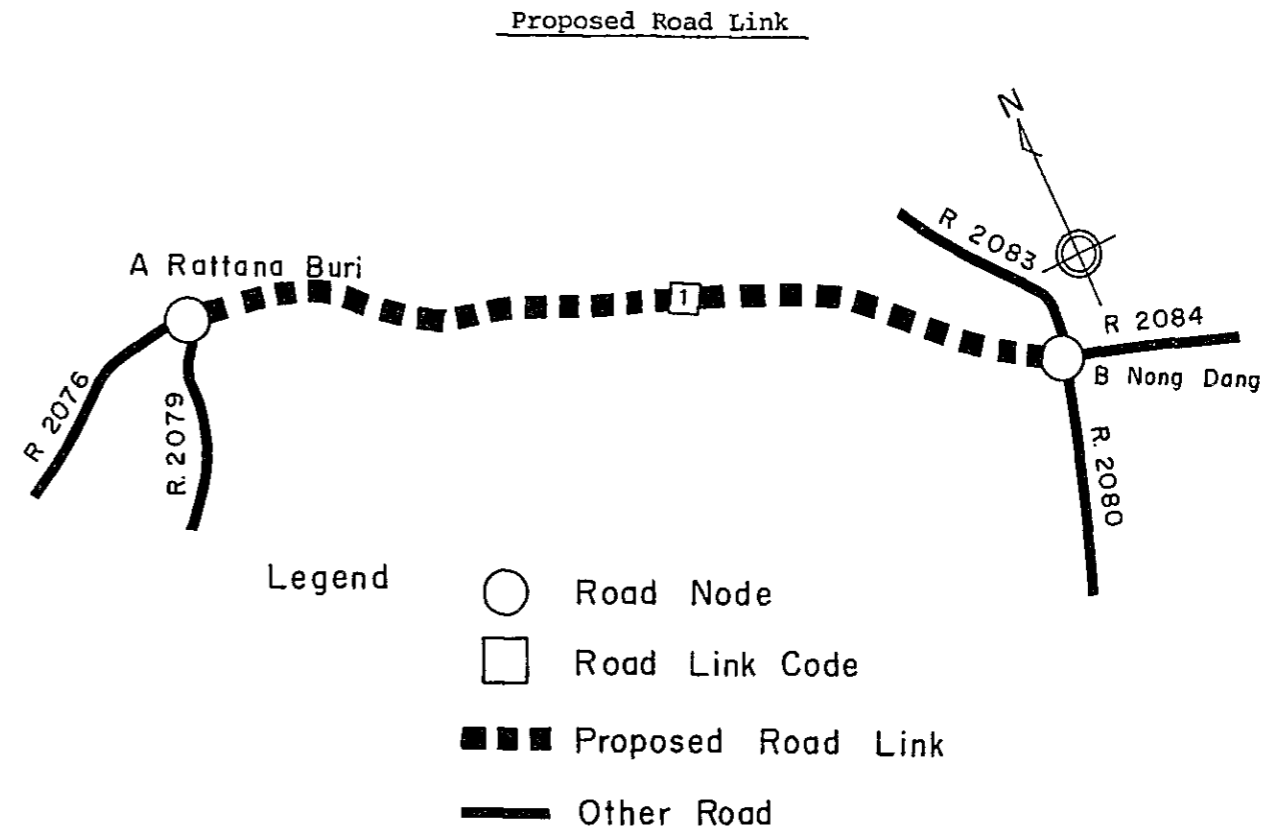
2. TRAFFIC

2.1 Method

Growth Rate Method was employed for traffic forecasting as no diverted traffic is expected after improvement of the proposed road.

2.2 Base Year Traffic

The base year traffic by road link by vehicle type was estimated referring DOHs traffic records as shown below.



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/}	30	9	27	32	1	2	4	19	30	154

Note : ^{1/} Route 2076 Section 0200 Station Km 0+500

2.3 Transport Movement

Passenger movement in terms of trips per day and freight movement in terms of tonnage per day on the proposed road link were estimated multiplying traffic volume in base year by the occupancy or average load obtained from roadside interview, as shown below:

PASSENGER MOVEMENT (1982)

PROPOSED ROAD LINK	TRIPS PER DAY
1	1214

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	143	161	304

2.4 Future Growth of Transport Movement

The growth rate of passenger and freight movements for the periods of 1981-1987, 1987-1993 and 1993-2001 were predicted by the formula described in 7.3.3-2) of the Main Report. The basis for the prediction is shown in the following tables:

GROWTH RATE OF PASSENGER MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981	1987	1993
	1987	1993	2001
PER CAPITA INCOME	4.2	4.5	4.7
TRANS. PRICE INCREASE	4.5	4.5	4.5
POPULATION	1.5	1.3	1.1
PASSENGER MOVEMENT	5.5	5.7	5.8

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981	1987	1993
	1987	1993	2001
NON-AGRI. AGRICULTURE	7.1	7.3	7.5
FREIGHT	3.6	3.6	3.6

2.5 Induced and Developed Traffic

The following ratios are used for the estimation of induced and developed traffic described in 7.3.3-3) of the Main Report:

RATE OF INDUCED AND DEVELOPED TRAFFIC

ITEM	(%)		
	YEAR		
	1987	1993	2001
INDUCED	15.0	15.0	15.0
DEVELOPED	0.0	0.5	0.4

2.6 Future Traffic

1) Traffic Composition

The movements of passenger and freight transport were transformed into traffic volume by vehicle type applying future traffic composition as shown in the following table:

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	30.3	9.1	27.3	32.3	1.0	3.6	7.3	34.5	54.5
	1987	24.3	15.6	25.5	30.5	4.1	7.6	9.9	34.7	47.8
	1993	18.3	22.1	23.7	28.7	7.3	11.7	12.5	34.8	41.0
	2001	10.2	30.8	21.3	26.2	11.5	17.0	16.0	35.0	32.0

2) Forecasted ADT

The average of the forecasted traffic on proposed road link is shown in the following table and details by road link by traffic type are shown in Table 26.2.1.

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	34	36	43	6	28	8	29	40	225	275	500
1993	34	45	54	14	55	15	40	48	305	326	630
2001	28	59	73	32	117	29	64	59	461	396	857

3. AGRICULTURAL DEVELOPMENT

3.1 Present Condition

Around 90% of cultivated land in the influence area is covered by puddy fields. The main upland crop is cassava, and others are kenaf and ground nuts.

Unused cultivable land for mainly upland field remains, but limited, in central part of the area.

Land use and capability conditions in the area of influence are shown in Table 26.3.1 and Figure 26.3.1.

Typical cropping calendars in the Surin and Si Sa Ket areas are shown in Figure 26.3.2.

3.2 Development Projection

Future agricultural development in the area of influence was projected for both cases of without project and with project. The projected planted area, unit yields by crop, and the consequent production volumes are shown in Table 26.3.2.

Farmgate prices and production costs of the selected crops are estimated as follows, referring to the Changwat data and field survey information as shown in Table 26.3.3.

Based on the above projected production volume, farmgate prices, production costs and land preparation cost estimated separately, net production value (NPV) was obtained as shown in Table 26.3.4. The difference between

NPV of with project case and NPV of without project case is deemed to be the development benefit of the subject road.

4. VOC SAVINGS

In accordance with the concept and basic data given in Chapter 7 of Vol. 1 Main Report, VOCs on each road link concerned were calculated in both cases of with project and without project. Elements of road condition, which affect the calculation of additional costs of VOC of each link, are shown below.

Road Condition

Link No.	Terrain	Without Project				With Project		
		Length (Km)	^{/1} Road Class	Nos. of Wooden Bridge	Nos. of Narrow C.Bridge	Length (Km)	^{/1} Road Class	Nos. of Wooden Narrow Bridge
1	Flat & Rolling	39.5	3	0	0	39.5	1 (F4)	0

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

VOC savings, obtained from the difference of total link VOCs in the cases of with project and those of without project case, were calculated as follows.

Vehical Operating Cost Saving

(Unit: 1,000 Baht)			
Road Class	1987	1993	2001
1 (F4)	8,108	10,600	15,232

5. ENGINEERING

5.1 Preliminary Design

Preliminary design was carried out based on the following design criteria.

Design standard	: F4 (feasible)
Geometric Design	: AASHTO (Rural Highways)
Typical Cross Section	: as shown in Figure 26.5.1
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	:	∅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 26.5.2.

Alignment of the route is shown in Figure 26.5.2.

5.2 Work Quantity and Construction Cost

Work quantities based on the preliminary design and construction cost together with unit rate by work item are shown in Table 26.5.1.

Total financial and economic construction costs by applied road class F4 are as given below:

F4 Standard (DBST)	L = 39.5 km
Financial Cost	74,327 · 10 ³ ₪
Economic Cost	67,347 · 10 ³ ₪

6. ECONOMIC EVALUATION

Yearly distribution of the economic costs and benefits and the calculated economic indicators for evaluation are given in Table 26.6.1.

The result indicates that the proposed project seems to be feasible under F4 Standard (DBST).

7. SOCIAL IMPACTS

Detailed data and results of quantification of indicators of social impacts are tabulated in Table 26.7.1. Social impacts of the proposed route are considerably high.

Table 26.1.1 SUMMARY OF ROAD INVENTORY

Item	Description	
Origin	B. Non Dang (J.R. 2030, 2033, 2034)	
Destination	A. Rattana Buri	
Length		
Total		39.5 km
Improvement Section		35.5 km
DOH Road	R. 2076	35.5 km
ARD Road		0 km
Others		0 km
New Alignment Section		4.0 km
Terrain	Flat and Rolling	
Alignment (Hori./Vert.)	Fair / Fair	
Formation Width	4.0 m - 7.0 m, 5.6 m (Weighted average)	
Embankment Section		
Length		39.5 km
Height	0.5 m - 2.5 m	
Cut Section		
Length		0 km
Depth	m - m	
Surface Type and Condition		
SBST or DBST		0 km
Soil Aggregate	Poor	39.5 km
Earth		0 km
Pipe Culvert	41 each	
Box Culvert	3 each	26.0 m
Bridge		
Permanent Bridge	2 each	170.0 m
Narrow Concrete Bridge	0 each	0 m (4m)
Wooden Bridge	0 each	0 m
Overflow Section	1 place	3.0 km

Table 26.1.2 ROAD INVENTORY (1)

PROPOSED ROUTE NO. IM-26

ROUTE NO. 2076

B. NON DANG (J.R. 2030, 2033, 2034) ~ A. RATTANA BURI

L = 39.5 Km.

SURIN/SI SA KET

STATION (Km)		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30					
VILLAGE																						
- Name																						
- Household (H)																						
- Population (P)																						
TERRAIN																						
CROSS SECTION	Formation Width (m)	8.0	5.00			4.00				5.00	4.50		4.00		5.00		6.50				7.00	
	Embankment Height (m)		0.50	1.00	2.00		1.00		1.50	1.00	0.50	1.00	0.50	1.00	0.50		1.00	2.50				1.00
	Cutting Depth (m)																					
PAVEMENT	Type/Length																					
	Condition																					
FLOODING	Overflow Length(Km)/Height(m)															L=3.0	H=0.1					
LAND USE	Left																					
	Right																					
PIPE CULVERT	Total Number															41 Pipes						
BOX CULVERT & BRIDGE	Station (Km)																					
	Dimension																					
RIGHT OF WAY (m)																						
ALIGNMENT	Horizontal															Fair						
	Vertical															Fair						
ROUTE NO., AGENCIES																	DOH 2076					

B. NON DANG (J.R. 2030, 2033,2034) ~ A. RATTANA BURI (Cont'd)

SURIN/SI SA KET

PROPOSED ROUTE NO. IM-26

ROUTE NO. 2076

STATION (Km)		30	32	34	36	38	40
VILLAGE							
- Name							
- Household (H)							
- Population (P)							
TERRAIN				Rolling			
CROSS SECTION	Formation Width (m)			7.00		6.00	
	Embankment Height (m)			0.80	0.40	0.00	
	Cutting Depth (m)						
PAVEMENT	Type/Length			Laterite			
	Condition			Poor			
FLOODING	Overflow Length(Km)/Height(m)						
LAND USE	Left			Paddy			
	Right			Paddy			
PIPE CULVERT	Total Number						
BOX CULVERT & BRIDGE	Station (Km)					39.1	
	Dimension					C-Br. 10.0 x 40.0	
RIGHT OF WAY (m)							
ALIGNMENT	Horizontal			Fair			
	Vertical			Fair			
ROUTE NO., AGENCIES				DOH 2076			

Table 26.2.1 TRAFFIC VOLUME ON ROUTE IM - 26

YEAR	1987		1993		2001		
LINK	1 AVR.		1 AVR.		1 AVR.		
P/C	N+D	30	30	30	30	25	25
	I	4	4	4	4	4	4
	DV	0	0	0	0	0	0
	TOTAL	34	34	34	34	28	28
L/B	N+D	31	31	39	39	51	51
	I	5	5	6	6	8	8
	DV	0	0	0	0	0	0
	TOTAL	36	36	45	45	59	59
M/B	N+D	37	37	47	47	63	63
	I	6	6	7	7	9	9
	DV	0	0	0	0	0	0
	TOTAL	43	43	54	54	73	73
H/B	N+D	5	5	12	12	28	28
	I	1	1	2	2	4	4
	DV	0	0	0	0	0	0
	TOTAL	6	6	14	14	32	32
P/P&T	N+D	25	25	48	48	101	101
	I	4	4	7	7	15	15
	DV	0	0	0	0	0	0
	TOTAL	28	28	55	55	117	117
4/T	N+D	7	7	13	13	25	25
	I	1	1	2	2	4	4
	DV	0	0	0	0	0	0
	TOTAL	8	8	15	15	29	29
6/T	N+D	25	25	35	35	56	56
	I	4	4	5	5	8	8
	DV	0	0	0	0	0	0
	TOTAL	29	29	40	40	64	64
10/T	N+D	35	35	41	41	51	51
	I	5	5	6	6	8	8
	DV	0	0	0	0	0	0
	TOTAL	40	40	48	48	59	59
ADT	N+D	196	196	264	264	399	399
	I	29	29	40	40	60	60
	DV	0	0	1	1	2	2
	TOTAL	225	225	305	305	461	461
M/C	N+D	252	252	300	300	371	371
	I	22	22	24	24	24	24
	DV	0	0	1	1	1	1
	TOTAL	275	275	326	326	396	396
TOTAL	N+D	448	448	564	564	770	770
	I	52	52	64	64	84	84
	DV	0	0	2	2	2	2
	TOTAL	500	500	630	630	857	857

NOTE

N : NORMAL TRAFFIC
DV : DEVELOPED TRAFFICD : DIVERTED TRAFFIC
I : INDUCED TRAFFIC

Figure 26.3.1 **LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM - 26**

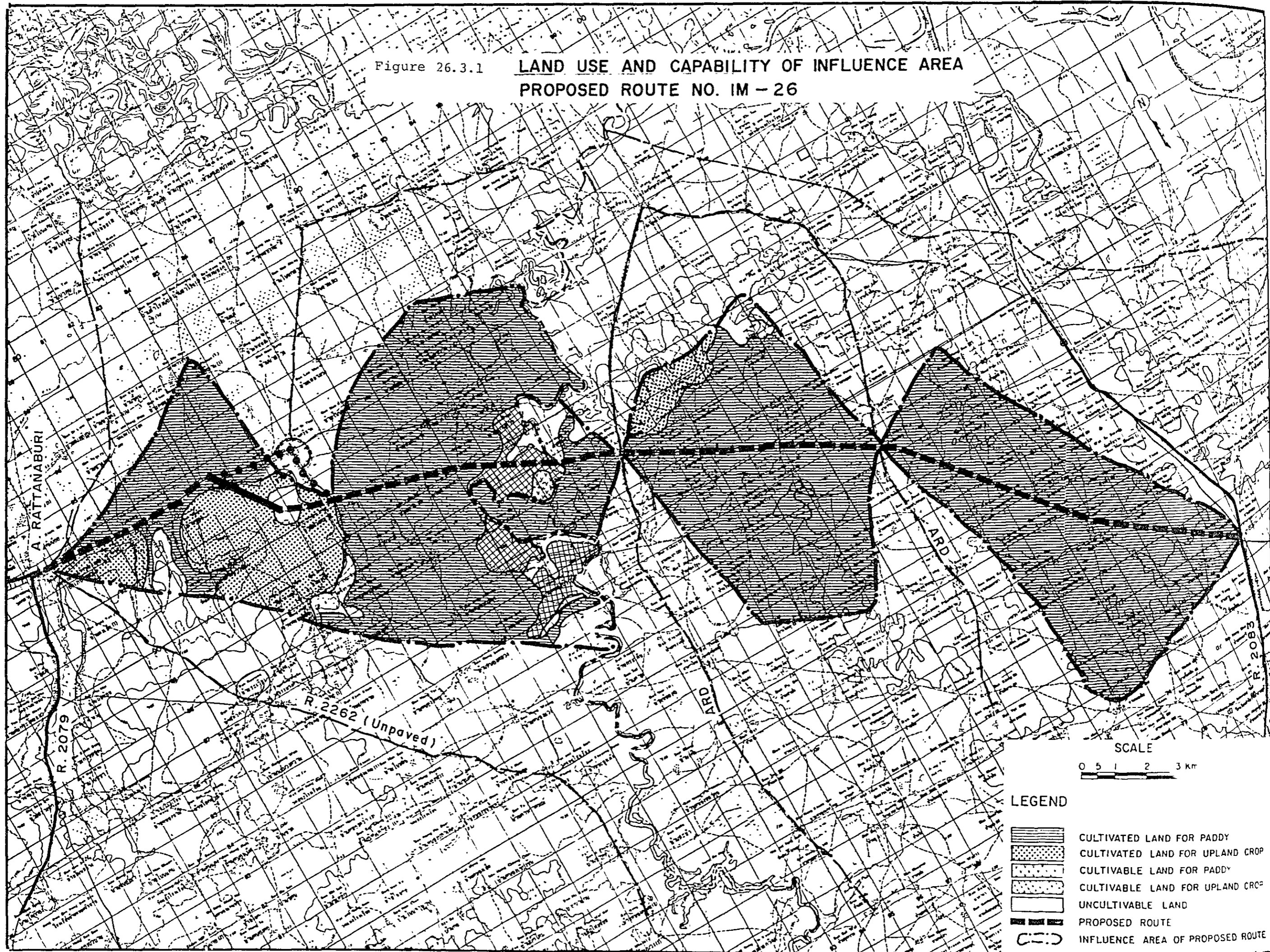
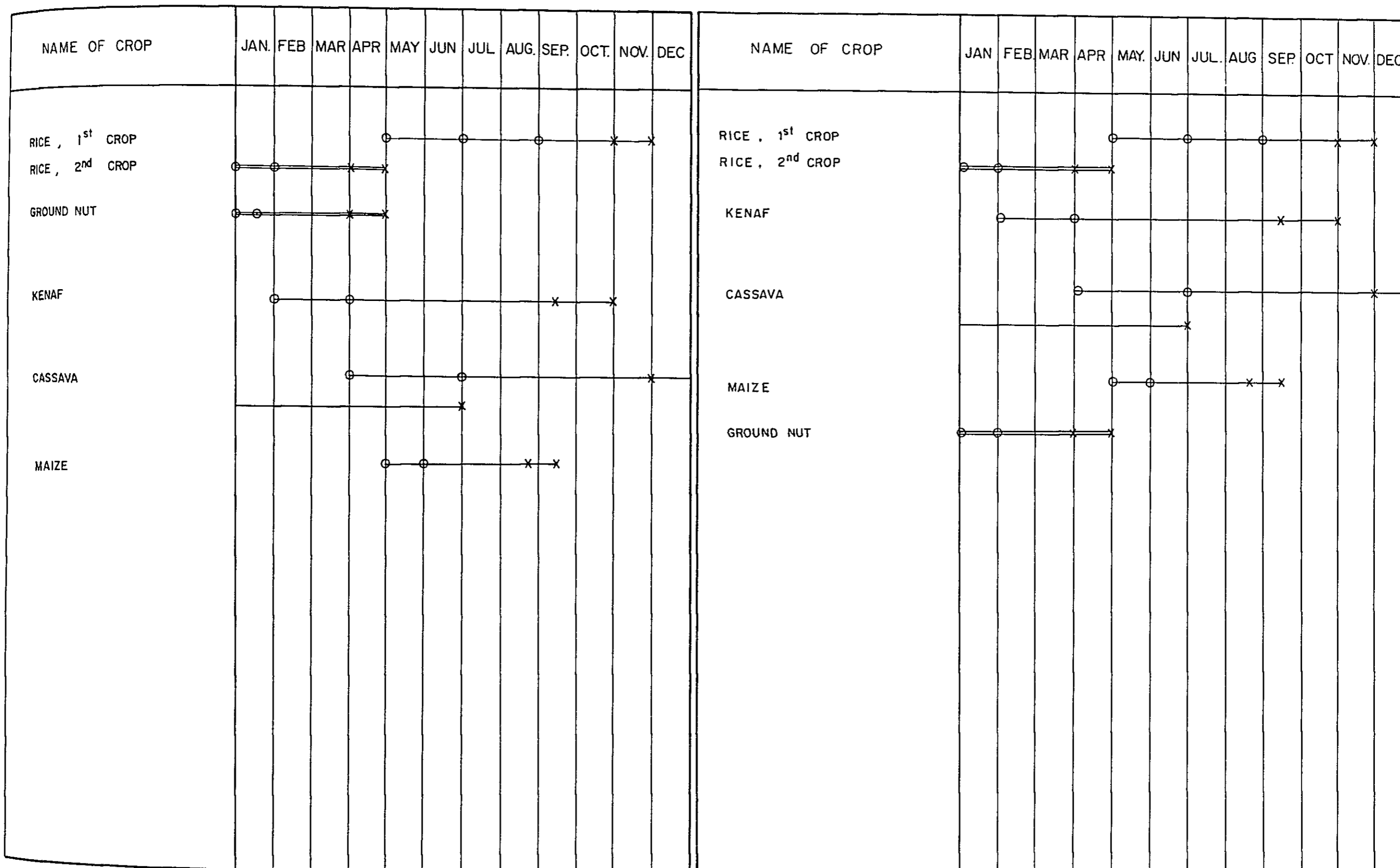


Figure 26.3.2 CROPPING CALENDAR (1)

1500 CHANGWAT SURIN

CROPPING CALENDAR (2)

1600 CHANGWAT SI SA KET



Note

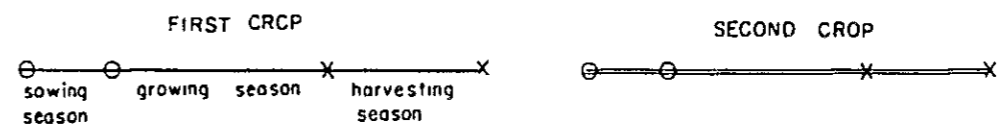


TABLE 26.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM²)]

AMPHOE	AMPHOE	CULTIVATED LAND			UNUSED CULTIVABLE LAND				
		CODE	NAME	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
				100.625 (161.0)	11.875 (19.0)	112.500 (180.0)	0.625 (1.0)	4.375 (7.0)	5.000 (8.0)
1506	RATTANABURI			41.875 (67.0)	10.000 (16.0)	51.875 (83.0)	0.625 (1.0)	4.375 (7.0)	5.000 (8.0)
1605	LITHUMPON PHISAI			58.750 (94.0)	1.875 (3.0)	60.625 (97.0)	-	-	-

TABLE 26.3.2 CROP PRODUCTION

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL	
PLANTED AREA (1000 RAI)											
1981	100.95	-	-	0.15	9.20	-	1.77	-	11.90	112.85	
1987	105.90	-	-	0.15	9.25	-	1.78	-	11.99	117.88	
1993	WITHOUT PROJECT	107.31	-	-	0.15	9.31	-	1.80	-	12.07	119.38
	WITH PROJECT	107.31	-	-	0.14	9.96	-	1.76	-	12.65	119.96
2001	WITHOUT PROJECT	107.31	-	-	0.15	9.38	-	1.81	-	12.19	119.50
	WITH PROJECT	107.31	-	-	0.14	9.95	-	1.76	-	12.65	119.96
CROP YIELD (KG/RAI)											
1981	198.7	-	-	222.3	2600.0	-	160.0	-	-	-	
1987	201.1	-	-	222.3	2600.0	-	160.0	-	-	-	
1993	WITHOUT PROJECT	203.5	-	-	222.3	2600.0	-	160.0	-	-	
	WITH PROJECT	207.2	-	-	223.6	2615.6	-	160.0	-	-	
2001	WITHOUT PROJECT	206.8	-	-	222.3	2600.0	-	160.0	-	-	
	WITH PROJECT	215.6	-	-	225.4	2636.6	-	160.0	-	-	
CROP PRODUCTION (TON)											
1981	20,055	-	-	32	23,908	-	284	-	24,398	44,453	
1987	21,291	-	-	33	24,051	-	285	-	24,549	45,840	
1993	WITHOUT PROJECT	21,835	-	-	33	24,196	-	287	-	24,701	46,536
	WITH PROJECT	22,230	-	-	32	26,059	-	281	-	26,551	48,781
2001	WITHOUT PROJECT	22,186	-	-	33	24,390	-	290	-	24,905	47,092
	WITH PROJECT	23,135	-	-	32	26,229	-	281	-	26,729	49,863

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 26.3.3 FARMGATE PRICE AND PRODUCTION COST

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	4,017	-	-	6,347	721	-	4,728	-
WITH PROJECT (1987 - 2001)	4,117	-	-	6,347	739	-	4,846	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	526	-	-	1,023	734	-	631	-
WITH PROJECT (1987 - 2001)	546	-	-	1,043	754	-	631	-

TABLE 26.3.4 NET PRODUCTION VALUE

YEAR	(1000 BAHT)					
	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	29,857	10,824	40,681	29,868	11,100	40,968
1993	31,299	10,891	42,190	32,964	12,050	45,014
2001	32,713	10,980	43,693	36,689	12,196	48,885

Figure 26.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE

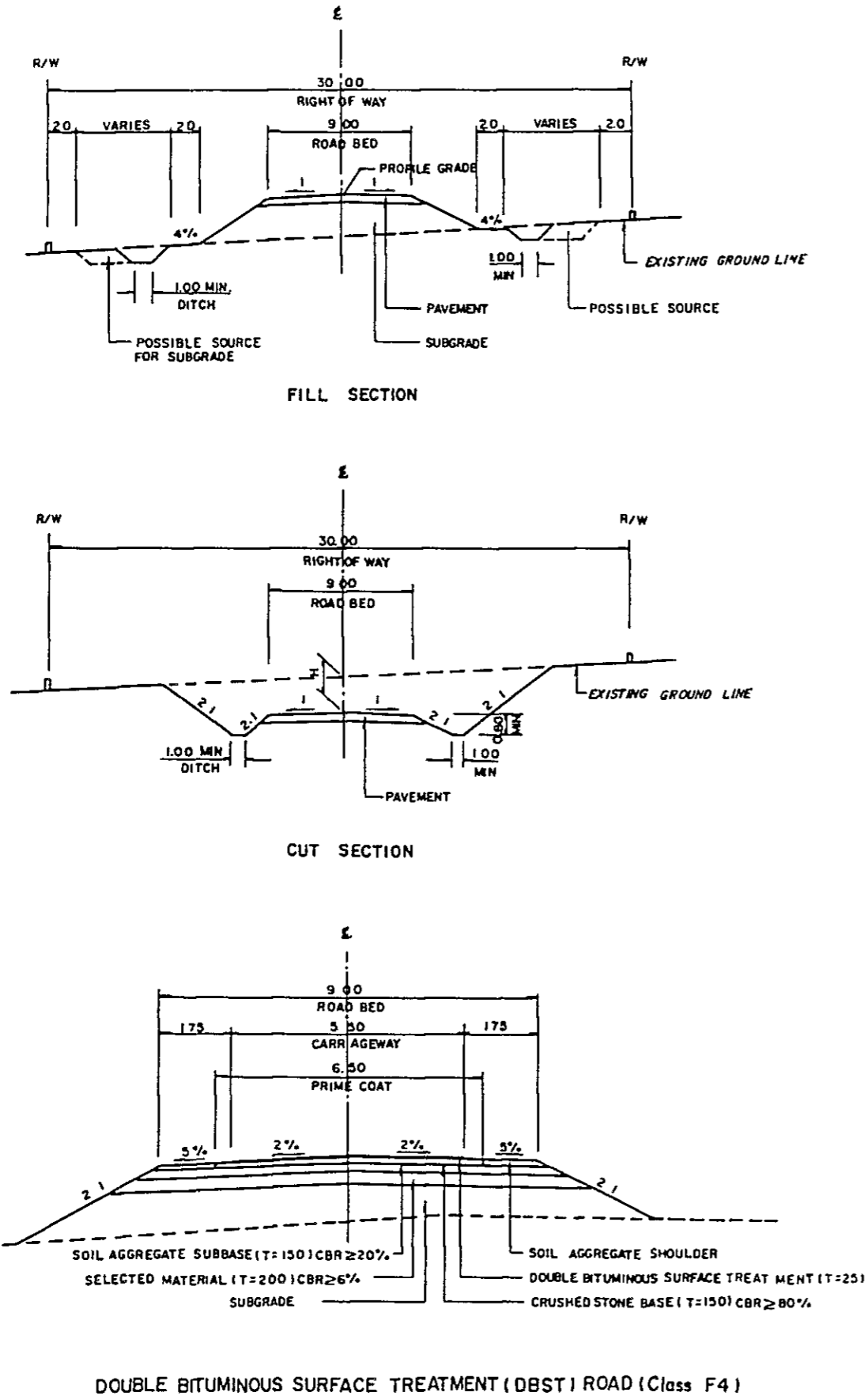
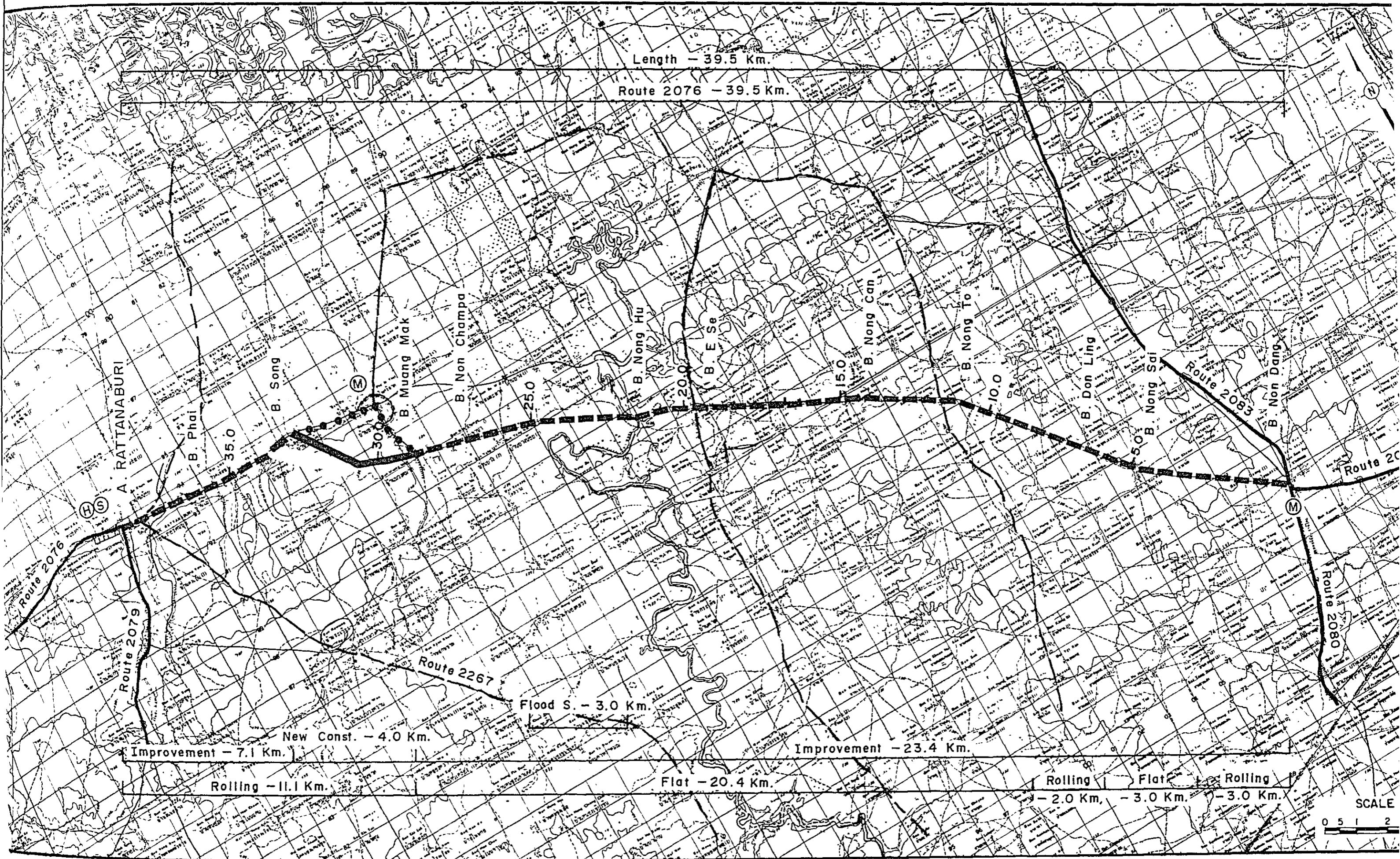
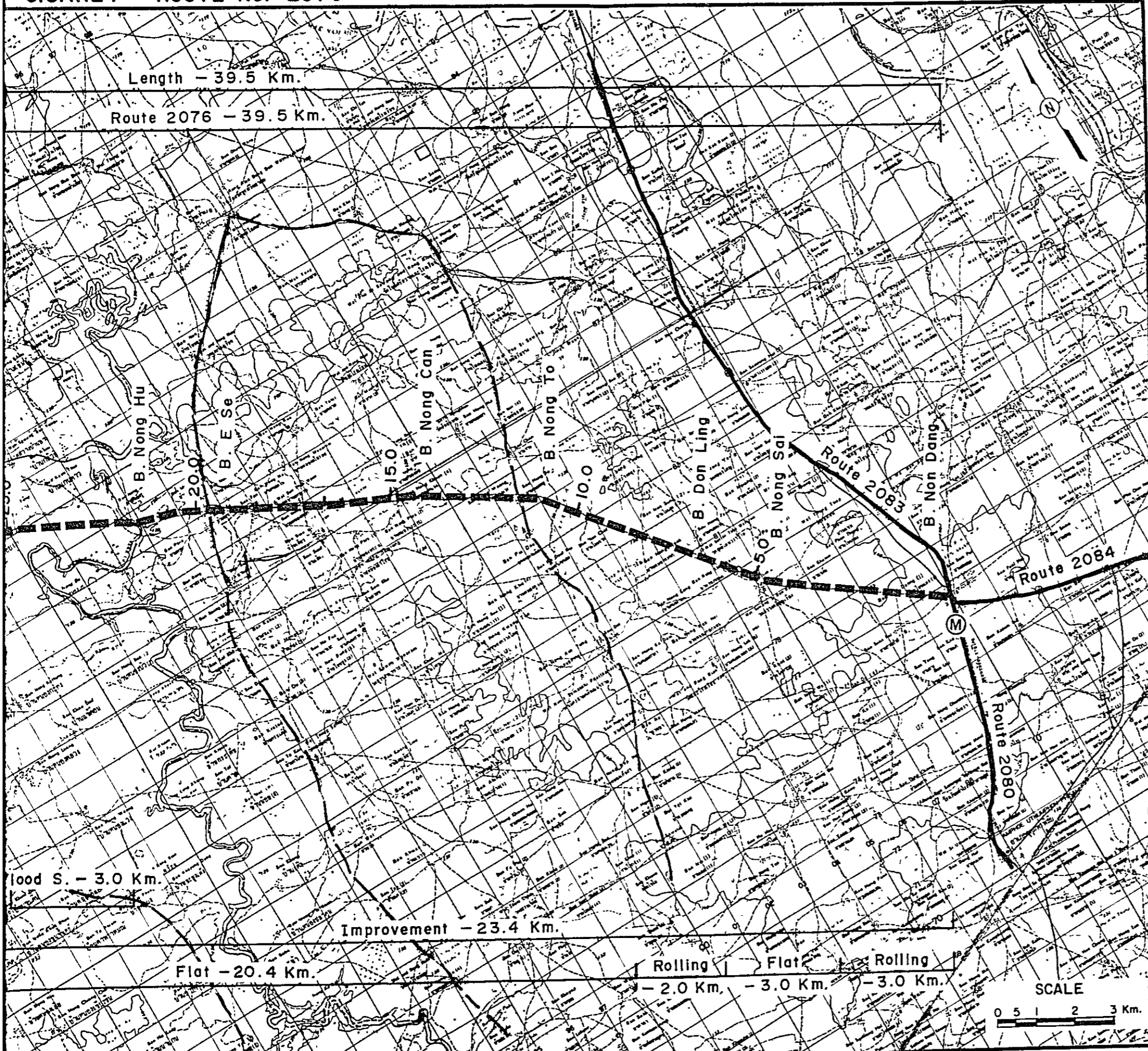


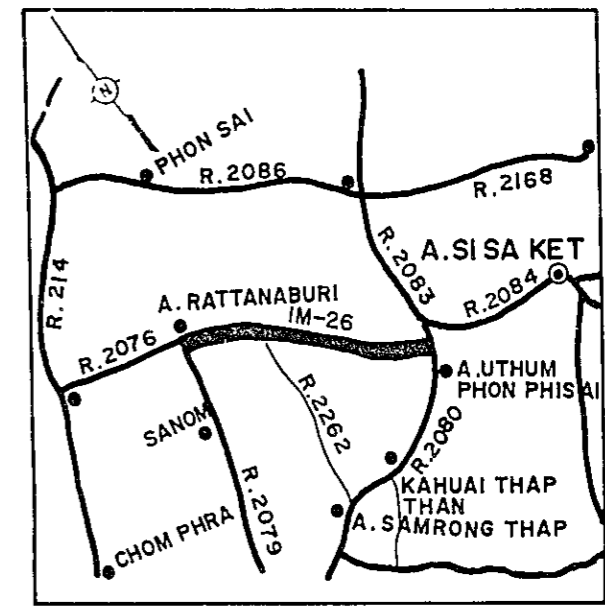
Figure 26.5.2 PROPOSED ROUTE NO. IM - 26 C. SURIN B. NON DANG (J.R. 2080, 2083, 2084)-A. RATTANA BURI
SISAKET ROUTE NO. 2076 L = 39.5 Km.



SURIN B. NON DANG (J.R. 2080, 2083, 2084)-A. RATTANA BURI
SISAKET ROUTE NO. 2076 L = 39.5 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	21.6	—	C - 9 50 x 130.00
2	24.0	C - 7.00 x 20 00	—
3	39.1	—	C - 10 0 x 40.00

LEGEND

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

Table 26.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-26 (39.5 km)

Items	Unit of Q'ty	Financial Unit Rate ₪	(DBST)	
			Q'ty	Economic Cost (10 ³ ₪)
DIRECT CONSTRUCTION COST				
Clearing and Grubbing	ha	15,000	99	1,485
Excavation - Soil	m ³	20	0	0
Excavation - Hard Rock	m ³	160	0	0
Embankment	m ³	45	161,200	7,254
Selected Material	m ³	80	83,700	6,696
Soil Aggregate Surface or Subbase	m ³	105	58,700	6,163
Crushed Stone Base	m ³	370	38,500	14,245
Soil Aggregate Shoulder	m ³	105	16,600	1,743
Prime Coat and DBST	m ²	55	217,300	11,952
Pipe Culvert	m	2,100	1,760	3,696
Box Culvert	m	16,000	68	1,088
Long Span Bridge	m	80,000	0	0
Short Span Bridge	m	40,000	20	800
Sub Total (a)			55,123	49,904
Miscellaneous Works (a) x 7%			3,859	3,493
Total (b)			58,982	53,397
PHYSICAL CONTINGENCY (b) x 15%			8,847	8,010
ENGINEERING AND ADMINISTRATION (b) x 10%			5,898	5,340
Sub Total			14,745	13,350
LAND ACQUISITION				
Highly Developed Land	ha	50,000	12	600
Less Developed Land	ha	15,000	0	0
Sub Total			600	600
GRAND TOTAL			74,327	67,347

Table 26.6.1 COST AND BENEFITS (F4 STANDARD)

YEAR	COST		BENEFITS		DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST BENEFIT
1984	13,469	0	0	0	0	18,923
1985	33,674	0	0	0	0	42,241
1986	20,204	0	0	0	0	22,628
1987	0	287	8,108	-79	8,316	0
1988	0	695	8,523	-70	9,148	0
1989	0	1,102	8,939	-61	9,980	0
1990	0	1,510	9,354	-52	10,812	0
1991	0	1,917	9,770	-43	11,644	0
1992	0	2,325	10,185	-34	12,476	0
1993	0	2,733	10,600	-25	13,308	0
1994	19,118	3,040	11,179	-11	14,208	8,648
1995	0	3,347	11,758	2	15,108	0
1996	0	3,655	12,337	15	16,007	0
1997	0	3,962	12,916	28	16,907	0
1998	0	4,270	13,495	41	17,806	0
1999	0	4,577	14,074	54	18,706	0
2000	0	4,885	14,653	67	19,605	0
2001	-31,303	5,192	15,232	81	20,505	-5,719
TOTAL	55,162	43,497	171,126	-86	214,536	86,721
DISCOUNTED ECONOMIC COSTS :					86,721	
DISCOUNTED ECONOMIC BENEFITS :					85,456	
AGRICULTURAL DEVELOPMENT BENEFIT					14,900	
VOC SAVING					70,751	
RMC SAVING					-195	
NET PRESENT VALUE :					-1,265	
BENEFIT COST RATIO :					0.99	
INTERNAL RATE OF RETURN :					11.8 %	

Table 26.7.1 SOCIAL INDICATORS
(Proposed Route IM-26)

Population (1,000)	
1982	: 33.8
1993	: 39.2
Average travelling speed, without (kph)	: 48
Isolation	
Access to Amphoe	
Average distance to Amphoe (km) ^{1/}	: 10.1
Per capita time savings (10 ⁻⁴)	: 0.018
Score	: 53
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	: 12
Impassability per year	: 0.231
Impassability per capita (10 ⁻⁴)	: 0.059
Score	: 492
Health	
Access to Hospital	
Average distance to Hospital (km) ^{1/}	: 12.0
Per capita time savings (10 ⁻⁴)	: 0.021
Score	: 49
Access to Medical Facilities	
Average distance to facilities (km) ^{1/}	: 6.9
Per capita time savings (10 ⁻⁴)	: 0.012
Score	: 48

Education	
Access to Secondary School	
Number of Student in 1993 (1,000) ^{2/}	: 7.8
Average distance to school (km)	: 12.0
Per capita time savings (10 ⁻⁴)	: 0.107
Score	: 58
Teacher Intensity	
Number of teachers ^{3/}	
University graduate	: -
Total	: 9
Number of Student	: 235
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	: 112.7
Without project	: 107.1
Per capita G.P.V. in 1993 (B)	
With project (W)	: 2,875
Without project (w)	: 2,732
Degree of Disparity	
(A/W) - (A/w) ^{9/}	: 0.05
Score	: 89
Total Score	: 903

Note:

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