

HIS MAJESTY'S GOVERNMENT OF NEPAL
MINISTRY OF WORKS AND TRANSPORT
DEPARTMENT OF ROADS

**THE STUDY
ON
KATHMANDU VALLEY
URBAN ROAD DEVELOPMENT**

FINAL REPORT

**PART A : MASTER PLAN STUDY
PART B : FEASIBILITY STUDY**

SUMMARY

MARCH 1993

JAPAN INTERNATIONAL COOPERATION AGENCY

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MARCH '93

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PREFACE

In response to a request from His Majesty's Government of Nepal, the Government of Japan decided to conduct the study on Kathmandu Valley Urban Road Development and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Nepal a study team headed by Mr. H. Shinkai, Nippon Koei Co., Ltd., 5 times between October 1991 and March 1993.

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

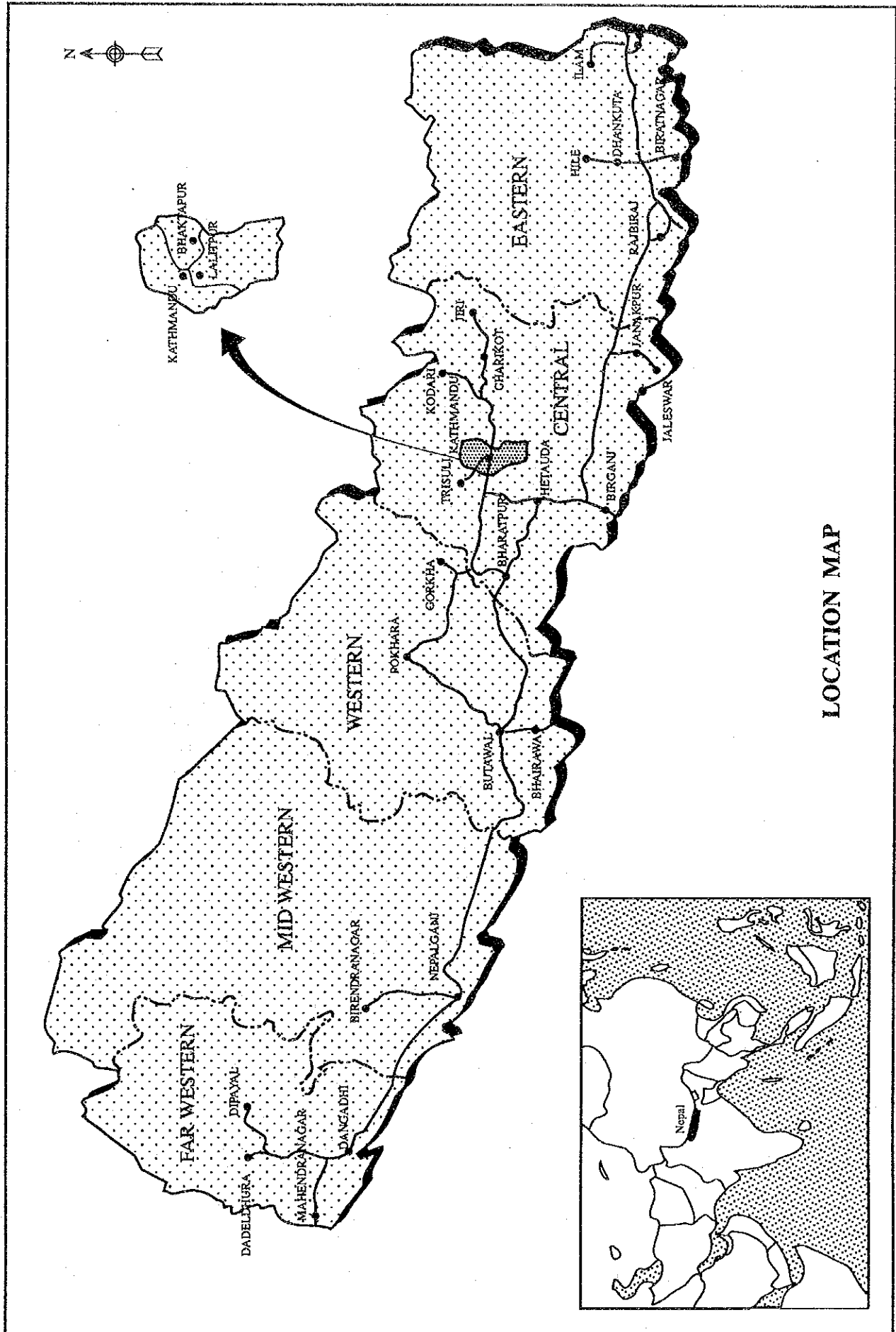
I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

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

March 1993



Kensuke Yanagiya
President
Japan International Cooperation Agency



LOCATION MAP

PART A

**SUMMARY
OF
MASTER PLAN STUDY**

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1. INTRODUCTION

1.1 Background of the Study

Kathmandu Valley comprises of the city of Kathmandu, the capital of Nepal, the city of Lalitpur (Patan), third largest city in Nepal, and the city of Bhaktapur. The population in this area which is estimated at about 1 million in 1991, is on the increase due to immigration of people from the other parts of Nepal and India. This fact along with inadequate provision of urban infrastructure, has given rise to a variety of urban problems including slumming inside the city, sprawling of urban area, traffic congestion on roads and poor facilities of public transport.

In the past, some comprehensive development plans including "Physical Development Plan for the Kathmandu Valley in 1969" and "Kathmandu Valley Physical Development Concept in 1984" and "Kathmandu Valley Urban Development Plans & Programs" have been conducted. However, in spite of these plans, condition of urban area of the Valley has worsened day by day.

In these circumstances, His Majesty's Government of Nepal, under the financial assistance from the Japan International Cooperation Agency (JICA), has decided to conduct a study of "Kathmandu Valley Urban Development Plans & Programs" with the aim of formulating of more concrete and implementation plans and programs for the realization of the various projects proposed in the master plan.

1.2 Objectives of the Study

The major objectives of the Study are:

- (1) Part A: To formulate master plan for Kathmandu Valley Urban Road Development for the period up to the year as shown below:

Long-term plan; Target year of 2015

Short-term plan; Target year of 1997

- (2) Part B: To conduct feasibility study on the high priority projects proposed in the short-term master plan (-1997).

1.3 Study Area

The Study area covers the whole area of Kathmandu Valley including Kathmandu District, a Part of Lalitpur District and Bhaktapur District as shown in Fig.1.1.

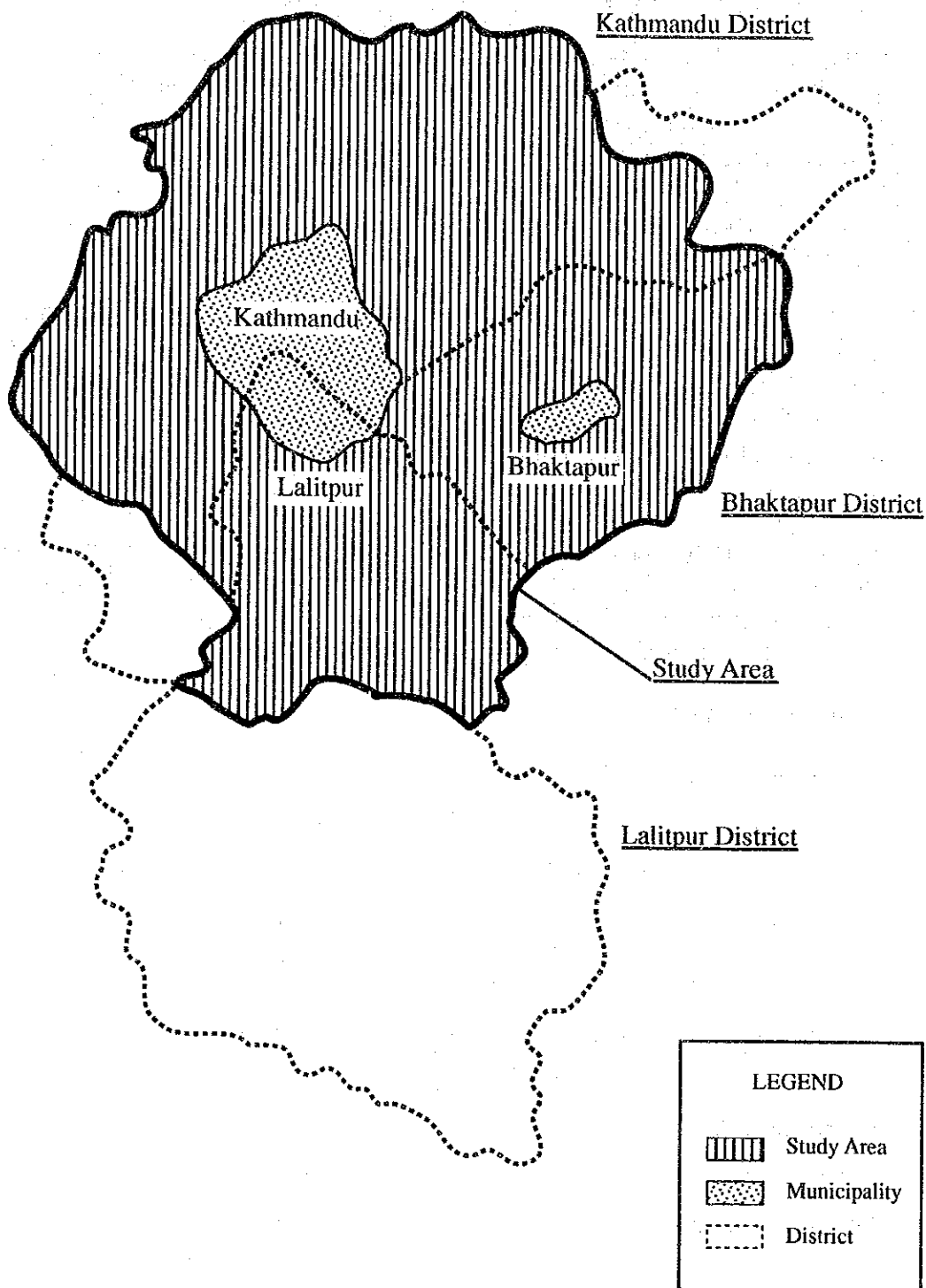


FIG. 1.1 STUDY AREA

2 SOCIO - ECONOMIC CONDITION

2.1 Existing Urban Trend

Urban area in the Study area is rapidly spreading in rather uncontrolled and disorderly manner.

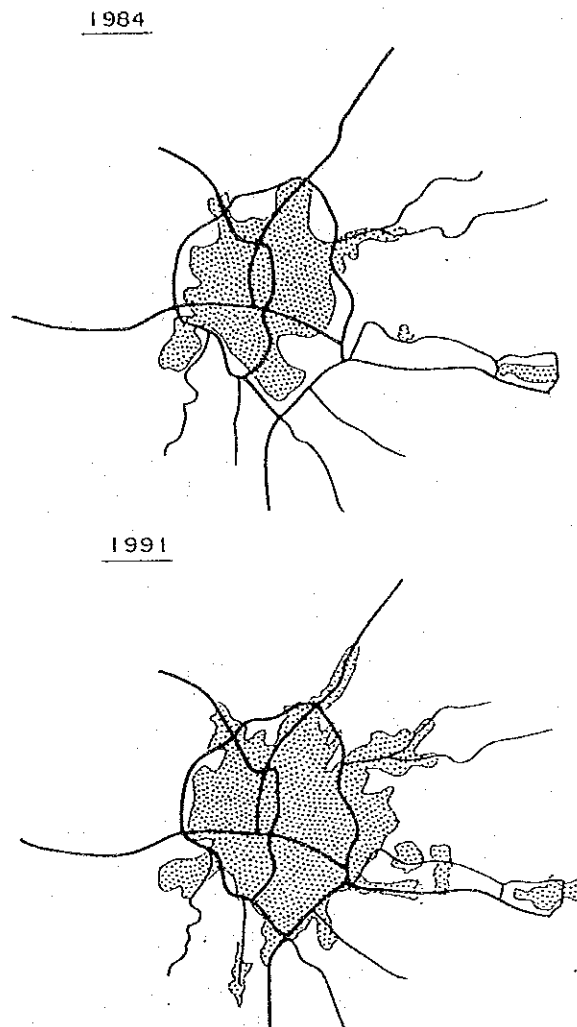


FIG. 2.1 TREND OF URBAN EXPANSION

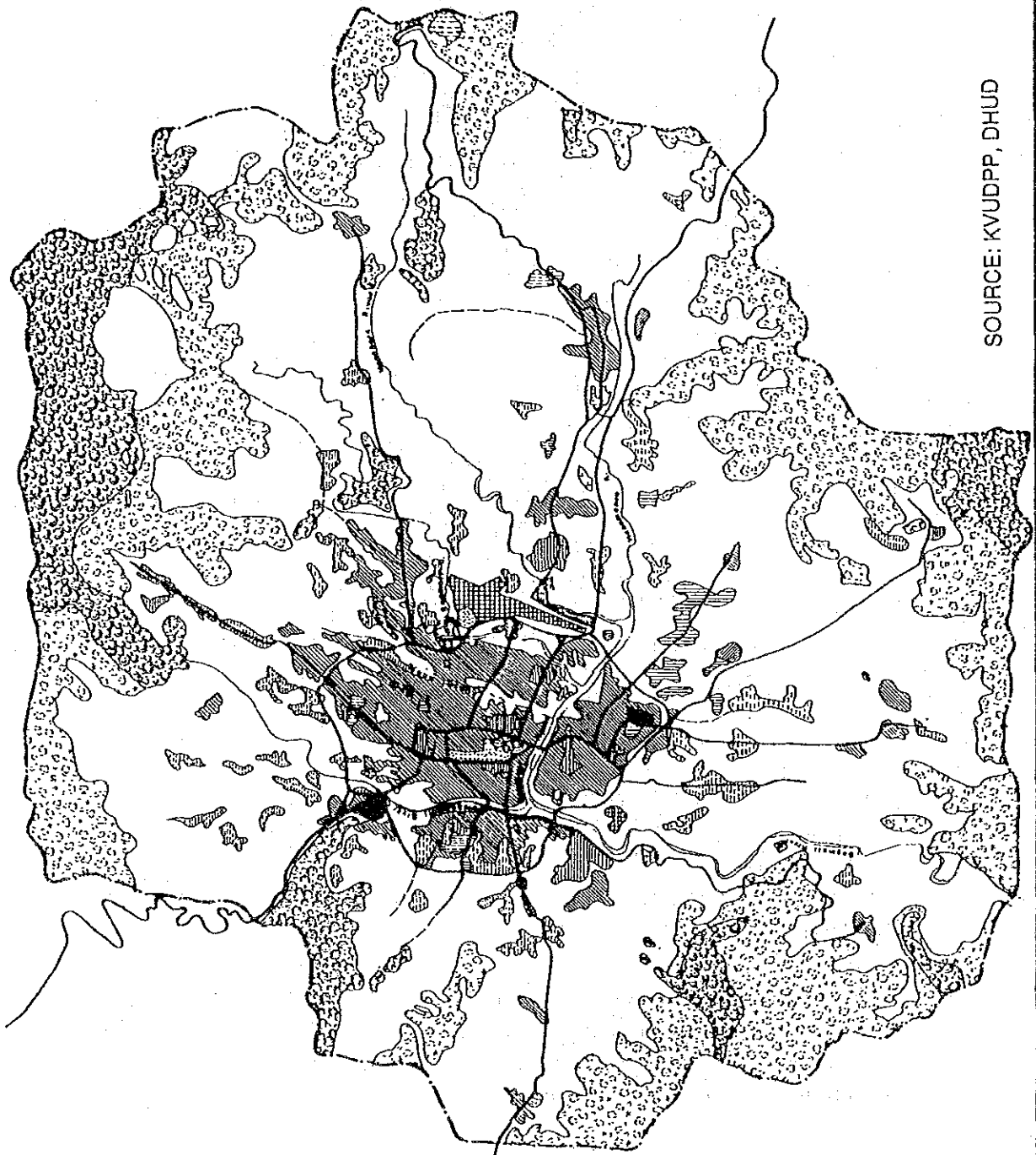
2.2 Land-use

The existing land-use within the Valley are shown in Fig. 2.2 and Fig. 2.3 prepared by KVUDPP.

Urban area has increased from 2,850 ha in 1984 to 7,195 ha in 1991 due to the expansion of Kathmandu city to the north and north-west. Along radial roads extending from core area, especially along the roads to Bhaktapur, Thankot and Godawari, great urban expansion has been done.

LEGEND

- Study Area Boundary
- Roads (Surfaced)
- Roads (Unsurfaced)
- Rivers & Stream
- Predominantly Residential (Urban and Compact Village)
- Residential with Some Agriculture
- Agriculture with Some Residential
- Recreation
- Institutional
- Military And Police
- Public Utilities
- Industry
- Brick Works
- Brick Factories
- Quarries
- Forests
- Shrub



SOURCE: KVUDPP, DHUD

HIS MAJESTY'S GOVERNMENTS OF NEPAL
(H.M.G)

KATHMANDU VALLEY
URBAN ROAD DEVELOPMENT

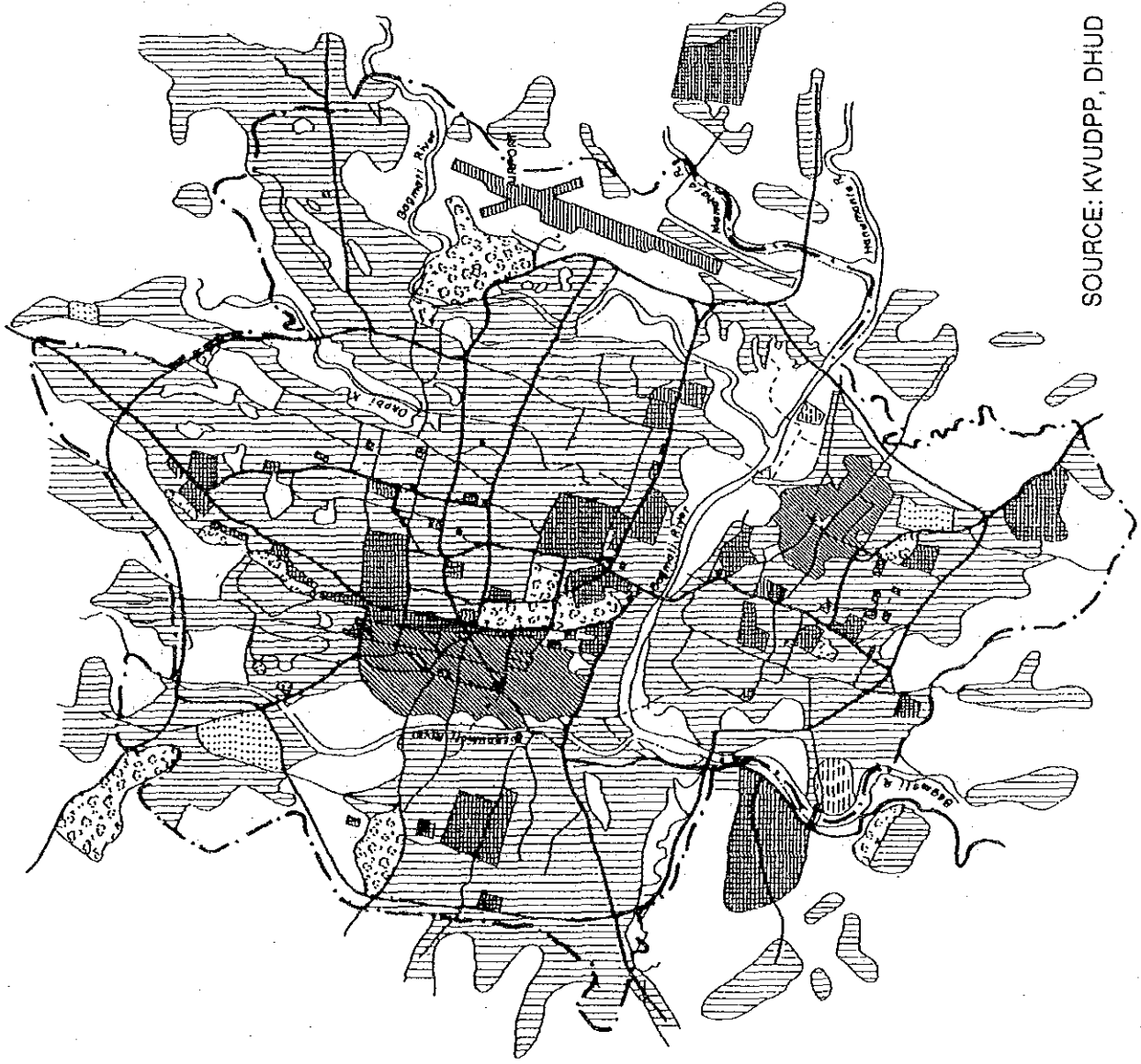
LAND USE (1991)

FIG. 2.2

JAPAN INTERNATIONAL COOPERATION
AGENCY (JICA)

LEGEND

- Municipal Boundary
- Major Roads
- Minor Roads
- River & Stream
- Core Area
- Residential Area
- Vacant Land
- Transport
- Industrial
- Institutions
- Woods and Open Space
- Utilities



HIS MAJESTYS GOVERNMENTS OF NEPAL
(H.M.G.)
KATHMANDU VALLEY
URBAN ROAD DEVELOPMENT
LAND USE IN THE GREATER
KATHMANDU (1991)

FIG. 2.3

JAPAN INTERNATIONAL COOPERATION
AGENCY (JICA)

SOURCE: KVUDPP, DHUD

2.3 Population

According to the Prompt Report of 1991 Census, the Valley's population in 1991 is 1,063,222. The average annual growth rate increased from 2.3% in the period between 1971 and 1981 to 3.7% in the period between 1981 and 1991.

Urban population in 1991 accounts for 592,589 which is 56% of the Valley's population. Urban population increased at 4.9% annually during the period 1981 - 91 due to rapid urban expansion in this period.

Urban population in Kathmandu District in 1991 is 414,264 which is about 70% of the Valley's urban population. Annual growth rate during the period 1981 - 91 is 5.7% while the urban population in Lalitpur and Bhaktapur districts are 117,203 and 61,122 respectively. Annual growth rates of these districts are 3.9% and 2.3% in the period 1981 - 91 respectively. Rural population increased from 369,847 in 1981 to 470,633 in 1991 at the annual growth rate of 2.4%.

TABLE 2.1 POPULATION GROWTH IN KATHMANDU VALLEY

	1971 *1	1981 *2	1991 *3	Annul Growth Rate (%)	
				1971-81	1981-91
Kathmandu District	353,756	427,100	668,605	1.9	4.6
Urban	191,445	238,265	414,264	2.2	5.7
(Municipalities)	54%	56%	62%		
Rural	162,311	188,835	254,341	1.5	3.0
	46%	44%	38%		
Lalitpur District	121,875	164,939	221,520	3.1	3.0
Urban	59,049	79,875	117,203	3.1	3.9
(Municipalities)	48%	48%	53%		
Rural *4	62,826	85,064	104,317	3.1	2.1
	52%	52%	47%		
Bhaktapur District	110,157	144,420	173,097	2.7	1.8
Urban	40,993	48,472	61,122	1.7	2.3
(Municipalities)	37%	34%	35%		
Rural	69,164	95,948	111,975	3.3	1.6
	63%	66%	65%		
Total	585,788	736,459	1,063,222	2.3	3.7
Urban	291,487	366,612	592,589	2.3	4.9
(Municipalities)	50%	50%	56%		
Rural *4	294,301	369,847	470,633	2.3	2.4
	50%	50%	44%		

*1 : Study Team Estimation based on 1991 Administration Boundary

*2 : Study Team Estimation based on 1991 Administration Boundary

*3 : 1991 Census (Prompt Report of 1991 Census)

*4 : Excluding VDC outside the Valley

3. PRESENT TRANSPORTATION SYSTEM IN THE VALLEY

3.1 Road Classification and Network

Kathmandu Valley is served with the Ring Road and radial pattern of road network as shown in Fig. 3.1 with a total length of 740 km according to the DOR Statistics of 1990.

The roads are classified into four(4) categories of the roads.

TABLE 3.1 ROAD NETWORK UNDER THE STUDY

	Study Network Road Length(km)	Other Minor Road Length(km)	DOR Network Road Length(km)
- Highway	34	0	4
4 lanes	5	0	5
2 lanes	29	0	29
- Feeder Road	25	0	25
2 lanes	5	0	5
1 lane	20	0	20
- District Road	124	218	342
2 lanes	14	0	14
1 lane	110	218	328
- Urban Road	157	182	339
4 lanes	7	0	7
2 lanes	71	20	91
1 lane	79	162	241
Total	340	400	740

(1) Highways and Feeder Roads

Tribhuvan and Arniko Highways are designated as national highways which basically are continuous throughout the country. They are the major connection between the capital, Kathmandu, with the areas outside Kathmandu Valley in the west and in the east respectively.

Thimi and Trisuli Roads are categorized as Feeder Roads which generally lead from the national highway to the district headquarters. Thimi Road connects District headquarter of Bhaktapur to Arniko Highway, while Trisuli Road connects headquarter of Nuwakot District with the Ring Road.

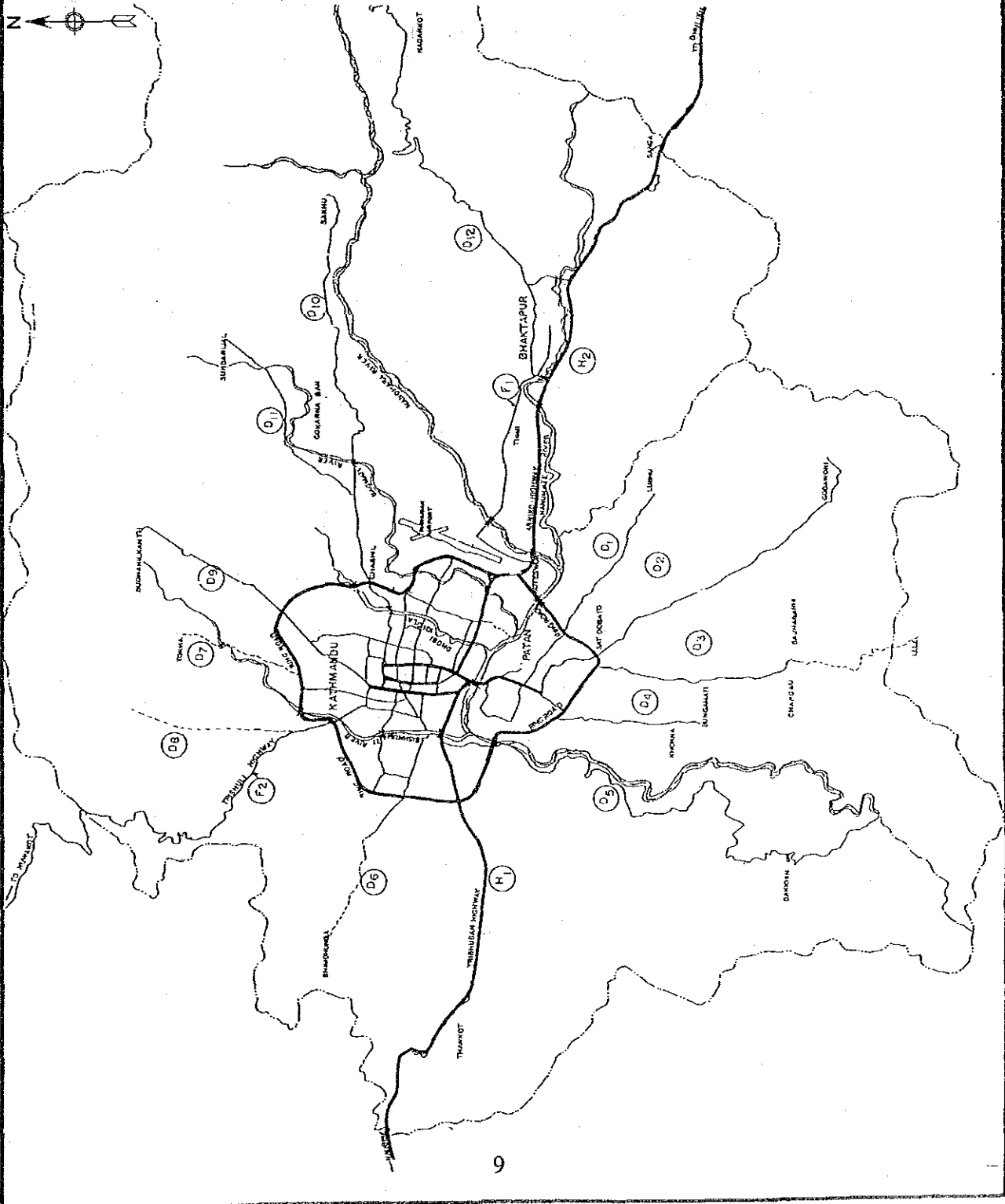
(2) District Roads

District road consists of all roads not defined as national highway or feeder and city roads and serves as primarily access to the towns and villages and abutting land.

(3) Urban Roads

Urban roads in the Valley consist of the Ring Road and city roads with sub-classification of four (4) grades from Class A to D.

The Ring Road as well as Class A and B roads are vital city roads constituting primary road network in the city and serve greater portion of the vehicular traffic passing through the city, while Class C and D roads are providing access to abutting residential and business areas.



LEGEND

- Highway
 - H1 Tribhuvan Highway
 - H2 Amiko Highway
- Feeder Road
 - F1 Thimi Road
 - F2 Trisuli Road
- District Road (Primary)
 - D1 Lubhu Road
 - D2 Godawari Road
 - D3 Chapagaun Road
 - D4 Burgmati Road
 - D5 Dakshinkali Road
 - D6 Bhimdhunga Road
 - D7 Tokha Road
 - D8 Phutung Road
 - D9 Budhanilkantha Road
 - D10 Sankhu Road
 - D11 Sundarjal Road
 - D12 Nagarkot Road
- Urban Road
 - R Ring Road
 - A Class A Primary
 - B Class B Secondary
 - C Class C Access
 - D Class D Access

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HIS MAJESTY'S GOVERNMENT OF NEPAL
(H.M.G.)
KATHMANDU VALLEY
URBAN ROAD DEVELOPMENT
FUNCTIONAL CLASSIFICATION OF
ROAD NETWORK
FIG. 3.1
JAPAN INTERNATIONAL COOPERATION
AGENCY (JICA)

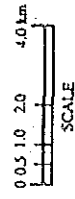
3.2 Public Transport

Public transport service in the Valley is composed of mass transportation services mainly by buses and minibuses on major roads and services by tempos and autorickshaws on secondary roads. Major bus route service at present, is being operated by Sajha Yatayat, Nepal Transport Corporation and many other private bus companies. Trolley bus is operated between Kathmandu and Bhaktapur by Nepal Transport Corporation since early 1970's.

The role of private sector in the public transportation services is dominant and about 80% of services are being undertaken by private sector.

Major bus network is illustrated in Fig. 3.2. The service level, in general, is quite low against growing demand by users .

LEGEND



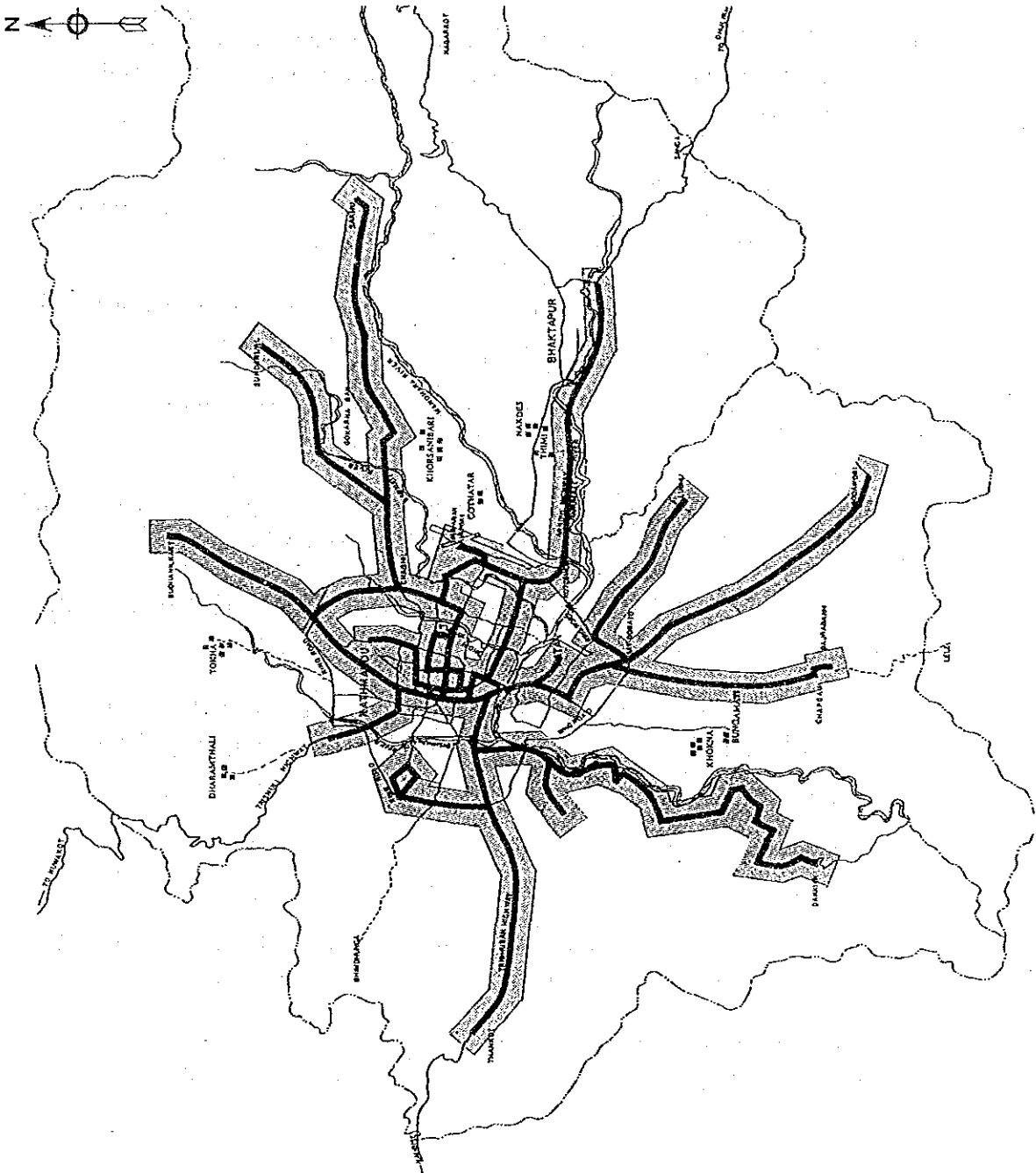
HIS MAJESTY'S GOVERNMENTS OF NEPAL
(H.M.G)

KATHMANDU VALLEY
URBAN ROAD DEVELOPMENT
SERVICE AREA OF EXISTING CITY

BUS

FIG. 3.2

JAPAN INTERNATIONAL COOPERATION
AGENCY (JICA)



3.3 On-going Traffic Management

At present, a variety of traffic management measures are being undertaken within the Study area. Some of the measures being undertaken are as follows:

- One-way operation
To enhance the capacities in the urban road, one way traffic regulation is undertaken on the streets in the central areas of Kathmandu and Lalitpur.
- Prohibition of on-street parking and provision of parking spaces on designated road sections.
- For the efficient use of road sections of high congestion level, on-street parking is prohibited, while road sections with wider spaces are utilized as authorized parking space,
- Route restriction on three-wheelers
For the smooth traffic flow especially for light vehicles, minibuses and buses, new permission of tempo route is suspended since late 1991,
- Heavy trucks are restricted to enter the area within the Ring Road during the day time to reduce the congestion there,
- Restriction on the registration of three-wheelers and autorickshaws in Kathmandu and Lalitpur districts,
- Restriction on operation of slow-vehicles on major roads during peak hours (9:00 A.M. - 11:00 A.M., 4:00 P.M. - 6:00 P.M.) on week days.
- Channelization of long-distance bus movements on the roads within the Ring Road.

The history of traffic management in the Study area began with the legislation of Traffic Acts during 1960s and afterwards. Major Acts noteworthy are as follows:

- Vehicle Condition Act (1963)
Regulation on vehicle standard/introduction of vehicle inspection system,
- Motor Vehicle Act (1963)
Restriction of vehicle weight on bridges and so on. Limitation on loading, tonnage and number of passengers,
- Public Road Act (1974)
Regulation on usage of road space and right-of-way.

4. PRESENT TRAFFIC CONDITION

4.1 Traffic Survey

In order to understand the characteristics of present traffic movement of the Valley and to prepare basic data for future traffic demand forecast, following traffic surveys have been conducted in December 1991.

- Home Interview Survey (Person Trip Survey)
- Roadside OD Survey
- Roadside Traffic Counts
- Intersection Traffic Counts
- Vehicle Speed Survey
- Public Transportation Survey / Firm Interview Survey

(1) Home Interview Survey (Person Trip Survey)

About 6.2% of the households or one household out of every 16 households have been selected applying systematic sampling technique and interviewed. All the family members in the selected households who are "deemed responsible for their behavior" were interviewed.

(2) Roadside OD Survey

About one third of the vehicles which passed each of 15 survey points were stopped by traffic police and interviewed about their origin and destination, purpose of trip and so on. The survey has been carried out for 16 hours (6:00-22:00) on certain week days which are regarded normal days of the week.

(3) Roadside Traffic Counts

Traffic counts were carried out at 29 survey points on major roads and streets in the Valley. Number of pedestrians and vehicles which passed the survey points were counted by vehicle type, by time band and by direction.

(4) Intersection Traffic Counts

Direction-wise traffic flow at eight intersections located in central area have been measured for two hours both in the morning and evening peak-hours.

(5) Vehicle Speed Survey

Vehicle speed survey has been carried out at 10 routes on major roads.

(6) Public Transportation Survey / Firm Interview Survey

For the purpose of understanding service levels and characteristics of vehicle movements by public transportation sector and major firms, information about major routes for operation, vehicle ownership and related information about vehicle operation have been surveyed.

4.2 Number of Vehicles in Use

There exists no reliable data about road traffic and number of vehicles in use in Nepal. Therefore, the Study Team has estimated the number of registered vehicles using a variety of data sources. Total number of vehicles in the Bagmati zone, which is a slightly larger area than the Study area, is estimated at about 55,000 in 1990/91.

TABLE 4.1 TOTAL NUMBER OF REGISTERED VEHICLE IN BAGMATI ZONE

SN.	VEHICLE	PUBLIC	PRIVATE	GOVERNMENT	CORPORATION	TOTAL		
		90/91	90/91	90/91	90/91	73/74	80/81	90/91
1.	Bus, Minibus, Truck	3,217	2,378	1,134	340	1,952	3,658	7,069
2.	Car, Jeep	2,140	11,719	3,379	762	6,012	10,979	18,000
3.	Tempo, Autorickshaw	1,770	644	-	-	-	NA	2,414
4.	Power tiller, Tractor	1,026	703	-	-	NA	632	1,729
5.	Motorcycle, Scooter	-	21,219	2,193	799	NA	11,100	24,211
6.	Rickshaw	470				NA	464	470
7.	Hand Cart	NA				NA	600	NA
8.	CD/UN Vehicles					NA	NA	883
	Total					7,964	26,750	54,776

Remarks : 1. NA - Data not available for the corresponding year.
2. Vehicle number data was gathered from different available sources. Analysed and estimated by the Study Team.

4.3 Traffic Volume

According to traffic survey carried out by the Study team, traffic volumes on the Ring Road are at the level of 5,000 - 7,000 vehicles (including bicycles). Traffic volume along Arniko Highway is about 9,000 vehicles near the eastern edge of the Ring Road while traffic on Tribhuvan Highway is about 5,000 vehicles near the western edge of the Ring Road. Bagmati bridge, Thapathali, is intensively used for the traffic which plys between Kathmandu and Patan. The daily traffic volume on this bridge is about 48,000 vehicles. Concentration of traffic in the downtown area is another aspect of urban traffic, traffic volumes on major arterial roads in this area are in the range of 25,000 - 40,000 vehicles.

In addition, traffic pattern in the Study area is getting more integrated among the three cities. This could be seen in such large traffic volumes on the boundaries of the cities :

Kathmandu - Lalitpur	:	48,000 (at Bagmati bridge, Thapathali)
Kathmandu - Bhaktapur	:	9,000 (at Koteswar, Arniko Highway)

(1) Vehicle Composition

The roads in the Study area are heavily used for slow vehicles including tempos, motorcycles and bicycles. The proportion of these vehicles lies between 40% and 80%. Larger proportion has been recorded on the streets in the central area while the Ring Road and National Highways have smaller proportion.

The proportions of trucks on the Ring Road are 15.5% and 11.4% on eastern section of the road (near Koteswar) and northern section (near Balaju) respectively. Arniko and Tribhuvan Highways have also shown large proportions of trucks.

The proportion of passenger cars are approximately in the range of 10 - 20%.

High proportions of minibuses and buses are recorded at eastern section of the Ring Road (15.0%), Tribhuvan Highway (13.9%) and Arniko Highway (24.9%) .

(2) Traffic Fluctuation

Hourly Variation of Traffic:

Traffic on these roads is rather uniformly distributed during the day time. Peak-hour of traffic lies during 9:00 - 10:00 in the morning and 17:00 - 18:00 in the evening at Kalankasthan. On the other hand, peak hour in City center lies during 10:00 - 11:00 in the morning and 16:00 - 17:00 in the evening.

Daily Variation of Traffic in the Week:

Traffic is rather uniformly distributed throughout the week except for Saturday, that is a holiday in Nepal.

Daylight Traffic Ratio:

The daylight traffic ratios on Tribhuvan Highway and in City center are 103.1 and 101.1 respectively.

(3) Traffic Distribution

The characteristics of traffic distribution are described as below:

- The number of trips which have both trip ends within Kathmandu city is about 226 thousands which account for about 65% of the total trips while those trips which have both trip ends within the Lalitpur city and Bhaktapur city are as small as about 20 thousands and 4 thousands respectively.
- Strong concentration of traffic is seen in Kathmandu city due to inflow of traffic from other areas.

Number of traffic which has either generating place or attraction in Kathmandu city is about 78 thousands of which major OD pairs are as follows:

Kathmandu City	⇔	Lalitpur City	:	54 thousands
Kathmandu City	⇔	Kathmandu Rural	:	13 thousands



FIG. 4.2 PRESENT TRAFFIC DESIRE LINE * (VEHICLE)

- TOTAL -

* Over 1,000 trips only

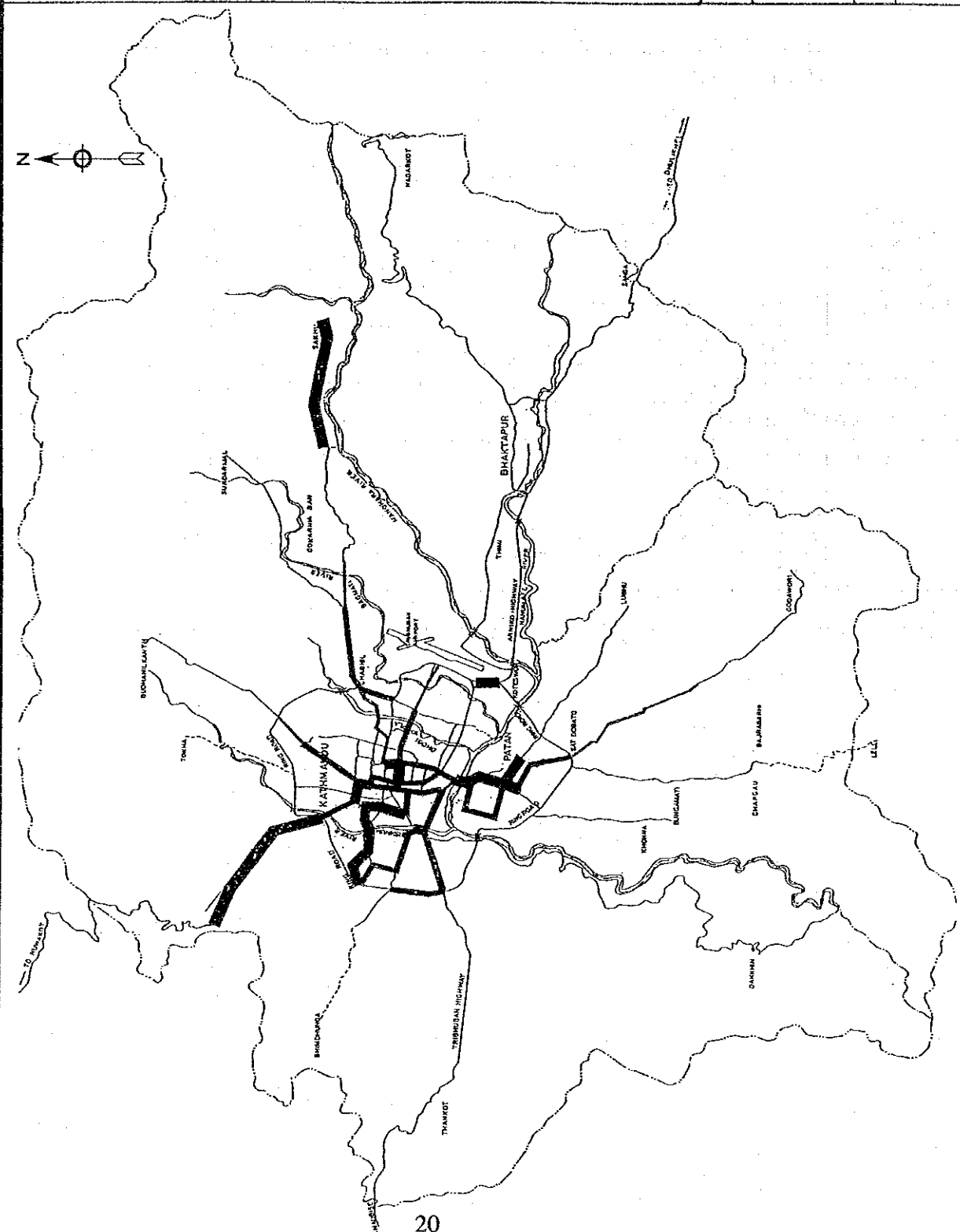
4.4 Vehicle Speeds

Characteristics of vehicle speeds by type of road are described as below:




- Average vehicle speeds differ by road geometry,
- Average vehicle speeds tend to decrease with the increase in traffic. Mixing of traffic is another reason for slow-down of vehicle speed,
- On most of the roads in the area within the Ring Road, average vehicle speed is about 20 km/h.

TABLE 4.2 AVERAGE VEHICLE SPEED

Type of Road	Name of Road	Average Vehicle Speed (km/h)	Main Reason for Slow-down of Vehicle Speed
Highway	Tribhuvan Highway (city area)	26	Narrow carriageway
	Amiko Highway	45	
Feeder Road	Trisuli Road	13	Road geometry
District Road	Sankhu Road	20	Road geometry
Ring Road	near Koteswar	18	Roadside parking
	near Chabahil	24	Roadside parking
	near Kalankisthan	25	Roadside parking
	other section	40 - 55	
City Road		around 20	Mixing of traffic



LEGEND

-  Vehicle Speed < 20 km/h (Average)
-  Vehicle Speed < 30 km/h (Average)
-  Vehicle Speed < 30 km/h (Peak Hour)

0 50 100 200 400 m

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(H.M.G)

KATHMANDU VALLEY
URBAN ROAD DEVELOPMENT

VEHICLE SPEED

FIG. 4.3

JAPAN INTERNATIONAL COOPERATION
AGENCY (JICA)

4.5 Nature of Traffic Issue in the Study Area

Factors behind the present traffic issues are described below.

1) Physical Factors

- Shortage in absolute road length
- Insufficient carriageway width
- Low road geometric design
- Insufficient intersection capacity
- Increase in vehicle ownership
- Extension of urban area

2) Public Transport Factors

- Shortage of fleet number
- Lack of bus routes
- Low frequency of buses

3) Managemental Factors

- Increase in roadside parking
- Mixing of slow-moving vehicles
- Lack of strict enforcement of regulation

5. FORMULATION OF URBAN AND TRANSPORTATION DEVELOPMENT STRATEGIES

5.1 Urban Development Strategies

(1) Urban Development Strategies

Regarding the future urban development strategy stances taken by ADB's KVUDPP Study (Kathmandu Urban Development Plans and Programmes) is respected.

In this Study, "Least Intervention Concept" is being adopted through the comparison of three different options, say

Option 1 : Satellite town

Option 2 : Growth corridors

Option 3 : Continuation of prevailing trends with least intervention

(2) Future Urban Trend

Prevailing tendency of urban development is considered as the most appropriate criteria for the estimation of future urban trend. With all the planned guidance of land use by agency concerned, existing trend of urban expansion would continue within foreseeable future. This will be proceeded such that:

- Expansion of the urban area will be proceed revolving around the two core cities in Kathmandu Valley,
- The city of Bhaktapur will be completely combined with Greater Kathmandu due to inclination of expansion of the urban area along the east-west corridor of the Valley,
- Due to geographical constraint, western part of Greater Kathmandu will remain undeveloped within foreseeable future. Especially, the area located in north of the Tribhuvan Highway will be difficult to be urbanized,
- With the expected population increase in the urban area, urbanization will be proceeded along the most of the radiation road. Starfish shaped urban area will be formed centered around the city centers of Kathmandu and Lalitpur (Patan),
- The city of Bhaktapur, which has long been isolated from the Greater Kathmandu will be exposed to the wave of urbanization and will become one of the cores of urban area in Kathmandu Valley, and the city itself would expand its urban area,
- and with the further population increase, the agricultural area in between the legs of starfish shaped urban area will be exposed to the urbanization. This would result in outward shift of Greater Kathmandu.

Urban area is expected to almost reach urban expansion boundary set up DHUD in the beginning of 21st century. Urban area which is estimated at about 550 ha and 1,160 ha for the year of 1997 and 2015 respectively which are 1.4 times and 2.1 times of that of urban area in 1991.

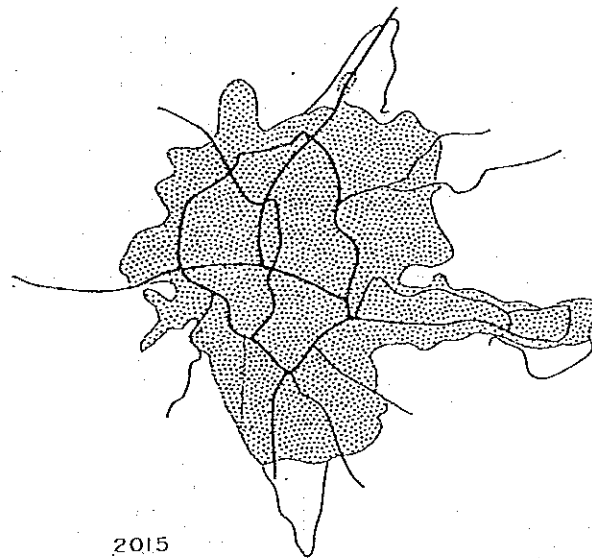
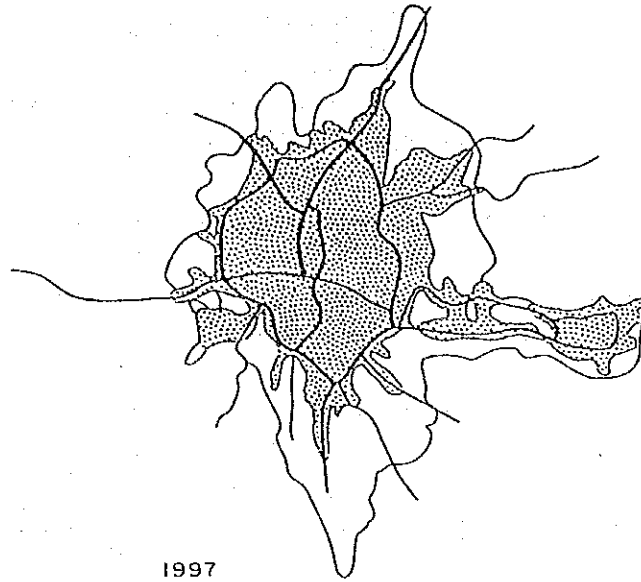


FIG. 5.1 EXPANSION OF URBAN AREA

(3) Future Land Use

KVUDPP Study has not make detailed mention as to land-use for every sub-division of land in urban area. However, in line with the urban expansion as explained above, existing land-use pattern, which is characterized by its disorderness with no distinction among different land-uses, is to be proposed to be improved to better one.

The Study Team has analyzed about probable land-use for every sub-division of urban area standing on the following assumption:

- Classification of land-use will become more distinct in which specialization in specific land-use will be promoted in urban area,
- Existing characteristics in land-use by each sub-division of area will be preserved in which central area will remain as the center of commercial and business while more manufacturing land-use will be took place in the area surrounding central and sub-urban areas,
- Urban fringes will be predominantly used for residential purposes and some educational institutes,
- and development in rural development will be controlled for the preservation of environment.

(4) Population Projection

Future population in 2015 is forecasted keeping consistency of the frame work of KVUDPP Study in which 2.8% of annual population growth rate is assumed.

Population is expected to reach 1.2 and 2.0 times of 1991's in 1997 and 2015 respectively.

TABLE 5.1 AREA-WISE POPULATION IN 2015

Area	Population	Annual Growth Rate *
Kathmandu District	1,355,000	3.0
Urban	946,000	3.5 *
Rural	409,000	2.0 *
Lalitpur district	436,000	2.9
Urban	268,000	3.5 *
Rural	168,000	2.0 *
Bhaktapur District	290,000	2.2
Urban	110,000	2.5 *
Rural	180,000	2.0 *
Total Kathmandu Valley	2,081,000	2.8
Urban	1,324,000	3.4
Rural	757,000	2.0

* Annual growth rate set up by KVUDPP Study.

5.2 Transportation Development Strategies

Targets for development have been set up as below through the identification of present issues in transportation and prospect.

1) Short-term plan

- Improvement of bottlenecks in urban road,
- Relief of the transportation-poor.

2) Long-term plan

- Establishment of well-balanced road transportation system as a capital of nation,
- Homogeneous development of the Valley.

Strategies or approaches to attain the above targets are formulated attributed to the categories of urban transport development policies as shown in Table 5.2 and 5.3.

TABLE 5.2 STRATEGIES FOR URBAN TRANSPORT DEVELOPMENT (short-term)

	Target for Development	Traffic Management			Public Transport	Road Development
		Legal / Administrative Measure	Institutional Measure	Facility Improvement		
Short Term	<ul style="list-style-type: none"> * Improvement of bottlenecks in urban traffic * Relief of the transportation-poor 	<ul style="list-style-type: none"> * Attachment of parking code into building code and introduction of penalty system * Enforcement of vehicle inspection system * Enforcement motor vehicle act * Coordination of policies among agencies * Traffic engineering section to be established in DOR to coordinate all traffic problems 	<ul style="list-style-type: none"> * Control on roadside parking * Control on roadside on-loading and off-loading * Control on illegal activities on right-of-way (workshop roadside stall, hawkker) 	<ul style="list-style-type: none"> * Construction of public parking spaces * Improvement of intersection facilities * Improvement of pedestrian stream (crossing point, fence between carriage way and pedestrian walk, pelican crossing) * Construction of truck yards along the Ring Road 	<ul style="list-style-type: none"> * Increase in fleet number and frequency (bus, mini-bus) * Integration of bus stops/ bus service routes and coordination among companies * Improvement of facilities at bus terminal/bus stops (bus bay, shelter, sign) * Route regulation for three-wheelers 	<ul style="list-style-type: none"> * Improvement of arterial road for operation of public transport * Strengthening of north-south corridor through the city of Kathmandu * Enhancement of crossing capacity over Bagmati River * Improvement / construction of road links in critical parts on road network and vital places of regional transportation * Strengthening of east-west linkages in Kathmandu * Integration of bridge construction with road improvement plan

TABLE 5.3 STRATEGIES FOR URBAN TRANSPORT DEVELOPMENT (long-term)

	Target for Development	Traffic Management			Public Transport	Road Development
		Legal / Administrative Measure	Institutional Measure	Facility Improvement		
Long Term	* Establishment of well-balanced road transport system as a capital of nation		* Regulation on heavy vehicle operation in the central area	* Introduction of bus terminal for east-bound buses	* Introduction of ride and ride system * Introduction of exclusive bus lanes	* Linkage among potential developing places in wider scopes in the light of Outer Ring Road Concept
	* Homogeneous development of the Valley					* Introduction of Inner Ring Road for efficient linkage of central area * Improvement of radiating roads from the cities of Kathmandu, Lalitpur and Bhaktapur

6 ROAD DEVELOPMENT PLAN

6.1 Basic Concept

Road development plan for the year of 2015 has been made taking into consideration land-use development plan, anticipated future traffic demands as well as the characteristics of traffic in the Valley.

The above orientation of future road development justify the following stances in road development in the Study area :

- Road development as a center of national economy,
- Road development in the wave of outward shift of urban area,
- Road development for the integration of three (3) existing city centers,
- Road development to streamline the traffic in central area, and
- Road development with impending necessity to improve existing bottleneck points and alleviation of transportation-poor.

6.2 Road Development Master Plan

Fig.6.1 shows the road development master plan in Kathmandu Valley for the year 2015. This master plan consists of the following road projects.

- (1) **Road development as a center of national economy**
 - 1) Construction of Arniko Bypass
 - 2) Construction of 2nd Tribhuvan Highway

- (2) **Road development in the wave of outward shift of urban area**
 - 1) Widening of radiating roads
 - Sundarijal Road
 - Sankhu Road
 - Lubhu Road
 - Chapagaun Road
 - Bungmati Road
 - Bhimdhunga Road
 - Tokha Road
 - Phutung Road

 - 2) Construction of ring roads
 - The Outer Ring Road
(Budhanilkantha - Thimi - Lubhu - Bungamati)
 - Thimi North-South Ladder Step Roads
 - Gothatar Service Road (East of Airport)

- (3) **Road development for the integration of three (3) existing city centers**
 - 1) Widening of Koteswor - Thimi - Bhaktapur Feeder Road
 - 2) Construction of Baneswor - Thimi Shortcut by provision of tunnel under Tribhuvan Airport

- (4) **Road development to streamline the traffic in central area**
 - 1) Construction of the Inner Ring Road
 - East-west link section in northern part of Kathmandu city
 - Bishnumati link section
 - Bagmati link section
 - Dhobi Khola link section

 - 2) Linkage of the Inner Ring Road with the Ring Road
 - Bijeswari - Swayambhunath Stupa - Ring Road West (Widening)
 - Teku - Ring Road West (Construction)
 - Dhobi Khola at Thapathali - Ring Road East South (Construction)
 - Hadigaun - Ring Road East North (Construction)

 - 3) Widening of Kantipath
 - 4) Widening of Bhaktapur Ring Road

- (5) **Road development with impending necessity to improve existing bottleneck points and alleviation of transportation-poor**
 - 1) Construction of new Bagmati Bridge
 - 2) Construction of road connecting Nayabazar and the Ring Road (Access to the New Bus Terminal)
 - 3) Widening of New Baneswar - Old Baneswar
 - 4) Improvement of Patan Access
 - Jhamsikhel - Ring Road (Extension and Widening)
 - Jawalakhel - Ring Road (Widening)
 - Sat Dobato - Ring Road (Widening)

Fig.6.2 and Fig.6.3 show the traffic demand and congestion in 2015 on each arterial road calculated on the basis of the road network. The congestion level on the arterial road inside the existing Ring Road is moderate ranging from 1.0 to 1.75. No serious congestion would be expected on the major arterial roads in Kathmandu Valley in the year of 2015 with the exception of some city roads in and around the core historic areas in Kathmandu city.

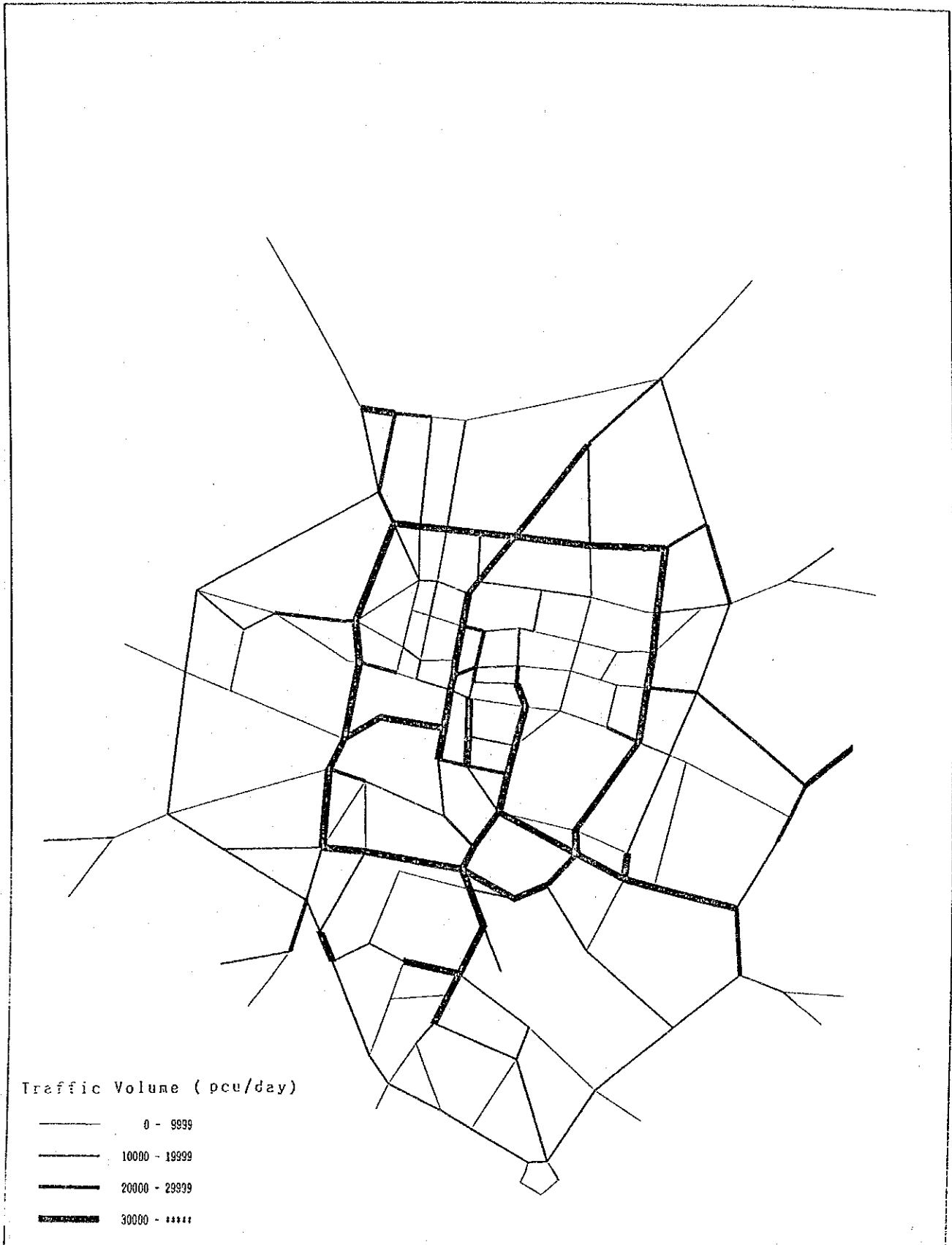


FIG.6.2 TRAFFIC VOLUME ASSIGNED (2015 - PROPOSED NETWORK)

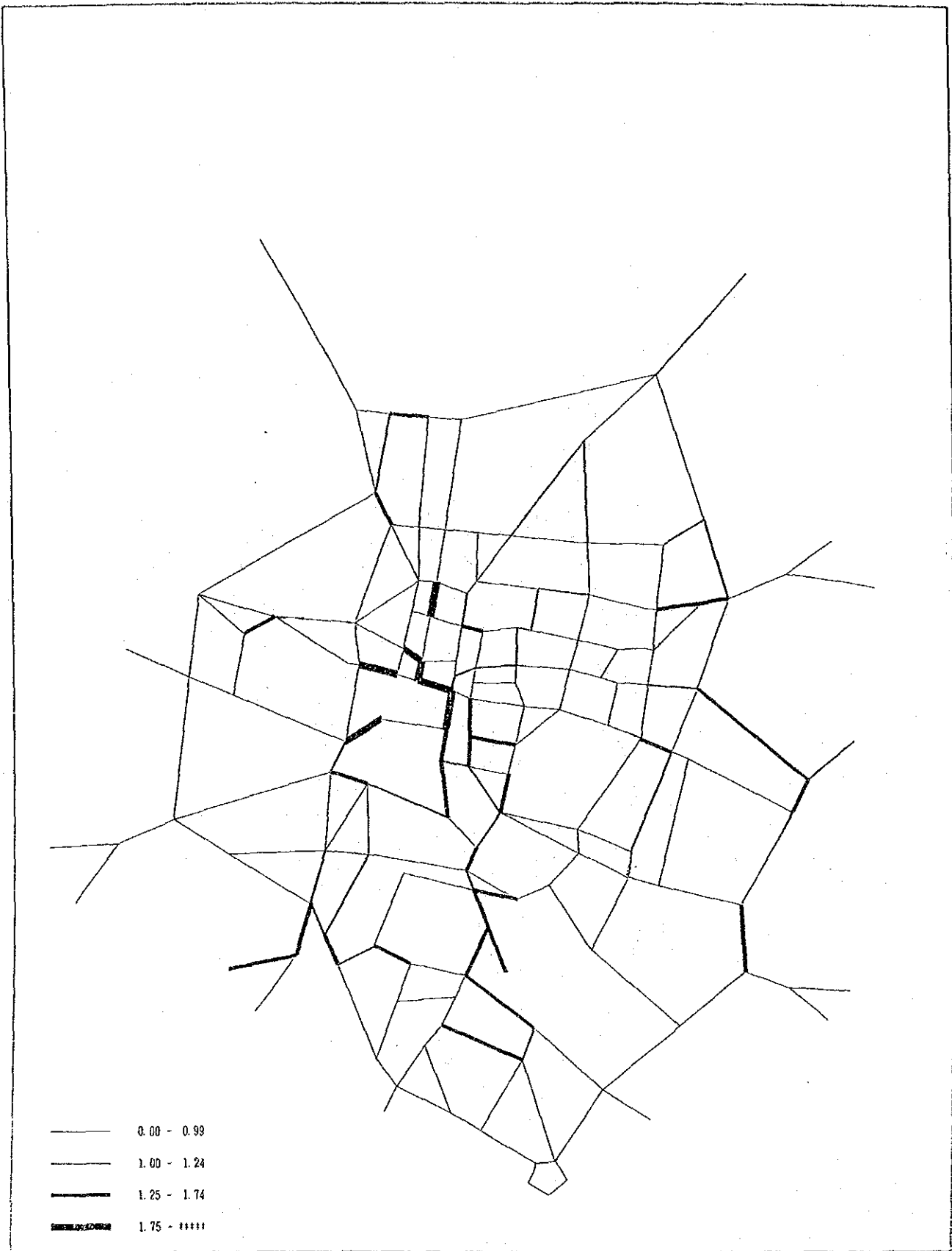


FIG.6.3 CONGESTION RATE (2015 - PROPOSED NETWORK)

7 PUBLIC TRANSPORT DEVELOPMENT

7.1 Basic Concept

Recognition along with the development strategy formulated determines the scope of short-term development plan as described below:

- Public transport development plan in conjunction with on-going plans,
- Public transport planning to provide better services in the central areas,
- Public transport planning to provide sufficient trunk line services between major cores in the Valley.

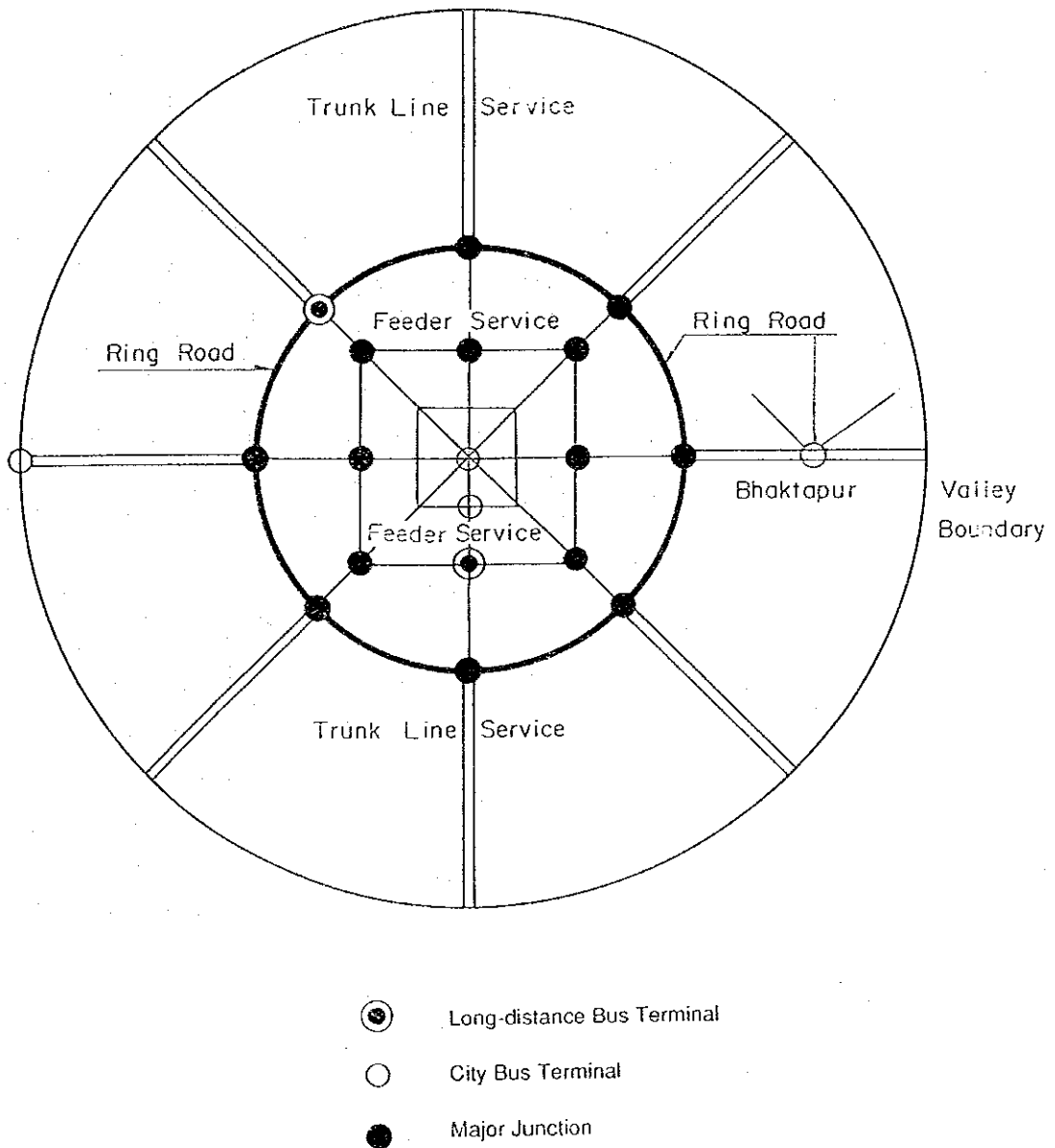


FIG. 7.3 PUBLIC TRANSPORTATION DEVELOPMENT CONCEPT (SHORT-TERM)

With the continued expansion of urban area and extension of arterial roads both within the existing Ring Road and suburban area, more improved public transport system is inevitable to be introduced in the expectation of increasing urban activities and diversification of traffic demands. The above recognition justifies the long-term prospect of public transportation development as described below:

- Dispersion of terminal facilities,
- Necessity of bus lane improvement taking advantage of improved road network, Promotion of ride-and-ride system at major terminals.

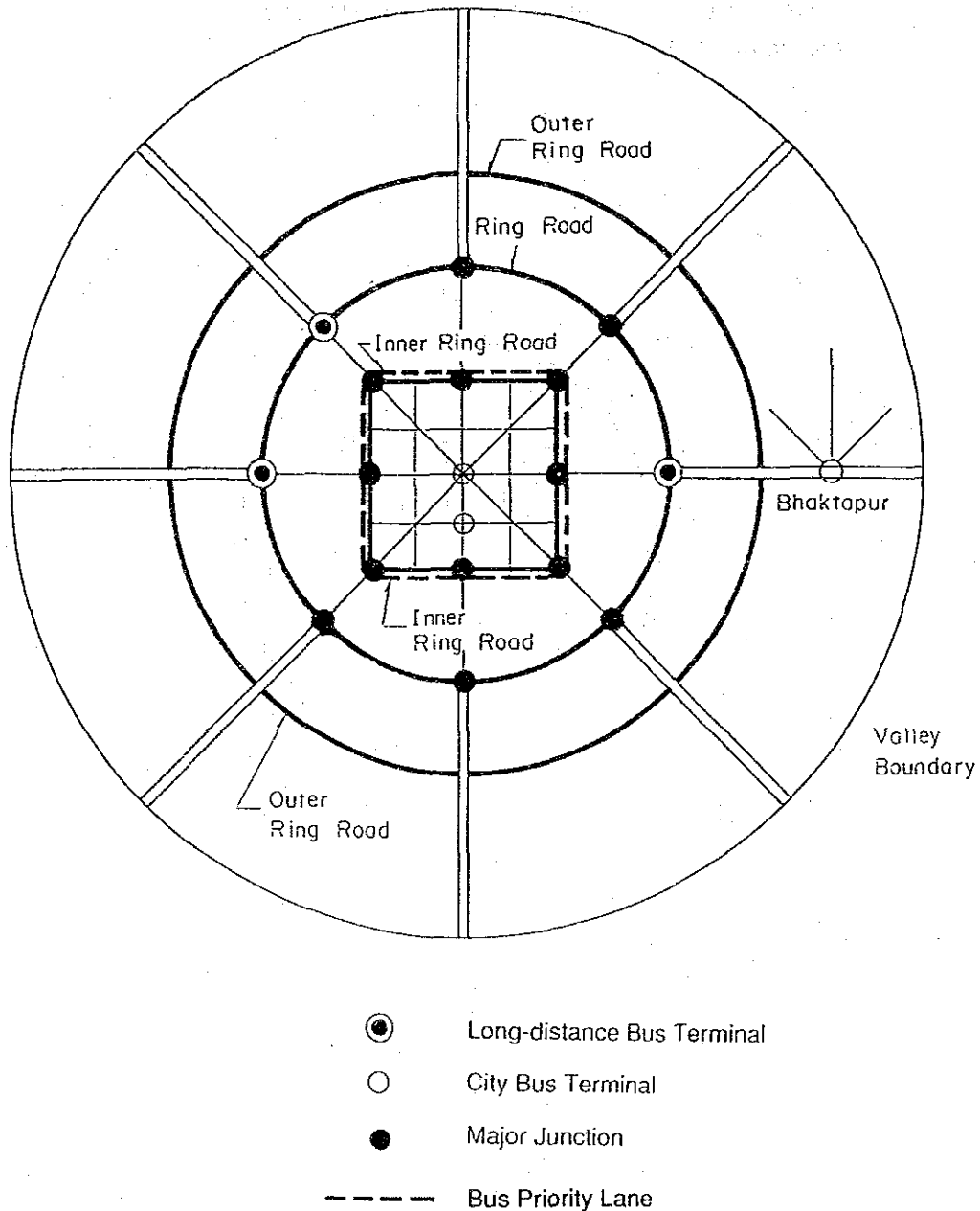


FIG. 7.4 PUBLIC TRANSPORTATION DEVELOPMENT CONCEPT (LONG-TERM)

7.2 Public Transport Development Master Plan

Public transport development plan is presented in the form of master plan as shown in Fig. 7.3.

Short-term Development Plan

- Shuttle bus services at new long-distance bus terminal,
- Improvement of city bus services on district roads in suburban area,
- Improvement of facilities at major bus stop
- Route regulation on three-wheeler public transport.

Long-term Development Plan

- Construction of east-bound long-distance bus terminal,
- Introduction of bus priority lanes on the Inner Ring Road.

(1) Shuttle Bus Services at New Long-distant Bus Terminal

Improvement of city bus function with the opening of new long-distance bus terminal at the north-west corner of the Ring Road would be first step towards the over all level up of public transport system in the Valley. The purpose of this plan is to provide efficient transit services to the users.

Shuttle bus service routes have been selected on the following two (2) routes.

Route A : New Long-distance Bus Terminal - City Bus Terminal at Ratna Park

Route B : New Long-distance Bus Terminal - City Bus Terminal in Lalitpur
(along the Ring Road)

(2) Improvement of City Bus Services on District Roads in Suburban Area

Substandard bus service in terms of frequency of and fleet condition as well as operation method in the growing demand for public transport has brought about a great number of "transportation-poor" or people who are unable to get sufficient transport services.

In this consideration, focuses of public transport development in the suburban area are placed on the following points:

- To provide bus service routes in the areas which are not serviced by present city bus system,
- To enhance the frequency of city bus services.

1) Introduction of New City Bus Service Routes

City bus services are requested to be extended on the following routes.

- Dharamthali - Balaju,
- Tokha - Balaju,
- Bhaktapur - Thimi - Koteswar,
- Bungamati - Ring Road.

30 minutes of frequency during the peak hour is proposed to provide minimal level of services to the users.

2) **Enhancement of Frequency of City Bus Service**

Frequency of city bus service is proposed to be enhanced on the following routes.

- Sundarijal - Baralgaun,
- Sankhu - Chabahil (Baralgaun),
- Bhaktapur - Koteswar,
- Lubhu - Ring Road,
- Godawari - Sat Dobato,
- Dhapakhel - Sat Dobato,
- Chapagaun - Sat Dobato,
- Kiritpur - Ring Road,
- Pharping - Ring Road.

(3) Improvement of Facilities at Major Bus Stops

Bus stops to be improved have been selected applying following criteria:

- Bus stops with considerable number of boardings and alightings
- Bus stops located on heavily trafficked roads
- Bus stops required urgent improvement work

(4) Route Regulation on Three-wheeler Public Transport

It is proposed to regulate the tempo operation on the arterial roads within the urban area. This would promote the transition to better modes of public transport under appropriate measures which include:

- More frequent service by minibuses on arterial roads
- Introduction of fare system which encourages the usage of minibus.





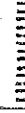



(5) Construction of East-bound Long-distance Bus Terminal

With the expected increase of eastbound long-distance bus passengers due to opening of Sindhuli road and so on some of the facilities at planned Balaju terminal are to be relocated to be east exit of Kathmandu city in a long-term. Opening of east-bound long-distance bus terminal would reduce the access time which otherwise has to be done by way of Balaju, which is located north-western corner of the city.

(6) Introduction of Bus Priority Lanes on the Inner Ring Road

As long as foreseeable future is concerned, bus would remain as major means of transportation in the Study area. Improved bus service would strengthen the inter regional interdependence among industries and daily activities of citizen. Introduction of bus lane on the sections of Inner Ring Road would provide easy access among the regions in the urban area.

LEGEND

-  Shuttle Bus Route
-  New City Bus Service Route
-  Bus Service Improve on District Road
-  Bus Priority Lane
-  Tempo Regulation Route
-  Long-distance Bus Terminal (On-going)
-  Long-distance Bus Terminal
-  Bus Stop to be improved

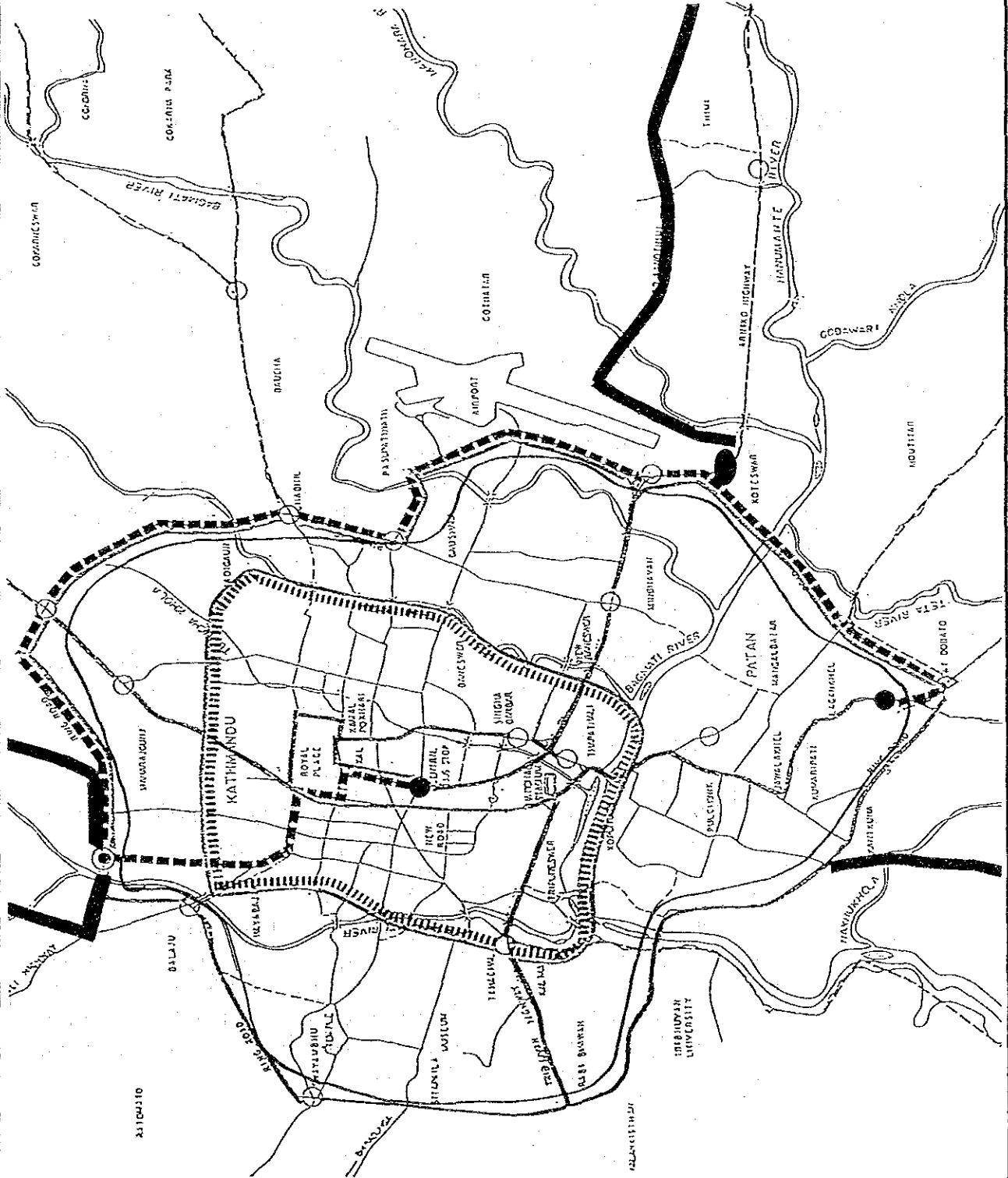
HIS MAJESTY'S GOVERNMENT OF NEPAL
(H.M.G.)

KATHMANDU VALLEY
URBAN ROAD DEVELOPMENT

PUBLIC TRANSPORT DEVELOPMENT PLAN

FIG. 7.3

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8 TRAFFIC MANAGEMENT PLAN

8.1 Basic Concept

In expectation of immediate effect from the measures to be undertaken, emphasis is put more on the physical measure of traffic management rather than legislative and legal ones. Legal and legislative measures which the Study area is provided with would more effectively work should supporting physical measures are given for the same purposes.

Taking the impacts of measures on the present urban traffic into accounts, following categories of traffic management have been proposed:

- Reduction of roadside parkings and efficient use of road space,
- Improvement of intersection traffic,
- Improvement of pedestrian stream to avert mixed traffic, and
- Traffic education.

Improvement of above four (4) categories of traffic management would bring about benefit both in tangible and intangible forms to the users of roads. These benefit will appear in the form of increase in vehicle operation cost saving and reduction of traffic accidents and enhancement of urban amenity.

Traffic management is interpreted as a measure to be taken until large scale innovation work is undertaken. However, as far as Study area is concerned, the traffic situation on urban road is chaotic and disordered to the level that spoil the fruits of physical improvement works on infrastructure. This fact seems to come from extremely poor traffic behaviors of road users.

8.2 Traffic Management Master Plan

The above proposed plans are described in the form of master plan for traffic management as shown in Fig. 8.1.

(1) Reduction of Roadside Parkings

1) Construction of Public Parking Lots

Provision of public parking lot would reduce roadside parkings which inevitably would promote the efficient usage of road spaces.

2) Construction of Truck Yards along the Ring Road

For the purpose of averting traffic congestion on arterial roads in the urban area, operation of heavy trucks during the day time is banned on the streets inside the Ring Road. In this situation, some of the roadsides on the Ring Road are used as the space for parking and place of on/off loading for heavy trucks. The scale of these yards are 20 parking spaces with minimum provision of on/off loading facilities.

(2) Improvement of Intersection

Intersections to be improved have been identified based on evaluation of saturation level and traffic accident data. As to improvement plan five (5) models have been introduced in which probable type of model to be adopted has been identified by intersection.

(3) Pedestrian Management

In expectation of the prompt effects, introduction of following physical measures are proposed here:

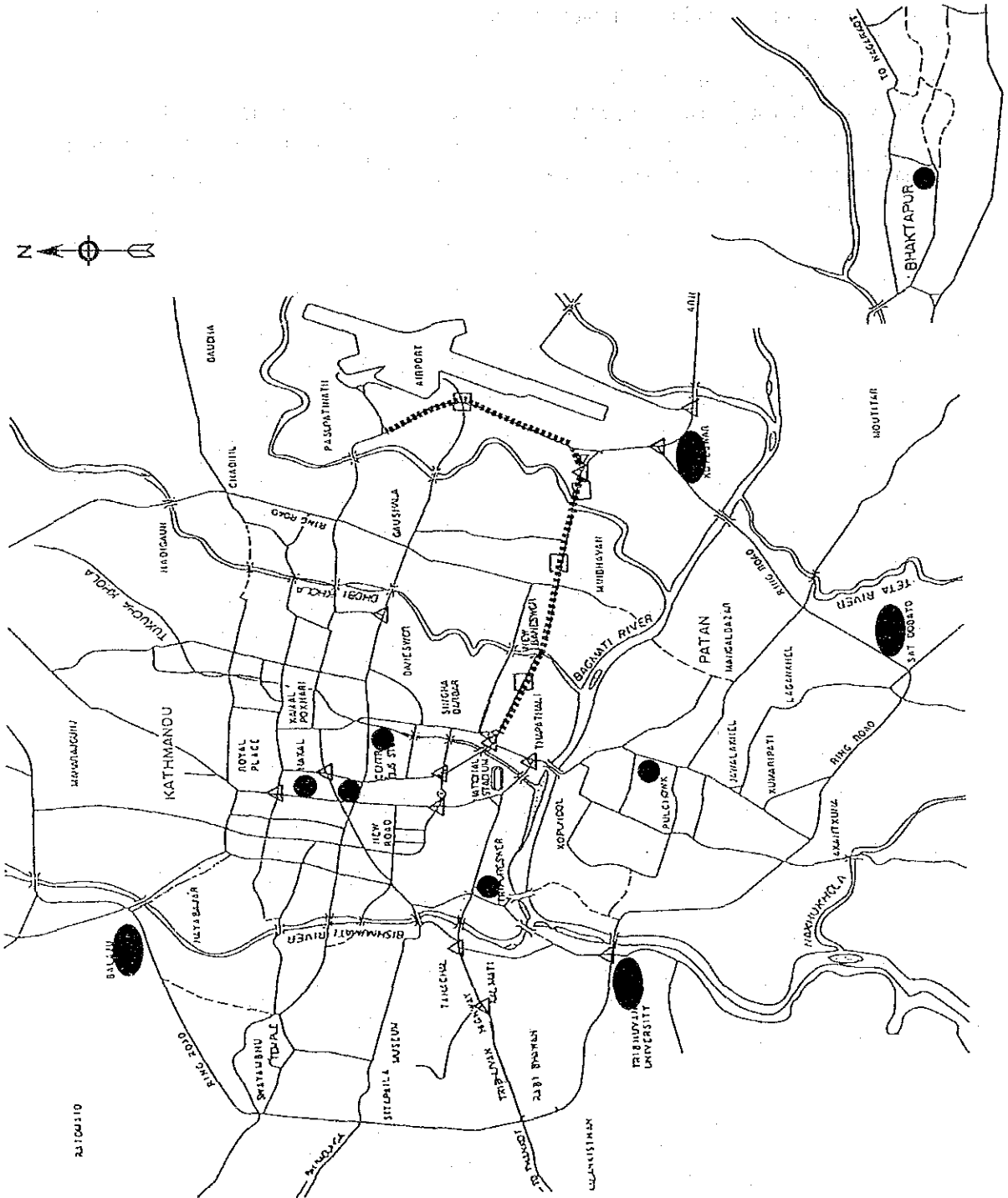
- Installation of pedestrian intrusion control fences,
- Installation of pelican signal/zebra crossings.

(4) Traffic Engineering Institute

To deal with traffic and transportation problems including research and training for traffic management and control, it is essential to establish an autonomous body named "Traffic Engineering Institute" under Ministry of Works & Transport.

LEGEND

- Public Parking Lot
- Truck Yard
- △ Intersection to be improved
- Pelican Signal
- ||||| Pedestrian Intrusion Control Fence



HIS MAJESTY'S GOVERNMENTS OF NEPAL
(H.M.G.)

KATHMANDU VALLEY
URBAN ROAD DEVELOPMENT
TRAFFIC MANAGEMENT PLAN

FIG. 8.1

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9 SHORT TERM DEVELOPMENT PLAN AND IMPLEMENTATION SCHEDULE

9.1 Short term Development Plan

The following two major targets were introduced for the short-term development plan:

- Improvement of bottlenecks in urban roads
- Improvement of the transportation-poor

(1) Short-term Road Development Plan

The recommended road network to be implemented in the short-term was presented in Fig. 9.1 and the concept of road development in the short-term plan is outlined as shown below:

- Improvement of Bagmati Transport Corridor
- Improvement of Bishnumati Transport Corridor
- Access to the New Bus Terminal at Balaju
- Improvement of Lalitpur Access
- Improvement of radial roads connecting with the central area

(2) Short-term Public Transport Development Plan

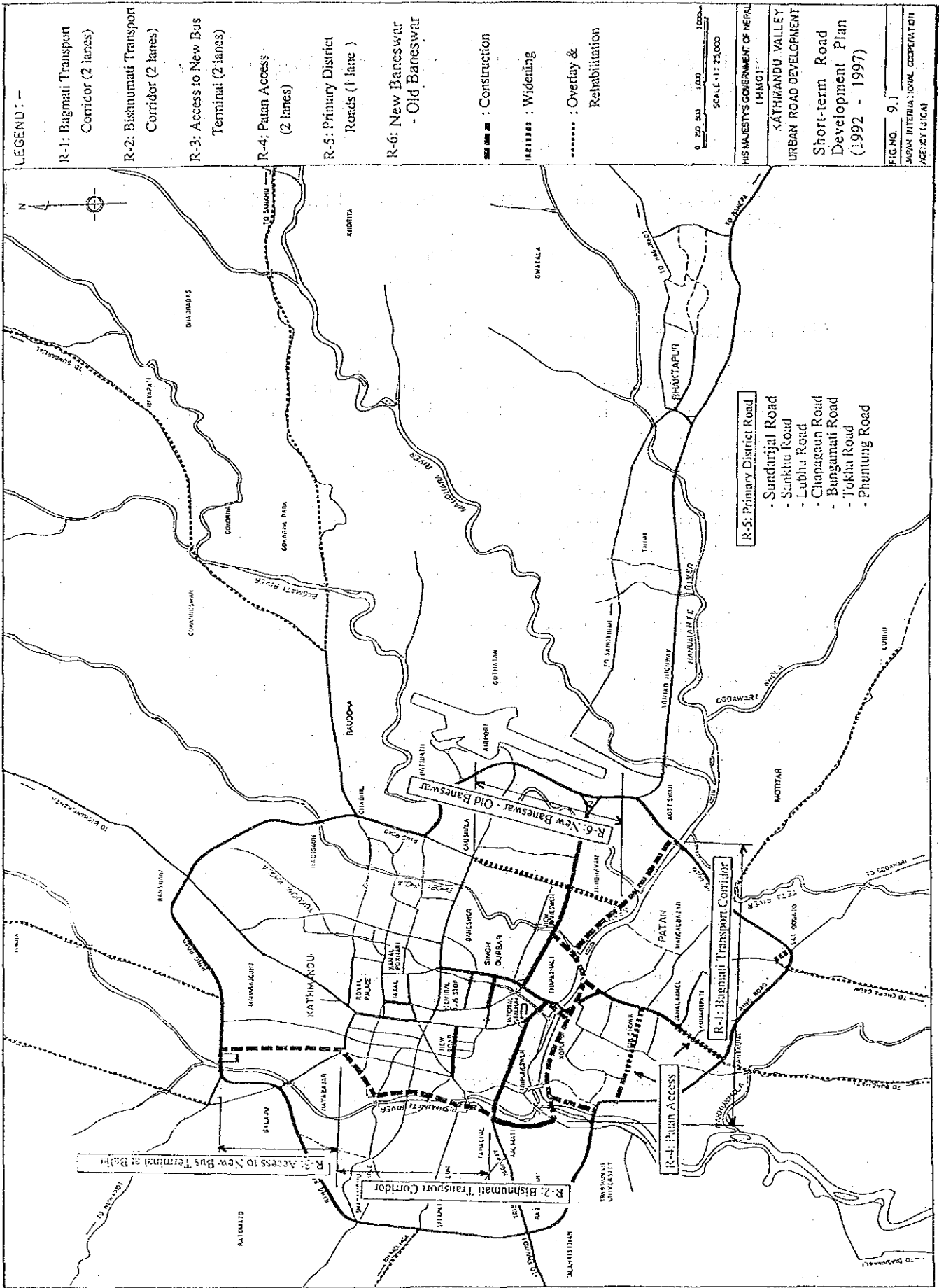
Regarding the short-term development plan for public transport, following plans are recommended to be implemented for the early solution of issues in public transport:

- Shuttle bus operation to and from new long distance bus terminal
- Improvement of bus operation along the radiate district roads
- Newly operation on city-bus along the radiate district roads which are not served by existing bus services
- Tempo bus regulation on arterial roads in the city center
- Improvement of bus stops

(3) Short-term Traffic Management Plan

The proposed plan to be implemented in the short-term plan are as follows:

- Construction of public parking lots
- Construction of truck yards
- Improvement of intersections
- Installation of pedestrian intrusion control fences and pelican signals



9.2. Implementation Schedule

Implementation schedule is illustrated in Fig.9.2, which was prepared by the Study team taking into account the following factors:

Short-term Plan

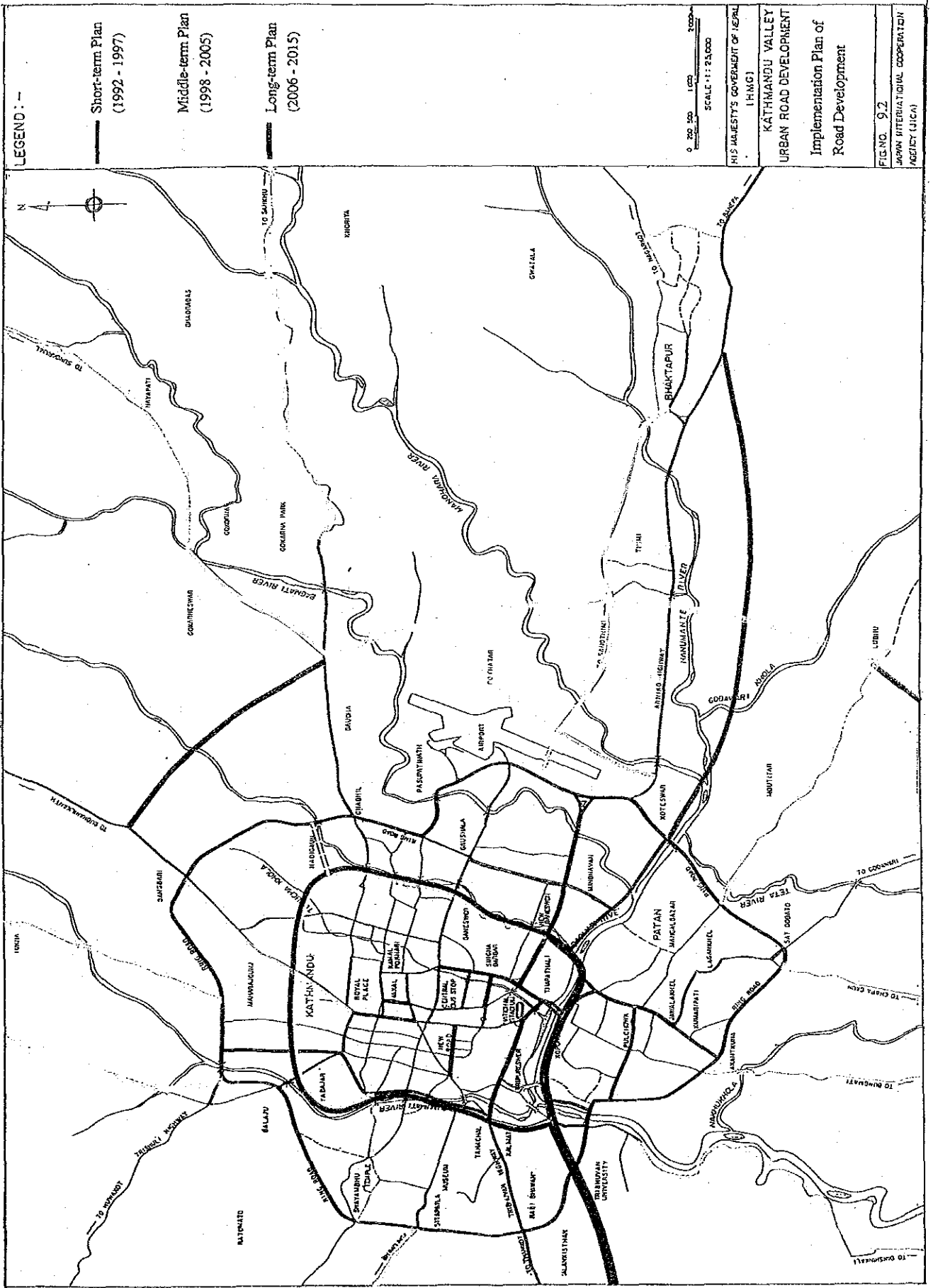
- Time requirement for subsequent services including feasibility study and detailed design required for implementation of the project
- Necessary arrangement for land/house acquisition and compensation to be done by Nepal Government
- Balance of the disbursement schedule of funds required for implementation of the project

Middle-term Plan

- Engineering requirement from the view point of traffic flow and demands
- Enhancement of urban development and control of urban sprawl in the fringes

Long-term Plan

- Establishment of road network for well-balanced urban development
- Engineering requirement from the view point of traffic demands
- Homogeneous development of the Valley



9.3 High Priority Projects

High priority projects are selected among the development plan proposed in the short-term. Selection was made taking into consideration the following factors:

- Required amount of the construction fund
- Required amount for land/house acquisition and compensation
- Ease of construction from the view point of acquiring land
- Urgency of the project
- Improvement of local traffic movement
- Decrease of the traffic accidents
- Construction technology
- Improvement of access to the public transport services

The Study team evaluated various development plan in terms of road, public transport and traffic management proposed in the short-term and recommends the following projects as a high priority project :

(1) Improvement of Bagmati Transport Corridor consisting of:

- 1) Construction of South Link of Inner Ring Road
The project is located on south bank of Bagmati river and connect Dhubhi Khola bridge on Arniko Highway at east end and Kuleswar-Kalimati Road at west end
- 2) Construction of Teku Access from Teku bridge to the Ring Road
- 3) Extension of East Bagmati Riverside Road along north bank of Bagmati river
- 4) Construction of New Bagmati Bridge with 2 lanes at Kupandol
- 5) Construction of Access from the south link of Inner Ring Road to Patan city

(2) Construction of Access to the New Bus Terminal at Balaju

The feasibility study will be conducted on high priority projects to confirm the technical and economical viability.

LEGEND

High Priority Projects to be followed by a feasibility study

(A) Improvement of Bagmati Transport Corridor

A-1: South Section of Inner Ring Road

A-2: Teku Access

A-3: New Bagmati Bridge with 2 lanes at Kopundor

A-4: East Bagmati Riverside Road along north bank of Bagmati River

A-5: Access from Inner Ring Road to Putan

(B) Access to New Bus Terminal at Balaju

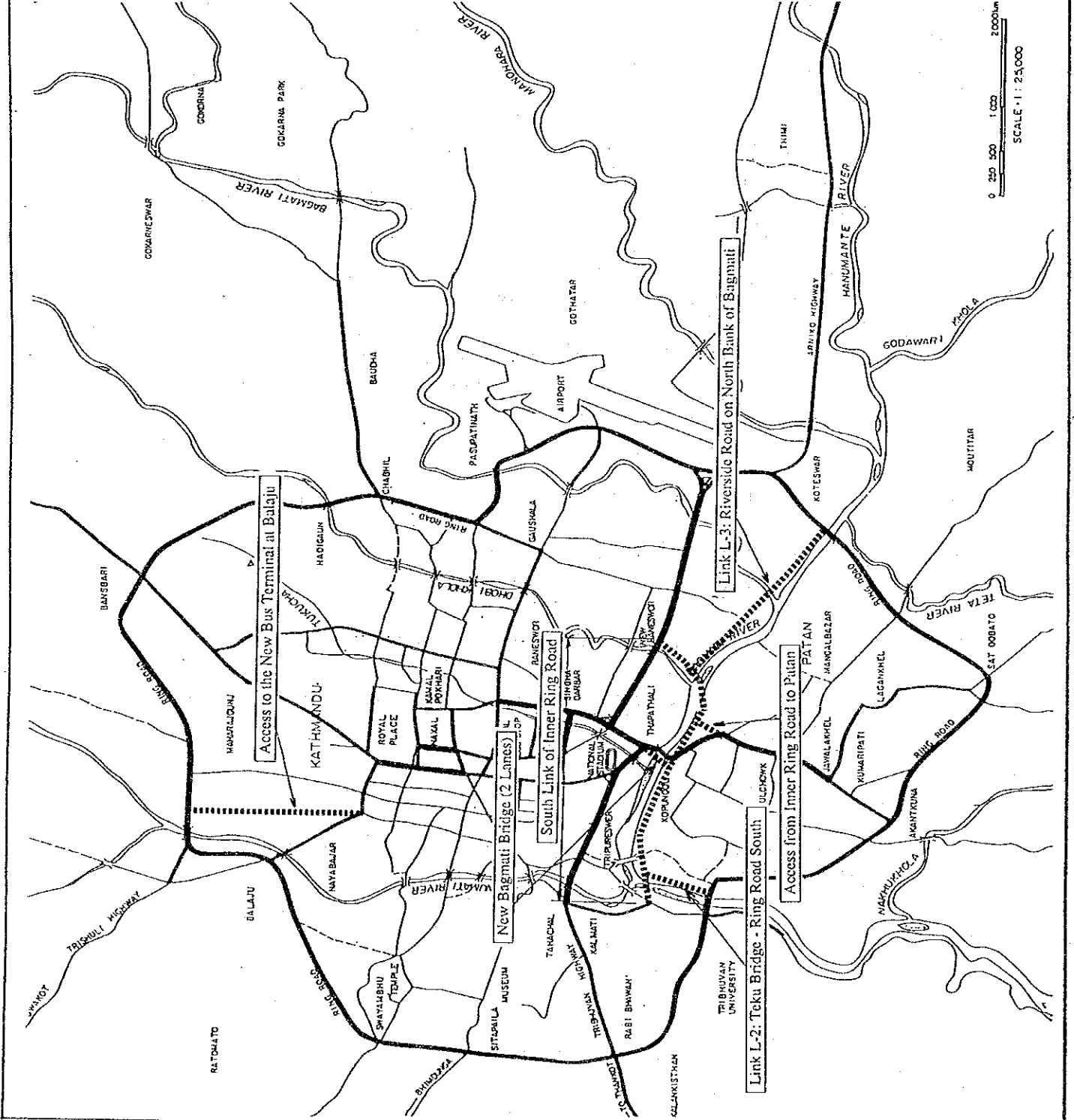
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KATHMANDU VALLEY
URBAN ROAD DEVELOPMENT

HIGH PRIORITY PROJECTS
TO BE FOLLOWED BY F/S

FIG. 9.3

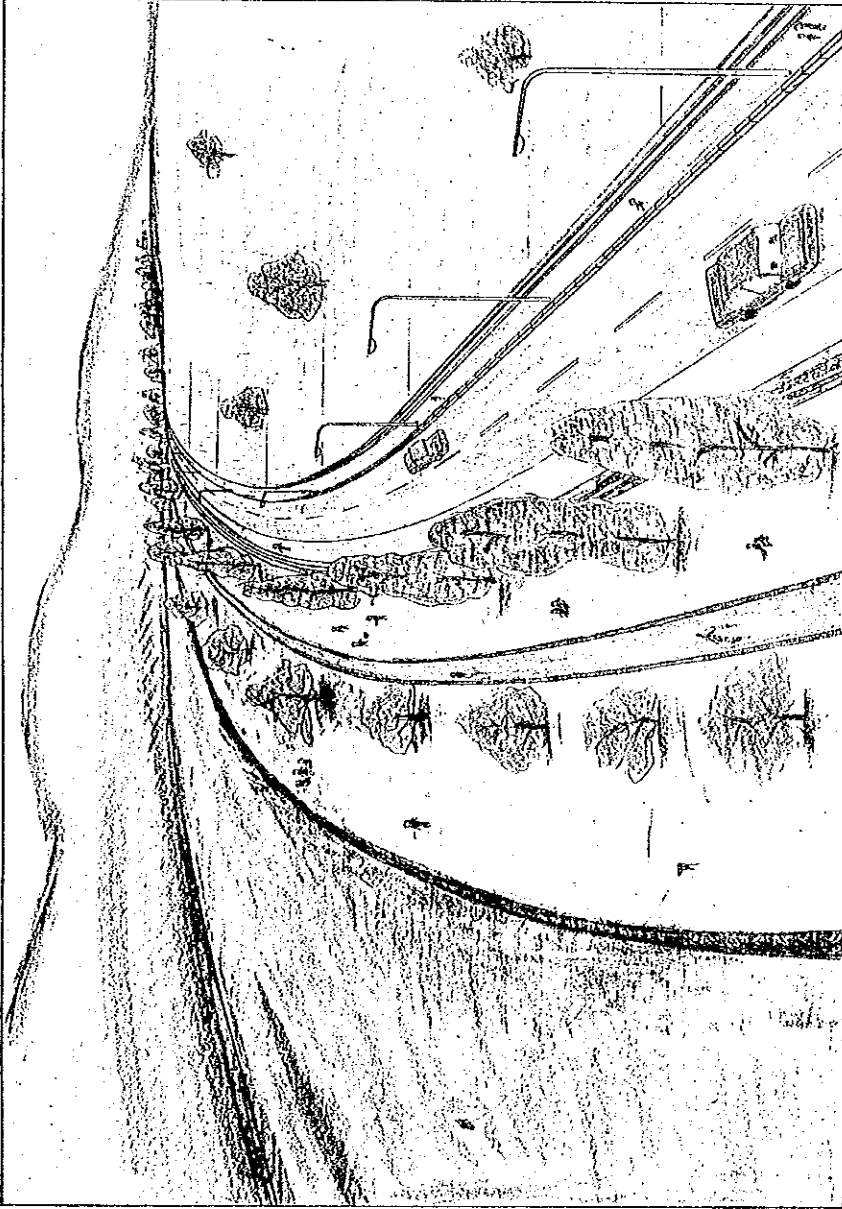
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PART B

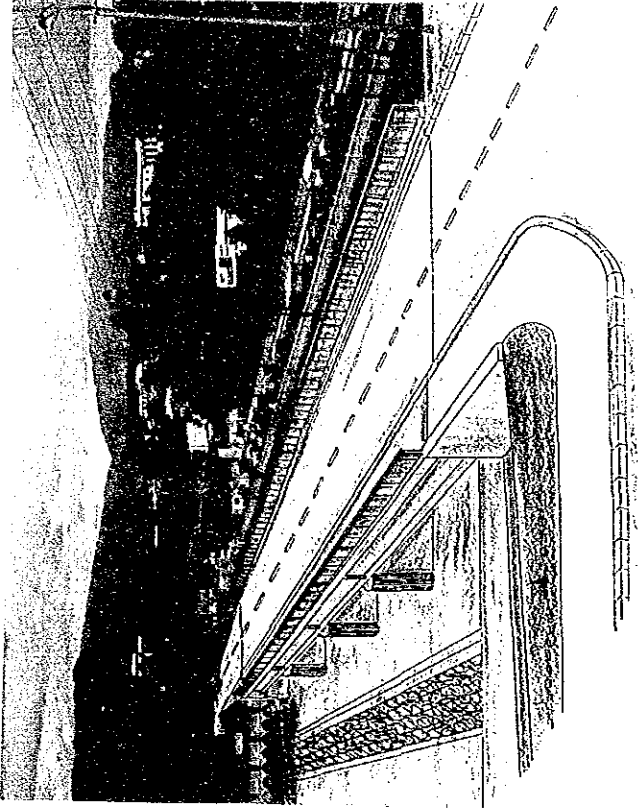
**SUMMARY
OF
FEASIBILITY STUDY**

← Tentative Bird's-Eyes View of South Link of Inner Ring Road along Bagmati River

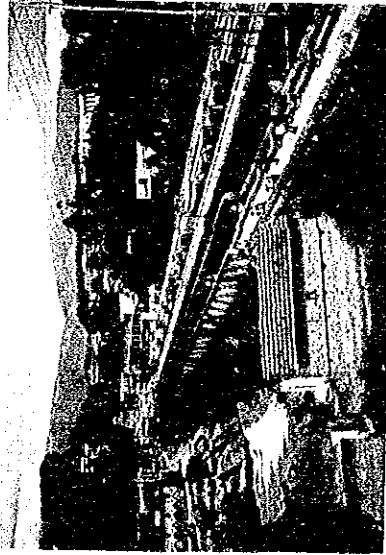


Photograph of Bagmati River and Vicinity taken from Teku Bridge (Proposed Road will Pass along the Right side of Tree Line)

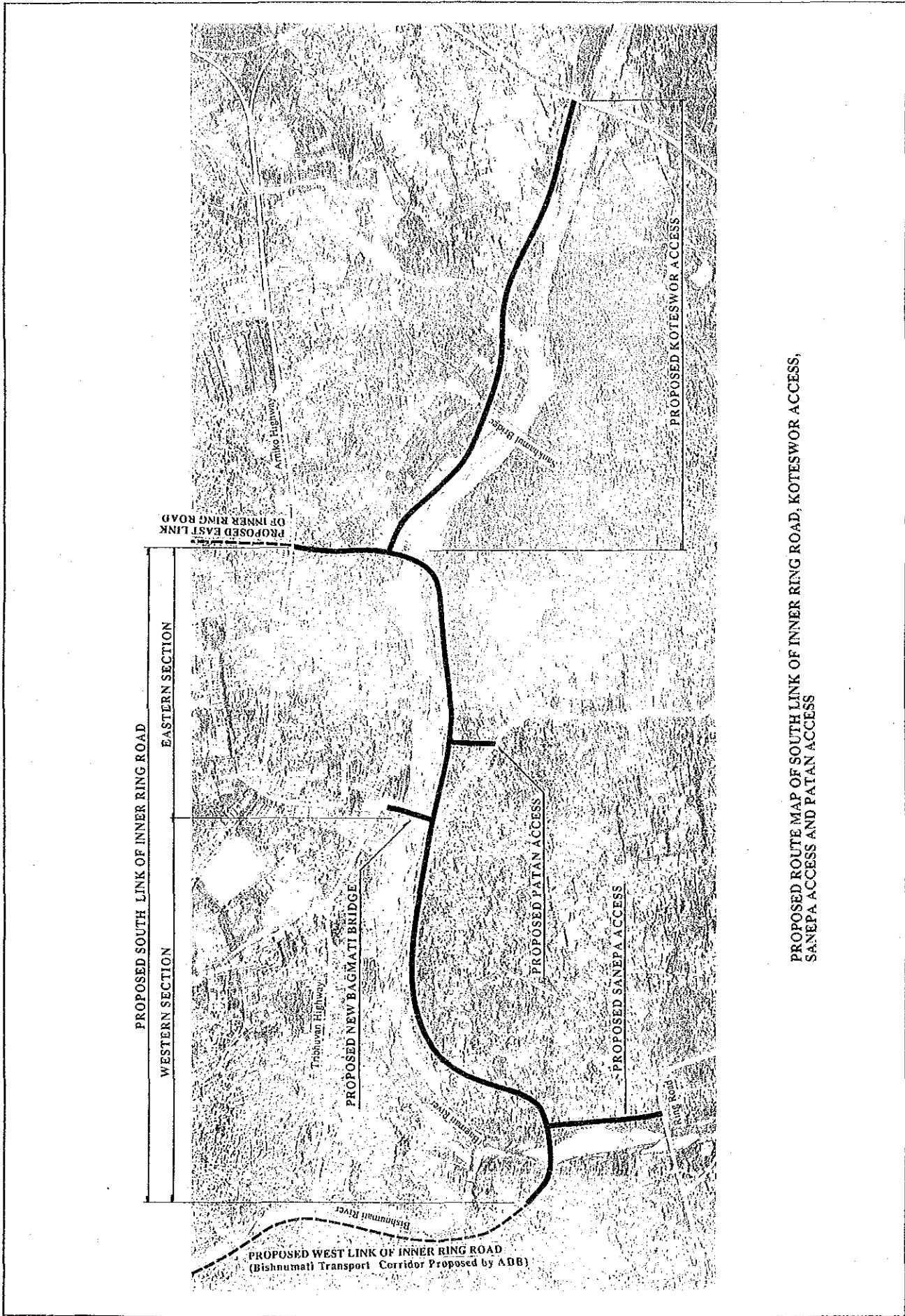




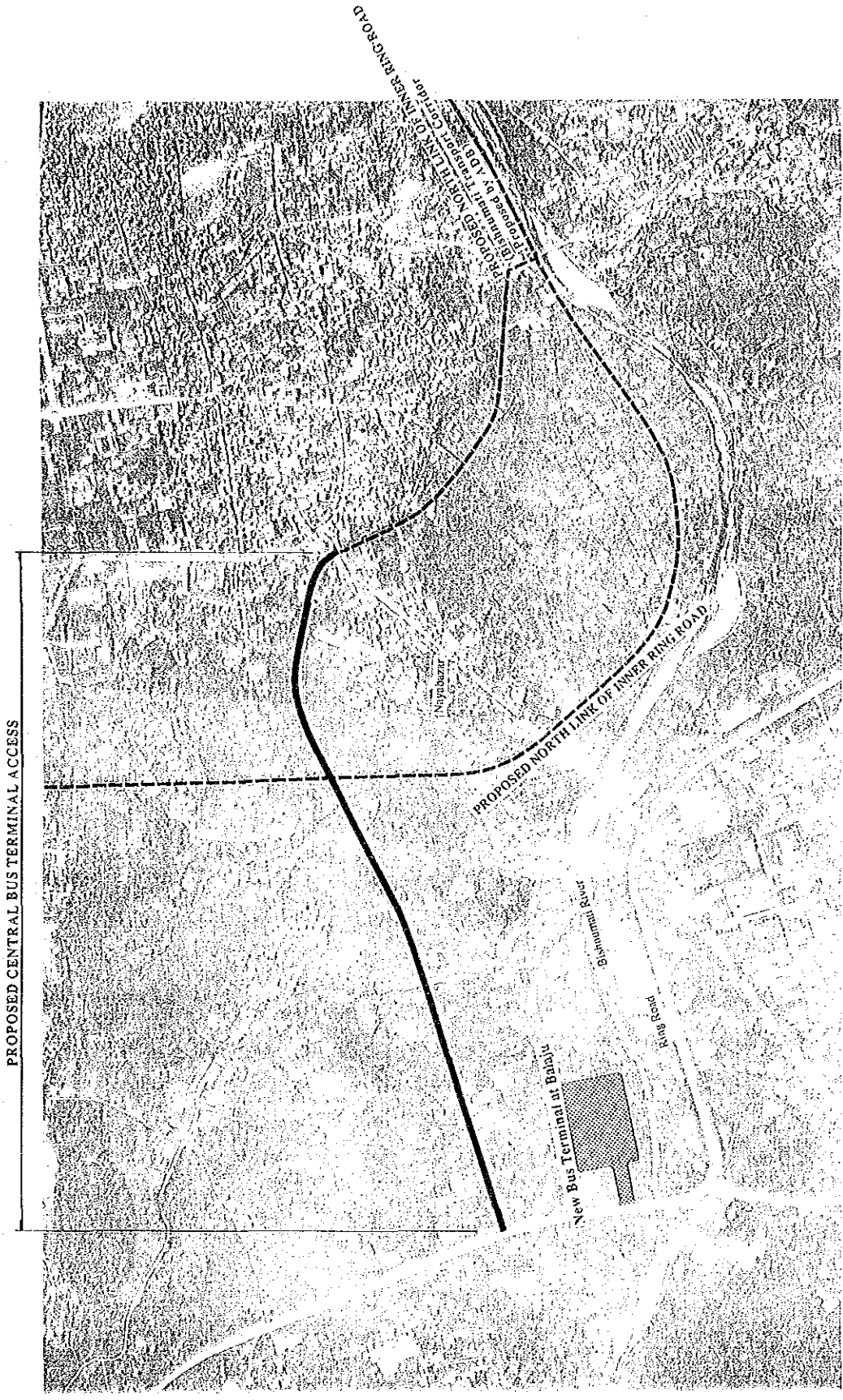
Tentative Bird's-Eyes view of New Bagmati Bridge at Thapathali



Existing Bagmati Bridge at Thapathali



PROPOSED ROUTE MAP OF SOUTH LINK OF INNER RING ROAD, KOTESWOR ACCESS, SANEPA ACCESS AND PATAN ACCESS



PROPOSED ROUTE MAP OF CENTRAL BUS TERMINAL ACCESS

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1. INTRODUCTION

1.1 Background of the Study

Kathmandu Valley comprises of the city of Kathmandu, the capital of Nepal, the city of Lalitpur (Patan), third largest city in Nepal, and the city of Bhaktapur. The population in this area which is estimated at about 1 million in 1991, is on the increase due to immigration of people from the other parts of Nepal and India. This fact along with inadequate provision of urban infrastructure, has given rise to a variety of urban problems including slumming inside the city, sprawling of urban area, traffic congestion on roads and poor facilities of public transport.

In the past, some comprehensive development plans including "Physical Development Plan for the Kathmandu Valley in 1969" and "Kathmandu Valley Physical Development Concept in 1984" and "Kathmandu Valley Urban Development Plans & Programs" have been conducted. However, in spite of these plans, condition of urban area of the Valley has worsened day by day.

In these circumstances, His Majesty's Government of Nepal, under the financial assistance from the Japan International Cooperation Agency (JICA), has decided to conduct a study of "Kathmandu Valley Urban Development Plans & Programs" with the aim of formulating of more concrete and implementation plans and programs for the realization of the various projects proposed in the master plan.

1.2 Objectives of the Study

The major objectives of the Study are:

- (1) Part A: To formulate master plan for Kathmandu Valley Urban Road Development for the period up to the year as shown below:

Long-term plan; Target year of 2015

Short-term plan; Target year of 1997

- (2) Part B: To conduct feasibility study on the high priority projects proposed in the short-term master plan (-1997).

1.3 Study Area

The Study area covers the whole area of Kathmandu Valley including Kathmandu District, a Part of Lalitpur District and Bhaktapur District as shown in Fig.1.1.

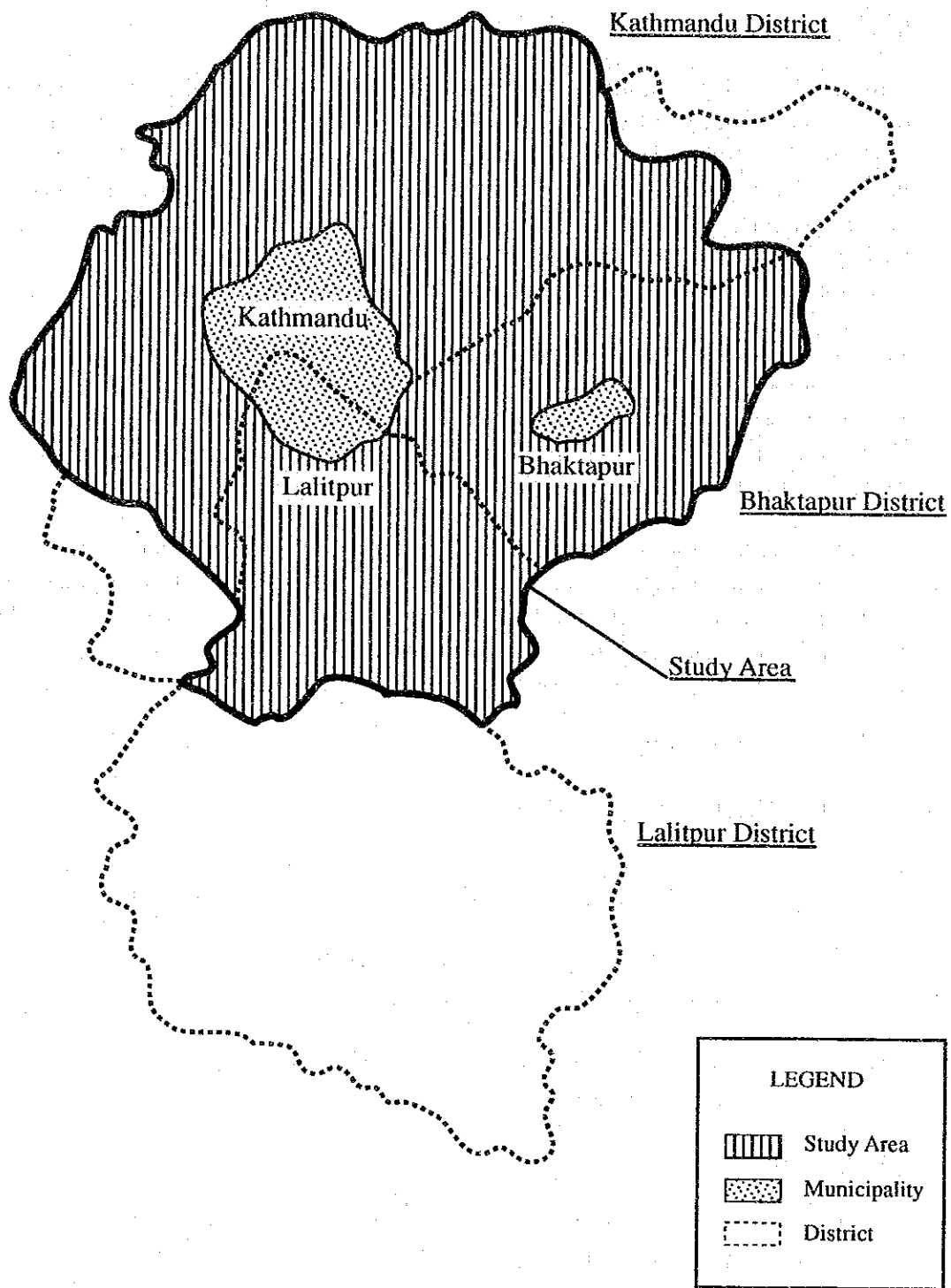


FIG. 1.1 STUDY AREA

2. MASTER PLAN AND HIGH PRIORITY PROJECTS

2.1 Urban Road Development Plan

In the text of Part A, the Study Team conducted master plan study on urban road development in Kathmandu Valley which consisted of the following three categories of the development plan in the short-term (target year 1997) as well as the long-term plan (target year 2015) :

- (i) Urban road development plan
- (ii) Public transport development plan
- (iii) Traffic management plan

2.2 Road Development Plan in Master Plan

Road development plan for the year of 2015 was proposed by the Study Team to achieve the following targets:

- Establishment of well-balanced road transportation system as a capital of nation
- Homogeneous development of the Valley

The development plan is presented in Fig. 2.1 which has been established employing the following development concepts:

- (i) Road development as a capital of nation
- (ii) Road development in the wave of outward shift of urban area
- (iii) Road development for the integration of three (3) existing city centers
- (iv) Road development to streamline the traffic flow inside the Ring Road
- (v) Road development with imminent necessity to erase existing bottleneck and alleviation of transportation-poor

2.3 Short-term Urban Road Development Plan

Short-term development plan was established to achieve the following two major targets:

- Improvement of bottlenecks in urban roads
- Relief of the transportation-poor areas

The recommended road network to be implemented in the short-term was presented in Fig. 2.2 and the concept of road development in the short-term plan is outlined as shown below:

- (i) Improvement of Bagmati Transport Corridor
- (ii) Improvement of Bishnumati Transport Corridor
- (iii) Access to the New Bus Terminal at Balaju
- (iv) Improvement of Lalitpur Access
- (v) Improvement of radial roads connecting with the central area

2.4 High Priority Projects to be conducted for Feasibility Study

High priority projects have been selected out of the projects proposed in the short-term road development plan. Selection of the high priority project was made taking into consideration the various factors, such as urgency, construction cost required, ease of implementation, impact on traffic improvement, etc.

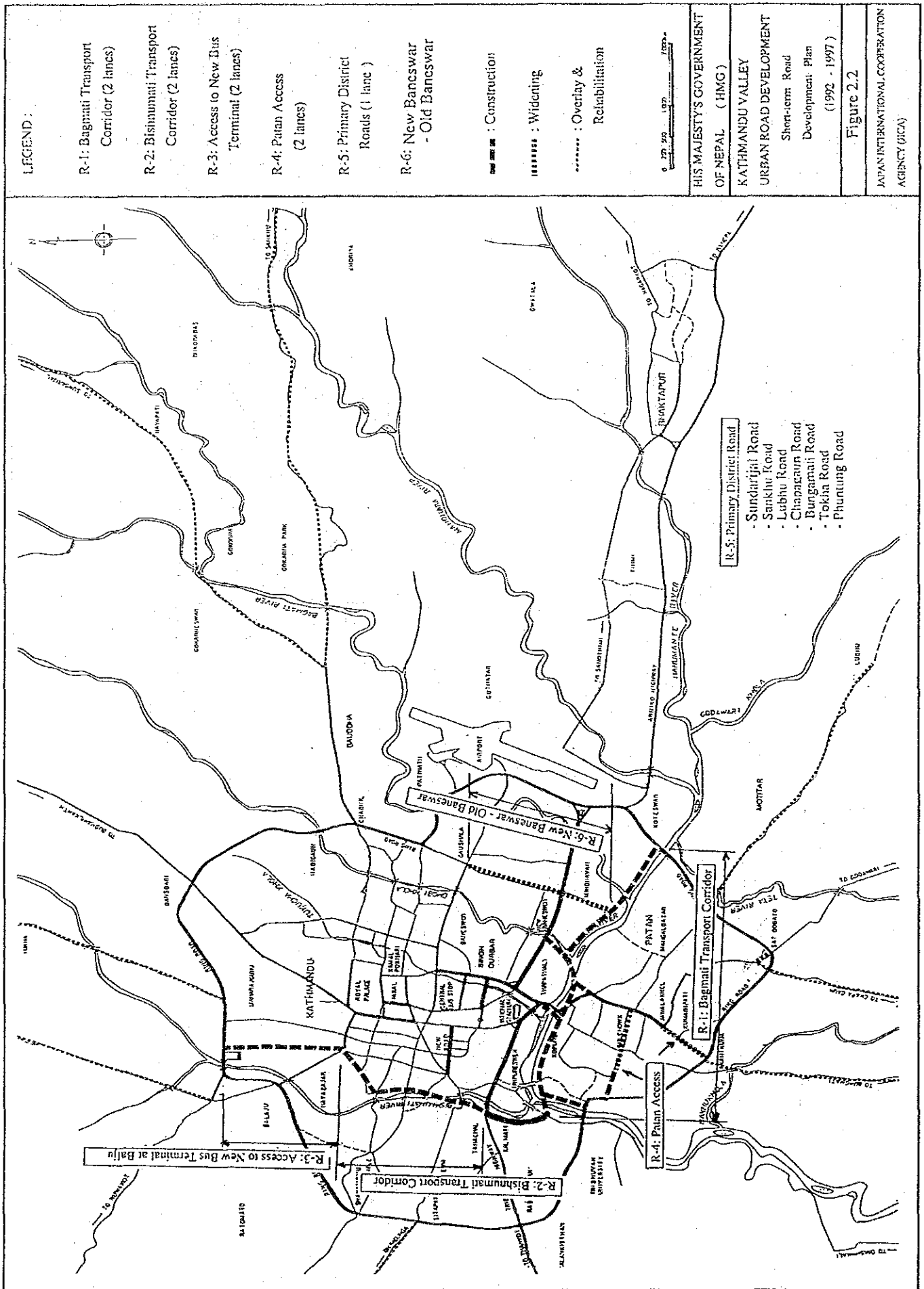
After conducting careful evaluation, the Study team selected the following projects as high priority project : (See Fig. 2.3)

- (1) Improvement of Bagmati Transport Corridor, which consists of:
 - 1) South Link of Inner Ring Road including access roads of Koteswor Access, Sanepa Access and Patan Access.
 - 2) New Bagmati Bridge with 2 lanes at Kupandol
- (2) Access to the New Central Bus Terminal at Balaju

In addition to the above road network improvement, improvement of the traffic management at three intersections are also recommended to be included as high priority projects

- (3) Improvement of Traffic Management at Intersections at Maitighar, Tripureswor, Koteswor.

Chapter 3 through Chapter 10 presented the summary of the results for feasibility study on the high priority projects selected above.



LEGEND

High Priority Projects to be followed by feasibility study

(A) Improvement of Bagmati Transport Corridor

- A-1 : South Section of Inner Ring Road
- A-2 : Teku Access
- A-3 : New Bagmati Bridge with 2 lanes at Kupandol
- A-4 : East Bagmati Riverside Road along north bank of Bagmati River
- A-5 : Access from Inner Ring Road to Patan

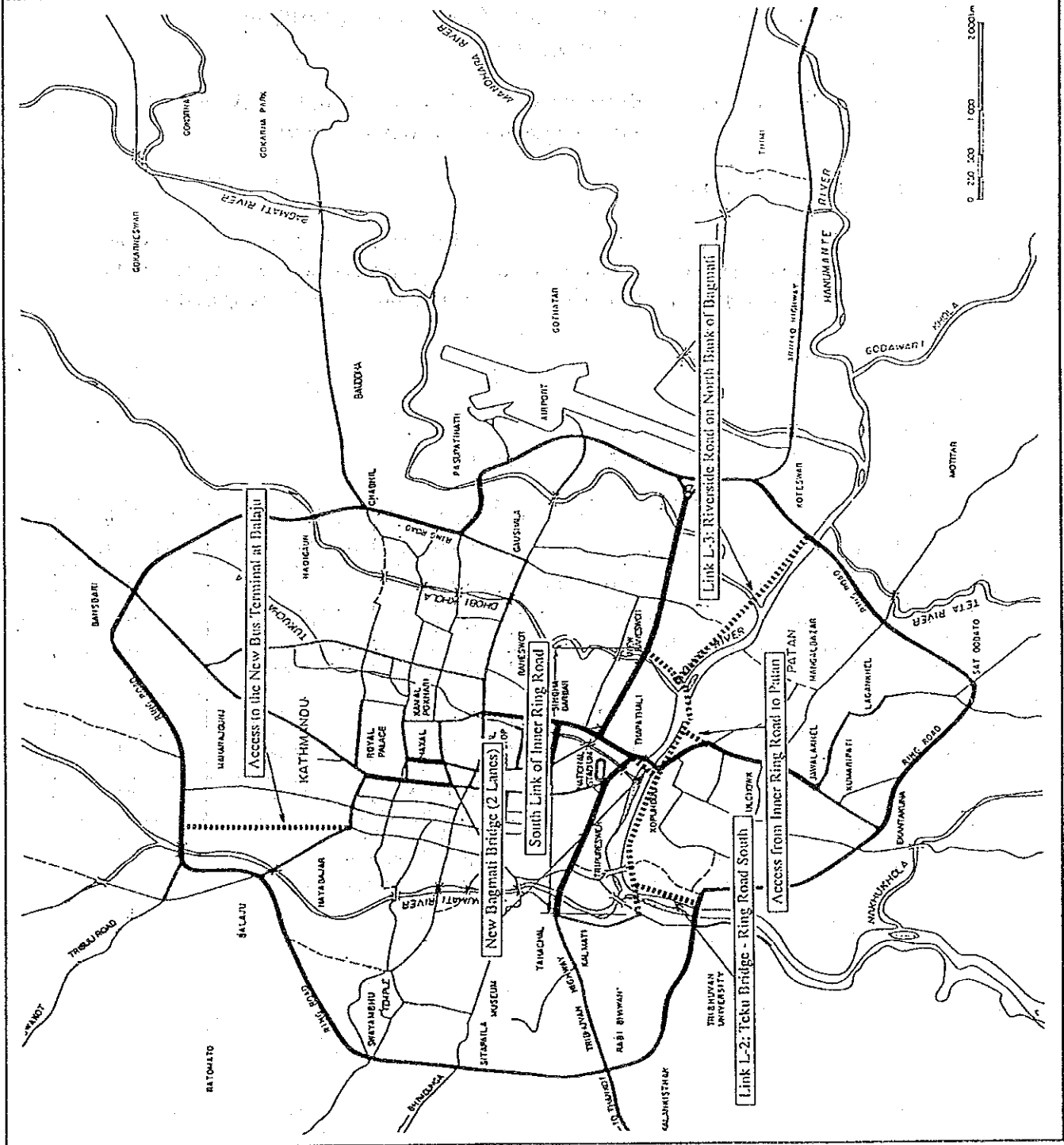
(B) Access to New Bus Terminal at Balaju

HIS MAJESTY'S GOVERNMENT OF NEPAL (HMG)

KATHMANDU VALLEY URBAN ROAD DEVELOPMENT HIGH PRIORITY PROJECTS TO BE FOLLOWED BY F/S

Figure 2.3

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3. DESIGN STANDARDS AND ALTERNATIVES

3.1 Design Standards and Typical Cross Sections

(1) Functional Classification of the Proposed Roads

The functional classification for each proposed road has been determined in accordance with Nepal Road Standards (2027) as well as Design Manual for Urban Roads as follow:

Arterial road: South Section of the Inner Ring Road, and New Bagmati Bridge

Collector road: Koteswor Access, Sanepa Access, Patan Access and New Central Bus Terminal Access

(2) Design Standards

The value of design speed are obtained in accordance with the Nepal Road Standards taking into consideration the expected function, anticipated traffic volume and terrain and surrounding condition along the proposed road as shown in Table 3.1.

Table 3.1 Design Speed

Proposed Roads	Expected Road Function	Surrounding Condition	Traffic Volume in 1997(ADT)	Design Speed (km/hr)
South Link of Inner Ring Road	Arterial Road	B and C	10,000	60
New Bagmati Bridge	Arterial Road	A	30,000	60
Sanepa Access	Collector Road	B and C	2,000	40
Koteswor Access	Collector Road	B and C	3,000	40
Patan Access	Collector Road	B	5,000	40
Access to New Bus Terminal	Collector Road	A and B	5,000	40

A; Commercial area
 B; Residential area
 C; Agricultural area

(3) **Standard Cross Sections and Right-of-way**

The standard roadway cross-section given in Nepal Road Standards shall apply in principle, however, alternative options are worked out for urban roads depending upon the availability of right of way for different roads. The right of way as per Nepal Road Standards is quite enough for proposed roads. Minimum width of right-of-way is proposed to adopt the sections where high land acquisition/building compensation cost is required.

3.2 Alternative Route Study on Proposed Roads

(1) **South Link of Inner Ring Road**

Two alternative routes were proposed at east section as shown in Figure 3.1 through the consideration of river conditions and land acquisition situation.

The aim of Alternative route 1 is to make the road free from scouring by Dhobi Khola at flood time and to improve accessibility to major road in Thapathali Area. Alternative route 2 aims at minimization of land acquisition and building compensation costs, and plans so as to protect bank erosion and river bed degradation.

Alternative route 2 was recommended taking into account of the construction cost, land acquisition cost, building compensation cost and river conditions.

(2) **New Bagmati Bridge at Thapathali**

Proposed New Bagmati Bridge is planned to be constructed beside the existing 2-lane Bagmati Bridge at Thapathali which is only the bridge across Bagmati river inside the Ring Road. Three alternative plans were considered for expansion of river crossing capacity of Bagmati river at Thapathali as follows (see Fig. 3.2):

Alternative 1: Construction of new bridge with 4 lanes

Alternative 2: Construction of dual bridge with 2 lanes (total 4 lanes)

Alternative 3: Construction of new bridge with 2 lanes and Improvement of existing 2-lane bridge (total 4 lanes)

Alternative 3 was recommended taking into consideration the smallest initial investment and ease of implementation among them.

Proposed cross section of Bagmati Bridge site is shown in Fig. 3.3

(3) Koteswor Access

Two alternative routes were proposed at middle section of Koteswor Access as shown in Figure 3.4. The Alternative 1 was planned taking into account bridge crossing site relative to river condition. Alternative route 2 is proposed to protect the encroachment of river by placing the road as a hard edge of the river side.

Alternative route 1 was selected for its advantage in construction and maintenance costs for river protection, and effect on development of inner area.

(4) Sanepa Access

Sanepa access is planned to connect east of Bagmati bridge on Ring Road with South Link of Inner Ring Road. There is no other alternative route for this Access. Estimated route length is 480 m.

(5) Patan Access

Patan Access is planned be constructed by widening the existing feeder road located 350 m south of the existing Bagmati Bridge. The length of the road will be about 180 m.

(6) Access to New Bus Terminal at Balaju

Two alternative routes are considered as shown in Fig.3.5.

Alternative 1; Construction of new access from Nayabazar to the Ring Road

Alternative 2; Widening of existing road

Alternative 1 is recommended taking into consideration ease of implementation due to less numbers of house compensation and land acquisition as well as better traffic movement in Nayabazar area near city center.

3.3 Alternative Bridge Study

Alternative bridge planning was conducted considering the natural conditions including soil and hydrology, construction cost and methodology, planning conditions (bridge width, length, formation height, etc.), etc.

Alternative Bridge Planning

The alternative bridge plan for each bridge is shown in Fig. 3.6 and summarized below:

Bridge Name and No.	Length m	Alternatives	Bridge Type	Approx. Span Arrangement
Bagmati Bridge No. 1	150.0	a)	PC-H	20+5 x 22+20
		b)	PC-T	5 x 30
		c)	H-Gr	20+5 x 22+20
		d)	St-Gr	5 x 30
Bagmati Bridge No. 2	140.0	a)	PC-T	16+4 x 31
		b)	St-Gr	16+4 x 31
Bagmati Bridge No. 3	120.0	a)	PC-H	6 x 20
		b)	PC-T	4 x 30
		c)	H-Gr	6 x 20
		d)	St-Gr	4 x 30
Bagmati Bridge No. 4	60	a)	PC-T	3 x 20
		b)	St-Gr	2 x 30

Note :
 PC-T : Prestressed Concrete T-Girder
 PC-H : Prestressed Concrete Hollow Slab
 H-Gr. : Composite Rolled Steel Girder
 St-Gr : Composite Steel Plate Girder

Alternative plan of each bridge was evaluated taking into consideration the construction and maintenance costs, construction period, environmental consideration etc. and selected the optimum plan as follow:

(a) Bagmati Bridge No. 1 (Kalimati Bridge):

Type of bridge; A multiple span composite steel plate girder bridge (St-Gr)

(b) Bagmati Bridge No. 2 (New Bagmati Bridge):

Type of bridge; Composite steel plate girder bridge (St-Gr)

(c) Bagmati Bridge No. 3 (Chakupat Bridge):

Type of bridge; A multiple span composite steel plate girder bridge (St-Gr)

(d) Bagmati Bridge No. 4 (Koteswor Bridge):

Type of bridge; A 2-span composite steel plate girder bridge (St-Gr)

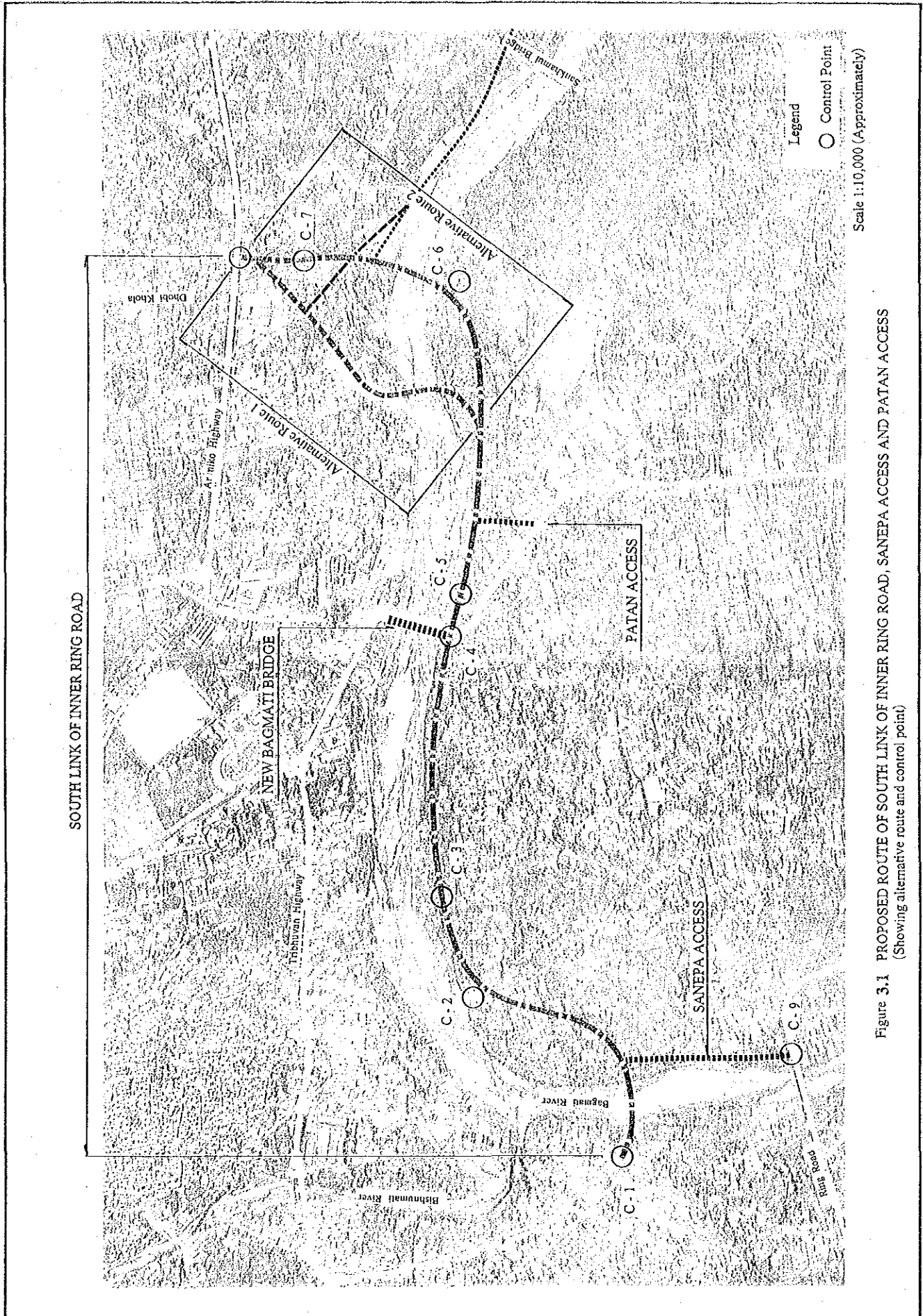


Figure 3.1 PROPOSED ROUTE OF SOUTH LINK OF INNER RING ROAD, SANEPA ACCESS AND PATAN ACCESS
 (Showing alternative route and control point)

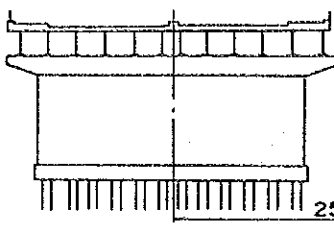
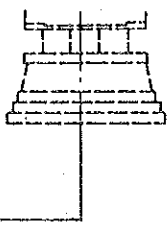
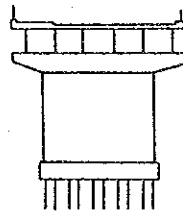
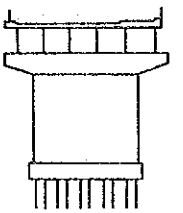
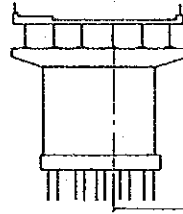
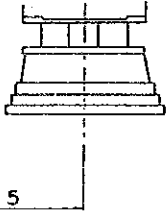
ALTERNATIVES	ELEVATION	
1	<p style="text-align: center;">NEW BRIDGE</p> 	<p style="text-align: center;">EXISTING BRIDGE</p> 
2	<p style="text-align: center;">NEW BRIDGE</p> 	<p style="text-align: center;">NEW BRIDGE</p> 
3	<p style="text-align: center;">NEW BRIDGE</p> 	<p style="text-align: center;">EXISTING BRIDGE</p> 

Figure 3.2 BAGMAT BRIDGE No.2 ALTERNATIVES

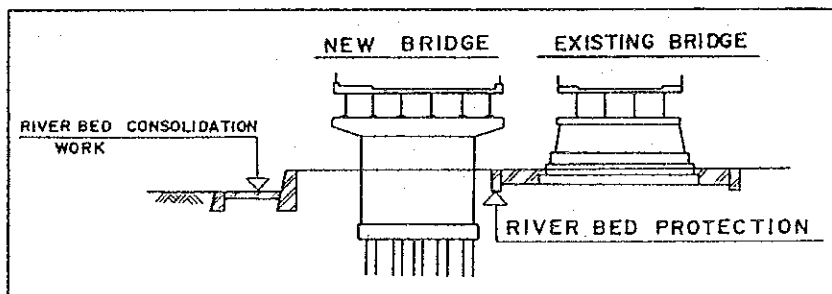
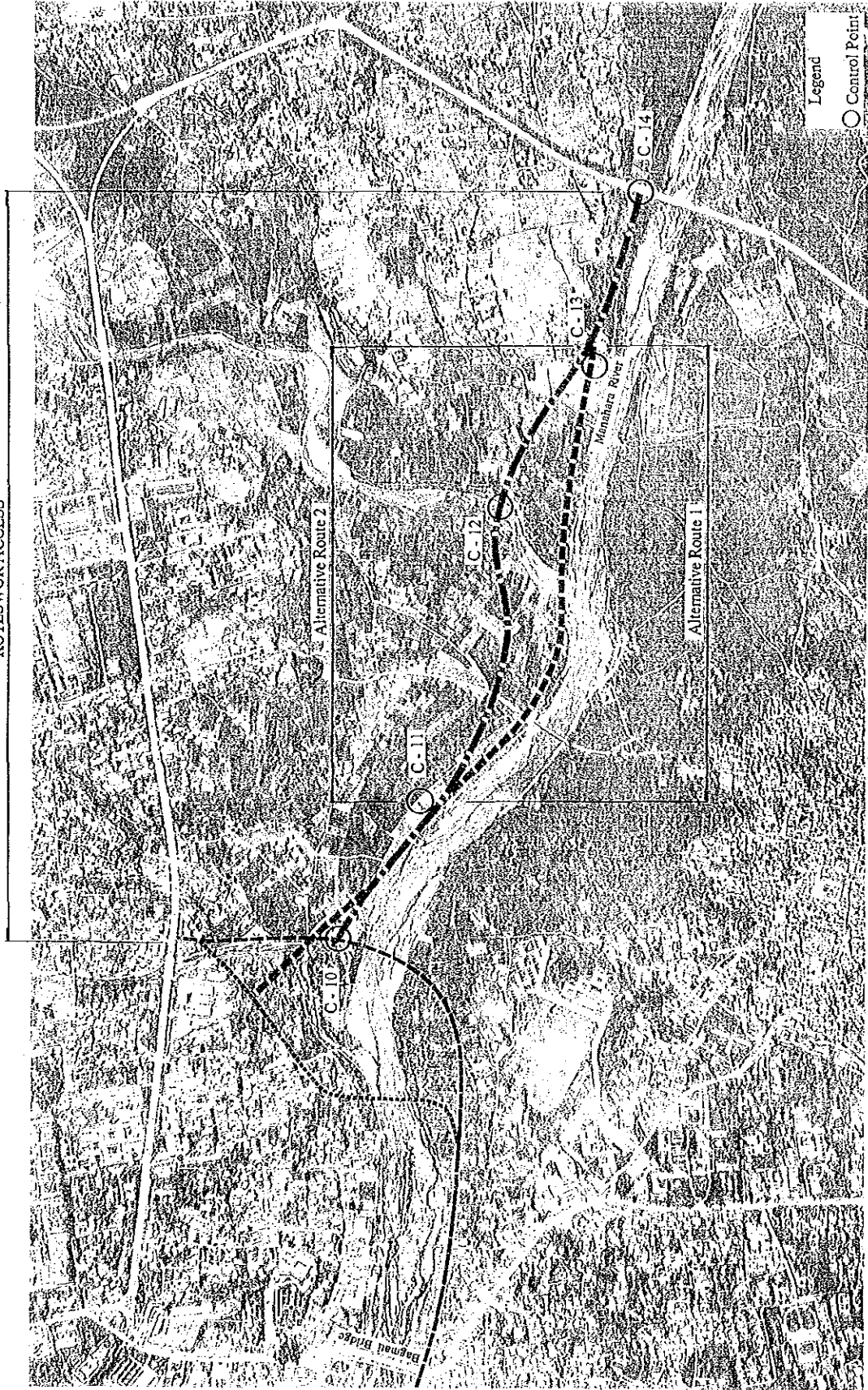


Figure 3.3 BAGMAT BRIDGE No.2 CROSS-SECTION

KOTESWOR ACCESS



Scale 1:10,000 (Approximately)

Figure 3.4 PROPOSED ROUTE OF KOTESWOR ACCESS
(Showing alternative route and control point)

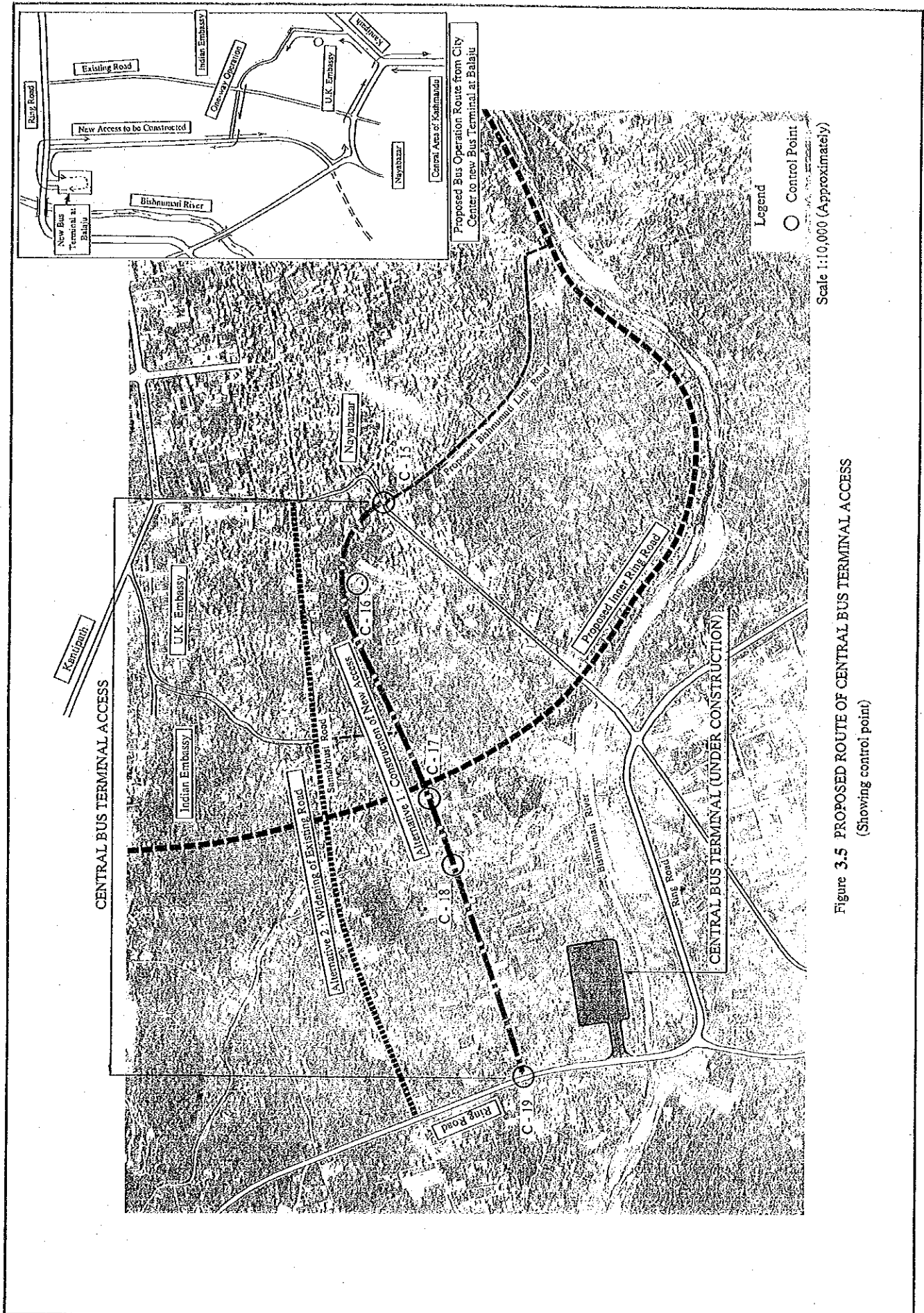


Figure 3.5 PROPOSED ROUTE OF CENTRAL BUS TERMINAL ACCESS
(Showing control point)

