

5. ECONOMIC EVALUATION

COST AND BENEFIT STATEMENT







(1000 BAHT)

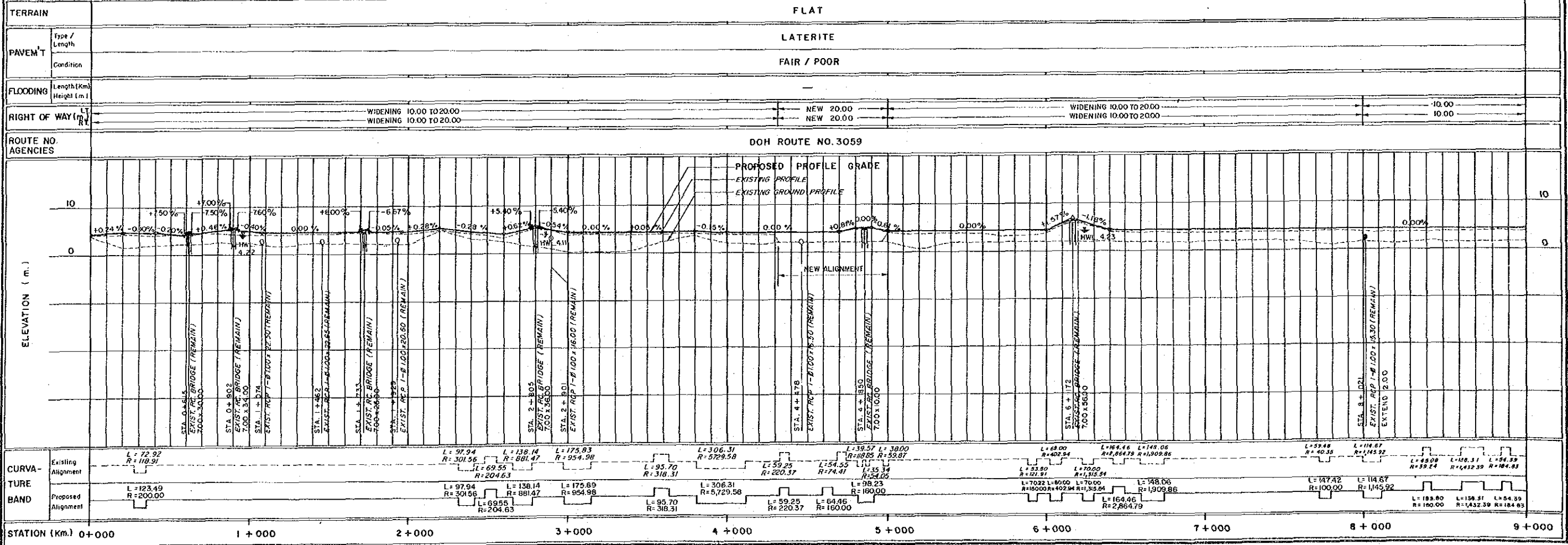
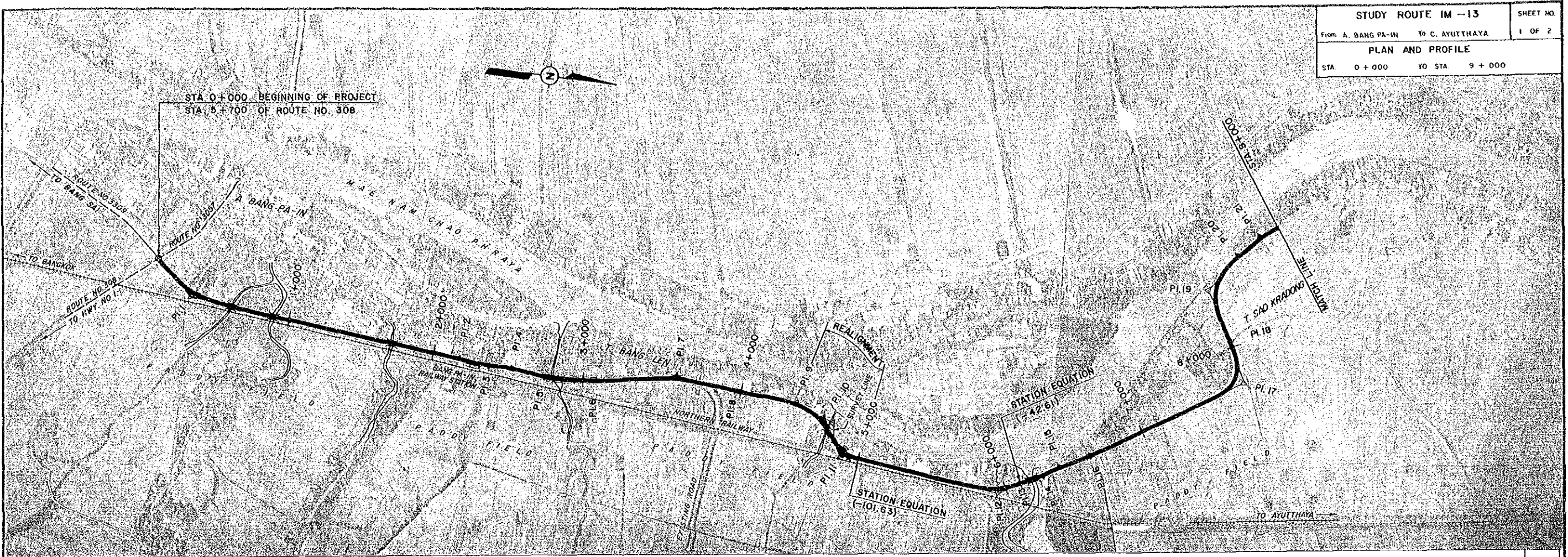
| YEAR | COST | | BENEFITS | | | DISCOUNTED (12%) | |
|-------|-------------|------------|-------------|---------------|---------|------------------|---------|
| | CONST. COST | VOC SAVING | TIME SAVING | MAINT. SAVING | TOTAL | COST | BENEFIT |
| 1992 | 25,159 | | | | 0 | 31,559 | 0 |
| 1993 | 46,725 | | | | 0 | 52,332 | 0 |
| 1994 | | 11,580 | 5,665 | 26 | 17,271 | 0 | 15,421 |
| 1995 | | 12,268 | 6,014 | 18 | 18,300 | 0 | 14,589 |
| 1996 | | 12,955 | 6,363 | 10 | 19,328 | 0 | 13,757 |
| 1997 | | 13,643 | 6,712 | 2 | 20,357 | 0 | 12,937 |
| 1998 | | 14,330 | 7,062 | (6) | 21,386 | 0 | 12,135 |
| 1999 | | 15,018 | 7,411 | (14) | 22,415 | 0 | 11,356 |
| 2000 | | 15,706 | 7,760 | (22) | 23,444 | 0 | 10,605 |
| 2001 | | 16,586 | 8,184 | (30) | 24,740 | 0 | 9,992 |
| 2002 | | 17,467 | 8,608 | (38) | 26,037 | 0 | 9,389 |
| 2003 | | 18,348 | 9,032 | (46) | 27,334 | 0 | 8,801 |
| 2004 | 12,348 | 19,229 | 9,456 | (54) | 28,631 | 3,976 | 8,231 |
| 2005 | | 20,110 | 9,879 | (62) | 29,927 | 0 | 7,682 |
| 2006 | | 20,991 | 10,303 | (70) | 31,224 | 0 | 7,156 |
| 2007 | | 21,871 | 10,727 | (78) | 32,520 | 0 | 6,654 |
| 2008 | (37,326) | 22,752 | 11,151 | (84) | 33,819 | (7,638) | 6,179 |
| TOTAL | 46,906 | 252,854 | 124,327 | (448) | 376,733 | 80,229 | 154,884 |

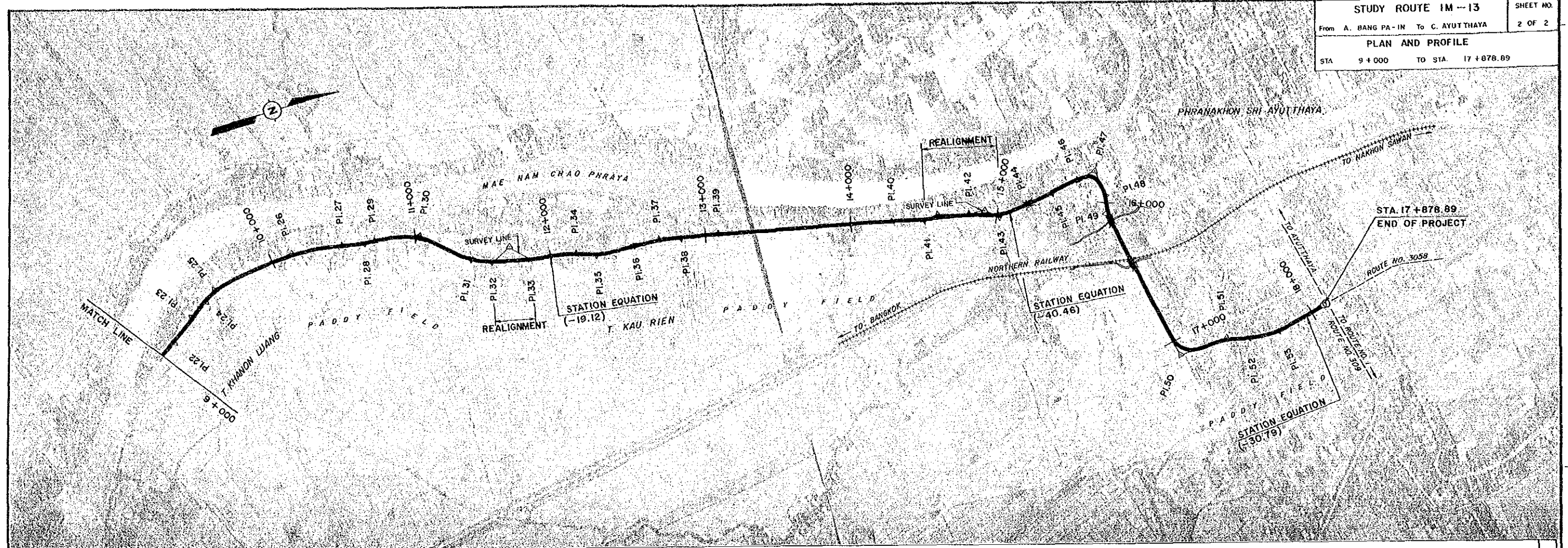
NET PRESENT VALUE : 74,655
 BENEFIT COST RATIO : 1.93
 INTERNAL RATE OF RETURN : 21.7%
 FIRST YEAR RATE OF RETURN : 18.4%

6. DRAWINGS

ABBREVIATIONS and SYMBOLS for PLAN and PROFILE

| | |
|---|---|
|  | NEW CONSTRUCTION SECTION OF STUDY ROUTE |
|  | IMPROVEMENT SECTION OF STUDY ROUTE |
|  | BRIDGE (PROPOSED, EXISTING) |
|  | BOX CULVERT (PROPOSED, EXISTING) |
|  | PIPE CULVERT (PROPOSED, EXISTING) |
|  | HIGH WATER LEVEL |
| HWY | HIGHWAY |
| PI | POINT OF HORIZONTAL INTERSECTION |
| NO. or # | NUMBER |
| Δ | DEFLECTION ANGLE |
| R | RADIUS OF CURVATURE |
| T | TANGENT LENGTH |
| L | LENGTH OF CURVE |
| RT | RIGHT |
| LT | LEFT |
| EXIST. | EXISTING |
| EXTD. | EXTEND |
| RC-P-n- ϕ a x l | PIPE CULVERT, n (ROW), ϕ a (DIAMETER, m), l (LENGTH, m) |
| RC-B-n-a x b x l | BOX CULVERT, n (NO. OF CELLS), a x b x l (CLEAR SPAN x DEPTH x LENGTH, m) |
| BR-T-a x l - n | TIMBER BRIDGE, a x l (WIDTH x LENGTH, m), n (NO. OF SPANS) |
| BR-RC-a x l - n | CONCRETE BRIDGE, a x l (ROADWAY WIDTH x LENGTH, m) n (NO. OF SPANS) |





| TERRAIN | | FLAT | |
|--|---------------------------|--|------------------------|
| PAVEMT | Type / Length | LATERITE | AC PAVEMENT |
| | Condition | FAIR / POOR | |
| FLOODING | Length (Km) Height (m) | --- | |
| RIGHT OF WAY (m) | LT RT | 10.00 10.00 | NEW 10.00 NEW 10.00 |
| ROUTE NO. AGENCIES DOH ROUTE NO. 3059 | | | |
| CURVA-TURE BAND | Existing Alignment | <p>PROPOSED PROFILE GRADE EXISTING PROFILE EXISTING GROUND PROFILE</p> | |
| | Proposed Alignment | <p>NEW ALIGNMENT</p> | |
| <p>ELEVATION (m)</p> <p>10 0</p> <p>GRADES: 0.00%, +0.20%, -0.10%, 0.00%, +0.32%, -0.15%, 0.00%, -0.15%, 0.00%, +0.20%, -0.05%, 0.00%, +0.05%, -0.10%, 0.00%, -0.07%, +0.35%, -0.11%, 0.00%, -0.55%, 0.00%, 0.80%, 0.00%, +2.66%</p> <p>STATION (Km.) 9+000 10+000 11+000 12+000 13+000 14+000 15+000 16+000 17+000 18+000</p> | | | |
| <p>STATION (Km.) 9+000 10+000 11+000 12+000 13+000 14+000 15+000 16+000 17+000 18+000</p> | | | |

PROJECT IM – 14

Changwat : Ayutthaya/Pathum Thani

A. Wang Noi – A. Thanyaburi

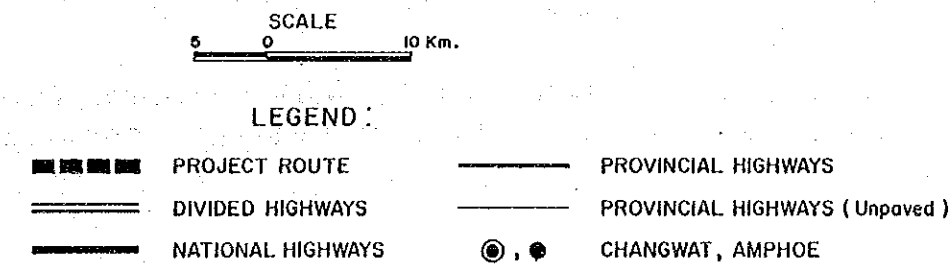
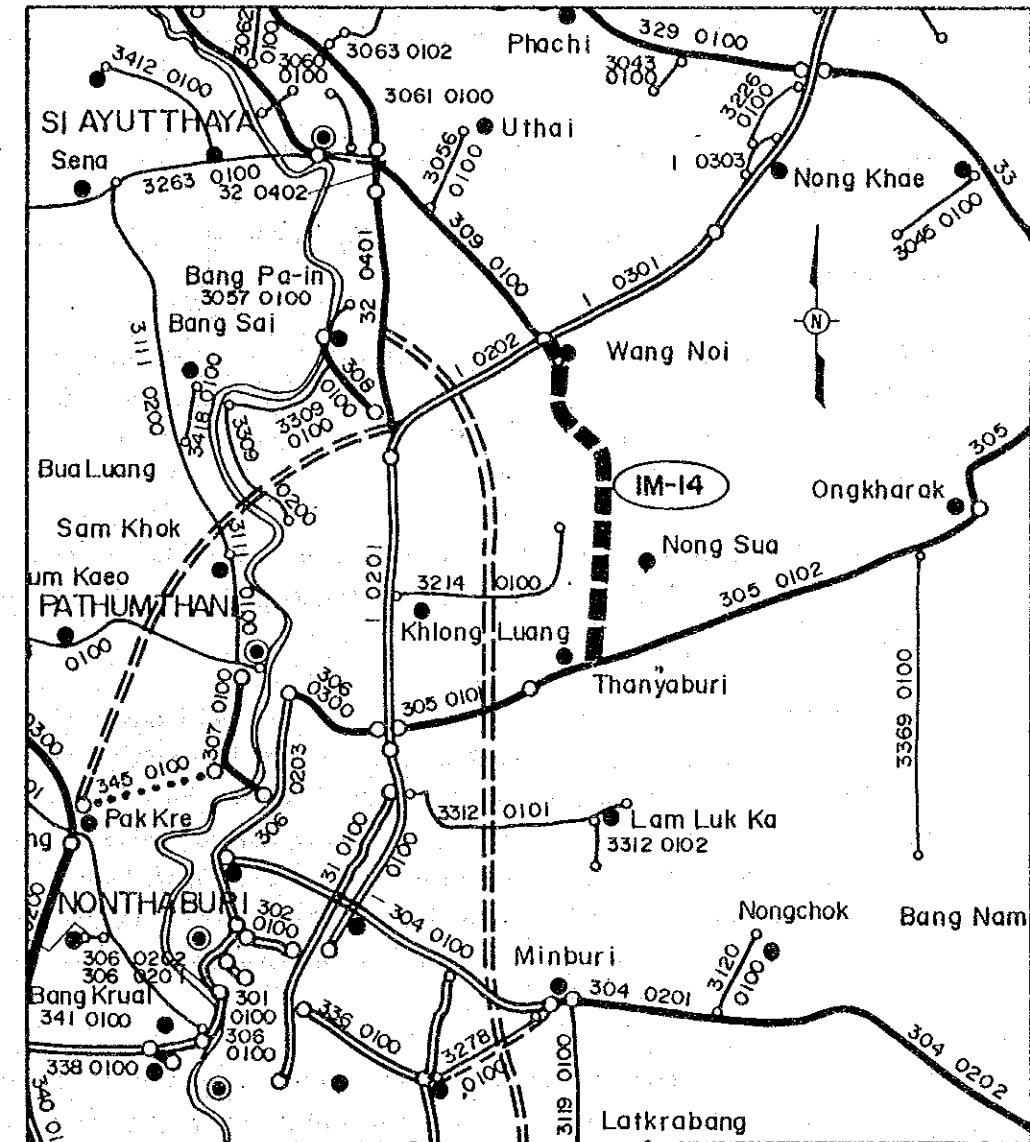
Length : 25.6 km

SUMMARY

PROJECT IM-14

| ITEM | DESCRIPTION |
|---------------------|-------------------------|
| Changwat | Ayutthaya/Pathum Thani |
| Origin | A. Wang Noi (Rt. 1) |
| Destination | A. Thanyaburi (Rt. 305) |
| Route No. | Rural |
| Project Length | 25.6 km |
| Standard | |
| - Existing | — |
| - Proposed | F3 |
| Traffic | |
| - Base | 84 ~ 164 |
| - 2000 | 900 ~ 1,000 |
| - 2008 | 1,300 ~ 1,400 |
| Pavement Type | |
| - Existing | Laterite |
| - Proposed | AC pavement (t=10) |
| Bridges | |
| - New Construction | 3 sites, 140 m |
| - Replacement | — |
| Construction Costs | |
| - Financial | 136,369,000 Baht |
| - Economic | 120,628,000 Baht |
| Economic Evaluation | |
| - IRR | 22.9% |
| - B/C | 2.07 |

LOCATION OF PROJECT ROUTE



1. GENERAL

The proposed route lies in Changwat Pathum Thani. It originates at the intersection of Routes 1 and 309 in Amphoe Wang Noi, and runs southward to end at the junction with Route 305 in Amphoe Thanyaburi with a total length of 25.6 km.

The route runs along two khlongs for the most part. Houses are densely built along the khlongs.

Except for two short sections (1 km each) at both ends, the surface is of laterite and its condition is generally poor.

The area is well cultivated with paddy throughout the area along the road.

There are two concrete bridges, one 40 m in length, but narrow. The other, a narrow concrete bridge 26 m in length, is adequate.

The proposed route follows an existing road except for a section south of Khlong Ruphiphat where a shortcut is proposed to avoid an undesirable horizontal alignment. Thus the proposed route is 2.9 km shorter than the existing road length. The proposed road class was determined to be F3.

A section of about 660 m from the starting point of this road is Route 3189 under DOH and is paved, but standards such as width are inadequate. A bridge at Km 5 + 000 requires replacement.

The section from the origin to STA 15 + 100 where it crosses Khlong Ruphiphat is to be newly constructed with a length of 1,800 m. The next section from STA 15 + 100 to STA 23 + 500 (about 8.4 km in length) runs along Khlong 7 on the east side. Border stakes indicating the right-of-way in this section are not clearly marked, and electricity poles and houses are placed at varying distances from the road and the khlong. The results of a topographic survey indicate that F3 class standards can be maintained in this section with a minimum effect on the existing houses by shifting the road center line by 2 to 4 m to the west (to the opposite side of the khlong).

The H.W.L. of the khlong is 2.60 m, about the same as the existing road surface level. The improved road needs to be raised. The height of the newly constructed section was determined at the same level.

A sharp curve at STA 23 + 500 is to be improved with the transfer of a house inside the curve. Another sharp curve at STA 23 + 800 can be improved without difficulty.

2. TRAFFIC FORECAST

Base Traffic Volume

(Unit: Vehicles/Day)

| Traffic Volume | | | | | | | | | | |
|----------------|---------|------|-----|----|----|----|----|----|----|-----|
| Project Code | Section | Year | MC | PC | LB | HB | LT | MT | HT | ADT |
| IM-14 | RURAL-N | 1988 | 423 | 9 | 4 | 0 | 91 | 29 | 31 | 164 |
| | RURAL-S | 1988 | 133 | 5 | 2 | 0 | 71 | 6 | 0 | 84 |

Traffic Growth Rate

(Unit: Percent)

| Project | Section | Period | MC | PC | LB | HB | LT | MT | HT |
|---------|---------|------------|------|------|------|------|------|------|------|
| IM-14 | RURAL-N | -1993 | 4.11 | 4.78 | 3.92 | 4.62 | 4.08 | 4.11 | 3.55 |
| | | 1994 -2000 | 5.03 | 5.67 | 5.91 | 5.08 | 4.62 | 4.86 | 4.42 |
| | | 2000 -2008 | 4.87 | 5.69 | 5.69 | 4.78 | 4.47 | 4.28 | 4.18 |
| | RURAL-S | -1993 | 4.11 | 4.78 | 3.92 | 4.62 | 4.08 | 4.11 | 3.55 |
| | | 1994 -2000 | 5.03 | 5.67 | 5.91 | 5.08 | 4.62 | 4.86 | 4.42 |
| | | 2000 -2008 | 4.87 | 5.69 | 5.69 | 4.78 | 4.47 | 4.28 | 4.18 |

Diverted Traffic Volume

(Unit: Vehicles/Day)

| Project | Section | Year | MC | PC | LB | HB | LT | MT | HT | ADT |
|---------|---------|------|----|----|----|----|-----|----|-----|------|
| IM-14 | RURAL-N | 1994 | 0 | 10 | 0 | 0 | 88 | 12 | 439 | 549 |
| | | 2000 | 0 | 14 | 0 | 0 | 115 | 16 | 569 | 714 |
| | | 2008 | 0 | 21 | 0 | 0 | 163 | 22 | 790 | 996 |
| | RURAL-S | 1994 | 0 | 10 | 0 | 0 | 88 | 19 | 439 | 556 |
| | | 2000 | 0 | 14 | 0 | 0 | 115 | 25 | 569 | 723 |
| | | 2008 | 0 | 21 | 0 | 0 | 163 | 35 | 790 | 1009 |

Induced Traffic Volume

(Unit: Vehicles/Day)

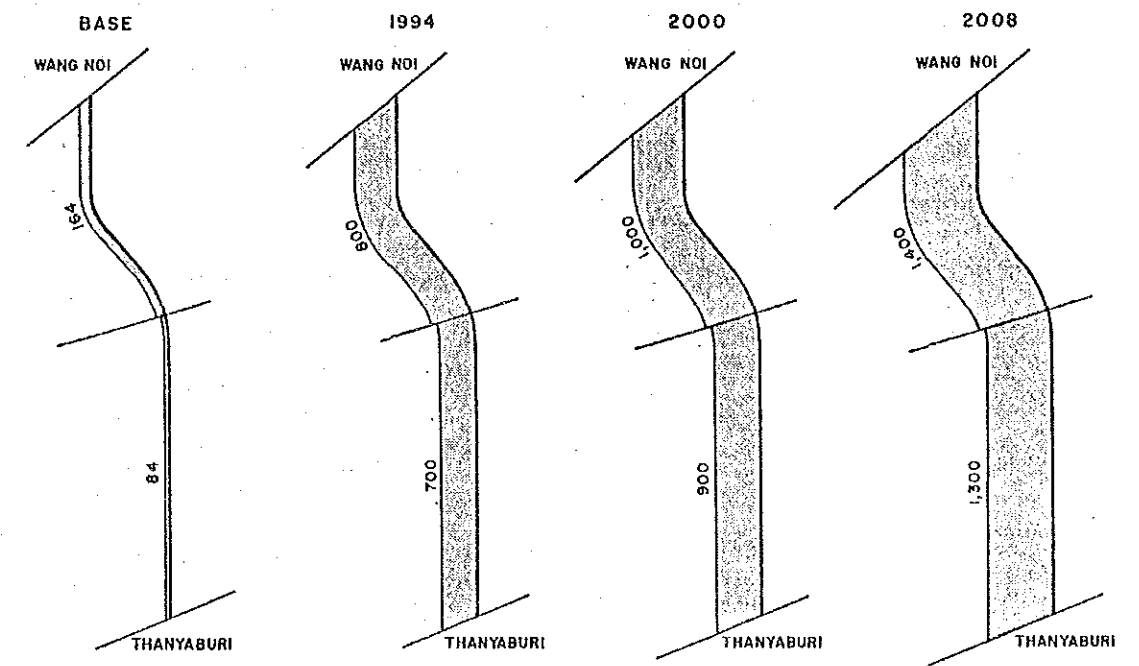
| Project | Section | Year | MC | PC | LB | HB | LT | MT | HT | ADT |
|---------|---------|------|-----|----|----|----|----|----|----|-----|
| IM-14 | RURAL-N | 1994 | 70 | 2 | 1 | 0 | 24 | | | 27 |
| | | 2000 | 97 | 3 | 2 | 0 | 32 | | | 37 |
| | | 2008 | 141 | 5 | 2 | 0 | 45 | | | 52 |
| | RURAL-S | 1994 | 50 | 3 | 1 | 0 | 28 | | | 32 |
| | | 2000 | 66 | 4 | 1 | 0 | 37 | | | 42 |
| | | 2008 | 96 | 6 | 2 | 0 | 52 | | | 60 |

Future Traffic Volume

(Unit: Vehicles/Day)

| Project | Section | Year | MC | PC | LB | HB | LT | MT | HT | ADT |
|---------|---------|------|------|----|----|----|-----|----|-----|------|
| IM-14 | RURAL-N | 1994 | 613 | 24 | 6 | 1 | 228 | 49 | 478 | 786 |
| | | 2000 | 827 | 34 | 9 | 2 | 300 | 65 | 619 | 1029 |
| | | 2008 | 1208 | 53 | 14 | 3 | 425 | 91 | 859 | 1445 |
| | RURAL-S | 1994 | 221 | 22 | 3 | 2 | 204 | 26 | 440 | 697 |
| | | 2000 | 295 | 31 | 5 | 2 | 268 | 35 | 571 | 912 |
| | | 2008 | 432 | 48 | 7 | 3 | 380 | 49 | 792 | 1279 |

Note. N: North Section S: South section



PROJECT IM - 14

UNIT : VEHICLE / DAY

3. ENGINEERING

3.1 Materials and Boring Results

(1) Materials

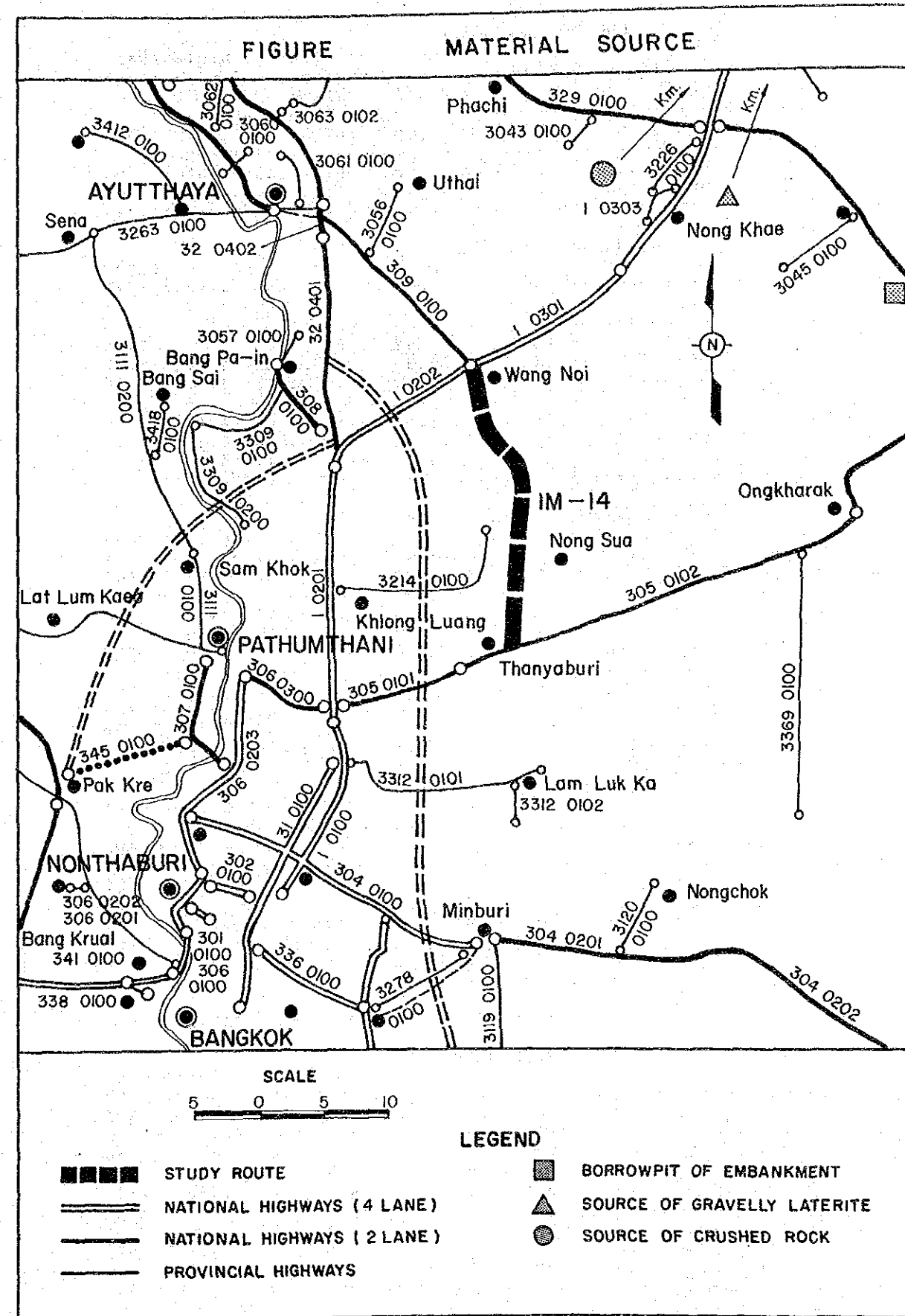
DESCRIPTION OF MATERIAL SOURCES

| Material | Source | Description of Sample | Estimated Quantity cu.m. | Hauling Distance (km) |
|--------------|---|---------------------------|--------------------------|-----------------------|
| Soil | Route 305 Km 37+000 Left Side 0.3 Km | Silty Clayey Fine Sand | Plentiful | 25 |
| Laterite | Route 2 Km 118+000 Left Side 3.6 Km | Gravelly Laterite | Plentiful | 52 |
| Crushed Rock | Route 1 Km 129+500 Both Sides | Lime Stone | Plentiful | 73 |

RESULTS OF LABORATORY TESTS

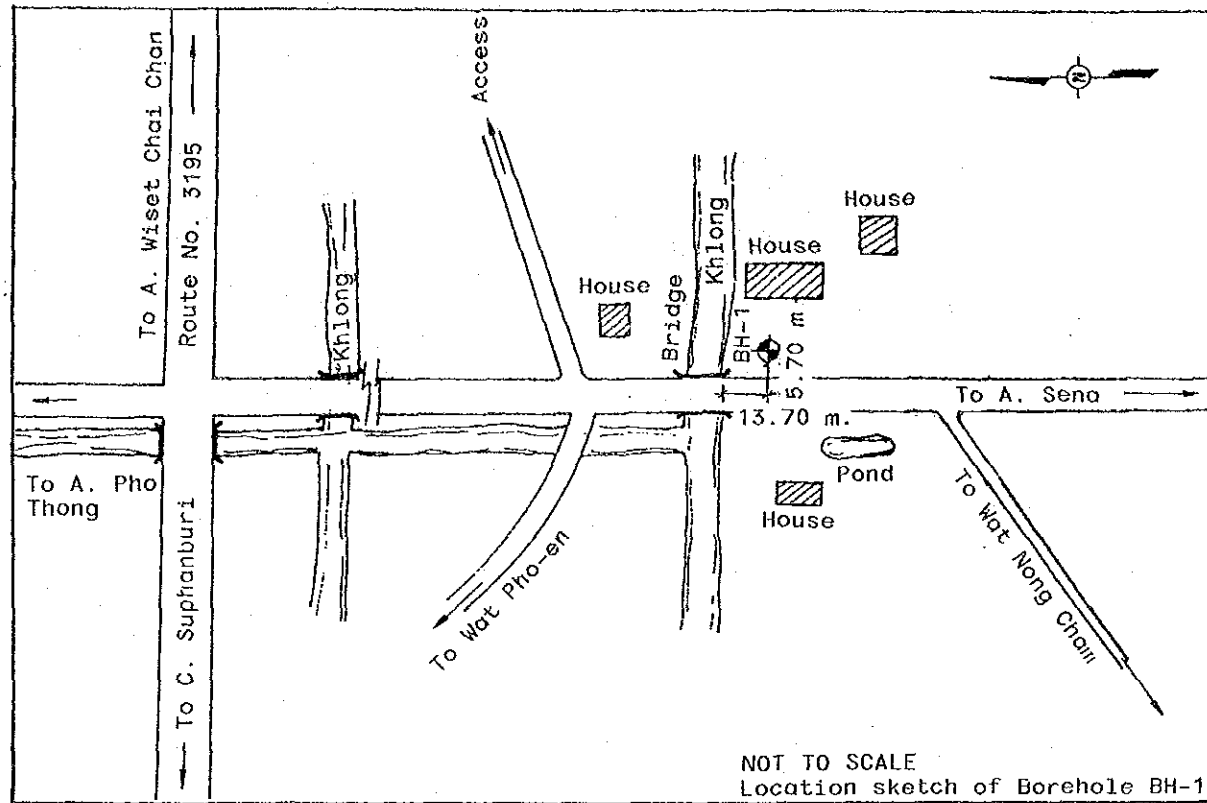
| | Sieve Analysis % Passing | | | | | | | Plasticity | | Comp. DH-T Stand. | | Lab. C.B.R. | | |
|--------------|--------------------------|------|------|-----|-----|-----|-----|------------|------|-------------------|----------------|-------------|---------|-----|
| | 50.0 | 25.0 | 19.0 | 9.5 | #4 | #10 | #40 | #200 | LL | PI | Opt. 95% gn/cc | CBR 95% | Swell % | |
| Soil | | | | | 100 | 96 | 84 | 34 | 22.0 | 9.1 | 10.3 | 2.01 | 6.0 | 0.1 |
| Laterite | 100 | 93 | 86 | 62 | 39 | 27 | 8 | 24.3 | 8.2 | 6.8 | 2.06 | 43 | - | |
| Crushed Rock | | | | | | | | | | | | 80 | | |

Note : Abrasion test result of Crushed Rock 22.6 %



(2) Boring Results

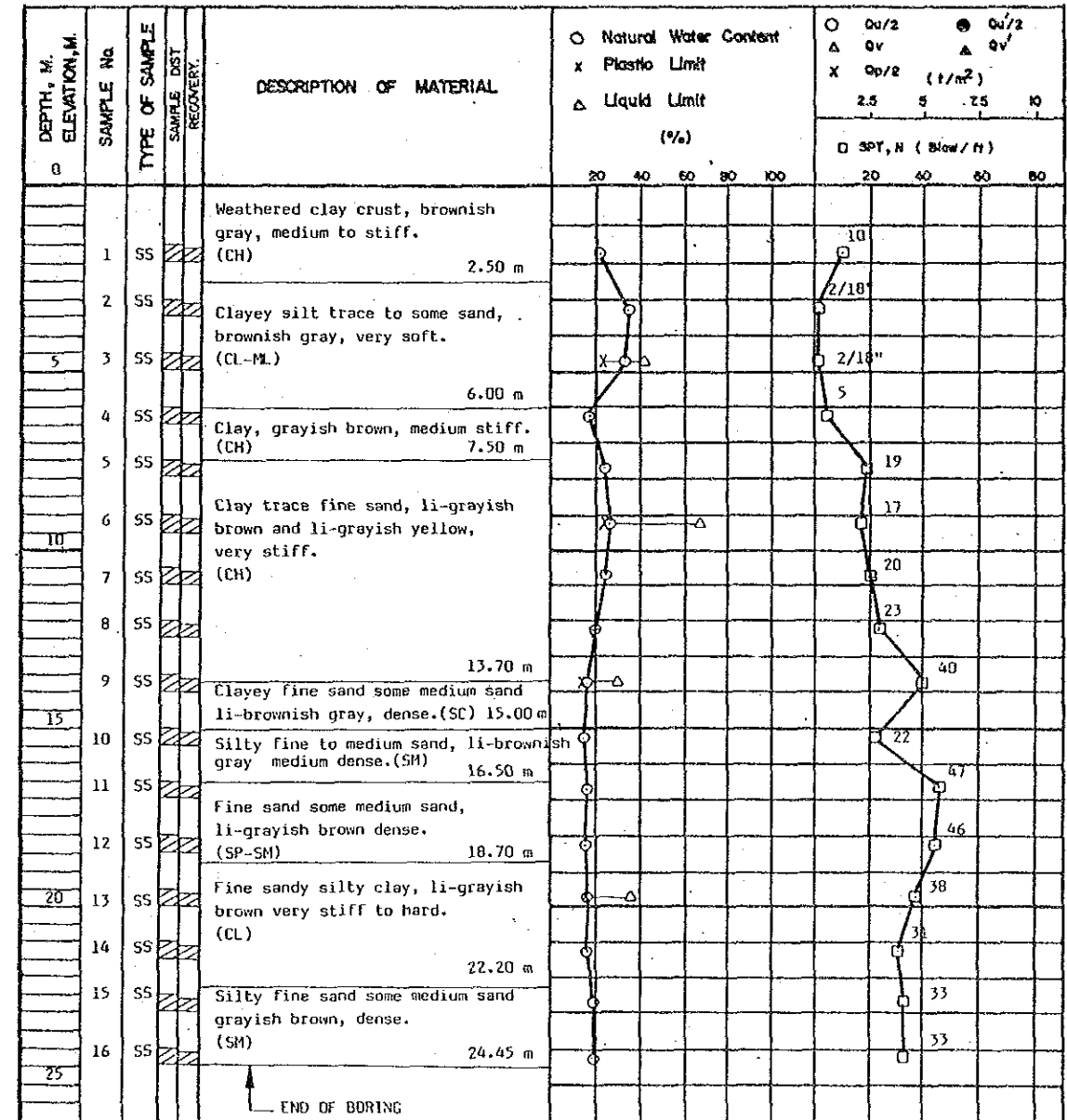
BOREHOLE LOCATION



SUMMARY OF TEST RESULTS

| SAMPLE No. | DEPTH M. | | WATER CONTENT % | ATTERBERG LIMIT % | | | WET UNIT WEIGHT γ_{m^3} | SIEVE ANALYSIS % FINER | | | | | CLASSIFICATION | UNDRAINED SHEAR STRENGTH γ_{m^2} | | | | STANDARD PENETRATION (N) | |
|------------|----------|------|-----------------|-------------------|------|------|--------------------------------|------------------------|-------|--------|--------|---------|----------------|---|---------|------------------|-------|--------------------------|----|
| | FROM | TO | | LL | PL | PI | | % FINER | | | | | | UNCONFINED SHEAR | | FIELD VANE SHEAR | | | |
| | | | | | | | | No. 3/8" | No. 4 | No. 10 | No. 40 | No. 200 | | $Q_u/2$ | $Q_u/2$ | Q_v | Q_v | | |
| SS-1 | 1.50 | 1.95 | 21.0 | | | | 1.86 | | | | | CH | | | | | 8.7 | 10 | |
| SS-2 | 1.00 | 1.45 | 33.6 | | | | 1.81 | 100 | 98 | 95 | 90 | CL-ML | | | | | 1.2 | 2/18" | |
| SS-3 | 1.50 | 1.95 | 31.4 | 40.8 | 23.2 | 17.6 | | | | | | CL-ML | | | | | 1.2 | 2/18" | |
| SS-4 | 1.00 | 1.45 | 18.0 | | | | 2.04 | | | | | CH | | | | | 7.5 | 5 | |
| SS-5 | 1.50 | 1.95 | 22.7 | | | | 2.08 | 100 | 99 | 98 | 97 | CH | | | | | 12.5 | 19 | |
| SS-6 | 1.50 | 1.95 | 24.9 | 68.1 | 24.4 | 43.7 | | | | | | CH | | | | | 11.2 | 17 | |
| SS-7 | 1.50 | 1.95 | 22.5 | | | | 1.98 | | | | | CH | | | | | 13.7 | 20 | |
| SS-8 | 1.50 | 1.95 | 20.2 | | | | 1.91 | 100 | 94 | 95 | 91 | CH | | | | | | | 23 |
| SS-9 | 1.50 | 1.95 | 17.3 | 30.2 | 15.3 | 14.9 | | 100 | 98 | 95 | 72 | 51 | SC | | | | | | 40 |
| SS-10 | 1.50 | 1.95 | 13.7 | | | | | | | | | SM | | | | | | | 22 |
| SS-11 | 1.50 | 1.95 | 16.7 | | | | | 100 | 97 | 87 | 60 | 12 | SP-SM | | | | | | 47 |
| SS-12 | 1.50 | 1.95 | 15.3 | | | | | | | | | SP-SM | | | | | | | 46 |
| SS-13 | 1.50 | 1.95 | 15.6 | 36.2 | 15.5 | 20.7 | 2.19 | | | | | CL | | | | | | | 38 |
| SS-14 | 1.50 | 1.95 | 16.7 | | | | 2.10 | | | | | CL | | | | | | | 31 |
| SS-15 | 1.50 | 1.95 | 18.5 | | | | | | 100 | 75 | 28 | SM | | | | | | | 33 |
| SS-16 | 1.50 | 1.95 | 19.0 | | | | | | | | | SM | | | | | | | 33 |

BOREHOLE LOG



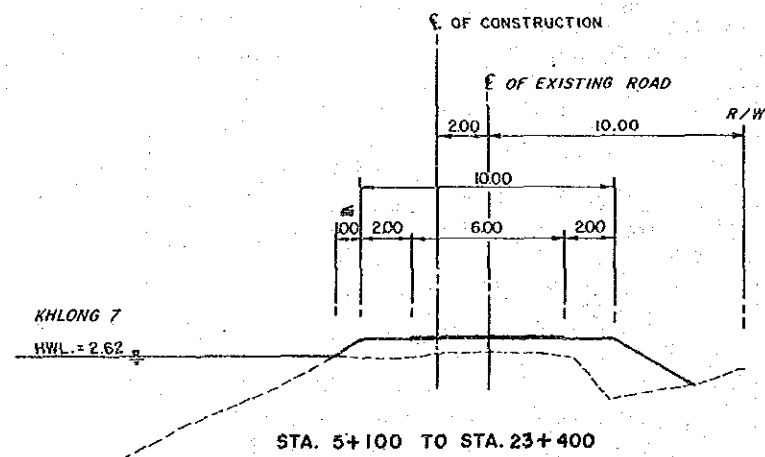
3.2 Preliminary Design

(1) Geometric Design Criteria

Design Standard : F-3
 Design Speed : 70-90 km/h

Geometric Design Criteria

| Description | Design Speed (km/h) | | |
|-------------------------------------|---------------------|-----|-----|
| | 70 | 80 | 90 |
| Minimum Radius & Curvature (m) | 160 | 210 | 280 |
| Minimum Stopping Sight Distance (m) | 90 | 115 | 140 |
| Maximum Gradient (%) | 7 | 6 | 5 |



(2) Pavement Design

| Design CBR of Subgrade | Cumulative No. of ESA W18 x 10 (10 years) | Thickness of Pavement Structure (cm) | |
|------------------------|---|--------------------------------------|----|
| 2.0 | 1,660 | Surface | 10 |
| | | Base | 20 |
| | | Subbase | 30 |

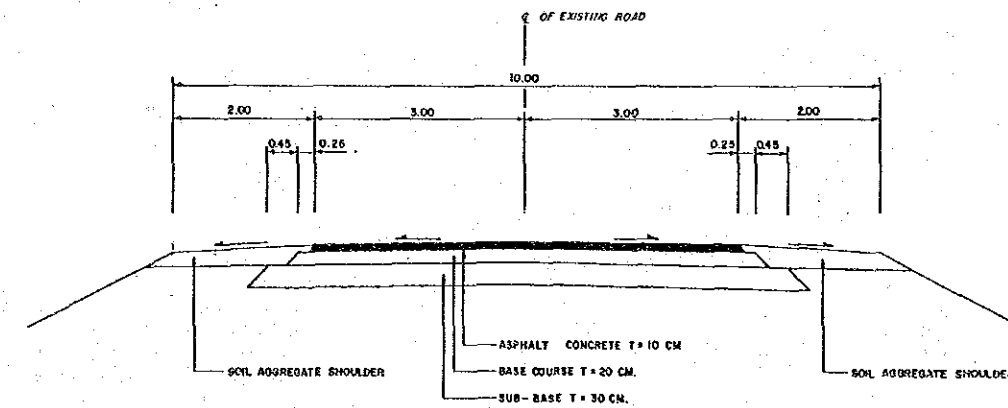


FIGURE TYPICAL PAVEMENT STRUCTURE FOR FLEXIBLE PAVEMENT IM-14

(3) Culverts

| NO. | CHAINAGE | EXISTING CULVERT | NEW CULVERT |
|-----|----------|---------------------|------------------------|
| 1 | 1+450 | - | RCP 1-Dia 1.00x16.00 |
| 2 | 2+315 | - | BOX 2-3.00x2.50x12.00 |
| 3 | 3+300 | - | RCP 1-Dia 1.00x15.00 |
| 4 | 3+850 | - | RCP 1-Dia 1.00x15.00 |
| 5 | 4+400 | - | RCP 1-Dia 1.00x15.00 |
| 6 | 5+800 | - | RCP 1-Dia 0.60x14.00 |
| 7 | 6+928 | RCP 1-Dia 0.60x8.50 | EXTEND 1-Dia 0.60x2.00 |
| 8 | 7+800 | - | RCP 1-Dia 0.60x14.00 |
| 9 | 9+400 | - | RCP 1-Dia 0.60x15.00 |
| 10 | 10+500 | - | RCP 1-Dia 0.60x13.00 |
| 11 | 11+900 | - | RCP 1-Dia 0.60x13.00 |
| 12 | 12+800 | - | RCP 1-Dia 0.60x15.00 |
| 13 | 14+400 | - | RCP 1-Dia 0.60x13.00 |
| 14 | 15+100 | - | RCP 1-Dia 0.60x14.00 |
| 15 | 16+600 | - | RCP 1-Dia 0.60x14.00 |
| 16 | 17+600 | - | RCP 1-Dia 0.60x13.00 |
| 17 | 18+000 | - | RCP 1-Dia 0.60x15.00 |
| 18 | 19+500 | - | RCP 1-Dia 0.60x13.00 |
| 19 | 21+500 | - | RCP 1-Dia 0.60x13.00 |
| 20 | 22+800 | - | RCP 1-Dia 0.60x13.00 |
| 21 | 24+000 | - | RCP 1-Dia 0.60x13.00 |
| 22 | 25+000 | - | RCP 1-Dia 0.60x13.00 |

(4) Bridges

| NO | CHAINAGE | EXISTING BRIDGE | PROPOSED BRIDGE |
|----|----------|--|-----------------|
| 1 | 0+487 | 8.00x26 SLAB TYPE | REMAIN |
| 2 | 0+692 | 3.50x36 SLAB TYPE W/LIFT CENTRAL SPAN | 11x40 SLAB TYPE |
| 3 | 2+485 | - | 11x50 SLAB TYPE |
| 4 | 5+118 | - | 11x50 SLAB TYPE |

3.3 Quantities and Construction and Road Maintenance Costs

(1) CONSTRUCTION QUANTITIES AND COSTS

(Project IM-14 Length = 25.6 km)

| Item | Unit | Financial Unit Rate Baht | Quantity | Financial Total Cost 1000 Baht | Economic Cost | | Residual Value | | |
|--|----------------|--------------------------------|----------|--------------------------------------|---------------|-----------|----------------|-----------|--------|
| | | | | | % | 1000 Baht | % | 1000 Baht | |
| EARTHWORK | | | | | | | | | |
| Clearing & Grubbing | ha | 10,000 | 44 | 440 | 85 | 374 | 90 | 337 | |
| Roadway Excavation (Unclassified) | m ³ | 18 | 25,100 | 452 | 84 | 380 | 90 | 342 | |
| Roadway Excavation (Classified Unsuitable Material below Grade) | m ³ | 51 | - | - | 84 | - | 90 | - | |
| Embankment (Common) | m ³ | 33 | - | - | 86 | - | 90 | - | |
| Embankment (Borrow) | m ³ | 115 | 251,300 | 28,900 | 86 | 24,854 | 90 | 22,369 | |
| Removal of Existing Structure | each | 60,000 | 1 | 60 | 84 | 50 | 90 | 45 | |
| Sub Total | | | | 29,852 | | 25,658 | | 23,093 | |
| SUBBASE and BASE COURSES | | | | | | | | | |
| Subbase | m ³ | 208 | 49,900 | 10,379 | 83 | 8,615 | 50 | 4,308 | |
| Aggregate base | m ³ | 339 | 36,600 | 12,407 | 84 | 10,422 | 50 | 5,211 | |
| Shoulder (Soil Aggregate) | m ³ | 241 | 16,300 | 3,928 | 83 | 3,260 | 50 | 1,630 | |
| Sub Total | | | | 26,714 | | 22,297 | | 11,149 | |
| SURFACE COURSES | | | | | | | | | |
| Asphaltic Prime Coat | m ² | 11 | 178,000 | 1,958 | 93 | 1,821 | 50 | 911 | |
| Asphaltic Tack Coat | m ² | 5 | 152,400 | 762 | 93 | 709 | 50 | 355 | |
| Double Bituminous Surface Treatment | m ² | 33 | - | - | 91 | - | 50 | - | |
| Asphalt Concrete Surfacing | ton | 923 | 36,000 | 33,228 | 90 | 29,905 | 50 | 14,953 | |
| Portland Cement Concrete Pavement | m ³ | 1,655 | - | - | 90 | - | 50 | - | |
| Sub Total | | | | 35,948 | | 32,435 | | 16,219 | |
| STRUCTURES (Equivalent) | | | | | | | | | |
| RC Pipe Culvert (D=1.00 m) | m | 1,800 | 180 | 324 | 88 | 285 | 50 | 143 | |
| RC Box Culvert (2-2.40x 2.40 m) | m | 10,000 | 16 | 160 | 90 | 144 | 50 | 72 | |
| RC Bridge (W=11.0 m) | m | 66,000 | 140 | 9,240 | 87 | 8,039 | 50 | 4,020 | |
| PC Bridge (W=11.0 m) | m | 96,000 | - | - | 87 | - | 50 | - | |
| Bearing Unit | m ² | 1,600 | - | - | 87 | - | 50 | - | |
| Sub Total | | | | 9,724 | | 8,468 | | 4,235 | |
| Total (a) | | | | 102,238 | | 88,858 | | 54,696 | |
| Miscellaneous Work ((a) x 7%) | | | | 1s | 7,157 | 87 | 6,227 | 0 | 0 |
| CONTRACT AMOUNT (b) | | | | | 109,395 | | 95,085 | | 54,696 |
| PHYSICAL CONTINGENCIES ((b) x 10%) (c) | | | | 1s | 10,940 | | 9,509 | | 5,470 |
| ENGINEERING AND SUPERVISION (((b) + (c)) x 10%) (d) | | | | 1s | 12,034 | 100 | 12,034 | 0 | 0 |
| LAND ACQUISITION | | | | | | | | | |
| Developed Land | ha | 250,000 | 16 | 4,000 | | | | | |
| Less Developed Land | ha | - | - | - | | | | | |
| Total (e) | | | | 4,000 | 100 | 4,000 | 100 | 4,000 | |
| PROJECT COST ((b) + (c) + (d) + (e)) | | | | | 136,369 | | 120,628 | | 64,166 |
| AVERAGE COST PER KM | | | | | 5,327 | | | | |

(2) Road Maintenance Costs

(Unit : Baht/Year)

| | Without Project | With Project |
|------|-----------------|--------------|
| 1994 | 274,799 | 267,139 |
| 2004 | 314,179 | 443,364 |

3.4 Construction Schedule

| Year and Month | 1992 | | | | | | | | | | | | 1993 | | | | | | | | | | | | | | |
|--------------------------------|------|---|---|---|---|---|---|---|---|----|----|----|------|---|---|---|---|---|---|---|---|----|----|----|--|--|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| Work Items | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Land Acquisition | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Preparatory Works | █ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Earth Works | | | | █ | | | | | | | | | | | | | | | | | | | | | | | |
| Pavement Works | | | | | | | | | █ | | | | | | | | | | | | | | | | | | |
| Bridge Works | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Miscellaneous Works | | | | | | | | | | █ | | | | | | | | | | | | | | | | | |
| Clearing - up | | | | | | | | | | | | | | | | | | | | | | █ | | | | | |
| Percentage of Disbursement (%) | | | | | | | | | | | | 35 | | | | | | | | | | | 50 | | | | |

4. BENEFITS

ROAD CONDITIONS

(unit : km)

| Section | Road Length | Without Project | | | | | With Project | | | | | | | |
|---------|-------------|-----------------|------|------|----------|------|----------------------|----------------------|-------------|------------|----------------------|----------------------|---|---|
| | | Paved | | | Laterite | | No. of Narrow Bridge | No. of Wooden Bridge | Road Length | Road Paved | No. of Narrow Bridge | No. of Wooden Bridge | | |
| | | Good | Fair | Poor | Good | Fair | | | | | | | | |
| RURAL-N | 8.0 | - | - | - | 0.8 | - | - | 7.2 | 2 | - | 5.2 | 5.2 | - | - |
| RURAL-S | 20.4 | - | - | 1.7 | - | - | - | 18.7 | - | - | 20.4 | 20.4 | - | - |

VOC AND TIME SAVINGS

(1000 BAHT)

| Year | VOC Savings | | | Time Savings | | | Total Savings | | |
|------|----------------|-----------------|--------|----------------|-----------------|-------|----------------|-----------------|--------|
| | Normal Traffic | Induced Traffic | Total | Normal Traffic | Induced Traffic | Total | Normal Traffic | Induced Traffic | Total |
| 1994 | 28,549 | 95 | 28,645 | 2,607 | 511 | 3,118 | 31,156 | 607 | 31,763 |
| 2000 | 37,202 | 131 | 37,333 | 3,421 | 686 | 4,107 | 40,624 | 817 | 41,441 |
| 2008 | 52,055 | 191 | 52,246 | 4,920 | 990 | 5,910 | 56,975 | 1,181 | 58,156 |

5. ECONOMIC EVALUATION

COST AND BENEFIT STATEMENT







(1000 BAHT)

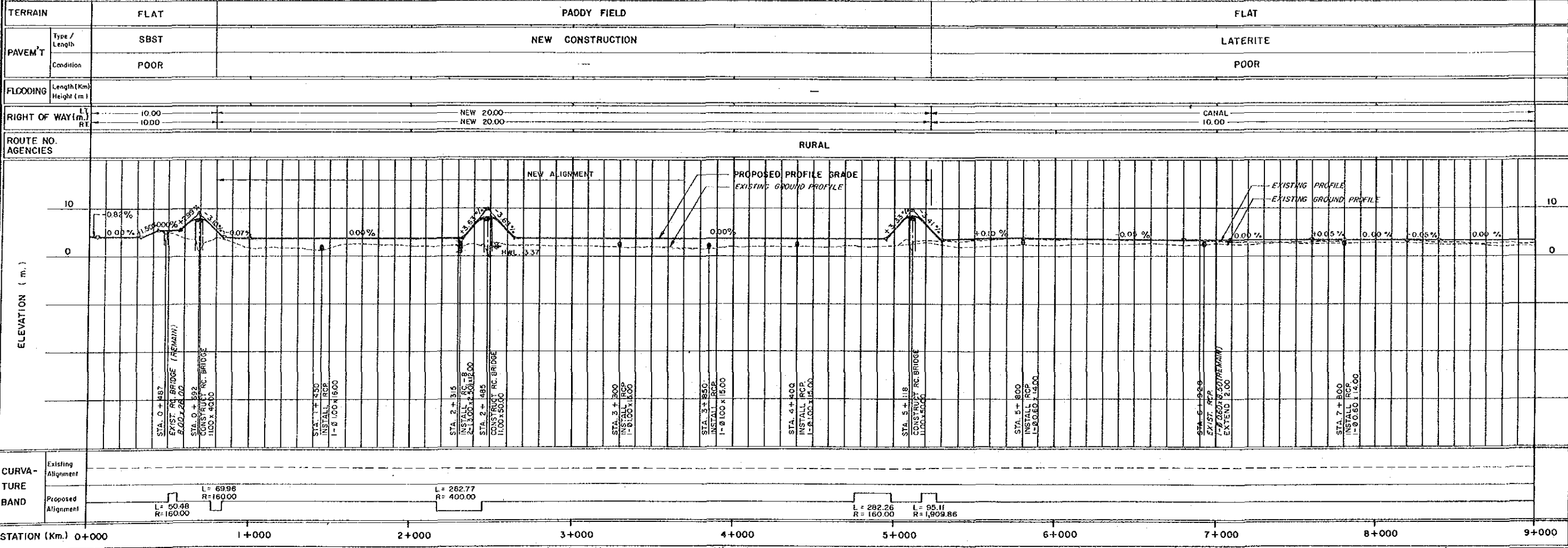
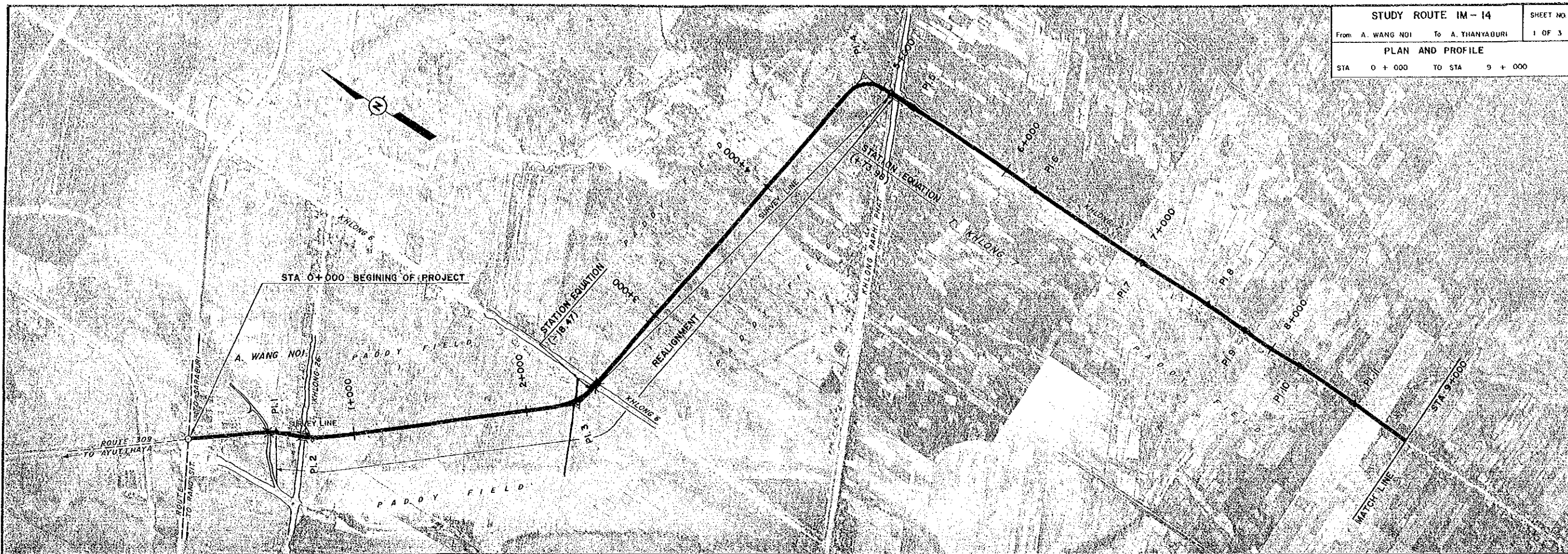
| YEAR | COST | | BENEFITS | | | DISCOUNTED (12%) | |
|-------|-------------|------------|-------------|---------------|---------|------------------|---------|
| | CONST. COST | VOC SAVING | TIME SAVING | MAINT. SAVING | TOTAL | COST | BENEFIT |
| 1992 | 42,220 | | | | 0 | 52,961 | 0 |
| 1993 | 78,408 | | | | 0 | 87,817 | 0 |
| 1994 | | 28,645 | 3,118 | 8 | 31,771 | 0 | 28,367 |
| 1995 | | 30,093 | 3,283 | (2) | 33,374 | 0 | 26,606 |
| 1996 | | 31,541 | 3,448 | (12) | 34,977 | 0 | 24,896 |
| 1997 | | 32,989 | 3,613 | (22) | 36,580 | 0 | 23,247 |
| 1998 | | 34,437 | 3,778 | (32) | 38,183 | 0 | 21,666 |
| 1999 | | 35,885 | 3,943 | (42) | 39,786 | 0 | 20,157 |
| 2000 | | 37,333 | 4,107 | (52) | 41,388 | 0 | 18,722 |
| 2001 | | 39,197 | 4,333 | (62) | 43,468 | 0 | 17,556 |
| 2002 | | 41,061 | 4,558 | (72) | 45,547 | 0 | 16,425 |
| 2003 | | 42,925 | 4,783 | (82) | 47,626 | 0 | 15,334 |
| 2004 | 16,446 | 44,789 | 5,009 | (92) | 49,706 | 5,295 | 14,289 |
| 2005 | | 46,654 | 5,234 | (102) | 51,786 | 0 | 13,292 |
| 2006 | | 48,518 | 5,459 | (112) | 53,865 | 0 | 12,344 |
| 2007 | | 50,382 | 5,685 | (122) | 55,945 | 0 | 11,447 |
| 2008 | (64,166) | 52,246 | 5,910 | (129) | 58,027 | (13,130) | 10,601 |
| TOTAL | 72,908 | 596,695 | 66,261 | (927) | 662,029 | 132,943 | 274,949 |

NET PRESENT VALUE : 142,006
 BENEFIT COST RATIO : 2.07
 INTERNAL RATE OF RETURN : 22.9%
 FIRST YEAR RATE OF RETURN : 20.2%

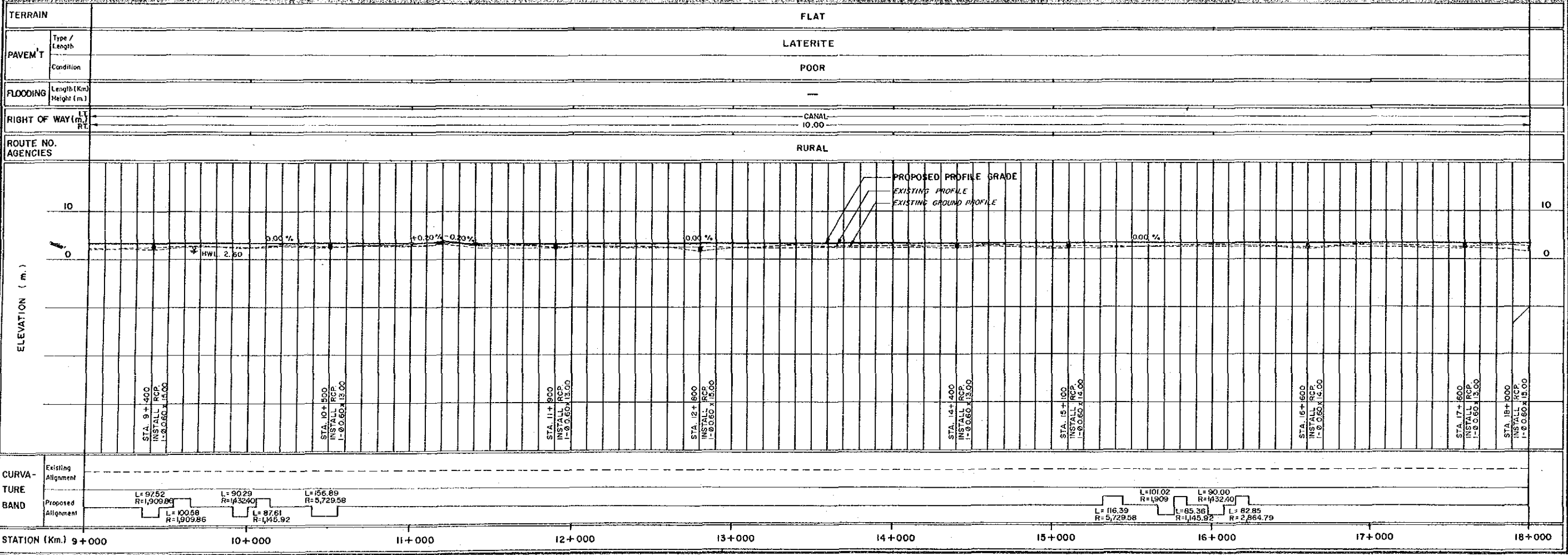
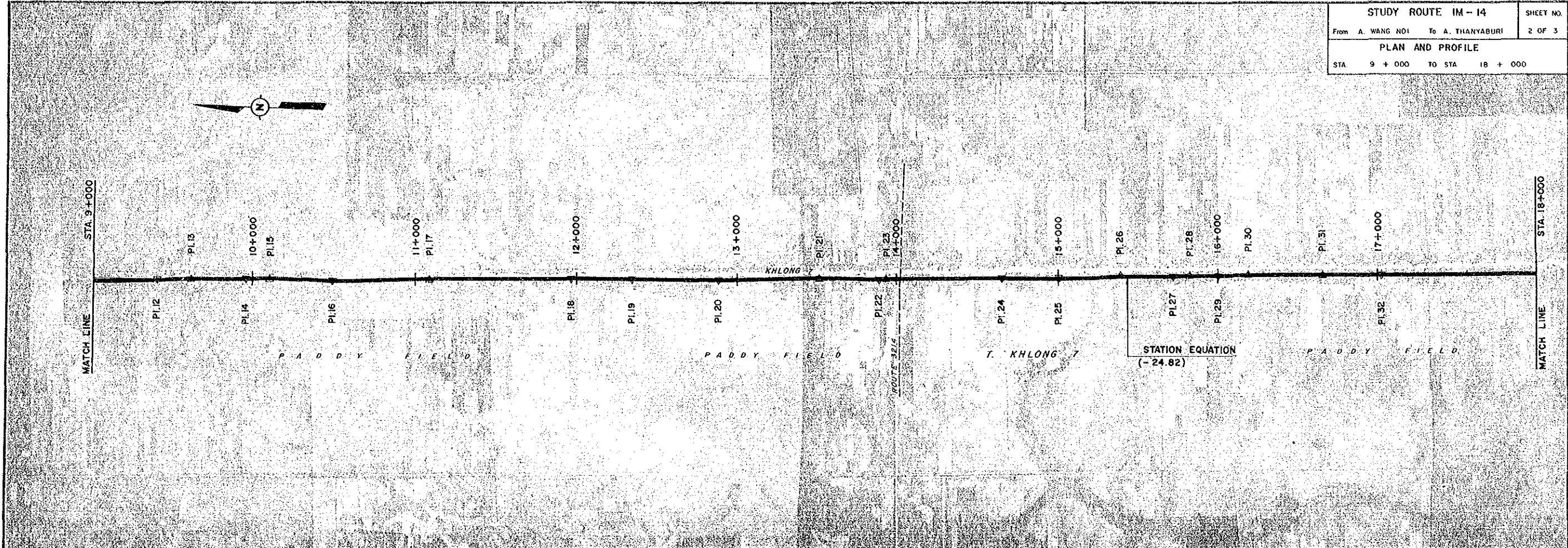
6. DRAWINGS

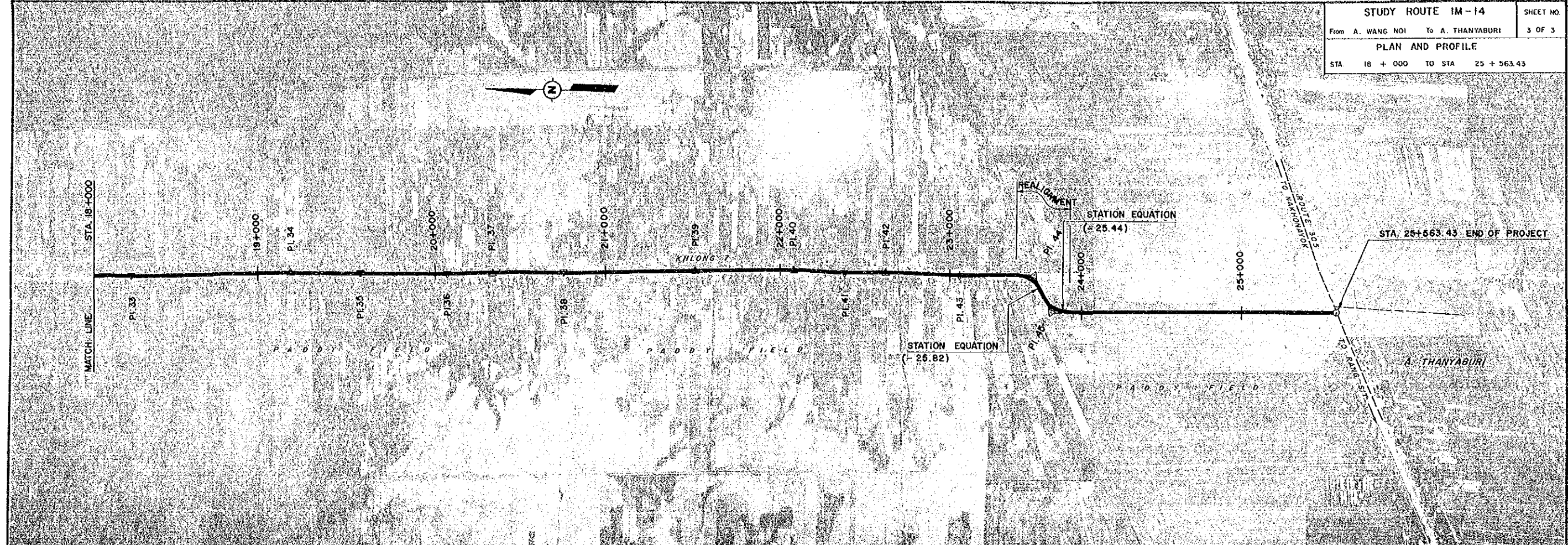
ABBREVIATIONS and SYMBOLS for PLAN and PROFILE

| | |
|---|---|
|  | NEW CONSTRUCTION SECTION OF STUDY ROUTE |
|  | IMPROVEMENT SECTION OF STUDY ROUTE |
|  | BRIDGE (PROPOSED, EXISTING) |
|  | BOX CULVERT (PROPOSED, EXISTING) |
|  | PIPE CULVERT (PROPOSED, EXISTING) |
|  | HIGH WATER LEVEL |
| HWY | HIGHWAY |
| PI | POINT OF HORIZONTAL INTERSECTION |
| NO. or # | NUMBER |
| Δ | DEFLECTION ANGLE |
| R | RADIUS OF CURVATURE |
| T | TANGENT LENGTH |
| L | LENGTH OF CURVE |
| RT | RIGHT |
| LT | LEFT |
| EXIST. | EXISTING |
| EXTD. | EXTEND |
| RC-P-n- $\phi a \times l$ | PIPE CULVERT, n (ROW), ϕa (DIAMETER, m), l (LENGTH, m) |
| RC-B-n-a \times b \times l | BOX CULVERT, n (NO. OF CELLS), a \times b \times l (CLEAR SPAN \times DEPTH \times LENGTH, m) |
| BR-T-a \times l - n | TIMBER BRIDGE, a \times l (WIDTH \times LENGTH, m), n (NO. OF SPANS) |
| BR-RC-a \times l - n | CONCRETE BRIDGE, a \times l (ROADWAY WIDTH \times LENGTH, m) n (NO. OF SPANS) |



STATION (Km.) 0+000 1+000 2+000 3+000 4+000 5+000 6+000 7+000 8+000 9+000





| | | | | | | | | | | |
|--------------------|----------------------------|----------------|--------|------------------------|----------------|--------|--------|--------|--------|-----------|
| TERRAIN | | FLAT | | | | | | | | |
| PAVEM'T | Type / Length | LATERITE | | NEW CONSTRUCTION | SBST | | | | | |
| | Condition | POOR | | | FAIR | | | | | |
| FLOODING | Length (Km) Height (m.) | - | | | | | | | | |
| RIGHT OF WAY (m.) | LT RT | CANAL 10.00 | | NEW 10.00 NEW 10.00 | 10.00 10.00 | | | | | |
| ROUTE NO. AGENCIES | | RURAL | | | | | | | | |
| ELEVATION (m.) | | | | | | 10 | | | | |
| | | | | | | 0 | | | | |
| CURVA-TURE BAND | Existing Alignment | - | | | | | | | | |
| | Proposed Alignment | | | | | | | | | |
| STATION (Km.) | | 18+000 | 19+000 | 20+000 | 21+000 | 22+000 | 23+000 | 24+000 | 25+000 | 25+563.43 |

STA. 18+500
 INSTALL RCP
 L=0.60 x 3.00

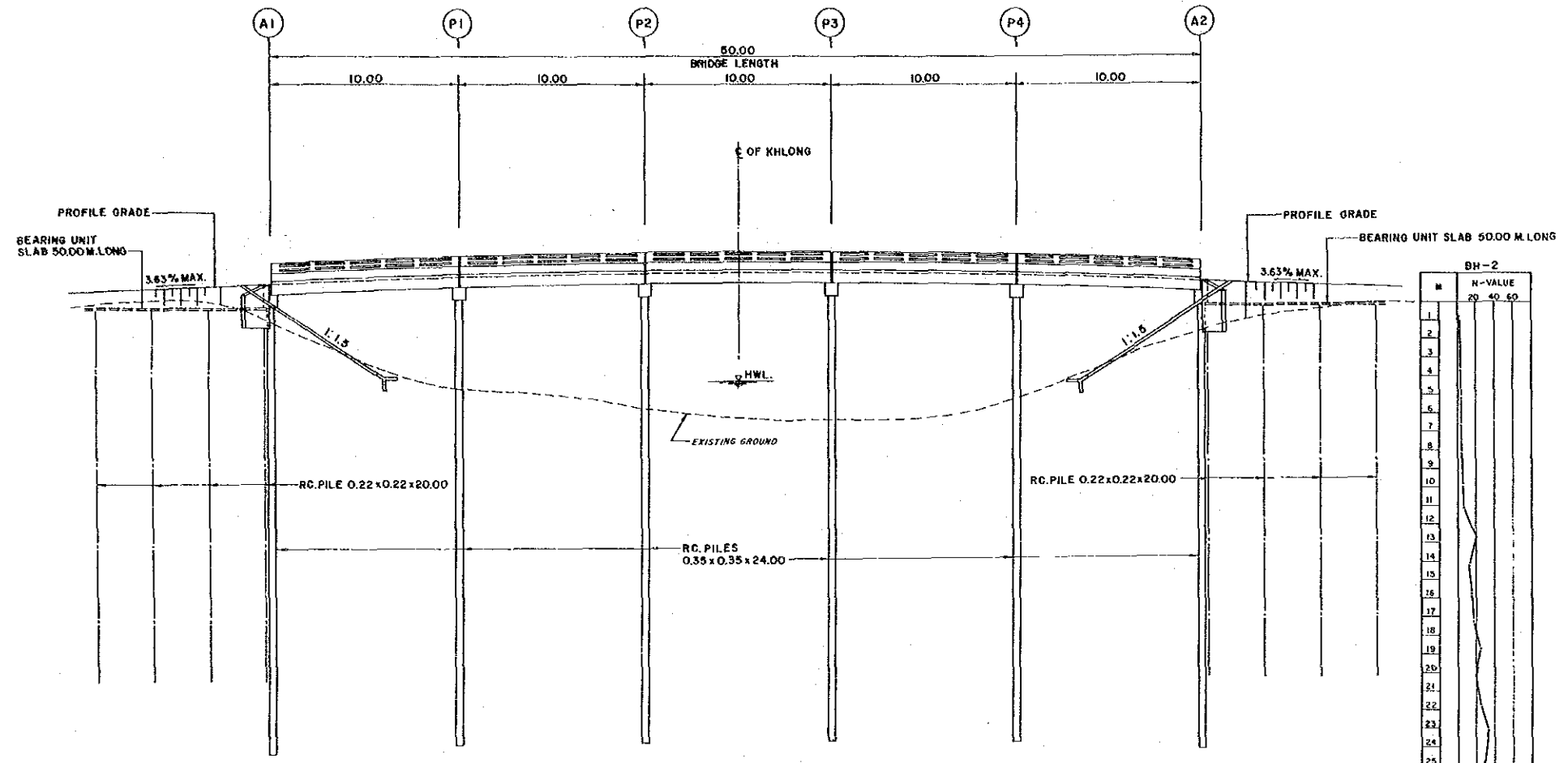
STA. 21+500
 INSTALL RCP
 L=0.60 x 3.00

STA. 22+800
 INSTALL RCP
 L=0.60 x 3.00

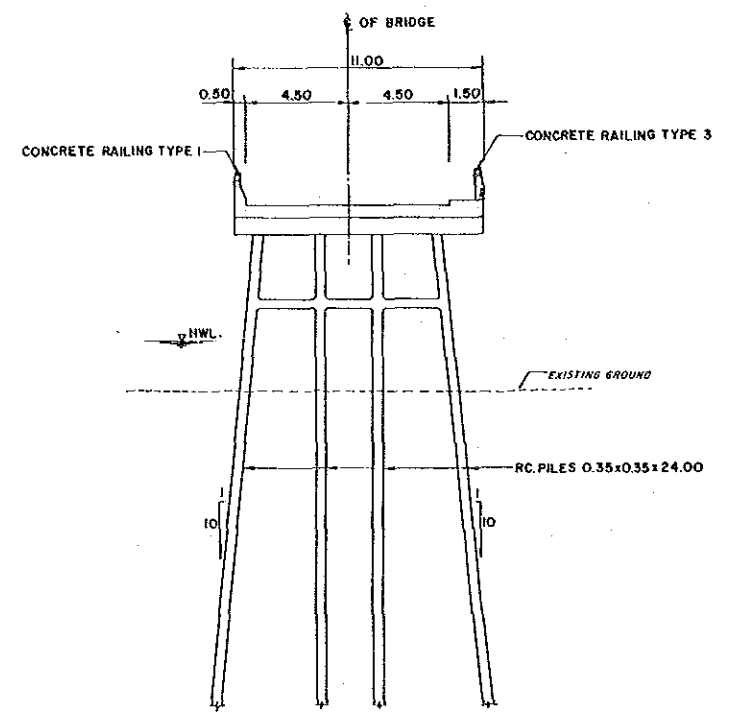
STA. 24+000
 INSTALL RCP
 L=0.60 x 3.00

STA. 25+000
 INSTALL RCP
 L=0.60 x 3.00

STA. 25+563.43 END OF PROJECT
 (STA. 25+558.80 SURVEY LINE)



GENERAL ELEVATION
 SCALE 1:150



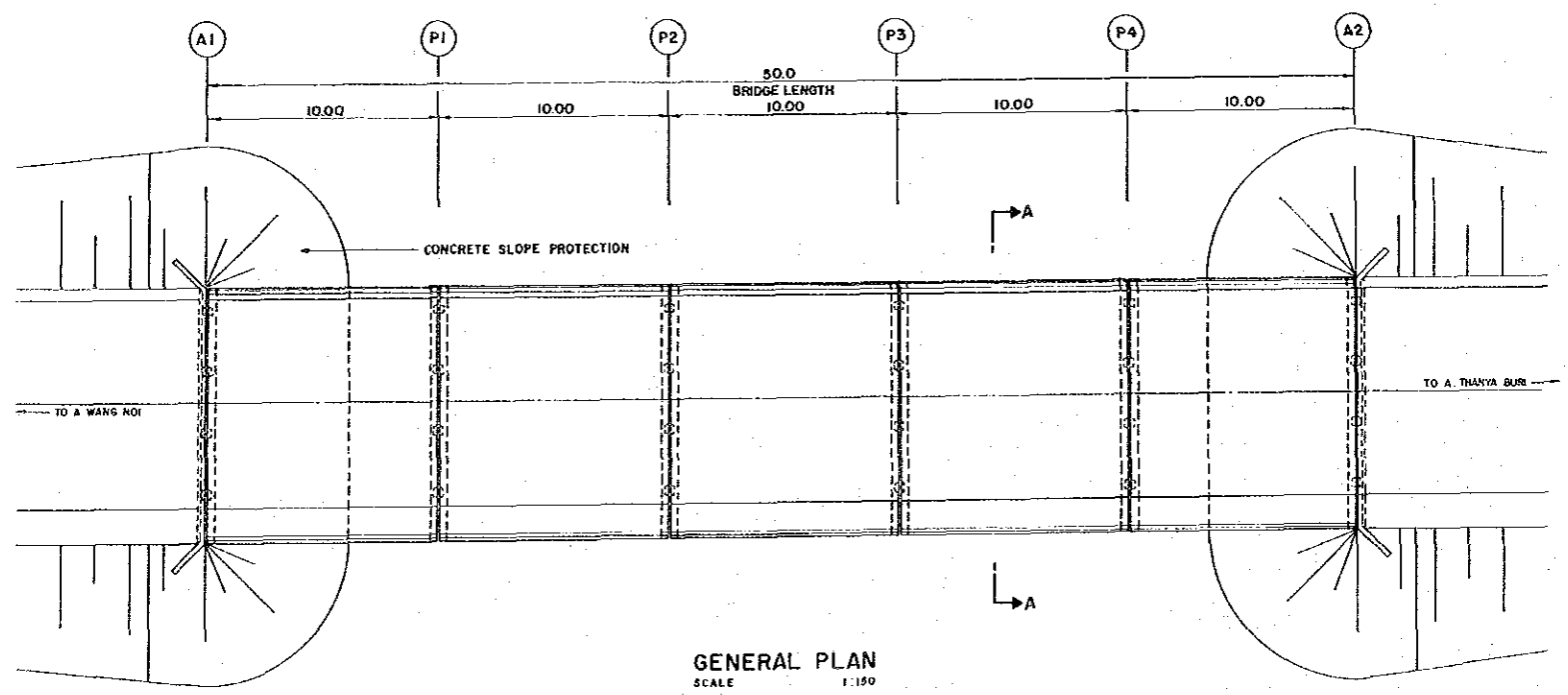
SECTION A-A
 SCALE 1:150

LIST OF EXISTING BRIDGE

| STA. NO. | WIDTH & LENGTH (M) | WITHDRAW (M ³) |
|----------|--------------------|----------------------------|
| 0+692 | 3.5x36.0 | 49 |

TABLE OF SUPERSTRUCTURE

| STA. NO. | BRIDGE LENGTH | NUMBER OF SPAN | TYPE | THICKNESS | ELEVATION | HWL |
|----------|---------------|----------------|---------|-----------|-----------|------|
| 0+692 | 40.00 | 4 (4@10.00) | RC SLAB | 0.53 | 7.80 | 2.80 |
| 2+485 | 50.00 | 5 (5@10.00) | RC SLAB | 0.53 | 8.20 | 2.00 |
| 5+118 | 50.00 | 5 (5@10.00) | RC SLAB | 0.53 | 8.60 | 2.60 |
| TOTAL | 140.00 | | | | | |



GENERAL PLAN
 SCALE 1:150

| ITEM | UNIT | QUANTITY | | | |
|---|----------------|------------|------------|------------|-------|
| | | STA. 0+692 | STA. 2+485 | STA. 5+118 | TOTAL |
| 1. CONCRETE CLASS B (1/2) FOR BRIDGE DECK | M ³ | 252 | 314 | 314 | 880 |
| CLASS B (1/2) FOR PILE BENT PIER & ABUTMENT | M ³ | 107 | 128 | 128 | 363 |
| CLASS SPECIAL B (1/2) FOR BEARING UNIT SLAB | M ³ | 330 | 330 | 330 | 990 |
| 2. STEEL REINFORCEMENT | T | 86 | 106 | 106 | 298 |
| 3. RC. PILES 0.22 x 0.22 M. | LM | 2,720 | 2,720 | 2,720 | 8,160 |
| 4. RC. PILES 0.35 x 0.35 M. | LM | 618 | 742 | 742 | 2,102 |
| 5. CONCRETE RAILING TYPE-1 | LM | 40 | 50 | 50 | 140 |
| TYPE-3 | LM | 40 | 50 | 50 | 140 |
| 6. CONCRETE SLOPE PROTECTION | M ² | 265 | 378 | 360 | 1,003 |

PROJECT IM - 15

Changwat : Pathum Thani/Bangkok

B. Khlong Luang - A. Min Buri

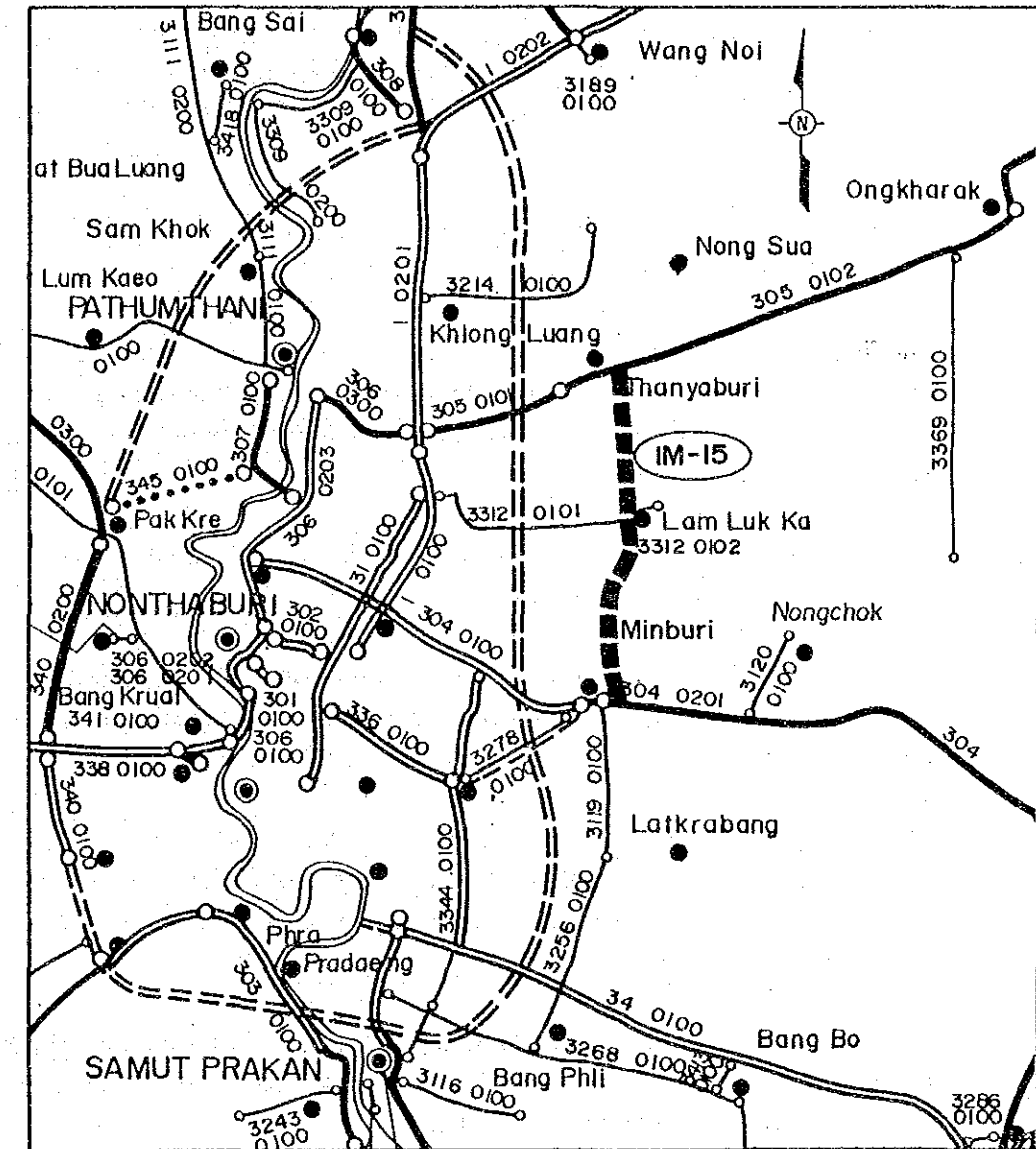
Length : 24.7 km.

SUMMARY

PROJECT IM-15

| ITEM | DESCRIPTION |
|---------------------|----------------------|
| Changwat | Pathum Thani/Bangkok |
| Origin | A. Thanyaburi |
| Destination | A. Min Buri |
| Route No. | Rural |
| Project Length | 24.70 km |
| Standard | |
| - Existing | — |
| - Proposed | F1/F2 |
| Traffic | |
| - Base | 379~2,003 |
| - 2000 | 1,700~4,500 |
| - 2008 | 2,400~6,600 |
| Pavement Type | |
| - Existing | Laterite/AC |
| - Proposed | AC pavement (t=10) |
| Bridges | |
| - New Construction | 6 sites, 72 m |
| - Replacement | — |
| Construction Costs | |
| - Financial | 115,250,000 Baht |
| - Economic | 101,977,000 Baht |
| Economic Evaluation | |
| - IRR | 32.5% |
| - B/C | 3.29 |

LOCATION OF PROJECT ROUTE



LEGEND :

- PROJECT ROUTE
- DIVIDED HIGHWAYS
- NATIONAL HIGHWAYS
- PROVINCIAL HIGHWAYS
- PROVINCIAL HIGHWAYS (Unpaved)
- CHANGWAT, AMPHOE

1. GENERAL

The proposed route is located in Bangkok and Changwat Pathum Thani.

It originates at the junction with Route 305 in Ban Khlong Luang, and runs southward to join Route 3312 near Amphoe Lam Lum Ka. The length of this section is about 10.3 km.

The second section starts at a point about 600 m east of the end point of the first section of Route 3312 and runs southward to end at the junction with Route 304 in Amphoe Min Buri. The length of the second section is 14.0 km. Combined, the total length of this project road is 24.3 km.

The terrain is flat. Paddy fields and orange orchards alternate along the first section. Along the second section paddy fields completely fill the area.

The first section is currently under PWD and the second under ARD. Except for the last 1 km of SBST, the first section is a laterite road, whereas the second section is applied with SBST over the entire length. The surface condition is fair to poor on both sections. Traffic is heavier on the second section.

Out of a total of eight bridges, seven are in the second section. All of them are of permanent structure and sufficient standards.

It was determined that the improved road would be of F2 class standard from the origin to STA 10 + 300 (intersection with Route 3312) and of F1 class standard to the end point (STA 24 + 800), considering projected future traffic levels.

The existing alignment of the first section requires no improvement. It was decided that the sharp curve on the approach to the intersection with Route 305 could be tolerated because of the low speed resulting from the adjoining bridge across a khlung and the intersection.

The alignment at the starting point of the second section (the intersection with Route 3312) was considered poor. It was, however, left unchanged based on the explanation by DOH that land acquisition would be very difficult.

The first section requires only a little widening and paving since the relationship between the existing road height and H.W.L. is good. However, the second section requires road height raising and widening, because the existing road height is the same as H.W.L. even though it is already paved.

When completed, this road will form a north-south route paralleling Route 1 together with Route 319 and proposed project road IM-14. Some traffic diversion can be expected.

2. TRAFFIC FORECAST

Base Traffic Volume

(Unit: Vehicles/Day)

| Project Code | Section | Year | Traffic Volume | | | | | | | ADT |
|--------------|---------|------|----------------|-----|----|----|-----|-----|-----|------|
| | | | MC | PC | LB | HB | LT | MT | HT | |
| IM-15 | RURAL-N | 1988 | 227 | 30 | 6 | 1 | 187 | 78 | 77 | 379 |
| | RURAL-S | 1988 | 349 | 217 | 87 | 32 | 890 | 397 | 380 | 2003 |

Traffic Growth Rate

(Unit: Percent)

| Project | Section | Period | MC | PC | LB | HB | LT | MT | HT |
|---------|---------|-----------|-------|---------|-------|------|------|------|------|
| | | | IM-15 | RURAL-N | -1993 | 6.23 | 6.35 | 6.71 | 5.68 |
| | | 1994-2000 | 5.99 | 6.22 | 6.13 | 6.26 | 5.37 | 5.54 | 5.00 |
| | | 2000-2008 | 5.61 | 6.09 | 5.66 | 4.93 | 4.77 | 4.74 | 4.52 |
| | RURAL-S | -1993 | 6.23 | 6.35 | 6.71 | 5.68 | 4.87 | 6.67 | 6.29 |
| | | 1994-2000 | 5.99 | 6.22 | 6.13 | 6.26 | 5.37 | 5.54 | 5.00 |
| | | 2000-2008 | 5.61 | 6.09 | 5.66 | 4.93 | 4.77 | 4.74 | 4.52 |

Diverted Traffic Volume

(Unit: Vehicles/Day)

| Project | Section | Year | MC | PC | LB | HB | LT | MT | HT | ADT |
|---------|---------|------|-------|---------|------|----|-----|----|-----|------|
| | | | IM-15 | RURAL-N | 1994 | 0 | 11 | 0 | 0 | 93 |
| | | 2000 | 0 | 15 | 0 | 0 | 127 | 30 | 670 | 842 |
| | | 2008 | 0 | 25 | 0 | 0 | 184 | 44 | 954 | 1207 |
| | RURAL-S | 1994 | 0 | 6 | 0 | 0 | 56 | 22 | 404 | 488 |
| | | 2000 | 0 | 9 | 0 | 0 | 77 | 30 | 542 | 658 |
| | | 2008 | 0 | 14 | 0 | 0 | 111 | 44 | 772 | 941 |

Induced Traffic Volume

(Unit: Vehicles/Day)

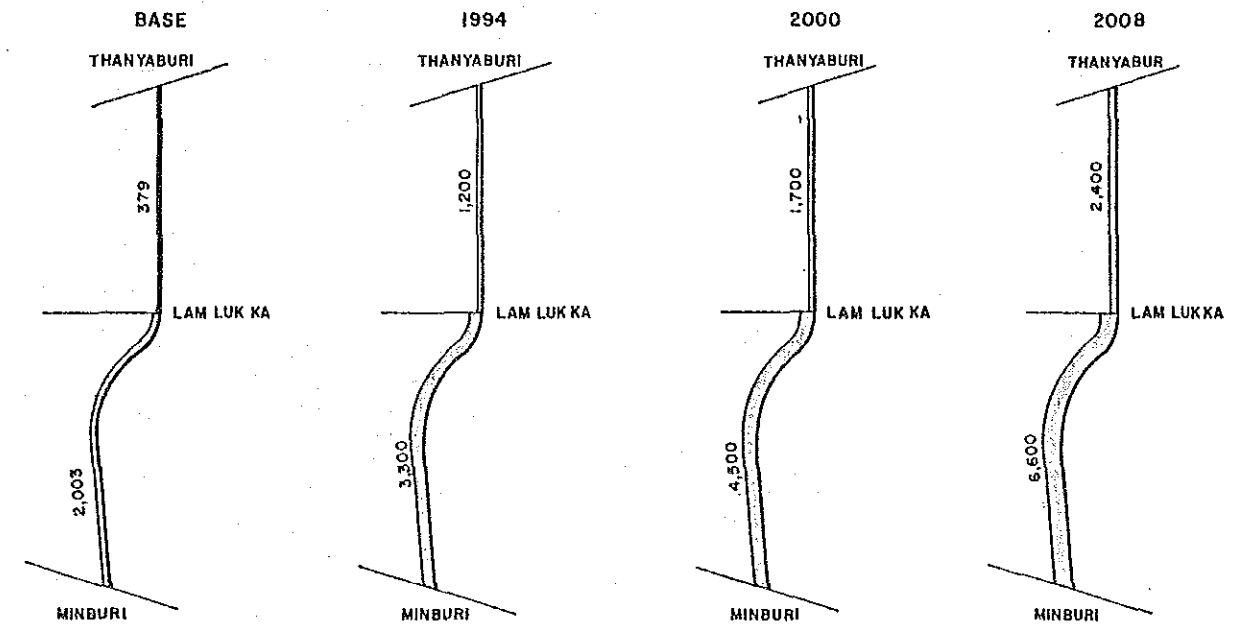
| Project | Section | Year | MC | PC | LB | HB | LT | MT | HT | ADT |
|---------|---------|------|-------|---------|------|----|-----|----|----|-----|
| | | | IM-15 | RURAL-N | 1994 | 44 | 10 | 2 | 0 | 59 |
| | | 2000 | 63 | 14 | 3 | 0 | 81 | | | 98 |
| | | 2008 | 99 | 23 | 5 | 0 | 118 | | | 146 |

Future Traffic Volume

(Unit: Vehicles/Day)

| Project | Section | Year | MC | PC | LB | HB | LT | MT | HT | ADT |
|---------|---------|------|-------|---------|------|-----|------|------|------|------|
| | | | IM-15 | RURAL-N | 1994 | 369 | 64 | 11 | 2 | 402 |
| | | 2000 | 524 | 92 | 16 | 2 | 550 | 187 | 817 | 1664 |
| | | 2008 | 813 | 148 | 24 | 3 | 799 | 271 | 1163 | 2408 |
| | RURAL-S | 1994 | 500 | 320 | 128 | 45 | 1246 | 600 | 946 | 3285 |
| | | 2000 | 709 | 459 | 183 | 65 | 1706 | 830 | 1267 | 4509 |
| | | 2008 | 1098 | 737 | 284 | 95 | 2475 | 1202 | 1805 | 6598 |

Note. N: North Section S: South section



UNIT : VEHICLE / DAY

PROJECT IM - 15

3. ENGINEERING

3.1 Materials and Boring Results

(1) Materials

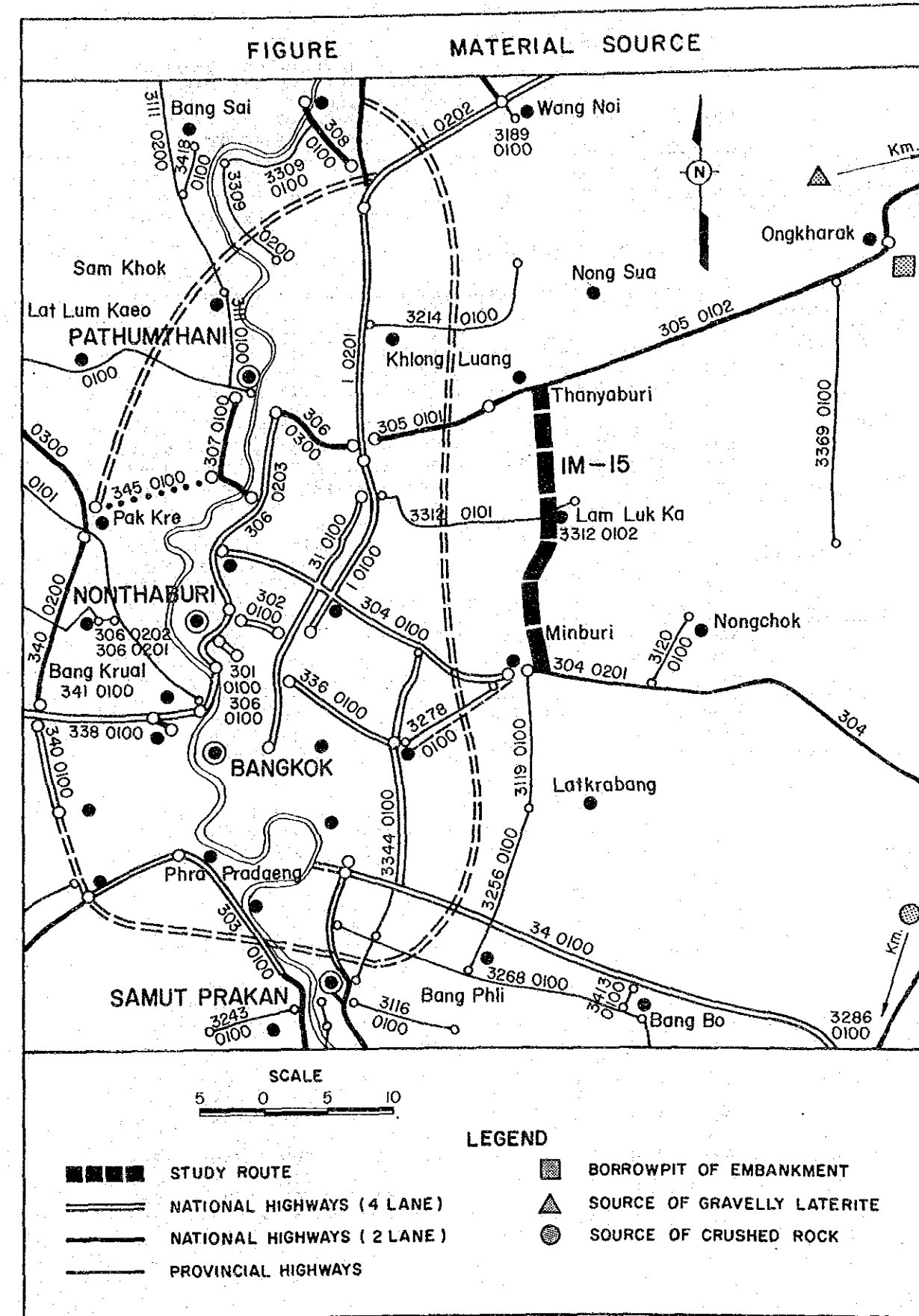
DESCRIPTION OF MATERIAL SOURCES

| Material | Source | Description of Sample | Estimated Quantity cu. m. | Hauling Distance (km) |
|--------------|--------------------------------------|------------------------|---------------------------|-----------------------|
| Soil | Route 305 Km 37+000 Left Side 0.3 Km | Silty Clayed Fine Sand | Plentiful | 25 |
| Laterite | Route 2 Km 118+000 Left Side 3.6 Km | Gravelly Laterite | Plentiful | 78 |
| Crushed Rock | Route 1 Km 129+500 Both Sides | Lime Stone | Plentiful | 88 |

RESULTS OF LABORATORY TESTS

| | Sieve Analysis % Passing | | | | | | | Plasticity | | Comp. DH-T Stand. | | Lab. C.B.R. | | |
|--------------|--------------------------|------|------|-----|-----|-----|-----|------------|------|-------------------|----------|-------------|---------|---------|
| | 50.0 | 25.0 | 19.0 | 9.5 | #4 | #10 | #40 | #200 | LL | PI | Opt. 95% | gn/cc | CBR 95% | Swell % |
| Soil | | | | | 100 | 96 | 84 | 34 | 22.0 | 9.1 | 10.3 | 2.00 | 6.0 | 0.1 |
| Laterite | 100 | 93 | 86 | 62 | 39 | 27 | 8 | 24.3 | 8.2 | 6.8 | 2.06 | 43 | - | |
| Crushed Rock | | | | | | | | | | | | | >80 | |

Note : Abrasion test result of Crushed Rock 22.6 %



3.2 Preliminary Design

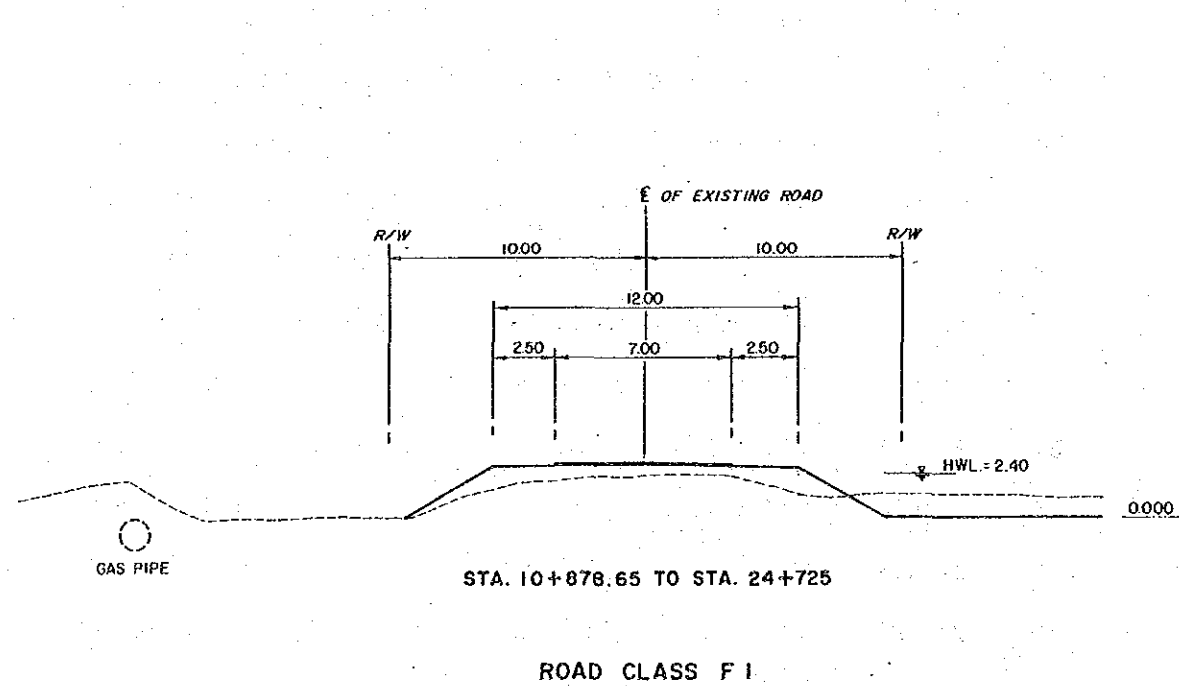
(1) Geometric Design Criteria

Design Standard : F-1 & F-2

Design Speed : 70-90 km/h

Geometric Design Criteria

| Description | Design Speed (km/h) | | |
|-------------------------------------|---------------------|-----|-----|
| | 70 | 80 | 90 |
| Minimum Radius & Curvature (m) | 160 | 210 | 280 |
| Minimum Stopping Sight Distance (m) | 90 | 115 | 140 |
| Maximum Gradient (%) | 7 | 6 | 5 |



(2) Pavement Design

| Design CBR of Subgrade | Cumulative No. of ESA W18 x 10 (10 years) | Thickness of Pavement Structure (cm) | |
|------------------------|---|--------------------------------------|----|
| 2.0 | 2,930 | Surface | 10 |
| | | Base | 20 |
| | | Subbase | 20 |

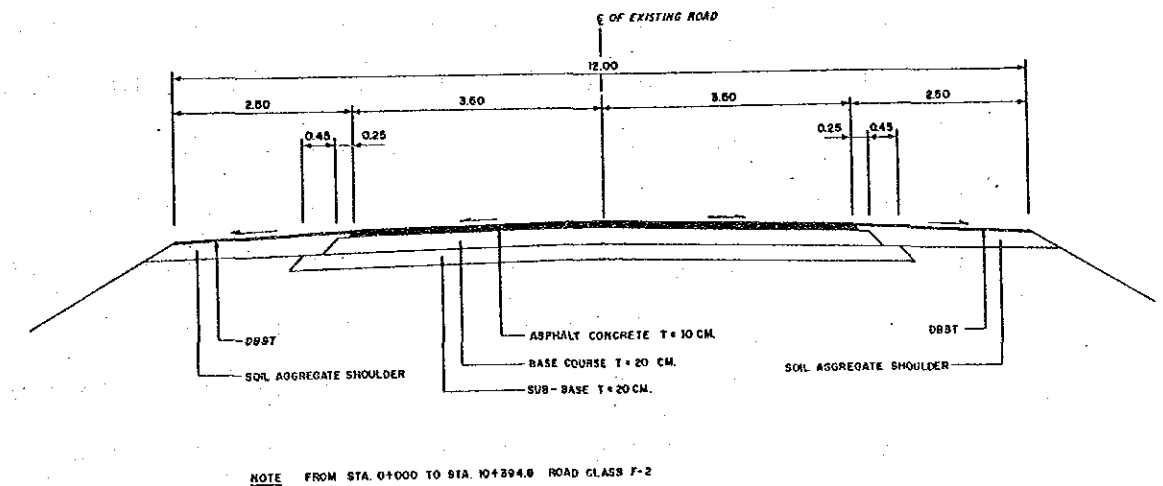


FIGURE TYPICAL PAVEMENT STRUCTURE FOR FLEXIBLE PAVEMENT IM-15

(3) Culverts

| NO. | CHAINAGE | EXISTING CULVERT | NEW CULVERT |
|-----|----------|----------------------|-------------------------|
| 1 | 2+380 | RCP 1-Dia 0.60x14.20 | EXTEND 1-Dia 0.60x 2.00 |
| 2 | 2+886 | RCP 1-Dia 0.60x14.00 | EXTEND 2-Dia 0.60x 2.00 |
| 3 | 3+118 | RCP 1-Dia 0.60x15.50 | EXTEND 1-Dia 0.60x 4.00 |
| 4 | 3+497 | RCP 1-Dia 2.00x14.50 | REMAIN |
| 5 | 3+702 | RCP 1-Dia 0.60x15.50 | EXTEND 1-Dia 0.60x 2.00 |
| 6 | 4+018 | RCP 1-Dia 0.60x19.50 | REMAIN |
| 7 | 4+471 | RCP 1-Dia 0.60x12.00 | EXTEND 1-Dia 0.60x 6.00 |
| 8 | 4+822 | RCP 1-Dia 0.60x13.00 | EXTEND 1-Dia 0.60x 2.00 |
| 9 | 5+053 | RCP 1-Dia 0.60x12.50 | EXTEND 1-Dia 0.60x 4.00 |
| 10 | 5+474 | RCP 1-Dia 0.60x14.00 | EXTEND 1-Dia 0.60x 4.00 |
| 11 | 5+697 | RCP 1-Dia 0.60x12.50 | EXTEND 1-Dia 0.60x 6.00 |
| 12 | 6+055 | RCP 1-Dia 0.60x16.00 | EXTEND 1-Dia 0.60x 2.00 |
| 13 | 6+212 | RCP 1-Dia 0.60x16.00 | EXTEND 1-Dia 0.60x 2.00 |
| 14 | 6+292 | RCP 1-Dia 0.60x13.00 | EXTEND 1-Dia 0.60x 4.00 |
| 15 | 6+528 | RCP 2-Dia 0.60x13.00 | EXTEND 2-Dia 0.60x 4.00 |
| 16 | 6+693 | RCP 1-Dia 0.60x13.00 | EXTEND 1-Dia 0.60x 4.00 |
| 17 | 6+708 | RCP 1-Dia 0.60x13.00 | EXTEND 1-Dia 0.60x 4.00 |
| 18 | 6+847 | RCP 1-Dia 0.60x14.30 | EXTEND 1-Dia 0.60x 4.00 |
| 19 | 7+057 | RCP 1-Dia 0.60x13.50 | EXTEND 1-Dia 0.60x 4.00 |
| 20 | 7+092 | RCP 1-Dia 0.60x14.00 | EXTEND 1-Dia 0.60x 4.00 |

| NO. | CHAINAGE | EXISTING CULVERT | NEW CULVERT |
|-----|----------|----------------------|-------------------------|
| 21 | 7+116 | RCP 1-Dia 0.60x14.00 | EXTEND 1-Dia 0.60x 2.00 |
| 22 | 7+287 | RCP 1-Dia 0.60x14.00 | EXTEND 1-Dia 0.60x 4.00 |
| 23 | 7+684 | RCP 1-Dia 0.60x14.00 | EXTEND 1-Dia 0.60x 4.00 |
| 24 | 7+869 | RCP 1-Dia 0.60x14.00 | EXTEND 1-Dia 0.60x 4.00 |
| 25 | 7+922 | RCP 1-Dia 0.60x19.60 | REMAIN |
| 26 | 8+043 | RCP 2-Dia 0.60x14.00 | EXTEND 2-Dia 0.60x 4.00 |
| 27 | 8+516 | RCP 2-Dia 0.60x13.00 | EXTEND 1-Dia 0.60x 6.00 |
| 28 | 8+669 | RCP 1-Dia 0.60x13.50 | EXTEND 1-Dia 0.60x 2.00 |
| 29 | 8+752 | RCP 1-Dia 0.60x14.00 | EXTEND 1-Dia 0.60x 2.00 |
| 30 | 8+759 | RCP 1-Dia 0.60x13.00 | EXTEND 1-Dia 0.60x 4.00 |
| 31 | 8+910 | RCP 1-Dia 0.60x14.00 | EXTEND 1-Dia 0.60x 2.00 |
| 32 | 9+089 | RCP 1-Dia 0.60x15.00 | EXTEND 1-Dia 0.60x 2.00 |
| 33 | 9+200 | RCP 1-Dia 0.60x15.00 | EXTEND 1-Dia 0.60x 2.00 |
| 34 | 9+547 | RCP 1-Dia 0.60x13.00 | EXTEND 1-Dia 0.60x 4.00 |
| 35 | 13+818 | RCP 1-Dia 0.80x14.50 | EXTEND 1-Dia 0.80x 2.00 |
| 36 | 14+537 | RCP 1-Dia 0.30x14.00 | RCP 1-Dia 0.60x17.00 |
| 37 | 16+604 | BOX 1-1.50x2.00x8.00 | EXTEND 1-1.50x2.00x5.00 |
| 38 | 17+016 | BOX 1-1.50x2.00x8.00 | EXTEND 1-1.50x2.00x6.00 |
| 39 | 21+128 | BOX 1-2.50x2.00x8.00 | EXTEND 1-2.50x2.00x8.00 |
| 40 | 24+830 | BOX 1-2.50x1.50x8.00 | EXTEND 1-2.50x1.50x8.00 |

(4) Bridges

| NO | CHAINAGE | EXISTING BRIDGE | PROPOSED BRIDGE |
|----|----------|-----------------|-----------------|
| 1 | 0+034 | 7x51 SLAB TYPE | REMAIN |
| 2 | 10+596 | 11x29 SLAB TYPE | REMAIN |
| 3 | 11+138 | 10x70 SLAB TYPE | REMAIN |
| 4 | 13+395 | 7x 8 SLAB TYPE | 12x 8 SLAB TYPE |
| 5 | 13+598 | 7x 8 SLAB TYPE | 12x 8 SLAB TYPE |
| 6 | 15+916 | 7x10 SLAB TYPE | 12x10 SLAB TYPE |
| 7 | 17+999 | 7x10 SLAB TYPE | 12x10 SLAB TYPE |
| 8 | 19+683 | 7x18 SLAB TYPE | 12x18 SLAB TYPE |
| 9 | 21+325 | 7x18 SLAB TYPE | 12x18 SLAB TYPE |

3.3 Quantities and Construction and Road Maintenance Costs

(1) CONSTRUCTION QUANTITIES AND COSTS

(Project IM-15 Length = 24.7 km)

| Item | Unit | Financial Unit Rate Baht | Quantity | Financial Total Cost 1000 Baht | Economic Cost | | Residual Value | |
|--|----------------|--------------------------------|----------|--------------------------------------|---------------|-----------|----------------|-----------|
| | | | | | % | 1000 Baht | % | 1000 Baht |
| EARTHWORK | | | | | | | | |
| Clearing & Grubbing | ha | 10,000 | 21 | 210 | 85 | 179 | 90 | 161 |
| Roadway Excavation (Unclassified) | m ³ | 18 | 7,100 | 128 | 84 | 108 | 90 | 97 |
| Roadway Excavation (Classified Unsuitable Material below Grade) | m ³ | 51 | - | - | 84 | - | 90 | - |
| Embankment (Common) | m ³ | 33 | - | - | 86 | - | 90 | - |
| Embankment (Borrow) | m ³ | 115 | 139,600 | 16,054 | 86 | 13,806 | 90 | 12,425 |
| Removal of Existing Structure | each | 60,000 | 6 | 360 | 84 | 302 | 90 | 272 |
| Sub Total | | | | 16,752 | | 14,395 | | 12,955 |
| SUBBASE and BASE COURSES | | | | | | | | |
| Subbase | m ³ | 224 | 27,900 | 6,250 | 83 | 5,188 | 50 | 2,594 |
| Aggregate base | m ³ | 354 | 39,200 | 13,877 | 84 | 11,657 | 50 | 5,829 |
| Shoulder (Soil Aggregate) | m ³ | 259 | 19,600 | 5,076 | 83 | 4,213 | 50 | 2,107 |
| Sub Total | | | | 25,203 | | 21,058 | | 10,530 |
| SURFACE COURSES | | | | | | | | |
| Asphaltic Prime Coat | m ² | 11 | 191,100 | 2,102 | 93 | 1,955 | 50 | 978 |
| Asphaltic Tack Coat | m ² | 5 | 166,300 | 832 | 93 | 774 | 50 | 387 |
| Double Bituminous Surface Treatment | m ² | 33 | 70,800 | 2,336 | 91 | 2,126 | 50 | 1,063 |
| Asphalt Concrete Surfacing | ton | 927 | 39,200 | 36,338 | 90 | 32,704 | 50 | 16,352 |
| Portland Cement Concrete Pavement | m ³ | 1,673 | - | - | 90 | - | 50 | - |
| Sub Total | | | | 41,608 | | 37,559 | | 18,780 |
| STRUCTURES (Equivalent) | | | | | | | | |
| RC Pipe Culvert (D=1.00 m) | m | 1,800 | 100 | 180 | 88 | 158 | 50 | 79 |
| RC Box Culvert (2-2.40x 2.40 m) | m | 10,000 | 9 | 90 | 90 | 81 | 50 | 41 |
| RC Bridge (W=12.0 m) | m | 72,000 | 72 | 5,184 | 87 | 4,510 | 50 | 2,255 |
| PC Bridge (W=12.0 m) | m | 104,700 | - | - | 87 | - | 50 | - |
| Bearing Unit | m ² | 1,600 | - | - | 87 | - | 50 | - |
| Sub Total | | | | 5,454 | | 4,749 | | 2,375 |
| Total (a) | | | | 89,017 | | 77,761 | | 44,640 |
| Miscellaneous Work ((a) x 7%) | | 1s | | 6,231 | 87 | 5,421 | 0 | 0 |
| CONTRACT AMOUNT (b) | | | | 95,248 | | 83,182 | | 44,640 |
| PHYSICAL CONTINGENCIES ((b) x 10%) (c) | | 1s | | 9,525 | | 8,318 | | 4,464 |
| ENGINEERING AND SUPERVISION (((b) + (c)) x 10%) (d) | | 1s | | 10,477 | 100 | 10,477 | 0 | 0 |
| LAND ACQUISITION | | | | | | | | |
| Developed Land | ha | 250,000 | - | - | | | | |
| Less Developed Land | ha | 100,000 | - | - | | | | |
| Total (e) | | | | 0 | 100 | 0 | 100 | 0 |
| PROJECT COST ((b) + (c) + (d) + (e)) | | | | 115,250 | | 101,977 | | 49,104 |
| AVERAGE COST PER KM | | | | 4,666 | | | | |

(2) Road Maintenance Costs

| (Unit : Baht/Year) | | |
|--------------------|-----------------|--------------|
| | Without Project | With Project |
| 1994 | 382,078 | 286,889 |
| 2004 | 407,203 | 440,195 |

3.4 Construction Schedule

| Year and Month | 1992 | | | | | | | | | | | | 1993 | | | | | | | | | | | |
|--------------------------------|------|---|---|---|---|---|---|---|---|----|----|----|------|---|---|---|---|---|---|---|---|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Land Acquisition | | | | | | | | | | | | | | | | | | | | | | | | |
| Preparatory Works | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | |
| Earth Works | | | | | | | | | | | | | | | | | | | | | | | | |
| Pavement Works | | | | | | | | | | | | | | | | | | | | | | | | |
| Bridge Works | | | | | | | | | | | | | | | | | | | | | | | | |
| Miscellaneous Works | | | | | | | | | | | | | | | | | | | | | | | | |
| Clearing - up | | | | | | | | | | | | | | | | | | | | | | | | |
| Percentage of Disbursement (%) | | | | | | | | | | | | | | | | | | | | | | | | |

4. BENEFITS

ROAD CONDITIONS

(unit : km)

| Section | Road Length | Without Project | | | | | | With Project | | | | | | | |
|---------|-------------|-----------------|------|------|----------|------|------|----------------------|----------------------|-------------|------------|----------------------|----------------------|------|------|
| | | Paved | | | Laterite | | | No. of Narrow Bridge | No. of Wooden Bridge | Road Length | Road Paved | No. of Narrow Bridge | No. of Wooden Bridge | | |
| | | Good | Fair | Poor | Good | Fair | Poor | | | | | | | Good | Fair |
| RURAL-N | 10.4 | - | - | - | - | - | - | 4.4 | 6.0 | - | - | 10.4 | 10.4 | - | - |
| RURAL-S | 14.4 | - | - | 7.6 | 6.8 | - | - | - | - | - | - | 14.3 | 14.3 | - | - |

VOC AND TIME SAVINGS

(1000 BAHT)

| Year | VOC Savings | | | Time Savings | | | Total Savings | | |
|------|----------------|-----------------|--------|----------------|-----------------|-------|----------------|-----------------|--------|
| | Normal Traffic | Induced Traffic | Total | Normal Traffic | Induced Traffic | Total | Normal Traffic | Induced Traffic | Total |
| 1994 | 37,279 | 76 | 37,355 | 4,527 | 345 | 4,872 | 41,806 | 421 | 42,227 |
| 2000 | 50,400 | 105 | 50,505 | 6,240 | 480 | 6,719 | 56,640 | 584 | 57,225 |
| 2008 | 72,629 | 162 | 72,791 | 9,175 | 727 | 9,902 | 81,805 | 888 | 82,693 |

5. ECONOMIC EVALUATION

COST AND BENEFIT STATEMENT






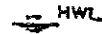
(1000 BAHT)

| YEAR | COST | | BENEFITS | | | DISCOUNTED (12%) | |
|-------|-------------|------------|-------------|---------------|---------|------------------|---------|
| | CONST. COST | VOC SAVING | TIME SAVING | MAINT. SAVING | TOTAL | COST | BENEFIT |
| 1992 | 35,692 | | | | 0 | 44,772 | 0 |
| 1993 | 66,285 | | | | 0 | 74,239 | 0 |
| 1994 | | 37,355 | 4,872 | 95 | 42,322 | 0 | 37,788 |
| 1995 | | 39,546 | 5,180 | 86 | 44,812 | 0 | 35,724 |
| 1996 | | 41,738 | 5,488 | 77 | 47,303 | 0 | 33,669 |
| 1997 | | 43,930 | 5,796 | 68 | 49,794 | 0 | 31,645 |
| 1998 | | 46,122 | 6,104 | 59 | 52,285 | 0 | 29,668 |
| 1999 | | 48,313 | 6,412 | 50 | 54,775 | 0 | 27,751 |
| 2000 | | 50,505 | 6,719 | 41 | 57,265 | 0 | 25,904 |
| 2001 | | 53,291 | 7,117 | 32 | 60,440 | 0 | 24,411 |
| 2002 | | 56,077 | 7,515 | 23 | 63,615 | 0 | 22,940 |
| 2003 | | 58,862 | 7,913 | 14 | 66,789 | 0 | 21,504 |
| 2004 | 18,592 | 61,648 | 8,311 | 5 | 69,964 | 5,986 | 20,113 |
| 2005 | | 64,434 | 8,709 | (4) | 73,139 | 0 | 18,773 |
| 2006 | | 67,220 | 9,106 | (13) | 76,313 | 0 | 17,489 |
| 2007 | | 70,005 | 9,504 | (22) | 79,487 | 0 | 16,265 |
| 2008 | (49,104) | 72,791 | 9,902 | (33) | 82,660 | (10,048) | 15,102 |
| TOTAL | 71,465 | 811,837 | 108,648 | 478 | 920,963 | 114,949 | 378,746 |

NET PRESENT VALUE : 263,797
 BENEFIT COST RATIO : 3.29
 INTERNAL RATE OF RETURN : 32.5%
 FIRST YEAR RATE OF RETURN : 31.8%

6. DRAWINGS

ABBREVIATIONS and SYMBOLS for PLAN and PROFILE

| | |
|---|---|
|  | NEW CONSTRUCTION SECTION OF STUDY ROUTE |
|  | IMPROVEMENT SECTION OF STUDY ROUTE |
|  | BRIDGE (PROPOSED, EXISTING) |
|  | BOX CULVERT (PROPOSED, EXISTING) |
|  | PIPE CULVERT (PROPOSED, EXISTING) |
|  | HIGH WATER LEVEL |

| | |
|----------|----------------------------------|
| HWY | HIGHWAY |
| PI | POINT OF HORIZONTAL INTERSECTION |
| NO. or # | NUMBER |
| Δ | DEFLECTION ANGLE |
| R | RADIUS OF CURVATURE |
| T | TANGENT LENGTH |
| L | LENGTH OF CURVE |
| RT | RIGHT |
| LT | LEFT |
| EXIST. | EXISTING |
| EXTD. | EXTEND |

| | |
|----------------------|---|
| RC-P-n- ϕ a x l | PIPE CULVERT, n (ROW), ϕ a (DIAMETER, m), l (LENGTH, m) |
| RC-B-n-a x b x l | BOX CULVERT, n (NO. OF CELLS), a x b x l (CLEAR SPAN x DEPTH x LENGTH, m) |
| BR-T-a x l - n | TIMBER BRIDGE, a x l (WIDTH x LENGTH, m), n (NO. OF SPANS) |
| BR-RC-a x l - n | CONCRETE BRIDGE, a x l (ROADWAY WIDTH x LENGTH, m) n (NO. OF SPANS) |



| | | |
|-----------------------|--|--|
| TERRAIN | FLAT | |
| PAVEM'T | Type / Length | LATERITE |
| | Condition | POOR FAIR |
| FLOODING | Length (Km) Height (m.) | - |
| RIGHT OF WAY (m.) | LT RT | 15.00 15.00 |
| ROUTE NO. AGENCIES | | RURAL |
| ELEVATION (m.) | <p>PROPOSED PROFILE GRADE EXISTING PROFILE EXISTING GROUND PROFILE</p> <p>OVERLAY SECTION TO MATCH EXISTING BRIDGE</p> <p>Grades: -0.71%, 0.00%, +0.05%, 0.00%, -0.05%, 0.00%, +0.05%, 0.00%, -0.10%, 0.00%, +0.05%</p> | |
| | Station | 0+000 to 9+000 |
| CURVA-TURE BAND | Existing Alignment | <p>L=44.02 R=98.79</p> <p>L=173.72 R=2,864.79</p> <p>L=182.44 R=2,864.74</p> <p>L=180.44 R=2,864.79</p> <p>L=160.68 R=2,864.79</p> <p>L=138.33 R=5,729.68</p> <p>L=115.30 R=1,145.92</p> <p>L=146.53 R=5,729.58</p> <p>L=115.29 R=1,909.86</p> <p>L=166.51 R=2,864.79</p> <p>L=104.32 R=818.51</p> |
| | Proposed Alignment | <p>L=44.02 R=98.79</p> <p>L=173.72 R=2,864.79</p> <p>L=180.44 R=2,864.79</p> <p>L=160.68 R=2,864.79</p> <p>L=138.33 R=5,729.68</p> <p>L=115.30 R=1,145.92</p> <p>L=146.53 R=5,729.58</p> <p>L=115.29 R=1,909.86</p> <p>L=166.51 R=2,864.79</p> <p>L=104.32 R=818.51</p> |
| STATION (Km.) | 0+000 | 1+000 2+000 3+000 4+000 5+000 6+000 7+000 8+000 9+000 |