Chapter 8

Highway 4/406 Short Cut Route (NC-5)

8. Highway 4/406 Short Cut Route (NC-5)

8.1 Natural Conditions and Land Use

The project locates in the southern part of Route 4 between Hat Yai Airport and Route 406. There are two sections in the project: the first section connecting Hat Yai Airport with Route 4; and the second section connecting Route 4 and 406 in a shorter distance.

The first section is on plateau with almost flatland at about 20 meter height from sea level. The second section is located at the foot of mountains in flat and rolling terrain at 40 - 100 meter height from sea level. The section detours the mountain along the boundary of national park.

The first section is surrounded mostly by grass land and shrub forest. About half of the second section is covered mostly with rubber plantation and coconut orchard with some intervals of grass and shrub forest. The remaining half is mostly surrounded by grass land and shrub forest.

	Hat Yai Airport - Route 406	Route 4 - Route 406
Residential	2 %	- %
Rubber Plantation	-	42 %
Coconut Orchard	-	8 %
Grass Land	52 %	32 %
Shrub Forest	46 %	18 %

It is estimated that the first section needs removal of about 20 houses just off the airport and that the second section needs removal of about 10 houses in the vicinity of Route 4. Land price varies from place to place in the range of B12,000 - 50,000 per rai for the first section and B20,000 - 100,000 per rai for the second section.

8.2 Socio-Economic Conditions

NC-5 road runs cross the amphoe boundary of Hat Yai and Ratta Phum. Both belong to Changwat Songkhla. First section locates in Amphoe Hat Yai while the second section starts in Amphoe Hat Yai and ends in Amphoe Ratta Phum.

Total population of amphoe Hat Yai and Ratta Phum was 330,500 persons in 1989. Amphoe Hat Yai showed a population growth rate of 2.2 % per annum during the period 1979 - 1989. Amphoe Rata Phum, however, showed negative growth rate of -1.4 % in the same period as shown in Table 8.2.1.

3.8 Highway 4/406 Short Cut Route (NC-5)

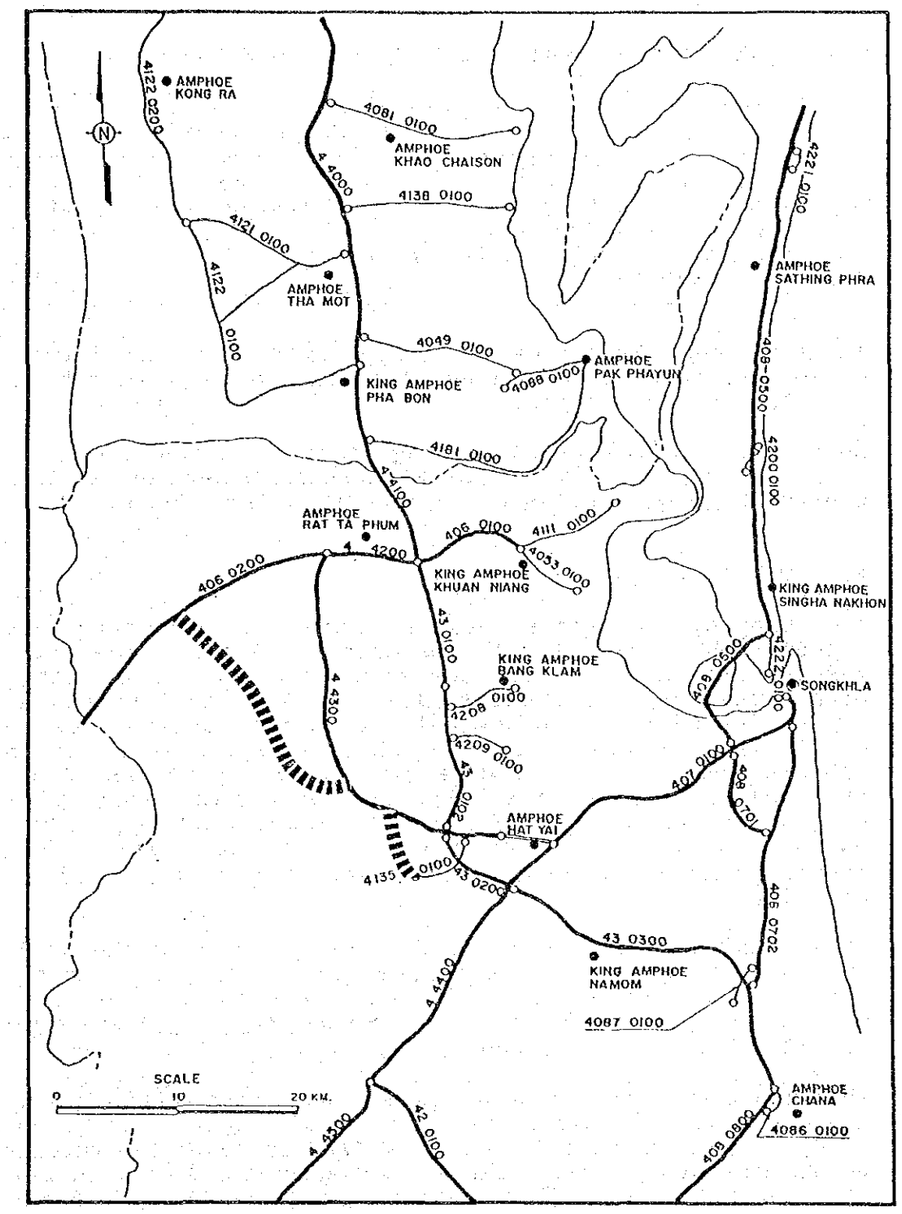


Fig. 8.1.1 HIGHWAY 4/406 SHORT CUT ROUTE (NC-5)

Table 8.2.1 POPULATION IN NC-5 CORRIDOR

	A. Muang Hat Yai	A. Ratta Phum
Area (km2)	600	1,029
Total Pop. (1989)	276,000	54,500
Pop. Density (per./km2)	418	53
Pop. Growth rate (% per annum) 1979-89	2.24	-1.44

In Hat Yai, there are 389 shops/factories and their average employment reaches 26 persons, the size being greater than that of the other project areas.

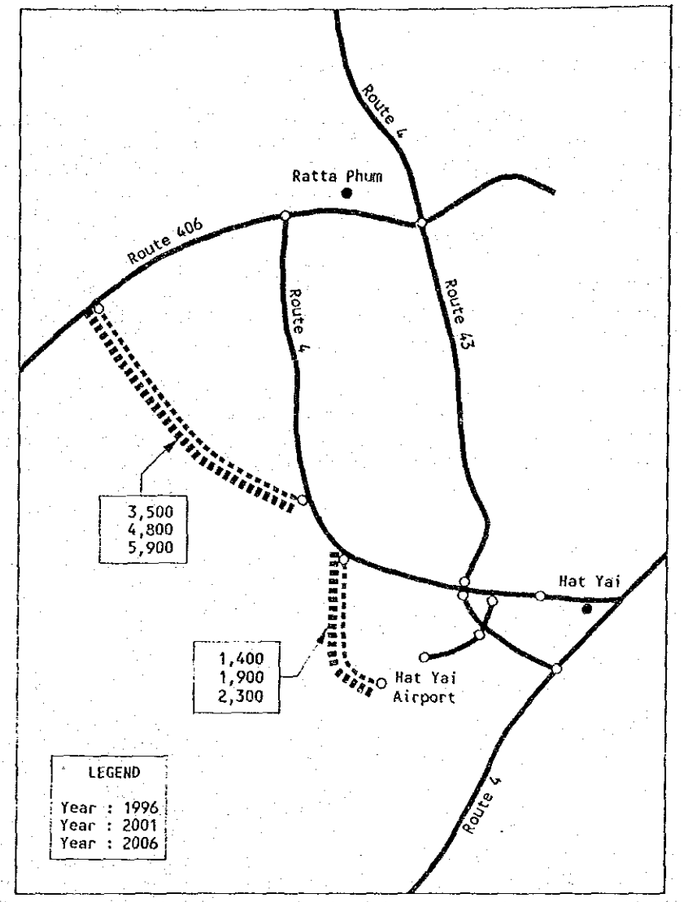
Most of the people engages in agriculture, accounting for 70-80%, followed by service sector of 10% and the others of 8%. Hat Yai has higher share of employment in manufacturing sector.

8.3 Traffic Conditions

The project comprises two sections of new construction as illustrated in Fig. 8.1.1: the first link for connecting Hat Yai Airport with Route 4; and the second link for connecting Route 4 with Route 406 in a shorter distance. The existing Route 4135 is of F3 standard with asphalt concrete surface of 6 meter carriageway, Route 4 in the project area is of P3 standard with asphalt concrete surface of 6 meter carriageway, and Route 406 in the project area is of S3 standard with single surface treatment of 5 meter carriageway. Traffic volume in 1989 was 3,783 AADT on Route 4135, 2,247 AADT on Route 4, and 1,635 AADT on Route 406. Traffic volume on Route 4135 far exceeds the design traffic capacity.

The roadside OD survey carried out on Route 4 in the project area indicated that 26 % of trucks carried manufactured products, 19 % construction materials and rubber, and 10 % fish. As to trip purposes of passengers, 67 % of cars was for work and business trip and 30 % for private purpose trip.

The future traffic volume on the second link connecting Route 4 and Route 406 was estimated, as shown in Fig. 8.3.1, at 3,500 AADT in 1996, 4,800 AADT in 2001 and 5,900 AADT in 2006. The future traffic volume on the first link was estimated at 1,400 AADT in 1996, 1,900 AADT in 2001, and 2,300 AADT in 2006 on the assumptions that airport related traffic would be distributed between Songkhla and Satun provinces based on the number of population of each province and that the present percentage share of airport related traffic on Route 406 would be applied to the future share on the second link.



Note; Average of ADTs on Route 406 is 3,100 in 1990.

Fig. 8.3.1 TRAFFIC VOLUME ON NC-5

8.4 Project Evaluation

The EIRR was calculated at 52.3 % though it was 53.8 % in the pre-feasibility study. The highway sections studied this time are consisted of two sections of "S2" standard: (1) a short cut connection between Route 4 and 406 over a distance of 17.3 kilometers; and (2) an airport connection to Route 4 over a distance of 6.8 kilometers, while only the former section of "S3" standard was designed in the pre-feasibility study. More disaster prevention measures including earth work and structures were introduced this time based on road inventory and field reconnaissance surveys. The project is judged viable.

The short cut route between Route 4 and 406 lies along the foot of the mountain which has been designated as national park and comes across with many small rivers. Small effects on environment is envisaged in terms of encroachment on ecology and erosion and siltation. Attention was paid to protect the highway from natural disasters, mud and debris flow in particular.

8.5 Engineering Study

1) Summary

The first section connecting Hat Yai airport to Route 4 passes on flat open forest terrain in a straight line, while the second section connecting Route 4 with Route 406 passes through hilly terrain along the foot of the mountain with some moderate horizontal curves and straight lines at a maximum gradient of 5.9 %.

The embankment height of the second section is planned to be 2.0 m in minimum (2.5 m on average) in order to install sufficient drainage facilities and keep enough height for bridges not to disturb river water flow in rainy season.

Twelve new bridges, including two "removal and reconstruction bridges", are proposed in the second section to pass many small rivers. Drainage facilities are especially important in this section.

Pavement structure comprises surface course of 7.5 cm, base course of 15 cm and subbase course of 20 cm, 42.5 cm in total.

One intersection with Route 4 in the first section and two intersections with Route 4 and Route 406 in the second section are planned to be signalized.

NC-5	Description
Changwat	: Songkhla
Name or Location	: Rt.4/406, Short Cut Route
Road Class	: S2
Cross Section (m)	: 2.25 + 6.5 + 2.25 (6.0:PWD)
Surface Type	: SA / ASC / SA
Bridge: New	: 12 sites, 290 m
Removal	: 2 sites, 14 m (PWD)
Length: Total	: 29.6 km
Without Work	: 5.5 km
New	: 22.0 km
Reconstruction	: 2.1 km (PWD)
AADT ('96/'01/'06)	: 3,500 / 4,800 / 5,900
Financial Cost	: 285.3 million baht (in 1990 price)
NPV	: 1,146 million baht (12% discount rate)
B/C	: 8.0 (12% discount rate)
EIRR	: 52.3 %

( ): Existing Condition

2) Design Standard and Conditions

(1) Design Criteria

Road Class : S3
Design Speed : 55 - 90 km/h

Geometric Design Criteria

Description	Design Speed (km/h)			
	90	80	70	55
Minimum Radius of Curvature (m)	280	220	160	90
Minimum Stopping Sight Distance (m)	150	120	100	70
Maximum Gradient (%)	6	7	7	8
Minimum Gradient for Drainage (%)	0.3	0.3	0.3	0.3

(2) Pavement Design Conditions

Design CBR : 6%
Design Method : AASHTO
Design Period : 7 years

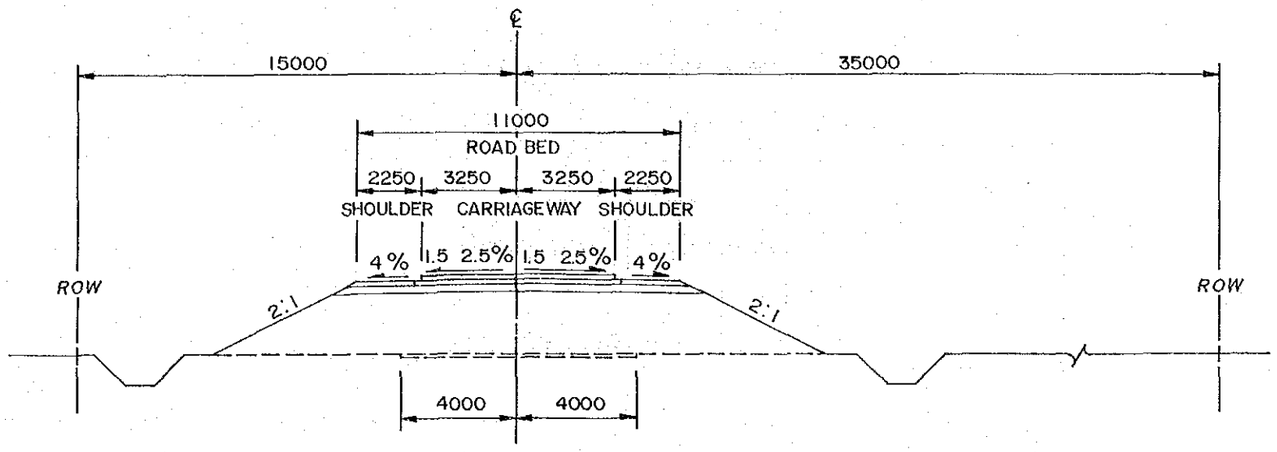
(3) Drainage Design Conditions

Rainfall Intensity : Rainfall Intensity Duration Curve at Songkhla Observatory

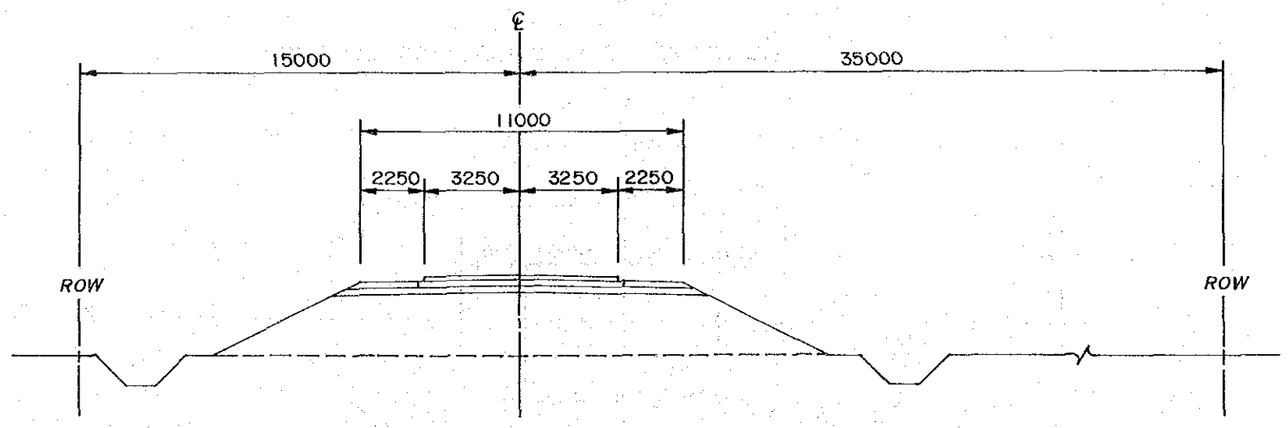
Return Period : Culvert--------10 years
: Minor Bridge---20 years

3) Typical Cross Section

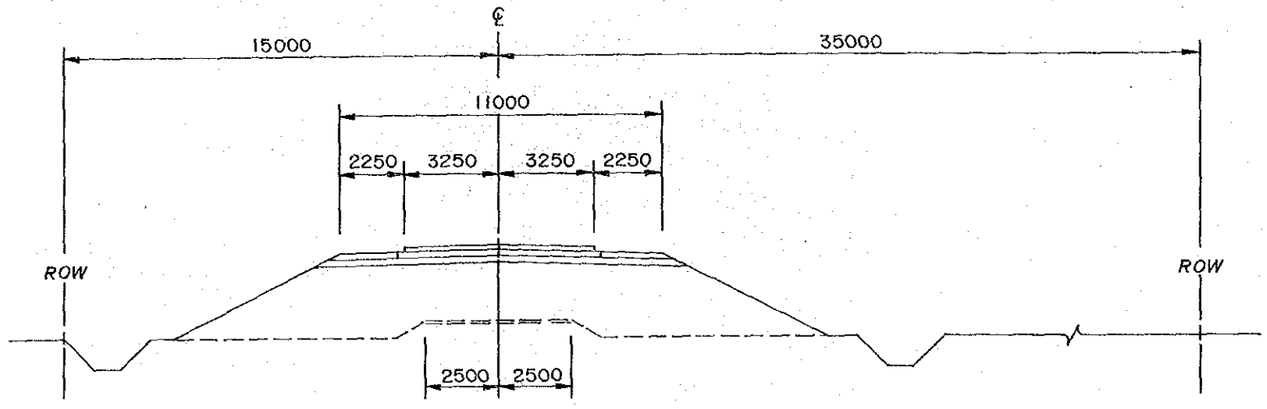
STA.0+000 ~ STA.0+550



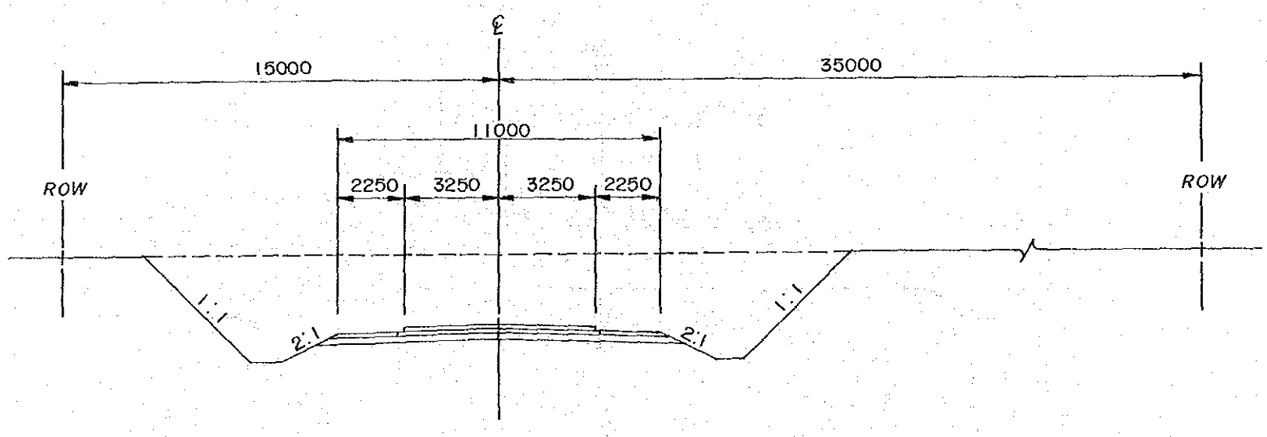
STA. 0+550~STA. 6+800
STA.13+790~STA.29+550 (EMBANKMENT SECTION)



STA. 12+250 STA. 13+790



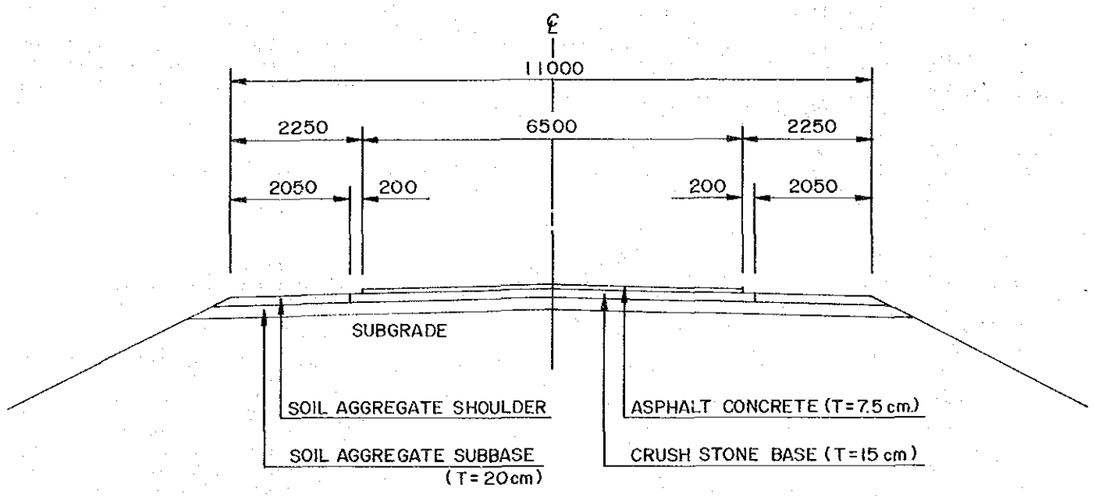
STA. 13+790 STA. 29+550 (CUT SECTION)



4) Pavement Design

New Road

Design CBR of Subgrade	Cumulative No. of ESA W18 x 10^3 (7 years)	Thickness of Pavement Structure (cm)
6.0	1,686	Surface 7.5 Base 15 Subbase 20



8.6 Construction Cost

Table 8.5.1 CONSTRUCTION COST

1) CONSTRUCTION QUANTITIES AND COSTS

(Project NC -5 Length = 24.100 Km)
(Improved Length 24.100 Km)

ITEM	Unit	Financial Unit Cost Baht	Quantity	Financial Total cost 1000 Baht	Economic cost %	1000 Baht	Residual Value %	1000 Baht
EARTH WORK					83		90	
Clearing & Grubbing	SQ.M	1	736,362	736				
Roadway Excavation(classified)	CU.M	85	98,642	8,385				
Embankment(Borrowed Material)	CU.M	100	775,871	77,587				
Slope Protection(Stripe Sodding)	SQ.M	6	247,887	1,487				
(Sodding)	SQ.M	9	0	0				
(Shot Concrete)	SQ.M	500	15,481	7,741				
(Concrete Block)	SQ.M	450	20,070	9,032				
Sand Mat (t=0.5m)	SQ.M	100	4,500	450				
Excavate Existing								
Thickness Over 10cm (2Lay)	SQ.M	14	0	0				
SUB TOTAL				105,417		87,496		78,747
SUBBASE AND BASE					83		50	
Subbase(Soil Aggregate)	CU.M	190	57,120	10,853				
Base Coarses(Crush Stone)	CU.M	295	24,633	7,267				
Shoulder(Soil Aggregate)	CU.M	190	15,708	2,985				
SUB TOTAL				21,104		17,516		8,758
SURFACE					83		50	
Asphaltic Prime coat	SQ.M	13	164,220	2,135				
Asphaltic Tack coat	SQ.M	7	0	0				
Asphalt concrete Surfacing	CU.M	1,900	11,603	22,046				
SUB TOTAL				24,181		20,070		10,035
STRUCTURES(Equivalent)					83		50	
RC Pipe Culvert(D= 600 m)	M	1,300	1,337	1,738				
(D= 800 m)	M	1,780	275	490				
(D=1000 m)	M	2,445	216	528				
(D=1200 m)	M	3,575	422	1,509				
(D=1500 m)	M	4,400	124	546				
(D=700m*2)	M	1,540	8	12				
RC Box Culvert(1-1.80*1.80 m)	M	4,200	131	550				
(1-2.10*2.10 m)	M	5,000	30	150				
(1-2.40*2.40 m)	M	5,900	23	136				
(2-1.80*1.80 m)	M	8,400	36	302				
(2-2.40*2.40 m)	M	11,800	51	602				
RC Bridge Wideing	SQ.M	9,600	0	0				
RC Bridge (W=12.0 m)	M	76,800	250	19,200				
PC Bridge (W=12.0 m)	M	120,000	40	4,800				
Bearing Unit Of Bridge	Ls	500,000	12	6,000				
Remove Of Existing Bridge	SQ.M	3,000	67	201				
Temporary Brige	SQ.M	5,000	53	265				
SUB TOTAL				37,028		30,734		15,367
INTERSECTION					90		90	
T-Intersection (Signal)	Ls	800,000	3	2,400				
T-Intersection (Unsignal)	Ls	80,000	0	0				
SUB TOTAL				2,400		2,160		1,944
TOTAL (a)				190,130		157,976		114,851
Miscellaneous Works [(a)*7%]	Ls	1		13,309		11,058		8,040
CONTRACT AMOUNT (b)				203,439		169,035		122,890
PHYSICAL CONTINGENCIES [(b)*10%] (c)	Ls	1		20,344		16,903		12,289
ENGINEERING & SUPERVISION [(b)+(c))*10%] (d)	Ls	1		22,378	85	19,022	0	0
LAND ACQUISITION & COMPENSATION								
Land Acquisition (Average)	SQ.M	26	1,169,460	30,757	100	30,757	100	30,757
Conpensation	Ls	8,400,000	1	8,400	100	8,400	100	8,400
TOTAL (e)				39,157		39,157		39,157
PROJECT COST [(b)+(c)+(d)+(e)]				285,319		244,116		174,336
AVERAGE COST PER KM				11,839				

2) MAINTENANCE COST

Project Road No, NC -5 Na= 9,300 Baht/Km/year
(Existing Road) Km= 1.162
Length = 2.090 Km

Laterite Surface

	ITEMS		Existing Condition	Factor
1.	A.D.T	A1	101-150	0.13
2.	Width Of Embankment (Surface & Shoulder)	A3	6.0 m	0.00
3.	R-O-W Width	B1	9 m	0.00
4.	Traffic Service Operation Topography	B2	0 - 3 %	0.05
5.	Drainage Topography	B3	0 - 3 %	0.00
6.	Bridge Quantity (m/Km)	B4	1~20	0.02
7.	NO. Of Lanes		2	

Ks (Existing)= 1+0.7(A1+A3)+0.3(B1+B2+B3+B4) = 1.112
Maintenance cost + Overhead = KS * Km * Na * 1.28 = 15,382 Baht/Km/year
Total Cost (Financial) = Length *(Baht/Km/year)= 32,148 Baht/year
(Economic) = = 26,683 Baht/year

Project Road No, NC -5 Na= 8,200 Baht/Km/year
(Proposed Road) Km= 1.001
Length = 24.100 Km

Asphalt Pavement

	ITEMS		Proposed Road (1996) Condition	Factor	(2001) Factor	(2006) Factor
1.	Surface /Bace Type	X1	AC	0.00	0.00	0.00
2.	Subgrade CBR	X2	4 %	0.50	0.50	0.50
3.	A.D.T	X3	3,500	1.14	1.76	2.25
4.	Service Life (year)	X4	NEW	0.00	0.00	0.00
5.	Pavement Width (m)	X5	6 m	0.19	0.19	0.19
6.	R-O-W Width (m)	Y1	50 m	0.05	0.05	0.05
7.	Shoulder,Access,Median Width (m)	Y2	2.00 m	0.05	0.05	0.05
8.	Traffic Service Operation Topography	Y3	0 - 3 %	0.00	0.00	0.00
9.	Drainage Topography	Y4	0 - 3 %	0.00	0.00	0.00
10.	Bridge Quantity (m/Km)	Y5	12	0.00	0.00	0.00
11.	NO. Of Lanes		2			

Ka = 1+0.5(X1+X2+X3+X4+X5+Y1+Y2+Y3+Y4+Y5)= 1.965 2.275 2.520
Maintenance cost + Overhead= Ka * Km * Na * 1.28 = 20,645 23,902 26,476 Baht/Km/year
Total Cost (Financial) = Length *(Baht/Km/year)= 497,551 Baht/year
(1996) (Economic) = = 412,967 Baht/year
Total Cost (Financial) = ADT(4,800 CAR/DAY) = 576,045 Baht/year
(2001) (Economic) = = 478,117 Baht/year
Total Cost (Financial) = ADT(5,900 CAR/DAY) = 638,081 Baht/year
(2006) (Economic) = = 529,607 Baht/year

Overlay Cost (2004) = = 18,878,976 Baht

3) CONSTRUCTION SCHEDULE

Project NC-5

(Two Section)

year and Month / Work Items	First Year												Second Year												Third Year											
	1	2	3	4	5	6	7	8	9	10	11	12	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 (%)								40 %												37 %												23 %				

4) ECONOMIC EVALUATION

Cost and Benefit Flows of the Project
Project; NC-5

(unit ; 1000 Baht)

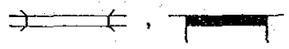
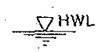
Year	Conct-ruction Cost	Mainte-nance Cost	Total Cost	VOC Saving	Time Saving	Balance	Sensi. Analysis
						Benefit=	0.8
						Cost=	1.2
1991	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0
1993	109,258	0	109,258	0	0	(109,258)	-131109
1994	75,909	0	75,909	0	0	(75,909)	-91091
1995	58,950	0	58,950	0	0	(58,950)	-70740
1996	0	386	386	103,568	50,099	153,281	122470
1997	0	386	386	105,769	84,885	190,268	152060
1998	0	386	386	107,970	119,671	227,255	181649
1999	0	386	386	110,171	154,457	264,242	211239
2000	0	386	386	112,372	189,243	301,229	240828
2001	0	451	451	114,573	224,029	338,151	270340
2002	0	451	451	109,441	275,226	384,216	307192
2003	0	451	451	104,309	326,423	430,281	344045
2004	0	19,330	19,330	99,178	377,621	457,468	358242
2005	0	451	451	94,046	428,818	522,412	417749
2006	0	503	503	88,914	480,015	568,426	454540
2007	0	503	503	88,914	480,015	568,426	454540
2008	0	503	503	88,914	480,015	568,426	454540
2009	0	503	503	88,914	480,015	568,426	454540
2010	0	503	503	88,914	480,015	568,426	454540
Total	244,116	25,582	269,698	1,505,967	4,630,547	5,866,816	4585573
					IRR =	52.26%	41.42%
					NPV (i;12%) =	1,146,167	
					B/C (i;12%) =	7.95	

8.7 Drawings

Drawing

SHEET NO.	LIST OF DRAWINGS
1. - 4.	Plan and Profile
5.	Plan of Intersection
6.	(A) Reinforced Concrete Slab Bridge
7.	(B) Bridge for Khlong Pom
8.	Box Culvert
9.	Pipe Culvert

ABBREVIATION AND SYMBOLS FOR PROFILE AND PLAN

	: Alignment of Proposed Route
	: Proposed Bridge
	: Proposed Box Culvert
	: High Water Level
	: Water Level
No.	: Number
R	: Radius of Curvature
L	: Length of Curve
BR.RC.SP.SL L	: Reinforced Concrete Bridge (Bridge Length)
BR.PC.GRDR L	: Prestressed Concrete Bridge (Bridge Length)
BR.ST.SP.TR L	: Steel Bridge (Bridge Length)
RC-B m - n x a x b x i	: Box Culvert (No. of Locations - No. of Cells x Clear Span x Depth x Length)

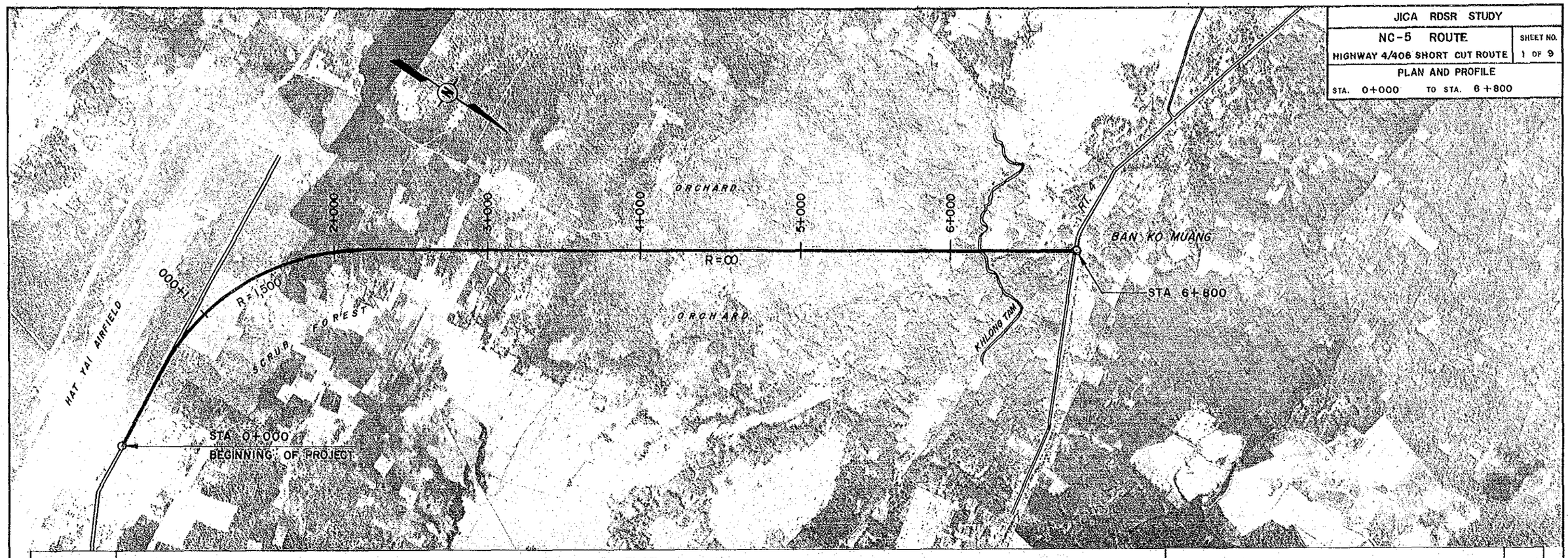
JICA RDSR STUDY

NC-5 ROUTE — SHEET NO. 1 OF 9

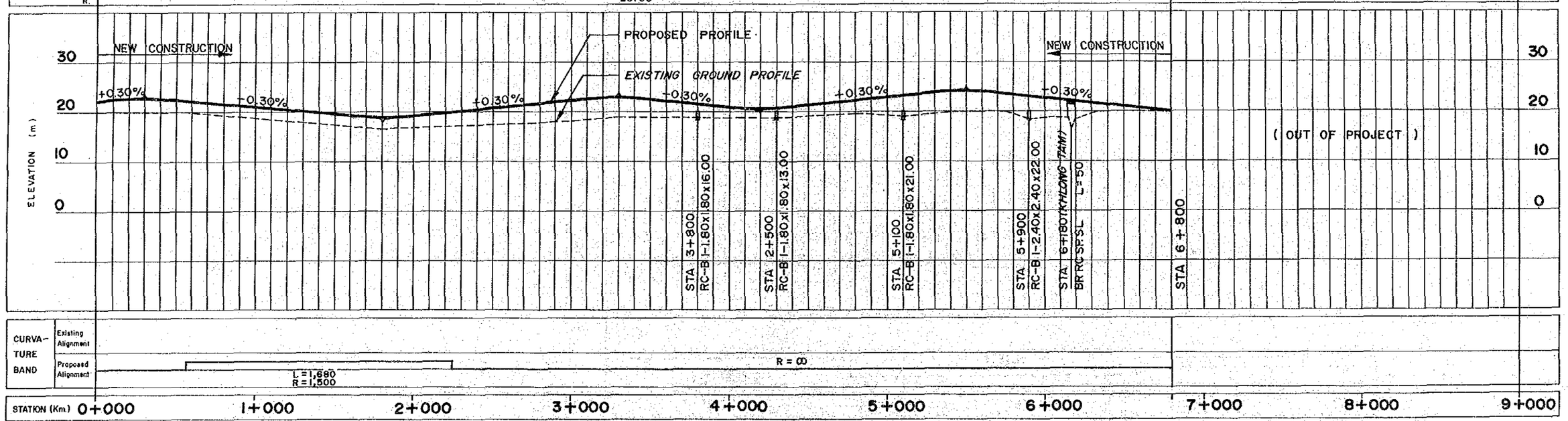
HIGHWAY 4/406 SHORT CUT ROUTE

PLAN AND PROFILE

STA. 0+000 TO STA. 6+800



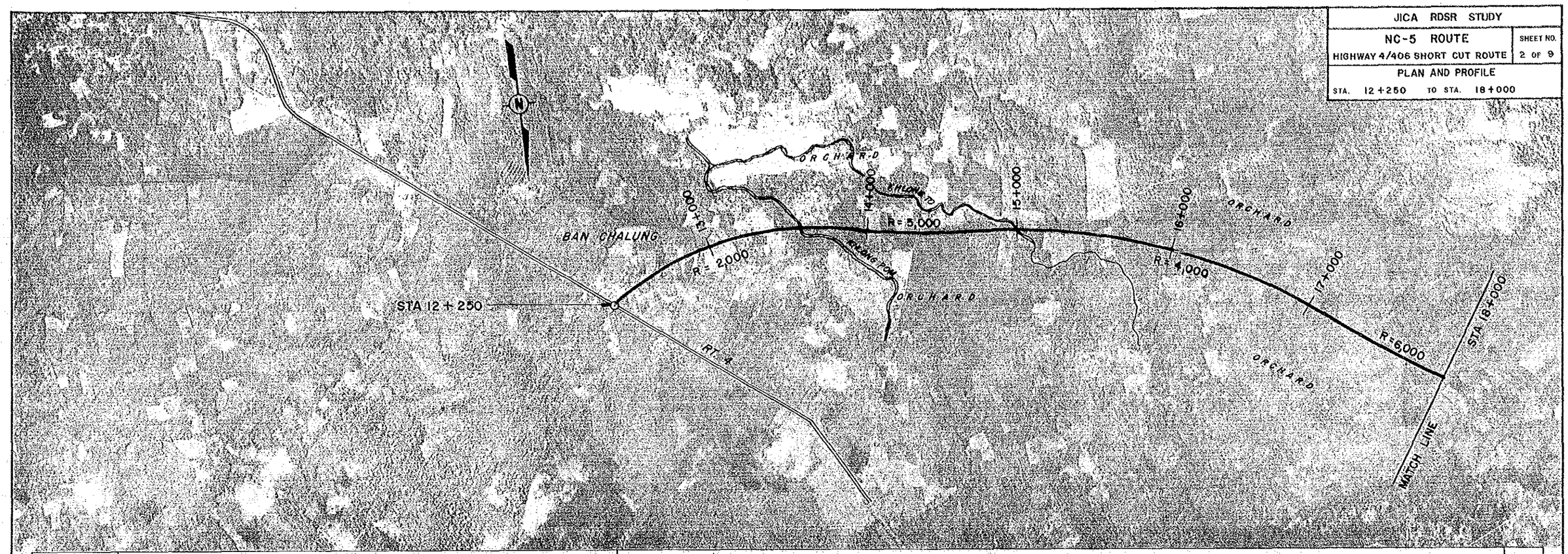
TERRAIN		FLAT
PAVEM'T	Type	AC PAVEMENT
	Existing Condition	—
FLOODING	Length(Km.) Hight (m.)	—
RIGHT OF WAY (m.)	L.	25.00
	R.	25.00



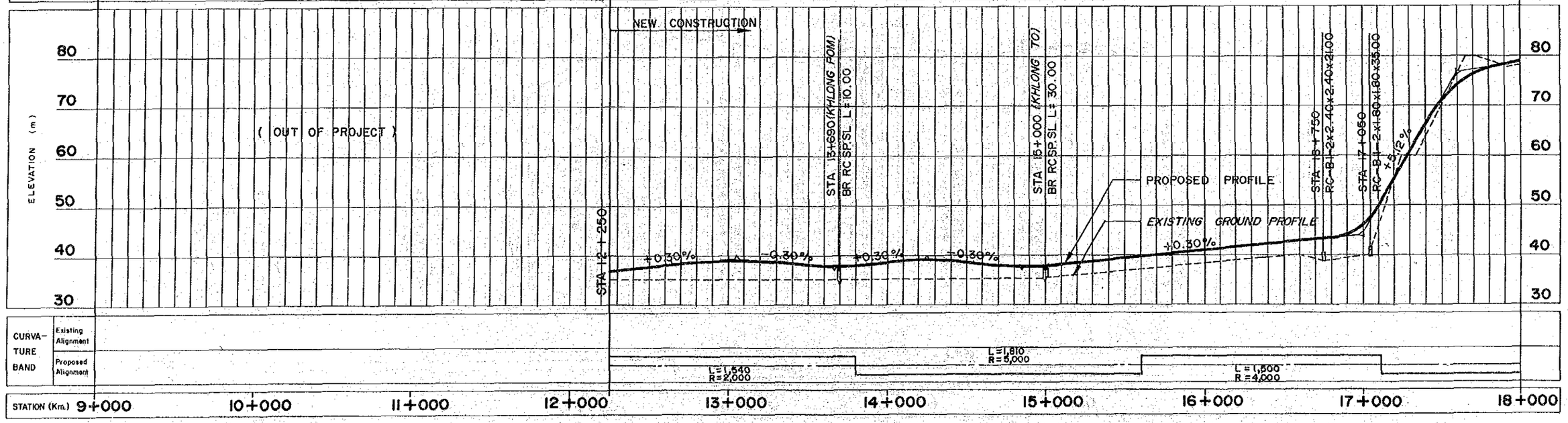
CURVATURE BAND	Existing Alignment	—
	Proposed Alignment	L=1,680 R=1,500; R=∞

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

JICA RDSR STUDY	
NC-5 ROUTE HIGHWAY 4/406 SHORT CUT ROUTE	SHEET NO. 2 OF 9
PLAN AND PROFILE STA. 12+250 TO STA. 18+000	



TERRAIN		FLAT
PAVEM'T	Type	AC PAVEMENT
	Existing Condition	—
FLOODING	Length (Km.)	—
	Hight (m.)	
RIGHT OF WAY (m)	L.	25.00
	R.	25.00



CURVATURE BAND	Existing Alignment	L=1,540 R=2,000 / L=1,810 R=5,000 / L=1,500 R=4,000
	Proposed Alignment	

STATION (Km.) 9+000 10+000 11+000 12+000 13+000 14+000 15+000 16+000 17+000 18+000

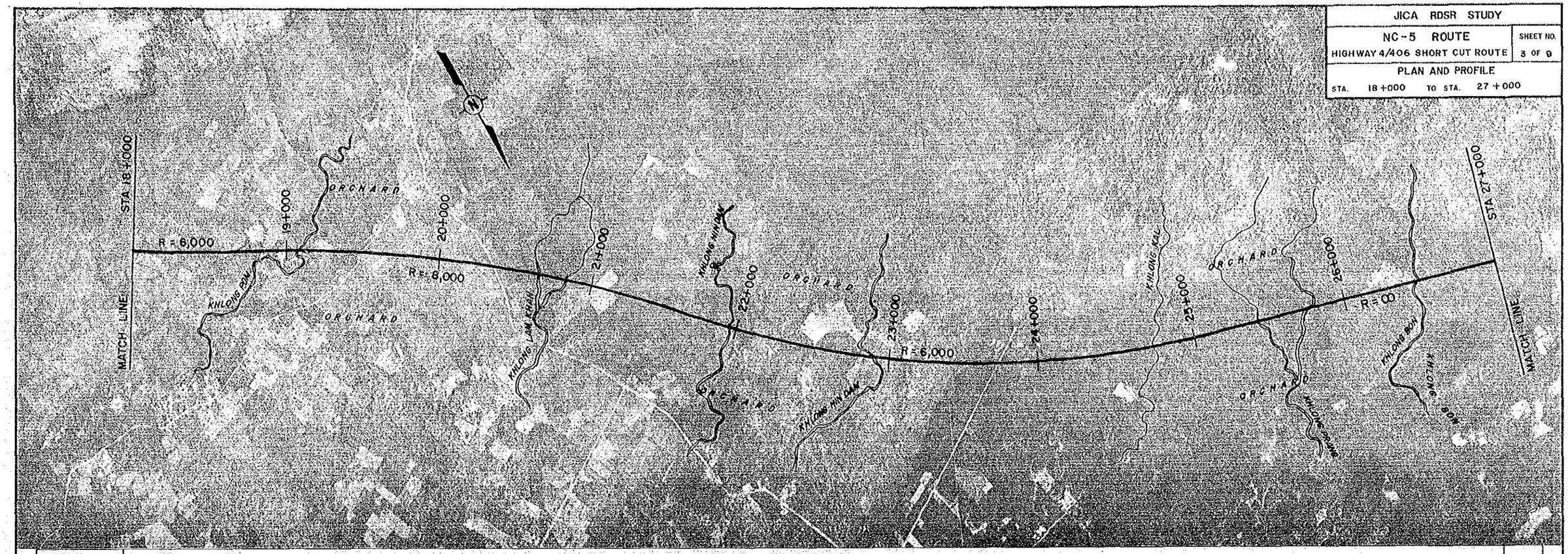
JICA RDSR STUDY

NC-5 ROUTE — SHEET NO. 3 OF 9

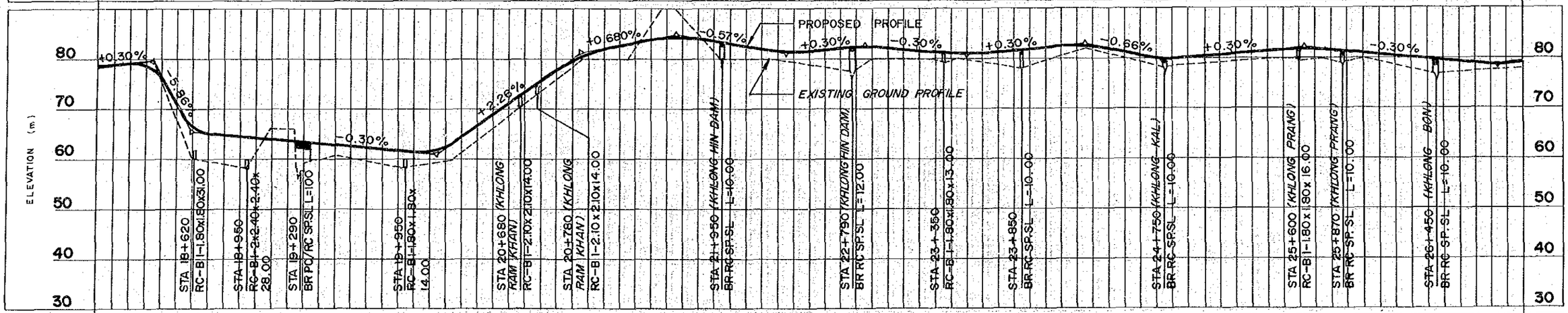
HIGHWAY 4/406 SHORT CUT ROUTE

PLAN AND PROFILE

STA. 18+000 TO STA. 27+000



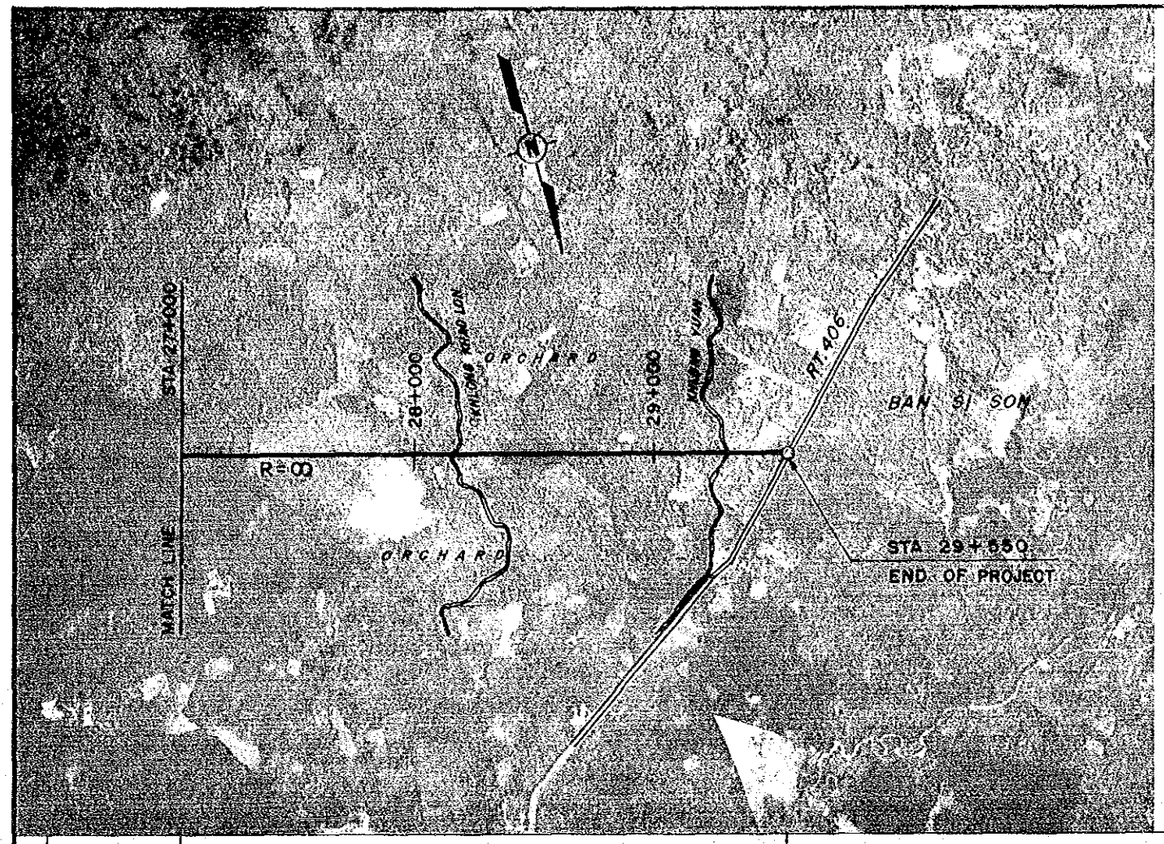
TERRAIN		FLAT
PAVEM'T	Type	AC VEMENT
	Existing Condition	—
FLOODING	Length (Km.) Hight (m.)	—
RIGHT OF WAY (m.)	L.	25.00
	R.	25.00



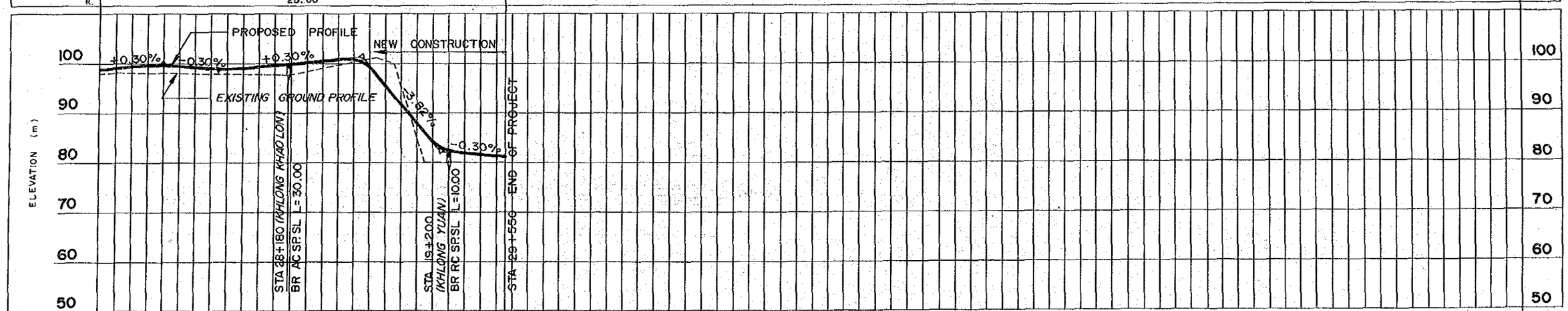
CURVATURE BAND	Existing Alignment	
	Proposed Alignment	L = 1,350 R = 6,000; L = 3,140 R = 6,000; L = 3,620 R = 6,000; R = ∞

STATION (Km.) 18+000 19+000 20+000 21+000 22+000 23+000 24+000 25+000 26+000 27+000

JICA RDSR STUDY	
NC-5 ROUTE HIGHWAY 4/406 SHORT CUT ROUTE	SHEET NO. 4 OF 9
PLAN AND PROFILE STA. 27+000 TO STA. 29+550	

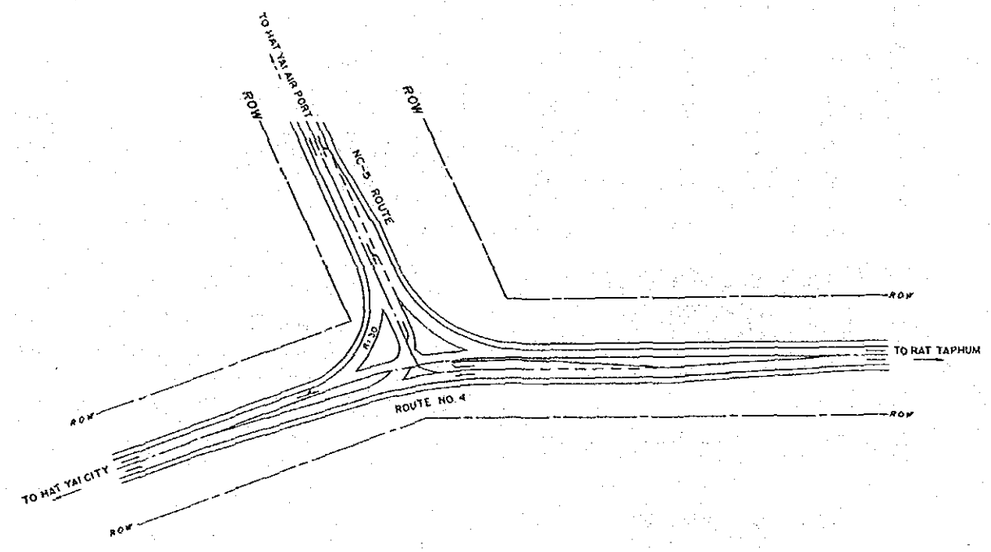


TERRAIN		FLAT
PAVEM'T	Type	AC PAVEMENT
	Existing Condition	—
FLOODING	Length(Km) Hight (m.)	—
RIGHT OF WAY (m.)	L.	25.00
	R.	25.00

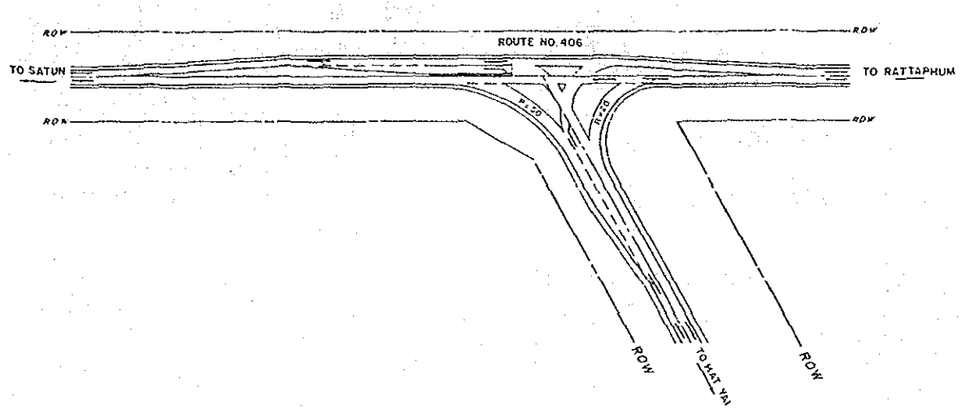


CURVATURE BAND	Existing Alignment	
	Proposed Alignment	R = ∞
STATION (Km.)		27+000 28+000 29+000

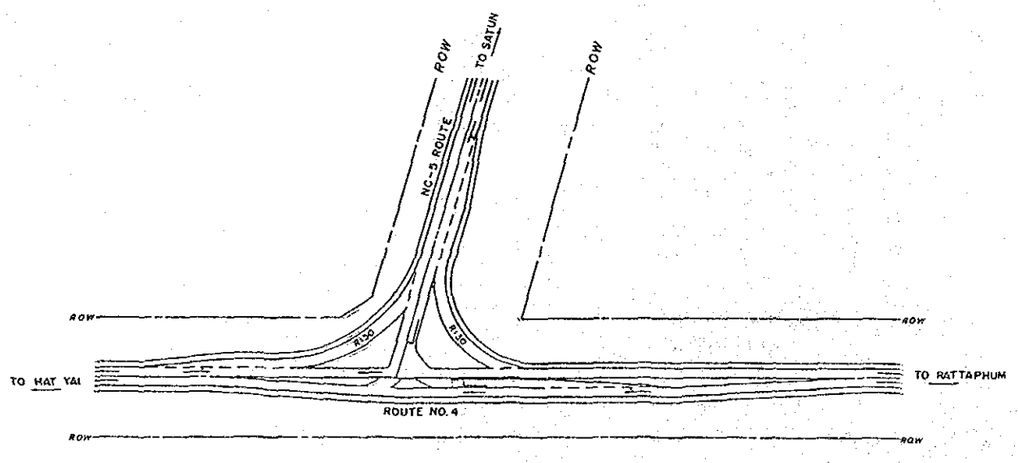
JICA RDSR STUDY	
NC-5 ROUTE HIGHWAY 4/406 SHORT CUT ROUTE	SHEET NO 5 OF 9
PLAN OF INTERSECTION	



Intersection with Rt.4
Scale 1:2000

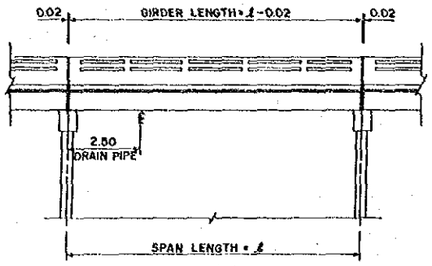


Intersection with Rt.406
Scale 1:2000

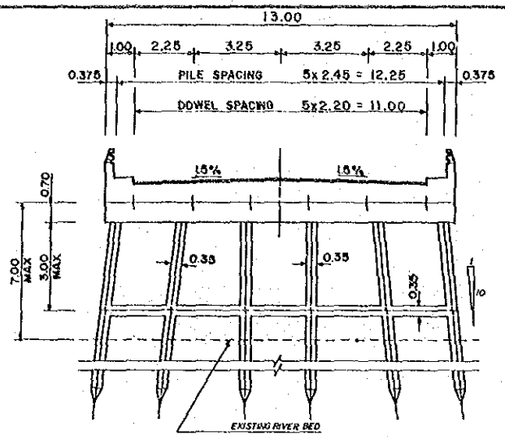


Intersection with Rt.4
Scale 1:2000

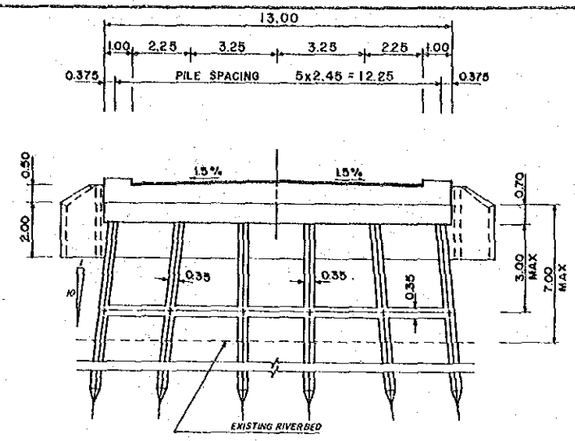
JICA RDSR STUDY.	
NC – 5 ROUTE HIGHWAY 4/406 SHORT CUT ROUTE	SHEET NO 6 OF 9
REINFORCED CONCRETE SLAB BRIDGE (A)	



SECTION A–A
SCALE 1:200

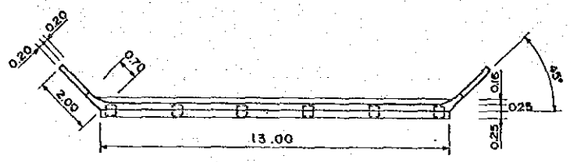


FOR 7.00–8.00 M. SPAN



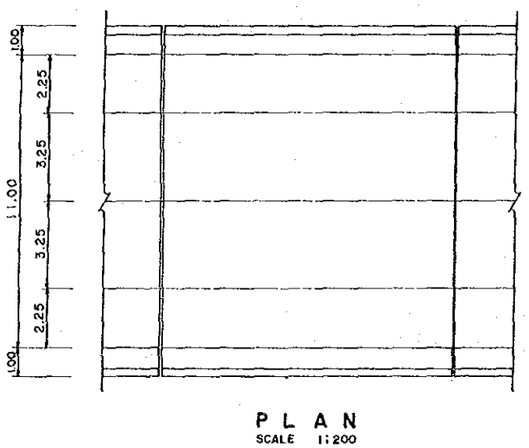
FOR 7.00–8.00 M. SPAN

ELEVATION
SCALE 1:200



FOR 7.00–8.00 M. SPAN

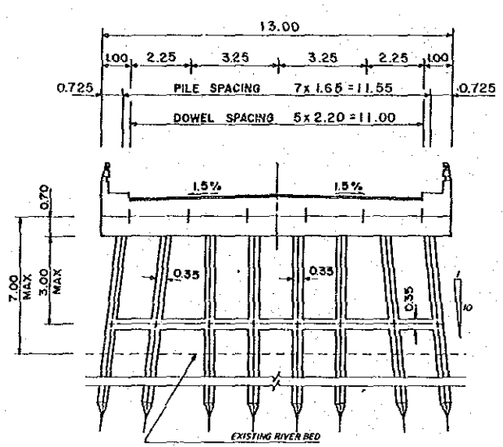
P L A N
SCALE 1:200



P L A N
SCALE 1:200

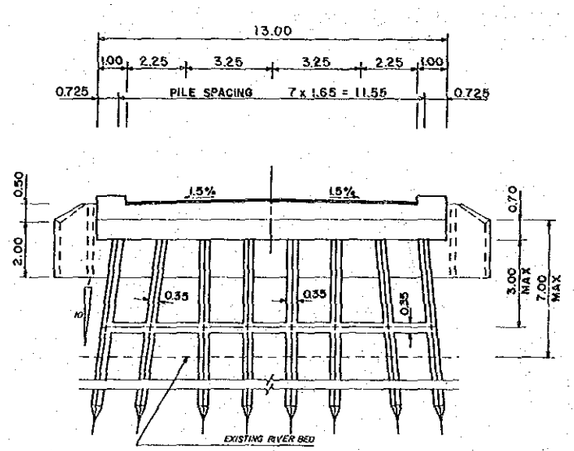
LIST OF BRIDGES

STATION	SPAN AND LENGTH (m)
6+180	5 x 10.00 = 50.00
13+690	1 x 10.00 = 10.00
15+000	3 x 10.00 = 30.00
21+950	1 x 10.00 = 10.00
22+790	1 x 10.00 = 10.00
23+850	1 x 10.00 = 10.00
24+750	1 x 10.00 = 10.00
25+870	1 x 10.00 = 10.00
26+450	1 x 10.00 = 10.00
28+180	3 x 10.00 = 30.00
29+200	1 x 10.00 = 10.00



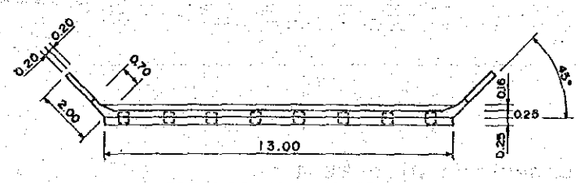
FOR 9.00–10.00 M. SPAN

PILE BENT LELVATION
SCALE 1:200



FOR 9.00–10.00 M. SPAN

ELEVATION
SCALE 1:200



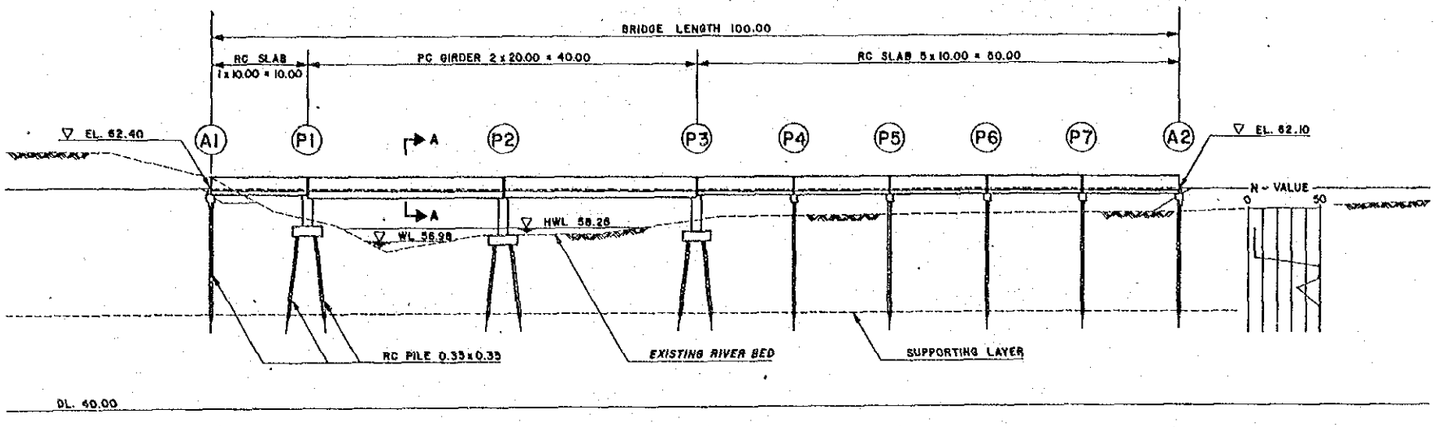
FOR 9.00–10.00 M. SPAN

P L A N
SCALE 1:200

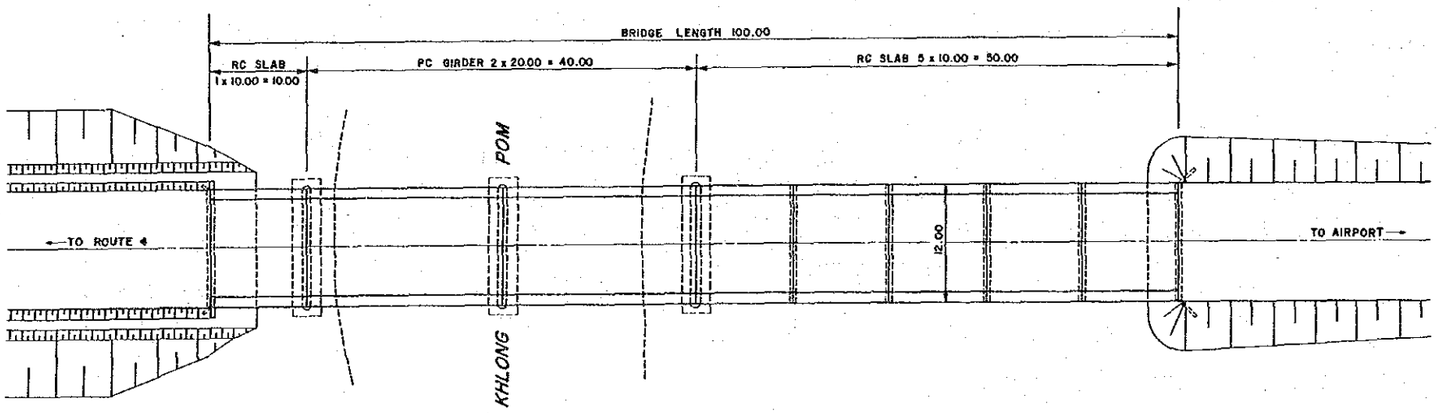
NOTES :

1. DESIGN STRESSES :
   a) CONCRETE , f_c = 70 KSC.
   b) STEEL , f_s = 1,400 KSC. (INTERMEDIATE GRADE)
   f_s = 1,200 KSC. (STRUCTURAL GRADE)
2. CONCRETE SHALL HAVE MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 210 KG/CM^2 FOR .15 X .15 X .15 CUBE AT 28 DAYS. AND APPROXIMATE MIX DESIGN PER CUBIC METER IS SUGGESTED AS FOLLOWS :
   PORTLAND CEMENT, MIN. . 350 KG.
   SAND 0.43 M^3
   CRUSHED ROCK OR GRAVEL 0.86 M^3
   CONCRETE SLUMP, MAX 10 CM.
3. CLEAR CONCRETE COVER FOR TOP REINFORCEMENT IN SLAB BRIDGE SHALL BE 3.5 CM. ELSEWHERE OF SLAB BRIDGE AND SIDEWALK SHALL BE 2.5 CM.
4. ALL CONCRETE EXPOSED CORNERS SHALL HAVE 2 CM. CHAMFER UNLESS OTHERWISE INDICATED.
5. REBARS #4 OR LARGER SHALL BE INTERMEDIATE GRADE DEFORMED BARS, OTHERS SHALL BE STRUCTURAL GRADE PLAIN BARS UNLESS OTHERWISE INDICATED.
6. LOCATIONS OF LAP SPLICE OF REBARS SHALL BE APPROVED BY THE ENGINEER.
7. LAP LENGTH SHALL NOT BE LESS THAN 40 DIAMETERS OF BIGGER BAR IN CASE OF PLAIN BARS AND 24 DIAMETERS OF BIGGER BAR FOR DEFORMED BARS.
8. IN CASE OF SALINE PROTECTION, HIGH SULPHATE RESISTANT PORTLAND CEMENT TYPE 5 CONFORMED TO AASHTO SPECIFICATIONS SHALL BE USED AND ADDITIONAL CONCRETE COVER OF 2.5 CM. FROM NORMAL CASE ALL AROUND SHALL BE PROVIDED WITHOUT ALTERING THE LOCATIONS OF REBARS.
9. ALL MATERIALS SHALL BE USED UNDER THE APPROVAL OF THE ENGINEER.
10. PAINTING SHALL BE PROVIDED ON ALL SURFACES AT BRIDGE ENDS WHICH EXPOSED TO TRAFFIC. WHITE AND BLACK COLOUR SHALL BE PAINTED ALTERNATELY. WHITE COLOUR SHALL BE LIGHT REFLECTED TYPE.
11. ALL DIMENSIONS SHOWN ARE IN METERS UNLESS OTHERWISE INDICATED.
12. BAR MARK S101 MAY BE TAKEN OUT ONE BAR ON EACH SIDE OF THE BRIDGE WHEREVER THEY PASS THROUGH DRAIN PIPES. IF THE LOCATIONS OF THESE BARS ARE NEAR V-DRIP SUCH THAT CONCRETE COVER IS NOT ADEQUATE, THEY SHALL BE PLACED ON TOP OF ST 101. OTHER BARS WHICH PASS THROUGH DRAIN PIPES SHALL BE BENT ALONG THE PIPES.
13. ALL PIERS WHICH DO NOT HAVE LOG PROTECTION WALLS SHALL BE HAUNCH UNDER THE TOP CROSS BRACING.
14. IF ANY NOTES ON THE DRAWINGS OF PIERS CONTRADICT THE NOTES ON THIS DRAWING, THEY WILL BE SUPERSEDED BY THESE NOTES.
15. THIS DRAWING IS ADAPTED FROM DOH DWG NO. 3 AD5-106-14/1A IN CASE OF ANY DISCREPANCY BETWEEN SUCH DRAWINGS ARISES, THE DOH. STANDARD DRAWING WILL PREVAIL UNDER THE APPROVAL OF THE ENGINEER.

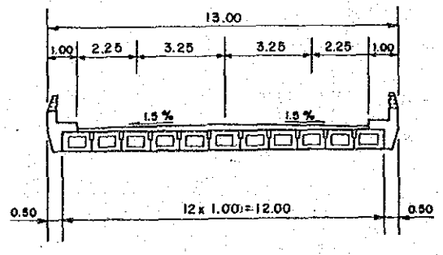
JICA RDSR STUDY	
NC – 5 ROUTE HIGHWAY 4/406 SHORT CUT ROUTE	SHEET NO. 7 OF 9
BRIDGE FOR KHLONG POM (B)	



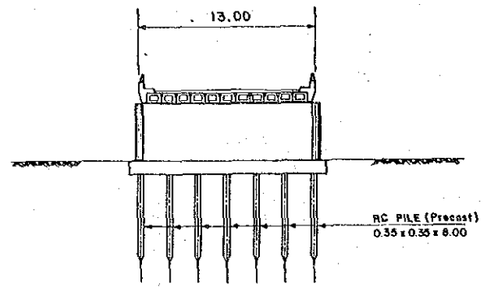
ELEVATION
SCALE 1:600



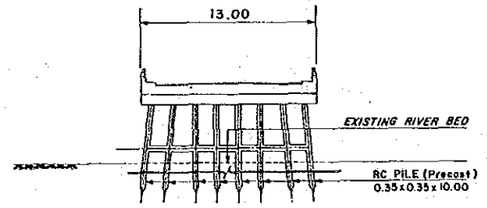
PLAN
SCALE 1:600



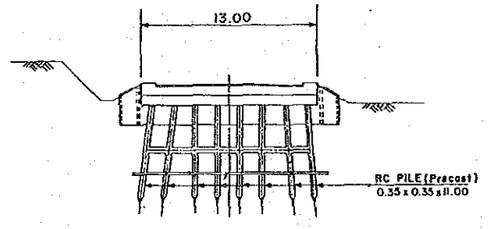
SECTION A-A
SCALE 1:200



P2



P4 P5 P6 P7

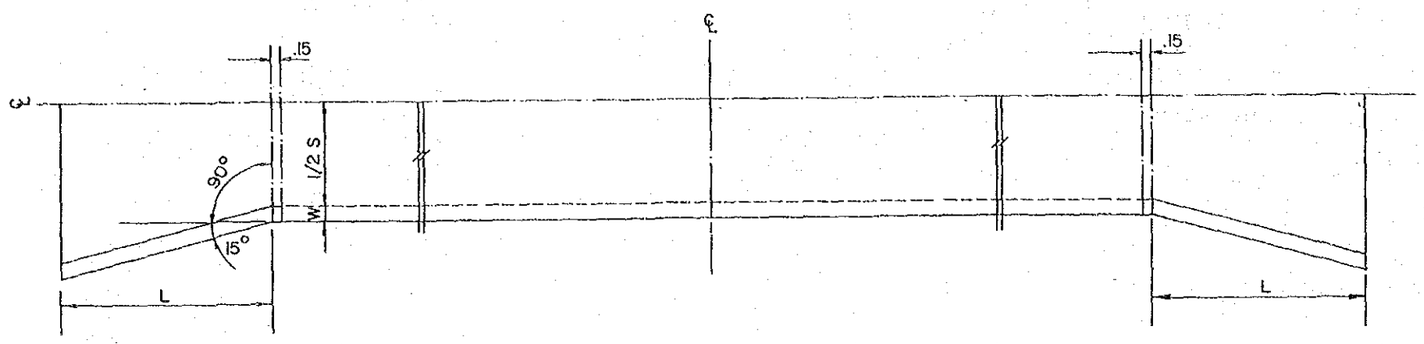


A1 A2

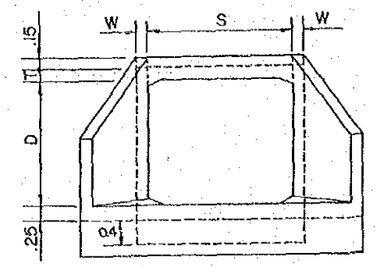
FRONT ELEVATION
SCALE 1:400

JICA RDSR STUDY	
NC – 5 ROUTE HIGHWAY 4/406 SHORT CUT ROUTE	SHEET NO. 8 OF 9
BOX CULVERT	

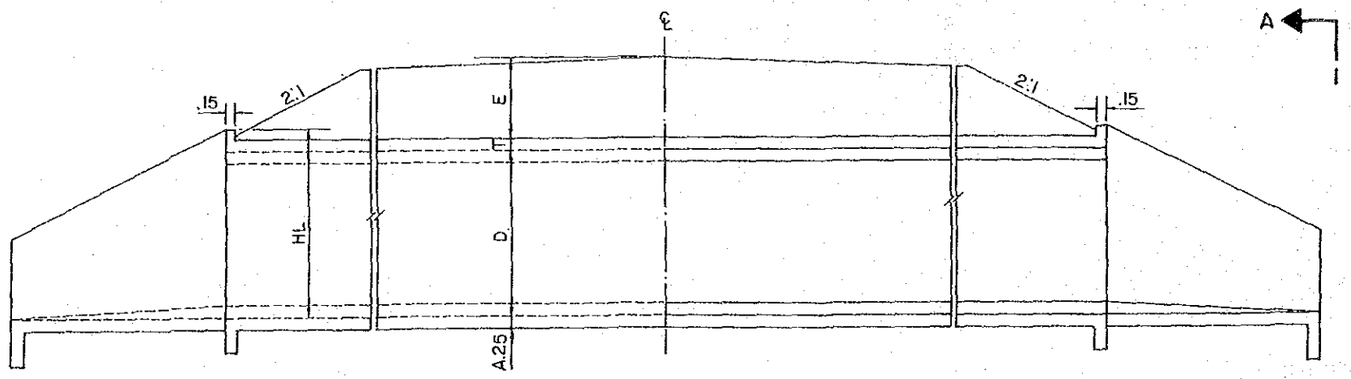
BOX CULVERT



HALF LONGITUDINAL PLAN

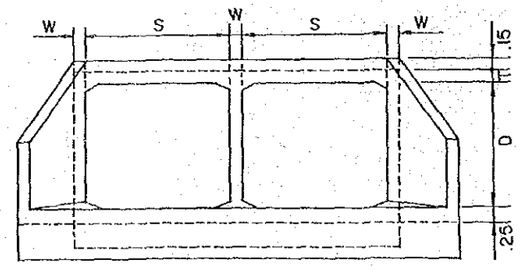


SINGLE TYPE



HALF LONGITUDINAL ELEVATION

HALF LONGITUDINAL SECTION

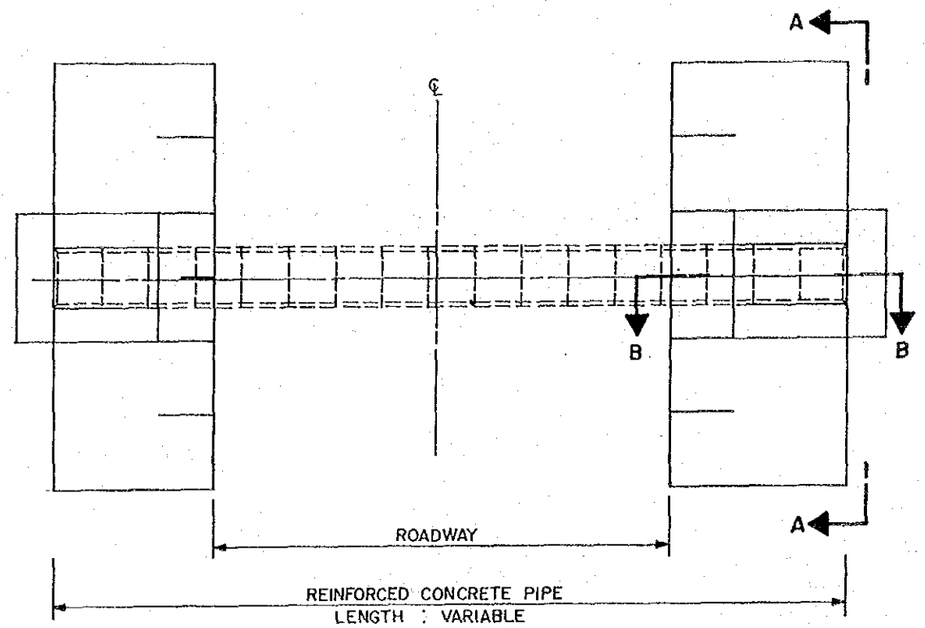


DOUBLE TYPE

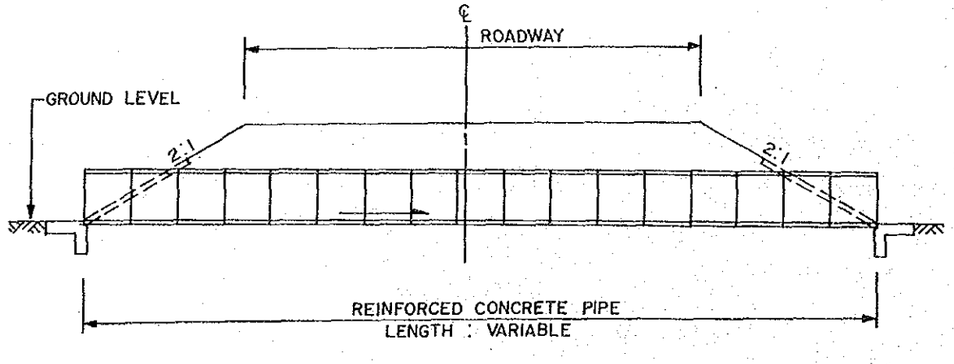
SECTION A–A

JICA RDSR STUDY	
NC – 5 ROUTE HIGHWAY 4/406 SHORT CUT ROUTE	SHEET NO. 9 OF 9
PIPE CULVERT	

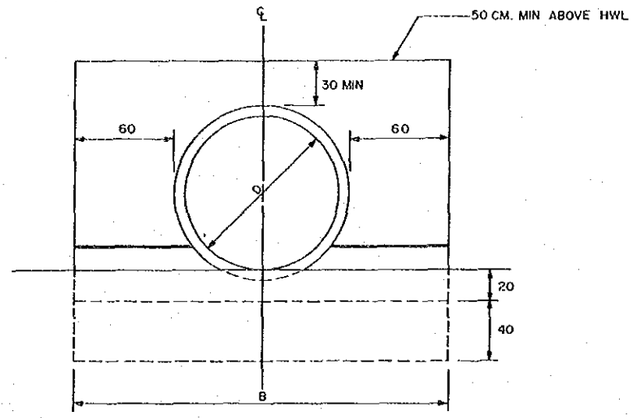
PIPE CULVERT



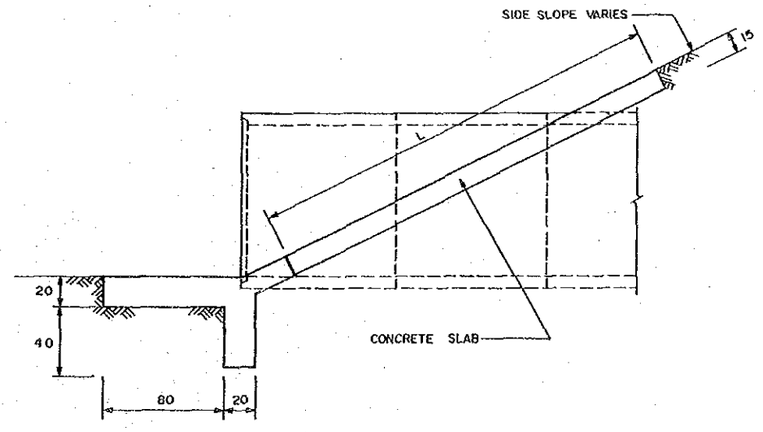
PLAN



PROFILE



SECTION A–A



SECTION B–B

List of Bridge

LIST OF BRIDGES (NC-5:S2)

Station	Materials	Structural System	Width (a+b+c+d+e:m)	Span and Length (m)	Remarks	(Fig.)
6+180	RC	SP.SL	0.3+0.7+11.0+0.7+0.3=12.0	5*10.0=50.0	New construction	(A)
13+690	RC	SP.SL	0.3+0.7+11.0+0.7+0.3=12.0 (0.2+0.3+4.0+0.3+0.2=5.0)	1*10.0=10.0 (1*7.0=7.0)	New construction Removal of existing bridge	(A)
15+000	RC	SP.SL	0.3+0.7+11.0+0.7+0.3=12.0 (0.2+0.3+3.5+0.3+0.2=4.5)	3*10.0=30.0 (1*7.0=7.0)	New construction Removal of existing bridge	(A)
19+290 Kh. Pom	PC/RC	SP.SL	0.3+0.7+11.0+0.7+0.3=12.0	1*10.0+2*20.0+5*10.0=100.0	New construction	(B)
21+950	RC	SP.SL	0.3+0.7+11.0+0.7+0.3=12.0	1*10.0=10.0	New construction	(A)
22+790	RC	SP.SL	0.3+0.7+11.0+0.7+0.3=12.0	1*10.0=10.0	New construction	(A)
23+850	RC	SP.SL	0.3+0.7+11.0+0.7+0.3=12.0	1*10.0=10.0	New construction	(A)
24+750	RC	SP.SL	0.3+0.7+11.0+0.7+0.3=12.0	1*10.0=10.0	New construction	(A)
25+870	RC	SP.SL	0.3+0.7+11.0+0.7+0.3=12.0	1*10.0=10.0	New construction	(A)
26+450	RC	SP.SL	0.3+0.7+11.0+0.7+0.3=12.0	1*10.0=10.0	New construction	(A)
28+180	RC	SP.SL	0.3+0.7+11.0+0.7+0.3=12.0	3*10.0=30.0	New construction	(A)
29+200	RC	SP.SL	0.3+0.7+11.0+0.7+0.3=12.0	1*10.0=10.0	New construction	(A)

Note: (1) Materials
RC: Reinforced Concrete Bridge
PC: Prestressed Concrete Bridge
(2) Structural System
SP.SL: Simply Supported Slab
(3) Width and length in parentheses on
lower column shows the existing conditions.

List of Culvert

LIST OF BOX AND PIPE CULVERT

STATION	CULVERT TYPE	CULVERT SIZE (m)		NO. of LOCATIONS	CULVERT LENGTH (m)		
		PIPE	BOX				
		NO. of ROW x DIAMETER	NO. of CELLS (CLEAR SPAN x DEPTH)		EXISTING	EXTENDED CONST-RUCTION	NEW CONST-RUCTION
0+000-3+550	Pipe	1x⊙1.20		17			23.0
3+800	Box		1(1.80x1.80)	1			17.0
3+550-4+000	Pipe	1x⊙1.00		2			25.0
4+300	Box		1(1.80x1.80)	1			14.0
4+000-4+800	Pipe	1x⊙1.00		3			19.0
5+100	Box		1(1.80x1.80)	1			22.0
4+800-5+550	Pipe	1x⊙1.00		1			27.0
	Pipe	1x⊙0.80		1			27.0
5+900	Box		1(2.40x2.40)	1			23.0
5+550-6+100	Pipe	1x⊙0.80		1			23.0
	Pipe	1x⊙0.60		1			23.0
6+100-6+800	Pipe	1x⊙0.80		4			19.0
12+250-14+250	Pipe	1x⊙0.60		7			16.0
12+850	Pipe	1x⊙0.80		1	8.0	4.0	
13+200	Pipe	2x⊙0.70		1	7.0	4.0	
13+550	Pipe	2x⊙0.70		1	7.0	4.0	
14+250-16+550	Pipe	1x⊙0.60		10			21.0
16+550-17+550	Pipe	1x⊙1.50		2			31.0
	Pipe	1x⊙1.20		1			31.0
16+750	Box		2(2.40x2.40)	1			22.0
17+050	Box		2(1.80x1.80)	1			36.0
17+550-17+850	Pipe	1x⊙1.50		2			31.0
17+850-18+150	Pipe	1x⊙1.00		2			12.0
18+150-19+250	Pipe	1x⊙0.60		5			31.0
18+620	Box		1(1.80x1.80)	1			32.0
18+950	Box		2(2.40x2.40)	1			29.0
19+250-19+550	Pipe	1x⊙0.60		2			21.0
19+550-20+450	Pipe	1x⊙1.00		1			23.0
	Pipe	1x⊙0.80		3			23.0
19+950	Box		1(1.80x1.80)	1			15.0
20+450-20+750	Pipe	1x⊙1.00		1			19.0
20+680	Box		1(2.10x2.10)	1			15.0
20+750-21+050	Pipe	1x⊙1.00		1			16.0
20+780	Box		1(2.10x2.10)	1			15.0
21+050-22+150	Pipe	1x⊙0.60		6			23.0
22+150-23+150	Pipe	1x⊙0.60		5			23.0
23+150-23+450	Pipe	1x⊙0.60		1			17.0
23+350	Box		1(1.80x1.80)	1			14.0
23+450-24+450	Pipe	1x⊙0.60		5			19.0
24+450-25+250	Pipe	1x⊙0.60		4			17.0
25+250-25+750	Pipe	1x⊙0.60		4			19.0
25+600	Box		1(1.80x1.80)	1			17.0
25+750-26+200	Pipe	1x⊙0.60		3			15.0
26+200-27+150	Pipe	1x⊙0.60		5			15.0
27+150-28+850	Pipe	1x⊙0.80		4			19.0
	Pipe	1x⊙0.60		5			19.0
28+850-29+650	Pipe	1x⊙0.60		4			19.0