

PROPOSED ROUTE NO. IM - 22

Changwat · Ubon Ratchathani

A. Khemarat - B. Huasa Phan (J.R.217)

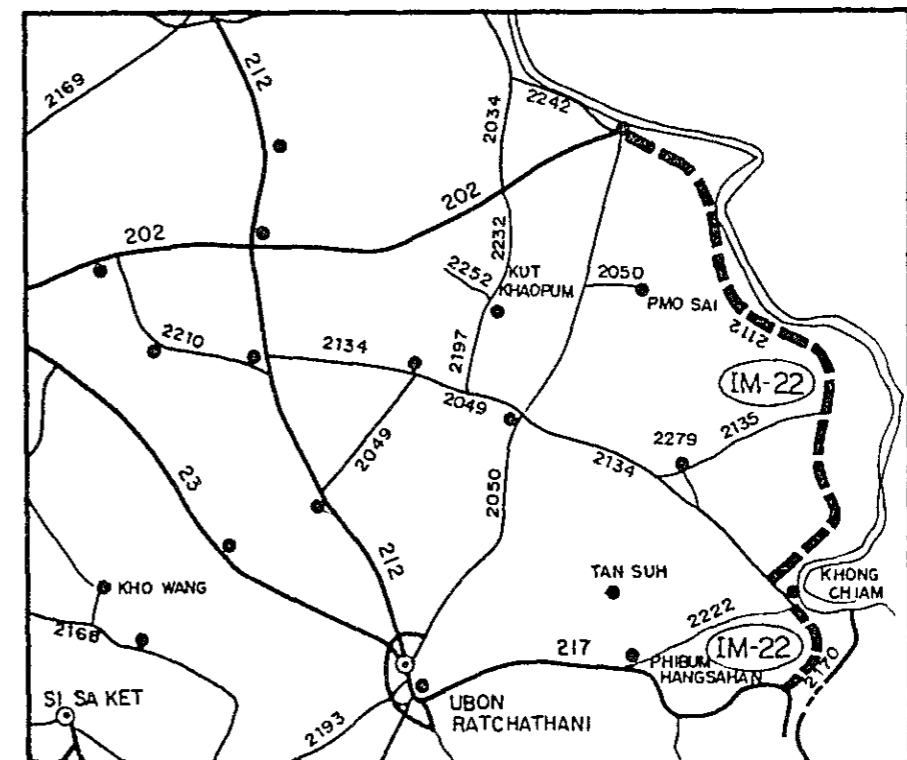
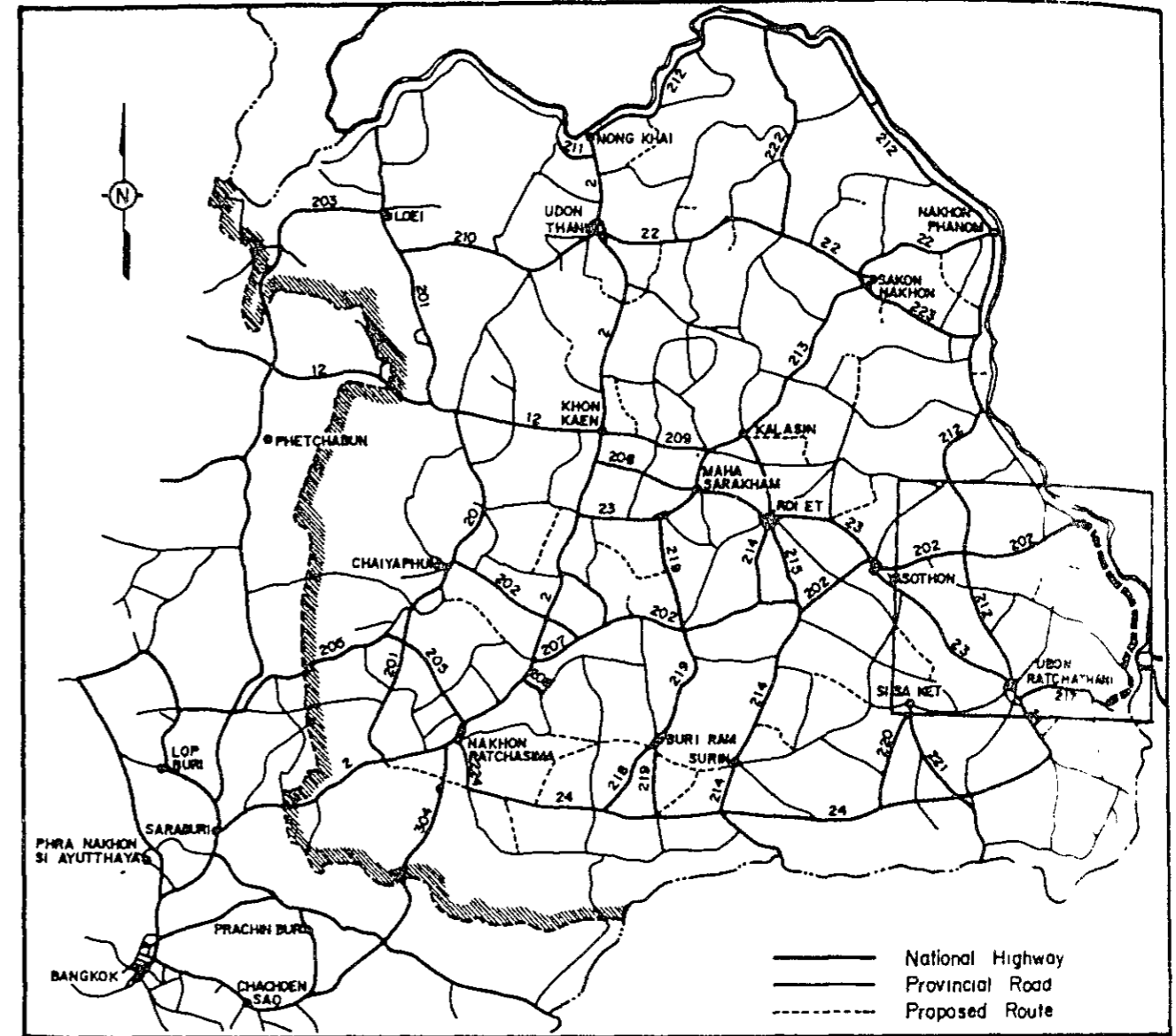
Length · 122.4 KM.

SUMMARY

PROPOSED ROUTE IM-22

Item	Description
Changwat	Ubon Ratchathani
Origin	A. Khemarat
Destination	B. Huasa Phan (J.R.217)
Length	
Total	122.4 km
Improvement Section	122.4 km
DOH Road	R.2112, R.2173 122.4 km
ARD Road	0 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Good - Poor
Terrain	Rolling and Mountainous
Influence Area	
Area	891 km ²
Population (1982)	18,100
Principal Crops	Paddy
Traffic (ADT)	
Existing	83
1993	381
2001	538
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	217,108 . 10 ³ ₪
Economic	196,082 . 10 ³ ₪
IRR	4.5 %
B/C	0.48
Social Impact	High
Recommendation	For further consideration

LOCATION OF PROPOSED ROUTE



1. GENERAL

1.1 Characteristics of the Route

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

The route, starting at Amphoe Khemarat, runs southeastward passing through Ban Si Yark, Ban Nam Thoeng and Amphoe Khong Chiam and ends at Ban Huasa Phan. Its total length is 122.4 km. (Figure 22.5.2)

The terrain is almost rolling, while there are two mountainous sections. In the influence area, there exists several villages with total population of 18,100. There are only one medical center at Ban Na Pho and one secondary school at Ban Saitong which is the origin of the route.

The route, passing through the national border line, is so important for the defense of the Kingdom.

1.2 Condition of Existing Road

Condition of existing roads to be utilized for the proposed route is summarized in Table 22.1.1.

The details are shown as the results of inventory survey in Table 22.1.2.

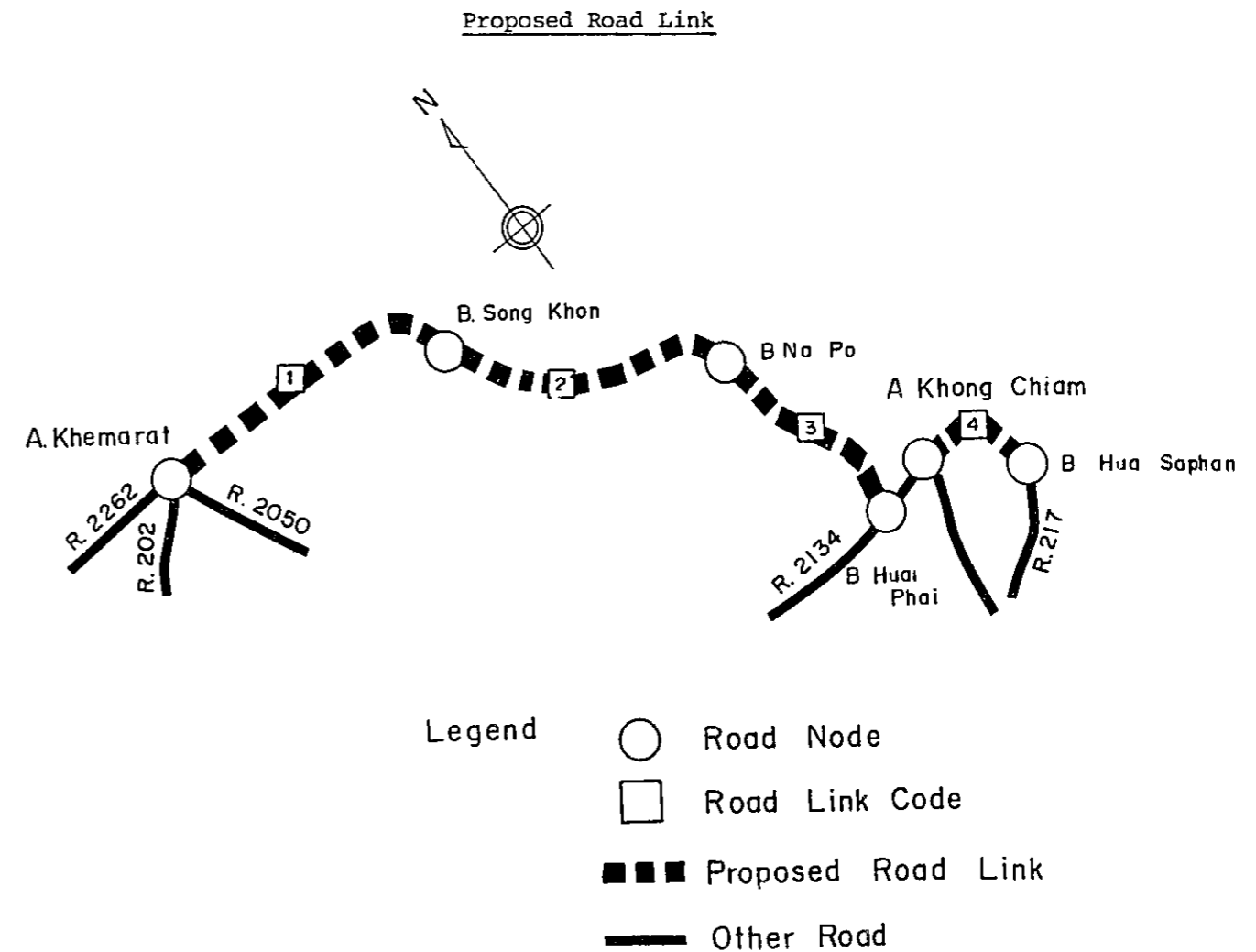
2. TRAFFIC

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 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/}	22	13	26	31	22	2	7	10	1	134
	2	n.a.									
	3 ^{2/}	1	3	4	5	2	-	2	3	-	20
	4 ^{3/}	67	36	29	35	-	6	18	-	-	191

Manual Counts (1982)	1	n.a.									
	2	-	13	15	5	3	2	-	14	1	52
	3	-	26	4	8	-	1	1	2	-	42
	4	n.a.									

Estimated	1	22	13	26	31	22	2	7	10	1	134
	2	-	13	15	5	3	2	-	14	1	52
	3	1	15	4	7	1	1	2	3	-	27
	4	67	36	29	35	-	6	18	-	-	191

Note: ^{1/} Route 2112 Station 0100 Station Km 24+000
^{2/} Route 2112 Station 0300 Station Km 99+600
^{3/} Route 2173 Station 0100 Station Km 6+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 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	1982
2	486
3	274
4	1479

FREIGHT MOVEMENT (1982)

PROPOSED ROAD LINK	TONNAGE PER DAY		
	NON-AGRI.	AGRI.	TOTAL
1	23	13	37
2	20	11	32
3	5	3	9
4	11	6	17

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	5.9

GROWTH RATE OF FREIGHT MOVEMENT

ITEM	GROWTH RATE (% P.A.)		
	1981	1987	1993
	1987	1993	2001
NON-AGRI. AGRICULTURE	7.5 0.5	7.6 0.3	7.7 0.3
FREIGHT	5.0	5.0	5.0

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	19.3	11.4	22.8	27.2	19.3	10.0	35.0	50.0	5.0
	1987	16.6	17.2	22.4	26.9	17.0	12.1	29.3	45.5	13.1
	1993	13.9	23.0	21.9	26.6	14.6	14.2	23.6	41.0	21.2
	2001	10.2	30.8	21.3	26.2	11.5	17.0	16.0	35.0	32.0
2	1982	0.0	36.1	41.7	13.9	8.3	12.5	0.0	87.5	0.0
	1987	2.7	34.7	36.3	17.1	9.2	13.7	4.2	73.7	8.4
	1993	5.9	33.0	29.9	21.0	10.2	15.1	9.3	57.1	18.5
	2001	10.2	30.8	21.3	26.2	11.5	17.0	16.0	35.0	32.0
3	1982	4.8	38.1	19.0	33.3	4.8	16.7	33.3	50.0	0.0
	1987	6.3	36.5	19.5	31.2	6.4	16.8	28.8	46.1	8.4
	1993	8.2	34.6	20.0	28.7	8.4	16.9	23.3	41.3	18.5
	2001	10.7	32.1	20.6	25.4	11.1	17.0	16.0	35.0	32.0
4	1982	40.1	21.6	17.4	21.0	0.0	25.0	75.0	0.0	0.0
	1987	32.7	29.0	16.3	19.8	2.2	22.6	57.3	10.5	9.6
	1993	25.3	36.4	15.2	18.6	4.5	20.2	39.6	21.0	19.2
	2001	15.4	46.3	13.8	17.0	7.5	17.0	16.0	35.0	32.0

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 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	1.3	1.3

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 22.2.1.

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	18	24	25	12	28	4	9	2	121	173	294
1993	22	33	37	17	46	3	8	3	169	212	381
2001	28	49	60	26	87	3	7	6	267	272	538

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:

3. AGRICULTURAL DEVELOPMENT

3.1 Present Condition

The cultivated land in the area of influence is limited because the route passes along the coast of Mekong river and mountainous areas. In the northern part, almost all cultivated land is covered by paddy fields. On the other hand, in the central and southern areas, the cultivated land are covered mainly by upland crops such as kenaf, cassava and ground nut. Unused cultivable land, mainly for upland field, remains in the central and southern parts of the area.

Land use and capability conditions in the area of influence are shown in Table 22.3.1 and Figure 22.3.1.

A typical cropping calendar in the Ubon Ratchathani area is shown in Figure 22.3.2.

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 22.3.2.

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 22.3.3.

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 22.3.4. 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>Without Project</u>				<u>With Project</u>				
<u>Link</u>		<u>Length</u>	<u>Nos. of</u>	<u>Nos. of</u>	<u>Length</u>	<u>Road Class</u>			<u>Nos. of</u>	
<u>No.</u>	<u>Terrain</u>	<u>(Km)</u>	<u>Class</u>	<u>Bridge</u>	<u>(Km)</u>	<u>Case 1</u>	<u>Case 2</u>	<u>Case 3</u>	<u>Wooden</u>	
									<u>Narrow</u>	
									<u>Bridge</u>	
1	Rolling	36.0	3	5	0	36.0	1		0	
2	Rolling & Mountainous	42.5	2B	7	0	42.5	1 (F4)	2A	2A (F5)	0
3	Rolling	31.7	2B	6	0	31.7		2A		0
4	Rolling	12.2	3	2	0	12.2		1		0

/1 Road 1 : Paved Road

Road 2A : Laterite Road with good surface condition and alignment

Road 2B : Laterite Road with good surface condition but poor alignment

Road 3 : Laterite Road with poor surface condition and alignment

Road 4 : Earth Road

VOC 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)	11,981	17,339	27,897
1+2A (F4+F5)	10,815	15,783	25,549
2A (F5)	7,725	11,415	18,489

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 22.5.1

Minimum Height of Embankment

Ordinary Section : 1.0m
 Approach of Bridge in Flat Area : 2.0m
 Flood Section : 0.7m (above flood level)

Pavement Structure

In case of F4 Standard

DBST : 2.5cm
 Crushed Stone Base CBR_>80% : 15.0cm
 Soil Aggregate Subbase CBR_>20% : 15.0cm
 Selected Material CBR_≥6% : 20.0cm

In case of F5 Standard

Soil Aggregate Surface CBR_≥20% : 15.0cm
 Selected Material CBR_≥6% : 20.0cm

Pipe Culvert

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

Box Culvert

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

Bridge

Standard Type (width 7.0m)
 Short Span Bridge : RC - Slab
 Long Span Bridge : PC - Girder
 Location : as shown in Bridge List
 in Figure 22.5.2

Alignment of the route is shown in Figure 22.5.2.

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 22.5.1.

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 g)		Remark
		Financial Cost	Economic Cost	
F4 (DBST)	122.4	217,108	196,082	
F5 (Soil Aggregate)	122.4	116,559	106,625	
F4 + F5	122.4	153,492	138,215	
F4	48.2	86,098	77,780	Adopted to link \geq 300 in ADT
F5	74.2	67,396	60,436	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 22.6.1, 22.6.2, 22.6.3.

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 22.7.1. Social impacts of the proposed route are considerably high.

Table 22.1.1 SUMMARY OF ROAD INVENTORY

Item	Description	
Origin	A. Khemarat	
Destination	B. Huasa Phan (J.R. 217)	
Length		
Total		122.4 km
Improvement Section	122.4 km	
DOH Road	R. 2112, R. 2173	122.4 km
ARD Road		0 km
Others		0 km
New Alignment Section	0 km	
Terrain	Rolling and Mountainous	
Alignment (Hori./Vert.)	Fair and Partially Poor	
Formation Width	5.0 m - 7.0 m, 5.7 m (Weighted average)	
Embankment Section		
Length		119.4 km
Height	0.2 m -	1.5 m
Cut Section		
Length		3.0 km
Depth	0.3 m -	m
Surface Type and Condition		
SBST or DBST	Poor	0.7 km
Soil Aggregate	Good - Poor	121.7 km
Earth		0 km
Pipe Culvert	122 each	
Box Culvert	1 each	20.0 m
Bridge		
Permanent Bridge	6 each	304.0 m
Narrow Concrete Bridge	0 each	0 m (4m)
Wooden Bridge	11 each	155.0 m
Overflow Section	0 place	0 km

Table 22.1.2 ROAD INVENTORY (1)

PROPOSED ROUTE NO. IM-22

ROUTE NO. 2112

A. KHEMARAT ~ B. HAUSA PHAN (J.R. 217)

L = 110.2 Km

C. UBON RATCHATHANI

STATION (Km)		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30		
VILLAGE																			
- Name				B. SAITHONG		B. BUNG KHOUNG			B. PHANASAYAM (KHUNNAMTHIANG)		B. THANG KHONG		B. DONNIN		B. PAK SAENG		B. SEE YAEK		
- Household (H)				H = 45		H = 55			H = 12		H = 15		H = 30		H = 64		H = 13		
- Population (P)				P = 225		P = 275			P = 60		P = 75		P = 150		P = 320		P = 65		
TERRAIN									Rolling										
CROSS SECTION	Formation Width (m)								7.00										
	Embankment Height (m)	1.00	2.00	1.00		0.50	1.00	0.40		1.00		0.60			1.00	0.60	1.00		
	Cutting Depth (m)																		
PAVEMENT	Type/Length	DT		Laterite				DT				Laterite							
	Condition								Poor										
FLOODING	Overflow Length(Km)/Height(m)																		
LAND USE	Left		Paddy					Forest			Paddy		Forest			Paddy	Forest		
	Right		Paddy					Forest			Paddy		Forest			Paddy	Forest		
PIPE CULVERT	Total Number								113 pipes										
BOX CULVERT & BRIDGE	Station (Km)		1.6	4.1	6.4	8.7		11.6			18.4		22.0	23.9			29.3		
	Dimension		C-Box 2-3.60 x 3.70 x 20.00	W-Br. 4.20 x 24.80	W-Br. 4.30 x 20.20	C-Br. 9.00 x 46.00		C-Br. 9.00 x 35.00			W-Br. 4.20 x 10.20		C-Br. 9.20 x 128.00	W-Br. 4.30 x 10.20			C-Br. 10.00 x 100.00		
RIGHT OF WAY (m)																			
ALIGNMENT	Horizontal								Fair										
	Vertical								Fair										
ROUTE NO., AGENCIES		DOH 2050							DOH 2112										

ROAD INVENTORY (2)

PROPOSED ROUTE NO. IM-22

ROUTE NO. 2112

A. KHEMARAT B. HAUSA PHAN (J.R. 217) (Cont'd)

L = 110.2 Km.

C. UBON RATCHATHANI

STATION (Km)		30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60								
VILLAGE		B. NAPHTIANG H = 5 P = 275																							
- Name																									
- Household (H)																									
- Population (P)																									
TERRAIN		Rolling														Mountainous									
CROSS SECTION	Formation Width (m)	7.00		8.00																					
	Embankment Height (m)	0.30		0.60		1.20		1.00		0.60		1.00		0.60		1.00									
	Cutting Depth (m)			0.30																					
PAVEMENT	Type/Length	Laterite																							
	Condition	Poor							Good																
FLOODING	Overflow Length(Km)/Height(m)																								
LAND USE	Left	Forest				Paddy		Forest		Paddy		Forest													
	Right	Forest				Paddy		Forest		Paddy		Forest													
PIPE CULVERT	Total Number																								
BOX CULVERT & BRIDGE	Station (Km)			34.9		37.2		38.5		39.4		44.1		48.8		50.1		53.4		58.0		58.6		59.4	
	Dimension			W-Br. 4.20 x 23.20		W-Br. 4.20 x 14.00		W-Br. 4.20 x 26.00		C-Br. 9.00 x 77.50		W-Br. 4.20 x 15.50		C-Br. 9.00 x 24.00		C-Br. 9.00 x 56.00		C-Br. 9.00 x 27.00		C-Br. 9.00 x 39.00		C-Br. 9.00 x 16.00		C-Br. 9.00 x 25.00	
RIGHT OF WAY (m)																									
ALIGNMENT	Horizontal	Fair																							
	Vertical	Fair														Poor									
ROUTE NO., AGENCIES		DOH 2112																							

ROAD INVENTORY (3)

PROPOSED ROUTE NO. IM-22

ROUTE NO. 2112

A. KHEMARAT ~ B. HAUSA PHAN (J.R. 217) (Cont'd)

L = 110.2 Km

C. UBON RATCHATHANI

STATION (Km)		60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90		
VILLAGE																			
- Name																			
- Household (H)																			
- Population (P)																			
TERRAIN		Mountainous			Rolling		Mountainous					Rolling							
CROSS SECTION	Formation Width (m)											8.00							
	Embankment Height (m)					1.00								1.50					
	Cutting Depth (m)																		
PAVEMENT	Type/Length											Laterite							
	Condition											Good							
FLOODING	Overflow Length(Km)/Height(m)																		
LAND USE	Left						Forest					Paddy			Forest				
	Right						Forest					Paddy			Forest				
PIPE CULVERT	Total Number																		
BOX CULVERT & BRIDGE	Station (Km)	60.9	63.2	64.3	66.6	68.3	69.6	72.5				76.9	77.4			81.3	84.2	89.9	
	Dimension	C-Br. 9.00 x 30.00	W-Br. 4.00 x 10.20	C-Br. 9.00 x 29.00	C-Br. 9.00 x 28.00	W-Br. 4.00 x 15.30	W-Br. 4.00 x 15.00			W-Br. 4.00 x 19.00				C-Br. 9.00 x 75.0	C-Br. 9.00 x 15.00			C-Br. 9.00 x 59.00	W-Br. 4.00 x 10.20
RIGHT OF WAY (m)																			
ALIGNMENT	Horizontal																	Fair	
	Vertical	Fair	Poor	Fair	Poor						Fair					Poor	Fair		
ROUTE NO., AGENCIES																		DOH 2112	

ROAD INVENTORY (4)

PROPOSED ROUTE NO. IM-22

ROUTE NO. 2112

A. KHEMARAT ~ B. HAUSA PHAN (J.R. 217) (Cont'd)

L = 110.2 Km.

C. UBON RATCHATHANI

STATION (Km)		90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	
VILLAGE																		
- Name																		
- Household (H)																		
- Population (P)																		
TERRAIN		Rolling																
CROSS SECTION	Formation Width (m)	8.00																
	Embankment Height (m)	1.50																
	Cutting Depth (m)	1.20																
PAVEMENT	Type/Length	Laterite																
	Condition	Good																
FLOODING	Overflow Length(Km)/Height(m)																	
LAND USE	Left	Forest																
	Right	Forest																
PIPE CULVERT	Total Number																	
BOX CULVERT & BRIDGE	Station (Km)		92.8	94.0					104.6		107.2		110.1					
	Dimension		W-Br. 4.20 x 20.00	W-Br. 4.00 x 20.20					C-Br. 8.00 x 70.00		W-Br. 4.30 x 15.00		W-Br. 4.00 x 15.00					
RIGHT OF WAY (m)																		
ALIGNMENT	Horizontal	Fair																
	Vertical	Fair																
ROUTE NO., AGENCIES		DOH 2112																

ROAD INVENTORY (5)

PROPOSED ROUTE NO. IM-22

ROUTE NO. 2173

B. HINLAD ~ B. HUASA PHAN (J.R. 217)

UBON RATCHATHANI

L = 12.2 Km.

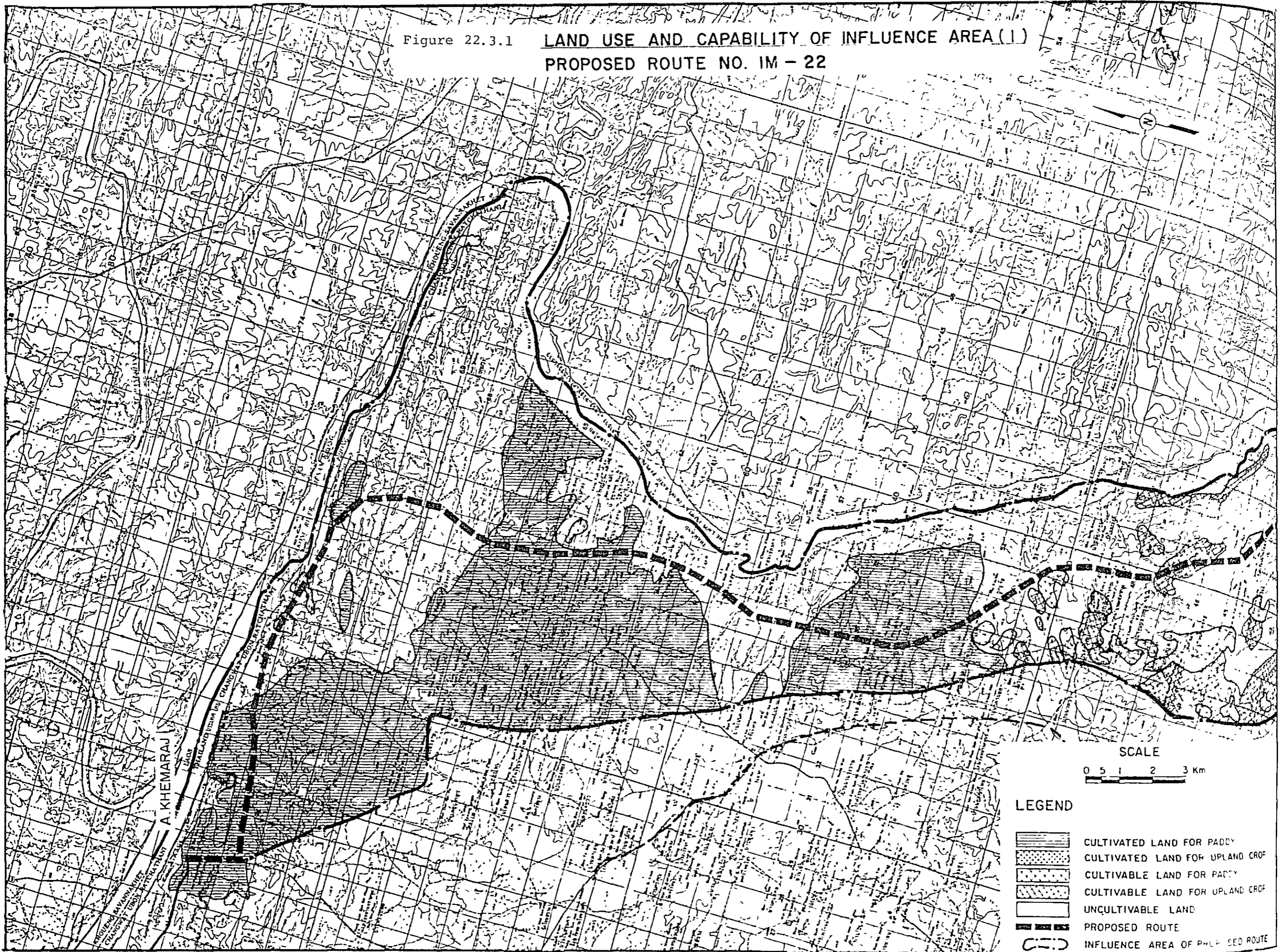
STATION (Km)		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	
VILLAGE																		
- Name																		
- Household (H)																		
- Population (P)																		
TERRAIN		Rolling																
CROSS SECTION	Formation Width (m)	5.0			6.0													
	Embankment Height (m)	0.30			0.50		0.30		1.00		0.30							
	Cutting Depth (m)																	
PAVEMENT	Type/Length	Laterite																
	Condition	Poor																
FLOODING	Overflow Length(Km)/Height(m)																	
LAND USE	Left				Forest			Orchard										
	Right				Forest			Orchard										
PIPE CULVERT	Total Number	9 pipes																
BOX CULVERT & BRIDGE	Station (Km)	2.2			7.1		8.9		10.3									
	Dimension	W-Br. 4.00 x 29.30			C-Br. 9.00 x 29.00		W-Br. 4.40 x 10.50		C-Br. 9.00 x 56.00									
RIGHT OF WAY (m)																		
ALIGNMENT	Horizontal	Fair																
	Vertical	Fair																
ROUTE NO., AGENCIES		DOH 2173																

Table 22.2.1 TRAFFIC VOLUME ON ROUTE IM - 22

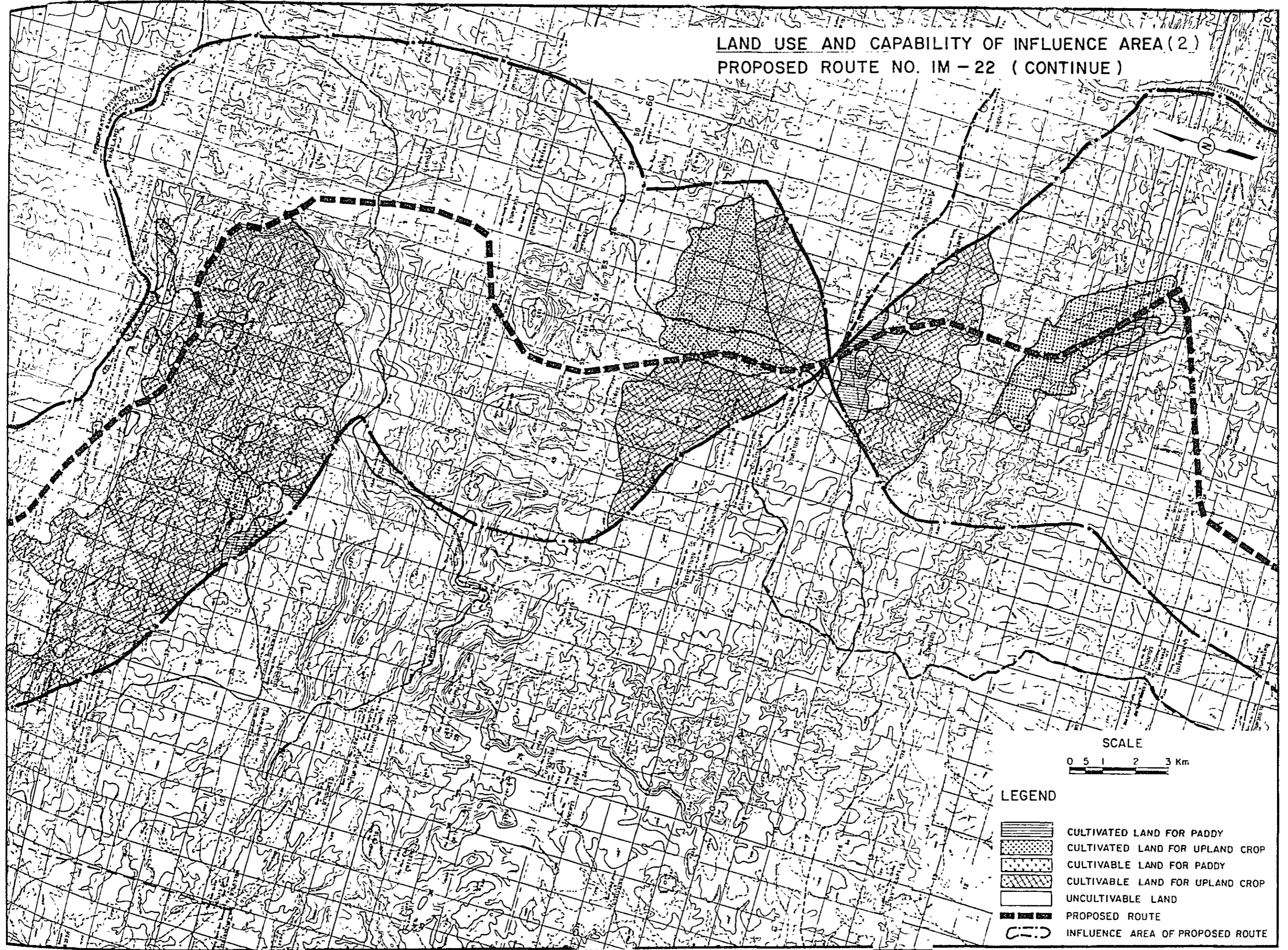
YEAR	1987					1993					2001					
	LINK	1	2	3	4	AVR.	1	2	3	4	AVR.	1	2	3	4	AVR.
P/C	N+D	26	1	2	68	15	33	4	3	71	19	42	10	6	64	24
	I	4	0	0	10	2	5	1	0	11	3	6	2	1	10	4
	DV	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0
	TOTAL	30	1	2	79	18	38	4	4	82	22	49	12	7	74	28
L/B	N+D	36	17	5	34	21	52	19	8	43	28	87	21	12	57	42
	I	5	3	1	5	3	8	3	1	6	4	13	3	2	9	6
	DV	0	0	0	0	0	1	0	0	1	0	1	0	0	1	1
	TOTAL	41	20	6	39	24	61	23	9	50	33	102	25	14	67	49
M/B	N+D	43	8	9	41	22	63	14	11	52	31	107	26	15	71	52
	I	6	1	1	6	3	10	2	2	8	5	16	4	2	11	8
	DV	0	0	0	0	0	1	0	0	1	0	2	0	0	1	1
	TOTAL	49	9	10	48	25	74	16	13	61	37	125	31	17	82	60
H/B	N+D	27	4	2	5	10	35	7	3	12	15	47	12	6	31	23
	I	4	1	0	1	2	5	1	0	2	2	7	2	1	5	3
	DV	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
	TOTAL	31	5	2	5	12	40	8	4	15	17	55	13	8	36	26
P/P&T	N+D	30	19	11	64	24	58	24	14	104	39	130	34	20	194	75
	I	4	3	2	10	4	9	4	2	16	6	19	5	3	29	11
	DV	0	0	0	0	0	1	0	0	2	1	2	1	0	3	1
	TOTAL	34	21	13	73	28	67	28	16	121	46	152	40	23	226	87
4/T	N+D	6	1	2	8	3	5	2	1	5	3	4	3	1	2	3
	I	1	0	0	1	0	1	0	0	1	0	1	1	0	0	0
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	7	1	2	9	4	6	2	1	5	3	5	4	1	2	3
6/T	N+D	9	12	2	1	8	9	10	2	2	7	9	7	2	4	6
	I	1	2	0	0	1	1	2	0	0	1	1	1	0	1	1
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	10	14	3	2	9	10	12	3	3	8	10	9	2	5	7
10/T	N+D	3	1	0	1	1	4	3	1	2	3	8	7	2	4	6
	I	0	0	0	0	0	1	0	0	0	0	1	1	0	1	1
	DV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	3	2	1	1	2	5	4	1	3	3	9	8	2	4	6
ADT	N+D	179	63	33	223	105	259	83	43	291	145	434	122	64	426	229
	I	27	10	5	33	16	39	12	6	44	22	65	18	10	64	34
	DV	0	0	0	0	0	4	1	1	4	2	7	2	1	7	4
	TOTAL	206	73	38	256	121	302	97	50	339	169	506	142	74	496	267
M/C	N+D	241	117	71	273	157	303	142	88	318	193	397	186	118	383	250
	I	22	13	8	23	15	25	15	10	25	18	25	18	13	24	20
	DV	0	0	0	0	0	2	1	1	2	2	2	2	1	2	2
	TOTAL	264	130	79	296	173	330	159	99	345	212	425	206	132	410	272
TOTAL	N+D	420	181	104	495	263	562	225	131	608	338	831	308	182	809	479
	I	49	22	13	57	31	64	27	16	68	39	91	37	22	88	54
	DV	0	0	0	0	0	6	3	2	7	4	9	4	2	9	5
	TOTAL	469	203	117	552	294	632	255	149	683	381	931	348	206	906	538

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

Figure 22.3.1 **LAND USE AND CAPABILITY OF INFLUENCE AREA (I)**
PROPOSED ROUTE NO. IM - 22



LAND USE AND CAPABILITY OF INFLUENCE AREA (2)
 PROPOSED ROUTE NO. IM - 22 (CONTINUE)



SCALE
 0 5 1 2 3 Km

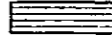

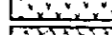
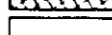

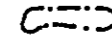

- LEGEND
-  CULTIVATED LAND FOR PADDY
 -  CULTIVATED LAND FOR UPLAND CROP
 -  CULTIVABLE LAND FOR PADDY
 -  CULTIVABLE LAND FOR UPLAND CROP
 -  UNCULTIVABLE LAND
 -  PROPOSED ROUTE
 -  INFLUENCE AREA OF PROPOSED ROUTE

Figure 22.3.2 CROPPING CALENDAR

1100 CHANGWAT _____ UBON RATCHATHANI _____

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

Note

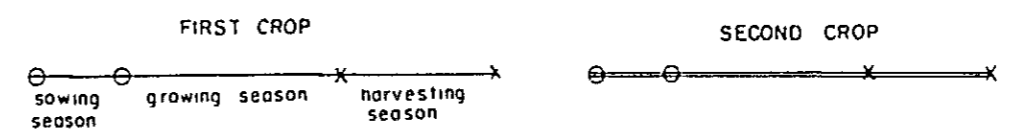


TABLE 22.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (KM²)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		72.500 (116.0)	11.875 (19.0)	84.375 (135.0)	4.500 (7.2)	63.438 (101.5)	67.938 (108.7)
1103	KHEMARAJ	65.625 (105.0)	0.625 (1.0)	66.250 (106.0)	3.750 (6.0)	42.500 (68.0)	46.250 (74.0)
1113	SI MUANG MAI	-	1.875 (3.0)	1.875 (3.0)	-	8.125 (13.0)	8.125 (13.0)
1114	KHONG CHIAM	6.875 (11.0)	9.375 (15.0)	16.250 (26.0)	0.750 (1.2)	12.813 (20.5)	13.563 (21.7)
1116	PIBUN MANGSAHAN	-	-	-	-	-	-

TABLE 22.3.2 CROP PRODUCTION

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)										
1981	69.59	-	-	0.69	3.20	-	8.01	-	11.92	81.51
1987	70.53	-	-	0.69	3.34	-	8.01	-	12.06	82.59
1993	70.53	-	-	0.69	3.48	-	8.01	-	12.20	82.73
	70.53	-	-	0.78	4.22	-	8.25	-	13.27	83.81
2001	70.53	-	-	0.69	3.68	-	8.01	-	12.40	82.93
	70.53	-	-	0.78	4.47	-	8.25	-	13.52	84.05
CROP YIELD (KG/RAI)										
1981	161.9	-	-	164.7	1888.2	-	146.0	-		
1987	162.8	-	-	164.7	1899.6	-	146.0	-		
1993	163.8	-	-	164.7	1911.0	-	146.0	-		
	166.8	-	-	165.7	1922.5	-	146.0	-		
2001	165.1	-	-	164.7	1926.3	-	146.0	-		
	172.2	-	-	167.0	1953.5	-	146.0	-		
CROP PRODUCTION (TON)										
1981	11,264	-	-	114	6,045	-	1,170	-	7,330	18,594
1987	11,485	-	-	114	6,341	-	1,170	-	7,627	19,111
1993	11,554	-	-	114	6,652	-	1,170	-	7,937	19,491
	11,763	-	-	129	8,120	-	1,205	-	9,456	21,219
2001	11,646	-	-	114	7,090	-	1,170	-	8,376	20,022
	12,145	-	-	130	8,725	-	1,205	-	10,062	22,207

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 22.3.3 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	-	-	8,693	577	-	4,664	-
WITH PROJECT (1987 - 2001)	3,835	-	-	8,693	591	-	4,783	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	414	-	-	1,024	677	-	641	-
WITH PROJECT (1987 - 2001)	425	-	-	1,044	708	-	641	-

TABLE 22.3.4 NET PRODUCTION VALUE

YEAR	(1000 BAHT)					
	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	13,741	2,007	15,748	14,036	2,115	16,151
1993	13,999	2,089	16,088	15,104	2,593	17,697
2001	14,346	2,207	16,553	16,568	2,788	19,356

Figure 22.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE

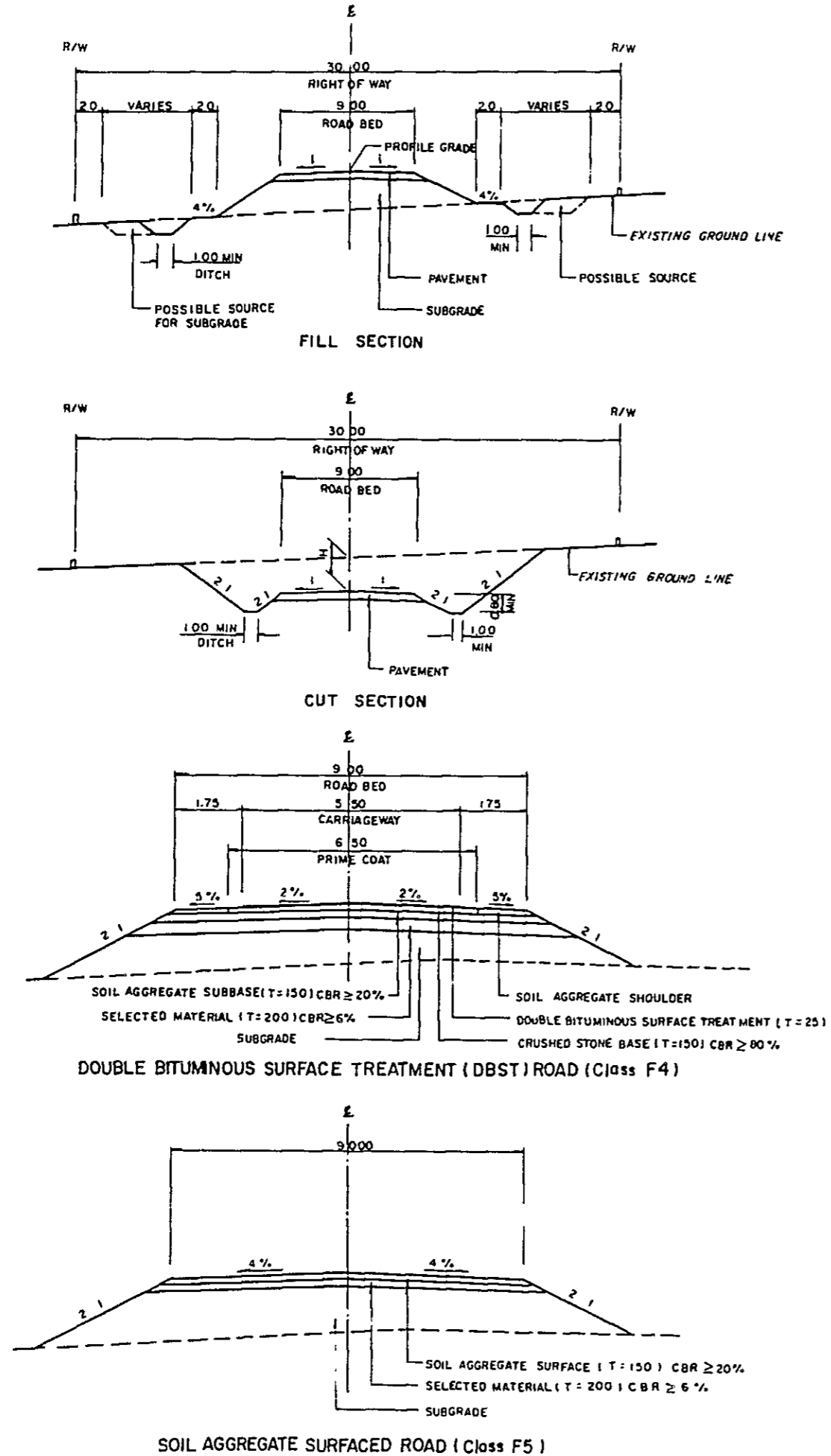
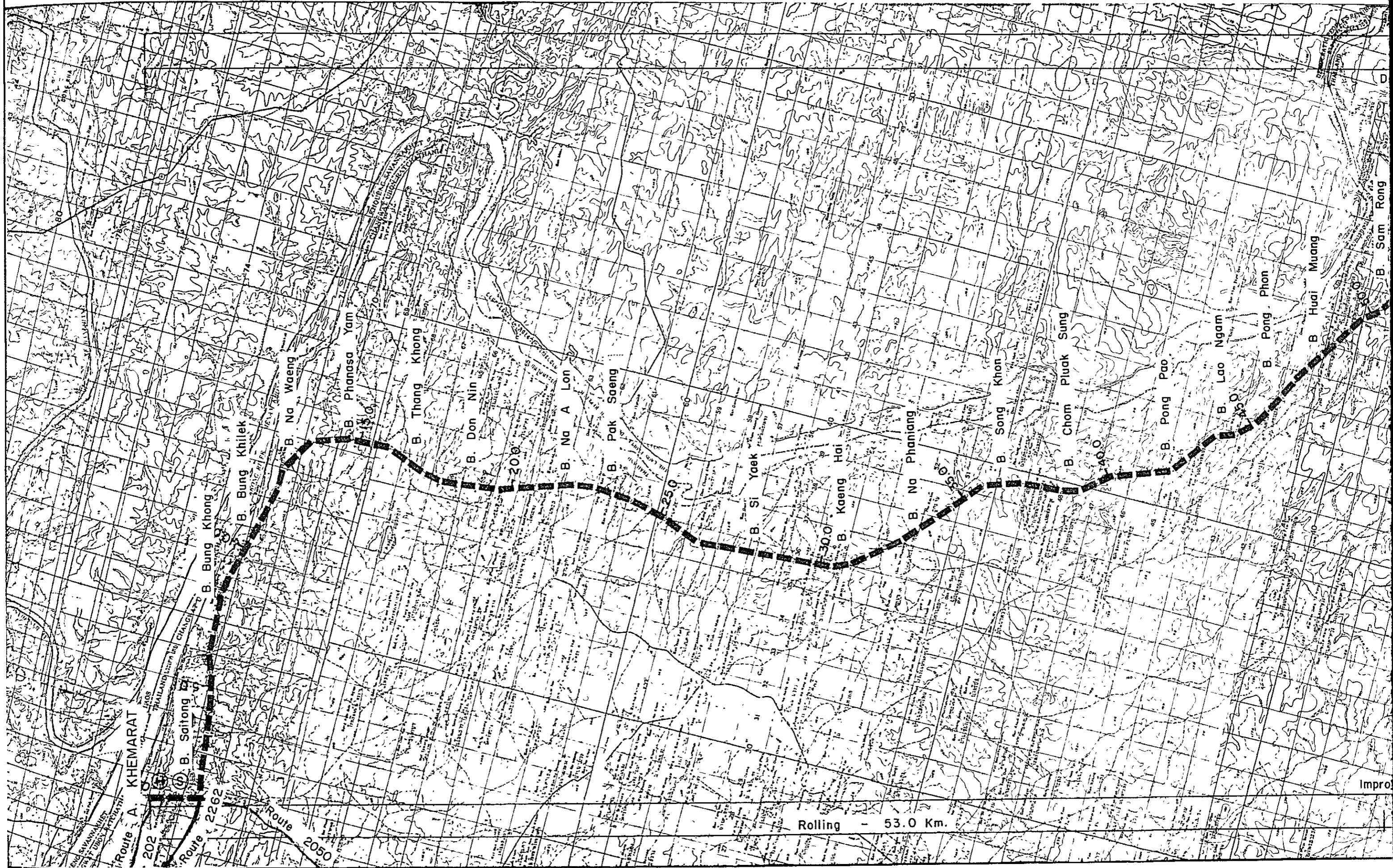
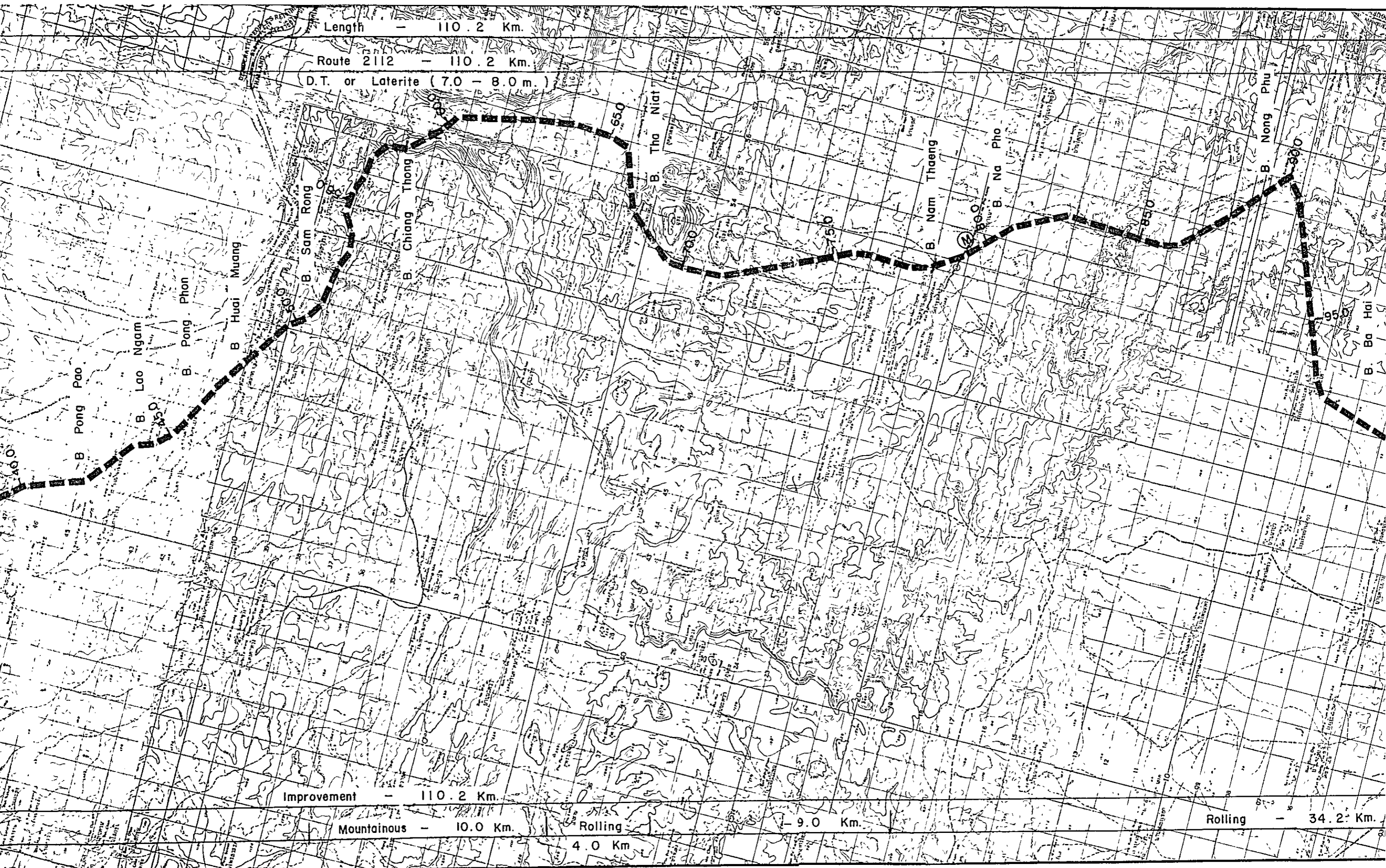


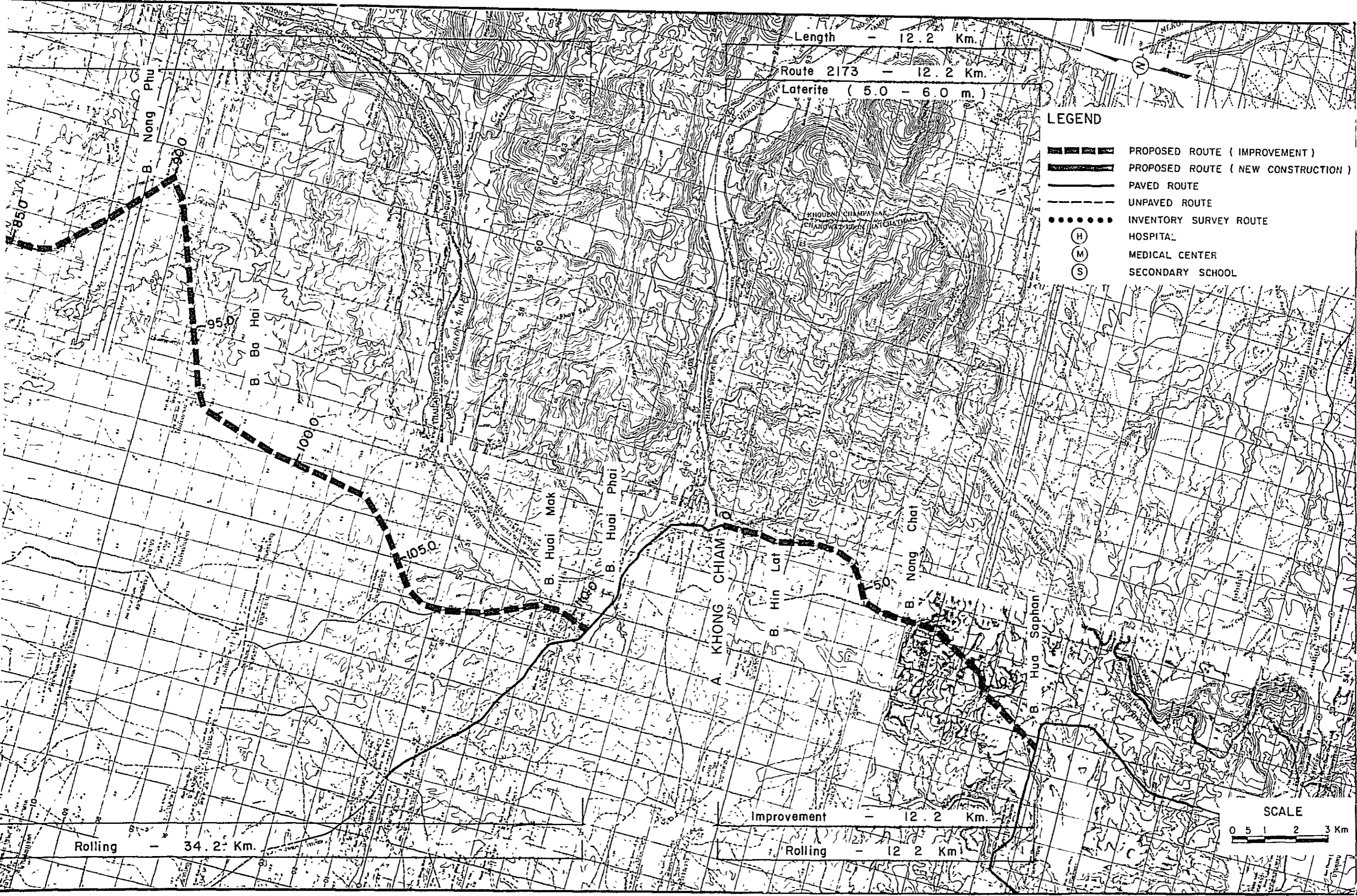
Figure 22.5.2 PROPOSED ROUTE NO.



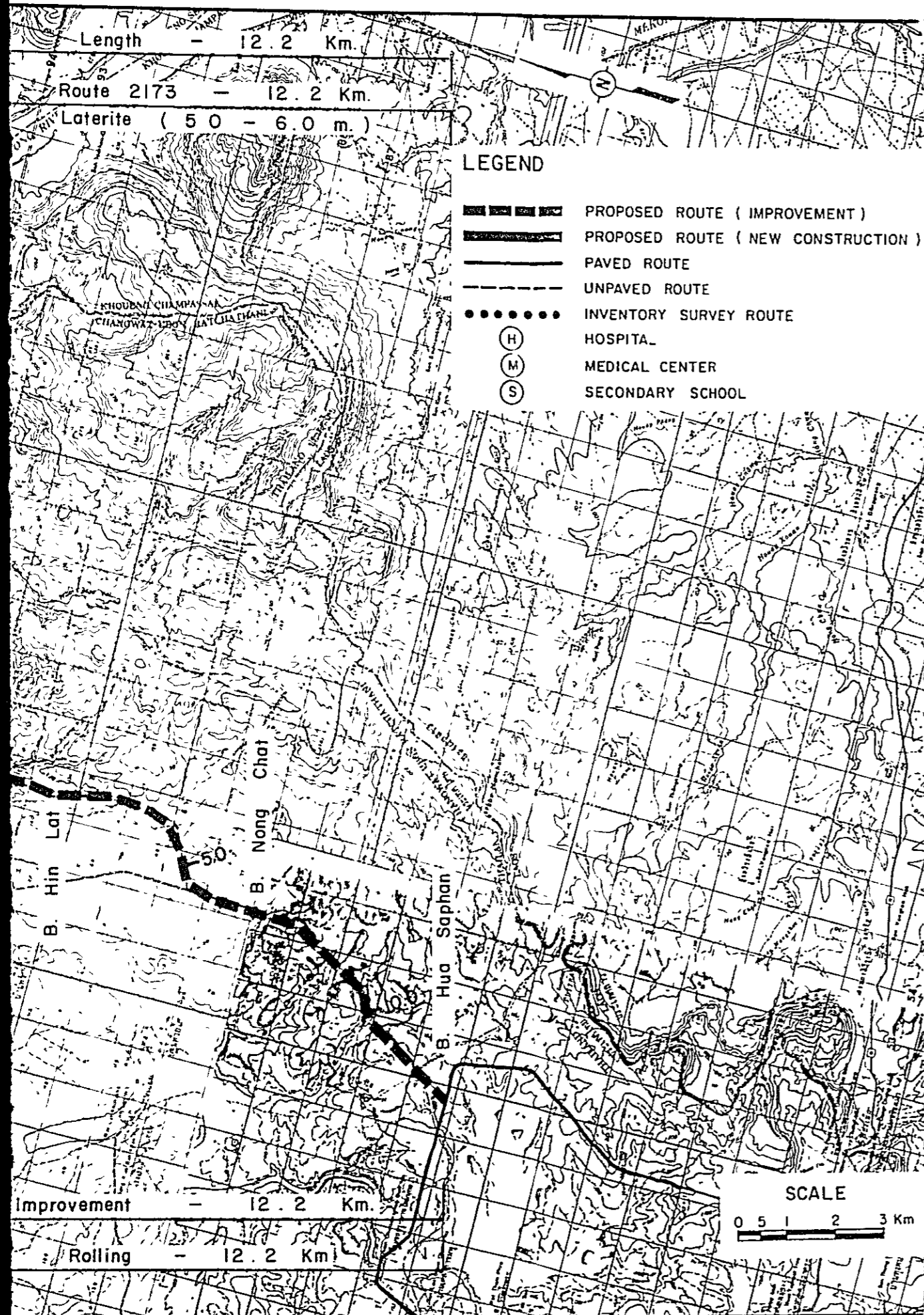
Rolling - 53.0 Km.

Impro

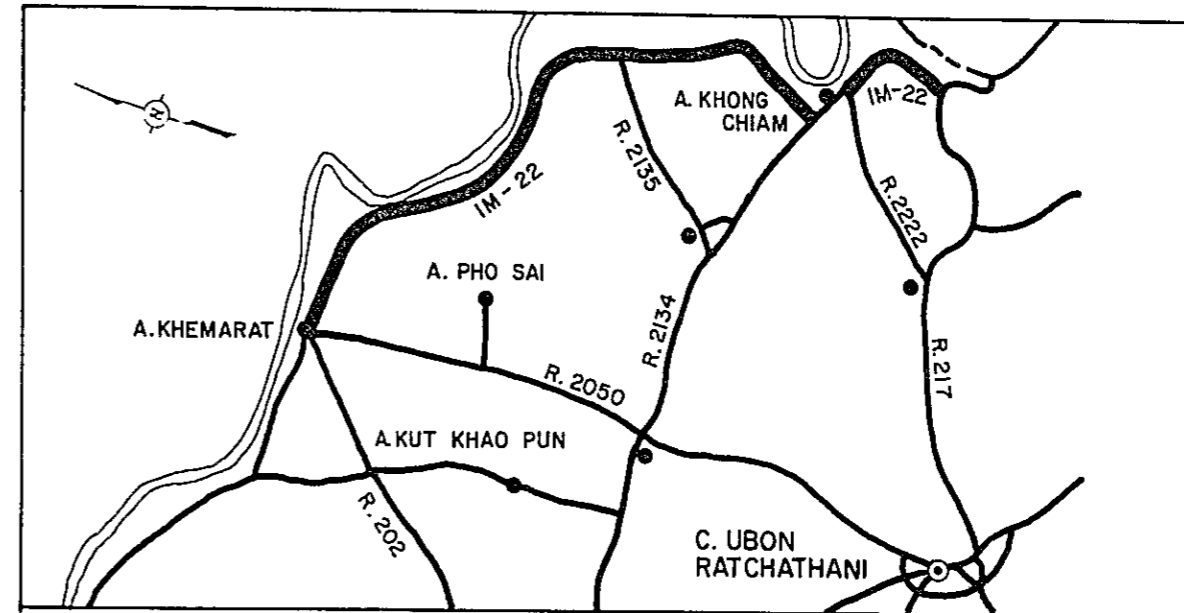




No.	S
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	4.1	C-7.00 x 27 00	W-4 20x24 80
2	64	C-7.00 x 24 00	W-4 30x20 20
3	87	—	C-9 00x46.00
4	116	—	C-9 00x35.00
5	184	C-7.00 x14 .00	W-4 20x10 20
6	220	—	C-9 20x128 00
7	239	C-7 00 x14 .00	W-4 30x10. 20
8	293	—	C-10.00x100 00
9	349	C-7.00 x 26 00	W-4 00x23 20
10	372	C-7 00 x 16 00	W-4 20x14. 00
11	385	C-7 00 x 28 00	W-4 20x26 00
12	394	—	C-9 00x77 50
13	441	C-7 00 x18 00	W-4 20x15. 50
14	488	—	C-9 00x24 00
15	501	—	C-9 00x56 00
16	534	—	C-9 00x27 00
17	580	—	C-9 00x39 00
18	586	—	C-9 00x16 00
19	594	—	C-9 00x25 00
20	609	—	C-9 00x30 00
21	632	C-7 00 x14 00	W-4 00x10 20
22	643	—	C-9 00x29 00
23	666	—	C-9 00x28 00

BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
24	683	C-7 00 x 18 00	W-4 00x15 30
25	696	C-7 00 x 18 00	W-4 00x15 00
26	725	C-7.00 x 21 00	W-4 00x19 00
27	76.9	—	C-9 00x75.00
28	77.4	—	C-9 00x15.00
29	81.3	—	C-9 00x59.00
30	84.2	C-7 00 x 12 00	W-4 00 x 10 20
31	89.9	C-7 00 x 18 00	W-4 00 x 15 50
32	92.8	C-7.00 x 22 00	W-4.20 x 20 00
33	94.0	C-7.00 x 24.00	W-4.00 x 20.20
34	104.6	—	C-8 00 x 70 00
35	107.2	C-7.00 x 18.00	W-4 30x15.00
36	110.1	C-7 00 x 18 00	W-4 00 x 15 00
(Route 2173)			
1	2.2	C-7 00 x 32.00	W-4 00 x 29.30
2	7.1	—	C-9 00 x 29.00
3	8.9	C-7 00 x 14.00	W-4 00 x 10 50
4	10.3	—	C-9 00 x 56 00

Table 22.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-22 (122.4 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	278	4,170	3,794	278	4,170	3,794
Excavation - Soil	m ³	20	41,600	832	748	41,600	832	748
Excavation - Hard Rock	m ³	160	0	0	0	0	0	0
Embankment	m ³	45	250,700	11,281	10,266	250,700	11,281	10,266
Selected Material	m ³	80	258,000	20,640	18,369	258,000	20,640	18,369
Soil Aggregate Surface or Subbase	m ³	105	180,700	18,973	16,886	180,700	18,973	16,886
Crushed Stone Base	m ³	370	118,700	43,919	40,405	15,000	5,550	5,106
Soil Aggregate Shoulder	m ³	105	51,100	5,365	4,775	6,500	682	607
Prime Coat and DBST	m ²	55	659,400	36,817	33,135	85,300	4,692	4,223
Pipe Culvert	m	2,100	2,090	4,359	4,037	2,090	4,389	4,037
Box Culvert	m	16,000	6	96	86	6	96	86
Long Span Bridge	m	80,000	0	0	0	0	0	0
Short Span Bridge	m	40,000	396	15,840	14,097	396	15,840	14,097
Sub Total (a)				162,323	146,603		87,147	78,224
Miscellaneous Works (a) x 7%				11,363	10,262		6,100	5,476
Total (b)				173,686	156,865		93,247	83,700
PHYSICAL CONTINGENCY (b) x 15%				26,053	23,530		13,787	12,555
ENGINEERING AND ADMINISTRATION (b) x 10%				17,369	15,687		9,325	8,370
Sub Total				43,422	39,217		23,312	20,925
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				217,108	196,082		116,559	104,625

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

Items	Unit of Q'ty	Financial Unit Rate ₪	Route Number								
			IM-22 (1-2, 5-6) (48.2 km)			IM-22 (2-3, 3-4) (74.2 km)			IM-22 (T) (122.4 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	113	1,695	1,542	165	2,475	2,252	278	4,170	3,794
Excavation - Soil	m ³	20	0	0	0	41,600	832	748	41,600	832	748
Excavation - Hard Rock	m ³	160	0	0	0	0	0	0	0	0	0
Embankment	m ³	45	125,000	5,625	5,118	125,700	5,656	5,147	250,700	11,281	10,266
Selected Material	m ³	80	100,700	2,056	7,169	157,300	12,584	11,199	258,000	20,640	18,369
Soil Aggregate Surface or Subbase	m ³	105	70,500	7,402	6,588	110,200	11,571	10,298	180,700	18,973	16,886
Crushed Stone Base	m ³	370	46,300	17,131	15,760	6,800	2,516	2,314	53,100	19,647	18,075
Soil Aggregate Shoulder	m ³	105	20,000	2,100	1,869	2,900	304	271	22,900	2,404	2,140
Prime Coat and DBST	m ²	55	261,300	14,372	12,934	38,500	2,118	1,906	299,800	16,489	14,840
Pipe Culvert	m	2,100	960	2,016	1,854	1,130	2,373	2,183	2,090	4,389	4,037
Box Culvert	m	16,000	6	96	86	0	0	0	6	96	86
Long Span Bridge	m	80,000	0	0	0	0	0	0	0	0	0
Short Span Bridge	m	40,000	147	5,880	5,233	249	9,960	8,864	396	15,840	14,097
Sub Total (a)				64,373	58,153		50,390	45,186		114,761	103,338
Miscellaneous Works (a) x 7%				4,506	4,071		3,527	3,163		8,033	7,234
Total (b)				68,879	62,224		53,917	48,349		122,794	110,573
PHYSICAL CONTEGENCY (b) x 15%				10,331	9,334		8,087	7,252		18,419	16,585
ENGINEERING AND ADMINISTRATION (b) x 10%				6,888	6,222		5,391	4,834		12,279	11,057
Sub Total				17,219	15,556		13,479	12,087		30,698	27,642
LAND ACQUISITION											
Highly Developed Land	ha	50,000	0	0	0	0	0	0	0	0	0
Less Developed Land	ha	15,000	0	0	0	0	0	0	0	0	0
Sub Total				0	0		0	0		0	0
GRAND TOTAL				86,098	77,780		67,396	60,436		153,492	138,215

Table 22.6.1 COST AND BENEFITS
(F4 STANDARD)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	39,216	0	0	0	0	55,096	0
1985	98,041	0	0	0	0	122,983	0
1986	58,825	0	0	0	0	65,884	0
1987	0	403	11,981	-445	11,939	0	10,660
1988	0	576	12,874	-423	13,026	0	10,385
1989	0	748	13,767	-402	14,114	0	10,046
1990	0	921	14,660	-380	15,201	0	9,661
1991	0	1,094	15,553	-358	16,289	0	9,243
1992	0	1,266	16,446	-337	17,376	0	8,803
1993	0	1,439	17,339	-315	18,463	0	8,352
1994	59,242	1,609	18,659	-282	19,986	26,798	8,072
1995	0	1,779	19,979	-249	21,509	0	7,756
1996	0	1,949	21,299	-216	23,031	0	7,415
1997	0	2,118	22,618	-183	24,554	0	7,059
1998	0	2,288	23,938	-150	26,077	0	6,693
1999	0	2,458	25,258	-117	27,599	0	6,325
2000	0	2,628	26,578	-84	29,122	0	5,959
2001	-90,197	2,798	27,897	-51	30,644	-16,479	5,599
TOTAL	165,127	24,074	288,848	-3,992	308,930	254,282	122,027

DISCOUNTED ECONOMIC COSTS :	254,282
DISCOUNTED ECONOMIC BENEFITS :	122,027
AGRICULTURAL DEVELOPMENT BENEFIT	8,577
VOC SAVING	115,646
RMC SAVING	-2,196
NET PRESENT VALUE :	-132,255
BENEFIT COST RATIO :	0.48
INTERNAL RATE OF RETURN :	4.5 %

Table 22.6.2 COST AND BENEFITS
(F4&F5 COMBINED)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	27,643	0	0	0	0	38,836	0
1985	69,108	0	0	0	0	86,689	0
1986	41,464	0	0	0	0	46,440	0
1987	0	403	10,815	-76	11,142	0	9,948
1988	0	576	11,643	-58	12,160	0	9,694
1989	0	748	12,471	-41	13,179	0	9,380
1990	0	921	13,299	-23	14,197	0	9,022
1991	0	1,094	14,127	-5	15,215	0	8,634
1992	0	1,266	14,955	12	16,234	0	8,224
1993	0	1,439	15,783	30	17,252	0	7,804
1994	26,717	1,609	17,004	57	18,670	12,085	7,540
1995	0	1,779	18,225	84	20,087	0	7,244
1996	0	1,949	19,445	111	21,505	0	6,924
1997	0	2,118	20,666	139	22,923	0	6,590
1998	0	2,288	21,887	166	24,341	0	6,248
1999	0	2,458	23,108	193	25,758	0	5,903
2000	0	2,628	24,328	220	27,176	0	5,561
2001	-63,579	2,798	25,549	247	28,594	-11,616	5,224
TOTAL	101,353	24,074	263,304	1,056	288,434	172,435	113,941

DISCOUNTED ECONOMIC COSTS :	172,435
DISCOUNTED ECONOMIC BENEFITS :	113,941
AGRICULTURAL DEVELOPMENT BENEFIT	8,577
VOC SAVING	105,199
RMC SAVING	165
NET PRESENT VALUE :	-58,494
BENEFIT COST RATIO :	0.66
INTERNAL RATE OF RETURN :	7.6 %

Table 22.6.3 COST AND BENEFITS
(F5 STANDARD)

(1000 BAHT)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	20,925	0	0	0	0	29,398	0
1985	52,313	0	0	0	0	65,621	0
1986	31,387	0	0	0	0	35,153	0
1987	0	403	7,725	26	8,154	0	7,281
1988	0	576	8,340	31	8,947	0	7,133
1989	0	748	8,955	36	9,740	0	6,933
1990	0	921	9,570	41	10,533	0	6,694
1991	0	1,094	10,185	46	11,325	0	6,426
1992	0	1,266	10,800	52	12,118	0	6,139
1993	0	1,439	11,415	57	12,911	0	5,840
1994	7,502	1,609	12,299	64	13,972	3,394	5,643
1995	0	1,779	13,184	70	15,033	0	5,421
1996	0	1,949	14,068	77	16,094	0	5,182
1997	0	2,118	14,952	84	17,155	0	4,932
1998	0	2,288	15,837	91	18,216	0	4,676
1999	0	2,458	16,721	98	19,277	0	4,418
2000	0	2,628	17,605	105	20,338	0	4,162
2001	-48,128	2,798	18,489	112	21,399	-8,793	3,910
TOTAL	63,999	24,074	190,146	991	215,211	124,774	84,787

DISCOUNTED ECONOMIC COSTS :	124,774
DISCOUNTED ECONOMIC BENEFITS :	84,787
AGRICULTURAL DEVELOPMENT BENEFIT	8,577
VOC SAVING	75,844
RMC SAVING	366
NET PRESENT VALUE :	-39,986
BENEFIT COST RATIO :	0.68
INTERNAL RATE OF RETURN :	8.1 %

Table 22.7.1 SOCIAL INDICATORS
(Proposed Route IM-22)

Population (1,000)		Education	
1982	: 18.1	Access to Secondary School	
1993	: 21.6	Number of Student in 1993 (1,000) ^{2/}	: 4.8
Average travelling speed, without (kph)		Average distance to school (km)	: 25.4
	: 48	Per capita time savings (10 ⁻⁴)	: 0.367
Isolation		Score	: 190
Access to Amphoe		Teacher Intensity	
Average distance to Amphoe (km) ^{1/}	: 26.2	Number of teachers ^{3/}	
Per capita time savings (10 ⁻⁴)	: 0.084	University graduate	: -
Score	: 255	Total	: 7
Access to Artery Highway		Number of Student	: 283
Average distance to highway (km) ^{1/}	: 12	Indicators	
Per capita time savings (10 ⁻⁴)	: 0.039	E1 ^{4/}	: -
Score	: 78	E2 ^{5/}	: 24.7
Impassability		E ^{6/}	: 24.7
Impassable week a year	: -	Degree of Improvement ^{7/}	: 2.77
Impassability per year	: 0	Score	: 176
Impassability per capita (10 ⁻⁴)	: 0	Disparity	
Score	: 0	G.P.V. in 1993 (Mn B) ^{8/}	
Health		With project	: 56.8
Access to Hospital		Without project	: 53.5
Average distance to Hospital (km) ^{1/}	: 25.4	Per capita G.P.V. in 1993 (B)	
Per capita time savings (10 ⁻⁴)	: 0.081	With project (W)	: 2,630
Score	: 188	Without project (w)	: 2,477
Access to Medical Facilities		Degree of Disparity	
Average distance to facilities (km) ^{1/}	: 16.0	(A/W) - (A/w) ^{9/}	: 0.07
Per capita time savings (10 ⁻⁴)	: 0.051	Score	: 25
Score	: 204	Total Score	: 1,216

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 - 23

Changwat · Ubon Ratchathani

B. Don Chik (JR.217) - B Non Rieng

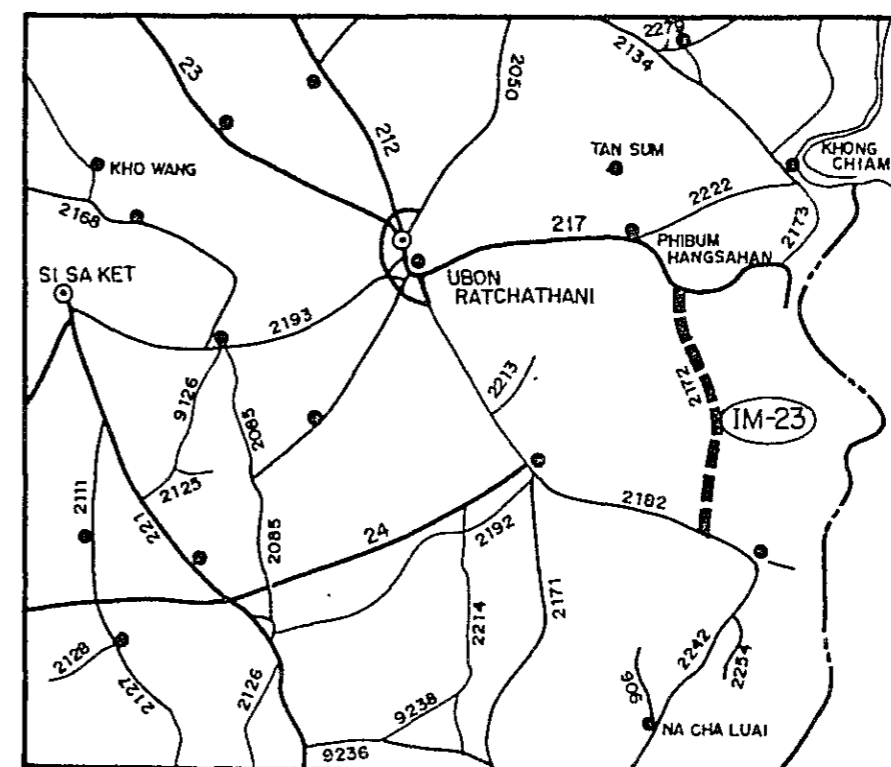
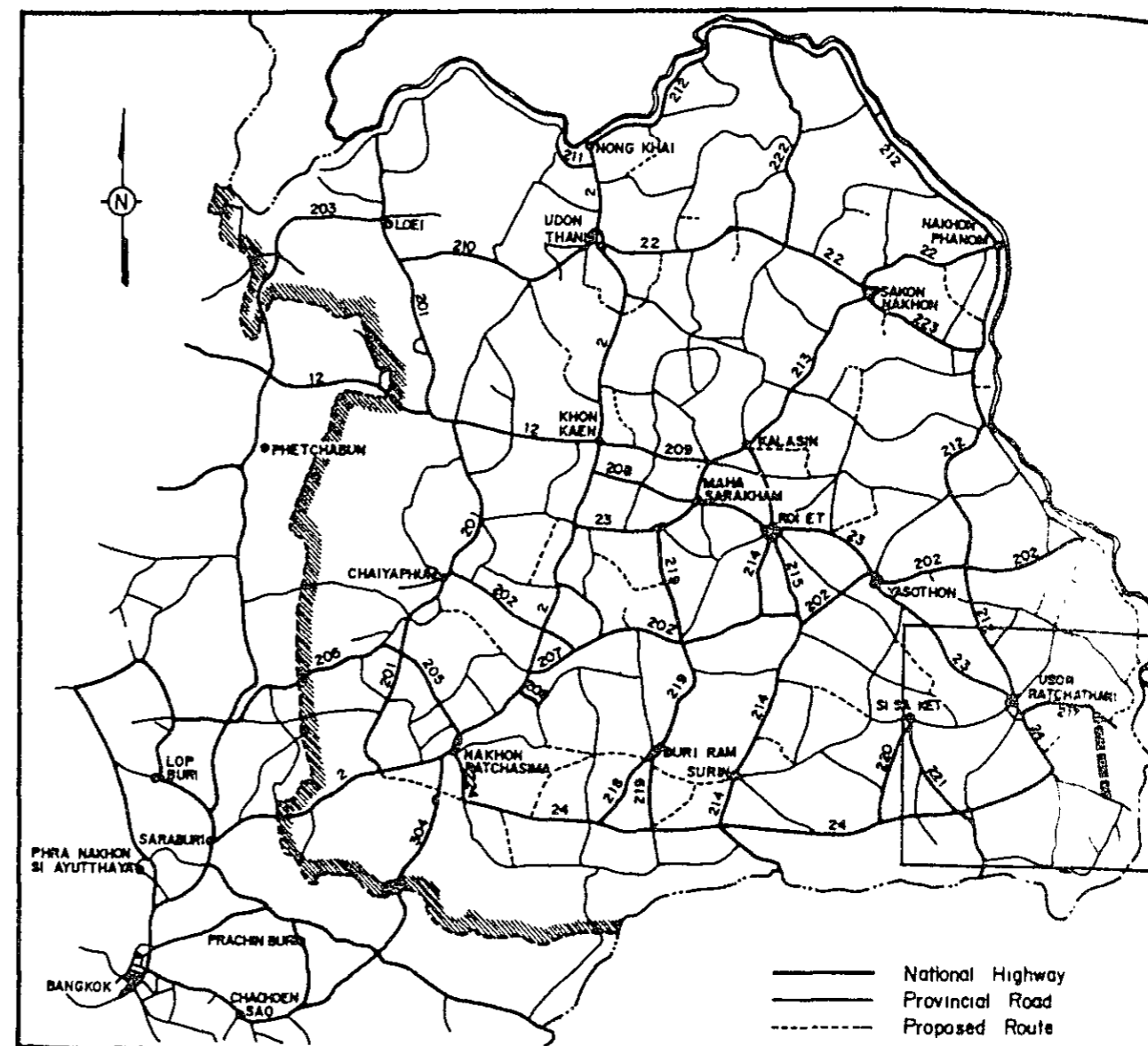
Length · 44.8 KM.

SUMMARY

PROPOSED ROUTE IM-23

Item	Description
Changwat	Ubon Ratchathani
Origin	B. Don Chik (J.R.217)
Destination	B. Non Rieng (J.R.2182)
Length	
Total	44.8 km
Improvement Section	44.8 km
DOH Road	R.2172 44.8 km
ARD Road	0 km
Others	0 km
New Alignment Section	0 km
Surface Type and Condition	Soil Aggregate, Good
Terrain	Flat and Rolling
Influence Area	
Area	314 km ²
Population (1982)	25,900
Principal Crops	Paddy
Traffic (ADT)	
Existing	141
1993	667
2001	1,008
Proposed Standard	F4 (DBST)
Construction Cost	
Financial	74,174 . 10 ³ ฿
Economic	67,049 . 10 ³ ฿
IRR	10.7 %
B/C	0.90
Recommendation	For further consideration

LOCATION OF PROPOSED ROUTE



1. GENERAL

1.1 Characteristics of the Route

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

The route, starting at Ban Don Chik, runs southward passing through Ban Ang Sila, Ban Na Phu and Ban Na Khan and ends at Ban Non Riang.

Its total length is 44.8 km. (Figure 23.5.2)

The terrain is almost flat, while some sections are rolling.

In the influence area, there exists several villages with total population of 25,900. There are two medical centers, no hospital and no secondary school along the proposed route.

The route, passing through the national border line, is so important for the defense of the Kingdom.

1.2 Condition of Existing Road

Condition of existing roads to be utilized for the proposed route is summarized in Table 23.1.1.

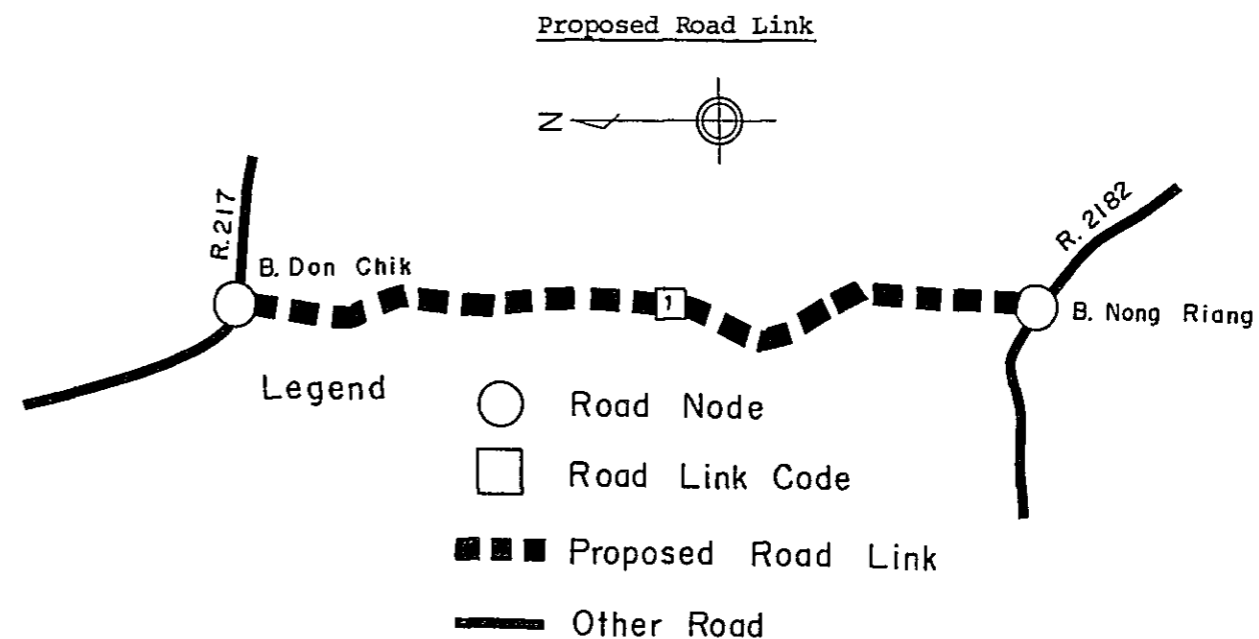
2. TRAFFIC

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/}	24	17	26	32	52	3	8	20	-	182
Manual Counts (1982)	1	-	31	1	46	2	3	4	11	-	93
Estimated	1	12	24	14	39	27	3	6	16	-	141

Note: 1/ Route 2172 Section 0100 Station Km 13+100

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)

<u>PROPOSED ROAD LINK</u>	<u>TRIPS PER DAY</u>
1	2179

FREIGHT MOVEMENT (1982)

<u>PROPOSED ROAD LINK</u>	<u>TONAGE PER DAY</u>		
	<u>NON-AGRI.</u>	<u>AGRI.</u>	<u>TOTAL</u>
1	31	10	41

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

<u>ITEM</u>	<u>GROWTH RATE (% P.A.)</u>		
	<u>1981</u>	<u>1987</u>	<u>1993</u>
	<u>1987</u>	<u>1993</u>	<u>2001</u>
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

<u>ITEM</u>	<u>GROWTH RATE (% P.A.)</u>		
	<u>1981</u>	<u>1987</u>	<u>1993</u>
	<u>1987</u>	<u>1993</u>	<u>2001</u>
NON-AGRI.	7.5	7.6	7.7
AGRICULTURE	0.2	0.2	0.2
FREIGHT	5.7	5.8	5.8

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 Main Report:

RATE OF INDUCED AND DEVELOPED TRAFFIC

<u>ITEM</u>	<u>(%)</u>		
	<u>YEAR</u>		
	<u>1987</u>	<u>1993</u>	<u>2001</u>
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	10.3	20.7	12.1	33.6	23.3	12.0	24.0	64.0	0.0
	1987	10.3	23.3	14.5	31.7	20.2	13.3	21.9	56.4	8.4
	1993	10.3	26.5	17.4	29.3	16.4	14.9	19.4	47.2	18.5
	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 23.2.1.

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	19	27	60	38	48	6	16	2	217	271	488
1993	30	51	86	48	83	6	15	6	325	342	667
2001	54	112	138	0	168	6	13	12	564	444	1008

3. AGRIGULTURAL DEVELOPMENT

3.1 Present Condition

Almot all cultivated land in the influence area is covered by paddy fields. Upland fields are limited, and planted by kenaf, cassava and ground nuts. The future potential of cultivable land is mainly for upland field in southern part of the area.

Land use and capability conditions in the area of influence are shown in Table 23.3.1 and Figure 23.3.1.

Typical cropping calendar in the Ubon Ratchathani area is shown in Figure 23.3.2.

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 23.3.2.

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 23.3.3.

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 23.3.4. 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>	<u>Class</u>	<u>Nos. of Wooden Bridge</u>	<u>Nos. of Narrow C.Bridge</u>	<u>Length (Km)</u>	<u>Road Class</u>	
							<u>Case 1</u>	<u>Case 2</u>	
1	Flat & Rolling	44.8	2B	7	0	44.8	1 (F4)	2A (F5)	0

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

VOC 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)	5,328	7,832	12,681
2A (F5)	1,817	2,939	4,901

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 23.5.1
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 23.5.2

Alignment of the route is shown in Figure 23.5.2.

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 23.5.1.

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

Road Class	Length (Km)	Construction Cost (10 ³ ₱)		Remark
		Financial Cost	Economic Cost	
F4 (DBST)	44.8	74,174	67,049	
F5 (Soil Aggregate)	44.8	38,544	34,785	

6. ECONOMIC EVALUATION

Yearly distribution of the economic costs and benefits, and the calculated economic indicator for evaluation are given in Table 23.6.1 and 23.6.2.

The result indicates that the proposed project seems to be not feasible in case of F4 Standard but feasible under F5 Standard.

7. SOCIAL IMPACTS

Detailed data and results of quantification of indicator of social impacts are tabulated in Table 23.7.1.

Table 23.1.1 SUMMARY OF ROAD INVENTORY

Item	Description	
Origin	B. Don Chik (J.R. 217)	
Destination	B. Non Rieng (J.R. 2182)	
Length		
Total	44.8 km	
Improvement Section	44.8 km	
DOH Road	R.2172	44.8 km
ARD Road		0 km
Others		0 km
New Alignment Section		0 km
Terrain	Flat and Rolling	
Alignment (Hori./Vert.)	Fair / Fair	
Formation Width	4.5 m - 7.0 m, 6.7 m (Weighted average)	
Embankment Section		
Length	44.8 km	
Height	0.2 m - 1.2 m	
Cut Section		
Length	0 km	
Depth	m - m	
Surface Type and Condition		
SBST or DBST	Good	14.5 km
Soil Aggregate	Good	30.3 km
Earth		0 km
Pipe Culvert	35 each	
Box Culvert	0 each 0 m	
Bridge		
Permanent Bridge	3 each	85.0 m
Narrow Concrete Bridge	0 each	0 m (4m)
Wooden Bridge	8 each	144.4 m
Overflow Section	0 place 0 km	

Table 23.1.2 ROAD INVENTORY(1)

PROPOSED ROUTE NO. IM-23

ROUTE NO. 2172

B. DON CHIK (J.R. 217) ~ B. NON RIANG (J.R. 2182)

L = 44.8 Km.

UBON RATCHATHANI

STATION (Km)		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
VILLAGE			B. DON CHIK H = 340 P = 1700		B. MUANG HI H = 65 P = 325		B. KO H = 75 P = 375		B. ANG SILA H = 600 P = 3000		B. NON SAWANG H = 130 P = 650		B. OU DOMSUK H = 40 P = 200				
TERRAIN		Rolling				Flat										Rolling	
CROSS SECTION	Formation Width (m)	7.00	4.50	6.50				7.00				6.00	7.00				
	Embankment Height (m)	0.30	1.00	0.30	1.00	0.50	1.00	0.50	1.00	0.50	1.20	0.50		0.20	0.30	0.80	0.30
	Cutting Depth (m)																
PAVEMENT	Type/Length	La	DT				Laterite		DT	Laterite							
	Condition		Good														
FLOODING	Overflow Length(Km)/Height(m)																
LAND USE	Left												Paddy				
	Right												Paddy				
PIPE CULVERT	Total Number												35 pipes				
BOX CULVERT & BRIDGE	Station (Km)		1.9	2.2		7.1		10.7		14.7	15.7	16.1					
	Dimension		W-Br. 4.20 x 4.00 C-Br. 10.00 x 62.00			C-Br. 11.00 x 5.00		W-Br. 4.80 x 15.60		W-Br. 4.20 x 10.00 W-Br. 4.50 x 15.00 C-Br. 11.00 x 18.00							
RIGHT OF WAY (m)																	
ALIGNMENT	Horizontal									Fair							
	Vertical									Fair							
ROUTE NO., AGENCIES																	DOH 2172

ROAD INVENTORY (2)

L = 44.8 Km.

B. DON CHIK (J.R. 217) ~ B. NON RIANG (J.R. 2182) (Cont'd)

UBON RATCHATHANI

PROPOSED ROUTE NO. IM-23 ROUTE NO. 2172

STATION (Km)		30	32	34	36	38	40	42	44						
VILLAGE		B. NA DHO H = 810 P = 4050		B. DON TA NO H = 130 P = 650		B. NA KHAN H = 135 P = 675		B. BOK NOI H = 35 P = 175		B. MAK MIAN H = 150 P = 750		B. NON RIANG H = 208 P = 1040			
TERRAIN		Rolling				Flat									
CROSS SECTION	Formation Width (m)	7.00				6.00	4.50		7.00						
	Embankment Height (m)	0.30	0.50	0.30	0.50	0.30	0.60	0.30	0.60	0.20	0.50	1.0			
	Cutting Depth (m)														
PAVEMENT	Type/Length	DT		Laterite				DT		Laterite		DT		Laterite	
	Condition	Good													
FLOODING	Overflow Length(Km)/Height(m)														
LAND USE	Left	Paddy													
	Right	Paddy													
PIPE CULVERT	Total Number														
BOX CULVERT & BRIDGE	Station (Km)	31.8		37.4		40.5		44.1							
	Dimension	W-Br. 4.30 x 15.30		W-Br. 4.80 x 24.50		W-Br. 4.20 x 30.00		W-Br. 4.00 x 30.00							
RIGHT OF WAY (m)															
ALIGNMENT	Horizontal	Fair													
	Vertical	Fair													
ROUTE NO., AGENCIES		DOH 2172													

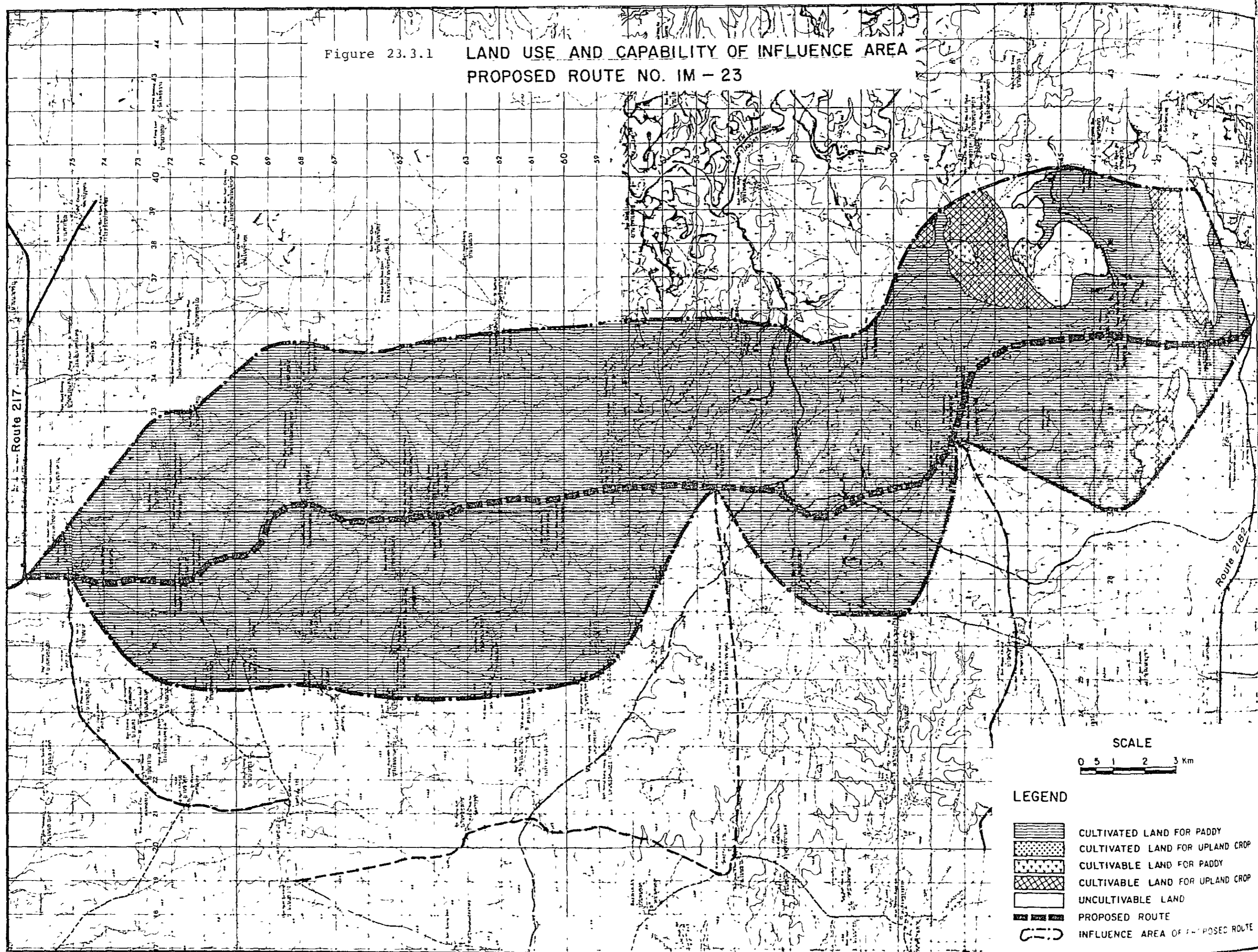
Table 23.2.1 TRAFFIC VOLUME ON ROUTE IM - 23

YEAR	1987		1993		2001		
	1 AVR.		1 AVR.		1 AVR.		
P/C	N+D	17	17	26	26	46	46
	I	3	3	4	4	7	7
	DV	0	0	1	1	1	1
	TOTAL	19	19	30	30	54	54
L/B	N+D	24	24	44	44	96	96
	I	4	4	7	7	14	14
	DV	0	0	1	1	2	2
	TOTAL	27	27	51	51	112	112
M/B	N+D	52	52	74	74	118	118
	I	8	8	11	11	18	18
	DV	0	0	2	2	2	2
	TOTAL	60	60	86	86	138	138
H/B	N+D	33	33	41	41	52	52
	I	5	5	6	6	8	8
	DV	0	0	1	1	1	1
	TOTAL	38	38	48	48	60	60
P/P&T	N+D	42	42	70	70	144	144
	I	6	6	11	11	22	22
	DV	0	0	1	1	3	3
	TOTAL	48	48	83	83	168	168
4/T	N+D	5	5	5	5	5	5
	I	1	1	1	1	1	1
	DV	0	0	0	0	0	0
	TOTAL	6	6	6	6	6	6
6/T	N+D	14	14	13	13	11	11
	I	2	2	2	2	2	2
	DV	0	0	0	0	0	0
	TOTAL	16	16	15	15	13	13
10/T	N+D	2	2	5	5	10	10
	I	0	0	1	1	2	2
	DV	0	0	0	0	0	0
	TOTAL	2	2	6	6	12	12
ADT	N+D	189	189	278	278	481	481
	I	28	28	42	42	72	72
	DV	0	0	6	6	10	10
	TOTAL	217	217	325	325	564	564
M/C	N+D	248	248	314	314	416	416
	I	22	22	25	25	25	25
	DV	0	0	3	3	3	3
	TOTAL	271	271	342	342	444	444
TOTAL	N+D	437	437	591	591	898	898
	I	51	51	67	67	97	97
	DV	0	0	9	9	13	13
	TOTAL	488	488	667	667	1008	1008

NOTE

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

Figure 23.3.1 LAND USE AND CAPABILITY OF INFLUENCE AREA
PROPOSED ROUTE NO. IM - 23



SCALE
0 5 1 2 3 Km

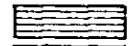

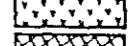

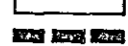
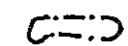

- LEGEND**
-  CULTIVATED LAND FOR PADDY
 -  CULTIVATED LAND FOR UPLAND CROP
 -  CULTIVABLE LAND FOR PADDY
 -  CULTIVABLE LAND FOR UPLAND CROP
 -  UNCULTIVABLE LAND
 -  PROPOSED ROUTE
 -  INFLUENCE AREA OF PROPOSED ROUTE

Figure 23.3.2 CROPPING CALENDAR

1100 CHANGWAT UBON RATCHATHANI

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

Note

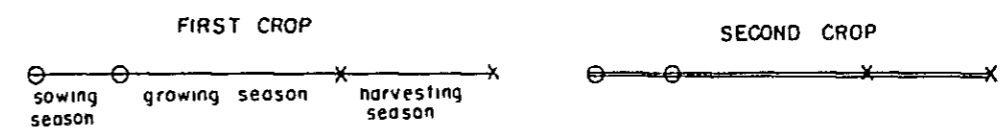


TABLE 23.3.1 CULTIVATED & CULTIVABLE LAND

(1979)

[UNIT : 1000 RAI (FM 2)]

AMPHOE CODE	AMPHOE NAME	CULTIVATED LAND			UNUSED CULTIVABLE LAND		
		PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
		178.125 (285.0)	-	178.125 (285.0)	0.625 (1.0)	9.375 (15.0)	10.000 (16.0)
1116	PIBUN MANGSAHAN	121.250 (194.0)	-	121.250 (194.0)	-	-	-
1117	DET UDOM	10.000 (16.0)	-	10.000 (16.0)	-	-	-
1120	BUNTHARIK	46.875 (75.0)	-	46.875 (75.0)	0.625 (1.0)	9.375 (15.0)	10.000 (16.0)

TABLE 23.3.2 CROP PRODUCTION

ITEM	PADDY	MAIZE	BEANS	GRUND NUTS	CASSAVA	SUGAR CANE	KENAF	COTTON	UPLAND TOTAL	TOTAL
PLANTED AREA (1000 RAI)										
1981	171.73	-	-	0.06	0.33	-	0.71	-	1.10	172.83
1987	171.73	-	-	0.06	0.35	-	0.71	-	1.12	172.84
1993	WITHOUT PROJECT	171.73	-	0.06	0.36	-	0.71	-	1.13	172.86
	WITH PROJECT	174.84	-	0.06	0.39	-	0.72	-	1.17	176.02
2001	WITHOUT PROJECT	171.73	-	0.06	0.38	-	0.71	-	1.15	172.88
	WITH PROJECT	174.84	-	0.06	0.41	-	0.72	-	1.20	176.04
CROP YIELD (KG/RAI)										
1981	156.5	-	-	112.0	2000.0	-	168.0	-	-	-
1987	158.3	-	-	114.0	2000.0	-	168.0	-	-	-
1993	WITHOUT PROJECT	160.2	-	116.1	2000.0	-	168.0	-	-	-
	WITH PROJECT	162.2	-	116.8	2012.0	-	168.0	-	-	-
2001	WITHOUT PROJECT	162.8	-	118.9	2000.0	-	168.0	-	-	-
	WITH PROJECT	167.4	-	120.6	2028.2	-	168.0	-	-	-
CROP PRODUCTION (TON)										
1981	26,867	-	-	6	666	-	119	-	792	27,659
1987	27,191	-	-	6	694	-	119	-	820	28,011
1993	WITHOUT PROJECT	27,519	-	7	724	-	119	-	850	28,369
	WITH PROJECT	28,355	-	7	787	-	121	-	915	29,270
2001	WITHOUT PROJECT	27,962	-	7	766	-	119	-	892	28,854
	WITH PROJECT	29,275	-	8	839	-	121	-	967	30,243

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE SMALL

TABLE 23.3.3 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	-	-	8,693	577	-	4,666	-
WITH PROJECT (1987 - 2001)	3,835	-	-	8,693	591	-	4,783	-
CROP PRODUCTION COST (BAHT/RAI)								
WITHOUT PROJECT (1981 - 2001)	406	-	-	848	677	-	729	-
WITH PROJECT (1987 - 2001)	406	-	-	868	697	-	729	-

TABLE 23.3.4 NET PRODUCTION VALUE

YEAR	(1000 BAHT)					
	WITHOUT PROJECT			WITH PROJECT		
	PADDY	UPLAND	TOTAL	PADDY	UPLAND	TOTAL
1987	31,955	214	32,169	34,556	229	34,785
1993	33,182	222	33,404	37,755	254	38,009
2001	34,840	233	35,073	41,284	272	41,556

Figure 23.5.1 TYPICAL CROSS SECTION AND TYPICAL PAVEMENT STRUCTURE

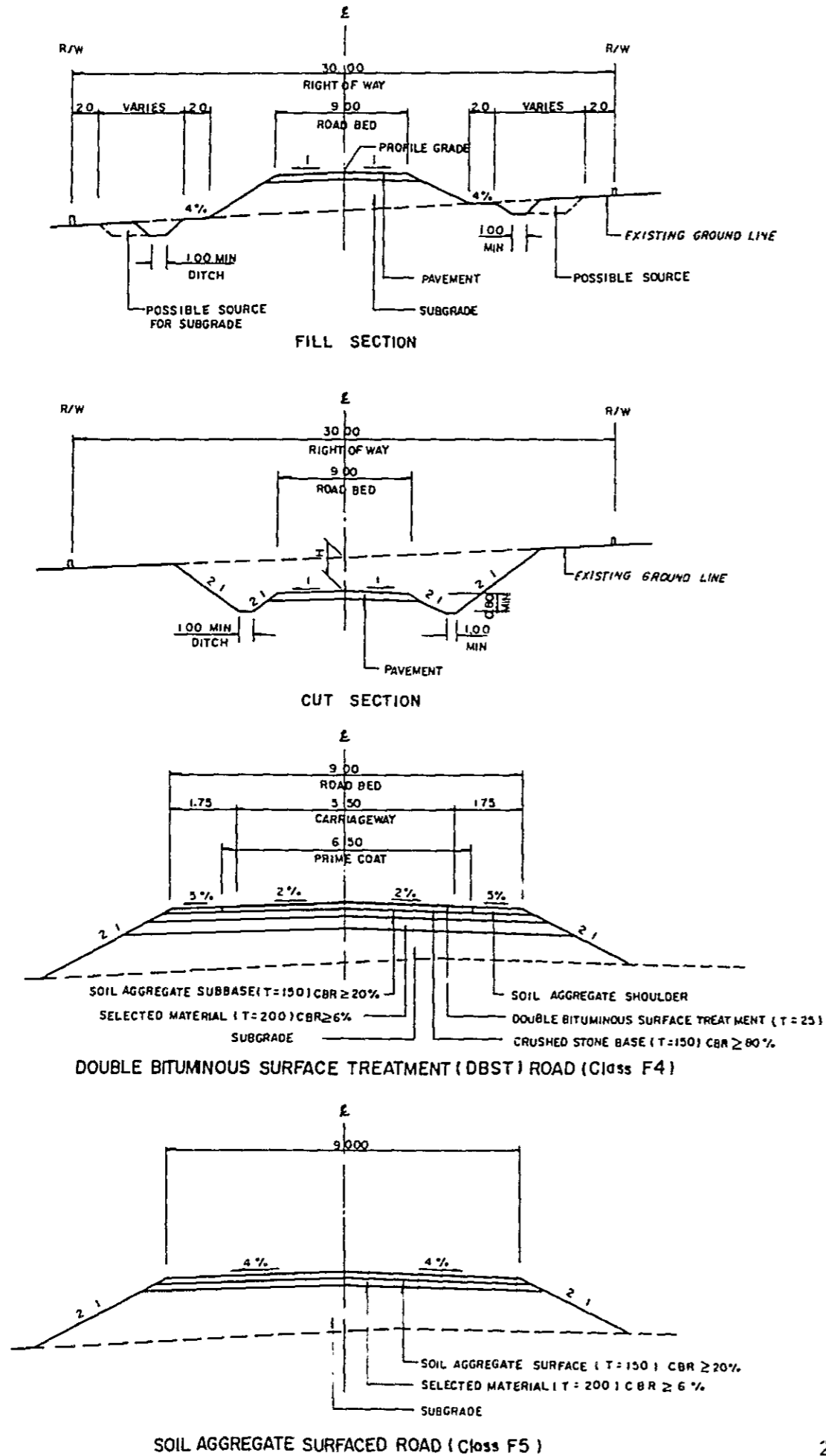
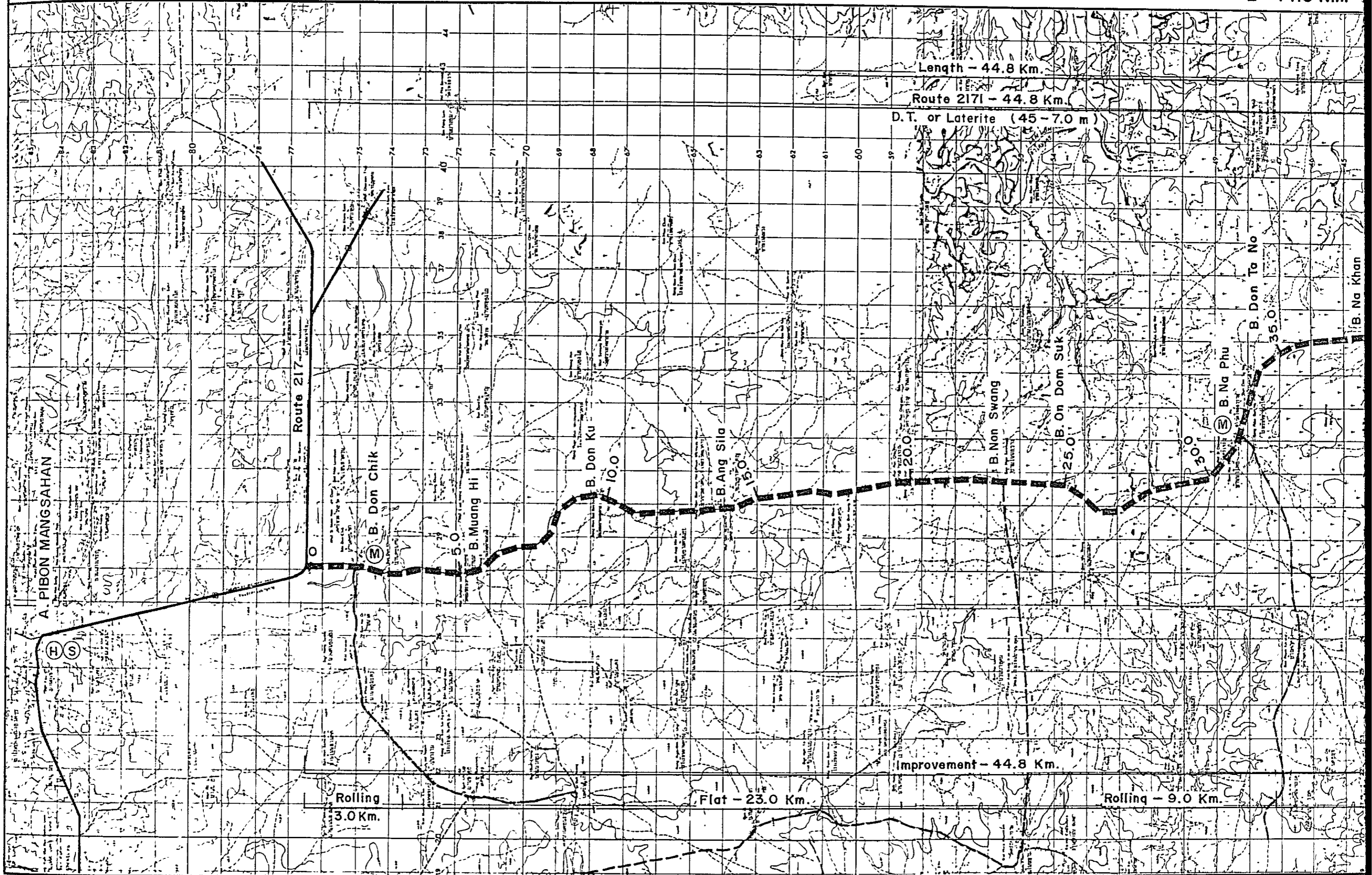
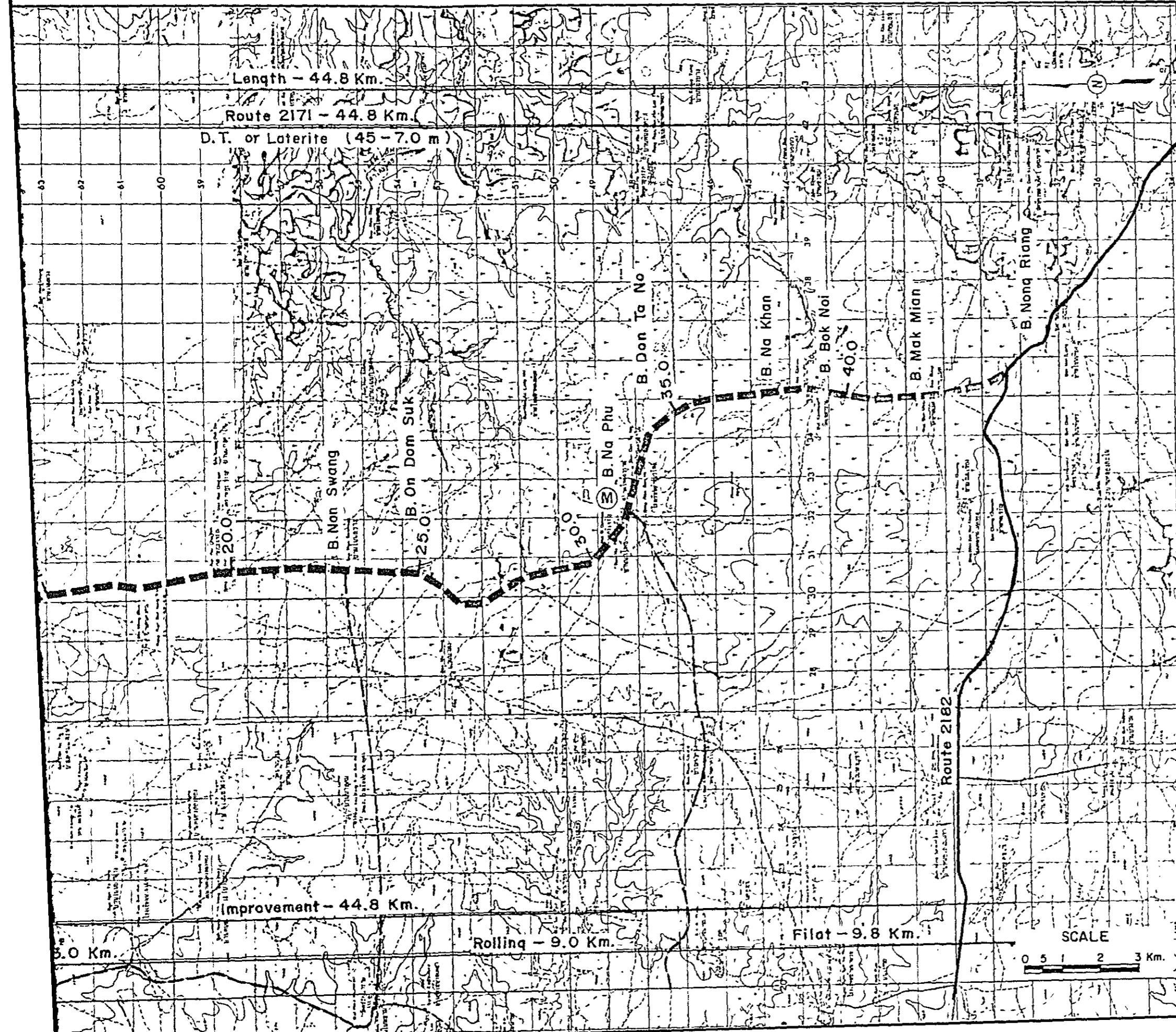


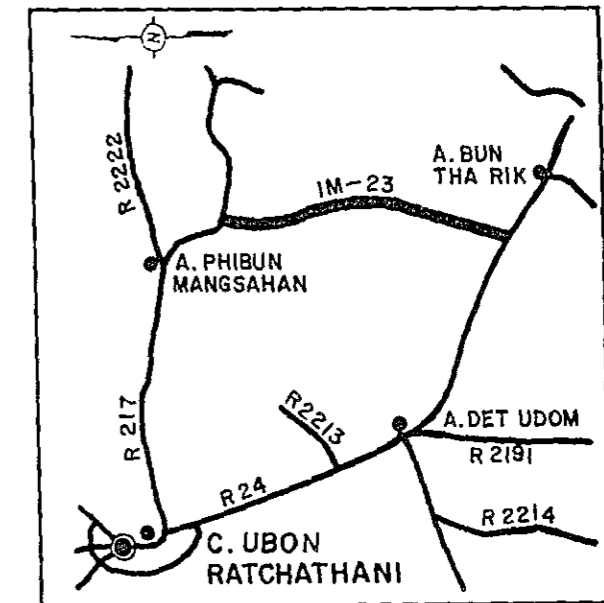
Figure 23.5.2 **PROPOSED ROUTE NO. IM-23** **C. UBON RATCHATHANI** **B. DON CHIK (J.R.217)– B. NON RIANG (J.R.2182)**
ROUTE NO. 2172 **L = 44.8 Km.**



BON RATCHATHANI B. DON CHIK (J.R.217) - B. NON RIANG (J.R.2182)
ROUTE NO. 2172 L = 44.8 Km.



LOCATION MAP



BRIDGE LIST

No.	Station Km.	Proposed Bridge	Existing Bridge
1	1.9	(BOX CULVERT)	W-4.20 x 4.00
2	2.2	—	C-10.00 x 62.00
3	7.1	—	C-11.00 x 5.00
4	10.7	C-7.00 x 18.00	W-4.80 x 15.60
5	14.7	C-7.00 x 12.00	W-4.20 x 10.00
6	15.7	C-7.00 x 18.00	W-4.50 x 15.00
7	16.1	—	C-7.00 x 18.00
8	31.8	C-7.00 x 18.00	W-4.30 x 15.30
9	37.4	C-7.00 x 27.00	W-4.80 x 24.50
10	40.5	C-7.00 x 32.00	W-4.20 x 30.00
11	44.1	C-7.00 x 32.00	W-4.00 x 30.00

LEGEND

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

Table 23.5.1 CONSTRUCTION QUANTITIES AND COSTS IM-23 (44.8 km)

Items	Unit of Q'ty	Financial Unit Rate ₱	(DEST)			(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	104	1,560	1,419	104	1,560	1,419
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	122,600	5,517	5,020	122,600	5,517	5,020
Selected Material	m ³	80	77,000	6,160	5,482	77,000	616	548
Soil Aggregate Surface or Subbase	m ³	105	53,900	5,659	5,036	53,900	5,659	5,036
Crushed Stone Base	m ³	370	35,400	13,098	12,050	6,300	2,331	2,144
Soil Aggregate Shoulder	m ³	105	15,200	1,596	1,420	2,700	283	252
Prime Coat and DEST	m ²	55	199,700	10,984	9,886	35,800	1,969	1,772
Pipe Culvert	m	2,100	2,020	4,242	3,902	2,020	4,242	3,902
Box Culvert	m	16,000	10	160	144	10	160	144
Long Span Bridge	m	80,000	0	0	0	0	0	0
Short Span Bridge	m	40,000	162	6,480	5,767	162	6,480	5,767
Sub Total (a)				55,457	50,130		29,818	26,008
Miscellaneous Works (a) x 7%				3,882	3,509		2,017	1,920
Total (b)				59,339	53,639		30,835	29,928
PHYSICAL CONTINGENCY (b) x 15%				8,901	8,046		4,625	4,174
ENGINEERING AND ADMINISTRATION (b) x 10%				5,934	5,364		3,083	2,782
Sub Total				14,835	13,410		7,708	6,956
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				74,174	67,049		38,544	34,785

Table 23.6.1 COST AND BENEFITS
(F4 STANDARD)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	AGRI. BENEFIT	VOC SAVING	RMC SAVING	TOTAL	COST	BENEFIT
1984	13,410	0	0	0	0	18,840	0
1985	33,524	0	0	0	0	42,052	0
1986	20,115	0	0	0	0	22,529	0
1987	0	2,616	5,328	-91	7,853	0	7,011
1988	0	2,864	5,745	-78	8,531	0	6,801
1989	0	3,112	6,163	-65	9,210	0	6,555
1990	0	3,360	6,580	-52	9,888	0	6,284
1991	0	3,609	6,997	-39	10,567	0	5,996
1992	0	3,857	7,414	-26	11,245	0	5,697
1993	0	4,105	7,832	-13	11,924	0	5,394
1994	21,683	4,402	8,438	7	12,847	9,808	5,189
1995	0	4,699	9,044	27	13,770	0	4,966
1996	0	4,997	9,650	47	14,693	0	4,731
1997	0	5,294	10,256	67	15,616	0	4,489
1998	0	5,591	10,862	86	16,540	0	4,245
1999	0	5,888	11,468	106	17,463	0	4,002
2000	0	6,186	12,074	126	18,386	0	3,762
2001	-30,842	6,483	12,681	146	19,309	-5,635	3,528
TOTAL	57,890	67,062	130,532	247	197,842	87,595	78,651

DISCOUNTED ECONOMIC COSTS :	87,595
DISCOUNTED ECONOMIC BENEFITS :	78,651
AGRICULTURAL DEVELOPMENT BENEFIT	26,666
VOC SAVING	52,103
RMC SAVING	-119
NET PRESENT VALUE :	-8,944
BENEFIT COST RATIO :	0.90
INTERNAL RATE OF RETURN :	10.7 %

Table 23.6.2 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	13,914	0	0	0	0	17,454	0
1986	20,871	0	0	0	0	23,376	0
1987	0	2,616	1,817	5	4,438	0	3,962
1988	0	2,864	2,004	4	4,873	0	3,884
1989	0	3,112	2,191	4	5,307	0	3,778
1990	0	3,360	2,378	3	5,742	0	3,649
1991	0	3,609	2,565	3	6,177	0	3,505
1992	0	3,857	2,752	3	6,611	0	3,350
1993	0	4,105	2,939	2	7,046	0	3,187
1994	3,146	4,402	3,184	-1	7,585	1,423	3,063
1995	0	4,699	3,429	-5	8,124	0	2,930
1996	0	4,997	3,675	-8	8,663	0	2,789
1997	0	5,294	3,920	-12	9,202	0	2,645
1998	0	5,591	4,165	-15	9,741	0	2,500
1999	0	5,888	4,411	-19	10,280	0	2,356
2000	0	6,186	4,656	-23	10,819	0	2,214
2001	-16,001	6,483	4,901	-26	11,358	-2,923	2,075
TOTAL	21,930	67,062	48,989	-85	115,965	39,329	45,888

DISCOUNTED ECONOMIC COSTS :	39,329
DISCOUNTED ECONOMIC BENEFITS :	45,888
AGRICULTURAL DEVELOPMENT BENEFIT	26,666
VOC SAVING	19,231
RMC SAVING	-10
NET PRESENT VALUE :	6,559
BENEFIT COST RATIO :	1.17
INTERNAL RATE OF RETURN :	13.9 %

Table 23.7.1 SOCIAL INDICATORS
(Proposed Route IM-23)

Population (1,000)		Education	
1982	: 25.9	Access to Secondary School	
1993	: 30.9	Number of Student in 1993 (1,000) ^{2/}	: 7.1
Average travelling speed, without (kph)	: 48	Average distance to school (km)	: 4.8
Isolation		Per capita time savings (10 ⁻⁴)	: 0.047
Access to Amphoe		Score	: 25
Average distance to Amphoe (km) ^{1/}	: 11.4	Teacher Intensity	
Per capita time savings (10 ⁻⁴)	: 0.026	Number of teachers ^{3/}	
Score	: 76	University graduate	: 3
Access to Artery Highway		Total	: 30
Average distance to highway (km) ^{1/}	: -	Number of Student	: 977
Per capita time savings (10 ⁻⁴)	: -	Indicators	
Score	: 100	E1 ^{4/}	: 3.1
Impassability		E2 ^{5/}	: 30.7
Impassable week a year	: -	E ^{6/}	: 33.8
Impassability per year	: 0	Degree of Improvement ^{7/}	: 2.02
Impassability per capita (10 ⁻⁴)	: 0	Score	: 129
Score	: 0	Disparity	
Health		G.P.V. in 1993 (Mn B) ^{8/}	
Access to Hospital		With project	: 109.9
Average distance to Hospital (km) ^{1/}	: 16.3	Without project	: 104.0
Per capita time savings (10 ⁻⁴)	: 0.037	Per capita G.P.V. in 1993 (B)	
Score	: 86	With project (W)	: 3,557
Access to Medical Facilities		Without project (w)	: 3,366
Average distance to facilities (km) ^{1/}	: 7.9	Degree of Disparity	
Per capita time savings (10 ⁻⁴)	: 0.018	(A/W) - (A/w) ^{9/}	: 0
Score	: 72	Score	: 0
		Total Score	: 488

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.