Appendix IV. 2 Installation Plan of Gentex Exchanges until 1984 - Whole Indonesia (2/3)

Witel	Area Code	Tandem Exchange	Terminal Exchange	Existing (1980)		Additional Line Capacity (1981 - 84)	Total Line Capacity (1984)	Estimated Cap. in the Year 2,000 Plan (1984)
				Line Capacity	No. of Telex Lines			
VI	2	Jakarta	Yogyakarta	300	283		300	
			Semarang	500	40		500	
			(Witel-VI Total)	(800)	(323)	(0)	(800)	800
IX	2	Jakarta	Pontianak	-	-	200	200	
	3	Surabaya	Balikpapan	200	96		200	
			Samarinda	300			300	
			Banjarmasin	80	45	320	400	
			(Witel-IX Total)	(580)	(141)	(520)	1,100)	1,100
VII			Surabaya	1,000	518	500	1,500	
			(Witel-VII Total)	(1,000)	(518)	(500)	(1,500)	1,500
VIII			Denpasar	300	129		300	
			(Witel-VIII Total)	(300)	(129)	(0)	(300)	300
X	7	Ujung Pandang	Ujung Pandang	500	82		500	
			Manado	100	56		100	

Appendix IV. 2 Installation Plan of Gentex Exchanges until 1984 - Whole Indonesia (3/3)

Witel	Area Code	Tandem Exchange	Terminal Exchange	Existing (1980)		Additional Line Capacity (1981 - 84)	Total Line Capacity (1984)	Estimated Cap. in the Year 2,000 Plan (1984)
				Line Capacity	No. of Telex Lines			
			Palu	50	18		50	
			(Witel -X Total)	(650)	(156)	(0)	(650)	650
XI			Ambon	100	47		100	
			(Witel-XI Total)	(100)	(47)	(0)	(100)	
								100
XII	7	Ujung Pandang	Jayapura	100	45			
			Sorong	-	-	50		
			(Witel XII Total)	(100)	(45)	(100)	(150)	150
Total Indonesia				11,930	5,307	3,910	15,840	15,700

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (1/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
D.I. ACEH	641	LANGSA	1,000	1,600	2,500	4,000	4,000
	642	Blangkejeren	5	100	200	300	300
	643	Tekeungon	350	600	800	1,000	1,000
	644	Bireun	400	600	1,000	1,600	2,000
	645	Lhokseumawe	1,000	1,600	2,500	4,000	4,000
	646	I d i	400	600	800	1,000	1,000
	651	BANDA ACEH	3,000	5,000	8,000	12,000	12,000
	652	Sabang	400	600	800	1,000	1,000
	653	Sigli	600	1,000	1,600	2,500	3,000
	654	Calang	50	100	200	300	300
	655	Meulaboh	600	1,000	1,600	2,500	3,000
	656	Tapaktuan	400	600	1,000	1,600	2,000
	657	Bakongan	-	100	200	300	300
	658	Singkil	100	200	200	300	300
	659	Kep. Banyak	-	100	100	200	200
	660	Sinabang	100	200	300	300	300

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (2/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
SUMATERA UTARA	61	MEDAN	39,400	63,000	100,000	160,000	172,000
	621	Tebingtinggi	1,000	1,600	2,500	4,000	4,000
	622	Pematangsiantar	4,600	7,000	11,000	19,000	20,000
	623	Tanjungbalai	2,040	3,000	5,000	8,000	8,000
	624	Rantauprapat	480	800	1,200	2,000	2,000
	625	Bangansiapi-api	900	1,400	2,000	3,000	3,000
	626	Pangururan	200	300	500	800	800
	628	Kabaniahe	1,000	1,600	2,500	3,000	3,000
	620	Pungkalanberan-dan	1,000	1,600	2,500	3,000	3,000
	629	Kutacane	160	300	500	800	1,000
	631	SIBOLGA	2,000	3,000	5,000	8,000	8,000
	632	Balige	100	200	300	500	500
	633	Tarutung	400	600	1,000	1,600	2,000
	634	Padangsidempuan	800	1,000	1,600	2,500	3,000
	635	Gunungtua	-	100	200	300	300
	636	Kotanopan	30	100	200	300	300
	637	Natal	-	100	200	300	300
	638	Pulautelo	-	100	200	300	300
	639	Gunungsitoli	200	300	500	800	800

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (3/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
SUMATERA BARAT	751	PADANG	8,000	13,000	20,000	32,000	32,000
	752	Bukittinggi	2,000	3,000	5,000	8,000	9,000
	753	Lubuksikaping	100	200	300	500	500
	754	Sijunjung	100	200	300	500	500
	755	Solok	640	1,000	1,600	2,500	3,000
	756	Painan	200	300	500	800	1,000
	757	Tapan	-	100	200	300	300
	758	Matobe	100	200	300	300	300
	759	Muarasiberut	50	100	200	300	300

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (4/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
RIAU	761	PAKANBARU	4000	6,000	10,000	16,000	16,000
	762	Bangkinang	200	300	500	800	1,000
	763	Pasirpangarayan	-	100	200	300	300
	764	Siaksriindrapura	-	100	200	300	300
	765	Dumai	600	1,000	1,600	2,500	3,000
	766	Bengkalis	300	500	800	1,200	1,500
	767	Selatpanjang	400	600	1,000	1,600	2,000
	768	Tembilahan	550	800	1,000	1,600	2,000
	769	Rengat	300	500	800	1,200	2,000
	760	Telukkuantan	200	300	500	800	1,000
	771	TANJUNGPINANG	1,000	1,600	2,500	4,000	5,000
	772	Terempa	-	100	200	300	300
	773	Genting	-	100	200	300	300
	774	Natuna Selatan	-	100	200	300	300
	775	Tambelan	50	100	200	300	300
	776	Dabo	-	100	200	300	300
	777	Tanjungbalai Karimun	250	400	600	1,000	1,000
	778	Tanjunguban	-	100	200	300	300

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (5/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
JAMBI	741	JAMBI	4,000	6,000	10,000	16,000	20,000
	741	Kualatungkal	650	1,000	1,600	2,500	3,000
	743	Muaratembesi	-	100	200	300	300
	744	Muaratebo	-	100	200	300	300
	745	Sarolangun	-	100	200	300	300
	746	Bangko	-	100	200	300	300
	747	Muarabungo	200	300	500	800	1,000
	748	Sungaipenuh	640	1,000	1,600	2,500	3,000
SUMATERA SELATAN	711	PALEMBANG	9,000	15,000	23,000	36,000	39,000
	712	Kayuagung	200	300	500	800	1,000
	713	Payakabung	-	100	200	300	300
	714	Sekayu	580	1,000	1,600	2,500	3,000
	715	Muntok	-	100	200	300	300
	716	Pangkalpinang	2,000	3,000	5,000	8,000	8,000
	717	Koba	-	100	200	300	300
	718	Tanjungpandan	400	600	1,000	1,600	2,000

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (6/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
BENGKULU	731	LAHAT	1,200	2,000	3,000	5,000	5,000
	733	Lubuklinggau	400	600	1,000	1,600	2,000
	734	Muaraenim	200	300	500	800	1,000
	735	Baturaja	1,620	2,500	4,000	6,000	6,000
	737	Muaraaman	100	200	300	500	500
	738	Surulangun	-	100	200	300	300
	739	Mukomuko	-	100	200	300	300
	730	Barhau	-	100	200	300	300
	732	Curup	640	1,000	1,600	2,500	3,000
	736	Manna	2,200	3,500	5,600	9,000	9,000
LAMPUNG	721	TANJUNGKARANG	10,400	17,000	26,000	42,000	45,000
	722	Kotaagung	100	200	300	500	600
	723	Krui	-	100	200	300	300
	724	Kotabumi	480	800	1,200	2,000	2,000
	725	Metro	1,000	1,600	2,500	4,000	4,000
	726	Menggala	-	100	200	300	300

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (7/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
DKIJAKARTA	21	JAKARTA	268,000	427,000	683,000	1,092,000	1,200,000
JAWABARAT	251	BOGOR	9,200	14,000	23,500	37,600	40,000
	252	Rangkasbitung	480	800	1,200	2,000	2,000
	253	Pandeglang	400	600	1,000	1,600	1,700
	254	Serang	2,000	3,000	5,000	8,000	8,500
	255	Cipanas	1,000	1,500	2,500	4,000	4,200
	22	BANDUNG	36,550	58,000	93,000	149,000	159,000
	261	Sumedang	1,000	1,500	2,500	4,000	4,200
	262	Garut.	2,200	3,400	5,500	9,000	9,600
	263	Cianjur	2,300	3,600	5,800	9,000	9,600
	264	Purwakarta	5,200	8,000	13,000	21,000	22,400
	265	Tasikmalaya	5,300	8,500	13,000	21,000	22,400
	266	Sukabumi	4,400	7,000	11,000	18,000	19,000
	231	CIREBON	5,400	8,500	14,000	22,000	23,500
	232	Kuningan	400	600	1,000	1,600	1,700
	233	Majalengka	400	600	1,000	1,600	1,700
	234	Indramayu	480	800	1,200	2,000	2,000

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (8/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
JAWA TENGAH	24	SEMARANG	20,000	32,000	51,000	81,000	86,600
	241	Kudus	2,500	4,000	6,300	10,000	10,700
	242	Purwodadi	480	800	1,200	2,000	2,000
	243	Magelang	4,980	8,000	13,000	21,000	22,400
	244	Kendal	1,000	1,500	2,500	4,000	4,200
	245	Pati	2,260	3,600	5,800	9,200	9,800
	246	Cepu	1,050	1,700	2,600	4,200	4,500
	247	Karimunjawa	-	200	300	300	300
	248	Salatiga	1,960	3,100	5,000	8,000	8,500
	271	SURAKARTA (Solo)	7,700	12,600	19,700	31,500	33,700
	272	Klaten	2,000	3,000	5,000	8,000	8,500
	273	Wonogiri	140	200	300	500	600
	274	D.I. YOGYAKARTA	7,200	11,500	18,000	29,500	31,500
	281	PURWOKERTO	4,800	7,600	12,200	20,000	21,000
	282	Cilacap	2,200	3,400	5,500	9,000	9,600
	283	Tegal	3,680	5,800	9,400	15,000	16,000
	284	Pemalang	640	1,000	1,600	2,600	3,000
	285	Pekalongan	4,000	6,400	10,000	16,000	17,500
	286	Wonosobo	250	400	600	1,000	1,000
	287	Kebumen	1,400	2,000	3,000	5,000	6,000
	288	Purworejo	640	1,000	1,600	2,600	3,000

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (9/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
JAWA TIMUR	31	SURABAYA	54,400	87,000	140,000	223,000	240,000
	321	Mojokerto	3,300	5,000	8,000	13,000	13,000
	322	Lamongan	170	200	300	500	600
	323	Bangkalan	810	1,300	2,000	3,000	3,500
	324	Pamekasan	1,480	2,000	3,500	6,000	6,500
	325	Bawean	-	100	200	300	300
	326	Sapudi	-	100	200	300	300
	327	Kangean	-	100	200	300	300
	331	JEMBER	3,600	6,000	9,000	15,000	16,000
	332	Bondowoso	2,300	3,600	5,800	9,000	9,600
	333	Banyuwangi	3,260	5,000	8,000	13,000	14,000
	334	Lumajang	1,080	1,700	2,700	4,000	4,200
	335	Probolinggo	2,200	3,500	5,600	9,000	9,600
	341	MALANG	10,280	30,000	49,000	79,000	126,000
	342	Blitar	2,300	3,600	5,800	9,000	9,600
	343	Pasuruan	4,960	8,000	12,000	20,000	22,000

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (10/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
	351	MADIUN	5,550	8,800	14,000	22,000	23,500
	352	Pacitan	680	1,000	1,800	3,000	3,000
	353	Bojonegoro	1,780	2,800	4,500	7,000	7,000
	354	Kediri	3,540	5,600	9,000	14,000	15,000
	355	Tulungagung	2,260	3,600	5,500	9,000	9,000
	356	Tuban	640	1,000	1,600	2,600	3,000
BALI	361	DENPASAR	10,080	16,000	25,000	41,000	44,000
	362	Singaraja	2,000	3,000	5,000	8,000	8,500
	363	Karangasem	200	400	600	1,000	1,000
	364	Mataram	3,400	5,400	8,700	14,000	14,000
NUSA TENGGA-RA BARAT	371	SUMBAWABESAR	1,400	2,000	3,500	5,700	6,000
	372	Taliwang	200	400	600	1,000	1,000
	373	Dompu	300	400	600	1,000	1,000
	374	Raba	-	400	600	1,000	1,000

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (11/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
NUSA TENGGA-RA TIMUR	381	ENDE	640	1,000	1,600	2,600	3,000
	382	Maumere	550	800	1,000	1,600	1,700
	383	Larantuka	100	200	400	600	600
	384	Bajawa	100	200	400	600	800
	385	Reo	580	900	1,500	2,400	2,500
	386	Waingapu	-	200	400	600	600
	387	Waikabubak	100	200	400	600	600
	391	KUPANG	1,400	2,000	3,500	5,700	6,000
	392	Soe	100	200	400	600	600
	393	Kefamenanu	100	200	400	600	600
	394	Atambua	400	600	1,000	1,600	1,700
	395	Baa	50	100	200	300	300
	396	Seba	-	100	100	200	200
	397	Kalabahi	200	400	600	800	1,000
	398	Ilwaki	-	100	100	200	200
TIMOR TIMUR	399	Baucau	200	400	600	1,000	1,000
	390	Dilli	900	1,500	2,500	4,000	4,000

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (12/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
KALIMANTAN TIMUR	541	SAMARINDA	3,000	5,000	8,000	13,000	14,000
	542	Balikpapan	3,000	5,000	8,000	13,000	14,000
	543	Tanahgrogot	-	100	200	300	300
	544	Muarasiram	-	100	200	300	300
	545	Longberang	-	100	200	300	300
	546	Tabang	-	100	200	300	300
	547	Sangkulirang	-	100	200	300	300
	551	TARAKAN	600	1,000	1,600	2,500	3,000
	552	Tanjungselor	-	100	200	300	300
	553	Binuang	-	100	200	300	300
	554	Tanjungredeb	50	100	200	300	300
	555	Longnawan	-	100	200	300	300
KALIMANTAN BARAT	561	PONTIANAK	2,000	3,000	5,000	8,000	8,000
	562	Singkawang	1,050	1,700	2,700	4,000	4,000
	563	Ngabang	50	100	200	300	300
	564	Sanggau	300	500	800	1,000	1,000
	565	Sintang	100	200	300	500	500
	566	Semitau	-	100	200	300	300
	567	Putusibau	150	200	300	500	500
	568	Nangapinoh	50	100	200	300	300
	569	P. Karimata	-	100	200	300	300

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (13/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
KALIMANTAN SELATAN	511	BANJARMASIN	6,100	10,000	16,000	25,000	26,000
	512	Pleihari	50	100	200	300	300
	513	Kuala Kapuas	200	300	500	800	1,000
	514	Palangkaraya	1,000	1,600	2,500	4,000	4,000
	515	Buntok	50	100	200	300	300
	516	Tanjung	100	200	300	500	500
	517	Kandangan	640	1,000	1,600	2,500	3,000
	518	Kotabaru	50	100	200	300	300
	519	Muarateweh	200	400	600	800	1,000
	531	SAMPIT	650	1,000	1,600	2,500	3,000
	532	Pangkalanbun	100	200	300	500	600
	533	Nangatayap	-	100	200	300	300
	534	Ketapang	800	1,000	1,600	2,500	3,000
	535	Sukadana	10	100	200	300	300
	536	Senamang	0	100	200	300	300
	537	Kualakurun	50	100	200	300	300
	538	Purukcau	-	100	200	300	300
SULAWESI SELATAN	411	UJUNGPANDANG	14,650	23,000	37,500	60,000	64,000
	412	Watampone	450	600	800	1,000	1,000
	413	Bontain	800	1,200	2,000	3,000	3,500
	414	Benteng	-	100	100	200	200
	415	Tanajampea	-	100	100	200	200

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (14/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
	421	PARE-PARE	3,200	5,000	8,000	13,000	14,000
	422	Majene	100	200	400	600	600
	423	Rantepao	80	100	200	400	400
	424	Palopo	300	500	500	600	600
	425	Singkang	400	400	600	800	800
	426	Mamuju	-	100	200	300	300
	427	Masamba	-	100	200	300	300
	428	Malili	-	100	200	300	300
	429	Karosa	-	100	200	300	300
SULAWESI UTARA	431	MANADO	6,800	11,000	17,000	28,000	29,900
	432	Tahuna	200	400	600	800	1,000
	433	Beo	-	100	100	200	200
	434	Kotamobagu	360	600	800	1,000	1,200
	435	Gorontalo	2,000	3,000	5,000	8,000	8,000
	436	Tilamuta	-	100	200	300	300
	437	Peleleh	-	100	200	300	300

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (15/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
SULAWESI TENGAH	451	PALU	2,400	3,800	6,000	9,800	10,000
	452	Poso	900	1,400	2,300	3,600	4,000
	453	Tolitoli	640	1,000	1,600	2,500	2,700
	454	Tojo	-	100	100	200	200
	455	Kolonodale	-	100	100	200	200
	456	Bungku	-	100	100	200	200
	457	Katupa	-	100	100	200	200
	458	Luwuk	800	1,000	1,600	2,500	3,700
	459	Banggai	-	100	100	200	200
SULAWESI TENGGARA	401	KENDARI	1,000	1,600	2,500	4,000	4,000
	402	Baubau	100	200	400	600	600
	403	Raha	-	100	100	200	200
	404	Papalia	-	100	100	200	200
	405	Kolaka	200	200	400	600	600
	406	Malamala	-	100	100	200	200
	407	Wawoheo	-	100	100	200	200
MALUKU	911	AMBOINA	3,600	6,000	9,000	14,000	15,000
	912	Piru	-	100	200	300	300
	913	Namlea	100	200	300	500	500
	914	Masohi	100	200	300	500	500
	915	Bula	-	100	200	300	300
	916	Tual	480	800	1,200	2,000	2,000
	917	Dobo	220	300	500	800	1,000
	918	Saumlaki	-	100	200	300	300

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (16/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
	919	Lea	-	100	200	300	300
	910	Bandanaera	-	100	200	300	300
	921	TERNATE	1,000	1,600	2,500	4,000	4,000
	922	Jailolo	-	100	200	300	300
	923	Pitu	-	100	200	300	300
	924	Tobelo	200	300	500	800	1,000
	925	Weda	-	100	200	300	300
	926	Umera	-	100	200	300	300
	927	Labuha	-	100	200	300	300
	928	Laiwui	-	100	200	300	300
	929	Sanana	-	100	200	300	300
IRIAN JAYA	951	SORONG	1,000	1,600	2,500	4,000	4,000
	952	Samate	-	100	200	300	300
	953	Atkri	-	100	200	300	300
	954	Inanwatan	-	100	200	300	300
	955	Bab	-	100	200	300	300
	956	Fakfak	-	1,000	1,600	2,500	3,000
	957	Kaimana	100	200	300	500	500
	958	Mimika	-	100	200	300	300
	961	BIAK	1,000	1,600	2,500	4,000	4,000
	962	Manokwari	1,000	1,600	2,500	4,000	4,000

Appendix IV. 3 Telecommunication Development Plan Until Year 2,000, According to Demand Forecast By 7% Annual Growth (17/17)

Province	Area Code	Area	1984	1989	1994	1999	2000
IRIAN JAYA	963	Serui	100	200	300	500	500
	964	Nabire	200	300	500	800	1,000
	965	Waren	-	100	200	300	300
	966	Sarmi	-	100	200	300	300
	967	Jayapura	3,000	5,000	8,000	12,000	12,000
	968	Biguba	-	100	200	300	300
	969	Wamena	200	300	500	800	1,000
	960	Kive	-	100	200	300	300
	971	MERAUKE	1,000	1,600	2,500	4,000	4,000
	972	Okaba	-	100	200	300	300
	973	Kalwa	-	100	200	300	300
	974	Tarua Aniem	-	100	200	300	300
	975	Tanah Merah	-	100	200	300	300
	976	Teluk Flamingo	-	100	200	300	300
	977	Birufu	-	100	200	300	300
	978	Yapen Waropen	100	200	300	500	500
TOTAL			729,075	1,181,500	1,915,600	3,017,300	3,295,200

Source: TELEKOMUNIKASI INDONESIA MENJELANG TAHUN 2000

Appendix IV. 4

Telex Demand Forecast till and Including Year 1999/2000 (1/2)

Nomor	Telecom District (WITEL)	Demand/Forecast (L.U)				Remarks
		1984	1989	1994	1999/2000	
1.	Witel I	800	1,400	2,100	3,150	
2.	Witel II	450	790	1,200	1,800	
3	Witel III	440	770	1,150	1,725	
4	Witel IV	6,420	11,240	16,850	25,275	
5.	Witel V	630	1,100	1,650	2,475	
6.	Witel VI	730	1,300	1,950	2,925	
7.	Witel VII	1,190	2,100	3,150	4,725	
8.	Witel VIII	190	340	520	780	
9.	Witel IX	400	700	1,050	1,575	
10.	Witel X	393	670	1,030	1,555	
11.	Witel XI	80	150	225	350	
12.	Witel XII	120	200	300	450	
		11,843	20,760	31,175	46,780	

Source: TELEKOMUNIKASI INDONESIA MENJELANG TAHUN 2000

Appendix IV.4 Telex Construction Plan till and Including 2000 (2/2)

Nomor	Telecom District (WITEL)	Construction Plan IN L.U. - (CAP)				Remarks
		1984	1989	1994	1999/2000	
1.	Witel I	1,100	1,800	2,800	4,200	
2.	Witel II	1,200	1,200	1,600	2,400	
3.	Witel III	500	1,000	1,500	2,200	
4.	Witel IV	7,600	15,000	22,000	34,000	
5.	Witel V	700	1,500	2,200	3,300	
6.	Witel VI	800	1,700	2,700	4,000	
7.	Witel VII	1,500	2,800	4,300	6,600	
8.	Witel VIII	300	500	700	1,100	
9.	Witel IX	1,100	1,100	1,400	2,000	
10.	Witel X	650	1,000	1,400	2,000	
11.	Witel XI	100	200	300	500	
12.	Witel XII	150	300	400	600	
		15,700	28,100	41,300	62,900	

Appendix IV-5

Telephone Density and GDP per Capita (in US$)

Relationships between GDP per capita and telephone density (number of subscriber telephone installations per 100 persons) as of the year 1973 in various countries are graphically presented in the attached figure.

In the figure, the horizontal axis is for GDP per capita and the vertical axis is for telephone density. On both graduated axes are the attached figure data plotted.
The straight line is the regression line at the plotted point.
The correlation formula follows:

$$Y = 0.000331 X^{1.3852}$$

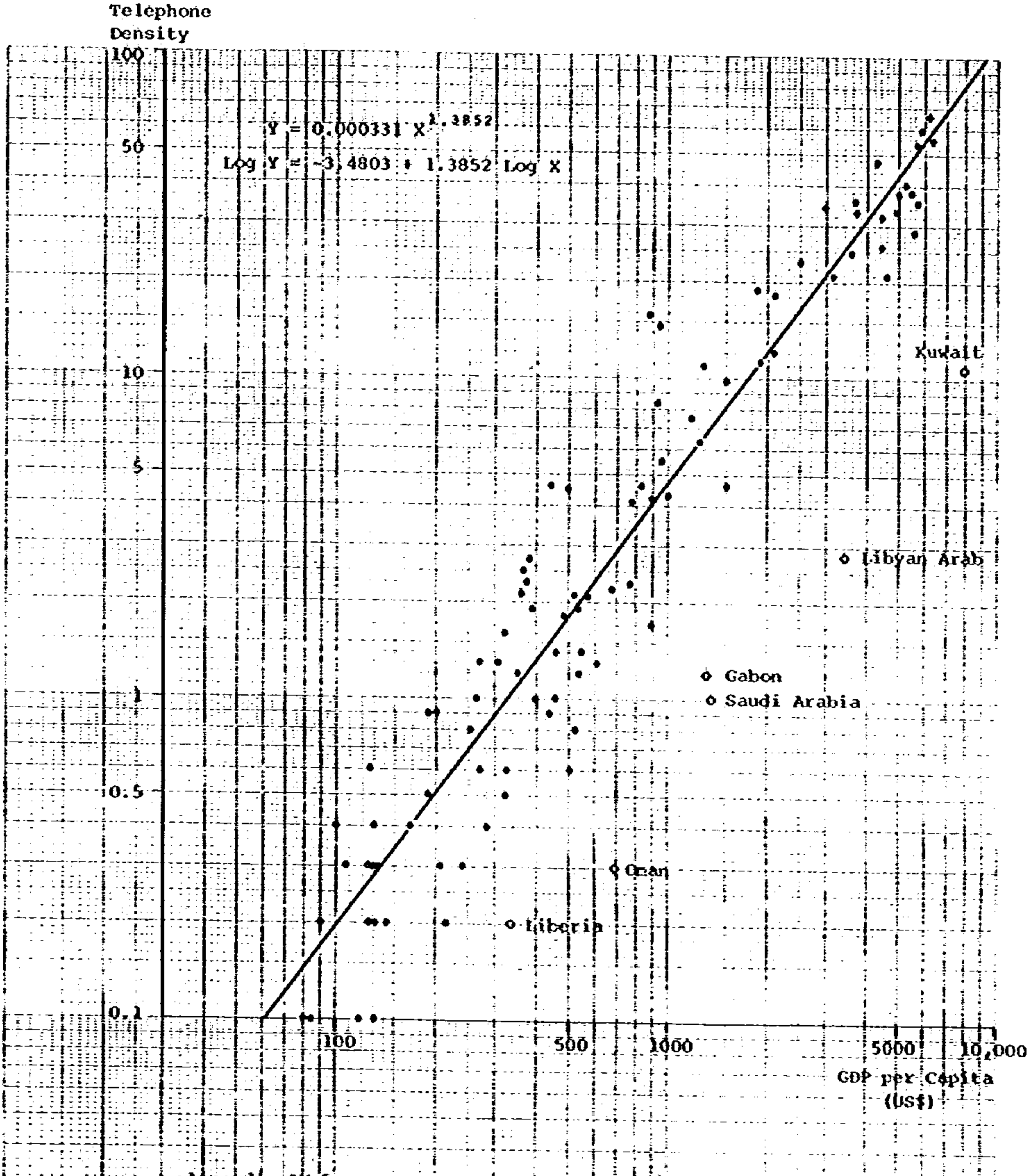
$$\text{Log } Y = -3.4803 + 1.3852 \log X$$

where

Y : Telephone density
(Number of telephones/100 persons)

X : GDP per capita (in US$)

Meanwhile, the data and correlation formula are those already reported in "JAKARTA CITY TELEPHONE PLANNING JTP '79."



Appendix IV.5.

Figure Telephone Density and GDP per Capita in 1973

Appendix IV. 5

Table G.D.P. per Capita, N.I. per Capita and Telephone Density in 1973 (1/7)

( ): National Income

Country	G.D.P. (NI) in 1973 Million (*Billion)	National Currency Exchange Rate per US $		Population in 1973 Million	G.D.P. (NI) per Capita	Telephone Density
Algeria	*29.7	4.185	Dinar	15.77	450	1.4
Australia	*50.7 (*46.7)	0.672	Dollar	13.13	5,746 (5,293)	35.5
Austria	*533.3 (*476.7)	19.85	Schilling	7.53	3,568 (3,189)	24.6
Bangladesh	*69.1	8.165	Taka	73.21	116	0.1
Barbados	425.9	2.07	Dollar	0.24	857	15.6
Belgium	*1,774.0 (*1,630.0)	41.32	Franc	9.74	4,408 (4,050)	25.7
Benin	*73.6	235.4	Franc	2.95	106	0.3
Bolivia	21,459.0 (18,492.0)	20.0	Peso	5.33	201 (173)	0.9
Botswana	192.0 (185.5)	0.6712	Pula	0.65	440 (425)	0.9
Brazil	*477.2 (*449.1)	6.22	Crueiro	100.56	763 (718)	2.3
Burma	11,735.0	4.862	Kyat	29.04	83	0.1
Canada	*124.5 (*109.4)	0.9958	Dollar	22.13	5,650 (4,964)	52.8
Colombia	*243.2 (*221.2)	24.89	Peso	22.27	439 (399)	4.6
Costa Rica	10,162.0 (9,310.0)	6.65	Colon	1.87	817 (749)	4.6
Cyprus	335.7 (331.3)	0.361	Pound	0.62	1,500 (1,480)	9.7
Denmark	*164.9 (*150.1)	6.29	Krone	5.02	5,222 (4,754)	40.0

Appendix IV. 5

Table G.D.P. per Capita, N.I. per Capita and Telephone Density in 1973 (2/7)

( ): National Income

Country	G.D.P. (NI) in 1973 Million (*Billion)	National Currency Exchange Rate per US $		Population in 1973 Million	G.D.P. (NI) per Capita	Telephone Density
Dominican Republic	2,345.0 (2,127.0)	1.00	Peso	4.43	529 (480)	1.9
Ecuador	*64.6 (*57.2)	25.0	Sucre	6.73	384 (340)	1.9
Egypt	3,663.0 (3,634.0)	0.3913	Pound	35.62	263 (261)	1.3
El Salvador	3,332.0 (3,146.0)	2.5	Colon	3.77	354 (334)	1.2
Ethiopia	5,005.0	2.09	Birr	26.55	90	0.2
Fiji	338.3 (318.7)	0.8092	Dollar	0.55	760 (716)	4.1
Finland	*66.7 (*59.7)	3.85	Markka	4.67	3,710 (3,320)	32.9
France	1,144.2 (*1,004.8)	4.708	Franc	52.18	4,535 (4,090)	21.7
Gabon	*161.1 (*123.8)	235.4	Franc	0.52	1,316 (1,011)	1.2
Germany	*918.6 (*824.4)	2.703	D. Mark	61.97	5,484 (4,922)	28.7
Ghana	3,501.0 (3,255.0)	1.15	Cedi	9.36	325 (302)	0.6
Greece	*484.0 (*467.0)	29.7	Drachma	8.93	1,825 (1,761)	18.7
Guatemala	2,569.0 (2,226.0)	1.00	Quetzal	5.74	448 (388)	1.0
Guyana	643.4 (581.8)	2.24	Dollar	0.76	378 (342)	2.3

Appendix IV. 5

Table G.D.P. per Capita, N.I. per Capita and Telephone Density in 1973 (3/7)

( ): National Income

Country	G.D.P. (NI) in 1973 Million (*Billion)	National Currency Exchange Rate per US $		Population in 1973 Million	G.D.P. (NI) per Capita	Telephone Density
Haiti	3,129.0 (3,061.0)	5.00	Gourde	4.44	141 (138)	0.2
Honduras	1,814.0 (1.675.0)	2.0	Lempira	2.78	326 (301)	0.5
Iceland	*95.4 (*82.9)	83.81	Krone	0.21	5,420 (4,710)	38.1
India	*576.8 (*545.6)	8.13	Rupee	574.42	124 (117)	0.3
Indonesia	*6,753.0 (*6,069.0)	415.0	Rupiah	129.15	126 (113)	0.2
Iran	*1,861.0	67.63	Rial	31.3	879	1.7
Iraq	1,626.0 (1,451.0)	0.2961	Dinar	10.41	528 (471)	1.2
Ireland	2,689.0 (2,500.0)	0.4305	Pound	3.05	2,048 (1,904)	12.0
Israel	41,875.0 (36,670.0)	4.2	Pound	3.21	3,106 (2,720)	20.8
Italy	*82,143.0 (*75,004.0)	607.92	Lira	54.91	2,461 (2,247)	22.9
Ivory coast	*556.2 (*528.6)	235.4	Franc	4.65	508 (483)	0.6
Jamaica	1,752.0 (1,546)	0.9091	Dollar	1.98	973 (859)	4.3
Japan	*111,061.0 (*97,069.0)	280.0	Yen	108.70	3,649 (3,189)	35.7
Jordan	268.5 (281.6)	0.3289	Dinar	2.54	321 (337)	1.6

Appendix IV. 5
Table G.D.P. per Capita, N.I. per Capita and Telephone Density in 1973 (4/7)

( ): National Income

Country	G.D.P. (NI) in 1973 Million (*Billion)	National Currency Exchange Rate per US $		Population in 1973 Million	G.D.P. (NI) per Capita	Telephone Density
Kenya	829.0 (785.0)	0.345	Pound	12.48	193 (182)	0.9
Korean Republic	*4,939.0 (*4,492.0)	398.0	Won	34.10	364 (331)	2.5
Kuwait	2,111.0 (1,626.0)	0.2967	Dinar	0.89	7,994 (6,158)	10.7
Lesotho	84.1 (112.9)	0.6712	Rand	0.99	127 (170)	0.3
Liberia	554.9 (419.2)	1.0	Dollar	1.63	334 (257)	0.2
Libyan Arab Jamahiriya	2,246.0 (1,816.0)	0.2961	Dinar	2.25	3,371 (2.726)	2.8
Luxembourg	*72.7 (*62.3)	41.32	Franc	0.35	5,027 (4,308)	38.2
Madagascar	*297.6 (*283.0)	235.4	Franc	7.57	167 (159)	0.4
Malawi	400 (371.0)	0.8475	Kwacha	4.79	99 (91)	0.4
Malaysia	14,401.0 (16,634.0)	2.45	Ringitt	11.31	520 (600)	2.1
Malta	115.7 (119.2)	0.3867	Pound	0.32	935 (963)	14.4
Mauritius	1,852.0 (1,868.0)	5.739	Rupee	0.86	375 (378)	2.7
Mexico	*619.6 (*566.6)	12.5	Peso	56.16	883 (807)	4.2
Morocco	*21.3 (*19.4)	4.29	Dirham	16.31	304 (277)	1.3

Appendix IV. 5
Table G.D.P. per Capita, N.I. per Capita and Telephone Density in 1973 (5/7)

( ): National Income

Country	G.D.P. (NI) in 1973 Million (*Billion)	National Currency Exchange Rate per US $		Population in 1973 Million	G.D.P. (NI) per Capita	Telephone Density
Nepal	9,969.0	10.56	Rupee	12.07	78	0.1
Netherlands	*168.1 (*154.7)	2.824	Ghilder	13.44	4,429 (4,076)	32.0
New Zealand	8,767.0 (8,046.0)	0.7001	Dollar	2.95	4,245 (3,896)	47.5
Nicaragua	7,665.0 (7,004.0)	7.026	Cordoba	2.01	542 (496)	0.8
Nigeria	9,001.0	0.6579	Naira	59.66	229	0.2
Norway	*111.8 (*95.3)	5.73	Krone	3.96	4,927 (4.200)	32.9
Oman	169.4 (129.2)	0.3454	Rialamani	0.72	681 (520)	0.3
Pakistan	*86.2	9.931	Rupee	66.23	131	0.3
Panama	1,472.0 (1,292.0)	1.0	Balbou	1.57	938 (823)	5.5
Papua New Guinea	1,040.6 (895.3)	0.672	Kina	2.56	605 (520)	1.3
Paraguay	*125.4 (*116.8)	126.0	Guarani	2.50	398 (371)	1.0
Peru	381.9 (*336.0)	38.7	Sol	14.71	671 (590)	2.2
Philippines	*71.8 (*65.2)	6.74	Peso	40.12	266 (241)	1.0
Portugal	*281.1 (*269.4)	25.85	Escudo	8.56	1,270 (1,217)	10.9
Saudi Arabia	*40.6 (*30.1)	3.55	Riyal	8.45	1,353 (1.003)	1.0

Appendix IV. 5
Table G.D.P. per Capita, N.I. per Capita and Telephone Density in 1973 (6/7)

( ): National Income

Country	G.D.P. (NI) in 1973 Million (*Billion)	National Currency Exchange Rate per US $		Population in 1973 Million	G.D.P. (NI) per Capita	Telephone Density
Senegal	*230.6	253.4	Franc	3.87	253	0.8
Seychelles	168.0	5.739	Repee	0.06	488	4.5
Sierra Leone	478.0 (433.0)	0.8609	Leone	2.67	208 (188)	0.3
Singapore	10,205.0	2.49	Dollar	2.19	1,871	11.4
South Africa	19,074.0 (16,788.0)	0.6712	Rand	24.31	1,169 (1.029)	7.5
Spain	*4,129 (*3,808.0)	56.85	Peseta	34.86	2,083 (1,921)	18.1
Sri Lanka	17,053.0 (16,028.0)	6.748	Rupee	13.25	191 (179)	0.5
Sudan	1,246.0 (1,137.0)	0.3482	Pound	15.0	239 (218)	0.3
Sweden	220.2 (*198.2)	4.588	Krone	8.14	5,896 (5,307)	59.4
Switzerland	*130.1 (*119.3)	3.244	Franc	6.43	6,237 (5,719)	56.0
Syrian Arab Republic	9,413.0	3.8	Pound	6.89	360	2.1
Thailand	216.5 (*201.3)	20.38	Baht	39.69	268 (249)	0.6
Thrinidad & Tobago	2,689.0	2.07	Dollar	1.06	1,226	6.3
Tunisia	1,163.0 (1,093.0)	0.445	Dinar	5.44	480 (452)	1.8
Turkey	*296.0 (*293.0)	14.15	Lira	37.36	560 (554)	2.1

Appendix IV. 5

Table G.D.P. per Capita, N.I. per Capita and Telephone Density in 1973 (7/7)

( ): National Income

Country	G.D.P. (NI) in 1973 Million (*Billion)	National Currency Exchange Rate per US $		Population in 1973 Million	G.D.P. (NI) per Capita	Telephone Density
United Kingdom	*72.0 (*66.3)	0.4304	Pound	55.93	2,991 (2,754)	34.0
United Republic of Cameroons	*416.0	235.4	Franc	6.17	286	0.4
Tanzania	13,103.0 (12,179.0)	6.9	Shilling	14.37	132 (123)	0.4
U.S.A.	*1,302.0 (*1,171.0)	1.0	Dollar	210.41	6,188 (5,565)	65.7
Uruguay	*2,537.5 (*2,443.5)	937.0	Peso	2.99	906 (872)	8.3
Venezuela	*72.5 (*63.6)	4.28	Bolivar	11.28	1,502 (1,317)	4.6
Yemen	3,710.0 (3,640.0)	4.575	Rial	6.29	129 (126)	0.1
Yemen Democratic	68.0	0.3454	Dinar	1.56	126	0.6
Zaire	1,501.8 (1,296.0)	0.5	Zaire	23.56	127 (110)	0.2
Zambia	1,616.0 (1,322.0)	0.6435	Kwacha	4.64	541 (443)	1.4

Source: Statistical Yearbook 1977 United Nations

Appendix IV-6 World Historical Trends of Telecommunication Services

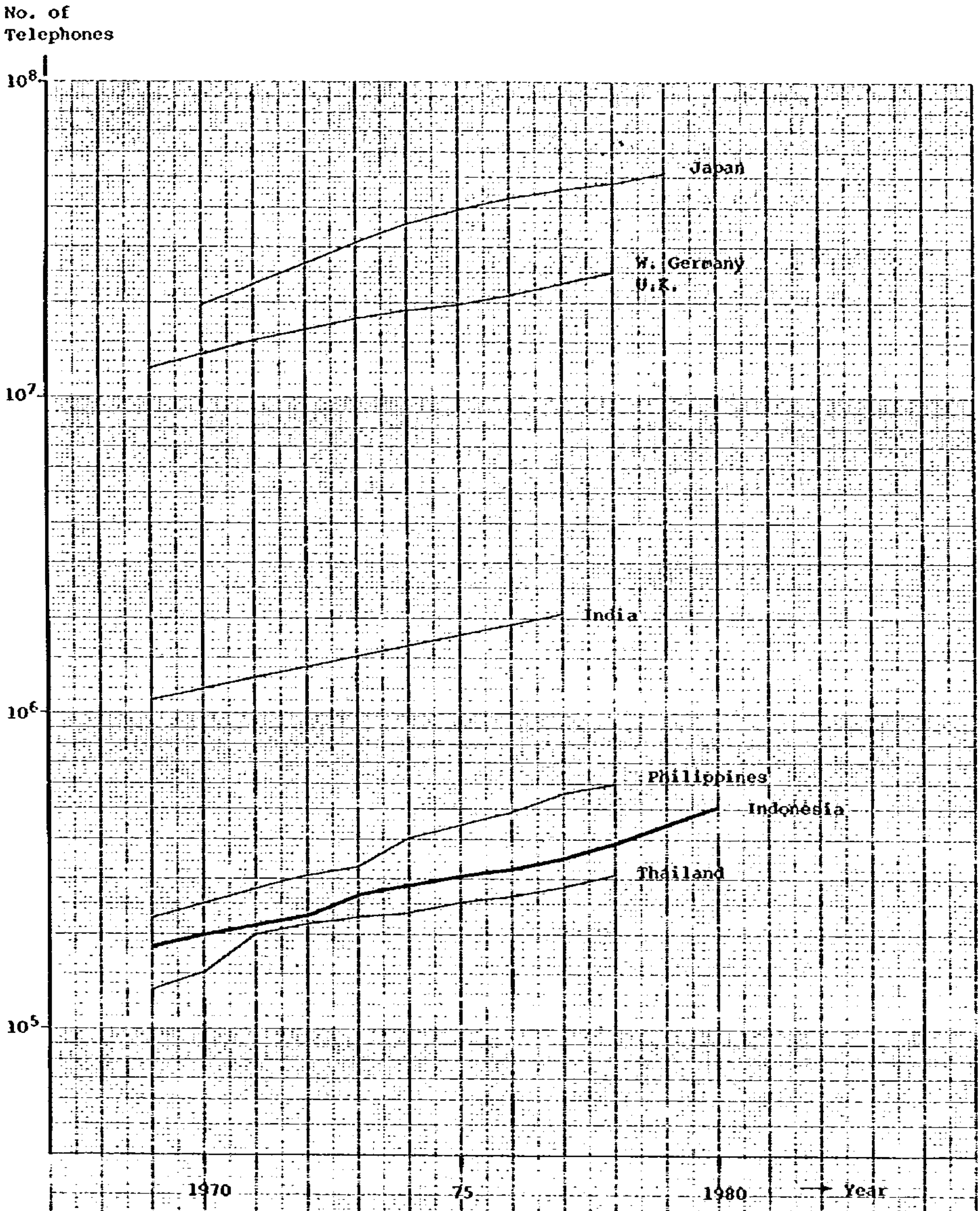
For the developed country group comprising England, West Germany and Japan and the developing country group represented by India, Thailand and the Philippines, the histrical trends of demand for all kinds of telecommunications services during the past 10 years (1969 - 1978) are shown in the attached figures. The service diffusion rates and the demand growth rates are given in the attached table.

(1) For telephone service, the demand is on the steady uptrend in both developed and developing countries.

(2) For domestic telegram service, the demand is on the downtrend in all developed countries; however, in developing countries, the demand continues the uphill trend except in Malaysia. This is because in developed countries the diffusion of telephone and telex services is to the extent of engulfing the demand for telegram service, whereas in developing countries the telephone and telex services are not diffused as much as to take over the demand for telegram service.

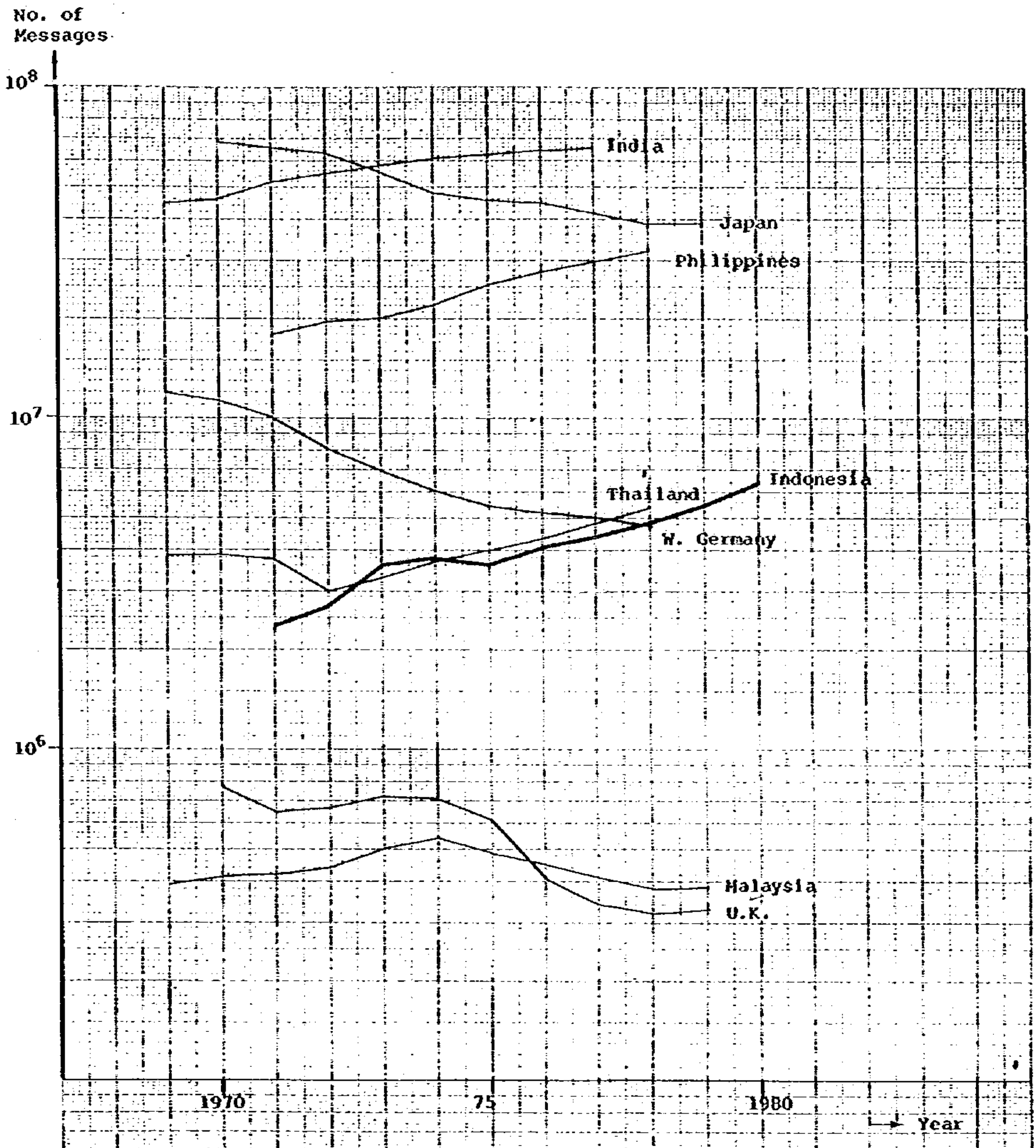
(3) The demand for telex service continues to increase, and steadily, in both developed and developing countries. Especially in developed countries the demand for such new services as data communication and facsimile has registered more than 20% rapid growth in the past 10 years. And, during the same decade, the growth trend of demand for telex service that mainly consists of message communication remained unabated. This fact deserves special attention.

(Source: Common Carrier Statistical Year Book 1979, ITU.)



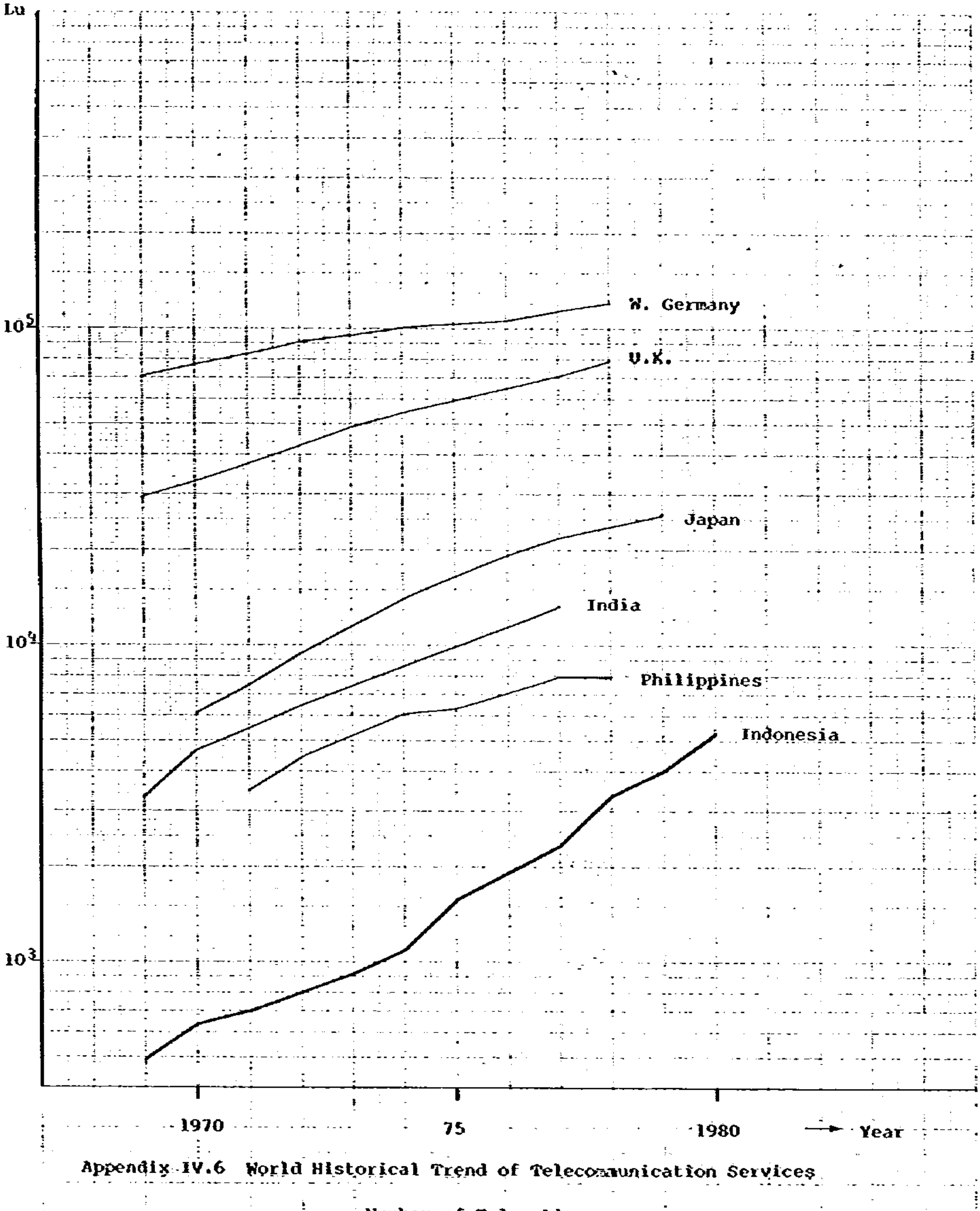
Appendix IV.6 World Historical Trend of Telecommunication Services

- Number of Telephone Stations -



Appendix IV.6 World Historical Trend of Telecommunication Services

- Number of Telegram Messages -



Appendix IV.6 World Historical Trend of Telecommunication Services

- Number of Telex Lines -

Appendix IV. 6

Table World Historical Trend of Telecommunication Service

Item / Countries	(*) GDP per capita (US$)	Penetration			Growth Rate (%)		
		Telephone (per 100 inhabit)	Telex (per 1000 inhabit)	Telegram (per 100 inhabit)	Telephone	Telex	Telegram
U.K.	4,377	44.7	1.4	5.9	+6.7	+11.8	-10.0
W. Germany	7,175	40.4	2.0	7.8	+7.9	+5.9	-10.8
Japan	7,525	44.2	0.2	33.9	+11.0	+12.7	-6.5
India	-	0.3	0.02	10.5	+8.1	+18.8	+8.6
Thailand	412	0.9	-	14.1	+13.1	-	+3.2
Philipines	459	1.3	0.11	70.2	+11.3	+5.1	+4.7
Indonesia	320	0.3	0.02	3.8	+8.7	+24.2	+11.7

Source ; Common Carrier Statistics Book - ITU ; 1979

(*) ; 1977 Market Price

Appendix IV-7 Demand Concurrence among All Kinds of Services

Service needs from among subscribers present variations conforming to variations of environmental factors, such as economic growth. And, in those variations of subscribers' service needs are found the tendencies described below. such tendencies provide a useful yardstick to demand forecasts for all kinds of services.

(1)
Telegram and telex services

Telex service requires fixed expenses including initial installation cost and monthly rental charge, so that the users are exclusively large scale commercial organizations and governmental offices that handle a large volume of information.
Telegram service requires message delivery fee only, so that the users, not to speak of general household users, are much wider spread than the telex service users.

As the volume of information handled by commercial organization and governmental offices continues to expand, the demand from these users is bound to transfer to telex service from other communication service media in whose case the cost of information transmission is relatively high.

(2) Telegram and telephone services

These are services, one differing in character from the other. Nevertheless, both are in competitive relations because the general tendency is that, as the telephone diffusion among general households progresses, the demand for telegram service diminishes fast.

(3) Telex service and new services (data communication, facsimile, etc.)

Both are services whose main users consist of large scale commercial organizations and governmental offices. As the volume of information handled by these users increases, the telex system terminals are bound to be replaced with new service terminals better fitted for the volume and characteristics of information. That is to say, when a greater volume of message transmission is required, the system terminal will be replaced with the facsimile terminal and, when the data transmission and processing are required, to the data communication terminal.

Appendix V-1 Digital Transmission System and Non-Voice Communication Services

1. Communication Information and Transmission Bit Rate

When the various kinds of communication demand expected in the future are classified by transmission bit rate, the result is as seen in Figure 1.

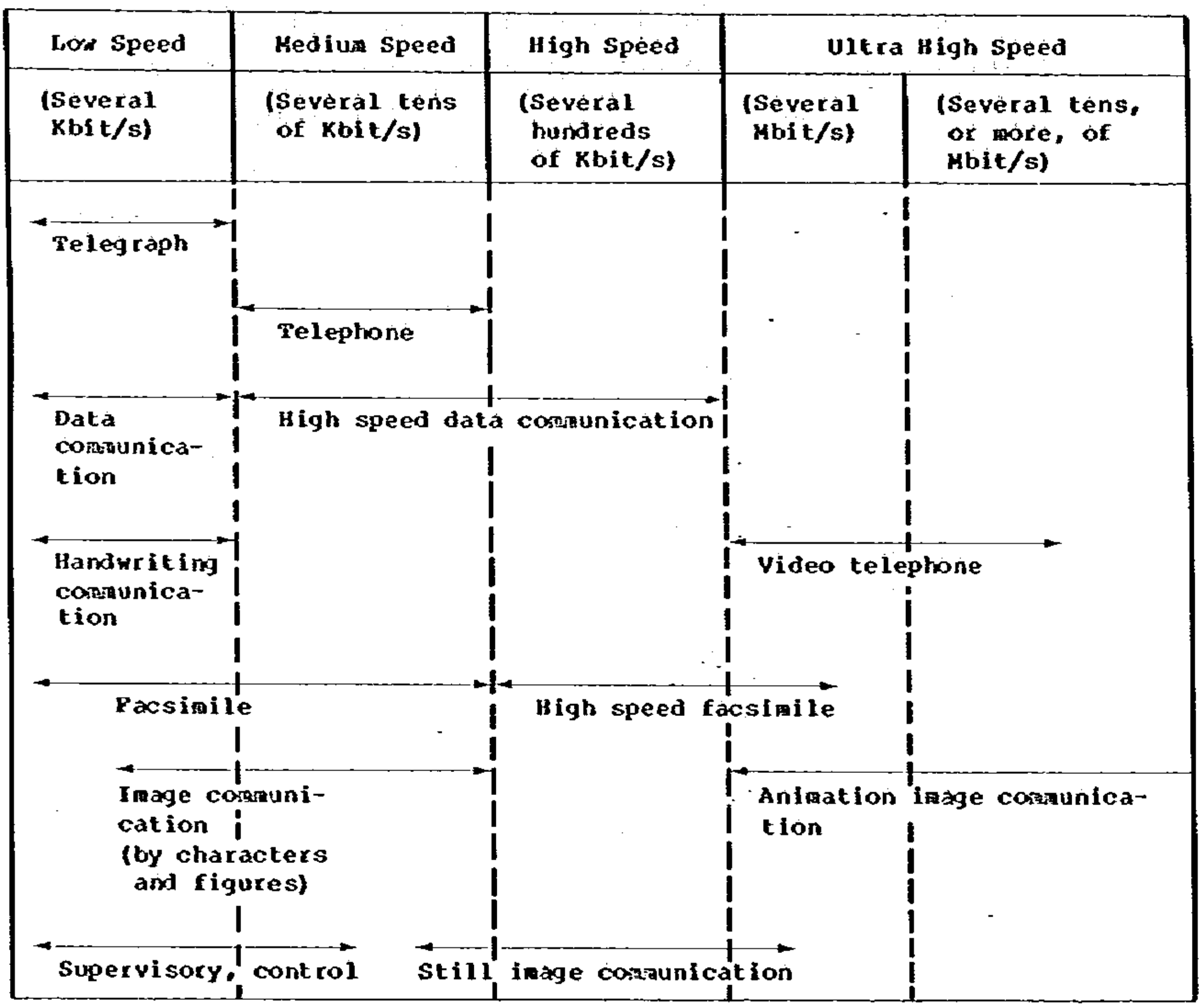


Figure 1 Communication Information and Transmission Bit Rate

Those multifarious kinds of information can be integrated by means of communication network digitalization; however, the general interpretation is that multiplexing of different kinds of information, one separated from another by 10 odd times or more in transmission bit rate, should rather be avoided by reason of unwholesome effects in respect of traffic routing efficiency and service quality standardization. Hence, for video telephone and animation image communication, for instance, whose transmission bit rate varies broadly from that of other service items, the general practice is to establish independent transmission networks. Furthermore, the demand for these ultra-high speed communication services will be from such special users as governmental offices and big commercial institutions only, for the time being. And, for these services, the simultaneous communication among a large number of points will take precedence over the point to point communication. In the case of Indonesia, it will be more effective to provide these services by the satellite communication network than by the terrestrial transmission network.

Assume that the independent transmission network be established for video telephone and animation image communication services. Then, for the most part of other information media, such as voice, data and still image, the range of distribution is from several Kbit/s to several hundred Kbit/s. For integrating these kinds of information, it is preferable to combine and reduce their transmission bit rates to as small a number as possible so as to avoid the diversified signal classification and the complicated switch control.

When combining and reducing the transmission bit rates of different kinds of information, it will be rational and justifiable to place primary emphasis on the transmission bit rate of telephone network (64 Kbit/s) because at present, and in the future also, the most part of demand is for telephone communication. In other words, when the transmission bit rates of all kinds of information are set at (64 x n) Kbit/s, n is to be defined in the smallest possible number.

In what range to define n depends upon the demand behavior for all kinds of communication services, and this judgement requires utmost circumspection. For the practical way of defining n, Figure 2 arrangement will be worth consideration.

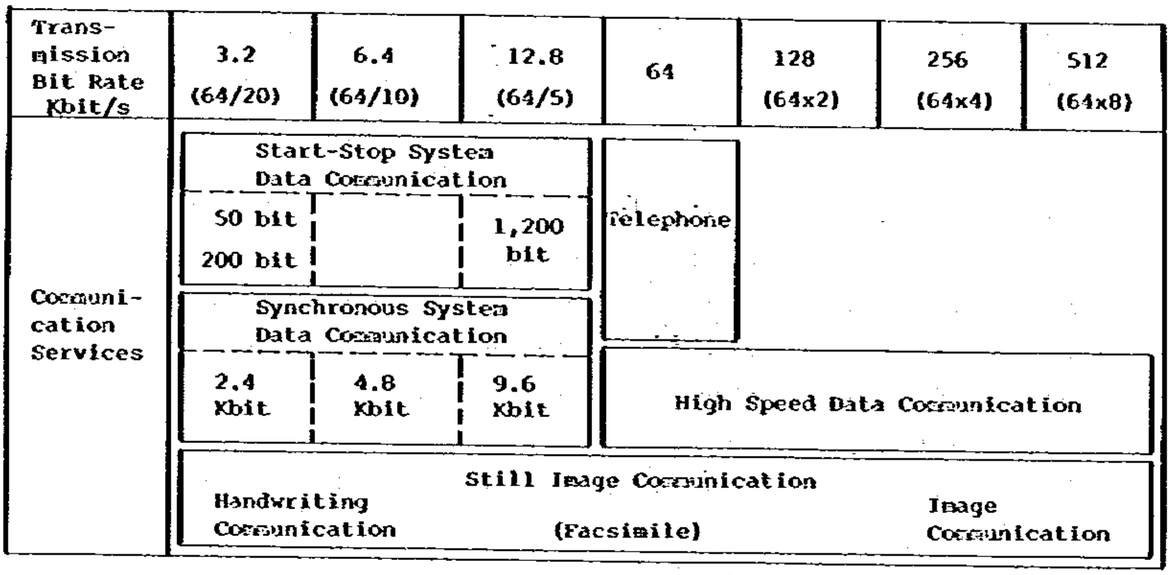


Figure 2 64 Kbit/s Network Block Diagram

Note: The multiplexing scheme for synchronous data networks are twofold: (6 + 2) envelope structure and (8 + 2) envelope structure. The former is used in Figure 2 arrangement. (For the two envelope structures, refer to CCITT Rec. X 50 and X51.) For the transmission route capacity setting, both systems make no difference. Therefore, in the study hereinafter, (6 + 2) envelope structure will be used.

2. Non-Voice Communication Service Trends

Demand for new communication services is fluid so that an accurate demand forecast is difficult. Especially for image communication and video telephone, development prospects as new media loom large; however, as of the present, it is next to impossbile to predict how much demand will arise in the near future. For data communication and facsimile that are already in service, the demand forecast is relatively easy. What is difficult is to estimate the appropriate transmission bit rate on the average of these two service items, though a higher transmission bit rate than in the past is foregone conclusion.

Thus, for non-voice communication service trends in Indonesia, there is need for investigation in full consideration of international trends. Such investigation is indispensable for the realization of integrated digital network.

3. Transmission Route Capacity Setting in Consideration of Non-Voice Communication Services

As previously stated, an accurate demand forecast for non-voice communication services is extremely difficult at the present stage. Therefore, in this study, main emphasis is on transmission route planning giving flexibility to the traffic carrying capacity of the route so that it can sufficiently meet even the unexpected new demand for non-voice communication services. More precisely:

(1) Non-voice communication circuit requirements (including leased circuits) forecasted in Chapter IV are mainly to cater for new demand for the existing service items, such as telegraphs, data communication and facsimile. The average transmission bit rate is set at 4,800 Kbit/s.

These kinds of information can be stored and re-transmitted so that the time occupancy rate of the circuits is lower than that of telephone circuits. When this fact is considered, it can be said that the average transmission bit rate quoted above leaves a sufficient margin.

The transmission bit rate of 4,800 Kbit/s shown in Figure 2 is one-tenth the transmission bit rate of telephone circuits. This means that one telephone circuit leaves room for ten non-voice communication circuits.

That in Chapter V the non-voice communication circuit requirements are estimated at 10% of the telephone circuits is based on the foregoing study result.

(2) For non-voice communication media other than telegraphs, data communication and facsimile, or the so-called new media, the circuit requirement forecast is difficult at the present stage. Hence, for the remedy, the transmission route with surplus capacity is planned.

Such is why (2 + 1) system is adopted for the terrestrial radio transmission system, though (1 + 1) system can suffice when the transmission system is composed of telephone circuits only. Such also constitutes one influential reason for the adoption of 1,920 channels, 140 Mbit/s submarine cable system.

APPENDIX V-2 Approach to Introduction of Solar Battery System

In Indonesia, the study team could obtain DATA IKLIM DI INDONESIA (Meteorological Data of Indonesia) of the past 10 years (1970 - 1979), published by DEPARTEMEN PERHUBUNGAN, PUSAT METEOROLOGI DAN GEOFISIKA. Based on this meteorological data, annual sunshine hours in the eastern region of Indonesia were estimated, and from this estimate were determined the basic requirements of the solar battery system that could be introduced in the proposed terrestrial transmission network.

The solar battery system is attracting attention as one of power supply sources to telecommunications equipment to be installed in the areas without AC mains. Of all merits of the solar battery system, worthy of note are: 1) relatively simple construction for local power generation; 2) free, unlimited energy source availability; and 3) no environmental pollution hazards.

However, at present, the solar battery element costs so much that the system application for telecommunications purposes still remains restricted. It is generally admitted that the solar battery system can break even only in case the load power consumption is 300 W at most. Hence, this study is on the assumption that the maximum load power consumption does not exceed 300 W.

On the other hand, considering the remarkable progress of system development and improvement up to the present, the cost of the solar battery element will be reduced broadly henceforward and the system applicability will be greatly increased in the not remote future. It is recommended that, in due consideration of the developmental trends from now, the introduction of the solar battery system be positively promoted.

1. Estimate of Sunshine Hours in Eastern Region of Indonesia

The aforementioned meteorological data contains not a few omissions by years and areas. Omissions for not more than two months per year were complemented by the data of other years or adjoining observation points. Figure 1 presents the annual sunshine hours at 28 observation points in the eastern region of Indonesia. When compared with the complemented data, considerable variations from one observation point to another are noticed.

Minimum annual sunshine hours are about 1,000, recorded at Basakih. The solar battery system requirements for the whole region can be safely estimated from the minimum sunshine hours at Basakih.

2. Determination of Solar Battery System Particulars

No measured value of radiant solar energy was available for determination of Basakih solar battery system particulars. For this reason, the following assumptions or estimates were made:

1) From the sunshine hours data collected, daily average sunshine hours of each month, by which to obtain the incident solar energy on the light absorbing element, were calculated.

2) The strength of solar energy radiation at the outer perimeter of the atmosphere was assumed to be constant. At the same time, an estimate was made as to the influence on solar energy radiation from the climate, geographic environment and seasonal changes in the tropical zone. Based on such assumption and estimate, the incident solar energy on the light absorbing element was calculated. From the incident

solar energy value thus obtained and from the required load power consumption, the optimum peak output power of the light absorbing element was determined.

3) The solar battery system capacity is so designed that, even in case no-sunshine days continue for 15 consecutive days, the system can make stable power supply to load.

By the foregoing assumptions and estimates, the number of solar battery modules and storage battery capacity required to feed the load power consumption were determined. The results appear in Figure 2. The solar battery system particulars at Basakih, based on Figure 2 requirements, are given in Table 1. Also shown in Table 1 for purpose of reference are the system particulars at Kayuwatu that recorded the second shortest annual sunshine hours after Basakih.

The study above is about the solar battery system applicable to Basakih, the place with the worst annual sunshine hours record in the eastern region of Indonesia. Hence, the system particulars determined are sufficient for use in all the objective areas of this study.

3. Solar Battery System Applicability Assessment

1) Power Consumption of Digital Microwave System

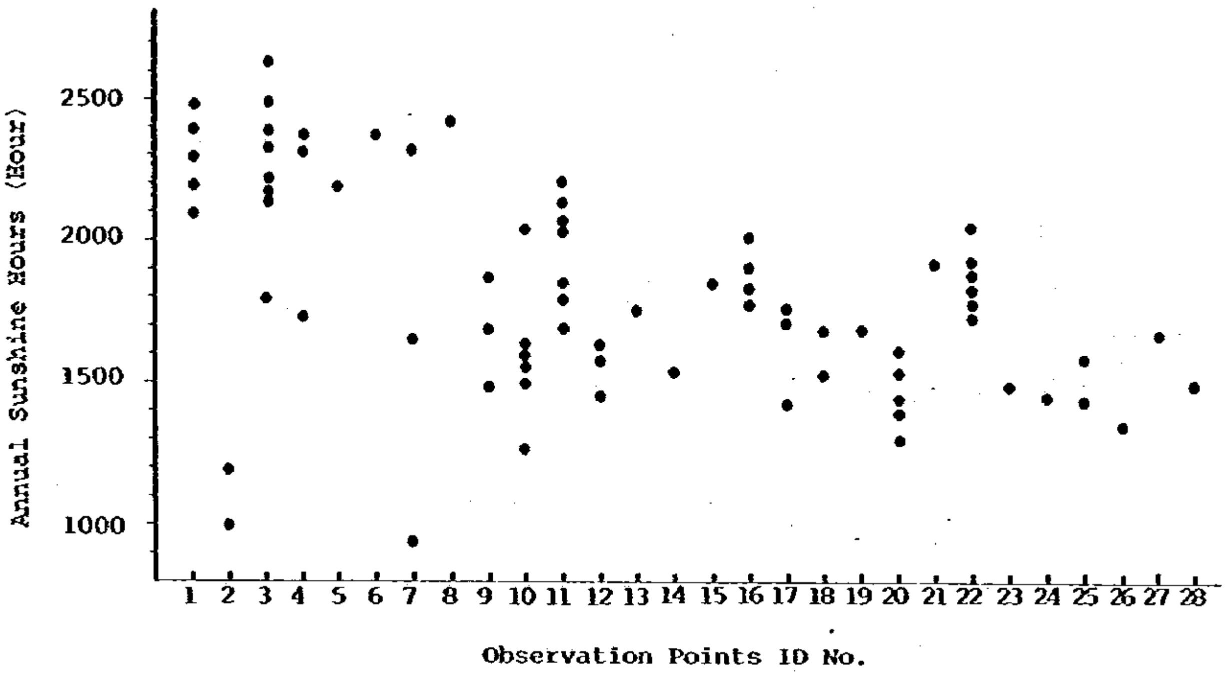
Approximate power consumption of each repeater station in the proposed digital microwave transmission system is as follows:

System	Transmission Capacity (Mbit/s)	Repeating System	Number of System	Power Consumption (W)
2 GHz	4x1, 8x1	Heterodyne	2+1	290
		Regenerative	"	400
6 GHz	34x1	Heterodyne	2+1	260
		Regenerative	"	400
	34x3	Heterodyne	2+1	260
		Regenerative	"	400

2) Stations to be Equipped with Solar Battery System

Insofar as the solar battery system can apply only to load power consumption not exceeding 300 W, stations that can be equipped with the system are bound to be those to adopt the heterodyne repeating system for both 2 GHz and 6 GHz transmission systems.

Power consumption figures quoted above are effective only when the station concerned is without extra power consuming loads, such as branching lines, space diversity system, automatic equalization function, and aircraft warning light. Actually, the situation differs from station to station. Therefore, the number of stations that can be equipped with the solar battery system will be considerably reduced.



1.	Deapasar	(Bali)	16.	Gorontalo	(Sulamesi)
2.	Besakih	(")	17.	Tompaso	(")
3.	Ampenang	(Nus.Barat)	18.	Manado	(")
4.	Sumbawa Basar	(")	19.	Samratulangi	(")
5.	Waingapu	(Nus.Timor)	20.	Kayumato	(")
6.	Manmere	(")	21.	Bitung	(")
7.	Kupang	(")	22.	Ternate	(Maluku)
8.	Dili	(Timor Timor)	23.	Manokwari	(Irian Jaya)
9.	Manasa	(Sulamesi)	24.	Ransiki	(")
10.	Panakukang	(")	25.	Biak	(")
11.	Hasanudin	(")	26.	Ganyem	(")
12.	P.G Bone	(")	27.	Sentani	(")
13.	Naha	(")	28.	Jayapura	(")
14.	Ambon	(Maluku)			
15.	Palu	(Sulawesi)			

Figure 1 Annual Sunshine Hours in the Eastern Region of Indonesia

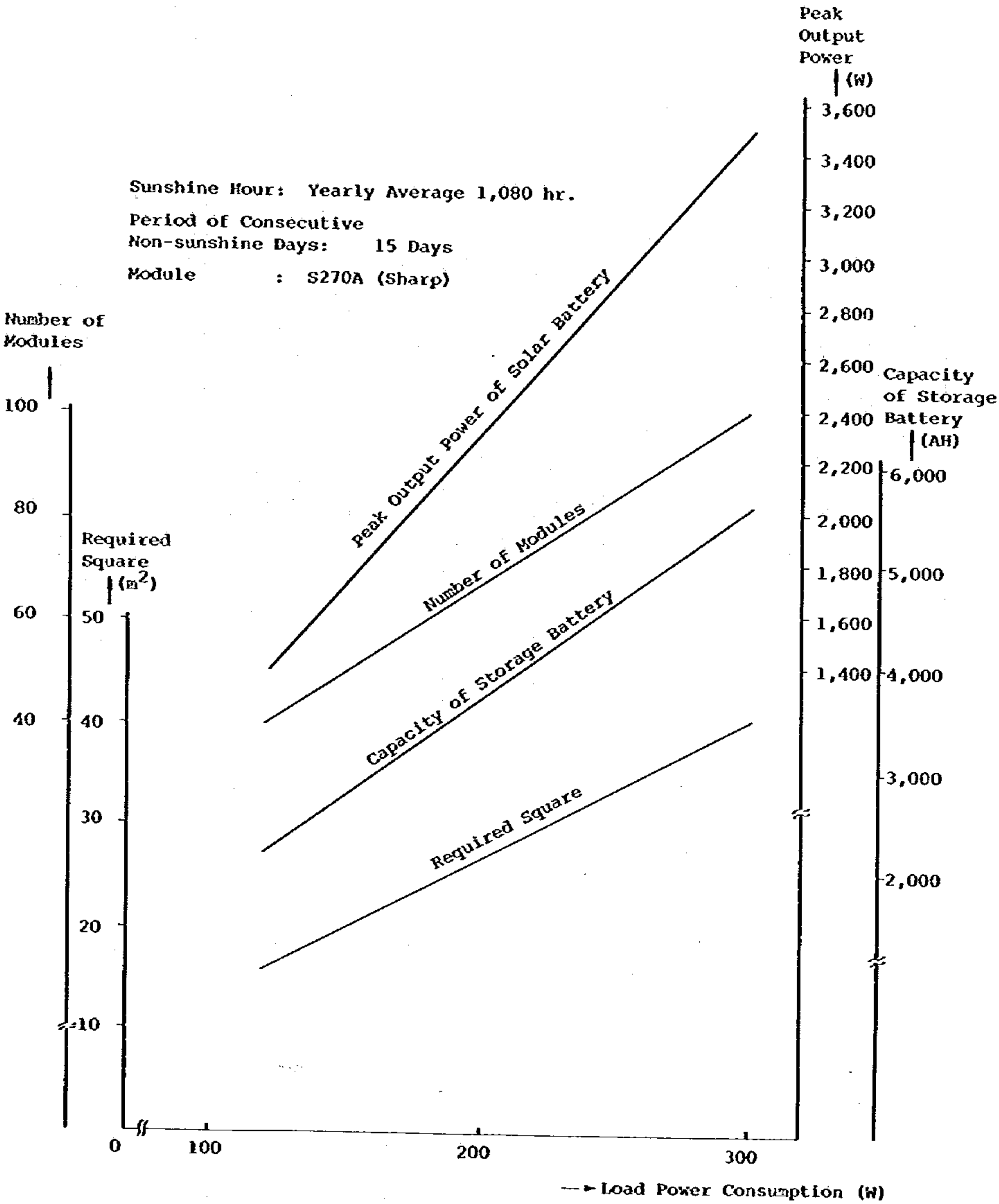


Figure 2 Calculation Results of Solar Battery System Particulars

Table 1 Determination of Solar Battery System Particulars

		Basakih				Kayuwatu	Note
		120W	180W	200W	300W	200W	
Annual Average Sunshine Hours		1,077 hr				1,464 hr	
District	Place	Bali				Sul. Utara	
	Latitude	08° 22' S				01° 33' N	
	Longitude	115° 28' E				124° 55' E	
Peak Output Power		1,400W	2,100W	2,310W	3,500W	2,240W	
Number of Modules		20px2S	30px2S	33px2S	50px2S	32Px2S	P: Parallel S: Sevies
Capacity of stokage Battery		2,800 (2236)	3,600 (3354)	4,000 (3794)	6,000 (5590)	4,000 AH (3533)	( ) Calculated values
Required Square (m^2)		16.1	24.1	26.5	40.2	25.7 m^2	

Appendix VI-1 Seabed Topography and Geological Features in Indonesia

The Plate tectonics theory is now the most remarkable theory in the geophysics field, and is accepted by many geologists. The theory says that a huge continent, which is called Pangea and existed in ancient times (about 300 mil years ago), was divided into such continents as South Ameria, Africa, India, Australia and the Antarctica by force of mantle convection. Then these continents gradually separated away from each other and moved to the present locations. According to this theory, Australia plate separated from the Antarctica plate and went up to the north, and hit Eurasia plate; the Pacific Ocean and Philippine Sea plates moved to the west; as a result, these plates collided and complicatedly affected each other in the Southeast Asia regions, particularly, in the Indonesia region. A trench is generally formed at the boundary where plates sink under the continent. (Such boundary is called subduction zone.) Around here, along the continent, islands are formed in one row (island arc) or two rows (double islands arc). In the underground, distortion by subduction and friction between plates accumulate energy to cause volcanic activities and earthquakes.
(Reference: "Tectonics of the Indonesia Region")

Around Indonesia, there can be observed subduction zone mentioned above, islands and trenches formed by the subduction and deep sea parts which are thought to be formed owing to the subduction. They are:

Trench .... Java Trench, North Sulawesi Trench, New Guinea Trench
Trough .... Timor Trough, Ceram Trough
Deep sea ..... Philippine Basin, Banda Basin, Flores Basin, Celebes Basin, Savu Basin
Island arc ... Sunda archipelago, Maluku Islands.

In addition to them, there is the continental shelf which was a part of the land during the glacial period:

Continental shelf ... Java Sea (central and western parts),
Arafura Sea.

Thus Indonesia is surrounded by some plates and has complicated structure which is a mixture of; trenches and basins which can be explained by the plate tectonics theory; and shallow sea or continental shelves. On the oter hand, the geological survey on the land of Indonesian islands has already been conducted and the result has been publicized. However, for the seabed, only the bottom material survey report* on the Java Sea is available. As for the other regions, data is described dispersedly in charts only.

* Reference: "Underwater Handbook, South China and Japan Sea, by Hydrographer of U.K. Navy", N.P.623.

The following is a preliminary examination result of charts and publicized ocean survey reports on each region.

(1) Central eastern part of Java Sea

A continental shelf, extending from the Malay Peninsula, lies in between western and central part of the Java Sea. The shelf is shallow and covered with sediment. According to the references, the bottom material is mainly mud, but mud/sand lie along coast of Java and Kalimantan. At the end of the shelf, coral reefs lies in a row.

In the eastern part of the Jave Sea, the Makassar Strait and Flores Sea lie. They are 2,000 m in depth and are studded with small islands surrounded by coral reefs. According to the charts, mud is the main geological feature in this region, and stones and ooze are seen in some places.

(2) Flores Sea

The western part is connected to the Java Sea and has medium depth. The other parts are occupied by more than 2,000 m deep basins. The bottom material consists of mud and partially sand. Although there is few depth measurement data, the slope is estimated to be steep (on the average, 15°). Many volcanic islands form island arc in the southern part.

(3) Banda Sea

More than 3,000 m deep basins lie in Banda Sea. The bottom material is mud in many places, and the existence of stone is reported in about 5,000 m deep places. There are mountains close to the coast. There are many stone beaches but less sandy beaches. Coral reefs can also be found in many places.

It is said that an arching subduction zone adjoining Timor Trough lies in the east of the Banda Sea. Inside the arch, there lie active volcanic islands.

(4) Molucca Sea and Halmahera Sea

Both seas have complicated seabeds. Eastern parts of the Molucca Sea is more than 4,000 m in depth and has steep slopes; central western parts are about 2,000 m in depth. According to the charts, materials consist of mainly sand, but stones, mud and ooze can be seen in some places as well.

There is an active volcanic belt in the east of the Molucaca Sea and in Halmahera Island. The depth of Halmahera Sea is less than 2,000 m. The coastline is formed of coral reefs.

(5) Ceram Sea

The subduction zone beginning from the east of the Banda Sea continues up to the southern part of the Ceram Sea. There are partly 5,000 m deep seas. Since only a few data are available, typical material cannot be specified, but it is reported that bottom materials are clay, mud and stones.

(6) Arafura Sea

The sea is a part of the shelf of continent including Australia and New Guinea, so that most of the sea is less than 200 m deep. The bottom material is mainly mud.

(7) Savu Sea

The Savu Sea is a small sea which is surrounded by such islands as Flores, Sumba and Timor. Insufficient depth measurement data in charts gives no clear geography. The depth is over 3,000 m. It is thought that the sea was formed by the activity of Timor Trough subduction. The bottom material of deep part is mud.

(8) Pacific Ocean in northern Irian Jaya

The slope between the land and sea is practically steep and goes down to about 3,000 m deep bottom in the Pacific Ocean. There are some faults near the land, and to the north of them the existence of a subduction zone is known. Although few depth data is available, it is assumed that the geography is complicated near the land. The bottom material cannot be typified owing to few data, but it is considered to be mud.

Appendix VI-2 Development Status of Optical Submarine Cable

1. Background

The modern coaxial submarine cable has increased its capacity of telephone transmission up to between 4,000-5,000 channels. However, further increase of the capacity has come to its limit in terms of technology and such enhancement no longer brings lower price. Therefore, new development of an economic system has been required.

On the other hand, digital technique, being superior in economization, flexibility, extensity and maintenability of system, has been introduced to land transmission lines and switches to meet such new service as data communication. This has pushed the submarine cable to be digitized so that it can share the same advantage with the switches and land transmission lines as described above.

Today, the low loss optical fiber and high performance laser diode are being materialized. It is expected that digital submarine cable system using optical fibers can meet the above two technique.

2. Research and Development

In 1966, Mr. Kao proved that optical fiber would be adaptable to communication. Then, laboratories opened the gate to its practical application. Recently it has been introduced in shorter transmission lines of land systems.

At the moment, principal laboratories in the world are developing the submarine cable system which uses optical fibers and can transmit a big capacity of channels at medium or long distance. Toward the end of 1980s, it will be expected to be practically applied. The laboratories has publicized the design objectives of the system they are now developing as shown in Table AVI-2-1.*

* I.YAMASHITA, et al.:

"The Application of Optical Fibers in Submarine Cable System," Telecommunication Journal, Vol. 49-II, 1982.

3. Development of medium capacity optical submarine cable

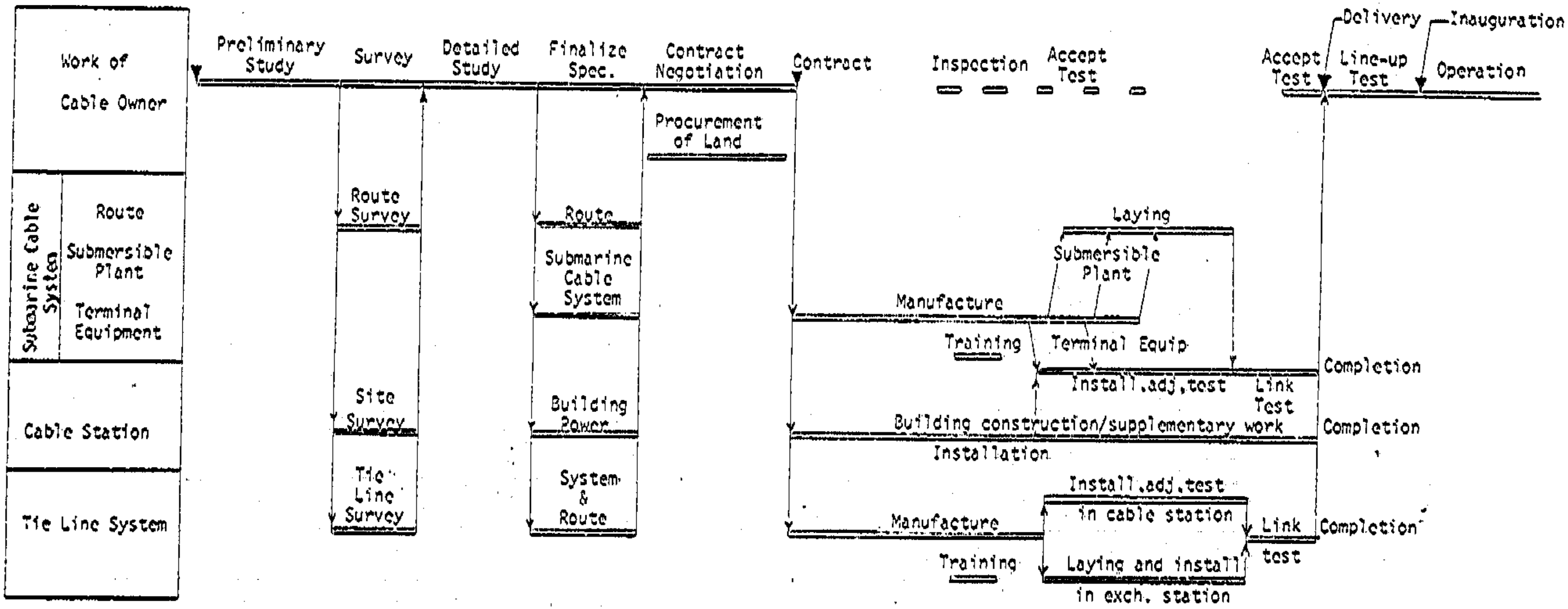
It can be said that medium distance (e.g., 1,500 Km) system, which has medium capacity (e.g., 2,000 ch) and is adaptable to the eastern part of Indonesia, will be feasible by using a part of technique which is now being developed for a large capacity system. This system will be expected to be practically applied in 1986 or so. However, the demand for the medium capacity system cannot be predicted at present. Thus, it seems that no manufacturers in the world have begun to design this type of system with full efforts.

For a short distance system, which is about 50 Km long and does not need a repeater, a new submarine cable system will be available in about 1984. The new system can accommodate small to medium capacity by changing its bit rate.

Table AVI-2-1 Objectives of Optical Submarine Cable Systems

		System Length (Km)	Bit Rate (Mbit/s)	Number of Subsystems	Telephone Ch per Subsystem	Repeater Span (Km)	Wavelength (m)
United States		8,000	274	Max 3	4,302	25-50	1.3
United Kingdom		7,500	140-280	1-5	1,920-3,840	25-50	1.3
France		10,000	140-280	1-4	1,920-3,840	25-50	1.3, 1.55
Japan	NTTPC	1,000	400	2-3	5,760	25-50	1.3
	KDD	10,000	260-300	Max 3	4,000	30-50	1.3

Appendix VI-3 Typical Procedure of Submarine Cable Project



Note : The length of horizontal axis does not necessarily correspond to the number of days required.

Appendix VI-4 Maintenance of Submarine Cable

Transmission link via submarine cable system is normally characterized as shown in Figure AVI-4-1. (with cable stations being established near the shore)

Submarine cable system is divided in two main portions:

(1) Submarine cable portion (including cable and repeaters)

(2) Cable terminal equipment (including power equipment to energize the repeaters, orderwire equipment and system maintenance equipment

The maintenance of ordinary transmission equipment and power facilities will be carried out in the cable station and the method of maintenance can be found in documents elsewhere, and thus not treated in this appendix.

The maintenance of cable terminal equipment and repair of submarine cable portion would require new knowledge, thus in this appendix the former is treated briefly and the latter is introduced mainly in view of cable ship.

1. Maintenance at cable station

   The submarine cable station has often duplicated equipment for important portions of terminal equipment and power equipment, in order to enhance the reliability of cable system.

   The following measures are required to reduce maintenance work in the station:

   - Duplication/automatic switch-over of important transmission equipment
   - Fewer adjusting points

- Enhanced monitoring function
- Automated measuring equipment

It is better to provide a maintenance instruction manual in order to conduct maintenance work smoothly.

The manual should regulates:

- Responsible officers for maintenance
- Maintenance procedure
- Procedure in the case of trouble
- Point of contract

2. Maintenance of submarine cable

In general, repair of submarine cables quite often requires a large scale of work using cable repair ships, and a lot of time and money until the recovery. Therefore, the cable route must be kept away from anchoring or trolling areas as well as the sea area where there is high possibility of troubles due to the natural phenomena. It is effective, to lessen such troubles caused by human activities, that submarine cable operating companies take protective measures, for example, to give cable warning charts to shipping companies, fishermen's unions, hydrographic office, offshore oil drilling organization and ask them for the protection of cables.

The repair requires the plant of the same specification as the laid cables and repeaters. Thus, at the time of cable construction, certain amount of spare cable and repeaters should be procured based on the length of the cable and submarine environment.

3. Cable ship

The repair of submarine cables requires cable ships equipped with special gears for cable laying and repairing. The cable ship anchors in a harbor at normal times and is prepared with cable repair equipment so that when required, the ship can be dispatched and operated immediately. On the ship, crews and cable engineers are trained periodically to maintain and enhance repairing capability. Particuarly, jointing of cables requires special technique, so that, in many cases, training is coducted periodically to certify qualified jointers.

3-1 Providing of cable ships

The following describes how to provide cable ships:

(1) Possession of own cable ship

A country provides its own cable ship when many domestic submarine cables are laid or a foreign cable ship is not allowed to enter the territorial waters. The country carries out the repair on its own responsibility.

Advantage: The cables are repaired by the ship of its own, so that no territorial problems emerge, and priority or the extent of emergency can be decided by itself.

Disadvantage: The huge construction (or procurement) cost of cable ship must be at one country's expense. In addition, a considerable expense for maintenance, administration, refit and so on is continuously required for the ship.

(2) Possession of common cable ship

Some countries (e.g. ASEAN countries) possess their cable ship in common for repair of the cables which these countries operate and manage. The responsibility for cable repair depends on the method of operation and management of the cable ship.

Advantage: Ownership and priority can be defined. Expense is shared among countries and thus it becomes less than the case (1).

Disadvantage: A large amount of cost is required.

(3) Charter of cable ship when necessary (charter base)

When a submarine cable requires repairing, the owner regotiates with a foreign cable ship owner on chartering a ship. The responsibility for repairing is decided by the negotiation.

Advantage: No Expense occurs periodically. Expense is only for repair works and is decided by negotiation with the ship owner. As the expense on charter base is generally high, it is favorable when cable faults occur less frequency (and unfavorable for frequent faults).

Disadvantage: When a cable ship is not available nearby or an appropriate ship is engaging in other works, it may take time to find a ship which can be chartered. As a result, speedy repair cannot be expected.

(4) Agreement on the Use of Cable ship (standby cost base)

Many cable operating companies make an agreement with cable ship owner on the use of cable ship. They are charged periodically with expenses of ship which is called standby cost and includes depreciation account, cost of repairs or refits, salaries of crew, taxes, administration fee and so on. The expense is shared by cable operating companies in proportion to the cable length, or cable length and number of channels.

In general, a cable ship owner has the responsibility for cable repair.

Advantage: The priority can be defined for the dispatch of cable ship.

Disadvantage: as the number of cables which is taken into the ship's coverage of maintenance increases, the standby cost decreases accordingly. However, this increases the possibility that the ship is engaging in the other works in case of need.

The maintenance of international submarine cables is mostly conducted by the standby cost base described in case (4). The dispatching priority of the ship and allotment of maintenance expenses (standby cost) are regulated based on the agreement. When the cable ship engages in repair work, the cable operating company is responsible for paying all expenses incurred, such as standby cost, running cost and the cost of used cable or repeaters.

3-2 Main cable ships

Table AVI-4-1 shows existing main cable ships in the world.

4. Storage of spares

Spare cables, being long and heavy, is often stored on land in strong containers (pans and tanks, etc.) after wound in a proper diameter. The cable operating company which has a lot of cables keeps plenty of spare cables as well. Thus the company must have a vast storage place (called cable depot) at the seaside so that it can quickly load cables to a cable ship when necessary. The spare repeaters must be kept away from vibration, shock and high temperature and are stored in the warehouse which is constructed in the cable depot.

Spare parts of terminal equipment are usually stored in the cable station.

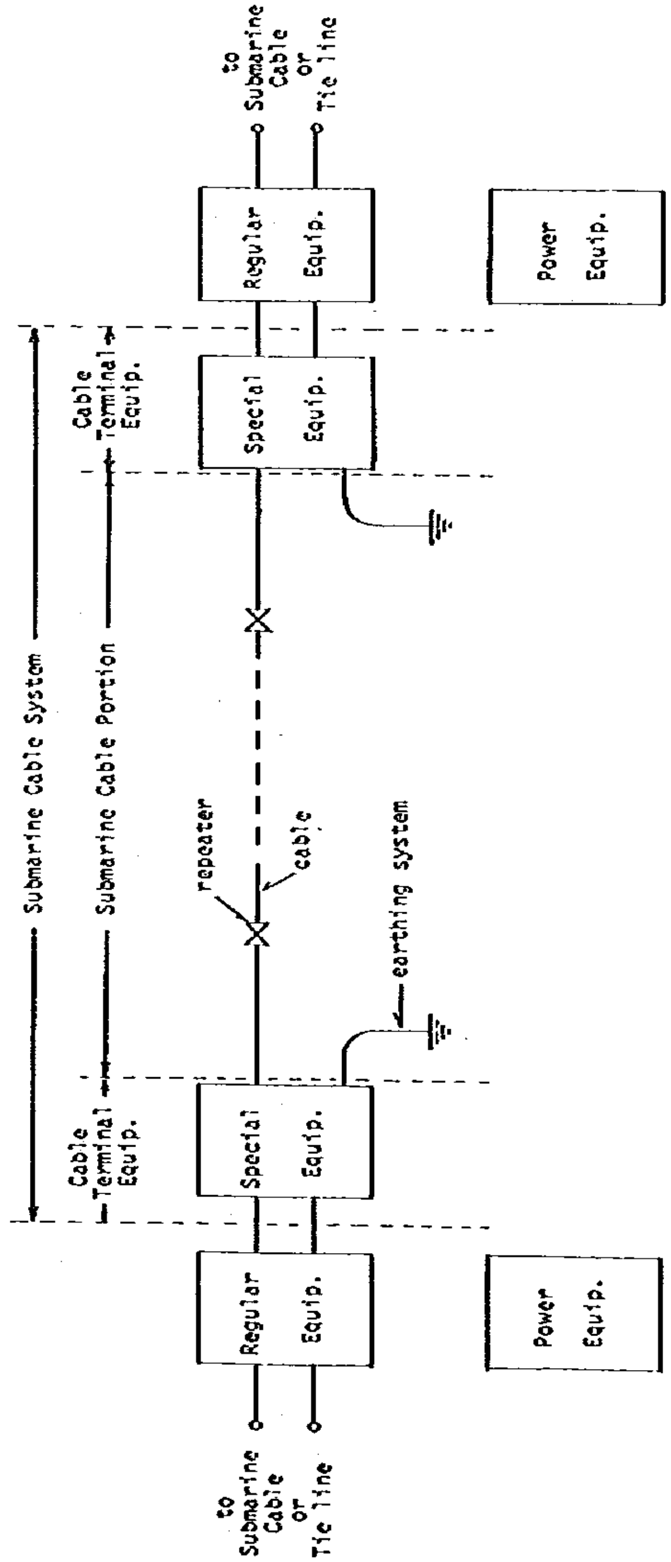


Figure AVI-4-1 Formation of Submarine Cable Link

AVI-4-7 (A113)

Table AVI-4-1 Main Cableships of the World

Name of Ship	Flag & Owner	Base	Built in	Gross tons	Crew	Length (m)	Power (HP)	Speed (knot)
Recorder	U.K. (C&W)	Singapore	1954	3,284	91	104	2,000	11.5
Alert	U.K. (BTI)	Southampton	1961	6,083	109	130	4,400	14
Retriever	U.K. (C&W)	Suva	1961	4,218	96	112	3,300	13
Cable Venture	U.K. (C&W)	Vigo	1962	8,399	118	151	5,125	13
Mercury	U.K. (C&W)	Bermuda	1962	8,962	135	144	6,000	14.5
Ingul	USSR (V/D SUDIM)	Nakhodka	1962	5,644	122	130	4,940	14
C.S.Long Lines	U.S.A. (AT&T)	Wilmington	1963	11,326	93	156	8,500	15
Cable Enterprise	U.K. (C&W)	Honolulu	1964	4,358	97	112	3,300	13
John Cabot	Canada (COTC)	St. Johns	1965	5,097	85	96	9,000	16
KDD Maru	Japan (KDD)	Yokohama	1967	4,257	76	114	4,400	16
Tsugaru Maru	Japan (NTTPC)	Yokohama	1969	1,662	60	85	3,000	13.5
Vercors	France (C&R)	Brest	1974	5,886	84	133	6,000	16.5
Kuroshio Maru	Japan (NTTPC)	Yokohama	1975	3,345	80	119	8,900	16.5
Monarch	U.K. (BTI)	Southampton	1975	3,874	64	97	5,200	15
Youdian Yi-Hao	China (SPT)	Shanghai	1976	1,327		71	2,200	14