PROPOSED ROUTE NO. IM - 27

Changwat : Surin / Buri Ram

B. Nong Khao (J R 2079) - A. Chom Phra (J R 214)

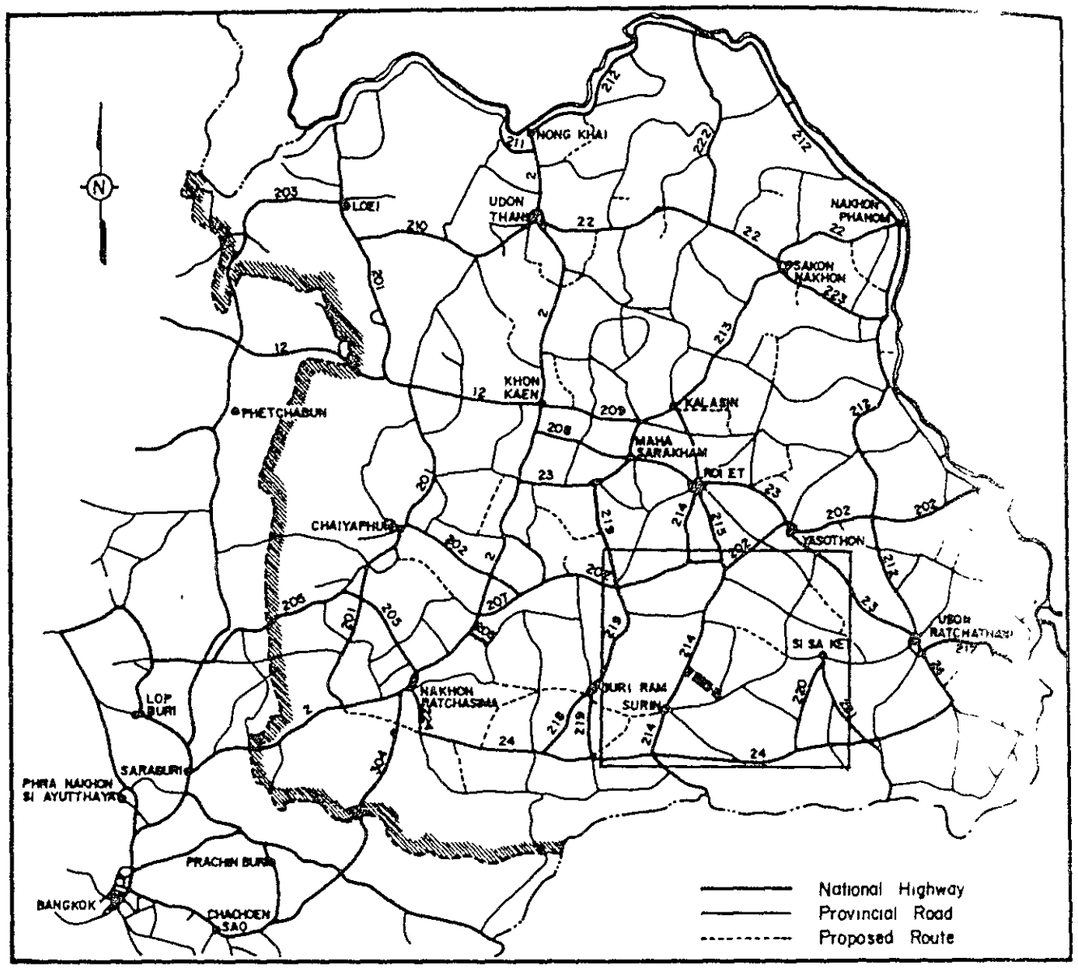
Length : 31 1 KM.

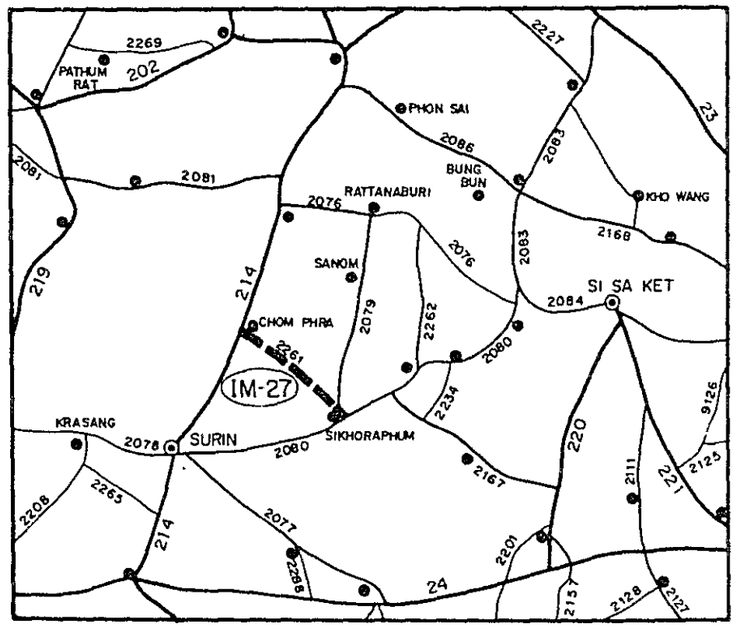
SUMMARY

PROPOSED ROUTE IM- 27

Item	Description	
Changwat	Surin/Buri Ram	
Origin	B. Nong Khao (J.R.2079)	
Destination	A. Chom Phra (J.R.214)	
Length		
Total		31.1 km
Improvement Section		31.1 km
DOH Road	R.2261	31.1 km
ARD Road		0 km
Others		0 km
New Alignment Section		0 km
Surface Type and Condition	Soil Aggregate, Good	
Terrain	Flat	
Influence Area		
Area		171 km^2
Population (1982)		32,200
Principal Crops		Paddy
Traffic (ADT)		
Existing		234
1993		898
2001		1,246
Proposed Standard		F4 (DBST)
Construction Cost		
Financial		51,994 . 10^3 ฿
Economic		47,048 . 10^3 ฿
IRR		11.3 %
B/C		27.0
Recommendation	For further consideration	

LOCATION OF PROPOSED ROUTE





1. GENERAL

1.1 Characteristics of the Route

The proposed route extends in two Changwat of Surin and Buri Ram.

The route, starting at Ban Norg Khao, runs northwestward passing through Ban Sam Rong, Ban Pra Thum and Ban Kham and ends at the intersection with Route 214 at Amphoe Chon Phra. Its total length is 31.1 km. (Figure 27.5.2)

The terrain is almost flat. In the influence area, there exists several villages with total population of 32,200. There are two medical centers, one hospital and two secondary schools along the proposed route.

The proposed route, upon completion, will form an important part of road network to connect two artery highways, Route 2080 and 214 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 27.1.1.

The details are shown as the results of inventery survey in Table 27.1.2.

2. TRAFFIC

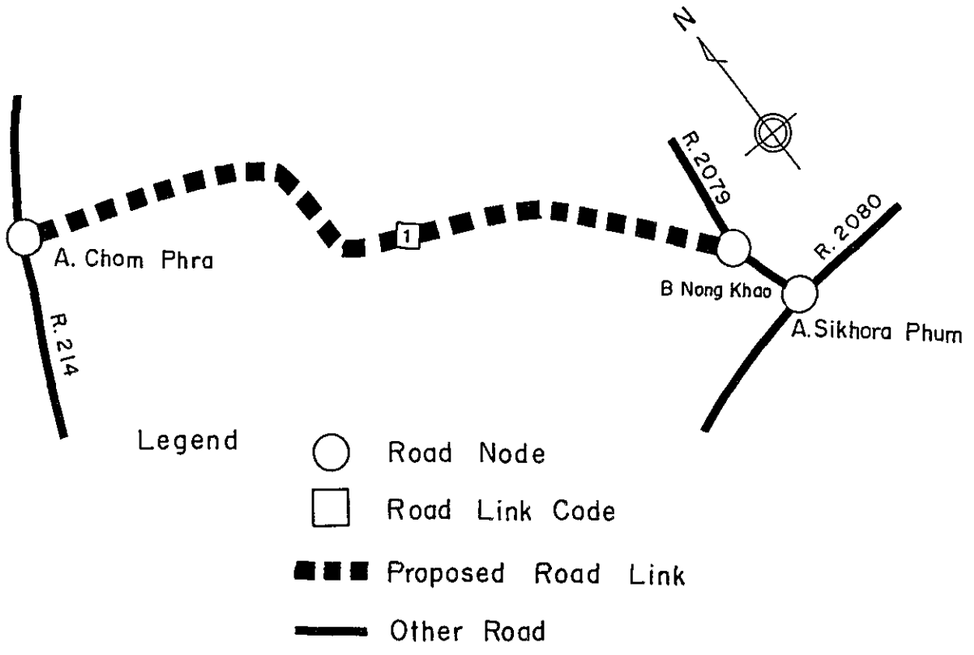
2.1 Method

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 to the DOHs traffic records as shown below:

Proposed Road Link



Traffic Volume in Base Year

Source (base year)	Link No	Vehicle Type									
		P/C	P/P	L/B	M/B	H/B	P/T	4/T	6/T	10/T	ADT
DOH (1981)	1 1/	39	43	13	15	14	7	21	47	35	234

Note : 1/ Route 2261 Section 0100

2.3 Transport Novement

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

Transport Movement

PASSENGER MOVEMENT (1982)

PROPOSED ROAD LINK	TRIPS PER DAY
1	1320

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	299	125	423

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	1.2	1.1	1.0
PASSENGER MOVEMENT	5.2	5.5	5.7

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981 - 1987	1987 - 1993	1993 - 2001
NON-AGRI.	6.7	7.1	7.3
AGRICULTURE	1.2	1.2	1.2
FREIGHT	5.1	5.4	5.5

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	1.8	1.8

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	31.5	34.7	10.5	12.1	11.3	6.4	19.1	42.7	31.8
	1987	27.0	39.2	11.0	13.0	9.9	9.6	18.2	40.4	31.9
	1993	22.5	43.6	11.5	13.9	8.5	12.7	17.2	38.1	31.9
	2001	16.5	49.6	12.2	15.1	6.6	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 27.2.1.

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	51	21	24	19	89	30	66	52	351	339	691
1993	61	31	38	23	148	40	87	73	501	398	898
2001	72	53	66	29	277	57	125	114	793	453	1246

3. AGRICULTURAL DEVELOPMENT

3.1 Present Condition

Almost all cultivated land in the influence area is covered by paddy fields. Cassava and kenaf are main crops in the upland field.

Land use and capability conditions in the area of influence are shown in Table 27.3.1 and Figure 27.3.1.

Typical cropping calendars in the Buri Ram and Surin areas are shown in Figure 27.3.2.

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 27.3.2.

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 27.3.3.

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 27.3.4. 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		Without Project				With Project			
No.	Terrain	Length (Km)	Road Class /1	Nos. of Wooden Bridge	Nos. of Narrow C.Bridge	Length (Km)	Road Class Case 1	Road Class Case 2	Nos. of Wooden Narrow Bridge
1	Flat	31.1	2B	1	0	31.1	1 (F)	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:

Vehicle Operating Cost Saving

Road Class	1987	1993	2001
1 (FA)	4,359	5,971	9,175
2A (F5)	610	776	1,052

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 27.5.1.

Minimum Height of Embankment

Ordinary Section : 1.0 m

Approach of Bridge in Flat Area : 2.0 m

Flood Section : 0.7 m (above flood level)

Pavement Structure

In case of F4 Standard

DBST : 2.5 cm

Crushed Stone Base CBR $\geq$ 80% : 15.0 cm

Soil Agfregate Subbase CBR $\geq$ 20% : 15.0 cm

Selected Matrrial CBR $\geq$ 6% : 20.0 cm

In case of F5 Standard

Soil Aggregate Surface CBR $\geq$ 20% : 15.0 cm

Selected Material CBR $\geq$ 6% : 20.0 cm

Pipe Culvert

Standard Size	:	ø 100 cm
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 7.0 m)		
Short Span Bridge	:	RC - Slab
Long Span Bridge	:	PC - Girder
Location	:	as shown in Bridge List in Figure 27.5.2

Alignment of the route is shown in Figure 27.5.2.

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 27.5.1.

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

Financial and Economic Construction Cost

Road Closs	Length (km)	Construction Cost (10^3¥) Financial cost	Economic cost	Remarks
F4 (DBST)	31.1	51,994	47,048	
F5(Laterite)	31.1	31,110	28,051	

6. ECONOMIC EVALUATION

Yearly distribution of the economic costs and benefits, and the calculated economic indicators for evaluation are given in Table 27.6.1.

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 indicator of social impacts are tabulated in Table 27.7.1.

Table 27.1.1 SUMMARY OF ROAD INVENTORY

Item	Description		
Origin	B. Nong Khao (J.R. 2079)		
Destination	A. Chom Phra (J.R. 214)		
Length			
Total		31.1	km
Improvement Section		31.1	km
DOH Road	R. 2261	31.1	km
ARD Road		0	km
Others		0	km
New Alignment Section		0	km
Terrain	Flat		
Alignment (Hori./Vert.)	Fair / Fair		
Formation Width		7.0	m
Embankment Section			
Length		31.1	km
Height	0.3 m - 1.0 m		
Cut Section			
Length		0	km
Depth	m - m		
Surface Type and Condition			
SBST or DBST		0	km
Soil Aggregate	Good	31.1	km
Earth		0	km
Pipe Culvert	54 each		
Box Culvert	0 each	0	m
Bridge			
Permanent Bridge	0 each	0	m
Narrow Concrete Bridge	0 each	0	m (4m)
Wooden Bridge	1 each	15.6	m
Overflow Section	0 place	0	km

Table 27.1.2 ROAD INVENTORY (1)

PROPOSED ROUTE NO. IM-27 ROUTE NO. 2261 B. NONG KHAO (J.R. 2079) ∿ A. CHOM PHRA (J.R. 214) L = 31.1 Km.

SURIN / BURI RAM

STATION (Km)		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
VILLAGE - Name - Household (H) - Population (P)		B. NONG KHAO H = 55 P = 275	B. DU H = 35 P = 175	B. PLASON H = 100 P = 500	B. SAM RONG H = 140 P = 900	B. NON CHAN H = 50 P = 300	B. A WUT H = 80 P = 400	B. TRAE H = 350 P = 1750	B. PRA THUM H = 104 P = 520	B. A YONG H = 250 P = 1250	B. SAWAI H = 40 P = 200	B. KHAI H = 400 P = 2000	B. NONG KHOK YAI H = 270 P = 1350	B. A KHOT H = 60 P = 300	B. PRAWIT H = 26 P = 130	B. A PHU H = 72 P = 360	B. KHOK SA ART B. NONG KHON H = 80 P = 400
TERRAIN		Flat															
CROSS SECTION	Formation Width (m)	7.00															
	Embankment Height (m)	0.50	1.00	0.70	0.30	1.00	0.50	1.00	0.50	1.00	0.80	1.00	0.30	1.00	0.30	1.00	0.50	1.00
	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	54 Pipes															
BOX CULVERT & BRIDGE	Station (Km)						5.9										
	Dimension						W-Br. 4.60 x 15.60										
RIGHT OF WAY (m)																	
ALIGNMENT	Horizontal	Fair															
	Vertical	Fair															
ROUTE NO., AGENCIES		DOH 2261															

ROAD INVENTORY (2) L = 31.1 Km.

B. NONG KHAO (J.R. 2079) ∿ A. CHOM PHRA (J.R. 214) (Cont'd)

SURIN / BURI RAM

PROPOSED ROUTE NO. IM-27 ROUTE NO. 2261

STATION (Km)		30	32	34	36
VILLAGE - Name - Household (H) - Population (P)		A. CHOMPRA			
TERRAIN					
CROSS SECTION	Formation Width (m)	6.00			
	Embankment Height (m)	0.70			
	Cutting Depth (m)				
PAVEMENT	Type/Length	La.			
	Condition	Good			
FLOODING	Overflow Length(Km)/Height(m)				
LAND USE	Left	Paddy			
	Right	Paddy			
PIPE CULVERT	Total Number				
BOX CULVERT & BRIDGE	Station (Km)				
	Dimension				
RIGHT OF WAY (m)					
ALIGNMENT	Horizontal	Fair			
	Vertical	Fair			
ROUTE NO., AGENCIES		DOH 2261			

Table 27.2.1 TRAFFIC VOLUME ON ROUTE IM - 27

YEAR		1987		1993		2001	
LINK		1	AVR.	1	AVR.	1	AVR.
P/C	N+D	44	44	52	52	62	62
	I	7	7	8	8	9	9
	DV	0	0	1	1	1	1
	TOTAL	51	51	61	61	72	72
L/B	N+D	18	18	27	27	46	46
	I	3	3	4	4	7	7
	DV	0	0	1	1	1	1
	TOTAL	21	21	31	31	53	53
M/B	N+D	21	21	32	32	56	56
	I	3	3	5	5	8	8
	DV	0	0	1	1	1	1
	TOTAL	24	24	38	38	66	66
H/B	N+D	16	16	20	20	25	25
	I	2	2	3	3	4	4
	DV	0	0	0	0	1	1
	TOTAL	19	19	23	23	29	29
P/P&T	N+D	78	78	126	126	237	237
	I	12	12	19	19	35	35
	DV	0	0	3	3	5	5
	TOTAL	89	89	148	148	277	277
4/T	N+D	26	26	34	34	49	49
	I	4	4	5	5	7	7
	DV	0	0	1	1	1	1
	TOTAL	30	30	40	40	57	57
6/T	N+D	57	57	75	75	107	107
	I	9	9	11	11	16	16
	DV	0	0	2	2	2	2
	TOTAL	66	66	87	87	125	125
10/T	N+D	45	45	63	63	98	98
	I	7	7	9	9	15	15
	DV	0	0	1	1	2	2
	TOTAL	52	52	73	73	114	114
ADT	N+D	306	306	428	428	677	677
	I	46	46	64	64	102	102
	DV	0	0	9	9	14	14
	TOTAL	351	351	501	501	793	793
M/C	N+D	316	316	373	373	439	439
	I	23	23	22	22	13	13
	DV	0	0	3	3	1	1
	TOTAL	339	339	398	398	453	453
TOTAL	N+D	622	622	800	800	1116	1116
	I	69	69	86	86	114	114
	DV	0	0	12	12	15	15
	TOTAL	691	691	898	898	1246	1246

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

Figure 27.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM – 27

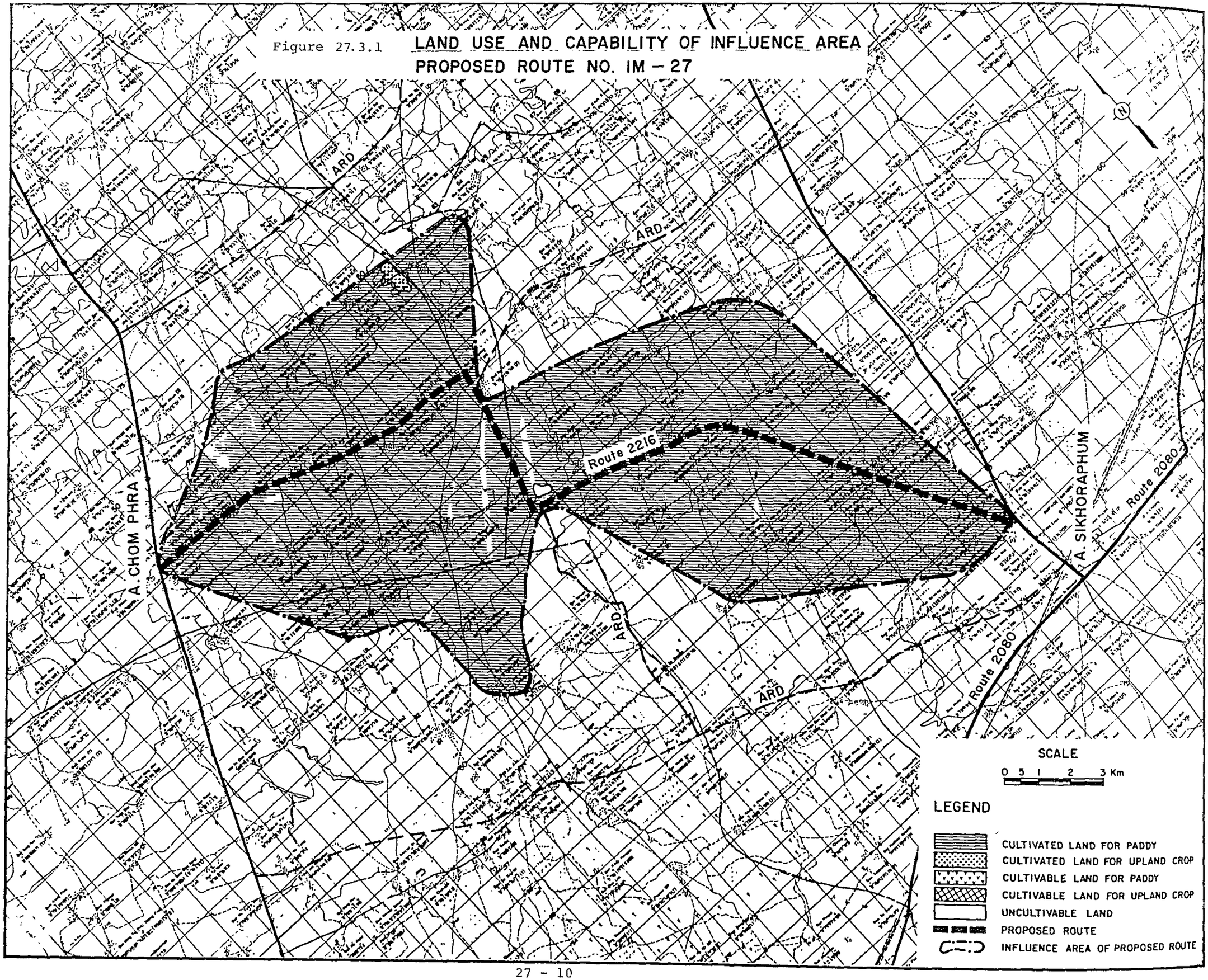
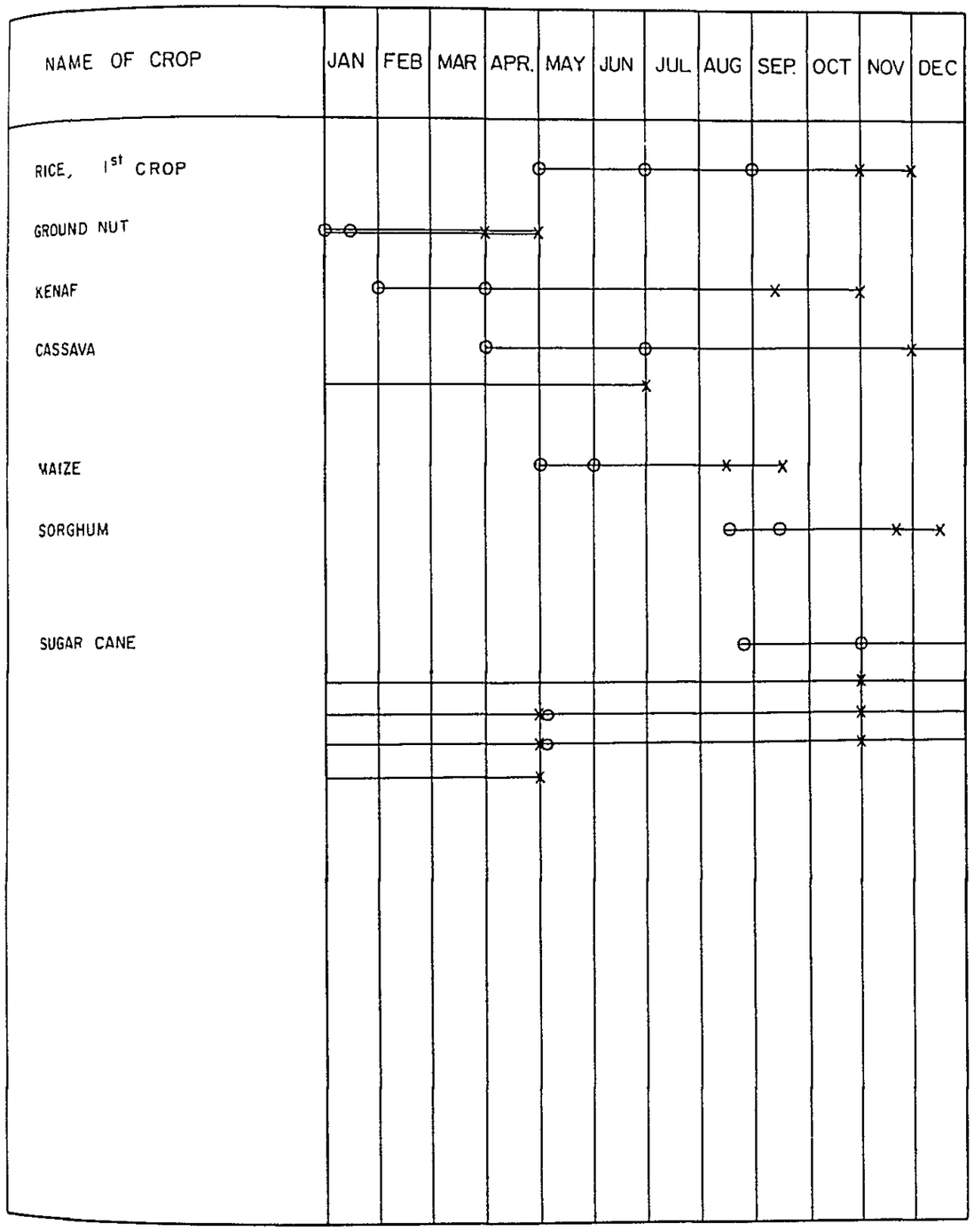


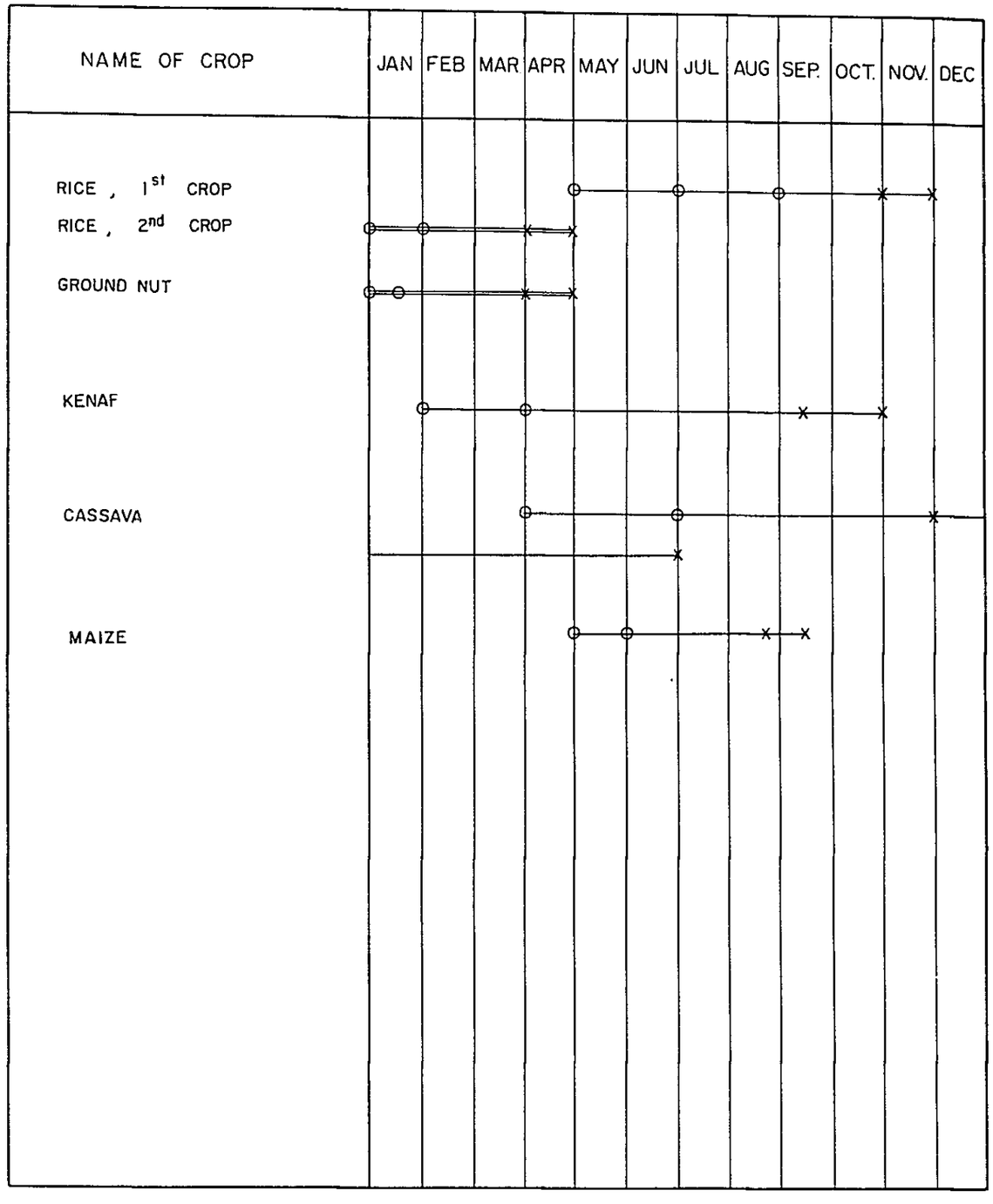
Figure 27.3.2 CROPPING CALENDAR (1)

1400 CHANGWAT BURIRAM



CROPPING CALENDAR (2)

1500 CHANGWAT SURIN



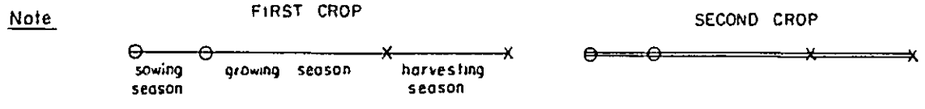


TABLE 27.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND PADDY	CULTIVATED LAND UPLAND	CULTIVATED LAND TOTAL	UNUSED CULTIVABLE LAND PADDY	UNUSED CULTIVABLE LAND UPLAND	UNUSED CULTIVABLE LAND TOTAL
		106.250 (170.0)	0.313 (0.5)	106.563 (170.5)	-	-	-
1401	M. BURI RAM	8.750 (14.0)	-	8.750 (14.0)	-	-	-
1504	CHOM PHRA	46.250 (74.0)	0.313 (0.5)	46.563 (74.5)	-	-	-
1508	SIKHORAPHUM	51.250 (82.0)	-	51.250 (82.0)	-	-	-

TABLE 27.3.2 CROP PRODUCTION

ITEM			PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)												
1981			79.06	-	-	-	0.19	-	0.09	-	0.31	79.37
1987			84.42	-	-	-	0.19	-	0.09	-	0.31	84.74
1993	WITHOUT	PROJECT	90.15	-	-	-	0.19	-	0.09	-	0.32	90.47
	WITH	PROJECT	91.77	-	-	-	0.21	-	0.10	-	0.34	92.11
2001	WITHOUT	PROJECT	98.40	-	-	-	0.19	-	0.09	-	0.32	98.72
	WITH	PROJECT	100.16	-	-	-	0.21	-	0.10	-	0.34	100.51
CROP YIELD (KG/RAI)												
1981			225.6	-	-	-	2500.0	-	154.0	-		
1987			227.0	-	-	-	2500.0	-	154.0	-		
1993	WITHOUT	PROJECT	228.3	-	-	-	2500.0	-	154.0	-		
	WITH	PROJECT	231.1	-	-	-	2515.0	-	154.0	-		
2001	WITHOUT	PROJECT	230.2	-	-	-	2500.0	-	154.0	-		
	WITH	PROJECT	236.7	-	-	-	2535.2	-	154.0	-		
CROP PRODUCTION (TON)												
1981			17,837	-	-	-	464	-	14	-	495	18,331
1987			19,161	-	-	-	467	-	14	-	498	19,659
1993	WITHOUT	PROJECT	20,584	-	-	-	470	-	14	-	501	21,085
	WITH	PROJECT	21,206	-	-	-	529	-	15	-	561	21,767
2001	WITHOUT	PROJECT	22,647	-	-	-	473	-	14	-	505	23,153
	WITH	PROJECT	23,707	-	-	-	537	-	15	-	570	24,277

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 27.3.3 FARMGATE PRICE AND PRODUCTION COST

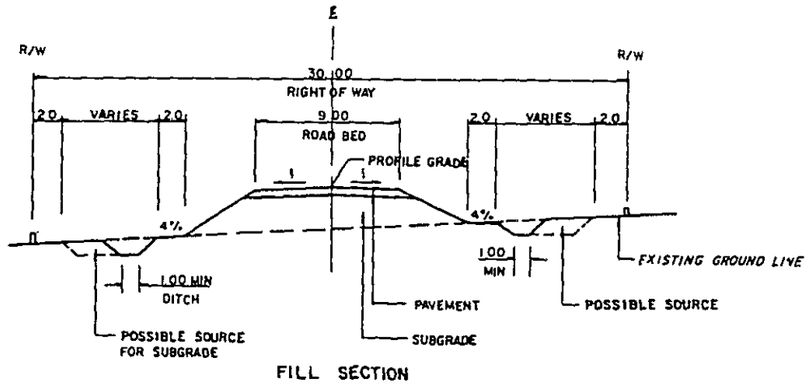
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	4,140	-	-	-	721	-	5,232	-
WITH PROJECT (1987 - 2001)	4,244	-	-	-	739	-	5,363	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	592	-	-	-	734	-	731	-
WITH PROJECT (1987 - 2001)	605	-	-	-	754	-	731	-

TABLE 27.3.4 NET PRODUCTION VALUE

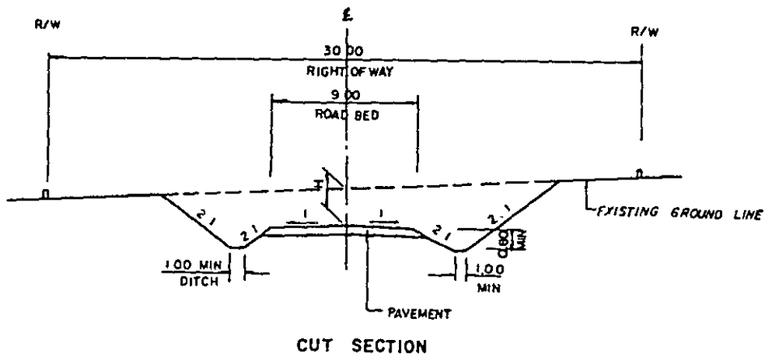
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	29,347	210	29,557	30,215	214	30,429
1993	31,847	210	32,057	34,446	242	34,688
2001	35,506	212	35,718	39,979	248	40,227

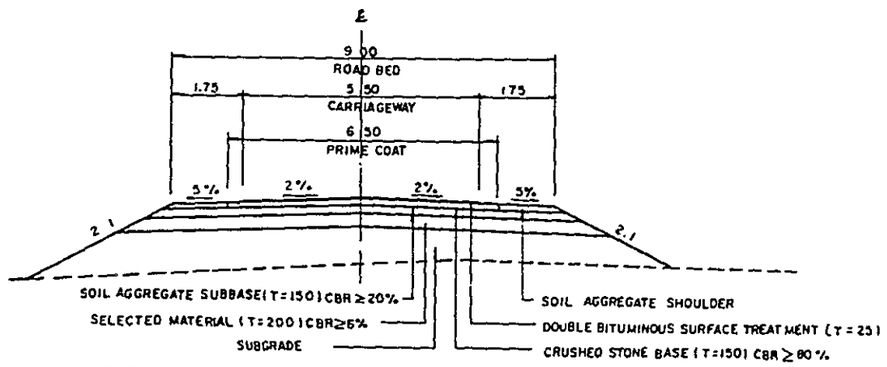
Figure 27.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



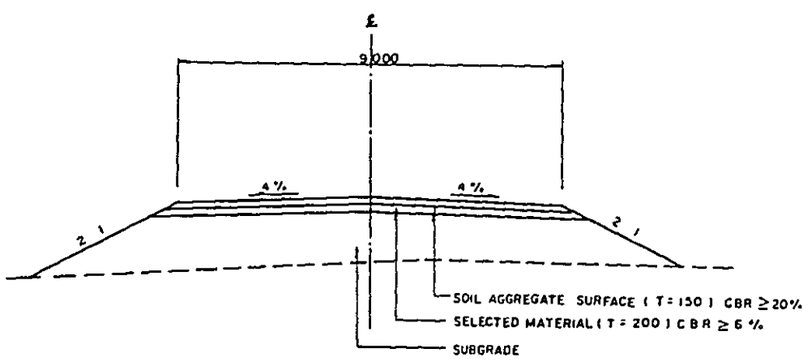
FILL SECTION



CUT SECTION

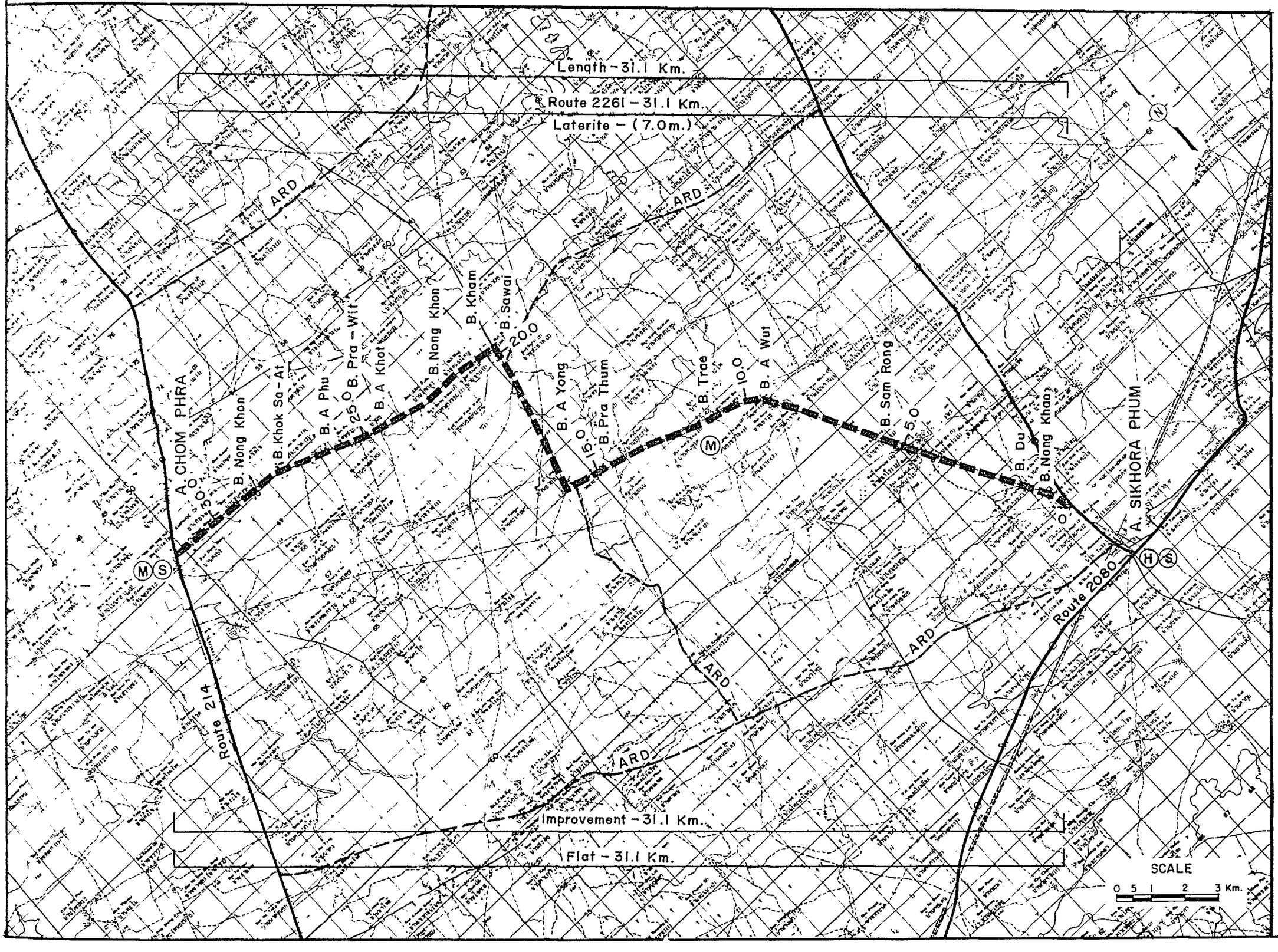


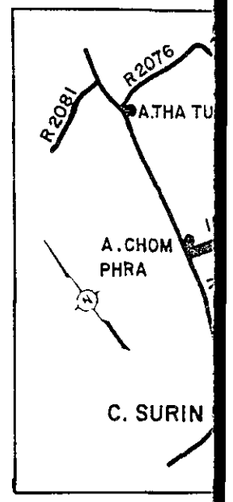
DOUBLE BITUMINOUS SURFACE TREATMENT (DBST) ROAD (Class F4)



SOIL AGGREGATE SURFACED ROAD (Class F5)

Figure 27.5.2 PROPOSED ROUTE NO. IM-27 C. SURIN B.NONG KHAO(J.R.2079)—A.CHOM PHRA(J.R.214)
C. BURI RAM ROUTE NO.2261 L = 31.1 Km.

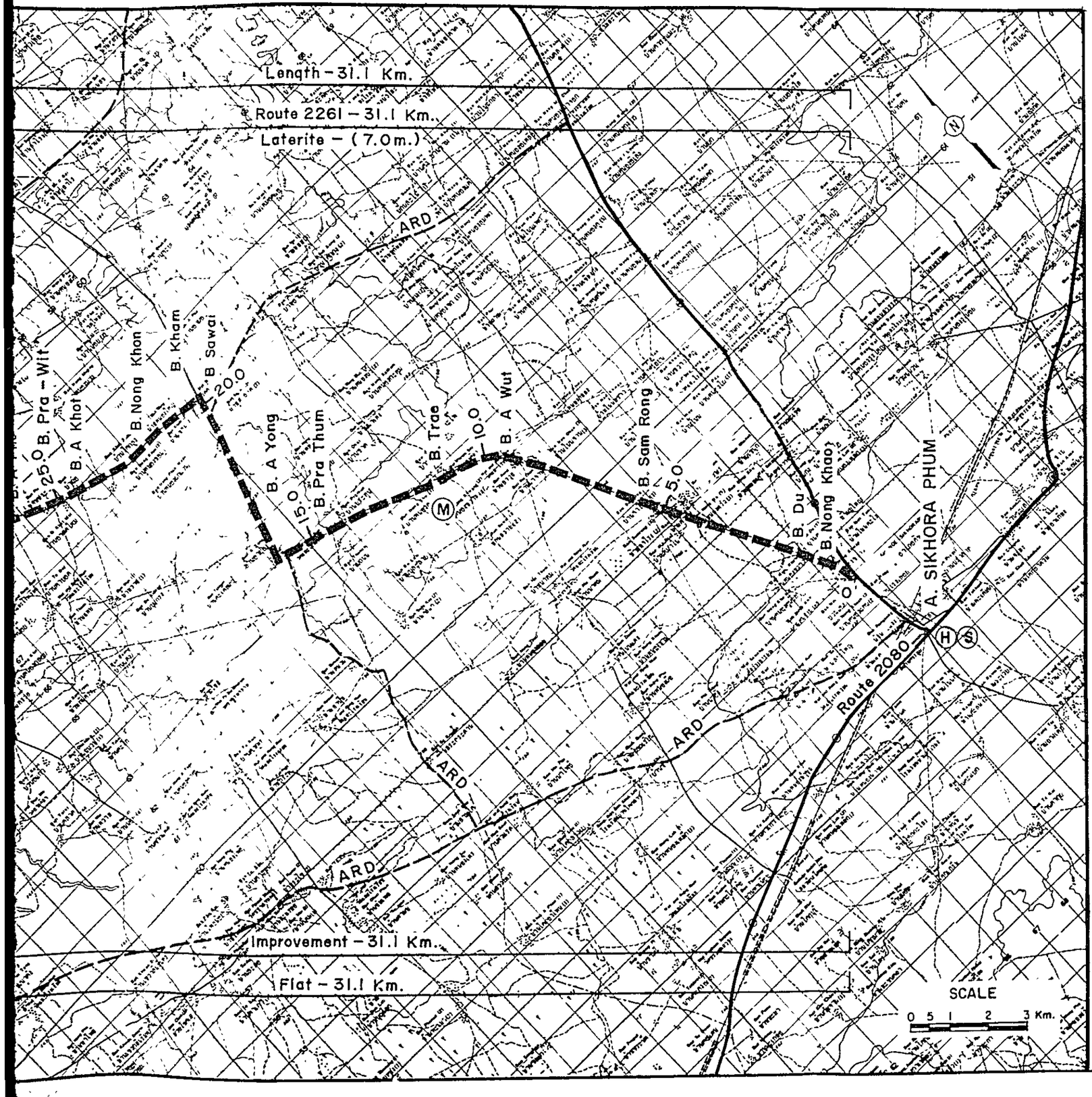




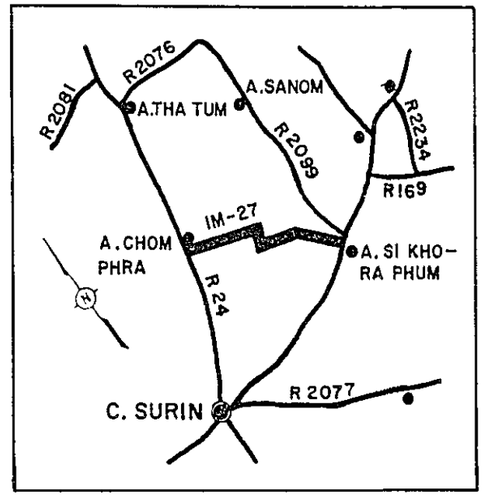
BRID

No.	Station Km.	Proposed
1	5.9	C-7.00 x

UTE NO. IM-27 C. SURIN B.NONG KHAO(J.R.2079)—A.CHOM PHRA(J.R.214)
C. BURI RAM ROUTE NO.2261 L = 31.1 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	5.9	C-7.00 x 18.00	W-4.60 x 15 60

LEGEND

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

Table 27.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-27 (31.1 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	72	1,080	982	72	1,080	982
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	56,100	2,524	2,297	56,100	2,524	2,297
Selected Material	m^3	80	65,100	5,208	4,635	65,100	5,208	4,634
Soil Aggregate Surface or Subbase	m^3	105	46,200	4,851	4,317	46,200	4,851	4,317
Crushed Stone Base	m^3	370	30,300	11,211	10,314	1,950	722	592
Soil Aggregate Shoulder	m^3	105	13,100	1,375	1,224	840	88	80
Prime Coat and DBST	m^2	55	171,100	9,405	8,465	11,000	405	545
Pipe Culvert	m	2,100	1,190	2,499	2,299	1,190	2,499	2,299
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	18	720	640	18	720	640
Sub Total (a)				38,874	35,176		18,297	16,387
Miscellaneous Works (a) x 7%				2,721	2,462		1,281	1,147
Total (b)				41,595	37,638		19,578	17,534
PHYSICAL CONTENGENCY (b) x 15%				6,239	5,646		2,937	2,630
ENGINEERING AND ADMINISTRATION (b) x 10%				4,160	3,764		1,958	1,753
Sub Total				10,399	9,410		4,895	4,383
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				51,994	47,048		24,473	21,917

Table 27.6.1 COST AND BENEFITS

(F4 STANDARD)

(1000 BAHT)

	COST	BENEFITS				DISCOUNTED(12%)	
YEAR	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	0	0	0	0	0	0	0
1985	18,819	0	0	0	0	23,607	0
1986	28,229	0	0	0	0	31,616	0
1987	0	872	4,359	2	5,234	0	4,673
1988	0	1,122	4,628	14	5,764	0	4,595
1989	0	1,372	4,897	25	6,293	0	4,480
1990	0	1,621	5,165	36	6,823	0	4,336
1991	0	1,871	5,434	48	7,353	0	4,172
1992	0	2,121	5,703	59	7,883	0	3,994
1993	0	2,371	5,971	71	8,413	0	3,806
1994	15,052	2,636	6,372	87	9,095	6,809	3,673
1995	0	2,901	6,772	104	9,778	0	3,526
1996	0	3,166	7,173	121	10,460	0	3,368
1997	0	3,431	7,573	138	11,142	0	3,203
1998	0	3,696	7,974	155	11,825	0	3,035
1999	0	3,961	8,374	172	12,507	0	2,866
2000	0	4,226	8,775	189	13,189	0	2,699
2001	-21,642	4,491	9,175	205	13,872	-3,954	2,534
TOTAL	40,458	39,860	98,344	1,427	139,631	58,078	54,960

DISCOUNTED ECONOMIC COSTS :	58,078
DISCOUNTED ECONOMIC BENEFITS :	54,960
AGRICULTURAL DEVELOPMENT BENEFIT	14,547
VOC SAVING	39,963
RMC SAVING	450
NET PRESENT VALUE :	-3,118
BENEFIT COST RATIO :	0.95
INTERNAL RATE OF RETURN :	11.3 %

Table 27.7.1 SOCIAL INDICATORS

(Proposed Route IM-27)

Population (1,000)		
1982	:	32.2
1993	:	36.5
Average travelling speed, without (kph)	:	48
Isolation		
Access to Amphoe		
Average distance to Amphoe (km) 1/	:	7.8
Per capita time savings (10^{-4})	:	0.015
Score	:	44
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	:	2
Impassability per year	:	0.038
Impassability per capita (10^{-4})	:	0.010
Score	:	83
Health		
Access to Hospital		
Average distance to Hospital (km) 1/	:	9.0
Per capita time savings (10^{-4})	:	0.017
Score	:	40
Access to Medical Facilities		
Average distance to facilities (km) 1/	:	4.5
Per capita time savings (10^{-4})	:	0.009
Score	:	36
Education		
Access to Secondary School		
Number of Student in 1993 (1,000) 2/	:	4.7
Average distance to school (km)	:	7.8
Per capita time savings (10^{-4})	:	0.115
Score	:	62
Teacher Intensity		
Number of teachers 3/		
University graduate	:	3
Total	:	16
Number of Student	:	383
Indicators		
E1 4/	:	7.8
E2 5/	:	41.8
E 6/	:	49.6
Degree of Improvement 7/	:	1.38
Score	:	88
Disparity		
G.P.V. in 1993 (Mn B) 8/		
With project	:	90.5
Without project	:	85.7
Per capita G.P.V. in 1993 (B)		
With project (W)	:	2,479
Without project (w)	:	2,348
Degree of Disparity		
(A/W) - (A/w) 9/	:	0.06
Score	:	107
Total Score	:	460

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 - 28

Changwat : Buri Ram

C. Buri Ram - Lam Chi (River) (JR. 2078)

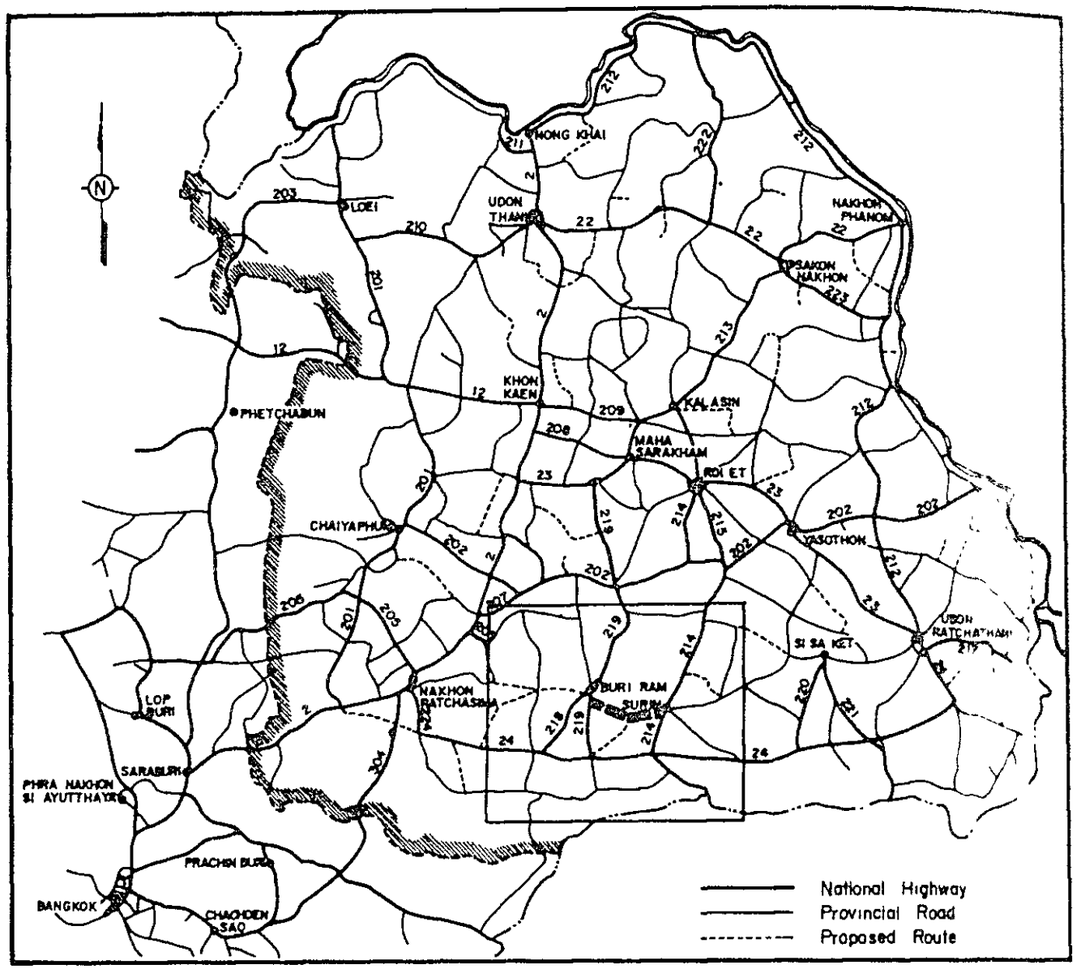
Length : 42.0 KM.

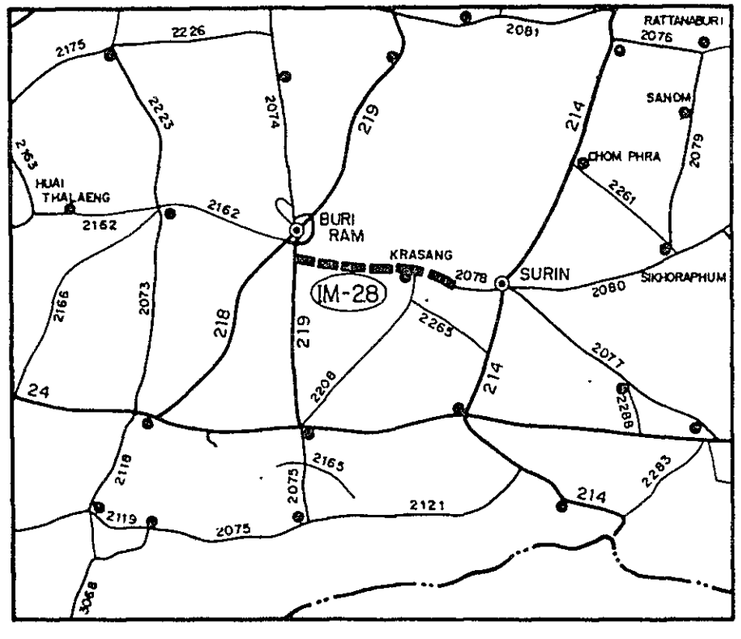
SUMMARY

PROPOSED ROUTE IM-28

Item	Description	
Changwat	Buri Ram	
Origin	C. Buri Ram	
Destination	Lam Chi (River)(J.R.2078)	
Length		
Total		42.0 km
Improvement Section		34.3 km
DOH Road	R.2078	11.1 km
ARD Road		23.2 km
Others		0 km
New Alignment Section		7.7 km
Surface Type and Condition	Soil Aggregate, Good	
Terrain	Flat	
Influence Area		
Area		261 km^2
Population (1982)	38,600	
Principal Crops	Paddy	
Traffic (ADT)		
Existing	348	
1993	1,722	
2001	2,426	
Proposed Standard	F4 (DBST)	
Construction Cost		
Financial	96,110 . 10^3 ฿	
Economic	89,938 . 10^3 ฿	
IRR	27.0 %	
B/C	2.83	
Recommendation	For further consideration	

LOCATION OF PROPOSED ROUTE





1. GENERAL

1.1 Characteristics of the Route

The proposed route is located in the east of Changwat Buri Ram.

The route, starting at Changwat Buri Ram, runs eastward passing through Ban Sawa Chick, Ban Song Chun and Ban Wa and ends at the termination of the paved section of Route 2078, after crossing the Chi river. Its total length is 42.0 km. (Figure 28.5.2)

The terrain is almost flat. In the influence area, there exists several villages with total population of 38,600. There are three medical centers, no hospital and two secondary schools along the proposed route.

The proposed route, upon completion, will connect two Changwats, Buri Ram and Surin. Moreover, it will contribute to complete the paved road between two giant Changwats, Nakhon Ratchasima and Ubon Ratchathani via several Changwats.

1.2 Condition of Existing Road

Condition of existing roads to be utilized for the proposed route is summarized in Table 28.1.1.

The details are shown as the results of inventory survey in Table 28.1.2.

2. TRAFFIC

2.1 Method

Assignment Method was employed for traffic forecasting as considerable diverted and induced traffic are expected after improvement of the proposed 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 Muang Buri Ram, Kra Sang and Muang Surin were chosen as the major destinations of transport demand originated in the area. The proposed route together with surounding roads concerned were divided into seven road links, five links in the proposed roads and two links in the surrounding roads.

Zoning map and characteristics of zone and links are shown in Figure 28.2.1, Table 28.2.1 and 28.2.2.

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	11	12
1	0	1595	918	650	417	941	519
2	0	0	294	945	198	639	207
3	0	0	0	594	184	549	196
4	0	0	0	0	463	863	895
5	0	0	0	0	0	724	223
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0

Grand Total = 12,014

The 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	3290
2	2919
3	3115
4	2832
5	2427

2) Freight

The freight movement in terms of tonnage per day on proposed roate was estiamted in accordance with the procedure described in 7.3.3-1) of the 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	1.15	1.10	1.06

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	195	43	238
2	167	37	204
3	182	40	222
4	161	35	196
5	132	29	161

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	1.6	1.4
PASSENGER MOVEMENT	5.8	6.0	6.0

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981 - 1987	1987 - 1993	1993 - 2001
NON-AGRI.	7.5	7.7	7.8
AGRICULTURE	0.1	0.1	0.1
FREIGHT	6.1	6.5	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	96.7	97.5	98.2
DEVELOPED	0.0	2.4	2.4

2.6 Future Traffic

1) Traffic Composition

The movements of passenger and freight transport were transformed into traffic volume of behicle 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
1-5	1982	3.1	53.1	0.0	43.8	0.0	12.5	18.8	59.3	9.4
	1987	6.0	50.2	4.2	37.4	2.2	13.7	18.1	52.9	15.3
	1993	9.4	46.8	9.2	29.7	4.9	15.1	17.2	45.2	22.5
	2001	14.0	42.2	15.8	19.5	8.5	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 28.2.3.

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	40	28	249	15	365	40	119	34	890	481	1371
1993	90	87	283	47	491	52	137	68	1255	467	1722
2001	210	236	291	127	707	73	160	146	1950	476	2426

3. AGRICULTURAL DEVELOPMENT

3.1 Present condition

Almost all cultivated land in the influence area is covered by paddy fields.

Average yield of paddy is comparatively low because of salinity affection in some parts of the paddy fields. In the upland field, Kenaf, cassava, ground nuts and sugar cane are planted.

Unused cultivable land for both paddy and upland fields still remain in some places in the area.

Land use and capability conditons in the area of influence are shown in Table 28.3.1 and Figure 28.3.1.

A typical cropping calendar in the Buri Ram area is shown in Figure 28.3.2.

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 28.3.2.

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 28.3.3.

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 28.3.4. 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		Without Project				With Project			
No.	Terrain	Length (Km)	/1 Road Class	Nos. of Wooden Bridge	Nos. of Narrow C.Bridge	Length (Km)	Road Class	/1 Nos. of Wooden Narrow Bridge	
1	Flat	11.0	2B	0	0	11.0		0	
2	Flat	10.0	2B	1	0	10.0		0	
3	Flat	11.0	2B	0	0	9.0	1 (F4)	0	
4	Flat	7.0	2B	0	0	3.0		0	
5	Flat	14.0	2B	3	0	9.0		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
Raod 3 : Laterite Road with poor surface conditon 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

(Unit: 1000 Baht)

Road Class	1987	1993	2001
1 (F4)	27,478	42,867	77.119

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 28.5.1

Minimum Height of Embankment

Ordinary Section : 1.0m

Approach of Bridge in Flat Area : 2.0m

Flood Section : 0.7m (above flood level)

Pavement Structure

In case of F4 Standard

DBST : 2.5cm

Crushed Stone Base CBR≥80% : 15.0cm

Soil Aggregate Subbase CBR≥20% : 15.0cm

Selected Material CBR≥ 6% : 20.0cm

Pipe Culvert

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

Box Culvert

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

Bridge

Standard Type (width 7.0m)		
Short Span Bridge	:	RC - Slab
Long Span Bridge	:	PC - Girder
Location	:	as shown in Bridge List in Figure 28.5.2

Alignment of the route is shown in Figure 28.5.2.

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 28.5.1.

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

F4 Standard (DBST) L = 42.0 km

Financial Cost 96,110 . 10^3 ₿

Economic Cost 89,938 . 10^3 ₿

6. ECONOMIC EVALUATION

Yearly distribution of the economic costs and benefits, and the calculated economic indicators for evaluation are given in Table 28.6.1.

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 28.7.1.

Table 28.1.1 SUMMARY OF ROAD INVENTORY

Item	Description		
Origin	C. Buri Ram		
Destination	Lamchi (River) (J.R. 2078)		
Length			
Total		42.0	km
Improvement Section		34.3	km
DOH Road	R. 2078	11.1	km
ARD Road		23.2	km
Others		0	km
New Alignment Section		7.7	km
Terrain	Flat		
Alignment (Hori./Vert.)	Fair / Fair		
Formation Width	5.5 m - 7.0 m, 6.4 m (Weighted average)		
Embankment Section			
Length		42.0	km
Height	0.3 m - 1.6 m		
Cut Section			
Length		0	km
Depth	m - m		
Surface Type and Condition			
SBST or DBST		0	km
Soil Aggregate	Good	42.0	km
Earth		0	km
Pipe Culvert	36 each		
Box Culvert	0 each	0	m
Bridge			
Permanent Bridge	2 each	29.3	m
Narrow Concrete Bridge	0 each	0	m (4m)
Wooden Bridge	1 each	10.5	m
Overflow Section	3 places	3.0	km

Table 28.1.2 ROAD INVENTORY(1)

PROPOSED ROUTE NO. IM-28 ROUTE NO. ARD 2078 C. BURI RAM ~ LAM CHI (RIVER) (J.R. 2078) BURI RAM L = 42.0 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)					B. HUAI LUK H = 18 P = 90	B. PLAONG H = 60 P = 300	B. KHOKKLANG H =25 B. SAWAYCHIK H = 500 P = 2500		B. NONG PRU NOI H = 200 P = 1000		B. SAMET H = 85 P = 425	B. SONGCHUN H = 500 P = 2500	B. TABAENG H = 25 P = 125				B. SUKSAMRAN H = 170 P = 850
TERRAIN		Flat															
CROSS SECTION	Formation Width (m)	6.00	7.50	7.00	6.50	7.50	5.50	6.00	6.50		6.00	7.00	6.50				5.50
	Embankment Height (m)	0.70	0.50	0.70	1.00	0.70	0.40 0.30	0.50	0.30	0.70	0.50	1.60	0.50	0.50			0.3
	Cutting Depth (m)																
PAVEMENT	Type/Length	Laterite															
	Condition	Good															
FLOODING	Overflow Length(Km)/Height(m)			L=1.0 H=0.15					L=1.0 H=0.4								
LAND USE	Left	Paddy	Forest	Paddy													
	Right	Paddy	Forest	Paddy													
PIPE CULVERT	Total Number	36 Pipes															
BOX CULVERT & BRIDGE	Station (Km)	0.2		4.5			10.0					19.8					
	Dimension	C-Br. 9.75 x 11.50		C-Br. 7.00 x 20.00			C-Br. 9.80 x 17.80					W-Br. 4.50 x 10.50					
RIGHT OF WAY (m)		25.0															
ALIGNMENT	Horizontal	Fair															
	Vertical	Fair															
ROUTE NO., AGENCIES		ARD															DOH 2078

ROAD INVENTORY (2)

PROPOSED ROUTE NO. IM-28 ROUTE NO. ARD 2078 C. BURI RAM ∿ LAM CHI (RIVER) (J.R. 2078) (Cont'd) L = 42.0 Km.

BURI RAM

		30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
STATION (Km)																	
VILLAGE - Name - Household (H) - Population (P)			B. WA H = 250 P = 1250			B. KHOK KHAMIN H = 21 P = 105	B. NON DANG H = 115 P = 375	B. LALUM									
TERRAIN			Flat														
CROSS SECTION	Formation Width (m)		5.50	6.50			6.00										
	Embankment Height (m)		0.30				1.00 0.50 0.60										
	Cutting Depth (m)																
PAVEMENT	Type/Length		Laterite														
	Condition		Good														
FLOODING	Overflow Length(Km)/Height(m)						L=1.0 H=0.6										
LAND USE	Left		Paddy														
	Right		Paddy														
PIPE CULVERT	Total Number																
BOX CULVERT & BRIDGE	Station (Km)																
	Dimension																
RIGHT OF WAY (m)																	
ALIGNMENT	Horizontal		Fair														
	Vertical		Fair														
ROUTE NO., AGENCIES			DOH 2078														

Figure 28.2.1 ZONING AND ROAD NETWORK

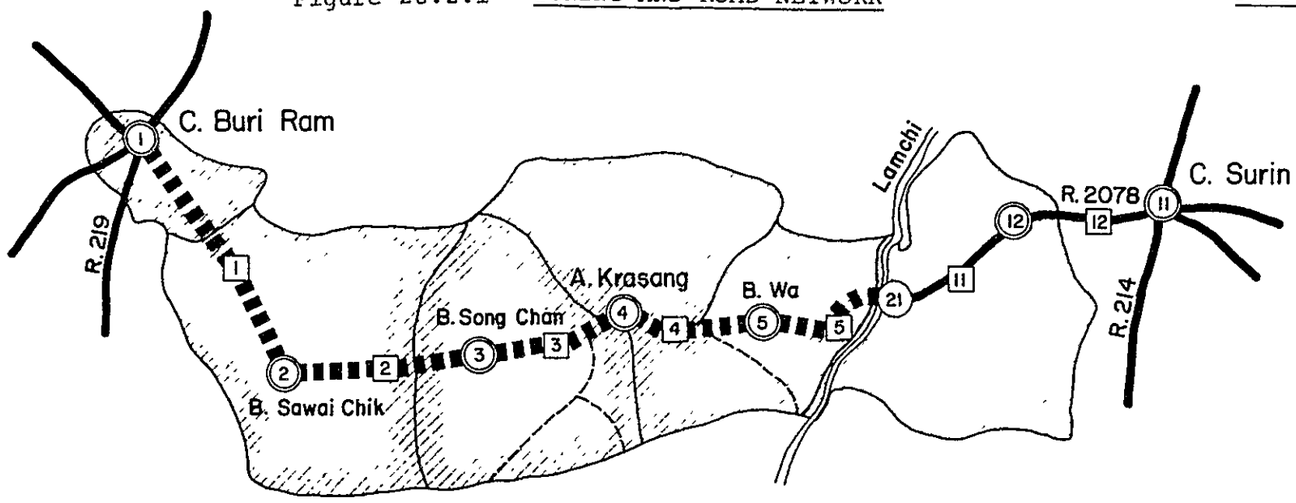


Table 28.2.1 ZONE CHARACTERISTICS

Zone	Administrative Division: Changwat	Amphoe	Tambon Code	Population: Tambon	%	Zone	Attraction
1	Buri Ram	Muang	1	25,719	100	25.7	
			2	16,772	20	3.4	
----	----------	----------	Total	------	---	29.1	206.6
2	Buri Ram	Muang	3	18,744	10	1.9	
			6	16,465	80	13.2	
----	----------	----------	Total	------	---	15.1	-
3	Buri Ram	Kra Sang	3	6,909	100	6.9	
			4	6,821	20	1.4	
			8	5,888	20	1.2	
----	----------	----------	Total	------	---	9.5	----------
4	Buri Ram	Kra Sang	1	10,252	100	10.3	67.8
5	Buri Ram	Kra Sang	5	8,264	60	5.0	
			8	5,888	40	2.4	
----	----------	----------	Total	------	---	7.4	----------
11	Surin	Muang	1	31,467	100	31.5	288.1
12	Surin	Muang	12	14,338	100	14.3	-

Table 28.2.2 LINK CHARACTERISTICS

Link No	Node Pair: Start Node	End Node	Length: $\bar{W}$	W	Grade: $\bar{W}$	W	Remark
1	1. C. Buri Ram	2. B. Saway Chik	11.0	11.0	8	4	ARD
2	2. B. Saway Chik	3. B. Song Chan	10.0	10.0	8	4	ARD
3	3. B. Song Chan	4. A. Krasang	11.0	9.0	8	4	ARD
4	4. A. Krasang	5. B. Wa	7.0	3.0	8	4	R.2078
5	5. B. Wa	21. Lamchi	14.0	9.0	9	4	R.2078
11	12. J.ARD	21. Lamchi	5.0	5.0	5	5	R.2078
12	11. C. Surin	12. J.ARD	6.0	6.0	5	5	R.2078

Table 28.2.3 TRAFFIC VOLUME ON ROUTE IM - 28

YEAR		1987						1993						2001					
LINK		1	2	3	4	5	AVR.	1	2	3	4	5	AVR.	1	2	3	4	5	AVR.
P/C	N+D	23	21	22	20	17	21	51	45	48	44	38	46	119	106	113	103	88	107
	I	12	20	21	23	23	19	27	44	45	50	52	42	64	102	106	118	121	98
	DV	0	0	0	0	0	0	2	2	2	2	2	2	4	5	5	5	5	5
	TOTAL	36	40	43	43	41	40	80	91	96	97	92	90	187	213	225	226	214	210
L/B	N+D	16	14	15	14	12	14	50	44	47	43	37	44	134	119	127	116	99	120
	I	9	14	14	16	16	13	26	42	44	49	50	41	72	115	120	132	136	110
	DV	0	0	0	0	0	0	2	2	2	2	2	2	5	6	6	6	6	6
	TOTAL	25	28	30	30	28	28	78	88	93	94	89	87	211	240	253	254	241	236
M/B	N+D	145	129	137	125	107	130	161	143	152	139	119	144	165	147	157	142	122	148
	I	77	124	129	143	147	119	86	137	143	159	163	132	88	141	147	163	167	136
	DV	0	0	0	0	0	0	6	7	7	7	7	7	6	7	7	7	7	7
	TOTAL	222	253	266	268	254	249	253	287	303	304	288	283	260	295	311	313	296	291
H/B	N+D	9	8	8	7	6	8	27	24	25	23	20	24	72	64	69	62	53	65
	I	5	7	8	9	9	7	14	23	24	26	27	22	39	62	64	71	73	59
	DV	0	0	0	0	0	0	1	1	1	1	1	1	3	3	3	3	3	3
	TOTAL	13	15	16	16	15	15	42	48	50	50	48	47	114	129	136	137	130	127
P/P&T	N+D	211	187	200	181	155	189	277	245	262	237	203	247	397	351	375	340	290	355
	I	114	183	191	212	217	176	150	242	252	279	286	232	217	349	364	403	413	335
	DV	0	0	0	0	0	0	11	12	13	13	12	12	15	17	18	18	17	17
	TOTAL	326	370	391	393	372	365	438	498	526	529	500	491	630	718	758	762	721	707
4/T	N+D	22	19	20	18	15	19	27	23	25	22	18	23	36	31	34	30	25	32
	I	14	22	24	26	26	22	18	29	30	33	33	27	25	41	43	47	48	39
	DV	0	0	0	0	0	0	1	2	2	2	2	2	2	2	2	2	2	2
	TOTAL	36	41	44	44	41	40	46	53	57	57	53	52	64	74	80	80	74	73
6/T	N+D	64	55	60	53	43	56	70	60	65	58	47	61	80	68	74	66	54	69
	I	41	66	70	76	76	63	47	75	80	87	88	72	55	89	95	104	104	86
	DV	0	0	0	0	0	0	3	4	4	4	4	4	4	5	5	5	5	5
	TOTAL	104	120	129	129	120	119	120	139	149	150	139	137	139	163	174	175	163	160
10/T	N+D	19	16	17	15	13	16	35	30	32	29	24	30	73	63	68	60	49	63
	I	12	19	20	22	22	18	23	37	40	43	44	36	50	82	86	95	95	78
	DV	0	0	0	0	0	0	2	2	2	2	2	2	4	4	5	5	4	4
	TOTAL	30	35	37	37	35	34	60	69	74	74	69	68	127	149	159	160	149	146
ADT	N+D	509	448	480	434	368	453	697	613	657	594	504	620	1078	949	1017	919	781	959
	I	283	456	477	526	537	437	391	629	658	727	742	604	610	981	1026	1133	1157	942
	DV	0	0	0	0	0	0	28	32	34	34	32	31	43	49	52	53	50	49
	TOTAL	792	903	956	960	905	890	1115	1274	1349	1355	1278	1255	1731	1980	2095	2105	1988	1950
M/C	N+D	415	394	406	388	359	394	460	443	453	439	413	443	476	479	479	478	469	476
	I	59	89	78	96	123	86	20	23	4	17	53	24	0	0	0	0	0	0
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	474	482	484	484	483	481	479	466	456	456	466	467	476	479	479	478	469	476
TOTAL	N+D	924	842	885	822	727	847	1156	1057	1110	1033	918	1063	1554	1428	1496	1398	1250	1435
	I	342	544	555	622	661	524	411	652	662	744	794	628	610	981	1026	1133	1157	942
	DV	0	0	0	0	0	0	28	32	34	34	32	31	43	49	52	53	50	49
	TOTAL	1266	1386	1440	1444	1388	1371	1595	1740	1805	1810	1744	1722	2207	2459	2574	2584	2457	2426

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

Figure 28.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM – 28

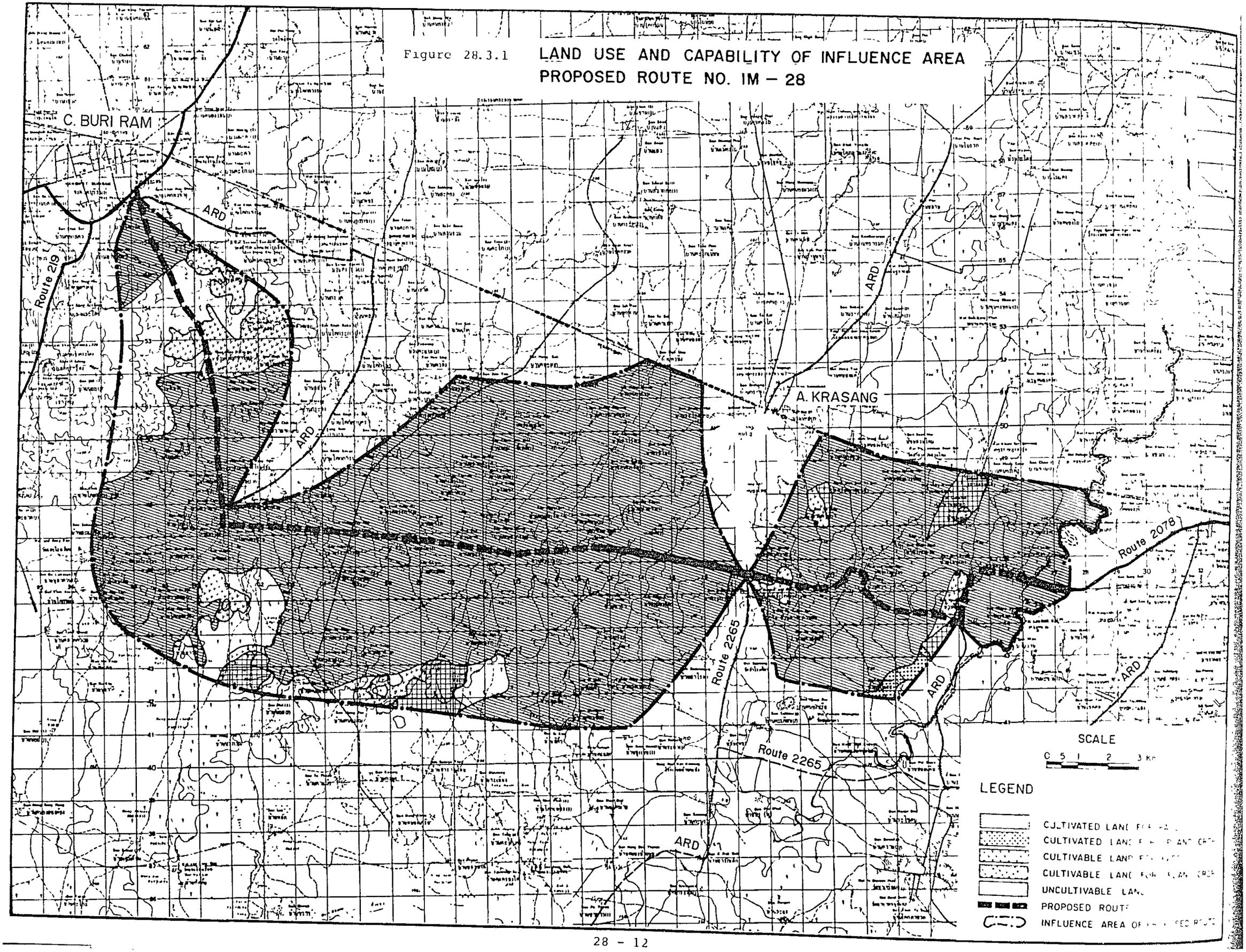


Figure 28.3.2 CROPPING CALENDAR

1400 CHANGWAT BURI RAM

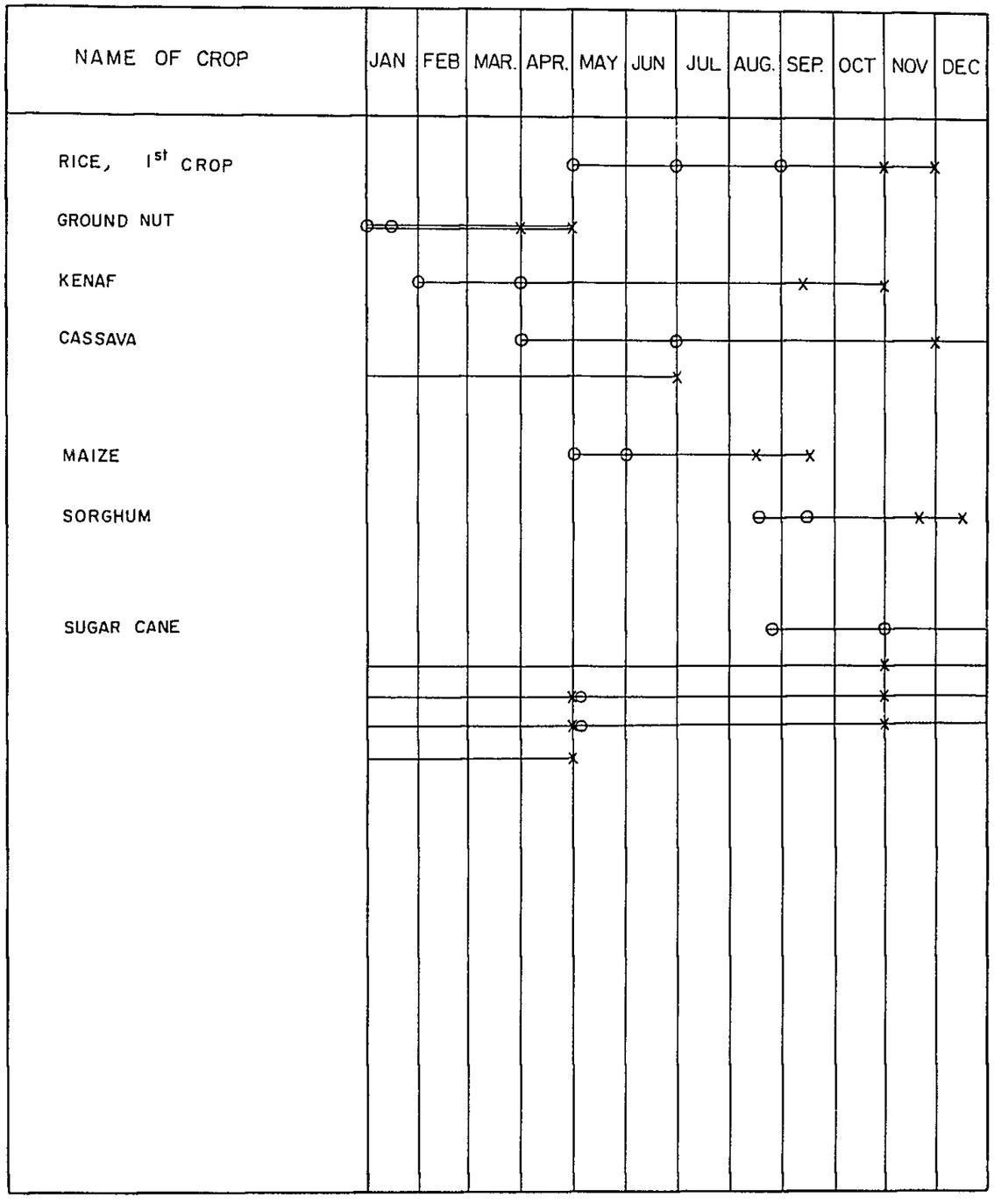


TABLE 28.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		136.250 (218.0)	0.625 (1.0)	136.875 (219.0)	7.813 (12.5)	4.063 (6.5)	11.875 (19.0)
1401	M. BURI RAM	34.375 (55.0)	-	34.375 (55.0)	5.625 (9.0)	0.938 (1.5)	6.563 (10.5)
1405	KARASANG	101.875 (163.0)	0.625 (1.0)	102.500 (164.0)	2.188 (3.5)	3.125 (5.0)	5.313 (8.5)

TABLE 28.3.2 CROP PRODUCTION

ITEM		PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)											
1981		115.44	-	-	0.32	0.61	0.11	1.50	-	2.70	118.14
1987		115.44	-	-	0.32	0.64	0.11	1.54	-	2.78	118.22
1993	WITHOUT PROJECT	115.44	-	-	0.32	0.66	0.11	1.59	-	2.87	118.30
	WITH PROJECT	118.23	-	-	0.32	0.72	0.12	1.59	-	2.93	121.16
2001	WITHOUT PROJECT	115.44	-	-	0.33	0.70	0.11	1.65	-	2.98	118.42
	WITH PROJECT	118.23	-	-	0.33	0.76	0.12	1.65	-	3.05	121.28
CROP YIELD (KG/RAI)											
1981		190.7	-	-	213.0	2500.0	6875.0	170.0	-		
1987		191.8	-	-	213.0	2500.0	6916.4	170.0	-		
1993	WITHOUT PROJECT	193.0	-	-	213.0	2500.0	6958.0	170.0	-		
	WITH PROJECT	196.4	-	-	214.3	2515.0	6999.8	170.0	-		
2001	WITHOUT PROJECT	194.5	-	-	213.0	2500.0	7013.8	170.0	-		
	WITH PROJECT	202.8	-	-	216.0	2535.2	7112.5	170.0	-		
CROP PRODUCTION (TON)											
1981		22,008	-	-	67	1,525	770	254	-	2,643	24,651
1987		22,141	-	-	68	1,590	775	262	-	2,723	24,863
1993	WITHOUT PROJECT	22,274	-	-	69	1,658	779	270	-	2,805	25,079
	WITH PROJECT	23,227	-	-	69	1,802	832	270	-	3,003	26,230
2001	WITHOUT PROJECT	22,453	-	-	70	1,753	786	281	-	2,921	25,374
	WITH PROJECT	23,981	-	-	71	1,920	846	281	-	3,150	27,131

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 28.3.3 FARMGATE PRICE AND PRODUCTION COST

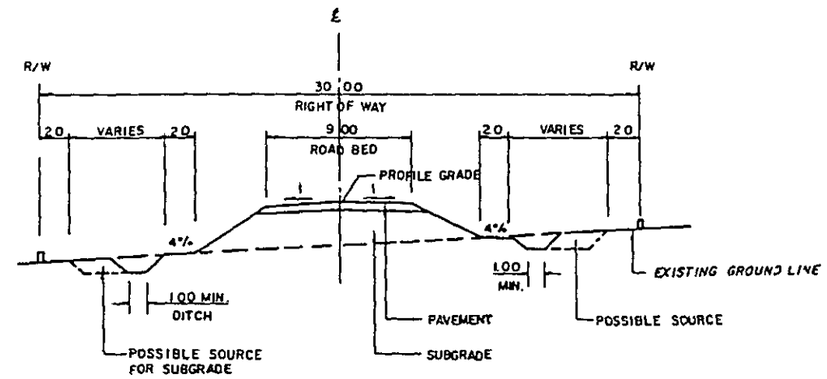
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	4,144	-	-	7,468	670	562	4,347	-
WITH PROJECT (1987 - 2001)	4,248	-	-	7,468	687	562	4,456	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	550	-	-	1,023	734	2,183	631	-
WITH PROJECT (1987 - 2001)	568	-	-	1,043	754	2,208	631	-

TABLE 28.3.4 NET PRODUCTION VALUE

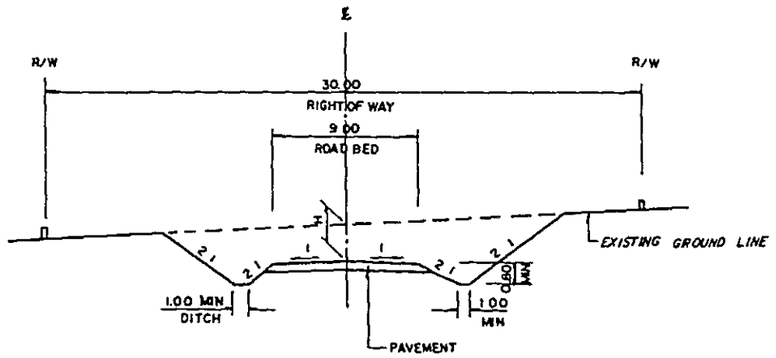
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	28,213	1,135	29,348	28,491	1,167	29,658
1993	28,764	1,173	29,937	31,517	1,283	32,800
2001	29,505	1,222	30,727	34,719	1,360	36,079

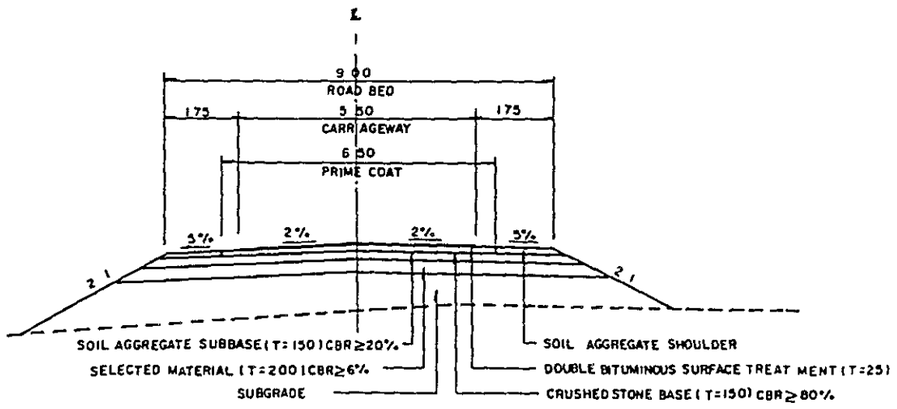
Figure 28.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



FILL SECTION



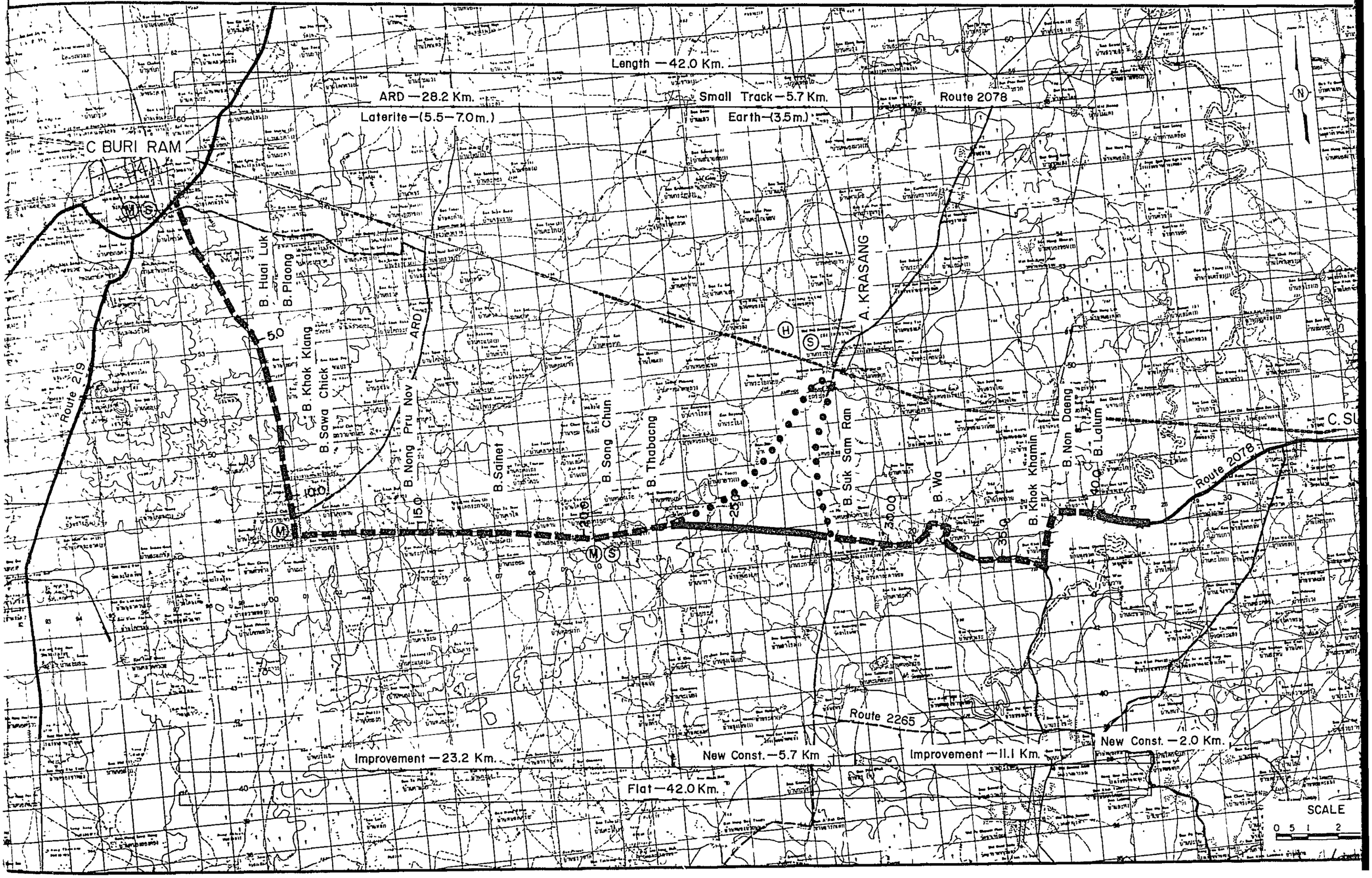
CUT SECTION



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

Figure 28.5.2 **PROPOSED ROUTE NO. IM—28** **C. BURI RAM**

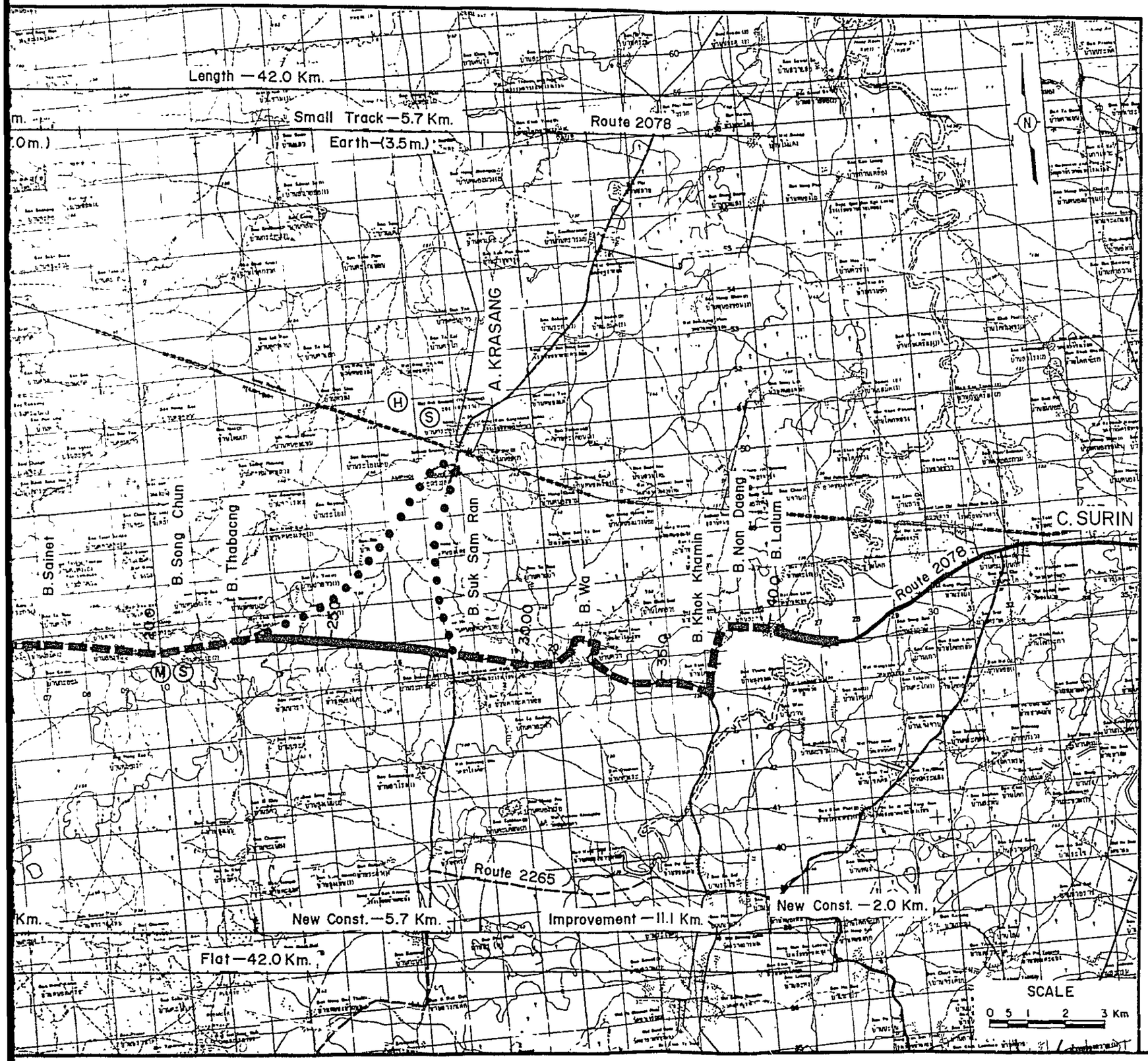
C. BURI RAM — LAM CHI (J.R. 2078)
ROUTE NO. 2078 + ARD L = 42.0 Km.



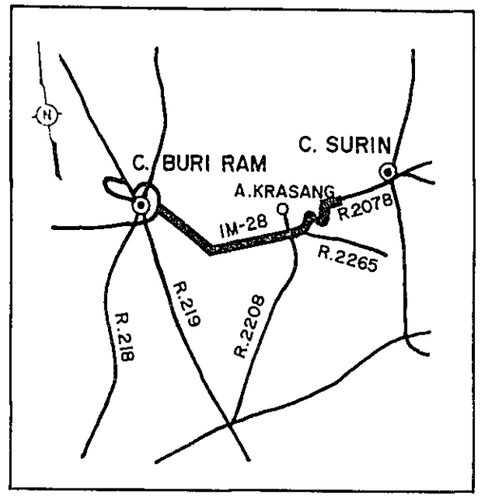
TE NO. IM—28 C. BURI RAM

C. BURI RAM — LAM CHI (J.R. 2078)

ROUTE NO. 2078 + ARD L = 42.0 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1.	0.2	—	C—9.75 x 11 50
2	4 5	C—700 x 20 00	—
3.	10.0	—	C—9.80 x 17.80
4	12.5	C—7.00 x 20 00	—
5.	19.8	C—700 x 14 00	W—4.50 x 10.50
6.	40.5	C—700 x 120 00	—
7	40 5	C—700 x 30 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 28.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-28 (42.0 km)

Items	Unit of Q'ty	Financial Unit Rate ฿	(DBST) Q'ty	(DBST) Financial Cost (10^3฿)	(DBST) Economic Cost (10^3฿)
DIRECT CONSTRUCTION COST					
Clearing and Grubbing	ha	15,000	81	1,215	1,105
Excavation - Soil	m^3	20	0	0	0
Excavation - Hard Rock	m^3	160	0	0	0
Embankment	m^3	45	204,100	9,184	8,357
Selected Material	m^3	80	89,000	7,120	6,336
Soil Aggregate Surface or Subbase	m^3	105	62,400	6,552	5,831
Crushed Stone Base	m^3	370	41,000	15,170	13,956
Soil Aggregate Shoulder	m^3	105	17,600	1,848	1,644
Prime Coat and DBST	m^2	55	231,000	12,705	11,435
Pipe Culvert	m	2,100	1,820	3,822	3,516
Box Culvert	m	16,000	0	0	0
Long Span Bridge	m	80,000	120	9,600	8,544
Short Span Bridge	m	40,000	84	3,360	2,990
Sub Total (a)				70,576	63,718
Miscellaneous Works (a) x 7%				4,940	4,460
Total (b)				75,516	68,178
PHYSICAL CONTENGENCY (b) x 15%				11,327	10,227
ENGINEERING AND ADMINISTRATION (b) x 10%				7,552	6,818
Sub Total				18,879	17,045
LAND ACQUISITION					
Highly Developed Land	ha	50,000	34	1,700	1,700
Less Developed Land	ha	15,000	1	15	15
Sub Total				1,715	1,715
GRAND TOTAL				96,110	86,938

Table 28.6.1 COST AND BENEFITS

(F4 STANDARD)

(1000 BAHT)

YEAR	COST: CONST. COST	BENEFITS: AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	DISCOUNTED(12%): COST	BENEFIT
1984	17,388	0	0	0	0	24,429	0
1985	43,469	0	0	0	0	54,528	0
1986	26,081	0	0	0	0	29,211	0
1987	0	310	27,478	789	28,577	0	25,515
1988	0	660	30,043	852	31,555	0	25,156
1989	0	1,010	32,608	916	34,534	0	24,580
1990	0	1,360	35,173	979	37,512	0	23,840
1991	0	1,710	37,737	1,043	40,490	0	22,975
1992	0	2,060	40,302	1,106	43,469	0	22,023
1993	0	2,410	42,867	1,170	46,447	0	21,010
1994	20,328	2,778	47,149	1,271	51,198	9,195	20,678
1995	0	3,146	51,430	1,373	55,949	0	20,176
1996	0	3,513	55,712	1,475	60,700	0	19,544
1997	0	3,881	59,993	1,577	65,452	0	18,816
1998	0	4,249	64,275	1,679	70,203	0	18,019
1999	0	4,616	68,556	1,781	74,954	0	17,177
2000	0	4,984	72,838	1,883	79,705	0	16,309
2001	-40,917	5,352	77,119	1,985	84,456	-7,475	15,430
TOTAL	66,349	42,041	743,279	19,881	805,200	109,887	311,248

DISCOUNTED ECONOMIC COSTS : 109,887

DISCOUNTED ECONOMIC BENEFITS : 311,248

AGRICULTURAL DEVELOPMENT BENEFIT	14,141
VOC SAVING	289,244
RMC SAVING	7,863

NET PRESENT VALUE : 201,361

BENEFIT COST RATIO : 2.83

INTERNAL RATE OF RETURN : 27.0 %

Table 28.7.1 SOCIAL INDICATORS

(Proposed Route IM-28)

Population (1,000)		
1982	:	38.6
1993	:	46.3
Average travelling speed, without (kph)	:	48
Isolation		
Access to Amphoe		
Average distance to Amphoe (km) 1/	:	7.5
Per capita time savings (10^{-4})	:	0.019
Score	:	56
Access to Artery Highway		
Average distance to highway (km) 1/	:	12 (21)
Per capita time savings (10^{-4})	:	0.058
Score	:	126
Impassability		
Impassable week a year	:	4
Impassability per year	:	0.077
Impassability per capita (10^{-4})	:	0.017
Score	:	142
Health		
Access to Hospital		
Average distance to Hospital (km) 1/	:	7.1 (9.0)
Per capita time savings (10^{-4})	:	0.019
Score	:	44
Access to Medical Facilities		
Average distance to facilities (km) 1/	:	3.6 (6.0)
Per capita time savings (10^{-4})	:	0.016
Score	:	64
Education		
Access to Secondary School		
Number of Student in 1993 (1,000) 2/	:	9.3
Average distance to school (km)	:	4.9 (6.0)
Per capita time savings (10^{-4})	:	0.061
Score	:	33
Teacher Intensity		
Number of teachers 3/		
University graduate	:	1
Total	:	21
Number of Student	:	447
Indicators		
E1 4/	:	2.2
E2 5/	:	47.0
E 6/	:	49.2
Degree of Improvement 7/	:	1.39
Score	:	89
Disparity		
G.P.V. in 1993 (Mn B) 8/		
With project	:	102.2
Without project	:	95.6
Per capita G.P.V. in 1993 (B)		
With project (W)	:	2,207
Without project (w)	:	2,065
Degree of Disparity		
(A/W) - (A/w) 9/	:	0.09
Score	:	161
Total Score	:	715

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 - 29

Changwat : Buri Ram / Surin

A Prakhon Chai (JR 24) - A. Krasang

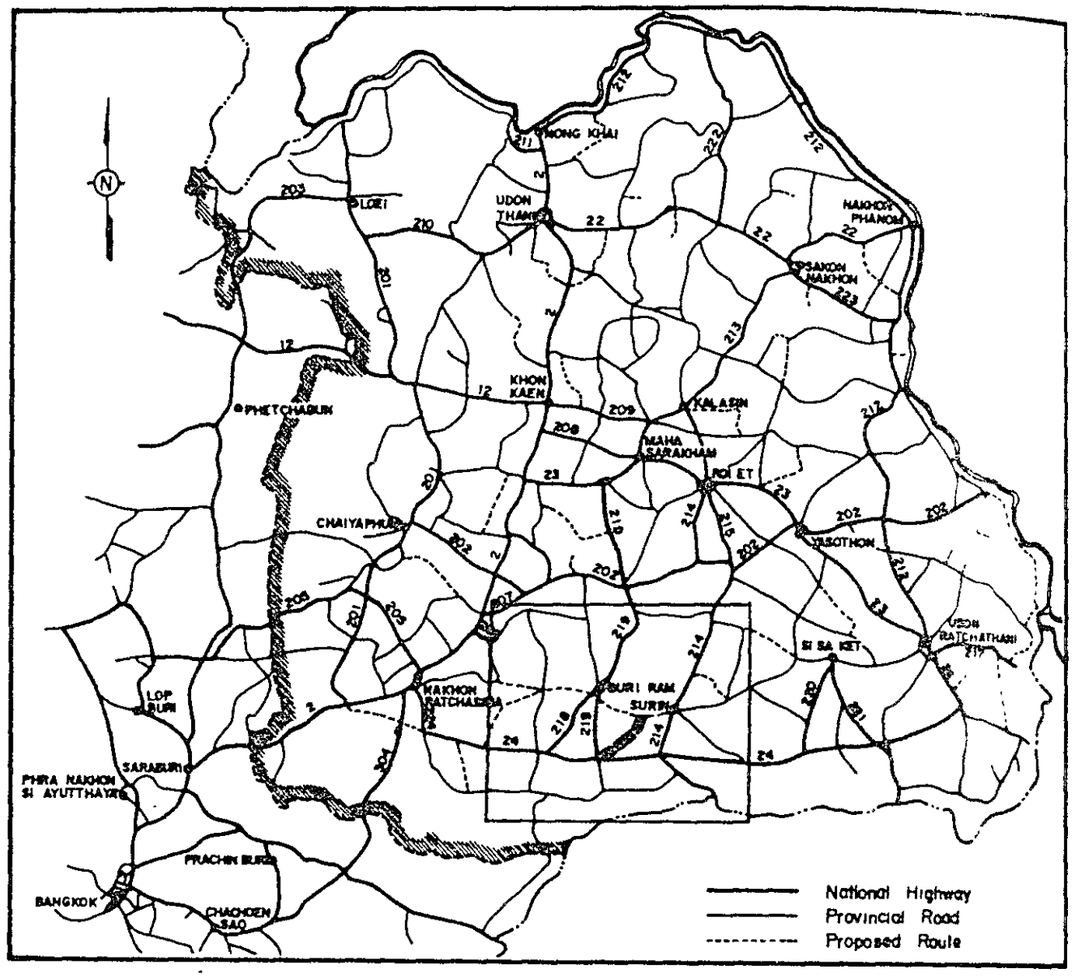
Length : 48.0 KM.

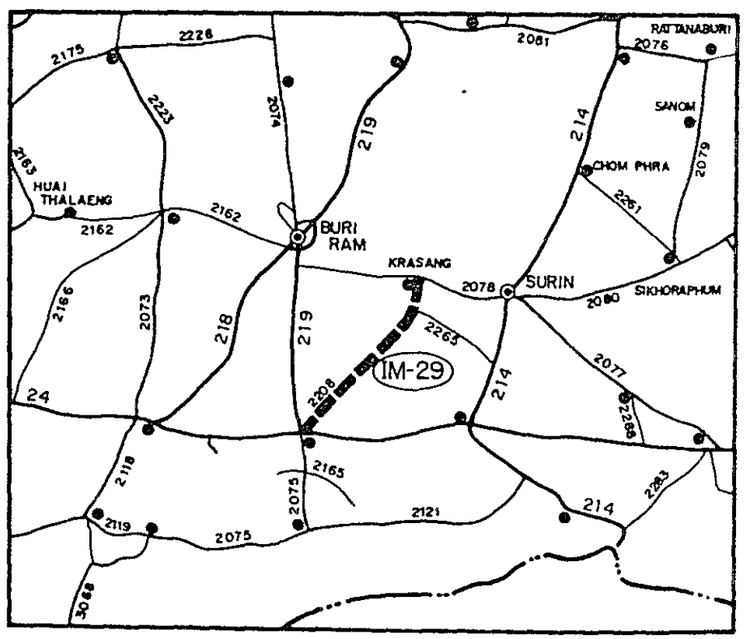
SUMMARY

PROPOSED ROUTE IM-29

Item	Description
Changwat	Buri Ram/Surin
Origin	A. Prakhon Chai (J.R.24)
Destination	A. Krasang
Length	
Total	48.0 km
Improvement Section	48.0 km
DOH Road	R.2208 36.0 km
ARD Road	12.0 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Good
Terrain	Flat
Influence Area	
Area	360 km^2
Population (1982)	59,800
Principal Crops	Paddy
Traffic (ADT)	
Existing	185
1993	772
2001	1,063
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	95,474 . 10^3 ฿
Economic	86,323 . 10^3 ฿
IRR	11.5 %
B/C	0.96
Recommendation	For further consideration

LOCATION OF PROPOSED ROUTE





1. GENERAL

1.1 Characteristics of the Route

The proposed route extends in two Changwat of Buri Ram and Surin.

The route, starting at the intersection of Route 24 with 219 at Amphoe Praphon Chai, runs northeastward passing through Ban Chan Dum, Ban Khok Kamin and Ban Phat and ends at Amphoe Krasang. Its total length is 48.0 km. (Figure 29.5.2)

The terrain is almost flat. In the influence area, there exists several villages with total population of 59,800. There are one medical center, two hospitals and two secondary schools along the proposed route.

The proposed route, upon completion, will form an important part of road network to connect two artery highways, Route 24 and 2078 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 29.1.1.

The details are shown as the results of inventory survey in Table 29.1.2.

2. TRAFFIC

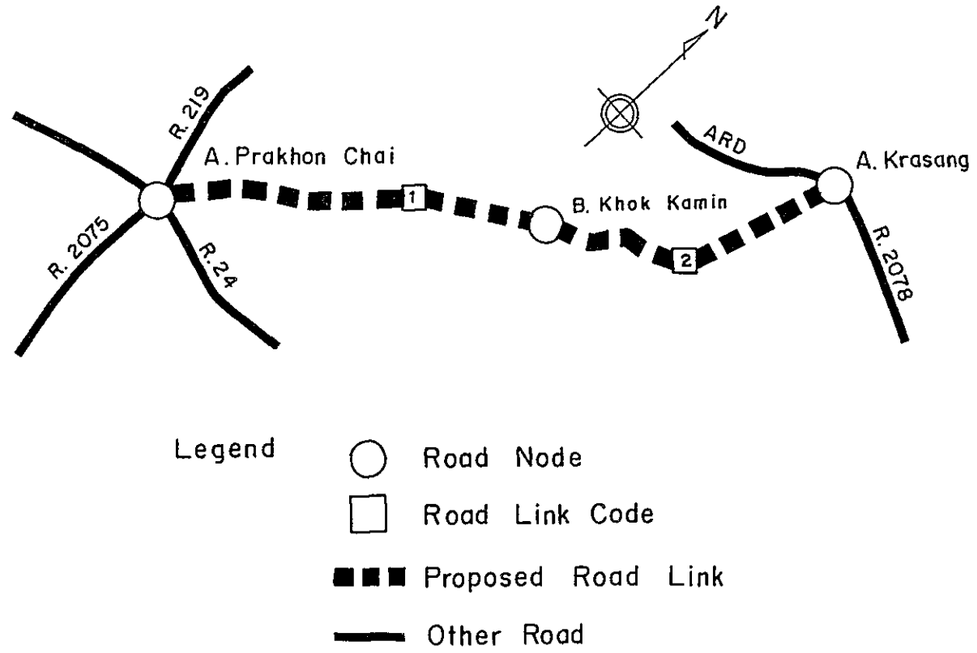
2.1 Method

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

Proposed Road Link



Traffic Volume in Base Year

Source (base year)	Link No	Vehicle Type									
		P/C	P/P	L/B	M/B	H/B	P/T	4/T	6/T	10/T	ADT
DOH (1981)	1 1/	28	35	28	35	23	6	18	15	10	198
	2	n.a.									
Manual Counts (1982)	1	n.a.									
	2	-	46	-	57	-	5	10	39	10	167
Estimated	1	28	35	28	35	23	6	18	15	10	198
	2	-	46	-	57	-	5	10	39	10	167

Note: 1/ Route 2208 Section 0100 Station Km 6+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 links 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	2234
2	1349

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	89	46	136
2	119	62	181

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	1.6	1.4
PASSENGER MOVEMENT	5.8	6.0	6.0

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981 - 1987	1987 - 1993	1993 - 2001
NON-AGRI.	7.5	7.7	7.8
AGRICULTURE	0.2	0.2	0.2
FREIGHT	5.0	5.1	5.2

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	5.6	5.6

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	18.8	23.5	18.8	23.5	15.4	12.2	36.7	30.6	20.4
	1987	16.3	26.0	19.4	24.1	14.2	13.7	30.5	31.9	23.9
	1993	13.9	28.4	20.0	24.8	12.9	15.1	24.3	33.2	27.4
	2001	10.6	31.7	20.8	25.7	11.2	17.0	16.0	35.0	32.0
2	1982	0.0	44.7	0.0	55.3	0.0	7.8	15.6	60.9	15.6
	1987	2.9	41.7	5.3	47.2	2.8	10.2	15.7	54.1	19.9
	1993	6.5	38.2	11.6	37.5	6.2	13.1	15.8	45.9	25.1
	2001	11.2	33.5	20.0	24.6	10.8	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 29.2.1.

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	24	30	63	21	71	17	32	16	274	307	582
1993	35	52	87	33	108	20	38	25	398	374	772
2001	52	100	123	54	179	21	45	42	616	447	1063

3. AGRICULTURAL DEVELOPMENT

3.1 Present Condition

Almost all cultivated land in the influence area is covered by paddy field. In the upland field, kenaf, cassava, ground nut and beans are planted. Unused cultivable land for both paddy and upland fields still remains mainly in the central part of the area.

Land use and capability conditions in the area of influence are shown in Table 29.3.1 and Figure 29.3.1.

Typical cropping calendars in the Buri Ram and Surin areas are shown in Figure 29.3.2.

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 29.3.2.

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 29.3.3.

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 29.3.4. 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 Saving

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		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	Nos. of Wooden Narrow Bridge
1	Flat	28.4	2B	7	0	28.4	1 (F4)	0
2	Flat	19.6	2B	0	4	19.6		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.

Vehicle Operating Cost Saving

(Unit: 1,000 Baht)

Road Class	1987	1993	2001
1 (F4)	7,979	11,687	19,254

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 29.5.1
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	:	ø100cm
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 29.5.2.

Alignment of the route is shown in Figure 29.5.2.

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 29.5.1.

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

F_4	Standard (DBST)	L = 48.0 km
	Financial Cost	95,474 . 10^3₱
	Economic Cost	86,323 . 10^3₱

6. ECONOMIC EVALUATION

Yearly distribution of the economic costs and benefits, and the calculated economic indicators for evaluation are given in Table 29.6.1.

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 29.7.1.

Table 29.1.1 SUMMARY OF ROAD INVENTORY

Item	Description			
Origin	A. Prakhon Chai (J.R. 24)			
Destination	A. Krasang			
Length				
Total			48.0	km
Improvement Section			48.0	km
DOH Road	R. 2208		36.0	km
ARD Road			12.0	km
Others			0	km
New Alignment Section			0	km
Terrain	Flat			
Alignment (Hori./Vert.)	Fair / Fair			
Formation Width	6.0 m - 7.0 m, 6.5 m (Weighted average)			
Embankment Section				
Length			48.0	km
Height	0.3 m - 2.0 m			
Cut Section				
Length			0	km
Depth	m - m			
Surface Type and Condition				
SBST or DBST			1.0	km
Soil Aggregate	Good		47.0	km
Earth			0	km
Pipe Culvert	86	each		
Box Culvert	0	each	0	m
Bridge				
Permanent Bridge	0	each	0	m
Narrow Concrete Bridge	4	each	102.0	m (4m)
Wooden Bridge	7	each	125.1	m
Overflow Section	0	place	0	km

Table 29.1.2 ROAD INVENTORY (1)

PROPOSED ROUTE NO. IM-29 ROUTE NO. 2208 ARD 2265 2078

A. PRAKHON CHAI (J.R. 24) ∿ A. KRASANG

BURI RAM/SURIN

L = 48.0 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. PRAKHON CHAI	B. PRAKHON CHAI H = 200 P = 1000			B. PALAT H = 250 P = 1250	B. CHAN DUM H = 300 P = 1500				B. SA DAO H = 370 P = 1850	B. PHLAP PHLA H = 35 P = 175		B. LAM DENG H = 150 P = 755		B. KHOK KAMIN H = 400 P = 2000	
TERRAIN		Flat															
CROSS SECTION	Formation Width (m)	7.00	6.00													6.50	
	Embankment Height (m)	0.20	1.20	0.60	0.50	1.00	0.30	0.50	0.70	1.00	0.50	1.00 2.00	1.00	0.50	0.30	1.50 2.00	
	Cutting Depth (m)																
PAVEMENT	Type/Length	Laterite								DT	Laterite						
	Condition	Good															
FLOODING	Overflow Length(Km)/Height(m)																
LAND USE	Left	Paddy															
	Right	Paddy															
PIPE CULVERT	Total Number	86 Pipes															
BOX CULVERT & BRIDGE	Station (Km)		3.2 4.1	5.5		8.5 9.6						20.8 21.8				29.2 29.6	
	Dimension		W-Br. 4.30 x 21.30 W-Br. 4.20 x 11.30	W-Br. 4.20 x 20.00		W-Br. 4.20 x 12.00 W-Br. 4.30 x 25.10						W-Br. 4.20 x 25.20 W-Br. 5.40 x 10.20				C-Br. 4.50 x 36.00 C-Br. 5.60 x 32.00	
RIGHT OF WAY (m)																12.0	
ALIGNMENT	Horizontal	Fair															
	Vertical	Fair															
ROUTE NO., AGENCIES		DOH 2208														ARD	

ROAD INVENTORY (2)

ROUTE NO. IM-29 ROUTE NO. 2208 / ARD / 2265 / 2078

A. PRAKHON CHAI (J.R. 24) ∿ A. KRASANG (Cont'd)

BURI RAM/ SURIN

L = 48.0 Km.

Item		30 – 60 (Km)
STATION (Km)		30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60
VILLAGE - Name - Household (H) - Population (P)		B. PA YAO H = 30 P = 150; B. BUA THANON H = 230 P = 1150; B. KRATHUM H = 26 P = 130; B. KANUNG H = 197 P = 1040; B. PHET H = 65 P = 325; B. SAMRONG H = 150 P = 750; B. RAKA H = 75 P = 375; B. NONG PLALAI; A. KRASANG
TERRAIN		Flat
CROSS SECTION	Formation Width (m)	6.50, 7.00, 6.50, 7.00, 6.50, 6.00, 7.50, 8.50
	Embankment Height (m)	1.00, 0.60, 1.50, 0.60, 1.00, 0.50, 1.00, 0.40, 1.00, 0.50, 0.30
	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	
BOX CULVERT & BRIDGE	Station (Km)	37.1, 37.2
	Dimension	C-Br. 4.50 x 12.00; C-Br. 4.50 x 22.00
RIGHT OF WAY (m)		12.0, 15.0, 10.0, 30.0
ALIGNMENT	Horizontal	Fair
	Vertical	Fair
ROUTE NO., AGENCIES		ARD, DOH 2265, DOH 2078

Table 29.2.1 TRAFFIC VOLUME ON ROUTE IM - 29

YEAR		1987			1993			2001		
LINK		1	2	AVR.	1	2	AVR.	1	2	AVR.
P/C	N+D	33	4	21	40	12	29	50	33	43
	I	5	1	3	6	2	4	8	5	6
	DV	0	0	0	3	1	2	3	2	3
	TOTAL	38	5	24	49	15	35	61	40	52
L/B	N+D	39	7	26	58	22	43	99	59	82
	I	6	1	4	9	3	6	15	9	12
	DV	0	0	0	4	1	3	6	4	5
	TOTAL	45	8	30	70	26	52	120	72	100
M/B	N+D	49	64	55	72	71	71	121	73	101
	I	7	10	8	11	11	11	18	11	15
	DV	0	0	0	5	5	5	8	5	7
	TOTAL	56	73	63	87	86	87	147	88	123
H/B	N+D	29	4	18	37	12	27	53	32	44
	I	4	1	3	6	2	4	8	5	7
	DV	0	0	0	2	1	2	3	2	3
	TOTAL	33	4	21	45	14	33	65	39	54
P/P&T	N+D	60	64	62	93	84	89	166	120	147
	I	9	10	9	14	13	13	25	18	22
	DV	0	0	0	6	5	6	11	8	9
	TOTAL	69	74	71	113	102	108	202	146	179
4/T	N+D	17	12	15	17	15	16	15	20	17
	I	3	2	2	3	2	2	2	3	3
	DV	0	0	0	1	1	1	1	1	1
	TOTAL	20	14	17	21	18	20	18	24	21
6/T	N+D	18	41	27	23	43	31	33	44	37
	I	3	6	4	3	6	5	5	7	6
	DV	0	0	0	1	3	2	2	3	2
	TOTAL	21	47	32	28	52	38	40	53	45
10/T	N+D	14	15	14	19	23	21	30	40	34
	I	2	2	2	3	4	3	5	6	5
	DV	0	0	0	1	2	1	2	3	2
	TOTAL	16	17	16	23	28	25	37	49	42
ADT	N+D	258	211	239	360	282	328	567	421	507
	I	39	32	36	54	42	49	85	63	76
	DV	0	0	0	23	18	21	37	27	33
	TOTAL	297	242	274	437	342	398	689	511	616
M/C	N+D	297	264	284	357	312	339	440	382	416
	I	24	23	24	25	25	25	21	24	22
	DV	0	0	0	10	10	10	7	9	8
	TOTAL	322	287	307	392	346	374	468	416	447
TOTAL	N+D	555	474	522	717	594	667	1007	803	924
	I	63	55	60	79	67	74	106	87	99
	DV	0	0	0	33	28	31	44	36	41
	TOTAL	618	529	582	829	688	772	1157	926	1063

NOTE

N : NORMAL TRAFFIC D : DIVERTED TRAFFIC

DV : DEVELOPED TRAFFIC I : INDUCED TRAFFIC

Figure 29.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM – 29

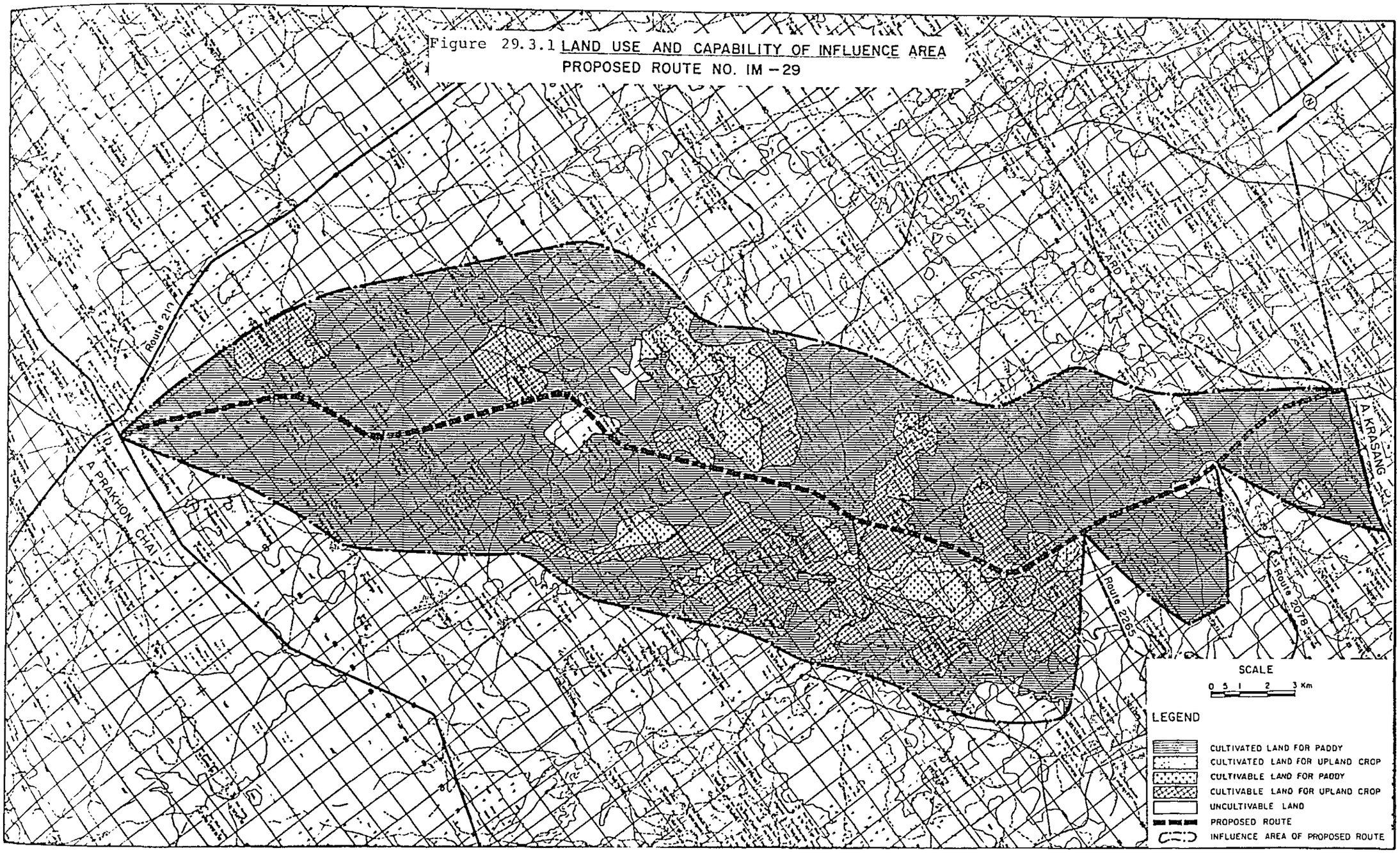
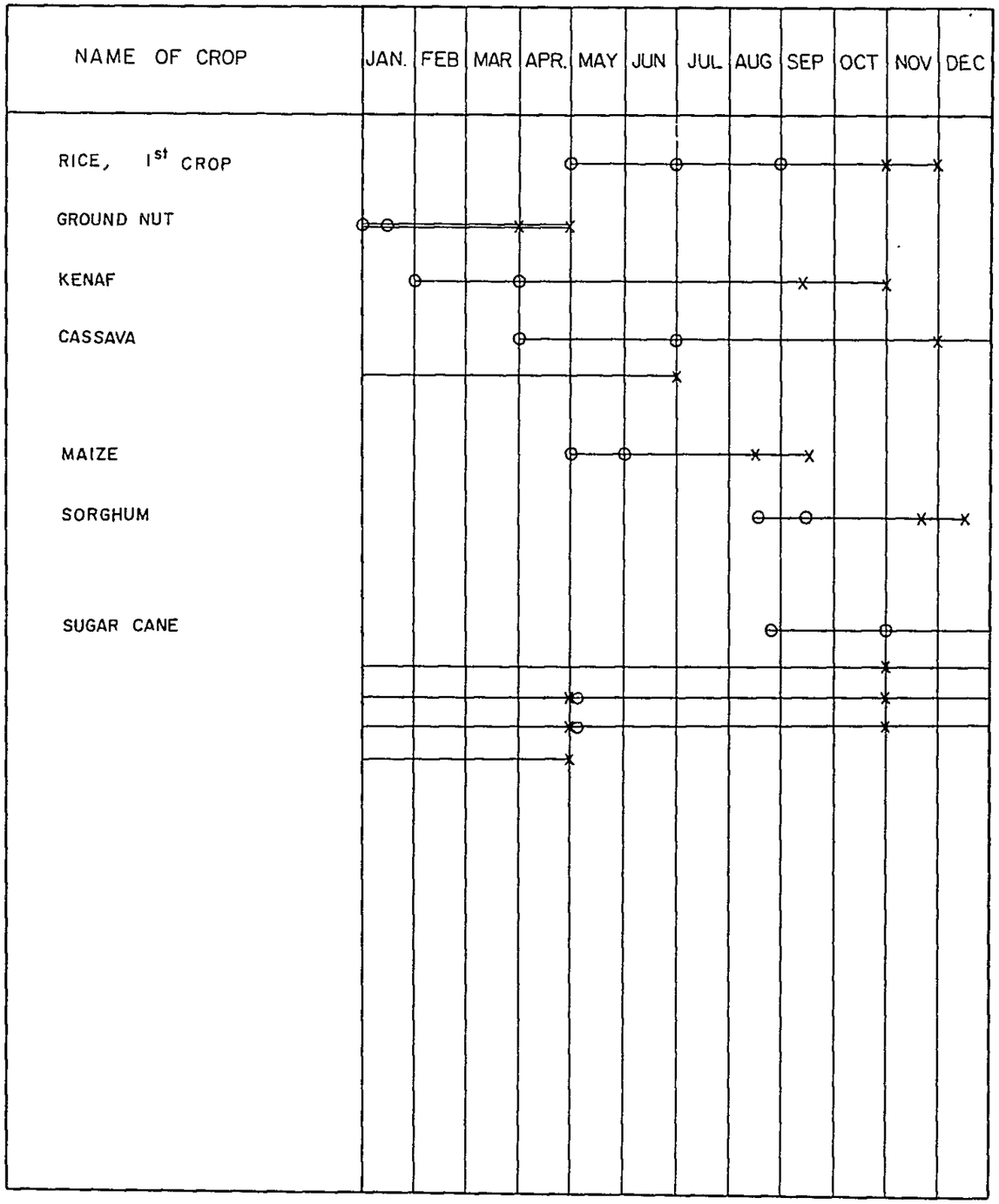


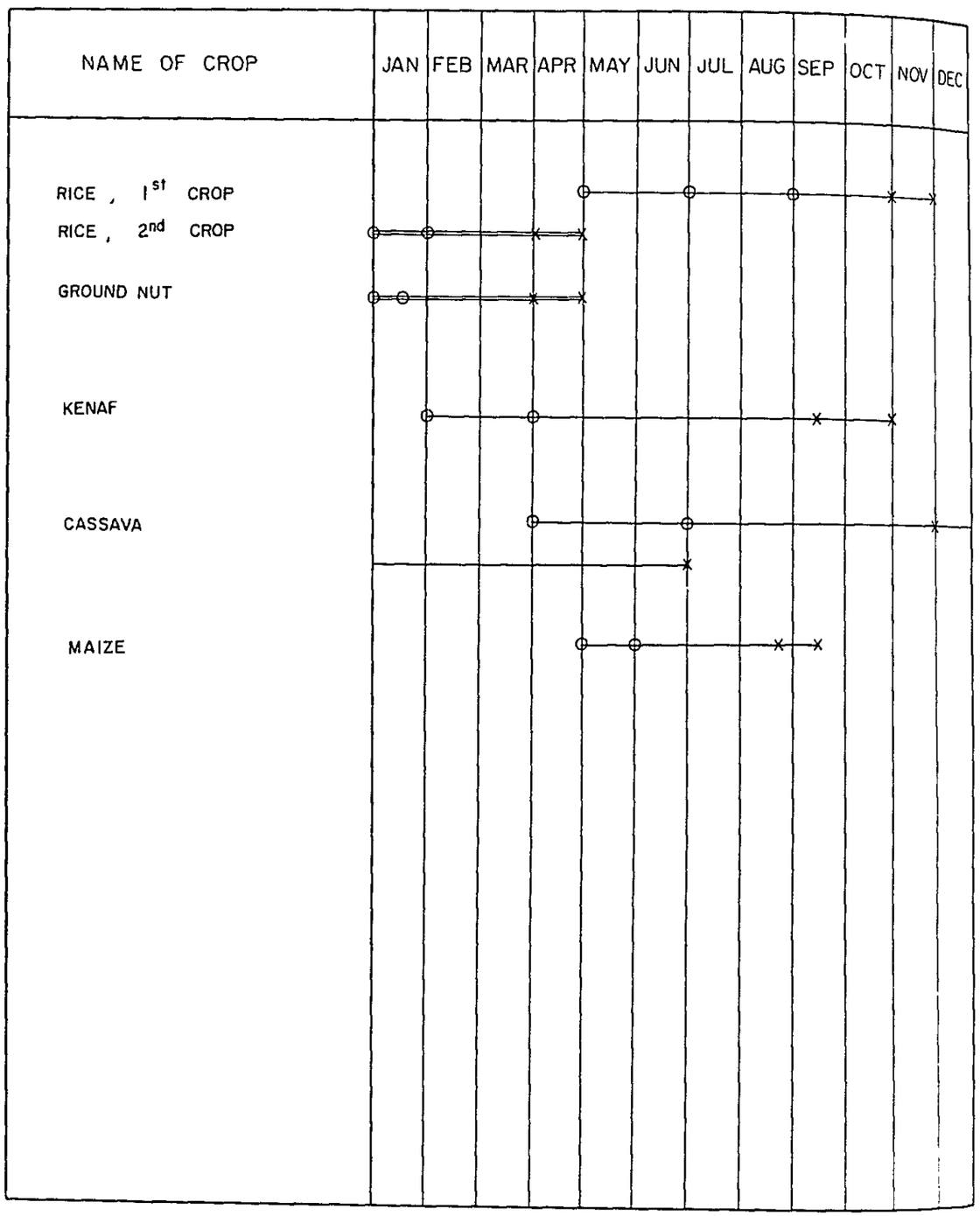
Figure 29.3.2 CROPPING CALENDAR (1)

1400 CHANGWAT BURI RAM



CROPPING CALENDAR (2)

1500 CHANGWAT SURIN



Note

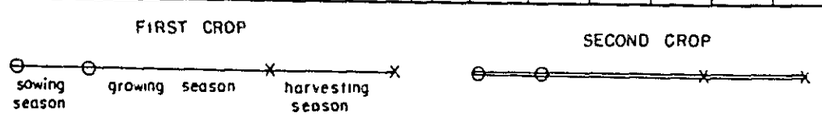


TABLE 29.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM^2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		170.125 (272.2)	-	170.125 (272.2)	13.125 (21.0)	35.625 (57.0)	48.750 (78.0)
1401	M. BURI RAM	1.375 (2.2)	-	1.375 (2.2)	-	-	-
1405	KARASANG	54.375 (87.0)	-	54.375 (87.0)	5.000 (8.0)	8.750 (14.0)	13.750 (22.0)
1411	PRAKHON CHAI	107.500 (172.0)	-	107.500 (172.0)	8.125 (13.0)	19.375 (31.0)	27.500 (44.0)
1501	M. SURIN	6.875 (11.0)	-	6.875 (11.0)	-	7.500 (12.0)	7.500 (12.0)

TABLE 29.3.2 CROP PRODUCTION

ITEM		PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)											
1981		154.20	-	0.08	0.51	1.47	-	2.36	-	4.80	159.00
1987		155.12	-	0.08	0.52	1.53	-	2.39	-	4.90	160.02
1993	WITHOUT PROJECT	156.06	-	0.08	0.53	1.58	-	2.42	-	5.00	161.06
	WITH PROJECT	164.67	-	0.08	0.53	1.93	-	2.47	-	5.40	170.06
2001	WITHOUT PROJECT	157.31	-	0.08	0.54	1.66	-	2.46	-	5.15	162.46
	WITH PROJECT	165.99	-	0.08	0.54	2.03	-	2.50	-	5.56	171.55
CROP YIELD (KG/RAI)											
1981		205.2	-	162.4	181.3	2493.2	-	170.0	-		
1987		206.5	-	163.4	181.3	2493.2	-	170.0	-		
1993	WITHOUT PROJECT	207.7	-	164.4	181.3	2493.2	-	170.0	-		
	WITH PROJECT	210.2	-	166.4	182.4	2508.2	-	170.0	-		
2001	WITHOUT PROJECT	209.4	-	165.7	181.3	2493.2	-	170.0	-		
	WITH PROJECT	215.3	-	170.4	183.8	2528.3	-	170.0	-		
CROP PRODUCTION (TON)											
1981		31,644	-	13	92	3,672	-	402	-	4,416	36,060
1987		32,026	-	13	94	3,807	-	407	-	4,561	36,587
1993	WITHOUT PROJECT	32,412	-	13	96	3,946	-	412	-	4,712	37,124
	WITH PROJECT	34,612	-	13	96	4,846	-	419	-	5,622	40,234
2001	WITHOUT PROJECT	32,934	-	13	98	4,139	-	418	-	4,921	37,855
	WITH PROJECT	35,736	-	14	99	5,124	-	426	-	5,920	41,657

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 29.3.3 FARMGATE PRICE AND PRODUCTION COST

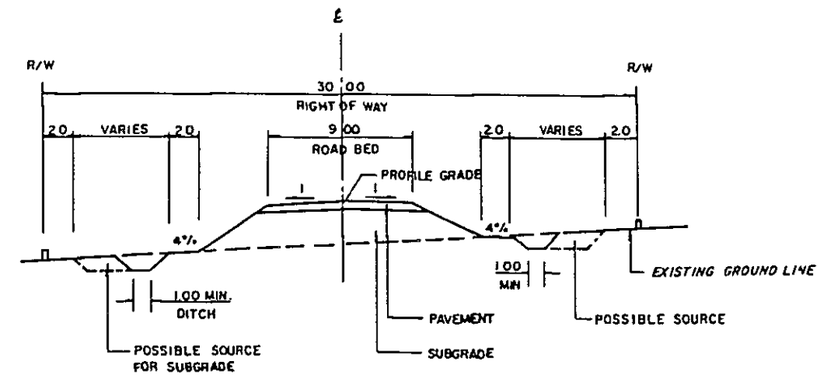
ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON
FARMGATE PRICE (BAHT/TON)								
WITHOUT PROJECT (1981 - 2001)	4,144	-	6,799	7,597	681	-	4,636	-
WITH PROJECT (1987 - 2001)	4,248	-	6,799	7,597	698	-	4,752	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	566	-	392	1,008	734	-	664	-
WITH PROJECT (1987 - 2001)	579	-	412	1,028	754	-	664	-

TABLE 29.3.4 NET PRODUCTION VALUE

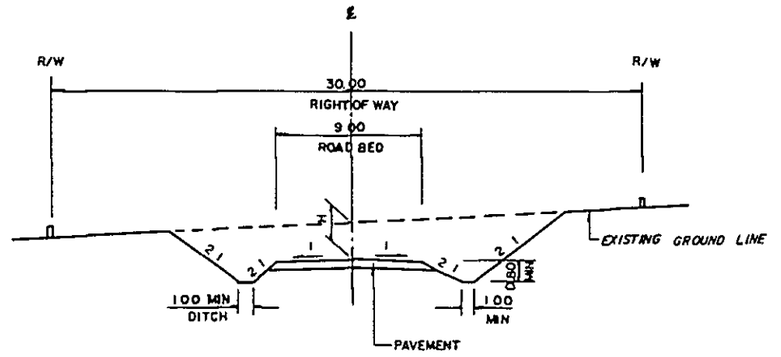
(1000 BAHT)

YEAR	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	44,960	2,038	46,998	46,206	2,103	48,309
1993	46,033	2,100	48,133	51,667	2,548	54,215
2001	47,490	2,188	49,678	55,677	2,699	58,376

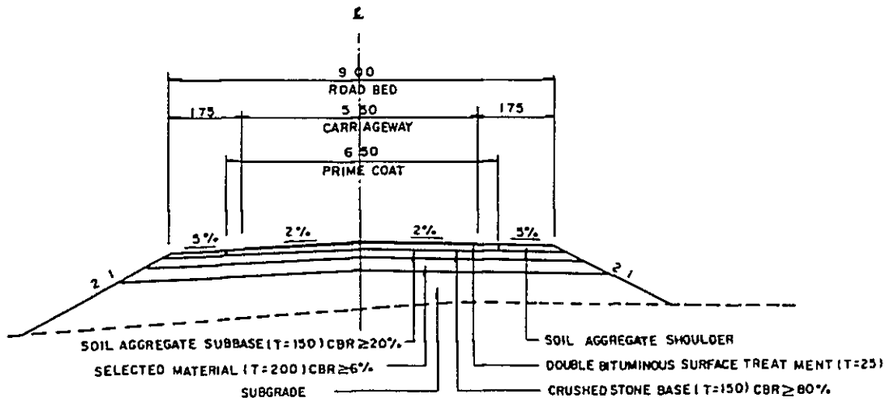
Figure 29.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE



FILL SECTION

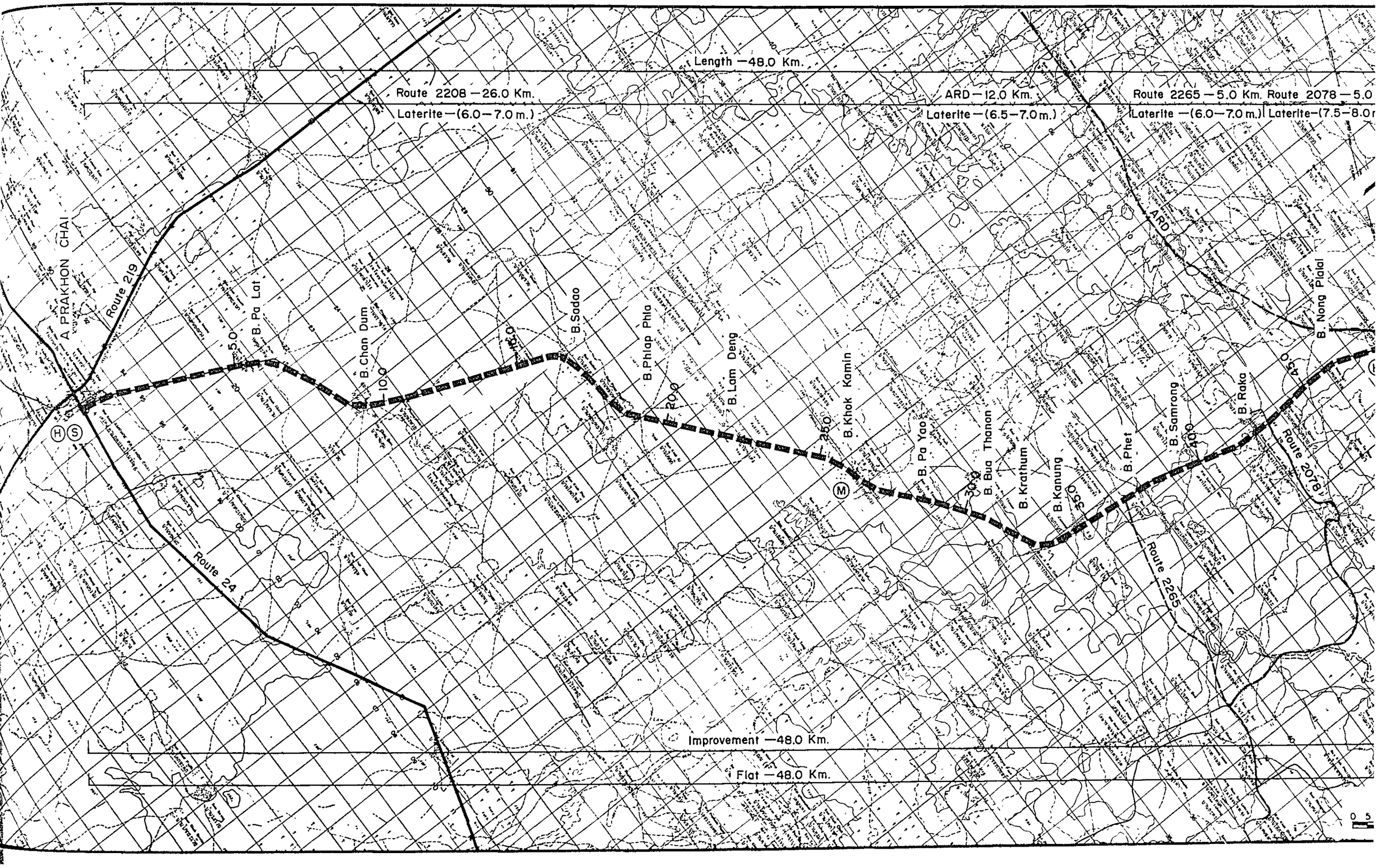


CUT SECTION



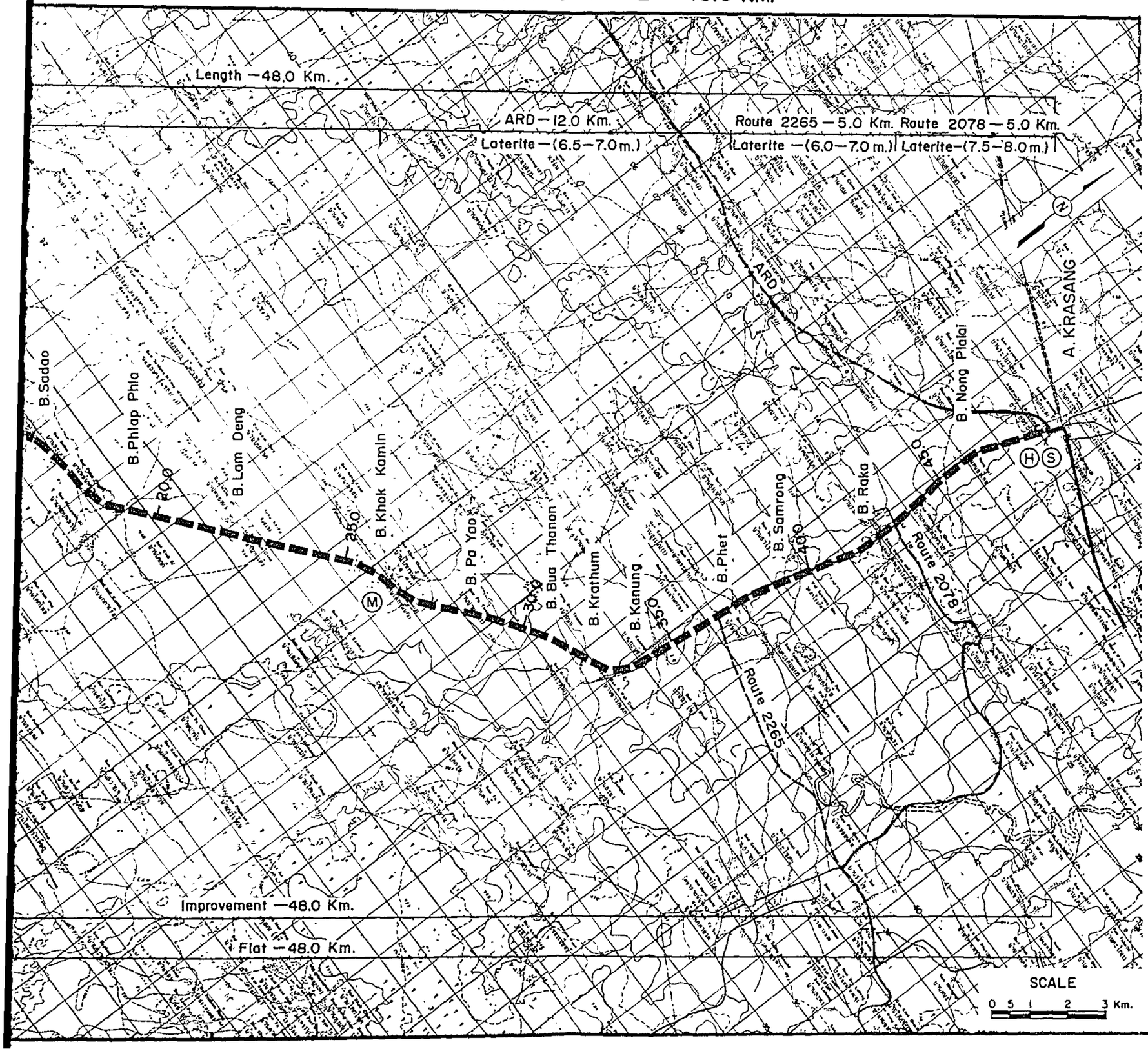
DOUBLE BITUMINOUS SURFACE TREATMENT (DBST) ROAD (Class F4)

Figure 29.5.2 **PROPOSED ROUTE NO. IM—29** | **C. BURI RAM** / C. SURIN | **A. PRAKHON CHAI (J.R. 24) — A. KRASANG** | ROUTE NO. 2208 + ARD + 2265 + 2078 | L = 48.0 Km.

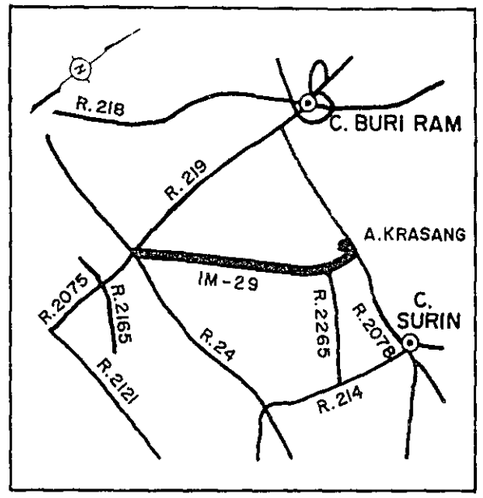


C. BURI RAM — A. PRAKHON CHAI (J.R. 24) — A. KRASANG

C. SURIN — ROUTE NO. 2208 + ARD + 2265 + 2078 — L = 48.0 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	3 2	C—7 00 x 24 00	W—4 30 x 21.30
2	4 1	C—7 00 x 14 .00	W—4 20 x 11.30
3	5.5	C—7.00 x 22 00	W—4 20 x 20 00
4	8.5	C—7.00 x 14 .00	W—4.20 x 12.00
5	9.6	C—7.00 x 28.00	W—4.30 x 25.10
6.	20 8	C—7.00 x 28 00	W—4.20 x 25.20
7.	21.8	C—7.00 x 14 .00	W—5.40 x 10.20
8	29.2	C—7.00 x 36.00	C —4.50 x 36 00
9	29 6	C—7 00 x 32 00	C —4 50 x 32.00
10	37.1	C—7 00 x 12.00	C —4.50 x 12.00
11.	37.2	C—7 00 x 22.00	C —4.50 x 22 00

LEGEND

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

Table 29.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-29 (48.0 km)

Items	Unit of Q'ty	Financial Unit Rate ฿	(DBST) Q'ty	(DBST) Financial Cost (10^3฿)	(DBST) Economic Cost (10^3฿)
DIRECT CONSTRUCTION COST					
Clearing and Grubbing	ha	15,000	113	1,695	1,542
Excavation - Soil	m^3	20	0	0	0
Excavation - Hard Rock	m^3	160	0	0	0
Embankment	m^3	45	150,200	6,759	6,150
Selected Material	m^3	80	99,600	7,968	7,091
Soil Aggregate Surface or Subbase	m^3	105	69,800	7,329	6,522
Crushed Stone Base	m^3	370	45,800	16,946	15,590
Soil Aggregate Shoulder	m^3	105	19,700	2,068	1,840
Prime Coat and DBST	m^2	55	258,500	14,218	12,796
Pipe Culvert	m	2,100	1,850	3,885	3,574
Box Culvert	m	16,000	0	0	0
Long Span Bridge	m	80,000	0	0	0
Short Span Bridge	m	40,000	246	9,840	8,757
Sub Total (a)				70,709	63,867
Miscellaneous Works (a) x 7%				4,950	4,471
Total (b)				75,659	68,338
PHYSICAL CONTENGENCY (b) x 15%				11,349	10,251
ENGINEERING AND ADMINISTRATION (b) x 10%				7,566	6,834
Sub Total				18,915	17,085
LAND ACQUISITION					
Highly Developed Land	ha	50,000	18	900	900
Less Developed Land	ha	15,000	0	0	0
Sub Total				900	900
GRAND TOTAL				95,474	86,323

Table 29.6.1 COST AND BENEFITS

(F4 STANDARD)

(1000 BAHT)

YEAR	COST CONST. COST	BENEFITS AGRI. BENEFIT	BENEFITS VOC SAVING	BENEFITS RMC SAVING	BENEFITS TOTAL	DISCOUNTED(12%) COST	DISCOUNTED(12%) BENEFIT
1984	17,245	0	0	0	0	24,228	0
1985	43,111	0	0	0	0	54,078	0
1986	25,867	0	0	0	0	28,971	0
1987	0	1,311	7,979	-47	9,244	0	8,253
1988	0	1,869	8,597	-30	10,436	0	8,319
1989	0	2,426	9,215	-14	11,628	0	8,276
1990	0	2,984	9,833	3	12,820	0	8,147
1991	0	3,541	10,451	19	14,012	0	7,951
1992	0	4,099	11,069	36	15,204	0	7,703
1993	0	4,656	11,687	52	16,396	0	7,417
1994	23,232	5,160	12,633	77	17,870	10,509	7,217
1995	0	5,664	13,579	102	19,345	0	6,976
1996	0	6,168	14,524	127	20,819	0	6,703
1997	0	6,672	15,470	151	22,294	0	6,409
1998	0	7,176	16,416	176	23,768	0	6,101
1999	0	7,680	17,362	201	25,243	0	5,785
2000	0	8,184	18,308	226	26,717	0	5,467
2001	-40,194	8,688	19,254	250	28,192	-7,343	5,151
TOTAL	69,261	76,279	196,377	1,331	273,987	110,443	105,875

DISCOUNTED ECONOMIC COSTS :	110,443
DISCOUNTED ECONOMIC BENEFITS :	105,875
AGRICULTURAL DEVELOPMENT BENEFIT	27,370
VOC SAVING	78,190
RMC SAVING	315
NET PRESENT VALUE :	-4,568
BENEFIT COST RATIO :	0.96
INTERNAL RATE OF RETURN :	11.5 %

Table 29.7.1 SOCIAL INDICATORS

(Proposed Route IM-29)

Population (1,000)	
1982	: 59.8
1993	: 71.8
Average travelling speed, without (kph)	: 48
Isolation	
Access to Amphoe	
Average distance to Amphoe (km) 1/	: 12.0
Per capita time savings (10^{-4})	: 0.012
Score	: 35
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	: 1
Impassability per year	: 0.019
Impassability per capita (10^{-4})	: 0.003
Score	: 25
Health	
Access to Hospital	
Average distance to Hospital (km) 1/	: 12.0
Per capita time savings (10^{-4})	: 0.012
Score	: 28
Access to Medical Facilities	
Average distance to facilities (km) 1/	: 7.3
Per capita time savings (10^{-4})	: 0.007
Score	: 28
Education	
Access to Secondary School	
Number of Student in 1993 (1,000) 2/	: 14.4
Average distance to school (km)	: 12.0
Per capita time savings (10^{-4})	: 0.058
Score	: 31
Teacher Intensity	
Number of teachers 3/	
University graduate	: -
Total	: 13
Number of Student	: 440
Indicators	
E1 4/	: -
E2 5/	: 29.5
E 6/	: 29.5
Degree of Improvement 7/	: 2.32
Score	: 148
Disparity	
G.P.V. in 1993 (Mn B) 8/	
With project	: 153.5
Without project	: 140.0
Per capita G.P.V. in 1993 (B)	
With project (W)	: 2,138
Without project (w)	: 1,950
Degree of Disparity	
(A/W) - (A/w) 9/	: 0.13
Score	: 232
Total Score	: 527

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.