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No. 2

KINGDOM OF NEPAL

DEVELOPMENT STUDY OF CIVIL AVIATION IN NEPAL

SEPTEMBER 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to a request from His Majesty's Government of Nepal, the Japanese Government decided to conduct a Development Study of Civil Aviation in Nepal and entrusted the study to Japan International Cooperation Agency (JICA).

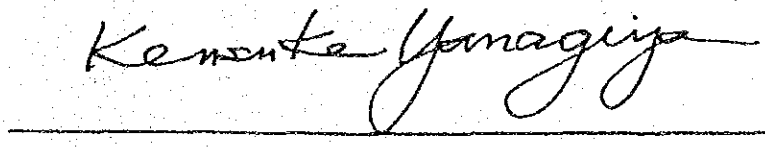
JICA sent to Nepal a survey team headed by Mr. Makoto Tanaka, and composed of members from Pacific Consultants International Co.,Ltd. and Chiyoda Engineering Consultants Co.,Ltd. from August, 1988 to September, 1989.

The team held discussions with officials concerned of the Government of Nepal, and conducted field surveys. After the team returned to Japan, further studies were made and the present report was prepared.

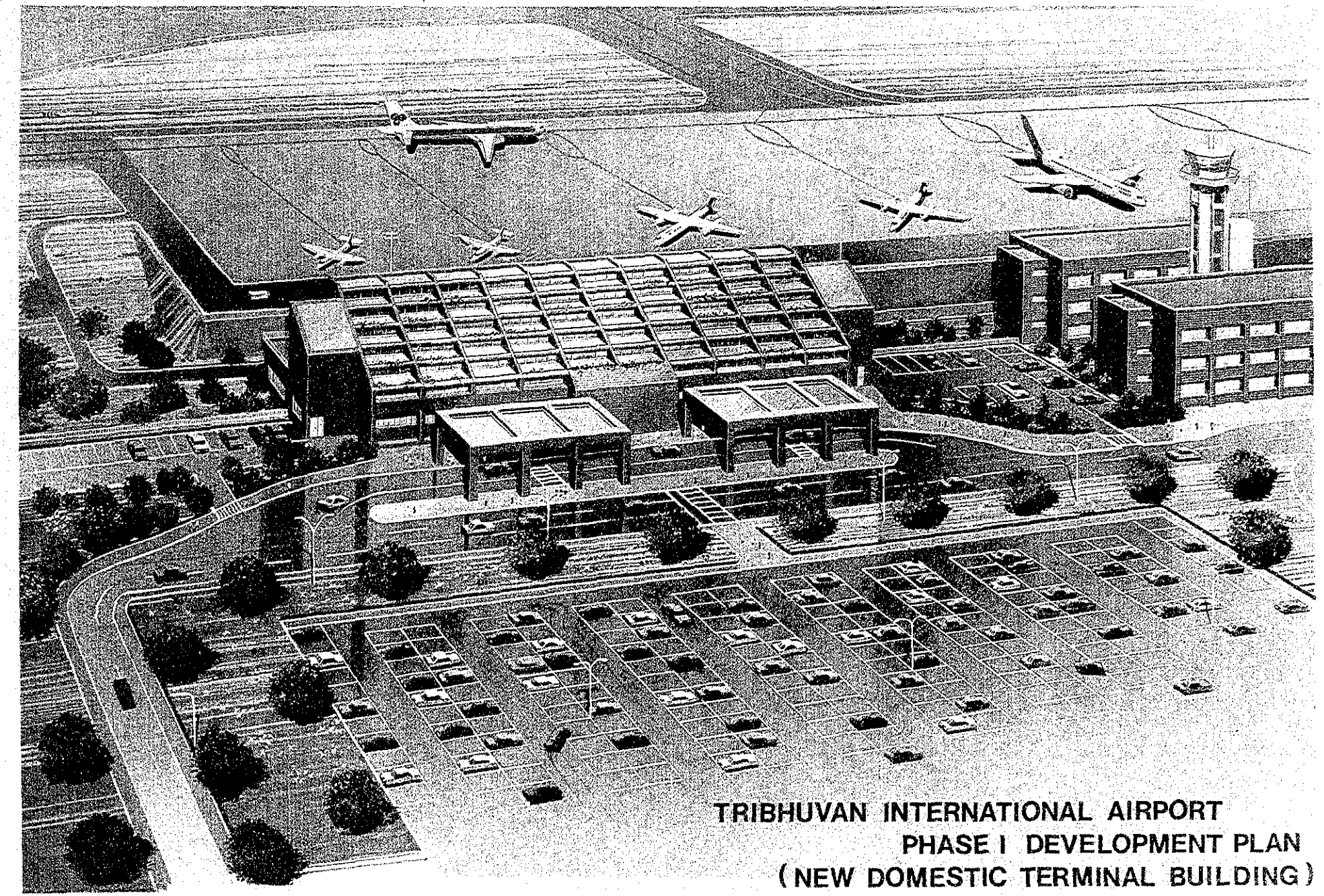
I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincerest appreciation to the officials concerned of His Majesty's Government of Nepal for their close cooperation extended to the team.

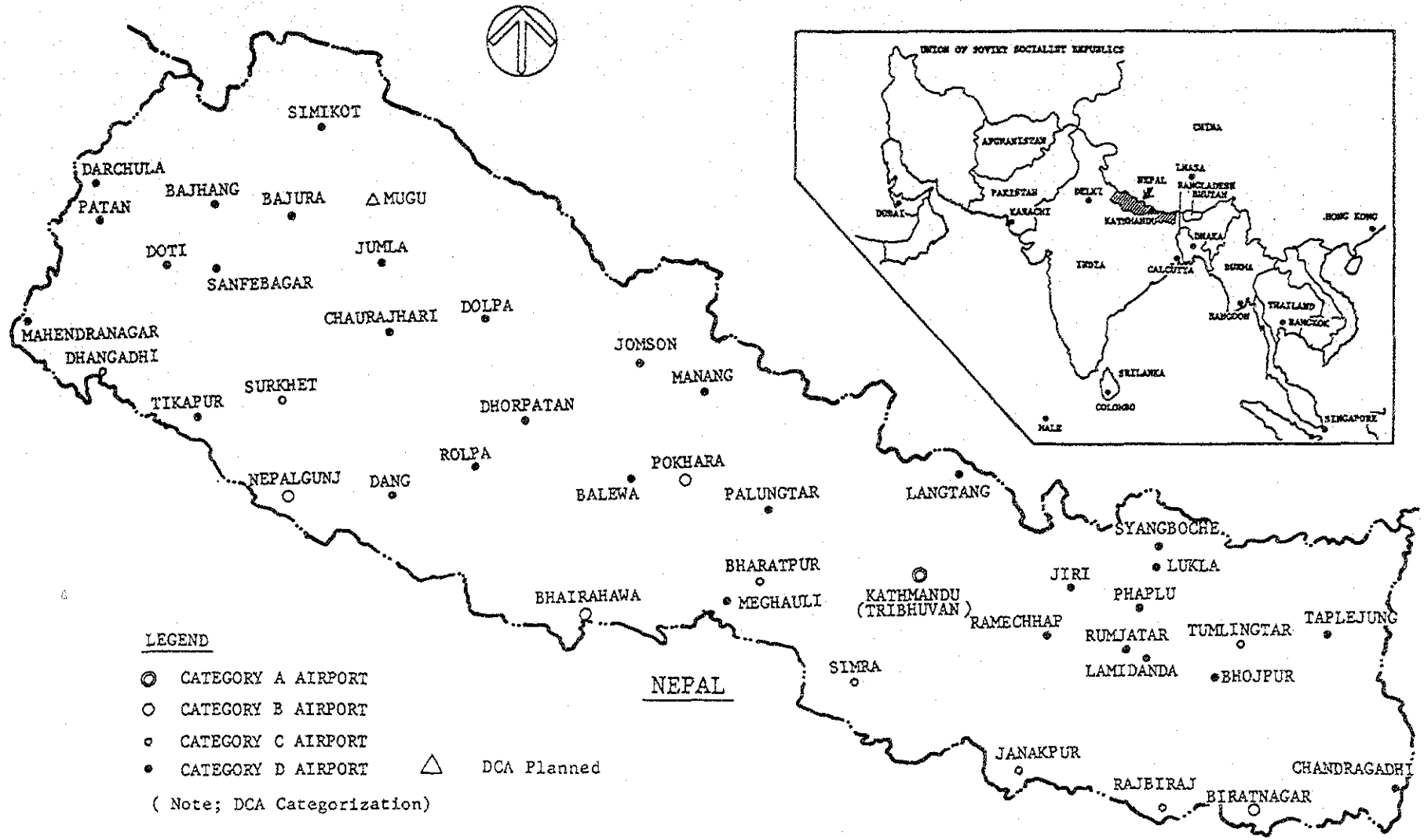
September, 1989



Kensuke Yanagiya
President
Japan International Cooperation Agency



TRIBHUVAN INTERNATIONAL AIRPORT
PHASE I DEVELOPMENT PLAN
(NEW DOMESTIC TERMINAL BUILDING)



PROJECT LOCATION MAP

0 20 50 100 200 Kilometres

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INTRODUCTION

INTRODUCTION

1. General

Nepal is the world's most precipitious staircase to the frozen heights of "the Roof of the World" squeezed between the vastness of China to the north and India to the south, east and west. It has a total area of 147,000 sq. km and a population of 17 million.

Except for the narrow strip of Terai plain along its southern boundary and temperate valleys spread across its middle, the country is entirely mountainous with more than a quarter of its land area above 3,000 m in altitude.

In this mountainous country with deep valleys etched between peaks and ranges, roads are vital for bringing together the various communities. But until the early 1950's, Nepal had nothing except village trails and mountain paths. Since then, there have been major efforts to construct roads, but there is still an insufficient road network.

In the light of the present conditions of land transportation, and the importance of invitation in the overall development of the country, it is considered indispensable to develop the air transport system in Nepal for enhancing public welfare in remote districts, the promotion of tourism sector, and the growth of both international and domestic trade.

His Majesty's Government of Nepal (hereinafter referred to as "HMG/N") has decided to request the Government of Japan to provide a technical assistance necessary for the development of civil aviation in Nepal.

Based on an agreement between the governments, Japan International Cooperation Agency (hereinafter referred to as "JICA"), an official agency responsible for the implementation of technical cooperation programs of the Government of Japan, was entrusted to carry out the Development Study for Civil Aviation in Nepal (hereinafter referred to as "the Study"). JICA organized the study team and commenced the study in August, 1988.

This Final Report explains results of above study finalized in accordance with the mutual understanding between HMG/N and JICA.

2. Objectives and Scope of Work

The objectives of this study are to develop schematically as a master plan, the overall development of Air Transport System in Nepal and finally, to examine the technical, economic, and financial feasibility on the priority plans elaborated in said master plan study.

The study comprises the following three (3) steps and fourteen (14) major items which are performed in accordance with the work flow chart indicated in Fig. 1.

I. Review and Field Work

(1) Review of the existing reports and data related to the study

(2) Data collection and supplementary survey

II. Formulation of Master Plan

(3) Analysis and forecast of air transport demand taking into account other modes of transport

(4) Evaluation of existing airports and related facilities with special emphasis on TIA, Pokhara, Nepalgunj, Dolpa, Jomsom, Jumla, Lukla, Phaplu, Sanfebagar, Mugu, Simikot, and Syangboche Airports

(5) Formulation of basic policies for development of airports and related facilities

(6) Identification of the air transport network to be developed

(7) Categorization of airports and determination of necessary related facilities for each category

(8) Preparation of master plan for key airports selected from viewpoints of economic and/or tourism development

(9) Recommendation on operational improvement, institutional requirements and management

(10) Identification of priority plans

III. Feasibility Study on Priority Plans

(11) Preparation of preliminary study

(12) Estimation of cost

(13) Project evaluation

(14) Preparation of implementation program

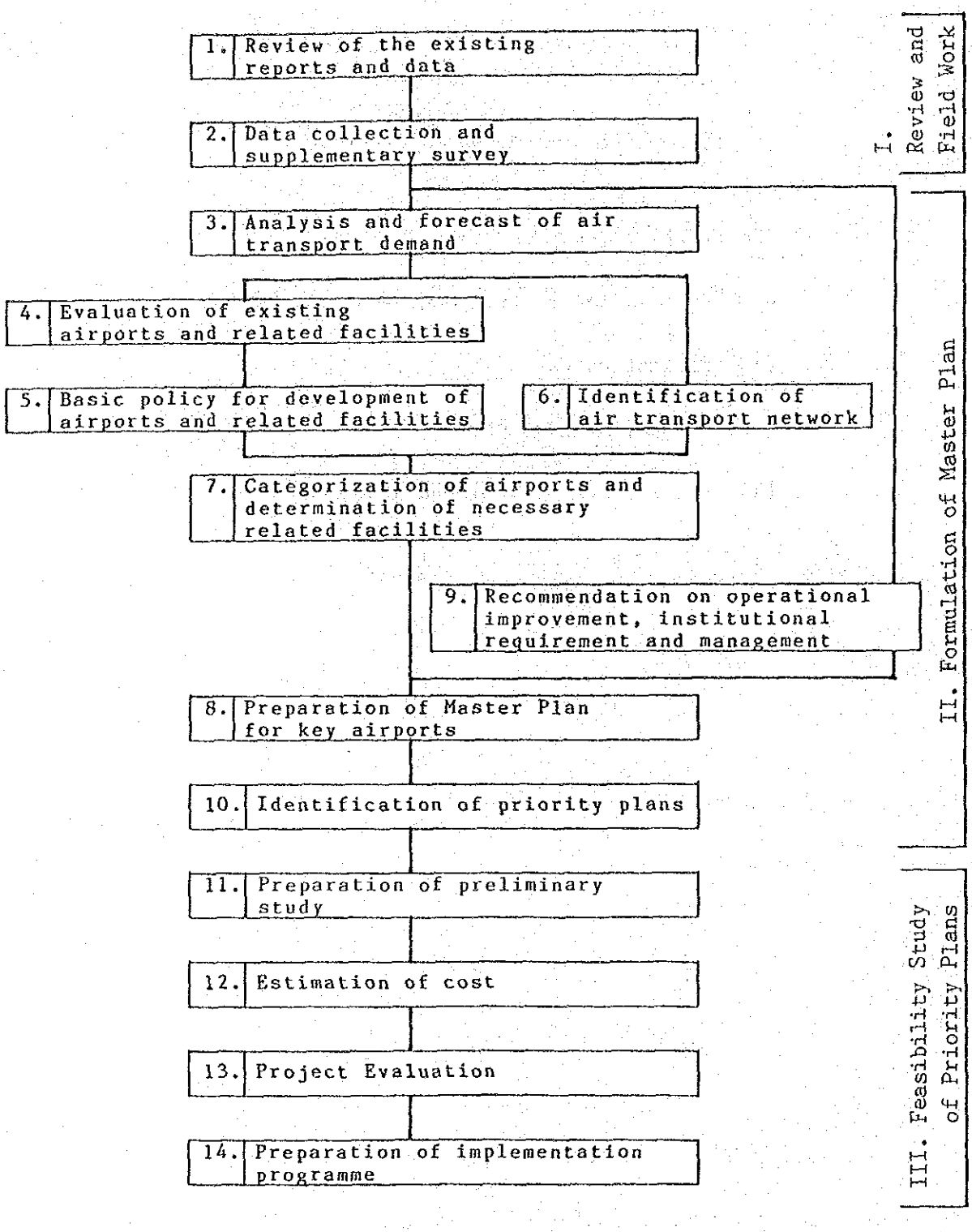


Fig. 1 Main Work Flow Chart

3. Execution Method and Reporting System

The Study Team conducted the Study in accordance with the procedures in the Inception Report accepted by the HMG/N in August, 1988.

The Study Team immediately started with data collection and site investigation of the main existing airports and a new airport. The Study Team, in the meanwhile, carried out the topographic survey, soil investigation, traffic survey, and the studies covering the air traffic analysis and demand forecast, evaluation of the existing airports and related facilities, study of basic policy for development of airports and related facilities, classification of airports and necessary facilities, selection of key airports, and airport master planning of Tribhuvan International Airport.

The Study Team after returning to Japan carried out further study on the air traffic demand forecast, the air transportation network to be developed, the preparation of the airport master plans of TIA and other items.

Interim Report containing the results of these studies were submitted to HMG/N in December 1988, and was accepted. The contents of the Interim Report are included as Chapters 1 through 12 of this report.

The Study Team had several meetings with Department of Civil Aviation (referred to as "DCA") in December, 1988. As the result of discussion, new alternative master plan of TIA came to agreement and comments by DCA on the Interim Report were completed.

The preliminary study for Phase I development of the priority plans were drawn up along the line of the results of the Interim Report incorporating DCA's comments. The Draft Final Report which was made by adding Chapters 13 through 23 to the Interim Report contains the comprehensive results of the feasibility study on priority projects. The Draft Final Report was submitted in July, 1989, and was accepted.

This Final Report is finalized incorporating DCA's comments on the Draft Final Report and consists of "Summary", "Main Report" and "Appendix".

4. Study Organization

The Study was carried out by the Study Team organized by JICA under the supervision of the JICA Advisory Committee and with the close cooperation of their counterparts officials of HMG/N. The organization chart is shown in Fig. 2.

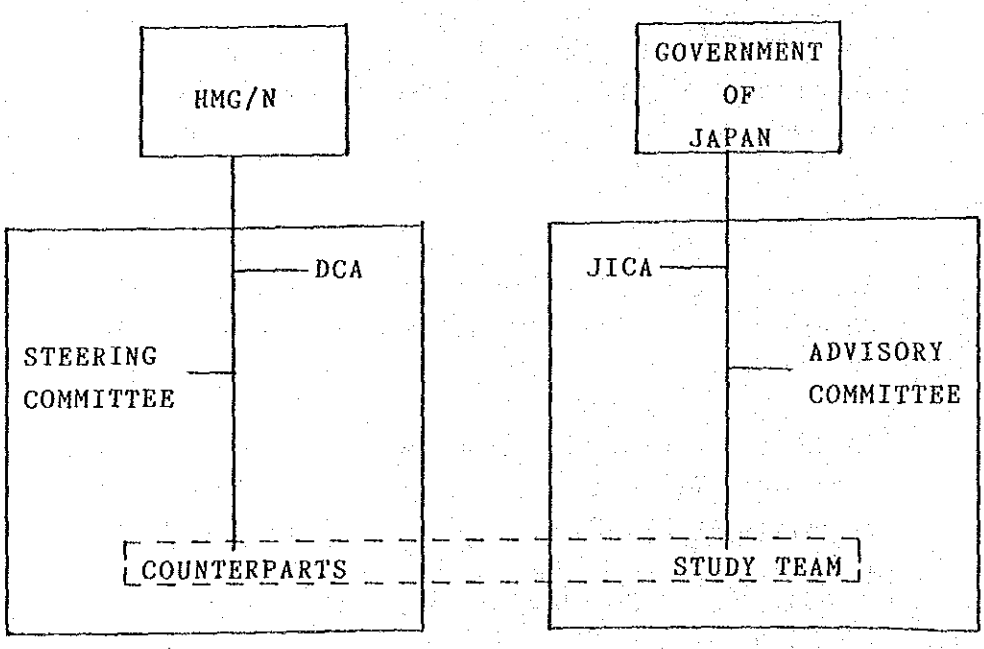


Fig. 2 The Overall Organization Frame

The members of JICA Advisory Committee, JICA Staff, Study Team, and DCA's Counterparts are presented in the following list:

JICA Advisory Committee

Chairman	Mr. Takenori Matsumoto	Director, Flight Standards Division, Engineering Department, Civil Aviation Bureau, Ministry of Transport
Member	Mr. Masamichi Watanabe	Deputy Director, Construction Division, Aerodrome Department Civil Aviation Bureau, Ministry of Transport
Member	Mr. Kenro Otsuka	Chief, First Facility Section, Radio Engineering Division, Air Traffic Service Department, Civil Aviatiion Bureau, Ministry of Transport
Member	Mr. Tomio Onuki	Assistant Director, International Cooperation Division, International Transport and Tourism Bureau, Ministry of Transport

JICA Staff

Project Coordinator	Mr. Mutsumi Narawa	Social Development Cooperation Department, Japan International Cooperation Agency (JICA)

JICA Study Team

Team Leader:	Mr. Makoto Tanaka
Airport Planner:	Mr. Naonori Takahata
Navaids Planner:	Mr. Keiichi Takeda
Terminal Facilities Planner:	Mr. Shinichi Sakabe

ATC Facilities Planner:	Mr. Tadamitsu Itoh
Operations and Management Planner:	Mr. Masaichi Yamamoto
Traffic Forecast and Economic/ Financial Analyst:	Mr. Yaichi Kobayashi
Airport Construction Planner:	Mr. Ryuji Taguchi

DCA Counterparts

Chairman	Mr. M. L. Shrestha	Project-in-Charge, Air Transport Development Project
Member	Mr. D. R. Sharma	Deputy Director, Technical
Member	Mr. G. B. Shrestha	Chief, Planning Section
Member	Mr. Y. M. Tamrakar	Divisional Engineer No. 1
Member	Mr. N. B. S. Dongol	Chief, Aviation Security
Member	Mr. H. B. Shrestha	Chief, Air Transport Section
Member	Mr. Maheshwor Shrestha	Chief, Communication
Member	Mr. R. R. Dali	Superintendent, ATS Section
Member	Mr. B. R. Rajbhandary	Superintendent, Radio
Member	Mr. A. M. Joshi	Superintendent, Com. & Navaid Development Project
Member	Mr. L. Shakya	Superintendent, Electro-Mechanical Section
Member	Mr. D. N. Rana	Civil Engineer, ATDP
Member	Mr. K. K. Verma	Communication Section
Member	Mr. D. S. Rana	Nepal Counterpart, Acting Divisional Engineer No. 2

PART I FORMULATION OF MASTER PLAN

CHAPTER 1 BACKGROUND OF THE PROJECT

PART I FORMULATION OF MASTER PLAN

CHAPTER 1 BACKGROUND OF THE PROJECT

1.1 Socio-Economic Conditions in Nepal

1.1.1 Geographical Conditions

Nepal is located in the northern area of the Indian subcontinent. It is a landlocked country with an area of about 147,000 square kilometers bounded on the north by the Tibet Autonomous Region of the People's Republic of China, and on the west, south, and east by the Republic of India.

The country is divided into three geographical belts running east to west. The Terai region in the south is a semi-tropical area with elevations as low as 70 m above mean sea level. The Hill region in the middle belt rises to an elevation of 3,000 m, while the Himalayan region in the north rises up to 8,000 m, as shown in Fig. 1.1.1.

The Himalayan region covers over 25% of the country and includes some of the world's highest peaks whose summits exceed 8,000 m.

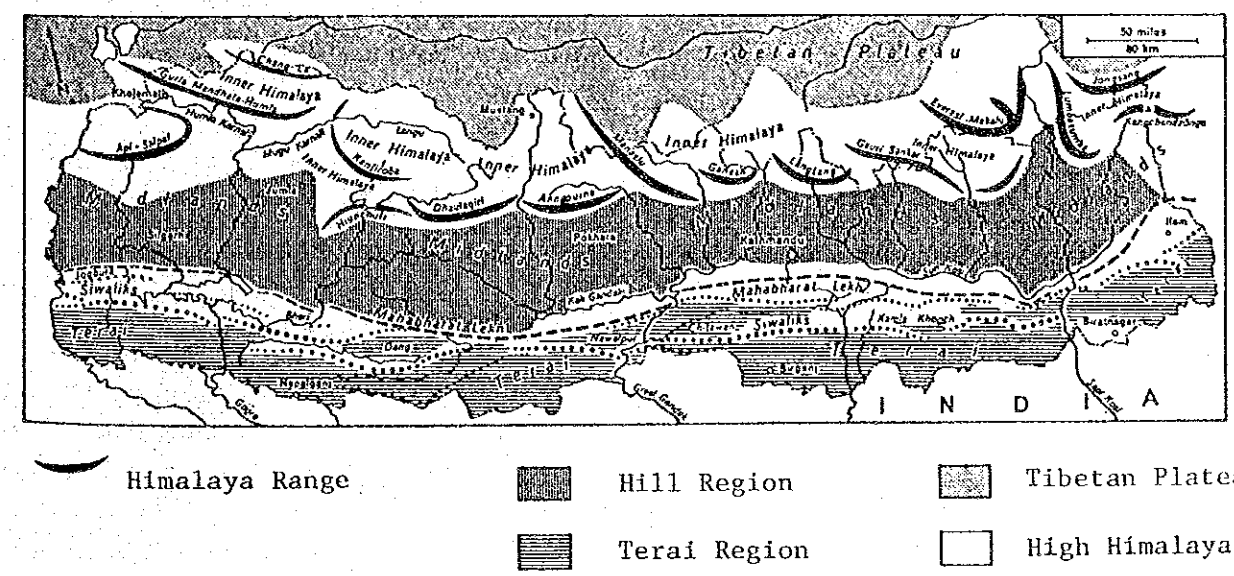


Fig. 1.1.1 Geographical Features in Nepal
(Source: Nepal, Toni Hagen)

Nepal's climate is as varied as its terrain. The weather is humid and tropical in the Terai region, temperate in the Hill region, and alpine in the Himalayan region.

Nepal has two distinct seasons, monsoon from June to September and dry from October to May. Most precipitation falls during the monsoon. In Kathmandu, 1,100 mm of the annual rainfall of 1,400 mm comes down between June and September. This causes flooding in low-lying areas.

1.1.2 Social Conditions

Nepal's total population is about 17 million (1987 estimate) and its population density is 116 inhabitants per square kilometer.

Ninety percent of the inhabitants live in rural areas. Kathmandu, the capital of Nepal and the nation's largest city, has about 235,000 inhabitants (District; 422,000) which is only 1.3% of the total population.

Nepal is a multiracial and a multilingual country. There are around 75 ethnic groups that speak around 50 different languages.

The state religion is Hinduism. Ninety percent of the population is Hindu, while 5% is Buddhist.

Nepal is the only monarchical Hindu kingdom in the world, which is governed by the Panchayat system.

The country is administratively divided into five development regions and further divided into 14 zones and 75 districts as shown in Fig. 1.1.2.

1.1.3 Economic Conditions

Nepal's gross domestic product (GDP) and the GDP per capita for fiscal year 1986/87 is estimated at Rs. 56,000 million (about 2,900 million US dollars) and Rs. 3,200 (about 160 US dollars) respectively (at current price). Past GDP and the annual growth rate trends are illustrated in Fig. 1.1.3. The annual growth rate during fiscal year 1986/87 is estimated to be 2.3% (at constant market price), which is lower than the population growth rate of 2.66%.

Fig.1.1.2 Administrative Division

Source ;
Topographical Survey Department
H.M.G. Nepal in 1987

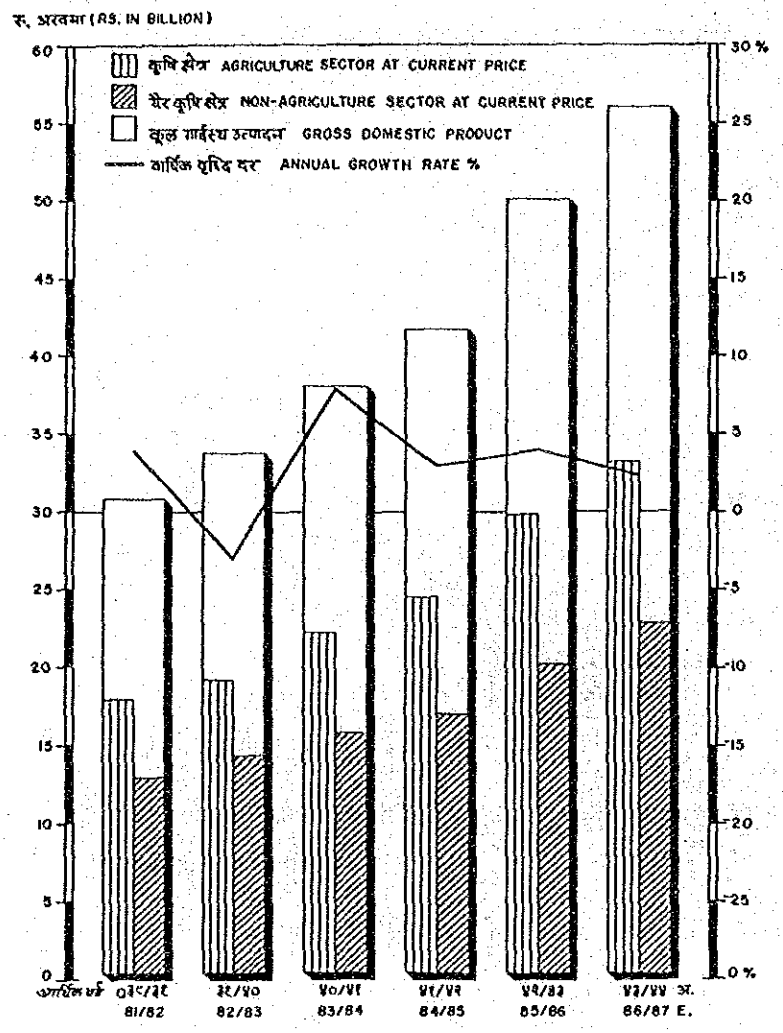


Fig. 1.1.3 Gross Domestic Product and Growth Rate

Source ; Economic Survey 86-87
H.M.G Ministry of Finance

Nepal's basic industries are agriculture and tourism. The manufacturing industry is mostly related to agriculture and its output is still only a small percentage of GDP.

Agriculture involves 90% of the population and its share of GDP (at current market price) is estimated as 59% in fiscal year 1986/87. The chief crops are rice, maize, wheat, barley, millet, sugarcane, jute, oil seeds, tobacco, and potatoes.

The manufacturing industry produces cement, paper, textiles, handicrafts, jute, leather, and plywood. Exportable goods are carpets, handicrafts, yak, wool, sweaters, cotton, garments, jute, foodgrains, timber, oil seeds, hides and skins, tea, and herbs.

Nepal has a high potential for tourism, including a splendid view of the Himalayan range which is attractive for foreign tourists. The number of tourists visiting Nepal has climbed steadily since 1981 to a level of about 233,000 in 1986. About 82% of all tourists arrived by air. Of those, 52% arrived from an Indian port and 16% from Bangkok.

In fiscal year 1985/86, foreign exchange earnings from tourism increased by 43% in comparison with fiscal year 1984/85 and reached Rs. 105 million (about 5 million US dollars) which occupied 34% of the foreign exchange earning from merchandise exports.

Accordingly, tourism is recognized as the most important industry contributing to foreign exchange earnings.

1.1.4 Transportation System

The transport system in Nepal is illustrated in Fig. 1.1.4.

The principal mode of transport in Nepal has been roads since ancient times. But Nepal's roads are still undeveloped in comparison with adjacent countries because of steep terrain, heavy rainfall during the monsoon, and economic conditions. The total road length in 1985 was about 5,900 km. Road network development is being expanded from the east-west highway in the Terai region to the north.

Fig.1.1.4 Land Transportation System in Nepal

Railways have been used to link Nepal with India. The railways are also undeveloped and covered only 52 km in 1984.

Ropeways are used for transportation of goods in the Hill region and cover 42 km.

Air transportation has increasingly become an important means for both domestic and international transportation in place of roads, especially in the remote and inaccessible districts of the hill and the Himalayan region.

Therefore, air transportation development is required immediately.

1.2 Air Transportation in Nepal

1.2.1 Existing Conditions and Problems of Airports and Related Facilities

Since it is difficult and expensive to develop sufficient surface transportation facilities in Nepal, an air transport network has been developed for nationwide transportation.

A total of 43 airports under the control of the Department of Civil Aviation (hereinafter referred to as "DCA") which consist of one international and 42 domestic airports exist as covering most all of country of 147,000 square kilometers, as shown in Fig. 1.2.1. Twelve airports are located in the Terai region, 27 in the Hill region, and four in the High Himalayan region.

Royal Nepal Airlines Corporation (hereinafter referred to as "RNAC") has scheduled flights to 38 airports of 42 domestic airports. (Ten airports of 38 airports have seasonally scheduled flights.)

The airports are classified into four categories according to the importance of the airport and the largest aircraft operated there. Table 1.2.1 shows the existing conditions of the facilities and operations in the airports. As a whole, the level of airport development is still low.

Table 1.2.2 summarizes the existing conditions and problems with regard to airport facilities, management, operation, and utilization in the whole of the airports.

Table 1.2.1 Existing Condition of Airport in Nepal

NO.	CATEGORY DCA	AIRPORT	CODE	INT	DOM	LOCATION REG.	LOCATION ZONE	ARP LATITUDE	ARP LONGITUDE	ELEV. (M)	RUNWAY DESIGNATION	RUNWAY DIMENSION (M)	RUNWAY SURFACE	RUNWAY LDG RWY	RUNWAY TKOF RWY	RUNWAY CONDITION AS FW CDM	EXISTING CONDITION MAX. ACFT	EXISTING CONDITION OPERATION YR SN	EXISTING CONDITION OPERATION ACFT	EXISTING CONDITION OPERATION CHTR	ANNUAL PASSENGERS (THOUSAND) 1981/82	82/83	83/84	84/85	85/86	86/87
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)					
1	A	KATHMANDU (TRIBHUVAN)	KTM	*		C	BAGMATI	27°41'47"	85°21'42"	1338	02/20	3050 X 45	ASP	02	02/20	*	DC-10	*	DC-10		I+D 556.5 INT 400.9 DOM 155.6	562.7 407.8 154.9	576.8 414.8 162.0	651.8 465.3 186.5	657.6 482.9 174.7	726.4 523.2 203.2
2	B	BHAIRAHAWA	BWA		*	W	LUMBINI	27 30 00	83 25 00	109	10/28	1524 X 30	ASP	10/28	10/28	*	HS748	*	HS748		11.9	9.1	7.1	12.0	11.3	12.9
3	B	BIRATNAGAR	BIR		*	E	KOSHI	26 29 00	87 16 00	72	09/27	1524 X 30	ASP	09/27	09/27	*	HS748	*	HS748		44.9	43.4	40.7	44.4	46.5	52.7
4	B	NEPALGUNJ	KEP		*	M.W	BHERI	28 06 00	81 40 00	165	08/26	1524 X 30	ASP	08/26	08/26	*	HS748	*	HS748		25.5	32.6	38.4	46.1	52.7	58.6
5	B	POKHARA	PKR		*	W	GANDAKI	28 12 00	83 59 00	827	03/21	1433 X 30	GRV	03/21	03/21	*	HS748	*	HS748		23.2	20.0	23.0	34.2	36.4	46.5
6	C	BHARATPUR	BHR		*	C	NARAYANI	27 41 00	84 25 00	183	14/32	1158 X 30	GRS	14/32	14/32	*	HS748	*	DHC-6		1.0	0.0	0.1	0.1	0.1	0.1
7	C	DHANGADHI	DHI		*	F.W	SETI	28 42 00	80 36 30	210	09/27	1524 X 30	GRS	12/30	12/30	*	HS748	*	DHC-6		9.6	7.1	7.3	11.2	11.7	14.1
8	C	JANAKPUR	JKR		*	C	JANAKPUR	26 40 00	85 55 00	78	09/27	1006 X 30	ASP	09/27	09/27		HS748	*	DHC-6		6.4	5.1	6.3	7.7	5.4	6.0
9	C	RAJBIRAJ	RJB		*	E	SAGARMATHA	26 31 00	86 45 00	76	11/29	1280 X 46	GRS	11/29	11/29	*	HS748	*	DHC-6		0.3	0.0	0.0	0.1	0.2	0.4
10	C	SIMRA	SIF		*	C	NARAYANI	27 09 00	84 59 00	137	02/20	1219 X 46	GRS	02/20	02/20	*	HS748	*	DHC-6		10.5	15.5	15.9	15.8	11.5	11.5
11	C	SURKHET	SKH		*	M.W	BHERI	28 35 00	81 36 00	732	02/20	1036 X 30	GRS	02/20	02/20	*	HS748	*	DHC-6		9.2	7.7	10.7	13.6	12.4	15.0
12	C	TUMLINGTAR	TMI		*	E	KOSHI	27 19 00	87 12 00	518	16/34	1219 X 46	GRS	16/34	16/34	*	HS748	*	DHC-6		13.2	12.8	11.3	7.6	11.9	13.1
13	D	BAITADI (PATAN)	BIT		*	F.W	MAHAKALI	29 28 00	80 32 00	1280	03/21	500 X 30	CLY	03	21	*	DHC-6		DHC-6		1.0	3.0	3.3	2.8	3.5	4.8
14	D	BAGLUNG (BALEWA)	BGL		*	W	DHAULAGIRI	28 13 00	83 40 00	1012	01/19	610 X 30	GRS	19	01	*	DHC-6	*	DHC-6		3.5	4.3	3.3	7.0	10.0	10.6
15	D	BAJHANG	BJH		*	F.W	SETI	29 33 00	81 12 00	1250	07/25	640 X 30	GRS	07	25	*	DHC-6	*	DHC-6		2.9	2.1	2.1	3.3	4.9	4.9
16	D	BAJURA	BJU		*	F.W	SETI	29 30 00	81 40 00	1311	09/27	573 X 30	GRV	27	09	*	DHC-6	*	DHC-6		0.0	0.0	1.2	2.9	4.2	5.1
17	D	BHOJPUR	BHP		*	E	KOSHI	27 09 00	87 03 00	1219	17/35	533 X 30	CLY	35	17	*	DHC-6	*	DHC-6		5.3	5.4	5.3	7.1	7.9	8.6
18	D	CHANDRAGADI	BDP		*	E	MECHI	26 34 00	88 05 00	91	10/28	1524 X 46	GRS	10/28	10/28	*	HS748	*	DHC-6		0.7	1.0	0.8	0.7	0.5	0.6
19	D	DANG (TULSIPUR)	DNP		*	M.W	RAPTI	28 07 00	82 18 00	640	16/34	832 X 46	GRS	16/34	16/34	*	HS748	*	DHC-6		5.6	3.5	2.9	2.5	1.3	1.4
20	D	DARCHULA	DAP		*	F.W	MAHAKALI	29 40 00	80 32 30	649	07/25	590 X 30	GRS	07	25	*	DHC-6		DHC-6		0.0	0.0	0.0	0.0	0.5	1.4
21	D	DHORPATAN			*	W	DHAULAGIRI	28 31 00	83 02 00	2728	09/27	366 X 30	GRS	-	-	*	PC-6			*	0.0	0.0	0.0	0.0	0.0	0.0
22	D	DOLPA	DOP		*	M.W	KARNALI	28 58 30	82 49 00	2500	15/33	457 X 30	GRS	15	33	*	DHC-6	*	DHC-6		1.2	2.5	1.6	2.5	2.6	2.9
23	D	DOTI (DIPAYAL)	SIH		*	F.W	SETI	29 15 30	80 57 00	640	14/32	427 X 30	GRS	32	14	*	DHC-6	*	DHC-6		5.2	7.5	8.7	8.2	8.2	10.6
24	D	GORKHA (PALUNGTAR)	GKH		*	W	GANDAKI	28 03 00	84 29 00	457	02/20	1097 X 46	GRS	02	20	*	HS748			*	0.0	0.0	0.0	0.0	0.0	0.0
25	D	JIRI	JIR		*	C	JANAKPUR	27 38 00	86 14 00	1828	14/32	366 X 18	GRS	32	14	*	DHC-6		PC-6		0.8	0.8	0.6	0.4	0.2	0.2
26	D	JOMSOM	JMO		*	W	DHAULAGIRI	28 46 50	83 43 30	2682	06/24	610 X 30	SND/STN	6/24	06/24		DHC-6	*	DHC-6		3.3	2.0	3.0	5.3	6.0	7.9
27	D	JUMLA	JUM		*	M.W	KARNALI	29 18 00	82 12 00	2347	09/27	670 X 30	GRS	09	27	*	DHC-6	*	DHC-6		5.3	6.5	5.0	5.6	8.7	9.2
28	D	LAMIDADA	LDN		*	E	SAGARMATHA	27 15 00	86 41 00	1250	08/26	518 X 30	GRS	26	08	*	DHC-6	*	DHC-6		8.7	8.8	6.7	8.5	9.8	11.1
29	D	LANGTANG			*	C	BAGMATI	28 12 00	85 36 00	3658	09/27	421 X 30	GRS	12	30	*	PC-6			*	0.0	0.0	0.0	0.0	0.0	0.0
30	D	LUKLA	LUA		*	E	SAGARMATHA	27 43 30	86 43 30	2774	07/25	488 X 30	GRS	07	25	*	DHC-6	*	DHC-6		8.9	11.0	12.1	12.6	12.6	14.3
31	D	MAHENDRANAGAR	XMG		*	F.W	MAHAKALI	58 57 30	80 09 00	198	17/35	884 X 30	GRS	17/35	17/35	*	HS748		DHC-6		3.6	5.7	5.6	4.5	7.3	8.6
32	D	MANANG	MGX		*	W	GANDAKI	28 38 00	84 00 00	3353	11/29	610 X 30	GRS	29	11	*	PC-6		PC-6		0.0	0.2	0.3	0.6	0.5	0.6
33	D	MEGHAULI	MEY		*	C	NARAYANI	27 35 00	84 14 00	183	08/26	1067 X 46	GRS	08/26	08/26	*	HS748		HS748		9.2	6.0	8.0	8.2	8.1	10.8
34	D	PHAPLU	PPL		*	E	SAGARMATHA	27 31 00	86 36 00	2743	02/20	670 X 30	GRS	02	20	*	PC-6		DHC-6		0.2	0.4	0.5	0.7	0.8	0.8
35	D	RAMECHHAP	RHP		*	C	JANAKPUR	27 24 00	86 05 00	474	03/21	518 X 30	GRS	03/21	03/21	*	DHC-6	*	DHC-6		0.2	1.3	2.5	3.0	3.1	3.3
36	D	ROLPA	RPA		*	M.W	RAPTI	28 16 00	82 46 00	1250	06/24	457 X 30	CLY	06	24	*	DHC-6		DHC-6		0.0	0.1	0.0	0.1	0.1	0.2
37	D	RUKUMKOT (CHAURAJHARI)	HRJ		*	M.W	RAPTI	28 38 00	82 12 00	762	03/21	488 X 30	GRS	03/21	03/21	*	DHC-6	*	DHC-6		5.1	7.0	7.9	8.9	8.7	10.0
38	D	RUMJATAR	RUM		*	E	SAGARMATHA	27 18 00	86 32 30	1524	01/19	549 X 30	CLY/GRS	01	19	*	DHC-6	*	DHC-6		0.3	0.3	2.0	5.9	5.6	6.8
39	D	SANFEBAGAR	FEB		*	F.W	SETI	29 14 00	81 13 00	695	03/21	427 X 30	GRS	03	21	*	DHC-6	*	DHC-6		4.6	5.7	5.6	7.9	14.2	14.8
40	D	SIMIKOT (HUMLA)	IMK		*	M.W	KARNALI	29 58 00	81 49 00	2818	10/28	549 X 18	GRS	28	10	*	DHC-6	*	DHC-6		0.5	1.1	1.3	1.1	3.4	2.9
41	D	SYANGBOCHE			*	E	SAGARMATHA	27 49 00	86 44 00	3748	13/31	405 X 30	GRS	31	13	*	PC-6			*	0.0	0.0	0.0	0.0	0.0	0.0
42	D	TAPLEJUNG	TPJ		*	E	MECHI	27 21 00	87 42 00	2377	07/25	594 X 30	GRS/GRV	07	25	*	DHC-6		DHC-6		0.3	0.4	0.8	1.4	1.7	2.6
43	D	TIKAPUR	TKP		*	F.W	SETI	28 31 00	81 09 00	183	05/23	549 X 30	GRS	05/23	05/23	*	DHC-6	*	DHC-6		0.0	0.0	0.0	0.8	2.5	1.8

(Source:DCA)

NOTE :

ACFT : AIRCRAFT
ARP : AIRPORT REFERENCE POINT
ASP : ASPHALT
AS : ALL SEASONS
CDM : CLOSED DURING MONSOON
CHTR : CHARTER FLIGHT
CLY : CLAY
DOM : DOMESTIC
FW : FAIR WEATHER
GRS : GRASS
GRV : GRAVEL
INT : INTERNATIONAL
LDG : LANDING
SND : SAND
STN : STONE
SN : SEASONAL
TKOF : TAKE OFF
YR : YEARLY
REG : REGION

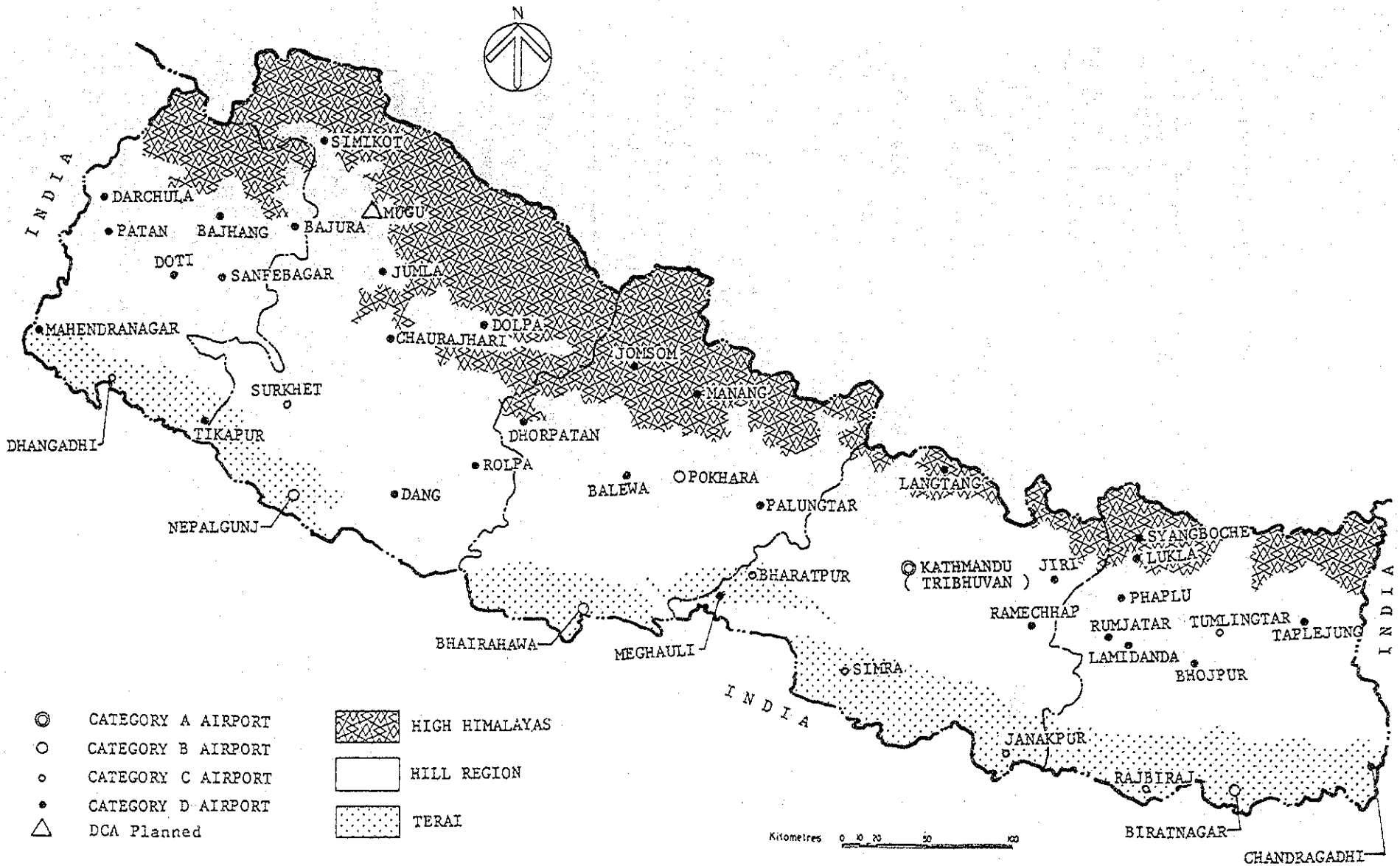


Fig. 1.2.1 Airports in Nepal

(Source:DCA)

Table 1.2.2 Overview of Airport Facilities and Management

Item	Existing Conditions and Problems
1. Runway Length	Because there is only one long runway at Kathmandu in Nepal, which can accommodate the jet aircraft, another long runway is required for transportation of relief goods at disaster and as an alternate to TIA. Some STOL airports have runway less than 500 m in length and this limits the operational performance of aircraft considerably. At many airports a sufficient Accelerate Stop Distance is not available. Therefore, at these airports take-off cannot be aborted even in the case of engine failure.
2. Runway Pavement	Only five airports have paved runways while the others have no pavement. Nine airports have to be closed during the rainy season because the runway surface becomes too soft and heavy storm water streams across the runway. The non-paved runway shorten life span of the aircraft's engines. If the runways are paved, the aircraft operation safety is expected to increase because the required runway length is shorter than that of non-paved runway.

Table 1.2.2 Continued

Item	Existing Conditions and Problems
3. Runway Profile	In the Hill and the High Himalayan regions,the longitudinal slopes of many runways exceed ICAO standards. Therefore, aircraft landing requires extremely careful operation to avoid damaging the aircraft's fuselage. At many airports the aircraft departure-approach pattern is limited to one direction because of geographical features and steep sloped runways.
4. Runway Strip and Obstacle Limitation Surfaces	Outside of the Terai region, because of topographical characteristics, it is difficult to ensure sufficient runway strip and obstacle limitation surfaces. In most cases it is physically impossible to solve this problem. The Tribhuvan International and Pokhara Airports have the same problem.
5. Terminal Building	Thirty-one airports have terminal buildings and new buildings are gradually being constructed at the remaining airports. At Tribhuvan International Airport, a new international terminal building has been completed.

Table 1.2.2 Continued

Item	Existing Conditions and Problems
6. Rescue and Fire Fighting Services	Rescue and fire fighting vehicles are provided at Tribhuvan International Airport and at two other airports but the level of protection do not meet ICAO recommendations and the improvement is necessary. The remaining airports require appropriate rescue and fire fighting services.
7. Aircraft Fuel Facilities	Aircraft fuel facilities are provided at the five major airports. On flights to the remaining airports it is necessary to load enough fuel for a round trip. This is operationally inefficient and limits the aircraft take-off weight.
8. Power Supply	Many airports in the High Himalayan region do not have electric power supply, and solar battery power is effectively used. Electric power supply for airports in the Terai region are unreliable and emergency generators in many airports are also not maintained sufficiently.

Table 1.2.2 Continued

Item	Existing Conditions and Problems
9. Air Traffic Services	Aerodrome Flight Information Service (AFIS) is provided at 22 airports. No AFIS staff is stationed at 13 airports. Engineering staff positions available at Tribhuvan, Biratnagar, Bhairahawa, Nepalgunj, Janakpur and Simra only. A recent flight check confirmed that most navaids operations are satisfactory. There are, however, some problems in supplying spare parts to repair the facilities.
10. Airport Revenues and Expenditures	Airport revenues are derived from airport tax, a landing fee and an air navigation facility charge. A total of airport revenues in DCA, in which most of the revenues is derived from Tribhuvan International Airport, are more than 30% of airport maintenance and operation cost excluding investment cost for airport development. But revenues are not sufficient and the level of airport maintenance and operation is inadequate.
11. Airport Usage	At many airports there has been a large-scale drop in demand due to newly developed roads. About 2/3 of the airports serve less than 10,000 passengers per year. In spite of very low usage some of the airports are in operation because of social welfare.

Table 1.2.2 Continued

Item	Existing Conditions and Problems
12. Aircraft Operations	Many flights are delayed or canceled due to poor weather conditions and/or poor facilities. At Tribhuvan International Airport, the fog limits the aircraft operations in the morning of winter season. In the High Himalayan region, clouds and turbulence limit aircraft operations to the early morning. In the Terai region some airports have to be closed during the monsoon season because of flooding of the runway and apron.
13. Access to Airports	Some of the airports is located very far from the center of the demand.

1.2.2 Existing Conditions and Problems of Air Traffic Control, Navigation Aids and Air Space Use

The Kathmandu Area Control Center (ACC) is managing the Flight Information Region (FIR). Aerodrome Control Services are provided in eight designated principal airports.

As shown in Fig. 1.2.2, the navigation aids are located in the airports or in their immediate vicinity.

Existing Airway System in Nepal is shown in Fig. 1.2.3. The only airways that are defined in terms of magnetic direction, route distance, and minimum enroute altitude are the three routes to India. On the airways between major domestic airports, aircraft receive only information service which is not positive air traffic control. Most of the airways in the remaining airspace are not established nor notified.

A general evaluation of Nepal's air traffic control, air navigation facilities, and air space utilization is given in Table 1.2.3.

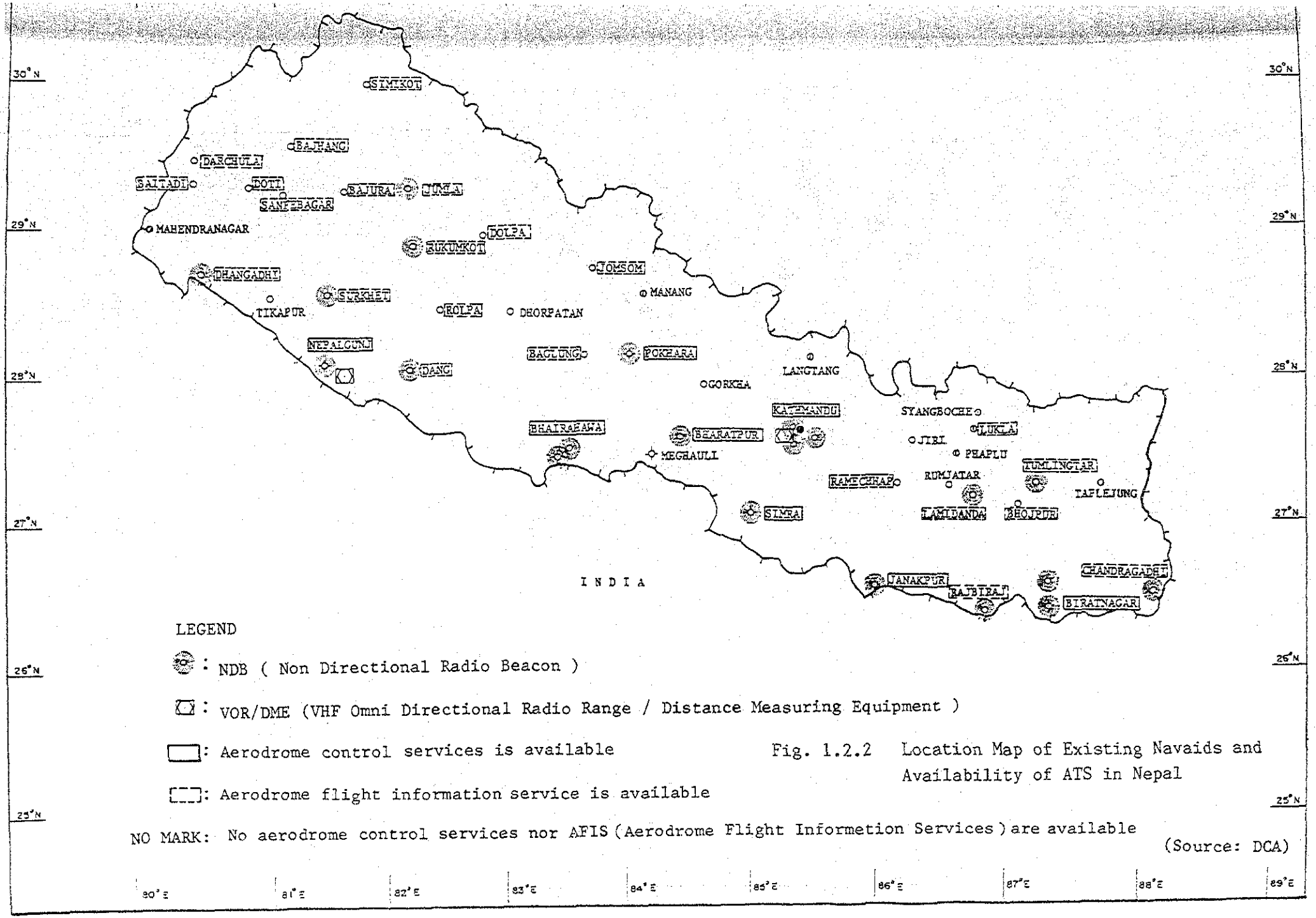
1.2.3 Existing Conditions and Problems of Air Transport Network

Nepal's domestic air transportation services are provided by RNAC, a government-controlled monopoly. Figs. 1.2.4 through 7 show RNAC's domestic and international air routes. RNAC owns three Avro HS-748's (48 seats), ten Twin Otter DHC-6's (19 seats), and one Pilatas Porter PC-6 (5 seats) for domestic services. Two B-757's (190 seats) and two B-727's (130 seats) are owned for international services. The aircraft to succeed the HS-748's are currently being studied. The DHC-6's will have to be replaced soon.

Domestic air routes radiate from Kathmandu and the feeder air routes from Nepalgunj, Biratnagar, Pokhara and Dhangadi Airports. Most domestic air routes other than trunk air routes are not serviced everyday. Because of changeable weather only about 85% of scheduled flights are actually capable to be accepted and the flights are often delayed. Since it is important for tourists, businessmen, and others to be able to get around within a limited time frame, these problems need to be improved.

Some domestic air routes are underused and not economical to operate because traffic demand has shifted from air to road with road development. In the future, new north-south feeder roads will be constructed between the existing east-west highway and the hill region and it will become necessary to reorganize the air transport network and reconsider closing affected airports.

RNAC has to use inefficient, small propeller planes on long range routes that directly connect Kathmandu with all of Nepal. The reorganization of the air transport network is going on now by RNAC and should be closely coordinated with the DCA in order to improve the existing situation.



LEGEND

: NDB (Non Directional Radio Beacon)

: VOR/DME (VHF Omni Directional Radio Range / Distance Measuring Equipment)

: Aerodrome control services is available

: Aerodrome flight information service is available

NO MARK: No aerodrome control services nor AFIS (Aerodrome Flight Informetion Services) are available

(Source: DCA)

Fig. 1.2.2 Location Map of Existing Navaids and Availability of ATS in Nepal

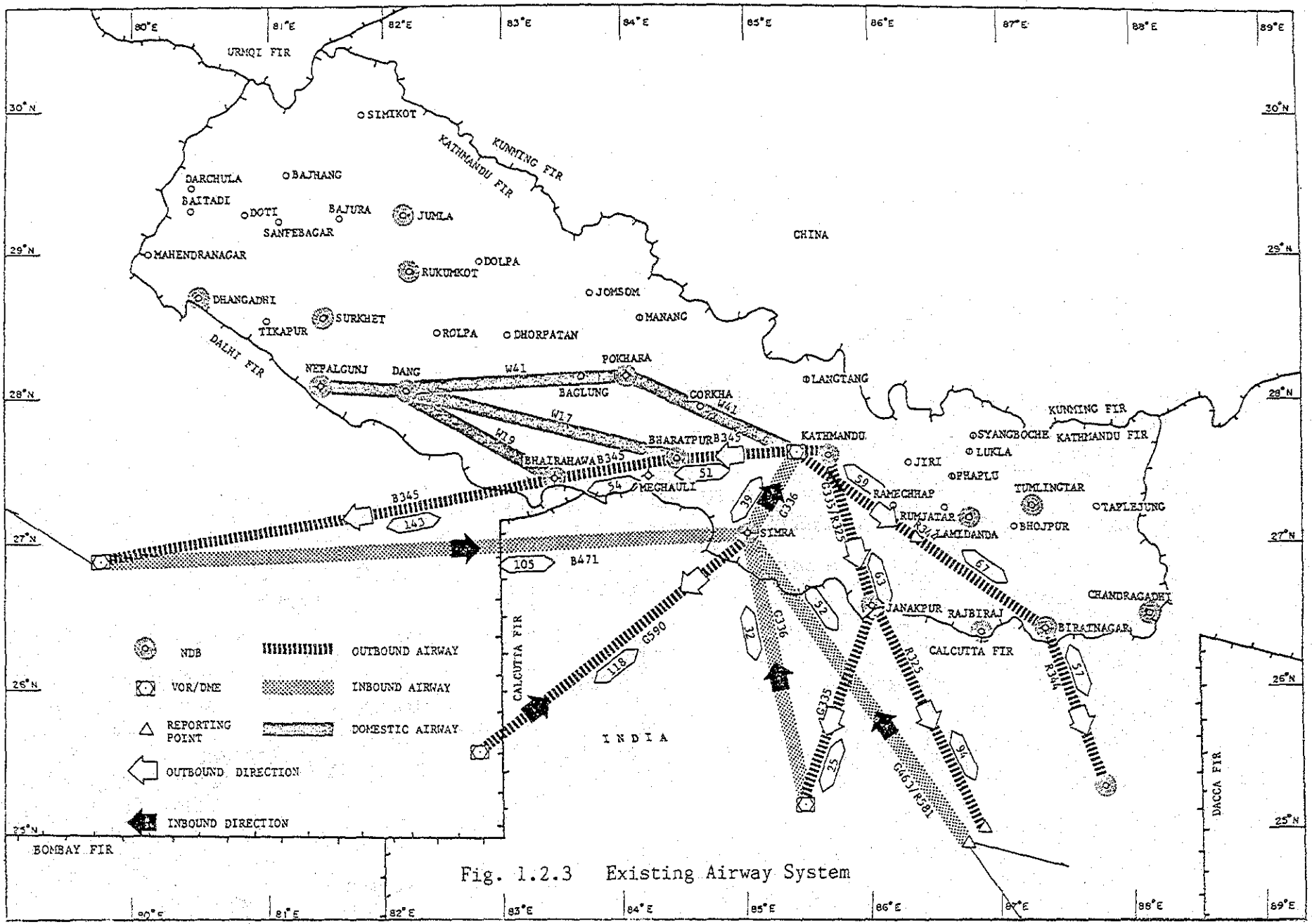


Fig. 1.2.3 Existing Airway System

Table 1.2.3 Overview of Existing Air Traffic Control, Air Navigation Facilities and Air Space Utilization

Item	Existing Conditions and Problems
1. Air Traffic Control:	
a. Aerodrome Control	Aerodrome control services are being provided at eight airports with established control zones. At 22 airports, only Aerodrome Flight Information Services (AFIS) are available.
b. Approach Control	At Tribhuvan International Airport, Approach Control Service is provided by the Aerodrome Control Tower.
c. Area Control	The Kathmandu Area Control Center (ACC) provides area control along the international airways within the Kathmandu Flight Information Region (FIR).
2. Air Navigation Aid:	
a. Radio Facilities	NDB (Non-Directional Radio Beacon) are in place at 17 airports. If locators are included, 22 airports have such facilities, but several facilities are outdated. The number of airports with NDB equipment should be increased. VOR/DME (VHF Omnidirectional Radio Range/Distance Measuring Equipment) is in place at both Tribhuvan International Airport and Nepalgunj Airport.

Table 1.2.3 Continued

Item	Existing Conditions and Problems
	ILS (Instrument Landing System) is not in place at any of the airports. Such a system is needed at Tribhuvan International Airport to improve efficiency of air traffic.
b. Air/ground Facilities	Control consoles with VHF and HF radios are provided as the minimum facilities at many local airports.
c. Fixed Communication Facility	Communications between Kathmandu Communication Centre and distant places, especially the Western region are difficult. It is necessary to install several RCAG (Remote Controlled Air Ground) stations or to divide the Kathmandu FIC (Flight Information Center) into two or three sub-areas. At Tribhuvan International Airport, there is an aeronautical fixed telecommunications network station with international circuits between Tribhuvan International Airport and Delhi and Calcutta. There is also ATS direct speech circuits between Kathmandu ACC and Calcutta ACC and Delhi ACC which is not in operation due to technical reasons. It is neccesary to improve the aeronautical fixed telecommunication in order to ensure air safety. The domestic aeronautical fixed communication equipment in place at the Nepalgunj Airport are inoperable due to a lack of operational and maintenance personnel.

Table 1.2.3 Continued

Item	Existing Conditions and Problems
d. Lighting Facilities	Both Tribhuvan International Airport and Nepalgunj Airport have simple approach lighting systems. Biratnagar and Bhairahawa Airports have runway edge lights and runway threshold lights but are not in operation. There are PAPIs (Precision Approach Path Indicator) at nine airports but many airports do not have any lighting facilities. PAPI is desirable to be implemented as a minimum facility.
e. Meteorological Facility	Half hourly weather observations are made in Tribhuvan International Airport and hourly observations are made at four airports. Many airports only have a wind direction and speed indicators. Altimeter settings are done at Tribhuvan International Airport and applied throughout the country. Hence, there are problems with operational safety of aircraft in other airfields.
3. Airspace Utilization:	
a. Airways	There are established airways between Nepal and India, but a national airway network is not yet established.
b. Arrival Route	The arrival route for Tribhuvan International Airport is required to be established for the air safety and to expedite air traffic flow.

Table 1.2.3 Continued

Item	Existing Conditions and Problems
c. Instrument Approach/ Departure Procedure	Instrument approach and departure procedures are established at only two airports besides Tribhuvan International Airport. Most airports are operating only by visual flight rules.
d. Control Zone	There are eight control zones established at airports but they should be expanded to other airports with increasing air traffic.
e. Designated Training Area	There is presently no training area but it is necessary that one be designated in the future.

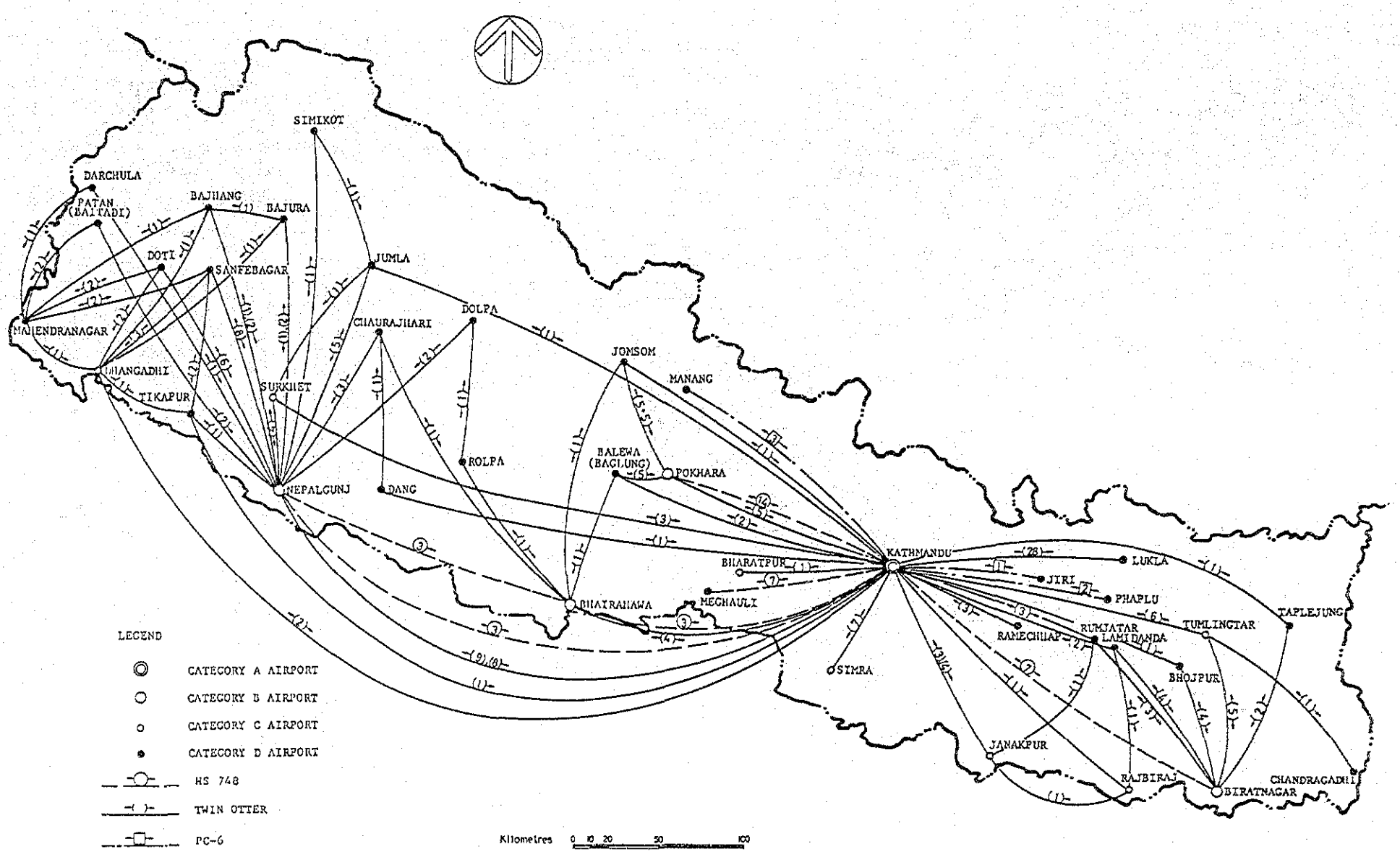


Fig. 1.2.4 Summer Schedule from Mar.1988
(Based on RNAC Schedule)

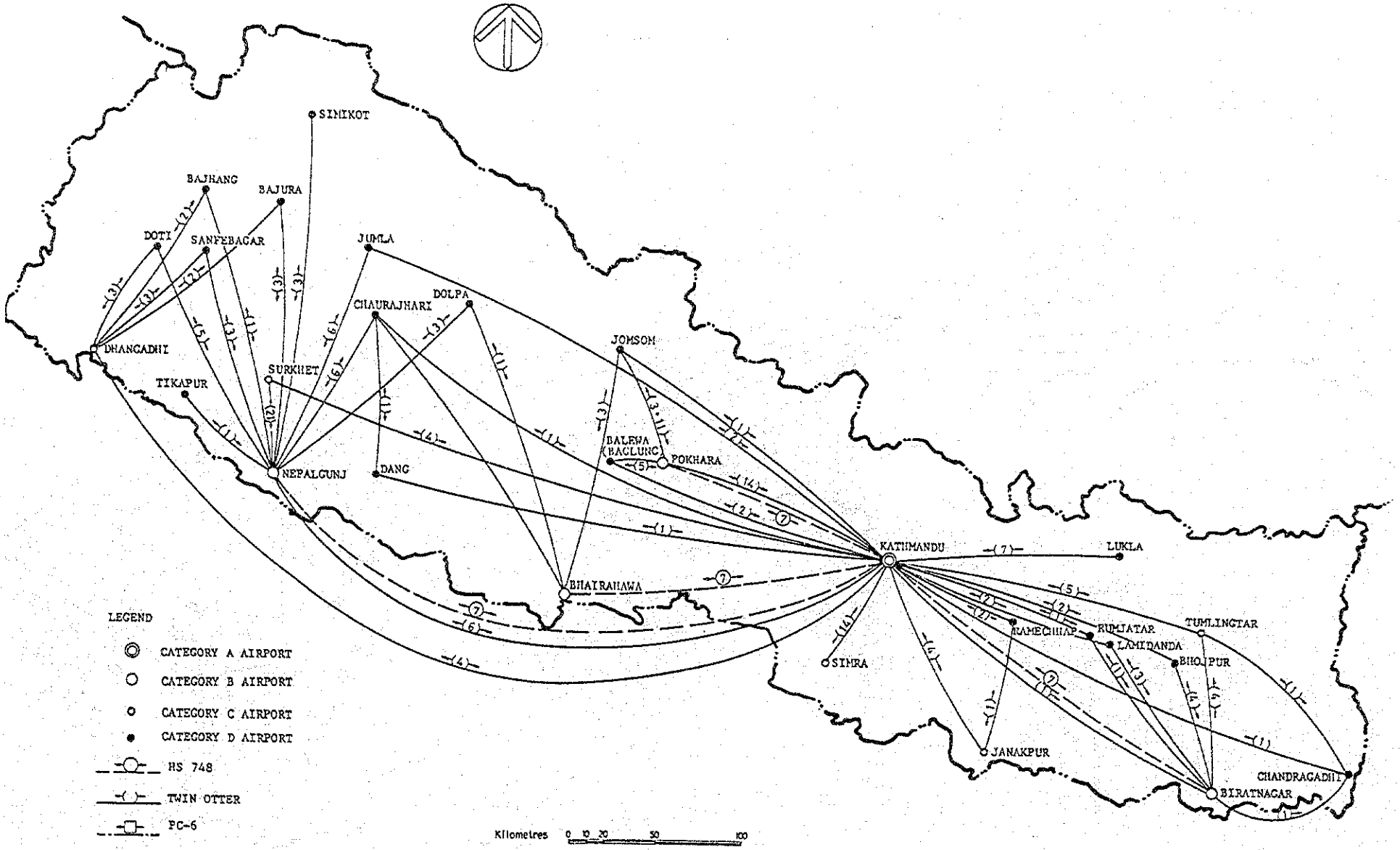


Fig. 1.2.5 Monsoon Schedule from July.10 .1988
(Based on RNAC Schedule)

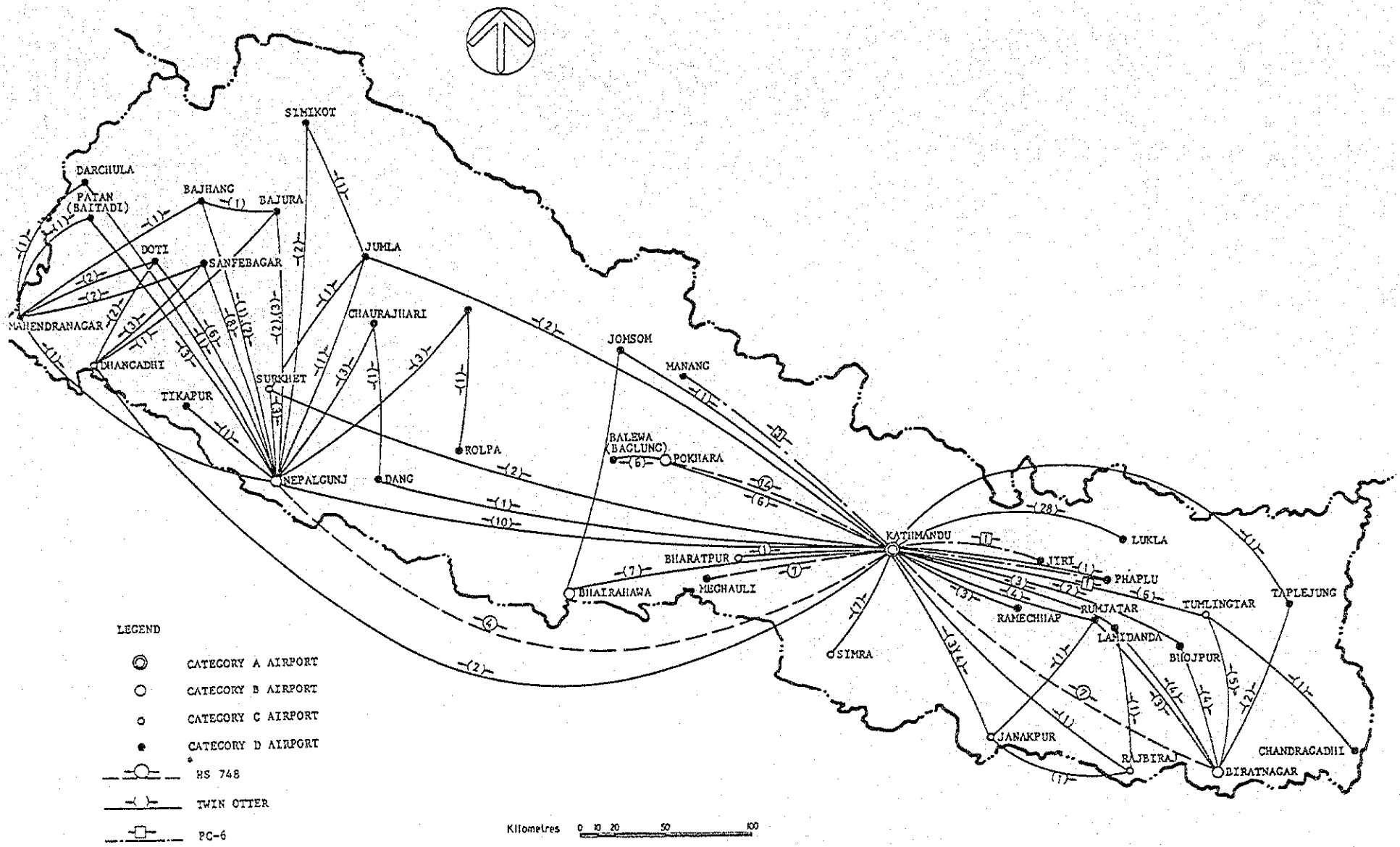


Fig. 1.2.6 Winter Schedule from Dec.1987
(Based on RNAC Schedule)

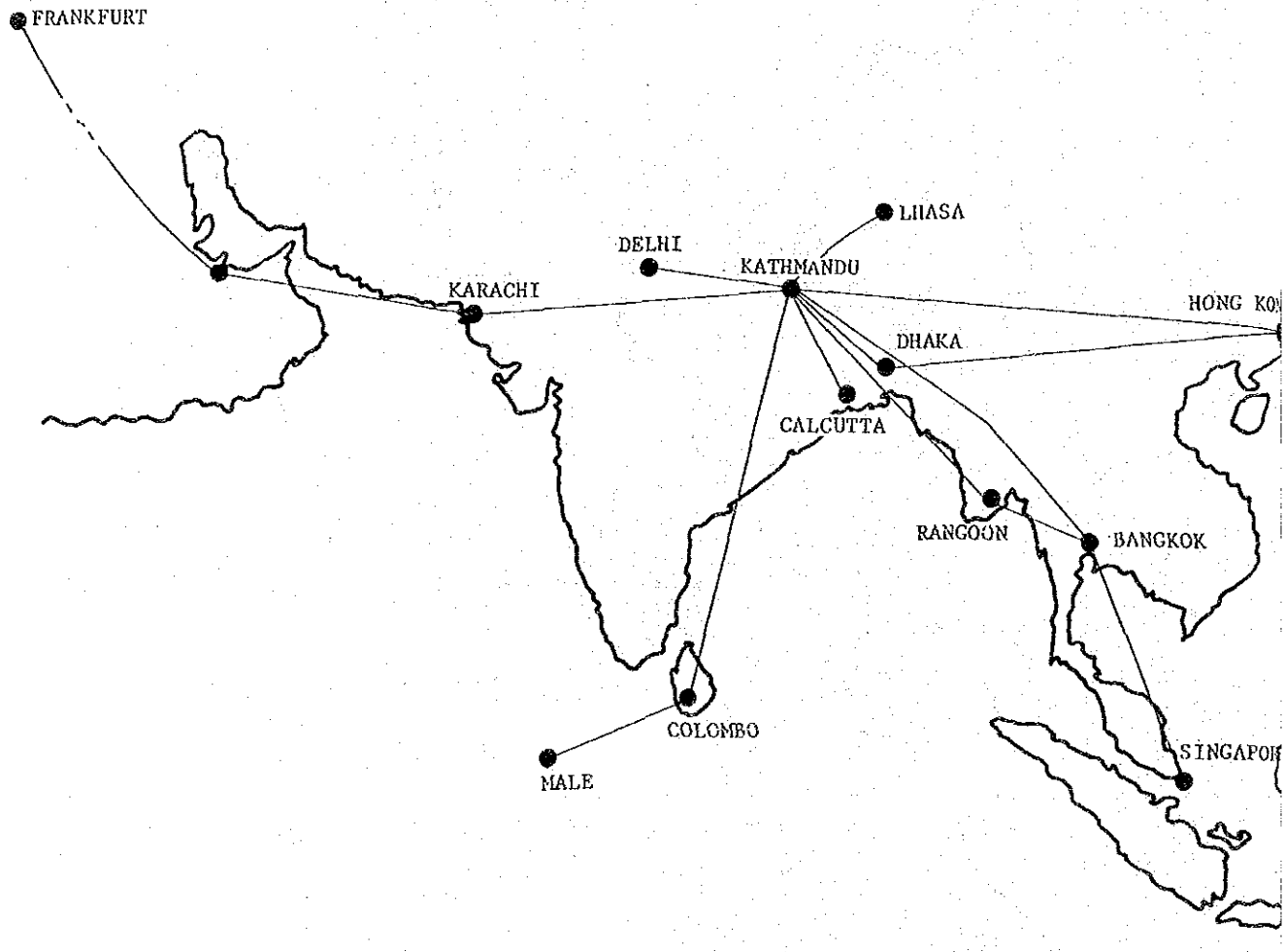


Fig. 1.2.7 International Air Routes