Appendix Table A-3-2 Air Traffic, Miri

Passenger (person), Cargo (ton) (per month)

Incoming (FROM)		K. L.	Singapore	Tawau	Sandakan	K/K	Labuan	Bander Serigawan	Bintulu	Sibu	Kuching	Long Semado	Lawas	Limbang	Bario	Long Seridan	Marudi	Mukah	Total
1973	Pass.	-	-	18	54	333	96	320	300	1,413	1,235	0	88	169	22	0	240	63	4,351
	Cargo	-	-	-	-	184	25	109	489	375	5,777	24	219	347	9	5	186	19	7,760
1974	Pass.	-	-	79	53	479	162	346	308	1,450	1,624	-	99	217	14	1	201	114	5,147
	Cargo	-	-	-	5	236	62	323	144	715	9,745	-	156	432	-	-	225	11	12,054
1975	Pass.	-	-	23	23	504	226	318	435	1,688	1,638	-	90	241	12	1	226	115	5,540
	Cargo	-	-	12	11	770	82	286	161	1,322	10,616	-	205	501	35	2	271	4	14,278
1976	Pass.	-	-	-	-	645	290	-	454	2,330	2,031	-	117	382	12	2	223	95	6,581
	Cargo	-	-	-	24	289	56	-	229	738	8,716	0	188	496	-	-	258	15	11,009
1977	Pass.	131	214	43	36	562	304	-	514	2,314	2,067	-	70	404	10	1	236	81	6,987
	Cargo	3,985	140	2	33	12,608	255	-	797	710	16,980	-	325	1,523	29	1	528	45	37,963
1978	Pass.	112	-	-	-	710	326	-	667	2,272	2,246	-	124	484	9	-	330	100	7,392
	Cargo	2,605	-	-	-	16,981	76	-	174	438	22,748	-	177	526	-	-	289	16	44,030

Outgoing (FOR)		K. L.	Singapore	Tawau	Sandakan	K/K	Labuan	Bander Serigawan	Bintulu	Sibu	Kuching	Long Semado	Lawas	Limbang	Bario	Long Seridan	Marudi	Mukah	Total
1973	Pass.	-	-	32	71	383	48	366	227	1,383	1,202	0	63	186	26	1	238	59	4,285
	Cargo	-	-	-	1	182	25	63	224	298	1,502	-	349	820	-	-	581	-	4,045
1974	Pass.	-	-	40	82	420	160	365	304	1,602	1,530	1	63	204	22	0	181	99	5,073
	Cargo	-	-	16	4	219	152	85	389	420	1,438	-	503	1,092	3	-	749	20	5,090
1975	Pass.	-	-	30	47	409	211	362	383	1,591	1,502	1	68	220	33	1	182	87	5,127
	Cargo	-	-	0	14	237	81	65	485	751	1,951	5	531	1,087	23	0	713	72	6,015
1976	Pass.	30	237	60	44	514	286	-	484	2,345	1,800	5	96	344	24	2	218	79	6,568
	Cargo	264	230	2	31	193	86	-	477	448	2,037	-	335	1,207	1	0	677	30	6,018
1977	Pass.	85	-	-	-	675	332	-	532	2,308	2,139	0	107	444	10	-	289	100	7,021
	Cargo	830	-	-	-	1,416	71	-	153	554	10,468	-	182	689	19	-	295	19	14,698
1978	Pass.	62	237	42	27	671	319	-	609	2,464	1,771	-	64	420	20	1	267	78	7,052
	Cargo	1,685	109	-	-	1,538	265	-	902	535	1,413	-	398	1,653	-	-	670	25	14,193

Source: Dept. of Civil Aviation

Appendix Table A-3-3 Air Traffic, Marudi

(per month)

Incoming (FROM)		Miri	Bario	Long Seridan	Total
1974	Pass.	189	51	16	256
	Cargo	1.14	1.79	1.30	4.23
1975	Pass.	211	48	15	274
	Cargo	1.93	2.12	0.96	5.01
1976	Pass.	227	52	19	298
	Cargo	3.12	3.16	1.50	7.78
1977	Pass.	263	40	15	318
	Cargo	2.98	2.69	0.96	6.63

Outgoing (FOR)		Miri	Bario	Long Seridan	Total
1974	Pass.	197	55	18	270
	Cargo	0.39	2.91	0.93	4.23
1975	Pass.	229	53	16	298
	Cargo	0.98	2.30	1.01	4.29
1976	Pass.	241	51	21	313
	Cargo	1.89	3.68	0.98	6.55
1977	Pass.	293	49	17	359
	Cargo	2.38	2.53	1.27	6.18

Source: Dept. of civil aviation

Appendix Table A-3-4 Air Traffic, Limbang

(per month)

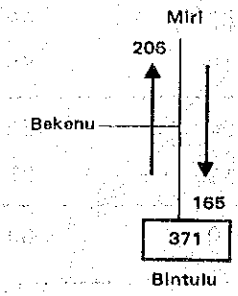
		Incoming Total	Outgoing Total
1974	Pass.	369	404
	Cargo	2,955	1,549
1975	Pass.	418	437
	Cargo	3,169	1,898
1976	Pass.	537	552
	Cargo	4,660	2,093
1977	Pass.	566	582
	Cargo	5,368	2,103
1978	Pass.	594	674
	Cargo	4,313	1,674

Source: Dept. of civil aviation

Appendix Table A-3-5 (1) Result of Road Traffic Count at Major Junctions

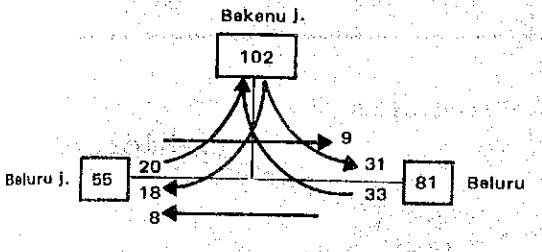
(Average of Two Days)

Miri-Bintulu road; Bekenu junction



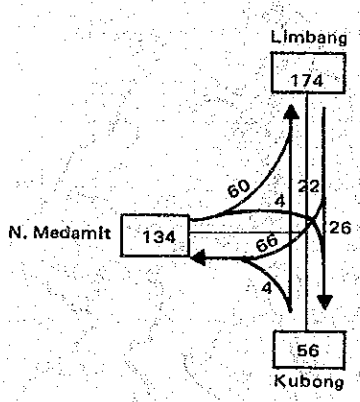
	Car Taxi	Van Pick-up	Truck	Bus	Total
No. of vehicle	179	60	122	10	371
Type of vehicle composition (%)	48.3	16.2	32.8	2.7	100

Beluru road; Peninjau junction



	Car Taxi	Van Pick-up	Truck	Bus	Total
No. of vehicle	38	22	57	2	119
Type of vehicle composition (%)	31.9	18.5	47.9	1.7	100

Limbang-N.Medamit road; Kubong junction



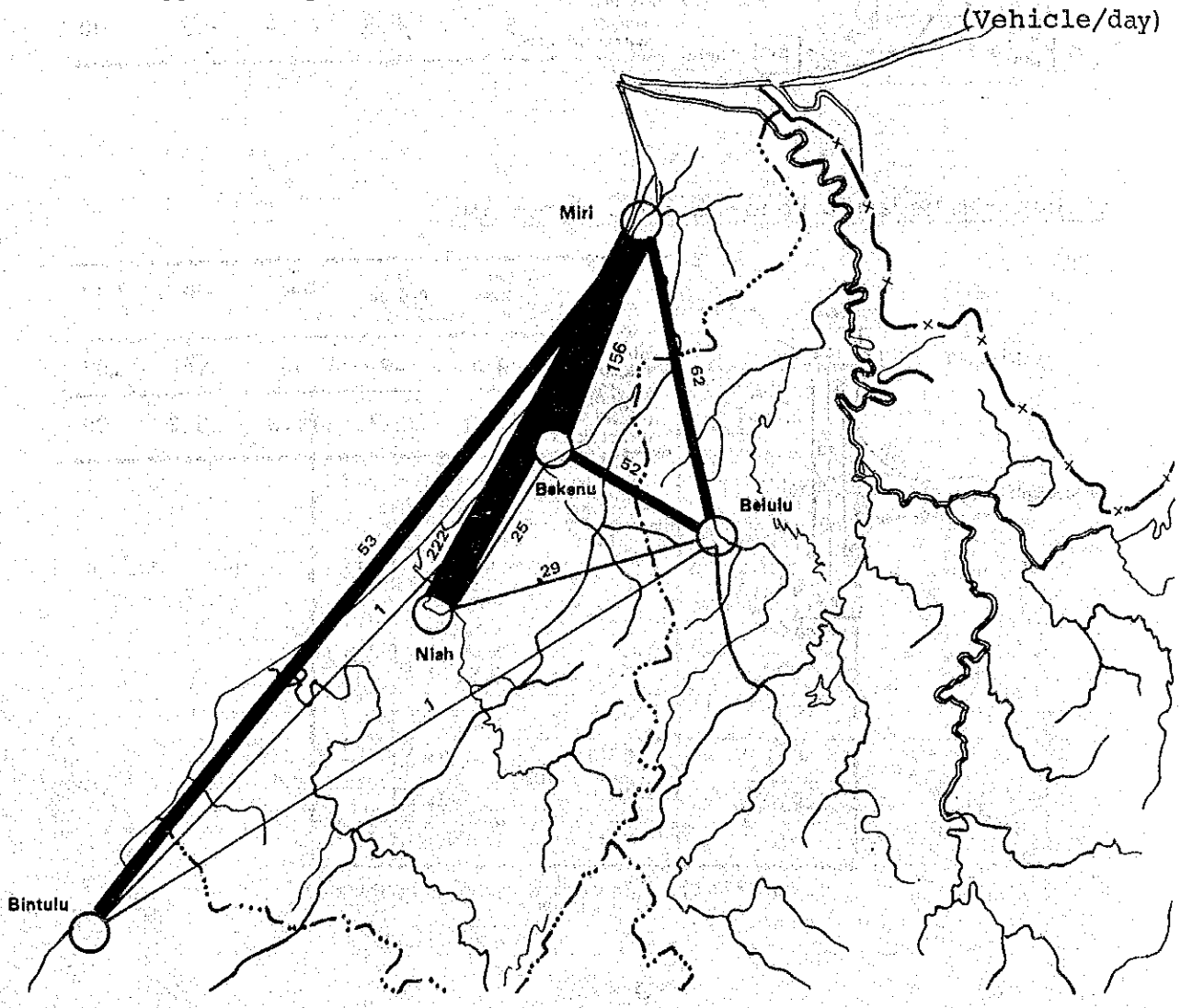
	Car Taxi	Van Pick-up	Truck	Bus	Total
No. of vehicle	80	42	36	24	182
Type of vehicle composition (%)	43.9	23.1	19.8	13.2	100

Appendix Table A-3-5 (2) Sample Rate of Road Side Interview Survey

(%)

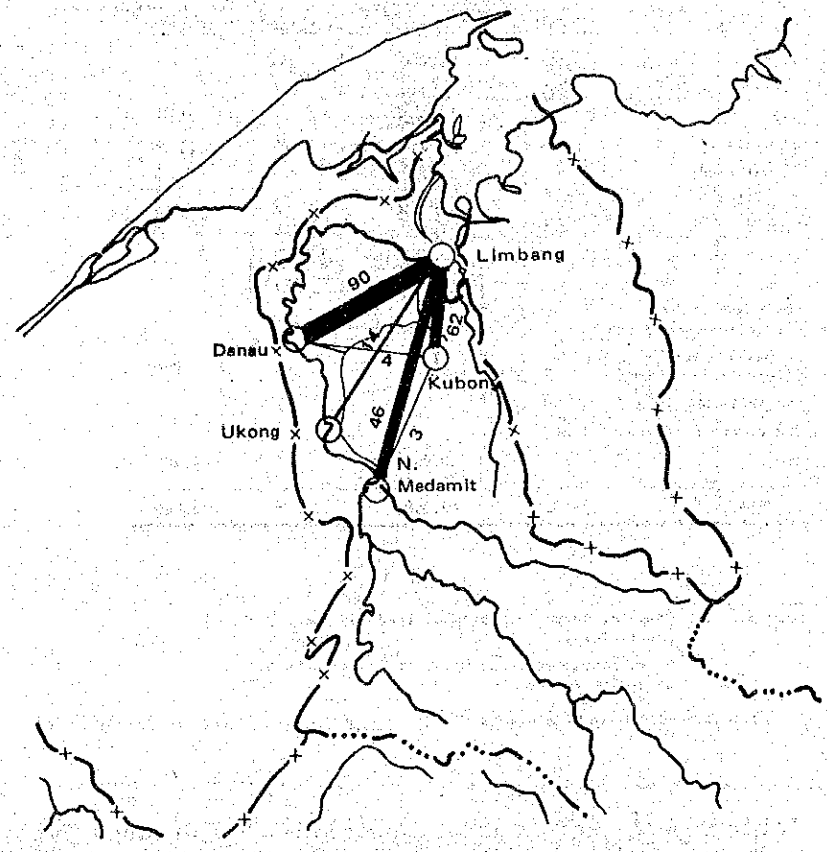
Survey post	Date	No. of vehicle	No. of Sample	Sample Rate
1 Miri-Bintulu road (Bekenu junction)	27 July	374	185	49.5
	28 July	368	219	59.5
2 Beluru road (Peninjau junction)	27 July	121	104	86.0
	28 July	115	112	97.4
Miri Total	-	978	620	63.4
3 Limbang-N.Medamit road (Kubong junction)	01 Aug.	182	163	89.6
	02 Aug.	180	165	91.7
Limbang Total	-	362	328	90.6

Appendix Fig. A-3-7 (1) Car Traffic Desired Line



Appendix Fig. A-3-7 (2) Car Traffic Desired Line

(vehicle/day)



Appendix Table A-3-5 (3) Trip Purpose Composition

( ): %

	Home Work Place	Work	To Home	Social intercourse recreation	Others	Total
Miri	3 (1.0)	185 (59.9)	49 (15.9)	52 (16.8)	20 (6.4)	309 (100)
Limbang	14 (7.2)	143 (73.7)	24 (12.4)	11 (5.7)	2 (1.0)	194 (100)
Total	17 (3.4)	328 (65.2)	73 (14.5)	63 (12.5)	22 (4.4)	503 (100)

Appendix Table A-3-5 (4) Average No. of Passengers

	Car	Taxi	Van Pick-up	Truck	Truck Trailer	Bus 1/
Miri	3.6	3.5	3.1	3.9	2.0	22.6
Limbang	3.9	3.1	3.4	3.2	1.4	13.9

1/ Excluding driver and conductor

Appendix Table A-4-1 Main Import of Commodity Items/Group at the Ports of Marudi and Limbang, 1977

TONS

Commodity Group/Item	MARUDI EXTERNAL A)	MARUDI INTERNAL 1/B)	LIMBANG EXTERNAL A)	LIMBANG INTERNAL B)
Food	262	1,600	345	620
Milled Wheat	132	110	108	60
Sugar	340	400	49	350
Beverages	89	150	69	80
Animal Feed	-	n.a.	267	n.a.
Fertilizer	-	n.a.	15	n.a.
Cement	844	1,100	1,529	200
Iron & Steel	301	400	67	350
Tobacco	3		17	
Crude Materials Inedible except fuels	17		1,257	
Animal and Vegetable *Oils*	4	6,200	64	2,000
Chemicals and Products	30		58	
Other General Cargo	1,600		1,500	
Fuels	-	10,000	-	4,200
TOTAL	3,622	19,960	5,345	7,860

Source: A; Computer Output of external trade by port, Dept. of Statistics

b; Consultants' estimates based on the results of interview survey etc.

1/ Includes Long Lama and Marudi

Appendix Table A-4-2 Per Capita Consumption of Grouped Import Items

	Commodity Group	Whole State (Sarawak) Average 1971-73	1974	1975	1976	Average 1974-76	Study Area 1/ (1977) Miri	Marudi	Limbang
	Food	65.87	72.29	72.77	47.47	64.18	64.23	5.44	14.00
042	Rice	63.49	78.87	33.53	57.12	56.51	0	0	0
08/081	Animal Feed	56.33	59.39	58.81	69.09	62.43	115.82	0	11.03
041	Wheat Flour	13.31	11.02	12.22	14.48	12.57	16.59	2.74	4.46
06	Sugar	22.75	24.35	23.97	25.36	24.56	45.03	7.05	2.02
11	Beverages	7.35	10.51	9.68	9.76	9.98	12.08	1.85	2.85
	Cement	86.24	88.76	100.88	112.22	100.62	206.18	17.51	63.18
56/561	Fertilizer	31.69	37.12	31.10	29.15	32.46	126.59	0	0
67	Iron & Steel	37.06	44.11	44.23	53.25	47.20	120.78	6.24	2.77
	Mis. Gen. Cargo	157.37	289.55	167.30	n.a.	228.43	591.98	24.90	61.98
	Total	541.46	715.97	554.49	n.a.	638.94	1,299.28	65.73	162.29

1/ Imports from outside Sarawak only

Appendix Table A-4-3 Time Distance of Each Zone Pair via Road

hr.

	2 Bekenu	3 Niah	4 Bintulu	5 Bakong	6 Tinjar	7 Lower Baram	8 Baram Middle	9 Upper Middle	10 Tutoh/ Apoh	11 N. Medamit	12 Limbang
1 Miri	0.95	1.70	3.38	1.14	1.88	-	2.37	-	3.44	4.55	5.19
2		1.25	2.93	0.69	1.43	-	1.92	-	2.99	4.10	4.74
3			2.00	1.10	1.84	-	2.33	-	3.40	4.51	5.15
4				2.78	3.52	-	4.01	-	5.08	6.19	6.83
5					0.74	-	1.23	-	2.30	3.41	4.05
6						-	0.49	-	1.56	2.67	3.31
7							-	-	-	-	-
8								-	1.07	2.18	2.82
9									-	-	-
10										1.11	1.75
11											0.64

Appendix Table A-4-4 Distance of Each Zone Pair via Road

km.

	2 Bekenu	3 Niah	3 Bintulu	5 Bakong	6 Tinjar	7 Lower Baram	8 Baram Middle	9 Upper Middle	10 Tutoh/ Apoh	11 N. Medamit	12 Limbang	13 Brunei
1 Miri	58	102	202	69	107	-	132	-	187	244	285	153
2		76	176	43	81	-	106	-	161	218	259	211
3			120	67	105	-	130	-	185	242	283	255
4				167	205	-	230	-	285	342	283	355
5					38	-	63	-	118	175	216	222
6						-	25	-	80	137	178	-
7							-	-	-	-	-	-
8								-	55	112	153	-
9									-	-	-	-
10										57	98	-
11											41	-
12												-

Appendix Table A-4-5 Estimate of Vehicle Operating Costs

Appendix Table A-4-5 (1) Operating Characteristics of Vehicles

	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 Kilometrage (000)	28.8	64	96	57.6	96	144	240	416	640
Km/Year (000)	9.6	12.8	16	14.4	19.2	24	48	64	80
Operating Days/Year	-	-	-	-	-	-	300	320	340
Average Km/Day	-	-	-	-	-	-	160	200	260
Average Running Speed Km/Hour	40	56	80	40	55	70	30	37	48

	Medium Truck (6 Ton)			Heavy Truck I (10 Ton Truck)			Heavy Truck II (20 Ton Truck Trailer)		
	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved
Life Years	5	6	7	5	6	7	5	6.5	8
Life Kilometrage (000)	240	384	560	200	320	490	280	520	896
Km/Year (000)	48	64	80	40	53.3	70	56	80	112
Operating Days/Year	260	280	300	260	280	300	280	300	320
Average Km/Day	185	230	270	155	190	235	200	270	350
Average Running Speed Km/Hour	35	43	55	25	32	45	32	40	52

Appendix Table A-4-5 (2) Vehicle Operating Cost (with Taxes)

M$/km

Cost Item	CAR			VAN/PICK-UP			BUS		
	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved
Depreciation	0.5047	0.2271	0.1514	0.4405	0.2643	0.1762	0.3304	0.1906	0.1239
Fuel Consumption	0.0752	0.0627	0.0502	0.1568	0.1254	0.0941	0.1018	0.0853	0.0688
Oil Consumption	0.0038	0.0031	0.0026	0.0045	0.0038	0.0033	0.0055	0.0046	0.0041
Tyre Wear	0.0262	0.0157	0.0079	0.0568	0.0316	0.0149	0.0644	0.0337	0.0177
Maintenance; Parts	0.0262	0.0189	0.0160	0.0660	0.0431	0.0304	0.4758	0.2775	0.1586
; Labour	0.0045	0.0033	0.0026	0.0063	0.0040	0.0030	0.0226	0.0130	0.0080
Wages	–	–	–	–	–	–	0.2500	0.1875	0.1500
Insurance	0.0371	0.0278	0.0222	0.0571	0.0428	0.0343	0.0229	0.0172	0.0138
License/Fees	0.0155	0.0116	0.0093	0.0235	0.0177	0.0141	0.0094	0.0070	0.0056
Overhead	0.0693	0.0370	0.0262	0.0812	0.0533	0.0370	0.1283	0.0816	0.0551
Total	0.7625	0.4072	0.2884	0.8927	0.5860	0.4073	1.4111	0.8980	0.6056

Cost Item	Medium Truck (6 Ton)			Heavy Truck I (10 Ton)			Heavy Truck II (20 Ton T. Trailer)		
	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved
Depreciation	0.2253	0.1408	0.0966	0.3818	0.2386	0.1558	0.6130	0.3301	0.1916
Fuel Consumption	0.1018	0.0853	0.0688	0.1458	0.1100	0.0825	0.2200	0.1650	0.1238
Oil Consumption	0.0055	0.0046	0.0041	0.0117	0.0097	0.0085	0.0166	0.0138	0.0120
Tyre Wear	0.1745	0.0914	0.0480	0.3875	0.2022	0.1033	0.6975	0.3639	0.1860
Maintenance; Parts	0.1893	0.1352	0.1082	0.3436	0.2367	0.1909	0.5149	0.3261	0.2574
; Labour	0.0226	0.0130	0.0080	0.0250	0.0150	0.0100	0.0361	0.0208	0.0128
Wages	0.2000	0.1500	0.1200	0.3300	0.2477	0.1886	0.3429	0.2400	0.1714
Insurance	0.0258	0.0193	0.0155	0.0446	0.0334	0.0255	0.0707	0.0495	0.0354
License/Fees	0.0098	0.0073	0.0059	0.0155	0.0116	0.0089	0.0188	0.0131	0.0094
Overhead	0.0955	0.0647	0.0475	0.1686	0.1105	0.0774	0.2531	0.1522	0.1000
Total	1.0501	0.7116	0.5226	1.8541	1.2154	0.8514	2.7836	1.6745	1.0998

Appendix Table A-4-5 (3) Vehicle Operating Cost (without Taxes)

Vehicle.km

Cost Item	CAR			VAN/PICK-UP			BUS		
	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved
Depreciation	0.4167	0.1875	0.1250	0.3734	0.2241	0.1494	0.2703	0.1560	0.1014
Fuel Consumption	0.0407	0.0339	0.0271	0.0848	0.0678	0.0509	0.1018	0.0853	0.0688
Oil Consumption	0.0034	0.0028	0.0024	0.0041	0.0034	0.0030	0.0050	0.0042	0.0037
Tyre Wear	0.0231	0.0139	0.0069	0.0500	0.0278	0.0132	0.0566	0.0297	0.0156
Maintenance; Parts	0.0216	0.0156	0.0132	0.0559	0.0366	0.0258	0.3893	0.2271	0.1298
; Labour	0.0041	0.0030	0.0023	0.0057	0.0036	0.0027	0.0203	0.0117	0.0072
Wages	–	–	–	–	–	–	0.2250	0.1688	0.1350
Insurance	0.0297	0.0222	0.0178	0.0457	0.0343	0.0274	0.0183	0.0138	0.0110
Overhead	0.0539	0.0279	0.0195	0.0620	0.0398	0.0272	0.1087	0.0697	0.0473
Total	0.5932	0.3068	0.2142	0.6816	0.4374	0.2996	1.1953	0.7663	0.5198

Cost Item	MEDIUM TRUCK (6 Ton)			HEAVY TRUCK I (10 Ton)			HEAVY TRUCK II (20 Ton T. Trailer)		
	Earth	Gravel	Paved	Earth	Gravel	Paved	Earth	Gravel	Paved
Depreciation	0.1735	0.1084	0.0744	0.2855	0.1785	0.1165	0.4880	0.2628	0.1525
Fuel Consumption	0.1018	0.0853	0.0688	0.1458	0.1100	0.0825	0.2200	0.1650	0.1238
Oil Consumption	0.0050	0.0042	0.0037	0.0106	0.0088	0.0077	0.0151	0.0125	0.0109
Tyre Wear	0.1536	0.0805	0.0423	0.3410	0.1779	0.0909	0.6138	0.3203	0.1637
Maintenance; Parts	0.1457	0.1041	0.0833	0.2570	0.1770	0.1428	0.4099	0.2596	0.2050
; Labour	0.0203	0.0117	0.0072	0.0225	0.0135	0.0090	0.0325	0.0187	0.0115
Wages	0.1800	0.1350	0.1080	0.2970	0.2229	0.1697	0.3086	0.2160	0.1543
Insurance	0.0206	0.0155	0.0124	0.0356	0.0267	0.0204	0.0566	0.0396	0.0283
Overhead	0.0801	0.0545	0.0400	0.1395	0.0915	0.0640	0.2145	0.1295	0.0850
Total	0.8806	0.5992	0.4401	1.5345	1.0068	0.7035	2.3590	1.4240	0.9350

Appendix Table A-4-5 (4) Price of Representative Vehicle [1/]

Vehicle Type	Average Market Price	Duty, Surtax Sales Tax	Price Without Taxes
1. Car (Toyota Corolla)	14,770	2,560	12,210
2. Van/Pick-up (Toyota Land Cruiser)	25,940	3,930	22,010
3. Medium Truck [2/] (Toyota 6 Ton)	45,000	11,020	33,980
4. Heavy Truck I (Isuzu 10 Ton)	81,000	19,800	61,200
5. Heavy Truck II (Nissan 20 Ton)	180,000	36,000	144,000
6. Bus [2/] (Bedford)	50,000	10,000	40,000

1/ Including tyres
2/ Excluding body

Appendix Table A-4-5 (5) Price of Body, 1978

Vehicle Type	Market Price	Tax	Price Without Tax
Medium Truck	11,000	1,650	9,350
Bus	30,000	4,500	25,500

Source: Interviews with dealers

Appendix Table A-4-5 (6) Fuel Consumption

Liter/1,000km

Vehicle Type	Road Type		
	Earth	Gravel	Paved
Car	120	100	80
Van/Pick-up	250	200	150
Medium Truck	370	310	250
Heavy Truck I	530	400	300
Heavy Truck II	800	600	450
Bus	370	310	250

Source: Quantification of Road User Savings, IBRD

Appendix Table A-4-5 (7) Price of Fuel, 1978 1/

Fuel Type	Price, M$/Gallon (M$/Liter) With Tax	Without Tax
Gasoline ; Super	3.45 (0.759)	2.08 (0.458)
; Regular	2.85 (0.627)	1.54 (0.339)
Diesel	1.25 (0.275)	1.25 (0.275)

Source: Interviews with dealers

1/ Average in Miri and Limbang areas

Appendix Table A-4-5 (8) Oil Consumption

Liter/1,000km

Vehicle Type	Road Type Earth	Gravel	Paved
Car	1.6	1.3	1.1
Van/Pick-up	1.9	1.6	1.4
Medium Truck	3.1	2.6	2.3
Heavy Truck I	6.6	5.5	4.8
Heavy Truck II	9.4	7.8	6.8
Bus	3.1	2.6	2.3

Appendix Table A-4-5 (9) Price of Oil, 1978

Oil Type	Price, M$/Gallon (M$/Liter) With Tax	Without Tax
For Gasoline Engine	10.75 (2.365)	9.75 (2.145)
For Diesel Engine	8.05 (1.771)	7.30 (1.606)

Appendix Table A-4-5 (10) Tyre Wear (Life Kilometrage)

000km

Vehicle Type	Road Type Earth	Gravel	Paved
Car	9	15	30
Van/Pick-up	10	18	38
Medium Truck	11	21	40
Heavy Truck I	12	23	45
Heavy Truck II	12	23	45
Bus	11	21	40

Appendix Table A-4-5 (11) Price of a Set of Tyres, 1978

Vehicle Type	Tyre Type	No. of Tyres	Price (M$) With Tax	Price (M$) Without Tax
Car	615 x 13	4	236	208
Van/Pick-up	750 x 16	4	568	500
Medium Truck	825 x 20	6	1,920	1,690
Heavy Truck I	1,000 x 20	10	4,650	4,092
Heavy Truck II	1,000 x 20	18	8,370	7,366
Bus	670 x 13	6	708	623

Appendix Table A-4-5 (12) Maintenance: Parts

Vehicle Type	% of Depreciable Value per 1,000km		
	Earth	Gravel	Paved
Car	0.18	0.13	0.11
Van/Pick-up	0.26	0.17	0.12
Medium Truck	0.35	0.25	0.20
Heavy Truck I	0.45	0.31	0.25
Heavy Truck II	0.30	0.19	0.15
Bus	0.60	0.35	0.20

Appendix Table A-4-5 (13) Maintenance: Labour 1/

Vehicle Type	Hours per 1,000km		
	Earth	Gravel	Paved
Car	1.13	0.83	0.66
Van/Pick-up	1.58	1.00	0.76
Medium Truck	5.64	3.24	2.00
Heavy Truck I	6.25	3.75	2.50
Heavy Truck II	9.03	5.19	3.20
Bus	5.64	3.24	2.00

1/ Hourly Cost of Labour:

$$\frac{\$600/\text{Month}}{150\text{hrs/Month}} = \$4.0/\text{hr.}$$

Appendix Table A-4-5 (14) Average Monthly Wages of Drivers and Assistants 1/

M$/Month

Vehicle Type	Driver	Assistant
Medium Truck	500	300
Heavy Truck I	800	300
Heavy Truck II	1,000	300 x 2
Bus	700	300

1/ Including trip allowances and other fringe benefits.

Appendix Table A-4-5 (15) Insurance

M$/Year

Vehicle Type	With Tax	Without Tax
Car	355.9	284.7
Van/Pick-up	822.6	658.1
Medium Truck	1,236.0	988.8
Heavy Truck I	1,782.0	1,425.6
Heavy Truck II	3,960.0	3,168.0
Bus	1,100.0	880.0

Appendix Table A-4-5 (16) Road Taxes/Fees

Vehicle Type	Amount (M$/Year)
Car	149.0
Van/Pick-up	339.0
Medium Truck	470.0
Heavy Truck I	620.0
Heavy Truck II	1,050.0
Bus	450.0

Appendix Table A-4-5 (17) Vehicle Operating Cost

(M$/veh.km.)

Vehicle Type	(Taxes)	Level tangent				Gradient (1/2) 0 ∿ 3% (1/2) 3 ∿ 5%		
		Earth	Gravel	(1/2)Gravel (1/2)Paved	Paved	Gravel	(1/2)Gravel (1/2)Paved	Paved
Car	(WITH)	0.7625	0.4072	0.3478	0.2884	0.4276	0.3652	0.3028
	(WITHOUT)	0.5932	0.3068	0.2605	0.2142	0.3221	0.2735	0.2249
Truck 6ton	(WITH)	1.0501	0.7116	0.6171	0.5226	0.9002	0.7806	0.6611
	(WITHOUT)	0.8806	0.5992	0.5197	0.4401	0.7580	0.6574	0.5567
10ton	(WITH)	1.8541	1.2154	1.0334	0.8514	1.5375	1.3073	1.0770
	(WITHOUT)	1.5345	1.0068	0.8552	0.7035	1.2736	1.0818	0.8899
20ton	(WITH)	2.7836	1.6745	1.3872	1.0998	2.1182	1.7548	1.3912
	(WITHOUT)	2.3590	1.4240	1.1795	0.9350	1.8014	1.4921	1.1828
BUS	(WITH)	1.4111	0.8980	0.7518	0.6056	1.1360	0.9510	0.7661
	(WITHOUT)	1.1953	0.7663	0.6431	0.5198	0.9694	0.8135	0.6575

Appendix Table A-4-6 Estimate of Vessel Operating Costs

Appendix Table A-4-6 (1) Operating Characteristics of Light Vessels

	Tug Boat				Barge (Tons)			Motor Vessel (Tons)		
	120HP	150HP	500HP	800HP	150	300	500	40	150	200
Loading Capacity	-	-	-	-	150	300	500	40	150	200
Ave. Operat. Speed(KPH)	10.0	10.0	12.0	12.0	8.0	8.0	8.0	11	12.5	13.5
Operating Hours/Day	10	10	10	10	14	14	14	10	24	24
Ave. Line Haul/Day(Km)	100	100	120	120	112	112	112	110	300	324
Operat. Days/Year	240	240	240	240	230	210	180	200	200	180
Operat. Km./Year	24,000	24,000	28,800	28,800	25,760	23,520	20,160	22,000	60,000	58,320
Life Years	15	15	20	20	20	22	25	15	22	25

Source: Interviews with Shipping Companies

Appendix Table A-4-6 (2) Operating Cost of Tug Boat

(M$/day)

Cost Item		120HP		150HP		500HP		800HP	
		WITH	WITHOUT	WITH	WITHOUT	WITH	WITHOUT	WITH	WITHOUT
1. Depreciation 1/	Engine:	22.92	15.83	41.67	29.17	58.33	40.83	83.33	58.33
	Hull:	20.83	17.70	55.56	47.22	75.00	63.75	114.58	97.40
2. Fuel 2/		96.60	94.20	128.80	125.60	193.20	188.40	241.50	235.50
3. Lubrication 3/		17.50	17.00	17.50	17.00	26.25	25.50	31.50	30.60
4. Maintenance 4/		41.67	35.42	62.50	53.12	125.00	106.25	166.67	141.67
5. Crew 5/		64.58	61.35	83.33	79.17	83.33	79.17	83.33	79.17
6. Stores 6/		6.25	5.94	6.25	5.94	9.17	8.71	10.00	9.50
7, Insurance 7/		5.42	4.24	12.50	10.00	20.83	16.83	31.25	25.31
8. Overhead 8/		27.58	25.17	40.81	36.72	59.11	52.94	76.22	67.75
Total/Day		303.35	276.85	448.92	403.94	650.22	582.38	838.38	745.23

1/ Price New,	Engine:	55,000	38,000	100,000	70,000	140,000	98,000	200,000	140,000
	Hull:	75,000	63,750	200,000	170,000	360,000	306,000	550,000	467,500
Life Years,	Engine:	10 years		10 years		10 years		10 years	
	Hull:	15 years		15 years		20 years		20 years	
2/ Fuel Consumption:		6 gallon/hr		8 gallon/hr		12 gallon/hr		15 gallon/hr	
Price of Fuel:		1.61/gal.	1.57/gal.	1.61/gal.	1.57/gal.	1.61/gal.	1.57/gal.	1.61/gal.	1.57/gal.
3/ Lubrication Consump:		0.02 gallon/mile		0.02 gallon/mile		0.025 gallon/mile		0.03 gallon/mile	
Price of Lubrit:		14.0/gal.	13.6/gal.	14.0/gal.	13.6/gal.	14.0/gal.	13.6/gal.	14.0/gal.	13.6/gal.
4/ Maintenance,	Engine:	10,000/year	8,500/year	15,000/year	12,750/year	30,000/year	25,500/year	40,000/year	34,000/year
	Hull:								
5/ Crew,	Captain:	1 x 5,000		1 x 7,000		1 x 7,000		1 x 7,000	
	Engineer:	-	15,500/year	1 x 6,000	20,000/year	1 x 6,000	20,000/year	1 x 6,000	20,000/year
	Hands	3 x 3,500		2 x 3,500		2 x 3,500		2 x 3,500	
6/ Stores:		1,500/year		1,500/year		2,200/year		2,400/year	
7/ Insurance:		1% on value/day							
8/ Overhead		10% of total of 1/ through 7/							

Appendix Table A-4-6 (3) Operating Cost of Motor Vessels

(M$/day)

	40 ton		150 ton		200 ton	
	WITH	WITHOUT	WITH	WITHOUT	WITH	WITHOUT
1. Depreciation 1/	43.33	33.88	431.82	345.45	555.56	444.44
2. Fuel 2/	96.60	94.20	579.60	565.20	695.52	678.24
3. Lubrication 3/	20.01	19.43	56.00	54.40	67.20	65.28
4. Maintenance 4/	55.00	46.75	250.00	200.00	388.89	311.11
5. Crew 5/	77.50	73.63	150.00	135.00	183.33	164.70
6. Stores 6/	-	-	15.00	14.25	22.22	21.11
7. Insurance 7/	5.00	3.95	95.00	76.00	138.89	111.11
8. Overhead 8/	29.74	27.18	157.74	139.03	205.16	179.60
Total/Day	327.18	299.02	1,735.16	1,529.33	2,256.77	1,795.59

Source: Interviews with operators and dealers

1/ Price New:	100,000	79,000	1,900,000	1,520,000	2,500,000	2,000,000
Life Years:			22 years (200 day/year)		25 years (180 day/year)	
2/ Fuel, Consump:	4.8 gallon/hr		15 gallon/hr		18 gallon/hr	
Price of Fuel:	1.61/gal.	1.57/gal.	1.61/gal.	1.57/gal.	1.61/gal.	1.57/gal.
3/ Lubrication, Consump:	1/7 gallon/hr		1/6 gallon/hr		1/5 gallon/hr	
Price of Lubricatn:	14.00/gal.	13.60/gal.	14.00/gal.	13.60/gal.	14.00/gal.	13.60/gal.
4/ Maintenance/Year:	11,000	9,350	50,000	40,000	70,000	56,000
5/ Crew, Captain:	1 x 5,000		1 x 8,000		1 x 8,000	
Mate:	-	15,500/year	1 x 7,000	30,000/year	1 x 7,000	33,000/year
Engineer:	-		1 x 6,000		1 x 6,000	
Hands:	3 x 3,500		3 x 3,000		4 x 3,000	
6/ Stores:	-		3,000/year		4,000/year	
7/ Insurance:	1% on value/day					
8/ Overhead	10% of total of 1/ through 7/					

Appendix Table A-4-6 (4) Operating Cost of Barge

(M$/day)

	150 ton		300 ton		500 ton	
	WITH	WITHOUT	WITH	WITHOUT	WITH	WITHOUT
1. Depreciation 1/	55.00	41.30	90.04	67.53	136.22	102.22
2. Maintenance 2/	30.43	24.35	57.14	45.71	94.44	75.56
3. Crew 3/	69.57	62.61	109.52	98.57	166.67	150.00
4. Stores 4/	12.00	11.40	18.00	17.10	28.00	26.60
5. Insurance 5/	11.00	8.80	19.81	15.85	32.26	25.81
6. Overhead 6/	17.80	14.85	29.45	24.48	45.76	38.02
Total/Day	195.80	163.31	323.96	269.24	503.35	418.20

Source: Interviews with operators and dealers

1/ Price New:	253,000	190,000	416,000	312,000	613,000	460,000
Life Years:	20 years (230 days/year)		22 years (210 days/year)		25 years (180 days/year)	
2/ Maintenance/year:	7,000		12,000		17,000	
3/ Crew,						
Crane Operator:	1 x 9,000	16,000/year	1 x 9,000	23,000/year	1 x 9,000	30,000/year
Hands:	2 x 3,500		4 x 3,500		6 x 3,500	
4/ Stores:						
5/ Insurance:	1% on Value/day					
6/ Overhead:	10% of total of 1 through 5					

Appendix Table A-4-6 (5) Operating Characteristics of Passenger Express Launch

Distance;	104 kilometers K. Baram/Marudi	109 kilometers Marudi/L. Lama
Size of Hull	73' x 13.5'	n.a.
Loading Capacity (No. of Pass.)	120	70
Max. Cruising Speed (KPH)	38	30
Ave. Cruising Speed (KPH)	30	22
Operating Hours/Day	3.5	5.0
Operating Days/Year	365	304 1/
Annual Kilometrage	39,600	32,832
Life Years	20	16
Life Kilometrage	792,000	525,000
Life Years of Engine	10	6

Source: Interviews with operators and dealers

1/ 365 x 5/6

Appendix Table A-4-6 (6) Operating Cost of Passenger Express Launch

Cost Item		K.Baram - Marudi		Marudi - Long Lama	
		WITH	WITHOUT	WITH	WITHOUT
1. Depreciation, 1/	Engine:	43.84	27.40	38.38	24.00
	Hull:	19.18	16.30	22.62	19.22
2. Fuel 2/		289.80	261.00	193.20	174.00
3. Lubrication 3/		21.00	20.40	14.00	13.60
4. Maintenance, 4/	Engine:	27.40	23.29	19.74	16.78
	Hull:	5.48	4.66	4.28	3.64
5. Crew 5/:		54.25	48.82	51.32	46.18
6. Insurance 6/:		8.60	6.30	7.50	5.20
7. Overhead 7/:		46.96	40.82	35.10	30.26
Total/Day:		516.50	448.99	386.14	332.88

1/	Price New, Engine:	80,000 x 2	50,000 x 2	70,000 x 1	43,750 x 1
	Hull:	140,000	119,000	110,000	93,500
	Life Years, Engine:	10 years		6 years	
	Hull:	20 years		16 years	
2/	Fuel Consumption:	180 gallon/trip		120 gallon/trip	
	Price of Fuel:	1.61/gal.	1.57/gal/	1.61/gal.	1.57/gal.
3/	Lubrication Consump:	1.5 gallon/trip		1.0 gallon/trip	
	Price of Lubricatn:	14.00/gal.	13.60/gal.	14.00/gal.	13.60/gal.
4/	Maintenance, Engine:	10,000/year		6,000/year	
	Hull:	2,000/year		1,300/year	
5/	Crew, Captain:	7,200/year		7,200/year	
	Crew:	4,200/year x 3		4,200/year x 2	
6/	Insurance:	1% on value/day			
7/	Overhead:	10% of total of 1/ through 6/			

Appendix Table A-4-6 (7) Operating Characteristics of Long Boats

	Long Boat		
	67' x 4'	45' x 2.5'	20' x 2'/16' x 1.75'/ 14' x 1.5'
Loading Capacity (No. of Passengers)	15-18	6-8	2-3
Life Years	5	4	4
Ave. Operating Speed	11.6	11.6	8
Ave. Life Kilometrage	30,000	24,000	15,000
Engine Type	40HP x 1	25HP x 1	6 - 9HP
Life Years of Engine	2.5 (18,000)	2.5 (15,000)	2.0 (7,500)

Appendix Table A-4-6 (8)
Price of Hull

Boat Type	Price (M$) With Tax	Price (M$) Without Tax
67' x 4'	3,000	2,760
45' x 2.5'	1,800	1,656
16' x 1.75'	400	400

Appendix Table A-4-6 (9)
Price of Outboard Engine

Engine Type	Price (M$) With Tax	Price (M$) Without Tax
40 HP	2,500 (25%)	1,875
25 HP	1,450 (25%)	1,088
9 HP	1,100 (25%)	825
6 HP	1,000 (25%)	750

Appendix Table A-4-6 (10) Operating Cost of Long Boat with Outboard Engine [4/]

		67' x 4'		45' x 2.5'		16' x 1.75'	
		WITH	WITHOUT	WITH	WITHOUT	WITH	WITHOUT
1. Depriciation [1/]	Engine:	0.1389	0.1042	0.0967	0.0725	0.1333	0.1000
	Hull:	0.1000	0.0920	0.0750	0.0690	0.0267	0.0267
2. Fuel [2/]		1.7457	1.5711	1.1638	1.0474	0.6750	0.6075
3. Maintenance [3/]	Engine:	0.0750	0.0497	0.0435	0.0326	0.0300	0.0225
	Hull:	0.0900	0.0828	0.0540	0.0497	0.0120	0.0090
Total/km		2.1496	1.8998	1.4330	1.2712	0.8770	0.7657

Source: Interviews with local operators

[1/] Price New, Engine: 2,500 (40HP) 1,875 | 1,450 (25HP) 1,088 | 1,000 (6HP) 750
Hull: 3,000 2,760 | 1,800 1,656 | 400 400
Life Years, Engine: 3.0 years | 2.5 years | 2.0 years
Hull: 5.0 years | 4.0 years | 4.0 years

[2/] Fuel, Consumption: 4.5 gal./hr./11.6 km | 3.0 gal./hr./11.6 km | 1.2 gal./hr./8 km
Price of Fuel: 4.5/gallon 4.05/gallon | 4.5/gallon 4.05/gallon | 4.5/gallon 4.05/gallon

[3/] Maintenance: 3% of depreciable value/1000km for hull and engine

[4/] Operating characteristics of long boats are as follow:

particulars	67' x 4'	45' x 2.5'	20' x 2' 16' x 1.75' 14' x 1.5'
loading capacity (no. of passengers)	15-18	6-8	2-3
life years	5	4	4
ave. operating speed	11.6 km	11.6 km	8.0 km
ave. life kilometrage	30,000	24,000	15,000
engine type	40HP x 1	25HP x 1	6-9HP x 1
life years of engine	3.0 (18,000 kms)	2.5 (15,000 kms)	2.0 (7,500 kms)

Appendix Table A-4-6 (11) Cost of Log Rafting

1 Racket 100 logs
2 Rackets 200 logs

(1) Labour 6.5men x 8hrs/2rackets
M$4.0/hr
6.5 x 8.0 x 4.0 = $208/200 logs --- $1.04/log

(2) Ropes; 8ft/10g x M$0.35/ft = M$2.8/log
$250(1 roll) = 720ft --- $0.35/ft
M$2.8 x 1/2 times use = M$1.4/log

(3) Cable; 400ft/2rackets
400ft x M$5.50/ft = M$2,200/8 time life = M$275/200 logs

Tons	(350)	(700)	(1,400)	(2,800)	(3,500)
	100	200	400	800	1,000
No.logs(Rackets)	(1)	(2)	(4)	(8)	(10)
Labour	104	208	416	832	1,040
Ropes	140	280	560	1,120	1,400
Cable	138	275	413	689	827
Total	382	763	1,389	2,641	3,267
Inc. Overhead (20%)	458	916	1,667	3,169	3,920
Per log	4.58	4.58	4.17	3.96	3.92

1 H/T = 1.803m^3

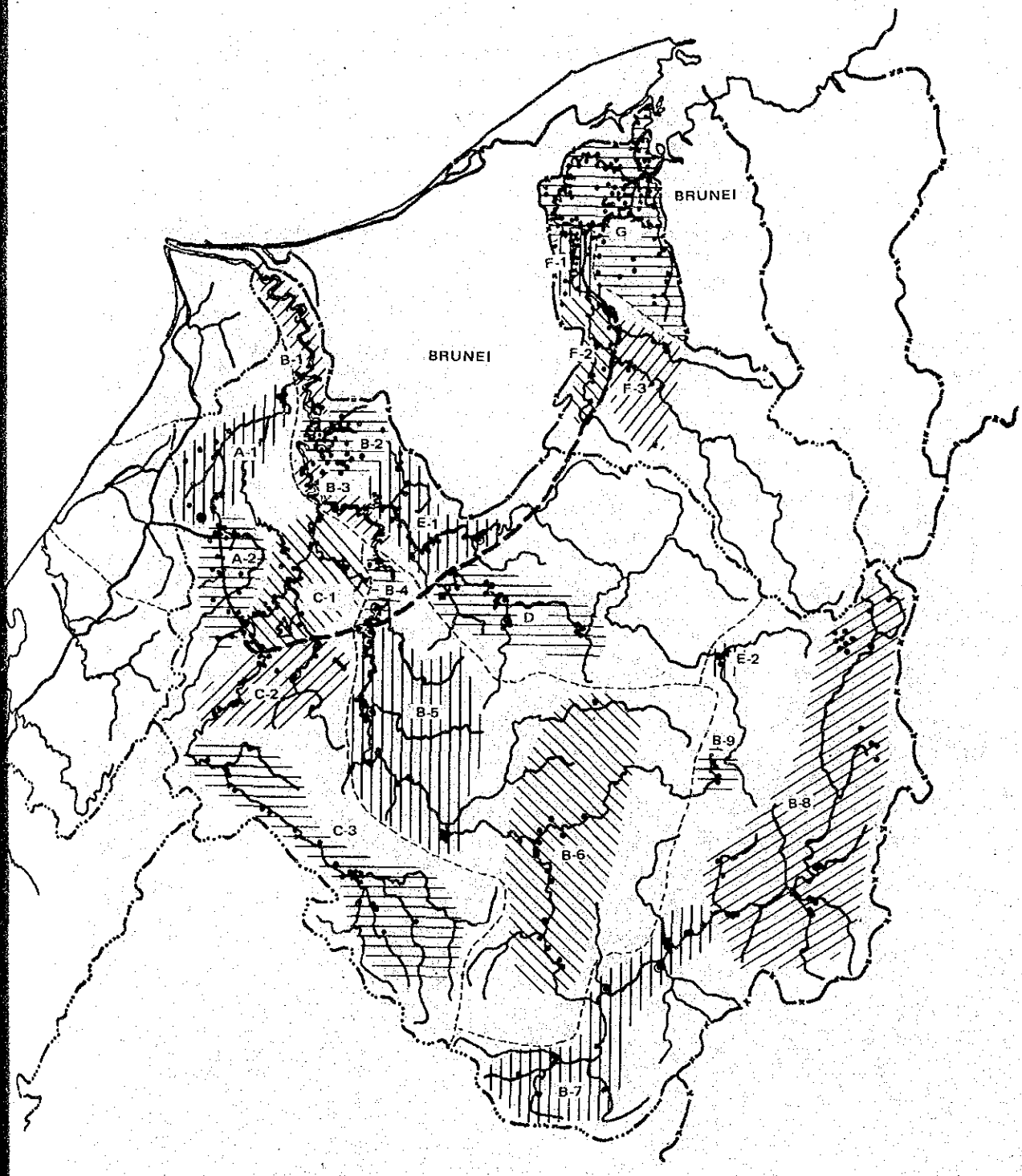
Appendix Table A-4-7 Population by Major River Basin

Area Code	Traffic Zone No.	1977	River Basin
A-1	5	2,900	
A-2	5	2,500	Sg. Bakong
Beluru	5	380	
C-1	6	4,100	
C-2	6	4,200	Sg. Tinjar
C-3	6	1,920	
B-1	7	1,000	
B-2	7	3,200	
B-3	7	1,700	
Marudi	7	5,000	
B-4	8	1,800	Bg. Baram
B-5	8	3,200	
B-6	9	2,600	
B-7	9	3,300	
B-8	9	2,400	
B-9	9	300	
Long Lama	8	1,500	
D	10	3,600	Sg. Apoh
E-1	10	2,500	Sg. Tutoh
E-2	10	100	
F-1	11	3,100	
F-2	11	2,300	Sg. Limbang
F-3	11	800	
G	12	18,000	Sg. Limbang

Appendix Table A-4-8 Estimated Future Population by Traffic Zone

Traffic Zone Code	Name	1977	1985	1995	2005
1.	Miri	50,700	72,100	106,500	153,100
2.	Bekenu	12,900	15,700	19,100	22,700
5.	Sg. Bakong	5,780	7,400	9,500	11,900
	Beluru	380	540	790	1,100
	Others	5,400	6,860	8,710	10,800
6.	Sg. Tinjar	10,220	12,800	16,400	20,500
7.	Lower Bg. Baram	10,900	13,000	15,800	18,400
	Marudi	5,000	5,700	6,600	7,300
	Others	5,900	7,300	9,200	11,100
8.	Bg. Baram Middle	6,500	8,000	9,900	12,100
	Long Lama	1,500	2,000	2,700	3,300
	Others	5,000	6,000	7,200	8,800
9.	Upper Bg. Baram	8,600	9,200	10,000	10,600
10.	Sg. Tutoh/Apoh	6,200	7,600	9,500	11,700
11.	N. Medamit	6,200	7,000	7,800	8,500
12.	Limbang	18,000	21,900	27,000	32,500
	TOTAL	136,000	174,700	231,500	302,000
3.	B. Niah	14,200	17,300	21,100	25,200
4.	Bintulu	18,200	28,800	51,100	90,600

Appendix Fig. A-4-1 Population Distribution by Major River Basin



Appendix Note A.4.1

Estimate of River Transport Demand in the Study Area

Appendix Note A.4.1 Estimate of River Transport Demand in the Study Area

(1) 河川貨物交通需要の推定

対象地域の貨物の動きは、基本的に農産物、木材、砕石が搬出され、消費物資、建設資材、肥料、飼料、燃料等が搬入されるものと考えられる。こうした物資の内計画道路に関連するものは、Baram地域の貨物量の相当部分とLimbang地域の貨物の一部と予想される。

1) 搬入量

貨物需要の内、搬入量を推定するために既存統計資料と現地調査の結果から、1人当りの品目別消費量の水準を求め、これを地域の人口に乗じて貨物需要量を求めたが、肥料については耕地面積当りの消費量、飼料については家畜頭数当りの消費量をもとにしている。

以上の結果は、表AおよびBに示されるものとなる。この1人当り消費量をサラワク全体と、対象地域各ディストリクトのそれと比較したものをAppendix Table A－4－2に示す。以上の結果を参考にBaramとLimbang ディストリクトの消費物資の予測をしたものが表Cである。

Appendix Table A Estimated Per Capita Consumption by Commodity Item/Group for Baram and Limbang Districts 1/

kg/person

Commodity Group/ Item	Baram				Limbang			
	1977	1985	1995	2005	1977	1985	1995	2005
Food	40	46.9	57.1	69.6	40	46.9	57.1	69.6
Milled Wheat	5	5.9	7.1	8.7	7	8.2	10.0	12.2
Sugar	15	17.6	21.4	26.1	17	19.9	24.3	29.6
Beverages	5	5.9	7.1	8.7	6	7.0	8.6	10.4
Cement	40	54.7	81.0	119.9	70	95.8	141.8	209.9
Iron and Steel	15	20.5	30.4	45.0	17	23.3	34.4	51.0
Others	130	152.3	185.7	226.3	200	234.3	285.6	348.2
Fuel	210	266.0	357.5	480.5	180	228.0	306.4	411.8
Total	460	569.8	747.3	984.8	537	663.4	868.2	1,142.7

1/ Annual gorwth rate for commodity group/item is assumed as follows; 2% for food, milled wheat, sugar, beverages and others, 3% for fuel and 4% for cement and iron & steel.

Appendix Table B Estimated Per Head Animal Feed Requirements, and Per Hectare Fertilizer Requirements

	1977	1985	1995	2005	
Animal Feed (kg/head)	50	50	50	50	(Limbang)
	20	20	20	20	(Baram)
Fertilizer: (kg/ha)					
Paddy	n.a.	200	200	200	
Rubber	n.a.	165	165	165	
Pepper	n.a.	280	280	280	

Appendix Table C Summarizes the Estimated Amount of Import Goods Required in the Baram and Limbang Districts

tons

Commodity Group/Item	Baram				Limbang			
	1977	1985	1995	2005	1977	1985	1995	2005
Food	1,928	2,720	4,060	5,930	968	1,535	1,987	2,854
Milled Wheat	241	342	505	741	169	237	348	500
Sugar	723	1,021	1,522	2,224	411	575	846	1,214
Beverages	241	342	505	741	145	202	299	426
Animal Feed 1/	189	221	270	329	261	306	373	454
Fertilizer	3,196	3,272	3,377	3,494	1,843	1,881	1,933	1,991
Cement	1,928	3,173	5,759	10,215	1,694	2,769	4,935	8,606
Iron and Steel	723	1,185	2,161	3,834	411	673	1,197	2,091
Petroleum Products	10,122	15,428	25,418	40,939	4,356	6,589	10,663	16,884
Miscellaneous Cargo	6,266	8,833	13,203	19,281	4,840	6,771	9,939	14,276
Total	25,557	36,537	56,780	87,728	15,098	21,358	32,520	49,296
Per Capita Consumption (tons)	530	630	799	1,030	624	739	934	1,202

1/ Annual growth rate of 2% throughout the years is assumed.

2) 農産物の搬出量

農産物は米を除いてMiri、Marudi、Limbangから殆んど輸出されるが、一部Kuchingを経由して輸出されるものもある。Baram地域の米の余剰は消費地であるMiriへ輸送されている。以下品目別に検討を加える。

米の輸送量は将来の地域の米の生産量と消費量を予測し、余剰量がMiriへ供給されるものと考える。この結果は表Dに示される。

Appendix Table D Estimated Future Deficit/Surplus Balance of Rice in The Study Area

tons

		1977	1985	1995	2005
Miri 1/ :	Production	2,646	2,997	3,333	3,612
	Demand 2/	7,632	10,097	14,444	19,338
	Balance	Δ4,986	Δ7,100	Δ11,111	Δ15,726
Baram :	Production	10,013	11,162	12,265	13,517
	Demand 2/	7,712	8,700	10,665	12,354
	Balance	2,301	2,462	1,600	1,163
Limbang :	Production	4,777	5,304	5,812	6,563
	Demand 2/	3,751	4,191	5,046	5,740
	Balance	1,026	1,113	766	823
Study AREa :	Production	17,436	19,463	21,410	23,692
	Demand	19,095	22,988	30,155	37,432
	Balance	Δ1,659	Δ3,525	Δ8,745	Δ13,740

1/ Includes Miri and Sibuti sub-districts

2/ Per capita consumption is assumed as follows:

Miri : 120 kg. for 1977, 115 kg. for 1985 and 1995 and 110 kg. for 2005.

Baram : 160 kg. for 1977, 150 kg. for 1985 and 1995 and 145 kg. for 2005.

Limbang : 155 kg. for 1977, 145 kg. for 1985 and 1995 and 140 kg. for 2005.

ゴムと胡椒は何れも全量が輸出されるものと考えられるが、搬出港は現在の港別取扱量から判断して次のように考える。

Appendix Table E Production and Exports of Rubber and Pepper of Baram and Limbang Districts

tons

Area		Rubber 1977	Rubber 1985	Rubber 1995	Rubber 2005	Pepper 1977	Pepper 1985	Pepper 1995	Pepper 2005
Baram	Production :	2,500	2,929	3,571	4,353	565	744	1,050	1,480
	Export :								
	Marudi	750	879	1,071	1,306	170	223	315	444
	Miri	750	879	1,071	1,306	170	223	315	444
	Kuching	1,000	1,171	1,429	1,741	225	298	420	592
Limbang	Production :	1,750	2,050	2,499	3,047	85	435	613	865
	Export :								
	Limbang	788	923	1,125	1,371	60	305	429	606
	Kuching	962	1,127	1,374	1,676	25	130	184	259

3) 骨材の搬出量

現在のLong Lama 近くのBatu Gadingで砕石が年間約150,000トン生産され、300～400トンバージでMarudi、Miri、Bruneiへ搬出されている。内Marudiでの消費量は、年間15,000トン程度であり、残りは大部分Miriへ、一部Brunei へ販売されている。埋蔵量は現在の生産量ペースで今後20年間は確保できるものであり、現地の状況から将来の骨材搬出量を次のように想定する。

Appendix Table F Production and Export of Stones from Batu Gading

000tons

	1978	1985	1995	2005
Production 1/ :	150	184.5	247.9	333.2
Export:				
Marudi 2/	15	16.6	19.3	22.4
Miri/Brunei	135	167.9	228.6	310.8

1/ Annual growth rate of 3% is assumed.

2/ Annual growth rate of 1.5% is assumed.

4) 原木の搬出量

原木の輸出量の内、計画道路より上流地域での生産量を次表に示されるよう今後とも増加するものと仮定した。

Appendix Table G Production and Export of Hill Timber of The Baram District

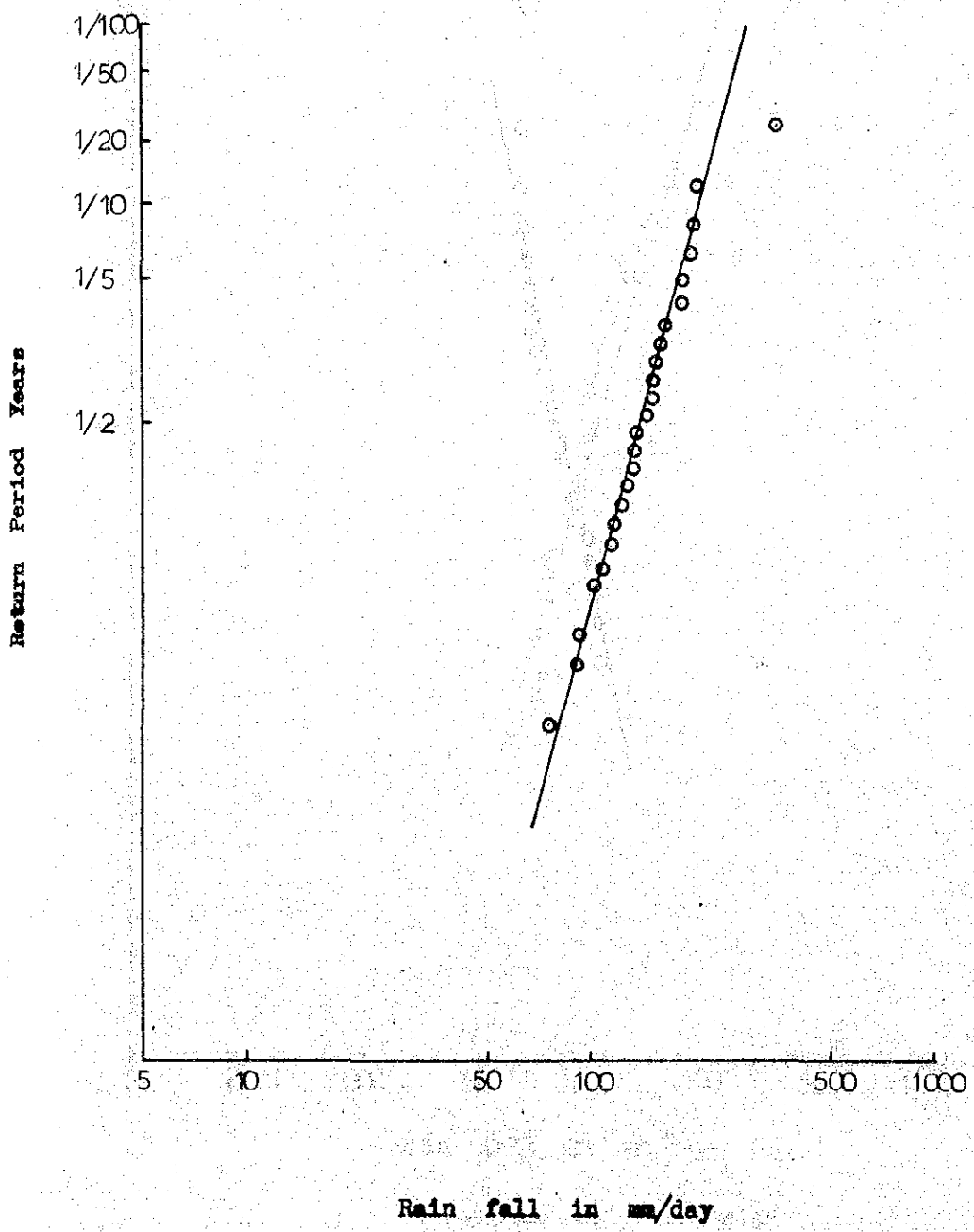
H/T

Area	1977	1985	1995	2005
Whole of Baram	600	610	665	715
Area upriver of the Project Road	150	201	286	380
(% of whole of Baram)	(25)	(33)	(43)	(53)

Appendix Fig. A-5-1

PROBABLE MAXIMUM DAILY RAINFALL

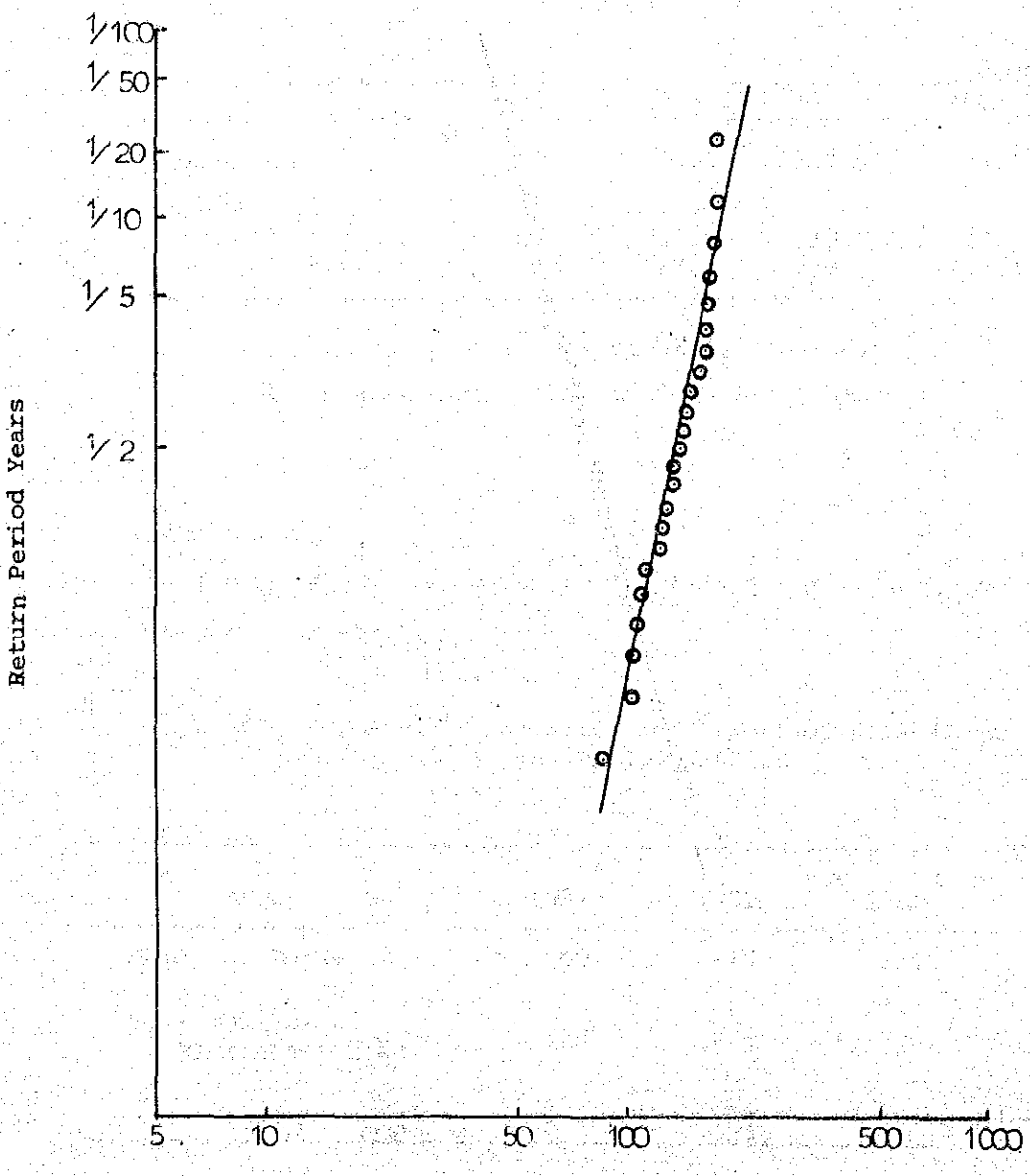
4 - 1 Lutong



Appendix Fig. A-5-2

PROBABLE MAXIMUM DAILY RAINFALL

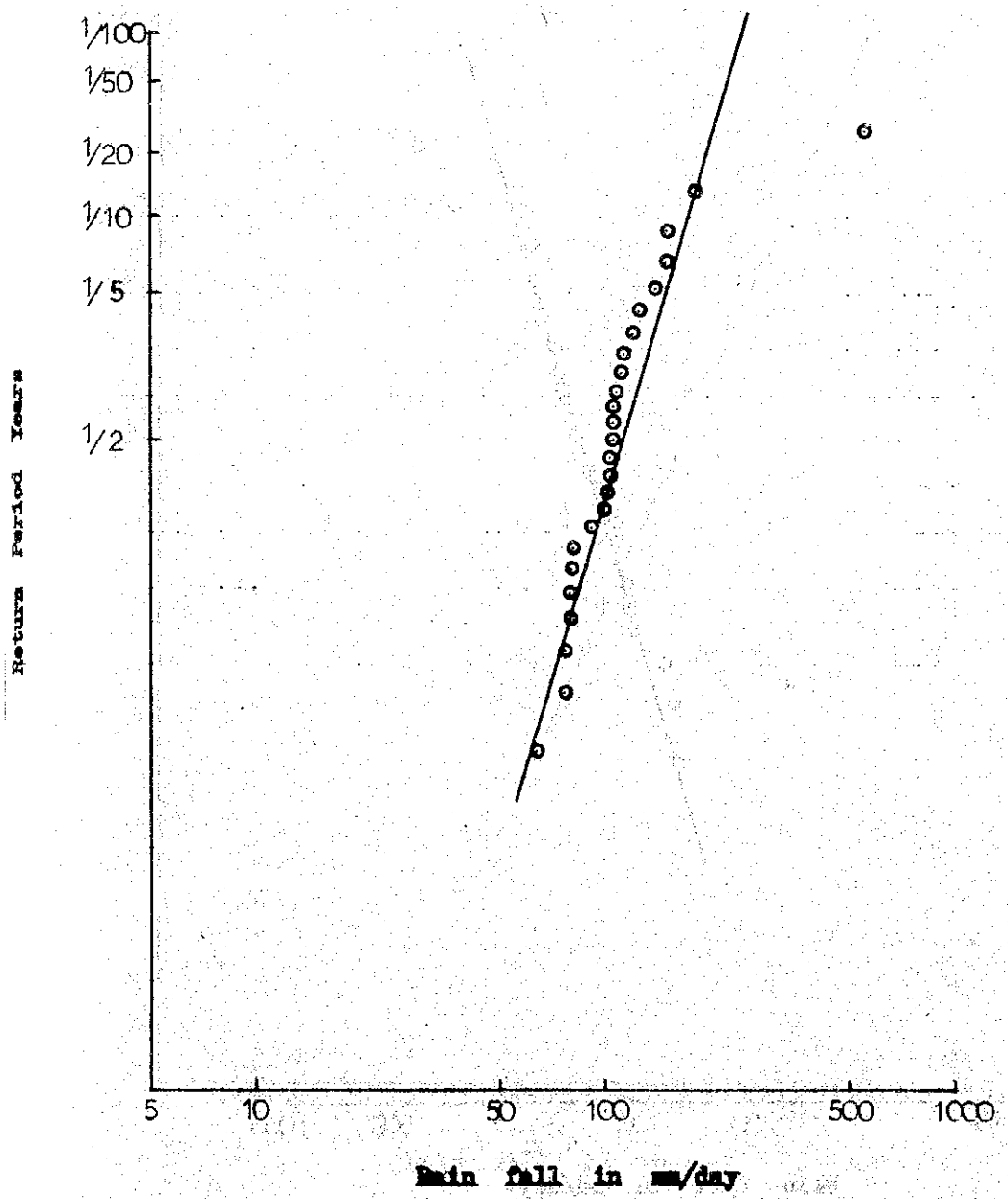
4 - 3 Long Akah



Appendix Fig. A-5-3

PROBABLE MAXIMUM DAILY RAINFALL

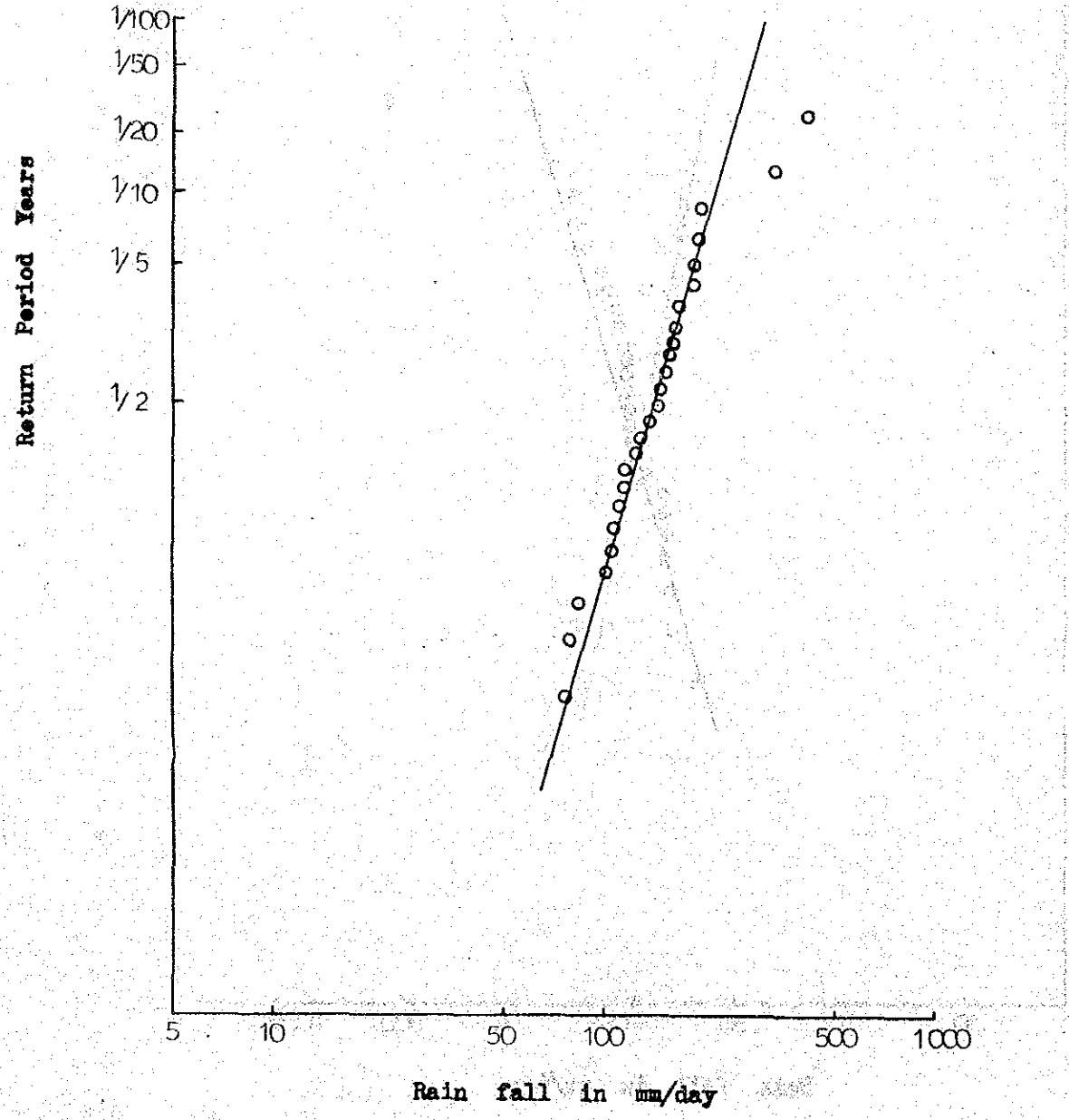
4 - 4 Maruai Airfield



Appendix Fig. A-5-4

PROBABLE MAXIMUM DAILY RAINFALL

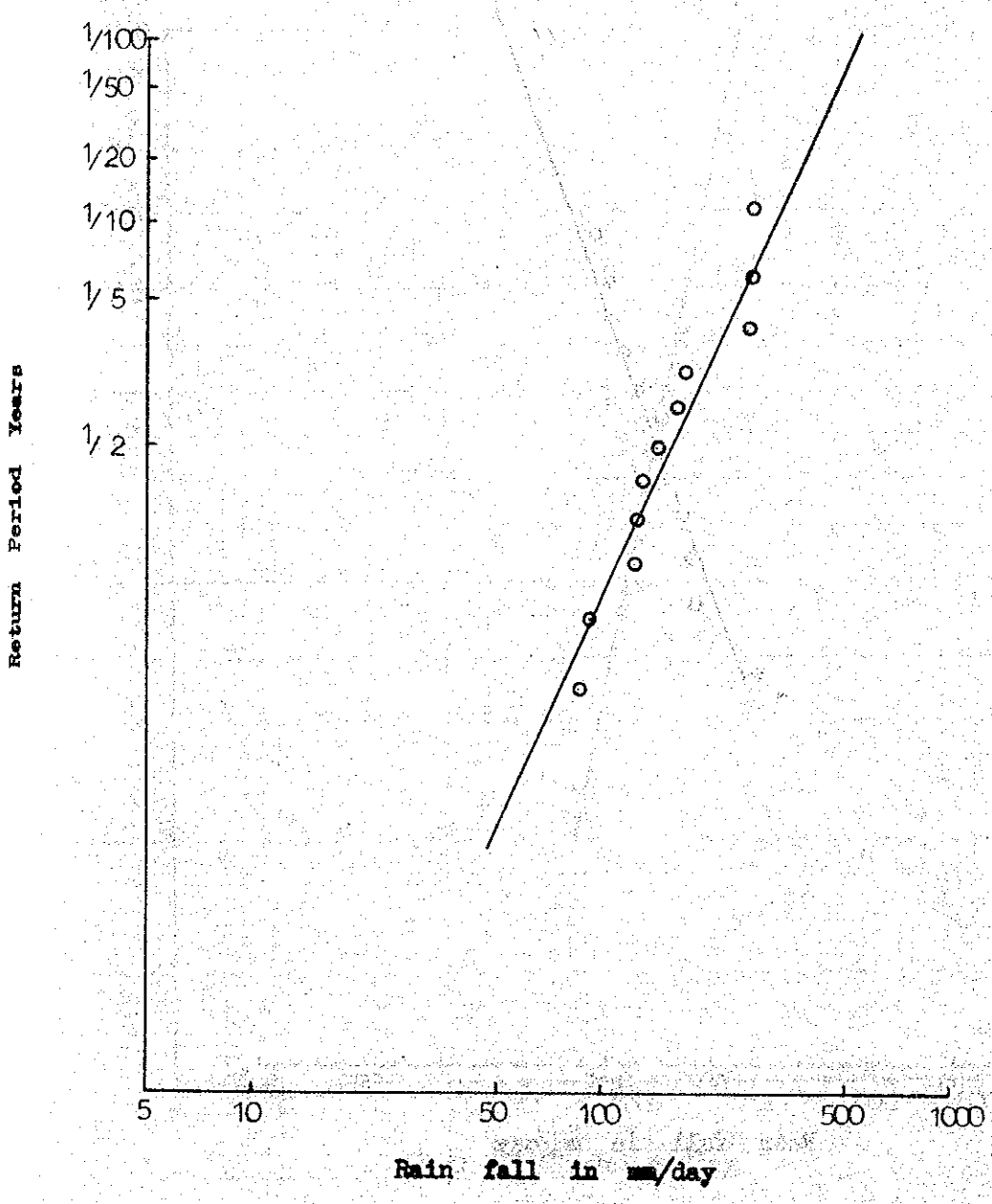
4 - 5 Miri Airport



Appendix Fig. A-5-5

PROBABLE MAXIMUM DAILY RAINFALL

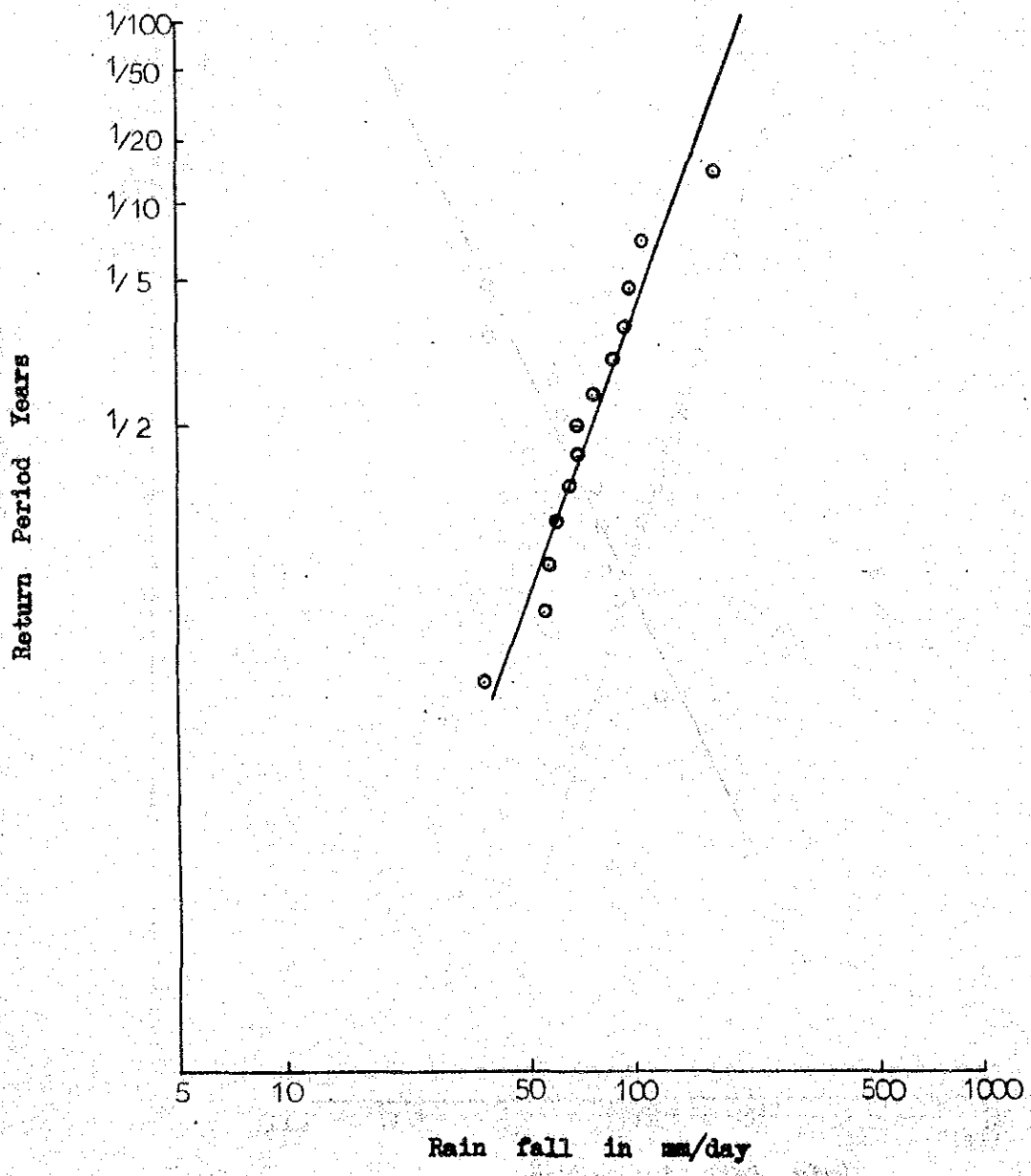
4 - 6 Bekenu Sibuti



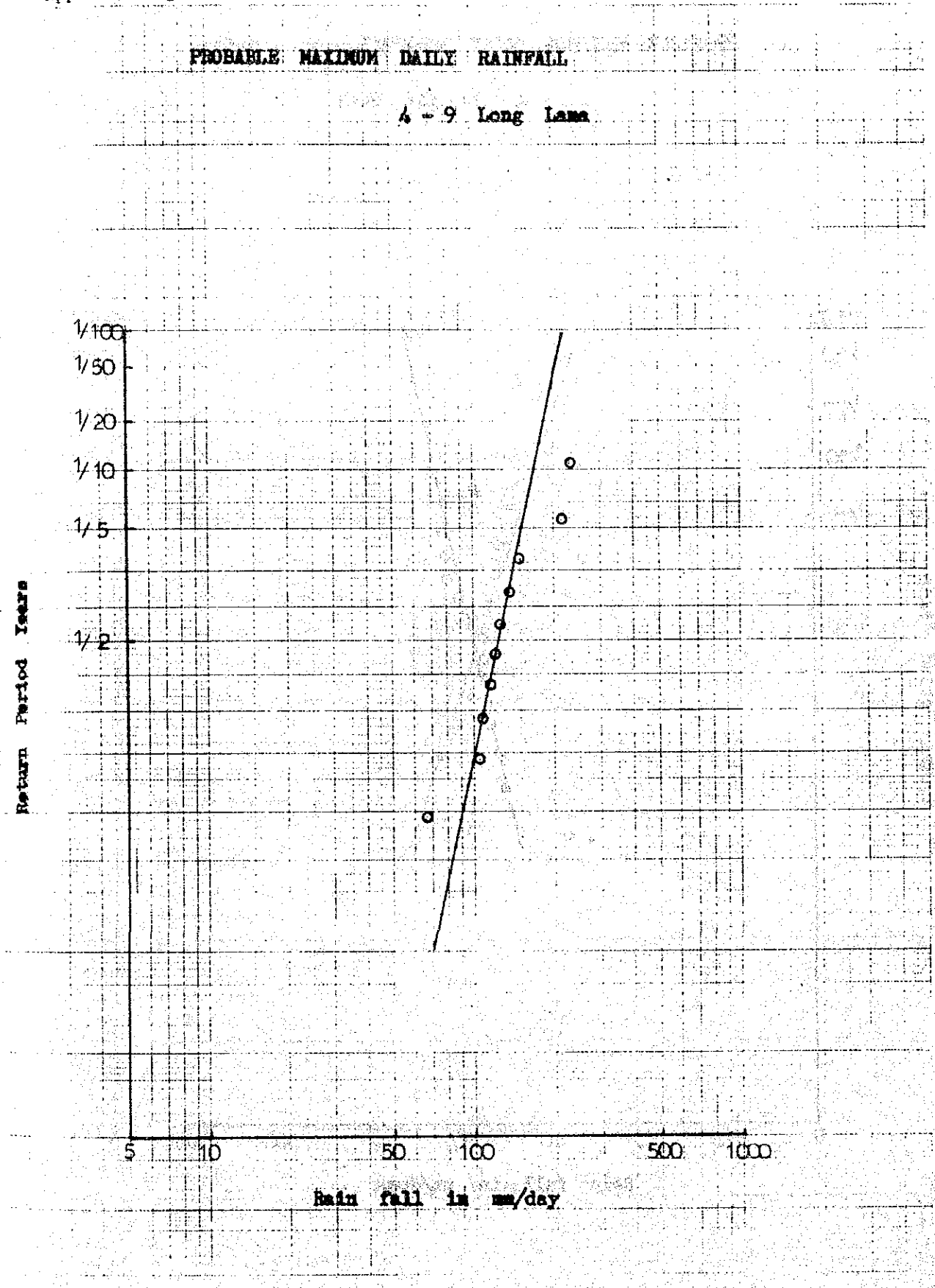
Appendix Fig. A-5-6

PROBABLE MAXIMUM DAILY RAINFALL

4 - 7 Bario



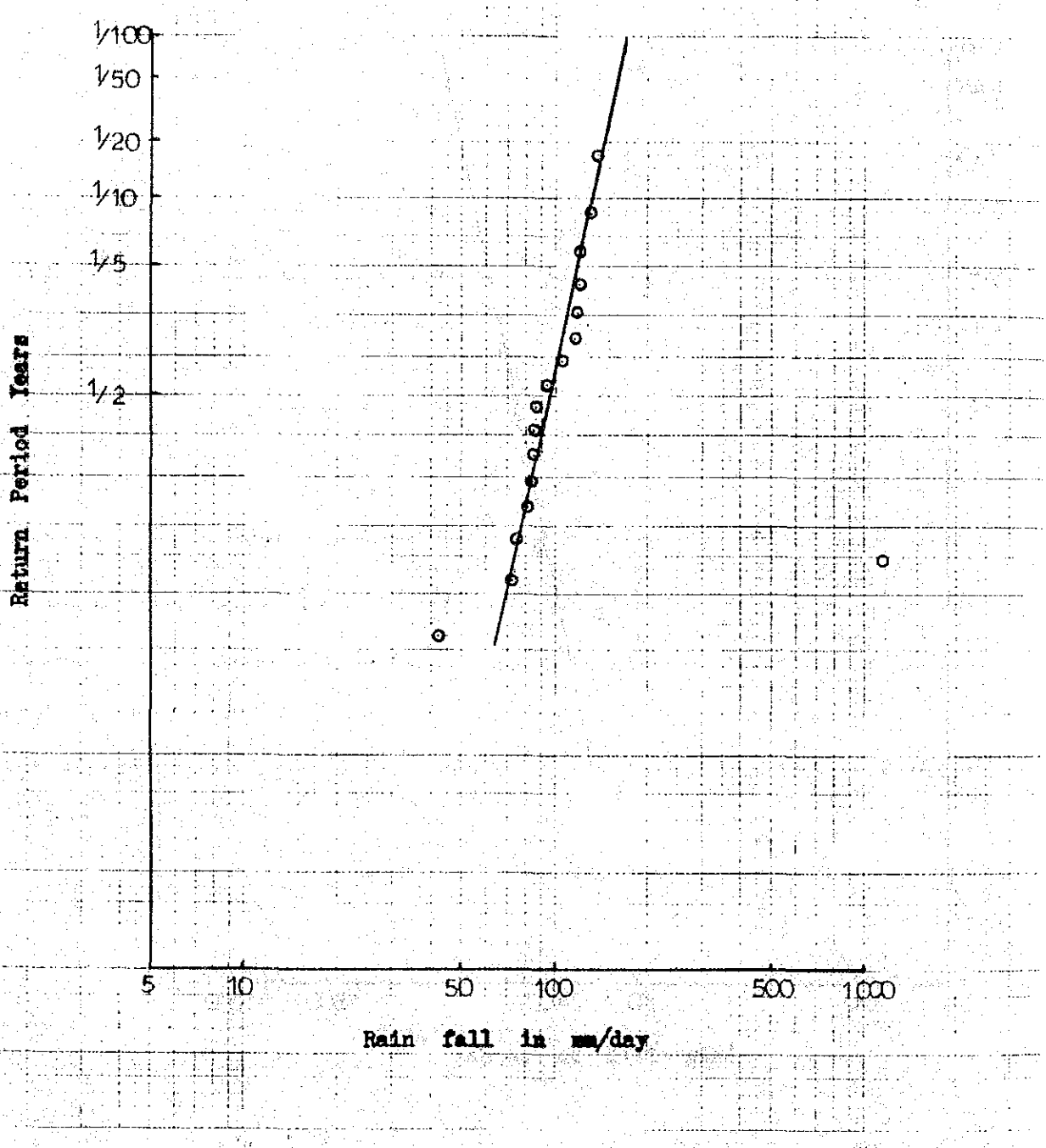
Appendix Fig. A-5-7



Appendix Fig. A-5-8

PROBABLE MAXIMUM DAILY RAINFALL

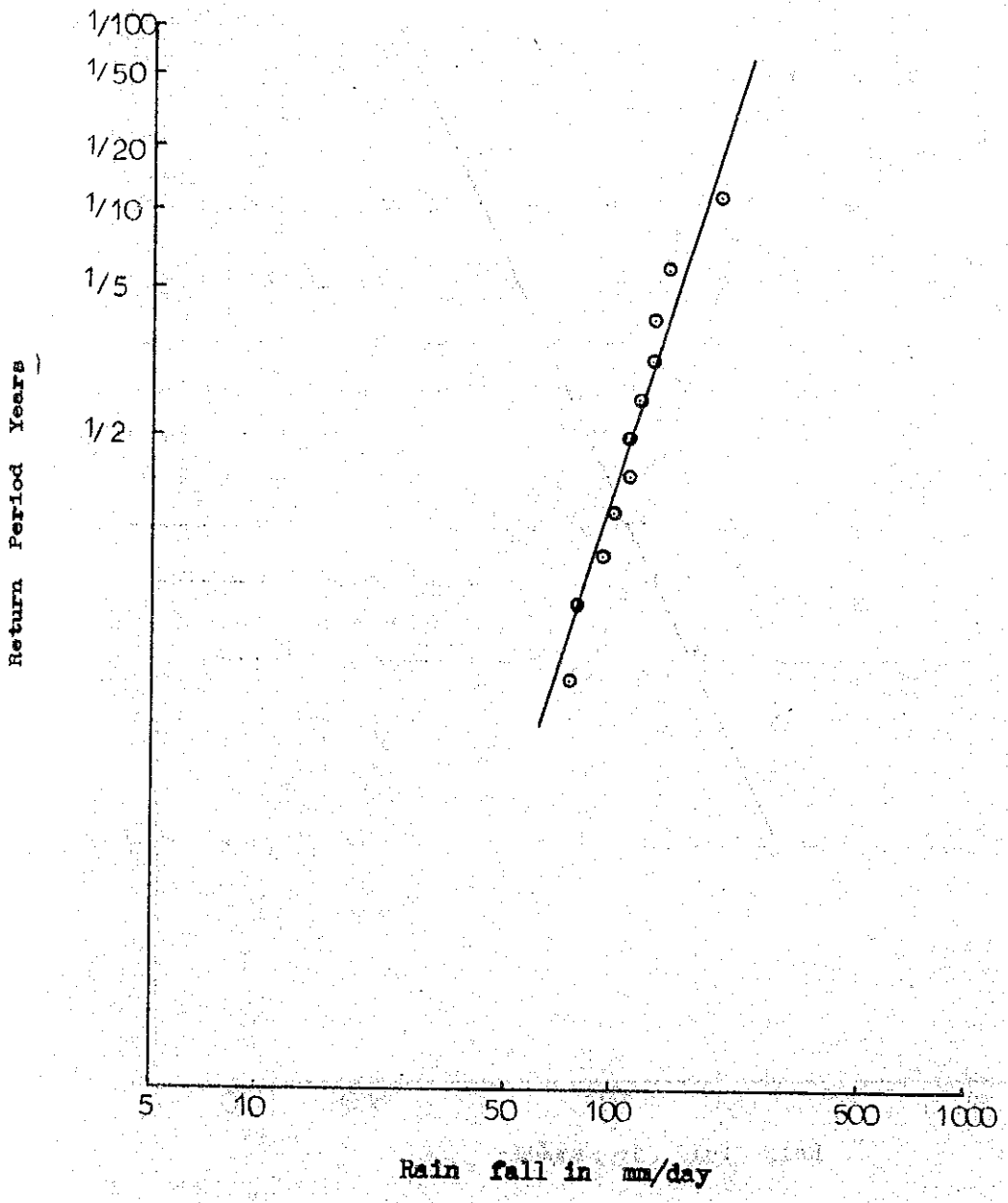
4 - 11 Lio Matu



Appendix Fig. A-5-9

PROBABLE MAXIMUM DAILY RAINFALL

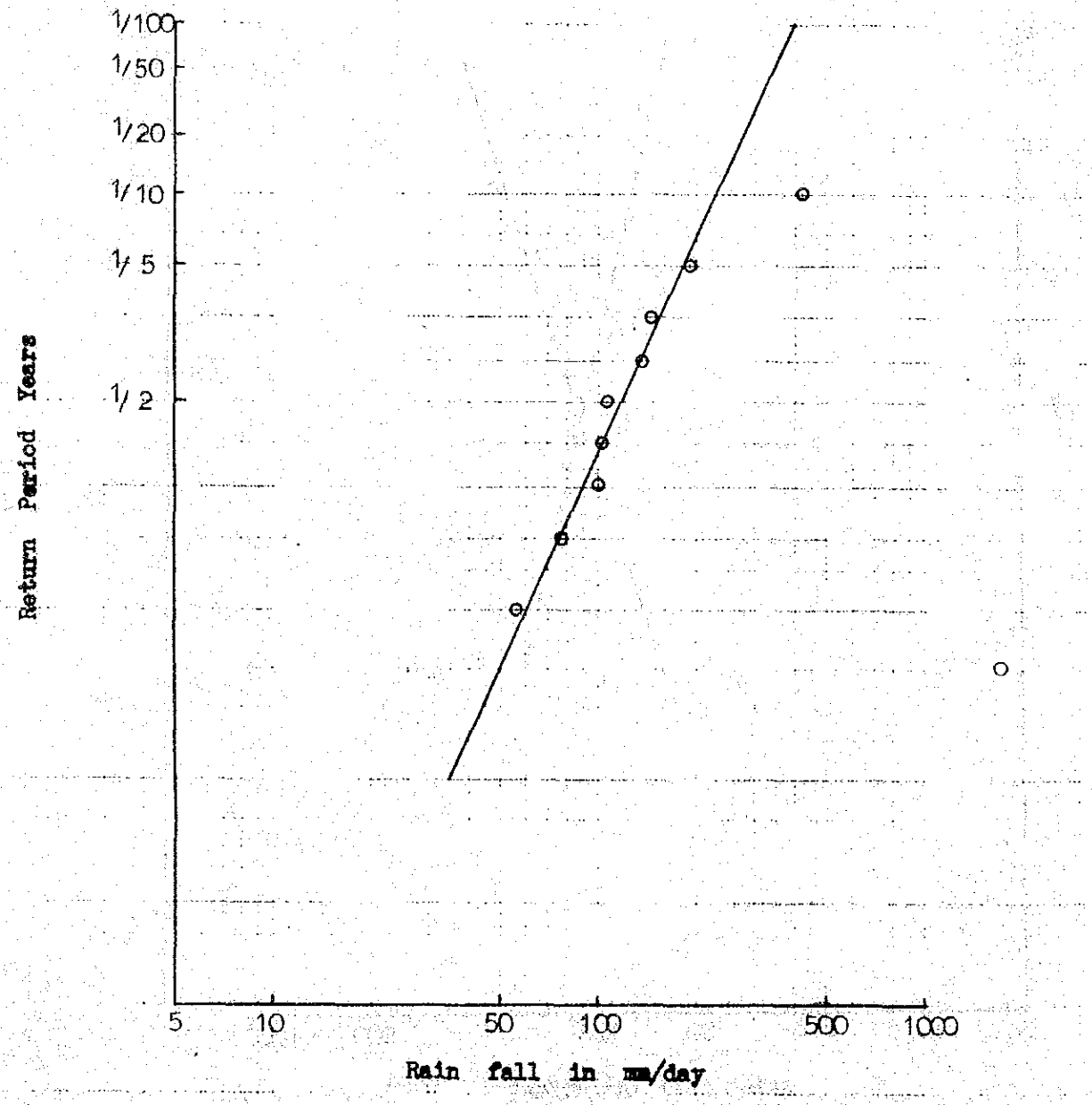
4 - 15 Long Moh



Appendix Fig. A-5-10

PROBABLE MAXIMUM DAILY RAINFALL

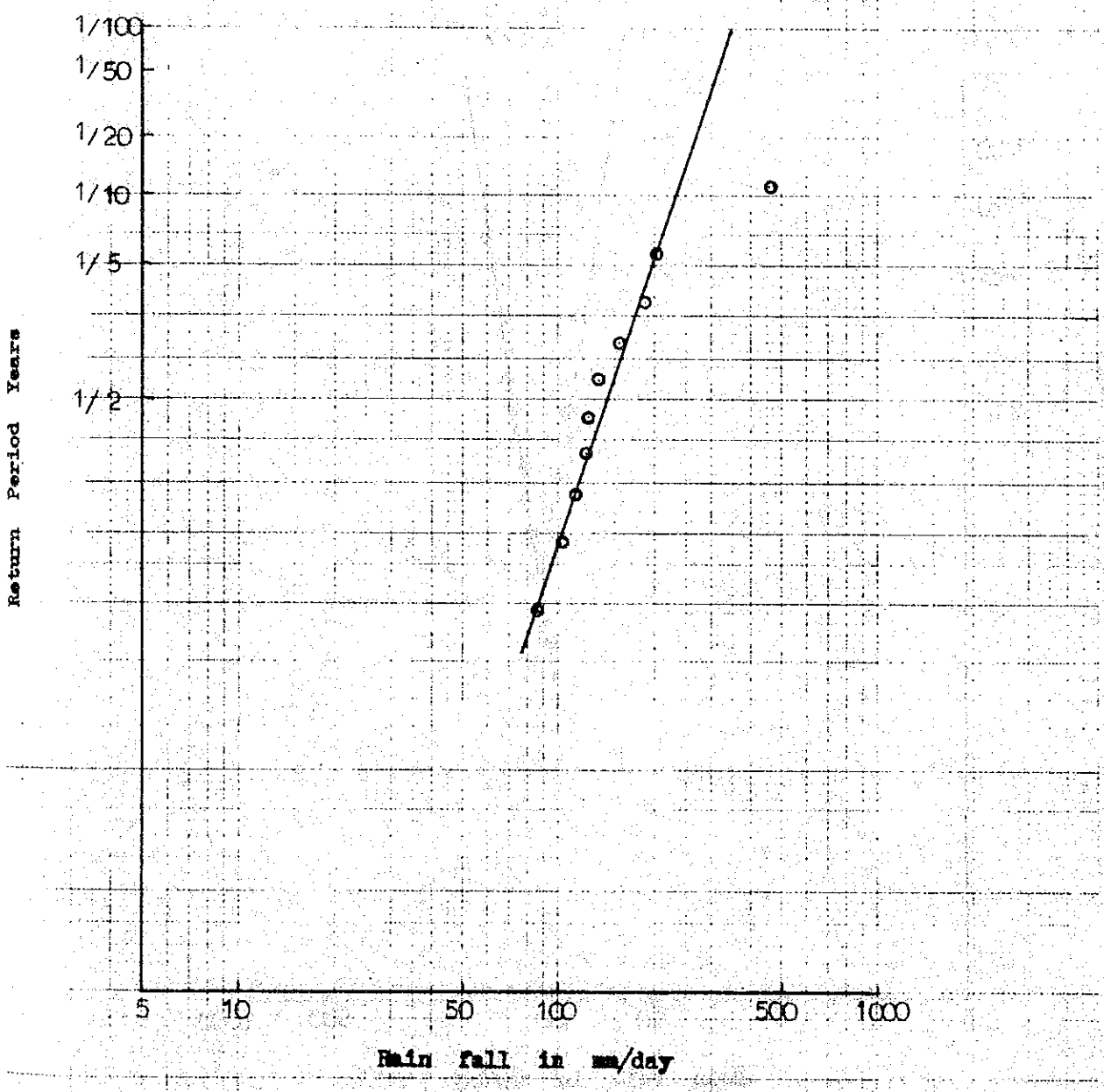
4 - 16 Niah



Appendix Fig. A-5-11

PROBABLE MAXIMUM DAILY RAINFALL

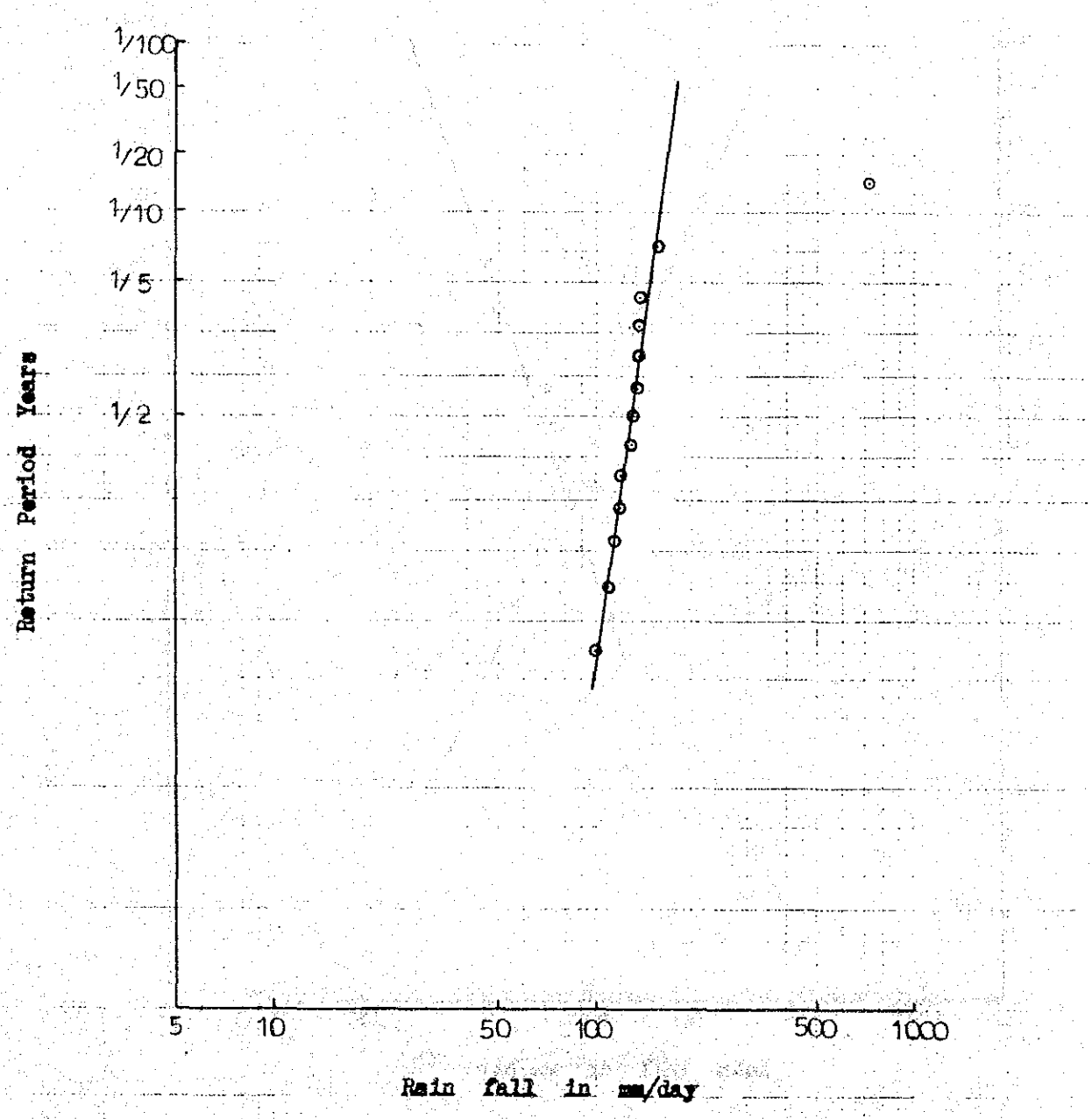
4 - 17 Long Panai



Appendix Fig. A-5-12

PROBABLE MAXIMUM DAILY RAINFALL

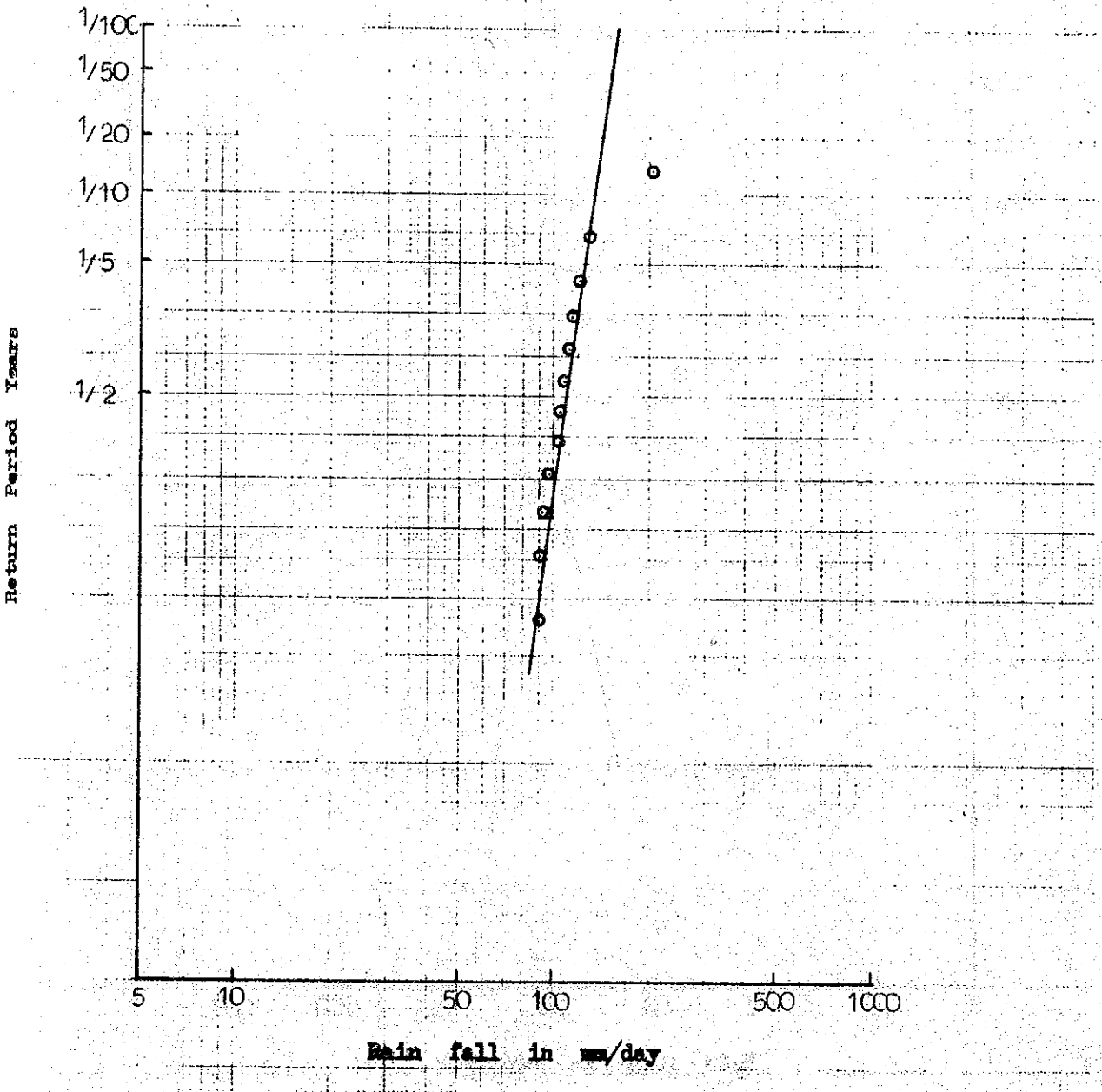
4 - 18 Long Pilah



Appendix Fig. A-5-13

PROBABLE MAXIMUM DAILY RAINFALL

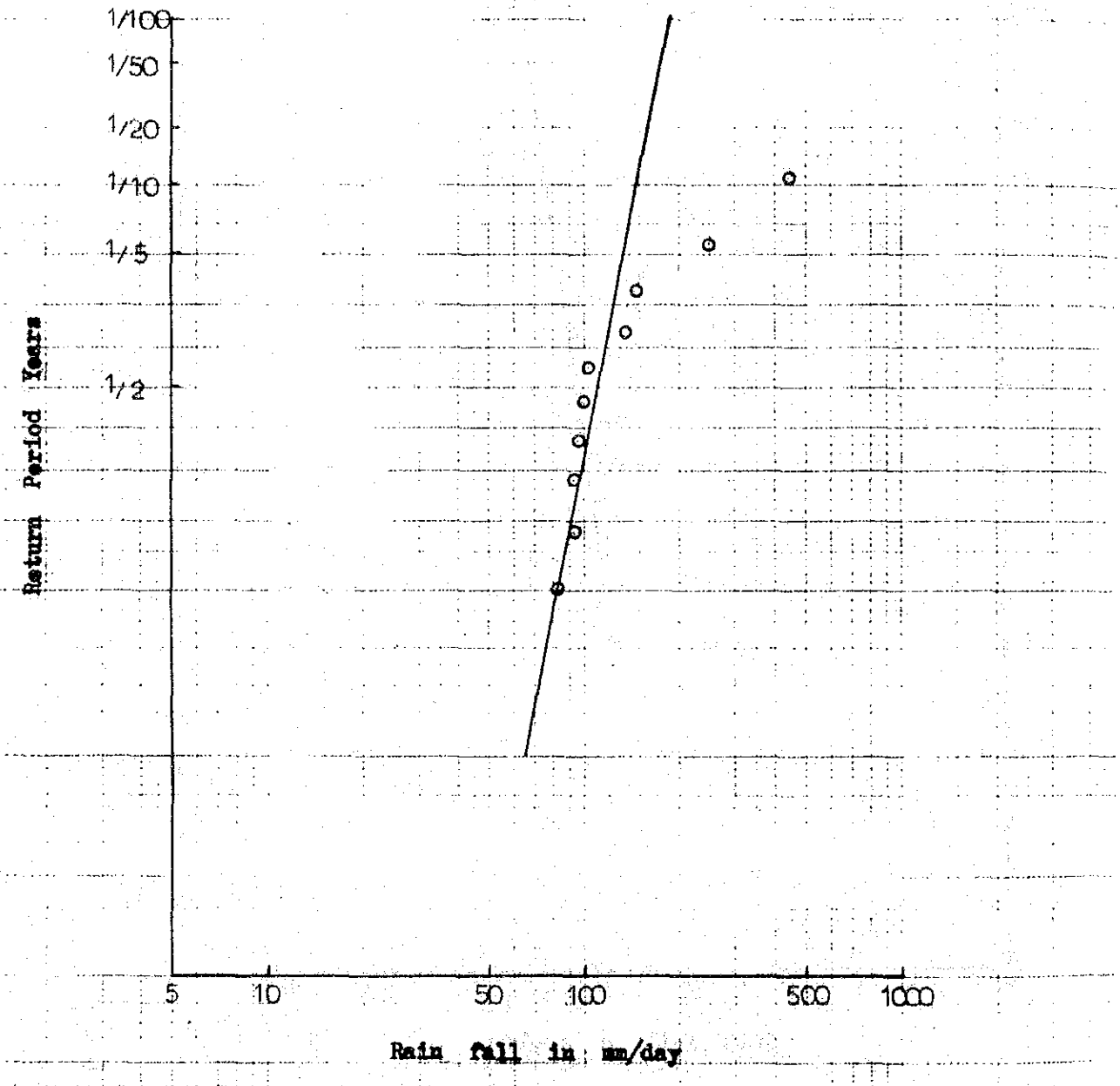
4 - 20 Long Seridan



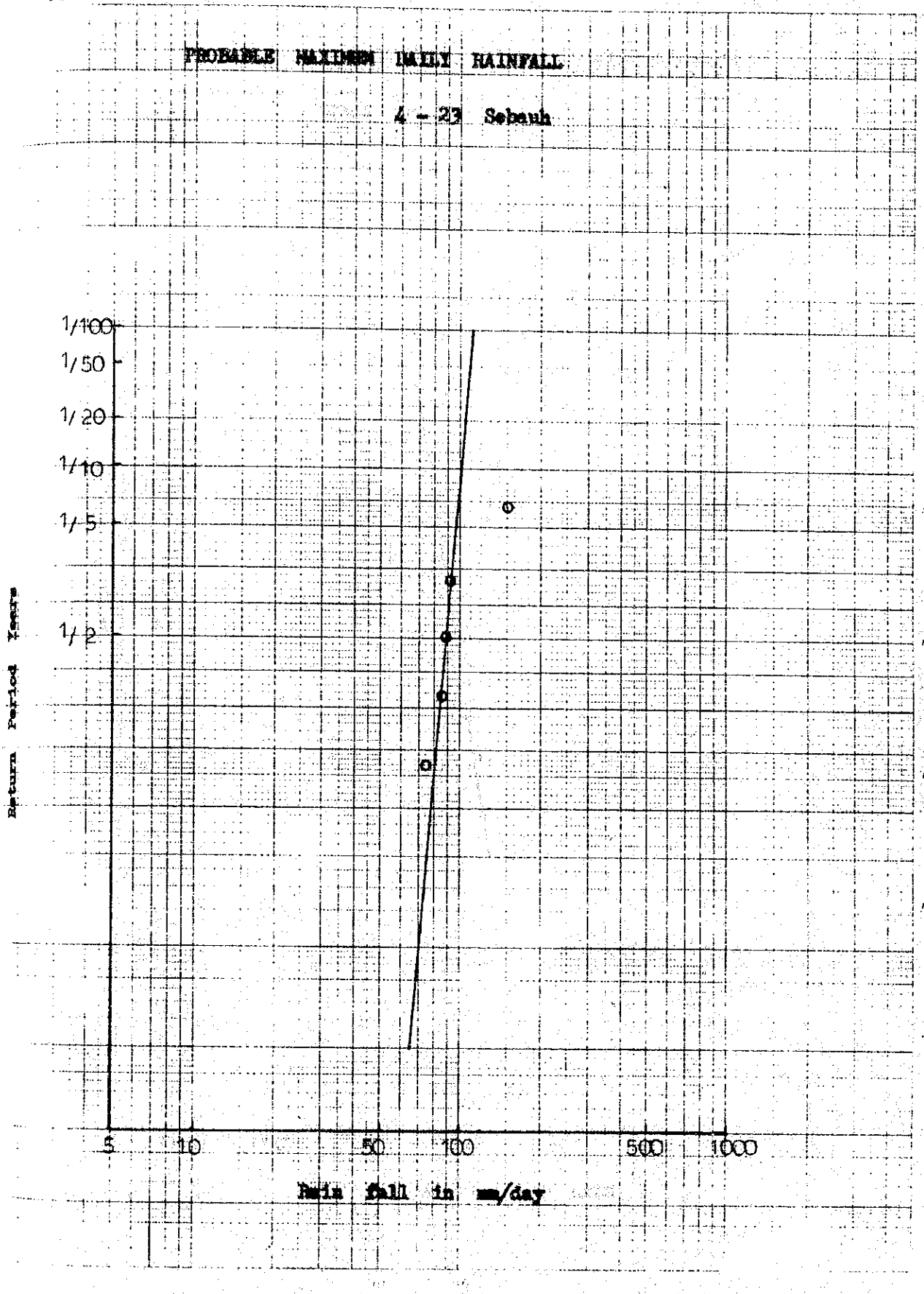
Appendix Fig. A-5-14

PROBABLE MAXIMUM DAILY RAINFALL

4 - 21 Tubau



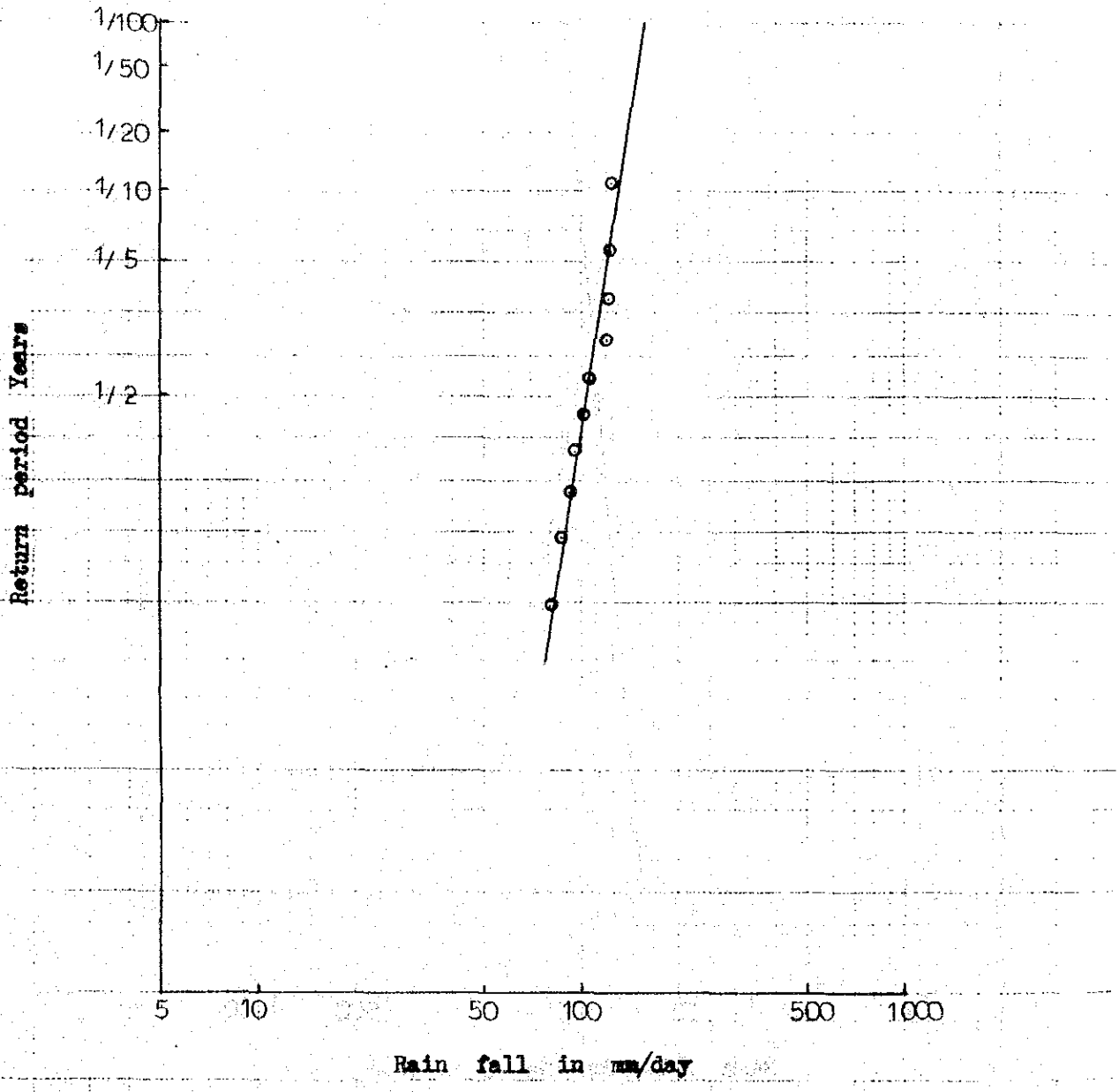
Appendix Fig. A-5-15



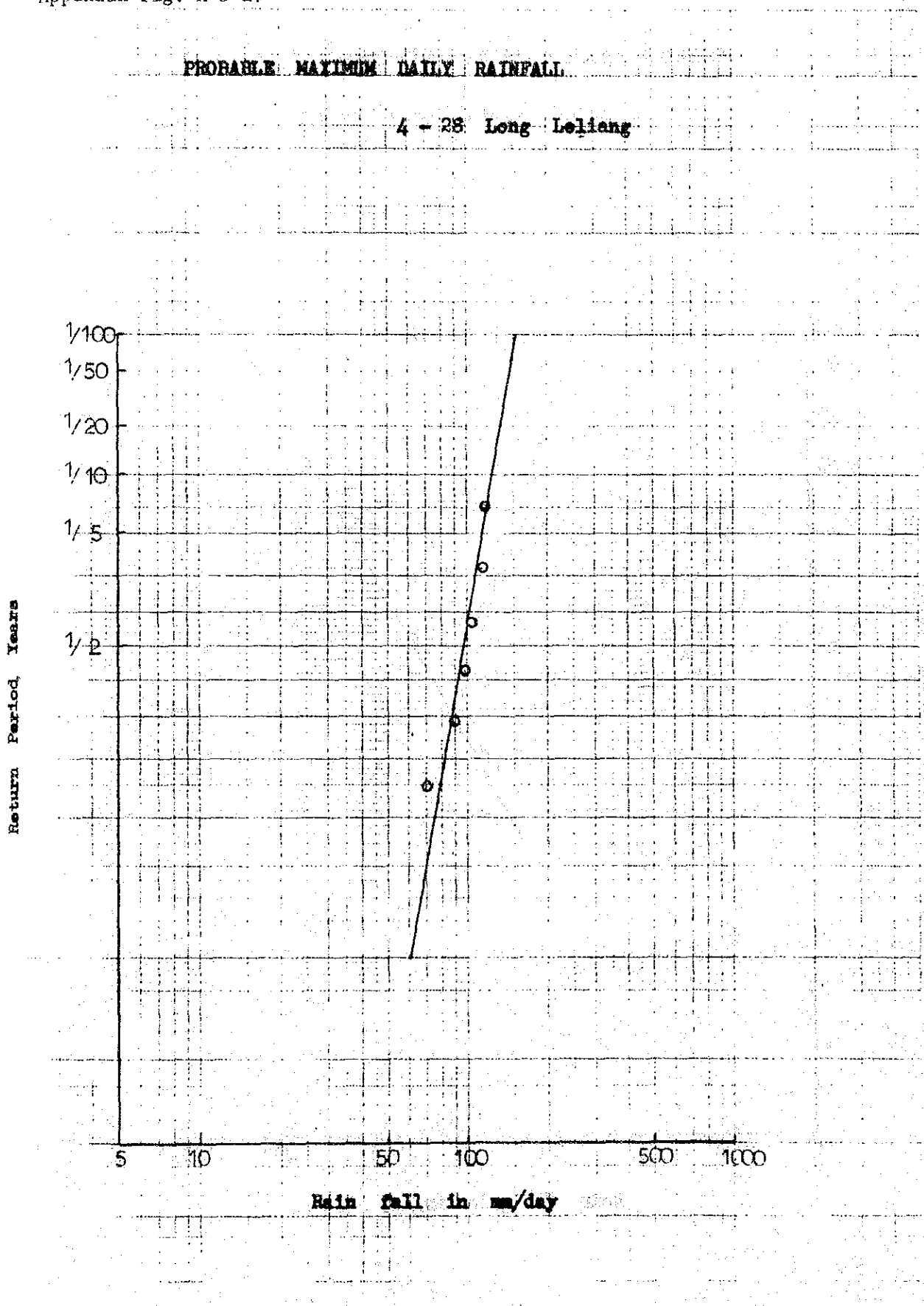
Appendix Fig. A-5-16

PROBABLE MAXIMUM DAILY RAINFALL

4 - 26 Long Anap



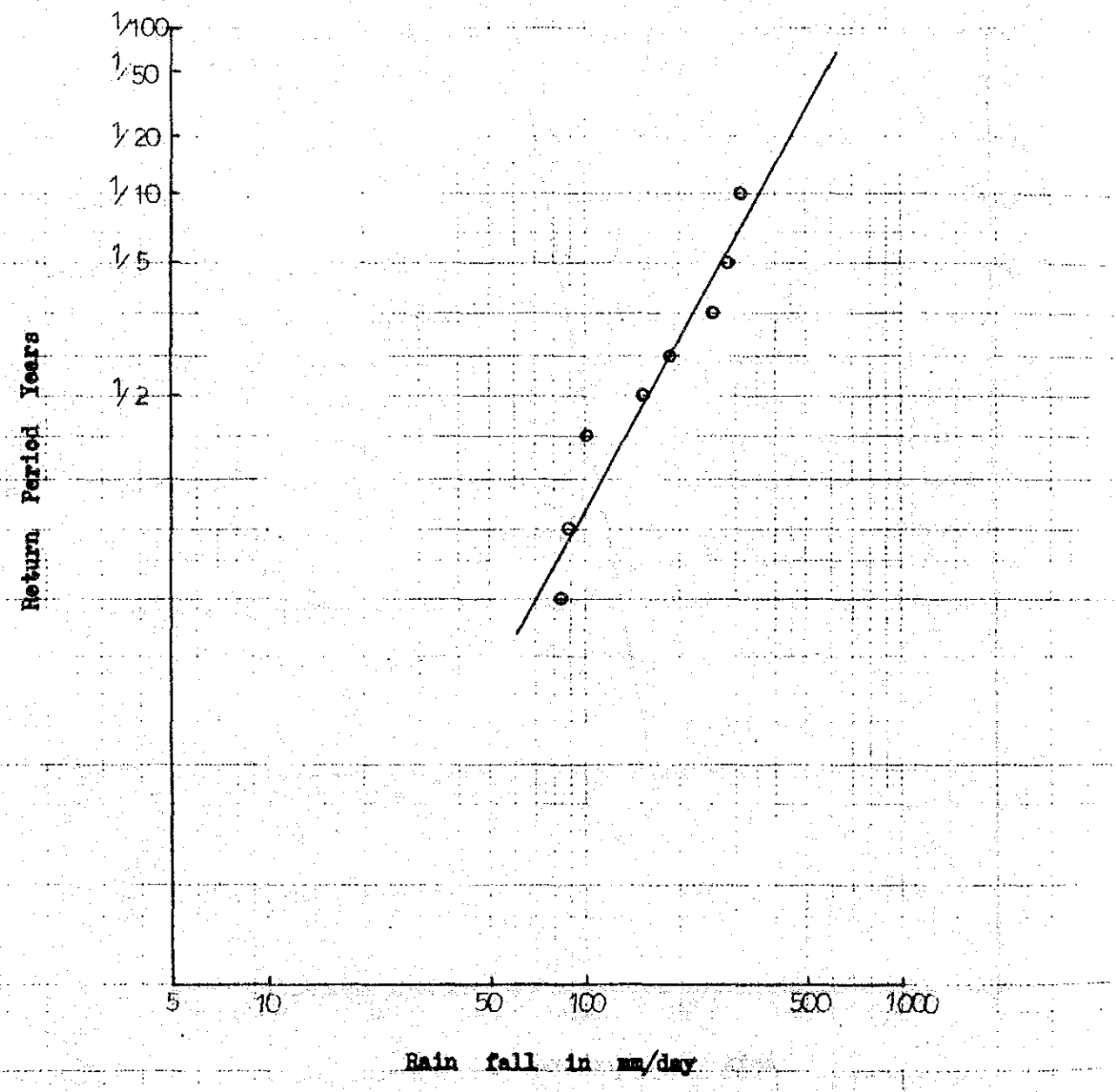
Appendix Fig. A-5-17



Appendix Fig. A-5-18

PROBABLE MAXIMUM DAILY RAINFALL

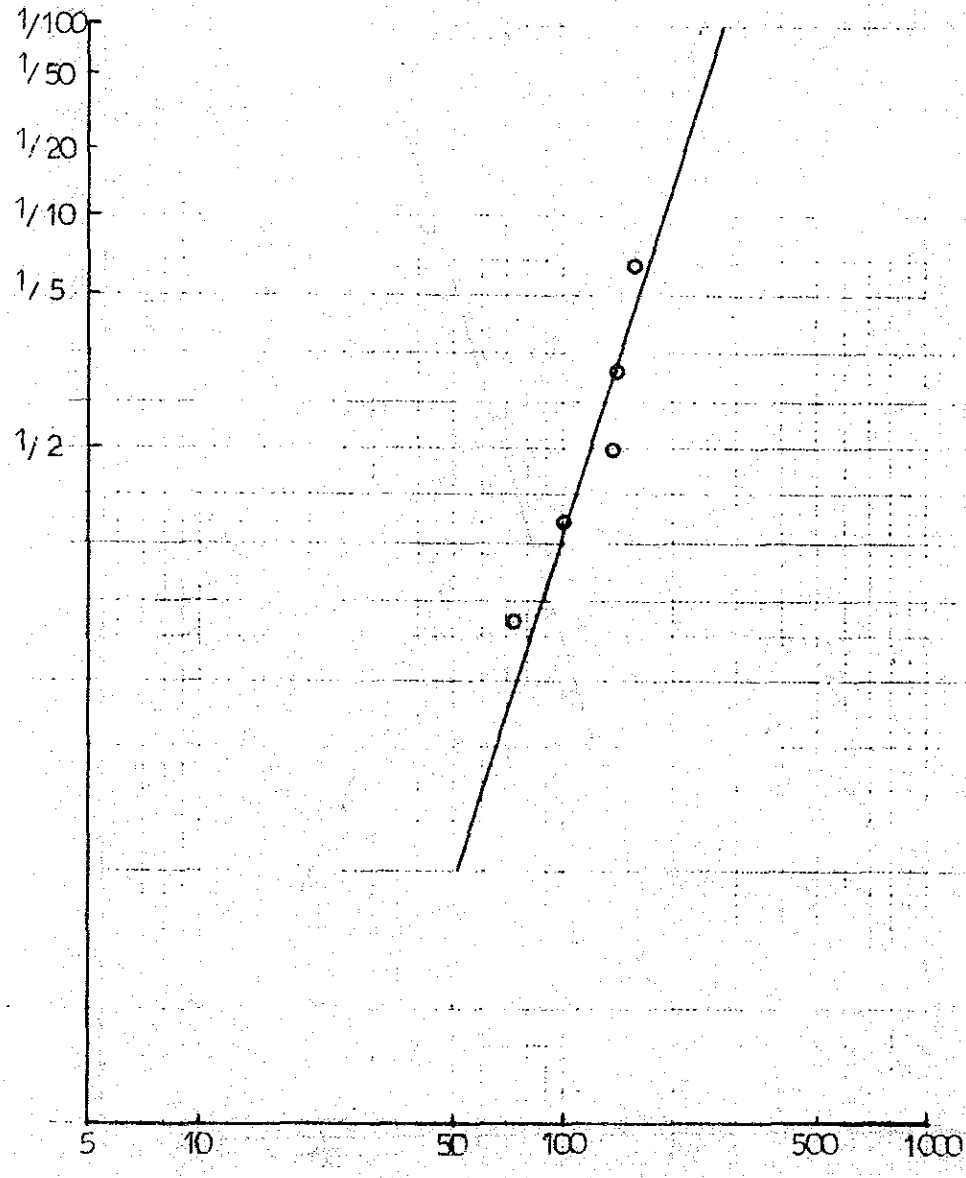
4 - 32 Long Subing



Appendix Fig. A-5-19

PROBABLE MAXIMUM DAILY RAINFALL

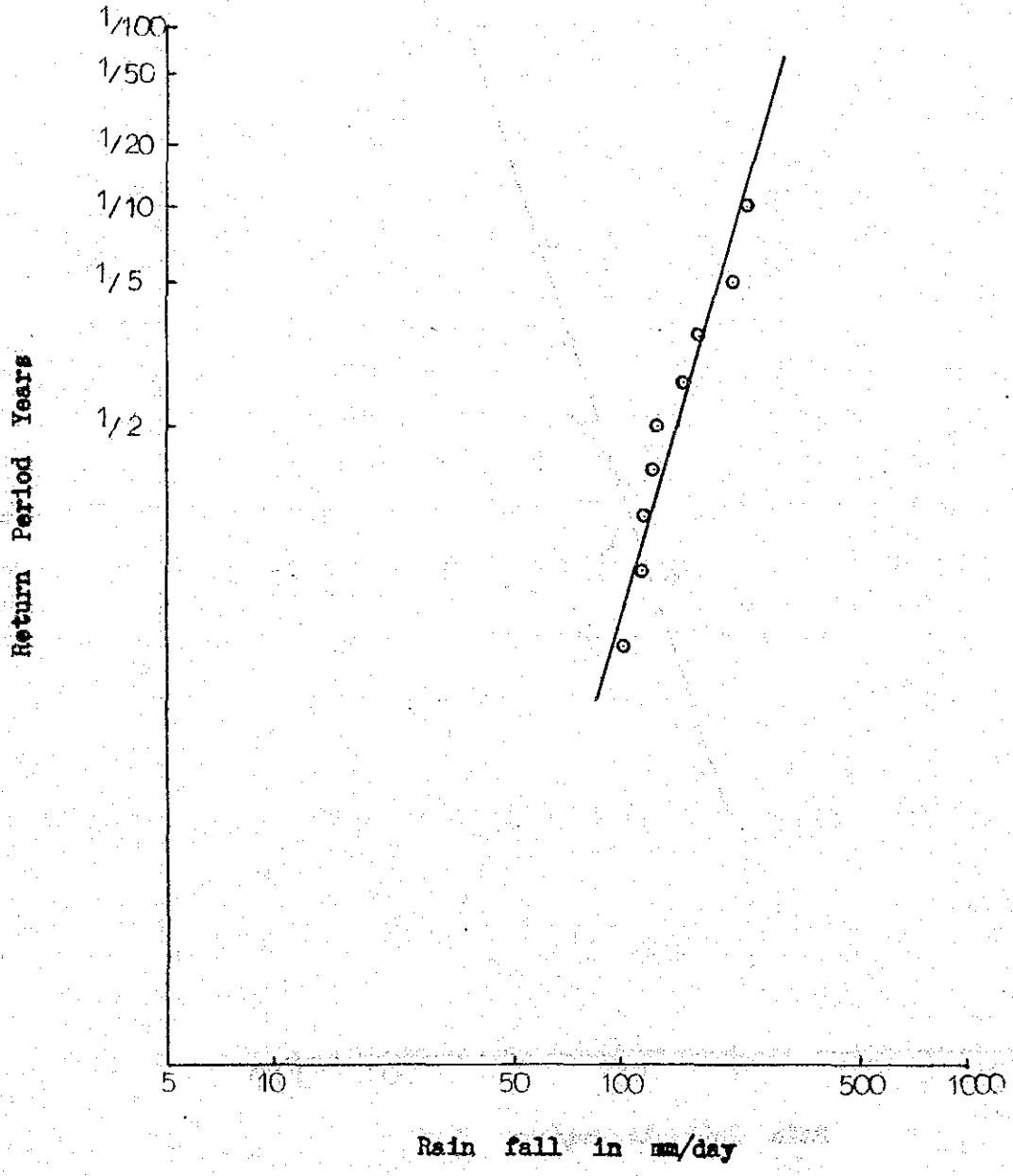
4 - 33 Long Japan



Appendix Fig. A-5-20

PROBABLE MAXIMUM DAILY RAINFALL

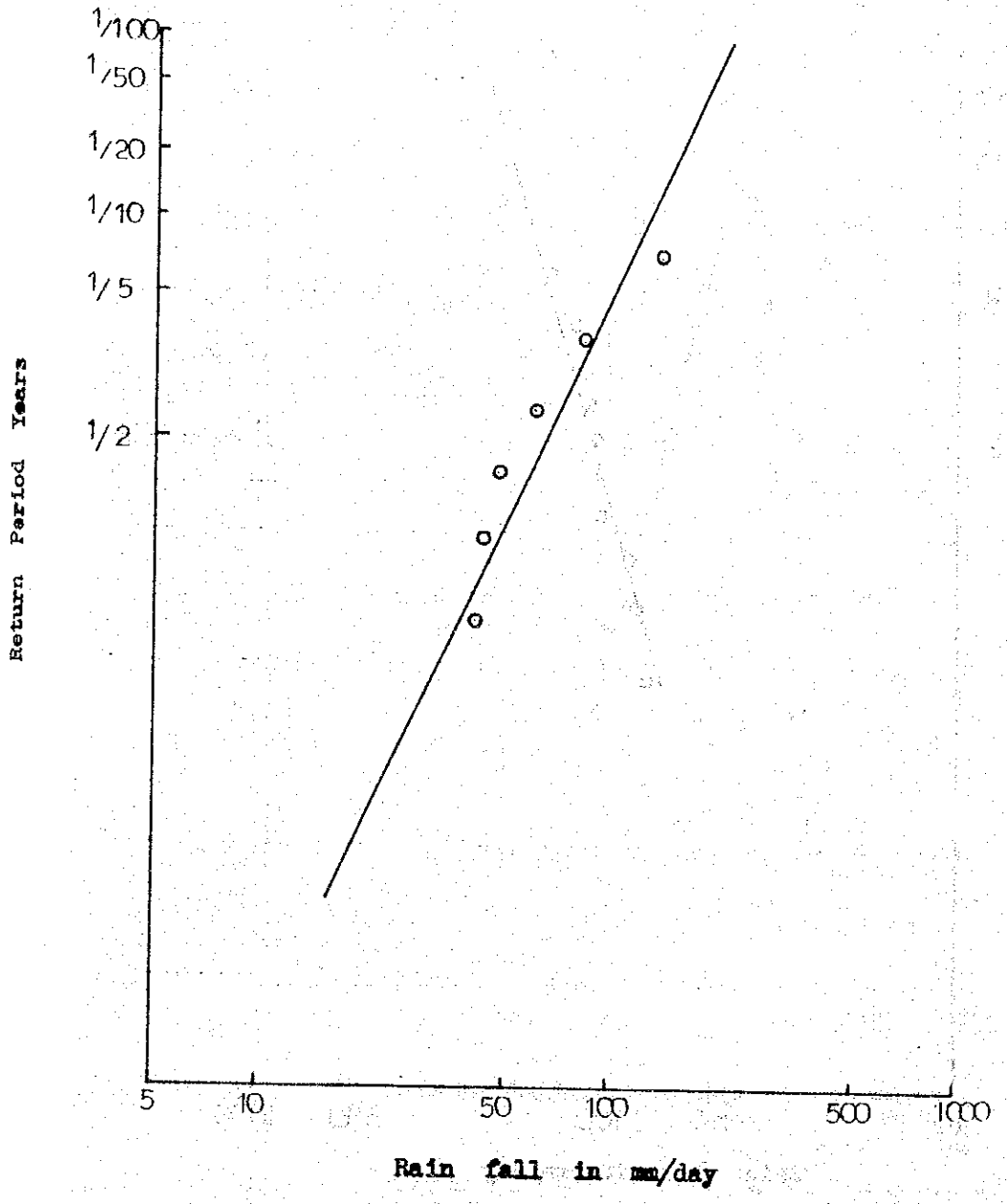
4 - 35 Long Atip



Appendix Fig. A-5-21

PROBABLE MAXIMUM DAILY RAINFALL

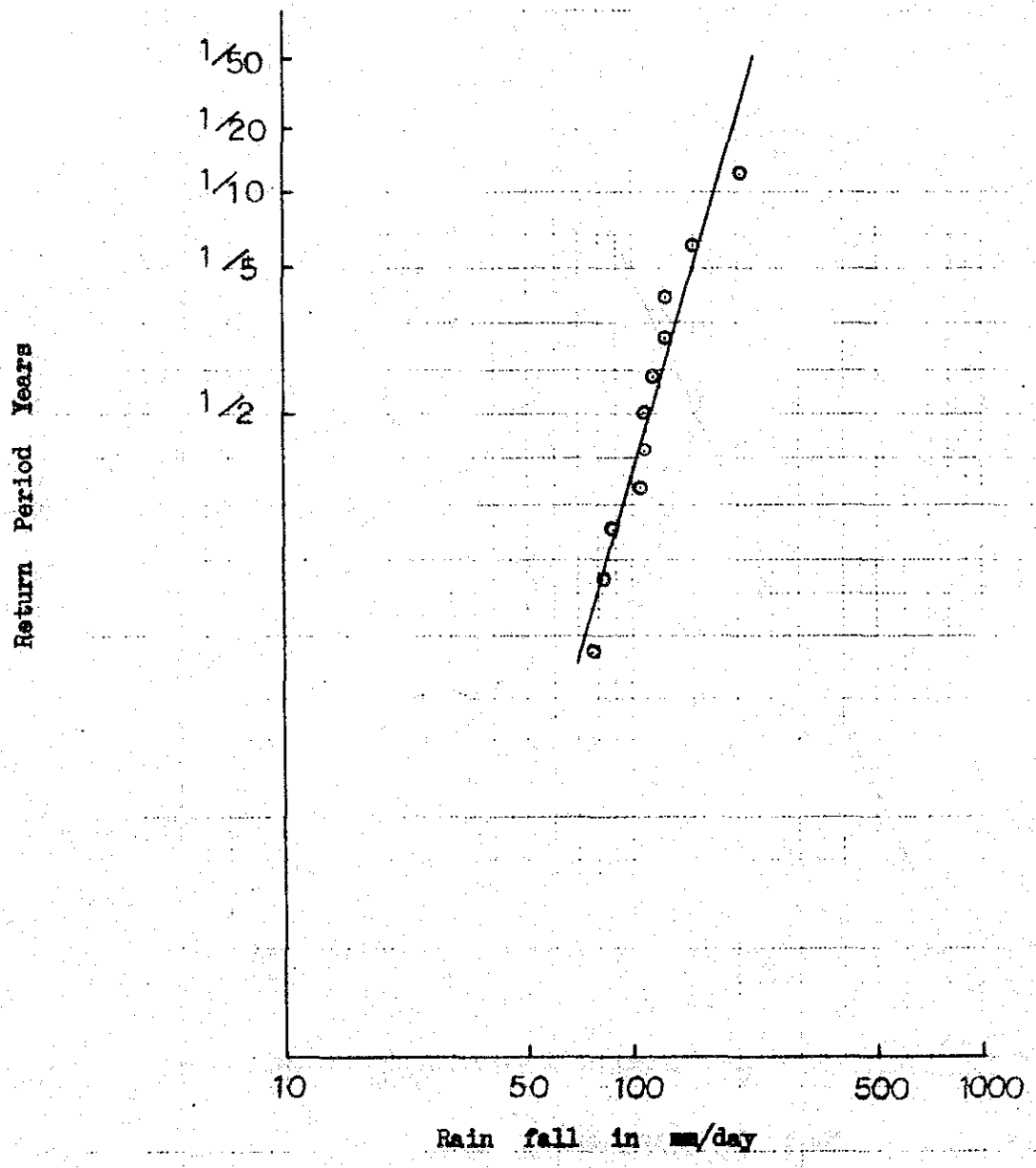
4 - 45 Sg. Niah



Appendix Fig. A-5-22

PROBABLE MAXIMUM DAILY RAINFALL

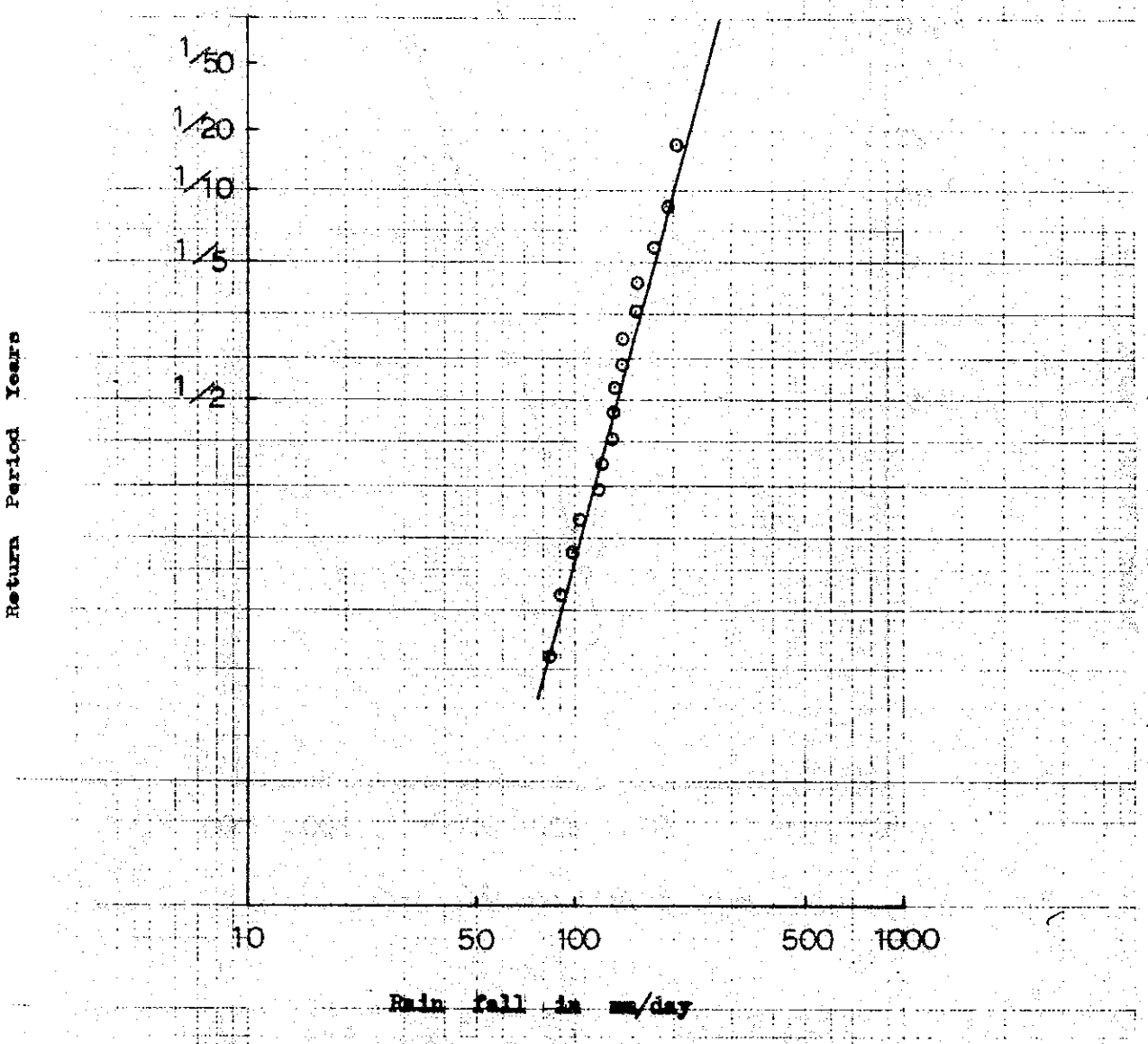
5 - 1 Limbang



Appendix Fig. A-5-23

PROBABLE MAXIMUM DAILY RAINFALL

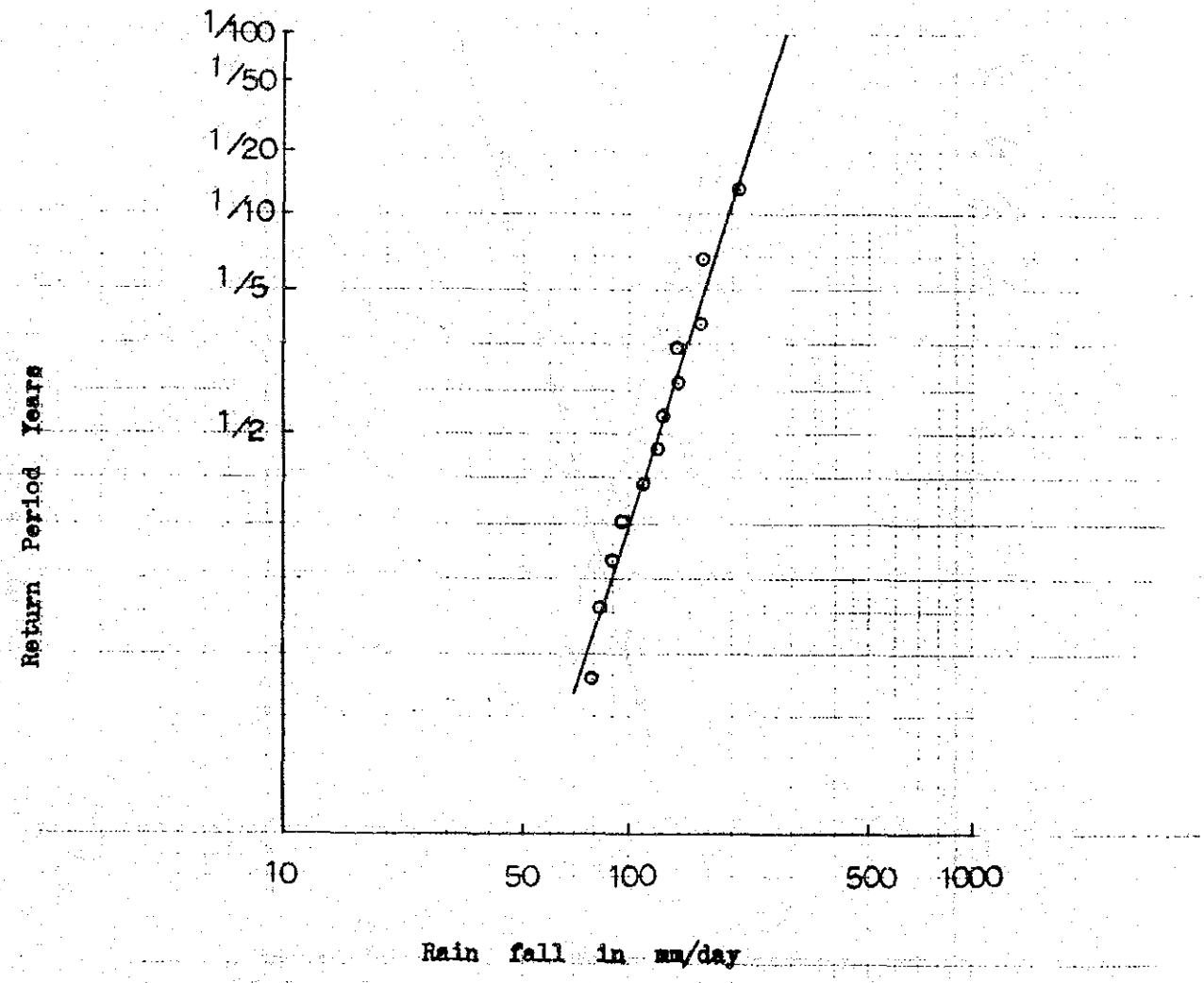
5 - 4 Ukong



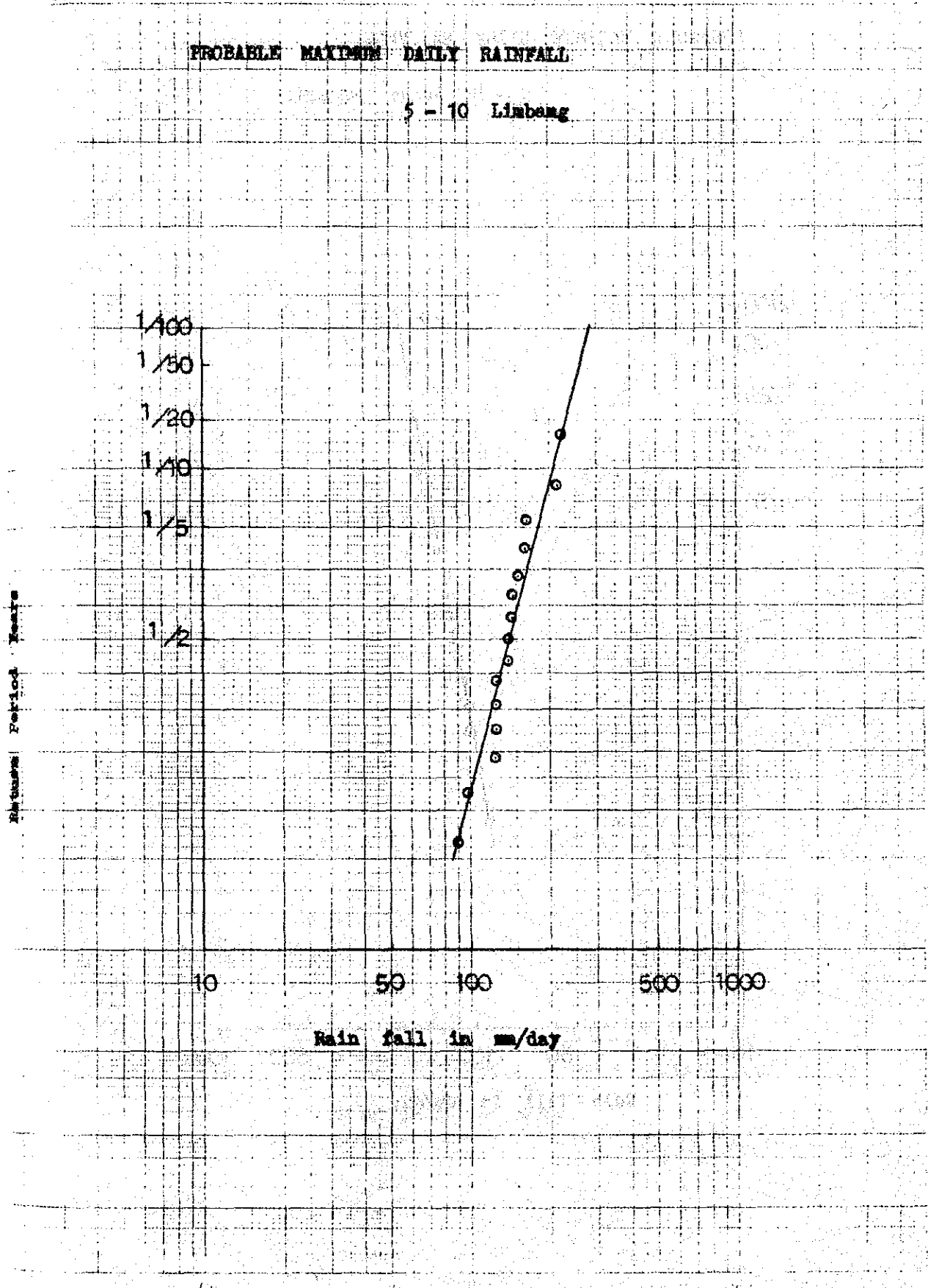
Appendix Fig. A-5-24

PROBABLE MAXIMUM DAILY RAINFALL

5 - 7 Kubong



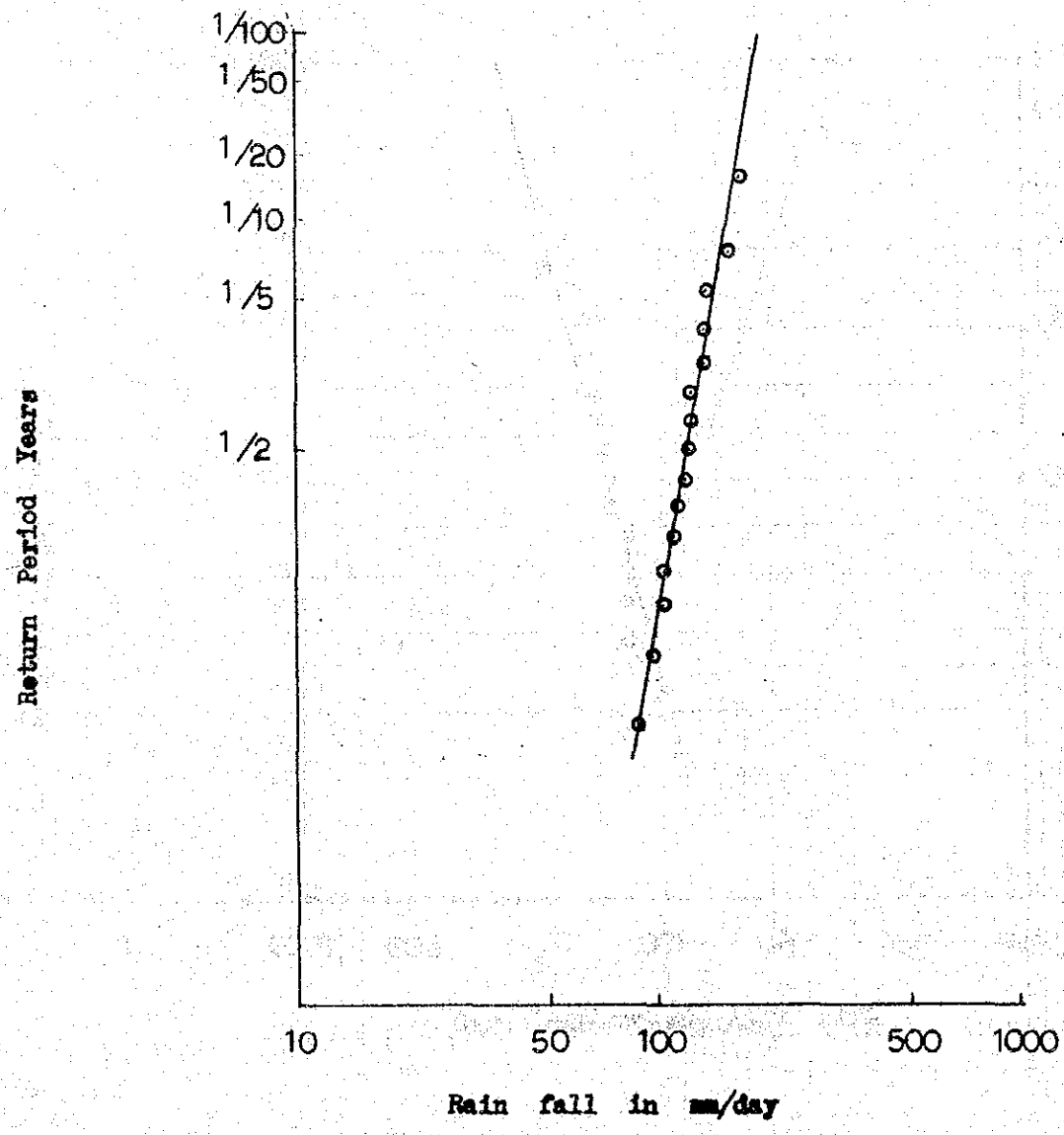
Appendix Fig. A-5-25



Appendix Fig. A-5-26

PROBABLE MAXIMUM DAILY RAINFALL

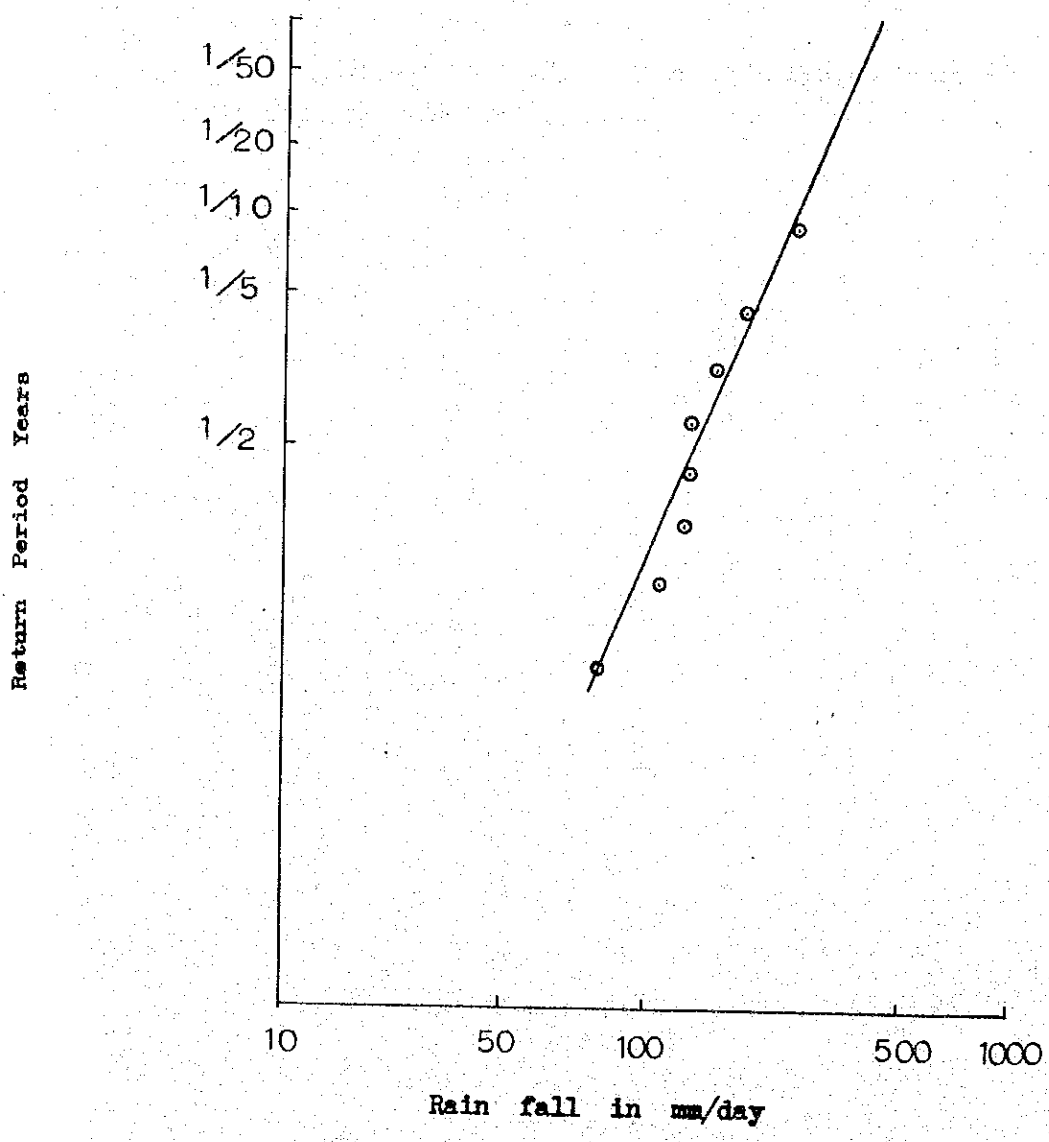
5 - 12 Nanga Madamit



Appendix Fig. A-5-27

PROBABLE MAXIMUM DAILY RAINFALL

5 - 16 Long Belong



Appendix Note A-6-1

Report on Study of Geometric Design Criteria for the Project Road

目　　次

第1章　概　　要

本報告書は、“ The Feasibility Study of Beluru／Long Lama／Limbang Trunk Road Construction Project ”の第2回目の報告書であり、1978年12月に提出された中間報告書に次ぐものである。

中間報告書においてＪＩＣＡ調査団は、現在のサラワク州における“ Trunk Road Standard“及びPeninsular Malaysiaの“Minimum Geometric Design Criteria for New Roads in Rural Arears ”を基本として世界の他の地域で使用されている類似性のある基準を参考にして、上記プロジェクトの目的にそって新らたに設計基準を提奨した。これらの提奨した基準について各種の異論が関係者より提起された。それらは、現状のサラワク州基準より低い規格であるという事とPnisular Malaysia 基準より対象交通量を考慮すると高いという点であった。

ＪＩＣＡ調査団は、この設計基準の比較検討を要請され、又現状基準の評価をする際にこの論点を明確化する事も要請された。

本報告書は、上記要請に応じて作成されたものである。これは論議されるべき基準における建設費用比較及び技術比較、さらに次に述べる事項を考慮した上で新らしい設計基準の導入の背景にある方針を明確化する事である。

＊　現状サラワク州基準に代る新規の設計基準の導入は、丘陵部及び山地部における道路建設が平地部における道路と同じ設計基準を用いたならば、必然的に起るであろう建設規模の増加を抑制するために望ましく、又更に建設費用の見地からも妥当である。

＊　現状の Penisular基準に代る新規基準の使用は、現状の道路網の構成上において建設費用が道路工事用基準を著しく混乱させるほどの基準変更を含むものでないので望ましい。

第2章　緒　　論

2－1　検討の主旨

本報告書は、Beluru／Long Lama／Limbang幹線道路建設計画における最適基準選定の為に次に述べるような設計基準の比較を行う。

i）ＪＩＣＡ調査団による推奨案

ii）サラワクP.W.Dの“Trunk Road Standard”

道路建設の品質を維持するために必要な補足因子は視距、緩和曲線、縦断曲線等である。Penisula Malaysianの“Minimum Design Criteria for New Roads in Rural Arears”はＡＡＳＨＴＯ基準“A Poliey on Geometric Design of Rural Highways”に非常に似ており、交通量より６つのタイプに分類される。

次に述べる見地からRecommeuded案とSarawak案との比較のために“Group０４”が採択された。

i）“Group０４”は日交通量４００～７５０台／日を対象としている。又、２００２年における当プロジェクトの予測交通量はおよそ最大で５００台／日である。

ii）“Group０４”の諸元は“Group０３”に比らべて現状のサラワク基準に比較的近い。

本報告書で検討された基準案の結果は次のTable－１に示される。

iii）Penisular Malaysia P.W.Dの“Minimum Geometric Design Criteria for New Roads in Rural Areas , Group０４”

又、次のような要素も含んでいる。

i）確立された理論より求めた規格値と各設計基準より求めたものとの比較

ii）各規準案に基づいた建設費用の比較

2－2　比較の対象となる設計基準

現行サラワク州の“Trunk Road Standard”はその発令時においては、地域情勢の構成上において道路開発の社会経済的効果を促進する上で効果的なものであり、又同基準は平地部における道路開発上好ましい設計基準として有効なものであった。

しかし、山地部、丘陵部が勝る内陸部における道路建設の要請が増加している見地から同基準に対する補足は、世界の他地域において使用されている設計基準に一般的に明らかにされている同地形上地区に対する設計基準の導入が特に重要になって来た。

Table - 1

		Recommended			Sarawak		Peninsular		
1	TERRAIN	F	R	M	-		F	R	M
2	DESIGN SPEED	80 (50)	64 (40)	48 km/H (30 MPH)	80 km/H	(50 MPH)	80 (50)	64 (40)	48 km/H (30 MPH)
3	PAVEMENT TYPE		-		-			-	
4	SURFACE WIDTH (PAVEMENT WIDTH)	7.32m	(24)		7.32 m	(24)	6.71 m	(22)	
5	USABLE SHOULDER	3.05 (10)	3.05 (10)	1.22 m (4)	3.05	(10)	2.44 (8)	2.44 (8)	1.22 m (4)
6	FORMATION WIDTH	13.42 (44)	13.42 (44)	9.76 m (32)	13.42	(44)	12.81 (42)	12.81 (42)	10.37 m (34)
7	CENTRAL RESERVATION		-		-			-	
8	RESERVE WIDTH	61/46 m		(290/150)	61/46 m	(200/150)	40/30 m	(132/100)	
9	MAXIMUM GRADIENT NORMAL / ABSOLUTE	4	6	8%		5% 8%	4	6	9%
10	CRITICAL GRADE LENGTH	336 (1,100)	183 (600)	122 m (400)		-	336 (1,100)	183 (600)	122 m (400)
11	STOPPING SIGHT DIST. - MIN.	107 (350)	84 (275)	61 m (200)		-	107 (350)	84 (275)	61 m (200)
12	PASSING SIGHT DIST. - MIN.	549 (1,800)	458 (1,500)	336 m (1,100)		-	549 (1,800)	458 (1,500)	336 m (1,100)
13	MINIMUM RADIUS NORMAL / ABSOLUTE	305 (1,000)	229 (750)	153 m (500)	305 m 228 m	(1,000 750)	214 (700)	131 (430)	70 m (230)
14	TRANSITION CURVES MIN. L	73 (240)	64 (210)	55 m (180)		-	73 (240)	64 (210)	55 m (180)
15	WIDENING	-	0.9 (3)	1.4 m (4.5)	According to M.O.T. Tables		-	0.9 (3)	1.4 m (4.5)
16	SUPERELEVATION MAX./MIN.		1 : 10		1:12 (8.3%)/1:38 (2.6%)			1 : 10	
17	CAMBER CROSS FAIL		1 : 38		1:38 (2.6%)			1 : 40	
18	VERT CURVES CREST MIN. K	26 (85)	17 (55)	9 m (28)		-	26 (85)	17 (55)	9 m (28)
	SAG MIN. K	23 (75)	17 (55)	11 m (35)		-	23 (75)	17 (55)	11 m (35)
19	OBLIQUE GRADE	10	10.5	11.5%		-		-	

Note: The figures in parenthesis show the values in feets.

第3章　技術上の比較検討

3－1　交通容量

各案のGeometrie Design Criteriaの数値に基づき可能交通量及び設計交通容量を計算した。

結果は、Table－2の通りであり、計算に使用した諸元は次の通りである。

i) 大型混合率

調査地域の特性より大型混合率は、その比率が高く、次の数値を採用した（中間報告書参照）。

Flat area	20%
Rolling anea	22%
Mountainous	36%

ii) 大型車の乗用車換算率

乗用車換算率は、2車線道路として、勾配及び勾配長を想定の上、次の数値とした。

Flat area	2.9
Rolling area	3.9
Mountainous area	4.0

iii) 車線巾員による補正

交通容量に影響を与えない限界値は3.5 mとして、3.5 m未満の場合はその減少に応じて補正率を決定した。

車線巾員(m)	補　正　率
3.50	1.00
3.25	0.94
3.00	0.85
2.75	0.77

iv) 側方余裕による補正

2車線道路にて、交通量に影響を与えない側方余裕巾の限界値を1.75 mとし、余裕不足による容量補正率を次の通りとした。

側方余裕巾(m)	補　正　率
1.75	1.00
1.50	0.98
1.25	0.96
1.00	0.93
0.75	0.91

V) 大型車による補正

大型車混入による交通容量補正率は、次式により算出した。

$$\gamma r = \frac{100}{100 - Pr + Er \cdot Pr}$$

こゝに γr …… 大型車混入による交通容量補正率 (%)

Pr …… 大型混合率 (%)

Er …… 大型車の乗用車換算率

Vi) 沿道条件による補正

沿道条件は、市街化している地域、或いは市街化していない地域等で、その補正率を次の通りとした。

市街地化の程度	補 正 率
市街化していない地域	1.0 ～ 0.9
幾分市街化している地域	0.9 ～ 0.8
市街化している地域	0.8 ～ 0.7

Vii) 可能交通容量の計算

可能交通容量は、基本交通容量 (2,000台/時)に前記の各補正率を乗じて求める。

$$C = Cb \times \gamma l \times \gamma c \times \gamma r \times \gamma i$$

こゝに、C …… 可能交通容量 (台/時)

Cb …… 基本交通容量 (〃)

γl …… 車線巾員による補正率

γc …… 側方余裕による 〃

γr …… 大型車による 〃

γi …… 沿道条件による 〃

Viii) 計画水準及び交通量、交通容量比

(Design Level and Ajustment of Design Level)

計画水準は、計画目標年次における交通状態が、ある一定水準以上を保てることを目途として、次の3種類に区分し、交通量、交通容量比は、次の値を採用した。

計画水準	交通量、交通容量比
1	0.75
2	0.85
3	1.00

ix) 設計交通容量 (Design Capacity)

設計交通容量は次式により算出した。

$$C.D = C \times ADL$$

こゝに　C.D …… 設計交通容量　（台／時）

C …… 可能　〃　（　〃　）

ADL …… 交通量、交通容量比

X) 設計基準交通量（Average Daily Traffic ）

設計基準交通量（ＡＤＴ）は次式により算出した。

$$ADT = \frac{100}{K} \cdot CD$$

こゝに　ＡＤＴ…… 設計基準交通量（台／時）

ＣＤ …… 設計交通容量　（台／時）

Ｋ …… ＡＤＴに対する３０番目時間交通量の割合（９％とする）

計算の結果、設計基準交通量（ＡＤＴ）は次の通りである。

Recommend 案	12,000～7,600	台／日
Sarawak 〃	9,500	〃
Peninsular 〃	11,000～7,100	〃

これに対し Proposed Road に於ける将来交通量の予測は２００２年に於て最大約５００台／日

Table-2 Traffic Capacity

	Recommended			Sarawak	Peninsular		
1. Terrain	F	R	M		F	R	M
2. Design speed (kph)	80	64	48	80	80	64	48
3. Lane width (m)	3.66	3.66	3.66	3.66	3.36	3.36	3.36
4. Lateral clearance Left (m)	3.05	3.05	1.22	3.05	2.44	2.44	1.22
Right (m)	-	-	-	-	-	-	-
5. Heavy vehicle Pct. of heavy vehicle (%)	20	22	36	30	20	22	36
Passenger car equivalent	2.9	3.9	4.0	3.5	2.9	3.9	4.0
6. Coefficient of adjustment Lane width	1.00	1.00	1.00	1.00	0.94	0.94	0.94
Lateral clearance	1,00	1.00	0.96	1.00	1.00	1.00	0.96
Heavy vehicle	0.72	0.61	0.48	0.57	0.72	0.61	0.48
Roadside condition	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Product of coefficient	0.72	0.61	0.46	0.57	0.68	0.57	0.43
7. Basic capacity (kph)	2,000	2,000	2,000	2,000	2,000	2,000	2,000
8. Possible capacity (vph)	1,440	1,220	920	1,140	1,360	1,140	860
9. Adjustment of design level (%)	0.75	0.75	0.75	0.75	0.75	0.75	0.75
10. Design capacity(kph)	1,080	915	690	855	1,020	855	645
11. Rate of peak hours (K) (%)	9	9	9	9	9	9	9
12. Average daily traffic (ADT) (kpd)	12,000	10,167	7,667	9,500	11,333	9,500	7,167