8. プロジェクトの実行計画

8.1 実行計画の策定の方針

建設期間は、3年以内とする。

実行計画は、経済・社会及び技術評価から合理的で実現可能なものとする。

2つの試案、すなわち、第1段階でルソン地域を対象とするものと、全国縦貫のOH幹線を対象とするものにより策定する。この2つの試案を比較した後に、最適の計画を採用する。

8.2 気象通信網実行計画

以下に述べるように2つの案が検討された。

スケジュールは、Table 8.1、(1／2)～(2／2)に、実行費用の年度別積算は、Table 8.2、(1／4)～(4／4)に示した。

8.2.1 第1案

本案では、最初にルソン地域気象通信網を整備し、次にビサヤ、ミンダナオ地域気象通信網が整備される。

第1年目の内容は、ルソン地域のOH機器、VHF機器、予備電源、気象測器、ミニコン等の製作及び中継所のアクセス道路、局舎等の整備である。第2年目の内容は、第1年目製作機器を設置すると共に、ビサヤ、ミンダナオ地域のOH機器の製作及び残りの中継所のアクセス道路、局舎等の整備である。第3年目の内容は、第2年目製作機器を設置すると共に、残りのVHF、全HF及びファクシミリの製作、設置を行う。

第1案によれば、第2年目にルソン地域の通信・通話が可能となり、第3年目で、ビサヤ、ミンダナオ地域も通信・通話が可能となる。

特徴は次のとおりである。

(1) 台風来襲頻度63%を示しているルソン地域を始めに実施するので、経済的メリットが大きい。

(2) 第2案と違って、機器装置は、同時には製作されない。しかし、コストには大きな差はない。

Table 8-1 (1/2)

Schedule of Implementation Plan on the Project

1st Plan

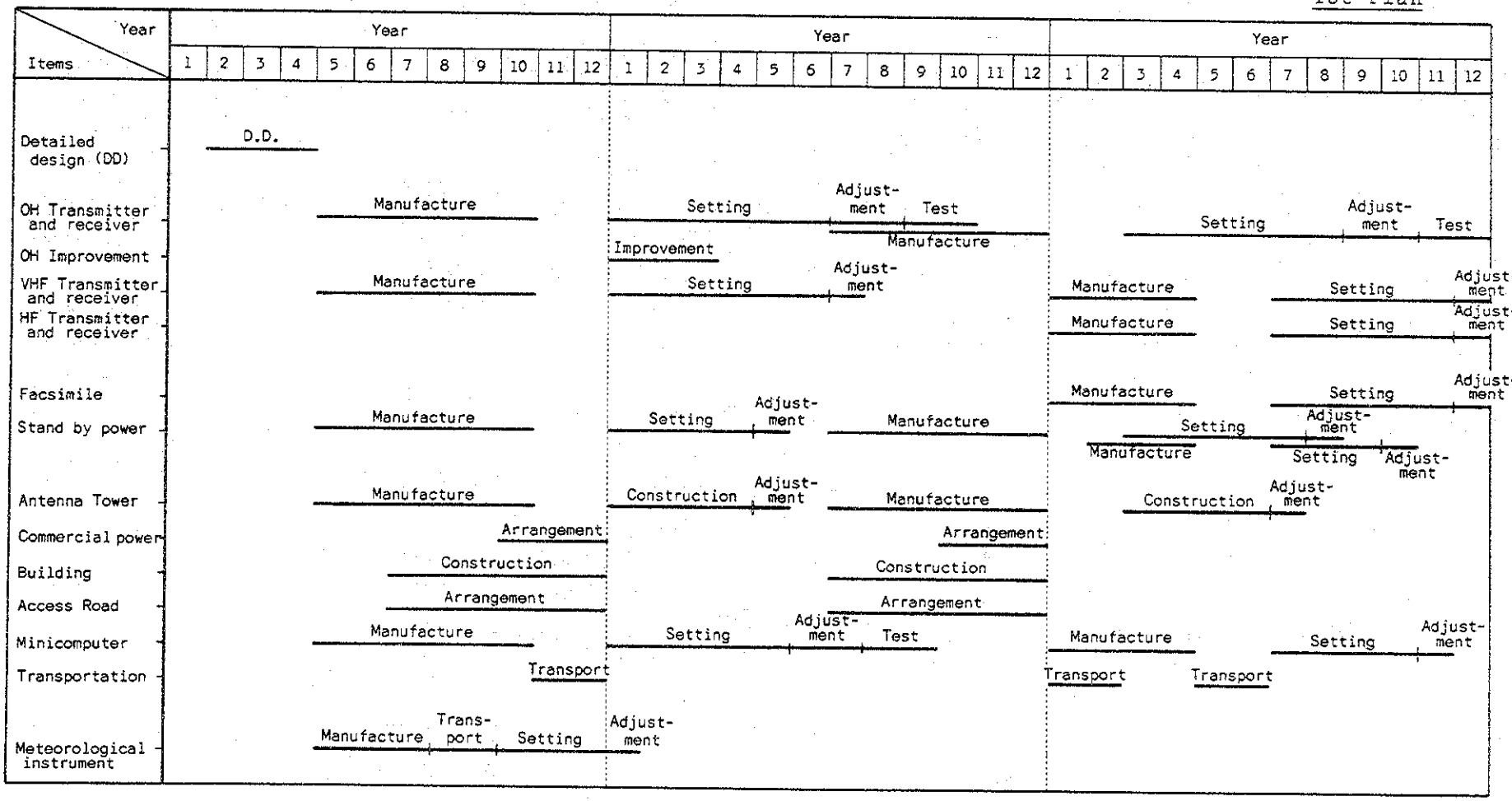
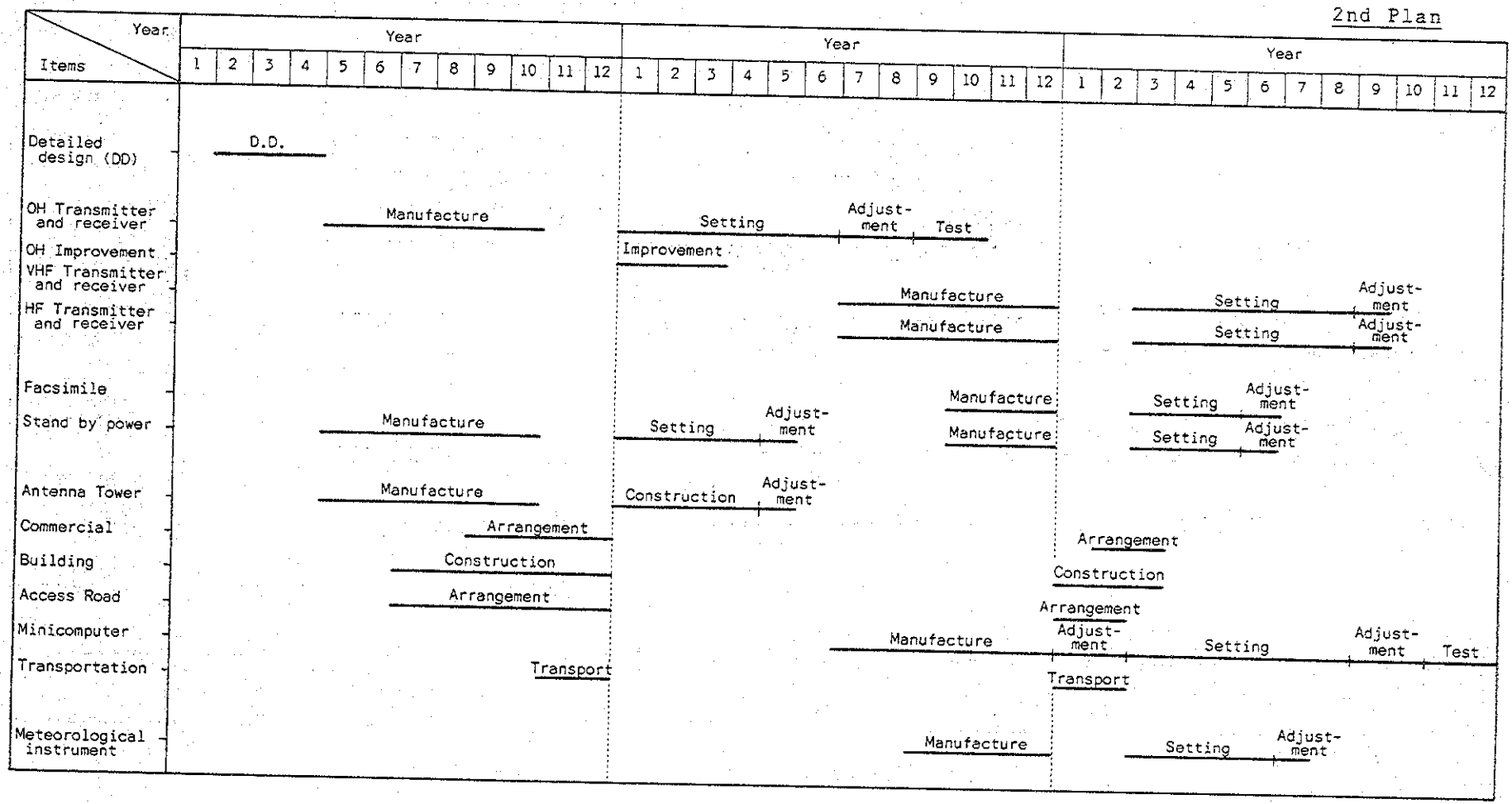


Table 8-1 (2/2)

Schedule of Implementation Plan on the Project



(Manufacture: OH main trunk equipments)

(Setting: OH equipments
Manufacture: VHF & other equipments)

(Setting: VHF, HF, equipments and Minicom.)

Table 8.2 (1/4)

1st Plan

Cost Estimation

Unit: ₱10³

Items	1st Year		2nd Year		3rd Year		Total	
	*1 F	*1 L	F	L	F	L	F	L
OH equipment	31,016		34,011				65,027	
Improvement of OH equipment			3,548				3,548	
VHF equipment	15,000				2,646		17,646	
HF equipment					9,128		9,128	
FAX equipment					3,412		3,412	
Peripheral or ARQ	6,884		395		9,052		16,331	
Mini computer	32,009		13,252				45,261	
Stand-by power supply	5,728		7,301		849		13,878	
Installation cost for all the aboves			18,860	333	22,459	395	41,319	728
Transportation cost for all the aboves	1,890			213	2,204	325	4,094	538
Antenna tower *2	1,818		4,454	908		2,852	6,272	3,760
Commercial power		987		1,911				2,898
Station building		2,957		4,048				7,005
Access road		2,617		4,363				6,980
Meteorological instrument *2	7,183	190					7,183	190
Total	101,528	6,751	81,821	11,776	49,750	3,572	233,099	22,099
Engineering & Administration	10,152	675	8,182	1,178	4,975	357	23,309	2,210
Physical contingency	10,152	675	8,182	1,178	4,975	357	23,309	2,210
Sub Total	121,832	8,101	98,185	14,132	59,700	4,286	279,717	26,519
Price contingency	4,922	2,612	6,010	7,361	4,921	3,210	15,853	13,183
Grand Total	126,754	10,713	104,195	21,493	64,621	7,496	295,570	39,702
Grand Total	137,467		125,688		72,117		335,272	

Notes: *1 F: Foreign currency portion, L: Local currency portion
*2 Including installation and transportation cost.

Table 8.2 (2/4)

Luzon Area

Unit: ₱10³

Items	1st Year		2nd Year		3rd Year		Total	
	*1 F	*1 L	F	L	F	L	F	L
OH equipment	31,016						31,016	
Improvement of OH equipment			3,548				3,548	
VHF equipment	15,000						15,000	
HF equipment					3,260		3,260	
FAX equipment					2,881		2,881	
Peripheral or ARQ	6,884				2,881		9,765	
Mini computer	32,009		11,372				43,381	
Stand-by power supply	5,728				243		5,971	
Installation cost for all the aboves			18,860	333	2,545	24	21,405	357
Transportation cost for all the aboves	1,890			213	190	68	2,080	281
Antenna tower *2	1,818			908			1,818	908
Commercial power		987						987
Station building		2,957		1,091				4,048
Access road		2,617						2,617
Meteorological instrument *2	4,789	127					4,789	127
Total	99,134	6,688	33,780	2,545	12,000	92	144,914	9,325
Engineering & Administration	9,913	669	3,378	255	1,200	9	14,491	933
Physical contingency	9,913	669	3,378	255	1,200	9	14,491	933
Sub Total	118,960	8,026	40,536	3,055	14,400	110	173,896	11,191
Price contingency	4,806	2,588	2,481	1,591	1,187	82	8,474	4,261
Grand Total	123,766	10,614	43,017	4,646	15,587	192	182,370	15,452
Grand Total	134,380		47,663		15,779		197,822	

Notes: *1 F: Foreign currency portion, L: Local currency portion
*2 Including installation and transportation cost.

Table 8.2 (3/4)

Visayas and Mindanao Area

Unit: ₱10^3

Items	1st Year		2nd Year		3rd Year		Total	
	*1 F	*1 L	F	L	F	L	F	L
OH equipment			34,011				34,011	
Improvement of OH equipment							-	
VHF equipment					2,646		2,646	
HF equipment					5,868		5,868	
FAX equipment					531		531	
Peripheral or ARQ			395		6,171		6,566	
Mini computer			1,880				1,880	
Stand-by power supply			7,301		606		7,907	
Installation cost for all the aboves					19,914	371	19,914	371
Transportation cost for all the aboves					2,014	257	2,014	257
Antenna tower *2			4,454			2,852	4,454	2,852
Commercial power				1,911				1,911
Station building				2,957				2,957
Access road				4,363				4,363
Meteorological instrument *2	2,394	63					2,394	63
Total	2,394	63	48,041	9,231	37,750	3,480	88,185	12,774
Engineering & Administration	239	6	4,804	923	3,775	348	8,818	1,277
Physical contingency	239	6	4,804	923	3,775	348	8,818	1,277
Sub Total	2,872	75	57,649	11,077	45,300	4,176	105,821	15,328
Price contingency	116	24	3,529	5,770	3,734	3,128	7,379	8,922
Grand Total	2,988	99	61,178	16,847	49,034	7,304	113,200	24,250
Grand Total	3,087		78,025		56,338		137,450	

Notes: *1 F: Foreign currency portion, L: Local currency portion
*2 Including installation and transportation cost.

Table 8.2 (4/4)

Cost Estimation

2nd Plan

Unit: ₱10³

Items	1st Year		2nd Year		3rd Year		Total	
	*1 F	*1 L	F	L	F	L	F	L
OH equipment	65,027						65,027	
Improvement of OH equipment			3,548				3,548	
VHF equipment			17,646				17,646	
HF equipment			9,128				9,128	
FAX equipment			3,412				3,412	
Peripheral or ARQ	1,168		15,163				16,331	
Mini computer			33,889		11,372		45,261	
Stand-by power supply	11,543		2,335				13,878	
Installation cost for all the aboves			26,459	607	14,860	121	41,319	728
Transportation cost for all the aboves	2,957			212	1,137	326	4,094	538
Antenna tower *2	6,272			3,760			6,272	3,760
Commercial power		2,819				79		2,898
Station building		4,013				2,992		7,005
Access road		6,889				91		6,980
Meteorological instrument *2					7,183	190	7,183	190
Total	86,967	13,721	111,580	4,579	34,552	3,799	233,099	22,099
Engineering & Administration	8,697	1,372	11,158	458	3,455	379	23,310	2,209
Physical contingency	8,696	1,372	11,158	458	3,455	380	23,309	2,210
Sub Total	104,360	16,465	133,896	5,495	41,462	4,558	279,718	26,518
Price contingency	4,216	5,310	8,196	2,862	3,418	3,414	15,830	11,586
Grand Total	108,576	21,775	142,092	8,357	44,880	7,972	295,548	38,104
Grand Total	130,351		150,449		52,852		333,652	

Notes: *1 F: Foreign currency portion, L: Local currency portion
*2 Including installation and transportation cost.

(3) 全経費は、建設期間の３年にわたって比較的均等に配分されている。

8.2.2 第２案

本案では、最初にＯＨ幹線通信網を整備し、次に、ＶＨＦ、ＨＦ通信網が整備される。

第１年目の内容は、ＯＨ幹線機器、予備電源等の製作及び中継所のアクセス道路、局舎等を整備する。第２年目の内容は、整備されたＯＨ機器を設置すると共に、VHF、ＨＦ、ミニコン、気象測器の製作である。第３年目で、ＶＨＦ関係中継局舎、アクセス道路を整備し、第２年目製作機器の設置を行う。

これにより、第２年目で幹線が開通し、そのブランチ観測所（８）の通信、通話も可能となり、第３年目でその他の観測所の通信、通話が可能となる。

特徴は次のとおりとする。

(1) 通信制御ミニコンが、ＯＨ幹線の構築に特に必要でないので、その設置は、ＶＨＦ通信回線の展開時でよい。

(2) 機器が一括製作されるので、コスト的メリットはある。

(3) 経費は、１年目、２年目に片寄っている。

8.2.3 比較検討の結果

この Feasibility Study における実行計画は、建設経費的にも、期間的にも合理的で実行可能なことが条件である。

したがって、前項で述べた事項を比較検討した結果、第１案が、このプロジェクトの実行計画として採用された。

(1) ルソン地域の気象通信網整備である第１案は、回線が２年目で構築され、通信、通話が可能となり、メリットが大きい。

(2) 両案とも、１年目の機器製作で研修し、２年目の設置で運用体制に移行するパターンであるが、第１案の方がＯＨ、ＶＨＦ共に移行出来るので、メリットが大きい。

(3) 経済比較の結果、即ち、１０％デスカウントした正味便益の現在の値を比較したものであるが、第１案の方が第２案よりも大きいことが見出された。従って、第１案の方が有利という結論を得た。（便益－費用）を両案について算定した結果を Table 8.3 及び 8.4 に示す。

この経済比較では、下記８点が想定されている。

(i) ＯＨ幹線を完成した時の便益は、対象６４局のうち、ＯＨ経由局８局のみが効果を発揮しうるものと想定し、全体便益の 8／64 を計上した。

(ii) ルソン地域の４支線網も含め、完成した時の便益は、Table 2.15 に示すとおり台風来襲頻度に基き全体便益の６３％が発生するものと想定した。

(iii) プロジェクトの便益としては、デルファイ法（9.1.3参照）によって算定した。予測台風被害の１７.４％を想定した。

（4） 第１案は、PAGASA の開発計画に合致している。

9. プロジェクトの評価

9.1 プロジェクトの予想効果

9.1.1 プロジェクトの災害防止と生産向上に及ぼす効果

本計画の完成により、気象情報の収集と配信がより正解、かつ、より迅速になることが期待される。その結果として、さらに信頼性の高い予報及び警報が、よりすみやかに一般大衆に伝達されることになる。本プロジェクトの効果は、次の2つに区分される。そのひとつは「防止効果」で、それは、自然災害の被害を軽減する効果であり、2つ目は「生産効果」で、これは例えば、農業の生産が増大する効果である。

本プロジェクトの防止効果は、先の2.4.3節に記述した通りであるが、以下にその概略を示す。

(1) 台風もしくは洪水によって生じる農作物、家畜、養魚の直接的被害の軽減

(2) 台風もしくは洪水によって生じる家屋及び建造物の直接的被害の軽減

(3) 台風もしくは洪水により被害を受けた鉄道、道路、橋梁の復旧促進

(4) 航空機及び船舶の燃料及びその他支出の節減

(5) 落雷を受けた発電施設の復旧促進と停電時間の短縮化

(6) 台風、洪水、地震による死者・行方不明者を含む死傷者数の減少

中でも、死傷者の減少は、本プロジェクトの効果の中で最も大きなものとなろう。正確な予報・警報が行われるようになれば、人々は、台風警報を信頼し、その襲来に万全の備えをするようになるだろう。本プロジェクトが実施に移されれば、警報は迅速に伝達され、人々は十分に余裕をもって台風に対する防禦手段を講じることができるようになろう。自然災害防止に責任を有する有識者に対するアンケート調査によれば、台風による死傷者は、ダム建設、洪水予警報システム、それに気象通信網のすべてが完成すれば、現在の70%程度に減少するものと考えられている。

地球規模で見た場合、本プロジェクトは、GTSを通じて地域の気象情報を流布することで、世界の気象情報の改善に貢献すると同時に、世界中の航空機及び船舶の安全性向上に寄与することになろう。

なお、本プロジェクトの生産効果は、将来、農業生産において検証されるだろう。本プロジェクト実施により、信頼に足る長期予報が可能となれば、予測された気象条件下において高い収穫が望める作付体系、もしくは品種を選定することができるだろう。

9.1.2 〝デルファイ法〃による台風被害の軽減予想

本プロジェクトの防止効果および生産効果は、前述のとおりであるが、これらの効果を計量するのは困難である。また、これらの効果を計測する方法も未だ確立されておらず、これらの効果を推測するに足るデータもない。

本プロジェクトの経済的便益としての検討では、本プロジェクトによってもたらされるであろう台風被害軽減効果のみを採用した。採用した便益は、本プロジェクトの全便益の一部分にすぎず、これ以外の便益は、これらの検討で取上げるには精度の点で難しいということを付記しておく。

将来の台風被害軽減は、本調査では〝デルファイ法〃(Delfi Method)の原理に基づいて見積られた。被害の推定を行う回答者に配布した質問書とその3回の記入結果は、Appendix C に添付されている。回答者には、MPWH, OCP, PAGASA, WMO, TCS, NIA, PNRC それに PCIC といつた台風被害防止に携わる、各分野から7人の経験豊かな有識者が選ばれた。

将来の状況について、下記の3条件を想定した。

(1) 現在調査中の気象通信網(MTS)が完成し、その効果が最大限に発揮されるように運営されていること。

(2) その結果、天気予報はその精度が著しく改善され、しかも台風の進路予報が一般大衆にすみやかに伝わることにより、人々は襲来する台風に対して考えうるあらゆる予防手段を時間的余裕をもって講じることができるようになること。

(3) 台風被害の軽減は、ダム及び堤防のような洪水防御構造物及び洪水予警報システム(FFWS)と、それに気象通信網(MTS)といった非構造物の総合効果があって、はじめて十分に達成される。本質問書では台風被害の軽減は、ダム及び堤防といった構造物が建造され、加えてFFWSとMTSが整備・確立されていることを想定していること。

上述(3)の想定は、主幹線の一部が、FFWS及びMTSにより共用され、しかもMTSによって入手した気象データは、ダムオペレーションに不可欠であるという現状にある。

上記の想定を基に、被害の推定を行う回答者は、各被害項目ごとに台風被害の軽減効果を現在の被害を100として、将来の被害を予想した。同一の質問書は、3回配布され、第一回目の記入後、集計結果が各回答者に配られた。第二回目の記入に当たり、回答者は他の人の予測を参考にして記入を行つた。三度目の記入においても同様

の方法がとられた。

推定結果は、予想されたとおり小範囲に収斂した。最終的には、各被害項目に対する７人の回答者の数値を平均し、これを基に推計値を算定した。

台風被害の推定軽減額についての調査結果は、概略以下の通りである。数値は、上述の想定の下で実現しうると予想された台風被害軽減率を示している。

	被害軽減率	
(i) 死者・行方不明者（人数）		
A. 死者ないしは行方不明	３０％	
B. 負傷者	２５％	
(ii) 倒壊家屋		
A. 全倒壊	２０％	
B. 一部倒壊	１５％	
(iii) 資産の被害（全額）		
A. 農作物	２０％	２５％
B. 家畜	５０％	
C. 養魚池	４０％	
D. 政府資産		
a. 公共事業施設	１０％	１０％
b. 道路＆橋梁	１０％	
c. その他	１０％	
E. 民家	１５％	

台風被害の内訳は、過去６年間（１９８０年については内訳を欠く）の最大級の台風についてTable 2.17 に示した。各被害項目の内訳については、その資料入手が限られるため、上記の歴史上の台風被害を、２カテゴリーに分別した。ひとつは、農作物、家畜、養魚といった第一次産品の被害、もうひとつは、公共事業施設、道路、橋梁を含む政府資産及び民家といった資産の被害である。過去６年間に発生した５つの台風の平均被害額をベースに、台風の総被害額に占める第一次産品及び資産の割合を推定すると、それぞれ４９.５％と５０.５％となった。（Table 2.16）

以上から、将来の台風被害軽減率は、下記に示す通り、総台風被害の１７.４％と見積られる。

第一次産品の被害軽減	：	49.5％ × 25％
資産の被害軽減	：	50.5％ × 10％
		17.4％

9.2 プロジェクトの経済評価

9.2.1 総　論

経済評価の主要目的は、プロジェクトが実施妥当性を有するか否かを確認することにある。資本の機会費用によって割り引いたプロジェクトの便益がプロジェクトの費用より大きい場合、プロジェクトは、全経済的見地から妥当なものであると判断される。前節9.1.2で述べたように、本調査においては、台風の直接的被害の軽減を本プロジェクトの経済的便益とみなした。台風の直接的被害の軽減は、ダム建設、FFWSそれにMTSが総合的な効果を発揮して初めて可能なものであり、それ故プロジェクトの費用を上述の総合効果と単純に比較することは出来ない。故に、プロジェクトの経済評価は、便益／費用比率（B／C）を算定するかわりに、同比率を1以上にする充分な便益について検討することにする。

9.2.2 フィリピンの台風被害将来予測

Table 9.1で示した1970年から1983年までの期間に発生した歴史上の台風被害状況に基づき、将来の台風被害予測は、下記に示す多重回帰式を用いて行った。

$$T = 1{,}491.45082 + 11.51213M + 0.14717I + 2{,}208.72076D$$

ここで、T：将来の台風被害
M：推定人口密度
I：推定の1人当たりGDP
D：ダミー変数

台風被害及びGDPに関する歴史的データは、1984年6月の価格水準（Table 9.1参照）を用いて評価を行った。2000年までの人口予測は、人口統計局によって行われた予測から中位予測を採り、それ以降は、年間人口成長率1.5％を推定した。将来のGDPは、過去の実績GDPを基に、単純直線回帰法を適用して推定した。人口及びGDPの予測結果は、Table 9.2に示す通りである。ダミー変数は、1970年から1983年までの経年データに見られる台風被害の例外的数値を調整するため用いられた。台風の被害予測は、Table 9.2に示す通りである。これは〝プロジェクトが実施されない〟場合における将来の台風被害予測を表わしている。この表中の軽減

されうる台風被害は、総合的効果が２０００年時点に完全に実現されるという想定のもとに予測されている。

9.2.3　プロジェクトの便益の検討

デルファイ法に基いて得られた１７.４％の軽減率は、ダム・ＦＦＷＳおよびＭＴＳの総合的効果として実現されうる軽減率である。従って、ＭＴＳの被害軽減に対する貢献は、この１７.４％以下であると予想される。

台風被害軽減に対するＭＴＳの貢献度は区別できないので、プロジェクトの便益をプロジェクトの費用と等しくする軽減率を Table 9.3 に基づいて求めた結果、軽減率1.7％を得た。この1.7％を算定するに当っては、運用維持費は建設費の３％と想定した（ 7.3参照）。機器については、価額の９０％相当分が１０年毎に更新されると想定した。評価期間は、建設期間３年を含む３３年間とした。

気象情報の改善を目的としたプロジェクトの経済評価は、まだ歴史も浅く、この種のプロジェクトの妥当性を評価する方法論は、いまだ確立されていない。このような状況においてＷＭＯのプラニング・リポートに掲載されたＪ．Ｃ．トンプソン氏の論文は貴重で参考となる。※この論文は、アメリカ合衆国の４地域の天気予報で得られた経済的利益を分析して、気象情報分野での科学的進歩及び運営上の改善が実現されれば、現在の悪天候に起因する損失を５％軽減できるとの結論に達している。

台風被害軽減に対するダム・ＦＦＷＳおよびＭＴＳの夫々の貢献については、何とも言えないとしても、前述のトンプソン論文に示されている軽減率５％を考え合せると、本プロジェクトの台風被害軽減に対する貢献は、1.7％以上であろうと予想される。更に、上述の便益が本プロジェクトの考えうる全便益の一部分のみに基いて計測されている事実を考えると、台風被害軽減に対するプロジェクトの真の貢献は、1.7％より大きいと推測しうる。以上のことから本プロジェクトの便益／費用比率は、１よりも大きいと推測されると云って差し支えないであろう。

もし、米国とフィリピンの気候的条件を無視してトンプソン研究をそのまま採用すれば、本プロジェクトの便益は、台風被害予測の５％として算定され、Table 9.4 に示すごとく経済的内部収益率は５２％となる。

※：「気象情報改善による潜在的経済便益」、Ｊ．Ｃ．トンプソン著、W.W.W プラニング報告書　№２７掲載、ＷＭＯ出版、１９６８年

１０．　結　　論

本調査では、技術面及び経済面からプロジェクトの妥当性が検討された。

計画では気象通信網には、ＯＨ幹線、ＶＨＦ及びＨＦ支線網、それに６４の観測所が含まれるが、この計画は技術的に健全なものと判断された。

経済的妥当性は、プロジェクトの予測便益を吟味することにより検討した結果、プロジェクトの便益は、プロジェクトの費用よりも大きいであろうと推論された。

前節2.4.3で述べたように、気象通信網の改善は、農業、漁業、鉄道、道路輸送、航空、海運、それに電力産業といった多くの産業活動に大きな効果をもたらすことになろう。それに台風による家屋及び建造物の被害軽減も期待できる。中でも予想される犠牲者数の減少は、「ベーシック・ヒューマン・ニーズ（ＢＨＮ）」の観点から、重要な意義をもつ。

最近の１９８４年９月の台風（Nitang）では、１０００人以上の人命が失われている。

本プロジェクトは、フィリピン国内のみならず、近隣諸国の気象業務の発展をも促進するものと期待される。

本プロジェクトの効果は、計測し難いものが多いが、整備されることによるフィリピン全体の社会経済に与える広汎かつ深甚なる効果を考えると、気象通信網整備は、早急に実施されるべきであると提言されうる。

Figure

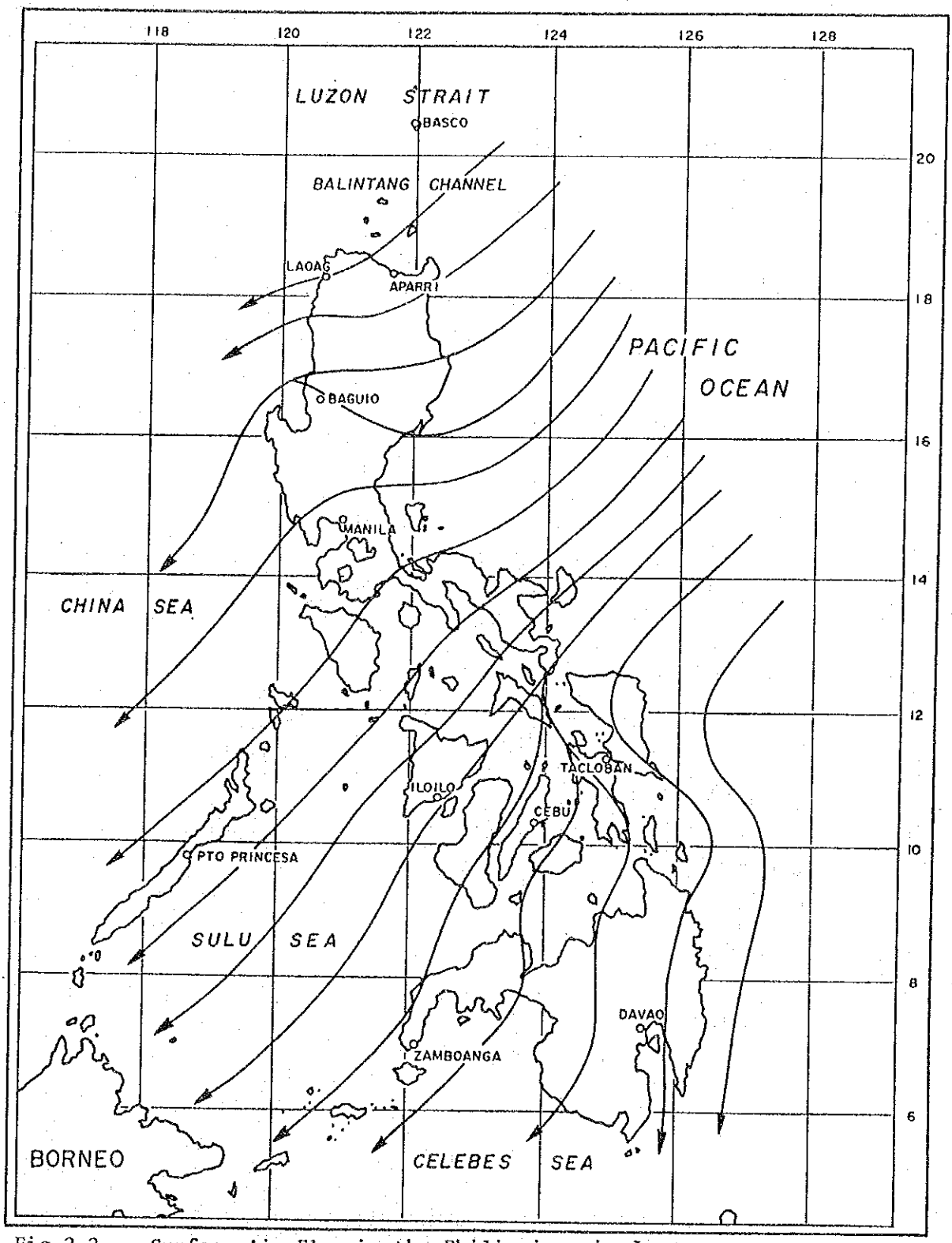


Fig.2.2 Surface Air Flow in the Philippines in January

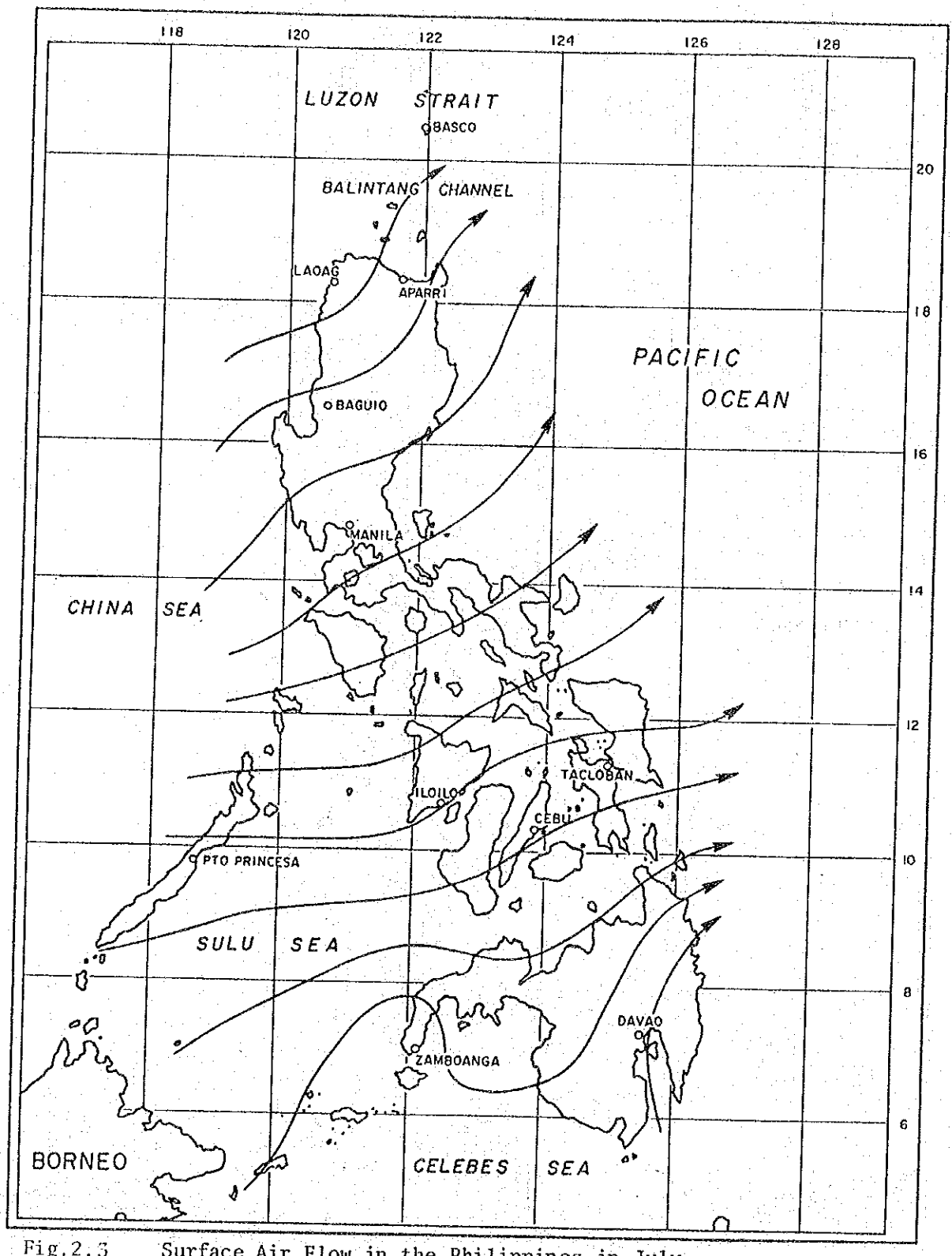


Fig.2.3 Surface Air Flow in the Philippines in July

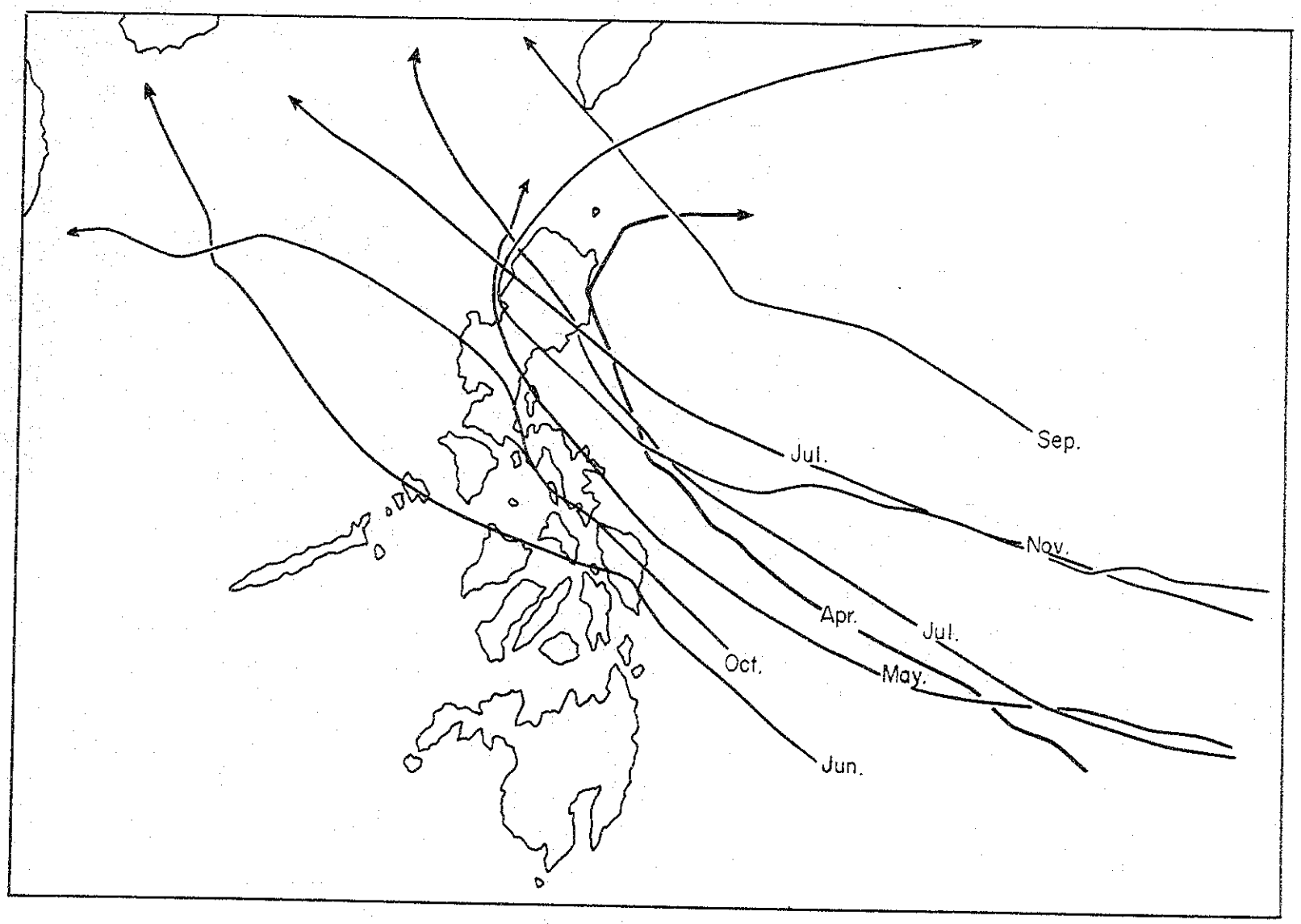


Fig.2.4 Typhoon Tracks in the Philippine Area of Responsibility in 1981

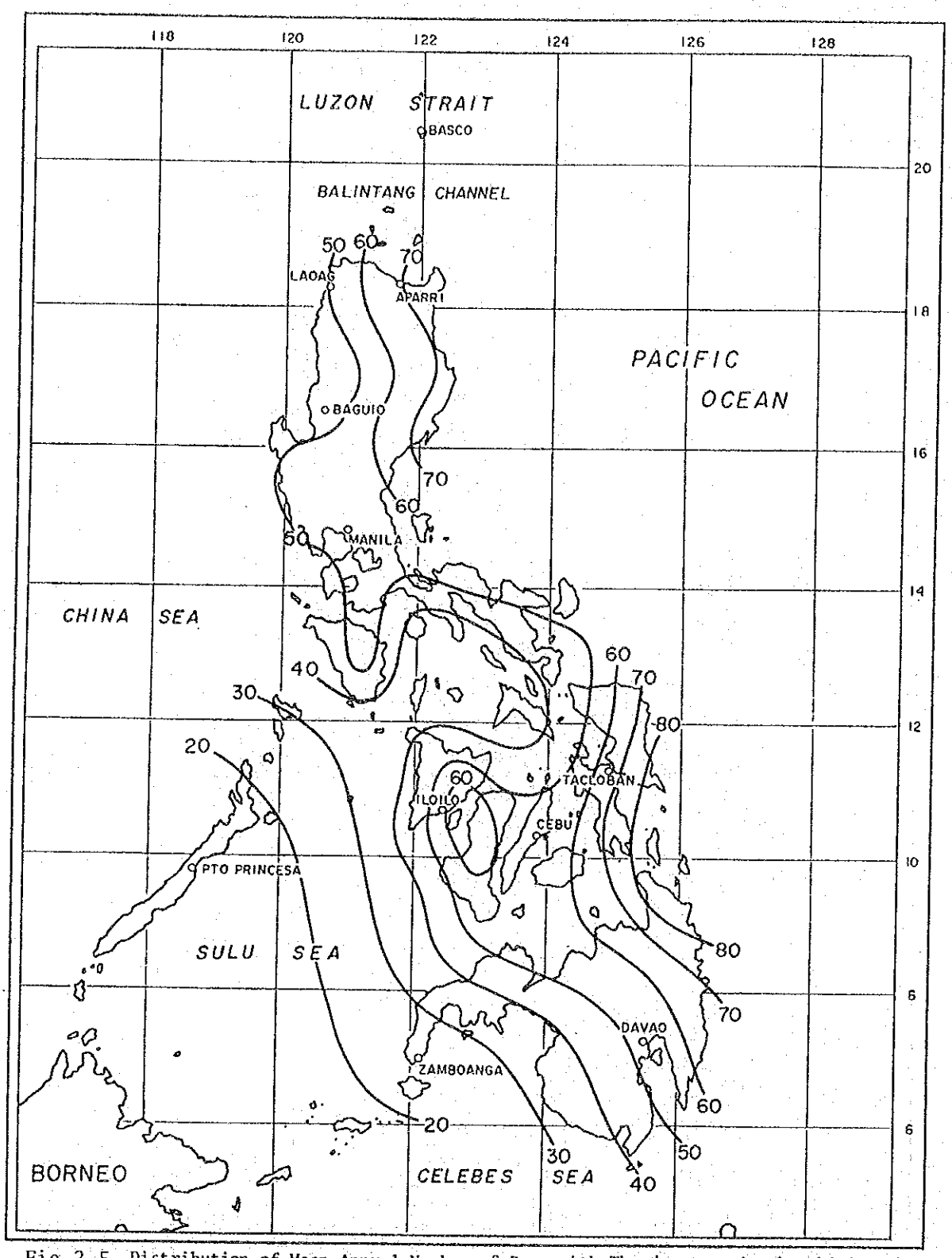


Fig.2.5 Distribution of Mean Annual Number of Days with Thunderstorm in the Philippines

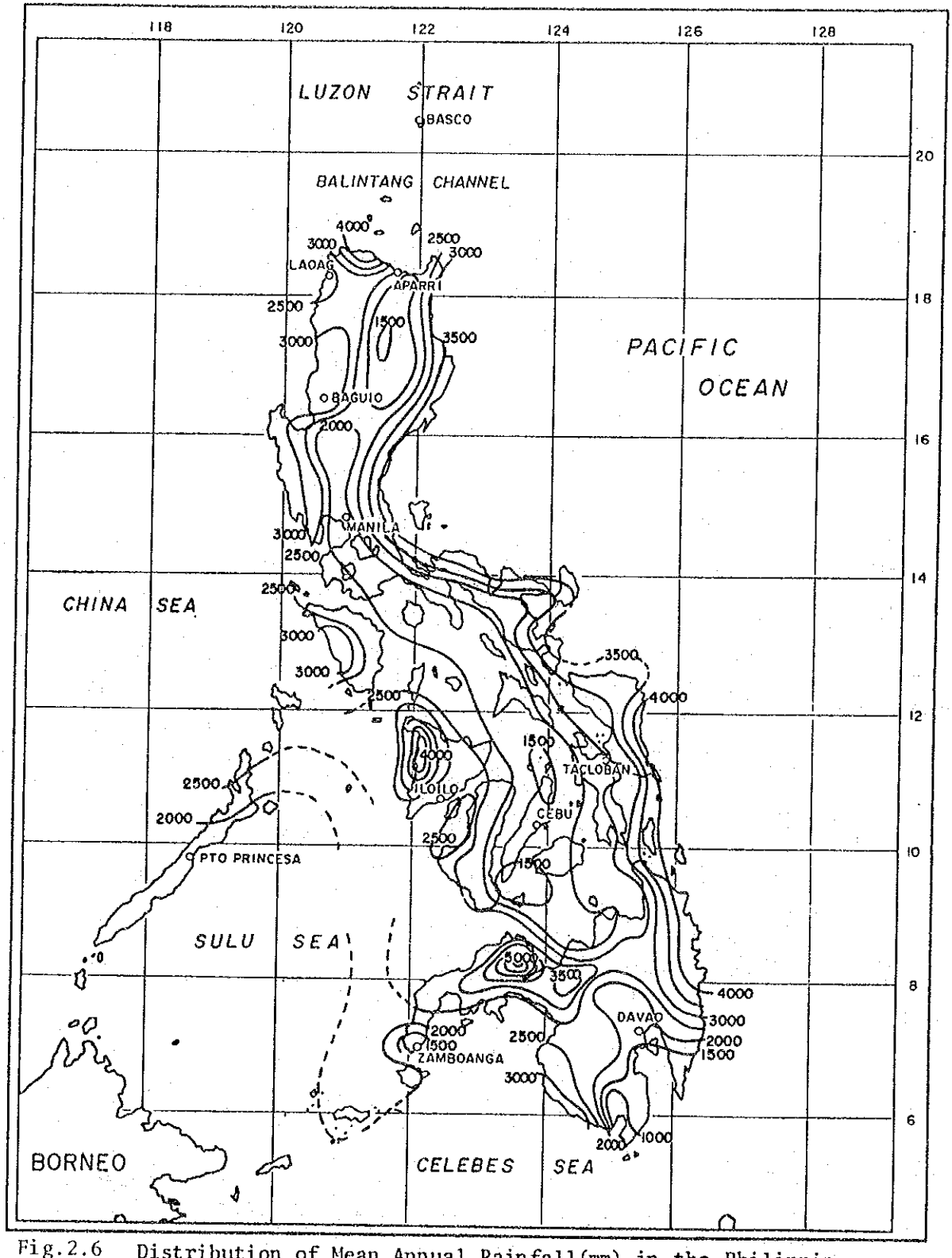


Fig.2.6 Distribution of Mean Annual Rainfall(mm) in the Philippines

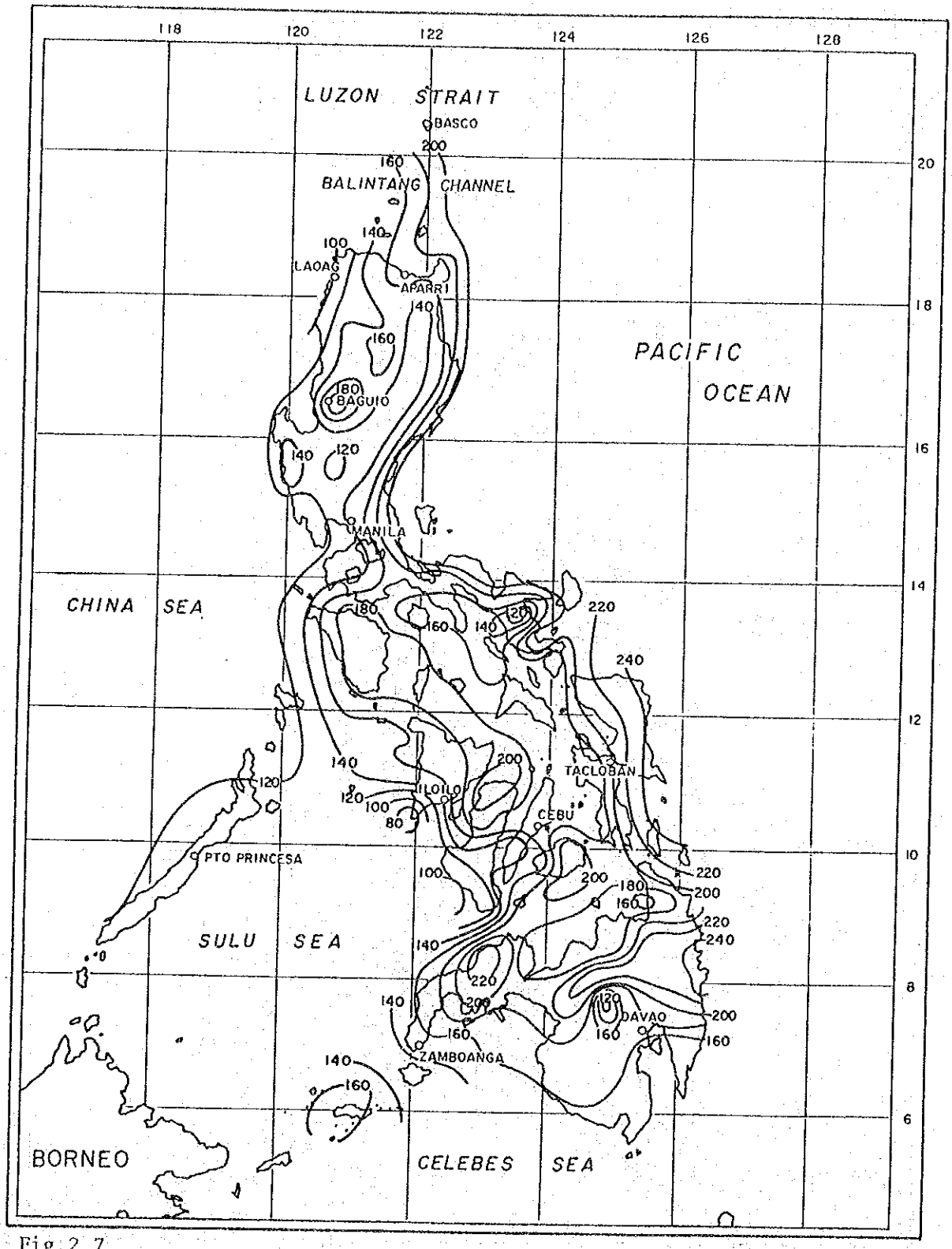


Fig.2.7

Distribution of Mean Annual Number of Rainy Days in the Philippines

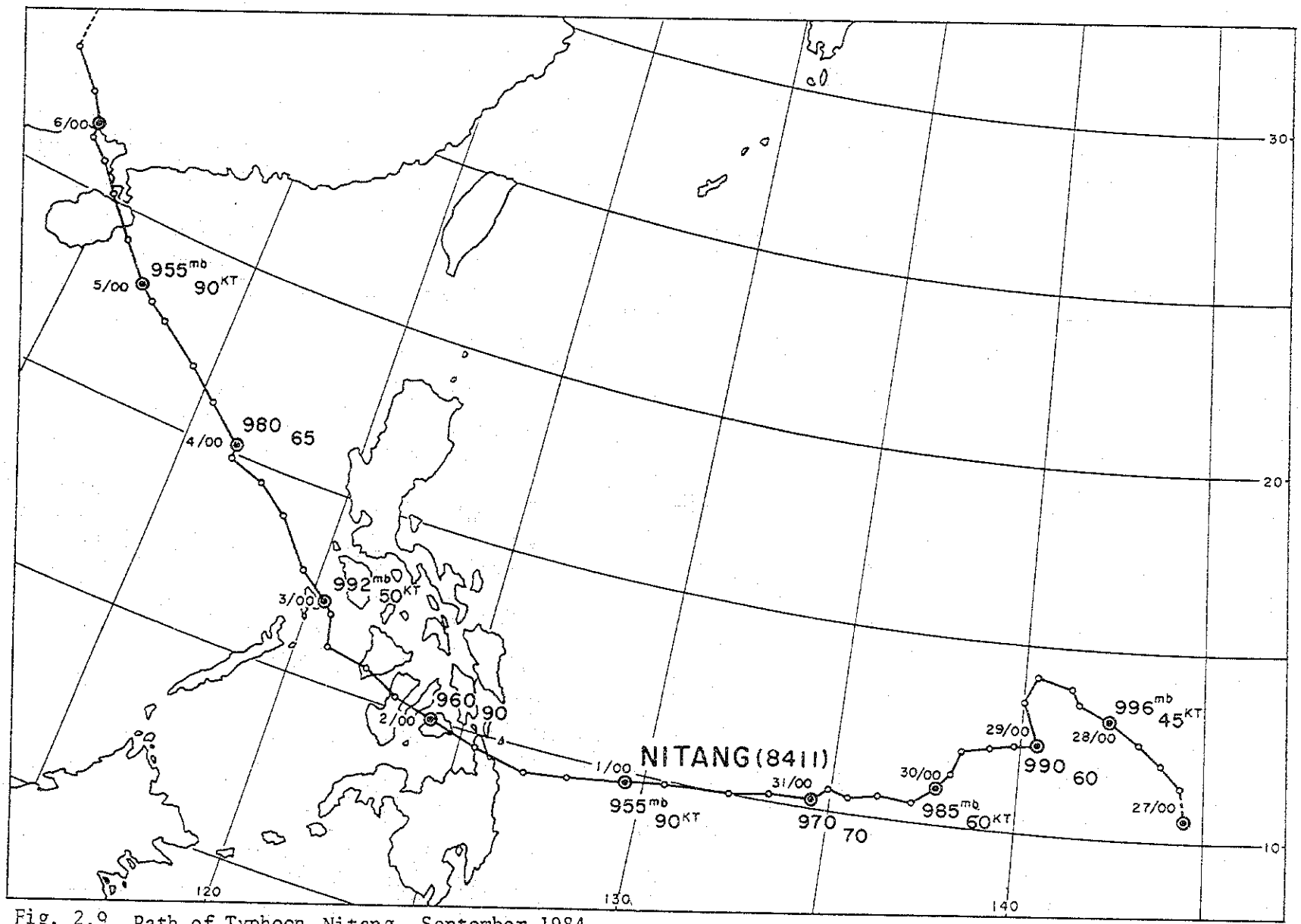


Fig. 2.9 Path of Typhoon Nitang September 1984

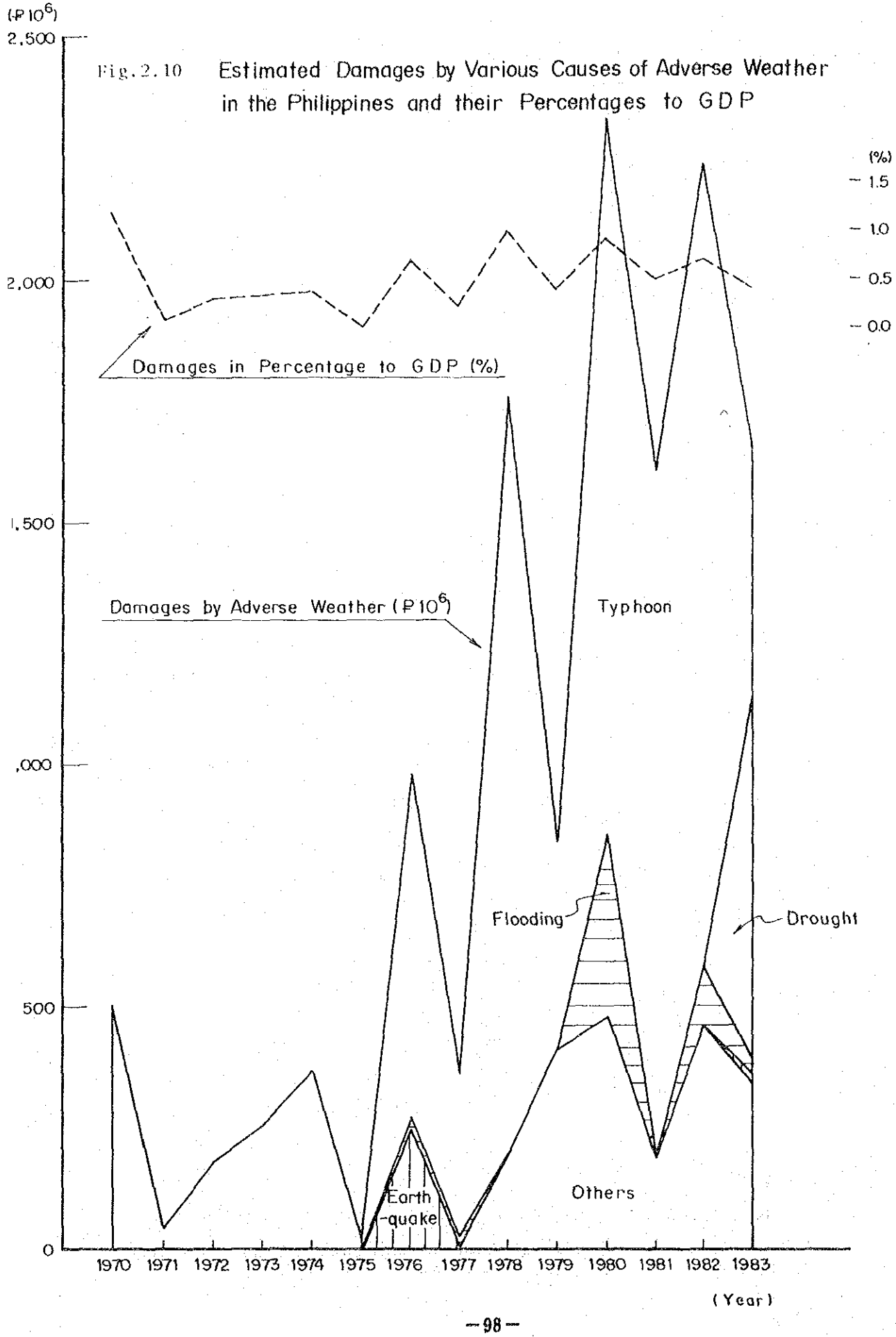
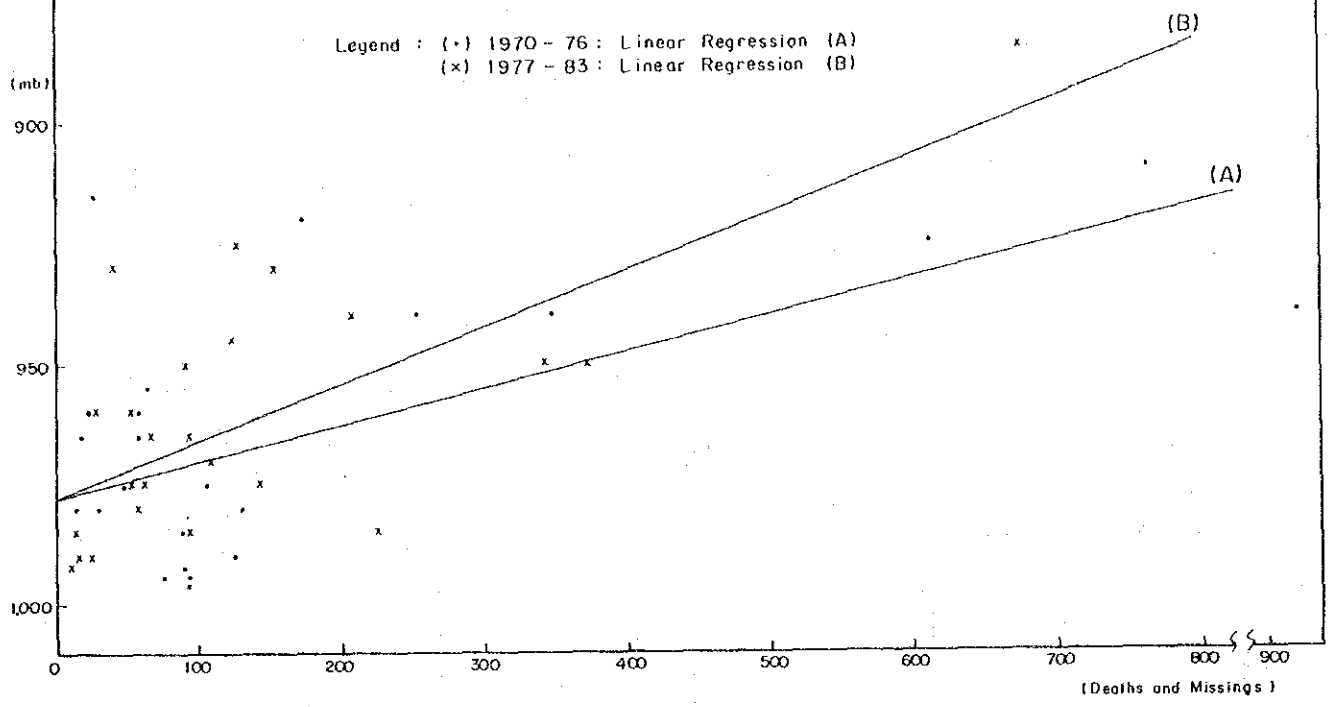


Fig. 2.10 Estimated Damages by Various Causes of Adverse Weather in the Philippines and their Percentages to GDP

Fig·2.11 Correlation between Magnitude of each Typhoon and Number of Deaths and Missings for the Period of 1970 - 83



Fig·2.12 Correlation between Magnitude of each Typhoon and Number of Deaths and Missings

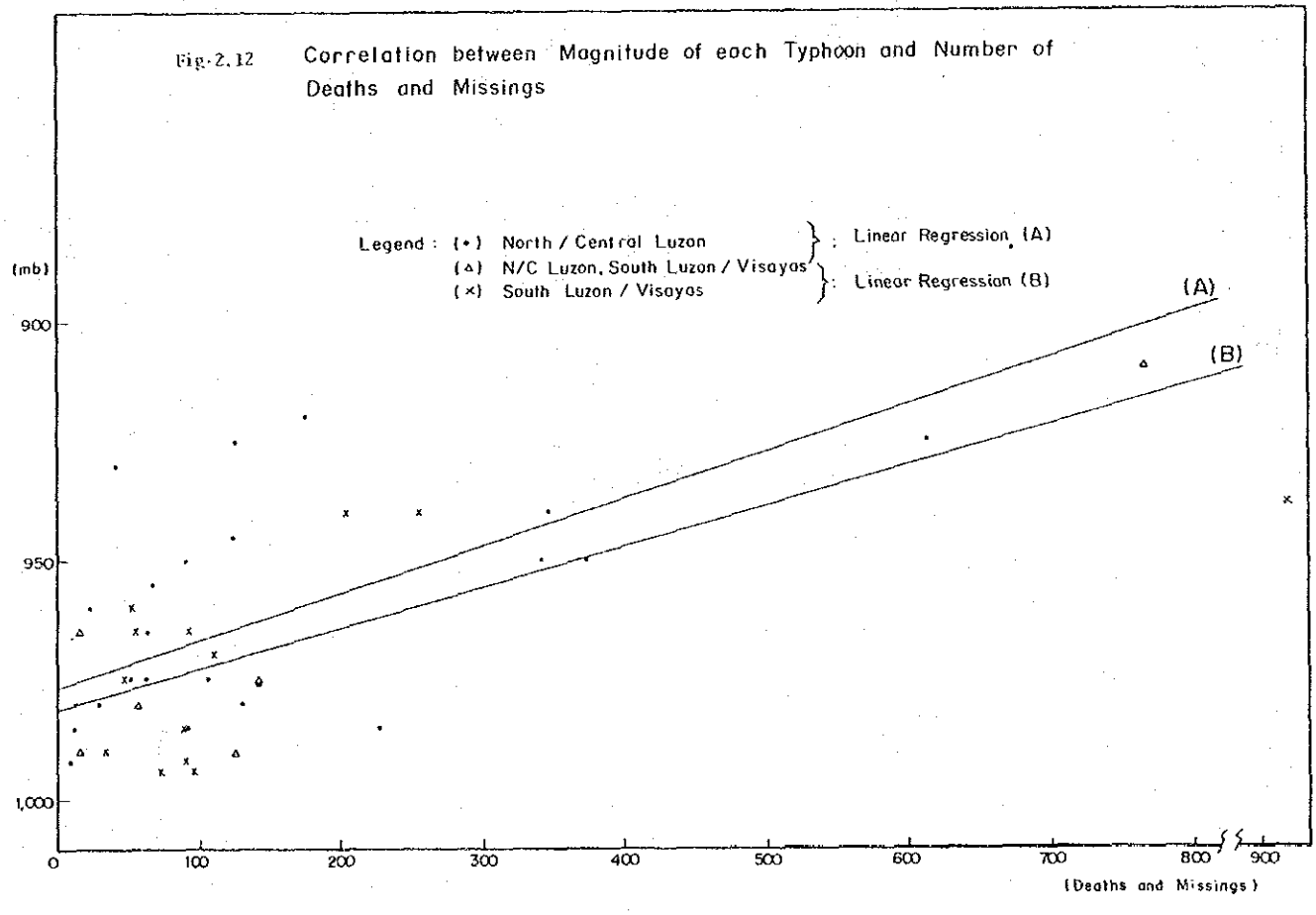
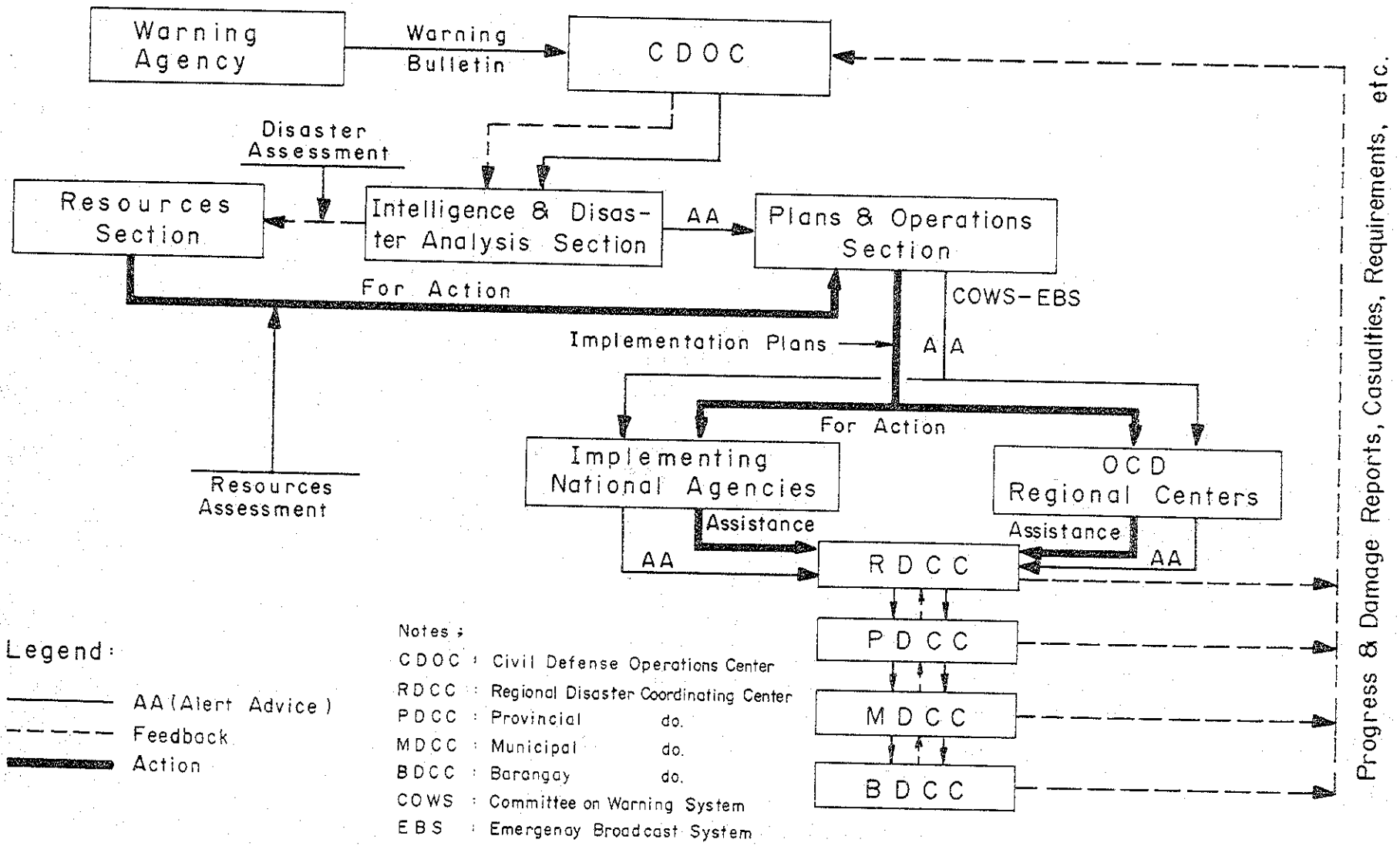


Fig. 2.13 Disaster Operations Flow Chart



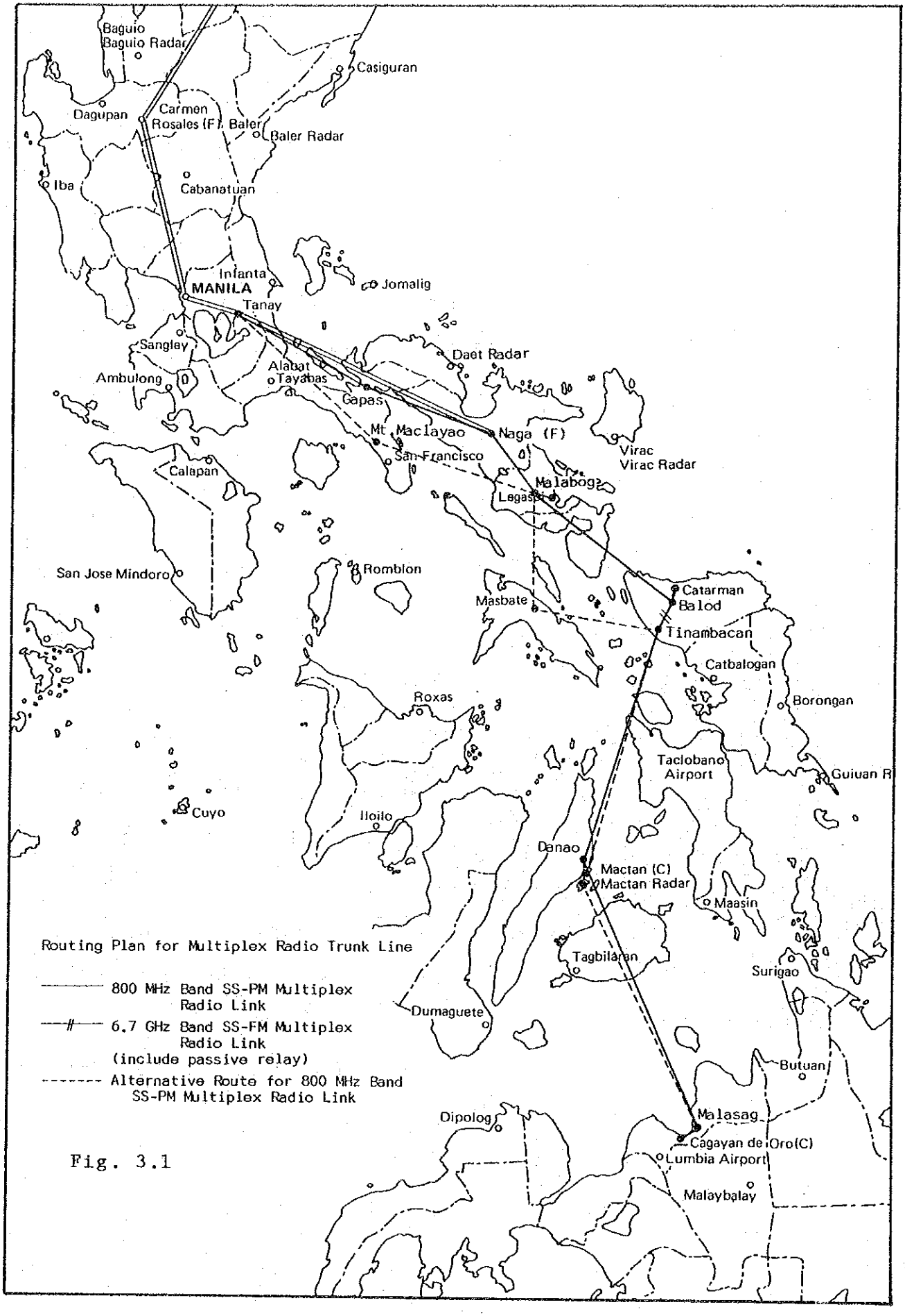

Baguio
Baguio Radar
Casiguran
Dagupan
Carmen
Rosales (F)
Baler
Baler Radar
Iba
Cabanatuan
Infanta
MANILA
Jomalig
Tanay
Sangley
Daet Radar
Alabat
Tayabas
Ambulong
Gapas
Mt. Maclayao
Naga (F)
San Francisco
Virac
Virac Radar
Calapan
Malabog
Legaspi
San Jose Mindoro
Romblon
Masbate
Catarman
Balod
Tinambacan
Catbalogan
Roxas
Borongan
Taclobano
Airport
Guiuan R
Cuyo
Iloilo
Danao
Mactan (C)
Mactan Radar
Maasin
Tagbilaran
Surigao
Dumaguete
Butuan
Dipolog
Malasag
Cagayan de Oro(C)
Lumbia Airport
Malaybalay
Routing Plan for Multiplex Radio Trunk Line
800 MHz Band SS-PM Multiplex Radio Link
6.7 GHz Band SS-FM Multiplex Radio Link (include passive relay)
Alternative Route for 800 MHz Band SS-PM Multiplex Radio Link

Fig. 3.1

Fig.3.2

Systematic Diagram of Propagation Test (OH)

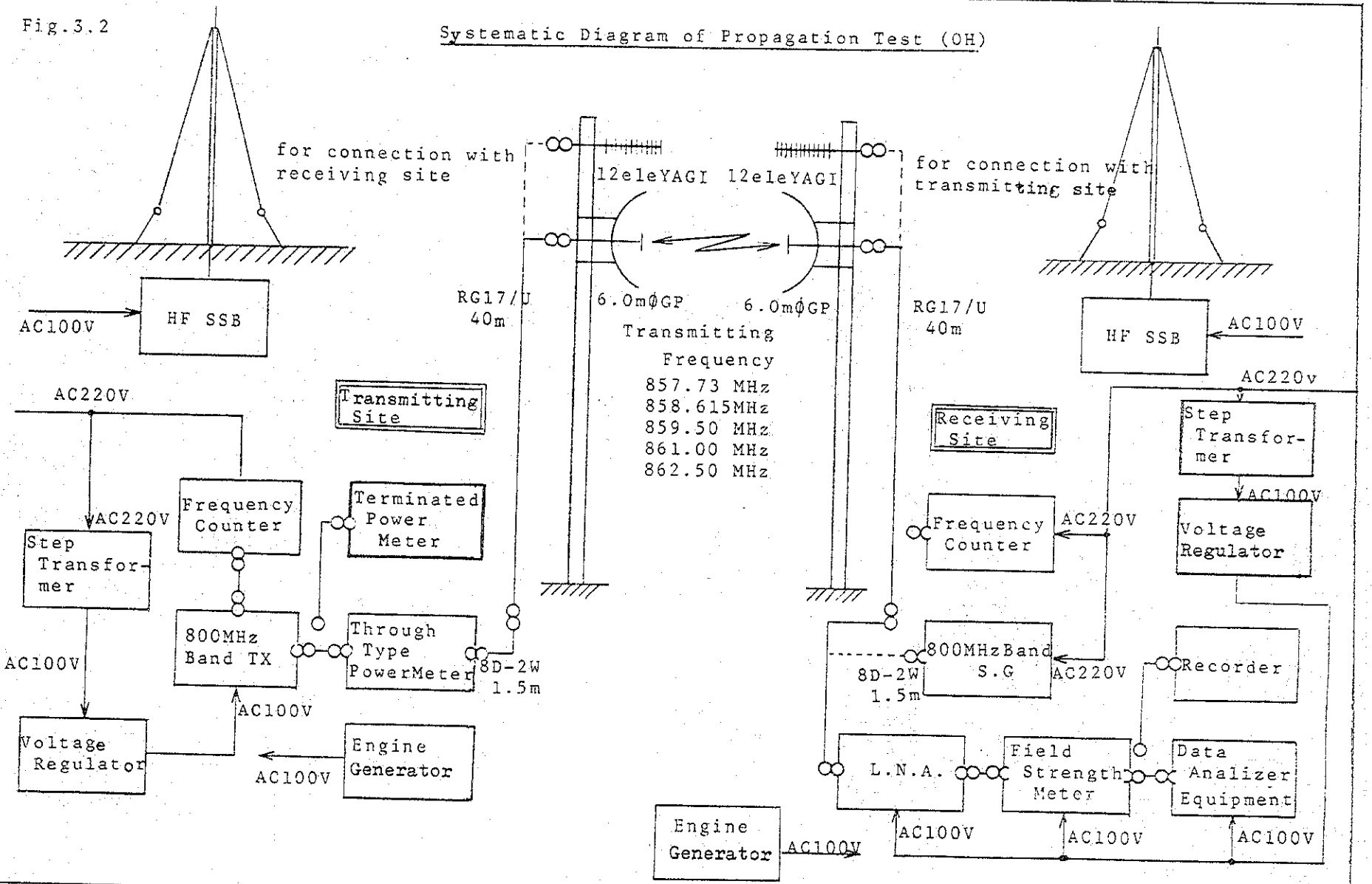
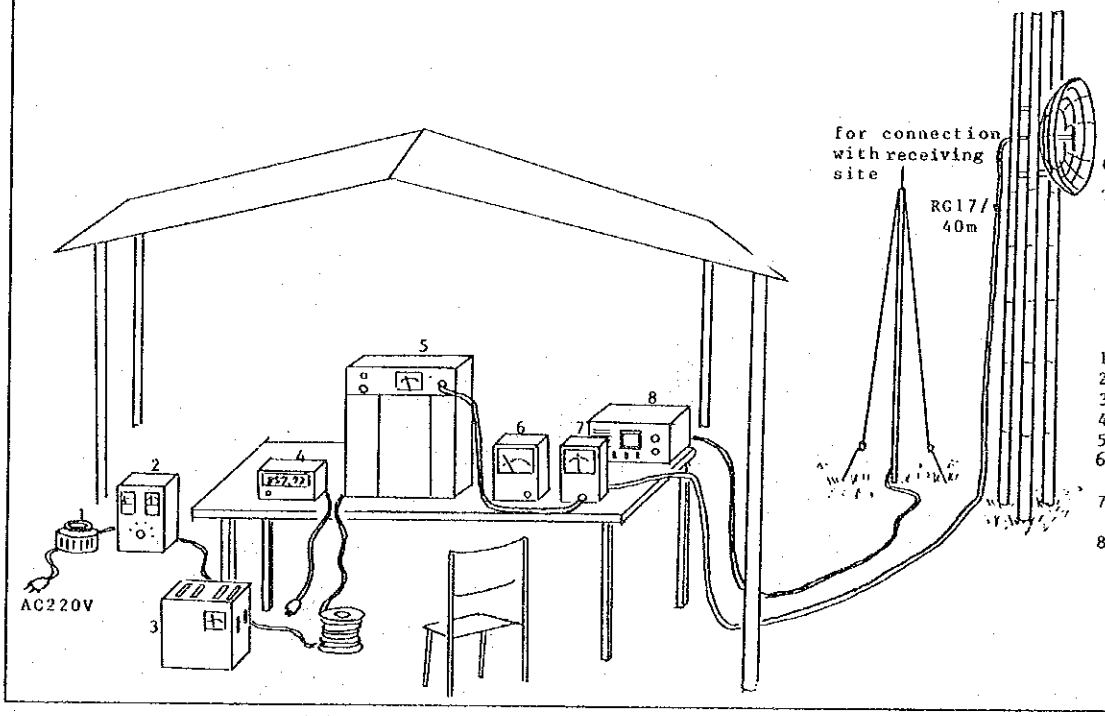


Fig.3.3 Figure of OH Propagation Test

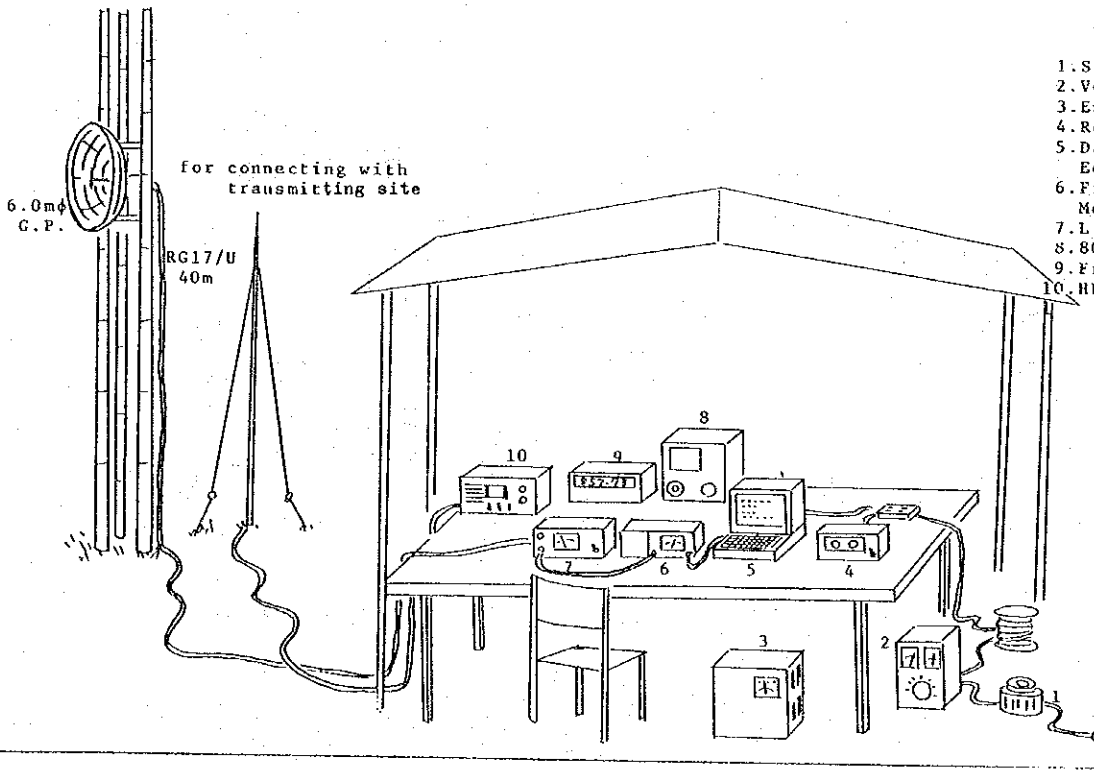
Transmitting Site



Transmitting Frequency
857.73 MHz
858.615MHz
859.50 MHz
861.oo MHz
862.50 MHz

1. Step Transformer
2. Voltage Regulator
3. Engine Generator
4. Frequency Counter
5. 800MHz Band TX
6. Terminated Power Meter
7. Through Type Power Meter
8. HF SSB

Fig.3.4 Receiving Site



1. Step Transformer
2. Voltage Regulator
3. Engine Generator
4. Recorder
5. Data Analizer Equipment
6. Field Strength Meter
7. L.N.A.
8. 800MHz Band S.G.
9. Frequency Counter
10. HF SSB

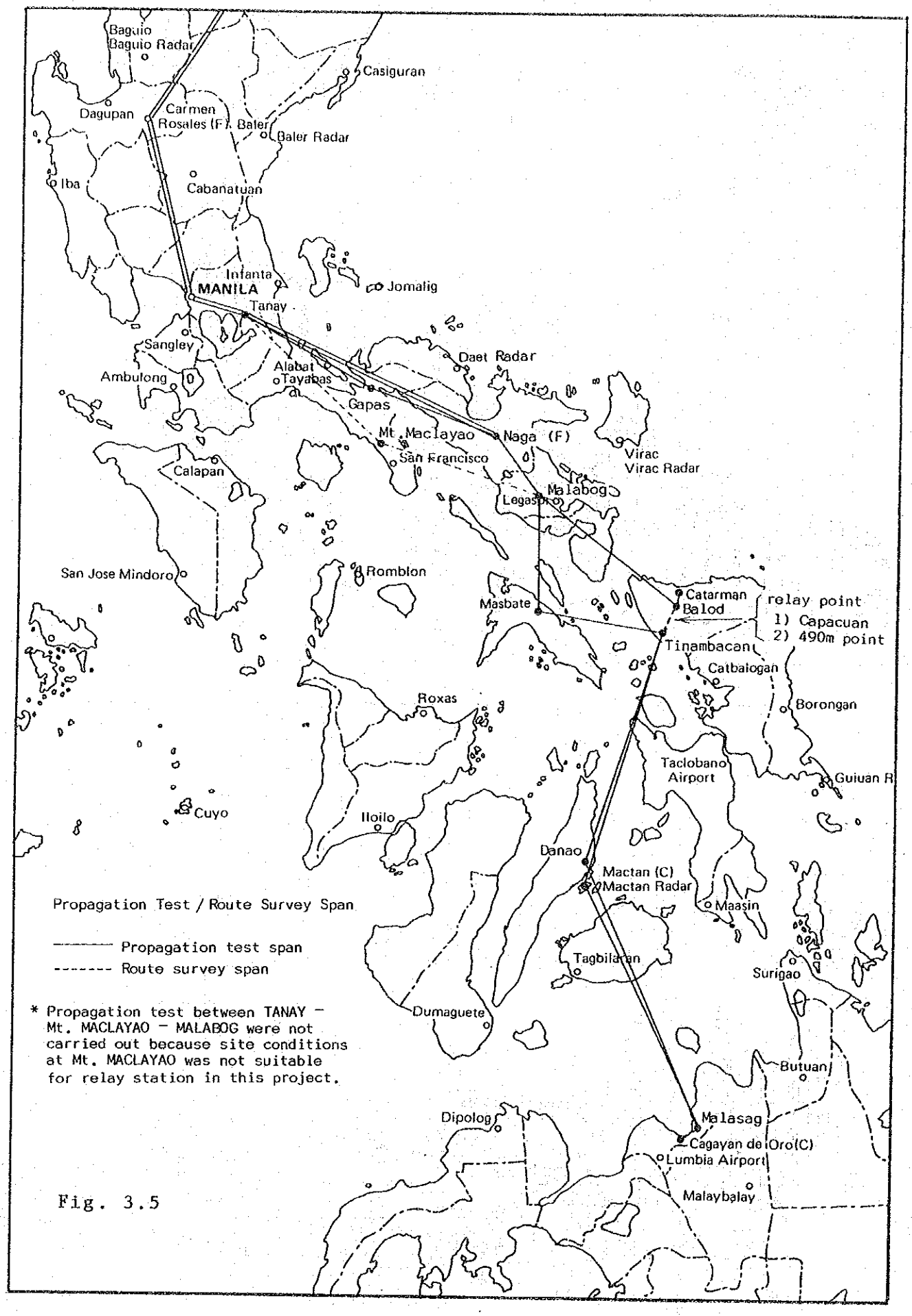
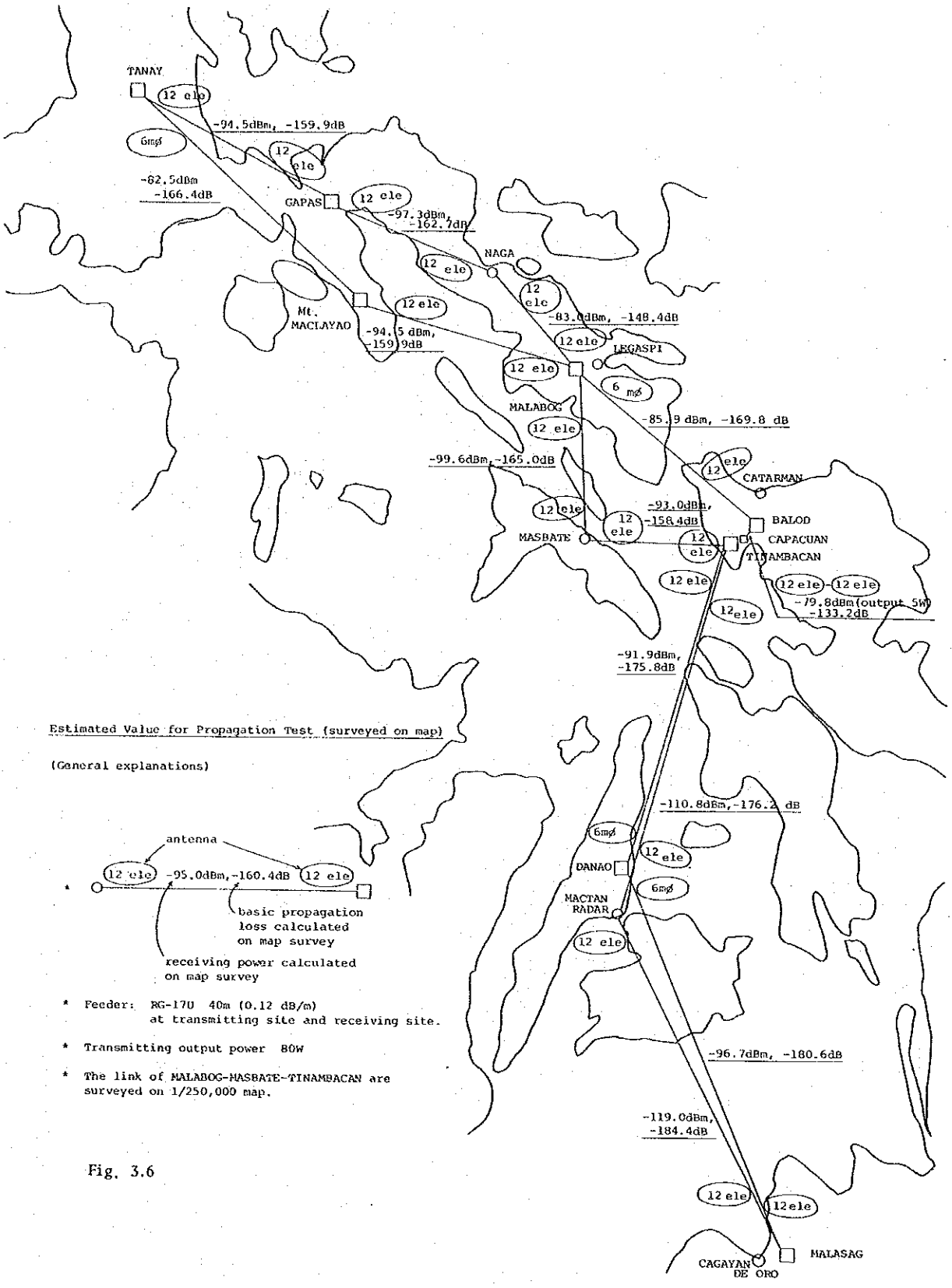

Baguio
Baguio Radar
Casiguran
Dagupan
Carmen
Rosales (F)
Baler
Baler Radar
Iba
Cabanatuan
Infanta
MANILA
Jomalig
Tanay
Sangley
Ambulong
Alabat
Tayabas
Gapas
Daet Radar
Mt. Maclayao
Naga (F)
San Francisco
Virac
Virac Radar
Calapan
Malabog
Legaspi
San Jose Mindoro
Romblon
Masbate
Catarman
Balod
relay point
1) Capacuan
2) 490m point
Tinambacan
Catbalogan
Roxas
Borongan
Taclobano
Airport
Guiuan R
Cuyo
Iloilo
Danao
Mactan (C)
Mactan Radar
Maasin
Tagbilaran
Surigao
Dumaguete
Butuan
Dipolog
Malasag
Cagayan de Oro(C)
Lumbia Airport
Malaybalay
Propagation Test / Route Survey Span
Propagation test span
Route survey span
* Propagation test between TANAY - Mt. MACLAYAO - MALABOG were not carried out because site conditions at Mt. MACLAYAO was not suitable for relay station in this project.

Fig. 3.5



Estimated Value for Propagation Test (surveyed on map)

(General explanations)

* Feeder: RG-17U 40m (0.12 dB/m)
at transmitting site and receiving site.

* Transmitting output power 80W

* The link of MALABOG-MASBATE-TINAMBACAN are surveyed on 1/250,000 map.

Fig. 3.6

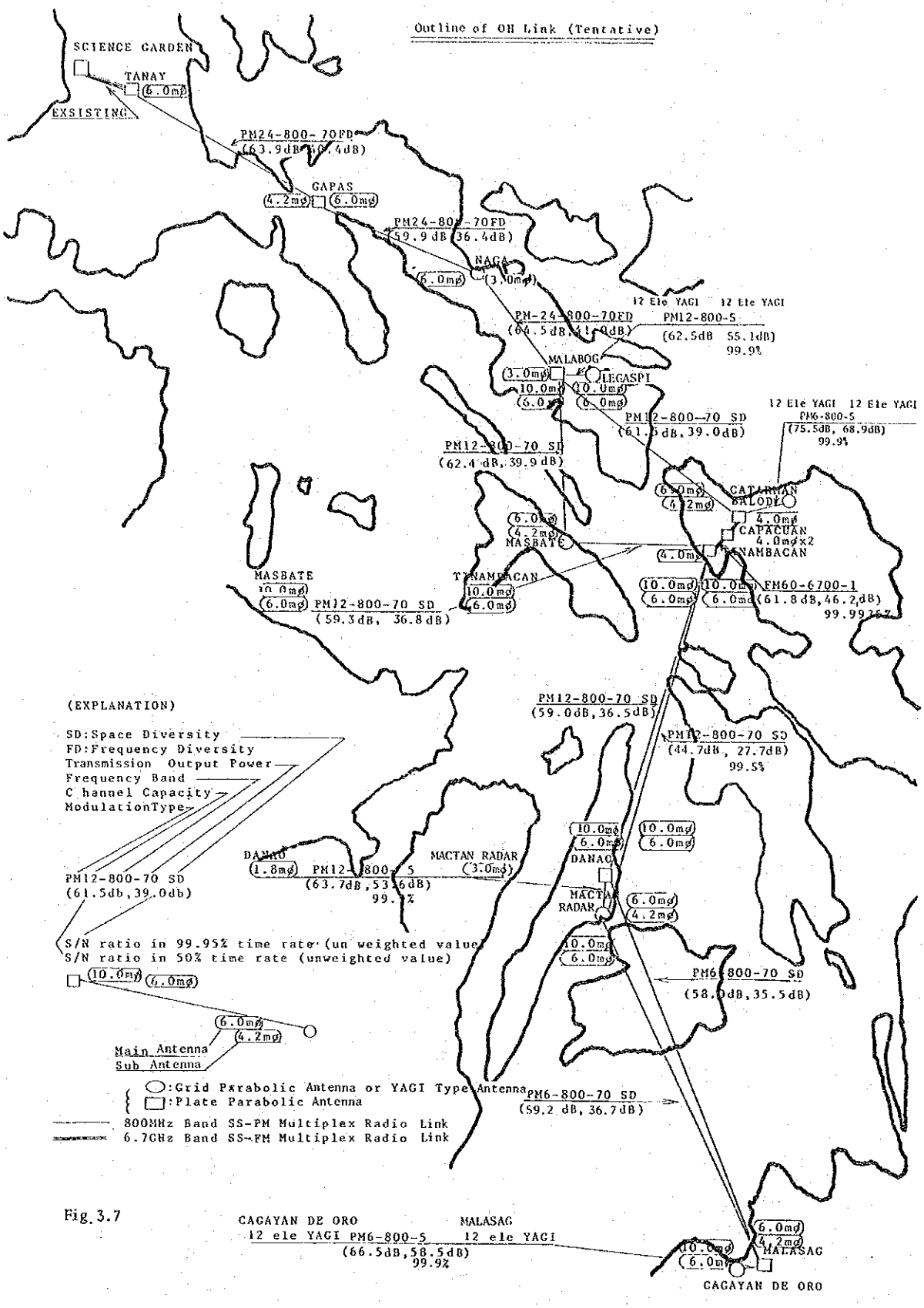

Outline of OH Link (Tentative)
SCIENCE GARDEN
TANAY
6.0mφ
EXSISTING
PM24-800-70FD
(63.9dB, 40.4dB)
GAPAS
4.2mφ
6.0mφ
PM24-800-70FD
(59.9 dB, 36.4dB)
NAGA
6.0mφ
3.0mφ
12 Ele YAGI
12 Ele YAGI
PM-24-800-70FD
(64.5dB, 41.0dB)
PM12-800-5
(62.5dB 55.1dB)
99.9%
MALABOG
LEGASPI
3.0mφ
10.0mφ
10.0mφ
6.0mφ
6.0mφ
12 Ele YAGI
12 Ele YAGI
PM6-800-5
(75.5dB, 68.9dB)
99.9%
PM12-800-70 SD
(61.5dB, 39.0dB)
PM12-800-70 SD
(62.4 dB, 39.9 dB)
6.0mφ
4.2mφ
CATARMAN
BALOD
4.0mφ
CAPACUAN
4.0mφ×2
NAMBACAN
6.0mφ
4.2mφ
MASBATE
4.0mφ
MASBATE
10.0mφ
6.0mφ
TINAMBACAN
10.0mφ
6.0mφ
PM12-800-70 SD
(59.3dB, 36.8dB)
10.0mφ
6.0mφ
10.0mφ
6.0mφ
PM60-6700-1
(61.8dB, 46.2dB)
99.99%
PM12-800-70 SD
(59.0dB, 36.5dB)
PM12-800-70 SD
(44.7dB, 27.7dB)
99.5%
(EXPLANATION)
SD:Space Diversity
FD:Frequency Diversity
Transmission Output Power
Frequency Band
C hannel Capacity
ModulationType
PM12-800-70 SD
(61.5db, 39.0db)
S/N ratio in 99.95% time rate (un weighted value)
S/N ratio in 50% time rate (unweighted value)
10.0mφ
6.0mφ
6.0mφ
4.2mφ
Main Antenna
Sub Antenna
:Grid Parabolic Antenna or YAGI Type Antenna
:Plate Parabolic Antenna
800MHz Band SS-FM Multiplex Radio Link
6.7GHz Band SS-FM Multiplex Radio Link
DANAO
1.8mφ
PM12-800-5
(63.7dB, 53.6dB)
99.9%
MACTAN RADAR
3.0mφ
10.0mφ
6.0mφ
DANAO
10.0mφ
6.0mφ
MACTAN RADAR
6.0mφ
4.2mφ
10.0mφ
6.0mφ
PM6-800-70 SD
(58.0dB, 35.5dB)
PM6-800-70 SD
(59.2 dB, 36.7dB)
CAGAYAN DE ORO
12 ele YAGI
PM6-800-5
12 ele YAGI
(66.5dB, 58.5dB)
99.9%
MALASAG
6.0mφ
4.2mφ
10.0mφ
6.0mφ
MALASAG
CAGAYAN DE ORO

Fig. 3.7

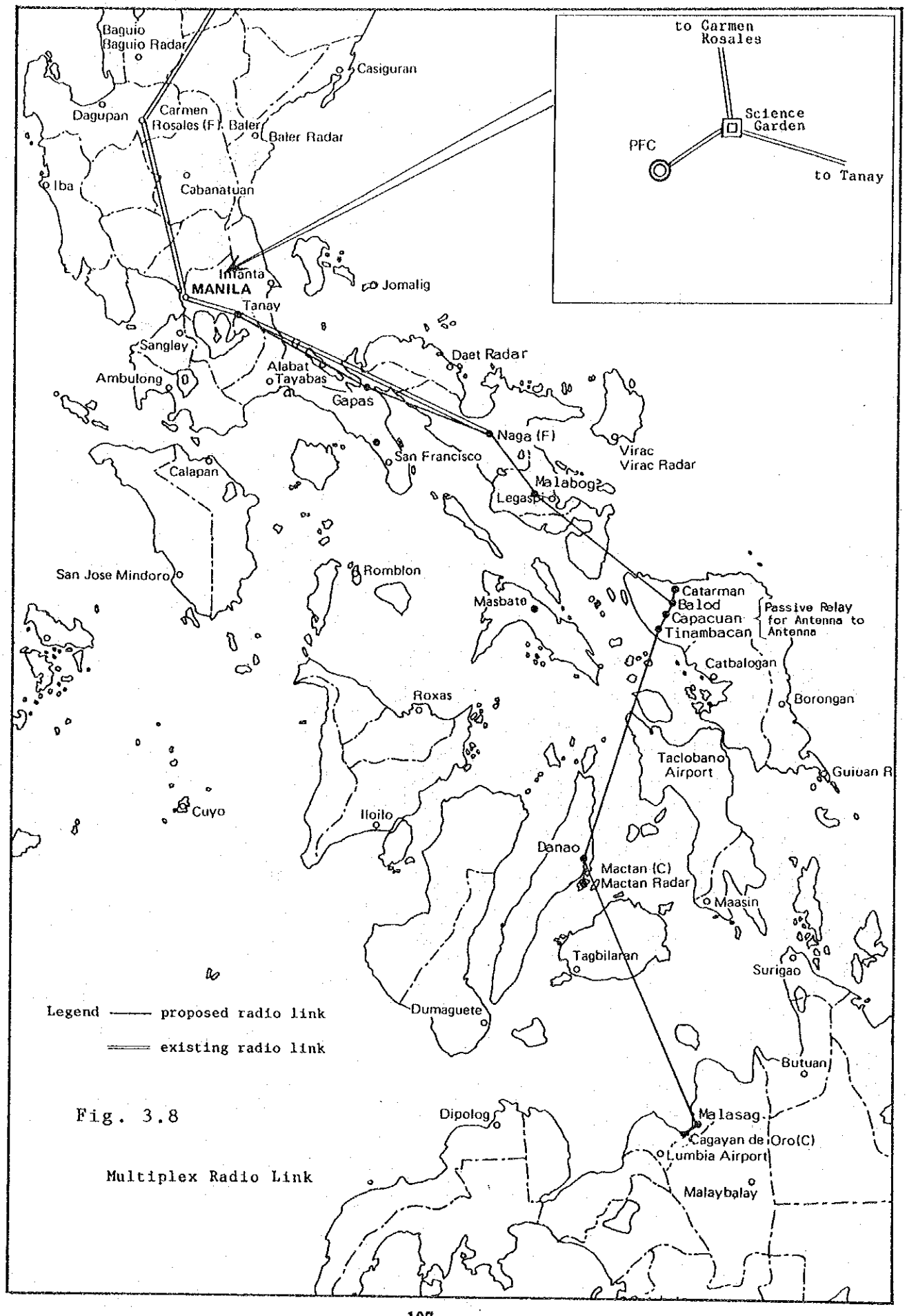


Fig. 3.8

Multiplex Radio Link

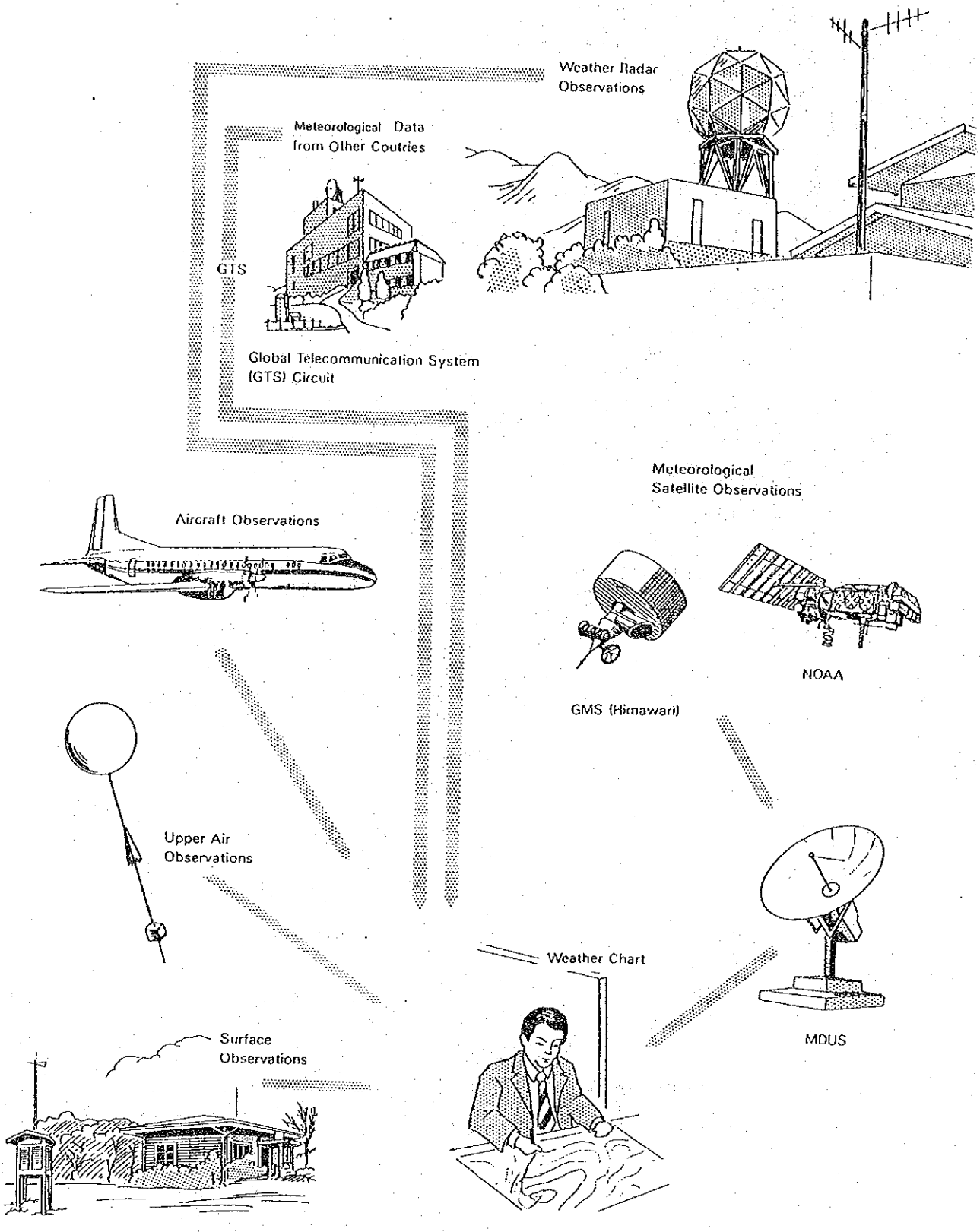


Fig. 3.9 Process of Weather Data Analysis

Fig. 3.10 PAGASA
Dissemination and Information Network

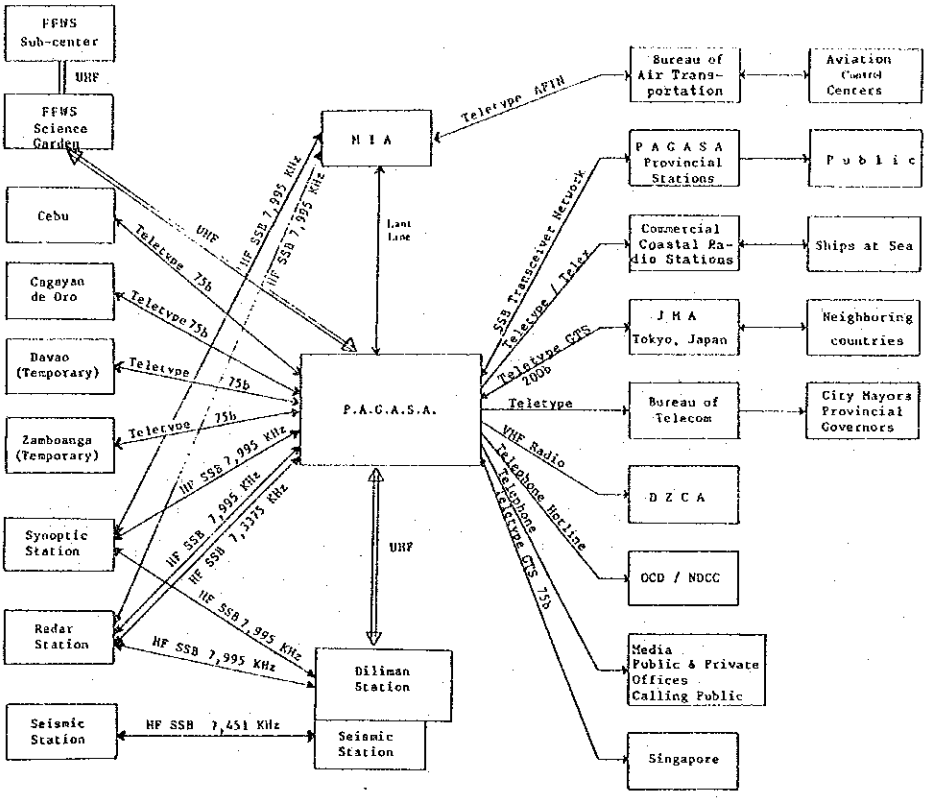


Fig. 3.11 STORM WARNING SIGNALS

Signal No. 1

One Blast

MEANING: Disturbance existing. Winds of up to 60 kilometers per hour may be expected in the locality within the next 24 to 36 hours. Be on the alert for further developments. Tune in to any of the radio stations for further information.

Signal No. 2

Two Blasts

MEANING: Disturbance approaching or affecting the locality. Winds of 60-100 kilometers per hour may be expected within the locality within the next 24 hours. Strengthen houses of light materials. Children are advised to stay indoors. Suspension of classes is optional and upon the advice of higher authorities.

Signal No. 3

Three Blasts

MEANING: Disturbance is dangerous to the locality. Winds in excess of 100 kilometers per hour would be expected in the locality within the next 12 to 24 hours. Everybody is advised to stay indoors. Classes are automatically suspended.

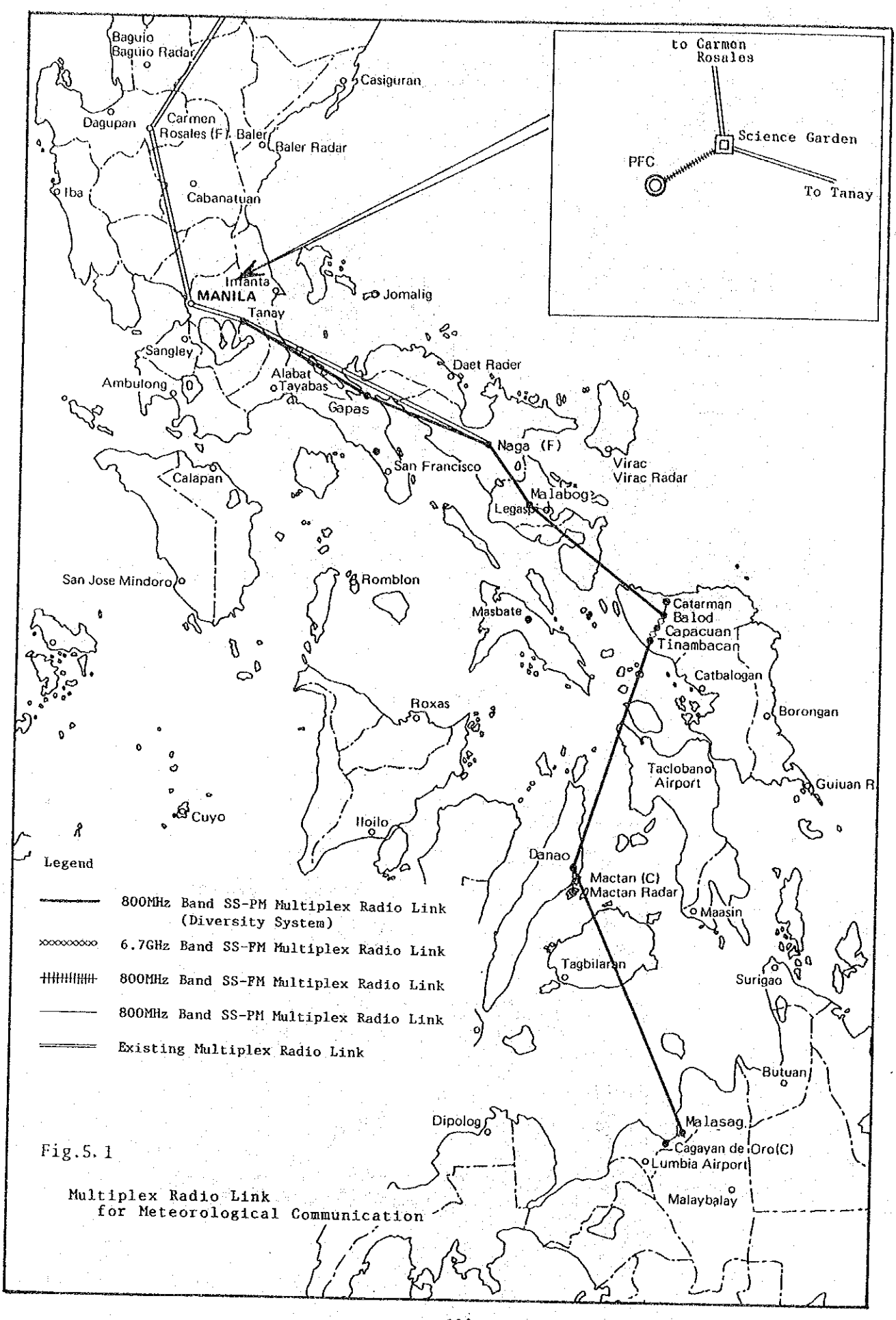


Fig.5.1

Multiplex Radio Link
for Meteorological Communication

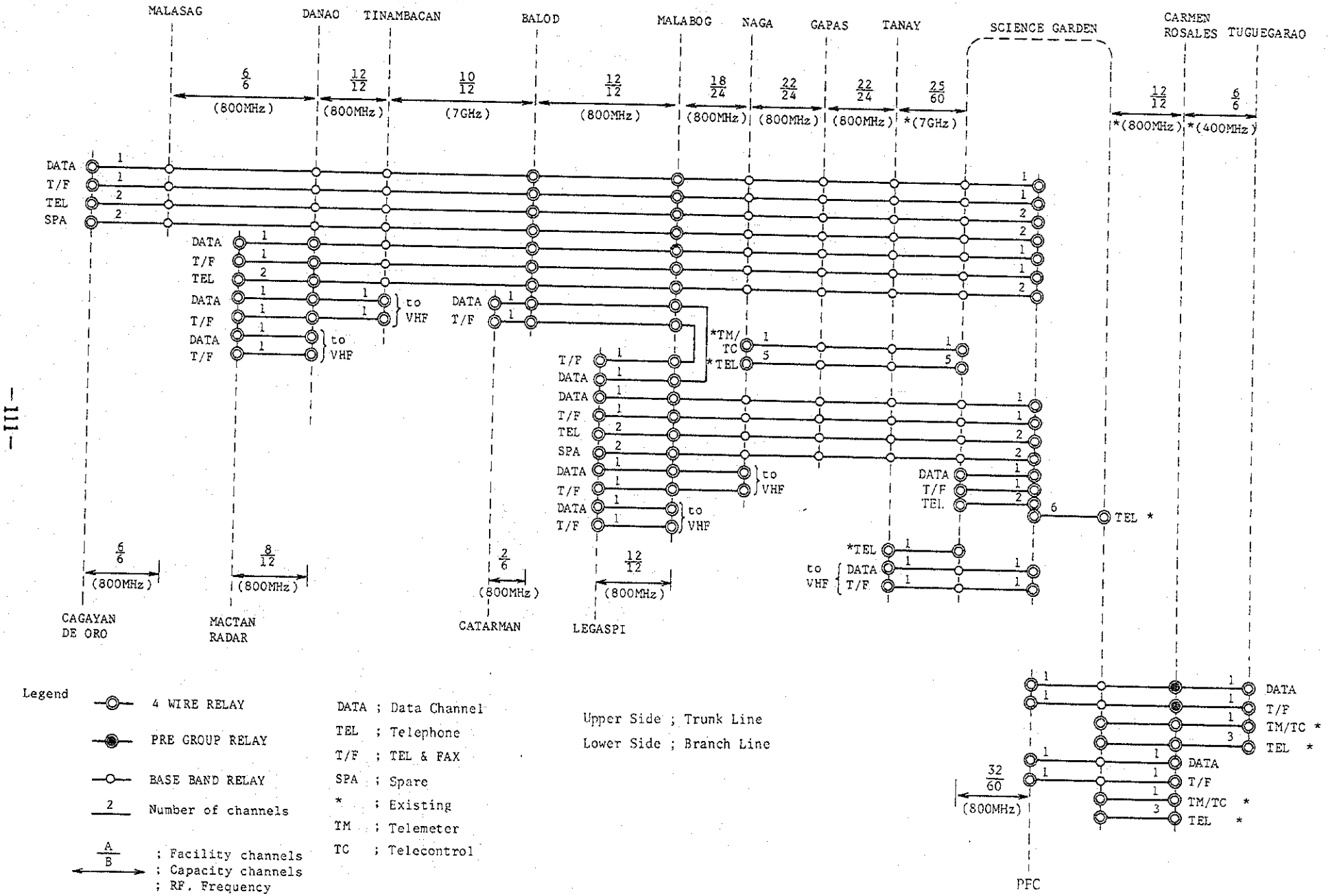
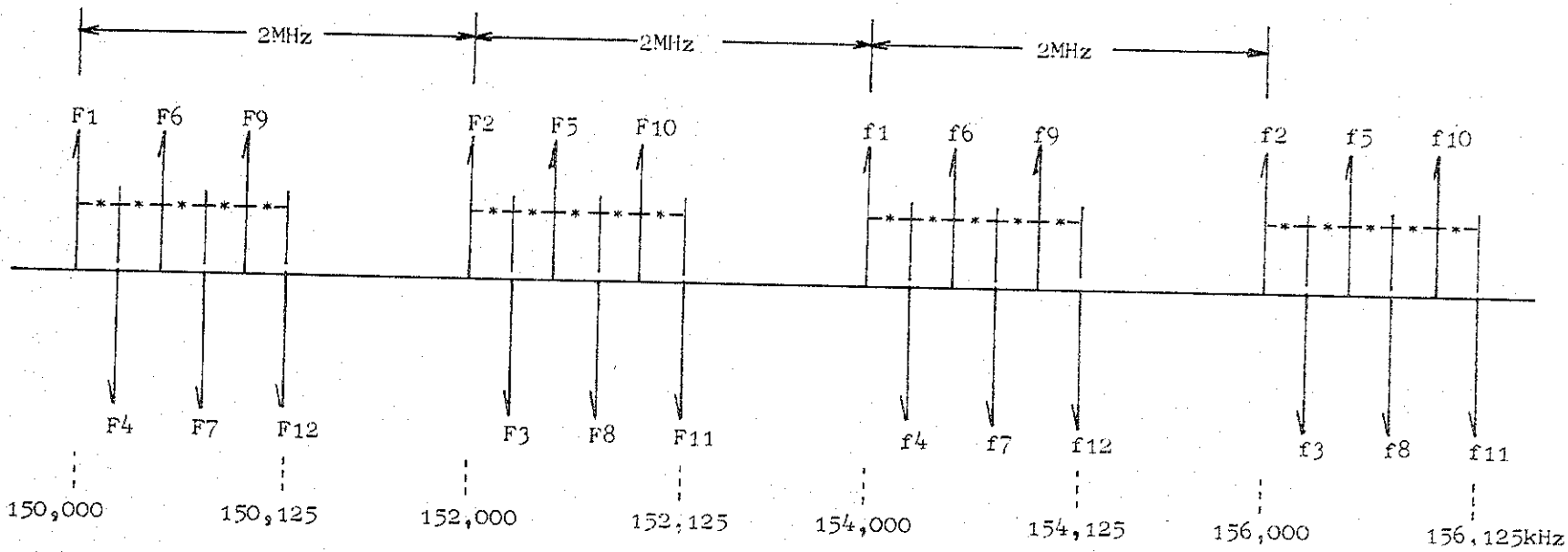


Fig. 5.2 Trunking Plan



Note 1. * : 25kHz

Note 2. Frequencies are shown in case of F1 = 150,000kHz.

Note 3. Frequencies should be allocated as follows:

Transmitting : 150,000 to 150,125kHz and 154,000 to 154,125kHz

Receiving : 152,000 to 152.125kHz and 156,000 to 156,125kHz

Note 3. In case of that one VHF radio channel (single channel) is used per link, F1 to F12 are used.

Fig.5.3 Allocation Plan of VHF

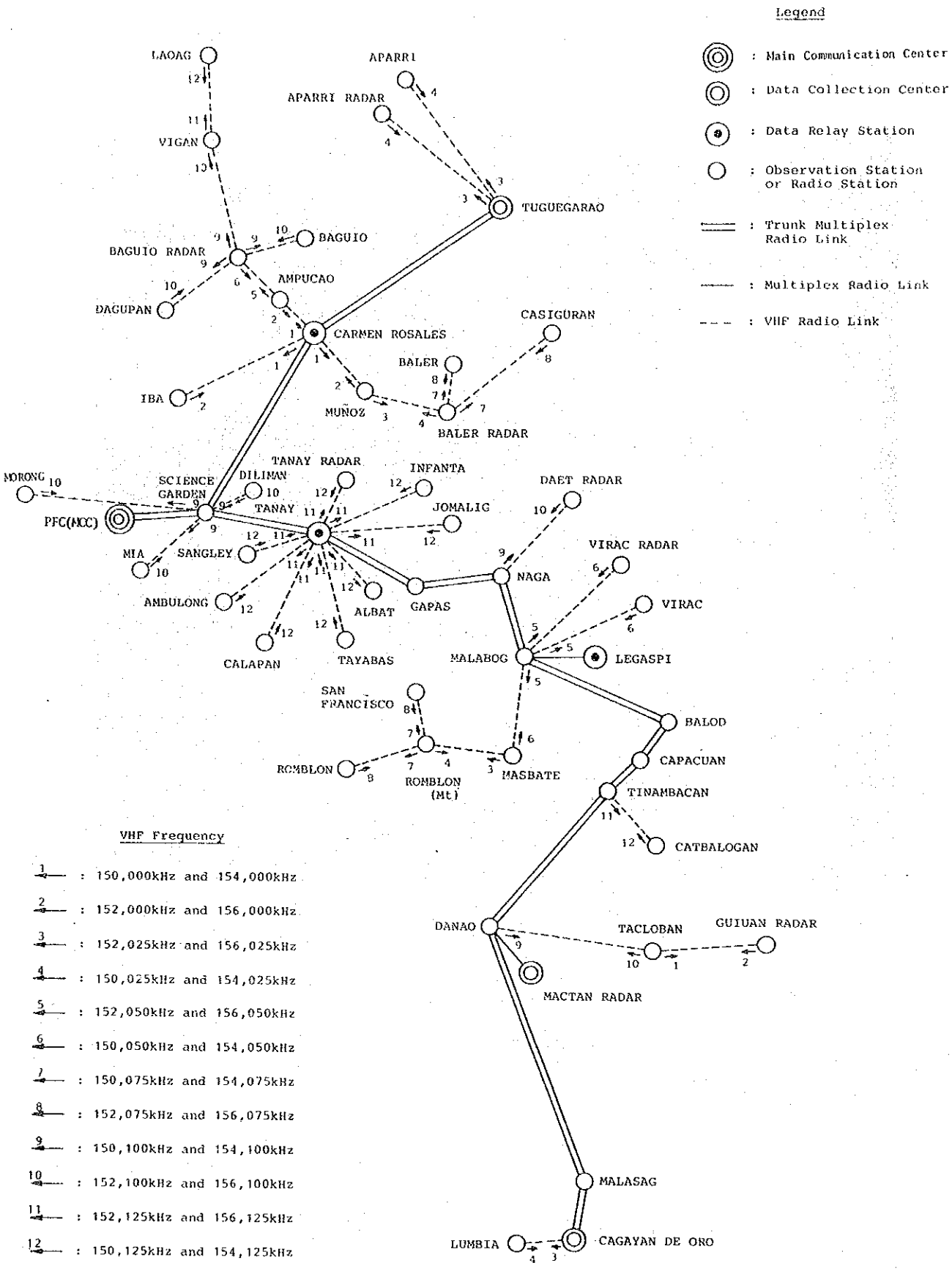
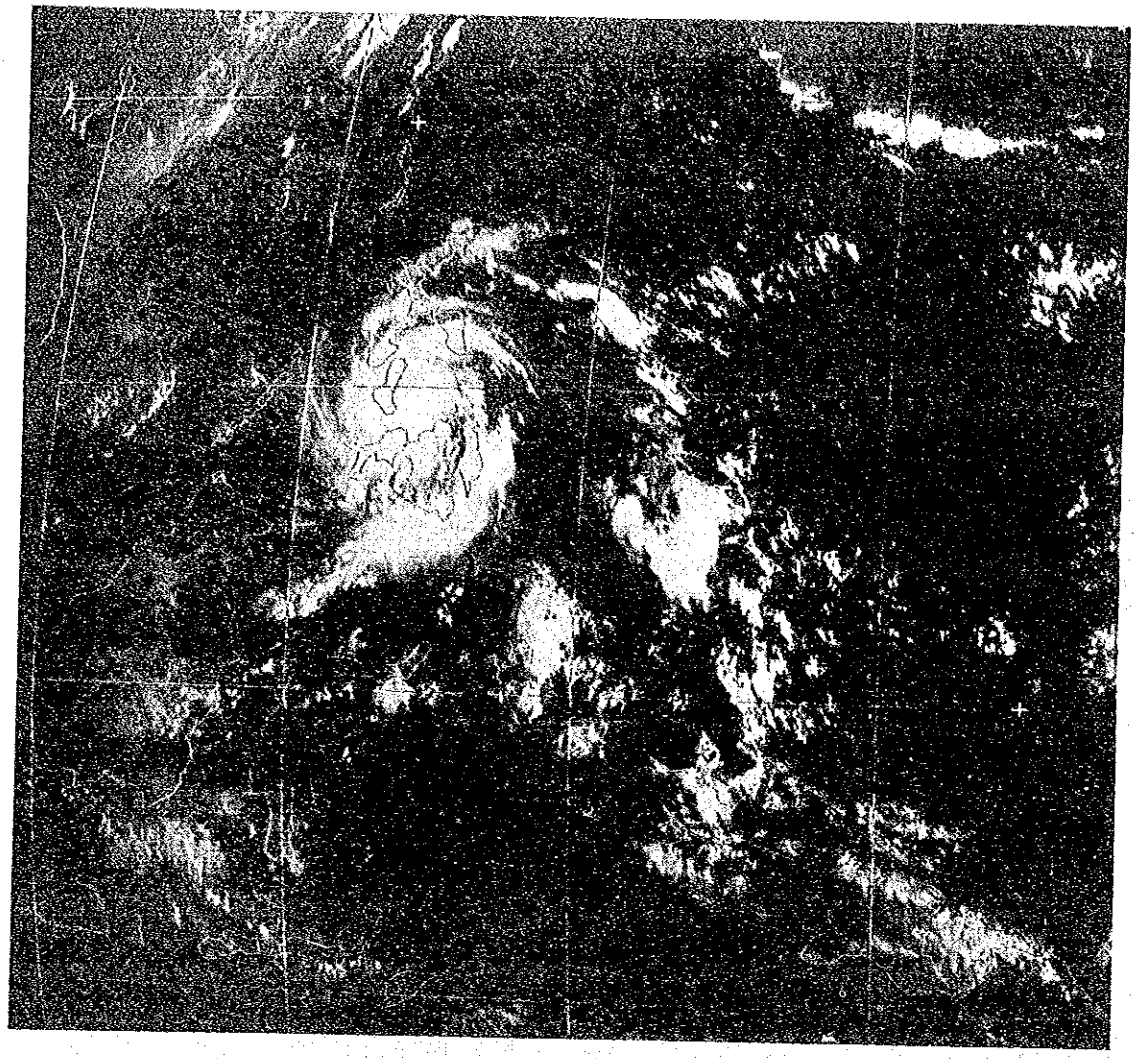


Fig. 5.4 Plan of Frequency Allotment (VHF)



Photograph 1 Photograph of Geostational Meteorological Satellite Typhoon NITANG (8411), (2nd. Sept. 1984 00Z)

Table

Table 1.1

Member of the JICA Study Team

Name	Organization	Assignment
Dr. Eizo Maruyama	Japan Weather Association	Meteorology. System Plan (General Manager)
Dr. Jutaro Kobayashi	"	Meteorology. System Plan Test Evaluation
Mr. Hideo Kato	"	Meteorology. Propagation Test Evaluation
Mr. Eiichi Kimura	"	Meteorology. Propagation Test Evaluation
Mr. Teruo Kobari	"	Meteorology. System Design Test Evaluation
Mr. Masashi Nakayama	"	Meteorology. Propagation Test Evaluation
Mr. Takefumi Okesha	"	Meteorology. Propagation System Design
Mr. Kazuo Muroi	"	Meteorology. Propagation
Mr. Shusho Yonaha	"	Meteorology. Propagation
Mr. Hiroshi Sasaki	"	Meteorology. Multiplex System Design
Mr. Takashi Saito	"	Meteorology. Multiplex System Design
Mr. Kei Ito	Nippon Koei Co., Ltd.	Meteorology. Facilities
Mr. Ken Yamada	"	Meteorology. Facilities
Mr. Kimihiko Yanagizawa	"	Project Evaluation

Table 1.2

Main Staff of PAGASA

Name	Assignment
Dr. Roman L. Kintanar	Administrator
Mr. Juanito F. Lirios	Director of National Weather Office
Mr. Ernesto V. Calpo	Director of National Geophysical and Astronomical Office
Mr. Manuel C. Bonjoc	Director of National Institute of Climatology
Mr. Catalino P. Arafiles	Director of National Institute of Atmospheric Sciences
Mr. Cipriano C. Ferraris	Director of National Flood Forecasting Office
Mr. Jesus F. Flores	Director of Typhoon Moderation and Research Office
Mr. Juan F. Asuncion	Asst. Chief of Weather Services, National Weather Office
Mr. Jovencion R. Guevarra	Chief of Financial Management Service
Miss Zenada L. Damasco	Project Coordinator of Special Infrastructure Group
Mr. Vincente M. Tio, Jr.	Chief of Technical Services
Mr. Ruben N. Encarnacion	Chief of Meteorological Communication Division

Table 1.3

Member of the Supervisory Committee

Name	Organization
Mr. Mitsuo Narui (Chairman)	Director Radio Communication Division Forecast Department Japan Meteorological Agency
Mr. Shigesaburo Kaneda	Chief of International Cooperation Office Planning Division Administration Department Japan meteorological Agency
Mr. Takeo Saito	Assistant Director Radio Communication Division Forecast Department Japan Meteorological Agency
Mr. Mamoru Ito	Researcher Radio Communication Division Forecast Department Japan Meteorological Agency
Mr. Mitsuo Igarashi	Technical Officer Radio Communication Division Forecast Department Japan Meteorological Agency

Table.1.4

The Schedule of The Study

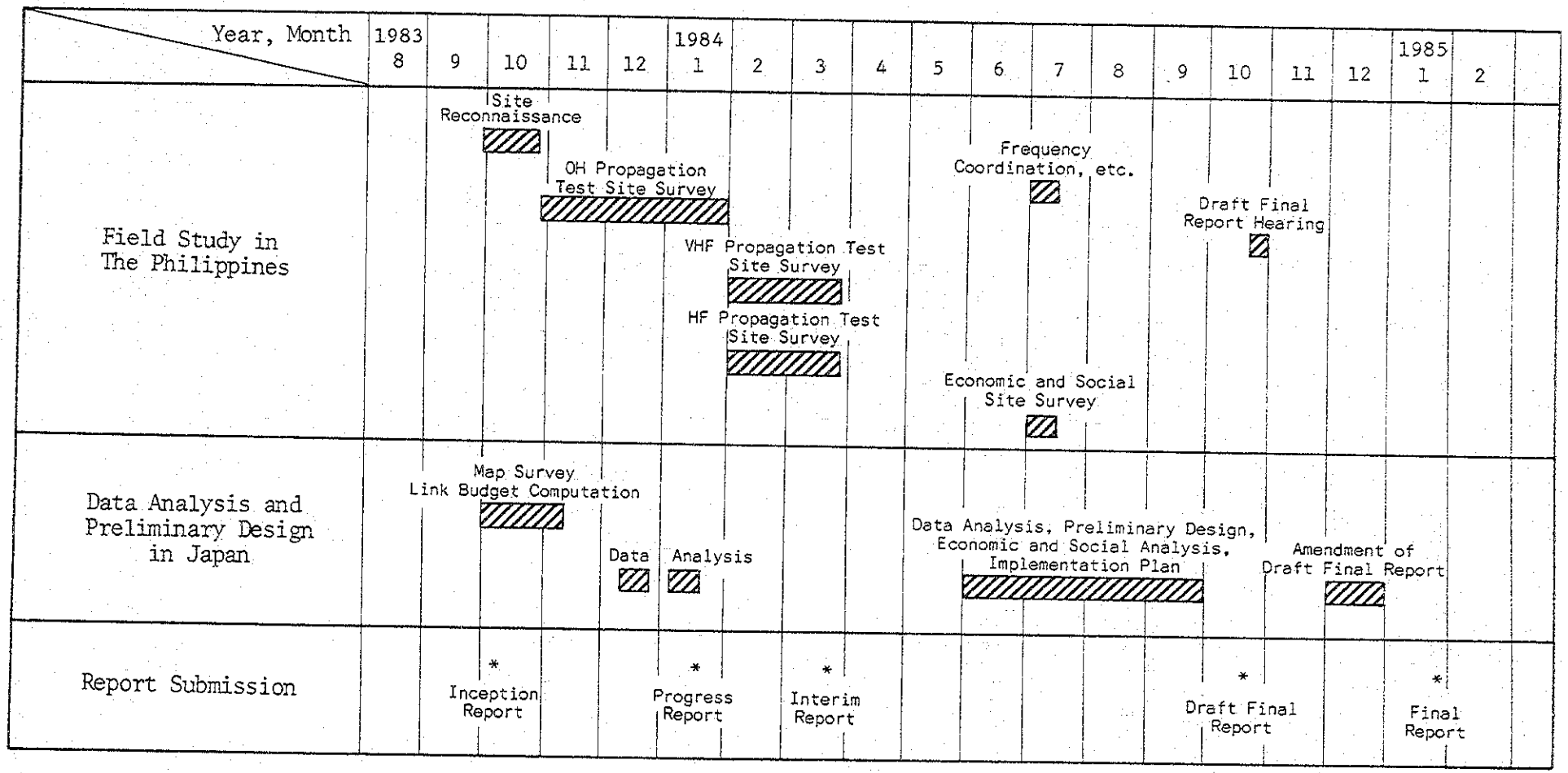


Table 2.1 (1/2) Socio-Economic Data in the Philippines

Population	1970 (10^3)	1975 (10^3)	1980 (10^3)	Growth (1970-80) (%p.a.)	Density (Persons/km^2)
Metropolitan Manila Area	3,967	4,970	5,926	4.1	9,317.4
Region 1	2,991	3,269	3,541	1.7	164.2
Region 2	1,691	1,933	2,215	2.7	60.9
Region 3	3,615	4,210	4,803	2.9	263.4
Region 4	4,457	5,214	6,119	3.2	130.4
Region 5	2,967	3,194	3,477	1.6	197.2
Region 6	3,618	4,146	4,526	2.3	223.8
Region 7	3,033	3,387	3,787	2.2	253.3
Region 8	2,381	2,600	2,799	1.6	130.6
Region 9	1,869	2,048	2,528	3.1	135.3
Region 10	1,953	2,314	2,759	3.5	97.4
Region 11	2,201	2,715	3,347	4.3	105.6
Region 12	1,941	2,070	2,271	1.6	97.5
Philippines	36,684	42,071	48,098	2.7	160.3

Gross Domestic Products	1970	1975	1980	1981	1982	1983
GDP at current price ($P10^9$)	42.45	114.60	266.01	305.27	340.26	380.82
Composition of GDP ($P10^9$)						
Agriculture, fisher & forestry	11.78	32.99	61.75	69.35	76.32	n.a.
Industrial sector	12.58	38.69	98.16	111.58	122.24	n.a.
Service sector	18.08	42.91	106.08	123.83	139.95	n.a.
GDP at 1980 price	145.37	196.56	266.01	276.51	285.93	288.93
Average annual growth at 1980 price (%)	6.2	6.2	3.9	3.4	1.0	
Per capita GDP at current price (Peso)	1,157	2,723	5,530	6,163	6,705	7,329 (US$660)
Composition on GDP by Industrial Group						
Agriculture, forestry & fishery (%)	28	28	23	23	23	n.a.
Industrial sector (%)	30	34	37	37	36	n.a.
Service sector	44	38	40	40	41	n.a.

Table 2.1 (2/2) Socio-Economic Data in the Philippines

International Trade	1970	1975	1980	1981	1982	1983
Composition of value of exports(%)						
Traditional exports	75	71	46	40	37	n.a.
Non-traditional exports	25	29	54	60	63	n.a.
Composition of value of imports(%)						
Consumer goods	11	16	18	20	22	n.a.
Capital goods	42	33	26	24	23	n.a.
Intermediate goods	47	51	56	56	55	n.a.
Foreign Reserves						
(10^6 US$ at end of year)	195	1,314	2,846	2,199	1,720	786
Exchange Rate						
(P/U.S.$, Period Average)	5.9	7.2	7.5	7.9	8.5	11.1
Balance of Payments (US$$10^6$)						
Exports	1,142	2,294	5,788	5,722	4,995	n.a.
Imports	1,159	3,459	7,727	7,946	7,800	n.a.
Overall balance	23	-521	-381	-560	-1,135	n.a.
Labor Force Employment						
Unemployed rate (%)						
Total employed (10^3 persons)	11,775	14,517	14,238	14,334	16,118	n.a.
Agriculture,forestry and fishery (%)	54	54	54	52	52	n.a.
Industrial sector (%)	16	15	15	14	14	n.a.
Service sector (%)	30	31	31	34	34	n.a.
Price Indices						
Wholesale price (1980=100)	22.9	57.8	100.0	113.1	125.2	142.4
Consumer price (1980=100)	27.8	57.9	100.0	113.3	125.7	139.4

Source: (1) 1983 Philippine Statistical Yearbook (NEDA)

(2) International Financial Statistics (IMF)

Table 2.2 Data on Agricultural Production

	1970	1975	1980	1981	1982
Composition of agricultural production (value)					
Food crops (%)	59	67	63	63	70
Commercial crops (%)	41	33	37	37	30
Mean yield in metric tons per hectare					
Food crops					
Palay (rice)	1.68	1.59	2.15	2.23	2.36
Corn	0.83	0.84	0.98	0.98	0.98
Commercial crops					
Cocunut	0.92	1.20	1.46	1.46	1.20
Sugarcane	7.09	6.13	7.35	7.59	7.23
Gross value added in agricultural crops (₱10^6 at current price)					
Palay	1,938	5,616	9,078	10,901	12,335
Corn	599	2,041	3,481	4,288	4,993
Coconut including copra	1,003	2,808	3,036	3,066	2,840
Sugarcane	730	2,601	2,699	3,182	3,675
Banana	715	1,896	4,845	5,141	5,370
Other crops	1,512	5,604	13,189	13,776	15,193
Agricultural crops	6,497	20.566	36,328	40,354	44,406

Source: 1983 Philippine Statistical Yearbook

Table 2.3 GDP of Industrial Sector

Industrial sector (at current price P10^6)	1970	1975	1980	1981	1982
Mining and quarring	1,181	2,000	8,095	6,849	5,443
Manufacturing	9,574	28,544	65,993	75,151	83,126
Construction	1,515	7,060	21,331	26,238	29,658
Electricity, gas and water	311	1,088	2,763	3,344	4,015
Total	12,581	38,692	98,162	111,582	122,242

Table 2.4 GDP Composition of Selected Manufacturing by Industry Group

Industry group (at current price $P10^6$)	1970	1975	1980	1981	1982
Foods	2,660	7,231	20,026	23,694	27,189
Petroleum and coal	738	3,526	9,535	10,651	11,617
Chemical	813	3,530	5,918	5,983	5,992
Textile	553	1,687	4,622	5,161	5,261
Others	4,810	12,570	25,832	29,662	33,067
Total	9,574	28,544	65,933	75,151	83,126

Source: 1983 Philippine Statistical Yearbook

Table 2.5 Telecommunication Facilities for Public Service (1982)

	Telecommunication facilities			Broadcasting stations	
	Telephone	Telegraph	Telex	Radio	TV
Philippines	219	2,153	122	326	22
Manila area	19	158	39	35	5
Region I	22	161	10	38	0
" II	9	122	5	13	0
" III	41	192	14	22	1
" IV	41	276	7	18	0
" V	16	159	6	25	1
" VI	14	197	11	35	4
" VII	9	204	8	29	4
" VIII	9	181	6	15	0
" IX	6	103	3	16	2
" X	10	162	6	28	1
" XI	19	136	4	23	3
" XII	4	102	3	19	1

Table 2.6 Number of Licensed Radio Stations by Type from 1975 to 1982

	1975	1976	1977	1978	1979	1980	1981	1982
Television stations	27	27	25	30	31	32	43	52
Coastal stations	203	153	143	166	171	241	162	244
Aircraft "	820	820	829	830	515	729	590	702
Land base radio stations	679	679	708	722	650	867	1,295	1,920
Ship stations	n.a.	n.a.	2,729	1,750	1,076	1,628	1,930	2,934

Source; 1983 Philippine Statistical Yearbook

Table 2.7 Projected Regional Per Capita Output (1978-1987)

Unit: ₱x10^3

	1978	1979	1980	1981	1982	1987	Annual increase rate for 1978-1987 (%)
Luzon	2,108	2,193	2,279	2,391	2,495	3,148	4.6
Visayas	1,569	1,663	1,751	1,841	1,938	2,523	5.4
Eastern Visayas	990	1,052	1,115	1,185	1,282	1,764	6.6
Mindanao	1,333	1,394	1,463	1,533	1,629	2,115	5.3
Philippines	1,804	1,885	1,967	2,064	2,163	2,756	4.8

Source: Five-year Philippine Development Plan, 1978 - 1982, Regional Development Framework, NEDA, Nov., 1977.

Table 2.8

Mean Monthly and Annual Frequency of Tropical Cyclones in the Philippines (1944 - 1983)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1944	1						1		1	2			5
45							2	1	2				5
46				1	1	1			2	1	1		7
47						1			1	1	2	1	6
48							2		3	1		2	8
49	1						1		1	2	1	2	8
50									1	1	1	1	4
51					1		1	2	2		1	1	8
52						1	2	1	1	3	2	1	11
53		1				2		1	1	1	1		7
54			1		1			1		1	4	1	9
55	1							1	1		1		4
56			1	1			1	1	2	2	2	1	11
57	1			2			1		3		1		8
58				1					2	1			4
59			1							1	1	1	4
60				1	1	2				2		1	7
61					2		1		1	1		1	6
62		1			2		1	1	2	1	2		10
63						2	1	1	1	1		2	8
64						1	2	2	5	3	4		17
65	1		1	1	1	2	2	2					10
66				1	1		2	1		1	2	1	9
67		1	1	1		1		1		1	2		8
68						1	2	1	1				5
69				1			2	1		1			5
70		1				1	1	1	1	4	2		11
71				1	1	1	5		1	3			12
72	1					1	1		3		1		7
73						1	1	2	2	2	2		10
74						1	1	1		4	2	2	11
75	1								1	1	1	1	5
76					1	1	1	2	1		1	1	8
77						3		1	4		1	1	10
78					1	1		1	3	3			9
79	1			1	1		1		1	1	2	1	9
80					2	1	2		1	1	1		8
81						2	1		1	2	1		7
82			2		1		1	1	2	1		1	9
83							1	2	1	2	2		8
Total	8	4	7	12	17	27	40	29	55	50	45	24	318
Frequency (%)	3	1	2	4	5	8	13	9	17	16	14	8	100

Table 2.9

Mean Monthly and Annual Rainfall for Stations (mm) in the Philippines (1951 - 1970)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
LUZON													
Ambulong	26.4	15.2	15.4	33.6	139.3	220.1	241.4	287.8	268.5	206.8	156.6	95.5	1706.4
Aparri	148.3	88.8	39.7	38.9	86.3	183.3	201.8	259.3	306.9	331.6	409.0	224.0	2317.9
Baguio	11.0	11.3	38.7	104.8	288.4	476.3	576.8	817.5	670.9	254.7	142.5	26.6	3422.2
Laoag	4.2	0.8	2.5	13.7	122.2	436.0	404.3	565.8	389.6	65.6	50.0	11.9	2067.2
Vigan	0.9	1.7	7.1	21.9	127.8	420.1	474.3	704.3	407.0	79.3	40.5	10.8	2295.7
Dagupan	4.0	8.3	22.2	86.5	211.5	346.5	433.9	541.6	370.3	140.6	64.9	17.2	2247.7
Basco	177.0	141.3	119.7	94.2	119.1	290.4	245.7	354.0	393.0	264.3	335.6	283.9	2818.2
Tuguegarao	20.4	18.8	37.4	54.3	103.6	192.8	211.5	248.9	220.4	226.3	280.1	105.4	1700.3
Cabanatuan	4.9	6.3	12.0	38.0	148.0	267.6	272.4	394.2	317.9	149.5	130.6	39.1	1780.5
Iba	2.6	1.6	10.8	38.0	261.0	602.9	717.1	939.1	733.6	163.7	75.0	28.6	3674.0
Legaspi	301.6	176.2	207.6	172.7	182.2	205.4	229.8	282.9	247.3	307.3	478.3	466.3	3257.6
Daet	361.8	191.7	165.2	131.7	137.2	163.9	206.1	275.7	270.3	494.7	614.1	537.6	3550.0
Baler	181.2	151.7	193.4	236.6	311.7	247.7	230.7	262.0	259.3	362.1	467.7	303.4	3207.5
Casiguran	230.8	180.5	198.6	143.3	239.3	226.5	239.3	266.8	265.0	351.7	637.5	457.3	3436.6
Manila	15.5	4.9	4.3	16.8	104.5	255.6	306.2	420.4	348.7	172.7	120.5	57.8	1827.9
Infanta	379.4	241.6	183.5	192.0	199.3	216.7	236.6	227.7	297.3	503.5	572.8	537.4	3787.8
Virac	232.0	138.3	119.2	131.6	188.1	183.1	214.0	203.1	226.8	374.2	484.4	430.7	2925.5
Average of Luzon	123.6	81.1	81.1	91.1	174.7	290.3	320.1	414.7	352.5	267.5	295.0	213.7	2705.4
VISAYAS													
Calapan	113.6	60.0	54.9	85.9	172.8	201.3	205.9	222.7	180.4	272.3	247.8	207.0	2024.6
Coron	27.1	6.7	4.6	18.8	180.2	380.3	489.8	562.3	456.1	276.0	177.9	103.2	2683.0
Pto. Princesa	58.9	33.0	40.9	53.9	168.2	197.9	220.7	194.8	240.5	267.2	274.6	235.7	1985.5
Cuyo	18.4	3.6	7.4	37.6	177.1	388.9	465.4	423.3	361.0	276.5	151.8	53.4	2364.4
Masbate	170.9	74.9	64.3	42.5	105.6	141.4	179.5	205.2	181.2	224.8	239.1	227.9	1857.3
Roxas	107.4	52.7	54.7	43.5	167.1	277.6	280.6	249.3	234.6	354.1	239.4	176.8	2237.8
Iloilo	42.0	20.0	33.7	38.6	137.7	258.7	280.1	332.8	242.6	212.9	184.0	95.4	1878.5
Cebu	100.2	70.3	53.9	58.2	114.8	178.1	208.7	189.5	178.1	191.1	161.9	133.3	1638.1
Mactan	110.5	80.6	33.0	28.6	66.2	139.2	184.4	143.7	216.8	138.6	133.0	150.8	1425.4
Dumaguete	81.3	52.0	66.8	40.6	82.6	134.8	157.9	111.5	112.8	163.2	176.4	126.4	1306.3
Borongan	605.9	414.7	306.5	265.2	332.5	220.5	210.9	209.2	190.7	305.3	512.7	670.5	4244.4
Guiuan Radar	237.8	291.4	149.9	175.9	120.0	300.9	178.2	132.3	208.7	162.9	310.8	362.7	2631.5
Tacloban	246.5	201.2	131.1	115.5	149.4	137.5	151.6	128.9	135.8	172.4	243.0	288.0	2000.7
Catarman	394.1	226.5	205.6	161.3	156.7	155.4	202.9	177.6	195.4	421.6	548.3	490.0	3346.4
Catabalogan	214.7	133.4	125.2	107.4	192.1	178.4	235.9	263.7	238.1	323.2	335.7	324.6	2672.3
Average of Visayas	165.6	114.1	88.8	84.9	154.9	219.4	243.5	236.5	231.5	250.8	262.4	243.0	2295.4
MINDANAO													
Zamboanga	48.8	29.1	43.5	58.5	94.7	142.9	122.7	147.3	144.0	177.7	118.9	84.5	1212.6
Dipolog	145.1	74.4	92.2	90.6	222.8	265.1	252.2	234.5	244.9	279.2	322.6	295.1	2518.7
Cagayan de Oro	95.1	71.3	45.6	31.9	118.7	204.3	219.0	207.3	215.6	169.7	127.7	119.5	1625.7
Lumbia	39.7	70.8	6.4	29.0	116.8	253.5	200.4	225.8	159.4	222.6	107.0	98.4	1529.8
Surigao	606.0	479.4	369.4	247.1	188.1	133.8	177.7	155.6	170.7	267.6	411.5	607.3	3814.2
Davao	124.7	109.9	86.0	139.6	226.0	162.2	195.5	153.0	171.5	171.3	149.9	114.7	1804.3
General Santos	65.5	69.5	44.3	51.1	103.3	104.5	101.0	82.0	78.4	85.9	88.2	70.0	943.7
Hinatuan	714.2	542.2	450.6	323.7	285.6	267.9	209.2	193.3	208.8	207.7	337.4	619.7	4360.3
Cotabato	71.3	90.9	95.3	131.8	257.2	251.4	248.9	323.7	238.3	253.6	176.7	98.7	2237.8
Jolo	95.5	89.7	93.2	163.3	249.6	258.0	205.4	146.6	181.8	240.9	202.9	144.6	2071.5
Average of Mindanao	200.6	162.7	124.9	126.7	186.3	204.4	193.2	217.9	181.3	207.6	204.3	225.3	2235.2

Table 2.10

Mean Monthly and Annual Number of Rainy Days
for Stations in the Philippines (1951 - 1970)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
LUZON													
Ambulong	6	5	3	4	10	17	20	21	20	16	13	10	145
Aparri	15	11	7	5	8	13	12	15	16	18	20	19	160
Baguio	4	3	5	10	19	23	26	27	25	17	9	5	173
Laoag	2	1	2	2	8	16	19	21	18	7	6	2	98
Vigan	1	1	1	2	8	17	20	22	17	6	5	2	99
Dagupan	2	3	4	7	13	18	22	24	21	11	6	3	129
Basco	20	15	14	11	12	16	17	21	21	20	20	21	207
Cabanatuan	2	2	3	4	12	18	20	24	22	12	10	6	130
Iba	2	2	2	5	12	18	24	25	22	14	7	4	132
Tuguegarao	6	4	5	5	10	13	14	15	15	14	15	11	127
Legaspi	21	17	17	17	14	16	19	20	20	20	21	23	225
Daet	24	18	14	14	13	15	17	19	19	24	24	27	225
Baler	16	16	18	19	19	18	18	19	18	18	18	17	214
Casiguran	18	15	15	15	16	15	17	18	18	18	20	20	203
Manila	4	2	4	4	12	19	23	24	23	17	14	9	148
Infanta	25	20	16	17	16	17	18	19	19	25	24	27	244
Virac	21	16	16	17	16	16	18	16	17	21	22	23	221
Average of Luzon	11	8	9	9	13	17	19	21	19	17	15	12	169
VISAYAS													
Calpan	18	12	10	10	13	17	16	18	16	18	19	21	188
Coron	3	2	2	2	9	19	22	22	21	16	10	7	130
Pto. Princesa	4	3	4	6	12	15	16	17	16	15	13	8	127
Cuyo	4	2	3	3	13	21	23	22	20	18	9	6	137
Masbate	15	11	10	6	8	14	16	17	15	16	16	16	159
Roxas	15	10	9	6	12	17	18	18	17	20	18	17	175
Iloilo	8	6	6	5	12	18	19	20	19	17	15	12	159
Cebu	13	11	11	8	12	16	18	17	16	20	15	16	173
Mactan	11	9	5	4	7	14	14	11	16	14	12	14	131
Dumaguet	14	10	8	6	9	15	16	15	14	17	15	16	155
Borongan	25	22	22	22	20	18	17	15	16	20	22	26	246
Guiuan Radar	21	17	16	18	12	22	16	13	18	18	23	24	218
Tacloban	20	18	17	16	15	16	18	15	16	18	20	22	210
Catarman	22	19	16	16	14	16	17	15	15	20	23	25	216
Catabalogan	18	15	15	15	16	17	19	18	17	20	21	22	213
Average of Visayas	14	11	10	10	12	17	18	16	17	18	17	17	176
MINDANAO													
Zamboanga	7	6	7	8	14	15	15	15	13	14	14	10	140
Dipolog	10	8	7	7	12	14	14	13	12	12	12	10	204
Cagayan de Oro	10	8	7	6	12	18	19	19	18	15	12	12	155
Lumbia	8	6	2	6	7	19	17	14	15	16	8	11	129
Surigao	26	22	22	19	15	13	16	14	14	18	21	26	227
Davao	18	14	12	11	15	19	18	17	17	19	21	21	174
General Santos	10	8	7	7	12	14	14	13	12	12	12	11	132
Hinatuan	25	24	25	22	20	18	18	16	16	17	19	25	245
Cotabato	10	11	10	14	20	19	21	20	19	21	19	14	198
Jolo	9	8	9	11	17	17	17	15	14	17	17	14	165
Average of Mindanao	13	12	11	11	14	17	17	16	15	16	14	15	177

Table 2.11

Mean Monthly and Annual Temperatures for Stations (°C)
in the Philippines (1951 - 1979)

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
LUZON													
Ambulong	26.0	26.9	27.9	29.2	29.3	28.3	27.6	27.3	27.4	27.4	27.1	26.3	27.5
Aparri	23.3	24.0	25.9	27.6	29.1	29.2	28.8	28.5	27.9	26.9	25.5	24.7	26.7
Baguio	17.8	18.3	19.5	20.3	20.4	19.8	19.4	19.0	19.1	19.4	18.9	18.4	19.2
Laoag	24.4	24.8	26.4	28.0	28.9	28.2	27.7	27.4	27.2	27.2	26.5	25.4	26.8
Vigan	25.5	26.0	27.2	28.4	28.9	27.8	27.3	26.8	26.8	27.3	26.8	26.1	27.1
Dagupan	26.1	26.7	28.3	29.6	29.7	28.8	28.3	27.8	27.9	28.2	27.4	26.7	28.0
Basco	21.9	22.7	24.3	26.2	27.8	28.1	28.3	27.9	27.5	26.4	24.9	23.1	25.8
Tuguegarao	24.5	25.5	27.7	29.5	30.5	29.9	29.1	29.0	28.6	27.5	26.1	24.9	27.7
Cabanatuan	25.9	26.3	27.8	29.3	29.7	28.6	28.1	27.5	27.6	27.6	26.8	26.2	27.6
Iba	25.8	25.9	27.1	28.3	28.6	27.6	27.1	26.7	26.9	27.3	27.1	26.3	27.1
Legaspi	25.5	25.7	26.4	27.3	28.2	28.3	27.8	27.7	27.6	27.2	26.7	26.0	27.0
Daet	25.3	25.6	26.4	27.5	28.5	28.6	28.1	28.1	27.8	27.2	26.8	26.0	27.2
Virac	25.5	26.0	27.2	28.4	28.9	27.8	27.3	26.8	26.8	27.3	26.8	26.1	27.0
Baler	24.6	24.8	25.8	27.1	28.1	28.5	28.3	28.1	28.0	27.1	26.1	25.3	26.8
Casiguran	23.6	23.8	24.9	26.2	27.4	27.8	27.5	27.4	27.2	26.4	25.4	24.5	26.0
Manila	25.9	26.4	27.7	29.1	29.6	28.4	28.0	27.5	27.5	27.8	27.2	26.3	27.6
Infanta	24.6	24.9	25.9	27.2	28.2	28.5	28.1	28.1	27.7	26.9	26.3	25.3	26.8
Average of Luzon	24.5	25.0	26.3	27.6	28.3	27.9	27.5	27.6	27.0	26.8	25.6	25.1	26.6
VISAYAS													
Calapan	25.4	25.6	26.8	28.1	28.4	28.0	27.5	27.4	27.3	27.1	26.6	25.6	26.9
Coron	27.1	27.3	28.1	28.9	28.9	27.7	26.8	26.8	26.9	27.4	27.5	27.3	27.6
Pto. Princesa	26.1	26.3	27.1	28.0	27.9	27.3	27.1	27.2	27.0	26.9	26.7	26.3	27.0
Cuyo	26.9	27.0	27.7	28.8	28.9	28.1	27.6	27.6	27.6	27.7	27.8	27.4	27.8
Masbate	26.3	26.6	27.5	28.7	29.4	29.3	28.5	28.6	28.5	28.3	27.6	26.9	28.0
Roxas	26.7	26.9	27.7	29.0	29.4	29.0	28.5	28.5	28.4	28.2	27.9	27.3	28.1
Iloilo	25.7	25.9	26.8	28.1	28.5	27.9	27.4	27.2	27.2	27.3	26.9	26.2	27.1
Cebu	26.5	26.6	27.3	28.4	28.8	28.1	27.5	27.6	27.6	27.5	27.3	26.8	27.5
Mactan	26.7	26.8	27.6	28.6	29.1	28.6	28.4	28.6	28.1	28.1	28.2	27.2	28.0
Dumaguete	26.7	26.7	27.6	28.6	28.8	28.3	27.8	28.0	28.0	27.8	27.6	27.2	27.8
Borongan	25.9	25.9	26.6	27.4	27.8	27.9	27.7	28.0	28.0	27.4	26.8	26.3	27.1
Guiuan Radar	26.1	26.0	26.7	27.4	28.2	27.7	27.6	28.2	27.8	27.8	27.2	26.4	27.3
Tacloban	26.0	26.0	26.7	27.5	28.0	28.0	27.8	28.1	28.1	27.8	27.2	26.5	27.3
Catabalogan	26.1	26.2	27.0	27.9	28.5	28.5	28.1	28.3	28.3	27.6	27.1	26.5	27.5
Catarman	25.2	25.3	25.9	26.6	27.4	27.7	27.3	27.6	27.5	26.7	26.4	25.8	26.6
Average of Visayas	26.2	26.3	27.1	28.1	28.5	28.1	27.7	27.8	27.2	27.6	27.3	26.6	27.4
MINDANAO													
Zamboanga	26.6	26.8	27.2	27.5	27.6	27.1	26.8	26.9	27.0	27.0	27.0	26.7	27.0
Dipolog	26.9	27.1	27.7	28.5	28.4	28.0	26.7	27.7	27.7	27.7	27.6	27.2	27.7
Cagayan de Oro	25.9	26.1	26.7	27.5	28.1	27.7	27.3	27.5	27.4	27.3	27.0	26.4	27.1
Lumbia	25.6	25.3	26.2	27.4	28.0	26.7	26.3	26.9	26.7	26.4	26.5	25.9	26.5
Surigao	25.6	25.6	26.2	27.0	27.7	27.8	27.5	27.9	27.9	27.3	26.7	26.1	26.9
Davao	26.3	26.6	27.3	27.9	27.8	27.3	26.9	27.1	27.2	27.4	27.3	26.8	27.2
General Santos	26.8	27.1	27.6	28.0	27.5	26.8	26.3	26.3	26.5	26.8	27.0	27.0	27.0
Hinatuan	25.5	25.2	25.9	26.5	27.1	27.1	27.1	27.3	27.3	27.1	26.7	26.2	26.6
Cotobato	26.9	27.2	27.8	28.2	27.9	27.4	27.0	26.9	27.0	27.3	27.2	27.1	27.3
Average of Mindanao	26.2	26.3	26.3	27.6	27.8	27.3	26.2	26.5	26.5	26.4	26.3	26.6	27.0

Table 2.12 Natural Disasters in the Philippines for the Period from 1970 to 1983

Items	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1. Typhoons														
a. No. of Typhoons entered the PAR/1	15	27	17	12	23	15	22	18	25	21	23	20	18	23
Destructive	8	6	4	4	9	2	6	7	8	9	9	7	8	4
b. Casualties														
Dead	1,328	89	298	74	53	39	313	99	663	69	143	696	337	126
Missing	495	110	5	89	89	8	188	23	395	68	29	342	223	28
Injured	1,917	72	33	24	118	8	37	118	834	79	55	1,996	347	168
c. Affected														
Families (10^3)	18	-	-	2	97	5	1,505	137	520	156	308	306	266	141
Persons (10^3)	110	-	-	12	444	27	2,744	23	2,853	924	1,667	1,750	1,569	747
d. Houses Destroyed														
Totally (10^3)	n.a.	n.a.	n.a.	n.a.	1.4	0.7	3.9	15.8	520.4	155.9	307.6	305.9	266.5	140.6
Partially (10^3)	n.a.	n.a.	n.a.	n.a.	4.6	1.5	4.9	16.1	2.853.1	924.3	1,667.0	1.750.1	1,569.0	747.2
e. Cost of Damage (₱10^6)	500.6	40.3	178.3	250.4	365.1	18.9	724.8	335.1	1.575.2	417.2	1,471.7	1.419.0	1,650.5	522.1
f. Cost of Assistance (₱10^6)	n.a.	n.a.	n.a.	0.4	1.5	0.2	4.0	0.6	5.5	1.2	0.2	5.5	5.0	2.1
2. Droughts														
a. Agr'l Areas Affected (10^3 ha)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	-	987
b. Farmer Affected									2,829	-	-	-	-	22,765
c. Production Losses (₱10^6)									n.a.	-	-	-	-	763
d. Assistance extended (₱)									7,566	-	-	-	-	101

Note: /1 Philippine Area of Responsibility

Items	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
3. Flooding														
a. No. of Occurrence	n.a.	n.a.	n.a.	2	1	4	3	6	2	3	5	4	2	6
b. No. of Province Affected				7	1	1	3	7	-	-	12	-	-	-
c. Casualties														
Dead				3	-	-	18	5	3	1	336	125	27	41
Missing				-	-	-	3	-	8	-	4,298	122	1	-
Injured				-	-	-	-	-	-	-	48	95	21	45
d. Affected														
Families (10^3)				5.0	1.8	0.1	14.6	1.5	0.4	16.6	126.5	0.7	99.6	5.5
Persons (10^3)				30.2	9.1	0.5	73.4	9.3	1.8	96.9	762.7	3.7	532.6	n.a.
e. Houses Destoyed				-	22	516	60	98	43	100	-	9	15	-
f. Cost of Damage (₱10^6)				3.3	0.0	0.8	12.3	16.2	-	5.2	366.3	4.2	115.1	12.6
g. Cost of Assistance (₱10^6)				-	-	-	0.1	-	-	-	-	4.2	2.0	0.1
4. Earthquakes														
a. No. of Occurrence	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	8	9	1	8	5	15
Minor							1	-	8	9	1	8	5	15
Major							-	-	-	-	-	-	-	-
b. No. of Province Affected							21	-	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
c. Casualties														
Dead							3,792	1	5	-	511	-	-	19
Missing							1,937	-	-	-	-	-	-	-
Injured							9,240	9	2	-	-	-	-	176
d. Affected														
Families (10^3)							60.4	-	-	-	9.2	-	-	0.5
Persons (10^3)							362.1	-	-	-	50.2	-	-	3.0

Items	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
e. Cost of Damage (₱10^6)							246.9	5.1	-	-	2.5	-	-	14.8
f. Cost of Assistance (₱10^6)							-	-	-	-	-	-	-	0.0
5. Tornado														
a. No. of Occurrence	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	17	24	7	1	-	4
b. Casualties														
Dead									-	2	8	-	-	2
Missing									-	-	-	-	-	1
Injured									22	-	54	-	-	5
c. Cost of Damage (₱10^6)									0.5	1.5	0.8	4.2	-	0.8
6. Land Slides														
a. No. of Occurrence	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	4	3	2	3	3	1
b. Casualties														
Dead									26	-	-	5	-	-
Missing									7	-	-	2	5	-
Injured									11	-	-	2	-	-
c. Cost of Damage (₱10^3)									0.0	0.0	-	-	-	-
7. Sea Mishaps														
a. No. of Occurrence	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	3	10	9	15	10
b. Casualties														
Dead									-	5	20	15	31	3
Missing									-	11	-	6	49	-
Injured									-	-	18	22	13	-
8. Air Mishaps														
a. No. of Occurrence	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2	1	5	4	6	1
b. Casualties														
Dead									3	-	-	8	3	-
Missing									-	-	7	-	-	-
Injured									-	-	133	3	10	-

Source: Office of Civil Defense, Ministry of National Defense

Table 2.13 Estimated Damages by Various Causes of Adverse Weather in the Philippines

Unit: $P10^6$

Items	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1. Typhoons	500.6	40.3	178.3	250.4	365.1	18.9	724.8	335.1	1,575.2	417.2	1,471.7	1,419.0	1,650.5	522.1
2. Droughts	na	na	na	na	na	na	na	na	na	-	-	-	-	763.1
3. Flooding	na	na	na	3.3	0.0	0.8	12.3	16.2	-	5.2	366.3	4.2	115.1	12.6
4. Earthquakes	na	na	na	na	na	na	246.9	5.1	-	-	2.5	-	-	14.8
5. Tornado	na	na	na	na	na	na	na	na	0.5	1.5	0.8	4.2	-	0.8
6. Land Slides	na	na	na	na	na	na	na	na	0.0	0.0	-	-	-	-
7. Others/1	na	na	na	na	na	na	na	na	188.6	411.0	484.0	177.5	460.9	338.3
Total (A)	500.6	40.3	178.3	253.7	365.1	19.7	984.0	356.4	1,764.3	834.9	2,325.3	1,604.9	2,226.5	1,651.7
cf. GDP ($P10^9$)(B)/2	42.4	50.1	56.1	71.8	99.6	114.6	133.9	155.6	178.6	220.5	266.0	304.8	338.5	375.9/3
(A/B x 10^3) (%)	1.18	0.08	0.32	0.35	0.37	0.02	0.73	0.23	0.99	0.38	0.87	0.53	0.66	0.44

Notes; /1 Includes big waves, ship collisions and fire incidents.
/2 At current prices.
/3 Estimate assuming the same growth as 1981-1982.

Source; Office of Civil Defense, Ministry of National Defense.

Table 2.14 Natural Disasters in Japan for the Period from 1977 to 1982

Items	1977	1978	1979	1980	1981	1982
1) Deaths & Missing (Persons)	174	153	208	163	232	524
2) House & Building						
Totally destroyed (Number)	1,707	1,671	509	351	371	1,386
Partially destroyed (Number)	2,114	7,495	3,075	654	894	2,353
3) Cost of Damage (¥ billion)	484	734	960	1,385	1,556	1,848
4) GNP (¥ billion)	188,804	206,763	222,043	240,647	253,811	267,351
5) Ratio to GNP ((3)/(4))(%)	0.26	0.35	0.43	0.58	0.61	0.69

Note; Natural disasters comprise typhoon, heavy rain, storm, high tide, earthquake, tidal wave and heavy snow.

Source; National Land Agency, Government of Japan.

Table 2.15 Monthly Frequency of Passage of Tropical Cyclone Centers over Regions in the Philippines from 1948 to 1977

Region \ Month	Jan. D	Jan. S	Jan. T	Feb. D	Feb. S	Feb. T	Mar. D	Mar. S	Mar. T	Apr. D	Apr. S	Apr. T	May D	May S	May T	June D	June S	June T	July D	July S	July T	Aug. D	Aug. S	Aug. T	Sept. D	Sept. S	Sept. T	Oct. D	Oct. S	Oct. T	Nov. D	Nov. S	Nov. T	Dec. D	Dec. S	Dec. T	Total D	Total S	Total T	Ave./ Year	Rank
1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	1	3	3	2	4	2	2	3	4	2	5	2	2	7	1	2	6	1	1	2	16	13	32	2.03	2nd
	0			0			0			1			3			6			9			7			11			11			9			4			61				
2	0	0	0	0	0	0	0	0	0	0	0	1	2	1	2	2	1	3	2	2	5	1	2	5	4	4	7	2	2	8	1	1	6	1	0	2	15	13	39	2.23	1st
	0			0			0			1			5			6			9			8			15			12			8			3			67				
3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	4	1	1	1	3	0	0	3	1	1	2	2	3	1	3	7	0	1	1	11	9	17	1.23	6th
	0			0			0			0			2			4			3			3			5			7			11			2			37				
4	1	0	1	0	0	0	0	0	1	0	1	1	1	1	2	1	1	1	1	2	2	0	1	1	2	1	1	2	1	5	2	4	4	1	2	5	11	14	24	1.63	3rd
	2			0			1			2			4			3			5			2			4			8			10			8			49				
5	1	0	0	0	0	0	0	0	0	0	1	0	1	1	2	1	1	2	2	2	1	0	0	1	2	1	1	3	1	3	1	7	2	1	2	3	12	16	15	1.43	5th
	1			0			0			1			4			4			5			1			4			7			10			6			43				
6	1	0	1	0	0	0	0	1	1	0	2	0	1	1	1	1	1	0	0	2	1	0	0	1	0	0	0	1	0	2	2	5	4	2	2	3	8	14	14	1.20	7th
	2			0			2			2			3			2			3			1			0			3			11			7			36				
7	1	0	1	0	0	0	0	1	1	0	2	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	2	2	6	2	1	3	5	8	14	0.90	8th
	2			0			2			2			1			0			2			0			0			2			10			6			27				
8	1	0	1	0	0	0	0	1	1	0	2	0	2	1	2	1	1	1	0	2	3	0	1	0	0	0	0	2	0	3	1	6	4	3	3	4	10	17	19	1.53	4th
	2			0			2			2			5			3			5			1			0			5			11			10			46				
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0.07	11th
	0			0			0			0			0			0			0			0			0			1			1			0			2				
10	2	0	1	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	3	3	2	2	2	8	8	7	0.77	9th
	3			0			1			1			2			0			0			0			0			1			9			6			23				
11	1	0	1	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	1	1	1	1	5	5	4	0.47	10th
	2			0			1			1			2			0			0			0			0			1			4			3			14				
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0.07	12th
	0			0			0			0			0			0			0			0			0			1			1			0			2				
Total	8	0	6	0	0	0	0	5	4	0	10	3	11	10	10	8	6	14	9	14	18	6	6	11	15	9	15	14	8	37	18	34	43	14	15	26	103	117	187		
	14			0			9			13			31			28			41			23			39			59			95			55			407				

Notes: D-Tropical Depression
S-Storm
T-Typhoon

(Source: Philippine Crop Insurance Corporation)

Table 2.16 (1/2) Data on Typhoon entered the Philippine Area of Responsibility for the Period of 1970-1983

Year	No.	Name[1]	Period of Typhoon[2]	Major Affected Area	Min. Pressure in PAR(mb)	Min. Pressure in the Lifetime(mb)	Number of Deaths	Missing	Total
1970	1	GEORGIA	9/10-9/12	Central Luzon	920	905	95	80	175
	2	JOAN	10/12-10/15	South Luzon Leyte, Samar	910	905	575	193	768
	3	KATE	10/16-10/23	South Mindanao	940	940	631	284	915
	4	PATSY	11/18-11/20	Central Luzon	925	910	230	381	611
1971	5	WANDA	4/24-4/28	Visayas	994	980	56	39	95
	6	DINAN	5/25-5/27	Leyte, Samar	965	960	13	44	57
	7	ELAINE	10/3-10/5	Leyte, Samar Visayas	985	965	10	80	90
1972	8	KIT	1/5-1/9	Leyte, Samar	940	940	204	5	254
	9	ORA	6/23-6/26	South Luzon	980	980	131	-	131
	10	THERESE	12/1-12/8	North Mindanao	992	-	90	-	90
1973	11	VERA	11/19-11/24	Leyte, Samar	994	990	56	21	77
1974	12	DINAH	6/8-6/11	Central Luzon	975	965	73	33	106
	13	IUY	7/19-7/21	North Luzon	955	950	20	46	66
	14	BESS	10/9-10/12	North Luzon	980	975	26	3	29
	15	CARMEN	10/14-10/17	North Luzon	980	975	13	-	13
	16	ELAINE	10/26-10/29	North Luzon	960	940	23	-	23
1975	17	LOLA	1/22-1/25	North Mindanao Visayas	975	975	39	8	47
1976	18	OLGA	5/18-5/26	North Luzon	940	940	200	147	347
	19	RUBY	6/22-7/1	Saman North Luzon	965	935	3	13	16
	20	NOKA	12/2-12/7	Samar South Luzon	990	990	110	15	125

Table 2.16 (2/2) Data on Typhoon entered the Philippine Area of Responsibility for the Period of 1970-1983

Year	No.	Name /1	Period of Typhoon /2	Major Affected Area	Min. Pressure in PAR(mb)	Min. Pressure in the Lifetime(mb)	Number of Deaths	Missing	Total
1977	21	SARAH	7/16-7/18	Samar South Luzon	990	970	4	11	15
	22	DINAH	9/15-9/20	North Luzon	965	965	54	11	65
	23	KIM	11/11-11/17	Central Luzon	930	920	40	-	40
1978	24	OLIVE	4/19-4/26	Leyte, Samar	970	955	66	45	111
	25	ELAINE	8/21-8/26	North Luzon	975	965	47	16	63
	26	LOLA	9/25-9/28	Samar South Luzon	980	965	32	25	57
	27	NINA	10/8-10/14	Central Luzon	975	975	24	29	53
	28	RITA	10/25-10/28	Central Luzon	885	880	444	230	674
1979	29	CECIL	4/14-4/19	Leyte, Visayas	965	965	30	63	93
	30	MAC	9/16-9/20	South Luzon	992	985	8	2	10
1980	31	KIM	7/23-7/26	North Luzon	950	910	36	55	91
	32	BELLY	11/2-11/6	North Luzon	925	925	103	25	128
1981	33	KELLY	6/29-7/2	South Luzon	985	975	210	19	229
	34	IRMA	11/25-11/26	Central Luzon	950	905	261	114	375
	35	LEE	12/24-12/27	Central Luzon	950	950	180	162	342
1982	36	MAMIE	3/19-3/22	North Midanao	990	990	25	8	33
	37	NELSON	3/23-3/29	Visayas	940	935	115	91	206
	38	WINONA	7/13-7/16	Central Luzon	985	985	10	2	12
	39	FAYE	8/20-8/26	Visayas	960	960	29	23	52
	40	IRVING	9/6-9/11	South Luzon	985	850	65	29	94
	41	NANCY	10/13-10/15	North Luzon	945	935	96	30	126
1983	42	VERA	7/12-7/16	Samar South Luzon	975	965	115	27	142

Notes: The typhoons caused deaths and missing of less than 10 persons were excluded.

/1 Denominated by U.S. Navy

/2 Period during crossing Philippine Area of Responsibility

Table 2.17 Damages by the Biggest Typhoon in Each Year from 1978 to 1983

Items / Name of Typhoon[/1]/Year	Kading 1978	Bebeng 1979	Osang 1980	Anding 1981	Welding 1981	Bebeng 1983	Average
I. Casualties (in Number)							
(1) Death and Missing	724	93	40	409	126	142	256
(2) Injured	749	73	55	116	183	145	220
II. Population Affected (in Number)							
(1) Family Affected	237,736	111,929	58,731	166,948	51,532	120,811	124,615
(2) Persons Affected	1,236,435	672,025	264,116	932,994	301,431	628,985	672,664
III. Houses Destroyed (in Number)							
(1) Totally destroyed	45,465	47,248	10,451	49,110	12,464	29,045	32,297
(2) Partially destroyed	65,040	57,087	18,279	98,324	34,111	76,346	58,198
IV. Damage to Properties (in P10[3])							
(1) Agricultural Crops	338,271	122,727		449,895	201,942	129,860	300,436
(2) Livestocks	41,336				1,784	1,633	
(3) Fishponds				-	-	214,734	
(4) Government Properties							
(i) Public Works							
a) Port, Pier or Sea Wall						7,650	306,453
b) School Building						27,861	
c) Public Building	190,871	13,487			282,860	111,457	
d) Flood Control Facilities				190,797		8,895	
e) Irrigation Facilities						2,245	
f) Other Public Facilities						2,464	
(ii) Road and Bridge	84,311	53,538			6,257	44,880	
(iii) Others	8,810	5,647				1,017	
(5) Private Houses	357,722	71,718		9,246	135,394	15,136	
Total from (1) to (5)	1,021,321	267,118	101,708	649,938	628,237	467,832	606,889
Percentage Share to Total Damage (%)							
Primary Products (Total from (1) to (3))	37.2	45.9	n.a.	69.2	32.4	74.1	49.5
Properties (Total of (4) & (5))	62.8	54.1	n.a.	30.8	67.6	25.9	50.5

Note: /1 Local names denominated by PAGASA

Source: Office of Civil Defense, Ministry of National Defense

Table 2.18 Yearly Marine Protests Filed by Classification (1972 - 1982)

(Unit: Number of Protest)

Nature	72	73	74	75	76	77	78	79	80	81	82	Total
* Grounding	6	7	6	2	8	0	3	3	2	2	12	51
* Allision	13	6	3	4	6	1	1	7	5	6	8	60
* Collision	8	10	9	6	7	4	8	7	6	2	2	69
* Sinking	7	15	14	9	6	9	9	4	7	8	8	96
Fire on Board	0	9	10	4	2	4	2	4	0	5	6	46
Damage to Pier	0	4	11	2	6	0	0	1	1	1	2	28
Damage to Fish Net	2	3	14	1	0	0	0	0	0	0	0	20
Death on Board	6	4	3	0	2	0	1	1	0	0	1	18
Jumping overboard	1	1	3	0	1	1	2	3	0	0	3	15
* Capsizing	1	0	0	2	0	0	0	0	0	0	4	7
Injury to Passenger	2	0	0	1	0	0	0	1	0	0	0	4
Prof. Misconduct	5	21	15	3	5	1	1	1	1	5	5	63
Others	0	16	8	3	1	0	0	4	6	1	2	41
T o t a l	51	96	96	37	44	20	27	36	28	30	53	518
Boisterous Weather	109	34	311	164	41	150	237	253	185	146	106	1736
Grand Total	160	130	407	201	85	170	264	289	213	176	159	2254

Note: *: Weather related mishaps other than "Boisterous weather"

Source: Board of Marine Inquiry, Ministry of Finance.

Table 3.1

Presumed Radio Link Design

Span	Distance	Antenna	Model of Equipment	Basic Propagation Loss at 800 MHz	S/N at Standard Condition	Presumed Fading Value at 99.95%	S/N at 99.95%
TANAY ↕ GAPAS	131.9 km	6.0mφ G.P 4.2mφ G.P	PM24-800-70 FD	-165.9 dB	62.7 dB	23.5 dB	39.2 dB
GAPAS ↕ NAGA	91.0 km	4.2mφ G.P 6.0mφ G.P	PM24-800-70 FD	-168.7 dB	59.9 dB	23.5 dB	36.4 dB
NAGA ↕ MALABOG	74.2 km	3.0mφ G.P 3.0mφ G.P	PM24-800-70 FD	-154.4 dB	64.7 dB	23.5 dB	41.2 dB
MALABOG ↕ BALOD	130.5 km	10.0mφ G.P (6.0mφ G.P) 6.0mφ G.P (4.2mφ G.P)	PM12-800-70 SD	-175.8 dB	61.4 dB	22.5 dB	38.9 dB
BALOD ↕ TINAMBACAN	km 20.0+25.7	3.0mφ P.P 6m×8m×2 (Reflector) 4.0mφ P.P	FM60-6700-1	-275.6 dB	62.2 dB	15.6 dB (99.99 %)	46.6 dB (99.99 %)
TINAMBACAN ↕ DANAO	183.9 km	6.0mφ G.P (4.2mφ G.P) 10.0mφ G.P (6.0mφ G.P)	PM12-800-70 SD	-181.8 dB	55.4 dB	22.5 dB	32.0 dB
DANAO ↕ MALASAG	239.3 km	6.0mφ G.P 10.0mφ G.P	PM6-800-70 FD	-186.6 dB	58.6 dB	23.5 dB	35.1 dB
MALABOG ↕ LEGASPI	7.0 km	12 ele YAGI 1.8mφ G.P	PM12-800-5	-119.4 dB	62.8 dB	7.4 dB (99.9 %)	55.4 dB (99.9 %)
BALOD ↕ CATARMAN	2.9 km	12 ele YAGI 12 ele YAGI	PM6-800-5	-106.3 dB	75.5 dB	6.6 dB (99.9 %)	68.9 dB (99.9 %)
DANAO ↕ MACTAN RADAR	20.5 km	1.8mφ G.P 3.0mφ G.P	PM12-800-5	-131.7 dB	63.7 dB	10.1 dB (99.9 %)	53.6 dB (99.9 %)
MALASAG ↕ CAGAYAN DE ORO	Approx. 10.0 km Line of Sight (presumed)	12 ele YAGI 12 ele YAGI	PM6-800-5	-116.5 dB	66.5 dB	8.0 dB (99.9 %)	58.5 dB (99.9 %)
TANAY ↕ Mt. MACLAYAO	165.4 km	10.0mφ G.P 6.0mφ G.P	PM24-800-70 FD	-172.4 dB	60.7 dB	23.5 dB	37.2 dB
Mt. MACLAYAO ↕ MALABOG	138.7 km	4.2mφ G.P 6.0mφ G.P	PM24-800-70 FD	-165.9 dB	59.7 dB	23.5 dB	36.2 dB
MALABOG ↕ MASBATE	88.7 km	6.0mφ G.P (4.2mφ G.P) 4.2mφ G.P (3.0mφ G.P)	PM12-800-70 SD	-171.0 dB	61.7 dB	22.5 dB	39.2 dB
MASBATE ↕ TINAMBACAN	102.9 km	4.2mφ G.P (3.0mφ G.P) 4.2mφ G.P (3.0mφ G.P)	PM12-800-70 SD	-164.4 dB	61.8 dB	22.5 dB	39.3 dB
TINAMBACAN ↕ MACTAN RADAR	204.6 km	6.0mφ G.P (4.2mφ G.P) 10.0mφ G.P (6.0mφ G.P)	PM12-800-70 SD	-182.2 dB	55.0 dB	22.5 dB	32.5 dB
MACTAN RADAR ↕ MALASAG	222.0 km	10.0mφ G.P 10.0mφ G.P	PM6-800-70 FD	-190.4 dB	58.8 dB	23.5 dB	35.3 dB

(* Basic propagation loss includes the presumed corrective value 6dB.)

Modulation Index
6 ch : 0.8 rad rms
12 ch : 0.4 rad rms
24 ch : 0.2 rad rms
IF band width : 460 kHz / 3 dB

Table 3.2

SCHEDULE OF SITE RECONNAISSANCE

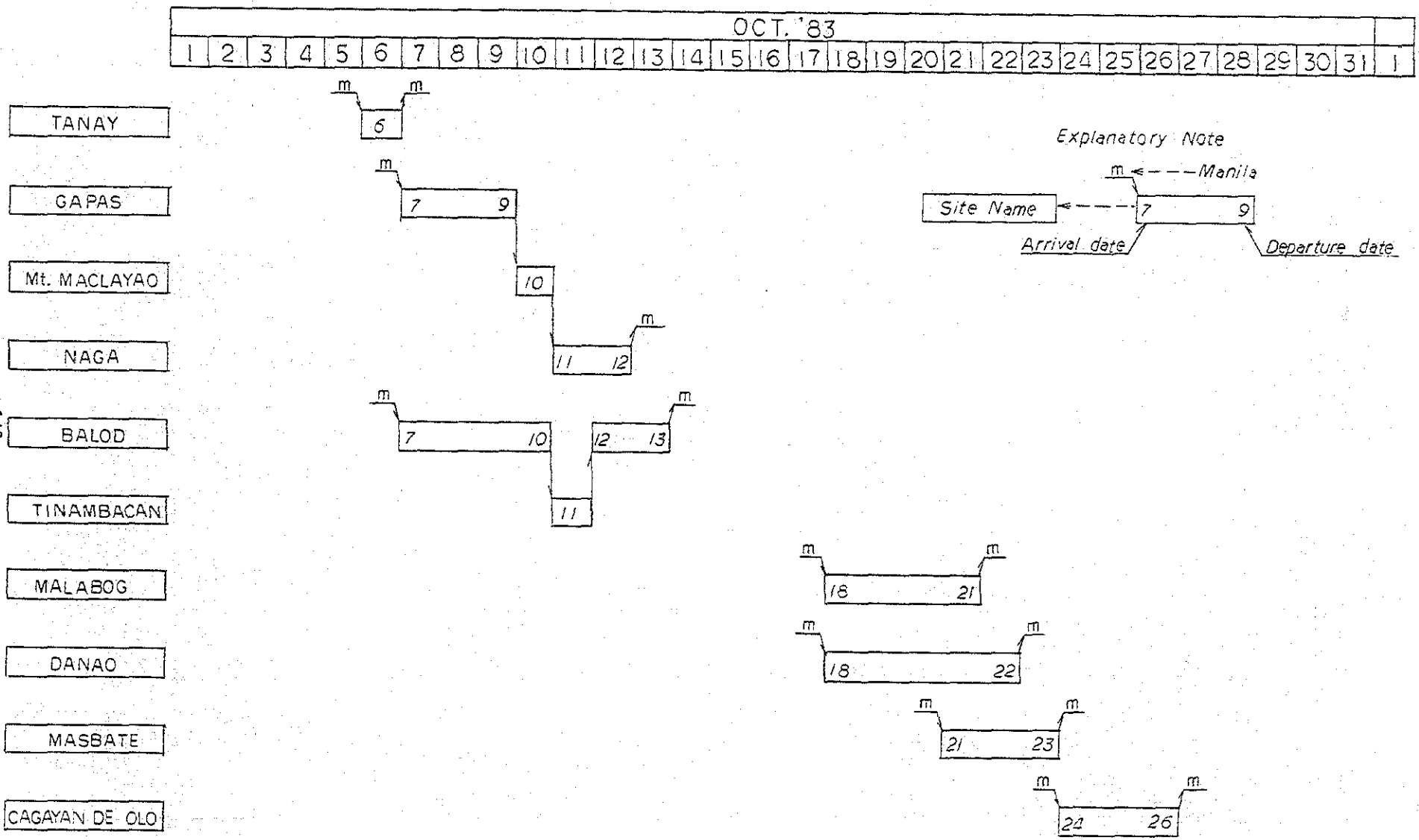
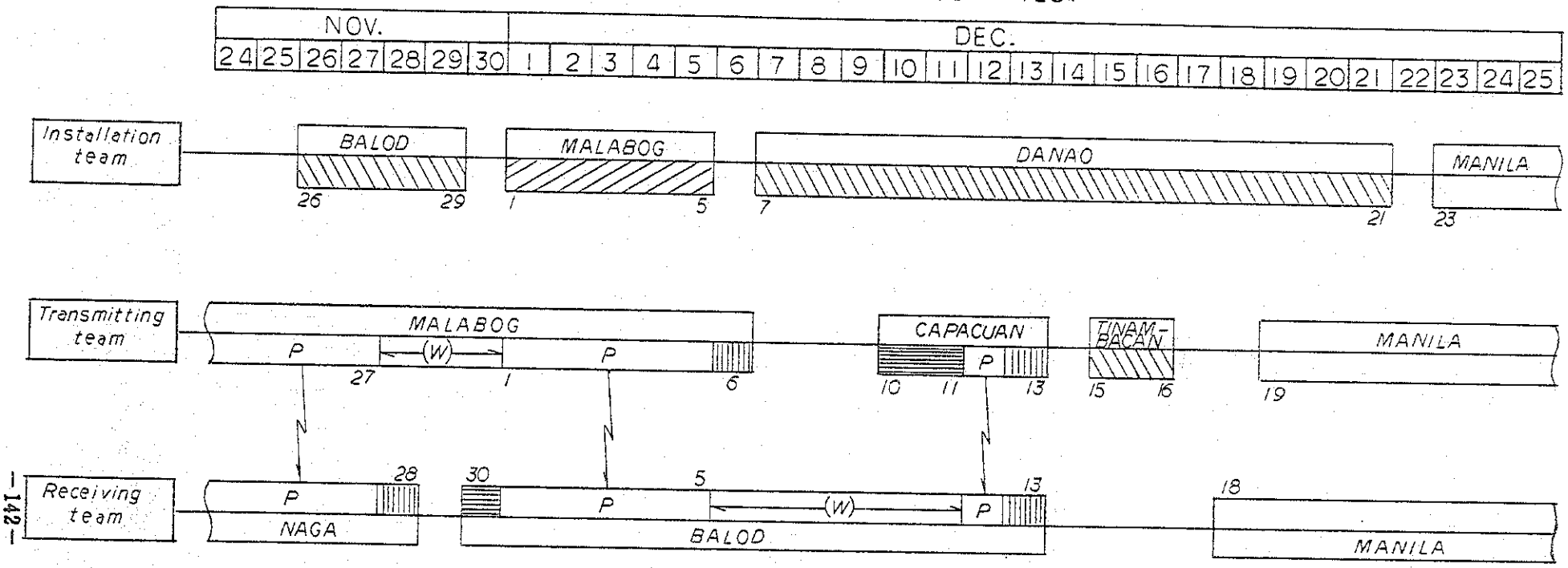


Table 3.3 Result of Site Survey at New OH Relay Station

NAME OF STATION	TANAY	GAPAS	NAGA	MALABOG	BALOO	CAPACUAN	TINAMBACAN	DANAO	MALASAG
LOCATION									
FIGURE	Attached	Attached	Attached	Attached	Attached	Attached	Attached	Attached	Attached
COORDINATES	14° 33' 53" N 21° 21' 07" E	13° 57' 10" N 122° 23' 28" E	13° 37' 16" N 123° 09' 56" E	13° 9' 55" N 123° 39' 48" E	12° 28' 41" N 124° 38' 19" E	12° 14' 50" N 124° 36' 06" E	12° 5' 9" N 124° 31' 14" E	10° 30' 33" N 124° 05' 40" E	8° 27' 52" N 124° 41' 25" E
ELEVATION	530 m (above sea level)	135 m (above sea level)	5 m (above sea level)	295 m (above sea level)	55 m (above sea level)	310 m (above sea level)	140 m (above sea level)	65 m (above sea level)	308 m (above sea level)
TOPOGRAPHY AT SITE	Top of a hilly terrain	Top of the mountain	Good condition, Station existing.	Near mountain top, rugged path	Terraced hills	Top of the mountain	Top of the mountain	Terraced hill	Terraced hills
SOIL CONDITION	Clay	Clay	Clay and Gravel	Loam and clay soil	Red clay	Sandy soil Red clay	Sandy soil	Lime stone	Red clay
LAND OWNER	Government	Private	Government	Private	Private	Private	Private	Private	Government
ACCESS ROAD									
DISTANCE FROM EXISTING ROAD	100 m	900 m	0 m	20 m	170 m	2000 m	920 m	420 m	200 m
TRAVEL TIME (BY WALKING)	1 min. (By vehicle)	30 mins.	0 min.	2 mins.	10 mins.	50 mins.	30 mins.	15 mins.	10 mins.
CONDITION OF THE ROAD	No Path existing (Slippery)	Mountain path (Slippery)	Good Pavement	Bad Narrow path	Mountainous path	Mountainous path	Mountainous path	Mountainous path	Mountainous path
DISTANCE FROM WATER SOURCE	DISTANCE: 150 m STATUS: Well	DISTANCE: 0 m STATUS: Well	DISTANCE: 1500 m Status: Water Service	DISTANCE: 100 m STATUS: Well	DISTANCE: 100 m STATUS: Spring	DISTANCE: 500 m STATUS: River	DISTANCE: 300 m STATUS: Spring	DISTANCE: 800 m STATUS: Well	DISTANCE: 160 m STATUS: Water Service
MEANS OF TRANSPORTATION	Vehicle	Items may be handcarried or by cableway	Vehicle	Vehicle	Cableway or by handcarry	Cableway or by helicopter	Cableway or by handcarry	Cableway or by handcarry	Cableway or by handcarry
POWER SUPPLY INFORMATION									
DISTANCE FROM EXISTING SERVICE WIRE	Existing 0 m	900 m	Existing 0 m	50 m	160 m	1800 m	700 m	900 m	200 m
OTHER REQUIREMENTS	None	Transformer and generator required	None	Transformer and generator required	Transformer and generator necessary	Transformer and generator necessary	Transformer and generator necessary	Transformer and generator necessary	Transformer and generator necessary
REMARKS	Station is existing. Generator is existing.	Difficult to reach access road. Transport by cable car of items for hand-carry.	Station is existing. Generator is existing.	Vehicle can pass through the summit. Dangerous during rainy weather. 40m span available for S.D.	Ideal site for S.D. antenna is under further study.	Construction of access road for installation of 13000V power line is needed.	Ideal site for S.D. antenna is under further study.	Volume of water source is little.	Ideal site for S.D. antenna is under further study.

Table 3.4 (1/4)

SCHEDULE OF OH PROPAGATION TEST

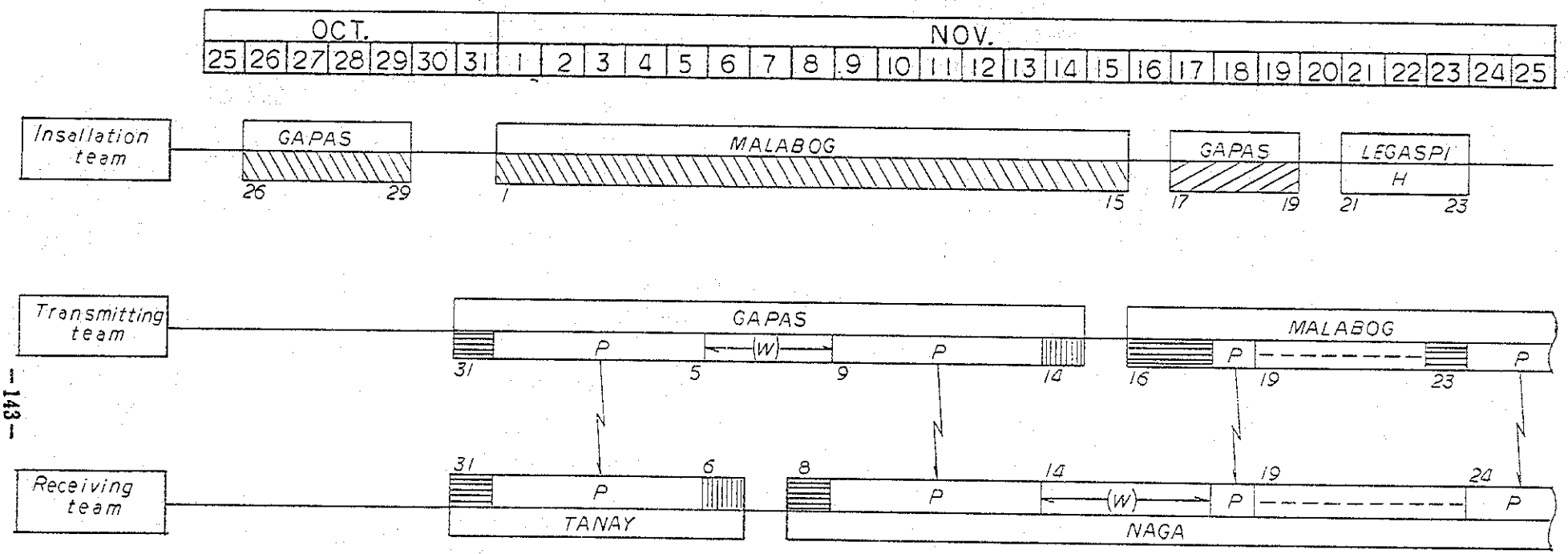


Explanatory Note :

- ---Construction of Antenna
- ---Withdrawing of Antenna
- H ---Assistance for Transmitting Team
- ---Arrangement of Equipments
- ---Withdrawing of Equipments
- (W) ---Waiting
- ----- ---Propagation Test was suspended by Typhoon
- P ---Propagation Test
- A ---Arrangement
- GAPAS ←--Site Name
- P ←--Withdrawing of Equipments
- 26 29 date

Table 3.4 (2/4)

SCHEDULE OF OH PROPAGATION TEST



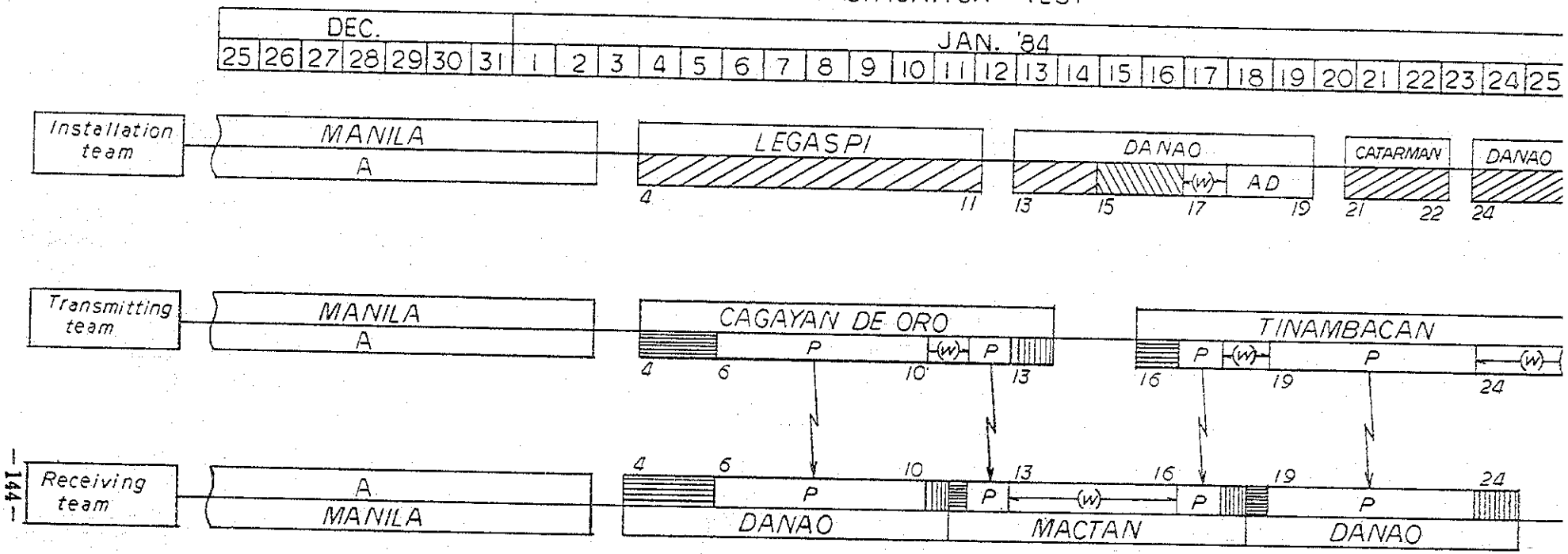
Explanatory Note :

- ---Construction of Antenna
- ---Withdrawing of Antenna
- H ---Assistance for Transmitting Team
- ---Arrangement of Equipments
- ---Withdrawing of Equipments
- (W) ---Waiting
- ----- ---Propagation Test was suspended by Typhoon
- P ---Propagation Test
- A ---Arrangement

GAPAS ← --Site Name
P ← --Withdrawing of Equipments
26 29
date

Table 3.4 (3/4)

SCHEDULE OF OH PROPAGATION TEST

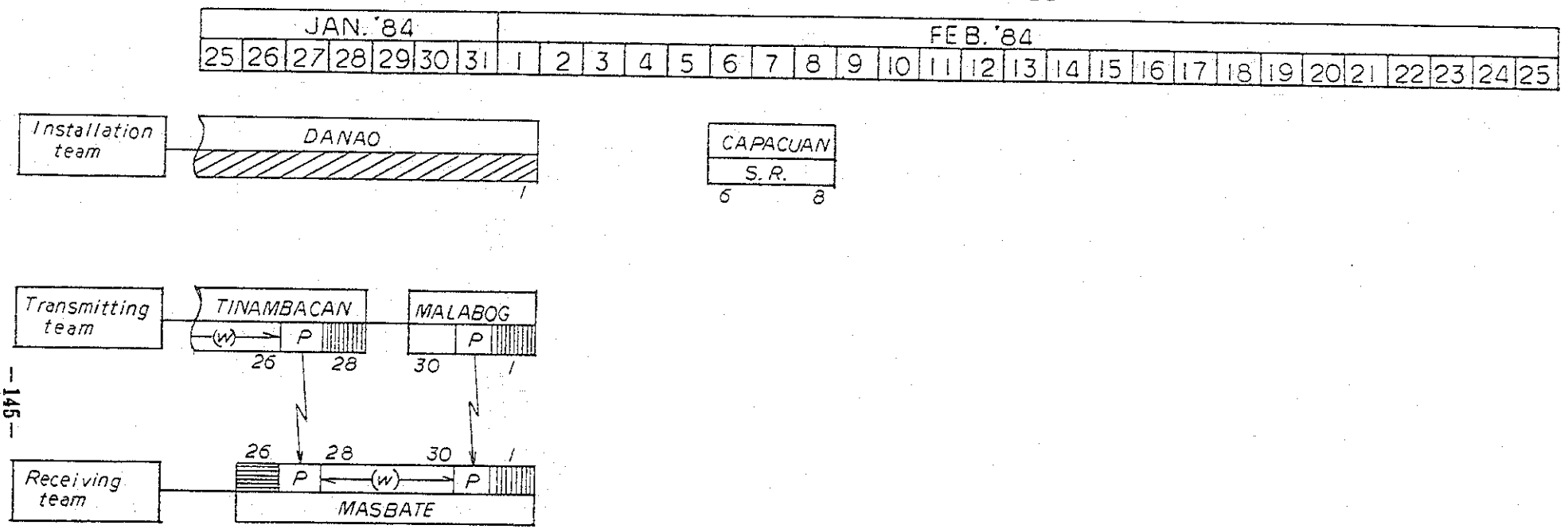


Explanatory Note :

- ---Construction of Antenna
- ---Withdrawing of Antenna
- H ---Assistance for Transmitting Team
- ---Arrangement of Equipments
- ---Withdrawing of Equipments
- (W) ---Waiting
- ---- ---Propagation Test was suspended by Typhoon
- P ---Propagation Test
- A ---Arrangement
- AD ---Adjustment Antenna
- GAPAS --Site Name
- P --Withdrawing of Equipments
- 26 29 date

Table 3.4 (4/4)

SCHEDULE OF OH PROPAGATION TEST



Explanatory Note :

- ▨ ---Construction of Antenna
- ▨ ---Withdrawing of Antenna
- H ---Assistance for Transmitting Team
- ▨ ---Arrangement of Equipments
- ▨ ---Withdrawing of Equipments
- (w) ---Waiting
- ----- ---Propagation Test was suspended by Typhoon
- P ---Propagation Test
- A ---Arrangement
- S.R. ---Site Reconnaissance
- GAPAS ---Site Name
- P ---Withdrawing of Equipments
- 26 29 date

Table 3.5

Outline of Test Equipment

1 Propagation Test Equipment of 800 MHz Band	NAF-141	JRC	Transmission Power: 80W Transmission Frequency: 857.73 MHz 858.615 MHz 859.50 MHz 861.00 MHz 862.50 MHz One of equipped 5 waves is selectively used. All is transistorized.
2 Low Noise Amplifier at 800 MHz Band	NAF-149R	JRC	Noise Figure: below 3 dB Gain of Amplifier: above 30 dB
3 Measuring Instrument for Electric Field Strength and Frequency Converter (attached External Stabilizing Oscillator)	ML 518 A6 and MH 650A	Anritsu	Selectivity: 7.5 KHz / 6dB Width
4 Grid Parabola Antenna of 6.0mϕ for 800 MHz Band	MAU-803-060B	Anten Ind. Co.	Diameter: 6.0 mϕ Gain : above 31.5 dB
5 800 MHz Band Yagi Antenna with 12 Elements	MAU-804-12	"	Gain: above 13.0 dB

Table 3.6

Test Results of OH Link

Observed Term	S p a n	Average Receiving Power		Corrective Value	Propagation Loss at 800 MHz
		Estimated	Measured		
1983 Nov. 1 - Nov. 5	TANAY —— GAPAS	- 91.8 dBm	- 93.3 dBm	- 1.5 dB	-161.4 dB
1983 Nov. 9 - Nov. 12	GAPAS —— NAGA	- 97.0 dBm	-102.9 dBm	- 5.9 dB	-168.5 dB
1983 Nov. 23 - Nov. 27	NAGA —— MALABOG	- 88.0 dBm	- 90.6 dBm	- 2.6 dB	-151.0 dB
1983 Dec. 1 - Dec. 5	MALABOG —— BALOD	- 88.4 dBm	- 93.5 dBm	- 5.1 dB	-174.9 dB
1984 Jan. 19 - Jan. 23	TINAMBACAN —— DANAO	- 90.6 dBm	- 96.5 dBm	- 5.9 dB	-181.7 dB
1984 Jan. 6 - Jan. 10	DANAO —— MALASAG	- 95.4 dBm	- 95.5 dBm	- 0.1 dB	-180.7 dB

Note: Average Receiving Power is the level when the 50% of sample is beyond this level.

Table 3.7

Test Result of OH Alternative Route

S P A N	Observed Term	Average Receiving Power		Corrective Value	Propagation Loss at 800 MHZ	Number of Acqired Data
		Estimaed	Measured			
MALABOG —MASBATE	1984 Jan 31	-104.8 dBm	-108.8 dBm ∿ -110.2dBm	-1.5 dB	-174.5 dB	5
MASBATE—TINAMBACAN	1984 Jan 27	-112.1 dBm	-101.6 dBm ∿ -114.5dBm	-1.3 dB	-181.6 dB	7
TINAMBACAN — MACTAN RADAR	1984 Jan 17	-122.5 dBm	-125.3 dBm ∿ -129.8dBm	-5.5 dB	-196.2 dB	4
MACTAN —— MALASAG RADAR	1984 Jan 11,12	-116.2 dBm	-117.2 dBm ∿ -123.1dBm	-3.3 dB	-187.7 dB	8

Table 3.8 (1/2)

Study of BALOD to TINAMBACAN Boute

Span	Frequency band Relay system Radio equipment characteristics S/N at average receiving power	BALOD Antenna and Antenna Height	TINAMBACAN Antenna and Antenna Height	Relay Point for BALOD Antenna and Antenna Height	 for TINAMBACAN Antenna and Antenna Height
(a) BALOD CAPACUAN TINAMBACAN	6.7 GHz band Plane reflector FM 60 - 6700 - 1 63.2 dB	3.0 mø P.P 60.6 m height	3.0 mø P.P 10.0 m height	4m X 6m Plane reflector 2 sets (foot length is 5 m)	
(b) BALOD CAPACUAN TINAMBACAN	6.7 GHz band Back to back coupling parabolic antenna FM 60 - 6700 - 1 61.8 dB	4.0mø P.P 40.4m height	4.0mø P.P 10 m height	4.0mø P.P 15 m height	4.0mø P.P 15 m height
(c) BALOD CAPACUAN TINAMBACAN	800 MHz band Active relay station with solar battery PM12 - 800 - 0.5 (NF3dB) 62.4 dB + 62.8 dB	3.0 mø G.P. 23 m height	1.8 mø G.P 10 m height	3.0 mø G.P 15 m height	1.8 mø G.P 15 m height
(d) BALOD 490m Peak TINAMBACAN	6.7 GHz band Plane reflector FM 60 - 6700 - 1 60.6 dB	3.0 mø P.P 59.7m height	3.0 mø P.P 43.8m height	4m X 6m Plane reflector (foot length is 5m)	
(e) BALOD 490m Peak TINAMBACAN	6.7 GHz Back to back coupling parabolic antenna FM 60 - 6700 - 1 60.2 dB	4.0 mø P.P 31.3m height	4.0 mø P.P 33.8m height	4.0 mø P.P 15m height	4.0 mø P.P 15m height

Table 3.8 (2/2)

Superiority or Inferiority List for BALOD - TINAMBACAN Route

Route	Frequency Band and Relay System	Maintenance	Scale for antenna and reflector plate	Scale for Antenna tower	Site condition for passive Repeater point	Total Judgement
BALOD | CAPACUAN | TINAMBACAN	6.7 GHz Band FM60-6700-1 Reflector Plate	o	x	x	o	-
	6.7 GHz Band FM60-6700-1 Antenna to antenna Coupling System	o	Δ	Δ	o	o
	800 MHz Band PM12-800-0.5 Active relay with Solar battery	x	o	o	o	-
BALOD | 490m point | TINAMBACAN	6.7 GHz Band FM60-6700-1 Reflector Plate	o	x	x	x	-
	6.7 GHz Band FM60-6700-1 Antenna to antenna Coupling System	o	Δ	Δ	x	-

* The sign "o" is superiority, next is "Δ" and "x" is inferiority.

Table 3.9 (1/2) Test Results for Main Route and Alternative Routes

		Span	Propa-gation Test	Route Survey	Basis Propa-gation Loss at 800 MHz	Radio Equipment's Model Antenna (Sub-antenna) Required Min. Antenna Height	S/N Ratio Time Rate 50%	S/N Ratio Time Rate 99.95%
MALABOG ~ TINAMBACAN	Main Route	MALABOG ~ BALOD	o	-	-174.9 dB	PM12-800-70 SD 10.0mø (6.0mø) - 6.0mø (4.2mø) 15 m 21.3 m	61.5 dB	39.0 dB
		BALOD~CAPACUAN~TINAMBACAN	-	o	-	PM60-6700-1 4.0mø - 4.0mø, 4.0mø - 4.0mø 40.4 m 15 m 10 m	61.8 dB	46.2 dB
	Alternative Route	MALABOG ~ MASBATE	o	-	-174.5 dB	PM12-800-70 SD 10.0mø (6.0mø) - 6.0mø (4.2mø)	62.4 dB	39.9 dB
		MASBATE ~ TINAMBACAN	o	-	-181.6 dB	PM12-800-70 SD 10.0mø (6.0mø) - 10.0mø (6.0mø) 10.5 m 10 m	59.3 dB	36.8 dB
TINAMBACAN ~ MALASAG	Main Route	TINAMBACAN ~ DANAO	o	-	-181.7 dB	PM12-800-70 SD 10.0mø (6.0mø) - 10.0mø (6.0mø) 10 m 15.3 m	59.0 dB	36.5 dB
		DANAO ~ MALASAG	o	-	-180.7 dB	PM6-800-70 SD 6.0mø (4.2mø) - 6.0mø (4.2mø) 15.3 m 10 m	58.0 dB	35.5 dB
	Alternative Route	TINAMBACAN ~ MACTAN RADAR	o	-	-196.2 dB	PM12-800-70 SD 10.0mø (6.0mø) - 10.0mø (6.0mø) 10 m 7.9 m	44.7 dB	27.7 dB (99.5%)
		MACTAN RADAR ~ MALASAG	o	-	-187.7 dB	PM6-800-70 SD 10.0mø (6.0mø) - 10.0mø (6.0mø) 10 m 10 m	59.2 dB	36.7 dB

Table 3.9 (2/2) Superiority or Inferiority List for Main and Alternative Routes

		Route	Scale of radio equipment and antenna	Reliability of radio link	Scale of antenna tower	Propa-gation condition	Site condition for radio station	Condition for commercial power	Traffic network to MANILA	Total Judgement
MALABOG-TINAMBACAN	Proposed Route	MALABOG BALOD CAPACUAN (Passive Ref.) TINAMBACAN	o	o	Δ BALOD: approx. 45m CAPACUAN: approx. 20m	o	Δ	Δ	o	o
	Alternative Route	MALABOG MASBATE TINAMBACAN	Δ Required antenna system BALOD-TINAMBACAN 4.0møP.P.x4 MASBATE-TINAMBACAN 10.0møG.P.x2 6.0møG.P.x2	o	o	o	o	x Commercial power does not turn for the better in future.	Δ	Δ
TINAMBACAN-MALASAG	Proposed Route	TINAMBACAN DANAO MALASAG	o	o	o	o	Δ	o	o	o
	Alternative Route	TINAMBACAN MACTAN MALASAG	Δ	x TINAMBACAN - MACTAN RADAR : S/N 44.7dB	o	x TINAMBACAN - MACTAN RADAR : reflection by sea	o	o	o	Δ

* The sign "o" is superiority, next is "Δ" and "x" is inferiority.

Table 3.10 (1/2)

VHF Link Budget Estimation Value

No.	Hops	Distance (Km)	Free Space Loss (dB)	Additional Loss (dB)	Fading (dB)	Receiving Power (dBw)	Standard S/N (dB)	Remarks
V-1	APARRI – TUGUEGARAO	79.4	113.0	35.4	8.0	-116.2	49.7	
V-2	APARRI RADAR – "	81.5	114.2	33.0	8.0	-116.2	49.7	
V-3	LAOAG – VIGAN	70.0	112.9	28.5	7.0	-110.4	55.5	
V-4	BAGUIO RADAR – "	135.8	118.6	5.0	13.6	-92.6	> 60	
V-5	" – BAGUIO	8.1	94.0	29.0	0.8	-92.0	> 60	
V-6	" – DAGUPAN	38.9	108.0	10.0	3.9	-87.0	> 60	
V-7	" – AMPUCAO	11.4	97.3	5.0	1.1	-71.3	> 60	
V-8	AMPUCAO – CARMEN ROSALES	49.1	109.8	11.0	4.9	-89.8	> 60	
V-9	IBA – "	96.5	115.8	39.2	9.7	-120.8	45.1	
V-10	MUÑOZ – "	38.0	107.6	35.0	3.8	-111.6	54.3	
V-11	" – BALER RADAR	78.0	113.8	40.2	7.8	-123.0	42.9	
V-12	BALER – "	6.5	93.0	5.0	0.6	-66.2	> 60	
V-13	CASIGURAN – "	79.3	114.0	36.4	7.9	-119.4	46.5	
V-14	SANGLEY – TANAY	48.2	109.2	10.0	4.8	-88.2	> 60	
V-15	AMBULONG – "	61.5	111.7	24.0	6.2	-104.7	> 60	

Table 3.10 (2/2)

VHF Link Budget Estimation Value

No.	Hops	Distance (Km)	Free Space Loss (dB)	Additional Loss (dB)	Fading (dB)	Receiving Power (dBw)	Standard S/N (dB)	Remarks
V-16	CALAPAN – TANAY	127.0	118.0	33.0	12.7	-115.0	50.9	
V-17	TAYABAS – "	63.9	112.1	29.4	6.4	-110.5	55.4	
V-18	ALABAT – "	88.4	114.9	36.5	8.8	-120.4	45.5	
V-19	JOMALIG – "	116.6	117.3	31.0	11.7	-117.3	48.6	
V-20	INFANTA – "	38.3	107.6	50.5	3.8	-127.1	38.8	
V-21	NAGA – DAET RADAR	99.0	115.9	47.5	9.9	-132.4	33.5	
V-22	VIRAC RADAR – MALABOG	87.8	114.8	14.0	8.8	-97.8	> 60	
V-23	VIRAC – "	76.8	113.7	25.0	7.7	-107.7	58.2	
V-24	MASBATE – "	88.6	114.9	37.5	8.9	-121.4	44.5	
V-25	" – ROMBLON (Mt.)	147.5	119.3	34.0	14.8	-122.3	43.6	
V-26	SAN FRANCISCO – "	89.0	114.9	5.0	8.9	-88.9	> 60	
V-27	TINAMBACAN – CATBA-LOGAN	52.9	110.4	9.0	5.3	-88.4	> 60	
V-28	DANAO – TACLOBAN	124.3	117.9	35.0	12.4	-121.9	44.0	
V-29	GUIUAN RADAR – "	80.7	114.1	9.7	8.1	-123.1	42.8	
V-30	BAGUIO RADAR – LAOAG	202.5	122.1	38.0	20.2	-129.1	36.9	
V-31	MORONG – SCIENCE GARDEN	79.3	114.0	36.0	8.0	-119.2	43.9	

Table 3.11 (1/2)

SCHEDULE OF VHF PROPAGATION TEST

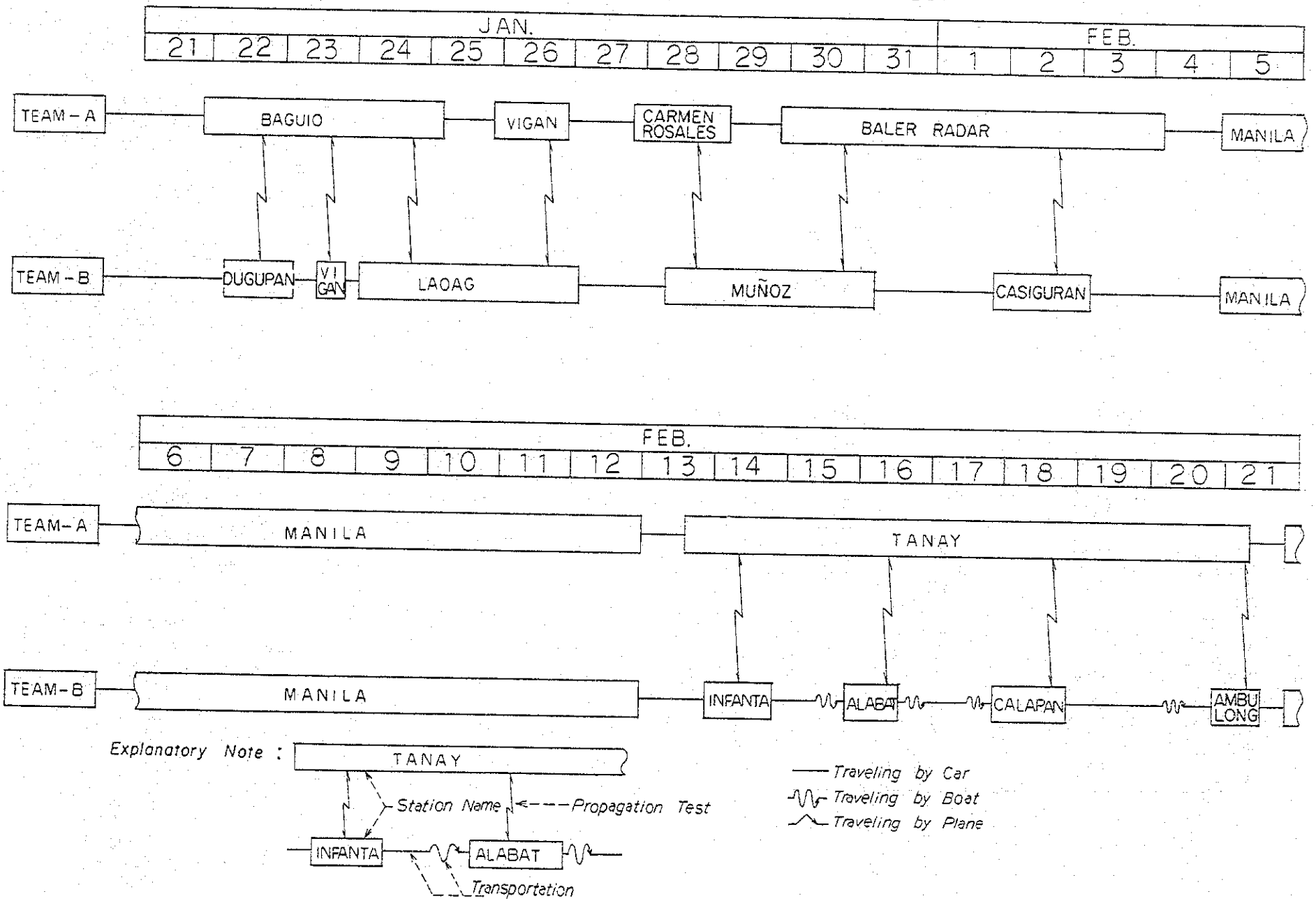


Table 3.11 (2/2)

SCHEDULE OF VHF PROPAGATION TEST

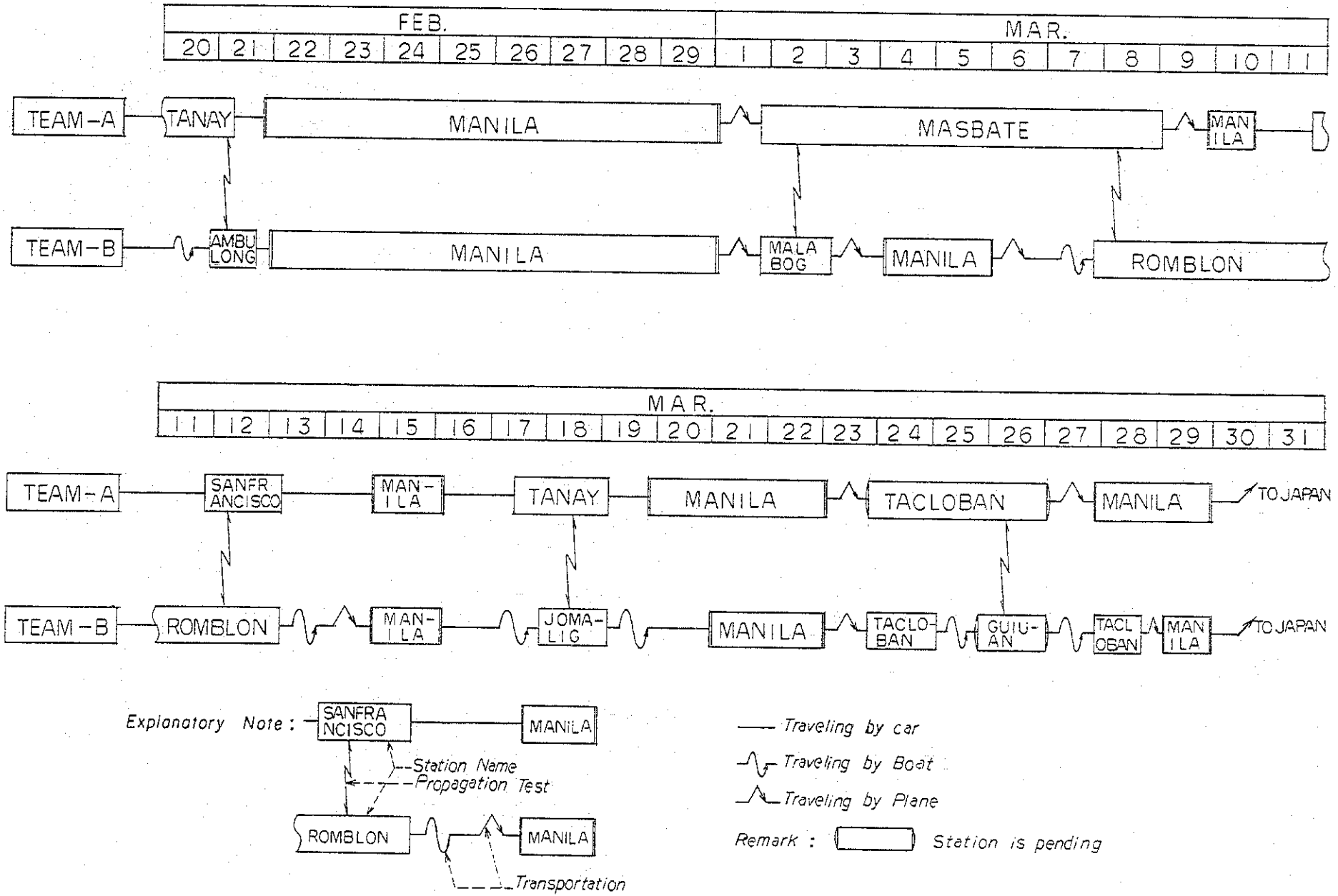


Table 3.12 Equipment for VHF Propagation Test

Items	Number	Standard	Remarks
VHF Transceiver	1	150 MHz 25 W	JHV-225
CN Watt meter	1	50 W	TKP-50W
Battery	1	12 V 35 A	
Field strength meter	1		ML-518A
VHF Antenna	1	150 MHz 8 EL	V8F-1530
Antenna pole	1	15 m	
Antenna elevator	1		MSA-15
Feeder	1	25 m	8D2V
Portable generator	1	200 V 1.5 KVA	EF-1400
Transformer	1	100 : 200 V	KD-1000
Cord reel	1	50 m	VDT-20

Table 3.13 Test Results of VHF Link

Span		Propagation Loss (dB)			S/N (dB)		Evaluation
		Estimated	Measured	Difference	Estimated	Measured	
BAGUIO RADAR	DAGUPAN	118.0	110.5	-7.5	> 60.0	> 60.0	M
BAGUIO RADAR	VIGAN	123.6	117.5	-6.1	> 60.0	> 60.0	M
BAGUIO RADAR	LAOAG	160.1	169.0	+8.9	32.4	29.0	C
VIGAN	LAOAG	141.4	150.7	+9.3	55.5	47.0	M
CARMEN ROSALES	MUÑOZ	142.0	142.5	+0.5	51.9	55.0	M
MUÑOZ	BALER RADAR	154.0	150.5	-3.5	40.5	47.0	M
BALER RADAR	CASIGURAN	150.4	142.0	-8.4	44.1	55.0	M
TANAY	AMBULONG	138.2	149.4	+11.2	56.3	48.0	M
TANAY	CALAPAN	151.0	152.4	+1.4	43.5	45.0	M
TANAY	ALABAT	151.4	151.4	0	43.1	46.0	M
TANAY	JOMALIG	148.3	152.8	+4.5	46.2	43.0	M
TANAY	INFANTA	158.1	151.4	-6.7	36.4	46.0	M
MALABOG	MASBATE	152.4	150.0	-2.4	42.1	48.0	M
MASBATE	ROMBLON (Mt.)	153.3	146.4	-6.9	41.2	48.0	M
ROMBLON (Mt.)	SAN FRANCISCO	119.9	123.8	-3.9	> 60.0	> 60.0	M
TACLOBAN	GUIUAN RADAR	154.1	146.8	-7.3	40.7	47.0	M

Remarks : 1. Estimated propagation loss includes corrective value at 5 dB, except BAGUIO RADAR — DAGUPAN and BALER — CASIGURAN.

2. S/N is estimated value by the test equipment.

3. External noise is assumed negligible.

Table 3.14

Transmitting Test Message
(Sample)

2 5 7 0 1	2 4 3 4 6	4 4 3 5 1	5 8 6 7 9
0 9 8 2 8	3 3 6 5 5	6 8 7 9 0	1 2 1 2 3
9 7 1 5 6	7 5 7 6 7	8 7 6 5 4	3 8 8 4 0
0 8 2 4 7	1 2 4 3 4	9 0 1 2 9	0 9 7 5 6
1 9 0 3 2	5 4 3 6 3	5 6 7 8 0	1 2 9 0 1
H G A D A	M Z X Y W	M E K L S	M Z A C J
I F B E C	P O N U V	D E H F G	X Y D B F
J K C L B	P Q R S T		

Table 3.15

Q Code

Code \ Grade		1	2	3	4	5
QSA	Signal strength	Rarely audible	Poor	Fair	Good	Excellent
QRM	Degrading effect of interference	Extreme	Severe	Moderate	Slight	Nil
QRN	Degrading effect of noise	Extreme	Severe	Moderate	Slight	Nil

Table 3.16 (1/2)

Results of HF SSB Propagation Test

Frequency: 7995 kHz

Date	Time (GMT)	Link	QSA					QRN					QRM					Receiving Message Error (%)							Time Needed for Receiving (Min.)						
			1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	<5	6-10	11-15	16-20	21-25	26-30	30 <	<5	6-10	11-15	16-20	21-25	26-30	30<
March 1	09 35	PFC → GUIUAN RADAR			○				○					○													○					
2	09 20	TACLOBAN				○			○					○					○									○				
3	09 25	SAN JOSE			○				○					○								○				○						
4	09 13	PTO. PRINCESA				○			○					○				○							○							
5	09 30	ILOILO			○				○					○				○							○							
6	09 30	DAVAO		○							○					○		○							○							
7	09 33	ZAMBOANGA				○		○						○				○											○			
1	09 58	MACTAN RADAR → GUIUAN RADAR				○			○					○				○							○							
2	09 30	TACLOBAN				○			○					○				○											○			
3	09 30	SAN JOSE			○				○					○				○									○					
4		PTO. PRINCESA																○							○							
5	09 17	ILOILO			○				○																							
6	10 00	CAGAYAN DE ORO → DAVAO			○				○					○				○							○							
7	09 40	ZAMBOANGA				○		○						○				○										○				
		Total		1	6	6		2	10		1			10		1		11	1			1			6	3	2	2				
1	21 10	PFC → GUIUAN RADAR		○						○					○			○										○				
2	21 00	TACLOBAN	○									○					○							*								
3	21 00	SAN JOSE										○					○							*								
4	20 50	PTO. PRINCESSA																						*								
5	21 00	ILOILO		○							○													*								
6	21 00	DAVAO																						*								
7	21 09	ZAMBOANGA		○					○							○		○						*								
1	22 00	MACTAN RADAR → GUIUAN RADAR															○												○			
2	23 05	TACLOBAN	○									○					○							*								
3	21 00	SAN JOSE										○					○	○									○					
4	20 50	PTO. PRINCESA															○							*								
5	21 00	ILOILO		○							○													*								
6	21 00	CAGAYAN DE ORO → DAVAO																						*								
7	21 50	ZAMBOANGA															○							*								
		Total	2	4					1	1	2	4			1	1	6	3						11			1	1	1			

* Impossible to contact

Table 3.16 (2/2)

Results of HF SSB Propagation Test

Frequency: 7995 kHz

Date	Time (GMT)	Link	QSA					QRN					QRM					Receiving Message Error ($)							Time Needed for Receiving (Min.)						
			1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	<5	6-10	11-15	16-20	21-25	26-30	30<	<5	6-10	11-15	16-20	21-25	26-30	30<
March 1	09 30	GUIUAN RADAR → PFC			○					○					○				○												
2	09 30	TACLOBAN					○		○				○					○												○	
3	09 30	SAN JOSE					○	○					○					○								○					
4	09 30	PTO. PRINCESA			○				○						○				○							○					
5	09 30	ILOILO				○			○					○				○								○					
6	09 30	DAVAO			○				○					○				○								○					
7	09 30	ZAMBOANGA				○			○						○			○								○					
1	09 30	GUIUAN RADAR → MACTAN RADAR		○						○				○				○												○	
2	09 30	TACLOBAN				○			○				○					○												○	
3	09 30	SAN JOSE					○		○				○					○												○	
4	09 30	PTO. PRINCESA	○								○				○									*							
5	09 30	ILOILO																○												○	
6	10 00	DAVAO → CAGAYAN DE ORO				○				○					○			○												○	
7	09 00	ZAMBOANGA				○				○					○			○												○	
		Total	1	1	3	5	3	1	7	4	1		4	3	6			11	2					1		6				7	
1	21 00	GUIUAN RADAR → PFC																						*							
2	21 00	TACLOBAN																						*							
3	21 00	SAN JOSE																						*							
4	21 00	PTO. PRINCESA																						*							
5	21 00	ILOILO																						*							
6	21 00	DAVAO																						*							
7	21 00	ZAMBOANGA		○							○					○					○						○				
1	21 00	GUIUAN RADAR → MACTAN RADAR	○							○				○										*							
2	22 30	TACLOBAN	○								○			○				○												○	
3	21 00	SAN JOSE	○								○				○									*							
4	21 00	PTO. PRINCESA									○													*							
5	21 00	ILOILO																						*							
6	21 00	DAVAO → CAGAYAN DE ORO	○								○					○								*							
7	21 00	ZAMBOANGA	○								○					○								*							
		Total	5	1						1	6			2	1	3		1			1			12				1			1

* Impossible to contact

Table 3.17

List of Instruments at Weather Stations

Observation	Element	Instrument
Surface (0, 3, 6, --- --- 18, 21GMT)	Air Pressure	Aneroid Barometer Microbarograph (Fortin Barometer)
	Air Temperature	Sling Thermometer Maximum/Minimum Thermometer
	Humidity	Dry-Wet Bulb Thermometer Hygrothermograph
	Wind	Windmill-type Anemometer Cup Anemometer
	Rain	Rain Gauge
Upper-Air (0, 6, 12, 18 GMT)	Air Pressure Air Temperature Humidity	Radiosonde Press. : Aneroid Barometer Temp. : Bimetallic Thermometer Humid. : Hair Hygrometer Gas : Hydrogen Brand (Mactan) Sonde · Vaisala Balloon: To-Tex (350g)
Radar (0, 3, 6, --- ---18, 21GMT)	Rain	Radar Brand (Mactan): Raytheon Pulse Radar "S" BAND Frequency : 2700 - 2900 MHz Wave Length 10.5 cm Peak Power : 50 KW Pulse Repetition Rates: 600 - 100 PPS *Steel Photograph Observation
Seismography	Earthquake	Short Period Seismograph Brand TELEDYNE GEOTECH Helicorder Magnification 125,000K

Table 3.18 (1/5)

Status of Meteorological Instrument in PAGASA

Name of Instrument	Air Temperature 1 Ordinary thermometer 2 Max./Min. thermometers 3 Thermograph	Atmospheric Pressure 1 Mercurial barometer 2 Aneroid barometer 3 Barograph	Wind 1 Wind vane 2 Anemometer (Anemograph) 3 Wind Mill Anemometer	Humidity 1 Psychrometer 2 Hair hygrometer	Precipitation 1 Rain gauge 2 Tilting bucket raingauge	Duration of Sunshine 1 Cambell-Stokes Recorder 2 Jordan Sunshine Recorder Solar Radiation 1 Eppley Pyranometer 2 Robitch Pyranometer	Special Observation Upper: Upper-air Observation Radar: Weather Radar Observation
Basco	1 USWB, 2 USWB, 3 USWB	1 JAPAN SUZUKI, 3 USA SELFORT	2 JAPAN OTA, 3 JAPAN ISUZU	1 USWB	1 LOCAL 8 in. Std., 2 USWB	1 LONDON	Upper
Vigan	1 USWB, 2 USWB	1 JAPAN SUZUKI, 3 USWB	2 JAPAN	1 USWB	1 USWB	NONE	NONE
Laoag	1 USWB, 2 USWB, 3 JAPAN TAMAYA '73	1 JAPAN SUZUKI, 2 USWB, 3 CACELLA & FRIEZ	1 JAPAN KOSHIN	1 KHALSICO '82	1 LOCAL 8 in. Std., 2 JAPAN OTA	1 USWB	Upper
Aparri Rad.		1 JAPAN KSF, 2 USWB, 3 USWB	2 USWB	1 USWB	2 JAPAN OTA '73	NONE	Radar
Aparri	1 USWB, 2 USWB	1 USWB, 2 USA BELFORT	1 USWB	1 USWB	1 JAPAN OTA '73, 2 USWB	NONE	NONE
Tuguegarao	3 JAPAN OTA '73	1 USWB, 3 USA BELFORT	1 USWB, 2 JAPAN	1 USWB	1 JAPAN OTA '73, 2 JAPAN OTA '73	NONE	NONE
Baguio Rad.						NONE	Radar
Iba	1 USWB, 2 USWB	1 JAPAN, 3 JAPAN OTA	1 USWB, 2 JAPAN	1 USWB	1 LOCAL 8 in. Std., 2 JAPAN OTA '73	NONE	NONE
Dagupan	1 USWB, 2 USWB, 3 JAPAN OTA '73	1 JAPAN OTA '73, 3 JAPAN '73	1 JAPAN	1 JAPAN	1 LOCAL 8 in. Std.'73, 2 JAPAN OTA '73	NONE	NONE
Baguio	1 USWB, 2 USWB, 3 ENGLAND	1 USWB, 3 USWB	2 JAPAN OTA	1 JAPAN KHALSICO	1 LOCAL 8 in. Std., 2 JAPAN OTA '73	1 USWB	Upper
Cabanatuan	1 USWB, 2 USWB, 3 JAPAN OTA	1 USWB, 3 USA BELFORT	1 JAPAN OTA S45	1 USWB	1 JAPAN OTA '73, 2 USWB	1 USWB	NONE
Baler	1 USWB, 2 USWB	1 JAPAN SUZUKI, 3 USA BELFORT	1 USWB	1 USWB	2 JAPAN OTA '73	NONE	NONE
Basco Rad.						NONE	Radar
Casigran							
Port Area	1 USWB, 2 USWB, 3 USWB	2 USWB	2 USWB	1 USWB, 2 USWB	1 USWB, 2 USWB	NONE	NONE
Tayabas	1 USWB '74, 2 WEKSLER '73, 3 BARCON	1 JAPAN '74, 2 FAURA '63, 3 JAPAN '73	1 USA BELFORT	1 USWB '74	1 LOCAL 8 in. Std. '70, 2 JAPAN OTA '64	NONE	NONE
Sangley	2 USWB	1 ——, 2 JAPAN OTA, 2 ——	1 JAPAN KOSHIN, 3 JAPAN OTA		1 JAPAN OTA, 2 JAPAN OTA	NONE	NONE

Table 3.18 (2/5)

Status of Meteorological Instrument in PAGASA

Name of Instrument	Air Temperature 1 Ordinary thermometer 2 Max./Min. thermometers 3 Thermograph	Atmospheric Pressure 1 Mercurial barometer 2 Aneroid barometer 3 Barograph	Wind 1 Wind vane 2 Anemometer (Anemograph) 3 Wind Mill Anemometer	Humidity 1 Psychrometer 2 Hair hygrometer	Precipitation 1 Rain gauge 2 Tilting bucket raingauge	Duration of Sunshine 1 Cambell-Stokes Recorder 2 Jordan Sunshine Recorder Soler Radiation 1 Eppley Pyranometer 2 Robiten Pyranometer	Special Observation Upper: Upper-air Observation Radar: Weather Radar Observation
MIA	M733 Micro Computer, USA	1 Fortin 2 NEW-JARSY 3 BALTI-MORE	M733 Micro Computer, USA	M733 Micro Computer, USA	1 LOCAL 8 in. Std. 2 JAPAN OTA '73	NONE	NONE
Science Garden	3 JAPAN '67	1 JAPAN 2 JAPAN 3 USA	1 USWB 2 USWB 3 USWB	1 USWB	1 JAPAN 2 JAPAN	1 USWB 2 USWB	
Calapan	2 USWB	1 WBZ 3 JAPAN OTA '73	3 USA BELFORT (W/D DEFECT)	1 USWB	1 LOCAL 8 in. Std. 2 JAPAN OTA '73	1 LONDON (CASELLA)	NONE
Ambulong	2 USWB	1 USWB (DEFECTIVE) 3 JAPAN OTA (DEFECTIVE)	DIGITAL KAHAL 1982	1 USWB 2 USWB	1 LOCAL 8 in. Std. 2 JAPAN OTA	1 USWB	NONE
Infanta	2 USWB	1 JAPAN SUZUKI 3 BENDX FREEX	1 USA BELFORT			NONE	NONE
Alabat	2 USWB 3 JAPAN OTA '73	1 USWB 3 USA BELFORT	1 JAPAN KOSHIN	1 —	1 LOCAL 8 in. Std. 2 JAPAN OTA	NONE	NONE
San Francisco	1 USWB 3 USWB	1 USWB 2 USWB	NONE	1 —	1 LOCAL 8 in. Std. 2 JAPAN OTA	NONE	NONE
Daet Rad.	1 USA WEKSLER 3 JAPAN OTA '73	1 JAPAN SUZUKI 3 USA BELFORT	2 JAPAN NAKAASA (DEFECT.)	1 JAPAN OTA	2 JAPAN OTA	NONE	Radar
Legaspi	1 USWB 2 USWB 3 JAPAN OTA '73	1 JAPAN SUZUKI '73	1 USWB 2 USWB 3 USWB	1 USWB	1 JAPAN OTA USWB	NONE	Upper
Virac	1 USWB 2 USWB 3 JAPAN OTA '73	1 JAPAN 3 JAPAN OTA '73	1 USWB 2 USWB	1 USWB 2 USWB	1 JAPAN '65	1 KALSICO	NONE
Virac Rad.	1 USWB 2 USWB	1 JAPAN	1 USWB 2 USWB	1 USWB 2 USWB	1 JAPAN OTA (DEFECT.)	NONE	Radar
Zamboanga	1 USWB 2 USWB 3 USA FRIEZ	1 JAPAN SUZUKI 2 USWB 3 JAPAN OTA	2 JAPAN ISUZU	1 USWB	1 LOCAL 8 in. Std. 2 JAPAN OTA	1 LONDON (CASELLA)	Upper
Davao	1 JAPAN OTA 2 JAPAN OTA 3 JAPAN OTA	1 JAPAN SUZUKI 3 USA BELFORT	3 JAPAN OTA (DEFECT)	1 JAPAN OTA	1 LOCAL 8 in. Std. 2 JAPAN OTA (DEFECT.)	1 LONDON (CASELLA) 1 EPPLEY (no chart)	Upper
Guiuan	1 USWB 2 USWB 3 USWB	1 JAPAN SUZUKI 3 USA BELFORT	1 WEATHER TROPICS '84 (DEFECT.)	1 USWB	1 LOCAL 8 in. Std. 2 JAPAN OTA	NONE	Radar
Tacloban	1 USWB 2 USWB	1 USWB 2 FAURA 3 USA BELFORT	2 USA BELFORT (DEFECT.) 3 JAPAN OTA	1 USWB	1 JAPAN OTA 2 JAPAN OTA	NONE	NONE
Sanjose Mindoro	1 USWB 2 USWB 3 ENGLAND	1 BOARD 3 USA BELFORT	2 INTB (DEFECT.) 3 JAPAN KOSHIN	1 USWB	1 LOCAL 8 in. Std. 2 JAPAN OTA '73	NONE	NONE
Puerto Princesa	2 USWB 3 JAPAN OTA	1 USWB 3 USA BELFORT	2 JAPAN OTA	1 USA WHIRLING	1 LOCAL 8 in. Std. 2 JAPAN OTA	NONE	Upper

Table 3.18 (3/5)

Status of Meteorological Instrument in PAGASA

Name of Instrument	Air Temperature 1 Ordinary thermometer 2 Max./Min. thermometers 3 Thermograph	Atmospheric Pressure 1 Mercurial barometer 2 Aneroid barometer 3 Barograph	Wind 1 Wind vane 2 Anemometer (Anemograph) 3 Wind Mill Anemometer	Humidity 1 Psychrometer 2 Hair hygrometer	Precipitation 1 Rain gauge 2 Tilting bucket raingauge	Duration of Sunshine 1 Cambell-Stokes Recorder 2 Jordan Sunshine Recorder Solar Radiation 1 Eppley Pyranometer 2 Robitch Pyranometer	Special Observation Upper: Upper-air Observation Radar: Weather Radar Observation
Iloilo							
Masbate	1 USWB, 2 USWB, 3 USWB	1 JAPAN SUZUKI, 2 ——, 3 USA BELFORT	1 WEATHER TROPICS, 3 ——	1 USWB	1 LOCAL 8 in. Std., 2 ——	1 KHALSI * Integral Digital Co. Printer USA	NONE
Mactan Rad.	NONE	NONE	NONE	NONE	NONE	NONE	Radar Upper
Mactan	1 USWB, 2 USWB, 3 USA BELFORT	1 JAPAN SUZUKI, 2 JAPAN NIHON KISHO SOKKI, 3 USA BELFORT (DEFECT.)	1 WEATHER TROPICS, 2 JAPAN ISUZU	1 USWB, 2 USWB	1 USWB, 2 JAPAN OTA (DEFECT.)	NONE	NONE
General Santos	1 USWB, 2 USWB	1 JAPAN SUZUKI, 3 USWB (DEFECT.)	1 JAPAN OTA '73	NONE	1 LOCAL 8 in. Std., 2 JAPAN OTA (DEFECT.)	NONE	NONE
Catarman	1 USWB '74, 2 USWB '74	1 JAPAN SUZUKI '81, 3 BELFORT '78 OTA '83 CASELLA '78	1 JAPAN OTA, 2 JAPAN OTA	1 USWB '74	1 LOCAL 8 in. Std., 2 JAPAN OTA	NONE	NONE
Lumbia	1 USWB, 2 USWB, 3 JAPAN OTA	1 JAPAN SUZUKI, 2 JAPAN NIHON KISHO SOKKI, 3 USA FRIEZ	1 WEATHER TROPICS	1 USWB	1 LOCAL 6 in., 2 JAPAN OTA	1 LONDON (CASELLA)	NONE
Masin	1 USWB, 2 USWB, 3 JAPAN OTA '73	1 USWB, 2 JAPAN, 3 USWB	1 USWB	1 USWB	1 JAPAN OTA '73	NONE	NONE
Catbalogan	1 USWB, 2 USWB	1 USA GREEO, 2 FAURA, 3 CASELLA	1 USA, 2 USA FRIEZ	1 USWB, 2 USWB	1 USWB LOCAL, 2 JAPAN OTA '73	NONE	NONE
Puerto Princesa	* SEISMOLOGICAL	o HELICORDER/RV-301 o HELIDYNE GEOTECH CALIBRATION CONTROL/CC-210 o HELICORDER AMPLIFIER/AR-311					
Roxas	1 USWB, 3 USA BELFOR	1 JAPAN SUZUKI, 3 JAPAN OTA	2 USA BELFORT	1 USWB	1 LOCAL 8 in. Std., 2 JAPAN OTA (DEFECT.)	1 ——	NONE
Tagbilaran	1 USWB, 2 USWB, 3 JAPAN OTA '73	1 JAPAN SUZUKI '73, 3 USA FRIEZ	1 JAPAN OTA '73	1 USWB	1 LOCAL 8 in. Std., 2 JAPAN	NONE	NONE
Cuyo	1 USWB, 2 USWB, 3 CASELLA	1 ——, 2 FAURA, 3 JAPAN OTA '81 USA FRIEZ	1 JAPAN KOSHIN (DEFECT.), 2 USWB '82 (WIND RECORD)	1 USWB (BROKEN)	1 USWB '45, 2 JAPAN OTA '73	NONE	Upper
Dumaguete	1 USWB '73, 2 USWB '73, 3 JAPAN '77	1 JAPAN '74, 2 FAURA '63, 3 USWB '51	1 WEATHER TROPICS	1 RATOR '51	1 LOCAL 8 in. Std., 2 JAPAN '64	1 LONDON (CASELLA) '80	NONE
Cagayan de Oro	2 USWB, 3 USWB	1 USWB, 2 FAURA (BROKEN), 3 USA BELFORT	(BROKEN)	1 ——	1 ——, 2 ——	NONE	NONE
Coron	1 USWB, USWB '49 2(NOT USABLE), 3 USWB '49	1 —— '75 USWB '49, 2 FAURA '72, 3 USWB '49	NONE	NONE	1 LOCAL 8 in. Std. '73, 2 —— '70	NONE	NONE

Table 3.18 (4/5)

Status of Meteorological Radar in PAGASA

Site	Type	Inspection Remarks	Date Manufactured	Status as of 01 March 1984
BASCO	RAYTHEON WSR-57M UPGRADED TO WSR-77		July 1979	Not operational. Trigger circuit defective.
APARRI	TOSHIBA TW11634			Operational
BAGUIO	RAYTHEON WSR-57M			Operational
BALER	RAYTHEON WSR-77		July 1979	Operational
DAET	RAYTHEON WSR-57M UPGRADED TO WSR-77			Operational
VIRAC	RAYTHEON WSR-77		July 1979	Operational
MACTAN	RAYTHEON WSR-57M UPGRADED TO WSR-77			Under maintenance.
GUIUAN	RAYTHEON WSR-77		July 1979	On site delivery of equipment and installation in progress.
BUSUANGA	RAYTHEON WSR-77		July 1979	System installation in progress.
TANAY	RAYTHEON WSR-77M		July 1979	Radar building under construction.

Table 3.18 (5/5)

Status of Meteorological Upper-air Instruments in PAGASA

Site	Type	Inspection Remarks	Date Manufactured	Status as of 01 March 1984
LAOAG	RS : Micro-cora (Vaisala) RW : 〃 Pibal: Theodolite (W.Knight)		—— —— 1982	Operational Operational Operational
MACTAN RADAR	RS : AR16 (Vaisala) RW : RT18 (〃) Pibal: Theodolite (W.Knight)		1974 1970 ——	Operational Operational Operational
ZAMBOANGA	RS : AR16 RW : RT16 Pibal: Theodolite (W.Knight)		1974 1963 ——	Operational Operational Operational
LEGASPI	RW : RT18 Pibal: Theodolite (W.Knight)		1970 ——	Non-Operational Operational
PTO. PRINCESA	RW : RT18 Pibal: Theodolite (W.Knight)		1970 ——	Operational Operational
DAVAO	RW : WFR100 (EEC) Pibal: Theodolite (W.Knight)		1978 1978	Operational Operational
BASCO	Pibal: Theodolite (W.Knight)		——	Operational
BAGUIO	Pibal: Theodolite (W.Knight)		——	Operational
CUYO	Pibal: Theodolite (W.Knight)		——	Non-Operational

Table 5.1 Design of Multiplex Radio Link

Span	Distance	Main Antenna (required min. ant. height) & Sub Antenna	Model of Equipment	S/N at Standard Condition	S/N at Fading Condition (99.95%)	Figure Number of Terrain Profile	Table Number of Data Sheet
TANAY - GAPAS	132.4 km	6.0mφ GP (13.7m) - 4.2mφ GP (22m)	PM24-800-70 FD	63.9 dB	40.4 dB	A.1 (1/19)	A.2 (1/20)
GAPAS - NAGA	90.5 km	6.0mφ GP (22m) - 6.0mφ GP (27.8m)	PM24-800-70 FD	59.9 dB	36.4 dB	A.1 (2/19)	A.2 (2/20)
NAGA - MALABOG	74.2 km	3.0mφ GP (22.85m)- 3.0mφ GP (22m)	PM24-800-70 FD	64.5 dB	41.0 dB	A.1 (3/19)	A.2 (3/20)
MALABOG - BALOD	130.5 km	10mφ GP (15m) - 6.0mφ GP (21.3m) 6.0mφ GP 4.2mφ GP	PM12-800-70 SD	61.5 dB	39.0 dB	A.1 (4/19)	A.2 (4/20)
BALOD - TINAMBACAN	25.7+20.0km	4.0mφ PP - 4.0mφ PP x 2 - 4.0mφ PP (40.9m) (15m) (10m)	FM60-6700-1	61.8 dB	46.2 dB	A.1 (5/19) A.1 (6/19)	A.2 (5/20)
TINAMBACAN - DANAO	183.9 km	10mφ GP (10m) - 10mφ GP (15.3m) 6.0mφ GP 6.0mφ GP	PM12-800-70 SD	59.0 dB	36.5 dB	A.1 (7/19)	A.2 (6/20)
DANAO - MALASAG	239.3 km	6.0mφ GP (15.3m) - 6.0mφ GP (10m) 4.2mφ GP 4.2mφ GP	PM6-800-70 SD	58.0 dB	35.5 dB	A.1 (8/19)	A.2 (7/20)
MALABOG - LEGASPI	7.0 km	12 ele YAGI (20m)- 12 ele YAGI (20m)	PM12-800-5	62.5 dB	55.1 dB	A.1 (9/19)	A.2 (8/20)
BALOD - CATARMAN	2.9 km	12 ele YAGI (30m)- 12 ele YAGI (20m)	PM6-800-5	75.5 dB	68.9 dB	A.1 (10/19)	A.2 (9/20)
DANAO - MACTAN RADAR	20.5 km	1.8mφ GP (20m) - 3.0mφ GP (20m)	PM12-800-5	63.7 dB	53.6 dB	A.1 (11/19)	A.2 (10/20)
MALASAG - CAGAYAN DE ORO	10 km (presumed)	12 ele YAGI (10m)- 12 ele YAGI (20m)	PM6-800-5	66.5 dB	58.5 dB	-	A.2 (11/20)
SCIENCE GARDEN - PFC	1.4 km	12 ele YAGI (50m)- 12 ele YAGI (-)	FM60-800-05 (5W + ATT 10dB)	69.1 dB	62.8 dB	-	

Table 5-2 (1/2)

List of Improved Observation Instruments

Items / Name of Station	Propeller and Vane Type Wind Sensor & Recorder	Tilting Bucket Type Rain Gauge Recorder	Psychrometer	Fortin Barometer
BASCO	○	○	○	○
APARRI	○	○	○	○
LAOAG	○	○	○	○
TUGUEGARAO	○	○	○	○
MUÑOZ		○	○	
SCIENCE GARDEN	○	○	○	○
DAET	○	○	○	○
CALAPAN	○	○	○	○
LEGASPI	○	○	○	○
ILOILO	○	○	○	○
CAGAYAN DE ORO	○	○	○	○
MACTAN	○	○	○	○
DAVAO	○	○	○	○
HINATUAN	○	○	○	○
ZAMBOANGA	○			○
CUYO	○			○
PTO PRINCESA		○	○	○
TACLOBAN	○	○	○	○
BALER	○	○	○	○
DAGUPAN	○	○	○	○
CASIGURAN	○	○	○	○
ALABAT	○	○	○	○
MALAYBALAY	○	○	○	
IBA	○	○	○	○
SURIGAO	○	○	○	○
TOTAL	23	23	23	23