

MALAYSIA
FEASIBILITY STUDY
ON
THE TATAU-KAPIT TRUNK ROAD PROJECT
IN SARAWAK

REFERENCE DATA

THIS REPORT IS A SUMMARY OF THE INFORMATION RECEIVED ALONG THE ROUTE FOR THE TATAU-KAPIT TRUNK ROAD PROJECT ALONG THE TATAU-KAPIT TRUNK ROAD PROJECT

JULY 1965

INTERNATIONAL DEVELOPMENT BANK

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MALAYSIA

FEASIBILITY STUDY

ON

THE TATAU-KAPIT TRUNK ROAD PROJECT

IN SARAWAK

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REFERENCE DATA

(PRELIMINARY ALIGNMENT STUDY ON THE ALTERNATIVE ROUTE ACCOUNTING FOR
THE HYDROELECTRIC PROJECT ALONG THE SUNGAI ANAP)

AUGUST 1985

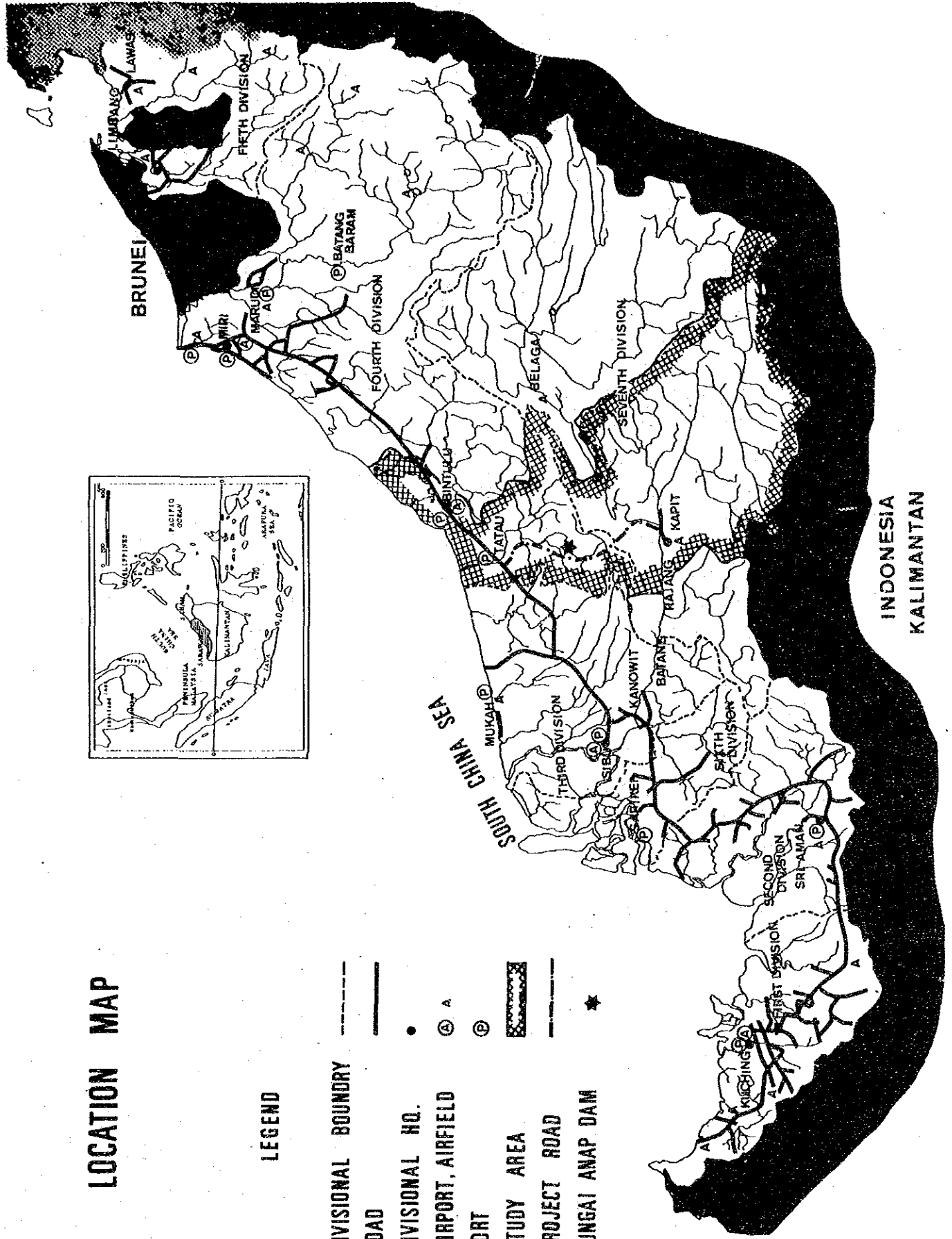
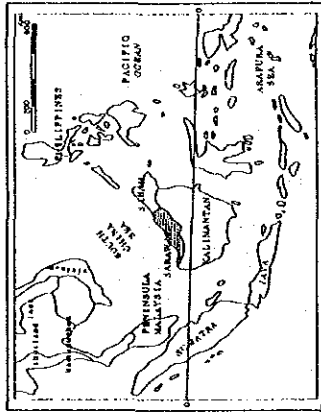
JAPAN INTERNATIONAL COOPERATION AGENCY

国際協力事業団	
受入 月日 '86. 9. 24	113
登録No. 15427	61.4
	SDS

LOCATION MAP

LEGEND

- DIVISIONAL BOUNDARY
- ROAD
- DIVISIONAL HQ.
- AIRPORT, AIRFIELD
- PORT
- STUDY AREA
- PROJECT ROAD
- SUNGAI ANAP DAM



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1. Introduction

It took four years to complete the feasibility study on the Tatau-Kapit Trunk Road Project, involving a two year pause for aerial photography due to continuously unfavorable weather in the Project Area. During the four years, project circumstances have changed slightly.

The Study Team was informed of the new dam construction project close to Sangkap along the Sungai Anap, in February, 1985. However, it was very difficult to involve, in the Final Report, the alternative route study taking into account the new dam construction project, in view of the feasibility study schedule and insufficient information on the dam project. Apart from the formal Final Report, a preliminary alignment study report is submitted herewith as reference data.

2. Technical Investigation on the Alternative Route

2-1 Conditions for Route Location

The following three conditions were taken into account for the alternative route location:

1) Topographical map

The route shall be selected on the basis of a 1:10,000 scale map. (In this connection, no new mapping work has been conducted.)

2) The highest appropriate water level is considered to be 80m. It is assumed the dam will be completed with special consideration given to the submerged area upstream from the confluence between the Sungai Ulu Anap and the Sungai Takan. The submerged area has been studied using the 1:50,000 scale topographical map.

3) The dam project site shall be the point selected by the Study Team in such a way that it may allow the route to be located along the extension in the 1:10,000 scale map.

The prime candidate for the site of the dam project has tentatively been revealed as a spot slightly upstream from the confluence between the Sungai Anap and the Sungai Malat.

2-2 Technical Considerations

The location map shows the alternative route, while Table 1 is a comparison between the original route and the alternative route. Although the alternative route is 1.9 km shorter than the original route in total length, the alternative route requires increased construction works for bridges, a revetment and a retaining wall.

3. Estimation of Construction Costs

Tables 2 and 3 show a breakdown of construction costs not only for the whole construction section, but also for construction sections 4 and 5 which are influenced by the dam construction project.

These tables indicate that while the cost of earth work is similar to the original plan as a whole, bridge construction costs increase remarkably.

In Section 4, total construction costs increase approximately 30% compared to the original plan due to an increase in revetment construction costs.

4. Economic Evaluation

4-1 Project Cost Allocation by Year

Table 3 summarizes the project cost allocation by year for the economic evaluation.

4-2 Benefits

Values in the Final Report are applied to evaluate benefits.

4-3 Results of Economic Evaluation

Table 4 and Table 5 respectively show the benefit cost ratio (B/C) and the net present value (NPV) of the alternative route construction plans using discount rates of 8% and 10%. Table 6 shows the IRR which has been reduced 0.3% - 0.84% below the level of the Final Report due to the increase in project costs.

However, the construction of the Project Road Section, Ulu Mukah - Bintulu Road - Sangkap is indispensable for the development of the Sungai Anap Hydroelectric Dam. If the construction cost savings of the road section are included in the benefits, they will contribute to a remarkable improvement in the outcome of the economic evaluation.

Although in Japan a number of feasibility studies have been performed with respect to potential hydroelectric resources, it should be noted that feasibility studies don't always result in the realization of dam projects.

Consequently, social capital around the study area, e.g. roads etc. have been constructed as follows.

In the case when the hydroelectric project has not yet been authorized, the road will normally be constructed independent of the dam project.

On the other hand, in the case when the hydroelectric dam project has materialized, resulting in the submergence of the existing roads, the relocation of the social capital, road realignment work, etc. will be carried out as a part of the dam project at the expense of the promoter of dam construction.

Table 1 COMPARISON BETWEEN THE ROUTE IN THE ORIGINAL PLAN AND THE ALTERNATIVE ROUTE

Item	Original Route Plan	Alternative Route Plan Resulting from the New Dam Construction
(1) Starting point	STA 55,800 m	STA 55,800 m
(2) End point	STA 94,000 m	STA 92,100 m
(3) Length	38.200 km	36.300 km
(4) Route passing area	The route passed along the river	The route is placed on the hill-side so that it is elevated more than 80 m over the dam plan's maximum water level.
(5) Alignment at bridge site	Stringent longitudinal alignment for economizing the bridge sub-structure	Moderate alignment to protect the bridge from being submerged. Short span PC structures with high piers are adopted.
(6)		To protect the road-bed from being submerged after the dam construction, the part which is anticipated to be submerged shall be protected by placing non-cutoff and other protective means on permeable sheets.

Table 2 SUMMARY OF CONSTRUCTION COSTS (1)

Unit: M\$'000

Section		Item	Gravel				Bituminous Surfacing			
			FC	LC	TAX	TOTAL	FC	LC	TAX	TOTAL
1 (0 ~ 21.0 km)	Tatau									
	General	927	827	13	1.767	927	827	13	1,767	
	Earthwork	7.596	4.460	188	12.244	7.596	4.460	188	12.244	
	Pavement	1.730	951	243	2.924	3.888	1.625	481	5.994	
	Bridge	1.022	890	149	2.061	1.022	890	149	2.061	
	Drainage	568	195	67	830	568	195	67	830	
	Miscellaneous	386	361	0	747	386	361	0	747	
	Sub-Total(Direct Cost)	12.229	7.684	660	20.573	14.387	8.358	898	23.643	
	Others	6.435	4.044	346	10.825	7.571	4.399	472	12.442	
	Compensation	0	100	0	100	0	100	0	100	
Total Project Amount		18.664	11.828	1.006	31.498	21.958	12.857	1.370	36.185	
Cost per Km									1.407	
2 (21.0 ~ 40.5km)	Sangan									
	General	861	768	12	1.641	861	768	12	1.641	
	Earthwork	8.951	5.201	275	14.427	8.951	5.201	275	14.427	
	Pavement	1.609	884	226	2.719	3.613	1.511	447	5.571	
	Bridge	915	756	131	1.802	915	756	131	1.802	
	Drainage	565	264	68	897	565	264	68	897	
	Miscellaneous	360	336	0	696	360	336	0	696	
	Sub-Total(Direct Cost)	13.261	8.209	712	22.182	15.265	8.836	933	25.034	
	Others	6.979	4.319	374	11.672	8.033	4.650	490	13.173	
	Compensation	0	100	0	100	0	100	0	100	
Total Project Amount		20.240	12.628	1.086	33.954	23.298	13.586	1.423	38.307	
Cost per Km									1.605	
3 (40.5 ~ 53.0km)	Muput									
	General	552	492	8	1.052	552	492	8	1.052	
	Earthwork	5.725	3.308	194	9.227	5.725	3.308	194	9.227	
	Pavement	1.010	555	143	1.708	2.286	594	284	3.524	
	Bridge	415	358	61	834	415	358	61	834	
	Drainage	359	186	42	587	359	186	42	587	
	Miscellaneous	231	216	0	447	231	216	0	447	
	Sub-Total(Direct Cost)	8.292	5.115	448	13.855	9.568	5.514	589	15.671	
	Others	4.363	2.692	236	7.291	5.035	2.902	310	8.247	
	Compensation	0	100	0	100	0	100	0	100	
Total Project Amount		12.655	7.907	684	21.246	14.603	8.516	899	24.018	
Cost per Km									1.567	
4 ~ 87.200 ²⁾ (53.0 ~ 88.550 km)	Sangkap									
	General	1.570	1.399	22	2.991	1.570	1.399	22	2.991	
	Earthwork	29.601 (29.803)	17.257 (17.376)	846 (851)	47.704 (48.030)	29.601 (29.803)	17.257 (17.376)	846 (851)	47.704 (48.030)	
	Pavement	2.873	1.577	407	4.857	6.503	2.713	807	10.023	
	Bridge	1.843 (12.367)	1.442 (9.677)	259 (1.738)	3.544 (23.782) ¹⁾	1.843 (12.367)	1.442 (9.677)	259 (1.738)	3.544 (23.782) ¹⁾	
	Drainage	1.867	735	222	2.824	1.867	735	222	2.824	
	Miscellaneous	668	615	0	1.283	668	615	0	1.283	
	Sub-Total(Direct Cost)	38.422 (49.148)	23.025 (31.379)	1.756 (3.240)	63.203 (83.767)	42.502 (52.778)	24.161 (32.515)	2.156 (3.640)	68.369 (88.933)	
	Others	20.220 (26.798)	12.116 (16.058)	924 (1.225)	33.260 (44.081)	22.129 (28.785)	12.714 (16.538)	1.135 (1.476)	35.978 (46.799)	
	Compensation	0	300	0	300	0	300	0	300	
Total Project Amount		58.642 (75.946)	35.441 (47.737)	2.680 (4.465)	96.763 (128.148)	64.181 (81.563)	37.175 (49.353)	3.291 (5.116)	104.647 (136.032)	
Cost per Km									2.404 (3.250) ³⁾	
S. Ulu Anap										

Table 2 SUMMARY OF CONSTRUCTION COSTS (2)

Unit: M\$'000

Section	Item	Gravel				Bituminous Surfacing			
		FC	LC	TAX	TOTAL	FC	LC	TAX	TOTAL
S. Ulu Anap 5 2)87.200 ~ (88.550 ~ 104.200 km)	General	691	616	10	1.317	691	616	10	1.317
	Earthwork	6.347 (6.826)	3.724 (4.005)	158 (170)	10.229 (11.001)	6.347 (6.826)	3.724 (4.005)	158 (170)	10.229 (11.001)
	Pavement	1.265	694	179	2.138	2.862	1.195	355	4.412
	Bridge	524 (892)	508 (864)	80 (136)	1.112 (1.892)	524 (892)	508 (864)	80 (136)	1.112 (1.892)
	Drainage	477	244	58	779	477	244	58	779
	Miscellaneous	283	268	0	551	283	268	0	551
	Sub-Total(Direct Cost)	9.587 (10.434)	6.054 (6.691)	485 (553)	16.126 (17.678)	11.184 (12.031)	6.555 (7.192)	661 (729)	18.400 (19.952)
	Others	5.045 (5.530)	3.185 (3.491)	255 (280)	8.485 (9.301)	5.886 (6.382)	3.450 (3.741)	347 (376)	9.683 (10.499)
	Compensation	0	100	0	100	0	100	0	100
	Total Project Amount	14.632 (15.964)	9.339 (10.282)	740 (833)	24.711 (27.079)	17.070 (18.413)	10.105 (11.033)	1,008 (1.105)	28.183 (30.551)
									Cost per Km 1.470 (1.652) ³⁾
Pelagus 6 (104.200 ~ 136.600 km)	General	1.431	1.275	20	2.726	1.431	1.275	20	2.726
	Earthwork	16.478	9.675	408	26.561	16.478	9.675	408	26.561
	Pavement	2.618	1.437	371	4.426	5.926	2.473	736	9.135
	Bridge	1.217	1.167	186	2.570	1.217	1.167	186	2.570
	Drainage	1.887	834	226	2.947	1.887	837	226	2.947
	Miscellaneous	591	557	0	1.148	591	557	0	1.148
	Sub-Total(Direct Cost)	24.222	14.945	1,211	40.378	27.530	15.981	1,576	45.087
	Others	12.746	7.865	638	21.249	14.488	8.410	829	23.727
	Compensation	0	250	0	250	0	250	0	250
	Total Project Amount	36.968	23.060	1,849	61.877	42.018	24.641	2,405	69.064
									Cost per Km 1.739
Right side of the Barang Rajang 7 (136.600 ~ 138.800 km)	General	97	87	1	185	97	87	1	185
	Earthwork	1.593	933	41	2.567	1.593	933	41	2.567
	Pavement	178	97	25	300	403	168	50	621
	Bridge	4.476	1,706	445	6.627	4.476	1.706	445	6.627
	Drainage	57	9	7	73	57	9	7	73
	Miscellaneous	51	41	0	92	51	41	0	92
	Sub-Total(Direct Cost)	6.452	2.873	519	9.844	6.677	2.944	544	10.165
	Others	3.395	1.512	273	5.180	3.512	1,550	286	5.348
	Compensation	0	50	0	50	0	50	0	50
	Total Project Amount	9.847	4.435	792	15.074	10.189	4.544	830	15.563
									Cost per Km 5.776
Lepong Balleh Road 8 (Repong Balleh Road) L = 5.0 km	Pavement	257	139	37	433	363	167	50	580
	Bridge	259	193	36	488	259	193	36	488
	Sub-Total(Direct Cost)	516	332	73	921	622	360	86	1.068
	Others	272	175	38	485	327	190	45	562
	Total Project Amount	788	507	111	1.406	949	550	131	1.630

Table 2 SUMMARY OF CONSTRUCTION COSTS (3)

Unit: N\$'000

Section	Item	Gravel				Bituminous Surfacing			
		FC	LC	TAX	TOTAL	FC	LC	TAX	TOTAL
	General	6.130	5.465	85	11.680	6.130	5.465	85	11.680
	Earthwork	76.290 (76.971)	44.559 (44.957)	2.110 (2.129)	122.959 (124.057)	76.290 (76.971)	44.559 (44.957)	2.110 (2.129)	122.959 (124.057)
	Pavement	11.540	6.334	1.630	19.504	25.845	10.805	3.210	39.860
	Bridge	10.671 (22.451)	7.020 (14.769)	1.349 (2.838)	19.040 (40.058) ¹⁾	10.671 (22.451)	7.020 (14.769)	1.349 (2.838)	19.040 (40.058) ¹⁾
	Drainage	5.779	2.467	691	8.937	5.779	2.467	691	8.937
	Miscellaneous	2.569	2.393	0	4.962	2.569	2.393	0	4.962
TOTAL:	Sub-Total(Direct Cost)	112.979 (125.440)	68.238 (76.385)	5.865 (7.373)	187.082 (209.198)	127.284 (139.745)	72.709 (80.856)	7.445 (8.953)	207.438 (229.554)
L=136.9 km	Others	59.456 (66.484)	35.909 (40.154)	3.087 (3.452)	98.452 (110.090)	66.983 (74.125)	38.262 (42.342)	3.917 (4.335)	109.162 (120.802)
	Compensation	0	1.000	0	1.000	0	1.000	0	1.000
	Total Project Cost	172.435 (191.924)	105.147 (117.539)	8.952 (10.825)	286.534 (320.288)	194.267 (213.870)	111.971 (124.198)	11.362 (13.288)	317.600 (351.356)
								Cost per Km	1.868 (2.096) ³⁾

Note: (): COST OF ALTERNATIVE ROUTE

1) : BRIDGES COST WITH BLOCK MASONARY & WALL COSTS

2) : FIGURE OF ALTERNATIVE ROUTE

3) : COST PER KM FOR ALTERNATIVE ROUTE

FC : FOREIGN COMPONENT

LC : LOCAL COMPONENT

Table 3 SUMMARY OF PROJECT COSTS

Unit: M\$'000

Year	Case A-1	Case A-2	Case B	Case C
1987	5,713(7,100)	6,144(6,500)	3,887	1,346
1988	12,400(12,838)	11,290(11,758)	5,776	2,870
1989	65,231(65,364)	74,654(65,110)	30,241	14,610
1990	80,395(83,808)	97,723(83,554)	36,480	16,390
1991	97,699(108,560)	97,723(98,934)	54,669	26,038
1992	35,979(46,064)	1,227(36,438)	27,379(34,079)	13,768
1993	833	1,227	35,441(42,521)	20,852
1994	833	1,227	37,967(45,552)	25,695
1995	833	1,227	50,271(60,271)	38,333(38,445)
1996	833	1,227	16,881(20,254)	20,829(22,442)
1997	833	1,227	833	30,539(31,389)
1998	4,087	1,227	2,594	33,633(44,160)
1999	833	1,227	532	42,573(53,101)
2000	833	1,227	532	13,913(23,937)
2001	833	1,227	532	671
2002	833	1,227	2,026	1,775
2003	4,087	1,227	278	482
2004	833	1,227	2,340	1,594
2005	833	1,227	278	1,702
2006	833	1,227	278	278
2007	833	1,227	278	278
2008	20,191	1,227	11,051	6,088
2009	278	1,227	9,418	7,035
2010	278	1,227	278	7,624
2011	278	1,227	278	278
2012	-24,667(-26,851)	-11,657(-12,255)	-38,625(-42,976)	-73,614(-78,492)
Total:	313,048 (339,095)	299,417 (313,950)	292,392 (321,780)	255,580 (284,356)

Note: (): Figures of Alternative Route

Table 4 PRESENT VALUE OF COST BENEFIT FOR
ALTERNATIVE PLANS (DISCOUNT RATE OF 8%)

Unit: M\$'000

Alter- native Case	Cost	Benefit				B/C Ratio	NPV (B-C)
		Diverted	Develop- ment	Induced	Total		
A-1	260,131	123,988	3,610	28,364	155,962	0.60	-114,169
A-2	243,284	113,879	3,158	28,364	145,401	0.60	-97,883
B	224,619	123,988	3,345	22,617	149,950	0.67	-74,669
C	175,841	114,540	2,888	126,666	134,094	0.76	-41,747

Table 5 PRESENT VALUE OF COST BENEFIT FOR
ALTERNATIVE PLANS (DISCOUNT RATE OF 10%)

Unit: M\$'000

Alter- native Case	Cost	Benefit				B/C Ratio	NPV (B-C)
		Diverted	Develop- ment	Induced	Total		
A-1	244,630	94,659	2,717	21,701	119,076	0.49	-125,554
A-2	229,215	86,944	2,377	21,701	111,023	0.48	-118,192
B	210,204	94,659	2,491	16,772	113,921	0.54	-96,283
C	155,255	86,419	2,119	11,993	100,530	0.65	-54,725

Table 6 INTERNAL RATE OF RETURN FOR ALTERNATIVE PLANS

Alternative Plan	I.R.R (%)
A-1	3.59
A-2	3.60
B	4.36
C	5.00

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NAL COOPERATION AGENCY

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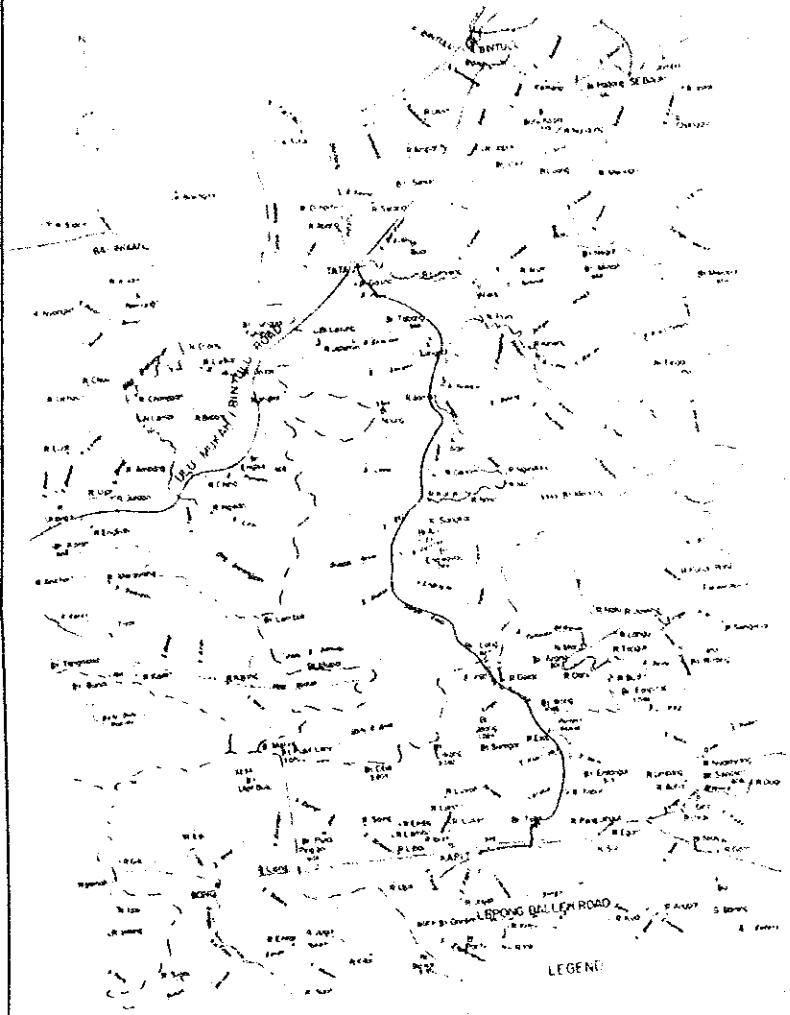
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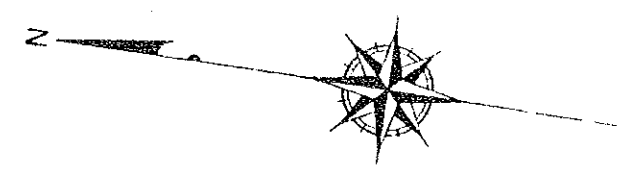
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THE ALTERNATIVE ROUTE..... 4.

KEY PLAN



MAP



SECTION 1

SECTION 2

PROJECT ROAD

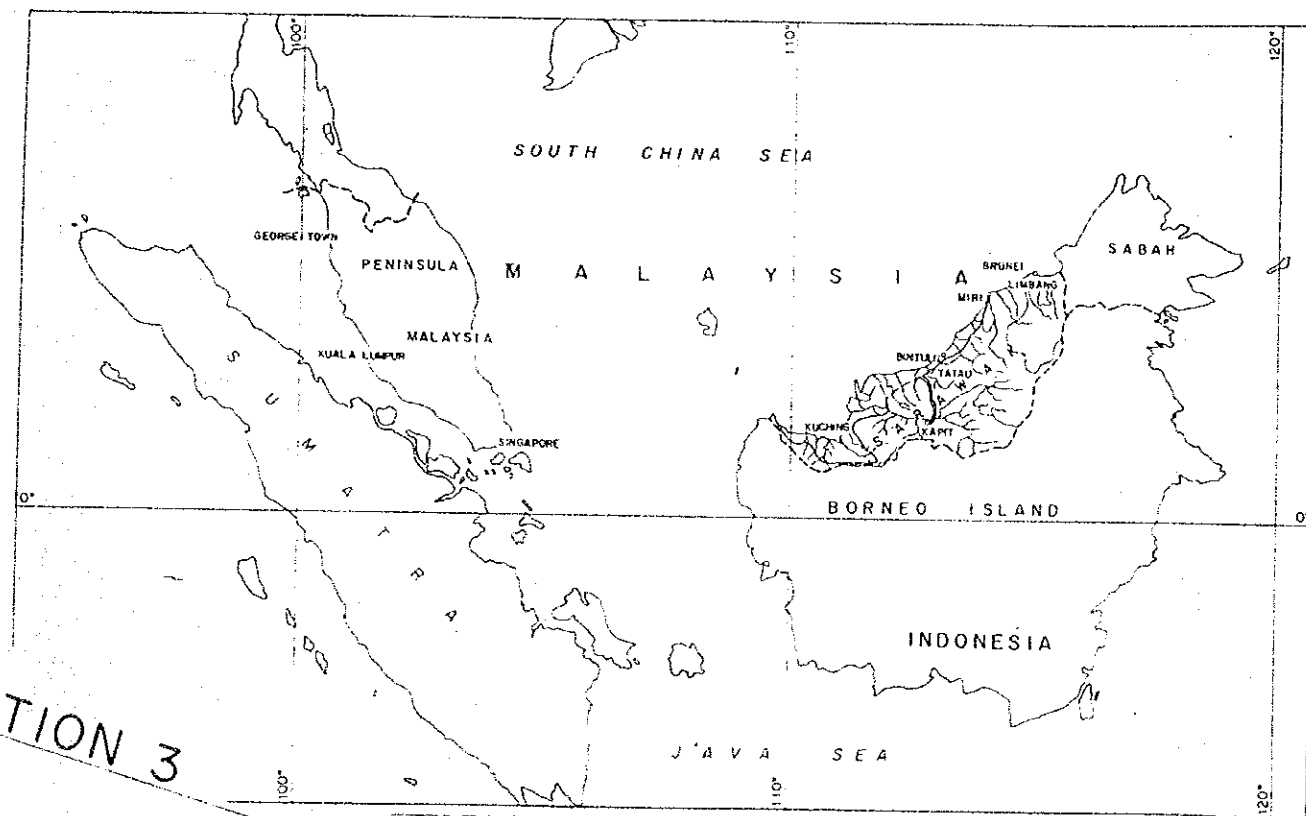
21,000

40,500

MAP OF THE PROJECT ROAD

SCALE, 1 : 100,000

MAP OF MALAYSIA



SECTION 2

SECTION 3

SECTION 4

SECTION 5

ALTERNATIVE ROUTE

40,500

53,000

88,500

104,200

TATAU - KAPIT TRUNK ROAD PROJECT IN SARAWAK

SHEET No.

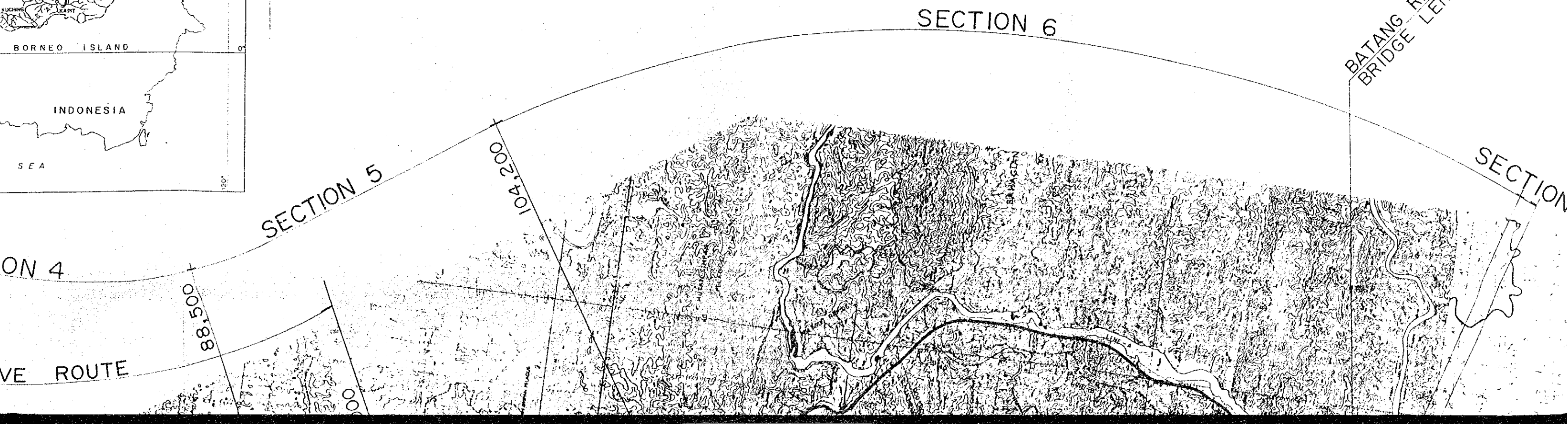
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MAP OF THE PROJECT ROAD.

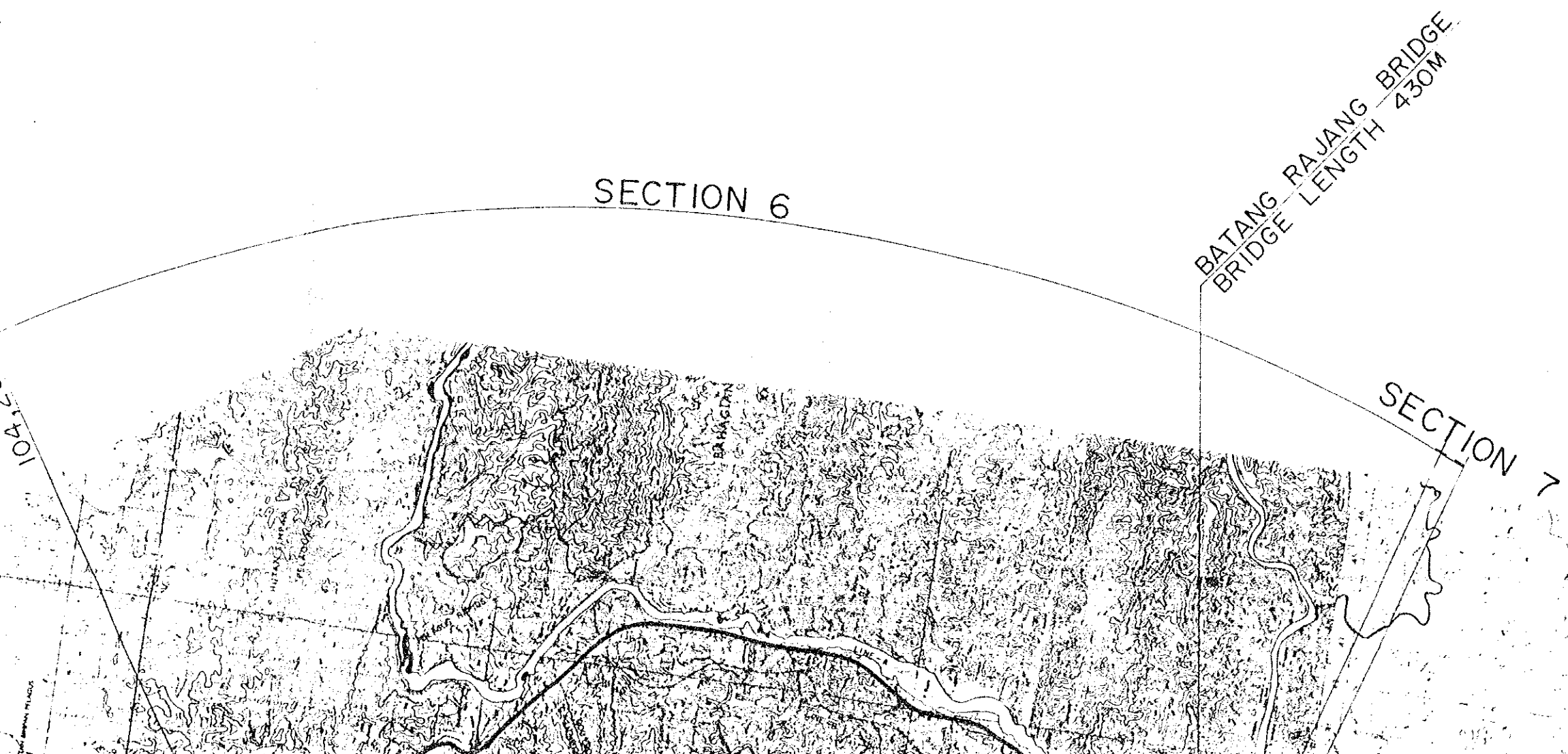
PROJECT ROAD

SCALE, 1 : 100,000

SIA



TATAU - KAPIT TRUNK ROAD PROJECT IN SARAWAK	SHEET No.	TOTAL SHEET
	1	9
MAP OF THE PROJECT ROAD.		Scale 100,000



SECTION 1

40,500

BEGINNING OF PROJECT ROAD





SECTION 3

INDONESIA

JAVA SEA

104200

SECTION 5

SECTION 4

ALTERNATIVE ROUTE

40,500

53,000

55,600

88,500

90,000

BAHAGIAN KETUPAT

BAHAGIAN KETUPAT

BAHAGIAN KETUPAT

SECTION 4

SECTION 5

ALTERNATIVE ROUTE

88,500

64,000

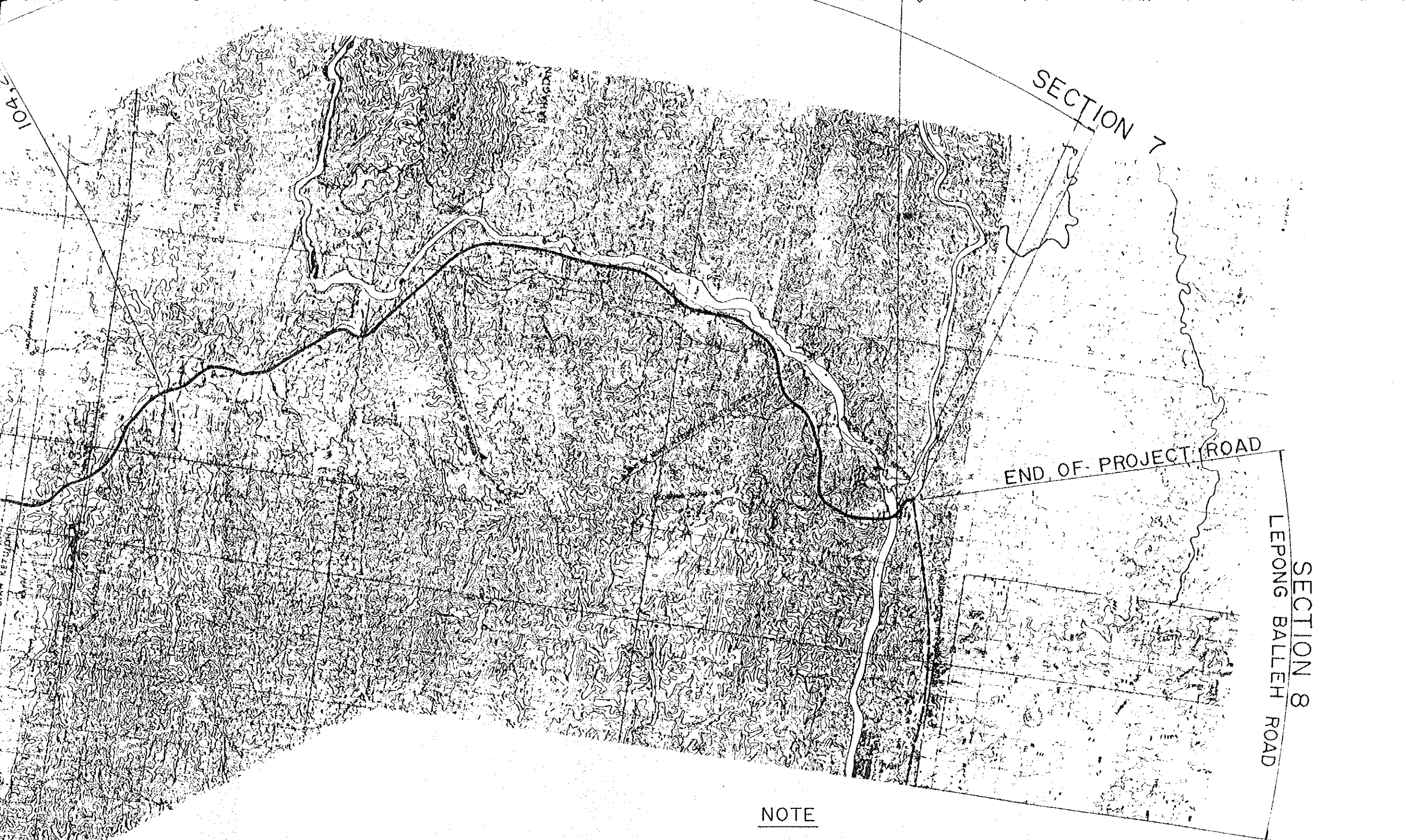
104,200

BAHAGIAN KETUPAN


BAHAGIAN

NOTE

- PROJECT ROAD
- ALTERNATIVE ROUTE
- ESTIMATED DAM SITE
- BY TATAU - KAPIT
- SURVEY TEAM



NOTE

- PROJECT ROAD : —————
- ALTERNATIVE ROUTE : - - - - -
- ESTIMATED DAM SITE : 
- BY TATAU - KAPIT ROAD
- SURVEY TEAM