## STUDY ROUTE NO. IM-7

Changwat : Udon Thani

B. Lao (J.R. 210) – B. Tha Yom (J.R. 2316)

Length : 40.7 KM.

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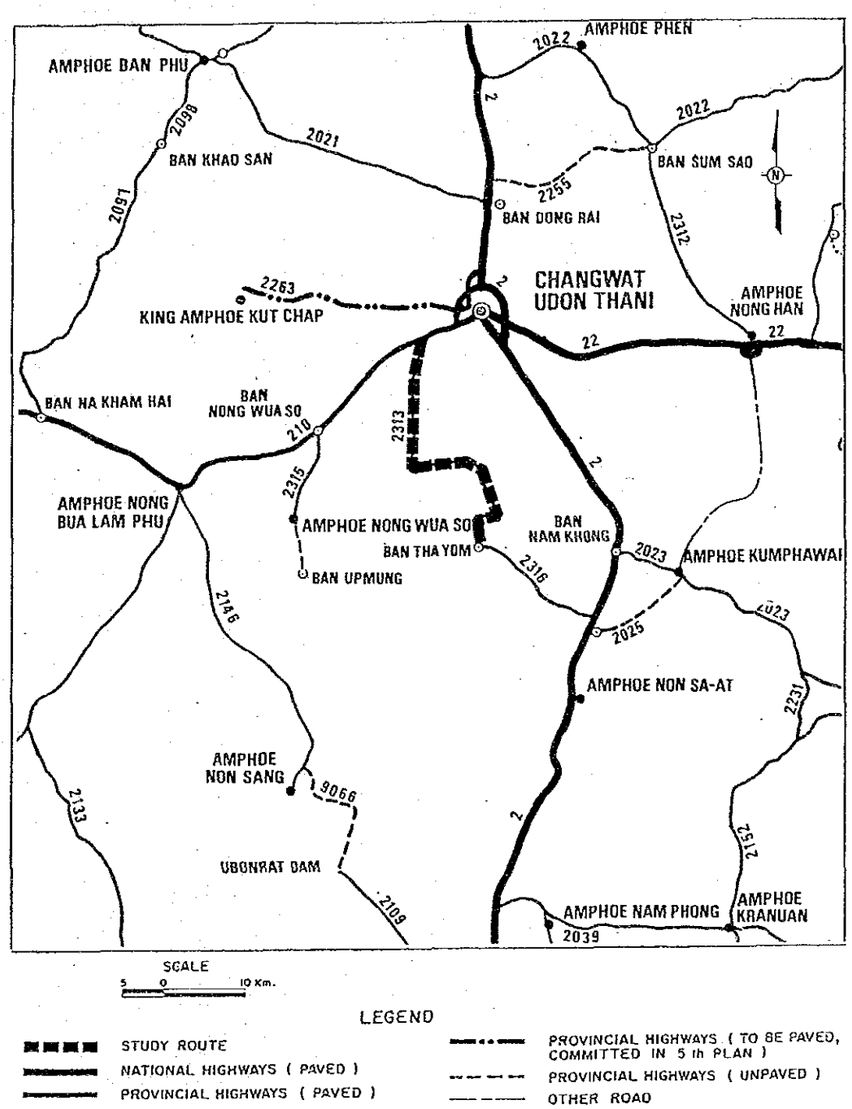
## SUMMARY

## STUDY ROUTE IM-7

| | | |
|---|---|---|
| General | | |
| Changwat | : | Udon Thani |
| Origin and Destination | : | B. Lao—B. Tha Yom |
| Connected Road Network | : | 210—2316 |
| Amphoe on Route | : | Ka Nong Saeng |
| Number of Related Villages | : | 5 |
| Influence Area | | |
| Area | : | 269 $km^2$ |
| Cultivated Area Ratio to Total Land Area in % | : | 74 |
| Population in 1983 | : | 31,000 |
| Main Crops | : | Paddy & Sugarcane |
| Number of Public Activities | | |
| Public Health Service Centers | : | - |
| Hospitals Changwat Level | : | 1 |
| Amphoe Level | : | 1 |
| Schools Primary | : | 8 |
| Secondary | : | 1 |
| Traffic (ADT) | : | 1984— 55 1988—126 1994—173 2002—264 |
| Nomenclature of Study Route | | |
| Total Length | : | 40.7 km |
| Improvement Section | : | 40.7 km |
| DOH Road | : | 17.7 km |
| ARD Road | : | 23.0 km |
| Other Road | : | - |
| New Construction Section | : | - |
| Design Standard Employed | : | F4 |
| Construction Cost in Baht | | |
| Financial | : | 65,041,000 |
| Economic | : | 54,647,000 |
| Economic Indicators | | |
| IRR | : | 11.1% Ranking: 13 |
| Social Impact | | |
| Social B/C Ratio | : | 0.321 Ranking: 3 |
| Recommendations | | |
| Opening Year | : | 1990 Overall Ranking: 13 |

### LOCATION OF STUDY ROUTE

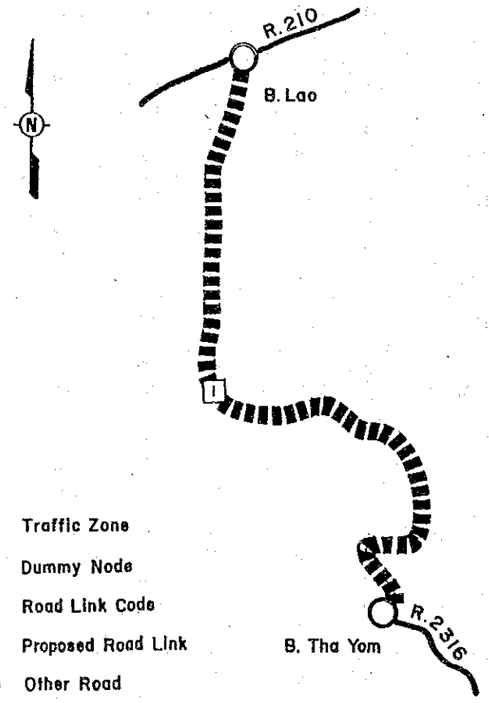


## 7.1 TRAFFIC

### 7.1.1 Method Employed in Traffic Forecasting

The growth rate method was employed in forecasting because no diverted traffic after improvement is expected on this study route.

### 7.1.2 Assumed Road Link




### 7.1.3 Traffic Forecast

1) Items necessary for forecasting traffic were:
   - Traffic volume in base year
   - Passenger and freight movements in base year
   - Growth rates of passenger and freight movement
   - Rate of induced and developed movements
   - Traffic composition

TRAFFIC VOLUME IN BASE YEAR

| LINK | TYPE OF VEHICLE | | | | | | | | ADT | M/C | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | P/C | L/B | M/B | H/B | P/P&T | 4/T | 6/T | 10/T | | | |
| 1 | 0 | 7 | 14 | 0 | 21 | 5 | 2 | 6 | 55 | 64 | 119 |

PASSENGER AND FREIGHT MOVEMENT IN BASE YEAR

| PROPOSED ROAD LINK | PASSENGER MOVEMENT (TRIPS PER DAY) | FREIGHT MOVEMENT (TONNAGE PER DAY) | | |
|---|---|---|---|---|
| | | NON-AGRI. | AGRI. | TOTAL |
| 1 | 447 | 7.9 | 44.5 | 52.4 |

GROWTH RATE OF PASSENGER MOVEMENT

(UNIT : % P.A.)

| YEAR | PER CAPITA INCOME | POPULATION | PASSENGER MOVEMENT |
|---|---|---|---|
| 1984 - 1988 | 3.1 | 1.2 | 5.6 |
| 1988 - 1994 | 3.1 | 1.0 | 5.5 |
| 1994 - 2002 | 3.1 | 0.9 | 5.3 |

GROWTH RATE OF FREIGHT MOVEMENT

(UNIT : % P.A.)

| YEAR | NON-AGRI. FREIGHT | AGRI. FREIGHT | FREIGHT MOVEMENT |
|---|---|---|---|
| 1984 - 1988 | 6.9 | 1.0 | 1.9 |
| 1988 - 1994 | 6.8 | 1.0 | 2.1 |
| 1994 - 2002 | 6.6 | 1.0 | 2.5 |

RATE OF INDUCED AND DEVELOPED MOVEMENT

(UNIT : %)

| YEAR | INDUCED | DEVELOPED | | |
|---|---|---|---|---|
| | LINK 1 | PASSENGER MOVEMENT | NON-AGRI. FREIGHT MOVEMENT | AGRI. FREIGHT MOVEMENT |
| 1988 | 64.0 | 0.0 | 0.0 | 0.8 |
| 1994 | 64.0 | 0.0 | 0.0 | 6.0 |
| 2002 | 64.0 | 0.0 | 0.0 | 6.9 |

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 |
| | 1984 | 0.0 | 58.2 | 13.9 | 27.9 | 0.0 | 18.8 | 31.3 | 12.5 | 37.5 |
| 1 | 1988 | 8.7 | 53.7 | 11.5 | 24.6 | 1.6 | 17.5 | 26.8 | 20.8 | 34.9 |
| | 1994 | 21.7 | 47.0 | 7.9 | 19.6 | 3.9 | 15.6 | 20.0 | 33.3 | 31.1 |
| | 2002 | 39.0 | 38.0 | 3.0 | 13.0 | 7.0 | 13.0 | 11.0 | 50.0 | 26.0 |

2) The following were output:

- Forecasted ADT
- Traffic volumes

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 | | | |
| 1988 | 8 | 11 | 24 | 2 | 57 | 8 | 6 | 10 | 126 | 201 | 326 |
| 1994 | 30 | 11 | 27 | 5 | 70 | 7 | 12 | 11 | 173 | 247 | 420 |
| 2002 | 86 | 7 | 29 | 15 | 89 | 5 | 22 | 11 | 264 | 308 | 572 |



TRAFFIC VOLUME ON ROUTE IM- 7 LINK COUNT= 1

| YEAR | | 1988 | | 1994 | | 2002 | |
|---|---|---|---|---|---|---|---|
| LINK | | 1 | AVR. | 1 | AVR. | 1 | AVR. |
| P/C | N+D | 5 | 5 | 18 | 18 | 52 | 52 |
| | I | 3 | 3 | 12 | 12 | 34 | 34 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 8 | 8 | 30 | 30 | 86 | 86 |
| L/B | N+D | 7 | 7 | 7 | 7 | 4 | 4 |
| | I | 4 | 4 | 4 | 4 | 3 | 3 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 11 | 11 | 11 | 11 | 7 | 7 |
| M/B | N+D | 14 | 14 | 17 | 17 | 17 | 17 |
| | I | 9 | 9 | 11 | 11 | 11 | 11 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 24 | 24 | 27 | 27 | 29 | 29 |
| H/B | N+D | 1 | 1 | 3 | 3 | 9 | 9 |
| | I | 1 | 1 | 2 | 2 | 6 | 6 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 2 | 2 | 5 | 5 | 15 | 15 |
| P/P&T | N+D | 35 | 35 | 43 | 43 | 54 | 54 |
| | I | 22 | 22 | 27 | 27 | 35 | 35 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 57 | 57 | 70 | 70 | 89 | 89 |
| 4/T | N+D | 5 | 5 | 4 | 4 | 3 | 3 |
| | I | 3 | 3 | 3 | 3 | 2 | 2 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 8 | 8 | 7 | 7 | 5 | 5 |
| 6/T | N+D | 4 | 4 | 7 | 7 | 13 | 13 |
| | I | 2 | 2 | 4 | 4 | 8 | 8 |
| | DV | 0 | 0 | 1 | 1 | 1 | 1 |
| | TOTAL | 6 | 6 | 12 | 12 | 22 | 22 |
| 10/T | N+D | 6 | 6 | 6 | 6 | 7 | 7 |
| | I | 4 | 4 | 4 | 4 | 4 | 4 |
| | DV | 0 | 0 | 0 | 0 | 1 | 1 |
| | TOTAL | 10 | 10 | 11 | 11 | 11 | 11 |
| ADT | N+D | 76 | 76 | 104 | 104 | 160 | 160 |
| | I | 49 | 49 | 67 | 67 | 102 | 102 |
| | DV | 0 | 0 | 2 | 2 | 2 | 2 |
| | TOTAL | 126 | 126 | 173 | 173 | 264 | 264 |
| M/C | N+D | 129 | 129 | 174 | 174 | 235 | 235 |
| | I | 72 | 72 | 72 | 72 | 72 | 72 |
| | DV | 0 | 0 | 1 | 1 | 1 | 1 |
| | TOTAL | 201 | 201 | 247 | 247 | 308 | 308 |
| TOTAL | N+D | 205 | 205 | 278 | 278 | 395 | 395 |
| | I | 121 | 121 | 139 | 139 | 174 | 174 |
| | DV | 0 | 0 | 3 | 3 | 3 | 3 |
| | TOTAL | 326 | 326 | 420 | 420 | 572 | 572 |

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

## 7.2 AGRICULTURAL DEVELOPMENT

### 7.2.1 Present Condition

Paddy and upland fields make up 46% in the influence area respectively. Many old paddy fields are affected by salinity and the average yield of rice is comparatively low. Among the major crops planted in the upland field in 1983 crop year, sugarcane ranks first followed by cassava and kenaf. There is a large sugar factory in Amphoe Muang Kumphawapi. Sugarcane is transported to the plant via Routes 2316 and 2023.

Land use and capability conditions in the area are shown in Table 7.2.1 and Figure 7.2.1. A typical cropping calendar in the area is shown in Figure 7.2.2.

### 7.2.2 Development Projection

Future agricultural development in the area of influence was projected for both cases of "with and without project". The projected planted area, unit yields by crop, and the consequent production amount are shown in Table 7.2.2.

Based on the above projected production amount, farmgate prices and production costs estimated separately, net production value (NPV) was obtained as shown in Table 7.2.3. The difference in NPV between the two cases is deemed to be the development benefit of the study route.

FIGURE 7.2.1 LAND USE AND CAPABILITY OF INFLUENCE AREA

STUDY ROUTE NO. IM-7

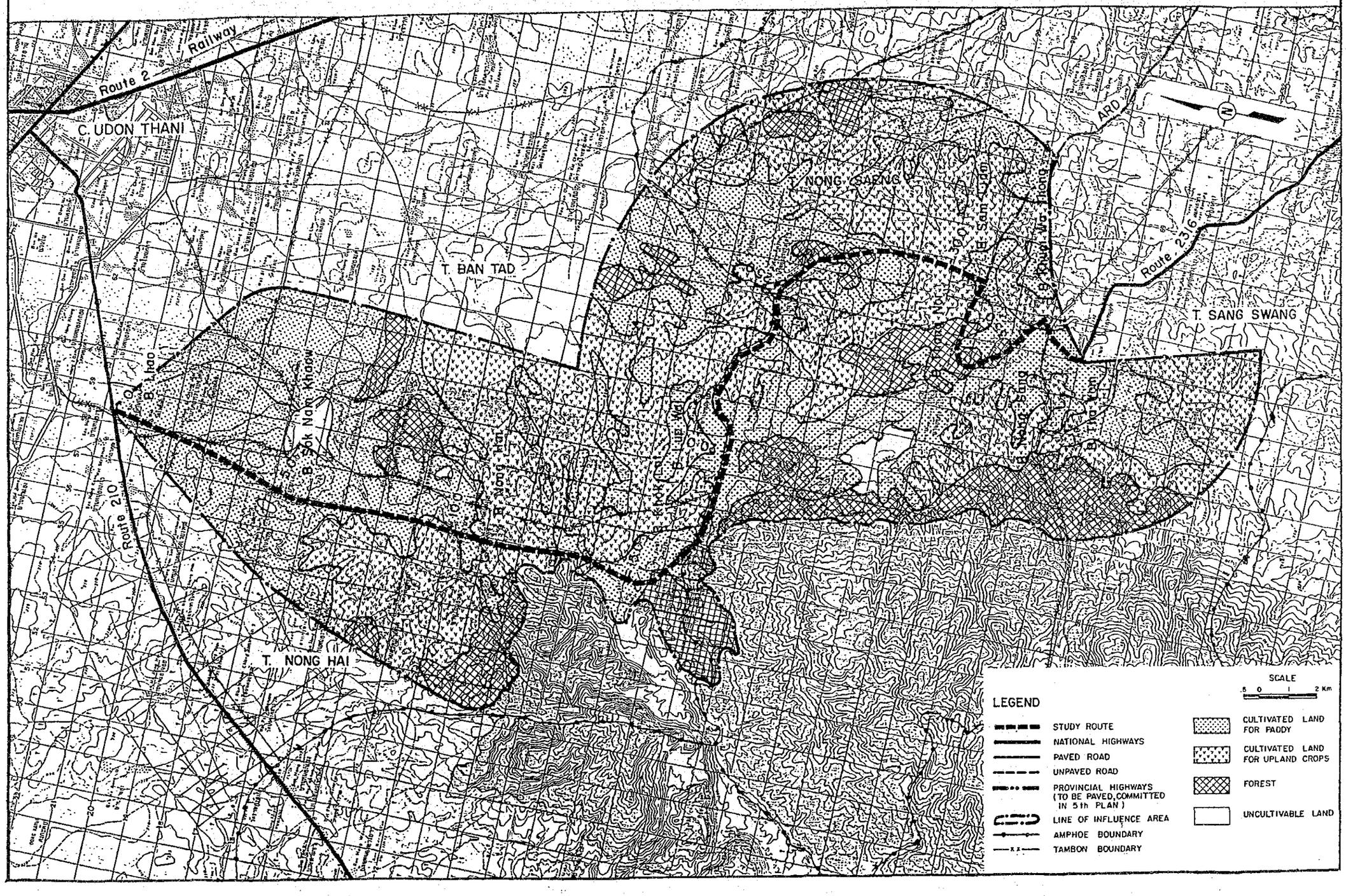
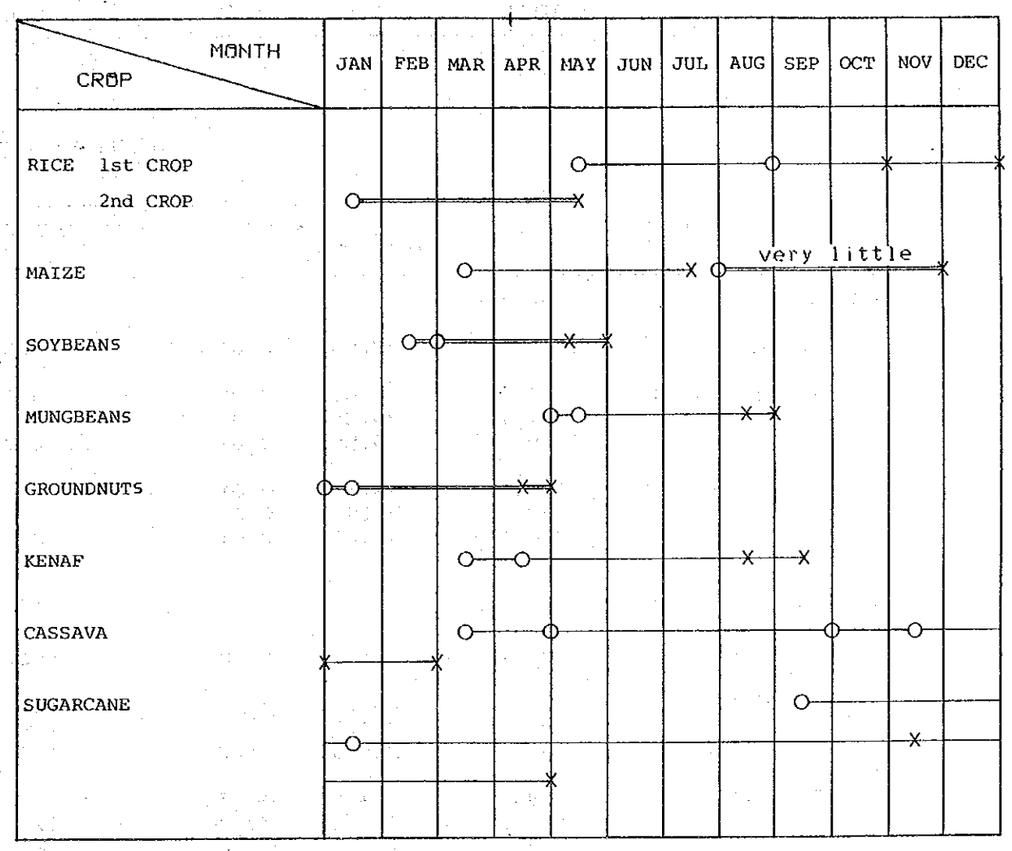


**FIGURE 7.2.2 CROPPING CALENDAR**

ROUTE IM-7

Related Amphoes: 0201 M. Udom Thani
0221 K. Nong Saeng




Note:

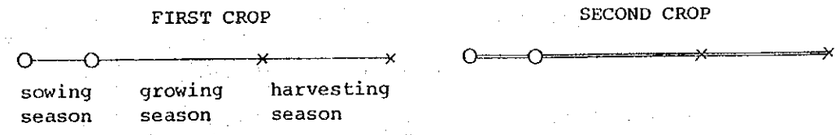


**TABLE 7.2.1 CULTIVATED LAND**

[ UNIT : 1000 RAI (KM2) ]

| CHANGWAT NAME | AMPHOE NAME | CULTIVATED LAND PADDY FIELD | UPLAND FIELD | TOTAL |
|---|---|---|---|---|
| UDON THANI | M. UDON THANI | 20.25 ( 32.40) | 32.38 ( 51.81) | 52.63 ( 84.21) |
| | NONG SAENG | 29.81 ( 47.70) | 26.69 ( 42.70) | 56.50 ( 90.40) |
| TOTAL | | 50.06 ( 80.10) | 59.07 ( 94.51) | 109.13 (174.61) |

**TABLE 7.2.2 CROP PRODUCTION**

| ITEM | | RICE (PADDY) | MAIZE | SORGHUM | BEANS | GROUND NUTS | CASSAVA | KENAF | SUGAR CANE | COTTON | CASTOR BEANS | UPLAND TOTAL | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANTED AREA | (1000 RAI) | | | | | | | | | | | | |
| BASE YEAR | (1983) | 39.90 | 0.01 | - | 0.05 | 0.16 | 11.34 | 2.91 | 15.65 | - | - | 30.12 | 70.02 |
| WITHOUT PROJECT | (1988) | 40.06 | 0.01 | - | 0.05 | 0.17 | 11.76 | 3.05 | 16.44 | - | - | 31.47 | 71.53 |
| | (1994) | 40.25 | 0.01 | - | 0.06 | 0.18 | 12.27 | 3.23 | 17.44 | - | - | 33.18 | 73.43 |
| | (2002) | 40.50 | 0.01 | - | 0.06 | 0.19 | 13.00 | 3.48 | 18.87 | - | - | 35.61 | 76.11 |
| WITH PROJECT | (1988) | 40.15 | 0.01 | - | 0.05 | 0.17 | 11.83 | 3.07 | 16.57 | - | - | 31.70 | 71.86 |
| | (1994) | 40.94 | 0.01 | - | 0.06 | 0.19 | 12.81 | 3.41 | 18.45 | - | - | 34.92 | 75.85 |
| | (2002) | 42.00 | 0.01 | - | 0.06 | 0.20 | 13.57 | 3.67 | 19.97 | - | - | 37.48 | 79.48 |
| CROP YIELD | (KG/RAI) | | | | | | | | | | | | |
| BASE YEAR | (1983) | 251.8 | 247.0 | - | 166.0 | 210.9 | 2805.0 | 225.3 | 7129.0 | - | - | | |
| WITHOUT PROJECT | (1988) | 253.2 | 248.2 | - | 167.7 | 210.9 | 2805.0 | 225.3 | 7164.7 | - | - | | |
| | (1994) | 254.8 | 249.7 | - | 169.7 | 210.9 | 2805.0 | 225.3 | 7207.8 | - | - | | |
| | (2002) | 257.0 | 251.7 | - | 172.4 | 210.9 | 2805.0 | 225.3 | 7265.7 | - | - | | |
| WITH PROJECT | (1988) | 254.1 | 248.7 | - | 168.2 | 210.9 | 2805.0 | 225.3 | 7171.9 | - | - | | |
| | (1994) | 261.6 | 253.2 | - | 173.3 | 210.9 | 2805.0 | 225.3 | 7258.4 | - | - | | |
| | (2002) | 272.0 | 259.4 | - | 180.3 | 210.9 | 2805.0 | 225.3 | 7375.3 | - | - | | |
| CROP PRODUCTION AMOUNT | (TON) | | | | | | | | | | | | |
| BASE YEAR | (1983) | 10,047 | 1 | - | 8 | 34 | 31,809 | 656 | 111,569 | - | - | 144,076 | 154,123 |
| WITHOUT PROJECT | (1988) | 10,141 | 1 | - | 9 | 35 | 32,974 | 687 | 117,794 | - | - | 151,501 | 161,642 |
| | (1994) | 10,255 | 1 | - | 9 | 37 | 34,430 | 727 | 125,725 | - | - | 160,930 | 171,184 |
| | (2002) | 10,409 | 2 | - | 10 | 40 | 36,471 | 784 | 137,136 | - | - | 174,443 | 184,851 |
| WITH PROJECT | (1988) | 10,204 | 1 | - | 9 | 36 | 33,175 | 692 | 118,865 | - | - | 152,778 | 162,982 |
| | (1994) | 10,710 | 1 | - | 10 | 39 | 35,923 | 767 | 133,947 | - | - | 170,688 | 181,398 |
| | (2002) | 11,424 | 2 | - | 12 | 43 | 38,055 | 827 | 147,287 | - | - | 186,225 | 197,649 |

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE

**TABLE 7.2.3 NET PRODUCTION VALUE**

| ITEM | | | RICE (PADDY) | MAIZE | SORGHUM | BEANS | GROUND NUTS | CASSAVA | KENAF | SUGAR CANE | COTTON | CASTOR BEANS | UPLAND TOTAL | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FARMGATE PRICE | (BAHT/TON) | | | | | | | | | | | | | |
| WITHOUT PROJECT | (1983 - 2002) | | 4,069 | 2,235 | - | 5,150 | 7,148 | 876 | 4,120 | 467 | - | - | | |
| WITH PROJECT | (1988 - 2002) | | 4,090 | 2,256 | - | 5,171 | 7,169 | 890 | 4,162 | 481 | - | - | | |
| CROP PRODUCTION COST | (BAHT/RAI) | | | | | | | | | | | | | |
| BASE YEAR | | (1983) | 704 | 479 | - | 438 | 951 | 776 | 803 | 1,958 | - | - | | |
| WITHOUT PROJECT | | (1988) | 707 | 480 | - | 438 | 951 | 776 | 803 | 1,962 | - | - | | |
| | | (1994) | 710 | 482 | - | 438 | 951 | 776 | 803 | 1,973 | - | - | | |
| | | (2002) | 715 | 484 | - | 443 | 951 | 776 | 803 | 1,982 | - | - | | |
| WITH PROJECT | | (1988) | 708 | 481 | - | 438 | 951 | 776 | 803 | 1,962 | - | - | | |
| | | (1994) | 723 | 485 | - | 443 | 951 | 776 | 803 | 1,979 | - | - | | |
| | | (2002) | 742 | 490 | - | 448 | 951 | 776 | 803 | 1,996 | - | - | | |
| NET PRODUCTION VALUE | (1000 BAHT) | | | | | | | | | | | | | |
| WITHOUT PROJECT | | (1988) | 12,943 | 0 | - | 22 | 94 | 19,747 | 382 | 22,701 | - | - | 42,946 | 55,889 |
| | | (1994) | 13,151 | 0 | - | 25 | 98 | 20,618 | 404 | 24,243 | - | - | 45,388 | 58,539 |
| | | (2002) | 13,394 | 0 | - | 27 | 106 | 21,840 | 436 | 26,573 | - | - | 48,982 | 62,376 |
| WITH PROJECT | | (1988) | 13,305 | 0 | - | 23 | 95 | 20,348 | 414 | 24,656 | - | - | 45,536 | 58,841 |
| | | (1994) | 14,208 | 0 | - | 27 | 105 | 22,033 | 459 | 27,907 | - | - | 50,531 | 64,739 |
| | | (2002) | 15,560 | 1 | - | 30 | 113 | 23,341 | 494 | 30,984 | - | - | 54,963 | 70,523 |
| NET VALUE ADDED | (1000 BAHT) | | | | | | | | | | | | | |
| 1988 | | | 362 | 0 | - | 1 | 1 | 601 | 32 | 1,955 | - | - | 2,590 | 2,952 |
| 1994 | | | 1,057 | 0 | - | 2 | 7 | 1,415 | 55 | 3,664 | - | - | 5,143 | 6,200 |
| 2002 | | | 2,166 | 1 | - | 3 | 7 | 1,501 | 58 | 4,411 | - | - | 5,981 | 8,147 |

NOTE : SYMBOL "-" MEANS ZERO OR NEGLIGIBLE

## 7.3 VOC SAVINGS

In accordance with the concept and data given in Section 3.4 of the Text Report, VOCs on the road link concerned were calculated in the two cases of "with and without project".

Road length by road class is shown in Table 7.3.1. Data for additional VOCs are shown in Table 7.3.2.

VOC savings, obtained as the balance of total link VOCs between the two cases, were calculated as shown in Table 7.3.3.

**TABLE 7.3.1 ROAD LENGTH BY ROAD CLASS**

(UNIT : KM)

| LINK NO. | WITHOUT PROJECT CASE | | | | | | WITH PROJECT CASE |
|---|---|---|---|---|---|---|---|
| | PAVED | LATERITE | | | EARTH | TOTAL | PAVED |
| | | GOOD | FAIR | POOR | | | |
| 1 | - | 5.2 | 20.6 | 15.0 | - | 40.8 | 40.8 |

**TABLE 7.3.2 DATA FOR ADDITIONAL VOC COST**

(UNIT OF LENGTH : M)

| LINK NO. | CASE | CURVE | | | | | | | | | GRADE | | | | | VILLAGE | | NO. OF INTER-SECTION | NO. OF TIMBER BRIDGE | NO. OF NARROW BRIDGE | NO. OF CORNER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 100 | 150 | 200 | 250 | 300 | 375 | 500 | 750 | 1500 | 1 | 2 | 3 | 4 | 5 | NO. | LENGTH | | | | |
| 1 | WITHOUT | 1252 | 303 | 619 | 292 | 716 | 593 | 1205 | 322 | 616 | 13750 | 8357 | 3700 | 2700 | 750 | 7 | 4313 | 6 | 2 | 2 | 1 |
| | WITH | 1252 | 303 | 619 | 292 | 716 | 593 | 1205 | 322 | 616 | 13150 | 8957 | 3300 | 2700 | 750 | 7 | 4313 | - | - | - | 1 |

**TABLE 7.3.3 VEHICLE OPERATING COST SAVING**

(UNIT : 1000 BAHT)

| LINK NO. | 1988 | | | 1994 | | | 2002 | | |
|---|---|---|---|---|---|---|---|---|---|
| | WITHOUT | WITH | SAVING | WITHOUT | WITH | SAVING | WITHOUT | WITH | SAVING |
| 1 | 11,050 | 7,952 | 3,098 | 14,526 | 10,614 | 3,912 | 21,007 | 15,658 | 5,349 |
| TOTAL | 11,050 | 7,952 | 3,098 | 14,526 | 10,614 | 3,912 | 21,007 | 15,658 | 5,349 |

N O T E
(1) WITHOUT : WITHOUT PROJECT CASE (2) WITH : WITH PROJECT CASE
(3) SAVING : VEHICLE OPERATING COST SAVING
(4) LINK NO. = 1 - 9 : PROPOSED LINK (5) LINK NO. = 11 - 19 : SURROUNDING LINK

## 7.4 ENGINEERING

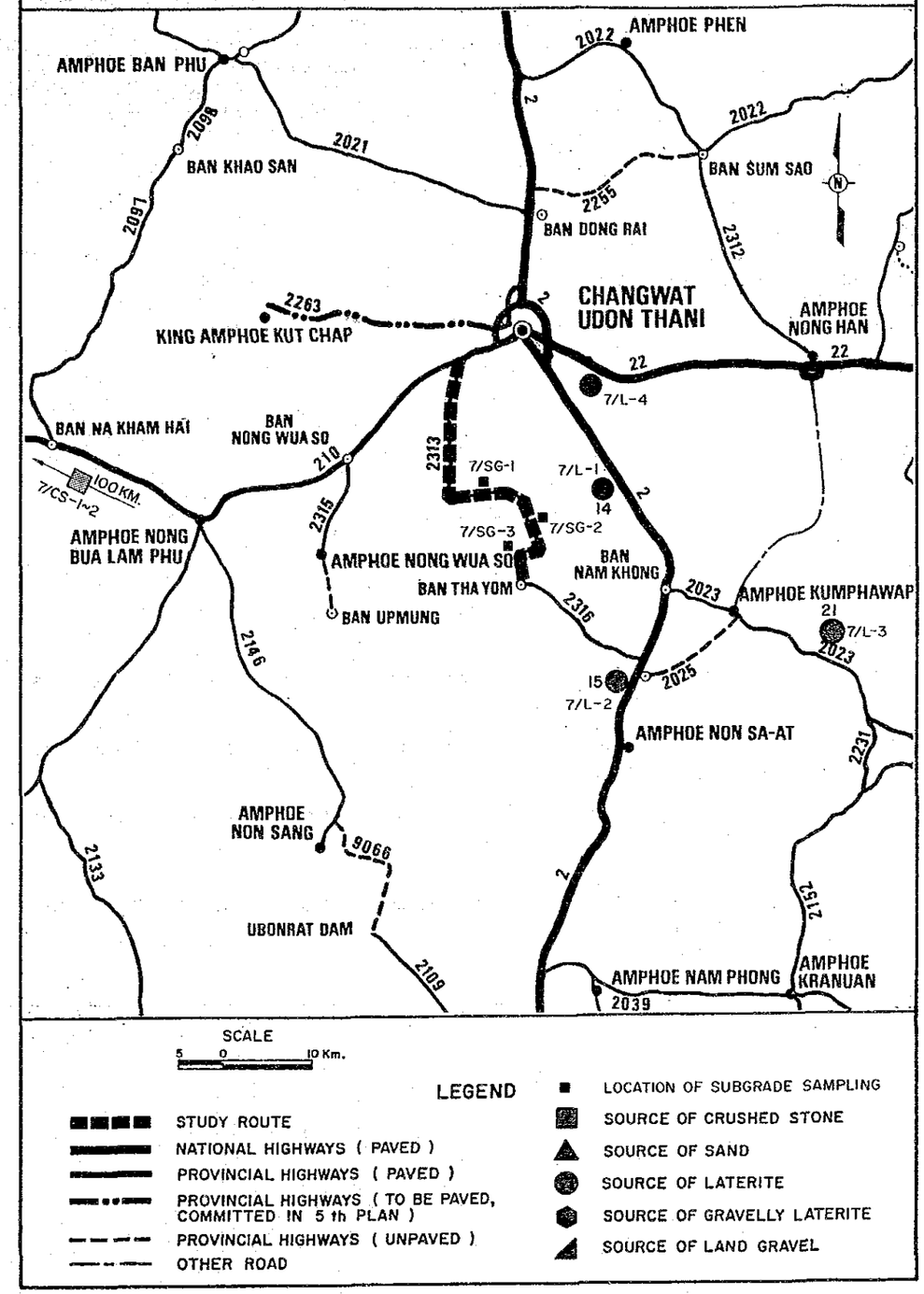
### 7.4.1 Soil and Materials

Existing subgrade soil and material sources in the vicinity of the Study Route investigated by DOH, and their physical characteristics are shown in Figure 7.4.1 and Table 7.4.1, respectively.

Rock aggregate sources were assumed as shown below:

| No. | Source | Description of Sample | Est. Quantity $m^3$ |
|---|---|---|---|
| 7/CS-1 | KM. 40+800 Rt close to Wang Saphung-Udon Thani | Limestone | Plentiful |
| 7/CS-2 | KM. 48+900 Rt Wang Saphung-Udon Thani (Scale Pattana Quarry) | Limestone | Plentiful |

FIGURE 7.4.1 SOIL AND MATERIAL SOURCES



## TABLE 7.4.1 PHYSICAL CHARACTERISTICS OF MATERIALS

| No. | Source | Description of Sample | Est. Quantity $m^3$ | AASHTO Classification | Sieve Analysis % Passing | | | | | | | | Plasticity | | Comp. DH-T Stand. Opt. | | Lab. C.B.R. | | Durability | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 50.0 | 25.0 | 19.0 | 9.5 | #4 | #10 | #40 | #200 | LL | PT | 95% | gm/cc | CBR 95% | Swell % | Abr. | Dur. |
| SUBGRADE | | | | | | | | | | | | | | | | | | | | |
| 7/SG-1. | KM. 3+500 Lt 12 M. | | | A-4 | | | | | | 100 | 99.5 | 49.4 | | N-P | 11.5 | 1.834 | 12.3 | - | | |
| 7/SG-2. | KM. 13+000 Lt 12 M. | | | A-2-4 | | | | | 100 | 99.9 | 95.0 | 34.5 | | N-P | 10.9 | 1.914 | 21.5 | - | | |
| 7/SG-3. | KM. 22+000 Rt 14 M. | | | A-4 | | | | | | 100 | 97.8 | 71.9 | | N-P | 13.6 | 1.806 | 10.6 | - | | |
| LATERITE | | | | | | | | | | | | | | | | | | | | |
| 7/L-1 | KM. 544+000 Lt 200 M. Khon Kaen - Udon Thani | Laterite | 16,000 | A-1-a | 100 | 98 | 90 | 59 | 34 | 22 | 17 | 11 | 24.2 | 4.3 | 8.0 | 2.360 | 53.5 | 0.20 | 57.6 | 65.5 |
| 7/L-2 | KM. 517+200 Lt 350 M. Khon Kaen - Udon Thani | Laterite | 20,000 | A-2-4 | 100 | 95 | 84 | 48 | 26 | 20 | 15 | 13 | 23.3 | 9.9 | 5.4 | 2.319 | 26.0 | - | 40.8 | 70.0 |
| 7/L-3 | KM. 13+950 Lt 300 M. Kumphawapi - Sri Tart | Laterite | 84,000 | A-2-4 | 100 | 90 | 81 | 46 | 28 | 23 | 22 | 12 | 24.0 | 9.1 | 7.4 | 2.233 | 39.5 | 0.24 | 46.6 | 67.6 |
| 7/L-4 | KM. 9+700 Rt 300 M. Udon Thani - Skon Na Korn | Laterite | 57,000 | A-2-4 | | 100 | 98 | 76 | 44 | 37 | 31 | 10 | 25.1 | 9.1 | 8.0 | 2.270 | 39.4 | 0.14 | 39.4 | 66.7 |

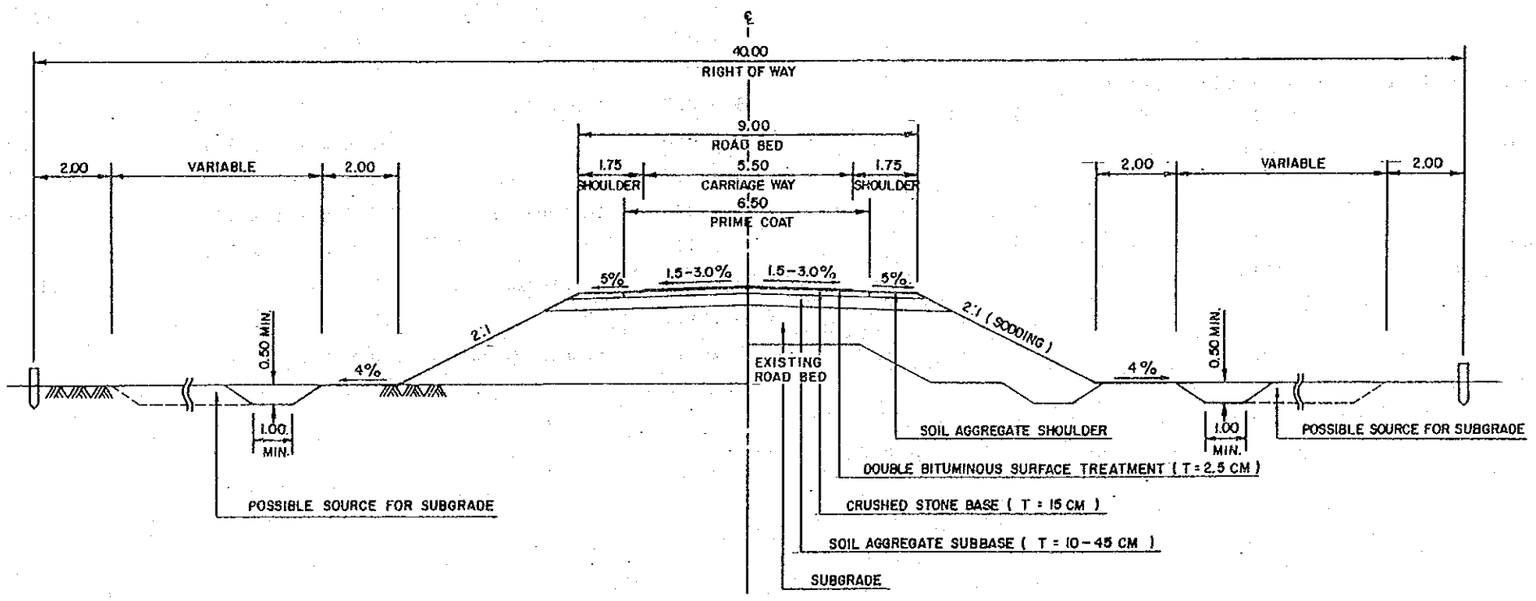
### 7.4.2 Preliminary Design

#### 7.4.2.1 Design Criteria

| | | |
|---|---|---|
| Design Standard | | : F4 |
| Geometric Design Criteria | | : DOH (Provincial Highway) |
| Typical Cross Section | | : as shown in Figure 7.4.2 |
| Minimum Height of Embankment in Flooding Section | | : 0.7 m above flood level |
| Pavement Structure | | |
| DBST | | : 2.5 cm |
| Crushed Aggregate Base | CBR ≥ 80% | : 15.0 cm |
| Soil Aggregate Subbase | CBR ≥ 25% | : 10.0 cm (minimum requirement) |
| Selected Materials | CBR ≥ 6% | : as required |
| Pipe Culvert | | |
| Standardized type | | : 80, 100, 120 & 150 cm in diameter |
| Location | | : as required |
| Standard intervals | | |
| Paddy area | | : 200 m |
| Others | | : 500 m |
| Box Culvert | | |
| Standard size | | : 1.5×1.5, 2.4×2.4 & 3.0×3.0 m |
| Location | | : as required |
| Bridge | | |
| Reinforced concrete standard type | | : Width 9.0 m |
| Substructure | | : Pile-bent type |

The existing and designed plan and profile are shown in Drawings 7-1/7-5.

FIGURE 7.4.4 TYPICAL CROSS SECTION




PROVINCIAL HIGHWAY ( CLASS F4 )

#### 7.4.2.2 Special Conditions in Designing

Employment of Higher Road Standards

About half the route had been improved according to F6 standards by DOH (RT 2313 L = 17.8 km). In this design, widening and paving with DBST surfacing were included.

#### 7.4.2.3 Pavement Design

1) Cumulative number of ESA in one direction

- ESA conversion factors

| | | |
|---|---|---|
| Heavy bus | : | 0.50 |
| Medium truck | : | 0.76 |
| Heavy truck | : | 1.24 |

- Forecasted ADT by vehicle type

- Cumulative number of ESA in one direction by road link

| Road link | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 7 years ($10^6$) | 0.028 | - | - | - |

2) Design CBR values

| Road link | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Design CBR (%) | 10.2 | - | - | - |

3) Required thickness of pavement

| | | |
|---|---|---|
| Surfacing | : | DBST (2.5 cm) |
| Aggregate base | : | 15 cm (CBR not less than 25%) |
| Subbase | : | Minimum requirement 10 cm |

| Road link | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| | 10 cm | - | - | - |

4) Overlay required in 7 years

DBST resurfacing

#### 5.4.2.4 Drainage and Structures

The locations of existing and designed RC box culverts and RC bridges and their dimensions are shown below:

| STATION | EXISTING STRUCTURES | | PROPOSED STRUCTURES | |
|---|---|---|---|---|
| | TYPE | SIZE | TYPE | SIZE |
| 9 + 219 | Box Culvert | 3-2.1 x 1.8 x 11.0 | Extd. | 6.0 m |
| 10 + 640 | " " | 3-2.4 x 2.1 x 10.5 | Extd. | 5.0 m |
| 14 + 038 | RC Bridge | 8.0 x 23.0 | - | - |
| 14 + 347 | Box Culvert | 2-2.4 x 2.1 x 11.5 | Extd. | 6.0 m |
| 15 + 790 | " " | 2-3.0 x 2.7 x 15.0 | Extd. | 3.0 m |
| 17 + 752 | RC Bridge | 3.5 x 24.0 | RC Bridge | 4.5 x 24.0 |
| 28 + 450 | " " | 3.5 x 21.0 | " " | 4.5 x 21.0 |
| 35 + 016 | Timber Bridge | 5.0 x 15.0 | " " | 9.0 x 15.0 |

### 7.4.3 Quantities and Construction and Road Maintenance Costs

The required construction costs were estimated based on the results of the preliminary design as shown in Table 7.4.2. Financial costs with breakdown into local and foreign currency portions, economic costs and residual values were estimated as follows and in 7.4.4:

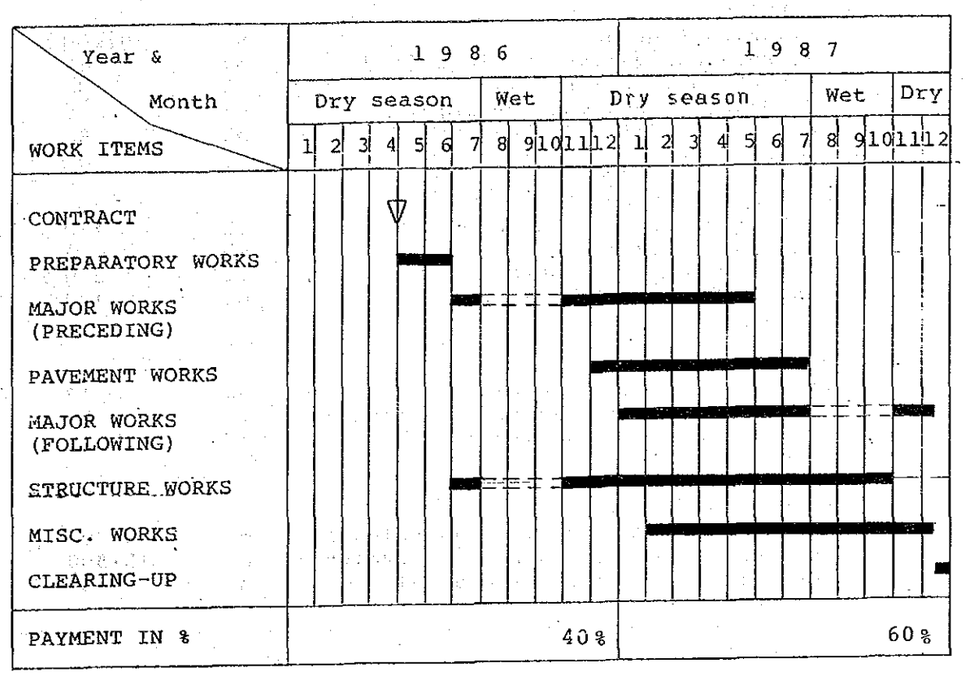
| | | | |
|---|---|---|---|
| IM—7 | L = 40.7 km | | (baht) |
| | Financial cost | : | 65,041,000 |
| | Economic cost | : | 54,647,000 |
| | Residual value | : | 22,223,000 |

The required road maintenance cost savings are shown in Table 7.4.3.

### 7.4.4 Construction and Disbursement Schedules

**IM—7** **Length = 40.7 km**

Construction Schedule
Assumption: Completion date December 31, 1987




Yearly Disbursement Schedule
Assumption: Annual rise in prices

| Year / Currency | Base year 1984 | (1985) | 1986 | 1987 |
|---|---|---|---|---|
| Local | 100 | 110.0 | 121.0 | 133.1 |
| Foreign | 100 | 106.5 | 113.4 | 120.8 |

LOCAL AND FOREIGN COMPONENTS OF CONSTRUCTION COST

( Route IM - 7 )

(Unit : Million Baht)

| | 1986 | | | 1987 | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | L/C | F/C | Total | L/C | F/C | Total | L/C | F/C | Total |
| Construction Cost | 13.2 | 12.8 | 26.0 | 19.8 | 19.2 | 39.0 | 33.0 | 32.0 | 65.0 |
| Price Contingency | 2.8 | 1.7 | 4.5 | 6.6 | 4.0 | 10.6 | 9.4 | 5.7 | 15.1 |
| Total | 16.0 | 14.5 | 30.5 | 26.4 | 23.2 | 49.6 | 42.4 | 37.7 | 80.1 |
| | ( 0.59) | ( 0.54) | ( 1.13) | ( 0.98) | ( 0.86) | ( 1.84) | ( 1.57) | ( 1.40) | ( 2.97) |

Remarks : L/C : Local Currency Portion
F/C : Foreign Currency Portion
( ) : US$ Equivalent ( US$ 1 = 27 Baht)

**TABLE 7.4.3 CONSTRUCTION QUANTITIES AND COSTS**
**(ROUTE IM---7 Length = 40.7 km)**

DBST

| Item | Unit | Financial Unit Rate B | Quantity | Financial Cost 1000 B | | | Economic Cost | | Residual Value | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total | Local | Foreign | % | 1000 B | % | 1000 B |
| EARTHWORK | | | | | | | 83 | | 90 | |
| Clearing & Grubbing | ha | 10,000 | 97 | 970 | | | | | | |
| Roadway Excavation, Unclassified | m3 | 19 | 0 | 0 | | | | | | |
| Embankment, Common Soil | m3 | 38 | 227,800 | 8,656 | | | | | | |
| Embankment, Selected Material | m3 | 70 | 0 | 0 | | | | | | |
| Replacement of Soft Spot | m3 | 88 | 3,800 | 334 | | | | | | |
| Sub Total | | | | 9,961 | 5,080 | 4,881 | | 8,267 | | 7,441 |
| SUBBASE & BASE COURSES | | | | | | | 83 | | 50 | |
| Subbase, Soil Aggregate | m3 | 112 | 38,300 | 4,290 | | | | | | |
| Aggregate Base* | m3 | 372 | 39,700 | 14,768 | | | | | | |
| Cement Stabilized Base | m3 | 390 | 0 | 0 | | | | | | |
| Shoulder, Soil Aggregate | m3 | 120 | 15,300 | 1,836 | | | | | | |
| Sub Total | | | | 20,894 | 11,283 | 9,611 | | 17,342 | | 8,671 |
| SURFACE COURSES | | | | | | | 85 | | 50** | |
| Asphaltic Prime/Tack Coat | m2 | 12 | 264,600 | 3,175 | | | | | | |
| Double Bituminous Surface Treatment* | m2 | 39 | 223,900 | 8,732 | | | | | | |
| Asphaltic Concrete Surfacing** | t | 750 | 0 | 0 | | | | | | |
| Sub Total | | | | 11,907 | 5,239 | 6,668 | | 10,121 | | 0 |
| STRUCTURES | | | | | | | 83 | | 50 | |
| RC Pipe Culvert (D 1.0m Equivalent) | m | 2,000 | 882 | 1,764 | | | | | | |
| RC Box Culvert (2.4mx2.4m Equivalent) | m | 18,800 | 69 | 1,297 | | | | | | |
| RC Bridge(W=9.0m L=10m Equivalent) | m | 46,500 | 67 | 3,116 | | | | | | |
| Sub Total | | | | 6,177 | 3,088 | 3,088 | | 5,127 | | 2,563 |
| Total (a) | | | | 48,939 | 24,690 | 24,248 | | 40,857 | | 18,675 |
| INCIDENTALS | | | | | | | 83 | | 0 | |
| Miscellaneous Work ((a)x7%) | ls | | | 3,426 | 1,713 | 1,713 | | 2,843 | | 0 |
| CONTRACT AMOUNT (b) | | | | 52,365 | 26,403 | 25,961 | | 43,701 | | 18,675 |
| PHYSICAL CONTINGENCIES ((b)x10%) (c) | ls | | | 5,236 | 2,640 | 2,596 | | 4,370 | | 1,868 |
| ENGINEERING AND SUPERVISION | | | | | | | 85 | | 0 | |
| (((b)+(c))x10%) (d) | ls | | | 5,760 | 2,304 | 3,456 | | 4,896 | | 0 |
| LAND ACQUISITION | | | | | | | 100 | | 100 | |
| Highly Developed Land | ha | 50,000 | 33 | 1,650 | | | | | | |
| Less Developed Land | ha | 15,000 | 2 | 30 | | | | | | |
| Sub Total (e) | ls | | | 1,680 | 1,680 | 0 | | 1,680 | | 1,680 |
| PROJECT COST ((b)+(c)+(d)+(e)) | | | | 65,041 | 33,028 | 32,014 | | 54,647 | | 22,223 |
| AVERAGE COST PER KM | | | | 1,598 | | | | | | |

Note : * The unit prices are modified by aggregate haulage distance
** Rate is applied only for Asphaltic Concrete Surfacing

**TABLE 7.4.4 ROAD MAINTENANCE COST SAVING**

| LINK NO. | YEAR | WITHOUT PROJECT CASE: AVERAGE DAILY TRAFFIC <ADT> (VEHICLE) | LENGTH OF LINK <L> (KM) | FACTOR FOR ADT <A1> | ROAD CHARA. FACTOR <KA> | UNIT MAINTE. COST <U> (BAHT/KM) | TOTAL MAINTE. COST <T> (1000 BAHT) | WITH PROJECT CASE: AVERAGE DAILY TRAFFIC <ADT> (VEHICLE) | LENGTH OF LINK <L> (KM) | FACTOR FOR ADT <X3> | ROAD CHARA. FACTOR <KB> | UNIT MAINTE. COST <U> (BAHT/KM) | TOTAL MAINTE. COST <T> (1000 BAHT) | ROAD MAINTE. COST SAVING (1000 BAHT) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1988 | 89.6 | 40.8 | 0.04 | 1.20 | 12,660 | 517 | 100.9 | 40.8 | 0.00 | 1.14 | 12,793 | 522 | -5 |
| 1 | 1994 | 124.3 | 40.8 | 0.13 | 1.26 | 13,253 | 541 | 137.8 | 40.8 | 0.00 | 1.14 | 12,793 | 522 | 19 |
| | 2002 | 196.0 | 40.8 | 0.29 | 1.37 | 14,481 | 591 | 210.6 | 40.8 | 0.00 | 1.14 | 12,793 | 522 | 69 |
| | 1988 | 89.6 | 40.8 | | | 12,660 | 517 | 100.9 | 40.8 | | | 12,793 | 522 | -5 |
| TOTAL | 1994 | 124.3 | 40.8 | | | 13,253 | 541 | 137.8 | 40.8 | | | 12,793 | 522 | 19 |
| | 2002 | 196.0 | 40.8 | | | 14,481 | 591 | 210.6 | 40.8 | | | 12,793 | 522 | 69 |

NOTE (1) TOTAL MAINTENANCE COST $T = U * L$

(2) UNIT MAINTENANCE COST $U = M * (KA \text{ or } KB) * FA * (1 + FR) * FE$

M ; SPECIFIED MAINTENANCE COST
WITHOUT PROJECT CASE M = 7,700 BAHT/KM
WITH PROJECT CASE M = 8,200 BAHT/KM

FA = 1.40 ADMINISTRATION FACTOR FOR DIRECT LABOUR OPERATION BY DOH
FR = 0.15 EMERGENCY REHABILITATION COST FACTOR
FE = 0.85 ECONOMIC MAINTENANCE COST FACTOR TO FINANCIAL MAINTENANCE COST

(3) ROAD CHARACTERISTIC FACTOR
WITHOUT PROJECT CASE $KA = 1.17 + 0.70 * A1$
WITH PROJECT CASE $KB = 1.14 + 0.05 * X3$

(4) FACTOR FOR ADT
WITHOUT PROJECT CASE $A1 = -0.1630 + 0.002320 * ADT$
WITH PROJECT CASE $X3 = -0.2034 + 0.000409 * (ADT / LANE)$ ; LANE = 2

## 7.5 EVALUATION

### 7.5.1 Economic Evaluation

The yearly distribution of the economic costs and benefits and the calculated economic indicators for evaluation are given in the table below.

The results indicate that the improvement of this study route is feasible by employing the F4 standard with DBST surfacing.

COST AND BENEFIT STATEMENT OF ROUTE IM -7

(1000 BAHT)

| YEAR | COST | BENEFITS | | | | DISCOUNTED(12%) | |
|---|---|---|---|---|---|---|---|
| | CONST. COST | AGRI. BENEFIT | VOC SAVING | RMC SAVING | TOTAL | TOTAL COST | TOTAL BENEFIT |
| 1986 | 21,859 | 0 | 0 | 0 | 0 | 27,420 | 0 |
| 1987 | 32,788 | 0 | 0 | 0 | 0 | 36,723 | 0 |
| 1988 | 0 | 2,952 | 3,098 | -5 | 6,045 | 0 | 5,397 |
| 1989 | 0 | 3,493 | 3,234 | -1 | 6,725 | 0 | 5,362 |
| 1990 | 0 | 4,035 | 3,369 | 3 | 7,406 | 0 | 5,272 |
| 1991 | 0 | 4,576 | 3,505 | 7 | 8,087 | 0 | 5,140 |
| 1992 | 0 | 5,117 | 3,640 | 11 | 8,768 | 0 | 4,975 |
| 1993 | 0 | 5,659 | 3,776 | 15 | 9,449 | 0 | 4,787 |
| 1994 | 0 | 6,200 | 3,912 | 19 | 10,130 | 0 | 4,582 |
| 1995 | 14,651 | 6,443 | 4,091 | 25 | 10,560 | 6,627 | 4,265 |
| 1996 | 0 | 6,687 | 4,271 | 31 | 10,989 | 0 | 3,963 |
| 1997 | 0 | 6,930 | 4,451 | 38 | 11,418 | 0 | 3,676 |
| 1998 | 0 | 7,174 | 4,630 | 44 | 11,847 | 0 | 3,406 |
| 1999 | 0 | 7,417 | 4,810 | 50 | 12,277 | 0 | 3,151 |
| 2000 | 0 | 7,660 | 4,989 | 56 | 12,706 | 0 | 2,912 |
| 2001 | 0 | 7,904 | 5,169 | 63 | 13,135 | 0 | 2,688 |
| 2002 | -22,223 | 8,147 | 5,349 | 69 | 13,565 | -4,060 | 2,478 |
| TOTAL | 47,075 | 90,394 | 62,293 | 422 | 153,109 | 66,710 | 62,054 |
| DISCOUNTED | 66,710 | 35,848 | 26,087 | 120 | 62,054 | | |

NET PRESENT VALUE : -4,656

BENEFIT/COST RATIO : 0.93

INTERNAL RATE OF RETURN : 11.1 %

FIRST YEAR RATE OF RETURN : 8.4 %

OPTIMUM OPENING YEAR : 1990

SENSITIVITY TESTS

| ITEM | CASE | | |
|---|---|---|---|
| | BASE | 1 | 2 |
| NET PRESENT VALUE | -4,656 | -14,662 | -13,964 |
| BENEFIT/COST RATIO | 0.93 | 0.81 | 0.79 |
| INTERNAL RATE OF RETURN | 11.1 % | 9.4 % | 9.1 % |
| FIRST YEAR RATE OF RETURN | 8.4 % | 7.3 % | 7.2 % |
| COSTS | BASE | +15% | BASE |
| BENEFITS | BASE | BASE | -15% |

### 7.5.2 Social Impact

The social impact brought about by the improvement of the study route is shown in the following social benefit indicators:

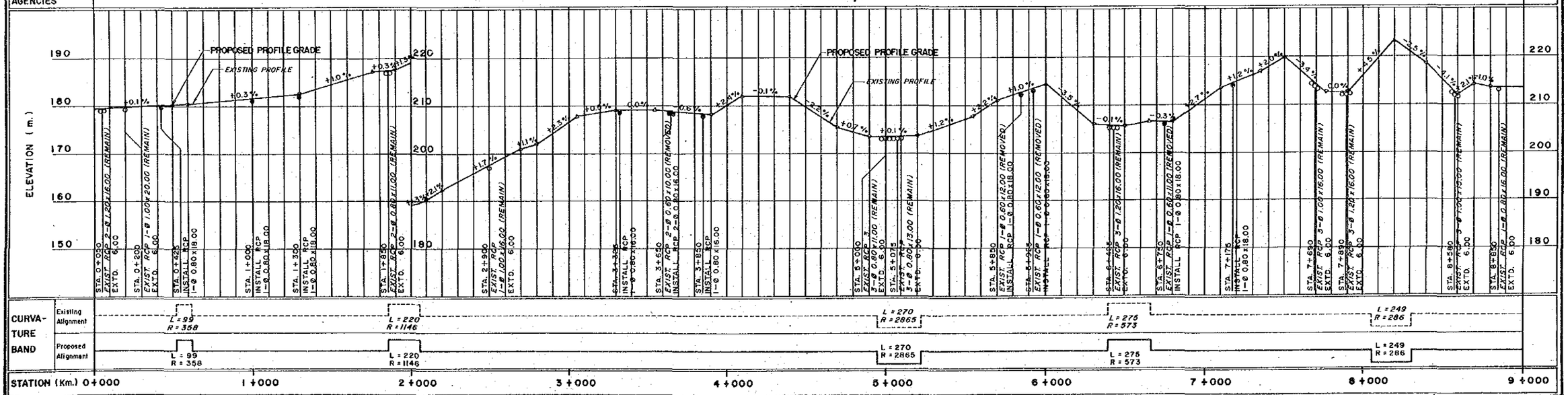
| | | |
|---|---|---|
| Construction Cost (million baht) | : | 54.6 |
| 1) General Accessibility Benefit (million baht) | : | 7.79 |
| 2) Education Benefit (million baht) | : | 2.53 |
| 3) Medical Care Benefit (million baht) | : | 0.178 |
| 4) Total Social Benefits (million baht) (1+2+3) | : | 10.50 |
| 5) Social Benefit/Cost Ratio ($\times 10^{-2}$) | : | 19.23 |
| 6) Ranking by Social Benefits | : | 2 |
| 7) Weighted Production Value Gain/Cost ($\times 10^{-2}$) | : | 12.87 |
| 8) Ranking by 7 | : | 5 |
| 9) Combined Ratio ($\times 10^{-2}$) | : | 32.10 |
| **Overall Ranking** | : | 3 |

### 7.5.3 Overall Evaluation

It is concluded that, considering the overall ranking and improvement schedule of the study routes with due consideration to prevailing opportunity cost of capital, the improvement of this study route with the opening year 1990 is recommended.

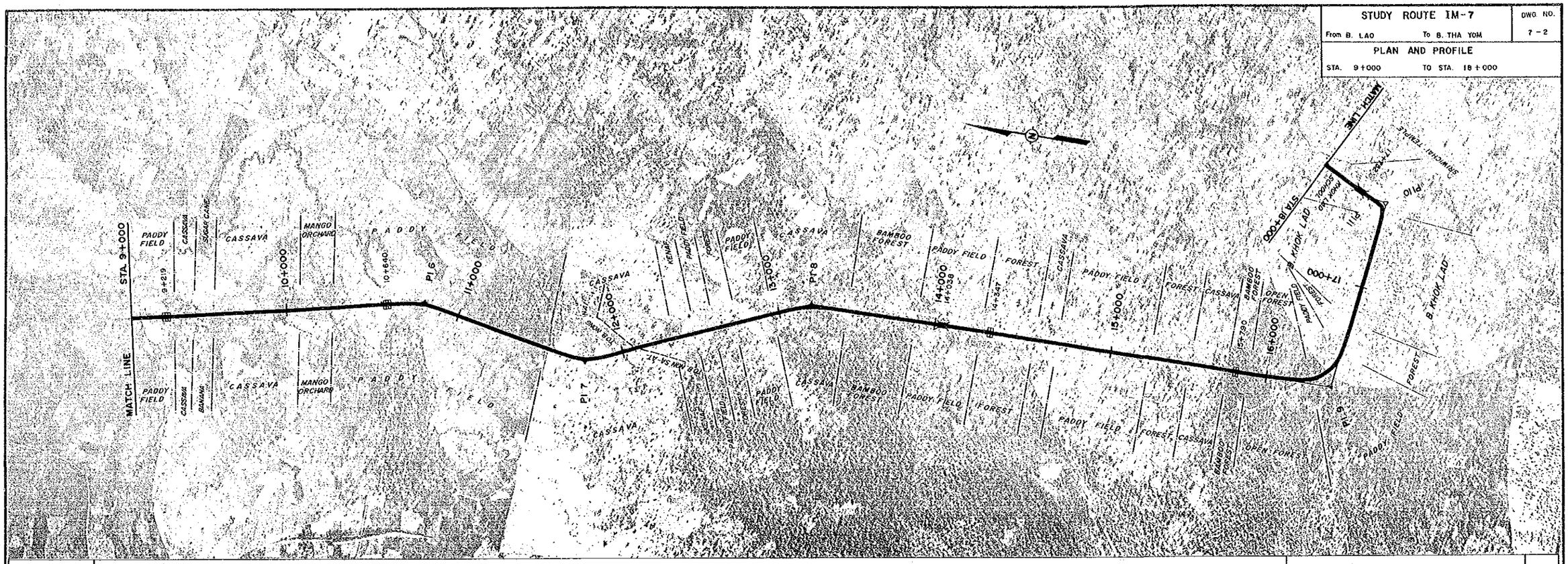
| STUDY ROUTE IM-7 | DWG. NO. |
|---|---|
| From B. LAO To B. THA YOM | 7-1 |
| PLAN AND PROFILE | |
| STA. 0 + 000 TO STA 9 + 000 | |

| | | |
|---|---|---|
| TERRAIN | | FLAT / ROLLING |
| PAVEMENT | Type | LATERITE |
| | Condition | GOOD / FAIR |
| FLOODING | Length (m.) / Height (m.) | |
| RIGHT OF WAY (m.) | | |
| ROUTE NO. AGENCIES | | DOH ROUTE NO. 2313 |

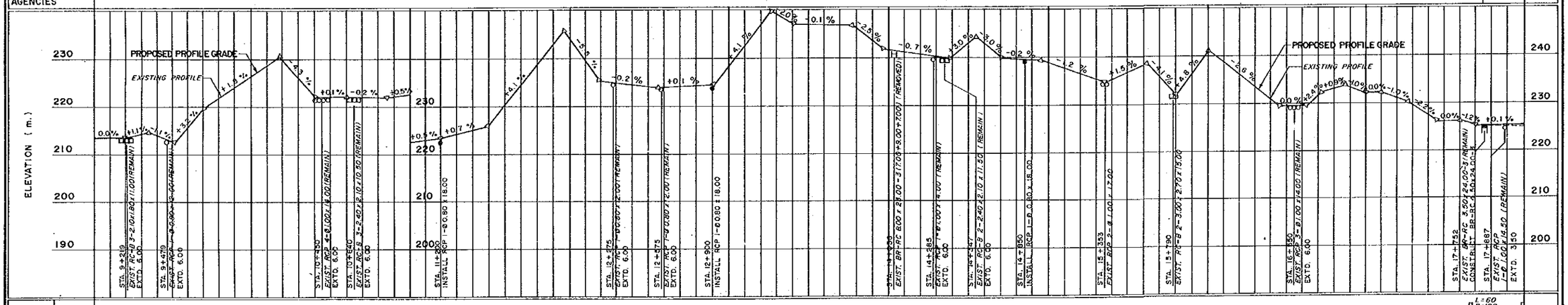



| | | |
|---|---|---|
| CURVATURE BAND | Existing Alignment | L = 99, R = 358 / L = 220, R = 1146 / L = 270, R = 2865 / L = 275, R = 573 / L = 249, R = 286 |
| | Proposed Alignment | L = 99, R = 358 / L = 220, R = 1146 / L = 270, R = 2865 / L = 275, R = 573 / L = 249, R = 286 |
| STATION (Km.) | | 0+000 1+000 2+000 3+000 4+000 5+000 6+000 7+000 8+000 9+000 |

| STUDY ROUTE IM-7 | DWG NO. |
|---|---|
| From B. LAO To B. THA YOM | 7 - 2 |
| PLAN AND PROFILE | |
| STA. 9+000 TO STA. 18+000 | |

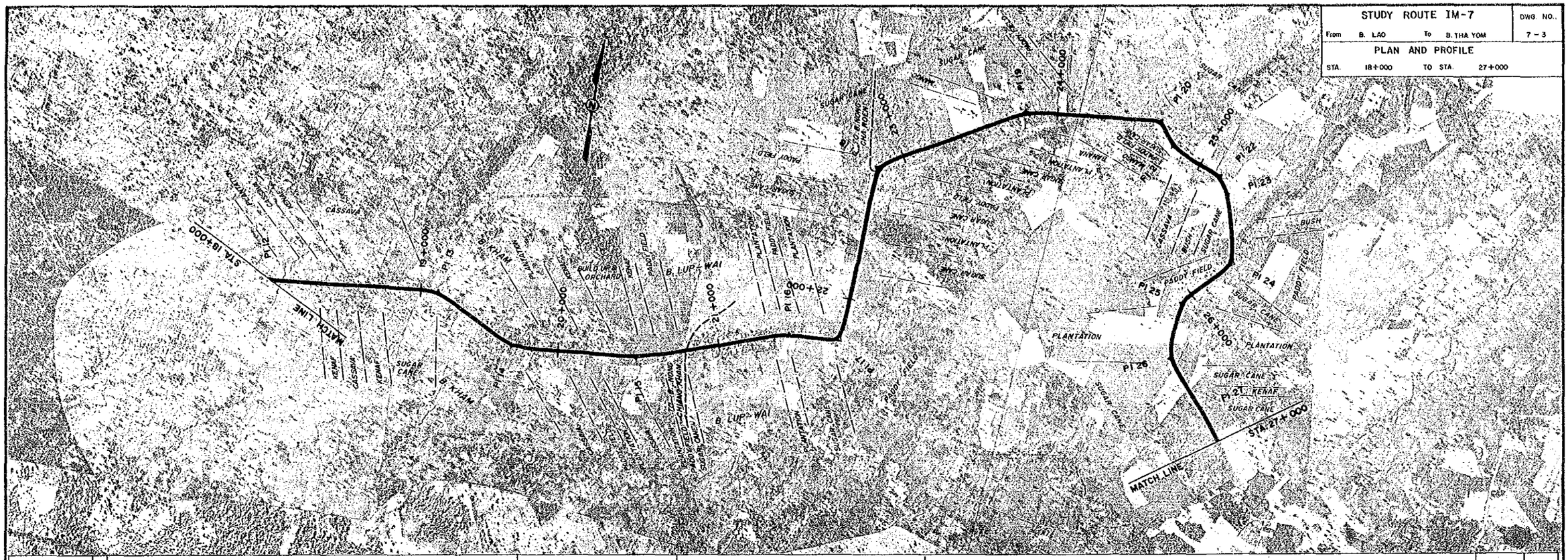



| | | |
|---|---|---|
| TERRAIN | | ROLLING / FLAT |
| PAVEM'T | Type | LATERITE |
| | Condition | FAIR |
| FLOODING | Length (m.) / Height (m.) | |
| RIGHT OF WAY (m.) | | |
| ROUTE NO. AGENCIES | | DOH ROUTE NO. 2313 / ARD |

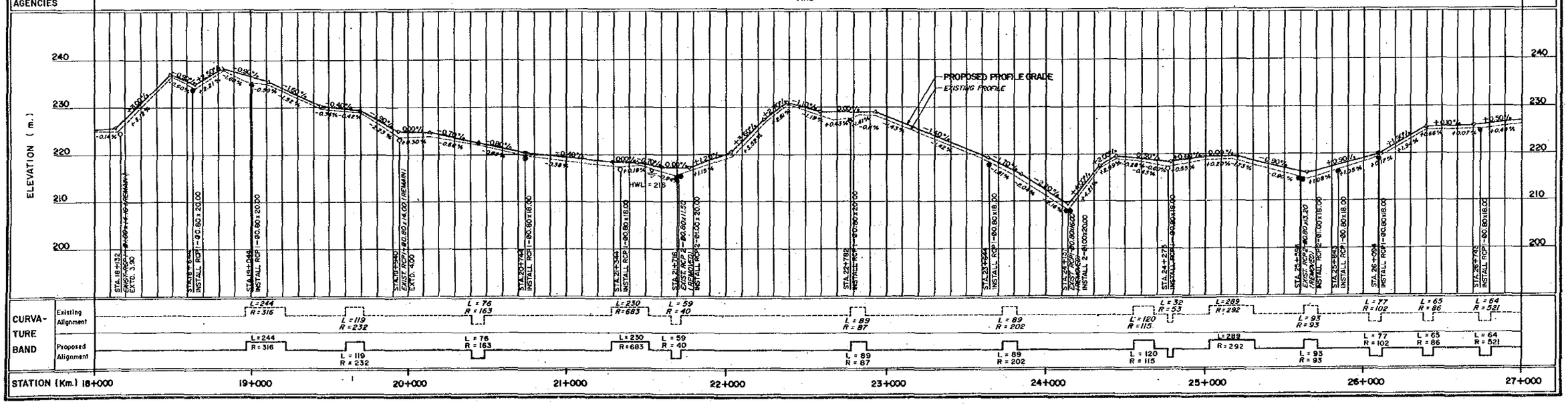



| | | |
|---|---|---|
| CURVATURE BAND | Existing Alignment | L = 261, R = 573 / L = 198, R = 382 / L = 235, R = 573 / L = 295, R = 205 / L = 35, R = 222 / L = 60, R = 198 |
| | Proposed Alignment | L = 261, R = 573 / L = 198, R = 382 / L = 235, R = 573 / L = 295, R = 205 / L = 35, R = 222 / L = 60, R = 198 |
| STATION (Km.) | | 9+000 10+000 11+000 12+000 13+000 14+000 15+000 16+000 17+000 18+000 |

| STUDY ROUTE IM-7 | DWG. NO. |
|---|---|
| From B. LAO To B. THA YOM | 7 - 3 |
| PLAN AND PROFILE | |
| STA. 18+000 TO STA. 27+000 | |

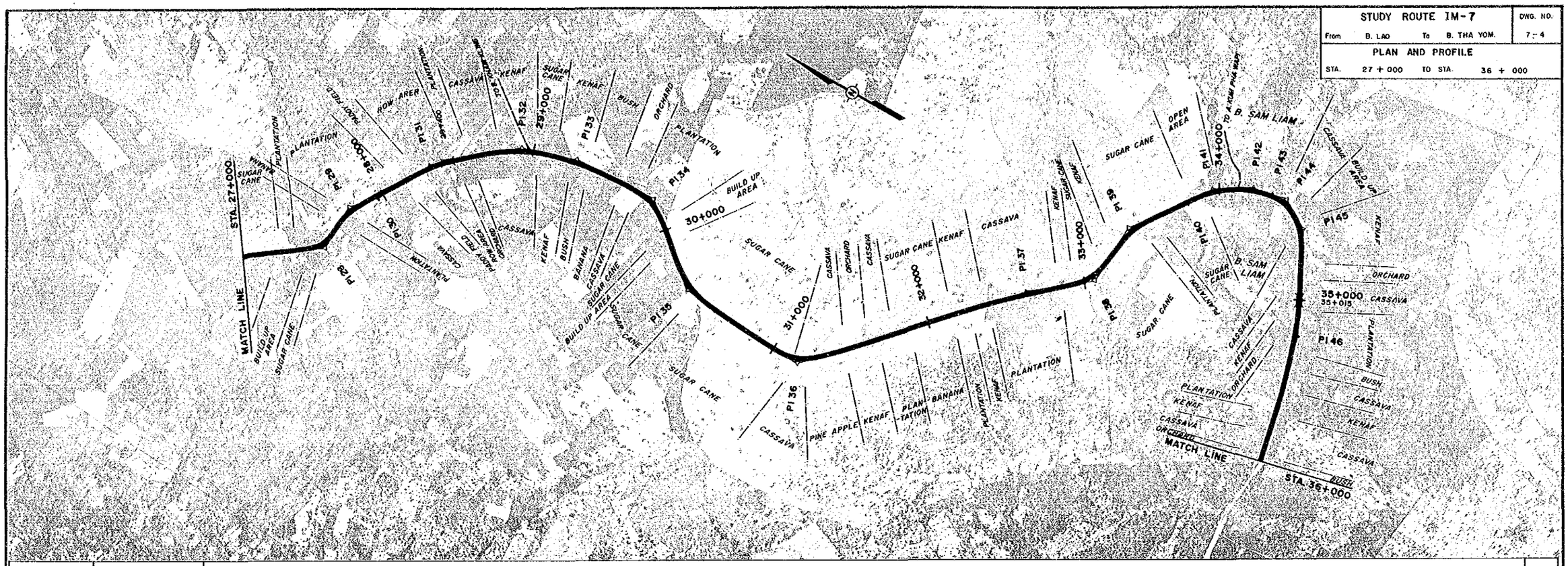



| | | | | |
|---|---|---|---|---|
| TERRAIN | | ROLLING | FLAT | ROLLING |
| PAVEM'T | Type / Length | LATERITE | | |
| | Condition | FAIR | | POOR |
| FLOODING | Length (Km) Height (m.) | | | |
| RIGHT OF WAY (m.) | | | | |
| ROUTE NO. AGENCIES | | ARD | | |

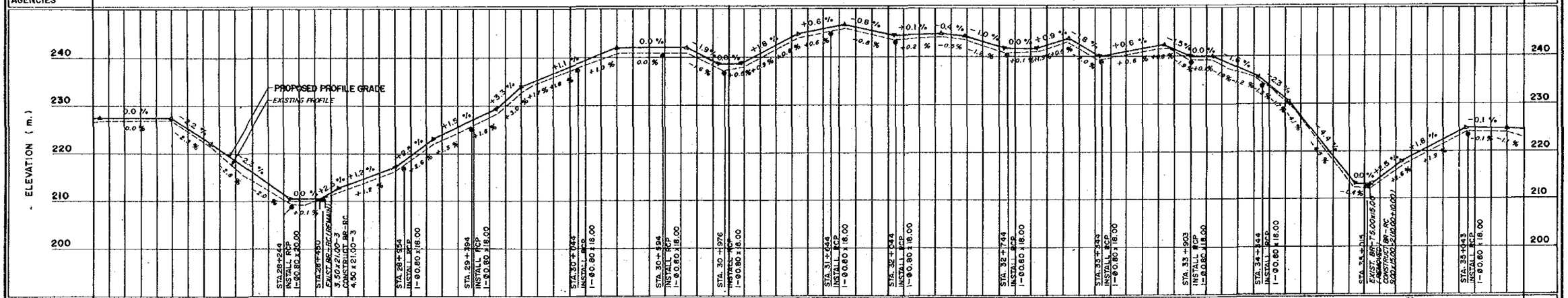



| | | | |

| STUDY ROUTE IM-7 | DWG. NO. |
|---|---|
| From B. LAO To B. THA YOM. | 7-4 |
| PLAN AND PROFILE | |
| STA. 27+000 TO STA. 36+000 | |

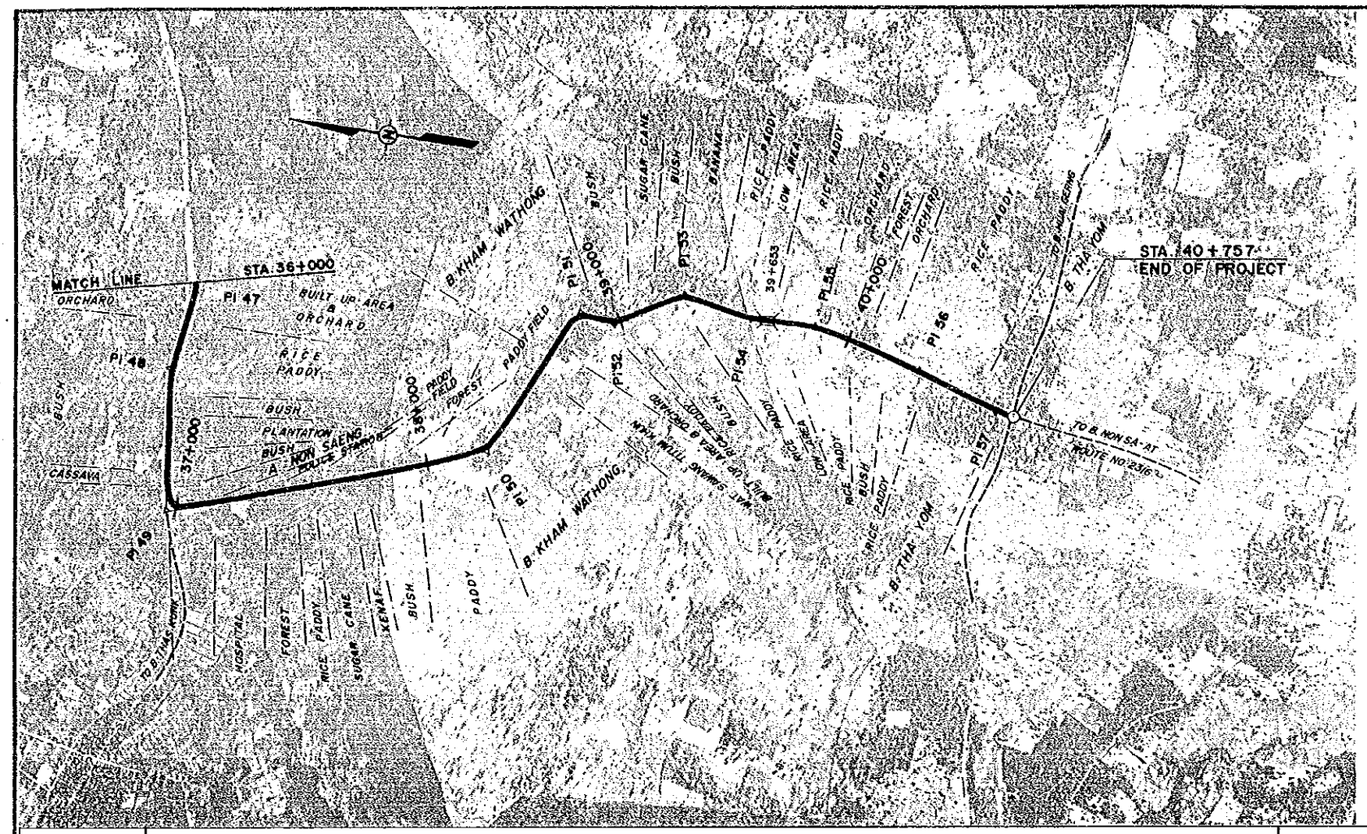



| | | |
|---|---|---|
| TERRAIN | | FLAT / ROLLING |
| PAVEMENT | Type | LATERITE |
| | Condition | POOR |
| FLOODING | Length (m.) | |
| | Height (m.) | |
| RIGHT OF WAY (m.) | | |
| ROUTE NO. AGENCIES | | ARD |

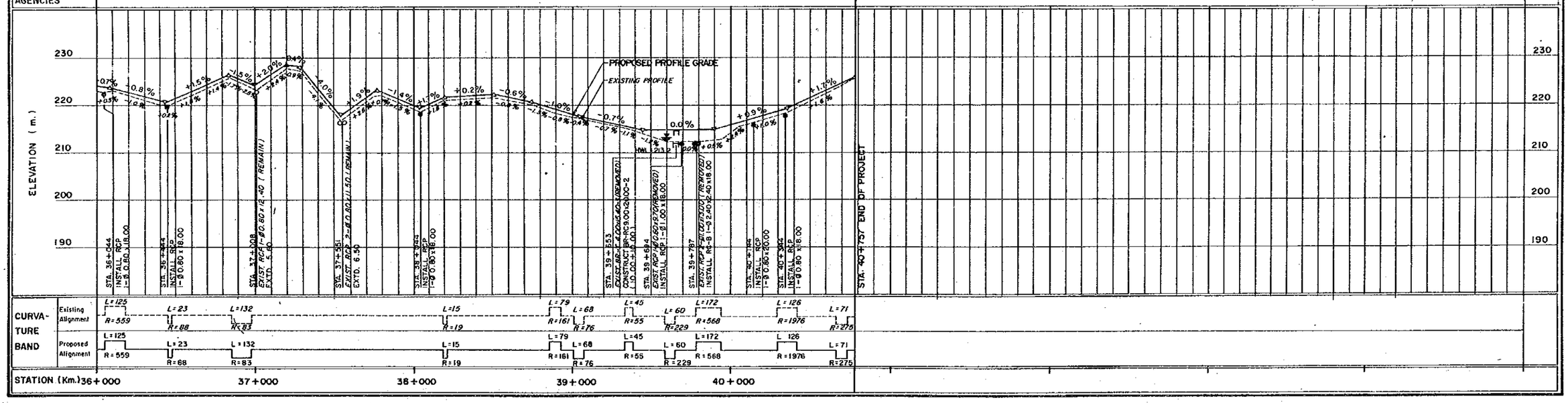



| | | |
|---|---|---|
| CURVATURE BAND | Existing Alignment | L=83 R=87; L=108.48 R=152.39; L=92 R=704; L=61 R=231; L=20 R=51; L=62 R=229; L=140 R=197; L=39 R=45; L=84 R=94; L=73 R=452; L=54 R=60; L=23 R=33; L=52 R=343; L=22 R=42; L=40 R=132; L=14 R=14; L=62 R=113; L=46 R=292; L=59 R=287 |
| | Proposed Alignment | L=83 R=87; L=108.48 R=152.39; L=92 R=704; L=61 R=231; L=20 R=51; L=62 R=229; L=140 R=197; L=39 R=45; L=84 R=94; L=73 R=452; L=54 R=60; L=23 R=33; L=52 R=343; L=22 R=42; L=40 R=132; L=14 R=14; L=62 R=113; L=46 R=292; L=59 R=287 |
| STATION (Km.) | | 27+000 28+000 29+000 30+000 31+000 32+000 33+000 34+000 35+000 36+000 |

| STUDY ROUTE IM-7 | | | | DWG. NO. |
|---|---|---|---|---|
| From B. LAO | To B. THA YOM | | | 7 - 5 |
| PLAN AND PROFILE | | | | |
| STA 36+000 | TO STA 40+757 | | | |




| | | |
|---|---|---|
| TERRAIN | | ROLLING |
| PAVEM'T | Type | LATERITE |
| | Condition | POOR |
| FLOODING | Length (m.) | 500 |
| | Height (m.) | 0.50 |
| RIGHT OF WAY (m.) | | |
| ROUTE NO. AGENCIES | | ARD |




| | | | |

## STUDY ROUTE NO. IM – 8

Changwat : Udon Thani

B. Huai Koeng (J.R. 2) – A. Kumphawapi (J.R. 2023)

Length : 14.2 KM.

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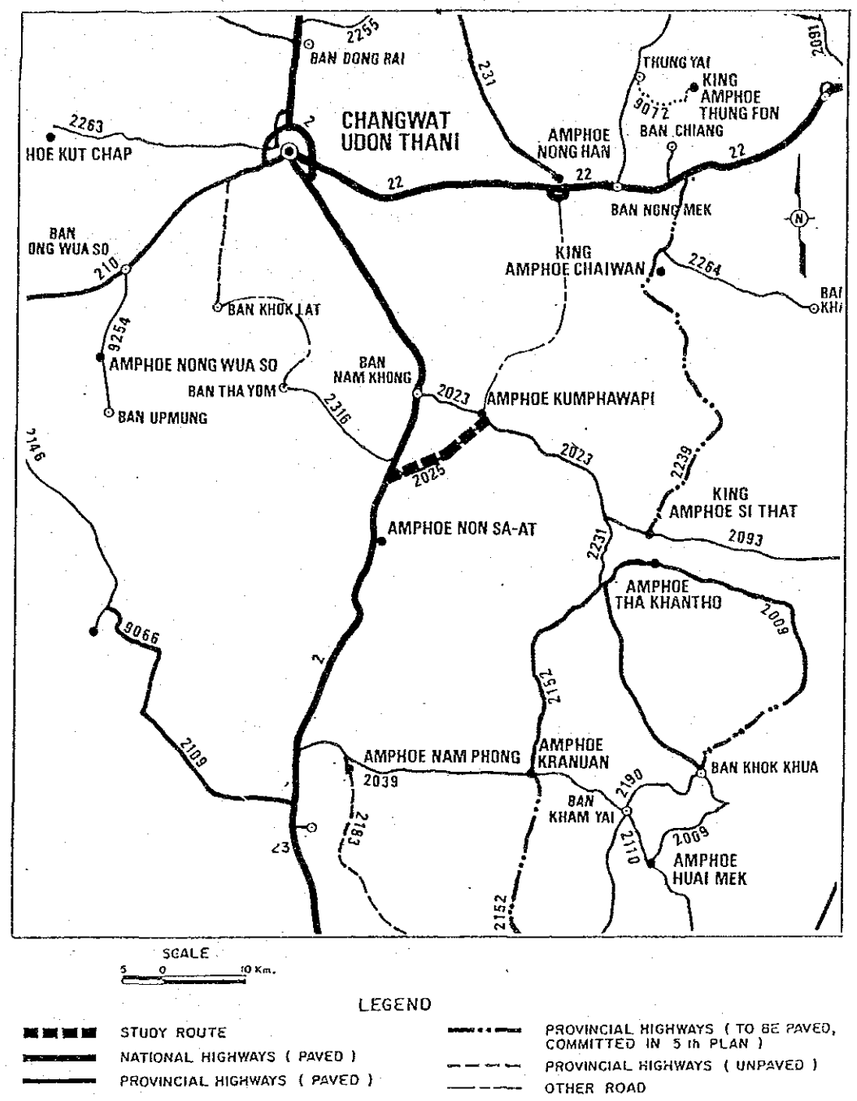
## SUMMARY

## STUDY ROUTE IM-8

| | | |
|---|---|---|
| General | | |
| Changwat | : | Udon Thani |
| Origin and Destination | : | B. Huai Koeng—A. Kumphawapi |
| Connected Road Network | : | 2—2023 |
| Amphoe on Route | : | - |
| Number of Related Villages | : | 2 |
| Influence Area | | |
| Area | : | 99 $km^2$ |
| Cultivated Area Ratio to Total Land Area in % | : | 61 |
| Population in 1983 | : | 21,100 |
| Main Crops | : | Paddy & Sugarcane |
| Number of Public Activities | | |
| Public Health Service Centers | : | - |
| Hospitals Changwat Level | : | - |
| Amphoe Level | : | 1 |
| Schools Primary | : | 4 |
| Secondary | : | 1 |
| Traffic (ADT) | : | 1984—193 1988—297 1994—390 2002—565 |
| Nomenclature of Study Route | | |
| Total Length | : | 14.2 km |
| Improvement Section | : | 14.2 km |
| DOH Road | : | 14.2 km |
| ARD Road | : | - |
| Other Road | : | - |
| New Construction Section | : | - |
| Design Standard Employed | : | F4 |
| Construction Cost in Baht | | |
| Financial | : | 22,274,000 |
| Economic | : | 18,621,000 |
| Economic Indicators | | |
| IRR | : | 13.5% Ranking: 10 |
| Social Impact | | |
| Social B/C Ratio | : | 0.400 Ranking: 2 |
| Recommendations | | |
| Opening Year | : | 1988 Overall Ranking: 7 |

### LOCATION OF STUDY ROUTE

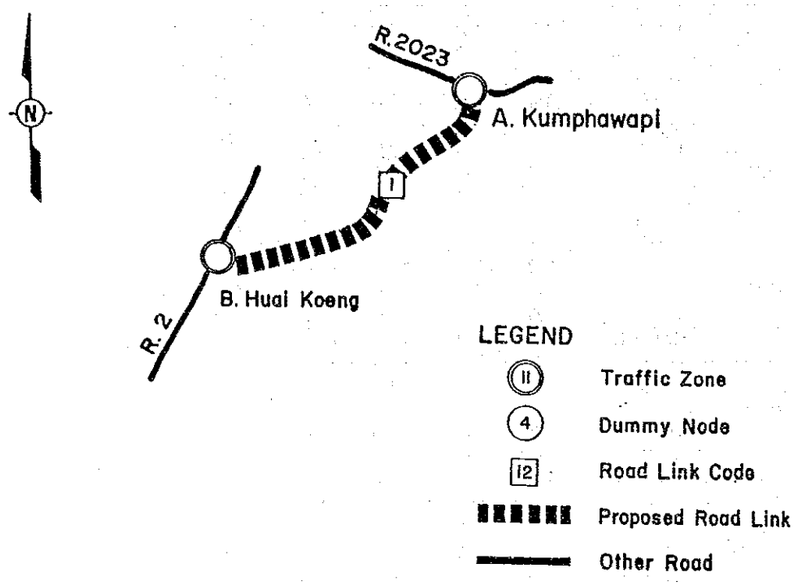


## 8.1 TRAFFIC

### 8.1.1 Method Employed in Traffic Forecasting

The growth rate method was employed in forecasting because no diverted traffic after improvement was expected on this study route.

### 8.1.2 Assumed Road Link




### 8.1.3 Traffic Forecast

1) Items necessary for forecasting traffic were:
   - Traffic volume in base year
   - Passenger and freight movement in base year
   - Growth rates of passenger and freight movement
   - Rate of induced and developed movement
   - Traffic composition

TRAFFIC VOLUME IN BASE YEAR

| LINK | TYPE OF VEHICLE | | | | | | | | ADT | M/C | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | P/C | L/B | M/B | H/B | P/P&T | 4/T | 6/T | 10/T | | | |
| 1 | 8 | 52 | 8 | 0 | 83 | 7 | 20 | 15 | 193 | 437 | 630 |

PASSENGER AND FREIGHT MOVEMENT IN BASE YEAR

| PROPOSED ROAD LINK | PASSENGER MOVEMENT (TRIPS PER DAY) | FREIGHT MOVEMENT (TONNAGE PER DAY) | | |
|---|---|---|---|---|
| | | NON-AGRI. | AGRI. | TOTAL |
| 1 | 940 | 86.5 | 74.8 | 161.2 |

GROWTH RATE OF PASSENGER MOVEMENT

(UNIT : % P.A.)

| YEAR | PER CAPITA INCOME | POPULATION | PASSENGER MOVEMENT |
|---|---|---|---|
| 1984 - 1988 | 3.1 | 2.7 | 7.2 |
| 1988 - 1994 | 3.1 | 2.3 | 6.8 |
| 1994 - 2002 | 3.1 | 1.9 | 6.4 |

GROWTH RATE OF FREIGHT MOVEMENT

(UNIT : % P.A.)

| YEAR | NON-AGRI. FREIGHT | AGRI. FREIGHT | FREIGHT MOVEMENT |
|---|---|---|---|
| 1984 - 1988 | 8.9 | 0.1 | 5.1 |
| 1988 - 1994 | 8.4 | 0.1 | 5.6 |
| 1994 - 2002 | 7.9 | 0.1 | 6.1 |

RATE OF INDUCED AND DEVELOPED MOVEMENT

(UNIT : %)

| YEAR | INDUCED | DEVELOPED | | |
|---|---|---|---|---|
| | LINK | PASSENGER | NON-AGRI. FREIGHT | AGRI. FREIGHT |
| | 1 | MOVEMENT | MOVEMENT | MOVEMENT |
| 1988 | 15.0 | 0.0 | 0.0 | 0.2 |
| 1994 | 15.0 | 0.0 | 0.0 | 1.2 |
| 2002 | 15.0 | 0.0 | 0.0 | 2.5 |

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 | 1984 | 7.0 | 61.5 | 27.3 | 4.2 | 0.0 | 23.6 | 12.7 | 36.4 | 27.3 |
| | 1988 | 14.1 | 56.3 | 21.9 | 6.2 | 1.6 | 21.3 | 12.3 | 39.4 | 27.0 |
| | 1994 | 24.8 | 48.4 | 13.8 | 9.1 | 3.9 | 17.7 | 11.8 | 43.9 | 26.6 |
| | 2002 | 39.0 | 38.0 | 3.0 | 13.0 | 7.0 | 13.0 | 11.0 | 50.0 | 26.0 |

2) The following were output:

- Forecasted ADT
- Traffic volumes

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 | | | |
| 1988 | 31 | 48 | 14 | 3 | 140 | 9 | 30 | 21 | 297 | 325 | 622 |
| 1994 | 71 | 39 | 26 | 11 | 157 | 12 | 46 | 28 | 390 | 365 | 755 |
| 2002 | 157 | 12 | 52 | 28 | 174 | 18 | 82 | 43 | 565 | 419 | 984 |



TRAFFIC VOLUME ON ROUTE IM- 8 LINK COUNT= 1

| | YEAR | 1988 | | 1994 | | 2002 | |
|---|---|---|---|---|---|---|---|
| | LINK | 1 | AVR. | 1 | AVR. | 1 | AVR. |
| P/C | N+D | 27 | 27 | 62 | 62 | 136 | 136 |
| | I | 4 | 4 | 9 | 9 | 20 | 20 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 31 | 31 | 71 | 71 | 157 | 157 |
| L/B | N+D | 42 | 42 | 34 | 34 | 10 | 10 |
| | I | 6 | 6 | 5 | 5 | 2 | 2 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 48 | 48 | 39 | 39 | 12 | 12 |
| M/B | N+D | 12 | 12 | 23 | 23 | 45 | 45 |
| | I | 2 | 2 | 3 | 3 | 7 | 7 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 14 | 14 | 26 | 26 | 52 | 52 |
| H/B | N+D | 3 | 3 | 10 | 10 | 24 | 24 |
| | I | 0 | 0 | 1 | 1 | 4 | 4 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 3 | 3 | 11 | 11 | 28 | 28 |
| P/P&T | N+D | 122 | 122 | 136 | 136 | 151 | 151 |
| | I | 18 | 18 | 20 | 20 | 23 | 23 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 140 | 140 | 157 | 157 | 174 | 174 |
| 4/T | N+D | 8 | 8 | 11 | 11 | 16 | 16 |
| | I | 1 | 1 | 2 | 2 | 2 | 2 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 9 | 9 | 12 | 12 | 18 | 18 |
| 6/T | N+D | 26 | 26 | 40 | 40 | 71 | 71 |
| | I | 4 | 4 | 6 | 6 | 11 | 11 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 30 | 30 | 46 | 46 | 82 | 82 |
| 10/T | N+D | 18 | 18 | 24 | 24 | 37 | 37 |
| | I | 3 | 3 | 4 | 4 | 6 | 6 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 21 | 21 | 28 | 28 | 43 | 43 |
| ADT | N+D | 258 | 258 | 339 | 339 | 491 | 491 |
| | I | 39 | 39 | 51 | 51 | 74 | 74 |
| | DV | 0 | 0 | 0 | 0 | 1 | 1 |
| | TOTAL | 297 | 297 | 390 | 390 | 565 | 565 |
| M/C | N+D | 305 | 305 | 345 | 345 | 398 | 398 |
| | I | 20 | 20 | 20 | 20 | 20 | 20 |
| | DV | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 325 | 325 | 365 | 365 | 419 | 419 |
| TOTAL | N+D | 563 | 563 | 683 | 683 | 889 | 889 |
| | I | 59 | 59 | 71 | 71 | 94 | 94 |
| | DV | 0 | 0 | 0 | 0 | 1 | 1 |
| | TOTAL | 622 | 622 | 755 | 755 | 984 | 984 |

NOTE

N : NORMAL TRAFFIC D : DIVERTED TRAFFIC

DV : DEVELOPED TRAFFIC I : INDUCED TRAFFIC