Appendix 1-6 AVERAGE DAILY TRAFFIC (A.D.T.) AT 17 LOCATIONS IN THE STATE OF SARAWAK, 1967-1978

Unit: Vehicle/day

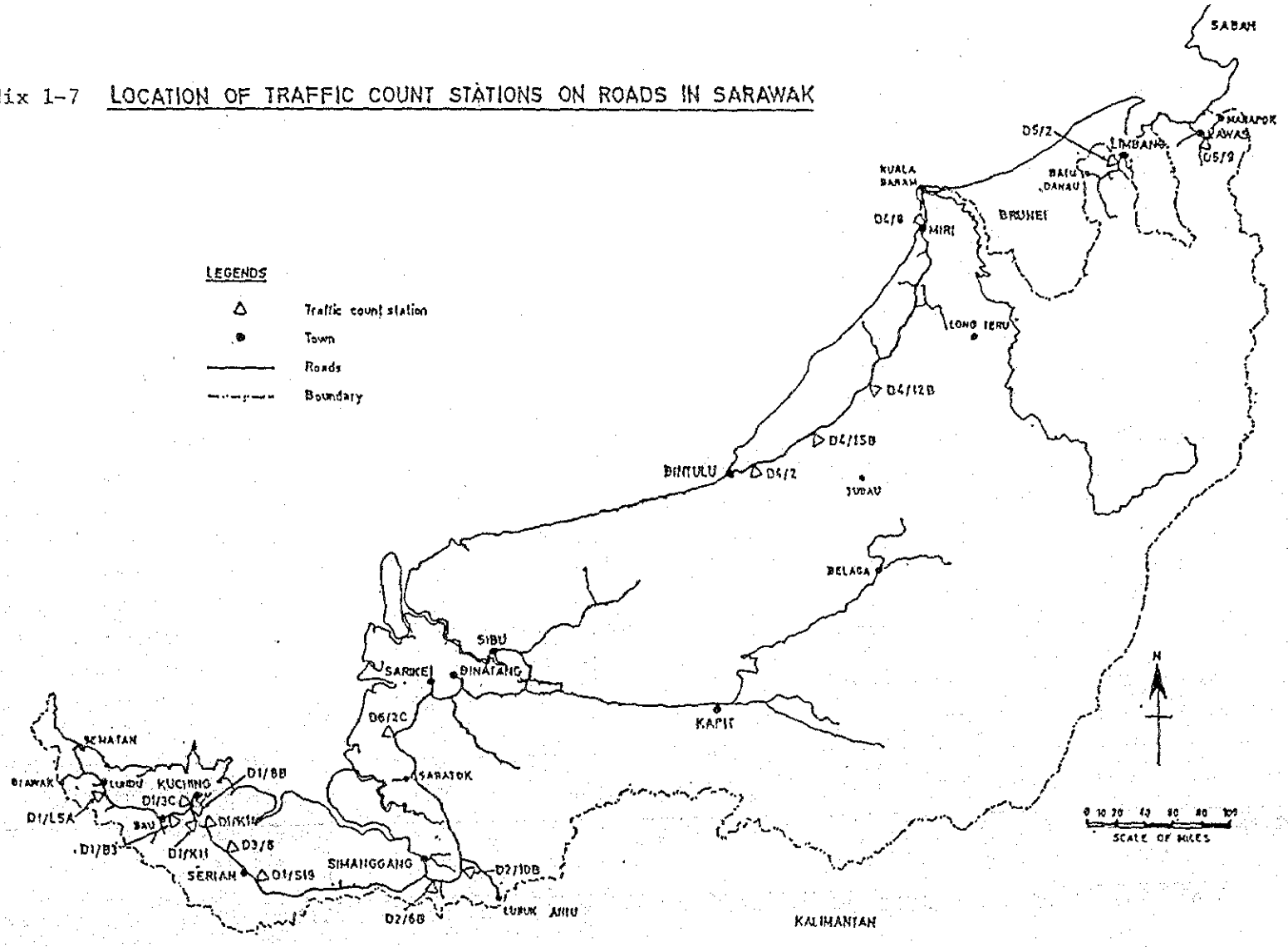
Station No.	Description of Location	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
1. D1/3C	Ml. 4.5 Kuching-Serian	-	-	-	-	-	-	8,686	10,325	9,404	11,388	9,509	13,428
2. D1/8B	Ml. 8.0 Kuching-Serian	-	-	-	-	-	4,718	4,766	6,266	6,934	7,809	5,969	7,356
3. D1/15A	Ml. 5.0 Lundu-Bau	-	-	-	-	-	-	-	-	104	142	138	125
4. D1/B3	Ml. 4.0 Bau-Kuching	488	560	550	596	-	534	864	983	1,041	1,095	1,043	1,283
5. D1/K11	Ml. 16.0 Kuching-Serian	-	-	-	-	-	-	1,036	-	1,666	1,584	1,601	1,885
6. D1/K14	Ml. 24.0 Kuching-Serian	432	488	482	532	632	672	1,009	986	958	894	958	1,179
7. D1/S10	Ml. 77.0 Kuching-Simanggang	-	-	-	-	-	-	-	264	322	176	238	270
8. D2/6B	Ml. 18.0 Simanggang-Sarikei	124	128	147	-	120	149	175	192	160	193	251	234
9. D2/10B	Ml. 40.0 Simanggang-Sarikei	104	127	134	139	125	132	154	150	121	129	132	130
10. D6/2C	Ml. 35.0 Saratok-Sarikei	501	502	517	662	-	-	-	578	595	599	-	-
11. D3/6	Ml. 45.0 Kuching-Sibu	107	75	72	39	47	-	-	113	97	-	-	-
12. D4/2	Ml. 18.0 Bintulu-Miri	-	-	-	-	-	76	-	133	143	153	119	187
13. D4/15B	Ml. 65.0 Bintulu-Miri	-	179	195	281	307	344	-	288	306	284	355	338
14. D4/12B	Ml.110.0 Bintulu-Miri	222	349	355	425	486	387	-	280	596	559	688	1,003
15. D5/2	Ml. 5.0 Limbang-Batu Danau	2,826	1,403	738	882	970	1,055	1,311	1,078	1,248	1,216	-	1,753
16. D4/8	Ml. 0.5 Miri-K. Baram	2,207	2,705	3,152	4,006	4,133	5,405	-	5,973	7,410	8,795	10,337	11,841
17. D5/9	Ml. 2.5 Lawas-Merapok	211	428	494	474	329	217	285	504	348	432	271	206

Note: 1. The location of the station is between the two towns given. The mileage given is from the first town.

2. Station numbers are Public Works Department's number.

Source: Public Works Department, Sarawak, Kuching

Appendix 1-7 LOCATION OF TRAFFIC COUNT STATIONS ON ROADS IN SARAWAK



Appendix 1-8 LIST OF BUS COMPANIES, SARAWAK, 1980

No.	Road Service Permit Holders	No. of Buses	Total Mileage	Total Passengers
1.	Sarawak Transport Company, Kuching	186	7,489,282	14,317,929
2.	Chin Lian Long Motor Vehicle Company Berhad, Kuching	73	3,435,499	21,278,011
3.	Kuching Matang Transport Company Berhad, Kuching	19	1,118,900	3,916,507
4.	Bau Transport Company Berhad, Bau	26	934,270	2,070,070
5.	Syarikat Kenderaan Sri Tebakang Sdn. Berhad, Serian	5	114,664	112,827
6.	Syarikat Kenderaan Bumiputre Gedong, Gedong, Serian	3	122,400	227,992
7.	Borneo Amalgamated Transport Company Berhad, Sarikei	35	1,467,720	1,790,603
8.	Teku Bus Company, Sibu	6	154,755	197,106
9.	Tai Hua Bus Company, Mukah	5	255,760	190,448
10.	Sungei Merah Bus Company Berhad, Sibu	31	1,034,688	5,914,625
11.	Lanang Road Bus Company Berhad, Sibu	39	901,644	3,437,278
12.	Miri Transport Company Berhad, Miri	29	3,767,591	2,435,074
13.	Miri Belait Transport Company Berhad, Miri	9	213,999	189,684
14.	Syarikat Bas Suria, Miri	10	256,032	272,687
15.	Syarikat Kenderaan Bumiputra, Bintulu	3	129,600	227,992
16.	Syarikat Bas Baram	3	58,050	21,700
17.	Lawas Bus Company, Lawas	12	548,651	696,362
18.	Syarikat Bas Limbang Sdn. Berhad, Limbang	9	144,600	124,810
TOTAL :		503	22,148,105	57,421,705

Appendix 1-9 AIRCRAFT MOVEMENT

Unit: Number

	Kuching		Sibu		Miri		Bintulu		Others (a)		All Aerodromes	
	Landings	Takeoffs	Landings	Takeoffs	Landings	Takeoffs	Landings	Takeoffs	Landings	Takeoffs	Landings	Takeoffs
1970	2,732	2,731	3,464	3,463	)	)	1,338	1,341	5,892	5,888	13,426	13,423
1971	2,820	2,823	3,476	3,478	) (b)	) (b)	935	935	6,734	6,734	13,965	13,970
1972	3,785	3,784	3,696	3,697	)	)	925	926	8,859	8,859	17,265	17,266
1973	5,771	5,774	4,003	4,002	4,158	4,156	1,015	1,013	4,284	4,282	19,231	19,227
1974	6,234	6,234	4,776	4,775	5,073	5,075	1,394	1,391	5,634	5,635	23,111	23,110
1975	5,706	5,707	4,662	4,663	4,986	4,983	1,726	1,726	6,056	6,055	23,136	23,134
1976	5,633	5,634	4,766	4,765	5,732	5,726	1,626	1,626	6,378	6,377	24,135	24,128
1977	5,636	5,638	4,700	4,703	7,349	7,341	1,660	1,660	7,356	7,352	26,701	26,694
1978	5,868	5,871	5,116	5,117	9,122	9,124	2,027	2,026	7,641	7,643	29,774	29,781
1979	6,589	6,604	5,178	5,179	8,330	8,321	2,737	2,738	7,015	7,010	29,849	29,852
1980	6,632	6,618	5,934	5,936	7,480	7,480	3,890	3,889	6,851	6,854	30,787	30,777

Note: Figures refer to commercial and private aircraft only
(Military aircraft has been excluded.)

(a) Includes Sematan, Mukah, Belaga, Lutong, Marudi, Long Akah, Long Semado, Simanggang, Bario, Lawas, Kapit, Long Seridan, Limbang and (prior to 1973) Miri.
(b) See footnote (a).

Source: Department of Civil Aviation

Appendix 1-10 AIRCRAFT PASSENGER MOVEMENT

Unit: Person

Year	Kuching		Sibu		Miri		Bintulu		Others (a)		All Aerodromes	
	Incoming	Outgoing	Incoming	Outgoing	Incoming	Outgoing	Incoming	Outgoing	Incoming	Outgoing	Incoming	Outgoing
1969	58,565	62,463	50,346	51,292	)	)	11,159	9,678	38,398	38,873	158,468	162,306
1970	71,665	72,345	55,264	53,399	)	)	13,732	14,337	48,420	47,797	189,081	187,878
1971	85,477	80,619	58,478	59,404	)(b)	)(b)	12,089	13,014	55,572	61,488	211,616	214,525
1972	93,936	94,471	64,989	66,299	)	)	11,470	11,889	59,222	62,376	229,617	235,035
1973	119,885	123,534	79,908	77,481	52,271	54,036	12,886	13,006	16,804	18,158	281,754	286,215
1974	145,370	143,045	94,860	92,246	61,586	62,743	16,748	16,550	18,905	19,380	337,469	333,964
1975	144,365	152,540	90,026	91,602	64,276	63,787	16,898	17,013	20,495	22,386	336,060	347,328
1976	167,281	169,376	96,327	107,546	80,247	78,311	20,105	19,818	21,538	28,065	385,498	403,116
1977	183,613	184,615	105,120	104,741	85,077	84,040	24,137	23,092	22,850	24,802	420,797	421,290
1978	192,388	202,362	115,434	115,300	95,281	89,864	32,339	31,278	26,154	29,570	461,596	468,374
1979	230,010	228,473	131,647	134,127	114,821	96,746	48,706	48,714	29,100	32,013	554,284	540,073
1980	296,655	287,927	157,155	157,143	162,011	153,257	77,759	75,061	31,655	33,093	725,235	706,481

Notes: (a) Includes Sematan, Mukah, Belaga, Lutong, Marudi, Long Akah, Long Semado, Simanggang, Bario, Lawas, Kapit, Long Seridan, Limbang and (prior to 1973) Miri.
(b) See footnote (a)

Source: Department of Civil Aviation

Appendix 1-11 AREA, PRODUCTION AND YIELD PER HECTARE OF PADDY BY SEASON

Season	Wet Paddy			Hill Paddy			Total Paddy		
	Area	Production	Approx. Yield Per hectare	Area	Production	Approx. Yield Per hectare	Area	Production	Approx. Yield Per hectare
	Hectares	Tons	Kilograms	Hectares	Tons	Kilograms	Hectares	Tons	Kilograms
1969 - 1970	51,545	78,959	1,532	75,818	67,990	897	127,363	146,949	1,154
1970 - 1971	61,572	97,499	1,583	73,267	59,973	819	134,839	157,472	1,168
1971 - 1972	60,062	101,224	1,685	85,628	61,172	714	145,690	162,396	1,115
1972 - 1973	48,179	85,746	1,780	62,501	44,208	707	110,680	129,954	1,174
1973 - 1974	50,658 (48,751)	103,299	2,119	66,549 (62,063)	50,083	807	117,207 (110,814)	153,382	1,384
1974 - 1975	54,176 (52,152)	97,030	1,861	64,201 (61,157)	47,182	771	118,377 (113,309)	144,212	1,273
1975 - 1976	58,066 (52,905)	101,276	1,914	65,950 (62,116)	49,797	802	124,016 (115,021)	151,073	1,313
1976 - 1977	67,788 (65,279)	127,370	1,951	63,551 (60,463)	44,820	741	131,339 (125,742)	172,190	1,369
1977 - 1978	68,445 (66,884)	134,143	2,006	66,709 (65,254)	49,963	766	135,154 (132,138)	184,106	1,393
1978 - 1979	70,613 (68,283)	139,671	2,045	73,109 (68,405)	52,806	772	143,722 (136,688)	192,477	1,408
1979 - 1980(a)	64,721 (63,234)	142,517	2,202	74,208 (67,224)	47,554	707	138,929 (130,458)	190,071	1,368

Note: (i) Yield is calculated from production over area planted. However, from the 1973 - 1974 season onwards, it is calculated from production over area harvested.

(ii) Figures on area harvested are shown in brackets.

Source: Department of Agriculture

Appendix 1-12 ESTIMATED AREA UNDER RUBBER CULTIVATION

(in hectares)

DIVISION \ YEAR		1960*	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
FIRST	High Yielding	6,197	21,333	21,522	21,522	21,522	21,522	21,522	22,083	22,910	24,166	25,630
	Ordinary	24,244	21,448	21,260	21,260	21,260	21,260	21,260	20,831	20,303	19,606	18,814
SECOND	High Yielding	3,605	15,871	15,871	15,871	15,871	15,871	15,871	16,105	16,445	17,186	18,034
	Ordinary	21,749	20,214	20,214	20,214	20,214	20,214	20,214	20,132	20,030	19,775	19,490
THIRD	High Yielding	1,569	9,219	9,219	9,219	9,219	9,219	9,219	9,386	9,459	9,864	10,427
	Ordinary	43,444	41,643	41,643	41,643	41,643	41,643	41,643	41,520	41,499	41,331	41,101
FOURTH	High Yielding	5,751	16,310	16,310	16,310	16,310	16,310	16,310	16,761	17,037	17,746	18,511
	Ordinary	8,748	7,995	7,995	7,995	7,995	7,995	7,995	7,813	7,730	7,506	7,316
FIFTH	High Yielding	2,633	7,174	7,189	7,189	7,189	7,189	7,189	7,250	7,284	7,484	7,646
	Ordinary	3,888	3,386	3,372	3,372	3,372	3,372	3,372	3,342	3,327	3,259	3,196
SIXTH	High Yielding	3,720	9,641	9,641	9,641	9,641	9,641	9,641	9,820	10,414	11,350	11,390
	Ordinary	13,382	11,712	11,712	11,712	11,712	11,712	11,712	11,567	11,241	10,755	10,732
SEVENTH	High Yielding	264	3,716	3,716	3,716	3,716	3,716	3,716	3,716	3,971	4,159	4,390
	Ordinary	4,046	3,388	3,388	3,388	3,388	3,388	3,388	3,388	3,357	3,295	3,204
SARAWAK TOTAL	High Yielding	23,289	83,264	83,468	83,468	83,468	83,468	83,468	85,121	87,520	91,955	96,028
	Ordinary	121,501	109,786	109,584	109,584	109,584	109,584	109,584	108,593	107,487	105,527	103,853
GRAND TOTAL		144,790	193,050	193,052	193,052	193,052	193,052	193,052	193,714	195,007	197,482	199,881

Source: Agricultural Statistics of Sarawak 1980

Appendix 1-13 AREA, YIELD AND PRODUCTION OF OIL PALM 1971 - 1980

Item / Year	AREA (in hectares)			YIELD (in tons/hectares)(a)			PRODUCTION (in tons)		
	Mature	Immature	Total	Fresh Fruit Bunch	Oil	Palm Kernel	Fresh Fruit Bunch	Oil	Palm Kernel
1971	-	2,670	2,670	-	-	-	-	-	-
1972	-	5,593	5,593	-	-	-	-	-	-
1973	34	7,165	7,199	-	-	-	-	-	-
1974	947	10,592	11,539	4.44	0.63	0.10	4,206	597	96
1975	4,391	11,187	15,578	5.60	0.75	0.14	24,572	3,283	615
1976	6,939	10,015	16,954	5.74	0.79	0.13	39,821	5,508	936
1977	9,661	8,534	18,195	6.50	1.32	0.21	62,760	12,728	2,034
1978	11,172	8,788	19,960	8.77	1.69	0.29	97,961	18,832	3,294
1979	14,078	7,313	21,391	7.75	1.50	0.29	109,094	21,151	4,145
1980	16,632	6,294	22,926	7.52	1.27	0.23	125,110	21,092	3,882

Note: (a) Based on mature area in production

Sources: 1) Department of Agriculture (Sarawak)
2) Sarawak Land Development Board (SLDB)
3) Sarawak Oil Palms Sdn. Bhd.
4) Sarawak Land Consolidation and Rehabilitation Authority (SALCRA)

Appendix 1-14 MANUFACTURING INDUSTRIES, 1971 - 1978

Year	No. of Establishments	Gross Value of Output (M$'000)	Cost of Input (M$'000)	Value Added (M$'000)	Number of persons engaged during December or during the last pay period			Salaries and Wages Paid in cash (M$'000)	Value of Fixed Assets (M$'000)
					Unpaid Workers	Paid Workers			
						Full-time	Part-Time		
1971	372	339,699	267,061	72,200	268	13,843	282	29,851	54,442
1972	367	432,839	361,691	71,146	378	14,036	282	31,522	60,269
1973	1,404	544,578	428,738	115,840	2,266	15,949	525	39,247	82,165
1974	382	768,807	647,419	121,388	427	15,176	237	39,687	93,639
1975	402	466,324	358,768	107,556	447	14,795	267	40,363	103,053
1976	429	567,147	438,453	128,694	465	16,283	312	45,169	127,676
1977	432	578,232	450,790	127,442	464	17,614	217	51,672	149,788
1978(a)	468	682,124	516,522	165,602	490	19,507	109	61,759	220,454

Note: - Data for the years 1971, 1972 and 1974 - 1978 relate to establishments having 5 or more paid full-time employees whereas figures for the year 1973 relate to census data.

- (a) Preliminary figures

APPENDIX 2-1 FORECAST OF AGRICULTURAL PRODUCTION WITHOUT/WITH THE PROJECT ROAD

(1) Case 1: "Without" the Project Road

App. 2-1-1 shows the projected production of rubber in the Study Area. It was assumed that in the Tatau Subdistrict, rubber will increase its acreage at an annual rate of 1% from 1981 onwards while keeping yield constant. In the Kapit District the acreage of land under rubber and the yield are assumed to be constant.

App. 2-1-2 and 2-1-3 show the estimated production of rice. In respect to wet paddy in the Tatau Subdistrict, the acreage is assumed to expand at an annual rate of 1% over the period concerned, with the yield expected to increase at the same rate. In the Kapit District, the acreage is assumed to remain constant while the yield is expected to rise at an annual rate of 1%. This is attributable to expansion into new cultivated lands for wet paddy in the Kapit District.

App. 2-1-4 shows the forecasted production of pepper. In the Tatau Subdistrict, the acreage and yield are assumed to increase at an annual rate of 1%. In the Kapit Subdistrict, the acreage is expected to remain constant while the yield is assumed to increase annually 1% over the period.

(2) Case 2: "With" the Project Road

The completion of the Project Road will allow access to a large portion of potential agricultural land which has been left uncultivated. According to the Department of Agriculture, there is plenty of suitable land for cultivation along the Project Road. However, it should be noted that these conditions do not necessarily guarantee the opening of agricultural land, nor do they guarantee an increased population.

The following factors pose problems for agricultural development:

a) Lack of capital required for land settlement and agricultural investment
b) Traditional way of life and prevailing subsistence farming
c) Psychological resistance to the introduction of new technology and mastering new techniques

It is quite certain that such traditional socio-economic factors are gradually changing by virtue of increased education and improved communication. Also, the

government is making an effort to modernize agriculture through various subsidy schemes and technical training programs.

The government's leadership will surely make it easier for agricultural development. If the proper development policies and strategies are planned and implemented, agricultural development along the Project Road will be encouraged and more rapid progress can be expected.

Appendices 2-1-5, 6, 7, 8, 9, 10 show the projected production of rubber, wet paddy, hill paddy, pepper and cocoa in the Study Area "with" the Project Road.

Appendix 2-1-1 FORECAST OF ACREAGE AND PRODUCTION OF RUBBER IN THE STUDY AREA "WITHOUT" THE PROJECT ROAD

Area	Item	Base year 1981	1985	1990	1995	2000	2005
Tatau Sub-district	Acreage (ha)	2,400	2,522 (1)	2,651 (1)	2,786 (1)	2,928 (1)	3,077 (1)
	Yield (tons/ha)	0.54	0.54	0.54	0.54	0.54	0.54
	Production (tons)	1,296	1,362	1,432	1,504	1,581	1,662
Kapit District	Acreage (ha)	36,000	36,000	36,000	36,000	36,000	36,000
	Yield (tons/ha)	0.54	0.54	0.54	0.54	0.54	0.54
	Production (tons)	19,440	19,440	19,440	19,440	19,440	19,440

Note: ( ) indicates the annual growth rate (%) during the individual 5-year period.

Appendix 2-1-2 FORECAST OF ACREAGE AND PRODUCTION OF WET PADDY IN THE STUDY AREA "WITHOUT" THE PROJECT ROAD

Area	Item	Base year 1981	1985	1990	1995	2000	2005
Tatau Sub-district	Acreage (ha)	690	725 (1)	762 (1)	801 (1)	842 (1)	885 (1)
	Yield (tons/ha)	1.8	1.89 (1)	1.98 (1)	2.08 (1)	2.18 (1)	2.29 (1)
	Production (tons)	1,242	1,370	1,509	1,666	1,836	2,027
	Rice Equiv. (tons)*	807	890	980	1,082	1,193	1,317
Kapit District	Acreage (ha)	400	400	400	400	400	400
	Yield (tons/ha)	1.4	1.47 (1)	1.54 (1)	1.62 (1)	1.70 (1)	1.79 (1)
	Production (tons)	560	588	616	648	680	716
	Rice Equiv. (tons)*	364	382	400	421	442	465

Notes: ( ) indicates the annual growth rate (%) during the individual 5-year period.

* : Rice Equivalent Ratio of 0.65

Appendix 2-1-3 FORECAST OF ACREAGE AND PRODUCTION OF HILL PADDY IN THE STUDY AREA "WITHOUT" THE PROJECT ROAD

Area	Item	Base year 1981	1985	1990	1995	2000	2005
Tatau Sub-district	Acreage (ha)	1,420	1,420	1,420	1,420	1,420	1,420
	Yield (tons/ha)	0.75	0.75	0.57	0.75	0.75	0.75
	Production (tons)	1,065	1,065	1,065	1,065	1,065	1,065
	Rice Equiv. (tons)*	660	660	660	660	660	660
Kapit District	Acreage (ha)	10,800	10,800 (0)	10,271 (-1)	9,669 (-1.2)	9,103 (-1.2)	8,483 (-1.4)
	Yield (tons/ha)	0.71	0.71	0.71	0.71	0.71	0.71
	Production (tons)	7,668	7,668	7,292	6,865	6,463	6,023
	Rice Equiv. (tons)*	4,754	4,754	4,521	4,256	4,008	3,734

Notes: ( ) indicates the annual growrth rate (%) during the individual 5-year period.

* : Rice Equivalent Ratio of 0.62

Appendix 2-1-4 FORECAST OF ACREAGE AND PRODUCTION OF PEPPER IN THE STUDY AREA "WITHOUT" THE PROJECT ROAD

Area	Item	Base year 1981	1985	1990	1995	2000	2005
Tatau Sub-district	Acreage (ha)	80	84 (1)	88 (1)	92 (1)	97 (1)	102 (1)
	Yield (tons/ha)	4.3	4.5 (1)	4.7 (1)	4.9 (1)	5.1 (1)	5.4 (1)
	Production (tons)	344	378	414	451	495	551
Kapit District	Acreage (ha)	200	200	200	200	200	200
	Yield (tons/ha)	4.3	4.5 (1)	4.7 (1)	4.9 (1)	5.1 (1)	5.4 (1)
	Production (tons)	860	900	940	980	1,020	1,080

Note: ( ) indicates the annual growth rate (%) during the individual 5-year period.

Appendix 2-1-5 FORECAST OF ACREAGE AND PRODUCTION OF RUBBER IN THE STUDY AREA "WITH" THE PROJECT ROAD

Area	Item	Base year 1981	1985	1990	1995	2000	2005
Tatau Sub-district	Acreage (ha)	2,400	2,522 (1)	2,651 (1)	2,786 (1)	2,928 (1)	3,077 (1)
	Yield (tons/ha)	0.54	0.54 (0)	0.54 (0)	1.09 (15)	1.09 (0)	1.09 (0)
	Production (tons)	1,296	1,362	1,432	3,037	3,192	3,354
Kapit District	Acreage (ha)	36,000	36,000	36,000	36,000	36,000	36,000
	Yield (tons/ha)	0.54	0.54 (0)	0.54 (0)	1.09 (15)	1.09 (0)	1.09 (0)
	Production (tons)	19,440	19,440	19,440	39,240	39,240	39,240

Note: ( ) indicates the annual growth rate (%) during the individual 5-year period.

Appendix 2-1-6 FORECAST OF ACREAGE AND PRODUCTION OF WET PADDY IN THE STUDY AREA "WITH" THE PROJECT ROAD

Area	Item	Base year 1981	1985	1990	1995	2000	2005
Tatau Sub-district	Acreage (ha)	690	725 (1)	762 (1)	801 (1)	842 (1)	885 (1)
	Yield (tons/ha)	1.8	2.0	2.2	2.5	2.5	2.5
	Production (tons)	1,242	1,450 (3.1)	1,676 (2.9)	2,003 (3.6)	2,103 (1.0)	2,213 (1.0)
	Rice Equiv. (tons)*	807	923	1,089	1,302	1,368	1,438
Kapit District	Acreage (ha)	400	400	400	400	400	400
	Yield (tons/ha)	1.4	1.5	1.6	1.8	2.0	2.2
	Production (tons)	560	600 (1.7)	640 (1.3)	720 (2.4)	800 (2.1)	880 (1.9)
	Rice Equiv. (tons)*	364	390	416	468	520	572

Notes: ( ) indicates the annual growth rate (%) during the individual 5-year period.

* : Rice Equivalent Ratio of 0.65

Appendix 2-1-7 FORECAST OF ACREAGE AND PRODUCTION OF HILL PADDY: PROPOSED PLANTATION ESTATE "WITH" THE PROJECT ROAD

	Item	Base year 1981	1985	1990	1995	2000	2005
Case 1	Acreage (ha)	-	-	15,000	17,815	21,158	25,130
	Yield (tons/ha)	-	-	0.75	0.75	0.75	0.75
	Production (tons)	-	-	11,250	13,361	15,869	18,848
	Rice Equiv. (tons)	-	-	6,975	8,284	9,839	11,686
Case 2	Acreage (ha)	-	-	7,500	8,908	10,579	12,565
	Yield (tons/ha)	-	-	0.75	0.75	0.75	0.75
	Production (tons)	-	-	5,625	6,681	7,934	9,424
	Rice Equiv. (tons)	-	-	3,488	4,142	4,919	5,843
Case 3	Acreage (ha)	-	-	5,000	5,938	7,053	8,377
	Yield (tons/ha)	-	-	0.75	0.75	0.75	0.75
	Production (tons)	-	-	3,750	4,454	5,290	6,283
	Rice Equiv. (tons)	-	-	2,325	3,682	4,373	5,194

Appendix 2-1-8 FORECAST OF ACREAGE AND PRODUCTION OF HILL PADDY IN THE STUDY AREA "WITH" THE PROJECT ROAD

Area	Item	Base year 1981	1985	1990	1995	2000	2005
Tatau Sub-district	Acreage (ha)	1,420	1,420	16,492	19,384	22,727	26,699
	Yield (tons/ha)	0.75	0.75	0.75	0.75	0.75	0.75
	Production (tons)	1,065	1,065	12,369	14,538	17,045	20,024
	Rice Equiv. (tons)	660	660	7,669	9,014	10,568	12,415
Kapit District	Acreage (ha)	10,800	10,800	11,073	11,352	11,639	11,933
	Yield (tons/ha)	0.71	0.73	0.75	0.77	0.77	0.77
	Production (tons)	7,668	7,884	8,305	8,741	8,962	9,188
	Rice Equiv. (tons)	4,754	6,888	5,149	5,419	5,556	5,697

Appendix 2-1-9 FORECAST OF ACREAGE AND PRODUCTION OF PEPPER IN THE STUDY AREA "WITH" THE PROJECT ROAD

Area	Item	Base year 1981	1985	1990	1995	2000	2005
Tatau Sub-district	Acreage (ha)	80	84 (1)	88 (1)	92 (1)	129 (7)	181 (7)
	Yield (tons/ha)	4.3	4.5	4.7	4.9	4.9	4.9
	Production (tons)	344	378	414	451	632	887
Kapit District	Acreage (ha)	200	200 (0)	200 (0)	210 (1)	232 (2)	256 (2)
	Yield (tons/ha)	4.3	4.5 (1)	4.7 (1)	4.9 (1)	4.9 (0)	4.9 (0)
	Production (tons)	860	900	940	1,029	1,137	1,254

Note: ( ) indicates the annual growth rate (%) during the individual 5-year period.

Appendix 2-1-10 FORECAST OF ACREAGE AND PRODUCTION OF COCOA: PROPOSED PLANTATION ESTATE "WITH" THE PROJECT ROAD

Area	Item	Base year 1990	1995	2000	2005
Tatau Sub-district	Acreage (ha)	250	319 (5)	407 (5)	520 (5)
	Yield (tons/ha)	0.7	0.7	0.7	0.7
	Production (tons)	175	223 (5)	285 (5)	364 (5)

Note: ( ) indicates the annual growth rate (%) during the individual 5-year period.

Appendix 3-1 TRAFFIC VOLUME ON THE TRUNK ROADS

Appendix 3-1-1 AVERAGE DAILY TRAFFIC VOLUME ON THE MIRI/BINTULU ROAD

Station No.	Location or Name of Station	1976 Motor Vehicles	1976 Motor Cycles	1976 Total	1977 Motor Vehicles	1977 Motor Cycles	1977 Total	1978 Motor Vehicles	1978 Motor Cycles	1978 Total	1979 Motor Vehicles	1979 Motor Cycles	1979 Total	1980 Motor Vehicles	1980 Motor Cycles	1980 Total	1981 Motor Vehicles	1981 Motor Cycles	1981 Total	Average Ann Growth Rate
D4/1A	M.2.from	823	443	1,266	1,002	599	1,601	1,616	702	2,318	934	292	1,226							
D4/12	Bintulu	65.0%	35.0%	100%	62.6%	37.4%	100%	69.7%	30.3%	100%	76.2%	23.8%	100%							4.5%
D4/1B	M.3 from Bintulu	332 79.0%	88 21.0%	420 100%	447 73.0%	165 27.0%	612 100%										437 94.4%	26 5.6%	463 100%	6.3%
D4/2	M.18. from	145	3	148	144	10	154				211	22	233	267	6	273	437	26	463	
D4/11	Bintulu	98.0%	2.0%	100%	93.5%	6.5%	100%				90.6%	9.4%	100%	97.8%	2.2%	100%	94.4%	5.6%	100%	40.3%
D4/15C	Batu Niah/	325	6	331	250	10	260	277	29	306	357	19	376	364	16	380	355	18	373	
D4/10B	M-B RD Junct	98.2%	1.8%	100%	96.2%	3.8%	100%	90.5%	9.5%	100%	94.9%	5.1%	100%	95.8%	4.2%	100%	95.2%	4.8%	100%	3.0%
D4/15B		327	14	341	344	16	360	422	36	458	469	24	493	467	24	491	504	17	521	
D4/10B		95.9%	4.1%	100%	95.6%	4.4%	100%	92.1%	7.9%	100%	95.1%	4.9%	100%	95.1%	4.9%	100%	96.7%	3.3%	100%	10.7%
D4/17C	Benaru/	329	16	345	590	34	624	738	38	776	517	25	542	445	18	463	730	48	778	
D4/ 8C	M-B RD.	95.4%	4.6%	100%	94.6%	5.4%	100%	95.1%	4.9%	100%	95.4%	4.6%	100%	96.1%	3.9%	100%	93.8%	6.2%	100%	24.4%
D4/17B	Junction	275	13	270	519	31	550	716	40	756	470	21	491	412	14	426	700	40	740	
D4/ 8B		95.2%	4.8%	100%	94.4%	5.6%	100%	94.7%	5.3%	100%	95.7	4.3%	100%	96.7%	3.3%	100%	94.6%	5.4%	100%	34.5%
D4/ 4C	Bekenu/	378	194	572	629	63	692	1,633	149	1,782	598	38	636	496	40	536	648	61	709	
D4/ 7C	M-B RD	66.1%	33.9%	100%	90.9%	9.1%	100%	91.6%	8.4%	100%	94.0%	6.0%	100%	92.5%	7.5%	100%	91.4%	8.6%	100%	14.3%
D4/ 4B	Junction	480	208	688	721	74	795	1,666	171	1,837	758	58	816	605	56	661	540	43	583	
D4/ 7B		69.8%	30.1%	100%	90.7%	9.3%	100%	90.7%	9.3%	100%	92.9%	7.1%	100%	91.5%	8.5%	100%	92.6%	7.4%	100%	2.5%
D4/12C	Bakam/	513	30	543	1,023	43	1,066	697	64	761	539	58	597	566	38	604	756	39	795	
D4/ 9C	M-B RD	94.5%	5.5%	100%	96.0%	4.0%	100%	91.6%	8.4%	100%	90.3%	9.7%	100%	93.7%	6.3%	100%	95.1%	4.9%	100%	9.5%
D4/12B	Junction	541	40	581	1,169	29	1,198	818	98	916	588	83	671	610	64	674	783	45	783	
D4/ 9B		93.1%	6.9%	100%	97.6%	2.4%	100%	89.3%	10.7%	100%	87.6%	12.4%	100%	90.5%	9.5%	100%	94.6%	5.4%	100%	8.9%
D4/10	M.11/2 from Miri	2,703 80.9%	638 19.1%	3,341 100%	3,966 83.1%	807 16.9%	4,773 100%	4,294 85.0%	760 15.0%	5,054 100%										29.4%
D4/5C	Airport RD/ M-B RD										1,928 86.5%	300 14.5%	2,228 100%	2,144 86.8%	325 13.2%	2,469 100%	2,394 88.1%	323 11.9%	2,717 100%	12.2%
D4/5B	Junction										2,835 87.6%	401 12.4%	3,236 100%	3,400 86.9%	425 11.1%	3,825 100%	3,870 90.0%	429 10.0%	4,299 100%	18.3%
D4/6C	Riam RD/ M-B RD										3,734 87.0%	560 23.0%	4,294 100%	5,245 87.6%	742 12.4%	5,987 100%	5,556 92.3%	464 7.7%	6,020 100%	24.4%
D4/6A	Junction										335 73.3%	122 26.7%	457 100%	902 89.5%	106 10.5%	1,008 100%	592 84.1%	112 15.9%	704 100%	38.4%
D4/6B											4,038 86.0%	659 14.0%	4,697 100%	5,898 88.0%	804 12.0%	6,702 100%	5,973 91.6%	550 8.4%	6,532 100%	24.0%
		596	141	737	900	161	1,061	1,073	174	1,247	1,221	179	1,400	1,398	221	1,619	1,618	150	1,768	36.3%

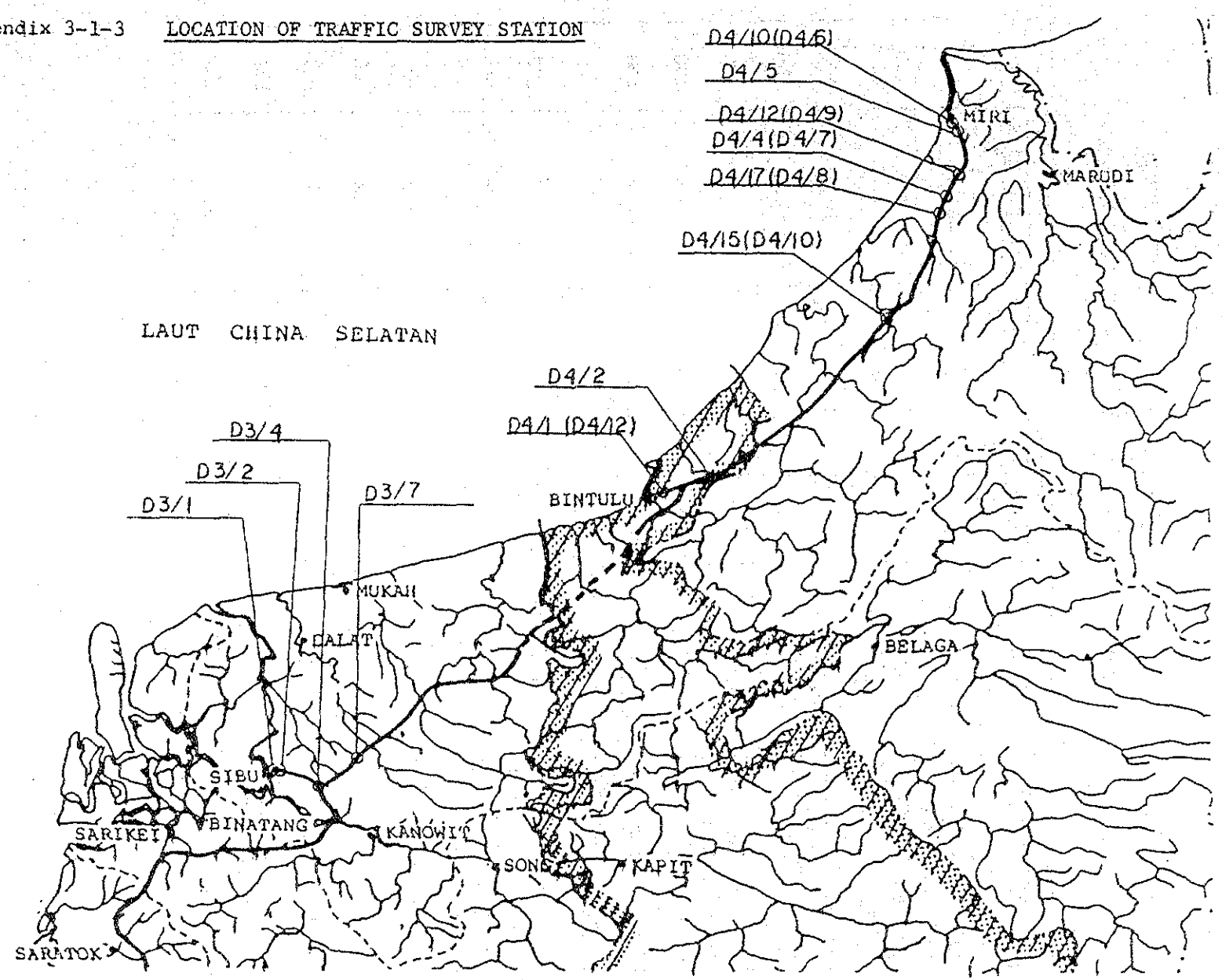
Source: P.W.D.

Appendix 3-1-2 AVERAGE DAILY TRAFFIC VOLUME ON THE SIBU/OYA ROAD

Station NO.	Location or Name of Station	1976			1977			1978			1979			Average Annual Growth Rate	
		Motor Vehicles	Motor Cycles	Total	Motor Vehicles	Motor Cycles	Total	Motor Vehicles	Motor Cycles	Total	Motor Vehicles	Motor Cycles	Total		
D3/1A	Sibu/K.P.G	8,483	4,060	12.543	8,047	3,456	11,503	8,171	3,133	11,304	10,817	3,400	14,217		
D3/8C	Nyabor RD. Junction	67.6%	32.3%	100%	70.0%	30.0%	100%	72.3%	27.7%	100%	76.1%	23.9%	100%	9.1%	-5.4%
D3/1B		10,340	4,864	15,204	9,578	3,728	13,306	10,188	3,624	13,812	13,328	988	14,316		
D3/8A		68.0%	32.0%	100%	72.0%	28.0%	100%	73.8%	26.2%	100%	93.1%	6.9%	100%	9.6	-26.6
D3/1C		7,007	3,505	10,512	8,069	2,587	10,656	7,948	2,536	10,484	11,069	2,886	13,955		
D3/8B		66.7%	33.3%	100%	75.7%	24.3%	100%	75.8%	24.2%	100%	79.3%	20.7%	100%	19.3	-5.9
D3/2A	Sibu/SG. Merah Access RD. Junction	1,472	317	1,789	1,139	309	1,448	2,002	485	2,487	1,383	428	1,811		
D3/14A		82.3%	17.7%	100%	78.7%	21.3%	100%	80.5%	19.5%	100%	76.4%	23.6%	100%	-2.0	11.7
D3/2C		1,953	377	2,330	1,373	313	1,686	2,287	495	2,782	1,682	442	2,124		
D3/14C		83.8%	16.2%	100%	81.4%	18.6%	100%	82.2%	17.8%	100%	79.2%	20.8%	100%	-4.6	5.7
D3/4A	Sibu/ Durin RD. Junction	592	63	655	475	63	538	632	72	704	713	91	804		
D3/15A		90.4%	9.6%	100%	88.3%	11.7%	100%	89.8%	10.2%	100%	88.7%	11.3%	100%	6.8	14.8
D3/4B		466	48	514	354	36	390	411	44	455	446	61	507		
D3/15B		90.7%	9.3%	100%	90.8%	9.2%	100%	90.3%	9.7%	100%	88.0%	12.0%	100%	-1.4	-9.0
D3/7A	Sibinter Scheme/ Uludya RD. Junction	217	2	219	175	16	191	189	22	211					
		99.1%	0.9%	100%	91.6%	8.4%	100%	89.6%	10.4%	100%				-4.3	333.3
D3/7B		224	16	240	174	14	188	173	17	190					
		93.3%	6.7%	100%	92.6%	7.4%	100%	91.1%	8.9%	100%				-5.4	2.1
D3/8A	Bukit Lima RD. Junction				2,538	1,619	4,157	3,063	1,658	4,721	707	355	1,062		
D3/1B					61.1%	38.9%	100%	64.9%	35.1%	100%	66.6%	33.4%	100%	-24.0	-26.0
D3/8B					1,940	1,273	3,213	819	187	1,006	1,879	1,628	3,507		
D3/1A					60.4%	39.6%	100%	81.4%	18.6%	100%	53.5%	46.5%	100%	-1.0	9.3
		2,796	1,205	4,001	2,605	1,032	3,637	2,704	944	3,704	3,820	934	4,754	12.2	-7.4

Source: P.W.D

Appendix 3-1-3 LOCATION OF TRAFFIC SURVEY STATION



Appendix 3-2 TRAFFIC COMPOSITION BY VEHICLE TYPE (1981)
(MIRI - BINTULU ROAD)

Census Station	Type of Vehicle				
	Passenger Cars	Buses	Lorries & Vans	Motor Cycles	Total
	(%)	(%)	(%)	(%)	(%)
D4/6A Riam RD. Junct.	54.3	4.1	25.6	15.9	100
D4/6B "	59.5	1.3	30.7	8.4	100
D4/6C "	60.1	0.9	31.3	7.7	100
D4/5B Airport RD. Junct.	64.1	1.6	23.7	10.6	100
D4/5C "	57.6	1.5	28.0	12.8	100
D4/7B Bekunu RD. Junct.	37.9	1.4	53.3	7.4	100
D4/7C "	39.4	1.1	50.9	8.6	100
D4/8B Beluru RD. Junct.	37.1	0.9	56.6	5.4	100
D4/8C "	36.2	1.0	56.6	6.2	100
D4/15B Batu Niah RD. Junct.	50.4	1.2	44.2	4.2	100
D4/15C "	43.2	0.7	50.0	6.2	100
D4/9B Bakam RD. Junct.	36.5	1.4	56.4	5.7	100
D4/9C "	36.2	1.5	57.2	5.2	100
D4/11 M18.B-M RD.	16.0	0.8	76.0	7.2	100
D4/12B TG. Kidorong RD. Junct.	44.2	3.5	37.8	14.5	100
D4/12C "	52.8	5.5	28.2	13.5	100

Source: P.W.D.

Appendix 3-3 TRAFFIC COMPOSITION IN THE TATAU AREA (VEHICLE)

Unit: %

Traffic OD	Car	Taxi	Van, Pickup	Medium Truck	Heavy Truck	Motor Cycle	Total
In Tatau Area	17	22	31	11	9	10	100
Tatau - Sibu	21	15	36	9	7	12	100
Tatau - Bintulu	14	28	27	12	10	9	100
Sibu - Bintulu Other - Other	12	7	30	27	24	0	100

Source: Road Traffic Count Survey

Appendix 4-1 SUMMARY OF THE MACKINTOSH PROBE TEST

Unit: in meters

Items \ Test Point No.	Item	1	2	3	4	5	6	7	8	9	10	Max.	Min.	Ave.	Remarks
Thickness of Fluvitile	L	9.0	6.0	2.0	4.5	4.5	4.5	3.5	5.5	3.0	3.0	9.0	1.0	4.1	at least 4 ton/sq.ft.
	R	8.5	5.0	3.5	1.0	2.0	4.5	4.0	5.0	1.5	2.0				
Thickness of Weathering Part of the Basement Rock	L	4.0	2.5	0	0	1.0	0.5	0	1.0	0.5	0	6.0	0	1.6	
	R	4.5	5.5	6.0	1.5	1.5	0	0	2.0	2.0	0				
Depth of Fresh Basement Rock	L	13.0	8.5	2.0	4.5	5.5	5.0	3.5	6.5	3.5	3.0	13.0	2.0	5.8	
	R	13.0	10.5	9.0	2.5	3.5	4.5	4.0	7.0	3.5	2.0				

Note L: denotes left side of the river

R: denotes right side of the river

Source : Study Team

Appendix 4-2 TEST LIMITS OF STONE ACCEPTABLE TO JKR

Parameter	Acceptable Limits					
	Road Pavement		Airfield Pavement		Concrete	
	Surfacing	Crushed stone base	Surfacing	Crushed stone base	Pavement	Structural
Aggregate Crushing Value	-	-	30% max.	30% max.	35% max.	-
Aggregate Impact Value	-	-	-	-	30% max.	45% max.
Los Angeles Abrasion Value	40% max.	50% max.	-	-	-	50% max.
Water Absorption	-	-	2% max.	-	-	-
Soundness of Aggregate (5 cycles with sodium sulphate solution)	12% max.	20% max.	12% max.	20% max.	12% max.	12% max.
10% Fines Value	-	-	-	-	10% tons min.	5 tons min.

Source: Denis N.K. Tan (1982) stone quarries and potential quarry sites in Sarawak

APPENDIX 4-3 GENERAL DESCRIPTION OF THE POTENTIAL QUARRY SITES

(A) Quarry Site A

The site is close to the Project Road, promises a reasonable aggregate supply and offers ample advantages. Sometimes, stone is scattered in the river bed. Since supply consists chiefly of river gravel, the quarry operation will depend upon the river water level.

(B) Quarry Site B

Like site A, the site is close to the Project Road and suggests an ample aggregate supply. Taking into consideration the Pelagus Hydroelectric Project, however, it is difficult to consider Point B acceptable at present.

(C) Quarry Site C

The site offers such advantages as a large quantity of river gravel and close proximity to the project road. As the water level of the Pelagus River is normally very low, exploitation of river gravel deposits will be carried out throughout most of the year.

(D) Quarry Site D

The site is satisfactory from the viewpoints of supply capacity and lithology. The site's disadvantage is its 10-kilometer deviation from the alignment of the Project Road. Another disadvantage is that transportation is required to cross the river Anap.

(E) Quarry Site E

The site provides ample deposits of gravel. Although it is 13-kilometers from the alignment of the Project Road, it is still convenient for transportation since a logging road has already been constructed.

(F) Quarry Site F

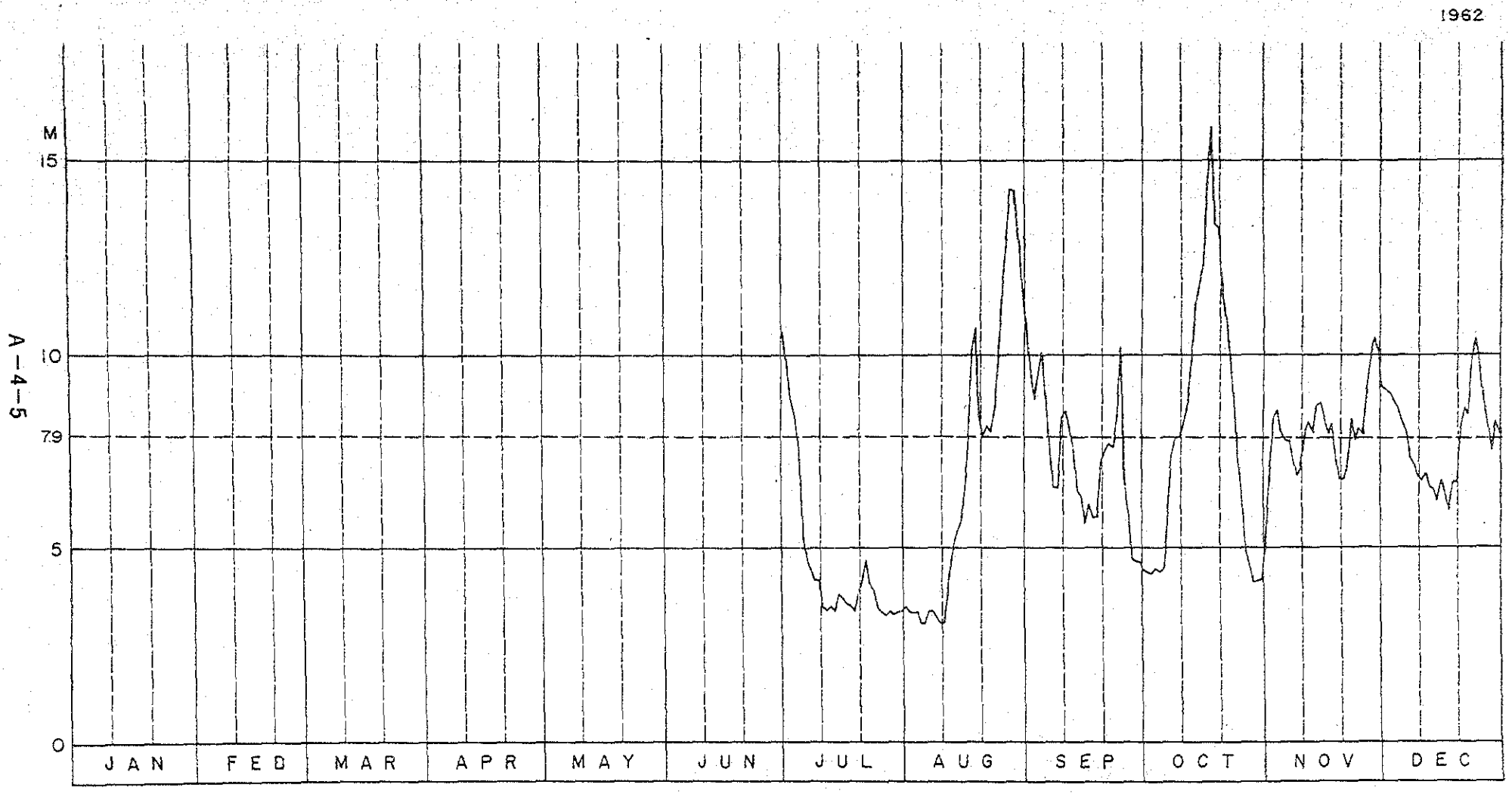
The site has a deposit capacity too lean (30,000 m^3) to meet the aggregate requirement.

It is also difficult to reach the rock, since the rock distribution spreads flatly and nearly parallel with the alluvium deposits.

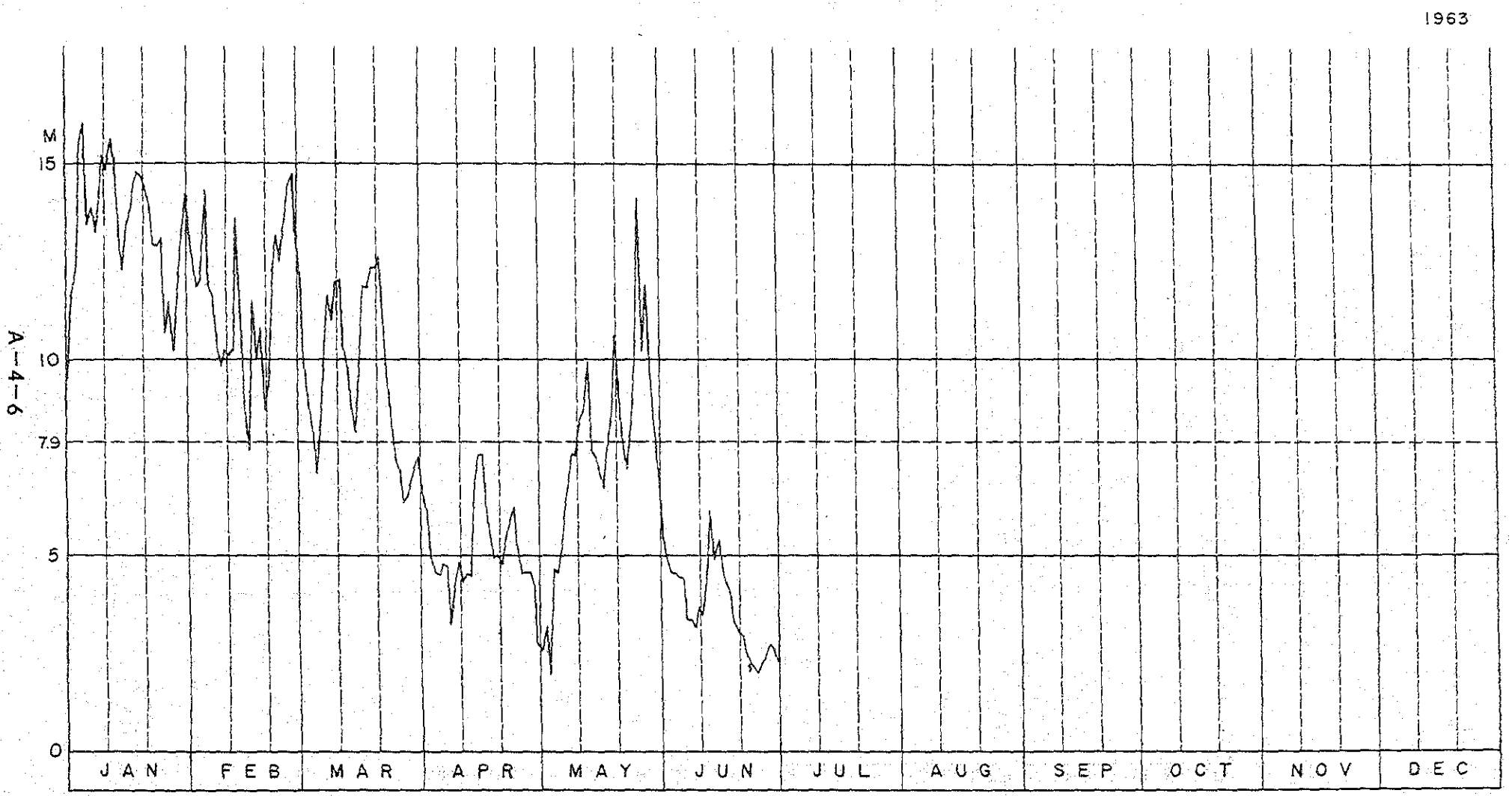
(G) Quarry Site G

The major rock of the site is igneous of outstanding quality and rich in deposits. Although this site is further from the alignment of the Project Road than any other potential quarry site, about 25 kilometers, as it is adjacent to the Sibu - Bintulu Road, transportation is convenient.

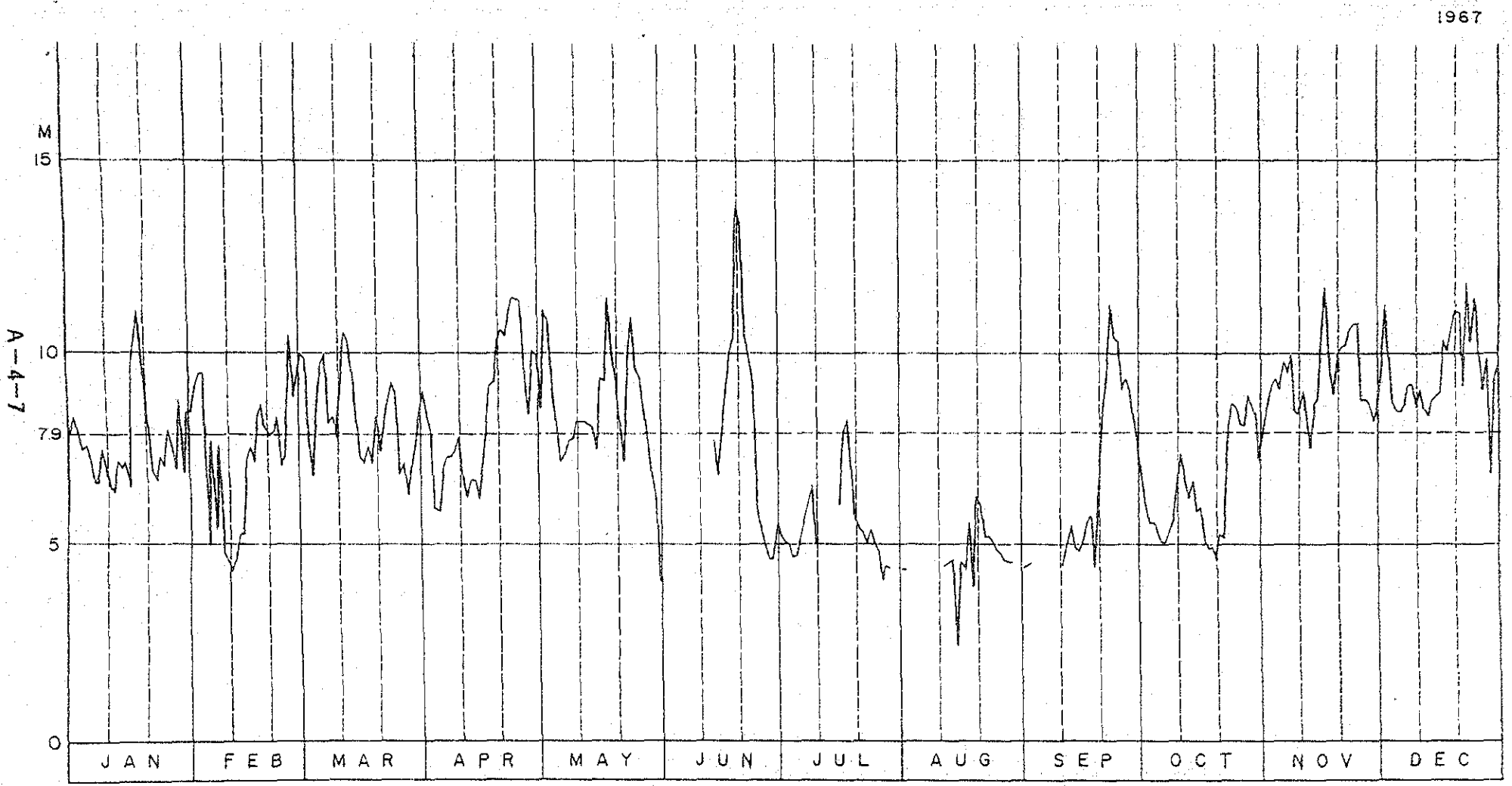
Appendix 4-4(1) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



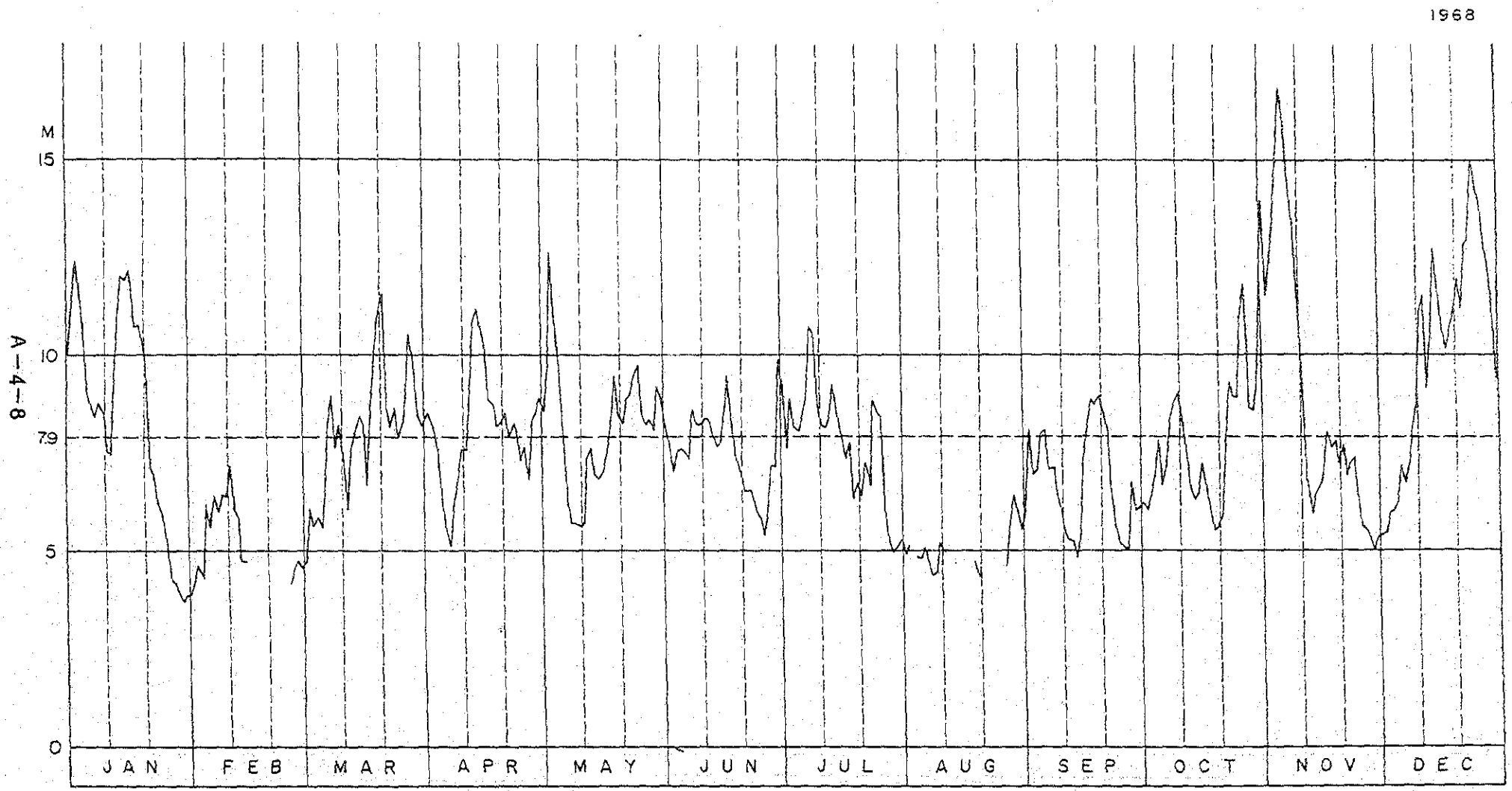
Appendix 4-4(2) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



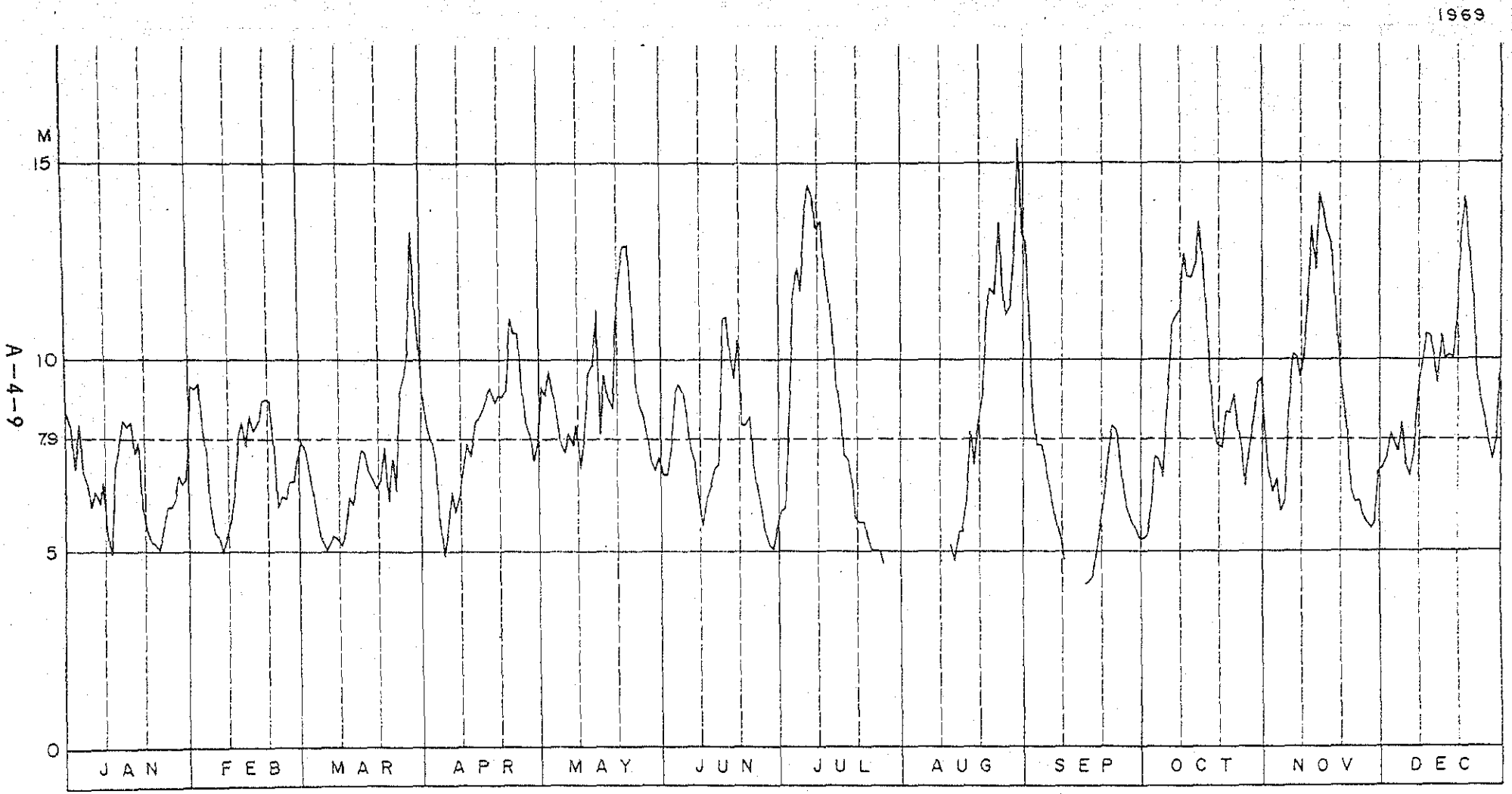
Appendix 4-4(3) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



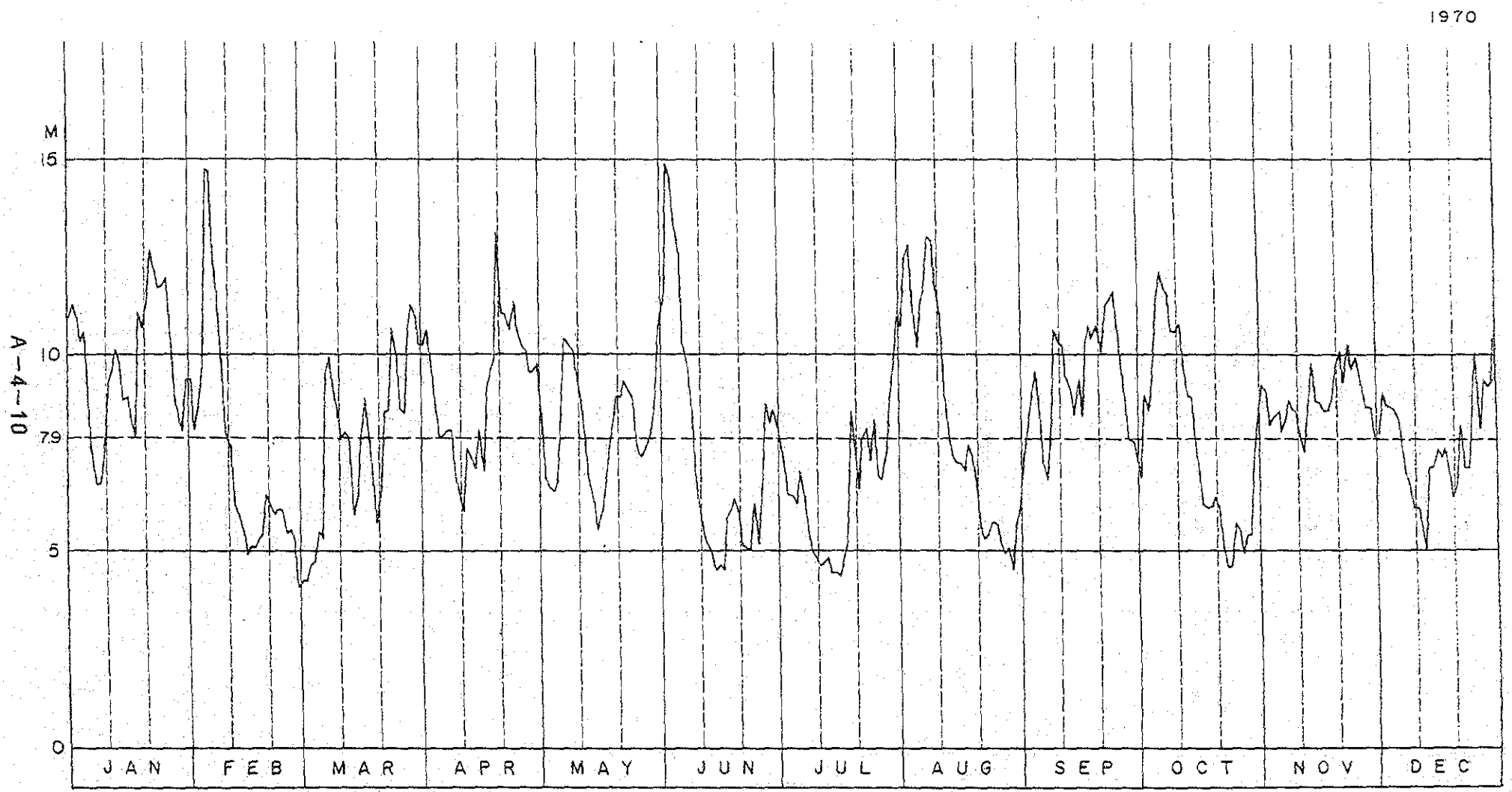
Appendix 4-4(4) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



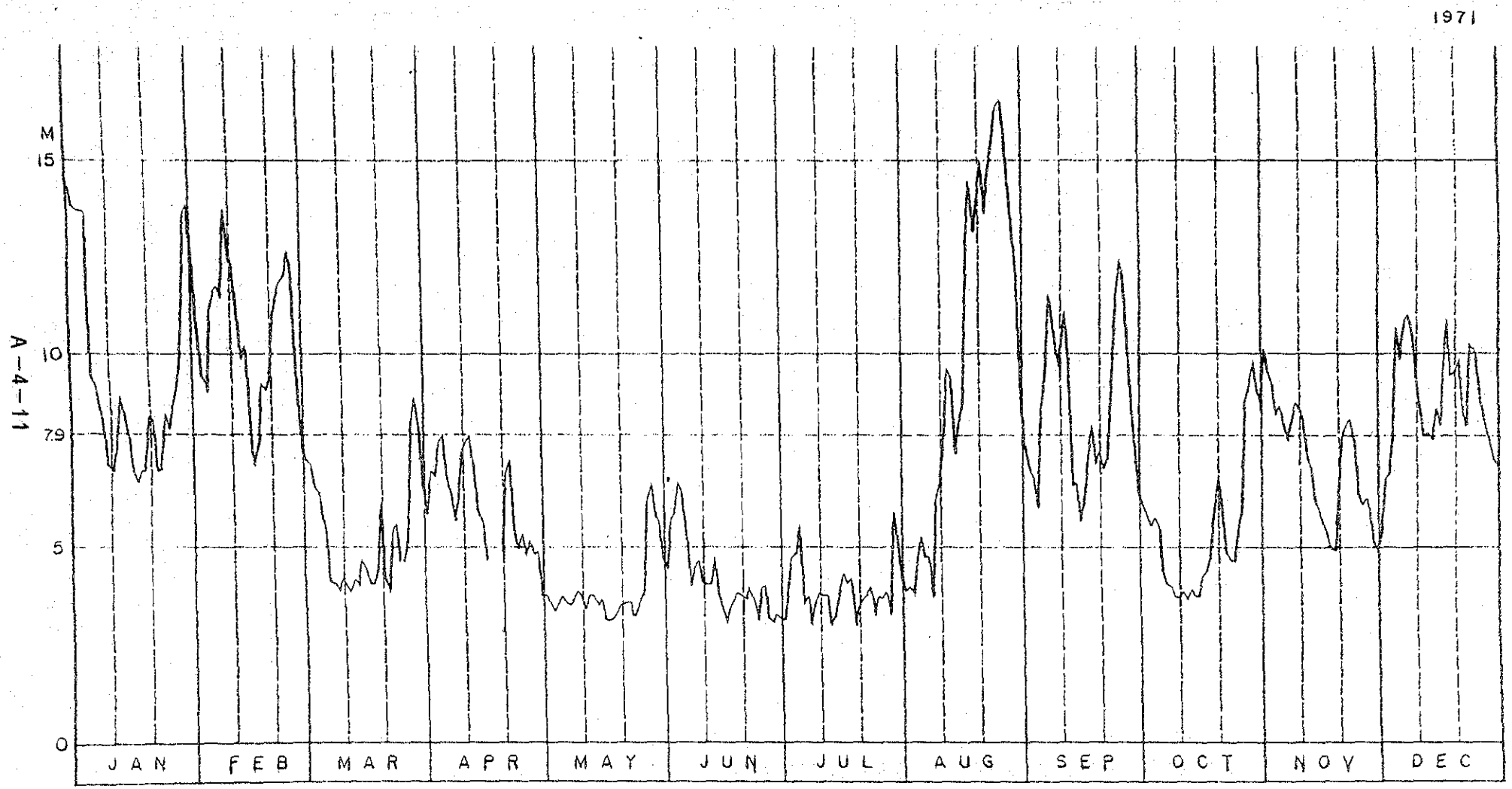
Appendix 4-4(5) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



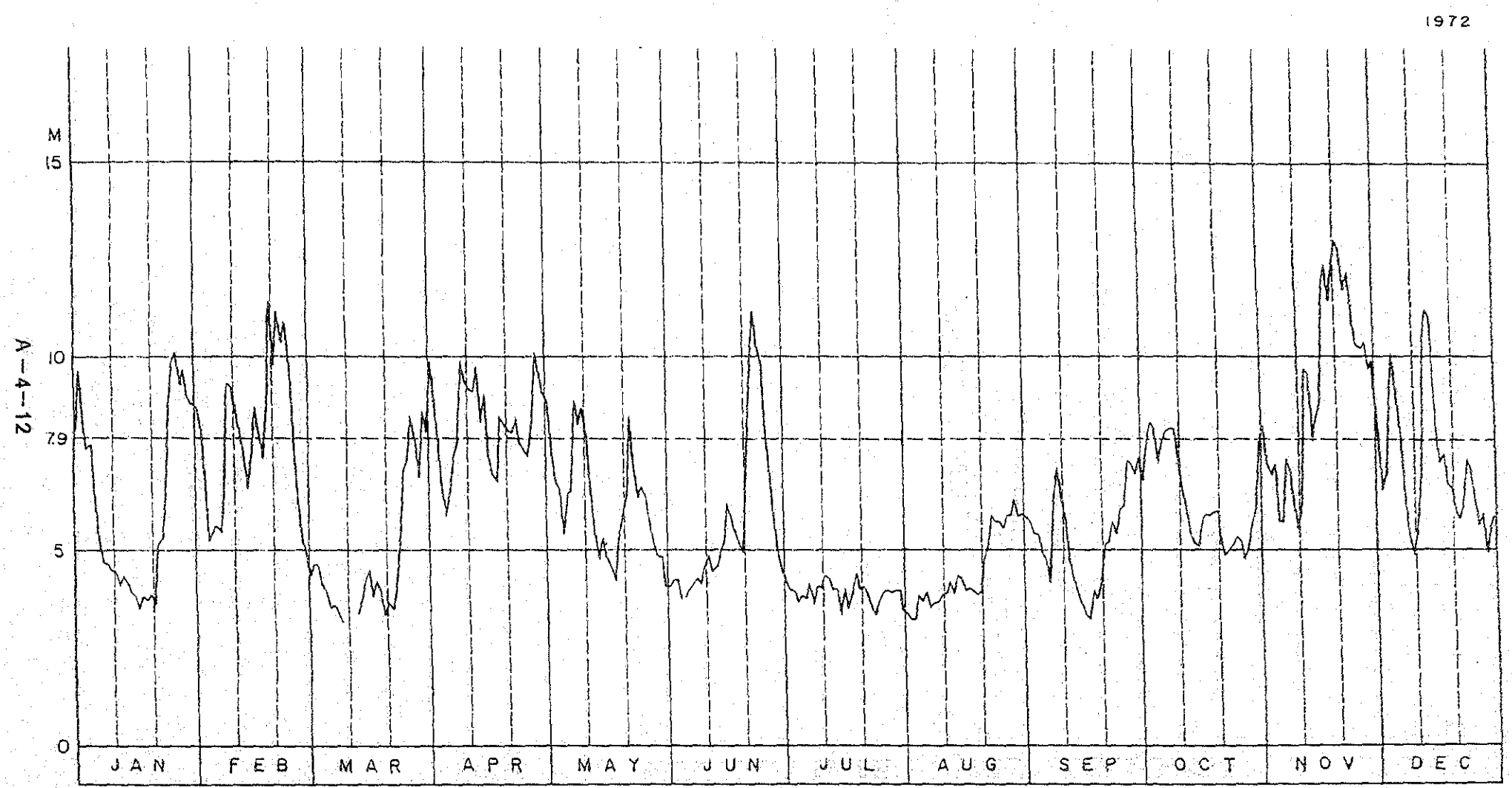
Appendix 4-4(6) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



Appendix 4-4(7) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT

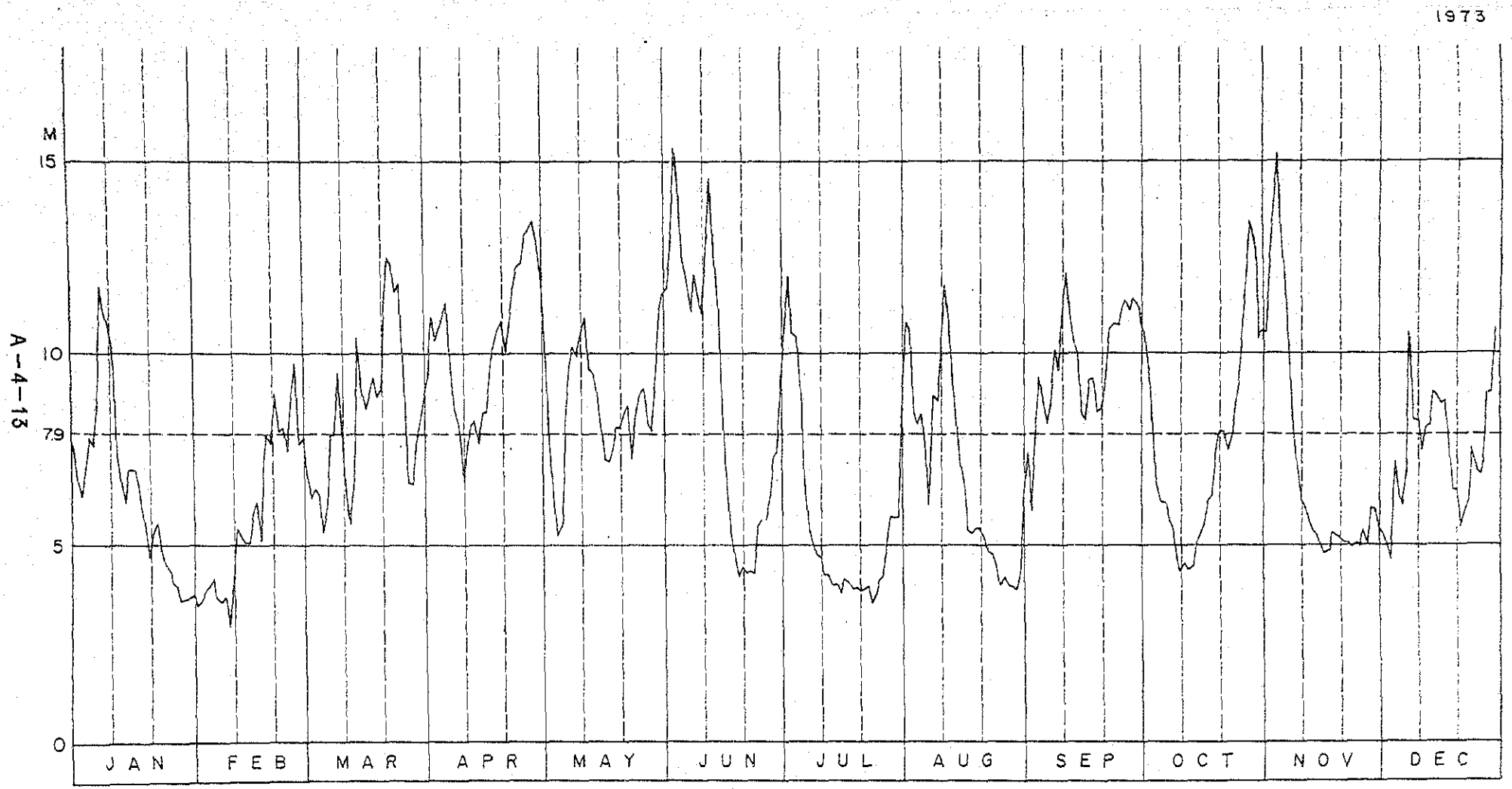


Appendix 4-4(8) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT

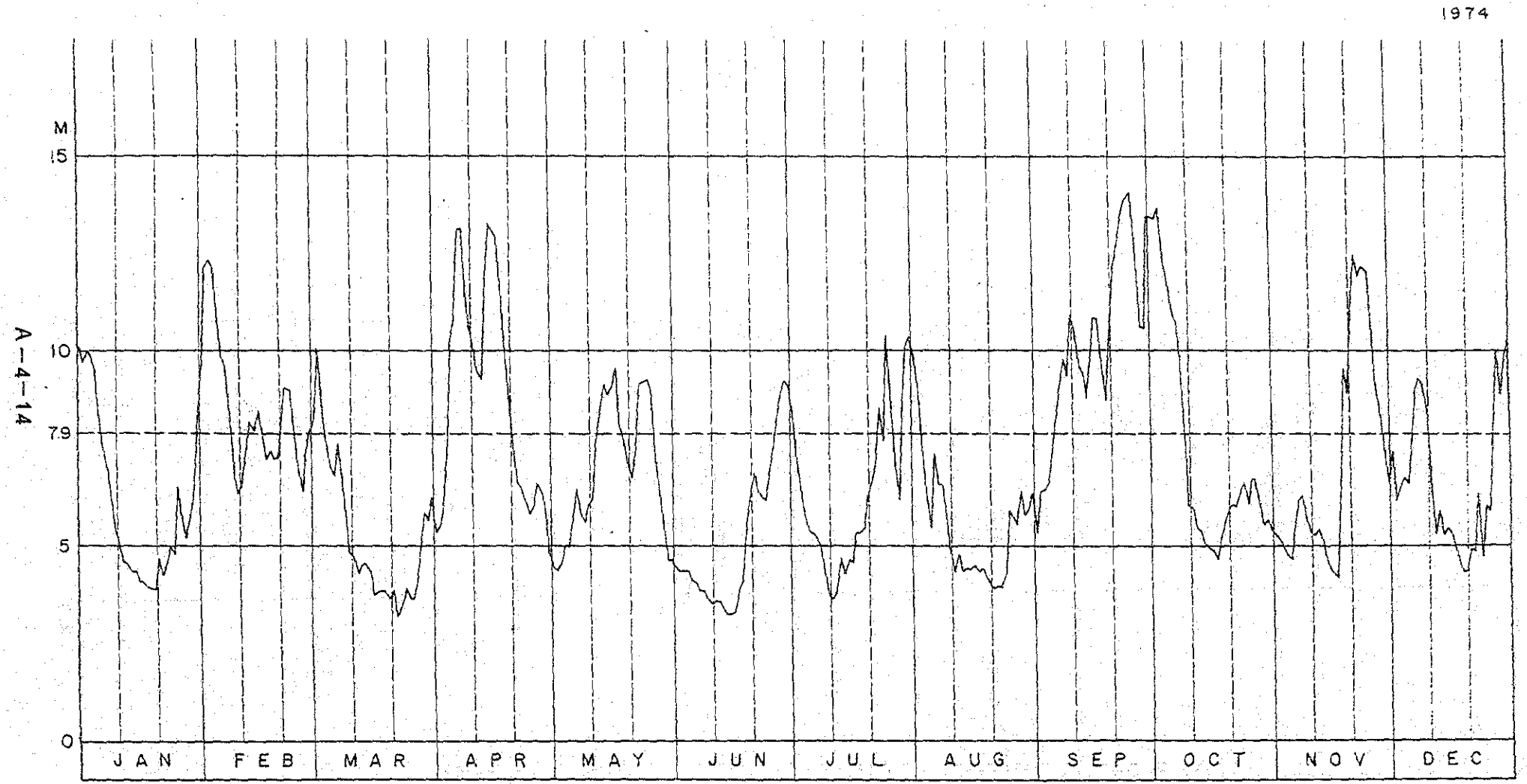


A-4-12

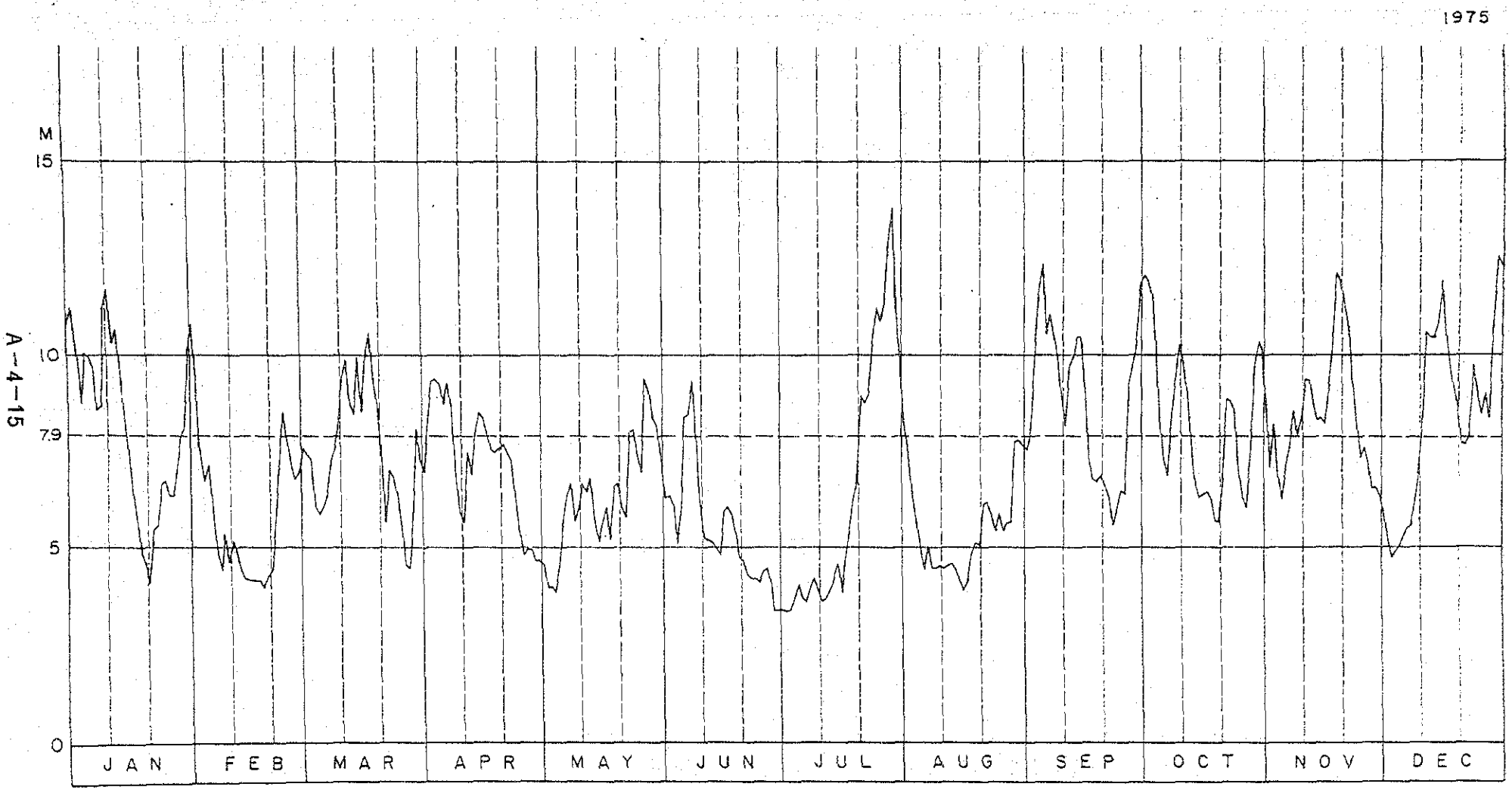
Appendix 4-4(9) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



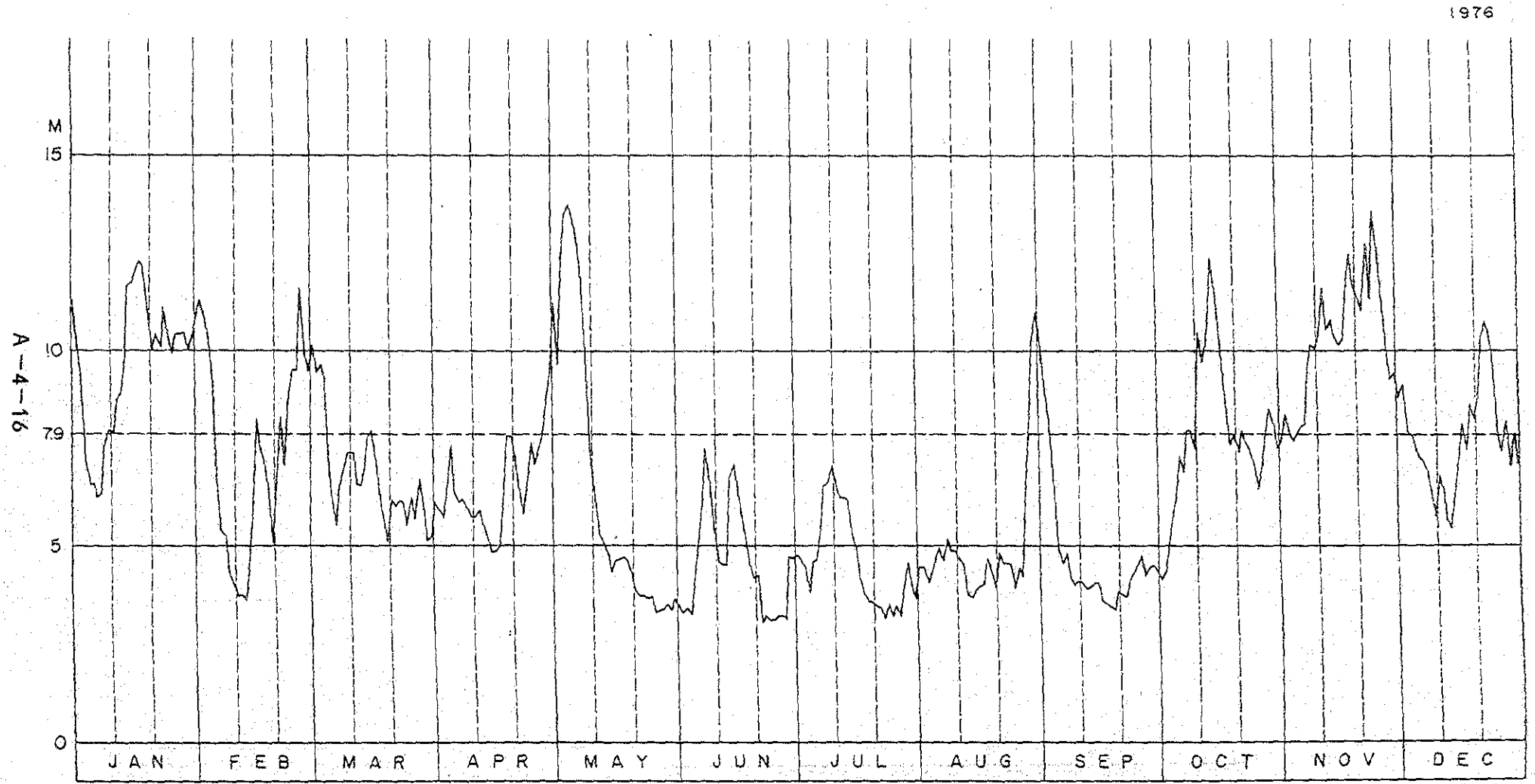
Appendix 4-4(10) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



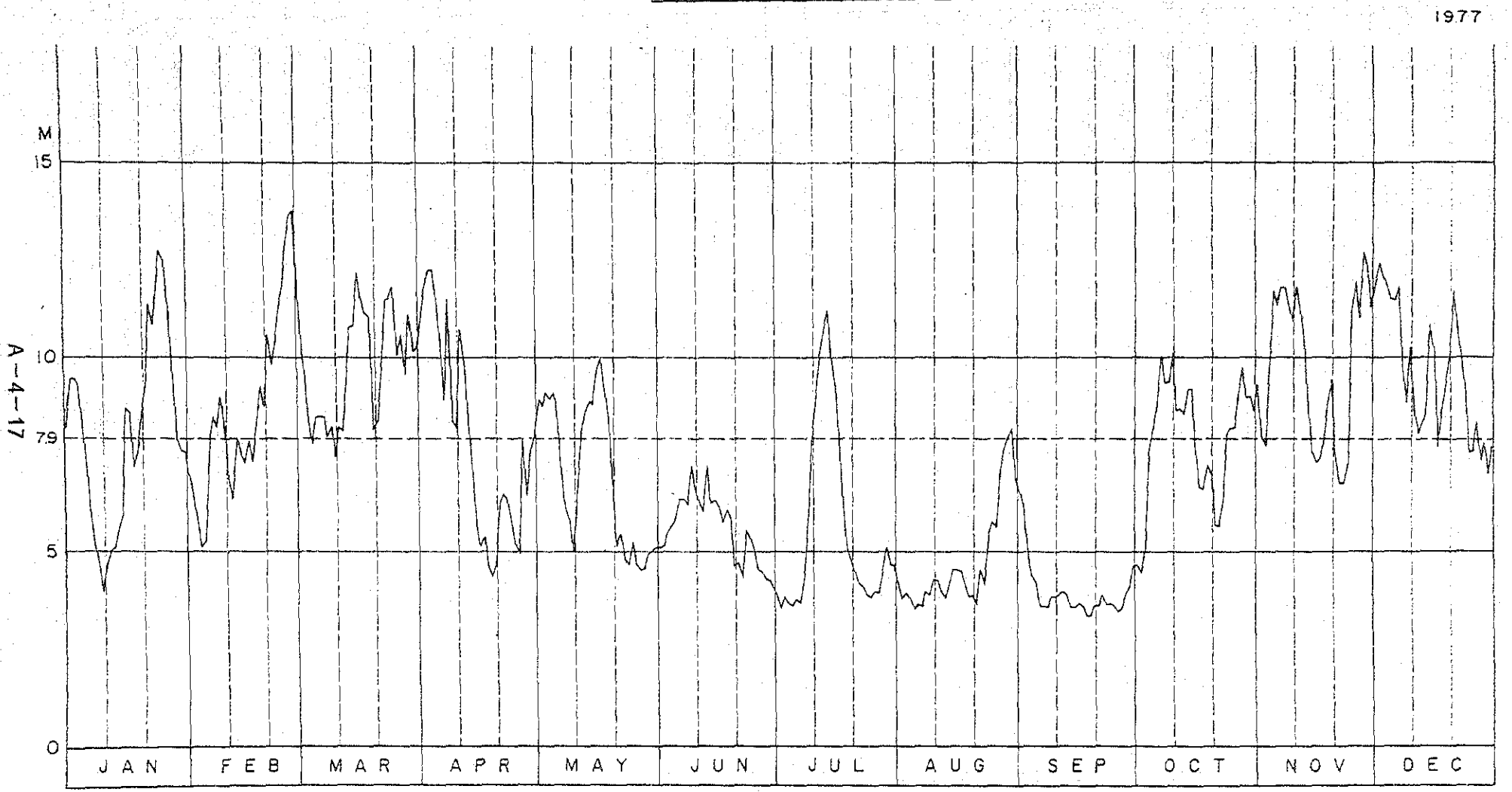
Appendix 4-4(11) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



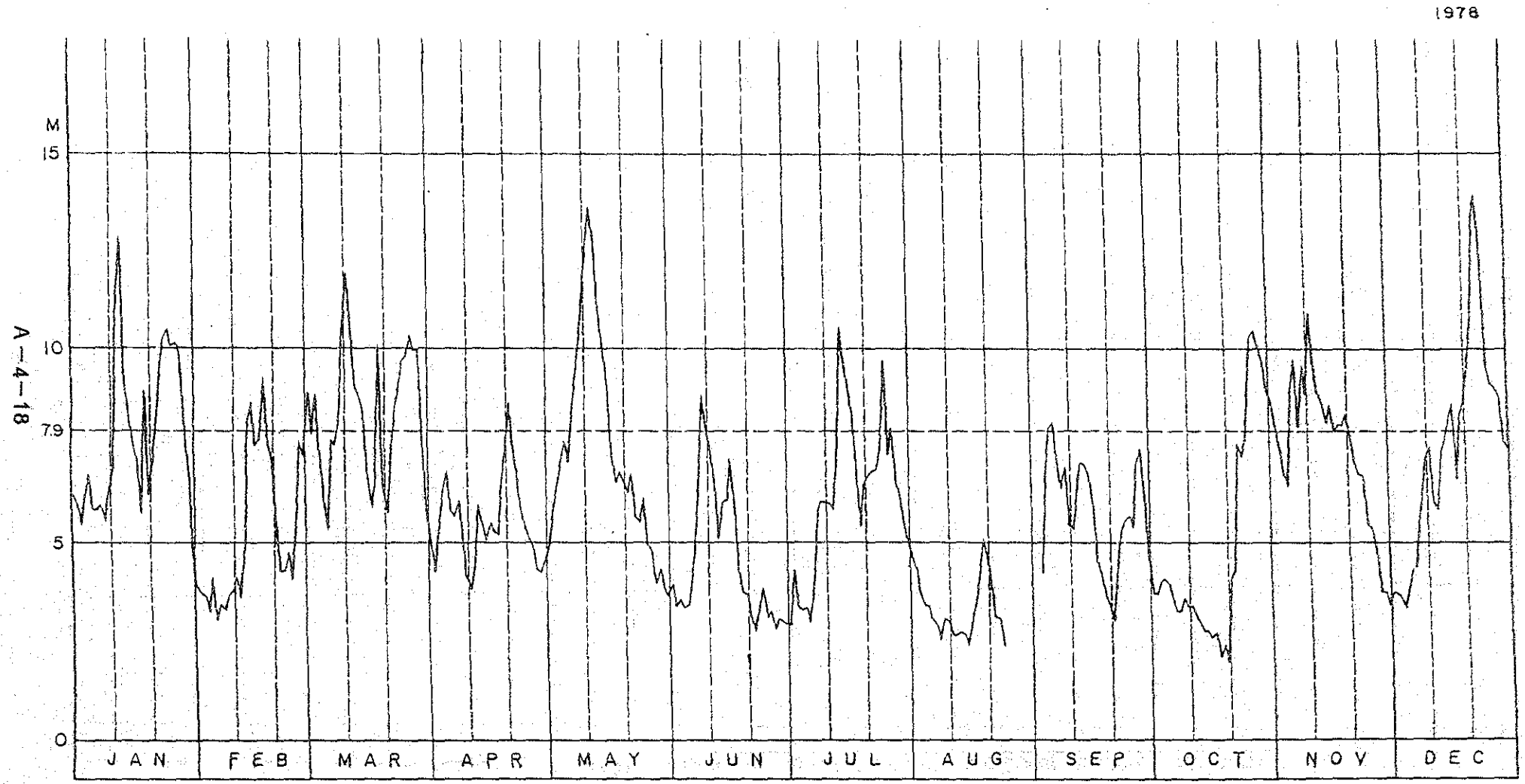
Appendix 4-4(12) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



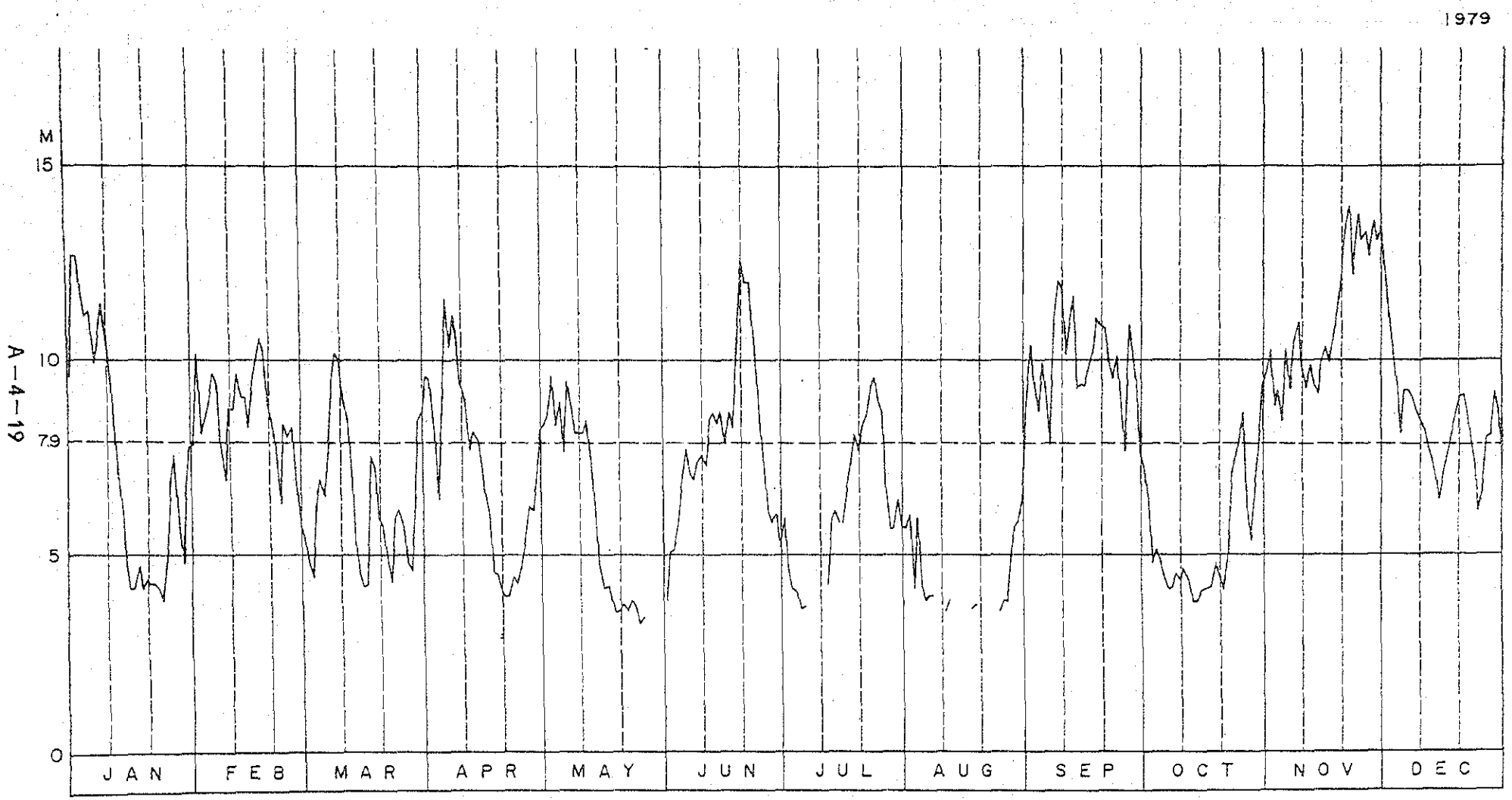
Appendix 4-4(13) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



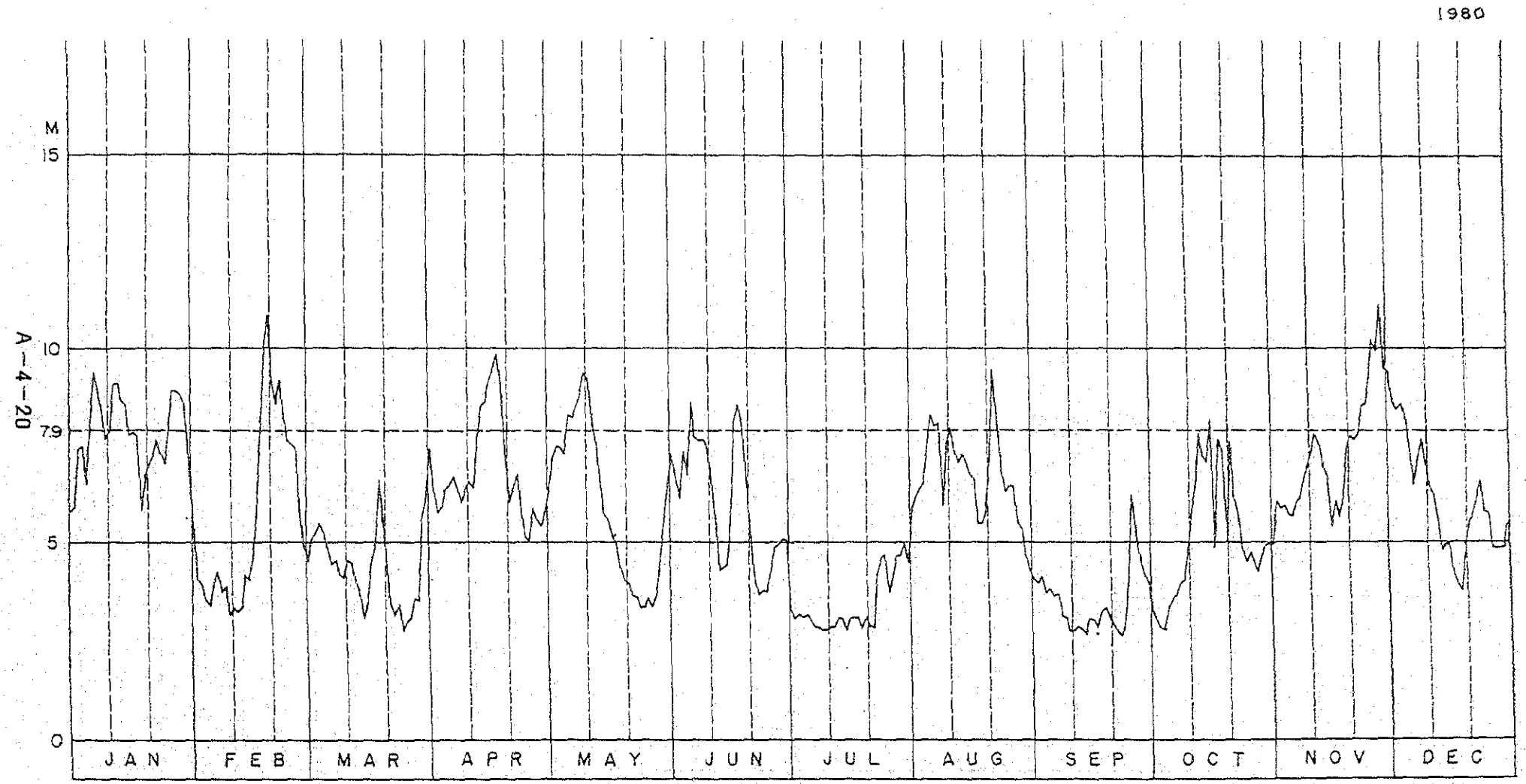
Appendix 4-4(14) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



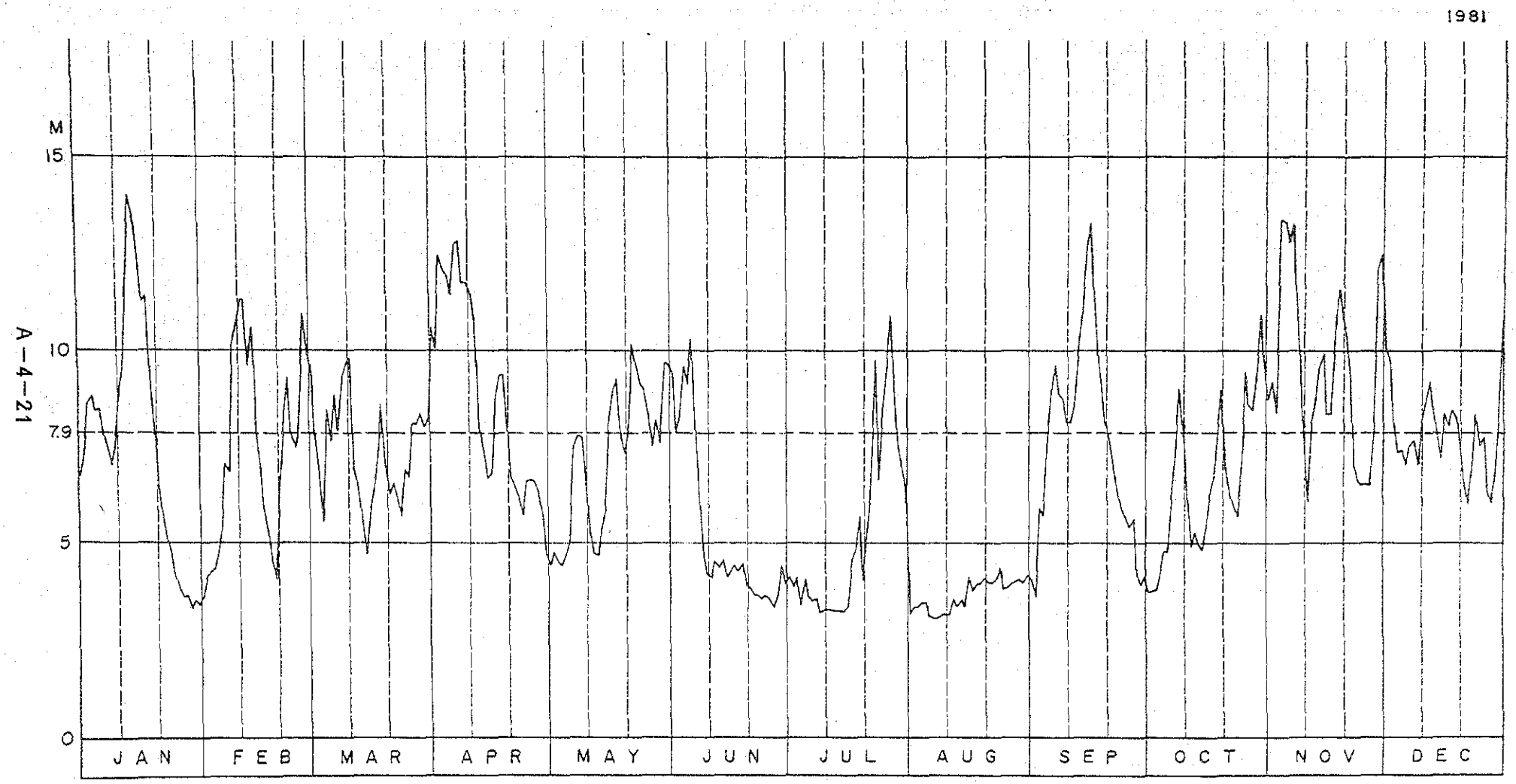
Appendix 4-4(15) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



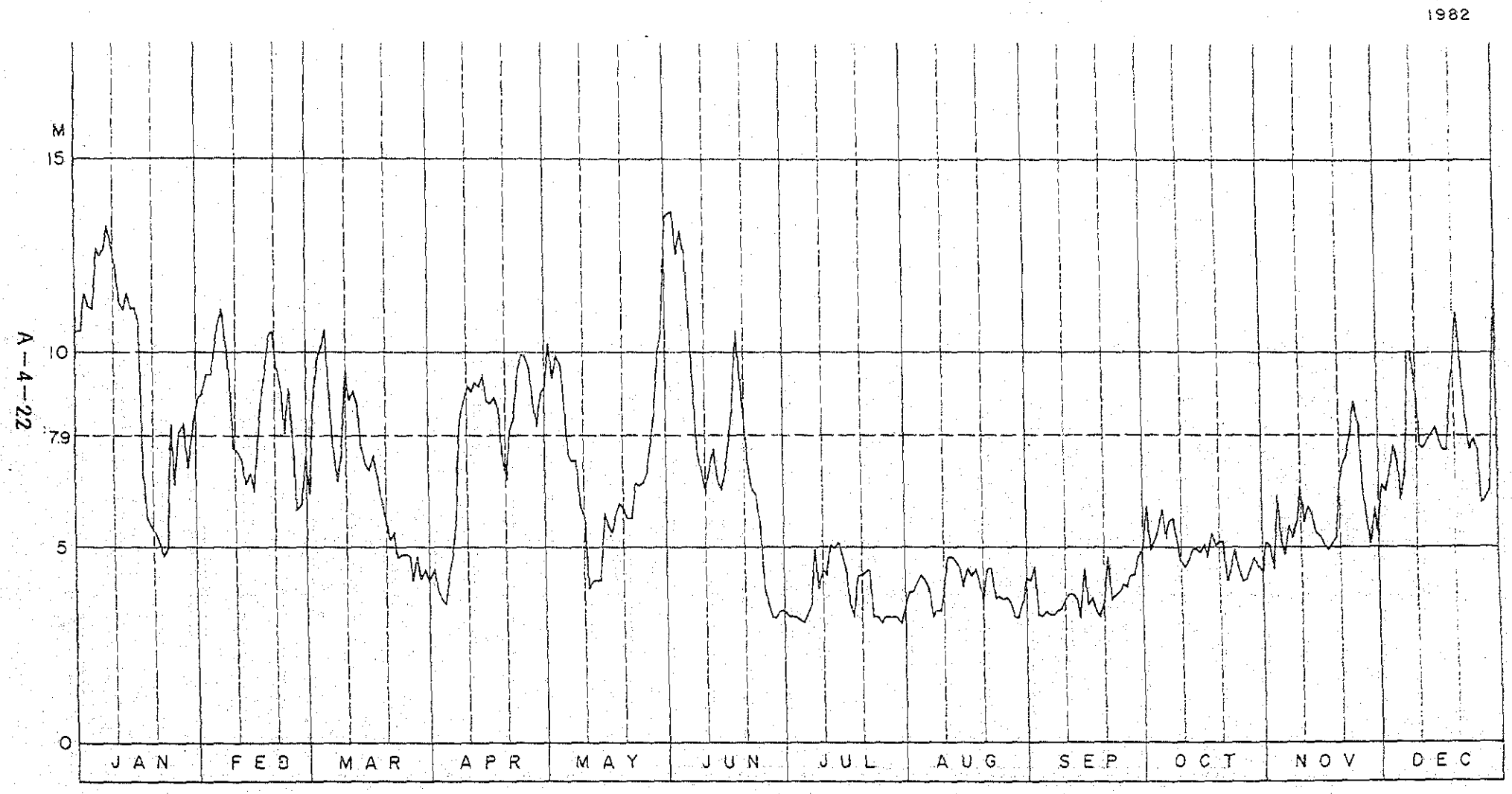
Appendix 4-4(16) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



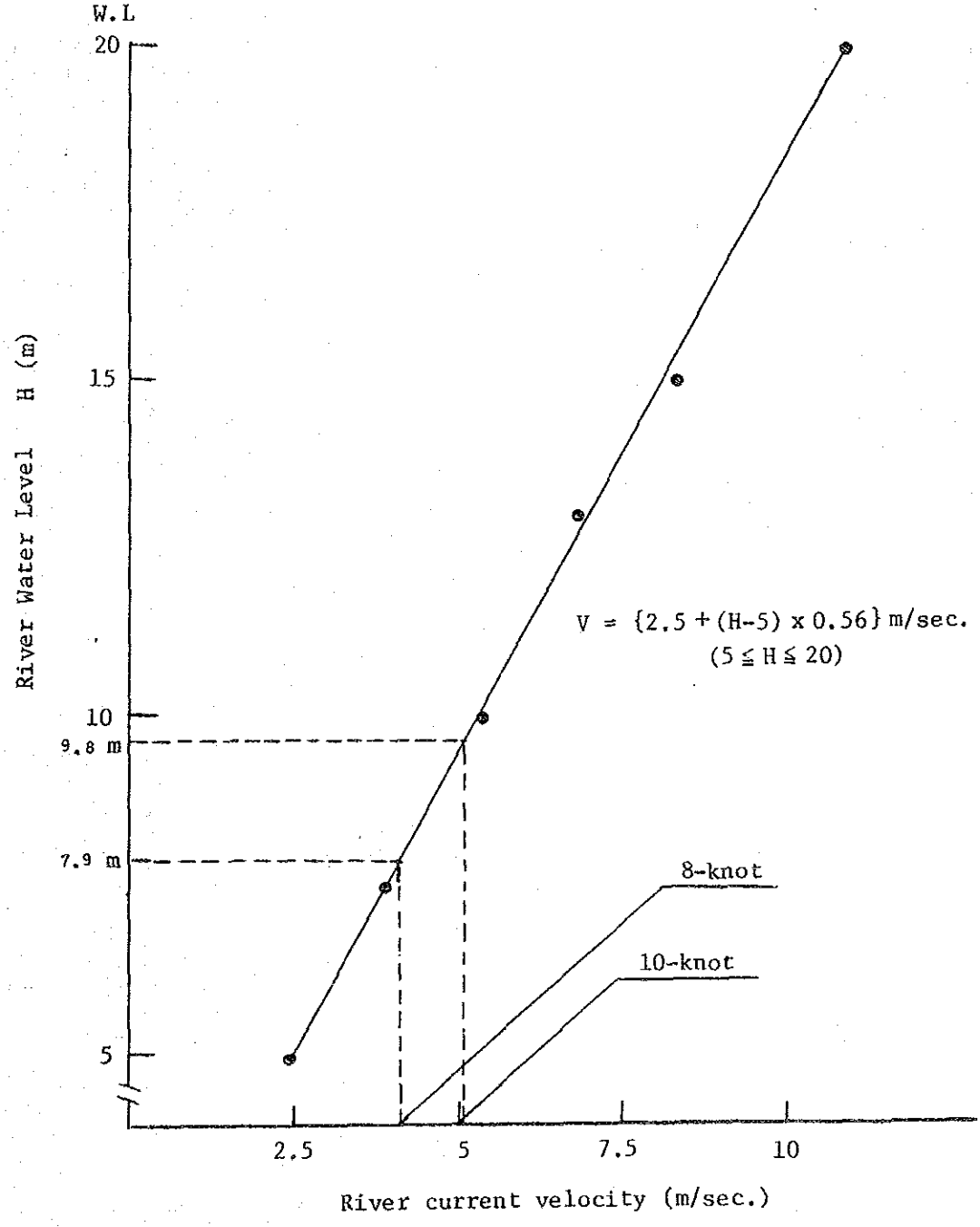
Appendix 4-4(17) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



Appendix 4-4(18) WATER LEVEL OF THE BATANG RAJANG RECORDED AT KAPIT



Appendix 4-5 H-V CURVE OF THE BATANG RAJANG AT KAPIT



Appendix 5-1 COMPARISON OF MAJOR ALTERNATIVE ROUTES

Description		Unit	Route-1	Route-2
Terrain	Flat/Rolling	Km	27.0	58.0
	Mountainous	Km	25.4	6.2
Vertical Alignment Distribution	0 - 2%	Km	38.6	56.5
	2 - 4%	Km	4.9	2.4
	4 - 6%	Km	7.6	2.8
	6 - 8%	Km	1.3	0.5
	Total	Km	52.4	64.2
Bridges	2@30.4^{m}+27.2^{m}=88^{m}	No.	0	1
	3@27.4^{m} =82^{m}	No.	0	1
	2@30.4^{m} =61^{m}	No.	1	1
	2@27.4^{m} =54.8^{m}	No.	1	0
	30.4^{m}	No.	1	0
	27.4^{m}	No.	0	1
	24.4^{m}	No.	1	4
	16.4^{m}	No.	1	2
	9.1^{m}	No.	5	6
Box Culvert	2 - 3.0^{m} x 3.0^{m}	m	25	150
	2 - 3.0^{m} x 2.5^{m}	m	25	50
	2 - 2.5^{m} x 2.5^{m}	m	50	100
	3.0^{m} x 3.0^{m}	m	25	125
	3.0^{m} x 2.5^{m}	m	0	0
	2.5^{m} x 2.5^{m}	m	50	100
	2.0^{m} x 2.0^{m}	m	100	225
	1.5^{m} x 1.5^{m}	m	50	50
Remarks			No.0 —— No.52 + 400	No.0 —— No.64 + 200

Appendix 5-2 CONSTRUCTION COST BY MAJOR ALTERNATIVE ROUTES

(Unit: M$)

Description	Unit Cost	Line-A Cost	Line-B Cost
1) Tree Cutting	22,300/km	1,168,520	1,431,660
2) Clearing and Grubbing	61,880/km	3,242,512	3,972,696
3) Earthwork		46,506,200	46,243,500
Flat/Rolling	678,700/km	18,324,900	39,364,600
Mountainous	1,109,500/km	28,181,300	6,878,900
4) Pavement	171,410/km		
5) Bridge		4,212,908	8,485,810
2 x 30.4 m + 27.4 m = 88 m	1,912/m^2	0	1,564,781
3 x 27.4 m = 82 m	1,515/m^2	0	1,155,339
2 x 30.4 m = 61 m	1,240/m^2	703,452	703,452
2 x 27.4 m = 54.8 m	1,515/m^2	772,105	0
30.4 m	1,240/m^2	350,572	0
27.4 m	1,912/m^2	0	487,216
24.4 m	2,300/m^2	521,916	2,087,664
16.4 m	2,045/m^2	311,903	623,806
9.1 m	3,670/m^2	1,552,960	1,863,552
6) Box Culvert		719,400	2,080,950
2-3.0 m x 3.0 m	4,688/m	117,200	703,200
2-3.0 m x 2.5 m	4,118/m	102,950	205,900
2-2.5 m x 2.5 m	3,450/m	172,500	345,000
3.0 m x 3.0 m	2,426/m	60,650	303,250
2.5 m x 2.5 m	1,785/m	89,250	178,500
2.0 m x 2.0 m	1,346/m	134,600	302,850
1.5 m x 1.5 m	845/m	42,250	42,250
Total Direct Cost		55,849,540	62,214,616

Appendix 5-3 COMPARISON OF MINOR ALTERNATIVE ROUTES

Item			Segment-1		Segment-2		Segment-3		Segment-4		Segment-5	
			Line-A	Line-B	Line-A	Line-B	Line-A	Line-B	Line-A	Line-B	Line-A	Line-B
Terrain	Flat/Rolling	Km	6.2	7.0	0	0	0	0	0	0	0	0
	Mountainous	Km	17.4	14.4	14.25	16.5	7.75	8.2	8.3	8.95	13.5	14.1
	Total	Km	23.6	21.4	14.25	16.5	7.75	8.2	8.3	8.95	13.5	14.1
Bridge	2×27.4^{M}	U	1	1	0	0	0	0	0	0	0	0
	27.4	U	0	1	0	0	0	0	0	0	1	1
	24.4	U	0	0	0	0	0	0	2	2	1	1
	16.4	U	0	1	1	3	0	1	0	0	0	0
	9.1	U	4	2	2	0	2	1	0	0	1	1
Box Culvert	$2\text{-}3.0^{W} \times 3.0^{H}$	m	0	25	0	25	0	0	0	50	25	25
	2-3.0 x 2.5	m	0	0	0	0	0	25	0	0	25	0
	2-2.5 x 2.5	m	50	0	25	0	25	0	50	50	25	25
	3.0 x 3.0	m	25	25	0	0	25	0	0	0	25	25
	3.0 x 2.5	m	0	75	0	50	0	0	0	0	0	0
	2.5 x 2.5	m	0	0	0	75	0	0	0	50	25	0
	2.0 x 2.0	m	25	0	25	50	0	75	50	0	25	75
	1.5 x 1.5	m	25	25	0	25	25	25	0	0	0	75
Remarks	Beginning Point		No.9 + 600		No.4 + 500		No.24 + 100		No.50 + 500		No.108 + 000	
	Terminal Point		No.33 + 200	No.31 + 000	No.18 + 750	No.21 + 000	No.31 + 850	No.32 + 300	No.58 + 800	No.59 + 450	No.121 + 500	No.122 + 100

Appendix 5-4(1) CONSTRUCTION COST OF SEGMENT-1 WITH MINOR ALTERNATIVE ROUTE

(Unit: M$)

Description	Unit Cost	Line-A Cost	Line-B Cost
1) Tree Cutting	22,300/km	526,280	477,200
2) Clearing and Grubbing	61,880/km	1,460,368	1,324,232
3) Earthwork		23,513,240	20,727,700
Flat/Rolling	678,700/km	4,207,940	4,750,900
Mountainous	1,109,500/km	19,305,300	15,976,800
4) Pavement	171,410/km	4,045,276	3,668,174
5) Bridge		2,014,473	2,192,408
2 x 27.4 m = 54.8 m	1,515/m^2	772,105	772,105
27.4 m	1,912/m^2	0	487,216
16.4 m	2,045/m^2	0	311,903
9.1 m	3,670/m^2	1,242,368	621,184
6) Box Culvert		287,925	358,725
2-3.0 m x 3.0 m	4,688/m	0	117,200
2-2.5 m x 2.5 m	3,450/m	172,500	0
3.0 m x 3.0	2,426/m	60,650	60,650
3.0 m x 2.5 m	2,130/m	0	159,750
2.0 m x 2.0 m	1,346/m	33,650	0
1.5 m x 1.5 m	845/m	21,125	21,125
7) Connecting Road Line-B		0	6,111,490
(1) Tree Cutting	22,300/km	0	156,100
(2) Clearing and Grubbing	61,880/km	0	433,160
(3) Earthwork	678,700/km	0	4,750,900
(4) Pavement	110,190/km	0	771,330
Total Direct Cost		31,847,562	34,859,929

Appendix 5-4(2) CONSTRUCTION COST OF SEGMENT-2
WITH MINOR ALTERNATIVE ROUTE

(Unit: M$)

Description	Unit Cost	Line-A	Line-B
		Cost	Cost
1) Tree Cutting	22,300/km	317,775	367,950
2) Clearing and Grubbing	61,800/km	881,790	1,021,020
3) Earthwork	1,109,500/km	15,810,375	18,306,750
4) Pavement	171,410/km	2,442,593	2,828,265
5) Bridge		933,087	935,710
16.4 m	2,045/m^2	311,903	935,710
9.1 m	3,670/m^2	621,184	0
6) Box Culvert		119,900	446,000
2-3.0 m x 3.0 m	4,688/m	0	117,200
2-2.5 m x 2.5 m	3,450/m	86,250	0
3.0 m x 2.5 m	2,130/m	0	106,500
2.5 m x 2.5 m	1,785/m	0	133,875
2.0 m x 2.0 m	1,346/m	33,650	67,300
1.5 m x 1.5 m	845/m	0	21,125
Total Direct Cost		20,505,520	23,905,695

Appendix 5-4(3) CONSTRUCTION COST OF SEGMENT-3 WITH MINOR ALTERNATIVE ROUTE

(Unit: M$)

Description	Unit Cost	Line-A	Line-B
		Cost	Cost
1) Tree Cutting	22,300/km	172,850	182,860
2) Clearing and Grubbing	61,880/km	479,570	507,416
3) Earthwork	1,109,500/km	8,598,625	9,097,900
4) Pavement	171,410/km	1,328,427	1,405,562
5) Bridge		621,184	622,495
16.4 m	2,045/m^2		311,903
9.1 m	3,670/m^2	621,184	310,592
6) Box Culvert		168,025	225,025
2-3.0 m x 2.5 m	4,118/m	0	102,950
2-2.5 m x 2.5 m	3,450/m	86,250	0
3.0 m x 3.0 m	2,426/m	60,650	0
2.0 m x 2.0 m	1,346/m	0	100,950
1.5 m x 1.5 m	845/m	21,125	21,125
Total Direct Cost		11,368,681	12,041,258

Appendix 5-4(4) CONSTRUCTION COST OF SEGMENT-4
WITH MINOR ALTERNATIVE ROUTE

(Unit: M$)

Description	Unit Cost	Line-A	Line-B
		Cost	Cost
1) Tree Cutting	22,300/km	185,090	199,585
2) Clearing and Grubbing	61,880/km	513,604	553,826
3) Earthwork	1,109,500/km	9,208,850	9,930,025
4) Pavement	171,410/km	1,422,703	1,534,120
5) Bridge		1,043,832	1,043,832
24.4 m	2,300/m^2	1,043,832	1,043,832
6) Box Culvert		239,800	496,150
2-3.0 m x 3.0 m	4,688/m	0	234,400
2-2.5 m x 2.5 m	3,450/m	172,500	172,500
2.5 m x 2.5 m	1,785/m	0	89,250
2.0 m x 2.0 m	1,346/m	67,300	0
Total Direct Cost		12,613,879	13,757,538

Appendix 5-4(5) CONSTRUCTION COST OF SEGMENT-5 WITH MINOR ALTERNATIVE ROUTE

(Unit: M$)

Description	Unit Cost	Line-A	Line-B
		Cost	Cost
1) Tree Cutting	22,300/km	301,050	314,430
2) Clearing and Grubbing	61,880/km	835,380	872,508
3) Earthwork	1,109,500/km	13,978,250	15,643,950
4) Pavement	171,410/km	2,314,035	2,416,881
5) Bridge		1,319,724	1,319,724
27.4 m	1,912/m^2	487,216	487,216
24.4 m	2,300/m^2	521,916	521,916
9.1 m	3,670/m^2	310,592	310,592
6) Box Culvert		445,325	428,425
2-3.0 m x 3.0 m	4,688/m	117,200	117,200
2-3.0 m x 2.5 m	4,118/m	102,950	0
2-2.5 m x 2.5 m	3,450/m	86,250	86,250
3.0 m x 3.0 m	2,426/m	60,650	60,650
2.5 m x 2.5 m	1,785/m	44,625	0
2.0 m x 2.0 m	1,346/m	33,650	100,950
1.5 m x 1.5 m	845/m	0	63,375
Total Direct Cost		20,193,764	20,995,918

Appendix 6-1 BRIDGE INVENTORY ALONG THE BEST ROUTE

STA. No. (km)	River	River Water Discharge (m^3/sec)	Bridge Length (m)	Remarks
1.160	S. Kelawit	410	30.540	100' Beam
5.340	S. Puak	125	16.500	54' Beam
12.570	S. Tanyail	64	9.180	30' Beam
15.650	S. Majau	52	9.180	"
20.040	S. Sangan	810	54.980	90' Beam x 2
25.900	S. Adai	100	9.180	30' Beam
30.450	S. Bejagang	95	9.180	"
33.770	S. Kana	210	24.440	80' Beam
39.680	S. Muput	1,110	61.080	100' Beam x 2
48.450	S. Paum	62	9.180	30' Beam
52.940	S. Malat	195	24.440	80' Beam
56.230	S. Barit	190	24.440	"
62.250	S. Beringit	115	16.500	54' Beam
63.560	S. Barong	65	9.180	30' Beam
65.740	S. Ayam	690	54.980	90' Beam x 2
69.010	S. Penyan	85	9.180	30' Beam
71.980	S. Lami	485	30.540	100' Beam
88.520	S. Anap	1,730	91.620	100' Beam x 3
98.090	S. Dapu	55	9.180	30' Beam
99.160	S. Latong	90	9.180	"
104.180	S. Pelagus	385	27.490	90' Beam
106.940	S. Surugan	115	16.500	54' Beam
107.800	S. Ansural	135	16.500	"
111.270	S. Nguah	55	9.180	30' Beam
111.470	S. Mejau	135	16.500	54' Beam
116.840	S. Kapit	295	24.440	80' Beam
122.960	S. Bahi	60	9.180	30' Beam
124.570	S. Chirmin	315	27.490	90' Beam
136.850	B. Rajang	19,800	430.000	
Lepong Balleh Road	S. Amang	390	27.490	90' Beam

Note: S denotes Sungai

Appendix 6-2(1) BOX CULVERT INVENTORY ALONG THE BEST ROUTE

STA. No. (km)	River Discharge (m^3/sec)	Dimension 1.5x1.5 (m)	2.0x2.0 (m)	2.5x2.5 (m)	3.0x2.5 (m)	3.0x3.0 (m)	2-2.5x2.5 (m)	2-3.0x2.5 (m)	2-3.0x3.0 (m)	Remarks
7.730	30						75			S. Puak
9.760	8.8		63							"
26.970	5.8	99								
28.690	25					36				S. Sunan
32.020	30						54			S. Sabuloh
34.890	37							27		S. Janga Hilir
35.350	14			33						S. Janga Ulu
38.000	8.6		28.5							
46.620	43								27	
46.900	5.9	36								
49.230	12			45						
49.520	9.2		45							
51.180	9.4		45							
52.500	11		39							S. Malat Marah
53.900	27						52.5			S. Malat Mit
58.220	30						46.5			S. Malat Besar
58.550	8.1		36							"
61.460	12			37.5						S. Makah
70.040	17			78						
71.680	8.5		84							S. Lami

Appendix 6-2(2) BOX CULVERT INVENTORY ALONG THE BEST ROUTE

STA. No. (km)	River Discharge (m^3/sec)	Dimension 1.5x1.5 (m)	2.0x2.0 (m)	2.5x2.5 (m)	3.0x2.5 (m)	3.0x3.0 (m)	2-2.5x2.5 (m)	2-3.0x2.5 (m)	2-3.0x3.0 (m)	Remarks
74.570	22					87				S. Kelatak
75.860	50								51	S. Balang
75.960	6.7		46.5							"
77.850	9.1		45							
78.630	9.8		43.5							
85.140	6.6		60							
89.660	50								39	Hulu S. Kilong
97.180	50								37.5	S. Dapu
102.910	11		30							S. Garin
103.810	35						42			S. Arak
104.340	30						37.5			S. Selaban
109.480	6.0	36								S. Awar
114.140	30						54			
115.040	7.3		46.5							
121.470	26						81			S. Mutau
126.410	40							57		S. Sebarek
129.260	16			150						S. Belawang
130.670	45								63	S. Sibau
133.770	25					105				S. Sapayang
Total	-	171	612	343.5	-	228	442.5	84	217.5	

Appendix 6-3(1) PIPE CULVERT INVENTORY ALONG THE BEST ROUTE

STA. No. (km)	River Discharge (m^3/sec)	Dimension ϕ1066	Dimension ϕ1524	STA. No. (km)	River Discharge (m^3/sec)	Dimension ϕ1066	Dimension ϕ1524
0.330		32		17.280		23	
2.230		30		17.460		39	
2.370		24		18.140		48	
2.800		39		19.250		24	
2.880		45		21.470		30	
3.040		68		21.900		30	
3.190		57		22.600		21	
3.330		57		22.800		33	
3.430		57		22.970		35	
4.000		45		23.160	1.1	63	
4.620		35		23.480		48	
5.670		39		23.950		45	
5.980		45		24.070	4.8		69
6.300		27		24.570		63	
6.440		24		25.180		41	
6.560		24		25.500		38	
6.740		32		26.200	5.4		27
7.060		50		26.670	1.5	24	
7.410		32		27.930		66	
9.080		56		28.260		42	
9.370		63		28.470		57	
9.980		69		28.840		27	
10.800		72		29.320		29	
11.440		81		30.780		66	
11.910		65		31.060		30	
13.070		35		36.400		23	
13.600		42		36.900	0.2	20	
14.600			35	36.980	4.0	21	
15.300		27		37.790	1.7	20	
15.990		27		41.100		26	

Appendix 6-3(2) PIPE CULVERT INVENTORY ALONG THE BEST ROUTE

STA. No. (km)	River Discharge (m^3/sec)	Dimension ϕ1066	Dimension ϕ1524	STA. No. (km)	River Discharge (m^3/sec)	Dimension ϕ1066	Dimension ϕ1524
44.900		26		59.580		65	
45.380		38		59.900		38	
47.440		32		60.100		42	
47.650		48		60.250		39	
48.800		45		60.850		30	
50.520		74		61.100		35	
50.700		45		61.260		33	
51.300		38		62.450		33	
51.450		45		63.200		72	
51.680		54		64.230		60	
51.920		24		64.950		48	
52.050		39		65.200			48
52.710		21		66.740	2.9		96
53.460		27		66.900		90	
53.600		27		68.150			69
54.070		33		68.340		87	
54.200		26		68.800		42	
54.500		44		69.680		78	
54.770		59		69.880		24	
54.950		48		72.600		54	
55.100		38		72.760		56	
55.350		21		72.870			63
55.420		21		73.250		47	
55.510		29		73.700		77	
56.480		45		73.900		75	
56.950		77		74.980		35	
57.180		74		75.150		30	
57.550		72		75.300		62	
59.090		42		75.500		63	
59.220		35		76.120	4.1		60

Appendix 6-3(3) PIPE CULVERT INVENTORY ALONG THE BEST ROUTE

STA. No. (km)	River Discharge (m^3/sec)	Dimension ø1066	Dimension ø1524	STA. No. (km)	River Discharge (m^3/sec)	Dimension ø1066	Dimension ø1524
76.310		36		87.760		54	
76.620		56		87.820		51	
76.780		56		88.850	2.3	29	
76.910		66		89.300		39	
77.250			41	90.020			24
78.010		45		90.400		27	
79.700			39	90.820		24	
79.850		27		91.260			23
80.390		85		91.800			23
80.650		60		93.050		33	
80.820		36		93.200		29	
81.090	4.0		60	93.800		21	
81.400		90		94.610		44	
81.530		66		95.350		35	
81.650		51		95.880		27	
81.800		72		96.250			24
81.950		59		97.700		26	
82.500		69		98.780		38	
82.600		42		100.020		30	
82.720		48		101.150		60	
82.830		44		101.440		27	
83.040		36		102.200		24	
83.210		51		103.190		30	
84.230		83		103.480		42	
85.320		39		105.200	3.5		45
85.760		56		105.460		54	
85.940		63		105.840		44	
86.080		81		106.050			59
86.550		48		106.300		44	
87.480		38		106.640		59	

Appendix 6-3(4) PIPE CULVERT INVENTORY ALONG THE BEST ROUTE

STA. No. (km)	River Discharge (m^3/sec)	Dimension ϕ1066	Dimension ϕ1524	STA. No. (km)	River Discharge (m^3/sec)	Dimension ϕ1066	Dimension ϕ1524
107.410	3.9		45	126.980		75	
108.270	5.0		71	127.390		78	
108.940		50		127.690		72	
109.760		26		127.820	5.2		92
110.110		24		128.740			96
110.440		36		129.780		108	
112.040		45		130.200		56	
112.700		50		131.150		48	
113.050	2.1	53		131.350		45	
113.210		59		131.720		53	
113.600		48		131.930		45	
116.210	2.0	53		132.200		71	
116.750			24	132.410		68	
118.160		83		132.680		51	
118.410	5.2		21	133.200		74	
118.900	3.3		63	133.450		56	
119.570		75		133.580		60	
120.010	3.5		78	134.410		60	
120.240		59		134.620		63	
120.720		66		134.760		99	
120.900		69		135.280		41	
121.830		54		135.700		81	
121.900		54		137.460		87	
123.500		84		137.960		72	
123.980		71		138.430		72	
124.130		47					
124.220		41		Total :		10,143	1,295
124.990		54					
125.440		63					
125.830		57					

Appendix 6-4(1) CONSTRUCTION COST BY SECTION

SECTION No. 1 (0.0 km - 21.0 km)

(Unit: M$)

DESCRIPTION	QUANTITY	UNIT	FOREIGN	LOCAL	TAX	TOTAL
Tree Cutting	8,400	Pieces	179,928	284,088	3,612	467,628
Clearing and Grubbing	840,000	m^2	747,600	542,640	9,240	1,299,480
Sub-total			927,528	826,728	12,852	1,767,108
Common Excavation (Short D)	200,200	m^3	338,538	225,225	2,603	566,366
Common Excavation (Medium D)	250,250	m^3	644,394	356,856	4,254	1,005,504
Common Excavation (Long D)	264,550	m^3	864,814	553,703	7,143	1,425,660
Soft Rock Excavation	572,000	m^3	2,649,504	1,448,304	15,444	4,113,252
Solid Rock Excavation	143,000	m^3	1,901,900	1,098,240	148,720	3,149,860
Embankment (Low)	198,600	m^3	142,793	90,959	1,192	234,944
Embankment (High)	1,271,400	m^3	1,053,990	686,556	8,900	1,749,446
Sub-total			7,595,933	4,459,843	188,256	12,244,032
Subgrade Regularization	165,900	m^2	13,604	10,016	104	23,724
Subbase Course t=15cm	159,600	m^2	587,328	328,776	79,800	995,904
Well Graded Aggregate Base Course t=20cm	151,200	m^2	1,096,200	592,704	160,272	1,849,176
Prime Coat	151,200	m^2	200,794	27,518	23,738	252,050
Penetration Macadam t=3cm	147,000	m^2	449,967	114,660	53,802	618,429
Sub-total			2,347,893	1,073,674	317,716	3,737,283
R.C. Beam Bridge L=9.1m	2	Unit	265,720	314,429	44,381	624,530
Prestressed Beam Bridge L=164m	1	Unit	136,943	152,596	22,480	312,019
P.C.T. Bridge L=304m	1	Unit	195,614	129,889	25,730	351,233
P.C.T. Bridge L=2x27.4m	1	Unit	423,207	293,345	56,830	773,382
Sub-total			1,021,484	890,259	149,421	2,061,164
Box Culvert 2.0m x 2.0m	63	m	45,670	33,842	5,301	84,813
Box Culvert 2-2.5m x 2.5m	75	m	139,903	101,863	17,020	258,786
Corrugated Pipe ø 1,066mm	1,479	m	367,679	57,149	43,630	468,458
Corrugated Pipe ø 1,524mm	35	m	14,515	2,084	1,724	18,323
Sub-total			567,767	194,938	67,675	830,380
Side Ditch	41,760	m	-	264,591	-	264,591
Slope Protection	241,000	m^2	385,600	96,400	-	482,000
Sub-total			385,600	360,991		746,591
Feeder Road (Development Road)	1,000	m	46,663	22,729	4,394	73,786
Total			12,892,868	7,829,162	740,314	21,462,344
2nd Stage						
Tack Coat	153,300	m^2	90,447	7,818	10,424	108,689
Asphalt Concrete Pavement t=5cm	153,000	m^2	1,402,695	521,220	148,701	2,072,616
Total			1,493,142	529,038	159,125	2,181,305
Total Direct Cost			14,386,010	8,358,200	899,439	23,643,649

Appendix 6-4(2) CONSTRUCTION COST BY SECTION

SECTION No. 2 (21.0 km - 40.5 km)

(Unit: M$)

DESCRIPTION	QUANTITY	UNIT	FOREIGN	LOCAL	TAX	TOTAL
Tree Cutting	7,800	Pieces	167,076	263,796	3,354	434,226
Clearing and Grubbing	780,000	m^2	694,200	503,880	8,580	1,206,660
Sub-total			861,276	767,676	11,934	1,640,886
Common Excavation (Short D)	231,000	m^3	390,621	259,875	3,003	653,499
Common Excavation (Medium D)	288,750	m^3	743,531	411,758	4,909	1,160,198
Common Excavation (Long D)	305,250	m^3	997,862	638,888	8,242	1,644,992
Soft Rock Excavation	660,000	m^3	3,057,120	1,671,120	17,820	4,746,060
Solid Rock Excavation	165,000	m^3	2,194,500	1,267,200	171,600	3,633,300
Embankment (Low)	172,900	m^3	124,315	79,188	1,037	204,540
Embankment (High)	1,107,100	m^3	917,786	597,834	7,750	1,523,370
Disposal	370,000	m^3	525,400	275,280	60,310	860,990
Sub-total			8,951,135	5,201,143	274,671	14,426,949
Subgrade Regularization	154,050	m^2	12,632	9,300	97	22,029
Subbase Course t=15cm	148,200	m^2	545,376	305,292	74,100	924,768
Well Graded Aggregate Base Course t=20cm	140,400	m^2	1,017,900	550,368	148,824	1,717,092
Prime Coat	140,400	m^2	186,451	25,553	22,043	234,047
Penetration Macadam t=3 cm	136,500	m^2	417,826	106,470	49,959	574,255
Sub-total			2,180,185	996,983	295,023	3,472,191
R.C. Beam Bridge L=9.1m	2	Unit	265,720	314,429	44,381	624,530
P.C.T. Bridge L=24.4m	1	Unit	281,808	201,140	38,979	521,927
P.C.T. Bridge L=2x30.4m	1	Unit	367,875	240,216	48,008	656,099
Sub-total			915,403	755,785	131,368	1,802,556
Box Culvert 1.5mx1.5m	99	m	44,395	34,161	5,076	83,632
Box Culvert 2.0mx2.0m	28.5	m	20,660	15,310	2,398	38,368
Box Culvert 2.5mx2.5m	33	m	31,560	23,572	3,751	58,883
Box Culvert 3.0mx3.0m	36	m	46,489	35,249	5,573	87,311
Box Culvert 2-2.5mx2.5m	54	m	100,731	73,341	12,254	186,326
Box Culvert 2-3.0mx2.5m	27	m	61,107	42,475	7,612	111,194
Corrugated Pipe ø 1,066mm	852	m	211,807	32,921	25,134	269,862
Corrugated Pipe ø 1,524mm	117	m	48,522	6,966	5,765	61,253
Sub-total			565,271	263,995	67,563	896,829
Side Ditch	38,800	m	-	245,837	-	245,837
Slope Protection	224,800	m^2	359,680	89,920	-	449,600
Sub-total			359,680	335,757	-	695,437
Feeder Road (Development Road)	1,000	m	46,663	22,729	4,394	73,786
Total			13,879,613	8,344,068	784,953	23,008,634
2nd Stage						
Tack Coat	142,350	m^2	83,986	7,260	9,680	100,926
Asphalt Concrete Pavement t=5cm	142,350	m^2	1,302,502	483,990	138,080	1,924,572
Total			1,386,488	491,250	147,760	2,025,498
Total Direct Cost			15,266,101	8,835,318	932,713	25,034,132

Appendix 6-4(3) CONSTRUCTION COST BY SECTION

SECTION No. 3 (40.5 km - 53.0 km)

(Unit: M$)

DESCRIPTION	QUANTITY	UNIT	FOREIGN	LOCAL	TAX	TOTAL
Tree Cutting	5,000	Pieces	107,100	169,100	2,150	278,350
Clearing and Grubbing	500,000	m^2	445,000	323,000	5,500	773,500
Sub-total			552,100	492,100	7,650	1,051,850
Common Excavation (Short D)	145,600	m^3	246,210	163,800	1,893	411,903
Common Excavation (Medium D)	182,000	m^3	468,650	259,532	3,094	731,276
Common Excavation (Long D)	192,400	m^3	628,956	402,693	5,195	1,036,844
Soft Rock Excavation	416,000	m^3	1,926,912	1,053,312	11,232	2,991,456
Solid Rock Excavation	104,000	m^3	1,383,200	798,720	108,160	2,290,080
Embankment (Low)	90,500	m^3	65,070	41,449	543	107,062
Embankment (High)	579,500	m^3	480,405	312,930	4,056	797,391
Disposal	370,000	m^3	525,400	275,280	60,310	860,990
Sub-total			5,724,803	3,307,716	194,483	9,227,002
Subgrade Regularization	98,750	m^2	8,097	5,962	62	14,121
Subbase Course t=15cm	95,000	m^2	349,600	195,700	47,500	592,800
Well Graded Aggregate Base Course t=20cm	90,000	m^2	652,500	352,800	95,400	1,100,700
Prime Coat	90,000	m^2	119,520	16,380	14,130	150,030
Penetration Macadam t=3cm	87,500	m^2	267,837	68,250	32,025	368,112
Sub-total			1,397,554	639,092	189,117	2,225,763
R.C. Beam Bridge L=9.1m	1	Unit	132,860	157,214	22,190	312,264
P.C.T. Bridge L=24.4m	1	Unit	281,808	201,140	38,979	521,927
Sub-total			414,668	358,354	61,169	834,191
Box Culvert 1.5mx1.5m	36	m	16,144	12,422	1,846	30,412
Box Culvert 2.0mx2.0m	129	m	93,515	69,296	10,854	173,665
Box Culvert 2.5mx2.5m	45	m	43,036	32,144	5,115	80,295
Box Culvert 2-3.0mx3.0m	27	m	67,859	50,396	8,324	126,579
Corrugated Pipe ⌀ 1,066mm	555	m	137,973	21,445	16,372	175,790
Sub-total			358,527	185,703	42,511	586,741
Side Ditch	24,900	m		157,766	-	157,766
Slope Protection	144,600	m^2	231,360	57,840	-	289,200
Sub-total			231,360	215,606	-	446,966
Total			8,679,012	5,198,571	494,930	14,372,513
2nd Stage						
Tack Coat	91,250	m^2	53,837	4,654	6,205	64,696
Asphalt Concrete Pavement t=5cm	91,250	m^2	834,937	310,250	88,513	1,233,700
Total			888,774	314,904	94,718	1,298,396
Total Direct Cost			9,567,786	5,513,475	589,648	15,670,909

Appendix 6-4(4) CONSTRUCTION COST BY SECTION

SECTION No. 4 (53.0 km - 88.55 km)

(Unit: M$)

DESCRIPTION	QUANTITY	UNIT	FOREIGN	LOCAL	TAX	TOTAL
Tree Cutting	14,220	Pieces	304,592	480,920	6,115	791,627
Clearing and Grubbing	1,422,000	m^2	1,265,580	918,612	15,642	2,199,834
Sub-total			1,570,172	1,399,532	21,757	2,991,461
Common Excavation (Short D)	774,200	m^3	1,309,172	870,975	10,065	2,190,212
Common Excavation (Medium D)	967,750	m^3	2,491,956	1,380,012	16,452	3,888,420
Common Excavation (Long D)	1,023,050	m^3	3,344,350	2,141,244	27,622	5,513,216
Soft Rock Excavation	2,212,000	m^3	10,245,984	5,600,784	59,724	15,906,492
Solid Rock Excavation	553,000	m^3	7,354,900	4,247,040	575,120	12,177,060
Embankment (low)	624,200	m^3	448,800	285,884	3,745	738,429
Embankment (High)	3,995,800	m^3	3,312,518	2,157,732	27,970	5,498,220
Disposal	770,000	m^3	1,093,400	572,880	125,510	1,791,790
Sub-total			29,601,080	17,256,551	846,208	47,703,839
Subgrade Regularization	280,845	m^2	23,029	16,955	177	40,161
Subbase Course t=15cm	270,180	m^2	994,262	556,571	135,090	1,685,923
Well Graded Aggregate Base Course t=20cm	255,960	m^2	1,855,710	1,003,363	271,318	3,130,391
Prime Coat	255,960	m^2	339,915	46,585	40,185	426,685
Penetration Macadam t=3cm	248,850	m^2	761,730	194,103	91,079	1,046,912
Sub-total			3,974,646	1,817,577	537,849	6,330,072
R.C. Beam Bridge L=9.1m	2	Unit	265,720	314,429	44,381	624,530
Prestressed Beam Bridge L=16.4m	1	Unit	136,943	152,596	22,480	312,019
P.C.T. Bridge L=24.4m	1	Unit	281,808	201,140	38,979	521,927
P.C.T. Bridge L=30.4m	1	Unit	195,614	129,889	25,730	351,233
P.C.T. Bridge L=2x27.4m	1	Unit	423,207	293,345	56,830	773,382
P.C.T. Bridge L=3x30.4m	1	Unit	540,137	350,533	70,286	960,956
Sub-total			1,843,429	1,441,932	258,686	3,544,047
Box Culvert 2.0mx2.0m	315	m	228,350	169,212	26,504	424,066
Box Culvert 2.5mx2.5m	115.5	m	110,458	82,504	13,129	206,091
Box Culvert 3.0mx3.0m	87	m	112,348	85,186	13,469	211,003
Box Culvert 2-2.5mx2.5m	99	m	184,673	134,459	22,466	341,598
Box Culvert 2-3.0mx3.0m	51	m	128,178	95,192	15,722	239,092
Corrugate Pipe ø 1,066mm	3,641	m	905,153	140,688	107,409	1,153,250
Corrugate Pipe ø 1,524mm	476	m	197,407	28,341	23,452	249,200
Sub-total			1,866,567	735,582	222,151	2,824,300
Side Ditch	70,630	m	-	447,512	-	447,512
Slope Protection	417,600	m^2	668,160	167,040	-	835,200
Sub-total			668,160	614,552	-	1,282,712
Total			39,524,054	23,265,726	1,886,651	64,676,431
2nd Stage						
Tack Coat	259,515	m^2	153,114	13,235	17,647	183,996
Asphalt Concrete Pavement t=5cm	259,515	m^2	2,374,562	882,351	251,730	3,508,643
Total			2,527,676	895,586	269,377	3,692,639
Total Direct Cost			42,051,730	24,161,312	2,156,028	68,369,070

Appendix 6-4(5) CONSTRUCTION COST BY SECTION

SECTION No. 5 (88.55 km - 104.2 km)

(Unit: M$)

DESCRIPTION	QUANTITY	UNIT	FOREIGN	LOCAL	TAX	TOTAL
Tree Cutting	6,260	Pieces	134,089	211,713	2,692	348,494
Clearing and Grubbing	626,000	m^2	557,140	404,396	6,886	968,422
Sub-total			691,229	616,109	9,578	1,316,916
Common Excavation (Short D)	168,000	m^3	284,088	189,000	2,184	475,272
Common Excavation (Medium D)	210,000	m^3	540,750	299,460	3,570	843,780
Common Excavation (Long D)	222,000	m^3	725,718	464,646	5,994	1,196,358
Soft Rock Excavation	480,000	m^3	2,223,360	1,215,360	12,960	3,451,680
Solid Rock Excavation	120,000	m^3	1,596,000	921,600	124,800	2,642,400
Embankment (Low)	162,100	m^3	116,550	74,242	972	191,764
Embankment (High)	1,037,900	m^3	860,419	560,466	7,265	1,428,150
Sub-total			6,346,885	3,724,774	157,745	10,229,404
Subgrade Regularization	123,635	m^2	10,138	7,464	78	17,680
Subbase Course t=15cm	118,940	m^2	437,699	245,016	59,470	742,185
Well Graded Aggregate Base Course t=20cm	112,680	m^2	816,930	441,706	119,441	1,378,077
Prime Coat	112,680	m^2	149,639	20,508	17,691	187,838
Penetration Macadam t=3cm	109,550	m^2	335,333	85,449	40,095	460,877
Sub-total			1,749,739	800,143	236,775	2,786,657
R.C. Beam Bridge L=9.1m	2	Unit	265,720	314,429	44,381	624,530
P.C.T. Bridge L=27.4m	1	Unit	258,568	193,409	35,876	487,853
Sub-total			524,288	507,838	80,257	1,112,383
Box Culvert 2.0mx2.0m	30	m	21,748	16,115	2,524	40,387
Box Culvert 2-2.5mx2.5m	42	m	78,346	57,043	9,531	144,920
Box Culvert 2-3.0mx3.0m	76.5	m	192,268	142,789	23,583	358,640
Corrugated Pipe ø 1,066mm	586	m	145,680	22,643	17,287	185,610
Corrugated Pipe ø 1,524mm	94	m	38,984	5,597	4,631	49,212
Sub-total			477,026	244,187	57,556	778,769
Side Ditch	31,210	m	-	197,746	-	197,746
Slope Protection	176,500	m^2	282,400	70,600	-	353,000
Sub-total			282,400	268,346	-	550,746
Total			10,071,567	6,161,397	541,911	16,774,875
2nd Stage						
Tack Coat	114,245	m^2	67,405	5,826	7,769	81,000
Asphalt Concrete Pavement t=5cm	114,245	m^2	1,045,342	388,433	110,818	1,544,593
Total			1,112,747	394,259	118,587	1,625,593
Total Direct Cost			11,184,314	6,555,656	660,498	18,400,468

Appendix 6-4(6) CONSTRUCTION COST BY SECTION

SECTION No. 6 (104.2 km - 136.6 km)

(Unit: M$)

DESCRIPTION	QUANTITY	UNIT	FOREIGN	LOCAL	TAX	TOTAL
Tree Cutting	12,960	Pieces	277,603	438,307	5,573	721,483
Clearing and Grubbing	1,296,000	m^2	1,153,440	837,216	14,256	2,004,912
Sub-total			1,431,043	1,275,523	19,829	2,726,395
Common Excavation (Short D)	434,000	m^3	733,894	488,250	5,642	1,227,786
Common Excavation (Medium D)	542,500	m^3	1,396,938	773,605	9,222	2,179,765
Common Excavation (Long D)	573,500	m^3	1,874,772	1,200,336	15,484	3,090,592
Soft Rock Excavation	1,240,000	m^3	5,743,680	3,139,680	33,480	8,916,840
Solid Rock Excavation	310,000	m^3	4,123,000	2,380,800	322,400	6,826,200
Embankment (Low)	432,300	m^3	310,824	197,993	2,594	511,411
Embankment (High)	2,767,700	m^3	2,294,423	1,494,558	19,374	3,808,355
Sub-total			16,477,531	9,675,222	408,196	26,560,949
Subgrade Regularization	255,960	m^2	20,989	15,452	161	36,602
Subbase Course t=15cm	246,240	m^2	906,163	507,254	123,120	1,536,537
Well Graded Aggregate Base Course t=20cm	233,280	m^2	1,691,280	914,458	247,276	2,853,014
Prime Coat	233,280	m^2	309,796	42,457	36,625	388,878
Penetration Macadam t=3cm	226,800	m^2	694,235	176,904	83,009	954,148
Sub-total			3,622,463	1,656,525	490,191	5,769,179
R.C. Beam Bridge L=9.1m	2	Unit	265,720	314,429	44,381	624,530
Prestressed Beam Bridge L=16.4m	3	Unit	410,830	457,787	67,439	936,056
P.C.T. Bridge L=24.4m	1	Unit	281,808	201,140	38,979	521,927
P.C.T. Bridge L=27.4m	1	Unit	258,568	193,408	35,876	487,852
Sub-total			1,216,926	1,166,764	186,675	2,570,365
Box Culvert 1.5mx1.5m	36	m	16,144	12,422	1,846	30,412
Box Culvert 2.0mx2.0m	46.5	m	33,709	24,979	3,912	62,600
Box Culvert 2.5mx2.5m	150	m	143,453	107,148	17,050	267,651
Box Culvert 3.0mx3.0m	105	m	135,593	102,811	16,256	254,660
Box Culvert 2-2.5mx2.5m	172.5	m	321,778	234,284	39,145	595,207
Box Culvert 2-3.0mx2.5m	57	m	129,003	89,671	16,069	234,743
Box Culvert 2-3.0mx3.0m	63	m	158,338	117,591	19,422	295,351
Corrugated Pipe ø 1,066mm	2,826	m	702,544	109,196	83,367	895,107
Corrugated Pipe ø 1,524mm	594	m	246,344	35,367	29,266	310,977
Sub-total			1,886,906	833,469	226,333	2,946,708
Side Ditch	64,560	m	-	409,052	-	409,052
Slope Protection	369,400	m^2	591,040	147,760	-	738,800
Sub-total			591,040	556,812	-	1,147,852
Total			25,225,909	15,164,315	1,331,224	41,721,448
2nd Stage						
Tack Coat	236,520	m^2	139,547	12,062	16,083	167,692
Asphalt Concrete Pavement t=5cm	236,520	m^2	2,164,158	804,168	229,424	3,197,750
Total			2,303,705	816,230	245,507	3,365,442
Total Direct Cost			27,529,614	15,980,545	1,576,731	45,086,890

Appendix 6-4(7) CONSTRUCTION COST BY SECTION

SECTION No. 7 (136.6 km - 138.8 km)

(Unit: M$)

DESCRIPTION	QUANTITY	UNIT	FOREIGN	LOCAL	TAX	TOTAL
Tree Cutting	880	Pieces	18,850	29,762	378	48,990
Clearing and Grubbing	88,000	m^2	78,320	56,848	968	136,136
Sub-total			97,170	86,610	1,346	185,126
Common Excavation (Short D)	42,000	m^3	71,022	47,250	546	118,818
Common Excavation (Medium D)	52,500	m^3	135,188	74,865	892	210,945
Common Excavation (Long D)	55,500	m^3	181,430	116,162	1,498	299,090
Soft Rock Excavation	120,000	m^3	555,840	303,840	3,240	862,920
Solid Rock Excavation	30,000	m^3	399,000	230,400	31,200	660,600
Embankment (Low)	39,200	m^3	28,185	17,954	235	46,374
Embankment (High)	250,800	m^3	207,913	135,432	1,755	345,100
Disposal	10,000	m^3	14,200	7,440	1,630	23,270
Sub-total			1,592,778	933,343	40,996	2,567,117
Subgrade Regularization	17,380	m^2	1,425	1,049	11	2,485
Subbase Course t=15cm	16,720	m^2	61,530	34,443	8,360	104,333
Well Graded Aggregate Base Course t=20cm	15,840	m^2	114,840	62,093	16,790	193,723
Prime Coat	15,840	m^2	21,036	2,883	2,487	26,406
Penetration Macadam t=3cm	15,400	m^2	47,139	12,012	5,636	64,787
Sub-total			245,970	112,480	33,284	391,734
Corrugated Pipe ø 1,066mm	231	m	57,427	8,926	6,814	73,167
Side Ditch	4,400	m	-	27,878	-	27,878
Slope Protection	32,100	m^2	51,360	12,840	-	64,200
Sub-total			51,360	40,718	-	92,078
Batang Rajang Bridge			4,476,395	1,705,584	445,410	6,627,389
Total			6,521,100	2,887,661	527,850	9,936,611
2nd Stage						
Tack Coat	16,060	m^2	9,476	819	1,092	11,387
Asphalt Concrete Pavement t=5cm	16,060	m^2	146,949	54,604	15,578	217,131
Total			156,425	55,423	16,670	228,518
Total Direct Cost			6,677,525	2,943,084	544,520	10,165,129

Appendix 6-4(8) CONSTRUCTION COST BY SECTION

CONNECTING ROAD L = 5,000 m

(Unit: US$)

DESCRIPTION	QUANTITY	UNIT	FOREIGN	LOCAL	TAX	TOTAL
Surface Regularization	35,000	m^2	2,870	2,113	22	5,005
New Aggregate Surface t=20cm	35,000	m^2	253,750	137,200	37,100	428,050
Penetration Macadam t=3cm	35,000	m^2	107,135	27,300	12,810	147,245
Sub-total			363,755	166,613	49,932	580,300
P.C.T. Bridge L=27.4m	1	Unit	258,568	193,409	35,876	487,853
Total Direct Cost			622,323	360,022	85,808	1,068,153

Appendix 6-5 ACQUISITION COST OF CONSTRUCTION EQUIPMENT

(Unit: M$)

ITEM	BRAND CAPACITY	FOREIGN COMPONENT	LOCAL COMPONENT	TOTAL	HOURLY RATE AS OF %
Air Compressor	10.5 M^3/min.	45,497.0	5,030.0	50,527	0.0337
Asphalt Plant	42 T/H	669,355.4	74,434.6	743,790	0.0206
Asphalt Finisher	3.6 M	128,077.4	15,807.6	143,885	0.0345
Bulldozer W/R	D8L	559,532.7	59,953.3	619,486	0.0222
Bulldozer	D7G	288,695.0	31,869.0	320,564	0.0234
Concrete Mixer	0.75 M^2	35,357.8	3,936.2	39,294	0.0278
Concrete Vibrator		1,818.8	181.2	2,000	0.0420
Crawler Crane Clamshell	0.6 M^3	290,480.8	33,048.2	323,529	0.0233
Crawler Drill	PCR110	86,549.0	11,655.0	98,204	0.0278
Crushing Plant	40 T/H	444,451.8	50,445.2	494,897	0.0128
Excavator (Backhoes)	0.4 M^3	126,986.0	15,699.0	142,685	0.0202
Generator	50 KVA	26,657.2	2,765.8	29,423	0.0265
Generator	213 KVA	81,609.2	8,440.8	90,050	0.0273
Motor Grader	3.7 M	167,165.3	19,716.7	186,882	0.0265
Macadam Roller	10 T	74,296.8	10,429.2	84,726	0.0261
Tired Roller	20 T	106,053.3	10,605.7	116,659	0.0297
Truck Crane	20 T	276,889.3	31,688.7	308,578	0.0226
Tractor Shovel	1.4 M^3	120,240.0	15,024.0	135,264	0.0243
Wheel Loader	1.4 M^3	111,509.6	14,150.4	125,660	0.0305
Pile Hammer	3.5 T	103,225.8	13,322.2	116,548	0.0316
Dump Truck	15 T	127,144.9	57,215.1	184,360	0.0267
Flatbed Truck	7 T	49,636.0	4,964.0	54,600	0.0256
Water Tanker	5,000 L	53,334.2	5,333.8	58,668	0.0255

Appendix 6-6 DURABILITY AND REPAIR COEFFICIENT OF MECHANICAL EQUIPMENT

MECHANICAL EQUIPMENT		ECONOMIC DURABILITY		REPAIR COEFFICIENT
		YEAR	HOURS	
Air Compressor	10.5 M^3/MIN	7	7,000	0.90
Asphalt Plant	42 T/HR	10	12,000	0.80
Asphalt Finisher	3.6 M	7	7,000	0.80
Bulldozer	D8L	10	12,000	1.00
Bulldozer	D7G	10	11,000	0.90
Concrete Mixer	0.75 M^3	8	8,000	0.70
Concrete Vibrator	ϕ42	5	4,000	0.35
Crawler Crane Clamshell	0.6 M^3	8	10,000	0.80
Crawler Drill PCR110		8	8,000	0.70
Crushing Plant	40 T/HR	12	18,000	0.50
Excavator (Backhoes)	0.4 M^3	10	12,000	0.75
Generator	200 KVA	7	7,000	0.45
Motor Grader	3.7 M	10	10,000	0.80
Macadam Roller	10 T	12	10,000	0.80
Tired Roller	20 T	6	8,000	0.80
Truck Crane	20 T	8	10,000	0.50
Tractor Shovel	1.4 M^3	10	11,000	1.00
Wheel Loader	1.4 M^3	10	10,000	0.90
Pile Hammer	3.5 T	8	8,000	1.00
Dump Truck	15 T	6	9,000	0.90
Flatbed Truck	7 T	7	10,000	0.90
Water Tanker	5,000 L	7	10,000	0.90

Appendix 6-7 HOURLY COST ANALYSIS

1984 PRICES

EQUIPMENT: BULLDOZER D8L 335HP

	ITEM	CALCULATION	NUMBER	UNIT
I.	GENERAL DATA			
	A. Type of Fuel		Diesel	
	B. Fuel Consumption		48.9	Lit/Hr
	C. Fuel Cost		0.63	M$
	D. Economic Life in Hours		12,000	Hours
	E. Economic Life in Years		10	Years
II.	ACQUISITION COSTS			
	F. Total Cost		619,486	M$
	G. Cost of Tires		-	M$
	H. Total Cost Less Tires	F-G	619,486	M$
III.	HOURLY OWNERSHIP COSTS			
	I. Depreciation	0.9 x H/D	46.46	M$/Hr
	J. Interest Insurance	$\frac{0.55 \times F \times 0.14}{D/E}$	39.75	M$/Hr
	K. Hourly Ownership Costs	I + J	86.21	M$/Hr
IV.	HOURLY OPERATING COSTS			
	L. Cost of Repairs	1.0 x H/D	51.62	M$/Hr
	M. Cost of Fuels	B x C	30.81	M$/Hr
	N. Cost of Lubricants, Filters	0.20 x M	6.16	M$/Hr
	O. Cost of Tires		-	M$/Hr
	P. Operator and Assistant	(4.22 + 2.78)	7.00	M$/Hr
	Q. Hourly Operating Costs		95.59	M$/Hr
V.	TOTAL COST		181.80	M$/Hr

HOURLY COST (Excluding Fuel and Operator) K + L = 137.83

Appendix 6-8 QUANTITIES OF MATERIALS TO BE PROCURED

Item	Quantity
Portland Cement	11,210 t
Bitumen, Straight Run	7,550 t
Bitumen, Cut Back	2,230 t
Reinfocing Steel	2,410 t
P.C Steel Bar	225 t
P.C Steel Cable	40 t
Diesel	33,500 Kℓ
Kerosene	1,150 Kℓ
Motor Oil	640 Kℓ
Grease	37,000 Kg
Explosive	210 t

Appendix 6-9 REQUIRED QUANTITY OF PRINCIPAL EQUIPMENT

	One-stage	Two-stage	Three-stage
Bulldozer D8L W/R	20	10	7
Bulldozer D7G	25	15	10
Motor Scraper WF-16	6	3	2
Motor Grader 3.7 M	7	4	2
Tractor Shovel 1.4 M^3	7	4	3
Wheel Loader 1.4 M^3	2	1	1
Tired Roller 20 T	13	7	5
Macadam Roller 10 T	4	3	2
Asphalt Plant 42 T/H	1	1	1
Asphalt Finisher 3.6 M	2	1	1
Batching Plant 90 M^3/H	1	1	1
Concrete Mixer	7	5	3

APPENDIX 6-10 ROAD MAINTENANCE COST PER KM

(1) Assuming an annual rate of 20% of total pavement construction

$$138{,}800 \text{ m} \times 7 \text{ m} = 971{,}600 \text{ m}^2$$
$$971{,}600 \text{ m}^2 \times 0.20 = 194{,}320 \text{ m}^2$$

The annual requirement is

$$194{,}320 \text{ m}^2 \times 4.285 \text{ M\$/m}^2 = 832{,}662 \text{ M\$}$$

Thus, routine maintenance per km is as follows:

$$832{,}662 \text{ M\$} \div 138.8 \text{ km} = 6{,}000 \text{ M\$/km}$$

(2) Annual Requirement for Periodic Maintenance

Periodic maintenance covers areas where local damage cannot be fixed by patching, and the entire surface is overlayed every 5-7 years. Thus, periodic maintenance per km is as follows:

$$971{,}600 \text{ m}^2 \times 4{,}207 \text{ M\$/m}^2 \div 138.8 \text{ km} = 29{,}450 \text{ M\$/km}$$

Appendix 7-1 ESTIMATION OF GOODS TRANSPORT DEMAND

Appendix 7-1-1 ESTIMATED PER CAPITA CONSUMPTION BY COMMODITY ITEM FOR THE STUDY AREA

Unit: Kg/person

Item \ Year	1982	1985	1990	1995	2000	2005
Food	35	37.1	41.0	45.3	50.0	55.2
Sugar/Wheat Flour	35	37.1	41.0	45.3	50.0	55.2
Beverages	20	21.2	23.4	25.8	28.5	31.5
Cement	50	56.2	68.4	83.2	101.2	123.1
Iron and Steel	25	28.1	34.2	41.6	50.6	61.6
Others	150	159.2	175.8	194.1	214.3	236.6
Fuel	200	218.5	253.3	293.6	340.4	394.6
Total	515	557.4	637.1	728.9	835.5	957.8

Annual Growth Rate:

2% for Food, Sugar/Wheat Flour, Beverages and Others
3% for Fuel
4% for Cement, Iron and Steel

Appendix 7-1-2 ESTIMATED PER HECTARE FERTILIZER REQUIREMENTS AND PER HEAD ANIMAL FEED REQUIREMENTS

Item \ Year	1982	1985	1990	1995	2000	2005
Fertilizer (kg/ha)						
Paddy	-	200	200	200	200	200
Rubber	-	165	165	165	165	165
Pepper	-	280	280	280	280	280
Cocoa	-	280	280	280	280	280
Animal Feed (kg/head)	-	40	40	40	40	40

Appendix 7-1-3 SUMMARY OF CONSUMPTION IN THE STUDY AREA

Unit: Ton

Item	Tatau Sub-district						Kapit District					
	1982	1985	1990	1995	2000	2005	1982	1985	1990	1995	2000	2005
Food	525	616	800	1,033	1,335	1,717	1,429	1,666	2,148	2,772	3,570	4,560
Sugar/Wheat Flour	525	616	800	1,033	1,335	1,717	1,429	1,666	2,148	2,772	3,570	4,560
Beverages	300	352	456	588	761	980	817	952	1,226	1,579	2,035	2,602
Animal Feed	(202)	214	236	261	288	318	263	279	308	340	375	414
Fertilizer	(840)	868	898	930	962	998	(8,236)	8,236	8,130	8,010	7,897	7,764
Cement	751	933	1,334	1,897	2,702	3,828	2,041	2,523	3,584	5,092	7,226	10,168
Iron and Steel	375	466	667	948	1,351	1,916	1,021	1,262	1,792	2,546	3,613	5,088
Fuel	3,002	3,627	4,939	6,694	9,089	12,272	8,168	9,811	13,273	17,968	24,305	32,594
Miscellaneous Cargo	2,252	2,643	3,428	4,425	5,722	7,358	6,126	7,148	9,212	11,789	15,301	19,543
Total	7,730	10,335	13,556	17,809	23,545	31,104	21,294	33,543	41,821	52,958	67,892	87,293
Per Capita (Kgs)	515	623	695	781	882	1,000	521	747	798	865	951	1,057

Note: Figures in parenthesis indicate assumed requirement based on per hectare consumption

Appendix 7-1-4 ESTIMATED FUTURE DEFICIT/SURPLUS BALANCE OF RICE IN THE STUDY AREA

(1) Without Road

Unit: Ton

District	Item	1982	1985	1990	1995	2000	2005
Tatau	Production	1,467	1,551	1,685	1,743	1,853	1,978
	Demand	2,102	2,274	2,613	2,941	3,338	3,763
	Balance	-635	-723	-972	-1,198	-1,485	-1,785
Kapit	Production	5,118	5,136	4,921	4,677	4,450	4,199
	Demand	5,717	6,151	7,022	7,895	8,925	9,995
	Balance	-599	-1,015	-2,101	-3,218	-4,475	-5,796
Total	Production	6,585	6,687	6,562	6,420	6,303	6,177
	Demand	7,819	8,425	9,635	10,836	12,263	13,758
	Balance	-1,234	-1,738	-3,073	-4,416	-5,960	-7,581

Per Capita Consumption:

1982: 140 kg 1985: 137 kg 1990: 134 kg
1995: 129 kg 2000: 125 kg 2005: 121 kg

(2) With Road

District	Item	1982	1985	1990	1995	2000	2005
Tatau	Production	1,467	1,583	8,758	10,316	11,936	13,853
	Demand	2,102	2,274	2,613	2,941	3,338	3,763
	Balance	-635	-691	6,145	7,375	8,598	10,090
Kapit	Production	5,118	5,278	5,565	5,887	6,076	6,269
	Demand	5,717	6,151	7,022	7,895	8,925	9,995
	Balance	-599	-873	-1,457	-2,008	-2,849	-3,726

Appendix 7-1-5 ESTIMATED PRODUCTION OF RUBBER AND PEPPER

(1) Without Road

Unit: Ton

District	Item	1982	1985	1990	1995	2000	2005
Tatau	Rubber	1,296	1,362	1,432	1,504	1,581	1,662
	Pepper	344	378	414	451	495	551
	Total	1,640	1,740	1,846	1,955	2,076	2,213
Kapit	Rubber	19,440	19,440	19,440	19,440	19,440	19,440
	Pepper	860	900	940	980	1,020	1,080
	Total	20,300	20,340	20,380	20,420	20,460	20,520

(2) Additional Production of Rubber and Pepper Development Scheme With Road

District	Item	1982	1985	1990	1995	2000	2005
Tatau	Rubber	-	-	-	1,533	1,611	1,692
	Pepper	-	-	-	-	137	336
	Cocoa	-	-	175	223	285	364
	Total	-	-	175	1,756	2,033	2,392
Kapit	Rubber	-	-	-	19,800	19,800	19,800
	Pepper	-	-	-	49	117	174
	Total	-	-	-	19,849	19,917	19,974

Appendix 7-2 ESTIMATION OF VEHICLE OPERATING COSTS

Appendix 7-2-1 SUMMARY OF VEHICLE OPERATING COSTS (With Taxes)

Unit: M$/km

Item	Passenger Car			Van/Pick Up			Bus			Medium Truck			Heavy Truck(10tons)			Heavy Truck(20tons)		
	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved
Depreciation	0.6867	0.3961	0.2575	0.5000	0.2947	0.1944	0.2917	0.1683	0.1094	0.2500	0.1563	0.1071	0.4615	0.2679	0.1714	0.9524	0.5556	0.3571
Fuel Consumption	0.1248	0.1040	0.0832	0.2600	0.2080	0.1560	0.2313	0.1938	0.1563	0.2313	0.1938	0.1563	0.3313	0.2500	0.1875	0.5000	0.3750	0.2813
Oil Consumption	0.0072	0.0059	0.0050	0.0086	0.0072	0.0064	0.0124	0.0104	0.0092	0.0124	0.0104	0.0092	0.0264	0.0220	0.0192	0.0376	0.0312	0.0272
Tire Wear	0.0622	0.0373	0.0187	0.0800	0.0444	0.0211	0.3327	0.1743	0.0915	0.2727	0.1429	0.0750	0.5083	0.2652	0.1356	0.9150	0.4774	0.2440
Maintenance-Parts	0.0371	0.0268	0.0227	0.0728	0.0476	0.0336	0.4200	0.2800	0.2100	0.2100	0.1500	0.1200	0.2700	0.1800	0.1350	0.6000	0.4000	0.3000
Maintenance-Labour	0.0045	0.0033	0.0026	0.0063	0.0040	0.0030	0.0226	0.0130	0.0080	0.0226	0.0130	0.0080	0.0250	0.0150	0.0100	0.0361	0.0208	0.0128
Wages	-	-	-	-	-	-	0.2500	0.2000	0.1702	0.1946	0.1286	0.1200	0.2933	0.1913	0.1630	0.4267	0.3200	0.2560
Insurance	0.0478	0.0368	0.0299	0.0787	0.0580	0.0459	0.0307	0.0230	0.0184	0.0344	0.0258	0.0206	0.0612	0.0405	0.0318	0.1263	0.0884	0.0663
License Fees	0.0161	0.0124	0.0101	0.0154	0.0113	0.0090	0.0094	0.0070	0.0056	0.0115	0.0086	0.0069	0.0159	0.0111	0.0083	0.0250	0.0175	0.0131
Overhead	0.0986	0.0623	0.0430	0.1022	0.0675	0.0469	0.1601	0.1070	0.0779	0.1240	0.0829	0.0623	0.1993	0.1243	0.0862	0.3619	0.2286	0.1558
Total	1.0850	0.6849	0.4727	1.1240	0.7427	0.5163	1.7609	1.1768	0.8565	1.3635	0.9123	0.6854	2.1922	1.3673	0.9480	3.9810	2.5145	1.7136

(Without Taxes)

Unit: M$/km

Item	Passenger Car			Van/Pick Up			Bus			Medium Truck			Heavy Truck(10tons)			Heavy Truck(20tons)		
	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved
Depreciation	0.5272	0.3042	0.1977	0.3666	0.2161	0.1424	0.2396	0.1382	0.0898	0.2149	0.1343	0.0921	0.3692	0.2143	0.1371	0.7619	0.4444	0.2857
Fuel Consumption	0.0860	0.0717	0.0574	0.1793	0.1434	0.1076	0.2313	0.1938	0.1563	0.2313	0.1938	0.1563	0.3313	0.2500	0.1875	0.5000	0.3750	0.2813
Oil Consumption	0.0064	0.0052	0.0044	0.0076	0.0064	0.0056	0.0110	0.0092	0.0081	0.0110	0.0092	0.0081	0.0234	0.0195	0.0170	0.0333	0.0276	0.0241
Tire Wear	0.0566	0.0339	0.0170	0.0727	0.0404	0.0191	0.3025	0.1585	0.0832	0.2479	0.1299	0.0682	0.4621	0.2411	0.1232	0.8318	0.4340	0.2218
Maintenance-Parts	0.0285	0.0206	0.0174	0.0543	0.0349	0.0246	0.3450	0.2300	0.1725	0.1805	0.1290	0.1032	0.2160	0.1440	0.1080	0.4800	0.3200	0.2400
Maintenance-Labour	0.0041	0.0030	0.0024	0.0057	0.0036	0.0027	0.0203	0.0117	0.0072	0.0203	0.0117	0.0072	0.0225	0.0135	0.0090	0.0325	0.0187	0.0115
Wages	-	-	-	-	-	-	0.2272	0.1705	0.1364	0.1751	0.1157	0.1080	0.2640	0.1722	0.1467	0.3840	0.2880	0.2304
Insurance	0.0382	0.0294	0.0239	0.0630	0.0464	0.0367	0.0246	0.0184	0.0147	0.0275	0.0206	0.0165	0.0490	0.0341	0.0255	0.1011	0.0707	0.0531
License Fees	0.0161	0.0124	0.0101	0.0154	0.0113	0.0090	0.0094	0.0070	0.0056	0.0115	0.0086	0.0069	0.0159	0.0111	0.0083	0.0250	0.0175	0.0131
Overhead	0.0763	0.0480	0.0330	0.0764	0.0535	0.0348	0.1411	0.0937	0.0674	0.1120	0.0753	0.0567	0.1753	0.1100	0.0762	0.3150	0.1996	0.1361
Total	0.8394	0.5284	0.3633	0.8401	0.5884	0.3825	1.5520	1.0310	0.7412	1.2320	0.8281	0.6232	1.9287	1.2098	0.8385	3.4646	2.1955	1.4971

Appendix 7-2-2 OPERATING CHARACTERISTICS OF VEHICLES

Item	Car			Van/Pick-up			Bus		
	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved
Life Years	3	4	5	4	5	6	5	6.5	8
Life Kilomerage (1,000 km)	30	52	80	56	95	144	240	416	640
Km/Year (1,000 km) [Miles]	10 [6]	13 [8]	16 [10]	14 [9]	19 [12]	24 [15]	48 [30]	64 [40]	80 [50]
Operating Days/Year	-	-	-	-	-	-	300	320	235
Average Km/Day	-	-	-	-	-	-	160	200	235
Average Running Speed Km/Hour	40	55	80	40	55	70	32	40	47

Item	Medium Truck			Heavy Truck (10 t)			Heavy Truck (20 t)		
	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved
Life Years	5	6	7	5	6	7	5	6	7
Life Kilometrage (1,000 km)	240	384	560	195	336	525	210	360	560
Km/Year (1,000 km) [Miles]	48 [30]	64 [40]	80 [50]	39 [25]	56 [35]	75 [45]	42 [26]	60 [37]	80 [50]
Operating Days/Year	260	280	300	260	280	300	280	300	320
Average Km/Day	185	230	270	150	200	250	150	200	250
Average Running Speed Km/Hour	35	43	55	30	40	50	30	40	50

Appendix 7-2-3 PRICE OF REPRESENTATIVE VEHICLES

(Unit: M$)

Vehicle Type	Average Market Price*1	Duty Sales Tax	Price without taxes
1. Car (Nissan Sunny)	20,600	4,783	15,817
2. Van/Pick-up (Mazda 2-ton)	28,000	7,470	20,530
3. Truck*2 (Nissan 6-ton)	49,500	6,840	42,660
4. Heavy Truck*3 (Nissan 10-ton)	90,000	18,000	72,000
5. Heavy Truck Trailer*3 (Nissan 20-ton)	200,000	40,000	160,000
6. Bus*2 (Hino)	40,000	8,000	32,000

Note: *1: Including Tires *2: Excluding Body *3: Imported

Appendix 7-2-4 PRICE OF BODY

(Unit: M$)

Vehicle Type	Average Market Price	Duty Sales Tax	Price without taxes
Medium Truck	10,500	1,580	8,920
Bus	30,000	4,500	25,500

Source: Interviews with Dealers

Appendix 7-2-5 FUEL CONSUMPTION

Unit: Liter/1,000 km

Vehicle Type	Road Type		
	Earth	Gravel	Paved
1. Car	120	100	80
2. Van/Pick-up	250	200	150
3. Medium Truck	370	310	250
4. Heavy Truck 10-ton	530	400	300
5. Heavy Truck 20-ton	800	600	450
6. Bus	370	310	250

Source: Quantification of Road User Saving, IBRD

Appendix 7-2-6 PRICE OF FUEL - 1982

Oil Type		Price M$/Gallon (M$/Liter)	
		With Tax	Without Tax
Gasoline	Super	5.30 (1.165)	3.79 (0.833)
	Regular	4.73 (1.040)	3.26 (0.717)
Diesel		2.84 (0.625)	2.84 (0.625)

Source: Interviews with Dealers

Appendix 7-2-7 OIL CONSUMPTION

Unit: Liter/1,000 km

Vehicle Type	Road Type		
	Earth	Gravel	Paved
1. Car	1.6	1.3	1.1
2. Van/Pick-up	1.9	1.6	1.4
3. Medium Truck	3.1	2.6	2.3
4. Heavy Truck 10-ton	6.6	5.5	4.8
5. Heavy Truck 20-ton	9.4	7.8	6.8
6. Bus	3.1	2.6	2.3

Appendix 7-2-8 PRICE OF OIL - 1982

Oil Type	Price M$/Gallon (M$/Liter)	
	With Tax	Without Tax
For Gasoline Engine	20.46 (4.500)	18.10 (3.982)
For Diesel Engine	17.82 (4.000)	16.09 (3.540)

Appendix 7-2-9 TIRE WEAR (LIFE KILOMETRAGE)

Unit: 1,000 km

Vehicle Type	Road Type		
	Earth	Gravel	Paved
1. Car	9	15	30
2. Van/Pick-up	10	18	38
3. Medium Truck	11	21	40
4. Heavy Truck 10-ton	12	23	45
5. Heavy Truck 20-ton	12	23	45
6. Bus	11	21	40

Appendix 7-2-10 PRICE OF A SET OF TIRES - 1982

Vehicle Type	Tire Size	No. of Tires	Price (M$)	
			with tax	without tax
1. Car	6.15 x 13	4	560	509
2. Van/Pick-up	7.50 x 16	4	800	727
3. Medium Truck	8.25 x 20	6	3,000	2,727
4. Heavy Truck (10-ton)	9.00 x 20	10	6,100	5,545
5. Heavy Truck (20-ton)	9.00 x 20	18	10,980	9,982
6. Bus	9.00 x 20	6	3,660	3,328

Appendix 7-2-11 MAINTENANCE: PARTS

Vehicle Type	% of Depreciable Value per 1,000 km		
	Earth	Gravel	Paved
1. Car	0.18	0.13	0.11
2. Van/Pick-up	0.26	0.17	0.12
3. Medium Truck 6-ton	0.35	0.25	0.20
4. Heavy Truck 10-ton	0.30	0.20	0.15
5. Heavy Truck 20-ton	0.30	0.20	0.15
6. Bus	0.60	0.40	0.30

Appendix 7-2-12 MAINTENANCE: LABOUR

Vehicle Type	Hour per 1,000 km		
	Earth	Gravel	Paved
1. Car	1.13	0.83	0.66
2. Van/Pick-up	1.58	1.00	0.76
3. Medium Truck	5.64	3.24	2.00
4. Heavy Truck 10-ton	6.25	3.75	2.50
5. Heavy Truck 20-ton	9.03	5.19	3.20
6. Bus	5.64	3.24	2.00

Hourly Cost of Labour:

$$\frac{600 \text{ M\$/Month}}{150 \text{ Hrs/Month}} = 4.0 \text{ M\$/Hr}$$

Appendix 7-2-13 AVERAGE MONTHLY WAGES OF DRIVER AND ASSISTANTS

Unit: M$/month

Vehicle Type	Driver	Assistants
1. Medium Truck	600	300
2. Heavy Truck 10-ton	800	300
3. Heavy Truck 20-ton	1,000	300 x 2
4. Bus	700	300

Appendix 7-2-14 INSURANCE

Unit: M$/year

Vehicle Type	with Tax	without Tax
1. Car	478	382.4
2. Van/Pick-up	1,102	881.6
3. Medium Truck	1,650	1,320.0
4. Heavy Truck 10-ton	2,388	1,910.4
5. Heavy Truck 20-ton	5,306	4,244.8
6. Bus	1,474	1,179.2

Appendix 7-2-15 ROAD TAXES/FEES

Vehicle Type	M$/Year
1. Car	161
2. Van/Pick-up	215
3. Medium Truck	550
4. Heavy Truck 10-ton	620
5. Heavy Truck 20-ton	1,050
6. Bus	450

Appendix 7-3 ESTIMATE OF VESSEL OPERATING COSTS

Appendix 7-3-1 OPERATING COSTS OF PASSENGER EXPRESS LAUNCHES

Unit: M$/day

Cost Item	Tatau - Gabong L.C.		Sibu - Kapit	
	with	without	with	without
Depreciation: Engine	19.18	12.79	23.01	15.34
Hull	6.85	5.71	6.85	5.71
Fuel Consumption	383.50	370.50	944.00	912.00
Lubrication	40.00	38.80	60.00	58.20
Maintenance: Engine	54.79	46.44	54.79	46.44
Crew Wages	55.89	50.30	55.89	50.30
Insurance	5.66	5.30	11.56	10.99
Overhead	62.87	58.87	128.46	122.11
Total	628.74	588.71	1,284.56	1,221.09

Appendix 7-3-2 COST DATA OF PASSENGER EXPRESS LAUNCHES

Unit: M$

Cost Item	Tatau - Gabong L.C.		Sibu - Kapit	
	with	without	with	without
Price New: Engine	70,000	46,700	84,000	56,000
Hull	50,000	41,700	50 000	41,700
Life Years: Engine	10 years		10 years	
Hull	20 years		20 years	
Fuel Consumption	65 Gal/Trip		160 Gal/Trip (650 liter)	
Price of Fuel	2.95M$/Gal	2.85M$/Gal	2.95M$/Gal	2.85M$/Gal
Lubrication Consumption	1.0 Gal/Trip		1.5 Gal/Trip	
Price of Lub. Oil	20.00M$/Gal	19.40M$/Gal	20.00M$/Gal	19.40M$/Gal
Maintenance	20,000M$/Yr	16,950M$/Yr	20,000M$/Yr	16,950M$/Yr
Crew: Captain	6,000	5,400	6,000	5,400
Crew	4,800 x 3	4,320 x 3	4,800 x 3	4,320 x 3
Insurance	1% on Value/Day		1% on Value/Day	
Overhead	10% of Total		10% of Total	

Appendix 7-3-3 OPERATING CHARACTERISTICS OF EXPRESS LAUNCHES

Item	Tatau (69 km)*	Kapit (152 km)*
Loading Capacity	64	60
Max. Cruising Speed (KpH)	38	38
Ave. Cruising Speed (KpH	35	35
Operating Hours/Day	7	8 - 9
Operating Days/Year	365	365
Annual Kilometrage	25,200	55,500
Life Year	20	20
Life Kilometrage	504,000	1,110,000
Life Years of Engine	10	10
Size of Hull	30 Tons	30 Tons
Hp	350 Hp	500 Hp

Note * Distance: Tatau - Gabong L.C. via Sangan 69 km
Kapit - Sibu 152 km

Appendix 7-3-4 OPERATING COSTS OF LONGBOATS WITH OUTBOARD ENGINES

(1) Operating Costs of Longboats

Unit: M$/km

Cost Item	40 Hp		25 Hp		6 Hp	
	with	without	with	without	with	without
Depreciation: Engine	0.125	0.100	0.077	0.062	0.137	0.109
Hull	0.067	0.062	0.040	0.037	0.040	0.040
Fuel Consumption	2.363	1.796	1.575	1.198	0.945	0.719
Maintenance: Engine	0.068	0.054	0.044	0.035	0.031	0.025
Hull	0.060	0.056	0.030	0.028	0.018	0.018
Total	2.683	2.068	1.766	1.360	1.171	0.911

Source: Interviews with operators

(2) Cost Data of Longboats

Unit: M$

Cost Item	40 Hp		25 Hp		6 Hp	
	with	without	with	without	with	without
Price new						
Engine	2,250	1,800	1,450	1,160	1,030	824
Hull	2,000	1,852	1,000	926	600	600
Life Years						
Engine	3 years		3 years		2 years	
Hull	5 years		4 years		4 years	
Fuel Consumption	4.5Gal/hr(12km)		3.0 Gal/12 km		1.2 Gal/8 km	
Price of Fuel* (Gal)	6.30	4.79	6.30	4.79	6.30	4.79
Maintenance	0.003% of depreciable value/km for Hull and Engine					

Note: * Mixed petrol including Lubricant Oil

Appendix 7-3-5 OPERATING CHARACTERISTICS OF LONGBOAT

Item	40 Hp	25 Hp	6 Hp
Loading Capacity (person)	10 ~ 12	5 ~ 6	2 ~ 3
Life Years	5	4	4
Average Operating Speed	12 km/hr	12 km/hr	8 km/hr
Average Life Kilometrage	30,000	25,000	15,000
Life Year of Engine	3	3	2

Appendix 7-3-6 OPERATING CHARACTERISTICS OF CARGO VESSELS

Unit: M$

Item	Tug Boat		Barge	Motor Vessels	
	240 Hp	480 Hp		50-ton	150-ton
Loading Capacity	-	-	500 tons	50 tons	150 tons
Average Operating Speed (KpH)	10.0	12.0	8	11	12.5
Operating Hours/Day	10	10	10	12	24
Average Line Haul/Day (Km)	100	120	80	132	300
Operating Days/Year	240	240	200	200	180
Operating Km/Year	24,000	28,800	16,000	26,400	54,000
Life Year	15	15	20	20	20

Appendix 7-3-7 OPERATING COSTS OF RIVER TUG BOATS

Unit: M$

Cost Item	240 Hp		480 Hp	
	with	without	with	without
Depreciation: Engine	104.17	80.13	145.83	112.17
Hull	69.44	58.86	72.92	61.79
Fuel Consumption	240.00	235.00	480.00	470.00
Lubrication Consumption	25.00	22.73	45.00	40.91
Maintenance	62.50	56.67	83.33	75.00
Crew	190.00	171.17	230.00	207.17
Insurance	20.83	16.84	29.17	23.58
Overhead	71.19	64.14	103.63	99.06
Total	783.13	705.54	1,194.88	1,089.68

Appendix 7-3-8 COST DATA OF TUG BOATS

Unit: M$

Cost Item	240 Hp		480 Hp	
	with	without	with	without
Price New: Engine	250,000	192,300	350,000	269,200
Hull	250,000	211,900	350,000	296,600
Life Years: Engine	10 years		10 years	
Hull	15 years		20 years	
Fuel Consumption	10 Gal/Hr (100 Gal/day)		20 Gal/Hr (200 Gal/Day)	
Fuel Price	2.40M$/Gal	2.35M$/Gal	2.40M$/Gal	2.35M$/Gal
Lubrication Consumption	1.25 Gal/Day		2.25 Gal/Day	
Price of Lub. Oil	20 M$/Gal		20 M$/Gal	
Maintenace	15,000 M$/Year		20,000 M$/Year	
Crew: Captain	19,200	17,300	19,200	17,300
Engineer	16,800	15,140	16,800	15,140
Crew	4,800 x 2	4,320 x 2	4,800 x 3	4,320 x 3
Insurance	1% on Value/Day		1% on Value/Day	
Overhead	10% of Total		10% of Total	

Appendix 7-3-9 OPERATING COSTS OF BARGES (500-ton)

Unit: M$/day

Cost Item	with Tax	without Tax
Depreciation	100.00	76.94
Maintenance	55.56	44.44
Crew	60.00	48.00
Insurance	20.00	15.39
Overhead	23.56	18.48
Total	259.12	203.25

Appendix 7-3-10 COST DATA OF BARGES (500-ton)

Unit: M$

Cost Item	with Tax	without Tax
Price New	360,000	277,000
Life Years	20 Years (180 days/year)	
Maintenance	10,000 M$/year	8,000 M$/year
Crew (M$/Yr)		
·Crane Operator	7,200	5,760
·Hands	3,600	2,880
Insurance	1% on value/day	1% on value/day
Overhead	10% of Total	10% of Total

Appendix 7-3-11 OPERATING COSTS OF MOTOR VESSELS

Unit: M$/day

Cost Item	50-Ton		150-Ton	
	with	without	with	without
Depreciation	30.00	23.75	555.56	444.44
Fuel Consumption	144.00	141.00	864.00	846.00
Lubrication Consumption	36.00	34.92	96.00	93.12
Maintenance	60.00	51.00	250.00	212.00
Crew	138.00	124.30	324.00	291.95
Insurance	6.00	4.75	111.11	88.89
Overhead	41.40	37.97	220.07	197.64
Total	455.40	417.69	2,420.74	2,174.04

Appendix 7-3-12 COST DATA OF MOTOR LAUNCHES

Unit: M$

Cost Item	50-Ton		150-Ton	
	with	without	with	without
Price New	120,000	95,000	2,000,000	1,600,000
Life Years	20 Years(200 Days/Yr)		20 Years(180 Days/Yr)	
Fuel Consumption	60 Gal/Day		360 Gal/Day	
Price of Fuel	2.40M$/Gal	2.35M$/Gal	2.40M$/Gal	2.35M$/Gal
Lubrication Consumption	0.15 Gal/Hr		0.20 Gal/Hr	
Price of Lub. Oil	20M$/Gal	19.40M$/Gal	20M$/Gal	19.40M$/Gal
Maintenance	12,000/Yr	10,200/Yr	50,000/Yr	42,400/Yr
Crew: Captain	18,000	16,220	21,600	19,460
Engineer	-	-	21,600	19,460
Crew	4,800 x 2	4,320 x 3	7,200 x 3	6,490 x 3
Insurance	1% on Value/Day		1% on Value/Day	
Overhead	10% of Total		10% of Total	

Appendix 7-4 COMPARISON OF GOODS TRANSPORT COSTS

Appendix 7-4-1 COMPARISON OF TRANSPORTATION COSTS
(Bintulu - Sangan, General Cargo)

Section	Bintulu - Sangan	
Commodity Type	General Cargo	
Mode	Road	River
Vehicle/ Vessel Type	6-ton Truck	50-ton Motor Vessel
Distance	75 km	108 km
Conditions	Gravel Road Flat Partly Rolling	
Transportation Cost (M$/ton)	Full Load Line Haul: 0.8745 M$/km x 1.05 x 75 km x 1/6 tons = 11.48 M$/ton Handling Cost: 4.0 M$/ton Total: 15.48 M$/ton	80% Load Line Haul: 455.40 M$ x 1 day x 132 km/day x 1/32 tons = 14.23 M$/ton Handling Cost: 4.5 M$/ton Total: 18.73 M$/ton

Note: Cost in 1982

Appendix 7-4-2 COMPARISON OF TRANSPORT COSTS
(Bintulu - Sangan, Logs (Sinker))

Section	Bintulu - Sangan	
Commodity Type	Logs (Sinkers)	
Mode	Road	River
Vehicle/ Vessel Type	20-ton Truck-trailer	500-ton Barge + 480 Hp Tug
Distance	75 km	108 km
Transportation Cost (M$/ton)	Full Load Line Haul: 2.3075 M$/km x 1.15 x 75 km x 1/20 tons = 9.95 M$/ton Handling Cost: 4.0 M$/ton Total: 13.95 M$/ton 80% Load 17.44 M$/ton	70% Load Line Haul: 1,454.00 x 1 day x 1/350 tons = 4.15 M$/ton Handling Cost: 5.0 M$/ton Total: 9.15 M$/ton

Note: Cost in 1982

Appendix 7-4-3 COMPARISON OF TRANSPORT COSTS
(Tatau - Sangan, General Cargo)

Section	Tatau - Sangan	
Commodity Type	General Cargo	
Mode	Road	River
Vehicle/ Vessel Type	6-ton Truck	50-ton Motor Vessel
Distance	24 km	48 km
Conditions	Partly rolling	
Transportation Cost (M$/ton)	Full Load Line Haul: 0.8745 M$/km x 1.05 x 24 km x 1/6 tons = 3.67 M$/ton Handling Cost: 4.0 M$/ton Total: 7.67 M$/ton	80% Load Line Haul: 455.40 M$ x 1/2 day (132 km/day) x 1/32 tons = 7.12 M$/ton Handling Cost: 4.5 M$/ton Total: 11.62 M$/ton

Note: Cost in 1982

Appendix 7-4-4 COMPARISON OF TRANSPORT COSTS
(Bintulu - Balleh vs.
Tg. Mani - Balleh, Log (Sinker))

Section	Bintulu - Balleh	Tg. Mani - Balleh
Commodity Type	Log (Sinker)/Sawn Timber	
Mode	Road	River
Vehicle/ Vessel Type	20-ton Truck	500-ton Barge + Tug
Distance	184 km	261 km
Transportation Cost (M$/ton)	Full Load Line Haul: 2.3075 M$/km x 1.15 x 184 km x 1/20 tons = 24.41 M$/ton Handling Cost: 4.0 M$/ton Total: 28.41 M$/ton	80% Load Line Haul: 1,454.00 M$ x 2 days x 1/400 tons = 7.27 M$/ton Handling Cost: 5.0 M$/ton Total: 12.27 M$/ton

Note: Cost in 1982

Appendix 7-4-5 COMPARISON OF TRANSPORT COSTS (Bintulu - Pelagus vs. Sibu - Pelagus, Cement/Stone)

Section	Bintulu - Pelagus	Sibu - Pelagus
Commodity Type	Cement/Stone	
Mode	Road	River + Road
Vehicle/ Vessel Type	10-ton Truck	500-ton Barge + 480 Hp Tug
Transportation Cost (M$/ton)	Full Load Line Haul: 1.2819 M$/km x 1.10 x 160 km x 1/10 tons = 22.56 M$/ton Handling Cost: 4.00 M$/ton Total: 26.56 M$/ton	80% Load Line Haul: River 1,454.74 M$ x 2 days x 1/400 tons = 7.27 M$/ton Line Haul: Road 0.8745 M$/km x 1.10 x 24 km x 1/6 tons = 3.85 M$/ton Handling Cost: 4.5 + 4.0/2 = = 6.5 M$/ton Total: 17.62 M$/ton

Note: Cost in 1982

Appendix 7-4-6 COMPARISON OF TRANSPORT COSTS
(Bintulu - Pelagus, Heavy Equipment)

Section	Bintulu - Pelagus	
Commodity Type	Heavy Equipment	
Mode	Road	Coastal + River
Vehicle/ Vessel Type	20-ton Trailer	480 Hp Tug + 500-ton Barge
Distance	160 km	553 km + 24 km
Transportation Cost (M$/ton)	Full Load Line Haul: 2.3075 M$/km x 1.15 x 160 km x 1/20 tons = 21.23 M$/ton Handling Cost: 4.0 M$/ton Total: 25.23 M$/ton	70% Load Line Haul: Coastal, River Coastal 1.454 M$ x 2 days x 1.3 = 3,780.4 M$ River 1,454 M$ x 2 days = 2,908.0 M$ 3,780.4 + 2,908.0 = 6,688.4 M$ 6,688.4 M$ x 1/350 tons = 19.11 M$/ton Handling Cost: 4.5 + 4.0/2 = = 6.5 M$/ton Total: 28.79 M$/ton

Note: Cost in 1982

Appendix 8-1 VEHICLE OPERATING COST RATIO DUE TO CHANGES OF GRADIENTS

Vehicle Type	Level Tangent	Gradients (%)		
		2-4	4-6	6-8
Car	100	105	110	120
Van/Pick-up	100	110	120	140
Med. Truck (6-ton)	100	115	130	145
Heav. Truck(10-ton)	100	120	150	170
Bus	100	115	130	145

Appendix 8-2 GRADIENT DISTRIBUTION BY ROAD SECTION

Road Section	0-2%	2-4%	4-6%	6-8%	Total(%)
1. Ulu Mukah/ Bintulu Rd. - Sangan	42.2	23.7	23.3	10.8	100
2. Sangan - Muput	42.2	28.9	11.5	17.4	100
3. Muput - Pelagus	33.0	18.0	39.0	10.0	100
4. Pelagus - Lepong Balleh	54.9	26.8	15.2	3.1	100
5. Lepong Balleh - Kapit	-	-	-	-	-
Average	41.2	22.6	26.8	9.4	100

Appendix 8-3 VEHICLE OPERATING COST RATIO BY ROAD SECTION (Level Tangent = 100)

Road Section	Car	Bus	Van	Med. Truck	Heav. Truck
1. Ulu Mukah/ Bintulu Rd. - Sangan	106	115	111	115	124
2. Sangan - Muput	106	116	112	116	124
3. Muput - Pelagus	107	119	114	119	130
4. Pelagus - Lepong Balleh	103	110	107	110	114
5. Lepong Balleh - Kapit	106	116	111	116	125
Average	106	116	111	116	125

Appendix 8-4 VEHICLE OPERATING COST BY PROJECT ROAD SECTION (ECONOMIC PRICE WITHOUT TAXES)

Unit: M$/Vehicle

Road Section	Car		Bus		Van/Pick-up		Med. Truck		Heav. Truck	
	Gravel	Paved	Gravel	Paved	Gravel	Paved	Gravel	Paved	Gravel	Paved
1. Ulu Mukah/ Bintulu Rd.-Sangan	0.5601	0.3851	1.1857	0.8524	0.6531	0.4246	0.9523	0.7167	1.5002	1.0397
2. Sangan-Muput	0.5601	0.3851	1.1960	0.8598	0.6590	0.4284	0.9606	0.7229	1.5002	1.0397
3. Muput-Pelagus	0.5654	0.3887	1.2269	0.8820	0.6708	0.4361	0.9854	0.7416	1.5727	1.0901
4. Pelagus-Lepong Balleh	0.5443	0.3742	1.1341	0.8153	0.6296	0.4093	0.9109	0.6855	1.3913	0.9643
5. Lepong Balleh-Kapit	0.5443	0.3742	1.1341	0.8153	0.6296	0.4093	0.9109	0.6855	1.3913	0.9643
Average	0.5601	0.3851	1.1960	0.8598	0.6531	0.4246	0.9606	0.7229	1.5123	1.0481

Appendix 8-5 BENEFIT TO DIVERTED TRAFFIC BY ZONE PAIR
(Passenger Traffic)

(Gravel)

Unit: M$'000/Year

Zone Pair	1993	1995	2000	2005	2010
Tatau - Kakus	857	1,011	1,394	1,931	2,435
- Anap	5,565	6,537	8,920	12,195	15,179
Kapit - Pelagus	1,373	1,543	2,267	3,330	4,458
- Lepong Balleh	2,004	2,249	3,306	4,859	6,500
Total	9,799	11,340	15,887	22,315	28,572

(Paved)

Unit: M$'000/Year

Zone Pair	1993	1995	2000	2005	2010
Tatau - Kakus	955	1,126	1,554	2,152	2,713
- Anap	5,959	7,000	9,552	13,058	16,253
Kapit - Pelagus	1,648	1,852	2,721	3,997	5,351
- Lepong Balleh	2,095	2,352	3,457	5,081	6,798
Total	10,657	12,330	17,284	24,288	31,115

Appendix 8-6 BENEFIT TO DIVERTED TRAFFIC BY ZONE PAIR (Cargo)

(Gravel)

Unit: M$'000/Year

Zone Pair	1993	1995	2000	2005	2010
Tatau - Kakus	13	14	18	22	27
- Anap	120	130	158	194	241
Kapit - Pelagus	74	77	90	105	123
- Lepong Balleh	39	41	48	56	66
Total	246	262	314	377	457

(Paved)

Unit: M$'000/Year

Zone Pair	1993	1995	2000	2005	2010
Tatau - Kakus	15	16	20	24	29
- Anap	129	139	169	207	257
Kapit - Pelagus	93	97	114	132	155
- Lepong Balleh	40	42	50	58	69
Total	277	294	353	421	510

Appendix 8-7 VOLUME OF CARGO WITH AGRICULTURAL DEVELOPMENT

Unit: Ton/Year

Zone Pair	1995	2000	2005	2010
Tatau - Kakus	2,446	3,269	3,781	4,382
- Anap	8,152	10,896	12,604	14,605
Sub-Total	10,598	14,165	16,385	18,987
Kapit - Pelagus	726	15,258	15,775	16,312
- Lepong Balleh	-	-	-	-
Sub-Total	726	15,258	15,775	16,312

Appendix 8-8 PASSENGER TRAFFIC BY VAN/PICK-UP WITH AGRICULTURAL DEVELOPMENT PASS./DAY

Unit: Traffic pass./Day

Zone Pair	1995	2000	2005	2010
Tatau - Kakus	9	15	18	21
- Anap	12	15	18	21
- Pelagus	3	60	63	66
- Lepong Balleh	-	-	-	-

Appendix 8-9 BENEFIT TO DEVELOPMENT TRAFFIC

(Gravel)

Unit: M$'000/Year

Type of Traffic		1995	2000	2005	2010
Tourism		209	237	303	388
Agricultural Products	Tatau - Kakus	12	16	18	21
	- Anap	96	129	149	172
	Kapit - Pelagus	3	66	68	71
	Sub-Total	111	211	235	264
Van/Pick-up Passenger Traffic	Tatau - Kakus	9	16	19	22
	- Anap	37	46	56	65
	Kapit - Pelagus	3	61	64	67
	Sub-Total	49	123	139	154
Grand Total		369	571	677	806

(Paved)

Unit: M$'000/Year

Type of Traffic		1995	2000	2005	2010
Tourism		243	275	352	452
Agricultural Products	Tatau - Kakus	13	17	20	23
	- Anap	103	137	159	184
	Kapit - Pelagus	4	83	86	89
	Sub-Total	120	237	265	296
Van/Pick-up Passenger Traffic	Tatau - Kakus	11	18	21	25
	- Anap	40	50	60	70
	Kapit - Pelagus	4	74	77	81
	Sub-Total	55	142	158	176
Grand Total		418	654	775	924

Appendix 8-10 BENEFIT/COST RATIO (B/C) and NET PRESENT VALUE (NPV) FOR ALTERNATIVE PLANS (Discount Rate at 8% and 12%)

(1) Discount Rate at 8%

Unit: M$'000

Alternative Case	Benefit				Cost	B/C Ratio	NPV (B-C)
	Diverted	Development	Induced	Total			
A - 1	123,988	3,610	28,364	155,962	241,186	0.65	-85,225
A - 2	113,879	3,158	28,364	145,401	236,159	0.62	-90,758
A - 3	120,241	3,158	28,954	152,353	236,159	0.65	-83,806
B	123,988	3,345	22,617	149,950	205,221	0.73	-55,270
C	114,540	2,888	16,666	134,094	162,910	0.82	-28,817

(2) Discount Rate at 12%

Unit: M$'000

Alternative Case	Benefit				Cost	B/C Ratio	NPV (B-C)
	Diverted	Development	Induced	Total			
A - 1	73,382	2,072	16,840	92,294	213,852	0.43	-121,557
A - 2	67,404	1,814	16,840	86,058	211,539	0.41	-125,481
A - 3	72,708	1,814	17,333	91,854	211,539	0.43	-119,685
B	73,382	1,878	12,598	87,858	172,787	0.51	-84,929
C	66,176	1,575	8,740	76,490	128,830	0.59	-52,340

Appendix 9-1 ECONOMIC EVALUATION INCLUSIVE OF THE BENEFITS RELATED TO THE HYDROELECTRIC DAM CONSTRUCTION PROJECT AT PELAGUS

1. **Case-1:** Economic evaluation inclusive of the benefits of reducing building costs of the construction road for construction materials transportation.

1-1 Section of construction road

The construction road section is assumed to correspond to the Kapit-Pelagus section of the Proejct Road.

1-2 Construction perriod by SESCO

The construction period by SESCO is assumed to be two years extended over the years 2001 and 2002.

1-3 Construction cost

The construction cost is assumed to be the same as that of the identical section of the Project Road with gravel surface, and costs are allocated to two years equally as follows:

Table-1 CONSTRUCTION COST ALLOCATION

Unit: M$'000

2000	2001	Total
39,179	39,179	78,358

1-4 Economic evaluation

The following table shows the results of an economic evaluation inclusive of the benefits of reducing building costs of the construction road for construction materials transportation.

Table-2 ECONOMIC EVALUATION INCLUSIVE OF THE BENEFITS OF CONSTRUCTION COST REDUCTION

(Unit: MS'000)

Alternative Case	Present Value (Discount Rate 10%)				IRR (%)
	Cost	Benefit	B/C Ratio	NPV B - C	
A-1	226,880	140,742	0.620	-86,138	5.52
C	144,693	122,196	0.845	-22,497	7.92

2. **Case 2:** Economic evaluation inclusive of traffic benefits caused by construction materials transportation for the Hydroelectric Project.

2-1 Materials transport volume and transport traffic

Traffic volume for materials transport is estimated based upon the necessary construction materials volume as follows:

Table-3 ESTIMATED COMMODITY VOLUME FOR THE PELAGUS HYDROELECTRIC PROJECT

	Unit: ton
Cement	515,600 ton
Steel	41,470 ton
Total	557,070 ton
No. of Vehicles	100/day

Note: a. carry by 10 ton-truck

b. 557,070 ton ÷ 5 (ton/day x 365 days x 3 years)

2-2 Period of traffic volume generated

Traffic is generated equally each year from 2002 to 2004.

2-3 Amount of benefits

The benefits are evaluated as one-half of transport savings cost per ton of diverted traffic since benefits are generated by development traffic. Transport savings cost per ton of diverted traffic is M$10.92/ton from Table 10-2 of Chapter 10. Commodity transport benefit will be:

10.92 M$/ton x 1/2 x 557,070 = 3,042,000 M$

The benefit to be generated will be M$1,014,000/year in 2002, 2003 and 2004, respectively.

2-4 Economic evaluation

The following shows an economic evaluation inclusive of development benefits due to construction materials transport.

Table-4 ECONOMIC EVALUATION INCLUSIVE OF THE TRAFFIC BENEFITS GENERATED BY CONSTRUCTION MATERIALS TRANSPORTATION

(Unit: MS'000)

Alternative Case	Present Value (Discount Rate 10%)				IRR (%)
	Cost	Benefit	B/C Ratio	NPV B - C	
A-1	226,880	119,740	0.528	-107,139	4.25
C	144,693	101,194	0.699	-43,499	5.96

3. Findings of the economic evaluation

As evidenced in Cases 1 and 2, the benefits of construction road cost savings will improve the results of the economic evaluation, while apparent traffic benefits generated by construction materials transportation will have no noticeable effect.

The overall economic evaluation will be greatly improved by a hastening of the realization of the Hydroelectric Project.

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