STUDY ROUTE NO. 29

Rt. 110 (B. Rong Sua Ten)
– B. Huai Khom
L = 13.2 Km
Changwat : Chiang Rai

1. GENERAL

1-1 Location of Route

The proposed road, Rt.1207 starts at the place just north of the Kok bridge on Rt.110, and extends to the north-western mountainous area, taking a distance of 13 Km. (see Figure 29-1-1)

The terrain traversed by the route is flat and partly rolling. Agricultural products mainly cultivated is rice followed by maize.

The proposed road is a finger type, so that most people in the surrounding area utilize this road. The population in the area of influence is about 12 thousand.

In geology, the route passes from alluvial basin of the Kok to granite and granodiorite igneous rock formation.

1-2 Conditions of Existing Road

For first 2 Km in the village are surface treated. Remaining section is surfaced with laterite. Horizontal alignment is repeatedly winding because of rough topography.

The road inventory of the route is summarized in Table 29-1-1.

Figure 29-1-1 ROUTE LOCATION
STUDY ROUTE NO. 29

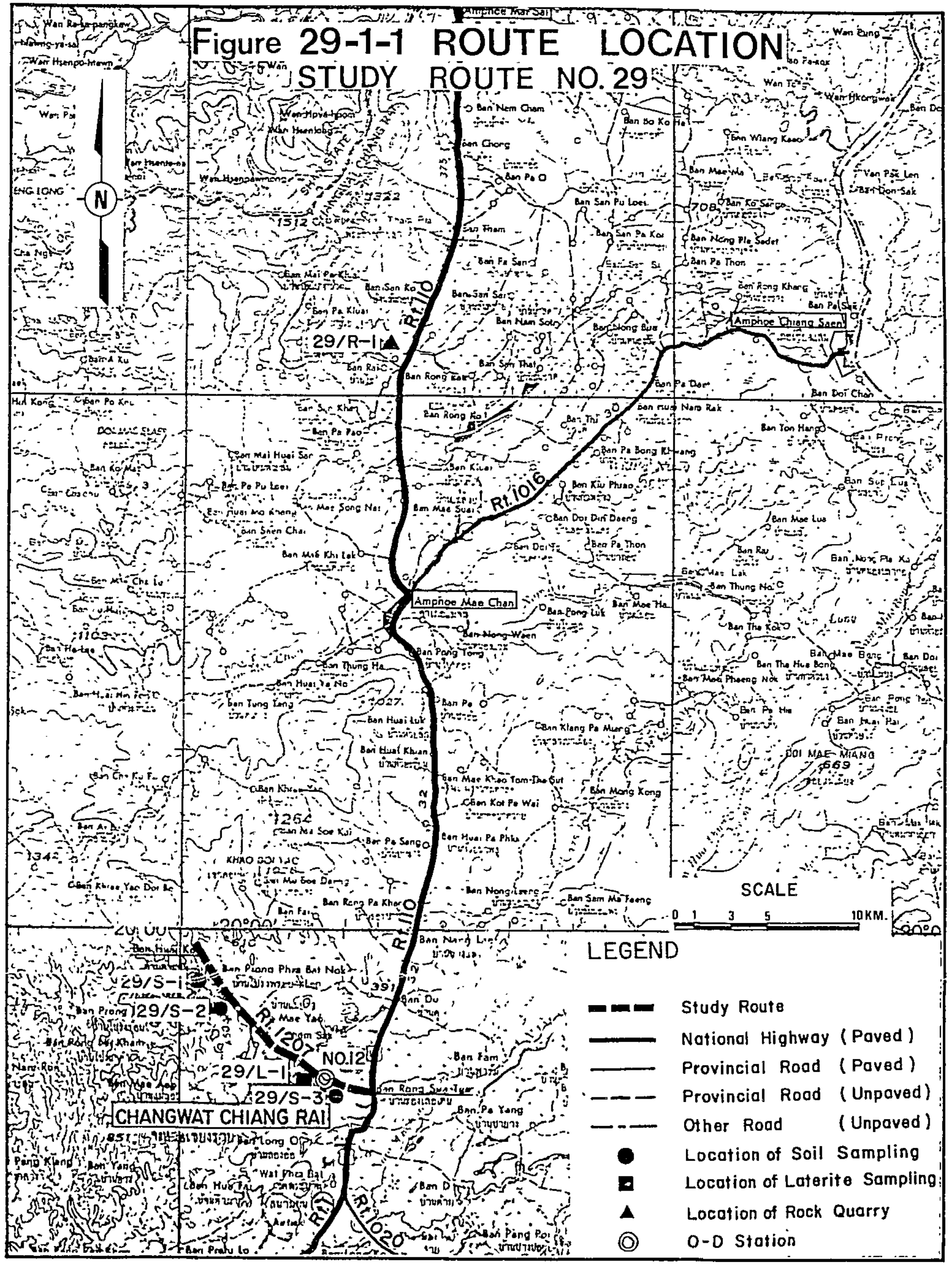


Table 29-1-1 SUMMARY OF ROAD INVENTORY - Route 29

Location (Changwat)	:	Chiang Rai		
Road belonged	:	DOH (Rt.1207)		
Origin/Destination	:	Rt.110 (B.Rong Sua Ten)/B.Huai Khom		
Length (Km)	:	13.2		
Terrain	:	Rolling		
Conditions of Roadway	:			
Surface		Earth	Laterite	S.T.
Length (Km)		0.4	10.8	2.0
Width (m)			5.0~9.0	5.5~10.0
Embankment (m)			0.5~1.0	0.5
Cutting (m)			0.5~1.0	-
Hori./Vert. Alignments			Fair/Fair	Fair/Fair
Surface Condition			Fair	Good
Bridge	:			
Number		3 (Timber)		
Width/Acc. Length(m)		4.5-6.0/37.0		
Land Use	:	Paddy / Maize		
Overflow Section	:			
Water Height/Length(m)		-		

2. TRAFFIC

2-1 Traffic Zone and Road Links

Traffic zoning was made as shown in Figure 29-2-1

The area of influence was divided into 2 traffic zones, and total population in the area amounts approximately to 11800. The density in terms of population per unit Km of the proposed road length is 890. Annual rate of population increase in the area is 2.1% in the past 3 years, which is almost same as the average of 2.2% in the Northern Region.

As the major destinations of transport demands originated in the area, four Amphoe of Muang Chiang Rai, Mae Sai, Chiang Saen and Mae Chan were chosen based on the O/D survey. Characteristics of the traffic zones are shown in Table 29-2-1.

The existing and proposed roads in the area together with surrounding roads concerned were divided into totaling 6 road links, 2 links in the proposed roads and 4 links in the surrounding roads. The details are shown in Table 29-2-2.

2-2 Transportation Demands

a) Passenger

Passenger transportation demands by O/D pair in the opening year of the project were estimated in both cases of with and without projects as follows:

Passenger O/D (without project)-1987

(trip/day)

	1	2	21	22	23	24
1	0	118	427	72	66	212
2	0	0	386	84	77	167
21	0	0	0	0	0	0
22	0	0	0	0	0	0
23	0	0	0	0	0	0
24	0	0	0	0	0	0

Passenger O/D (with project)-1987

(trip/day)

	1	2	21	22	23	24
1	0	200	427	73	66	215
2	0	0	809	107	97	246
21	0	0	0	0	0	0
22	0	0	0	0	0	0
23	0	0	0	0	0	0
24	0	0	0	0	0	0

b) Agricultural Freight

The major destinations of agricultural freight originated in the influencial area were selected at A. Muang Chiang Rai, basing on the agro-economic survey results.

The estimated agricultural freight O/D volumes in 1987 for the both cases of with and without projects are as follows:

Agri. Freight O/D (without project)-1987

(1,000 ton/year)

	1	2	21	22	23	24
1	0.0	0.0	3.4	0.0	0.0	0.0
2	0.0	0.0	9.2	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0

Figure 29-2-1 ZONING AND ROAD NETWORK

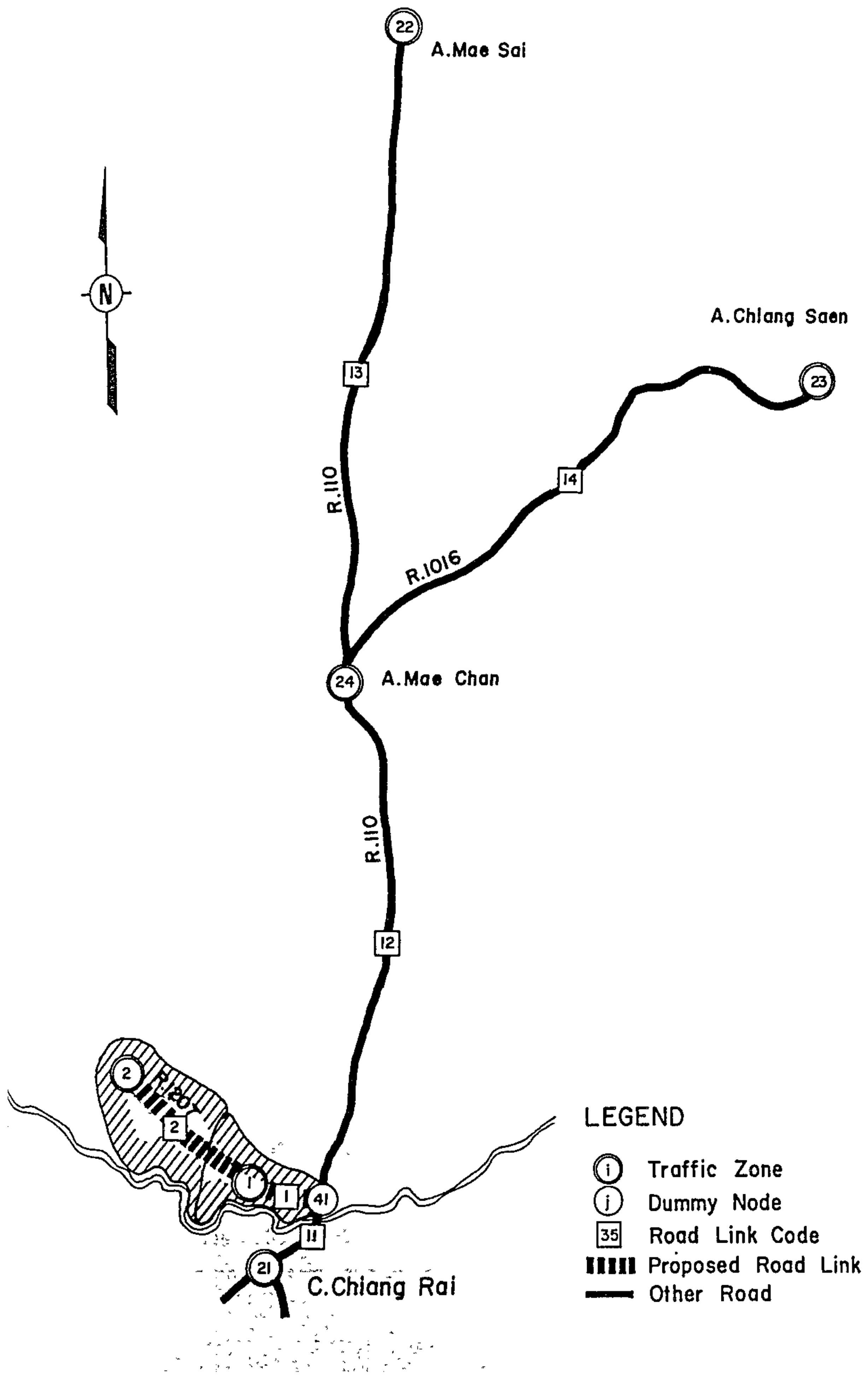


Table 29-2-1 ZONE CHARACTERISTICS

Traf. Zone	Relative Administrat. Div. Changwat	Amphoe	Tambon Code	% of Popul. in Traf. Zone	Popul. in 1981 (10^3)	Post Trend of Popul. Increase	Annual Rate of Increase 1981-1987	Projected Population in 1987 Generation	Attraction
1	C.R	M.Chiang Rai	090102	28	4.0	1.7	1.6	4.5	4.5
2	C.R	M.Chiang Rai	090106	72	7.8	2.2	1.7	8.7	8.7
21	C.R	M.Chiang Rai	090100	100	195.8	0.9	0.9	-	207.1
22	C.R	Mae Sai	090200	100	63.4	0.4	0.7	-	65.8
23	C.R	Chiang Saen	090300	100	47.2	0.9	0.9	-	49.5
24	C.R	Mae Chan	090500	100	103.3	0.7	0.7	-	107.8

Table 29-2-2 ROAD LINK CHARACTERISTICS

NO	SN	EN	LO	GOD	GOR	LW	GWD	GWR	TO	TW	REMARKS
1	1	41	2.0	5	5	2.0	4	4	2.0	1.7	R.1207
2	1	2	11.2	9	12	11.2	5	5	22.5	11.2	R.1207
11	21	41	3.0	1	1	3.0	1	1	2.3	2.3	R.110
12	24	41	27.0	1	1	27.0	1	1	20.8	20.8	R.110
13	22	24	32.0	1	1	32.0	1	1	24.6	24.6	R.110
14	23	24	30.0	4	4	30.0	4	4	25.7	25.7	R.1016

Note SN: Start Node, EN: End Node, LO: Link Length ($\overline{W}$), GOD: Road Grade in Dry Season ($\overline{W}$), GOR: Road Grade in Rainy Season ($\overline{W}$), LW: Link Length (W), GWD: Road Grade in Dry Season (W), GWR: Road Grade in Rainy Season (W), TO: Time ($\overline{W}$), TW: Time (W).

Agri. Freight O/D (with project)-1987

(1000ton/year)

	1	2	21	22	23	24
1	0.0	0.0	3.4	0.0	0.0	0.0
2	0.0	0.0	9.2	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0

c) Non-agricultural Freight

The non-agricultural freight transportation demands are estimated based on the model described in 3-3-3 in the Summary Report. Their movements on each road link were obtained relating with the passenger movements which were derived from the assignment of the passenger O/D volumes shown in the above a).

2-3 Traffic Composition, Occupancy and Loading Ratio

a) Traffic Composition

In accordance with the examination of the classified traffic counts in the Phase I and II studies and DOH's traffic records, the traffic composition on the existing roads of the project area was estimated as follows:

Existing Traffic Composition

Survey Points and Source	Passenger Traffic P/C	P/P	L/B	M/B	H/B	Total	Freight Traffic P/T	4/T	6/T	10/T	Total
No. 12(PhaseII)	.15	.34	.52	.00	.00	1.00	.08	.60	.32	.00	1.00
R. 1207(DOH)	.11	.23	.66		.00	1.00	.50		.50	.00	1.00
Estimated	.14	.30	.52	.04	.00	1.00	.12	.53	.35	.00	1.00

Changes in traffic composition due to income growth and road surface condition were predicted for the both cases of with and without projects as shown in the following tables:

Passenger Traffic Composition

Year	Without Project P/C	P/P	L/B	M/B	H/B	With Project P/C	P/P	L/B	M/B	H/B
1981	.14	.30	.52	.04	.00	.14	.30	.52	.04	.00
1987	.16	.34	.46	.04	.00	.18	.32	.45	.04	.01
1993	.18	.37	.42	.03	.00	.22	.33	.39	.03	.03
2001	.20	.42	.35	.03	.00	.27	.35	.30	.03	.05

Freight Traffic Composition

Year	Without Project P/T	4/T	6/T	10/T	With Project P/T	4/T	6/T	10/T
1981-2001	.12	.53	.35	.00	.19	.16	.65	.00

b) Occupancy

Occupancy by vehicle type and the average were determined as follows:

Occupancy

Vehicle Type	Person per Vehicle
P/C	3.1
P/P	4.4
L/B	10.9
M/B	16.2
H/B	38.3
Ave. (1993, $\overline{W}$)	7.3
(1993, W)	8.0

c) Loading Ratio

Loading ratio by vehicle type and the average were determined as follows:

Loading Ratio

Vehicle Type	Ave. Load of Loaded Truck	Rate of Loaded Trucks	Loading Ratio (ton)
P/T	0.65	.45	0.3
4/T	2.0	.50	1.0
6/T	4.1	.55	2.3
10/T	12.6	.60	7.6
Ave.($\overline{W}$)	-	-	1.4
(W)	-	-	1.7

2-4 Growth Rates of Transportation Demands

The growth rates of passenger, agricultural freight and non-agricultural freight transport demands for the periods of 1987-1993 and 1993-2001 were projected. The basis for the estimation of growth rate for passenger, and the projected rates are shown in the following tables:

The Basis for Estimation of Passenger Demands Growth

Indicator	Annual Growth Rate (%) 1987 - 1993	1993 - 2001	Elasticity
Per capita Income	5.7	5.5	1.08
Transportation price	3.6	3.6	-0.24
Population	1.4	1.1	1.00

Growth Rate of Transportation Demands

Type of Demand	Annual Growth Rate (%)		Index 1987=100	
	1987 - 1993	1993 - 2001	1993	2001
Passenger	6.7	6.2	147	238
Agri. Freight	0.1	0.1	100.8	102.4
Non-Agri. Freight	8.0	7.4	159	281

2-5 Forecasted Traffic

a) Forecasted Traffic by Vehicle Type

The forecasted traffic is summarized in the following table:

Forecasted Traffic

Year	P/C	L/B	M/B	H/B	P/P P/T	4/T	6/T	10/T	ADT	M/C
1987	35	88	8	2	77	12	47	0	269	498
1993	63	111	9	9	114	17	69	0	391	621
2001	124	138	14	23	195	28	115	0	637	772

b) Forecasted Traffic by Road Link

Details of the forecasted traffic by road link by traffic type are shown in the following table, taking a sample of the case of 1993:

Forecasted Traffic by Road Link

TRAFFIC VOLUME ON ROUTE 29 (1993)

LINK		1	2	AVR.
P/C	N+D	60	34	38
	I	22	25	25
	DV	0	0	0
	TOTAL	82	59	63
L/B	N+D	107	60	67
	I	39	45	44
	DV	0	0	0
	TOTAL	146	105	111
M/B	N+D	8	5	5
	I	3	3	3
	DV	0	0	0
	TOTAL	.11	8	9
H/B	N+D	8	5	5
	I	3	3	3
	DV	0	0	0
	TOTAL	11	8	9
P/P&T	N+D	111	61	69
	I	41	46	45
	DV	0	0	0
	TOTAL	151	107	114
4/T	N+D	17	9	10
	I	6	7	7
	DV	0	0	0
	TOTAL	23	16	17
6/T	N+D	70	38	43
	I	26	27	27
	DV	0	0	0
	TOTAL	95	65	69
10/T	N+D	0	0	0
	I	0	0	0
	DV	0	0	0
	TOTAL	0	0	0
ADT	N+D	381	211	237
	I	140	156	154
	DV	0	0	0
	TOTAL	521	367	391
M/C	N+D	603	363	400
	I	186	228	221
	DV	0	0	0
	TOTAL	790	591	621
TOTAL	N+D	984	574	636
	I	327	384	375
	DV	0	0	0
	TOTAL	1311	959	1012

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

3. AGRICULTURAL DEVELOPMENT

3-1 Crop Production

Relatively intensive cultivation of paddy and upland crops has been performed in the area. Beside the major crop of paddy, mainly grown are maize, vegetables, fruits, tobacco and ground nuts. More than 70% of paddy in the area is glutinous rice, and its yield, more than 600 kg/rai, is of high level in the Northern Region. All surplus commodities are sent to assembly markets or factories in Chiang Rai city.

In Chiang Rai city, there exist 10 rice mills of 60 t ~ 120 t /day and several mills of 60t /day.

Land use and capability in the area of influence is illustrated in Figure 29-3-1. Typical cropping calendar in Chiang Rai area is also shown in Figure 29-3-2. Based on the estimated planted area and yields, the future crop production in the area of influence after opening of the proposed road is given in the following Table 29-3-1.

3-2 Net Value Added

In accordance with the concept discussed in Chapter 4 of Summary Report, net value added was calculated for both cases, with project and without project. The agricultural development benefit, indicated by the increment of net value added of crop production in the with project case, attributable to the project is estimated at 1.9, 2.1 and 2.4 in million Baht for 1987, 1993 and 2001 respectively.

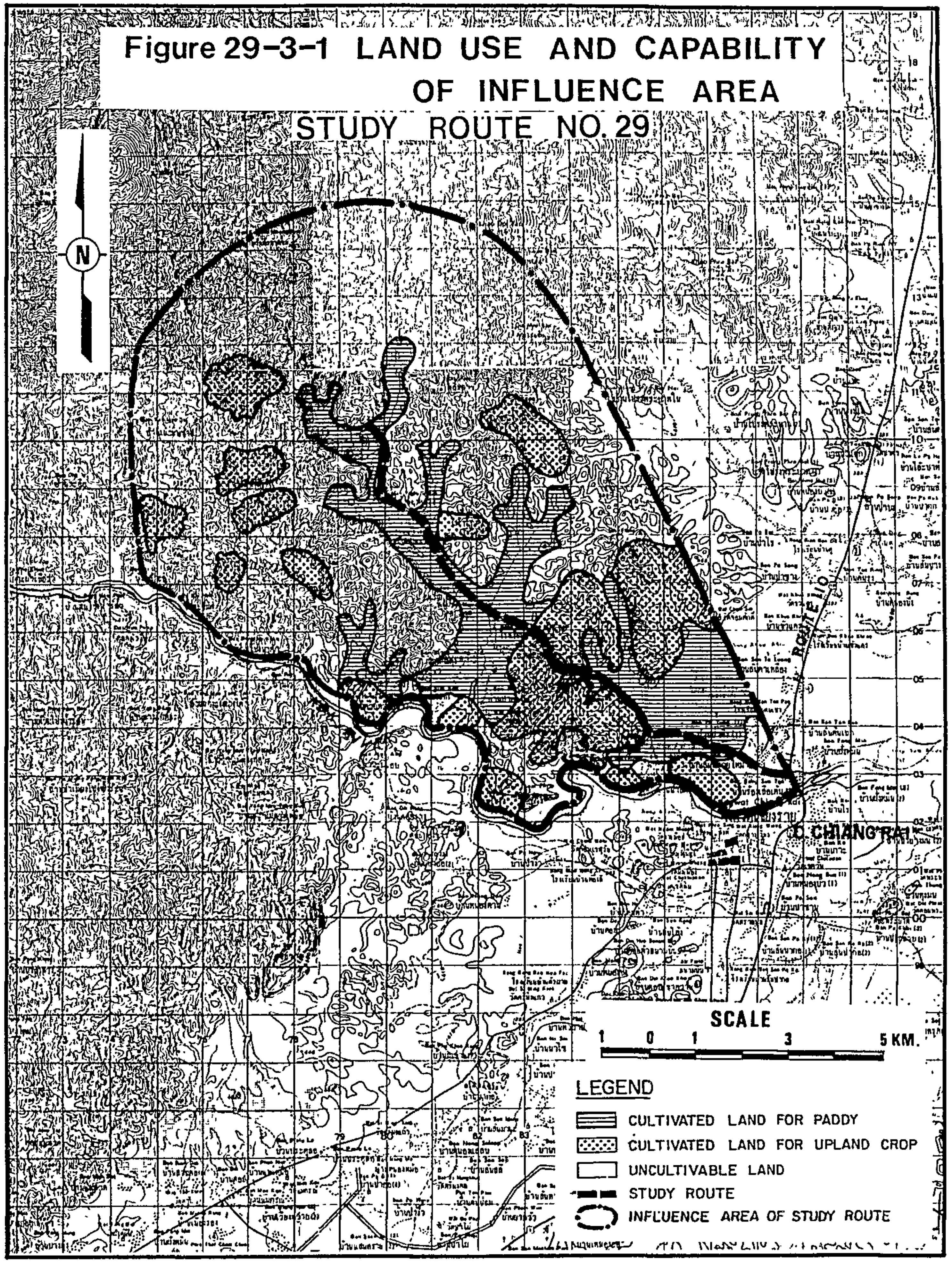


Figure 29-3-1 LAND USE AND CAPABILITY OF INFLUENCE AREA STUDY ROUTE NO. 29

Figure 29-3-2 TYPICAL CROPPING CALENDAR - Route 29

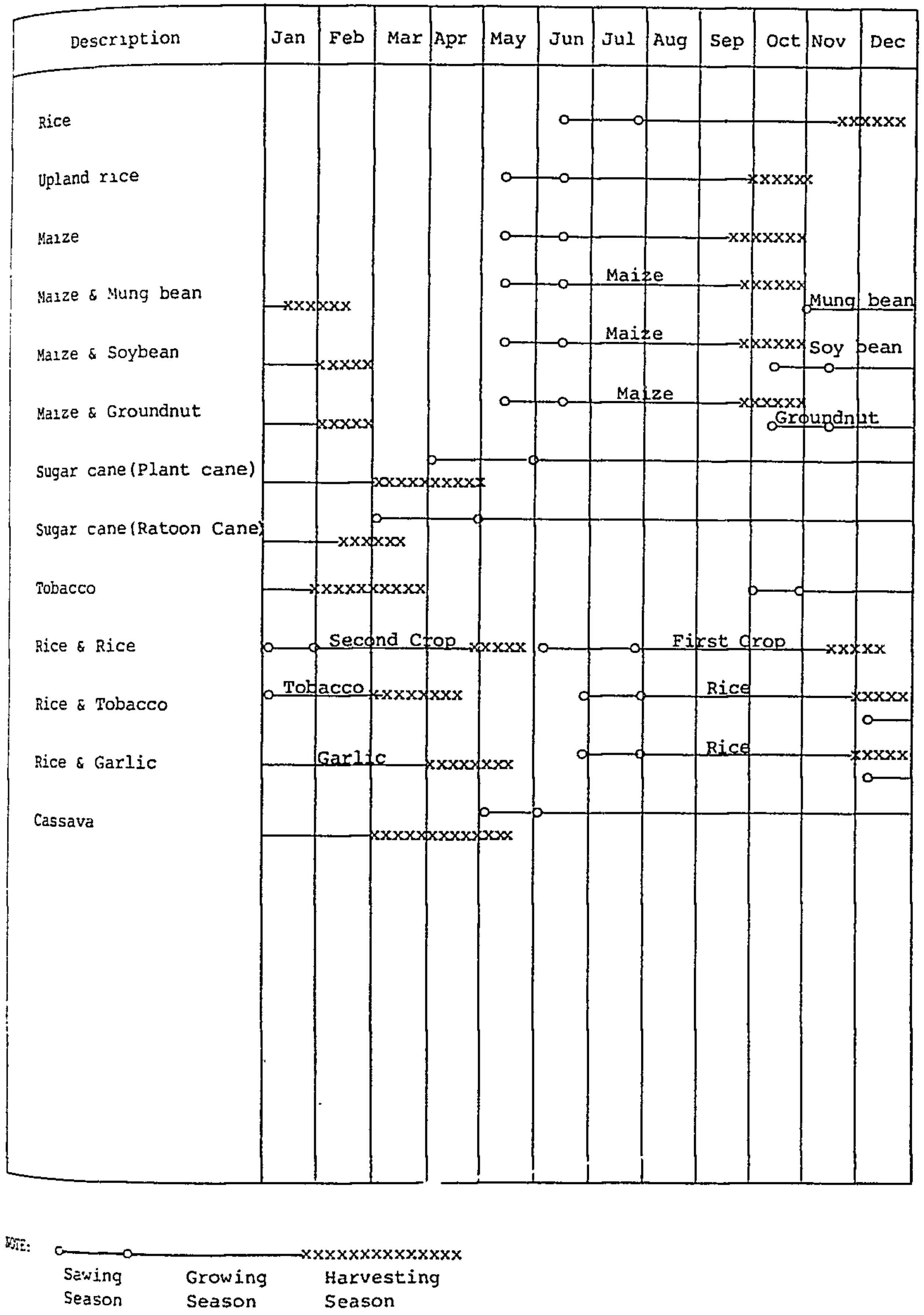


Table 29-3-1 CROP PRODUCTION - Route 29

(1000 TON)

CROP	1987		1993		2001	
	W/O	W	W/O	W	W/O	W
PADDY	6.2	6.2	6.2	6.3	6.2	6.3
MAIZE	1.8	1.8	1.8	1.9	1.8	1.9
MUNG BEAN	0.1	0.1	0.1	0.1	0.1	0.1
SOY BEAN	0.1	0.1	0.1	0.1	0.1	0.1
GROUND NUTS	0.5	0.5	0.5	0.5	0.5	0.6
SORGHUM	0.0	0.0	0.0	0.0	0.0	0.0
CASSAVA	0.1	0.1	0.1	0.1	0.1	0.1
SUGAR CANE	0.1	0.1	0.1	0.1	0.1	0.1
TOBACCO	0.7	0.7	0.7	0.7	0.7	0.7
COTTON	0.0	0.0	0.0	0.0	0.0	0.0
GARLIC	0.1	0.1	0.1	0.1	0.1	0.1
CHILLI	0.0	0.0	0.0	0.0	0.0	0.0
SESAME	0.0	0.0	0.0	0.0	0.0	0.0
VEGETABLES	1.3	1.3	1.3	1.3	1.3	1.3
FRUITS	0.7	0.7	0.7	0.7	0.7	0.7
OTHERS	0.9	0.9	0.9	0.9	0.9	0.9

4. ROAD USERS COST SAVINGS

In accordance with the concept and basic data described in Chapter 5 of Summary Report, sums of VOC on each road link concerned were calculated in both cases of with project and without project.

Road users cost savings, defined as the difference of total link VOC in the case of with project and that in the without project case, were estimated at 1.8, 2.9 and 5.1 in million Baht for 1987, 1993 and 2001 respectively.

5. ENGINEERING

5-1 Soils and Materials

Test results of subgrade soil, materials for subbase and shoulders and crushed rocks along the route or in the vicinity of the project area are shown in Table 29-5-1.

Location of smaplings for the soil test done in this study are shown in the Location Map of Figure 29-1-1.

5-1-1 Subgrade Soils

Subgrade soils along the study route consist mainly of silty clay of N.P. They were classified as A-1-6 and A-4 in the AASHTO Classification. CBR values are from 4.0 to 13.0%.

5-1-2 Subbase and Shoulder Materials

Test results of laterite sampled along the study route indicated that the plasticity-index in the portion passing the No. 4 sieve was about 20.0% and the soaked CBR was about 23.0%.

The laterite along the study route are not suitable for use in subbase and shoulder layer because of its high plasticity and low CBR value. This was used as the selected material. The materials for subbase and shoulder were planned to carry from the laterite source commonly used by DOH at 2.5 km of Route 1232.

5-1-3 Rock Material

The rock quarry available for the proposed road is the source 29/R-1 which is located along Rt. 1149, 40 km north of the proposed road. The Los Angeles abraision test indicated the loss of 21%, less than DOH specified value.

5-2 Preliminary Design

Design speed employed in the Studies is 60 Km/hr according to F4 class of DOH Design Standard.

5-2-1 Alignment and Earthwork

As the horizontal and vertical alignments are fair condition, no major improvements to the existing road are required.

The widening width and the raising height vary from 1.0m to 5.5 m and from 0.3 m to 2.0 m, respectively.

5-2-2 Pavement Design (F4 Class)

1) Design Traffic Number (DTN)

The basic data on traffic volume for DTN calculation are as follows:

	Heavy Truck	Medium Truck	Heavy Bus	Total	Remarks
Average Number of Heavy Vehicles	-	47	2	49	ADT in 1987

Using the traffic analysis chart,DTN obtained for DTN7 (7 years design period) and DTN15 (15 years) were 2.0 and 5.0 , respectively.

2) Design CBR

Design CBR of 30 percentile value was calculated at 4.2 percent from the following testing results.

Table 29-5-1 TEST RESULTS OF SOILS AND MATERIALS

Description	Sample No.	Location of Source (KM)	Deptn (m)	Description of Sample	AASHO Classi- fication	Sieve Analysis (% Passing) 50.0	25.0	19.0	9.5	#4	#10	#40	#200	Plasticity LL (%)	PI (%)	Compaction DH-T STD. Opt. Mc.(%)	γd gm/cc.	Lab.CBR CBR (%)	Swell (%)	Moisture Content (After Soaked) (%)	Abrasion (%)
Subgrade Soil	29/S-1	1+975 (L.3m)	0.1-0.7	silty clay	A-4	-	-	100	98.6	95.6	91.2	84.2	72.8	N - P		19.0	1.697	4.1	0.33	24.7	
	29/S-1	3+575 (L.3)	0.1-0.7	silty clay	A-1-6	-	100	89.6	84.6	77.0	67.0	35.8	21.8	N - P		10.4	1.910	7.2	0.42	13.0	
	29/S-3	11+000 (L.3)	0.1-0.7	silty clay	A-2-4	-	-	100	99.6	93.6	83.8	50.8	31.4	N - P		12.6	1.868	13.2	0.11	15.2	
Subbase/ Shoulder Material	29/L-1	KM 3+575 (LT.)		laterite	-	100	89.9	83.6	66.5	44.2	25.8	22.3	19.2	49.2	22.8	23.0*	1.598*	16.0	0.62		37.6
Crushed Rock	29/R-1	Km. Post 872+000 1.5 Km from Rt.110 Along Rt.1149																			21.0

Note : * Compaction by DH-T-MOD

Sample No.	1	2	3	Design CBR
CBR Testing Values	4.1	7.1	(13.1)1/	4.2

Note: 1/ Subgrade soil with high value of CBR exists in short section only along the route. Therefore this value was not employed in the calculation of design CBR.

A lot of sources of laterite suitable for the selected material can be found along the route.

To reduce the pavement thickness, 200 mm thick layer of selected material with the CBR value of 15% was considered on the subgrade soil. As the result, the design CBR obtained from the formula described in Volume 1 was 5.6.

3) Thickness of Pavement

Thickness of full-depth asphaltic concrete were obtained from the Thickness Design Chart as 130 mm and 155 mm for TA7 (7 years design period) and TA15 (15 years), respectively.

Thickness of pavement structures of SBST was determined from calculated TA7 130 mm full-depth asphaltic concrete as follows:

SBST		12 mm
Crushed stone base	CBR $\geqq$ 80	150 mm
Soil aggregate subbase	CBR $\geqq$ 20	150 mm
Selected material layer	CBR $\geqq$ 6	200 mm

Thickness of overlay required at 7th year is 25 mm (TA15-TA7) in case of asphaltic concrete. If it is planned with SBST, the layer composition is as follows:

SBST		12 mm
Crushed stone base	CBR 80	50 mm

5-2-3 Drainage

1) Pipe Culvert

Pipe culverts (ø 1.0 m) are installed at intervals of 200 m for first 3.5 km, where the land is used almost for paddy fields and at every sag points for the remainder.

Box culverts were not planned.

5-2-4 Bridge

Short span concrete bridge was planned where the river is relatively narrow and shallow. The length of bridges was determined by comparing discharge with flow capacity of bridge opening.

List of Bridge

Station	Existing Structure	Catchment Area (Km^2)	Intensity (mm/hr)	Discharge (m^3/sec)	Proposed Structure 1/	Capacity (m^3/sec)
2+300	BR-T(6.0x6.0)	3	100	60	BR-C-10.0	63
7+200	BR-T(6.0x6.0)	6	100	88	BR-C-10.0	89
12+800	BR-T(4.5x25.0)	31	81	377	BR-C-34.0	388

Total length = 54.0 m

Note: 1/ Carriageway width of bridge is 7.0 m

6. CONSTRUCTION COST

Construction costs were obtained by applying the unit rates to the respective work quantities calculated on the basis of the engineering studies.

Rock materials used for SBST, base course and structure works were supposed to be transported from rock quarry 29/R-1 with a hauling distance of 52 km. The transportation cost for this hauling distance was reflected to each unit rate.

The construction cost together with land acquisition cost are givenin Table 29-6-1.

The construction period for the proposed road was estimated to be 2 years. Yearly disbursements of construction cost together with price contingency are shown in the following table.

YEARLY COST DISBURSEMENT - Route 29

(Million Baht)

	1984		1985		1986		Total		
	L/C1/	F/C2/	L/C	F/C	L/C	F/C	L/C	F/C	Total
Construction Cost	-	-	3.5	3.3	8.2	7.6	11.7	10.9	22.6
Price Contingency3/	-	-	1.6	0.8	4.9	2.4	6.5	3.2	9.7
Total	-	-	5.1	4.1	13.1	10.0	18.2 (0.79)	14.1 (0.61)	32.3 (1.40)

Note: 1/ Local Currency

2/ Foreign Currency

3/ At assumed annual escalation rates as follows (% p.a.):

	Local C.	Foreign C.
1981 - 1983	15	7.5
1983 - 1987	10	6.5

( ) Million US$ Equivalent (1 US$ 22.63 Baht)

Table 29-6-1 CONSTRUCTION COST - Route 29 (F-4 / 13.2 Km)

Description	Unit of Quantity	Financial Unit Rate (Baht)	Quantity	Economic Cost (10^3 ฿)
Clearing & Grubbing	ha	17,000	22	340
Roadway Excavation-Classified Earth	m^3	36	0	0
Roadway Excavation-Classified Soft Rock	m^3	80	0	0
Embankment-Side Borrow	m^3	45	74,100	3,035
Embankment-Borrow Pit	m^3	60	0	0
Embankment-Selected Material	m^3	80	0	0
Subbase-Soil Aggregate	m^3	106	19,600	1,849
Base-Crushed Rock	m^3	337	12,900	4,000
Shoulder-Soil Aggregate	m^3	170	5,500	832
Asphaltic Prime Coat	m^2	11.3	85,800	892
Single Bituminous Surface Treatment	m^2	28.0	72,600	1,830
R.C. Pipe Culvert	m	2,700	210	522
R.C. Box Culvert	m	18,700	0	0
R.C. Bridge-Short Span	m	41,400	54	1,990
P.C. Bridge-Long Span	m	71,600	0	0
Sub-Total				15,290
Miscellaneous Works1/				1,070
Total Direct Construction Cost				16,360
PHYSICAL CONTINGENCY2/				2,454
DESIGN AND CONSTRUCTION SUPERVISION3/				1,636
Total				20,450
Land Acquisition				
Highly Devel'd Land	ha	50,000	0	0
Less Devel'd Land	ha	15,000	0	0
Grand Total				20,450
FINANCIAL COST (10^3 Baht)				(22,570)

NOTE: 1/ 7% of direct construction cost of major work items.

2/ 15% of direct construction cost.

3/ 10% of direct construction cost.

7. EVALUATION

In accordance with the basic conditions of economic evaluation discussed in Chapter 8 of Summary Report and economic costs and benefits estimated as in the foregoing sections, internal rate of return of the proposed road project was calculated at 15.6%. This implies that the proposed project is economically viable, assuming that the opportunity cost of capital is 12%.

Details of costs and benefits stream are given in Table 29-7-1.

Table 29-7-1 COSTS AND BENEFITS STATEMENT - Route 29

(1000 BAHT)

YEAR	COST: CONST. COST	BENEFITS: AGRI. BENEFIT	BENEFITS: VOC SAVING	BENEFITS: RMC SAVING	TOTAL	DISCOUNTED(12%): COST	DISCOUNTED(12%): BENEFIT
1983	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0
1985	6,140	0	0	0	0	7,702	0
1986	14,310	0	0	0	0	16,027	0
1987	0	1,860	1,803	-28	3,634	0	3,245
1988	0	1,897	1,987	-25	3,859	0	3,076
1989	0	1,933	2,171	-21	4,083	0	2,906
1990	0	1,970	2,355	-18	4,308	0	2,738
1991	0	2,007	2,540	-14	4,533	0	2,572
1992	0	2,043	2,724	-10	4,757	0	2,410
1993	0	2,080	2,908	-7	4,982	0	2,253
1994	8,893	2,118	3,185	-1	5,301	4,023	2,141
1995	0	2,155	3,461	5	5,621	0	2,027
1996	0	2,193	3,737	11	5,940	0	1,913
1997	0	2,230	4,013	17	6,260	0	1,800
1998	0	2,268	4,289	23	6,579	0	1,689
1999	0	2,305	4,566	28	6,899	0	1,581
2000	0	2,343	4,842	34	7,219	0	1,477
2001	-9,407	2,380	5,118	40	7,538	-1,719	1,377
TOTAL	19,936	31,780	49,699	35	81,513	26,033	33,205

DISCOUNTED ECONOMIC COSTS : 26,033

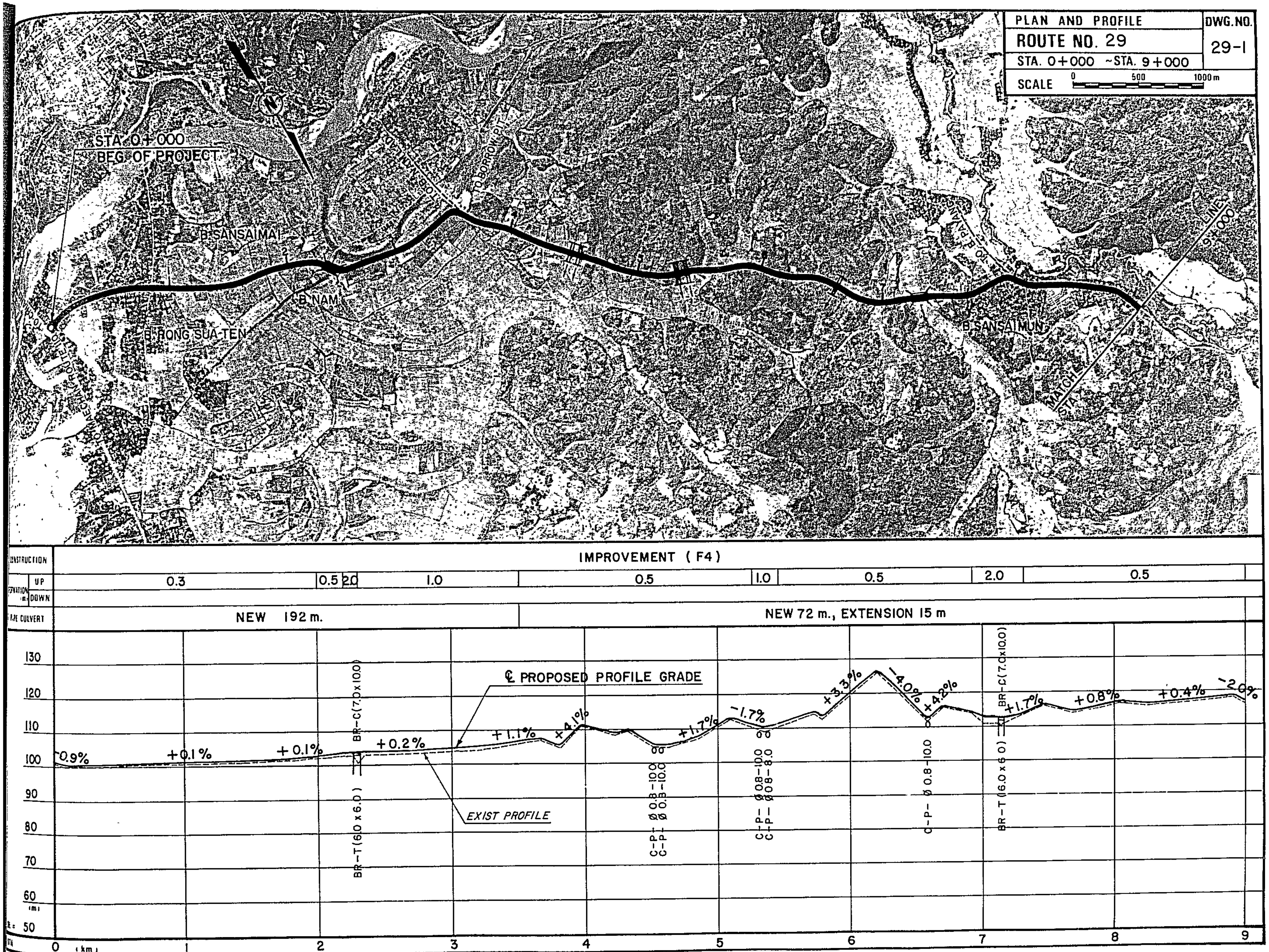
DISCOUNTED ECONOMIC BENEFITS : 33,205

AGRICULTURAL DEVELOPMENT BENEFIT 13,919
VOC SAVING 19,337
RMC SAVING -51

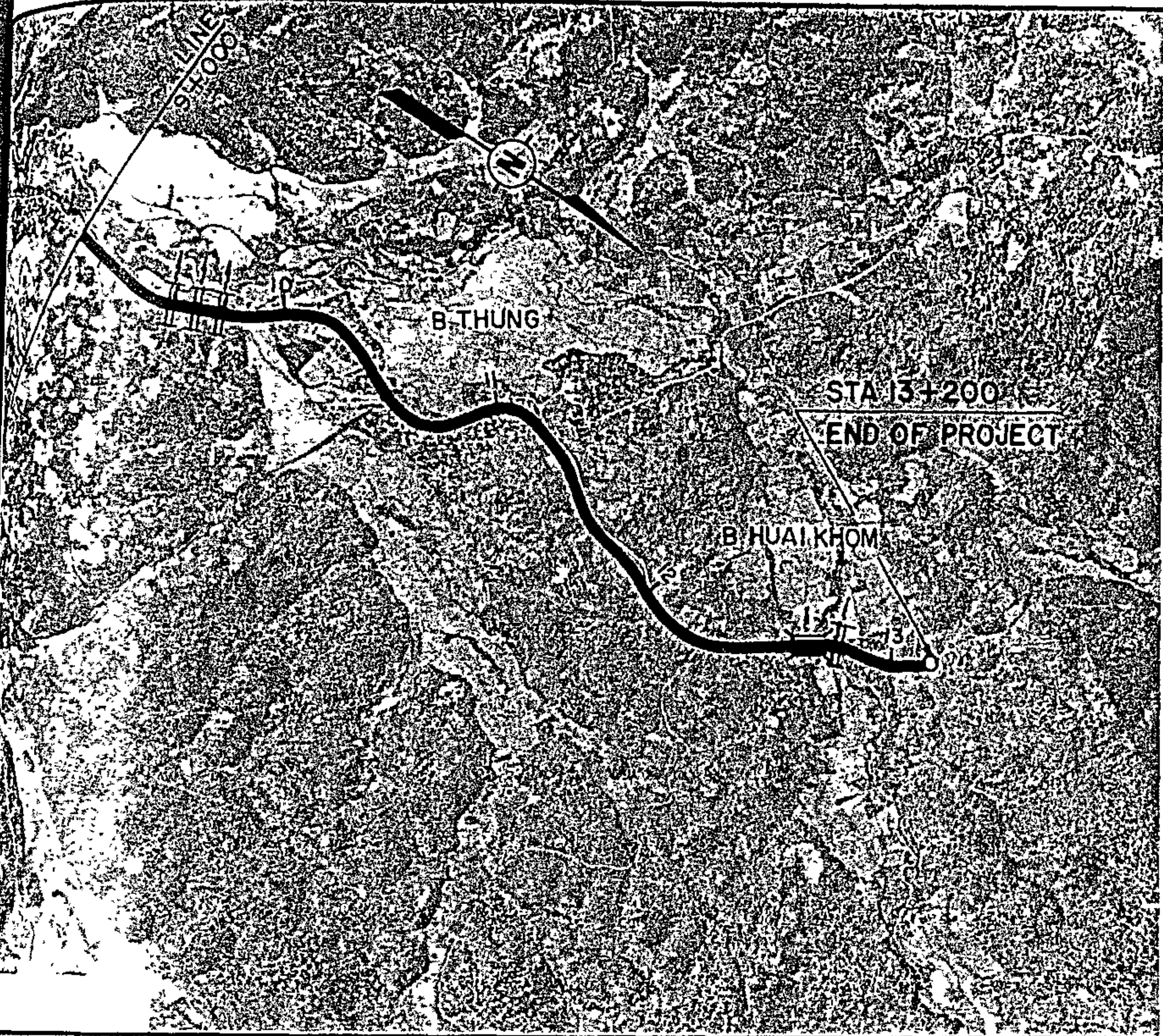
NET PRESENT VALUE : 7,172

BENEFIT COST RATIO : 1.28

INTERNAL RATE OF RETURN : 15.6 %


PLAN AND PROFILE
ROUTE NO. 29
STA. 0+000 ~STA. 9+000
SCALE 0 500 1000 m
DWG. NO.
29-1
STA. 0+000
BEG. OF PROJECT
B. SANSAIMAI
B. NAM
B. RONG SUA-TEN
B. SANSAIMUN
STA. 9+000
IMPROVEMENT (F4)
0.3
0.5
2.0
1.0
0.5
1.0
0.5
2.0
0.5
UP
DOWN
CULVERT
NEW 192 m.
NEW 72 m., EXTENSION 15 m
℄ PROPOSED PROFILE GRADE
EXIST PROFILE
-0.9%
+0.1%
+0.1%
+0.2%
+1.1%
+4.1%
+1.7%
-1.7%
+3.3%
-4.0%
+4.2%
+1.7%
+0.8%
+0.4%
-2.0%
BR-C(7.0x10.0)
BR-T(6.0x6.0)
C-P- Ø 0.8-10.0
C-P- Ø 0.8-10.0
C-P- Ø 0.8-10.0
C-P- Ø 0.8- 8.0
C-P- Ø 0.8-10.0
BR-C(7.0x10.0)
BR-T(6.0x6.0)
130
120
110
100
90
80
70
60
(m)
50
0 (km)
1
2
3
4
5
6
7
8
9

PLAN AND PROFILE	DWG NO
ROUTE NO. 29	29-2
STA 9+000 ~STA 13+200	
SCALE 0 500 1000 m	



CONSTRUCTION		IMPROVEMENT (F4)
ELEVATION (m)	UP	1.0 · 0.5 · 1.0 · 0.5 · 2.0 · 0.5
	DOWN	
PIPE CULVERT		NEW 108 m., EXTENSION 10 m.