

## CHAPTER 7 LAND-USE SURVEY AND URBAN DEVELOPMENT STUDY

### 7.1 Outline of Land Use and Urban Development Study

#### 7.1.1 Land Use Study

##### (1) Satellite Image Mapping and Analysis

A satellite image map will be prepared from the Quick Bird data (60 cm/pixel, 8-bit) for analysis work of existing land use and population distribution in the Kathmandu Valley. Though comparison between the latest satellite image and the older image, the latest development activities in the valley are known. In addition, the Survey Team reviewed several related studies and surveys done by Nepalese planners or GIS experts.

##### (2) Population Growth Trend

Comparing the census results of 1991, 2001, and 2011 (full report has not been published yet), the population growth trend will be analyzed at least by ward level to know which area are facing development pressure. Moreover, the forecast will be calculated based on the final result of the census in 2011. Until the Survey Team gets final result of Census 2011, the Survey Team will utilize other data such as the District Development Profile of Nepal 2010/2011 with VDC Profile for analysis.

##### (3) Development Project Survey

Since the Apartment Ownership Act in 1997, development activities by the private sector became a big trend in Nepal especially in Kathmandu Valley. Information and data of major development projects are studied through the listing of approved projects, field survey, websites, Google earth, and interview survey.

For the public sector development projects, there are three types of planned development done or ongoing in Kathmandu Valley such as 1) Sites & Services Development, 2) Guided Land Development (GLD), and 3) Land Pooling (LP). The data and information (plan, satellite image) of these development projects will be collected and reviewed for field survey.

##### (4) Field and Interview Surveys on Development Activities

Based on the above mentioned study and review, development activities in the Kathmandu Valley will be investigated by field survey to confirm what type of development projects are ongoing and population volume and density will be examined to estimate future population expansion. The Survey Team conducted series of interviews with developers including the KVTDC, who implement or coordinate development projects in the valley, based on the result of field survey.

#### 7.1.2 Urban Planning Study

##### (1) History of Urban Growth in Kathmandu Valley

To know the urbanization history of Kathmandu Valley, the Survey Team studied important social, economical, and political events which happened in the past.

##### (2) Study on Urban Planning and Development Regulation and Policy

The Survey Team studied the laws, regulations and policy on urban planning and development.

##### (3) Analysis on Issues of Urban Planning Administration

The Survey Team conducted a series of meetings with related ministries and local governments to confirm critical issues of urban planning administration in Kathmandu Valley.

##### (4) Population Projection and Distribution

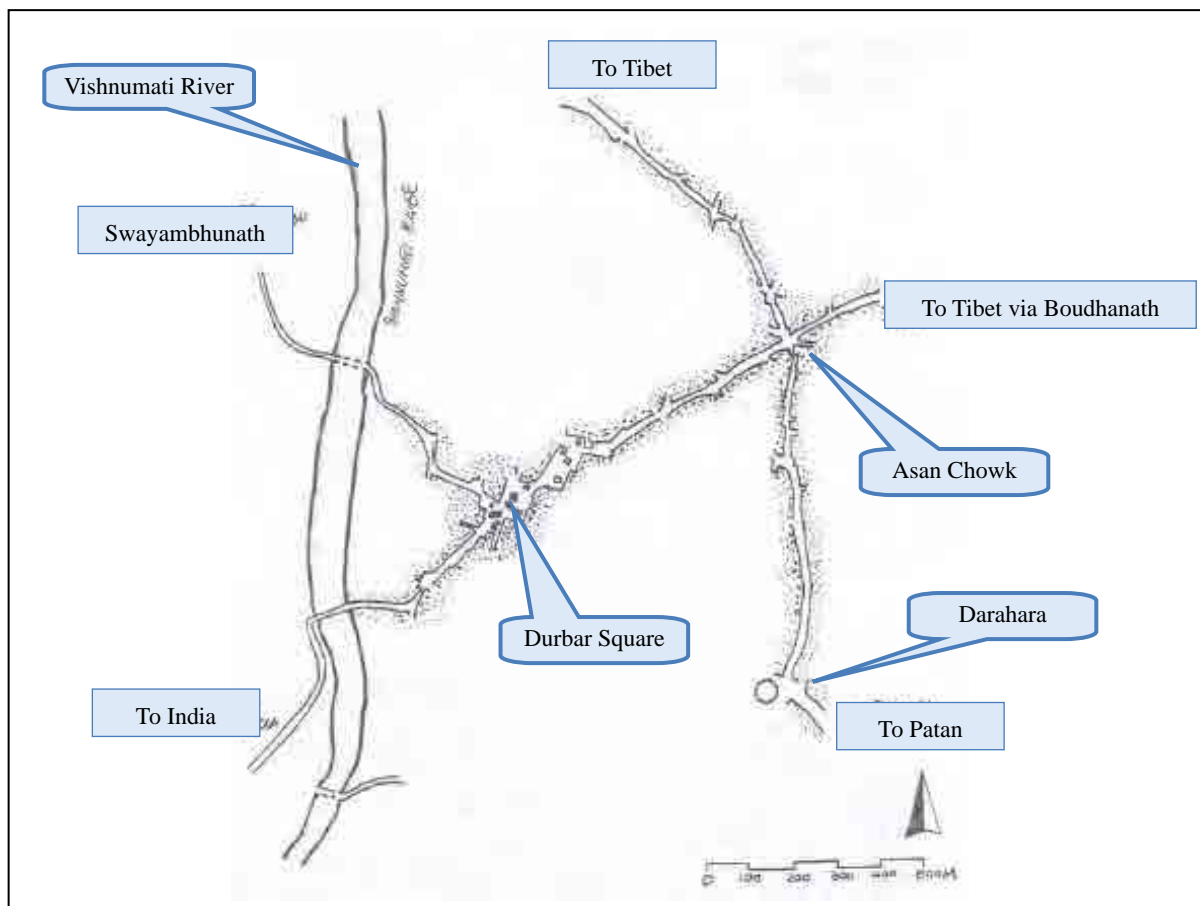
Population of the three municipalities in the valley in 2011 was approximately 2.5 million. The population forecast for 2021 may reach 4 million. The population distribution shall be calculated based on the above mentioned development scenarios to check its volume.

## 7.2 History and Urbanization of Kathmandu Valley

### 7.2.1 History of Kathmandu Valley

#### (1) Ancient History

It has to be mentioned that the history of ancient Nepal is the history of Kathmandu Valley. There are two reasons for this. One is the lack of historical records for other parts of Nepal and the other is that the colourful past of this beautiful valley easily out dazzles what is known about elsewhere. There is also the fact that the name of the country is taken from what Kathmandu used to be known in earlier times – Nepal Valley.<sup>1</sup>



Source: Joshi PS 2004

**Figure 7.2.1 Early Settlement of Kathmandu**

The ancient history of Kathmandu is based in mythology. According to *Swayambhu Purana*, the present-day Kathmandu was once a lake called *Nagdaha*. The hill where the *Swayambu Stupa* rests had lotus plants with beautiful lotus flowers abloom. One story says that the god *Manjusri* cut a gorge at a place called *Kashapaal* (later called *Chobhar Gorge*) with his *Sword of Wisdom* and drained away the waters in order to establish a city called *Manjupattan* which was located midway between *Swayambhu* and *Gujeshwori* (near what is today the Kathmandu Airport), and proclaimed his disciple *Dharmakarma* as the ruler of that city.

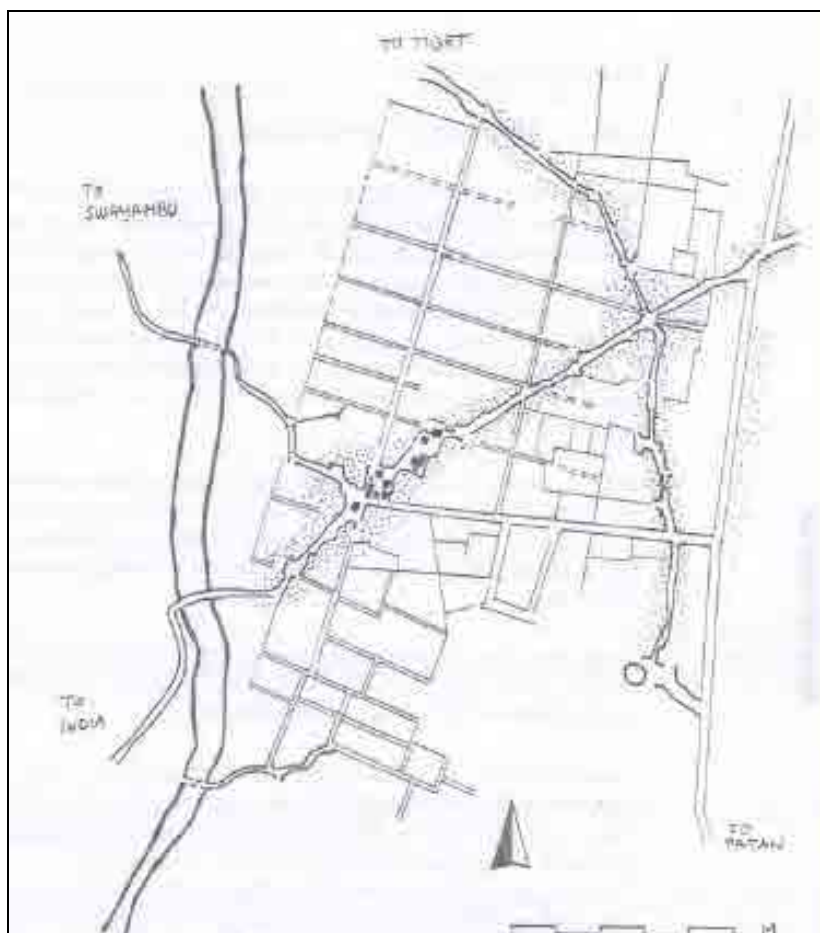
*Gopalraj Vansawali*, a genealogy of Nepalese monarchs, states that *Gopalas*, *Mahispalas*, *Aabhirs* and *Kiratas* had ruled Kathmandu Valley before *Licchavis*. Very few historic records of this era exist.

<sup>1</sup> <http://www.newatravels.com/nepal-2.html>

## (2) Medieval History

During this era, Kathmandu was ruled by *Licchavis* (4<sup>th</sup> to 9<sup>th</sup> century) and *Mallas* (13<sup>th</sup> to 18<sup>th</sup> century). The city grew largely during this time. Most of the historic temples, monasteries, and buildings were built during this era. The city served as an important transit point in the trans-Himalayan trade between India and China.

During the *Lichchavi* era, they brought in the first golden era of Nepalese art and culture. They were also the ones who introduced the Hindu caste system into the valley. Among the 48 *Licchavi* rulers, *Mana Deva I*, who ascended the throne in AD 464, was a ruler of considerable talent and abilities. He consolidated the kingdom in all directions with his powerful army and political tact. Besides this, he was also a patron of the arts. Pagoda-roofed structures came into vogue. Sculptors fashioned exquisite images of their gods and kings. It was during this same period that the *Changunarayan* and other temples were built. Other notable masterpieces include the Reclining Vishnu of *Budhanilkantha*, the gilding of the roof of *Pashupatinath* Temple, the struts of *Hanuman Dhoka* and the *Basantapur* Tower, the *Uku Bahal* in Patan, and the *Indreshwar Mhadev* Temple at Panauti. The *Lichchavi* era was followed by *Malla* era.



Source: Joshi PS 2004

**Figure 7.2.2 Grids Superimposed by Mallas**

During late *Malla* era, the valley of Kathmandu consisted of four fortified cities, namely Kantipur, Lalitpur, Bhaktapur, and Kirtipur, which served as the capitals of *Malla* confederation of Nepal. These states competed with each other on arts, architecture, aesthetics, and trade, which resulted in massive development. The *Newar* people – the indigenous inhabitants of Kathmandu Valley - came to dominate most forms of artistry during this time, both within the valley and throughout the greater Himalayas. Highly sought after, they travelled extensively throughout Asia, creating religious art for their neighbors, as in the case of *Araniko* and the group of artists he led to Tibet and China. The kings themselves were directly involved or influenced construction of public buildings, squares, temples, water spouts, institutionalization of trusts (called *guthis*), codification of laws, writing of dramas, and orchestration of plays in city squares. Influx of ideas from India, Tibet, China, Persia, and Europe,

among others, can be found in a stone inscription of King *Pratap Malla*. Prominent architectural buildings of this era are Kathmandu Durbar Square, Patan Durbar Square, Bhaktapur Durbar Square, former durbar of Kirtipur, *Nyatapola*, *Kumbheshwar*, *Krishna* temple, etc.

### (3) Early Modern Era

The termination of *Malla* Confederation by the *Gorkha* Kingdom in the mid-18<sup>th</sup> century marks the beginning of the modern era. Kathmandu was adopted as the capital of their *Gorkha* Empire, and the empire itself was dubbed as Nepal. During the early phase of this era, Kathmandu saw a continuation of its culture. New buildings in Nepali architecture such as the nine-story tower of Basantapur were built during this era. Trade declined during this era because of continuous wars with neighboring nations. The alliance of *Bhimsen Thapa* with France against Great Britain led to the development of modern military structures in Kathmandu such as modern barracks. The change in policy from anti-British to pro-British during the *Rana* regime saw the first development of western architecture in Kathmandu. The most prominent buildings of this era are *Singha Durbar*, *Kaisar Mahal*, *Shital Niwas*, the *old Narayanhiti Palace*, etc. New Road was the first modern commercial road built during this era.

### (4) Land Use Change in the Modern Era

Urban growth of Kathmandu Valley started through the construction of two highways and the international airport in the 1950s to 1960s. Construction of the Ring Road and radial roads in the 1970s accelerated urban development along these roads. Rapid urban area expansion along the radial road caused encroachment of rich farmlands and the spread of the built-up area without appropriate infrastructure such as service roads, water supply, sewerage, and electricity.

Development activities in recent years were mainly in farmlands located in peripheral area of Kathmandu Valley. Due to economical reasons and weak development control by the local government, most of the development activities were not well-planned.

In the recent past, five to seven thousand buildings were constructed every year in Kathmandu Valley. Most of these buildings were built in the rural area. MOPPW is expecting that 60% of the area of Kathmandu Valley would be urbanized until 2020, with most ignoring the land use plan and building permission procedures.

## 7.2.2 Urban Area Expansion

### (1) Land Use Change in Kathmandu Valley

Land use statistics and transition matrices are important information to analyze the temporal and spatial changes of land use, and examine the driving forces behind those changes. This analysis used satellite image to identify rough land use percentage.

Data processing methods and target area between 1967-2001 results and 2011 result were different, so that the total area and some figures showed different aspects. Especially, the distinction among forests, shrubs and agricultural land was difficult by the satellite image. However, it could set the rough trend in the results.

The clearest trend of land use change is the continuous increase of the urban/built-up areas in the valley. The percentage of urban/built-up area had a noticeable increase, from 3% (2,010 ha) of the total land in 1967 to 25% (16,216 ha) in 2011.

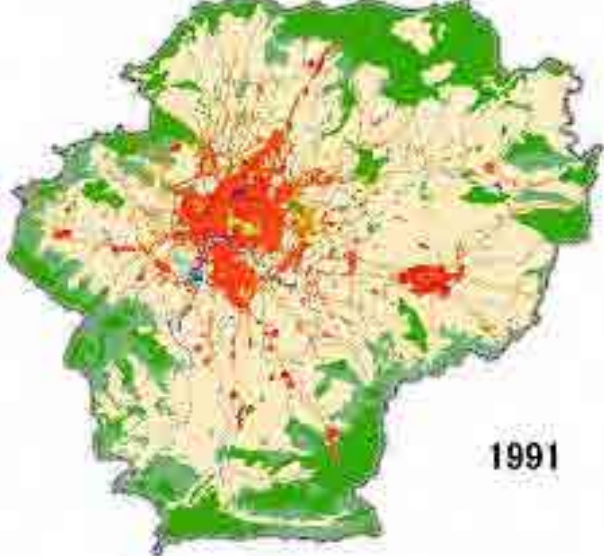
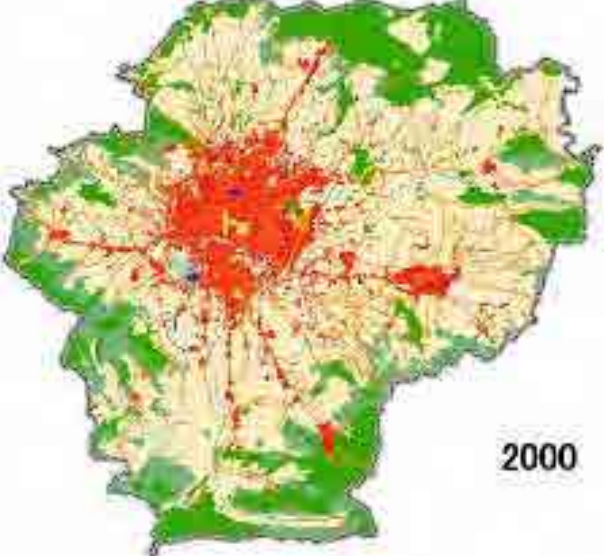
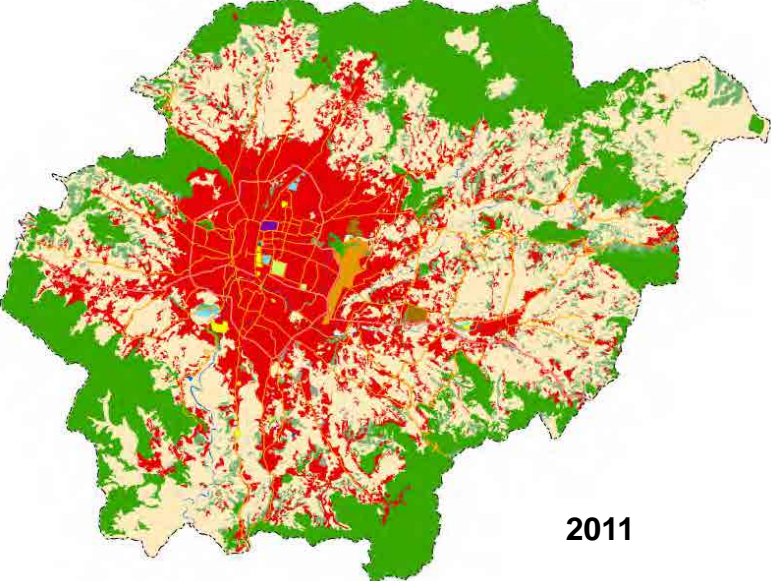
**Table 7.2.1 Land Use Statistics**

Land Use Type	1967		1978		1991		2000		2011	
	ha	%	ha	%	ha	%	ha	%	ha	%
Shrubs	13,563	19.81	12,124	17.71	8,129	11.87	7,150	10.44	33,67	5.13
Forest	15,800	23.08	16,311	23.82	13,887	20.29	13,301	19.43	18,156	27.66
Water	1,337	1.95	1,380	2.02	1,341	1.96	1,266	1.85	235	0.36
Urban/built-up area*	2,010	2.94	3,362	4.91	6,313	9.22	9,717	14.19	16,216	24.70
Open space	100	0.15	95	0.14	135	0.20	171	0.25	105	0.16
Agricultural area	35,648	52.07	35,186	51.40	38,653	56.46	36,853	53.84	27,567	41.99
Total	68,458	100.00	68,458	100.00	68,458	100.00	68,458	100.00	65,646	100.00

\*Includes built-up areas, industrial areas, roads, airport, institutional areas, government secretariat areas and the Royal Palace.

Source: Thapa & Murayama 2009 (1967-2000) and JICA Survey Team 2012 (2011)

Land Use Map	Remarks
	<ul style="list-style-type: none"> <li>• Kathmandu urban area was limited between two rivers, Bishnumathi and Dhobi Kola.</li> <li>• The urban/built-up areas in the valley were 2,010 ha, 2.94% of the total land in 1967.</li> <li>• Agricultural area was 52% of the total land.</li> <li>• Forest and shrub area were 23% and 20%, respectively.</li> <li>• 1956: Tribuvan Highway opened.</li> </ul>
	<ul style="list-style-type: none"> <li>• 1970s: Ring Road constructed.</li> <li>• The urban/built-up areas increased by 1,352 ha. Percentage of urban/built-up areas was changed from 2.9% to 4.9% of the total land in 1978.</li> <li>• Built-up area expanded west of Dhobi Kola and Patan.</li> <li>• Agricultural land and shrub decreased by 463 ha and 1,439 ha, respectively.</li> </ul>

 <p style="text-align: right;"><b>1991</b></p>	<ul style="list-style-type: none"> <li>▪ Most of the area within Ring Road was changed to built-up area.</li> <li>▪ The urban/built-up areas increased by 88% from 3,362 ha (4.9%) to 6,313 ha (9.2%). The difference is 2951 ha. Agricultural area also increased by 3,466 ha from 1978 to 1991.</li> <li>▪ At the same time, shrubs area decreased by 3,995 ha and forest area also decreased by 2,424 ha. It was a significant reduction compared to other periods.</li> </ul>
 <p style="text-align: right;"><b>2000</b></p>	<ul style="list-style-type: none"> <li>▪ The urban/built-up areas increased from 9.2% in 1991 to 14.2% of the total land in 2000. The area increased to 3,404 ha.</li> <li>▪ The urban/built-up areas expanded mainly inside and at the out fringes of the Ring Road and along major roads in the valley.</li> <li>▪ During this period, agricultural area, shrubs and forest area decreased by 1,800 ha, 979 ha and 586 ha, respectively.</li> </ul>
 <p style="text-align: right;"><b>2011</b></p>	<ul style="list-style-type: none"> <li>▪ Certain distances outside from the Ring Road were changed into urban/ built-up area. Especially, northern part showed significant expansion.</li> <li>▪ Certain areas along the feeder roads were developed.</li> <li>▪ The eastern area of the airport to Bhaktapur was developing as well.</li> </ul>

Source: Thapa & Murayama 2009, JICA Survey Team

**Figure 7.2.3 Land Use Change in Different Periods**

### 7.2.3 Population Growth in Kathmandu Valley

#### (1) VDC and Ward-level Population

The Government of Nepal conducted the 2011 Census survey in June 2011. Preliminary result was published in September 2011. However, the data is just district base summary only. The VDC level detailed census data is expected to be publicized in 2013.

To estimate VDC and ward-level population in 2011 and for future population projection, the JICA Survey Team utilized the data from the District Development Profile of Nepal 2011/2011 published by Mega Publication & Research Center in December 2010. This information was helpful before the publication of the detailed census data.

#### (2) Change of Population Growth Rate

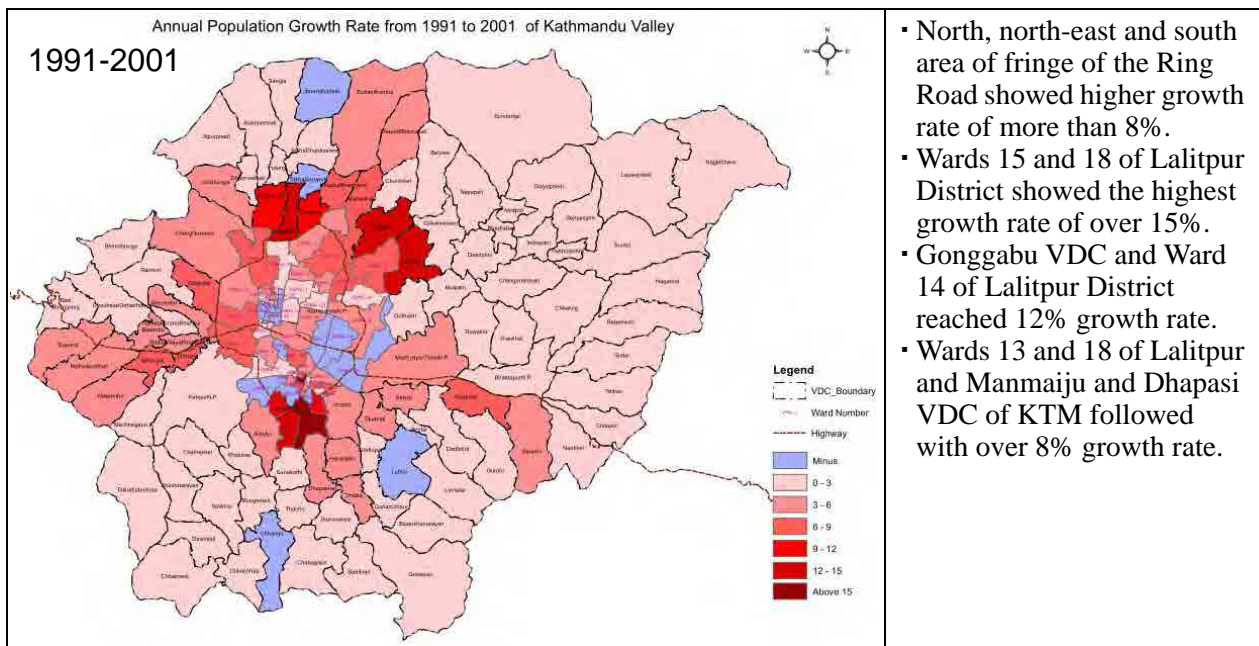
Annual population growth rate at the VDC and ward levels from 1991 to 2001 and from 2001 to 2011 are shown in the maps of Figure 7.2.4 and Figure 7.2.5 below.

During these two decades, population growth in the northern and southern areas outside of the Ring Road showed high growth rate of over 8% per annum. Other areas along the Ring Road and two highways also showed higher growth.

On the other hand, some wards showed continuous decrease in the core area, such as wards 23, 24, 27, and 30 around the Kathmandu Durbar Square.

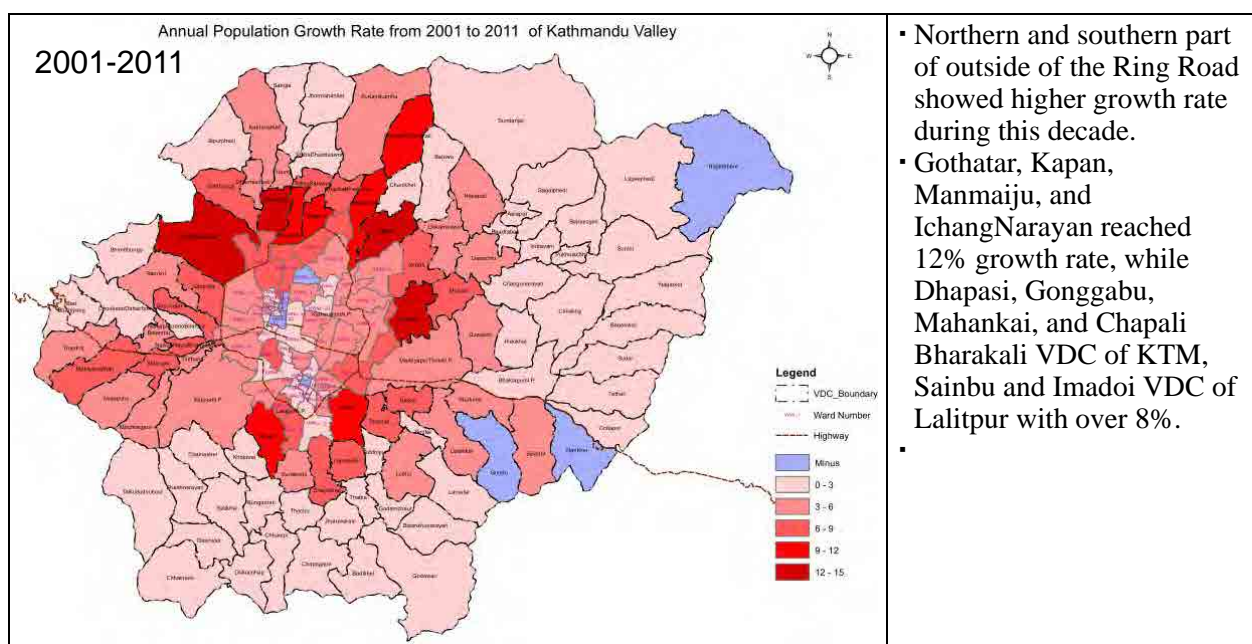
Although the population growth trend may continue during the next decade, higher population growth VDCs might be spread out with certain distance from the Ring Road such as the eastern area of the airport, and the north fringes or southern part of the valley. However, these are just expected figures made from unplanned population growth without any development concept or vision of the valley.

Governmental bodies of the Kathmandu Valley should draw up the development vision with specific development programs as soon as possible.



Source: JICA Survey Team

**Figure 7.2.4 Population Growth Rate in Kathmandu Valley (1)**



Source: JICA Survey Team

**Figure 7.2.5 Population Growth Rate in Kathmandu Valley (2)**

### (3) Changes in Population Density

The average population densities of each district are shown below. Kathmandu District showed the highest population density among the three districts, and Lalitpur District followed. Average population growth rate of the valley has been over 4.0% since 1991.

The population density of Kathmandu Municipality increased from 85% in 1991, 136% in 2001 to 204% in 2011.

**Table 7.2.2 Population Densities of Districts and Municipalities (persons/ha)**

	1991 Population Density	2001 Population Density	2011(Estimate) Population Density	2022 (Projection) Population Density
<b>Bhaktapur District</b>	14.1	18.2	25.5	36.4
Bhaktapur N.P.	93.2	110.6	128.0	150.1
MadhyapurThimi N.P.	28.7	43.0	75.8	141.6
<b>Lalitpur District *</b>	18.7	24.7	35.7	58.0
Lalitpur N.P.	77.3	107.6	148.9	208.3
<b>Kathmandu District</b>	16.2	25.7	44.1	78.9
Kathmandu N.P.	84.8	135.9	203.6	317.6
Kirtipur N.P.	21.2	27.7	44.8	76.0
<b>Total *</b>	16.2	24.1	37.6	67.2

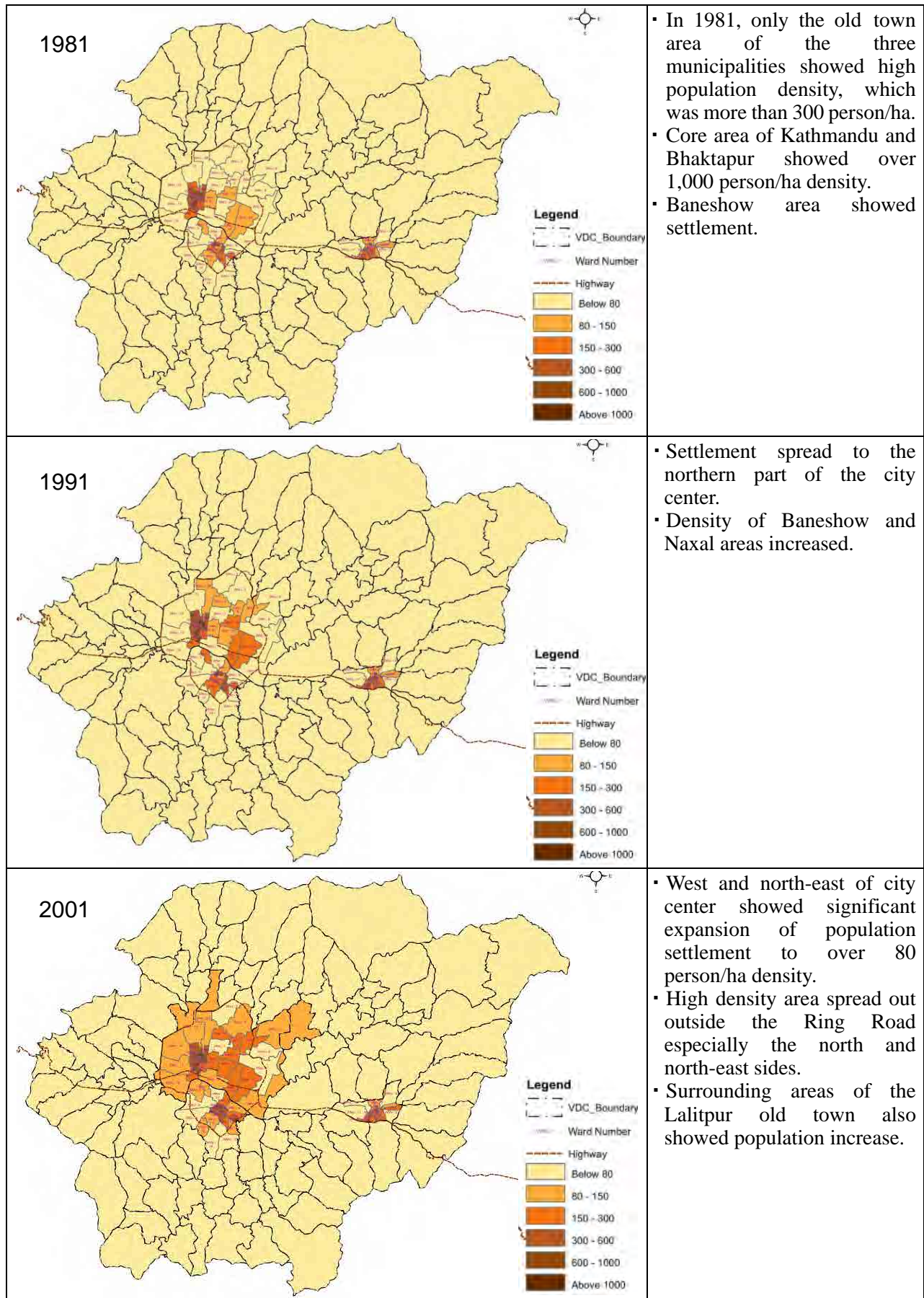
(\* This data does not include those outside of the valley, which is the southern part of Lalitpur District.)

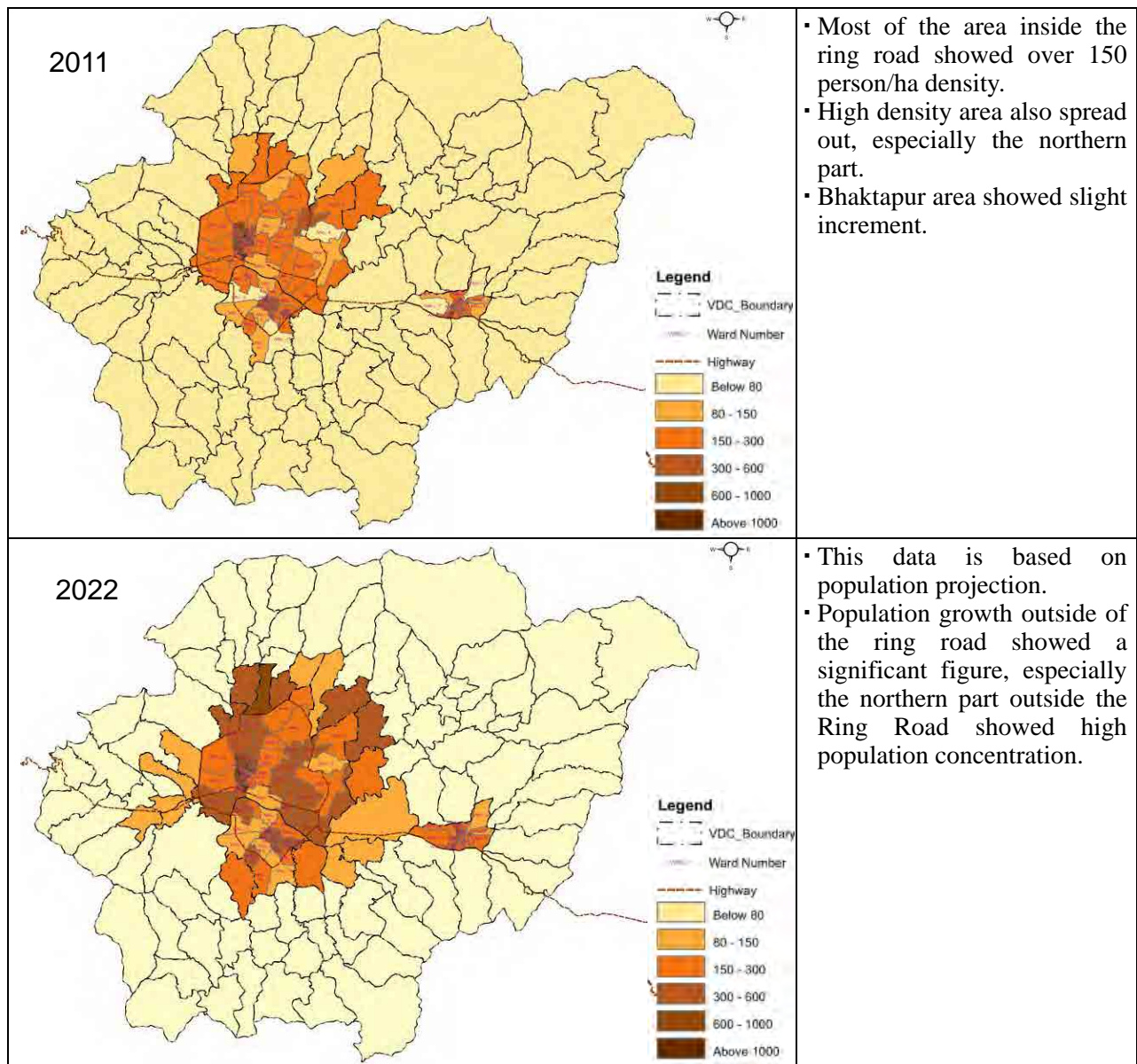
Source: Census & JICA Survey Team

The population density maps at the VDC and ward levels are shown below describing the population growth trend in Kathmandu Valley.

Major population settlement was within the Ring Road in 1991. But in 2011, in most of the areas inside of the Ring Road, population density has jumped up to more than 160 person/ha and some areas reached 200 person/ha. Population density outside of the Ring Road also went up to over 80 person/ha.







Source: JICA Survey Team

**Figure 7.2.6 Population Density in Kathmandu Valley**

#### 7.2.4 Typical Population Density in Kathmandu Valley

In Kathmandu Valley, there are several types of development patterns that can be seen.

The most characteristic type is the old town area around Durbar Square. This area has over 1,000 person/ha population density. Buildings stand right up next to each other and have common squares. Streets and squares are connected to each other like a web by passage.

Surrounding areas of old town has over 600 person/ha density. Newly developed areas with small size plot showed about 300 person/ha population density, while areas with large plot size showed around 150 person/ha.

Regarding the distribution of the increasing population, the land use plan should consider population density together with land use zoning. During the future M/P study, it should be discussed among certain stakeholders.

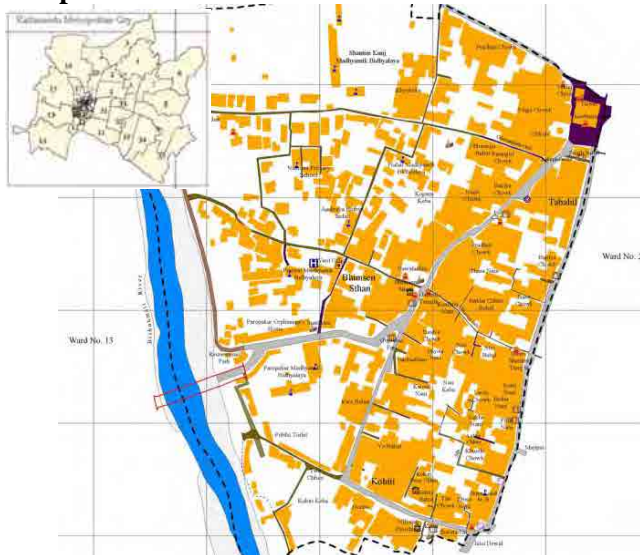
**1,000 person/ha:**



Ward No.27 of KMC (Asan, Indrachowk)  
 1,014.7 person/ha (7,712 persons, 7.6 ha)



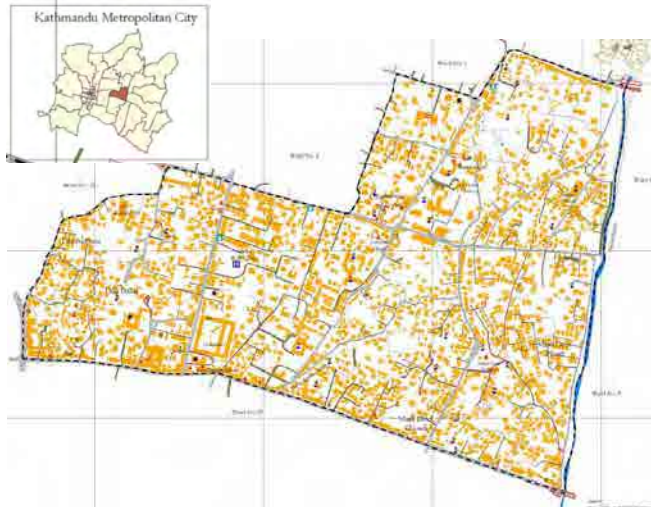
**600 person/ha:**



Ward No.20 of KMC (Bhimsen Sthan)  
 674.8 person/ha (10,595 persons, 15.7 ha)

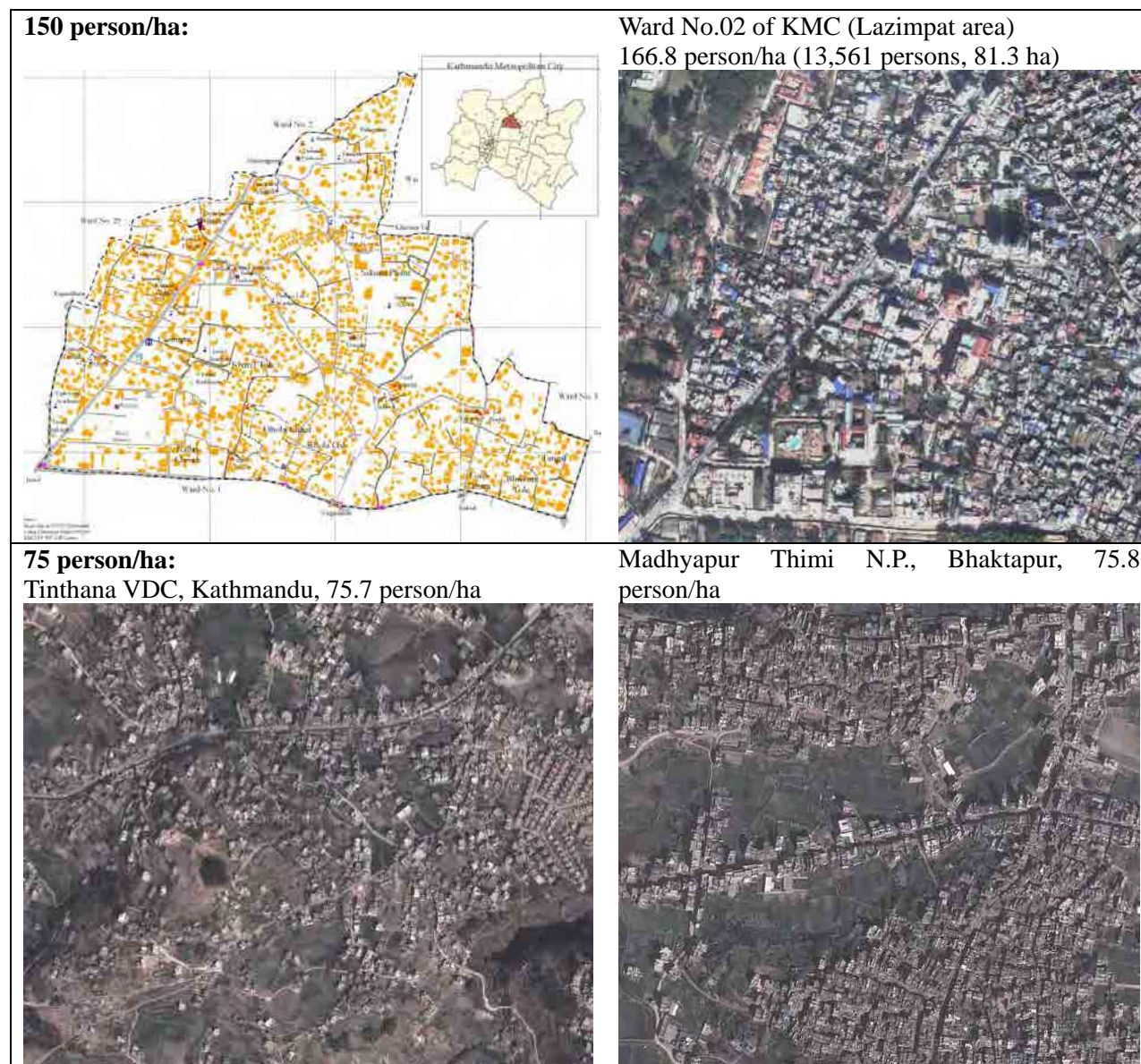


**300 person/ha:**



Ward No.33 of KMC (Dhili Bazar area)  
 317.4 person/ha (27,203 persons, 85.7 ha)





Source: KMC, JICA Survey Team

**Figure 7.2.7 Typical Population Density in Kathmandu Valley**

Population density of major cities in the world are summarized below. High-density Asian cities' population density is over 250 person/ha.

**Table 7.2.3 Population Density of Major Cities in the World**

	City	Country	Area (sq km)	Population (million)	Population Density (person/ha)	Highest Density (person/ha)
Asia	Manila	Philippines	38.6	1.66	430.8	
	Dhaka	Bangladesh	324	11.17	350.0	
	Macau	China	21	0.56	273.1	600.0
	Mumbai	India	777	20.90	271.0	
	Kolkata	India	185	4.49	242.5	
	Jakarta	Indonesia	740.3	9.58	144.6	
	Tokyo Metro	Japan	622	8.95	143.8	218.7
	Osaka	Japan	222	2.67	119.9	200.0
	Kuala Lumpur	Malaysia	243.7	1.63	67.0	
Other	Paris	France	105	2.167	205.6	249.3
	Monaco	Monaco	1.95	0.03	165.5	
	London, GB	England	1,579	7.55	47.8	162.0

Source: UN 2009–2010 Demographic Yearbook, Wikipedia

## 7.2.5 Suitable or Unsuitable Land for Development in Kathmandu Valley

### (1) River Bed Protection

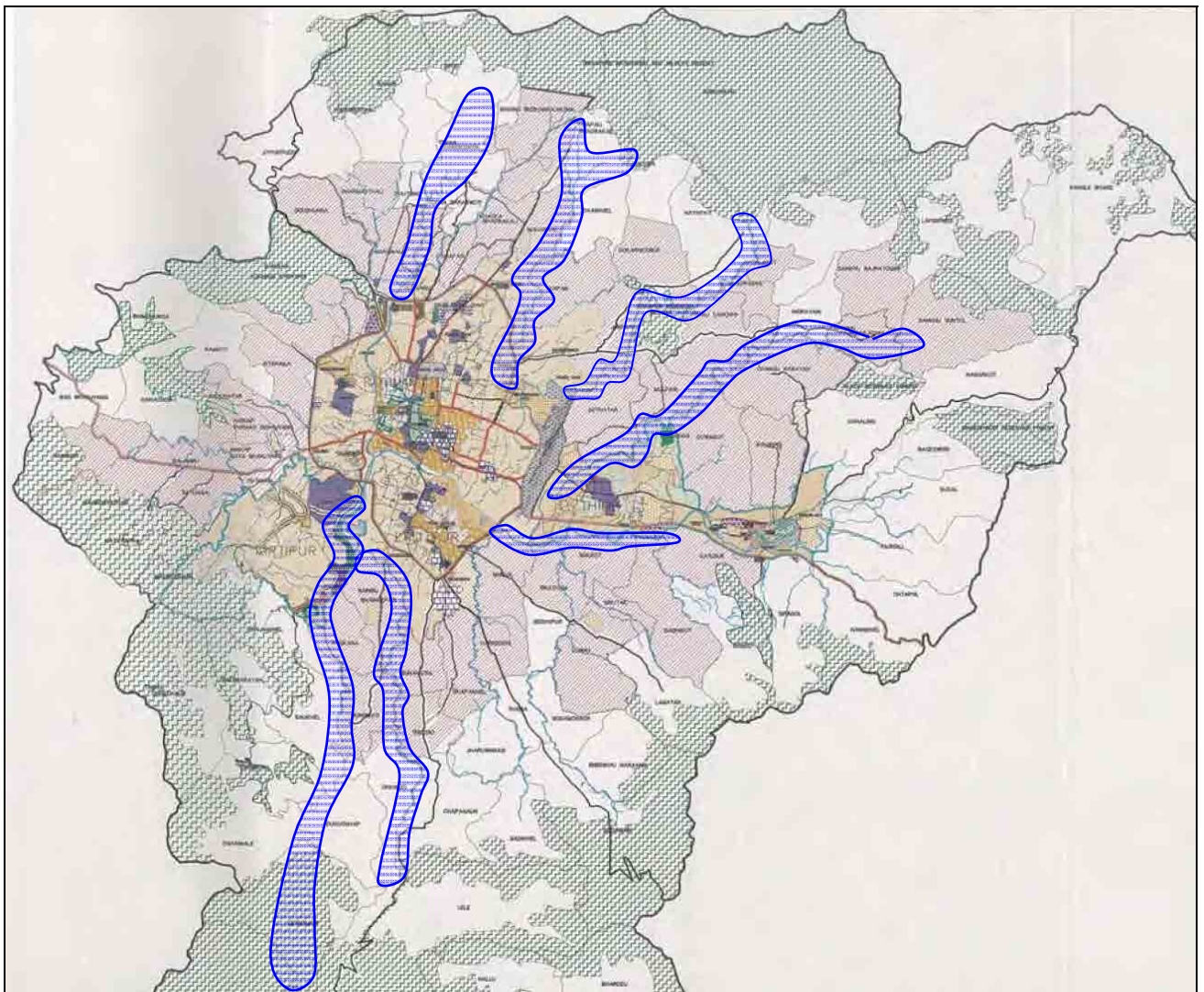
In the Land Use Zoning Plan in the KVBB 2007, the river bed is designated as Urban Expansion Zone together with its surrounding areas. This Urban Expansion Zone is identified as the same as the Urban VDC. It is not a land use plan.

Certain width of the river bed, especially outside of the Ring Road, should be protected from urbanization activities as a Green Zone or Agricultural Zone. These rivers are the Sangla Khola, Dhobi Khola, Manahara Khola, Hanumante Khola, Nakhu Khola, and Bishnumati.

River bed area is usually lower than other areas, thus, these areas can suffer from flooding after a heavy rainfall.

The ground of the river bed is usually not firm enough to resist earthquake. For this reason, these areas are not suitable for urban development. A JICA report in 2002 stated some possibility of liquefaction along Bagmati River.

This kind of wide open space can be used as evacuation areas after disaster.



Source: KVTDC, JICA Survey Team

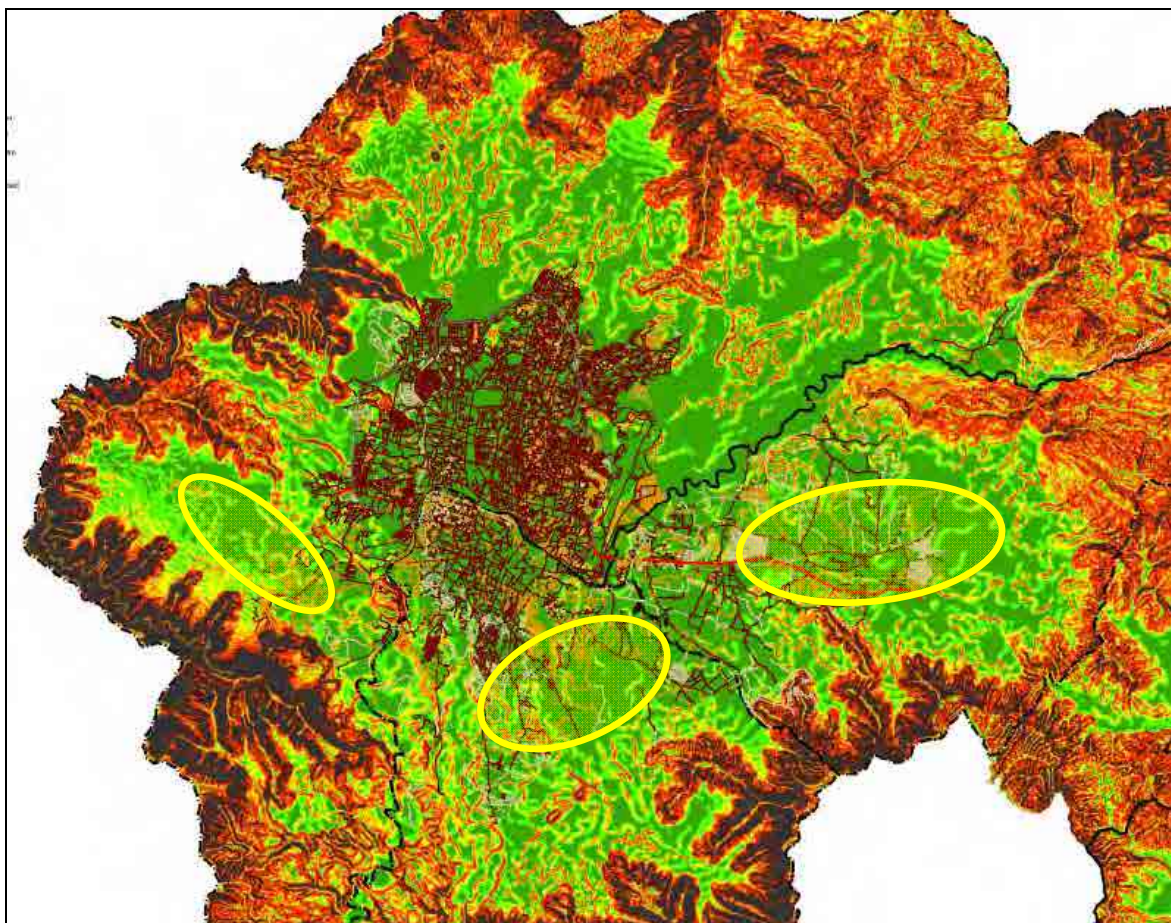
**Figure 7.2.8 Protection Area from Urbanization along Rivers**

## (2) Land Inclination

The figure below shows land inclination in color. Green color indicates inclination of 0 to 4 degrees and yellow green color indicates 4 to 8 degrees. In general, land inclination of up to 8 degrees can be suitable for urban development.

Urban development at steep slopes has the risk of landslides during heavy rain or earthquake. The JICA Report 2002 described the possibility of slope failure in the figure shown below. Geomorphologically, Kathmandu Valley is roughly divided into two areas: 1) a mountainous area surrounding the valley, and 2) a gentle area (easy slope land) in the centre of the valley. In the mountainous area, the slope areas have high possibility of slope failure. In the gentle area, narrow zones of steep slopes are seen along the edge of terrace surfaces. The potential hazard was determined on the basis of the relative height of the terrace surface.

In Kathmandu Valley, the gentle area near the Ring Road is already developed. Many, outside of such areas, are divided into small piece by rivers. However, some areas have certain extent for urban development, which is shown in the map in Figure 7.2.9.



Source: JICA Survey Team

**Figure 7.2.9 Possible Areas for Large-scale Urban Development**

## 7.3 Institutional and Legal Framework

### 7.3.1 Institutional Frameworks

#### (1) Two Line Ministries on Urban Development in the Valley

There were two ministries – the Ministry of Physical Planning and Works (MOPPW) and Ministry of Local Development (MOLD) - directly involved in urban development.

The MOPPW was the line agency responsible for policy development, physical development plans, building regulations and standards. The Department of Urban Development and Building Construction (DUDBC) and the Department of Water Supply were separated from MOPPW, and then established the Ministry of Urban Development (MOUD) in April 2012.

The MOLD is responsible for the administrative and personnel management function of the local government, consisting of the municipalities and Village Development Committees (VDCs).

##### 1) MOUD, DUDBC, and KVDA

The MOUD formulates plans and policies regarding investments in infrastructure development, while it is the MOLD's responsibility to oversee local governance. The DUDBC is an implementation body under the MOPPW responsible to mobilize the capital for investments in infrastructure. Similarly, the Town Development Fund (TDF) under the same ministry has also been set up as an autonomous body to provide financial and technical support for infrastructure and revenue-generating activities in municipalities. It mobilizes grants and loans. The Town Development Committees (TDCs) under the MOPPW can also carry out urban development-related activities at the local level.

Through its DUBDC, urban development plans and programs in Nepal are implemented.

##### 2) MOLD, Municipalities, and VDCs

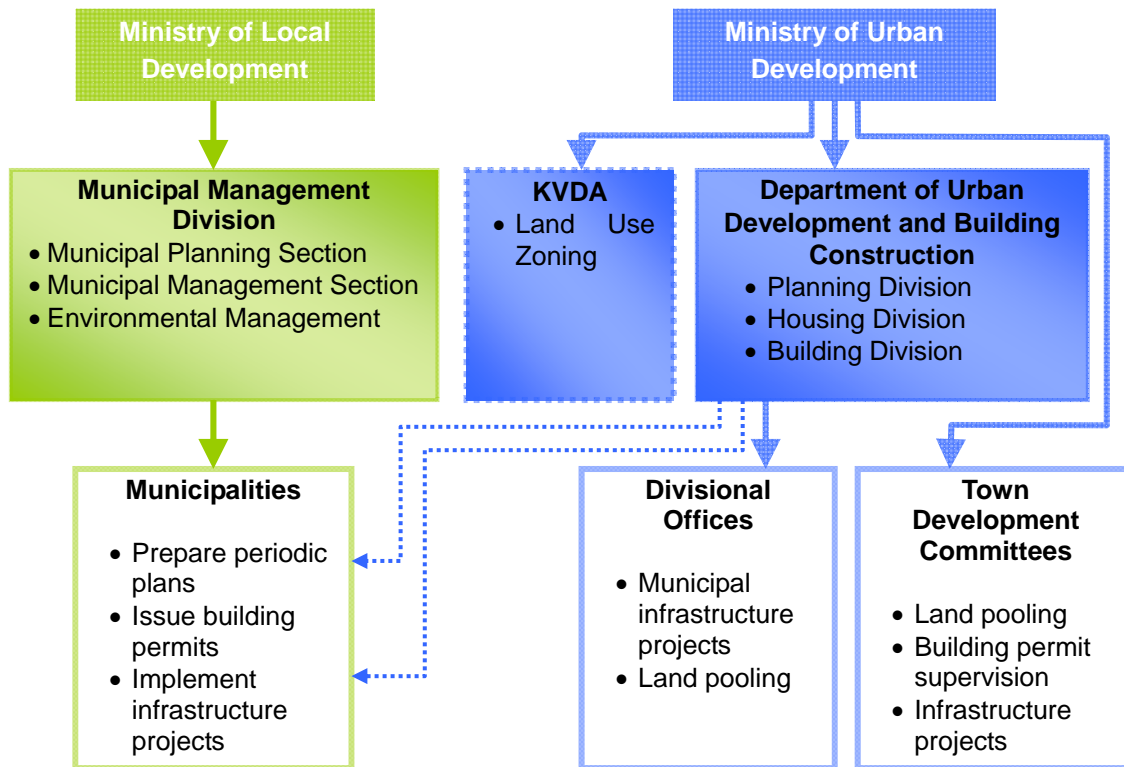
The municipalities are under the MOLD. The Local Self-Governance Act has authorized the local bodies to formulate and execute development plans at the local level. Therefore, municipalities also get a certain amount of budget from the district authorities. Other than these urban actors, various other departments/divisions related to roads, water supply, electricity, environment, and health also form and execute plans on the development and management of related infrastructures.

The entire ministry supports and encourages all the local bodies – District Development Committees (DDC), municipalities, and the VDCs – to prepare their own periodic plans.

#### (2) KVTDC and the Municipalities in Kathmandu Valley

The Kathmandu Valley Town Development Committee (KVTDC) was established through the Town Development Act 1988 under the Ministry of Physical Planning and Works (MOPPW). Its basic objectives are to develop the entire Kathmandu Valley in a planned manner, to formulate and implement physical development plans, and to provide the people of the valley with basic services. It is a unique institution in Nepal with its own legal identity and authority over more than one district. The GON is planning to upgrade KVTDC's status to ministry level to have stronger administrative power.

The KMC and other municipalities in the valley are also key players to govern in the Kathmandu Valley. The donor community tries to empower municipalities' capacity through various projects based on their decentralization policy.



Source: UN-Habitat, 2010

**Figure 7.3.1 Relation between MOPPW and MOLD**

### 7.3.2 Legal and Regulatory Framework

#### (1) Town Development Act (1988)

The *Town Development Act* (TDA) is intended to facilitate the reconstruction, development, and expansion of urban areas throughout Nepal, by means of a series of measures giving municipalities and town councils the authority to (among others): i) prepare and enforce land-use plans and building by-laws; ii) demolish any non-permitted works; iii) freeze land transfers for a period of up to two years; and iv) undertake guided land development, land pooling and sites and services programs with the consent of 51% of property owners.

At the same time, the MOPPW submitted the *Draft Kathmandu Valley Development Authority Act* to the cabinet to establish an authority to manage urban planning and development in the valley, however, it was not approved.

Thus, the TDA provides the legal basis for the establishment of the KVTDC within the MOPPW. However, in undertaking development control and monitoring activities, the KVTDC can only act with the collaboration of the local government, which reportedly is not always forthcoming.

#### (2) Local Self-governance Act (1999)

The *Local Self-governance Act* of 1999 is Nepal's decentralization act, giving municipalities and VDCs the authority to raise funds by taking loans and levying taxes, and carry out town development plans and housing programs.

#### (3) Kathmandu Valley Development Authority Act (2012)

After the revised Kathmandu Valley Development Authority Act was promulgated in March 2012, the Kathmandu Valley Development Authority was established by reorganization of KVTDC in April 2012.

The objectives of KVDA are presented below.



- To develop the Kathmandu Valley as the administrative, tourism, and economic center of the country,
- To reconstruct and expand the cities as well as construct new cities,
- To determine the land use zone for physical development, and
- To provide effective services for the people.

To fulfill the above objectives, the government has managed to form the following two committees:

- Kathmandu Valley Physical Development Committee
- Management Committee

The members of the Kathmandu Valley Physical Development Committee are related ministries' ministers and secretaries, chief persons of the District Development Committees, chief of municipalities and development commissioners.

The members of the Management Committee are chiefs of municipalities, chiefs of related departments, governmental authorities, and corporations.

#### **(4) Building Act (1997), National Building Code (1996), and Kathmandu Valley Building By-laws (2007)**

*The Building Act of Nepal* was enforced in 1997, applicable for all municipalities and villages in Nepal. *Building Act (1997)* has categorized all buildings into four types according to the standards in the *Nepal National Building Code*.

The extensive *Nepal National Building Code* has 23 volumes, which cover all above categories of buildings, approved by the cabinet in 2003. Municipalities and Village Development Committees can issue building permits. Monitoring of all categories of building should be done by the municipalities and Town Development Committees.

Besides the building code, there are *building by-laws* in each municipality. As per the *Local Self-Governance Act (1999)*, municipalities are given authorities to prepare and implement building by-laws in their respective areas. The *Kathmandu Valley Building By-laws (2007)*, which for the municipalities in Kathmandu Valley and emerging towns, have been revised in 2007 to accommodate the changing urban context of the valley, these changes included plot ratio, ground coverage, and set back.

*The Ancient Monuments Conservation Act (1957)* also stipulates historical conservation areas and regulates building codes for the area.

#### **(5) Apartment Ownership Act (1997) and Apartment Ownership Regulation (2003)**

Promulgation of the *Apartment Ownership Act (1997)* paved the way for the private sector to intervene into the housing sector. It covers a wide range of ownership rights, rights of customers, operational management, buyer's duties, and developer's liabilities. It is compulsory to form a user committee of apartment owners for the proper operation and maintenance of the apartments and their premises.

### **7.3.3 Policy on Urban Development**

#### **(1) Neglected Sector in the National Plans (UN-HABITAT, 2010)**

Budget allocation for housing and urban development hardly exceeded 1% and was included within the 'other social service' heading in the periodic plans of Nepal. Despite the significant role being played by the urban sector in the national economy, it was never accorded high priority in the periodic allocation of national resources (see Table 7.3.1)

**Table 7.3.1 Allocation of Government Resources under Different Periodic Plans Since 1956**

Five-Year Plan (FYP)	Total Budget (NPR million)	Budget in Housing & Urban Planning (NPR million)	Budget in Housing & Urban Planning (USD thousand)	(% of Total Budget)
First FYP (1956-61)	33	-	-	-
Second Three YP (1962-65)	60	-	-	-
Third FYP (1965-70)	250	-	-	-
Fourth FYP (1970-75)	354	38	430	10.7%
Fifth FYP (1975-80)	919	170	1910	18.5%
Sixth FYP (1980-85)	2,175	25	280	1.1%
Seventh FYP (1985-90)	29,000	158	1,780	0.5%
Eighth FYP (1992-97)	113,479	2,304	25,900	2.0%
Ninth FYP (1997-02)	18,958	175	1,970	0.9%
Tenth FYP (2002-07)	234,029	1,126	12,660	0.5%
Eleventh Interim Plan (2007-10)	45,630	600	6,745	1.3%

Source: JICA Survey Team, UN-HABITAT, 2010

The Seventh Five-Year Plan (1987-92) included urbanization as a separate policy component. During the same time, the Local and Urban Development Training Centre (LUDTC) and Town Development Committees (TDCs) were also set up. The Town Development Fund was also established in 1988.

The Eighth Five-Year Plan (1992-97) considered urban development as a contributing factor to the national economy. The National Shelter Policy, approved in 1996, took initiatives for the development of the housing sector. Similarly, the Town Development Act 1998 incorporated legal provisions for land development. It was in 1997, with the formation of the Apartment Act, that Nepal initiated the concept of group housing for the management of urban population. The Local Self-Governance Act (LGA) 1999 empowered local bodies to undertake and execute development plans at the local level.

## (2) National Urban Policy (2007)

The National Urban Policy (NUP) dated June 2007 and prepared by the MOPPW/DUDBC, attempts to address the considerable challenges apparent in the urban sector at present in an integrated and well-coordinated manner. Hence, it is considered an important guiding urban sector policy initiative.

The NUP has three main objectives:

- 1) **To develop a balanced national structure:** in which all regions are self-reliant, through the provision of support for sustained development and poverty reduction, and the careful and equitable allocation of investment.
- 2) **To develop a clean and safe urban environment:** as a means of improving the quality of life of urban residents.
- 3) **To make urban management effective:** by institutionally and legally strengthening local bodies as well as by developing coordination and support between different urban sector institutions.

In order to achieve these objectives, the NUP sets out a number of different strategies and supporting policies. NUP strategies that are directly relevant to the Kathmandu Valley urban (land use and transportation) sectors include:

- 1) Linked to Objective 1: (Balanced National Urban Structure);
  - Conservation and development of Kathmandu Valley into a political, cultural, and tourism centre;
  - Encouragement of development activities that do not comply with the policy in other urban centers outside the Kathmandu Valley; and
  - Promotion and strengthening of rural-urban linkage.
- 2) Linked to Objective 2: (Clean and Safe Urban Environment):
  - Guidance and assistance to local authorities in carrying out urban development activities

- according to approved plans, through the provision of necessary support and motivation;
  - Encouragement of less environmentally-polluting forms of public transportation;
  - Conservation of cultural, historical, and social characteristics of urban areas while executing urban development activities;
  - Development of a local urban management system, based on an integrated and collective vision.
- 3) Linked to Objective 3: (Effective Urban Management):
- Establishment of the local authority as a focal body for implementation of urban development plans and strengthening of their institutional capacity;
  - Capacity building of central government institutions involved in the formulation and implementation of urban planning; and
  - Development of the necessary legal and institutional tools to implement an integrated urban planning and monitoring system.

### (3) Kathmandu Valley Long-term (2002-2020) Development Concept (KVLTD)

The KVLTD was prepared in 2002 by the MOPPW/KVTDC, and remains the guiding framework for most of the government's urban development planning and investment in Kathmandu Valley, including the proposal for the formation of a higher authority for urban development of the valley.

The KVLTD is a comprehensive document, which includes the following:

- 1) A historical background to development of the valley;
- 2) Survey and analysis of existing (2001/2) demographic, land use, economic activity, infrastructure, public services, environmental, and cultural conditions;
- 3) Proposed planning standards and guidelines, including those for land use and residential density; and
- 4) Projections of the likely future demand for land. The KVLTD concludes with a concept plan for the Kathmandu Valley through to 2020.

Those of special significance to the urban development sector in Kathmandu Valley are summarized below:

**Table 7.3.2 Summary of Kathmandu Valley Long-term (2002-2020) Development Concept**

Population Growth/ Distribution	From an estimated baseline population in 2001 of approximately 1.57 million, the population of Kathmandu Valley is projected to increase to just over 2.0 million by 2011, almost 2.6 million by 2021, and almost 3.34 million by 2031. By 2031, around 68% of the valley population will be living in Kathmandu District. By 2031, almost 80% of the population will be living in municipal areas, up from 61% in 2001.
Economic Growth	The KVLTD noted the rise of labour-intensive manufacturing industries such as carpet, bricks, and tile making which had contributed to the rapid deterioration of air and water quality throughout the valley. Although recognizing the value of these manufacturing activities, the future development strategy set out in the KVLTD envisaged the promotion of non-polluting economic activities as a way of reversing this trend. This includes promotion of tourism and high-tech industries, as well as urban agricultural activities.
Land Use	The KVLTD noted that due to the continuing rapid rate of urbanization, there had been considerable and increasing conversion of agricultural land in recent decades. Urbanization mainly occurred in the form of strip development along arterial roads and scattered rural settlements. If the current (2001) trends continue, the KVLTD estimated that by 2025, all agricultural lands in the valley will be converted to urban use, with significant adverse economic, environmental and cultural consequences.  In order to retain some form of developmental balance and contain urban sprawl, the KVLTD recommended a series of preventative and precautionary land management policies. Preventative policies include regulations to retain agricultural land use, investment policies, and

	<p>incentives that would limit the development of agricultural land. Precautionary policies include the encouragement of infill development and maximizing land use efficiency. This would include the relocation of military activities and polluting industries from prime urban lands.</p>
Transportation	<p>The KVLTDTC reported that although, relative to other areas, substantial investment had been made in urban roads throughout Kathmandu Valley, most urban roads were narrow and less than two lanes in width. The rapid increase in the numbers of private motor vehicles at the cost of increased public transport options has been the primary cause of vehicle congestion throughout the valley.</p> <p>In order to address these deficiencies, the KVLTDTC recommended a series of actions to meet both present and future transportation needs in the valley.</p> <p>Present needs: Action was recommended to improve transport circulation efficiency by reducing congestion, improving neighborhood access and pedestrian facilities, providing reliable and efficient public transport, and reducing motor vehicle emissions and air pollution.</p> <p>Future needs: The KVLTDTC recommended upgrading the quality of existing road stock rather than building costly new roads, including improvement and completion of the Inner Ring Road and the Bhaktapur-Kathmandu section of the Arniko Highway. The KVLTDTC supported the concept of an inner ring road around the Kathmandu City core, which would offer the opportunity for creation of a car-free zone and increased reliance on public transport and pedestrianization, supported by improved peripheral parking facilities and improved traffic management. In suggesting the various transportation improvements, the KVLTDTC emphasized the need to ensure consistency with recommended land use policies of containment and urban infill.</p>
Land Development and Demand	<p>In order to limit continued urban sprawl and reduce the need for the continued conversion of agricultural lands, the KVLTDTC recommended a minimum average gross residential density for Kathmandu Valley of 300 person/ha, equivalent to a net residential density of 600 person/ha. Based on this proposed gross density and projected population growth, the land demand over the period to 2021 was just over 3600 ha. This is barely 25% of what will be required if the current trend of uncontrolled urban expansion and agricultural land conversion continues.</p>
Guiding Development Principles	<p>In terms of urban form, some of the key guiding principles underpinning the development concept for the valley include: i) the need for a regional approach to planning and development of the entire Kathmandu Valley and surrounding districts; ii) improved urban growth management, especially in consideration of rural-urban transition; iii) creation of a functional and livable built environment, including considerations of optimum land use, housing, infrastructure and transportation, and the conservation/preservation of historical/cultural sites, agricultural land and natural environment.</p>
Policy Framework	<p>The basic policy framework identified in the KVLTDTC to facilitate effective growth management and promote balanced development of the valley was structured on three main goals:</p> <ul style="list-style-type: none"> <li>• <b>Promote the valley-wide regional planning approach, instead of individual and uncoordinated efforts of local governments and line agencies:</b> i) promote KVTDC as a strong regional planning agency and as an advisor and regulator to local governments and sectoral agencies operating in the Katmandu Valley; and ii) enact a law for mandatory plan acknowledgement to insure institutional coordination and conformity of local government/line agency plans with the valley's development goals and objectives</li> <li>• <b>De-concentrate investment to other regions of the country:</b> i) pursue the long-term development vision for the valley; ii) discourage large-scale capital investment that would exacerbate further urban proliferation; iii) discourage economic activities such as manufacturing or industries not consistent with the development vision, to other regions; iv) encourage relocation of polluting industries (carpet-making and brick/tile manufacturing) as well as military installations to or beyond appropriate peripheral locations.</li> <li>• <b>Promote balanced development of the valley:</b> i) pursue equitable growth throughout all three districts; ii) preserve agricultural land through various regulatory, investment and incentive measures; iii) channel growth only to designated urban areas; iv) promote a high standard urban environment through the enforcement of planning and building permits approvals and EIAs for large projects; vi) preserve the natural environment through appropriate regulation and legislation involving local communities.</li> </ul>

<p>Summary of KVLTD Recommendations</p>	<p>The main provisions of the KVLTD are:</p> <ul style="list-style-type: none"> <li>• The establishment of Kathmandu Valley into a single planning unit, development of separate law for planning, approval and monitoring by government, local, and private sector, and establish valley-level institution under that law.</li> <li>• Execution of all types of physical development activities in Kathmandu Valley under a single integrated regional plan and for that implementation of approved long-term development concept of Kathmandu Valley.</li> <li>• Conservation and sustainable use of natural resources of Kathmandu Valley like agricultural land, river and streams, watershed areas, forest areas, etc.</li> <li>• Conservation and development of traditional skills and method that conserve and protect the culturally valuable physical infrastructure in Kathmandu Valley, and encourage private investment in such activities.</li> <li>• Follow alternative options like transfer of development rights that compensate the loss to the private sector due to adoption of cultural heritage conservation during physical development.</li> <li>• Execution of special programs which conserve and protect cultural heritage and provision of new sector of financial mobilization or additional central support to local authority.</li> <li>• To emphasize development of such infrastructure in Kathmandu Valley that could be utilized for organization of international level seminar, fair, demonstration, and sports.</li> <li>• Discouraging centralized administration service in Kathmandu Valley, and shift such activities outside the valley to the extent possible.</li> <li>• Shifting industrial and trade activities that adversely affect the environment and cultural values.</li> <li>• Emphasize development of the urban centre close to the valley to reduce haphazard urbanization in Kathmandu Valley.</li> </ul>
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Following figures are development concepts drawing for the valley.

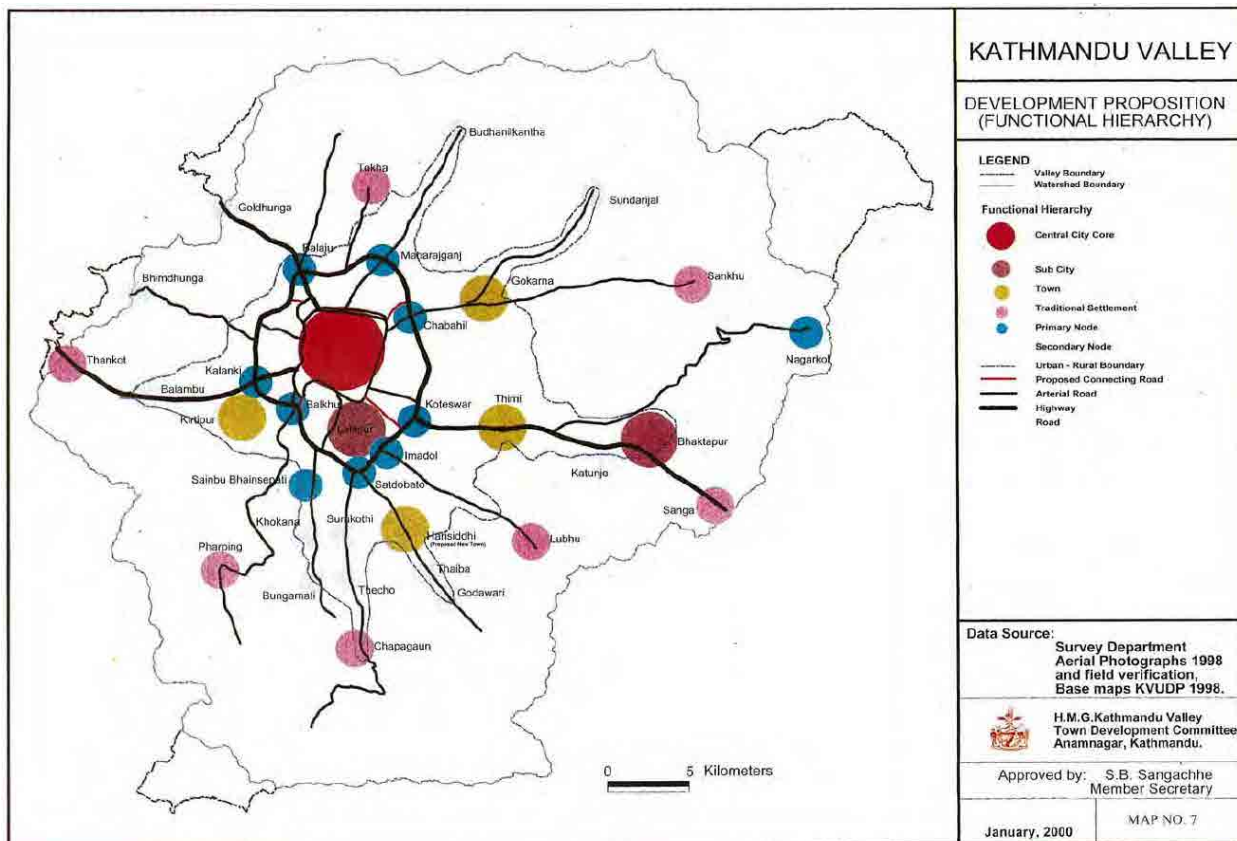


Figure 7.3.2 Development Proposition (Functional Hierarchy)

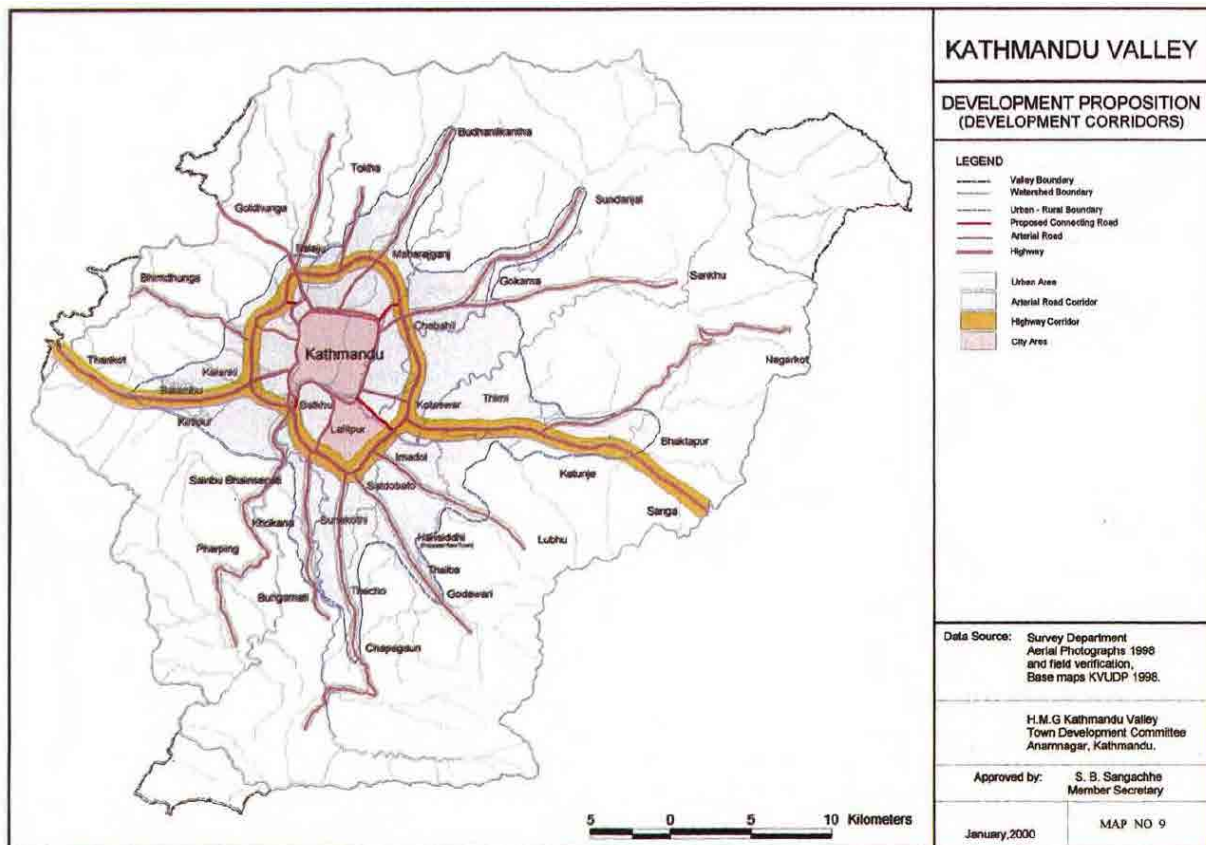


Figure 7.3.3 Development Proposition (Development Corridors)

**(4) Kathmandu Valley Building By-laws (2007)**

The Kathmandu Valley Building By-laws (KVBB) was prepared by the KVTDC in 2007. Although this is a building control regulation, it encompasses general land use zoning maps for the entire Kathmandu Valley, including for all five municipalities (Kathmandu, Lalitpur, Bhaktapur, Kirtipur, and Madhyapur- Thimi).

The KVBB also covers general plans giving broad land use details of heritage sites and conservation areas within the valley, including Kathmandu Durbar Square (plus the Hanuman Dhoka Durbar Square), and the Swayambhunath, Pasupatinath and Bouddhanath areas in Kathmandu, as well as the Patan and Bhaktapur Durbar squares. However, the machinery for development control and enforcement of these land use and zoning plans is not explicit at this stage.

The KVBB specifies nine different categories and three sub-categories of land use, although there are no provisions governing change of approved use. They also define building construction set-back distances from the road center (right of way or ROW), but only for new buildings, repairs, and renovations are exempted from the provisions.

**Table 7.3.3 Contents of the Kathmandu Valley Building By-laws (2007)**

Chapter 1. Definition and General Arrangement
1. Definition
2. General arrangement
Chapter 2. Kathmandu, Lalitpur, Kirtipur, and VDCs
1. Cultural heritage conservation zone
2. Residential zone
3. Institutional zone
4. Industrial zone
5. Reserved zone
6. Urban expansion zone
7. Surface transport zone
8. Airport zone
9. Sports zone
10. Standards for Narayanhiti Palace area

- 11. Construction along banks of river
- 12. Apartment building
- Chapter 3. Madhyapur Thimi Municipality
  - 1. Traditional residential zone
  - 2. Industrial zone
  - 3. Developing zone
  - 4. Reserved zone
  - 5. Green zone
- Chapter 4. Bhaktapur Municipality
  - 1. Traditional cultural residential zone
  - 2. Development zone
  - 3. Green zone
- Chapter 5. Standards Related to Building
  - 1. Standards for Passupati area
  - 2. Electricity regulation and setback
  - 3. Standards for petro pump
  - 4. Standards for cinema hall
  - 5. Standards for apartments, group housing and planned housing
    - A) Standards for physical plan and housing
    - B) Apartment housing, group housing, and planning permit procedure
    - C) Standards for apartment housing
- Chapter 6. Annex
- Chapter 7. Drawings
  - 1. Kathmandu Valley Land Use Zoning Map
  - 2. Kathmandu Metropolitan City Zoning Map
  - 3. Lalitpur Sub-Metropolitan City Zoning Map
  - 4. Kirtipur Municipality Zoning Map
  - 5. Bhaktapur Municipality Zoning Map
  - 6. Madhyapur Thimi Municipality Zoning Map
  - 7. Kathmandu Valley Heritage Site
  - 8. Kathmandu Durbar Square Cultural Heritage Conservation Zone
  - 9. Hanuman Dhoka Durbar Square Cultural Heritage Conservation Zone
  - 10. Swayambhunath Area Cultural Heritage Conservation Zone
  - 11. Pasupatinath Area Cultural Heritage Conservation Zone
  - 12. Bouddhabath Area Cultural Heritage Conservation Zone
  - 13. Patan Durbar Square Cultural Heritage Conservation Zone
  - 14. Patan Durbar Square Cultural Heritage Conservation Zone
  - 15. Bhaktapur Durbar Square Cultural Heritage Conservation Zone

##### (5) Land Use Plan for Kathmandu Valley in KVBB

The prevailing land use plan for Kathmandu Valley was prepared in 1976 with only minor updating/ amendments in the early 1990s. This fact and the generally weak development control mean that the plan bears little relevance to development on the ground, which is mostly characterized by a generally haphazard, low density, mixed use pattern of land use, undertaken mostly by private individual land and building owners.

Before the land use plan in the KVBB was designated in 2007, there were no land use regulations outside of the Ring Road. Furthermore, there is no regulation to control land use change from forest and agricultural land to residential and other urban land uses.

This unregulated form of development has resulted in the loss of extensive areas of productive agricultural land. Indications are that the percentage of agricultural land has declined from 64% of the total Kathmandu Valley land area in 1984 to 52% in 1994, and less than 42% by 2000. No doubt this trend has continued to the present day.

The KVTDC has commissioned the preparation of a detailed digital map of existing land use throughout the Kathmandu Valley. This base map of the municipalities of Kathmandu Valley was completed in 2007. It will provide the basis for preparation of an updated land use plan and related zoning and development control guidelines in the coming years, as well as the spatial dimension of all component sectoral plans (including transportation), making up a comprehensive and fully integrated development plan and supporting programs to ensure sustainable development throughout Kathmandu Valley. (Shambhu, 2010)

The following maps are land use zoning in the Kathmandu Valley Building By-laws (2007).

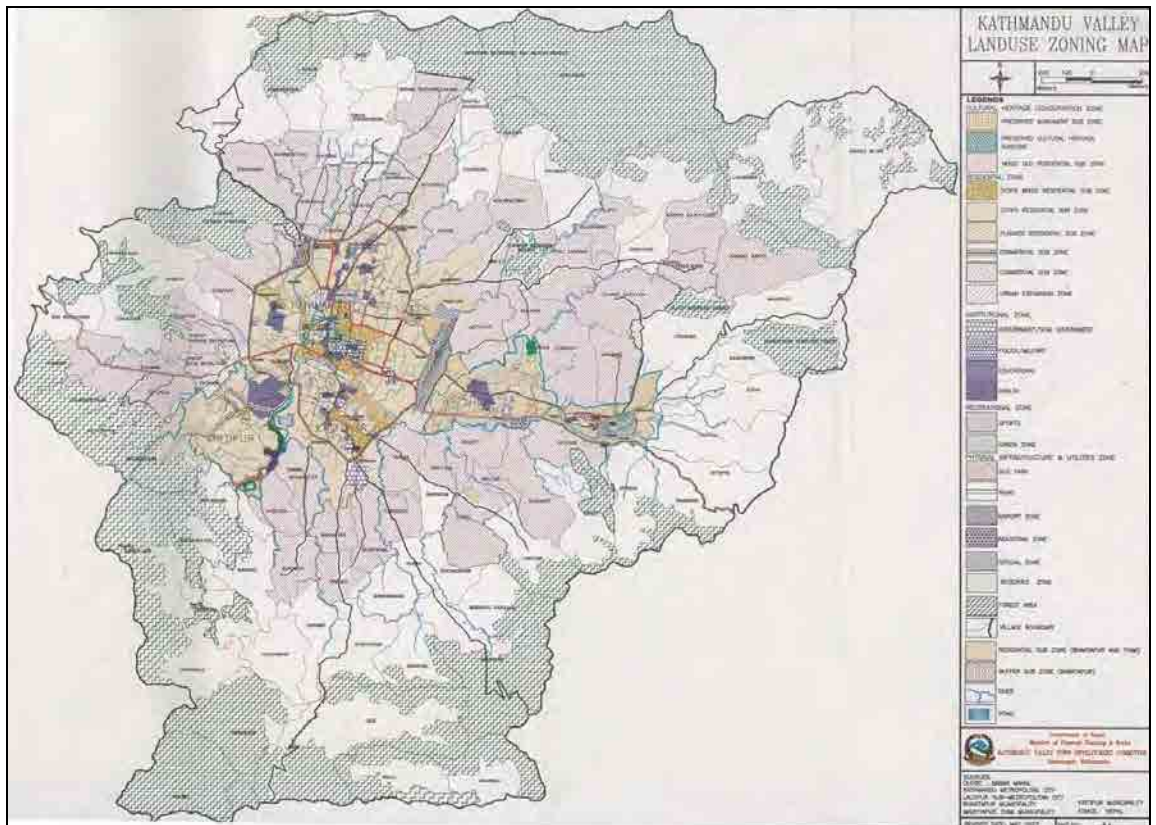


Figure 7.3.4 Kathmandu Valley Land Use Zoning Map

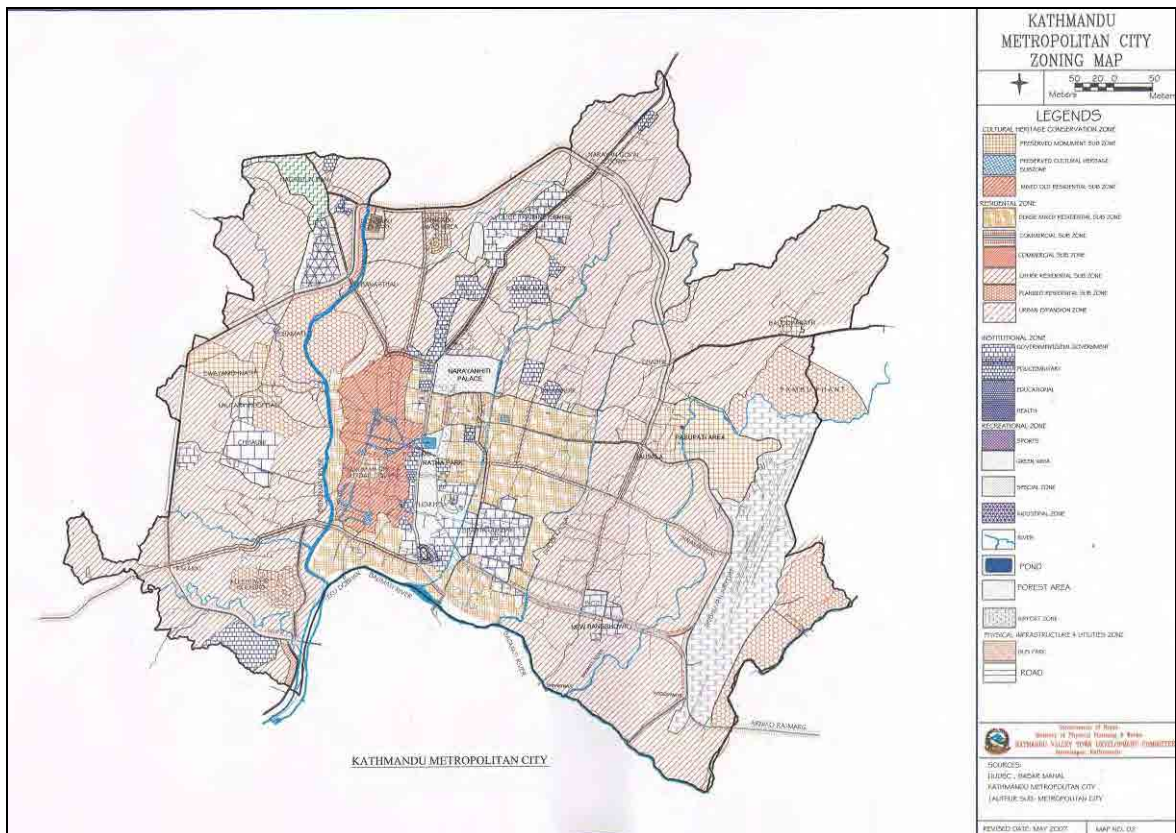


Figure 7.3.5 Kathmandu Metropolitan City Zoning Map



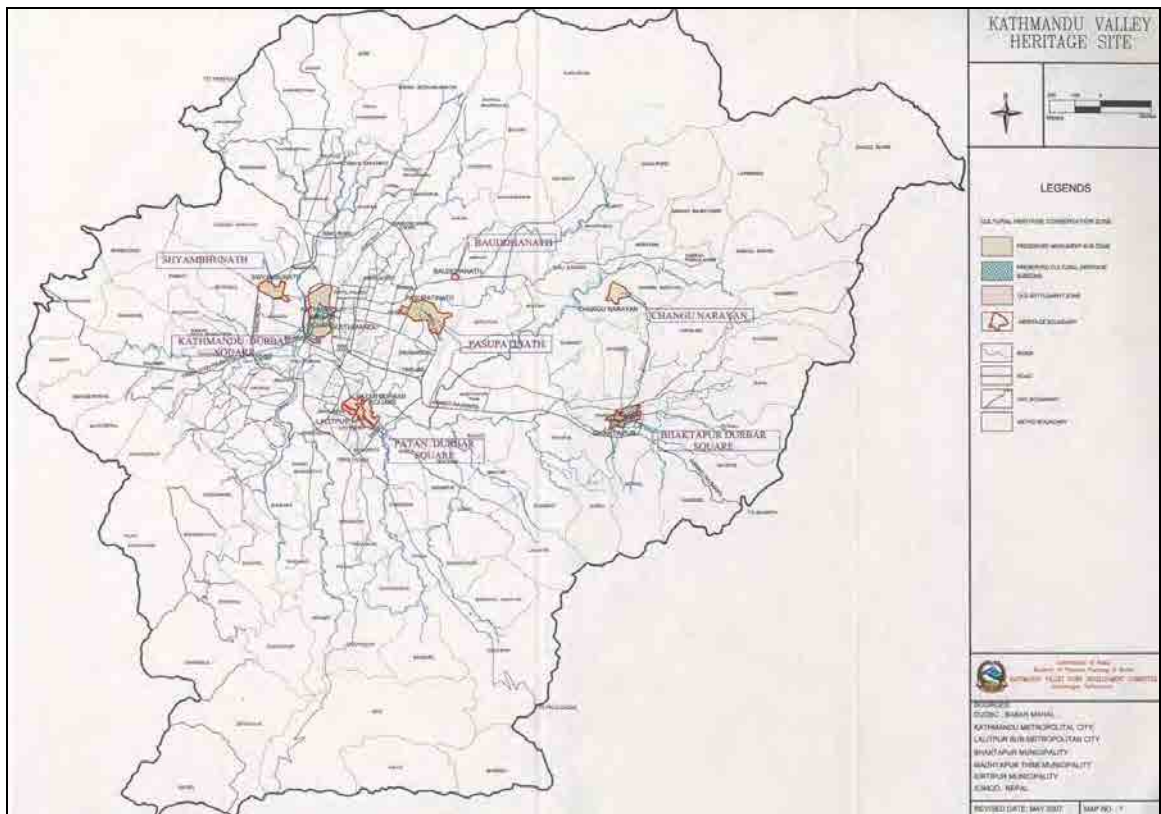


Figure 7.3.6 Kathmandu Valley Heritage Site

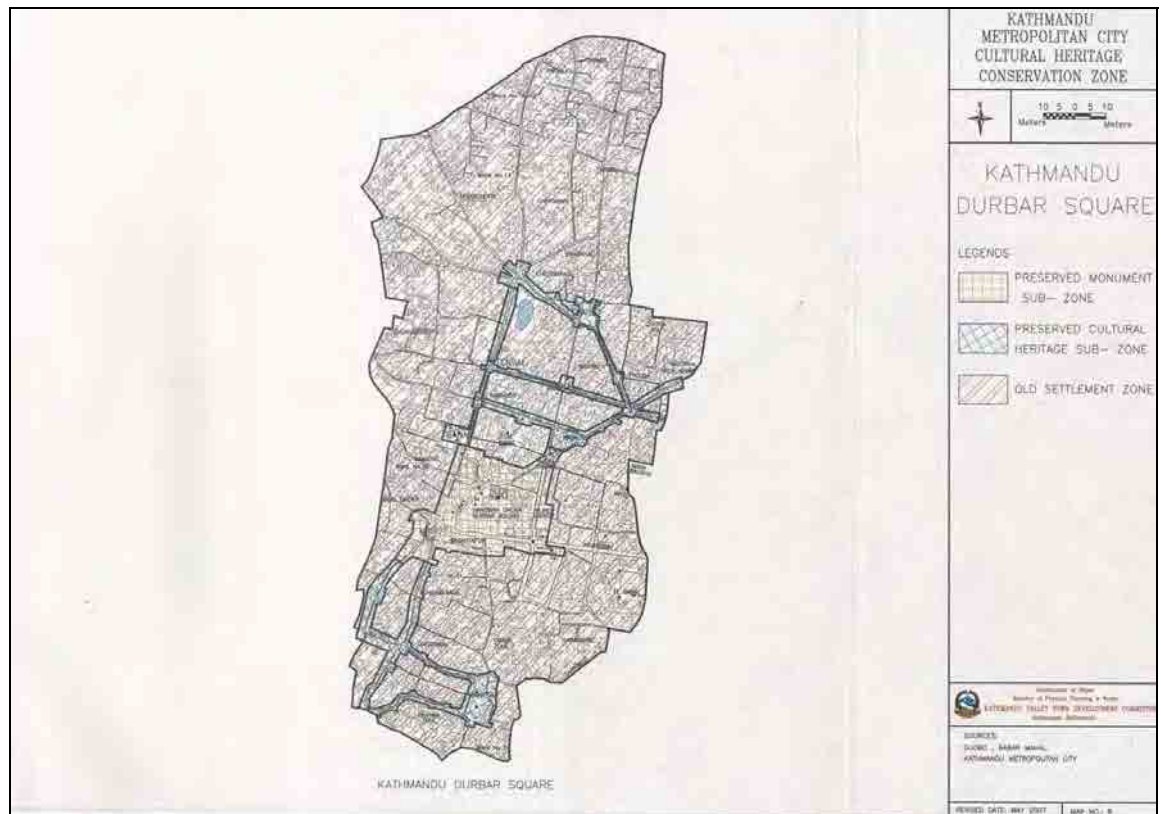


Figure 7.3.7 Kathmandu Durbar Square Cultural Heritage Conservation Zone

Although KVBB 2007 has a land use zoning map for Kathmandu Metropolitan City, the KMC Municipality also has a different land use zoning and land use plan. In addition, they have the municipal budget to revise these land use zoning and land use plans, and have building regulations for their own.

There is no coordination with other municipalities and VDCs as well as KVTDC. This kind of overlapping of plans can be seen in the Kathmandu Valley Administration.

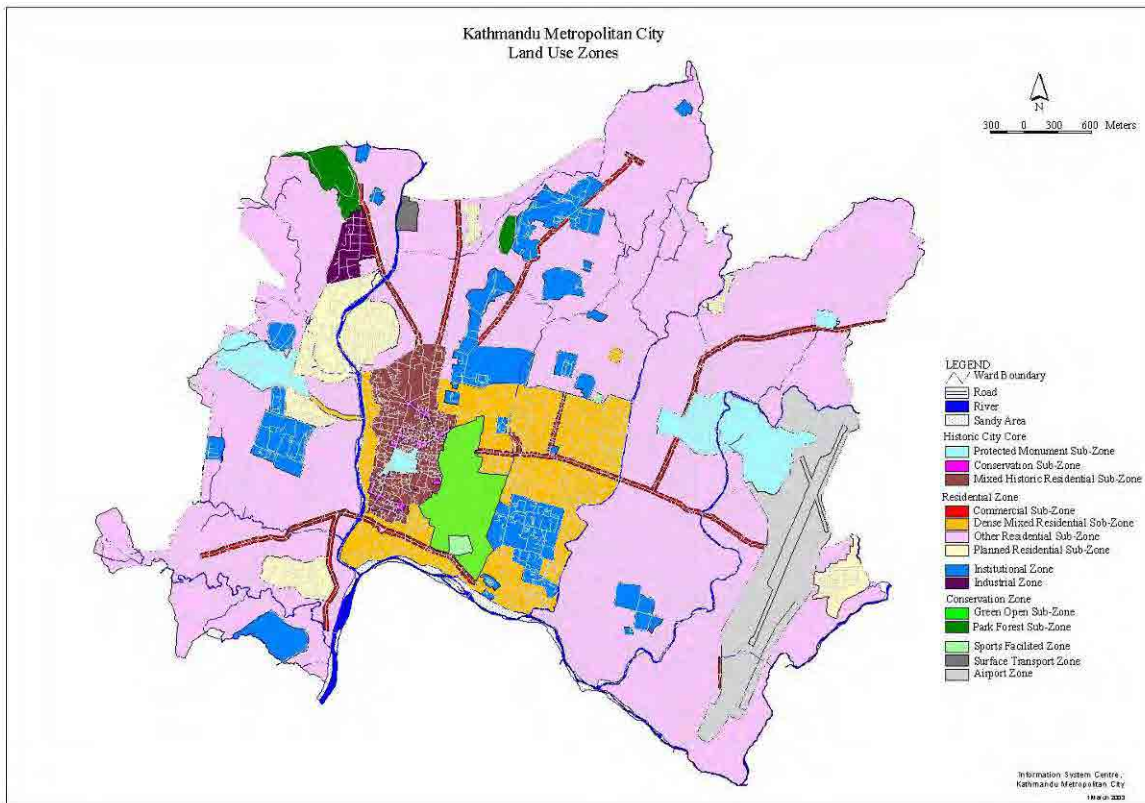


Figure 7.3.8 Land Use Zones by KMC

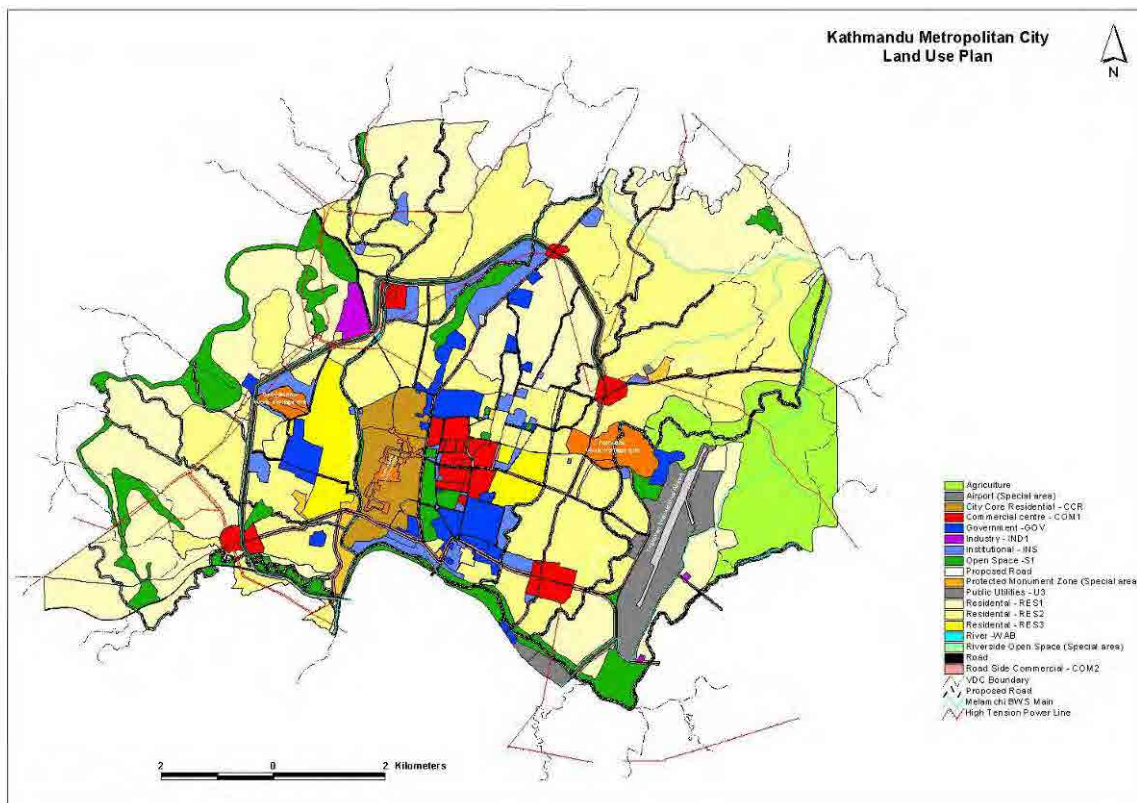


Figure 7.3.9 Land Use Plan by KMC

### 7.3.4 Building Permission System

#### (1) Procedure

The building permission system for land development and building construction before the establishment of KVDA is summarized below.

**Table 7.3.4 Procedure of Building Permission**

Process	Authority	Remarks
1 Planning permit	KVTDC	In the valley, KVTDC is in charge of issuing the planning permit. Check BD level documents.
2 Initial Environmental Examination (IEE)	Related ministry	For urban development, MOPPW is in charge for IEE.
3 Environmental Impact Assessment (EIA)	MOE	If necessary, depending on the project size.
4 Structure safety permit	Division office of DUDBC	Check all technical functions based on the National Building Code.
5 Building permit	Municipality or VDC	
6 Completion certificate	Municipality or VDC	Necessary IEE/EIA certificate and structure safety permit
7 Registration of property	Land Revenue Office	

#### (2) Effectiveness of the Permission System

Developers or owners of group housing or joint housing (apartment) cannot sell any housing unit without registration of the property at the Land Revenue Office under the Ministry of Land Reform and Management. For registration of the property, it is necessary for the completion certificate to be issued for the building from the local government authority such as municipality, DDC, or VDC. This should be functioning to avoid low quality or illegal buildings.

However, mainly for individual buildings, owners do not want to register their buildings at the Land Revenue Office to avoid taxation. Thus, it is not necessary to have a structure safety permit and completion certificate for the buildings. Landowners can just construct their building and start to live in without any permission. This is one of the reasons why government authorities cannot control all development or construction activities in the valley.

## 7.4 Urban Development Activities in Kathmandu Valley

### 7.4.1 Current Situation

The city of Kathmandu has undergone a rapid process of growth in recent decades. Increasing urbanization has been driven by its growing importance within Nepal's economy, as a center of government, industry and tourism, and which has drawn increasing number of migrants from rural areas. This trend has been exacerbated by the Maoist insurgency in large areas of Nepal. This has led to displacement of people from rural areas and a favoring of the Kathmandu area as a safe haven for both living and investing.

The process of rapid urbanization has had dramatic consequences on Kathmandu Valley, a broad river basin approximately 40 km across, with the city of Kathmandu at its centre. The processes and impacts that have taken place are similar to those in many peri-urban areas under conditions of rapid urban growth. Not only have increasing areas of fertile farmland been converted to residential and other urban land uses, but increasing demand for land for development, combined with a ready supply of financial capital from remittances, credit and transfers of savings from less secure rural areas, have resulted in huge increases in the price of land. In the context of weak governance structures, speculative activity and poorly controlled development have become rife, with various negative consequences. (Shrestha 2011)

## 7.4.2 Key Players

Key players involved in housing and urban development in Nepal are summarized below.

**Table 7.4.1 Major Organizations Involved in Housing and Urban Development in Nepal**

PLAYER	ROLE	PRODUCTION
<b>Central government</b>		
National Planning Commission (NPC)	<ul style="list-style-type: none"> <li>National level policy formulation</li> </ul>	
Ministry of Local Development (MOLD)	<ul style="list-style-type: none"> <li>Monitor the role of the municipalities under the Local Self Governance Act 1999</li> </ul>	
Ministry of Physical Planning and Works (MOPPW)	<ul style="list-style-type: none"> <li>Responsible for carrying out the 1996 Housing Policy</li> <li>Set up of the Urban Development Committee and Town Development Committees</li> <li>Responsible for infrastructures, including urban infrastructures</li> </ul>	
Department of Urban Development and Building Construction (DUDBC)	<ul style="list-style-type: none"> <li>Supporting municipalities in preparing periodic plans and digital base maps</li> <li>Preparing building code and its regular updating</li> <li>Partnering with NGOs in addressing slum and squatter issues</li> </ul>	
<b>Local government</b>		
Town Development Committees (TDCs)	<ul style="list-style-type: none"> <li>Formulate and implement the town development plans</li> <li>Implement land development activities, i.e., guided land development, land pooling and sites, and services programs</li> <li>Enforce construction rules and building codes</li> </ul>	Estimated supply of more than 11,000 serviced plots in urban areas in the last four decades
Municipalities	<ul style="list-style-type: none"> <li>Formulate and implement the town development plans</li> <li>Implement land development and housing programs</li> <li>Enforce construction rules and building codes</li> </ul>	
<b>NGO/INGOs</b>		
Lumanti	<ul style="list-style-type: none"> <li>Improve quality of life for urban poor</li> <li>Secure shelter for the poor</li> <li>Solidarity with the poor</li> </ul>	Squatter upgrading projects
Habitat for Humanity	<ul style="list-style-type: none"> <li>Assist other partners (NGOs) to build affordable housing using local construction technologies</li> </ul>	Started a 5,000-unit slum upgrading project, primarily rural housing
<b>Private sector</b>		
Real Estate Developers	<ul style="list-style-type: none"> <li>Development of houses and apartments</li> </ul>	Estimated 750 houses and 7,000 apartments
Land Brokers	<ul style="list-style-type: none"> <li>Provision of serviced land for construction</li> </ul>	Estimated supply of 50,000 serviced plots in urban areas in the last four decades

Source: UN-Habitat, 2010

### 7.4.3 Urban Development Activities in the Public Sector

#### (1) KVTDC Land Development Programs

A feature of urbanization throughout Kathmandu Valley in recent years is due to rising land prices in more centrally-located, accessible, and well-serviced location. Construction activities, especially of housing, are taking place in more peripheral, inaccessible areas, without reference to any agreed local land use plan or issuance of any construction permit, and in advance of the provision of necessary road access, infrastructure, and public utilities.

In order to address the problem of providing serviced land and housing for the rapidly increasing population of Kathmandu Valley, within the constraints placed on the government on the acquisition of private lands by existing legislation, the KVTDC has launched a number of land development initiatives in Kathmandu Valley, in accordance with the provisions of Town Development Act 1989.

##### 1) Sites and Services Development

This is a well-known form of land development that evolved through the 1960s and 1970s in response to the growing need for affordable housing in urban areas throughout the developing world. This development concept is specifically targeted towards the provision of serviced land for the construction of affordable low cost housing on a self-help basis. It involves either public land or the purchase of raw private vacant land by the government.

There are currently two sites and services projects in Kathmandu Valley at present, at Kuleshwor and Golphutar in Kathmandu District.

##### 2) Guided Land Development (GLD)

GLD projects involved the provision of access or service roads to one or more parcels of privately owned land in Kathmandu Valley. This process is undertaken by the KVTDC through coordination with private land owners and residents. With their approval and inputs, the KVTDC prepares and then implements a road layout plan utilizing a proportion of private land.

By the late 1990s, more than 320 km out of 475 km proposed access roads had been opened up under the GLD program approach, since at this time, numerous other GLD projects have been undertaken by KVTDC throughout Kathmandu Valley. GLD can only be implemented when private owners with land potentially accessible from the existing main road network indicate their willingness to participate in the joint venture effort.

KVTDC has exerted great efforts to implement this scheme, however, from the urban planning point of view, it is a symptomatic treatment for an existing situation.

##### 3) Land Pooling (LP)

LP projects depend entirely on landowners' participation. In these projects, scattered undeveloped or underdeveloped privately-owned land parcels are consolidated and then readjusted in a manner agreed by KVTDC with the owners, and in accordance with a similarly agreed plan for the provision of infrastructure, public utilities, and services prepared by the KVTDC in coordination with the appropriate agencies. The readjusted plots remain the property of the owners, with the relative increase in land value accruing as a result of the improvements again offsetting the price of the privately donated land.

Although certain up-front costs are incurred by the KVTDC in this process, the bulk of all land development costs is funded through the sale of a portion of the private land. Although cost-effective in this regard and in line with limited public sector resources, LP projects again can only be undertaken when and where conditions allow, and not necessarily as part of a rational land use plan. Nevertheless, by the late 1990s, more than 14,000 developed plots with the area of about 250 hectares and about 159 km of roads had been developed in Kathmandu Valley under the LP program approach, benefiting more than 10,000 people. (Shambhu KC 2010)

**Table 7.4.2 Completed Land Pooling Projects**

No.	Name of Project	Area (ha)	Period
1	Gongabu, Kathmandu Metropolitan City-Ward No: 29	14.4	1988-1996 (8 years)
2	Lubhu, Lubhu Village Development Committee, Lalitpur	13.5	1993-1996 (3 years)
3	Kamal Vinayak, Bhaktapur Municipality-Ward No:4	7.3	1991-1996 (5 years)
4	BagmatiPhant (Jwagal), Lalitpur Sub-Metropolitan Ward No: 10	9.8	1992-2001 (9 years)
5	Libali, Bhaktapur Municipality- Ward No: 1 & 2	34	1995-1998 (3 years)
6	Sinchitar, Madhyapur-Thimi Municipality-Ward No:1 & 2	26.9	1996-2003 (7 years)
7	Sainbu, Sabinbu Village Development Committee, Lalitpur	22.5	1991-2002 (11 years)
8	Dallu, Kathmandu Metropolitan City-Ward No: 15	20	1991-2002 (11 years)
9	Khusinbu Nayabazar, Kathmandu Metropolitan City-Ward No: 16&17	44.25	1995-2002 (7 years)
10	Chabahil, Kathmandu Metropolitan City-Ward No: 7	10.9	1995-2002 (7 years)
11	Sinamangal, Kathmandu Metropolitan City-Ward No: 35	36	1995-2002 (7 years)
12	ChikuPhantKirtipur (I), Kirtipur Municipality	5.3	2004-2008 (4 years)

**Table 7.4.3 Land Pooling Projects Implementing**

No	Name of Project	Area(ha)	Period
1	Bagmatinagar, Kathmandu Metropolitan City-Ward No: 6 & 8	63.5	September 2003
2	Kamerotar, Madhyapur-Thimi Municipality-Ward No:1 & 2	13.5	2004
3	Chamati, Kathmandu Metropolitan City-Ward No: 15	7.3	2003
4	BagmatiPhant, (Sankhamul) Lalitpur Sub-Metropolitan-Ward No: 10	7.0	2008
5	TamuchoDugureChokha, Bhaktapur Municipality- Ward No: 1&2	30	2008
6	Ichangu, Ichangu Village Development Committee, Kathmandu	32.5	2006
7	ManoharaPhant, Kathmandu Metropolitan City-Ward No: 35	88.5	2006
8	SainbuNakkhudol, Sabinbu Village Development Committee, Lalitpur	17.7	2008
9	Diveshowori, Kathmandu Metropolitan City-Ward No:	27.6	2009 (planned)
10	Kirtipur (II), Kirtipur Municipality	45.8	2009 (planned)

Source: Shambhu KC, 2010

## (2) Current Major Urban Development Activities in the Valley

### 1) Road Widening

The important strategic road networks (SRN) in Kathmandu Valley have been frequently suffering from traffic congestion problem. KVTDC, DOR and traffic police have been widening major city roads to manage traffic and the city by demolishing illegal structures, which started in November 2011. A total length of 400 km in the valley is being widened. The task inside the Ring Road will be first completed and then later go beyond the Ring Road. This road widening project is based on KVBB 2007.

### 2) Outer Ring Road Development through Land Pooling

DUDBC planned to develop the outer ring road (ORR) to connect the fringe areas of the valley to adopted expanding urbanization areas. The LP scheme is utilized to secure the land for ORR development.

Detailed design work started at the south-western part of ORR. However, the design level is not satisfactory.

## (3) Other Major Urban Development Activities in the Country by DUDBC

### 1) Urban Environment Improvement Project (UEIP) in eight municipalities

From 2003 to 2009, DUDBC had implemented the Urban Environment Improvement Project (UEIP) in eight municipalities—Banepa, Panauti, Ratna Nagar, Bidur, Dhulikhel, Bharatpur, Hetauda, and Kamalimai. The project was also funded in part by the Asian Development Bank (ADB).

2) Development of Six Municipalities

The World Bank (WB) has agreed to provide NRP 2 billion for the development of six municipalities that have the potential for extensive urbanization. Six municipalities that stand to receive assistance are Mechinagar, Itahari, Dhankuta, Tansen, Baglung, and Lekhnath.

Out of the proposed NRP 2 billion, NRP 1.1 billion will be provided as loan while NRP 900 million will be offered in the form of assistance. WB intends to upgrade the municipalities' basic infrastructure and support their institutional development through the amount. From fiscal year 2009/10, DUDBC has begun 'Janata Aawash Project' to provide houses to the poor and underprivileged people. So far, the department has built around 5000 houses under this project.

3) Secondary Towns Integrated Urban Environmental Improvement Project (STIUEIP)

The government has implemented the five-year long STIUEIP in Biratnagar Sub-metropolitan City, Birgunj Sub-metropolitan City, and Butwal Municipality, in addition to the Kavre Valley Integrated Water Supply Project in three municipalities of the Kavre Valley. The project was initiated in 2010 and about NRP 7.7 billion has been invested for its implementation. According to Sharma, ADB, Saudi Fund, and the municipalities concerned have invested in the project NRP 4.8 billion, NRP 1.36 billion, and NRP 760 million, respectively.

4) Integrated Urban Development Project (IUDP)

The DUDBC has come up with the Integrated Urban Development Project (IUDP) in four municipalities— Dharan, Janakpur, Siddharthanagar, and Nepalgunj—to be implemented from 2013 to 2014. The project with an estimated cost of USD 83.87 million is targeted to be completed by June 2017.

#### 7.4.4 Development Activities in the Private Sector

##### (1) Brief History

Private developers are a recent phenomenon in Nepal. The background of this situation is discussed below:

- 1) The high influx of population to cities, particularly in Kathmandu Valley and other prominent cities like Pokhara and Birgunj during and after the ten-year long insurgency in the country,
- 2) The remittance fund inflow from workers outside the country,
- 3) Availability of housing loans, and
- 4) Improvement in construction technologies saw a slowly emerging formal housing market.

It was the promulgation of the Apartment Ownership Act 1997 that provided the legal framework for development sales and management of multi-storey buildings, and paved the way for private sector developers to enter into the housing sector.

Since the enactment of the Apartment Ownership Act 1997, there has been a gradual increase of companies entering the market. In 2000, the *Ansal Chaudhary Company* was the first to launch an apartment-based housing project in Nepal 'Kathmandu Residency' in Lalitpur. The project comprised a total of 180 apartments with prices ranging from NPR 900,000 (USD 12,200) for a one bedroom apartment to NPR 1.9 million (USD 25,800) for a three-bedroom one at that time.

Since then, around 150 private companies have registered with the Nepal Land and Housing Developers' Association (NLHDA), out of which most are operating in Kathmandu, Pokhara, and Bharatpur.

As of yet, the supply of housing estates and modern apartment complexes is mainly geared towards the upper middle class, including *non-resident Nepalese* living abroad. In fact, many of the developers specifically target the latter group and organize housing expositions in America and Australia as part of their marketing program to attract clients. So far there has been no evidence of any developer targeting low-income group customers.

Picking up on the South Asian trend in which apartments are emerging as a status symbol, and fuelled by banks willing to provide financing, the property market in Nepal developed very quickly in the last decade, with signs of overheating in 2009. In the absence of alternative investments and with low interest rates, land and real estate became the preferred investment vehicle, with many purchasing for speculative purposes; indeed, anecdotal evidence suggests over half of the apartments remain unoccupied. In selected commercial locations in Kathmandu such as Thamel, New Road, and Durbar Marg, land prices went up to over NPR 80,000 per square foot or USD 13,000 per square meter, exceeding price levels in Hong Kong, New York, or London.

## (2) Private Sector Development Activities (Shrestha, 2011)

The private real estate sector in Kathmandu Valley has boomed in recent years, and the immediate driver of this boom has been an enormous rise in land prices within the valley. A growth of 300% from 2003 to 2008 has been widely reported.

Commercial pressures on land in Kathmandu Valley are being driven by three overarching factors, which are:

- 1) Rural to urban migration, which in turn is driven by the economic development of the city relative to the countryside, the cultural attraction of the city, and the displacement of large numbers of people due to conflict in rural areas.
- 2) Capital flows, including remittances from *Gurkhas* (soldier to serve military service in India) and other emigrant workers, asset transfers from other, less secure regions of Nepal, and credit provided by domestic financial institutions.
- 3) Weak governance, including ineffective planning and land management, and the weakness of government in the face of the real estate sector lobby.

Table 7.4.4 shows the number of approved planning permissions from three municipalities from year 2003. A total of 185 development projects got approval from municipalities, which planned to provide 17,847 units or plots covering 156 ha. After year 2007, the number of projects approved grew.

**Table 7.4.4 Planning Permissions from Municipalities**

	Kathmandu			Lalitpur			Bhaktapur		
	No. of Project	Area (m2)	Unit/Plot	No. of Project	Area (m2)	Unit/Plot	No. of Project	Area (m2)	Unit/Plot
2003				3	31,370	11			
2004	3	36,201	89	4	45,217	222			
2005	7	101,387	514	2	31,404	0	1	22,092	101
2006	5	69,017	375	2	20,907	227	2	20,711	45
2007	27	159,909	1,395	2	8,942	265	1	4,749	7
2008	29	190,318	2,250	13	131,836	1,408	1	17,607	88
2009	22	174,290	2,038	9	69,565	598	2	19,876	64
2010	19	191,157	2,015	11	76,921	2,080	1	1,725	10
2011	10	83,593	577	7	51,885	509			
	122	1,005,872	9,253	53	468,047	5,320	10	86,760	3,274

Source: KVTDC, 2011

However, the realty market has cooled down recently because of several conditions as explained below:

- 1) After the earthquake in eastern Nepal in September 2011 with magnitude 6.9 and the image of 3.11 earthquakes in Japan, buyers put importance on quake-resistant buildings and avoid high-rise tower apartments.



- 2) The ceiling amount of housing loans was reduced to NRP 8 million and limited to 70% of the total cost of premises. This limit cannot fit into the existing soaring prices.
- 3) Central bank policy changed to reduce real estate loans down to 25% in the bank portfolio by the end of fiscal year 2012/13. The banking sector cannot give housing loans as much as possible.

### (3) Type of Development

There are three types of development scheme, which can be invested by private developers.

#### 1) Land Development

The land development scheme is changing landforms from a natural or semi-natural state for the purpose of housing. Developers purchase certain portions of land, develop housing plots and the necessary infrastructure, and then sell these plots for the market. Purchasers have to build their houses by themselves on their plot.

#### 2) Group Housing

Developers purchase land, develop house units with land and certain infrastructure, and then sell these houses with land by the name of blocks or similar other designations in the same land.

#### 3) Joint housing (Apartment)

A joint housing building means a building which has two or more floors, contains two or more housing units and is built in any land. This term also includes similar types of two or more buildings which are built by the name of units or similar other designations in the same land. Developers purchase land, develop joint housing building with infrastructure and common facilities, and then sell housing units.

**Table 7.4.5 Number of Approved Development Project by Type**

Kathmandu				Lalitpur			Bhaktapur			
Land dev't	Group housing	Joint housing	Unknown	Land dev't	Group housing	Joint housing	Land dev't	Group housing	Joint housing	
31	20	69	2	0	24	28	8	2	0	
			122						52	10

Source: KVTDC



Source: <http://www.housingnepal.com/>

**Figure 7.4.1 Image of Each Development Type, Group Housing, and Joint Housing in the Valley**

## 7.4.5 Housing Loan

### (1) Brief History of Housing Loans (Pokharel 2006)

Previously, a housing loan from the financial institutions to commoners was not available. It was however available to employees of financial institutions such as banks as an incentive.

*Karmachari Sanchaya Kosh* (KSK, Employees Provident Fund (EPF) in English) started providing housing loans in 1962 under the Employee's Provident Fund Act for the depositors, with the interest rate ranging from 8% to 12%. The loan period was up to 25 years or until the age of retirement. A collateral of land title and a personal guarantee of two-year salary was required for this purpose.

The Nepal Housing Development Finance Company (NHFDC), established in the year 1989, is the first finance company completely focusing on the housing sector set up in Nepal. It grants loan for the improvement of existing housing arrangement, launching new housing schemes, and providing housing-related services. The loan-giving institutions were very few in the past but now their number is increasing as can be seen from Table 7.4.6. Presently, most of the financial institutions, including cooperatives, are offering housing loans.

**Table 7.4.6 Number of Financial Institutions**

Types of Financial Institutions	Number of Institutions in Mid July						
	1980	1985	1990	1995	2000	2005	2010
Commercial Banks	2	3	5	10	13	17	27
Development Banks	2	2	2	3	7	26	79
Financial Companies	-	-	-	21	45	60	79
Micro Credit Development Banks	-	-	-	4	7	11	18
<b>Total</b>	<b>4</b>	<b>5</b>	<b>7</b>	<b>38</b>	<b>72</b>	<b>114</b>	<b>203</b>
Savings and Credit Cooperatives				6	19	20	18,000

Source: Monetary Policy Report, Nepal Rastra Bank

### (2) Institutional, Legal, and Regulatory Frameworks of Monetary Sector

The Central Bank of Nepal was established under the Central Bank Act 1955. The Central Bank regulates, directs, and monitors the entire banking and financial sectors for smooth operations and to ensure financial and monetary stability and discipline in the country.

The commercial banks are established under the Commercial Bank Act 1974, and the Bank and Financial Institution Act 1964 (old). The development banks are established under the Development Bank Act 1996. Financial companies are established under the Finance Company Act 1985. These acts were repealed by the Bank and Financial Institution Act 2006.

Microcredit institutions are regulated by various laws. These are the: Nepal Rastra Bank Act 2002, Agriculture Development Act 1967, Cooperative Act 1972, Finance Company Act 1985, Development Bank Act 1996, Social Welfare Act 1991, Company Act 1947, Financial Intermediary Act 1998, and Insurance Act.

Cooperative societies are established under the Co-operative Act 1991. The cooperatives are regulated, monitored, and supervised by the Department of Co-operatives, Government of Nepal.

### (3) Key Players of the Monetary Sector

#### 1) Commercial Banks

The commercial banking sector in Nepal is relatively small in comparison to the size of country's 23 million populations. There are 27 banks in total, but wealthy families own many of them with other business interests. Yet, especially in recent years, commercial banks and financial institutions have become an important source of housing finance, both for purchasers and developers.

In the absence of investment alternatives, the housing finance has been a major business for banks and financial institutions in the last decade. According to the July 2009 Central Bank data, commercial banks had invested NPR 76.4 billion (USD 1 billion) in real estate and housing loans, accounting for 19% of the total loan portfolio, with some banks having almost half of their

outstanding loans in housing and real estate. In an attempt to cool down the overheating property market and improve risk management in Nepal's fragile financial sector, the Central Bank directed all 26 commercial banks in Nepal to bring their shares of individual mortgage loans down to 10% within three years. Moreover, the monetary policy of NRB (July 2010) has slightly raised the share of housing loans to 15% and real estate loans to 10%.

2) Nepal Housing Development Finance Company Ltd. (NHDFC)

The Nepal Housing Development Finance Company was established in 1990. For the first time, the Seventh Five-Year Plan (1985-1990) realized the need of introducing housing finance in Nepal in the following words: "A housing financing institution will be established for the development of residential areas and residential housing" (The Seventh Plan 1985: 837). Further, it stated: "Priority will be given to solving the residential problems of low- and middle-income families by encouraging private sector investment"...T, bid). Following the objectives of the plan, the NHDFC was established under the Finance Company Act (1985) in 1990, with the main objectives of improving the existing housing delivery system and launching new housing schemes through housing loan facilities and other related service in order to meet the growing demand for housing in Nepal.

3) Employee's Provident Fund (EPF)

The Employee's Provident Fund was established under EPF Act (1962) initially to manage the NPR 3.7 million (USD 50,374) fund of 26,000 government employees and military staff which now has evolved into a fund with 440,000 clients and a net worth of NPR 79.15 billion (USD 107 million).

The provident fund provides housing loans to permanent employees of government (civil, police, military), semi-government (corporations), academics institutions, and organized private sector.

4) Savings and Loans (Cooperative) Program

Nepal has a long history of co-operative movement and there are an estimated 15,000 number of registered co-operative societies in Nepal. Most of these co-operative societies have been established for agricultural development and agri-marketing in rural areas, but increasingly, they follow the population drift toward the urban centers. Savings and loan programs have been implemented by various non-government organizations and albeit a small percentage, housing loans are part of their service package.

5) Micro Finance Institutions (MFIs)

MFIs in Nepal are emerging as one of the most important sources of small credit to low-income people to start their small business enterprises and improve agriculture including poultry farming and livestock.

6) UN-HABITAT'S Experimental Reimbursable Seeding Operations (ERSO)

The Habitat for Humanity International, Nepal is the partner agency which handles UN-HABITAT's designated trust fund under the ERSO model for slum upgrading and infrastructure projects related to housing for low income families in eight urban slums in Nepal through 15 local NGOs partners and microfinance institutions. The projects in the eight slum areas are expected to last three years and benefit over 1,760 families comprising 6,700 individuals. (UN-HABITAT, 2010)

**(4) Existing Situation in Housing and Real Estate Loans**

According to the new policy put forth by the Nepal Rastra Bank, the banks have been instructed to limit their investments in real estate up to 25% of total investments by the end of fiscal year 2012/13. Thus, most banks have temporarily discontinued home loan facilities along with other personal loans. This caused the cooling down of the realty market in Nepal.

This policy should be relaxed after the land use plan to revitalize the realty market in the near future is drawn up.

## 7.5 Recommendations for the Next Steps

### (1) Recommendation for Short-term Technical Cooperation Components

#### 1) Determine Urban Development Scenario in the Valley:

The previous M/P (in 1993) recommended the valley's integrated development of its three core cities namely Kathmandu, Lalitpur and Bhaktapur. However, the existing development situation is in a concentrated form to Kathmandu and Lalitpur. Although the Kathmandu-Bhaktapur Road was constructed through Japanese Grant Aid, the role of Bhaktapur is not sufficient in the valley.

It is necessary to discuss and determine the future development vision of Kathmandu Valley among the related stakeholders of the government in a technical workshop during the future M/P study. The scenarios should consider population distribution by population density planning to accommodate increasing population in the limited land in the valley. The future M/P should be planned based on the discussed scenario.

#### 2) Determine Concept of the Kathmandu Valley Land Use and Zoning Plan:

Revised land use/zoning classifications and supporting regulations and building by-laws would be designed (among others) to support all aspects of improved transportation planning, especially the relative location of residential and commercial, industrial areas, and the increase in development densities around public transport nodes. Strengthened environmental management provisions are also needed.

It is necessary to review, discuss, and determine the direction and outline of revision of the Kathmandu Valley Land Use and Zoning Plan (the Plan). Detailed revision of the Land Use Zoning will be in the next phase.

#### 3) Guideline for Urban Development to Strengthen Road Network:

Existing large-scale urban development projects are not contributing much to make and strengthen the road network in the valley. Most of the project plans are self-sufficient in their project site. There is not enough guidance or instruction from government administration to draw an appropriate development plan.

It is necessary to draw-up the guideline for large-scale urban development to strengthen feeder road and ladder road network by utilizing Land Pooling or other urban development scheme.

#### 4) Plan Transit Terminals:

There are two bus terminals developed inside the Ring Road, which was planned in the previous M/P (in 1993). However, the existing situation spreading out of bus stops shows the necessity for more space of planned transportation terminals in the valley. This is also related transportation future M/P.

Although it is necessary to secure certain land for terminals to develop a transportation terminal, it is difficult to find open space for the terminals. It is necessary to develop the surrounding areas together with the terminals. An urban re-development scheme is needed to introduce to Nepal.

#### 5) Plan Logistic Center and Industrial Park:

Logistic centers are necessary and its location, function and size in the future M/P should be determined to encourage economic and social development.

Industrial park also considered in the future M/P together with cargo terminals though economic analysis.

### (2) Recommendation for Mid-term Technical Cooperation Components

#### 1) Institutional Strengthening, Capacity Building & Training:

The enhancement of planning skills for young staff members, especially in the field of urban planning and management, land development program and institutional strengthening of DUDBC, KVDA, and municipalities to improve their level of institutional performance, governance, and inter-agency coordination. Additionally, the education system in universities and colleges for urban

planning and management should be reviewed. Through this cooperation, capacity building for local consultants also considered to level up plans in valley.

The OJT type technical cooperation through an on-going project such as the land pooling project and outer ring road project is necessary to strengthen knowledge and experience of younger staffs.

2) **Formulate Draft Rules and Regulations on Urban Development to Strengthen Road Network:**

Existing large-scale urban development projects are not contributing much to make and strengthen the road network in the valley. Most of the project plans are self-sufficient in their project site. There is not enough guidance or instruction from government administration to draw the appropriate development plan.

It is necessary to draw-up a guideline for large-scale urban development to strengthen feeder road and ladder road networks by utilizing land pooling or other urban development scheme.

3) **Prepare a Comprehensive Development Plan for the Kathmandu Valley including Update of the Land Use, Zoning Plan, Development Control Regulations & Building By-laws:**

Prepare a Comprehensive Development Plan (CDP) as a rational and consistent basis for public and private sector investment over the next 20 years or so, and for improved urban management involving a fully integrated approach to all aspects of planning and development, including land use and transportation.

Two to three years technical cooperation for the DUDBC, KVDA, and municipalities through one or two experts is required. The Nepali side has manpower to do these works in both public and private sector, but technical advice is required.

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## CHAPTER 8 TRAFFIC DEMAND FORECAST

### 8.1 Future Population Projection

Population in Nepal increased rapidly until 2001 but the recent Population Census 2011 showed that the rate of increase from 2001 to 2011 has declined. The same tendency was also observed in the population of the central development region in which Kathmandu Valley is located. Table 8.1.1 shows these population trends.

**Table 8.1.1 Population Trend in Nepal 1981-2011**

Year	Nepal		Central Development Region	
	Population	Annual Increase Rate	Population	Annual Increase Rate
1981	15,022,839	-	4,909,357	-
1991	18,491,097	2.10%	6,183,955	2.33%
2001	23,151,423	2.27%	8,031,629	2.65%
2011	26,620,809	1.41%	9,713,702	1.92%

Source: Central Bureau of Statistics

The Central Bureau of Statistics of Nepal issued the Population Projection for Nepal, 2002-2021 based on the results of the Population Census 2001. The projection is the sole population projection in Nepal right now. The projection estimated the future population under three cases considering recent decline of fertility rate as shown in Table 8.1.2.

**Table 8.1.2 Population Projection for Nepal, 2002-2021**

Year	Fast Fertility Decline		Medium Fertility Decline		Slow Fertility Decline	
	Population	Annual rate	Population	Annual Rate	Population	Annual Rate
2001	23,151,423					
2006	25,767,919	2.165%	25,886,736	2.259%	26,005,554	2.352%
2011	28,177,690	1.804%	28,584,975	2.003%	29,060,622	2.246%
2016	30,174,690	1.379%	31,327,341	1.849%	32,218,337	2.084%
2021	32,030,767	1.201%	34,172,144	1.754%	35,387,192	1.894%

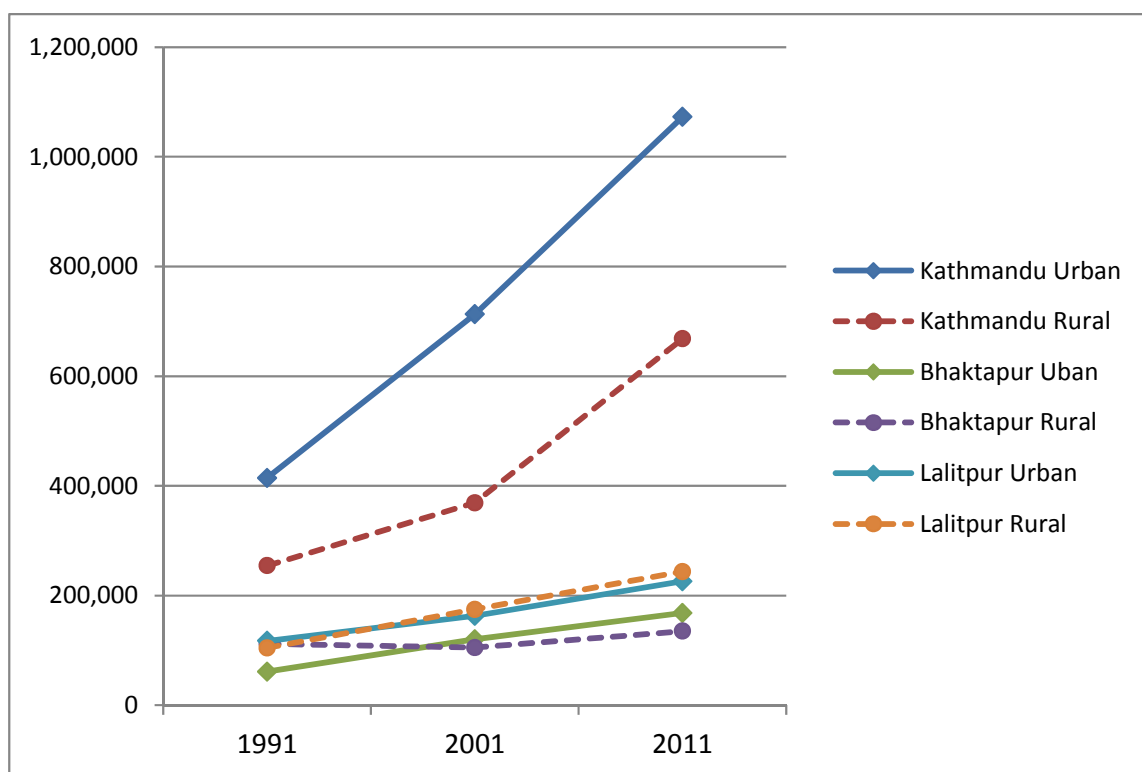
Source: Central Bureau of Statistics

The result of Population Census 2011 shows that the fertility decline has been more rapid than estimated. The population projection by the government, which is the basic index for population projection in this survey, needs to be reviewed now. Therefore in this survey, the future population in the Kathmandu Valley is estimated temporarily, and shall be adjusted based on the forthcoming new population projection.

**Table 8.1.3 Population Trend in Kathmandu, Bhaktapur and Lalitpur Districts, 1991-2011**

District	Area	1991	2001		2011	
		Population	Population	Annual Rate	Population	Annual Rate
Kathmandu District	Total	668,605	1,081,845	4.93%	1,740,977	4.87%
	Urban	414,264	712,681	5.58%	1,072,726	4.17%
	Rural	254,341	369,164	3.80%	668,251	6.11%
Bhaktapur District	Total	173,097	225,461	2.68%	303,027	3.00%
	Urban	61,122	120,294	7.01%	168,152	3.41%
	Rural	111,975	105,167	-0.63%	134,875	2.52%
Lalitpur District	Total	221,520	337,785	4.31%	466,284	3.28%
	Urban	117,203	162,991	3.35%	225,785	3.17%
	Rural	104,317	174,794	5.30%	243,499	3.37%
3 Districts Total	Total	1,063,222	1,645,091	4.46%	2,510,288	4.32%
	Urban	592,589	995,966	5.33%	1,463,633	3.92%
	Rural	470,633	649,125	3.27%	1,406,625	4.89%

Source: Central Bureau of Statistics



Source: Central Bureau of Statistics

**Figure 8.1.1 Population Trend in Urban and Rural Area 1991-2011**

From 1991 to 2001, population increase in urban areas was larger than in rural areas. From 2001 to 2011, the trend was reversed and the increase in rural areas became larger. This is because population concentration in urban areas is gradually reaching its limit. This inclination is presumed to continue and accelerate toward the target year.

Future population increase rate is derived by analyzing the increase rate in individual areas. The estimated population increase rates in urban and rural areas of the three districts are shown in Table 8.1.4.

**Table 8.1.4 Future Population Increase Rate**

District	Area	Annual Increase Rate	
		2011-2021	2021-2031
Kathmandu District	Urban	3.00%	2.00%
	Rural	6.00%	6.00%
Bhaktapur District	Urban	3.40%	3.40%
	Rural	5.00%	6.00%
Lalitpur District	Urban	3.20%	3.00%
	Rural	5.00%	6.00%

Source: JICA Survey Team



Based on the population increase rate from past population census data in 1991, 2001 and 2011, the future population by urban or rural area in each district was predicted using an exponential regression curve obtained from the three year data by the JICA Survey Team as shown in Table 8.1.5. Furthermore, the future population for the survey area in Kathmandu Valley was estimated in Table 8.1.6. Future population in the survey area is assumed to be 3,835,600 in 2022 with an annual growth rate of 4.18 % from 2011 to 2022, which means an increase of 56.9% of the population in 2011.

**Table 8.1.5 Population Projection in Kathmandu, Bhaktapur and Lalitpur Districts**

District	Area	2011	2022
Kathmandu District	Total	1,740,977	2,740,000
	Urban	1,072,726	1,470,000
	Rural	668,251	1,270,000
Bhaktapur District	Total	303,027	480,000
	Urban	168,152	240,000
	Rural	134,875	240,000
Lalitpur District	Total	466,284	730,000
	Urban	222,785	310,000
	Rural	243,499	420,000
Three Districts Total	Total	2,510,288	3,950,000
	Urban	1,463,663	2,030,000
	Rural	1,046,625	1,920,000

Note: Total population of three districts includes the population outside the survey area.  
The population of the survey area is 2,444,151 in 2011.

Source: JICA Survey Team

**Table 8.1.6 Estimated Future Population**

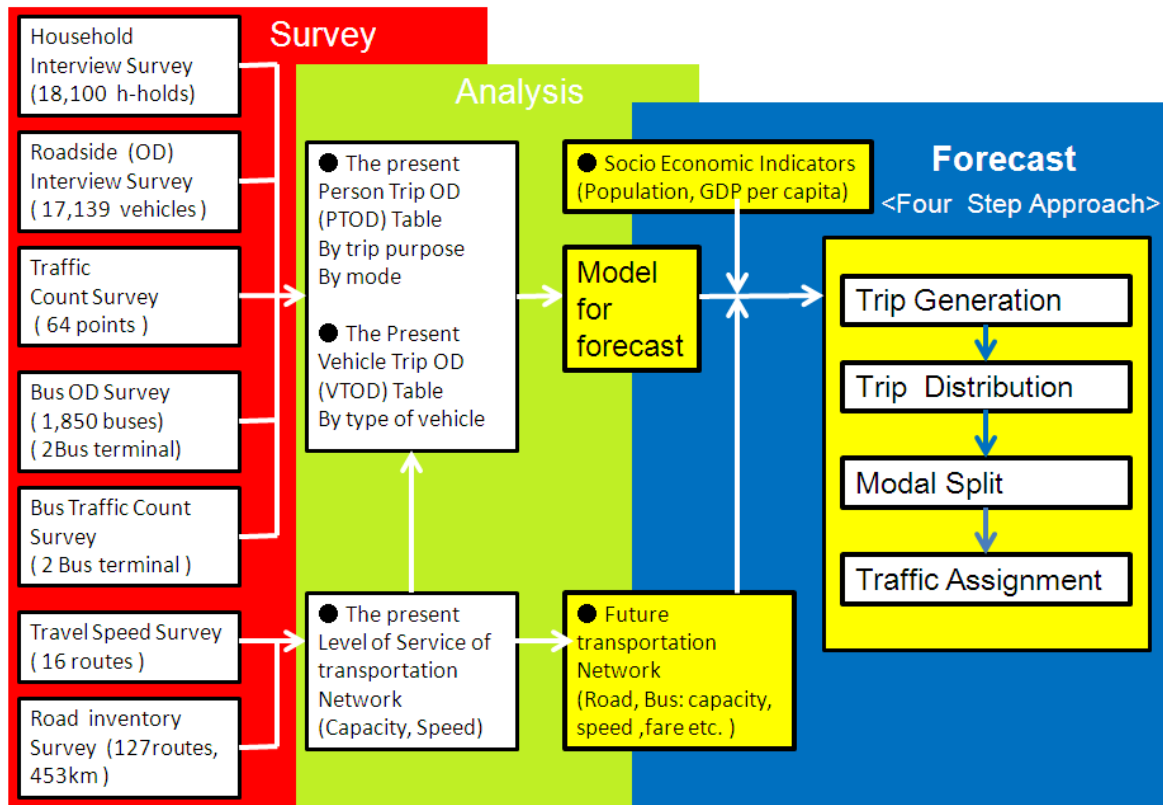
Items	Assumption	Notes
Target Year	2022	
Population in the survey area of Kathmandu Valley	3,835,600 in 2022 (2,444,151 in 2011) (1,560,670 in 2001)	Estimated by the trend with an annual growth rate of 4.18%, corresponding to 56.9% between 2011 and 2022
Population in Nepal	30,624,576 in 2022 (26,620,809 in 2011) (23,151,423 in 2001)	Estimated by the trend with an annual growth rate of 1.28%, corresponding to 15.0% between 2011 and 2022

Source: JICA Survey Team

## 8.2 Methodology of Traffic Demand Forecast

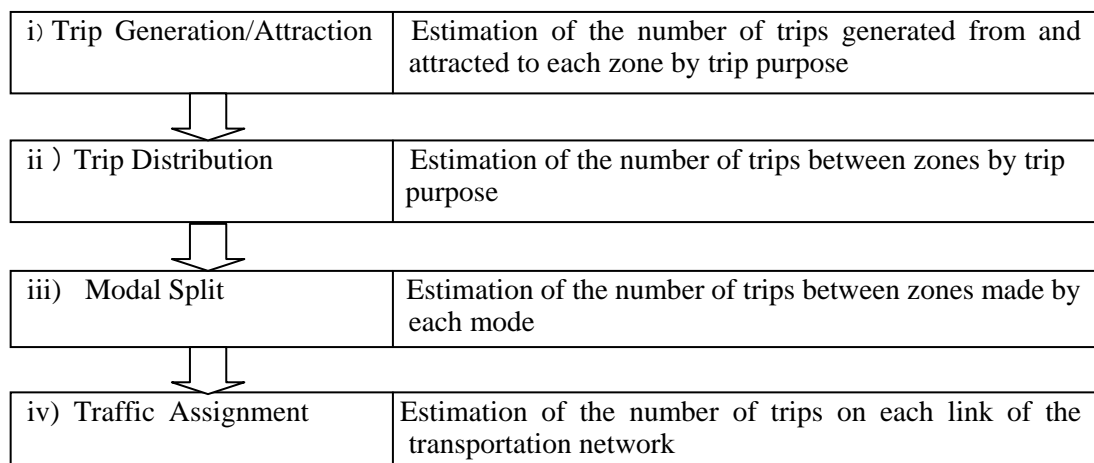
### (1) Process of Four-Step Approach

The traffic demand forecast was conducted by using a variety of data obtained from traffic survey and so on as shown in Figure 8.2.1. A four-step approach was used to forecast future traffic demand for the survey area in Kathmandu Valley. This method has been most widely used as a method for urban transportation demand forecasting, as shown in Figure 8.2.2.



Source: JICA Survey Team

**Figure 8.2.1 Process of Traffic Demand Forecast**



Source: JICA Survey Team

**Figure 8.2.2 Four-Step Approach**

**(2) Zoning**

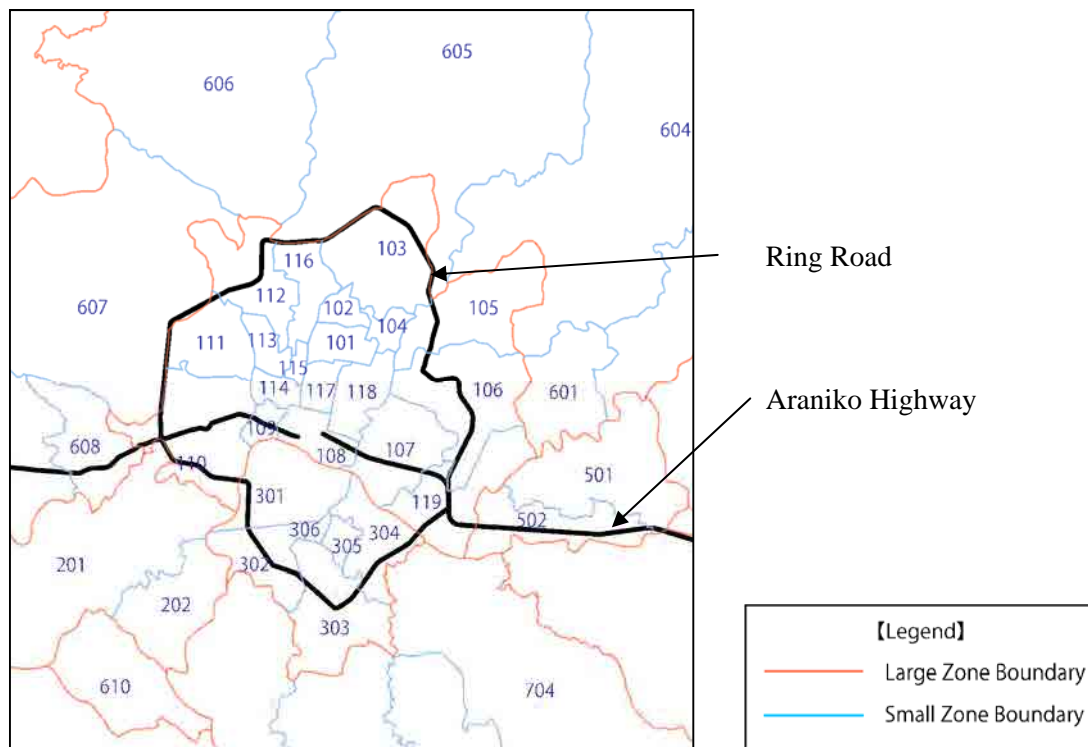
The survey area was divided into 10 large zones, 50 small zones, and 86 traffic zones. Basic zoning involves the 50 small zones system, which shows that the average population of small zones is approximately 50,000. Most of the analysis including model building of future demand forecasting was based on the 50 small zones system. The 86 small zones system was used only for traffic assignment on the transportation network in order to ensure the accuracy of the traffic demand forecasted on each link.

**Table 8.2.1 Number of Traffic Zones for Demand Forecasting in the Survey Area**

City	Population 2011 (persons)	Large Zone (10 zones)	Small Zone (50 zones)	Zones for Traffic Assignment (86 zones)
Kathmandu	1,719,630	3	31	47
Lalitpur	421,494	2	10	26
Bhaktapur	303,027	3	9	13
Total	2,444,151	8	50	86

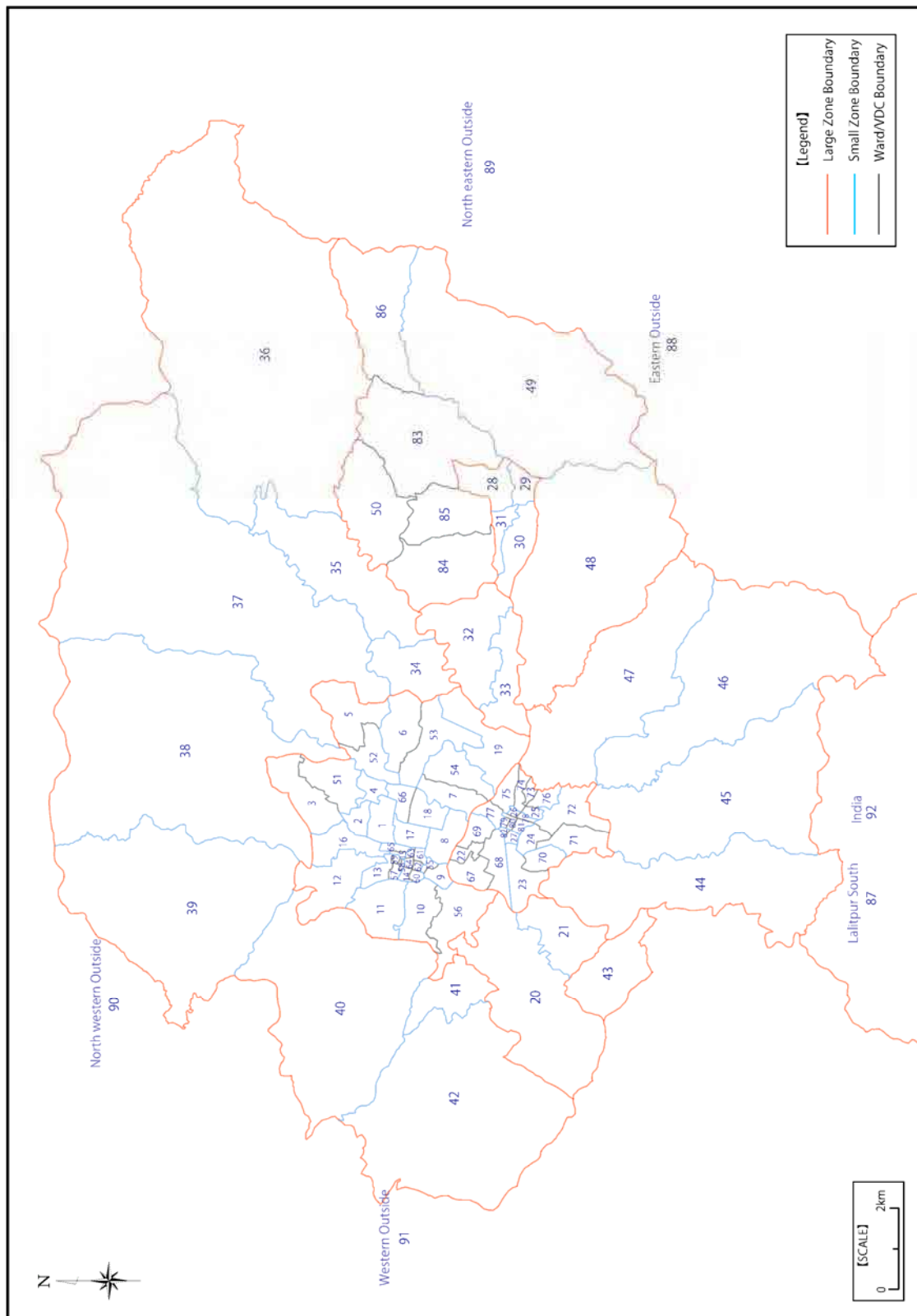
Note: In addition to the above zones, the other six zones outside Kathmandu Valley were used for analysis and demand forecasting.

Source: JICA Survey Team



Source: JICA Survey Team

**Figure 8.2.3 Small Zones around the Ring Road (50 Zones)**



Source: JICA Survey Team

**Figure 8.2.4 Zones for Traffic Assignment in Kathmandu Valley (86 Zones)**

**(3) Trip Purpose**

The nine trip purpose categories in the household interview survey were integrated into five purpose categories in the demand forecasting as shown in Table 8.2.2.

**Table 8.2.2 Trip Purpose Categories in Demand Forecasting**

Trip Purpose Categories in Household Interview Survey		Trip Purpose Categories in Demand Forecasting	
1	To Work (from Home)	1	To Work
2	To School	2	To School
3	To Home	3	To Home
4	Business	4	Business
5	Shopping	5	Others
6	Eating		
7	Leisure/Recreation		
8	Medical/Treatment		
9	Others		

Note: The private purpose categories, such as shopping, eating, leisure, medical and others, were integrated into the “others” category in the demand forecasting.

Source: JICA Survey Team

**(4) Travel Mode**

The ten travel mode categories in the household interview survey were integrated into five categories in the demand forecasting as shown in Table 8.2.3.

**Table 8.2.3 Travel Mode Categories in Demand Forecasting**

Travel Mode Categories in Household Interview Survey		Travel Mode Categories in Demand Forecasting	
1	Walk	1	Walk
2	Bicycle	2	Bicycle
3	Motorcycle	3	Motorcycle
4	Car	4	Car
5	Taxi		
6	Truck		
7	Tempo	5	Bus
8	Minibus		
9	Bus		

Source: JICA Survey Team

**(5) Level of Service in the Existing Transportation Networks**

Several conditions relating to the level of service of the existing or future transportation network were considered to forecast the future traffic demand. The following capacities, velocities, fares and fuel costs were presented in Table 8.2.4 based on the traffic survey results.

**Table 8.2.4 Level of Service for Analysis and Demand Forecasting**

**a. Capacities of Roads**

**unit: pcu/day**

	Direction	Area Inside the Ring Road	Area Outside the Ring Road
Roads with narrow 2 lanes	Both	6,000	7,000
	One way	14,000	17,000
Roads with 2 lanes	Both	17,000	20,000
	One way	27,000	33,000
Roads with 4 lanes	Both	52,000	57,000
Roads with 6 lanes	Both	75,000	83,000

Source: JICA Survey Team

**b. Velocities**

**unit: km/hour**

Type of Pavement	Condition of Surface	Velocity in Off Peak Hours (free speed)	Velocity in Peak Hours (congested speed)	Velocity on Average (average speed)
Asphalt	Good	60	20	40
	Fair	45	15	30
	Bad	30	10	20
Gravel	Good	50	20	35
	Fair	35	15	25
	Bad	20	10	15
Earthen	Good	40	20	30
	Fair	25	15	20
	Bad	10	10	10

Note: These velocities were applied to all transportation modes including cars, motorcycles, and buses on the road. In addition, buses include getting on/off times at each bus stop. Travel time of buses consists of both running time and getting on/off time. In this survey, getting on/off time at each bus stop of 2 minutes per 500 meters was added.

Source: JICA Survey Team

**c. Fares and Costs**

Bus fares	The present fare was set up by area and distance. For example: NPR 15 for 5 km within the Ring Road	The fare table has been applied since October 30, 2011 by the Government of Nepal. New fare was increased by 9.9% of the old fare.
Taxi fares	The minimum fare is NPR 30 within a distance of 1 km and an additional fare for distance beyond 1km is added at NPR 5.95 per 200 m. For example: NPR 149 for 5 km	
Petrol cost and Fuel efficiency	Petrol: NPR 114/L Car: 15 km/L, Motorcycle: 25 km/L	Petrol price was set at the price in Kathmandu City in January 2012.

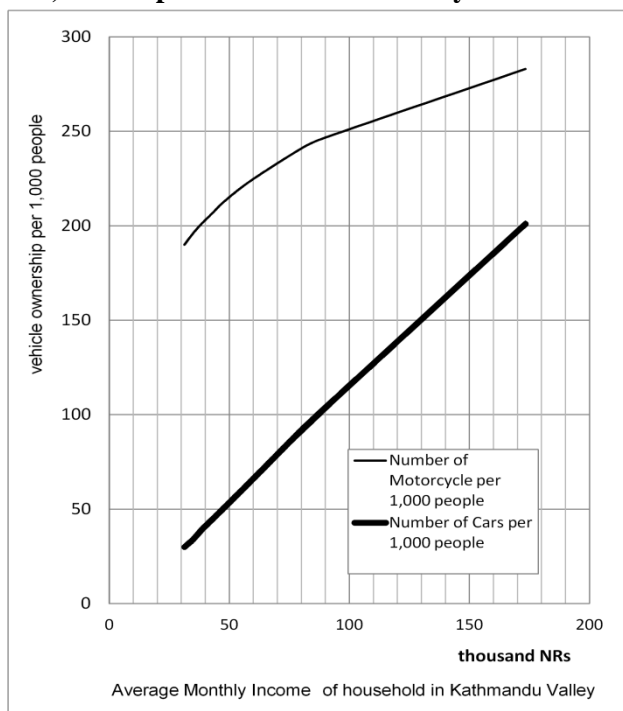
Source: JICA Survey Team

### (6) Vehicle Ownership

Car or motorcycle ownership greatly affects the people’s decision on choosing their form of transportation mode. Car ownership level is still low at 25 vehicles per 1,000 people, although motorcycle level is getting higher at 184 vehicles per 1,000 people. Vehicle ownership ratios in 2011 and 2022 were estimated by the JICA Survey Team based on the household interview survey.

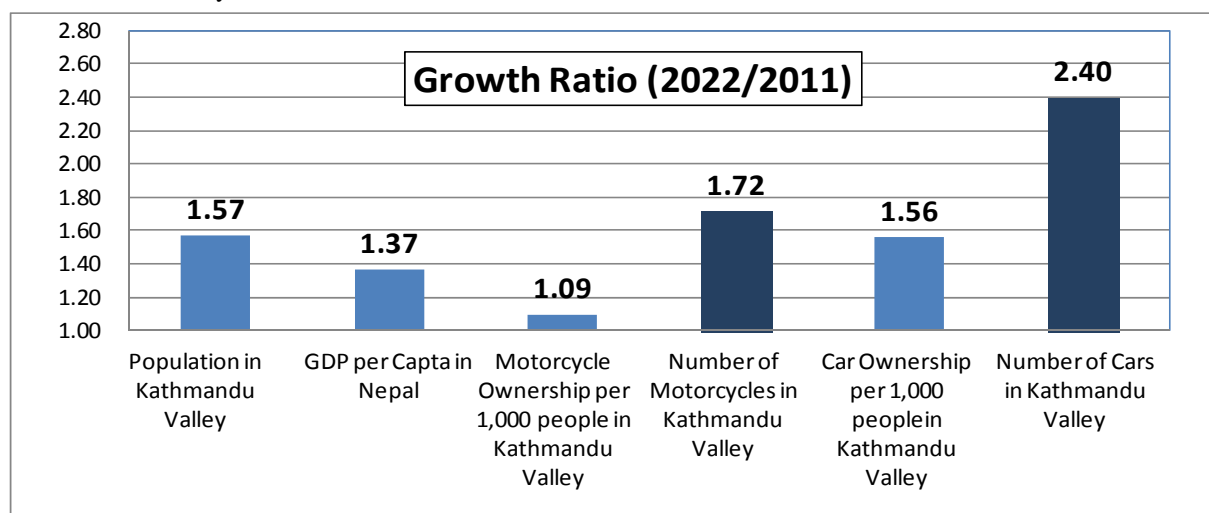
**Table 8.2.5 Vehicle Ownership Rate per 1,000 People in Kathmandu Valley**

Item	Year	Motorcycle	Car
Note: Total number of Vehicle	2011	448,630	62,109
	2022	769,305	148,987
	Growth (2022/2011)	<b>1.715</b>	<b>2.399</b>
Number per 1,000 people	2011	184	25
	2022	201	39
	Growth (2022/2011)	<b>1.092</b>	<b>1.560</b>
Population	Growth (2022/2011)	<b>1.569</b>	
GDP per capita	Growth (2022/2011)	<b>1.368</b>	
Average Monthly Income of Household unit:NRs	2011	28,077	
	2022	38,412	
	Growth (2022/2011)	<b>1.368</b>	



Estimations relating to vehicle ownership above were based on the household interview survey.

Source: JICA Survey Team



Source: JICA Survey Team

**Figure 8.2.5 Growth Ratio of Population, GDP per Capita and Car Ownership**

**(7) Base Case for Future Demand Forecast (Case-1)**

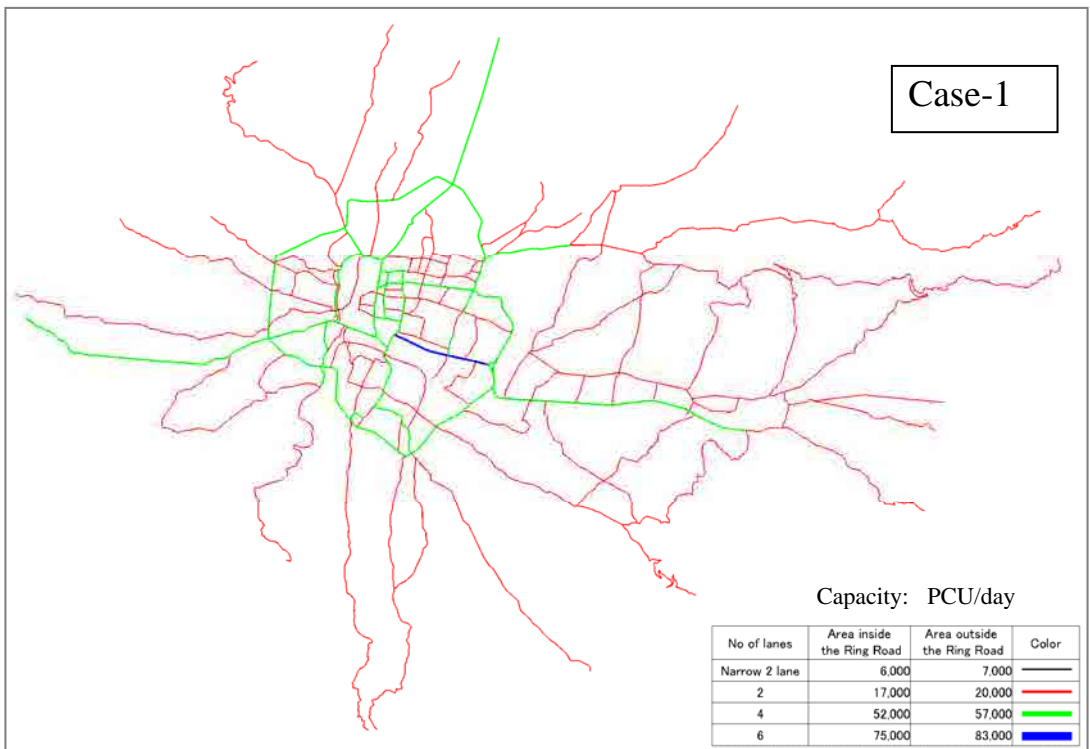
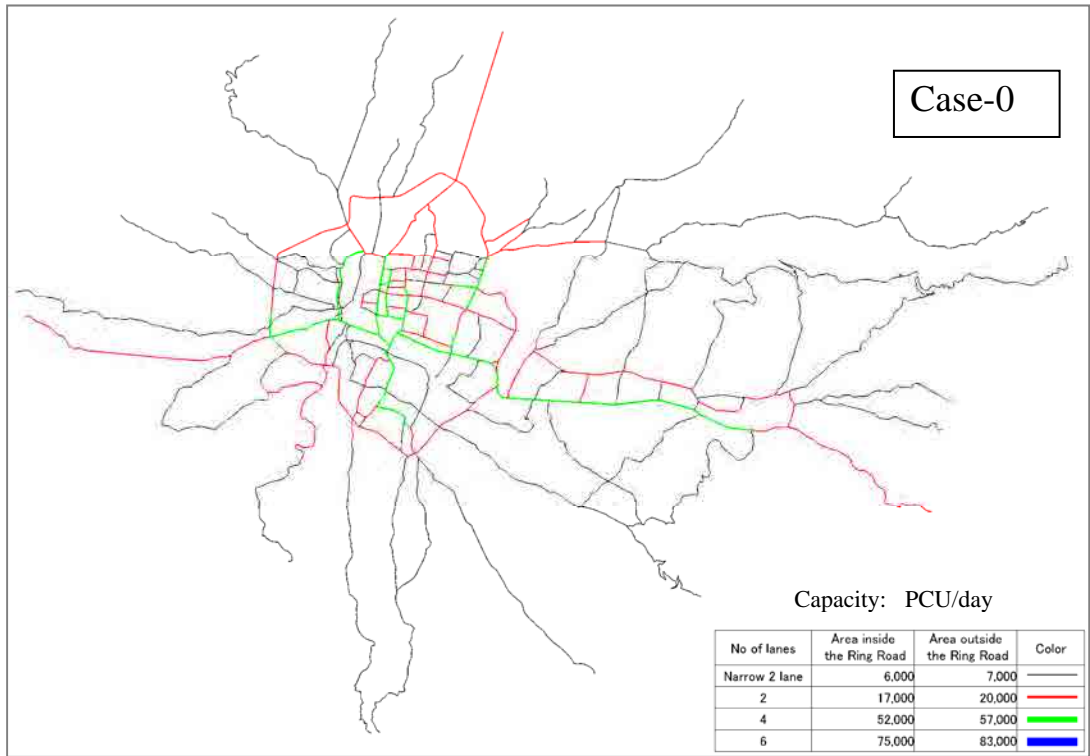
The base case for future demand forecast was established as shown in Table 8.2.6. This case is named Case-1, which is based on the past trend. In Case-1, several road projects, such as the expansion of the Ring Road, are assumed to be completed, although public transport vehicles like buses have no change from its existing service level. On the other hand, the do-nothing case for future traffic demand is named Case-0. In Case-0, the supply-side situation of transportation as a whole is assumed to be the same as the existing road network and bus services.

**Table 8.2.6 Base Case for Future Demand Forecast (Case-1)**

Items	Assumption	Notes
Target year	2022	
Population in the survey area of Kathmandu Valley	3,835,600 in 2022 (2,444,151 in 2011) (1,560,670 in 2001)	Estimated with an annual growth rate of 4.18%, corresponding to 56.9% between 2011 and 2022
Population in Nepal	30,624,576 in 2022 (26,620,809 in 2011) (23,151,423 in 2001)	Estimated with an annual growth rate of 1.28%, corresponding to 15.0% between 2011 and 2022
Land use and population distribution	Land use pattern and population distribution of Kathmandu Valley will not change.	Urbanized area would expand to suburbs based on the trend in the past 10 years
GDP per capita in Nepal	Annual growth rate of 2.89%, corresponding to 36.8% between 2011 and 2022	Based on the annual growth rate of 2.89% estimated by the IMF between 2011 and 2017
Vehicle ownership ratio (vehicles/1000 people)	Car: 39 in 2022 (25 in 2012) Motorcycle: 201 in 2022 (184 in 2012)	Estimated by the Survey Team based on the household interview survey; Ownership will increase in proportion to the GDP per capita
Bus service	same as present level of services, such as frequency, speed and fare	
Future road network	- Ongoing major road development projects are assumed to be completed by 2022. 1) Ring Road: expansion to 4 lanes 2) Arniko Highway: expansion to 6 lanes inside the Ring Road 3) Tribuvan Highway: expansion to 4 lanes outside the Ring Road 4) All narrow roads would be improved to have a capacity of at least 2 lanes. (Feeder, urban roads) -F021, F022, F025, F026, F103 -KMU0002, KMU017, KMU016 5) All roads with bad surface condition would be improved to have fair condition at least.	

Source: JICA Survey Team





Source: JICA Survey Team

**Figure 8.2.6 Road Network in Case-0 and Case-1**

## 8.3 Traffic Demand Forecast

### 8.3.1 Trip Generation

#### (1) Trip Generation Rate per Person

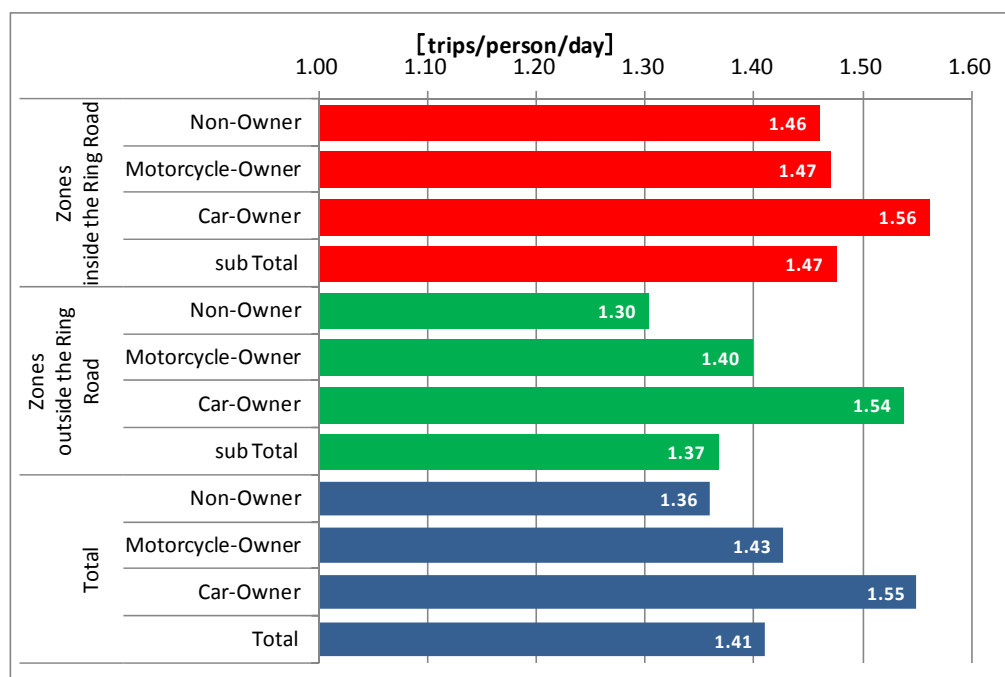
Based on the analysis of trip rate per person obtained from the household interview survey, trip generation rate per person can be appropriately classified by area as well as the vehicle ownership level, as shown in Table 8.3.1. These results were applied to forecast the future demand as total number of trips generated.

**Table 8.3.1 Trip Generation Rate per Person**

Note: Owner in the above table means a person whose household has a motorcycle or a car.  
Owners who have both motorcycle and car are included in the category of Car-Owner

Area	Ownership	a. Population [ persons ]	b. Trips Generated [ trips/day ]	b/a Trip rate [ trips/person/day ]
Zones inside the Ring Road	Non-Owner	341,565	498,386	1.45912491
	Motorcycle-Owner	540,417	793,517	1.46834204
	Car-Owner	97,008	151,357	1.56025276
	sub Total	978,990	1,443,260	1.47423365
Zones outside the Ring Road	Non-Owner	600,823	782,381	1.30218217
	Motorcycle-Owner	779,523	1,089,170	1.39722625
	Car-Owner	80,424	123,582	1.53663086
	sub Total	1,460,770	1,995,133	1.36580913
Total	Non-Owner	942,388	1,280,767	1.35906548
	Motorcycle-Owner	1,319,940	1,882,687	1.42634286
	Car-Owner	177,432	274,939	1.54954574
	Total	2,439,760	3,438,393	1.40931608

Source: JICA Survey Team



Source: JICA Survey Team

**Figure 8.3.1 Trip Generation Rate per Person**

## (2) Trip Generation and Attraction Model

Trip generation models by trip purpose were developed to estimate the number of trips as shown in Table 8.3.2 below.

$$Y_i = a_k \cdot X_{ik}$$

Where,

i: zone, k: purpose

Y<sub>i</sub> : number of trips generated in zone i

a<sub>k</sub>: parameter in zone i

X<sub>ik</sub>: population in zone i

**Table 8.3.2 Trip Generation Model by Trip Purpose**

Area	Purpose	Parameter (Population)	Correlation Coefficient	Number of Samples
Zones Inside the Ring Road	To Work	0.2809	0.9733	22
	To School	0.2767	0.9920	22
	Business	0.0856	0.9218	22
	Others	0.1497	0.9858	22
Zones Outside the Ring Road	To Work	0.2431	0.9942	28
	To School	0.2841	0.9821	28
	Business	0.0436	0.8533	28
	Others	0.1277	0.9672	28

Note: Trips with purpose of “To Home” were calculated automatically by return trips of home-based trip

Source: JICA Survey Team

Trip attraction models by trip purpose were not developed to estimate the number of trips because proper variables by each zone, such as statistics of number of workers, were not available. Therefore, the number of trips attracted in each zone was calculated by using the trip attraction/generation ratio obtained in the household interview survey in 2012. The ratios of zones are shown in Appendix 2.1.1.

## (3) Future Trip Generation and Attraction (Case-1)

The results of future trip generation and attraction by each trip purpose are shown in Table 8.3.3 and Table 8.3.4. Number of trips generated in 2022 was estimated at 5.46 million, corresponding to 1.59 times of the 3.44 million trips generated in 2011.

The reason why the growth ratio of trip generation and attraction in the area inside the Ring Road is greater than that in the area outside the Ring Road is explained as follows:

- The car ownership ratio of people living in the central area of Kathmandu is higher than in other places, therefore the growth ratio of trip generation would be a little higher by 2022 although the increase of population in the central area is lower than in the suburbs. Nevertheless, if the recent rapid growth of population in the suburbs continues in the long run after 2022, the growth ratio of person trips will surely become greater than in the central area.

For Case-1, trip attraction/generation ratio was assumed to be the same in each small zone. The central area has attracted a great number of trips from the suburbs. This trip concentration pattern would remain because a big difference in urban functional agglomeration is not expected. Such kind of situation is difficult to change in the short run. Therefore, the growth of trip attraction in the central area would be maintained as shown in Table 8.3.4.

**Table 8.3.3 Future Trip Generation in 2022 (Unit: person trips/day)**

Area	Item	Trip Generation		Composition Ratio		The Ratio (2022/2011)
	Year	2011	2022	2011	2022	
	Purpose	Present	Case-1	Present	Case-1	Case-1
Area Inside the Ring Road	To Work	281,317	460,296	15.9%	16.1%	1.64
	To School	264,508	419,827	14.9%	14.7%	1.59
	Business	89,903	148,420	5.1%	5.2%	1.65
	Others	152,055	242,461	8.6%	8.5%	1.59
	To Home	983,991	1,586,629	55.5%	55.5%	1.61
	<b>Sub Total</b>	<b>1,771,774</b>	<b>2,857,633</b>	<b>100.0%</b>	<b>100.0%</b>	<b>1.61</b>
Area Outside the Ring Road	To Work	353,144	564,762	21.2%	21.7%	1.60
	To School	392,522	611,919	23.6%	23.5%	1.56
	Business	63,566	104,287	3.8%	4.0%	1.64
	Others	192,142	297,397	11.5%	11.4%	1.55
	To Home	665,245	1,020,204	39.9%	39.3%	1.53
	<b>Sub Total</b>	<b>1,666,619</b>	<b>2,598,569</b>	<b>100.0%</b>	<b>100.0%</b>	<b>1.56</b>
Total	To Work	634,461	1,025,058	18.5%	18.8%	1.62
	To School	657,030	1,031,746	19.1%	18.9%	1.57
	Business	153,469	252,707	4.5%	4.6%	1.65
	Others	344,197	539,858	10.0%	9.9%	1.57
	To Home	1,649,236	2,606,833	48.0%	47.8%	1.58
	<b>Total</b>	<b>3,438,393</b>	<b>5,456,202</b>	<b>100.0%</b>	<b>100.0%</b>	<b>1.59</b>

Source: JICA Survey Team

**Table 8.3.4 Future Trip Attraction in 2022 (Unit: person trips/day)**

Area	Item	Trip attraction		Composition Ratio		The Ratio (2022/2011)
	Year	2011	2022	2011	2022	
	Purpose	Present	Case-1	Present	Case-1	Case-1
Area Inside the Ring Road	To Work	411,304	673,232	22.7%	23.4%	1.64
	To School	359,400	566,122	19.8%	19.7%	1.58
	Business	105,107	173,231	5.8%	6.0%	1.65
	Others	215,824	340,851	11.9%	11.8%	1.58
	To Home	720,203	1,127,149	39.7%	39.1%	1.57
	<b>Sub Total</b>	<b>1,811,838</b>	<b>2,880,585</b>	<b>100.0%</b>	<b>100.0%</b>	<b>1.59</b>
Area Outside the Ring Road	To Work	223,157	351,826	13.7%	13.7%	1.58
	To School	297,630	465,624	18.3%	18.1%	1.56
	Business	48,362	79,476	3.0%	3.1%	1.64
	Others	128,373	199,007	7.9%	7.7%	1.55
	To Home	929,033	1,479,684	57.1%	57.4%	1.59
	<b>Sub Total</b>	<b>1,626,555</b>	<b>2,575,617</b>	<b>100.0%</b>	<b>100.0%</b>	<b>1.58</b>
Total	To Work	634,461	1,025,058	18.5%	18.8%	1.62
	To School	657,030	1,031,746	19.1%	18.9%	1.57
	Business	153,469	252,707	4.5%	4.6%	1.65
	Others	344,197	539,858	10.0%	9.9%	1.57
	To Home	1,649,236	2,606,833	48.0%	47.8%	1.58
	<b>Total</b>	<b>3,438,393</b>	<b>5,456,202</b>	<b>100.0%</b>	<b>100.0%</b>	<b>1.59</b>

Source: JICA Survey Team

**Table 8.3.5 Trip Attraction/Generation Ratios**

Area	Item	Attraction/Generation Ratio	
	Year	2011	2022
	Purpose	Present	Case-1
Area Inside the Ring Road	To Work	1.46	1.46
	To School	1.36	1.35
	Business	1.17	1.17
	Others	1.42	1.41
	To Home	0.73	0.71
	<b>Sub Total</b>	<b>1.02</b>	<b>1.01</b>
Area Outside the Ring Road	To Work	0.63	0.62
	To School	0.76	0.76
	Business	0.76	0.76
	Others	0.67	0.67
	To Home	1.40	1.45
	<b>Sub Total</b>	<b>0.98</b>	<b>0.99</b>

Source: JICA Survey Team

### 8.3.2 Trip Distribution

#### (1) Trip Distribution Model

Trip distribution is the second step in the demand forecasting process. Trip distribution model shall estimate the number of trips between zones from origin to destination by each trip purpose. The output of trip distribution is represented as an origin-destination (OD) table. Trip distribution pattern consists of intra-zonal trips and inter-zonal trips.

##### 1) Intra-zonal Trip Rate

In the area inside the Ring Road, approximately 90% of “to work” and “to school” trips were intra-areal trips in 2011 considering the center of urban function in Kathmandu Valley. On the other hand, in the area outside the Ring Road, approximately 54-70% of “to work” and “to school” trips were intra-areal as shown in Table 8.3.6.

This is why most of the employments exist in the area inside the Ring Road. This characteristic would continue if no industrial and housing measures are done. Therefore, since the situation is not changed, this macro framework of trip distribution pattern is basically maintained for demand forecasting. In addition, the intra-zonal trip ratios of small zones derived from the household interview survey are applied for future demand forecasting, and are assumed to be constant, as shown in Appendix 2.1.2.

**Table 8.3.6 Intra-areal Trip Ratios**

Area classified	to Work	to School	Business	Others	to Home	Total
Total of zones inside the Ring Road	88.9%	90.3%	83.8%	84.3%	64.8%	75.0%
Total of Other zones	54.0%	69.2%	52.7%	53.9%	87.6%	70.9%

Source: JICA Survey Team

##### 2) Inter-zonal Trip Model

Secondly, two kinds of methods for inter-zonal trips were used to estimate the future trip distribution in the Kathmandu Valley, namely, a) present pattern method, and b) gravity model, as follows:

###### a) Present Pattern Method

Present pattern method is used when future land use pattern, population distribution pattern, and transport level of service in a survey area would not change much from the present. One example of such calculation method is the so called Fratar Model. This is a mathematical formula that estimates the number of trips between two zones using the current trip flow and the growth factor of generation and attraction. This model was used in the base case in this survey.

###### b) Gravity Model

A gravity model is used when future conditions relating to trip distribution pattern would be changed. For example, a large-scale urban development is scheduled to take place in the suburb. Therefore, a gravity model will be developed to estimate future trip distribution if a large-scale urban development in the Kathmandu Valley will be planned. In this survey, it was assumed as a case study that a new city center would be developed in Bhaktapur as described in Section 8.4. The gravity model was used in this case and the formula of the model is as follows:

$$X_{ij} = k \cdot \frac{G_i^\alpha \cdot A_j^\beta}{T_{ij}^\gamma}$$

Where,  
 i, j: zone  
 Xij : number of trips between zone i and zone j  
 Gi: number of trips generated in zone i  
 Aj: number of trips attracted in zone j  
 Tij: distance (m) on the road between zone i and zone j  
 K, α, β, γ: parameter

**Table 8.3.7 Trip Distribution Model (Gravity Model)**

OD Pattern	Purpose	α	β	γ	k	Multiple Correlation Coefficient	No of Samples
OD Trips Between Zones Inside the Ring Road	To Work	1.2258 (36.4323)	0.9295 (30.2113)	1.1782 (29.4246)	0.0103 (8.1343)	0.9275	756
	To School	1.4547 (21.0941)	0.9728 (20.2150)	1.5615 (24.2411)	0.0311 (3.6953)	0.8734	573
	Business	1.0799 (24.0849)	0.8538 (24.4850)	0.9338 (15.4473)	0.0455 (4.9914)	0.8886	441
	Others	1.1739 (20.3078)	0.8638 (23.7353)	1.0987 (15.1871)	0.0308 (4.9057)	0.8637	429
Other Trips Between Zones	To Work	1.1572 (34.4491)	0.7665 (32.5044)	1.2338 (23.7349)	0.6115 (0.7544)	0.8509	1,632
	To School	1.2816 (32.0311)	0.8886 (29.6258)	1.2746 (21.6385)	0.1526 (2.5034)	0.8355	1,850
	Business	0.4790 (12.1974)	0.4677 (15.4919)	0.6968 (10.6140)	36.4283 (4.7151)	0.6854	620
	Others	1.0238 (21.1111)	0.7545 (26.1031)	1.2248 (17.9565)	3.8163 (1.5311)	0.8039	1,179

Note: Number in ( ) means t-value.

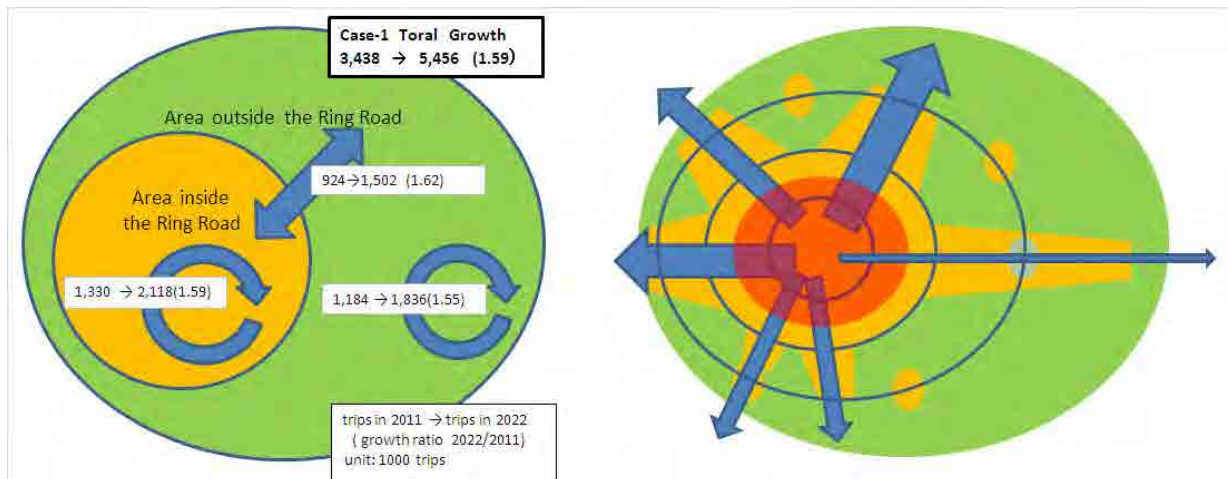
Source: JICA Survey Team

**(2) Future Trip Distribution (Case-1)**

Present pattern method was applied for Case-1 using the Fratar Model. The result, as shown in Figure 8.3.2, demonstrates that the future flow pattern of person trip is estimated to be almost the same as the present. Although every direction of flow would be increased by a growth ratio of nearly 1.59, the trips particularly between the central area and suburbs tend to become greater than other inter- and intra-areal trips. The overall trip flow pattern in Kathmandu Valley shows a typical mono-concentration structure with rapid population growth in the suburbs. Therefore, the pattern becomes more defined in the future without a change in the land use pattern.

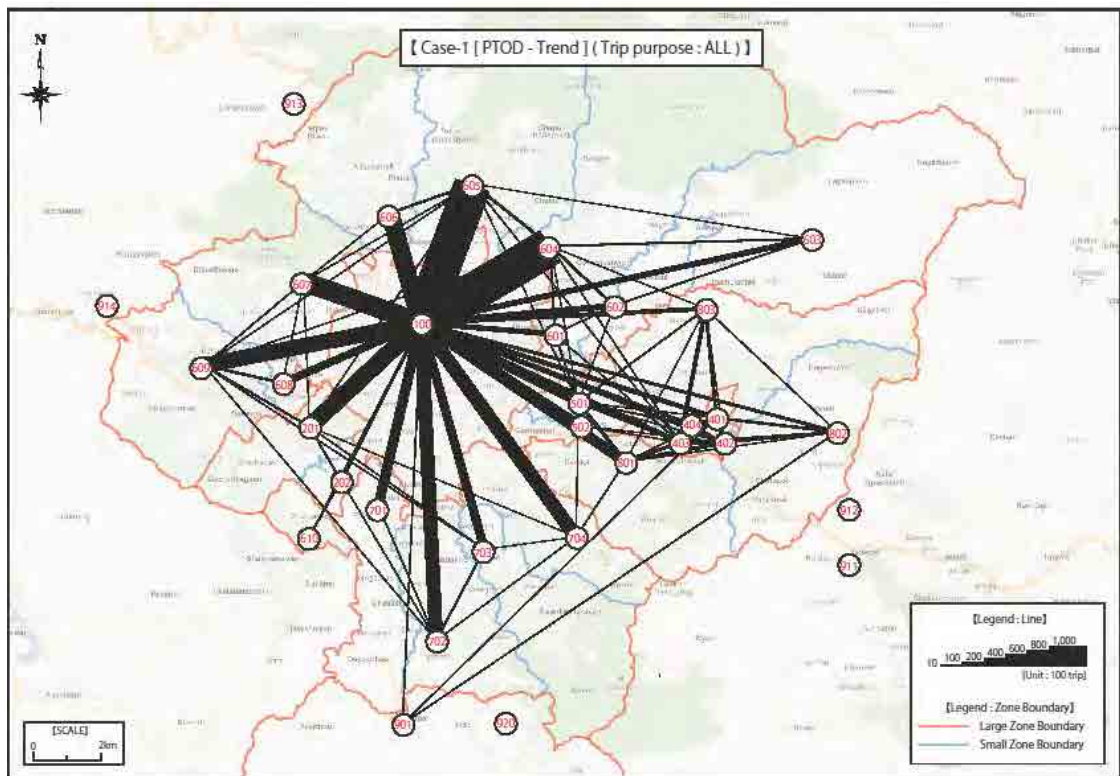
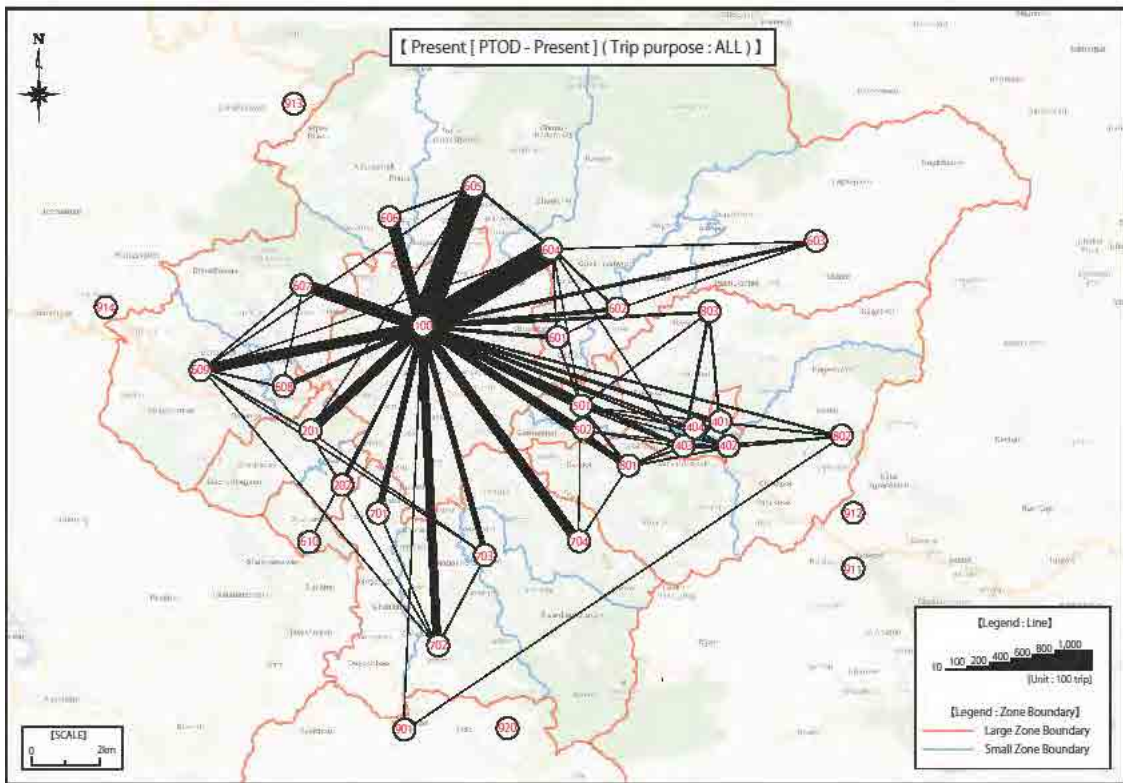
**(Trip Distribution Pattern)**

**(Mono-concentration Structure)**



Source: JICA Survey Team

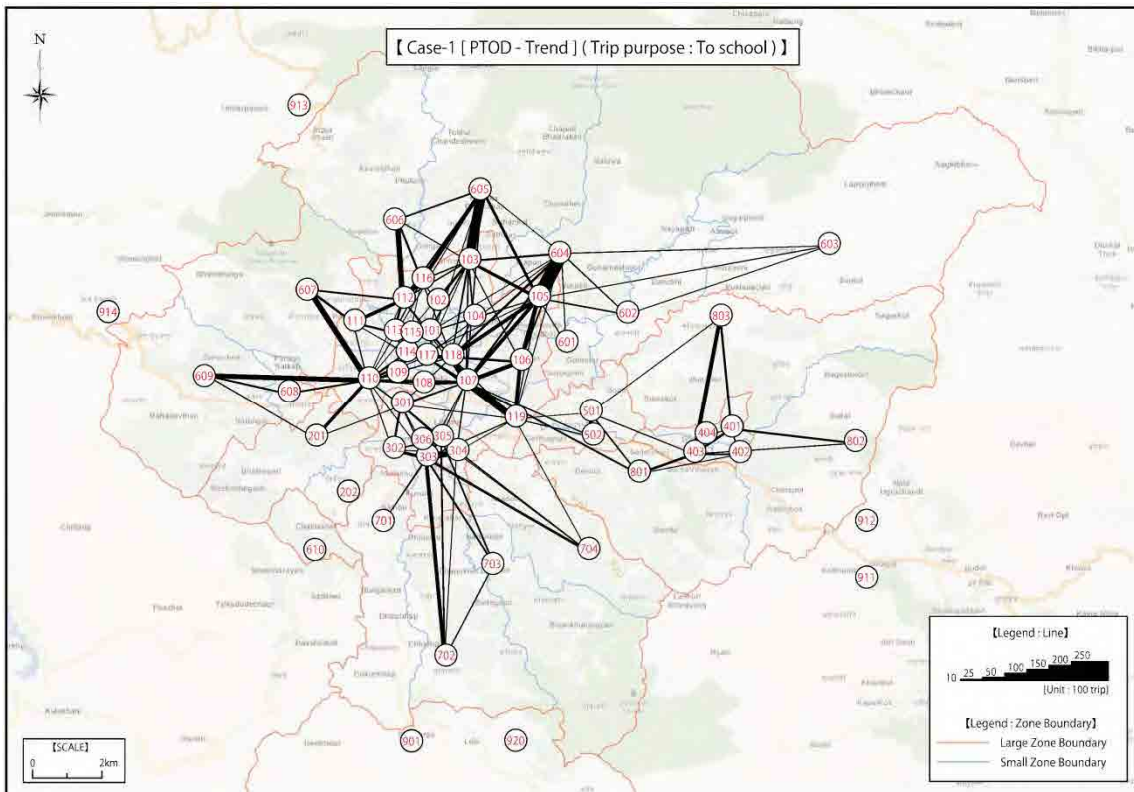
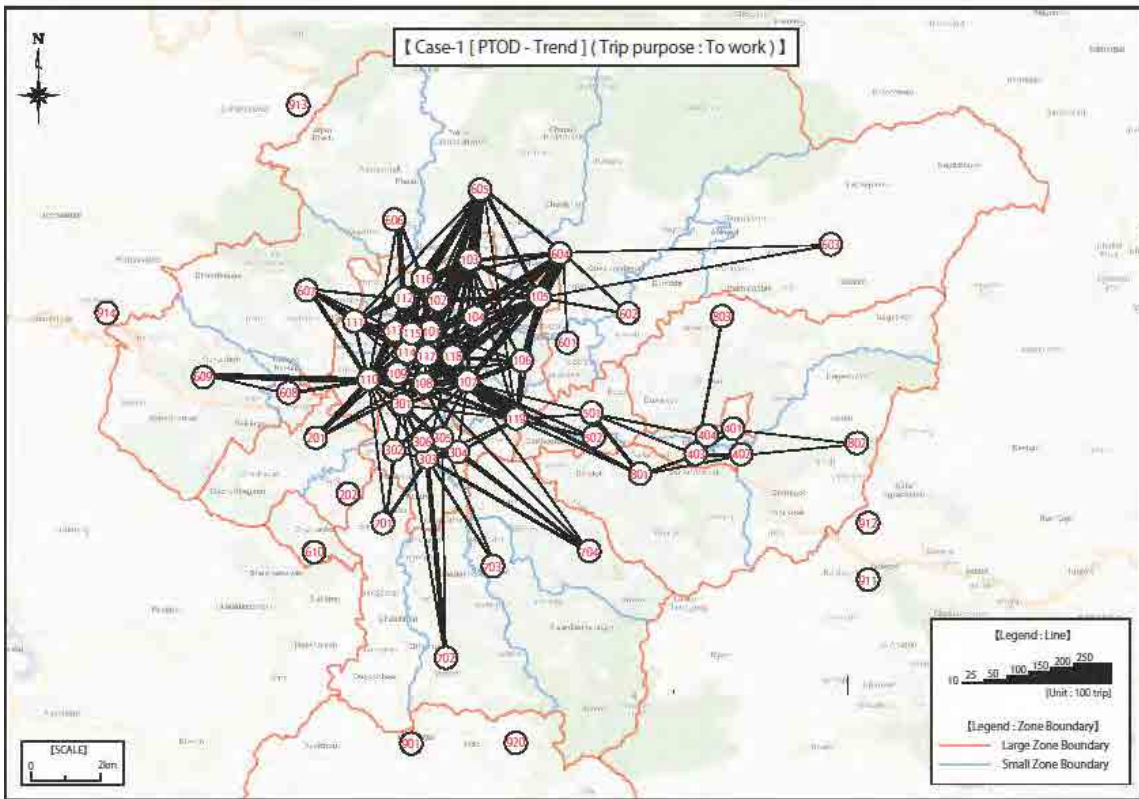
**Figure 8.3.2 Estimated Trip Flow in 2011 and 2022 (Between Areas)**



Note: The central area of Kathmandu is aggregated to one zone encompassing the small zones inside the Ring Road.

Source: JICA Survey Team

Figure 8.3.3 Estimated Trip Flow in 2011 and 2022 (All Purposes)



Note: The figure shows person trip flow between small zones.

Source: JICA Survey Team

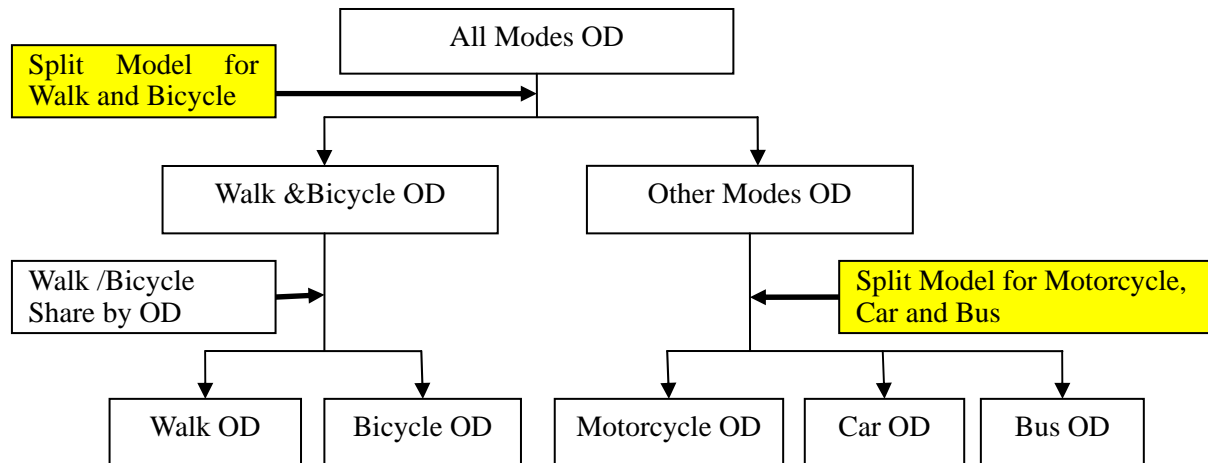
**Figure 8.3.4 Estimated Trip Flow in 2022 (Case-1: “To Work” and “To School”)**



### 8.3.3 Modal Split

#### (1) Modal Split Hierarchy

The modal split hierarchy for the model building process in this survey is shown in Figure 8.3.5 below. With regard to inter-zonal model, two models were developed, namely, split model for walk and bicycle, and split model for motorcycle, car and bus. Furthermore, intra-zonal model within a small zone was also developed.



Source: JICA Survey Team

Figure 8.3.5 Modal Split Hierarchy

#### (2) Split Model for Walk and Bicycle (Inter-zonal Model)

The share of walk and bicycle among all modes between zones was determined by trip length as shown in the following formula:

$$P_{ij} = \frac{1}{1 + \alpha \cdot D_{ij}^{\beta}}$$

Where,

i, j: zone

P<sub>ij</sub>: share of walk and bicycle between zone i and zone j

D<sub>ij</sub>: distance (m) on the road between zone i and zone j

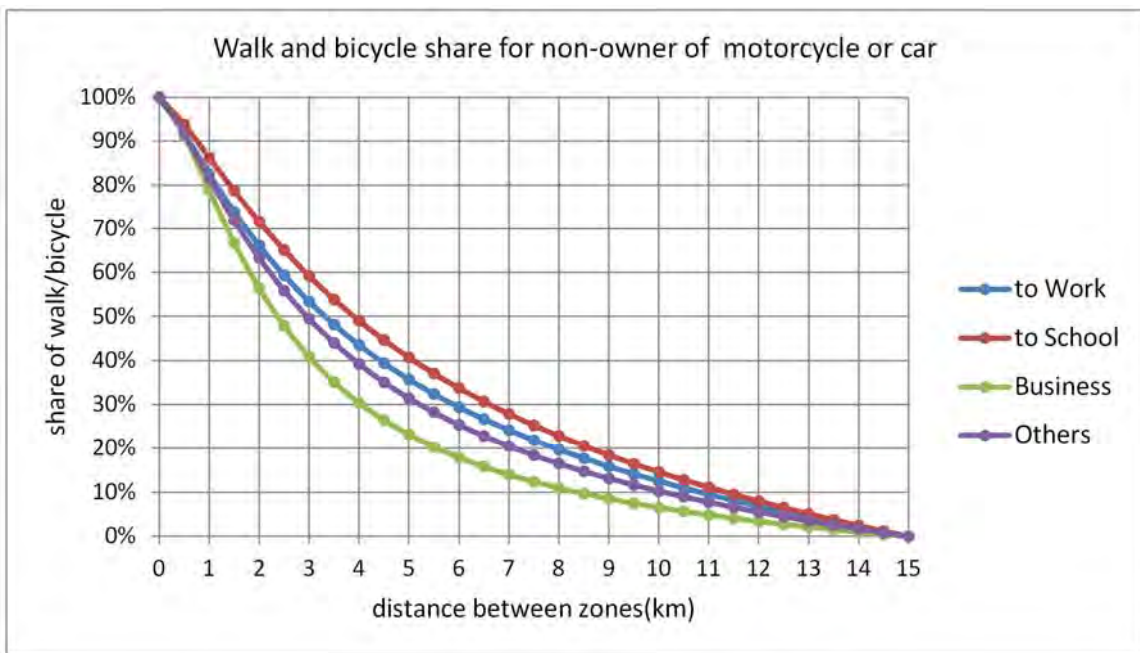
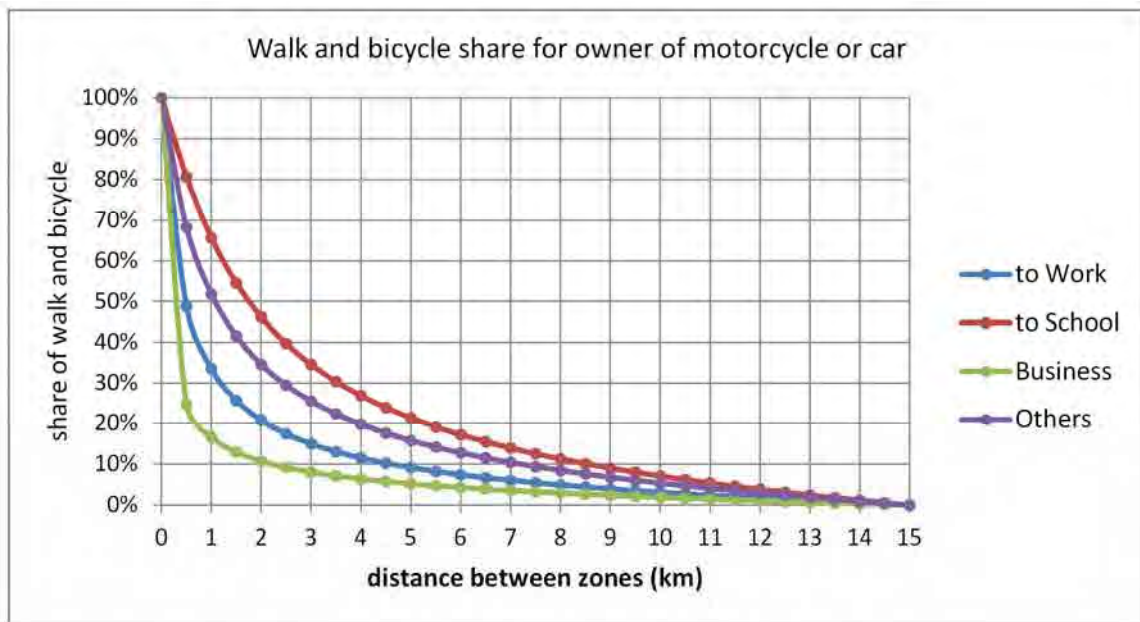
α, β: parameter

Table 8.3.8 Modal Split Model for Walk and Bicycle

Ownership	Purpose	α	β	Correlation Coefficient	No of Samples
Non-Owner	To Work	0.1976 (43.7712)	1.2403 (51.2910)	0.9208	474
	To School	0.1437 (48.0065)	1.2924 (46.2471)	0.9023	490
	Business	0.2623 (19.0624)	1.5075 (25.2700)	0.9086	137
	Others	0.2157 (29.2733)	1.3321 (38.9540)	0.9137	302
Owner	To Work	1.9559 (22.9728)	0.9080 (46.5037)	0.9268	357
	To School	0.5094 (20.5701)	1.1269 (50.0524)	0.9109	516
	Business	4.9054 (24.2167)	0.6937 (14.7748)	0.8243	105
	Others	0.9124 (2.4400)	0.9925 (40.6759)	0.9246	283

Note: Number in ( ) means t-value.

Source: JICA Survey Team



Source: JICA Survey Team

**Figure 8.3.6 Inter-zonal Modal Split Model for Walk and Bicycle**

After determining the share of walk and bicycle between small zones, a proportion of walk was assumed to be the same as the existing proportion obtained from the household interview survey.

**(3) Split Model for Motorcycle, Car and Bus (Inter-zonal Model)**

A disaggregated model was developed to estimate the split among motorcycle, car and bus by trip purpose. In this model, travel time, travel cost, motorcycle and car ownership, and area classification whether trip is generated inside the Ring Road or not were used as explanatory variables.

$$P_i = \frac{e^{V_i}}{\sum_i e^{V_i}}$$

$$V_i = \beta_1 Z_{1i} + \beta_2 Z_{2i} + \dots + \beta_k Z_{ki}$$

Where,

Pi : choice probability of mode i

Vi: utility of mode i

Zki: explanatory variable of mode i

β k: parameter of mode i

**Table 8.3.9 Modal Split Model for Motorcycle, Car and Bus**

Purpose	Mode	Time (min)	Cost (NRs)	Motorcycle Ownership	Car Ownership	Erea Dummy Variable (inside the Ring road)	Car Dummy Variable	Bus Dummy Variable	ρ <sup>2</sup>	Hitting Ratio	No of Samples
To Work	Motorcycle	-0.0568 (-3.777)	-0.0550 (-4.727)	5.2757 (12.930)					0.4455	78.0%	900
	Car	-0.0568 (-3.777)	-0.0550 (-4.727)		4.3121 (15.858)		2.6908 (8.372)				
	Bus	-0.0568 (-3.777)	-0.0550 (-4.727)			0.5607 (3.109)		3.3082 (7.089)			
To School	Motorcycle	-0.0786 (-6.576)	-0.1011 (-9.682)	4.8951 (11.873)					0.3834	70.0%	810
	Car	-0.0786 (-6.576)	-0.1011 (-9.682)		2.7916 (10.222)		3.4937 (10.775)				
	Bus	-0.0786 (-6.576)	-0.1011 (-9.682)			1.5549 (7.702)		4.0686 (5.879)			
Business	Motorcycle	-0.1056 (-6.702)	-0.1310 (-8.715)	4.5720 (12.765)					0.4109	73.7%	900
	Car	-0.1056 (-6.702)	-0.1310 (-8.715)		3.3622 (14.307)		3.6821 (10.416)				
	Bus	-0.1056 (-6.702)	-0.1310 (-8.715)			0.3048 (2.021)		2.7693 (8.242)			
Others	Motorcycle	-0.0950 (-7.436)	-0.0283 (-3.586)	2.6649 (9.704)					0.3627	70.8%	750
	Car	-0.0950 (-7.436)	-0.0283 (-3.586)		2.9202 (12.062)		1.1966 (6.156)				
	Bus	-0.0950 (-7.436)	-0.0283 (-3.586)			2.1211 (10.849)		1.9938 (2.867)			

Source: JICA Survey Team

**(4) Intra-zonal Model**

Intra-zonal share was assumed to be proportional with the rate of motorcycle and car ownership. This was done on purpose in a small zone because both motorcycle and car shares were closely related to the level of ownership of the two transportation modes as shown in Appendix 2.1.3.

(5) Future Modal Split (Case-1)

Number of trips and modal share of both motorcycle and car were estimated to increase due to their growing ownership ratios. In contrast, bus share would decrease due to the modal shift from bus to private vehicles, motorcycle and car.

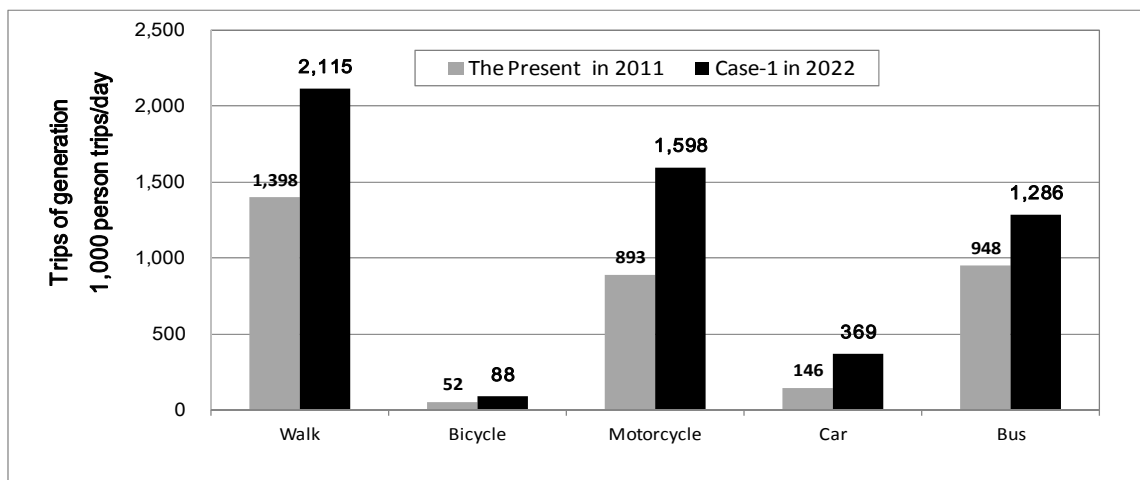
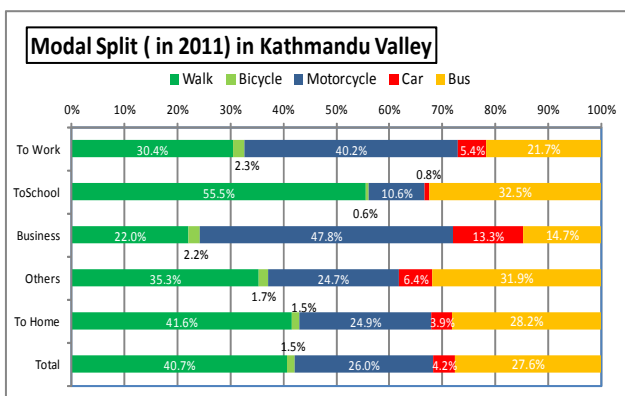


Figure 8.3.7 Person Trips by Mode (in 2022 and 2022(Case-1))in Kathmandu Valley

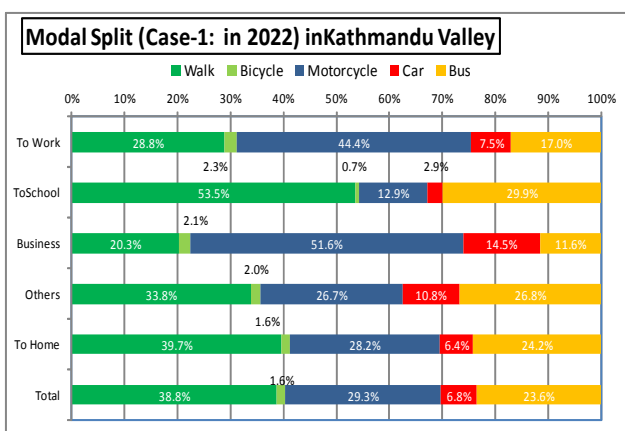
Table 8.3.10 Future Modal Split (Case-1) in Kathmandu Valley



Modal Split (The present in 2011) in Kathmandu Valley

unit: person trips/day

	Walk	Bicycle	Motorcycle	Car	Bus	Total
To Work	193,076	14,291	254,992	34,349	137,753	634,461
To School	364,601	4,157	69,324	5,167	213,781	657,030
Business	33,790	3,433	73,306	20,389	22,551	153,469
Others	121,501	5,924	85,167	21,863	109,742	344,197
To Home	685,410	24,640	410,337	64,212	464,637	1,649,236
Total	1,398,378	52,445	893,126	145,980	948,464	3,438,393



Modal Split (Case-1: Future in 2022) in Kathmandu Valley

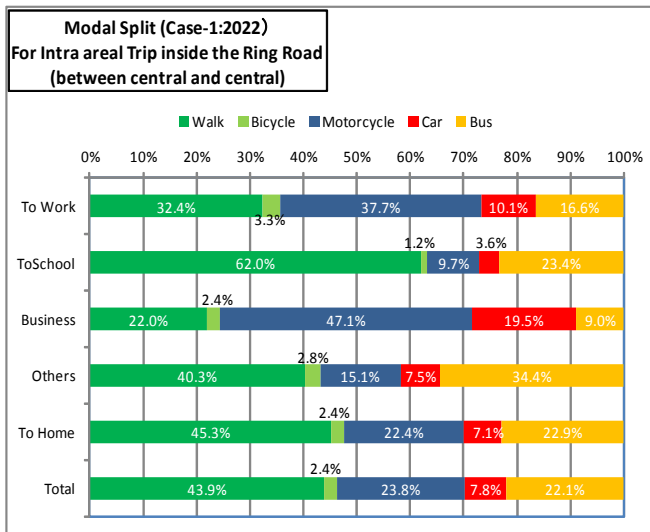
unit: person trips/day

	Walk	Bicycle	Motorcycle	Car	Bus	Total
To Work	295,566	23,399	454,622	77,357	174,114	1,025,058
To School	552,400	7,474	133,604	30,118	308,150	1,031,746
Business	51,298	5,236	130,285	36,599	29,289	252,707
Others	182,390	10,550	144,180	58,232	144,506	539,858
To Home	1,033,741	41,614	735,131	166,718	629,629	2,606,833
Total	2,115,395	88,273	1,597,822	369,024	1,285,688	5,456,202

Source: JICA Survey Team

Person trip flows of more than 2.1 million inside the Ring Road with a length of 3-5 km would increase per vehicle mode. Those in between the central and the suburbs were estimated to be more than 1.5 million person trips per day with vehicles riding mainly by motorcycle and bus.

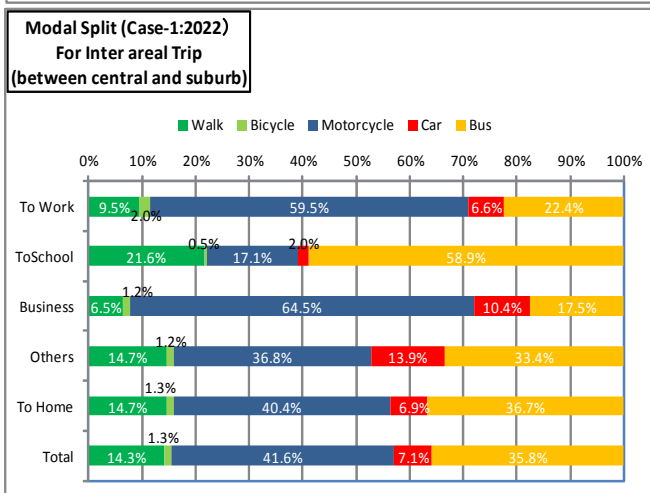
**Table 8.3.11 Future Modal Split (Case-1) for Areal Flow in Kathmandu Valley**



Modal Split (Case-1:2022 )  
For Intra areal Trip inside the Ring Road  
(between central and central)

unit: person trips/day

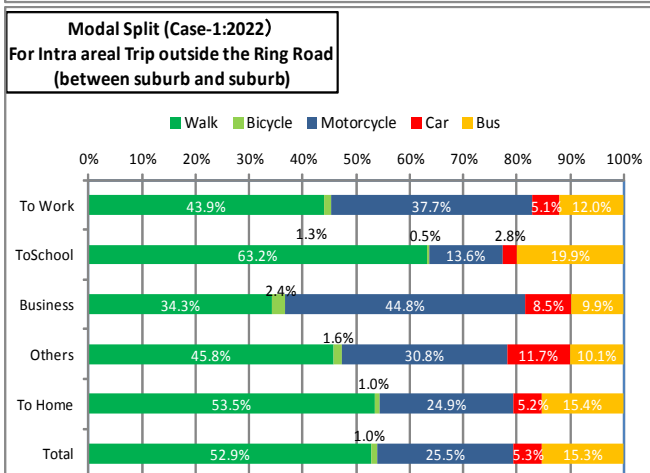
	Walk	Bicycle	Motorcycle	Car	Bus	Total
To Work	132,968	13,389	154,949	41,338	68,108	410,752
To School	234,665	4,433	36,852	13,786	88,619	378,355
Business	27,470	3,035	58,718	24,334	11,163	124,720
Others	82,849	5,825	30,986	15,371	70,740	205,771
To Home	452,035	23,751	223,345	70,758	228,865	998,754
Total	929,987	50,433	504,850	165,587	467,495	2,118,352



Modal Split (Case-1:2022 )  
For Inter areal Trip  
(between central and suburb)

unit: person trips/day

	Walk	Bicycle	Motorcycle	Car	Bus	Total
To Work	29,763	6,087	185,736	20,637	69,801	312,024
To School	49,542	1,035	39,151	4,588	134,923	229,239
Business	4,675	851	46,570	7,498	12,617	72,211
Others	25,259	2,106	63,212	23,867	57,326	171,770
To Home	105,011	9,265	289,308	49,507	263,179	716,270
Total	214,250	19,344	623,977	106,097	537,846	1,501,514



Modal Split (Case-1:2022 )  
For Intra areal Trip outside the Ring Road  
(between suburb and suburb)

unit: person trips/day

	Walk	Bicycle	Motorcycle	Car	Bus	Total
To Work	132,835	3,923	113,937	15,382	36,205	302,282
To School	268,193	2,006	57,601	11,744	84,608	424,152
Business	19,153	1,350	24,997	4,767	5,509	55,776
Others	74,282	2,619	49,982	18,994	16,440	162,317
To Home	476,695	8,598	222,478	46,453	137,585	891,809
Total	971,158	18,496	468,995	97,340	280,347	1,836,336

Source: JICA Survey Team

### 8.3.4 Traffic Assignment

#### (1) Method of Traffic Assignment

Traffic assignment is carried out by using vehicle trip OD (VTOD) table and transportation network data. There are several methods for traffic assignment. In this survey, the user equilibrium assignment was selected because this method has been mostly used and has higher level of accuracy. The user equilibrium assignment method assumes that every traveler has perfect information concerning the attributes of network alternatives and chooses routes that minimize his/her travel time or travel costs, and that all travelers have the same valuation of network attributes. The method requires link performance functions, such as travel time on a link under various level of congestion as measured by volume-to-capacity ratios. The following BPR equation, which is most widely used as a link performance function, was applied to estimate the traffic volume on each link of the future road network alternatives.

$$V_c = \frac{V_o}{1 + \alpha(Vol / C)^\beta}$$

Where,  $V_c$  : Congested Speed

$V_o$  : Free Flow Speed

$Vol$ : Traffic Volume (PCU)

$C$  : Ideal Traffic Capacity (PCU)

$\alpha, \beta$ : parameter  $\alpha=0.48, \beta=2.82$

Source: JICA Survey Team

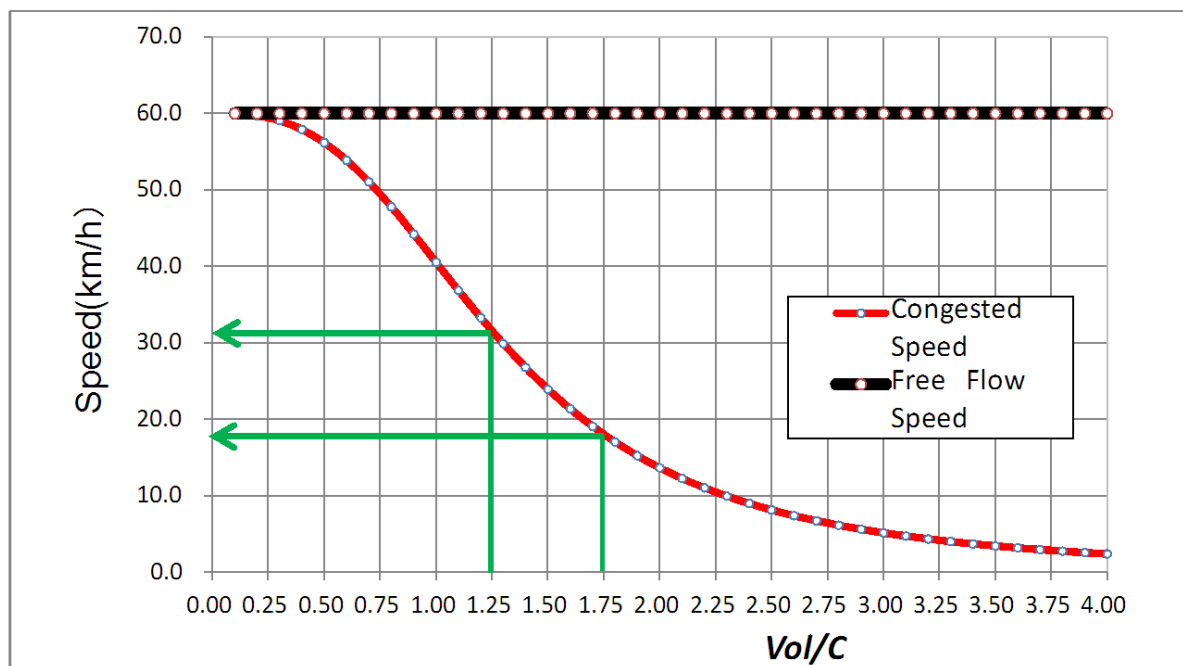
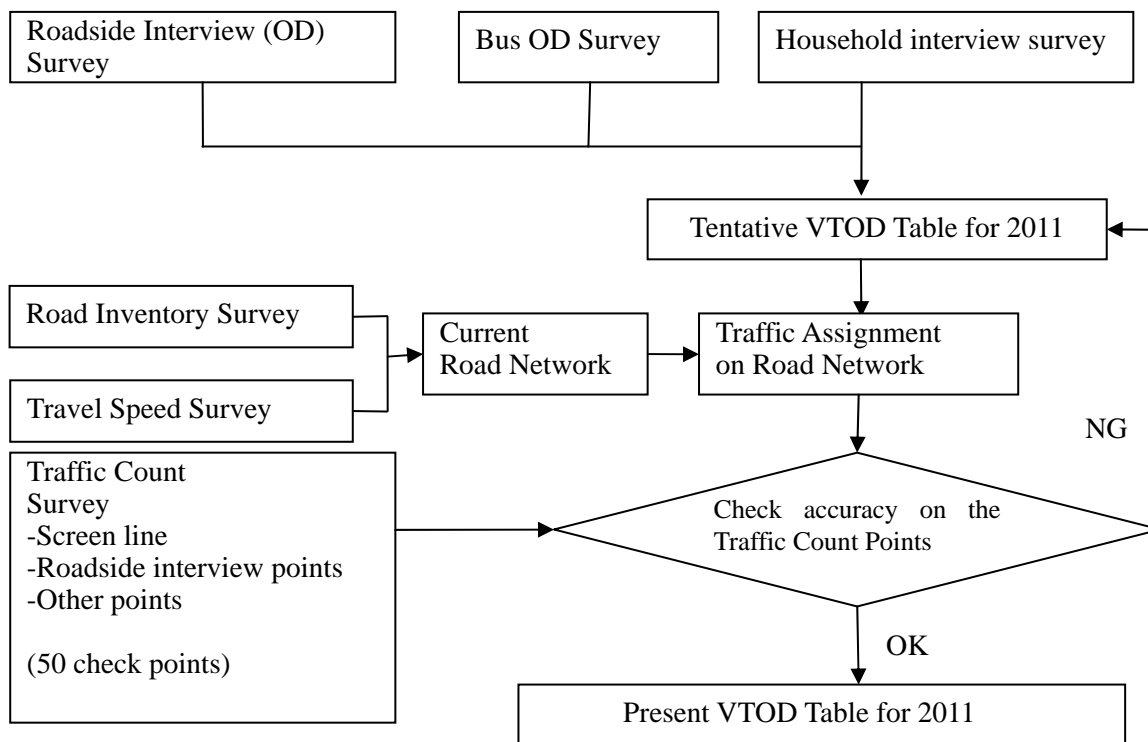


Figure 8.3.8 Travel Speed Variation with Vol/C

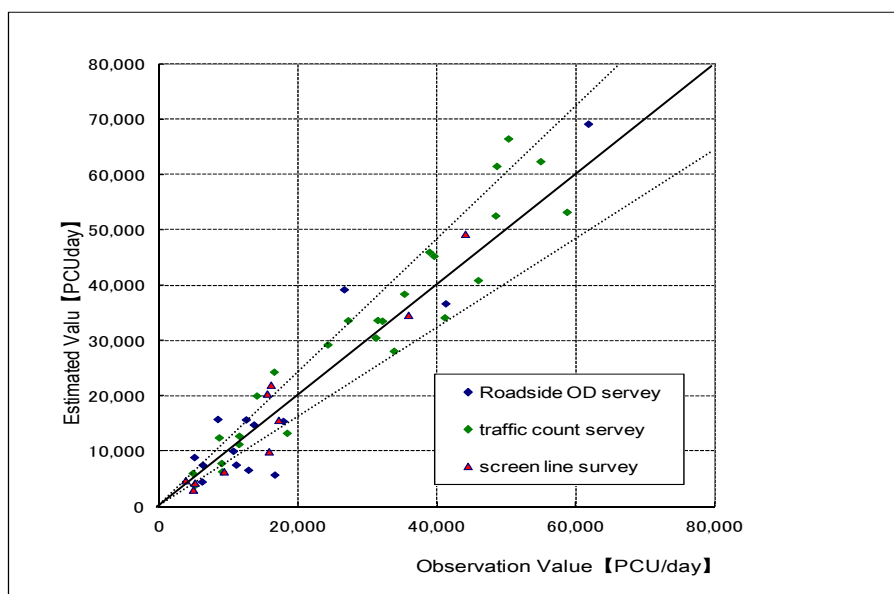
**(2) Present VTOD Table**

In this survey, the present VTOD table was firstly made based on the data collected from the roadside interview survey, household interview survey, bus OD survey, traffic count survey and other related information as shown in Figure 8.3.9. To secure a higher accuracy for traffic assignment, the present OD table was revised repeatedly until the obtained error is approximately within 20% of gap between estimation and observation values on the traffic count survey points.



Source: JICA Survey Team

**Figure 8.3.9 Flow Chart of Making Present VTOD Table**

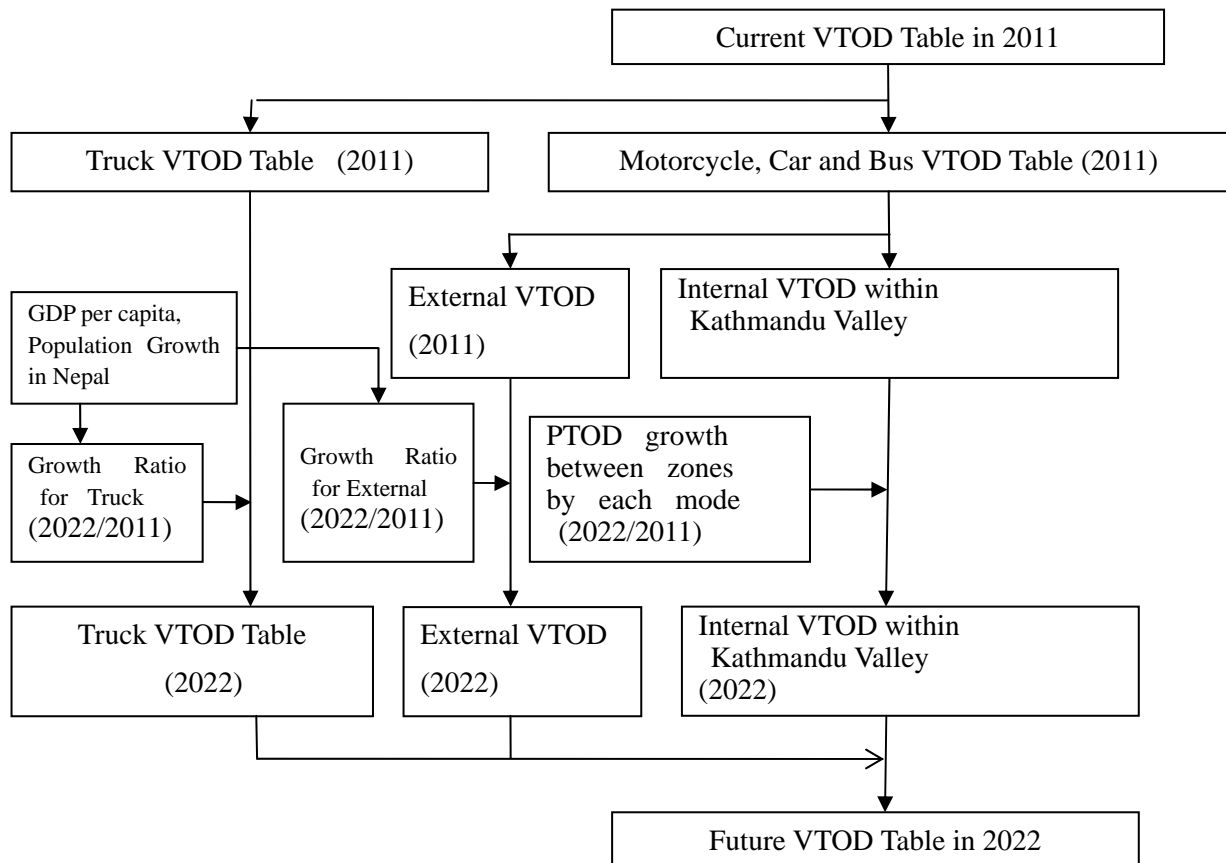


Source: JICA Survey Team

**Figure 8.3.10 Checked Result of Estimated Traffic Volume on the Survey Points**

**(3) Future VTOD Table**

Secondly, the future VTOD table was made by using the present VTOD, future person trip OD (PTOD) table, future socio-economic indicators like GDP. The process is shown in Figure 8.3.11.



Note: Growth Ratio for Truck

= Growth ratio of population in Kathmandu Valley × Growth of GDP per capita=2.13

Growth Ratio for External trips

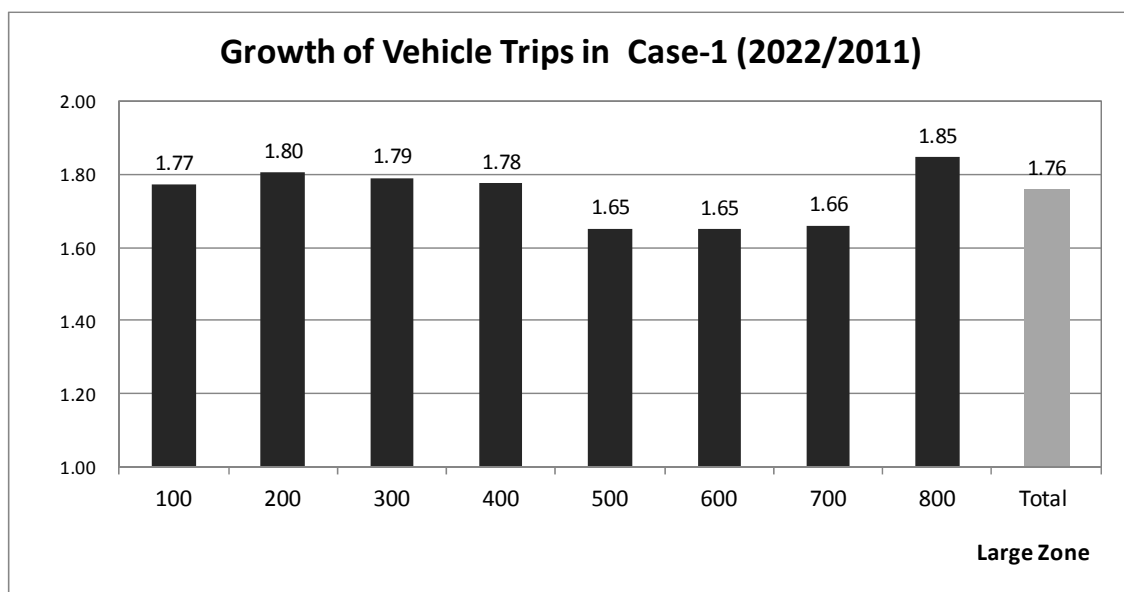
= Growth ratio of population in the other areas except Kathmandu Valley × Growth of GDP per capita=1.52

Source: JICA Survey Team

**Figure 8.3.11 Flow Chart for Making Future VTOD Table**

The future VTOD for Case-1 was estimated through the above-described process. Total generation of vehicle trips in 2022 was estimated at 1.862 million, corresponding to a 1.76 growth ratio. Zones which have relatively higher growth rates are Kathmandu N.P.(Zone100), Kirtipur N.P.(Zone200), Lalitpur N.P.(Zone300), Bhaktapur N.P.(Zone400) and Bhaktapur Dist.(Zone800).





Source: JICA Survey Team

**Figure 8.3.12 Growth of Future Vehicle Generation (Case-1) by Large Zone in Kathmandu Valley**

**Table 8.3.12 Future Vehicle Generation (Case-1) in Kathmandu Valley**

Large Zone	① Present Generation in 2011 [thousand vehicles]					② Case-1 Generation in 2022 [thousand vehicles]				
	Motorcycle	Car	Truck	Bus	Total	Motorcycle	Car	Truck	Bus	Total
100	452	147	42	81	721	819	250	89	119	1,278
200	8	2	0	2	12	15	3	1	3	22
300	92	25	10	14	140	167	43	21	21	252
400	16	4	5	2	27	27	6	12	3	48
500	13	4	3	1	21	21	5	6	2	35
600	45	12	9	20	86	73	21	19	28	141
700	25	6	3	3	38	42	10	6	5	62
800	8	2	2	1	13	14	5	4	1	25
Total	659	202	74	123	1,058	1,178	343	158	183	1,862

Large Zone	② / ① Growth of Case-1				
	Motorcycle	Car	Truck	Bus	Total
100	1.81	1.71	2.14	1.48	1.77
200	1.89	1.50	2.09	1.71	1.80
300	1.82	1.71	2.12	1.52	1.79
400	1.72	1.55	2.14	1.64	1.78
500	1.60	1.48	2.14	1.61	1.65
600	1.64	1.70	2.14	1.43	1.65
700	1.66	1.52	2.13	1.49	1.66
800	1.68	2.28	2.12	1.77	1.85
Total	1.79	1.70	2.13	1.49	1.76

Source: JICA Survey Team

**(4) Result of Traffic Assignment**

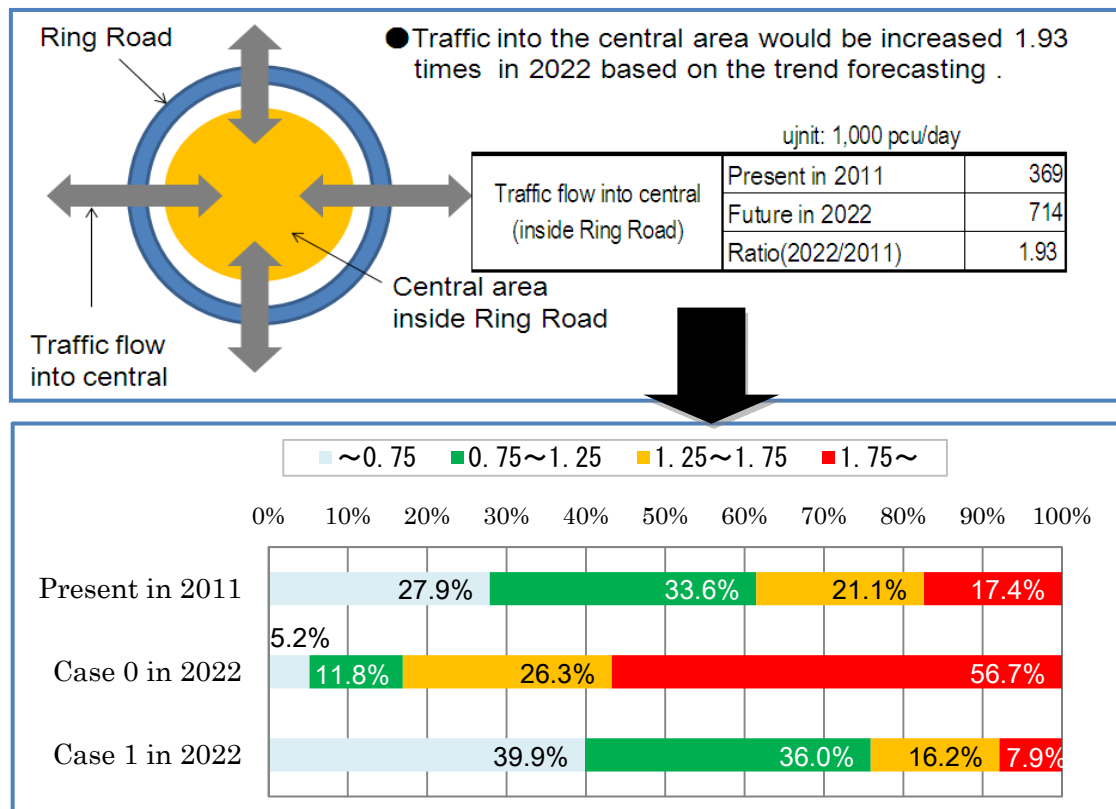
The results of traffic assignment for the current case in 2011, Case-0 in 2022, and Case-1 in 2022 are shown in Table 8.3.13 and Figure 8.3.13. The results show that the do-nothing case until 2022 (Case-0) would result to serious traffic jam all day. On the other hand, Case-1, where effective road projects such as the expansion of the Ring Road are assumed to be completed by 2022, could make the traffic along the roads inside the Ring Road smooth and nearly at the same level as the present (current case in 2011).

The traffic demand in Kathmandu Valley in the long run can probably be seen as a growing trend line. For example, the ownership level of car is still lower at present and ten years later. If GDP continues to grow, there would be more and more car owners. The additional and continuous increase of traffic demand requires further transportation improvement measures or appropriate land use control to prevent large development unsuitable with the level of infrastructure provision.

**Table 8.3.13 Comparison of Congestion Ratio**

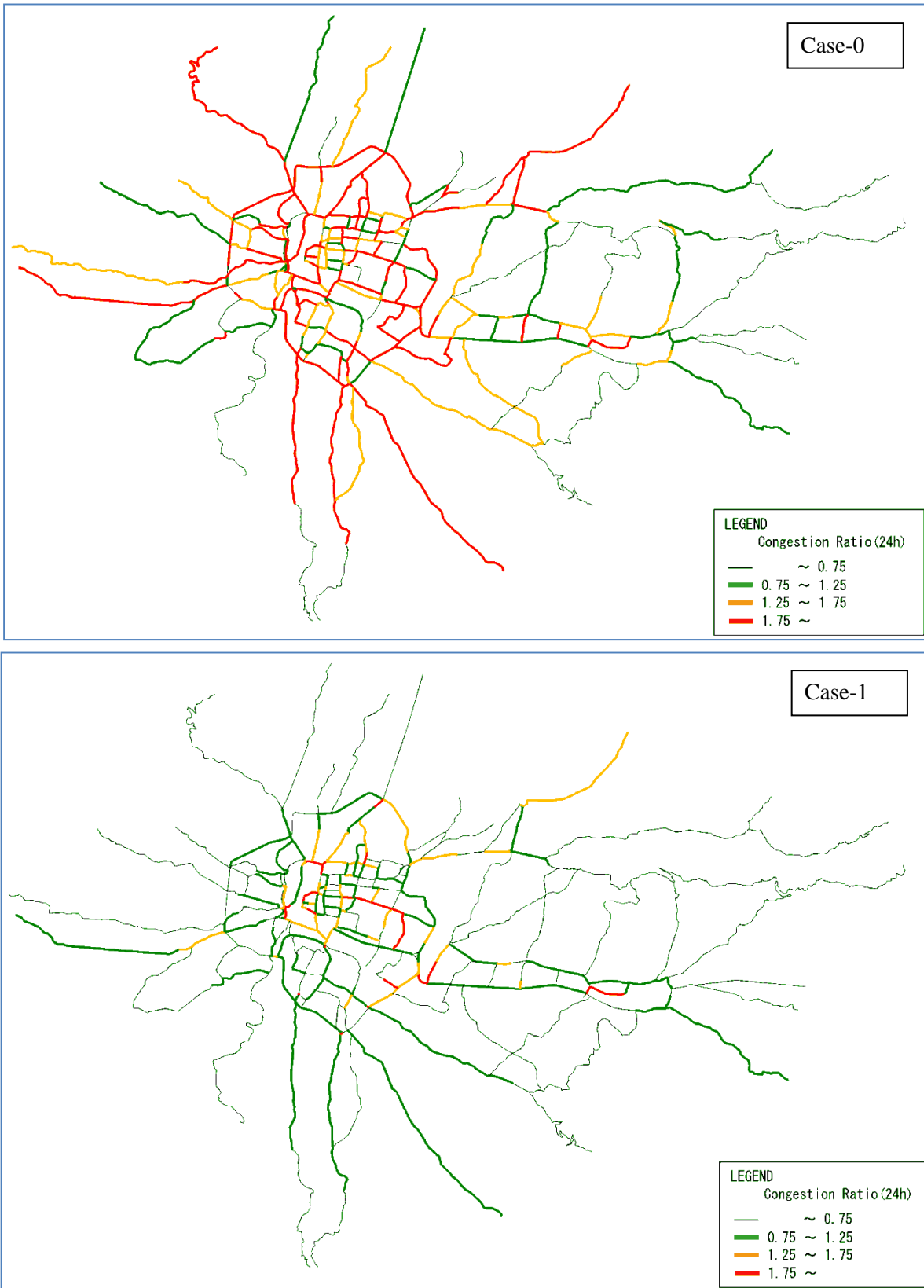
Indicators	Area	Current in 2011		Case 0 in 2022		Case 1 in 2022	
Average Congestion Ratio	Area inside The Ring Road	0.99		1.83		0.97	
	Total	0.84		1.51		0.70	
Ratio of length by congestion rank inside the Ring Road	Length(km)	Ratio	Length(km)	Ratio	Length(km)	Ratio	
	~ 0.75	29.6	27.9%	5.5	5.2%	41.6	39.9%
	0.75 ~ 1.25	35.7	33.6%	12.5	11.8%	37.6	36.0%
	1.25 ~ 1.75	22.5	21.1%	28.0	26.3%	16.9	16.2%
	1.75 ~	18.5	17.4%	60.3	56.7%	8.2	7.9%

Source: JICA Survey Team



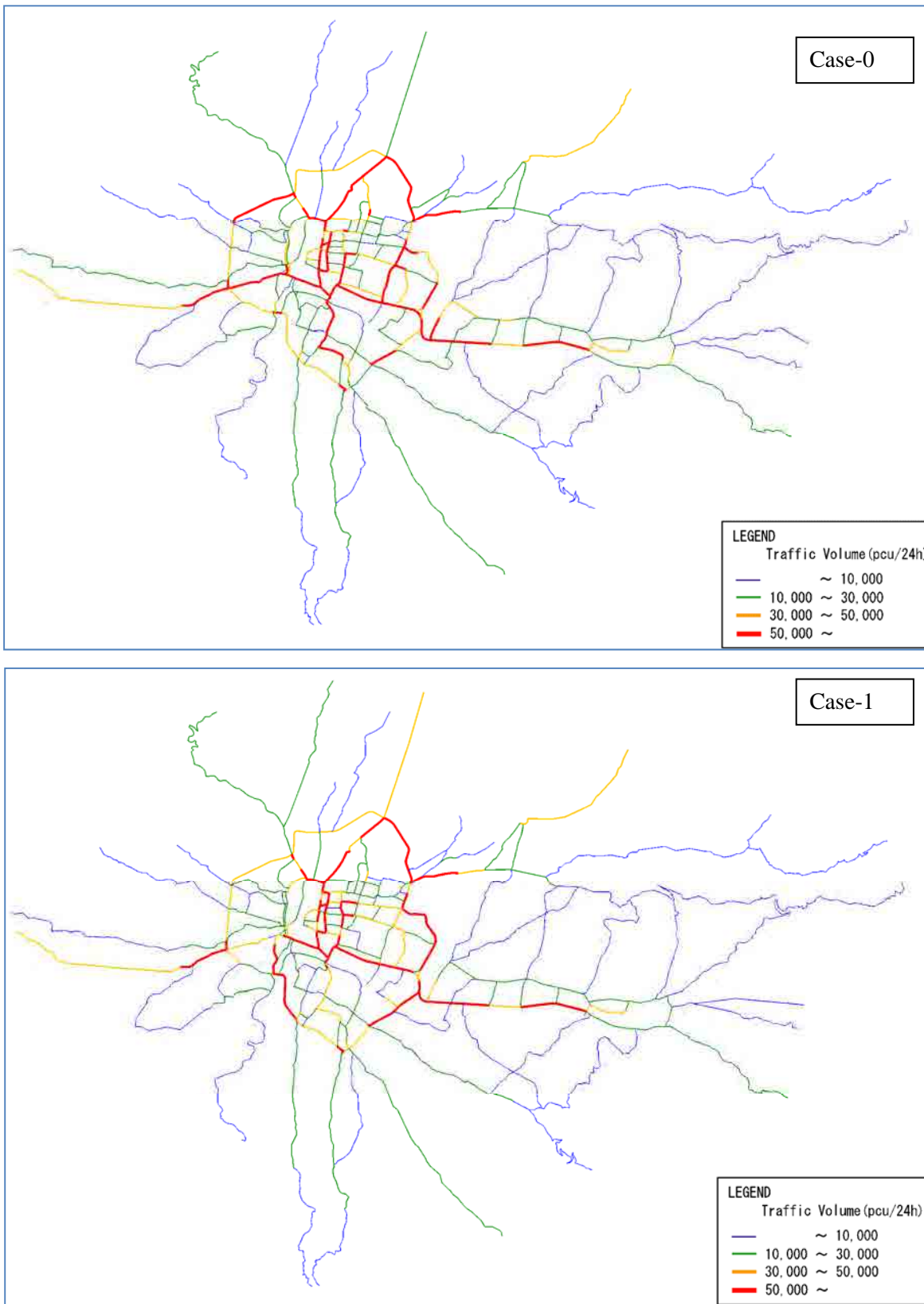
Source: JICA Survey Team

**Figure 8.3.13 Comparison of Congestion Ratio Inside the Ring Road**



Source: JICA Survey Team

**Figure 8.3.14 Future Congestion Ratio for Case-0 and Case-1**



Source: JICA Survey Team

Figure 8.3.15 Future Traffic Volume for Case-0 and Case-1

## 8.4 Case Study of Future Traffic Assignment in 2022

### 8.4.1 Comparative Case Setting

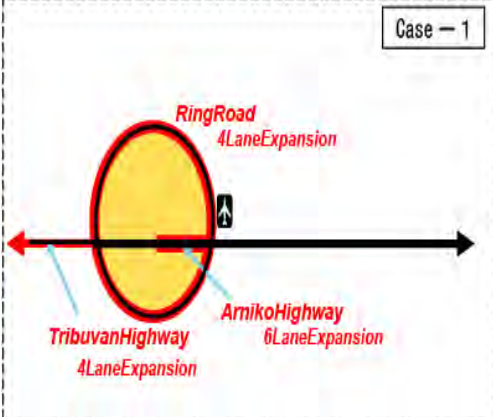
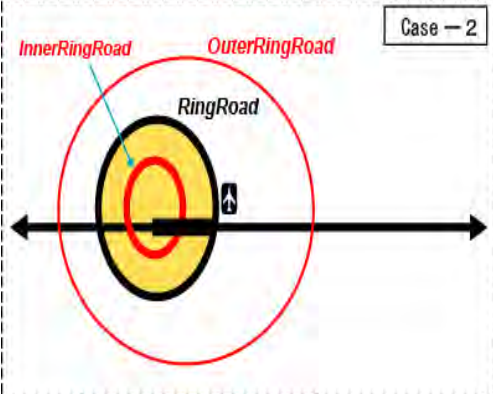
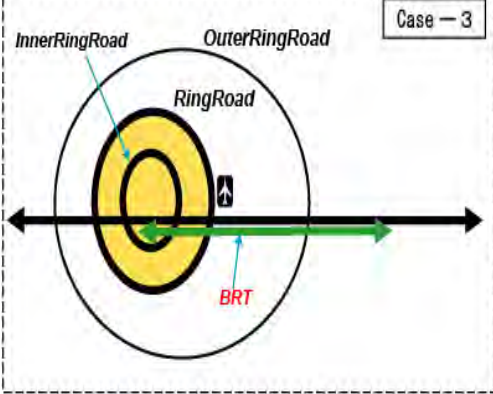
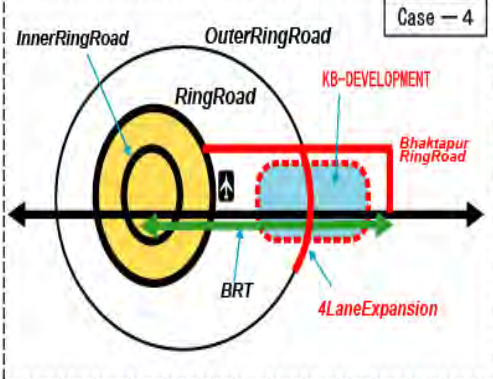
Based on the perspective of growth of population, GDP and vehicle ownership, it seems that the growth of traffic demand after 2022 might be higher than the growth between 2011 and 2022. Therefore, considering sustainability in the long term and in order to find several ideas for more effective and efficient way to address traffic congestion, comparative cases (Case-2,3,4) in addition to the base case (Case-1) were set up as shown in Table 8.4.1.

**Table 8.4.1 Four Kinds of Cases for the Long Term Perspective**

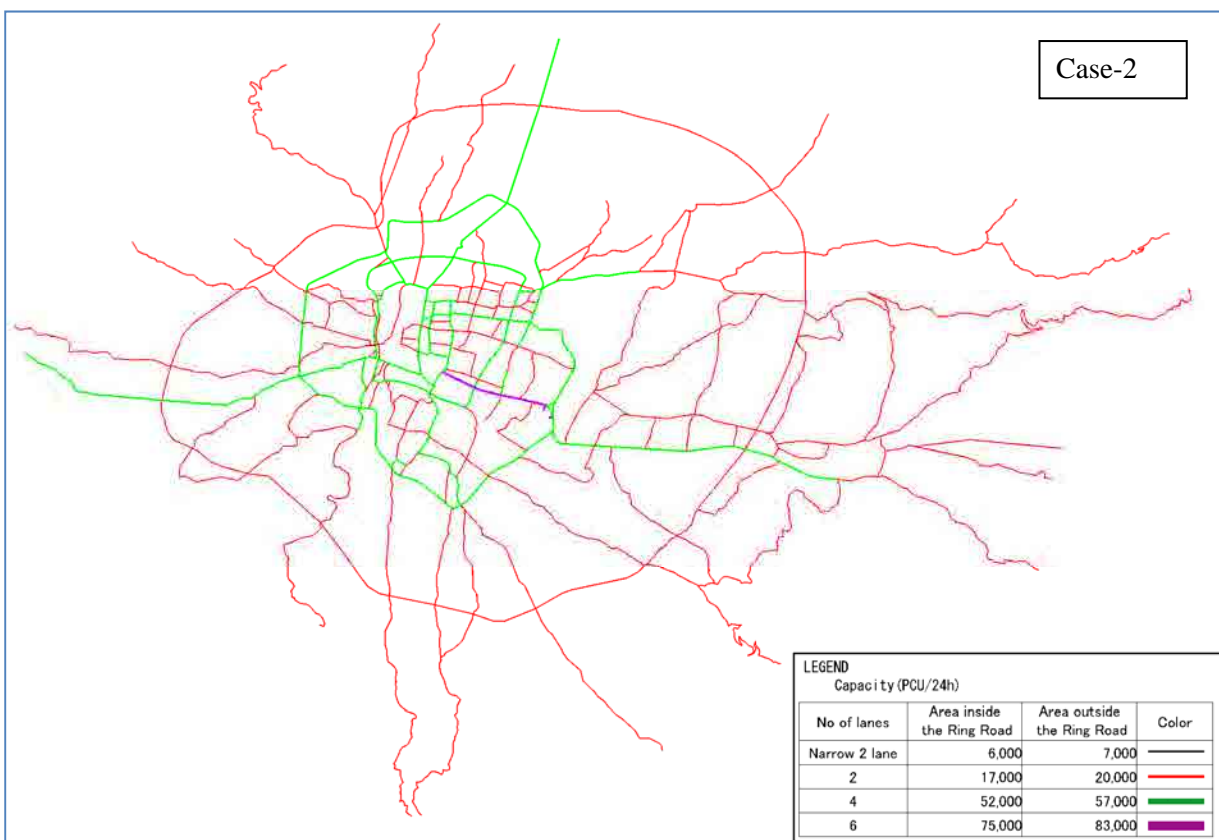
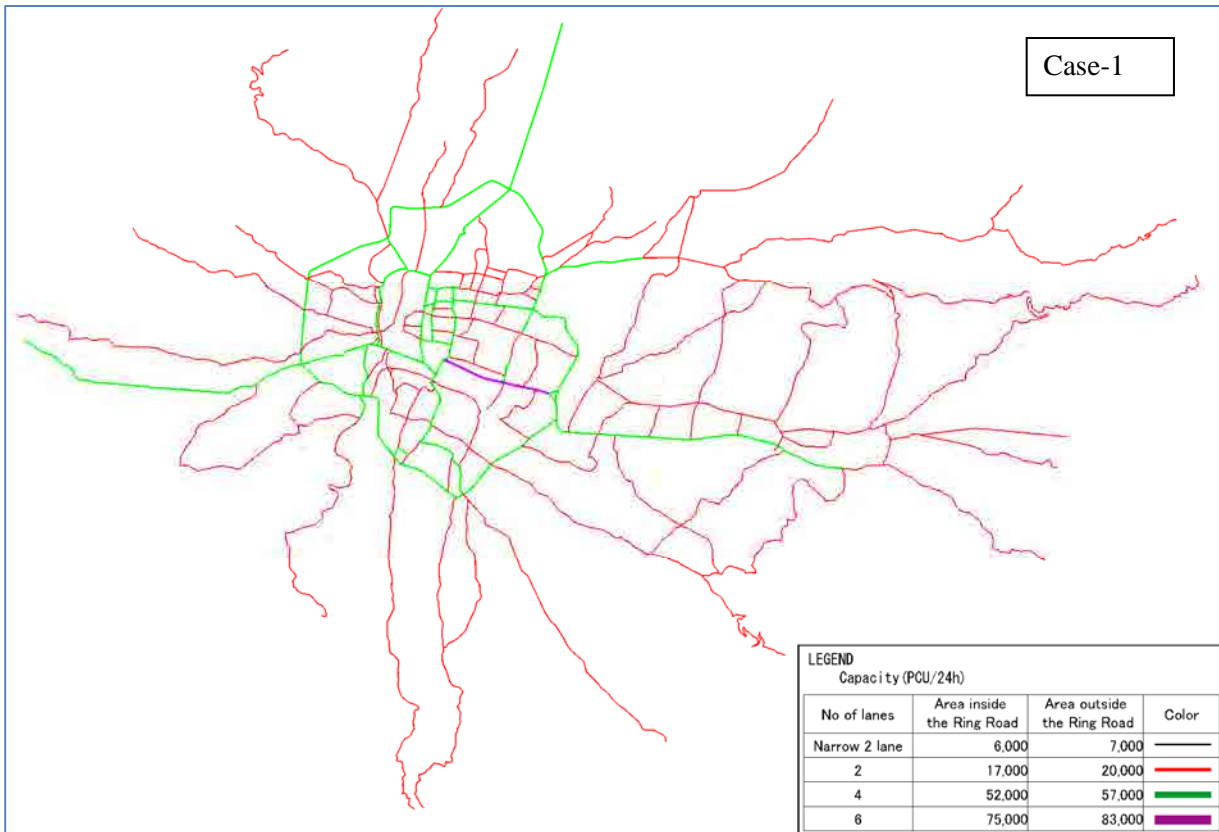
Trend of car ownership in the long run		
		<p>-If cars increase at the same rate between 2011 and 2032, the number would be more than 5 times of the present. The following four cases were set up to find several appropriate ways to address such continuous increase of traffic demand.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Between 2011 and 2022, Socio-economical growth was estimated ;</p> <ul style="list-style-type: none"> <li>● Population                      annual growth rate 4.18%, 1.57 times</li> <li>● GDP per capita                      annual growth rate 2.89%, 1.37 times</li> <li>● Number of motorcycles*                      annual growth rate 5.05%, 1.72 times</li> <li>● Number of cars*                      annual growth rate 8.28%, 2.40 times</li> </ul> <p>* this number is for vehicles in household excluding company cars etc</p> </div>
Case	Assumption of Demand	Assumption of Supply
Case-1	<ul style="list-style-type: none"> <li>- Trend of expansion of urbanized area to suburbs</li> <li>- Same land use pattern as the present</li> <li>- Same distribution pattern of population as the present</li> <li>- Person trip OD pattern was estimated by the present pattern method</li> </ul>	<ul style="list-style-type: none"> <li>- Case-1 assumes that ongoing road projects would be completed, as follows:                             <ol style="list-style-type: none"> <li>1) Ring Road: expansion to 4 lanes</li> <li>2) Arniko Highway: expansion to 6 lanes</li> <li>3) Tribuvan Highway: expansion to 4 lanes</li> <li>4) All narrow roads would be improved to have a capacity of at least 2 lanes (Feeder, urban roads)                                     <ul style="list-style-type: none"> <li>-F021, F022, F025, F026, F103</li> <li>-KMU0002, KMU017, KMU016</li> </ul> </li> <li>5) All roads with bad surface condition would be improved to have fair condition at least.</li> <li>6) Land use pattern is assumed to be the same as the present pattern which is expanding to suburbs.</li> </ol> </li> </ul>
Case-2	Same as Case-1 in terms of population distribution, PTOD and VTOD	<ul style="list-style-type: none"> <li>-In addition to Case-1 network, both Inner and Outer Ring Roads would be completed.</li> <li>-These roads were suggested to reinforce road network by the previous M/P in 1993.</li> </ul>
Case-3	Same as Case-1 in terms of population distribution, but modal choice is different because bus rapid transit (BRT) is introduced. Therefore, PTOD by mode and VTOD are different from Case-1 and Case-2.	<ul style="list-style-type: none"> <li>- In addition to Case-2 network, BRT system would be introduced between Kathmandu and Bhaktapur.</li> <li>-BRT would promote to use public transport between Kathmandu and Bhaktapur along Arniko Highway, where traffic demand would continue to increase rapidly.</li> </ul>
Case-4	<ul style="list-style-type: none"> <li>- KB development (Kathmandu-Bhaktapur Corridor Development) is assumed as a new subcenter building project in order to relax the concentration of excessive traffic in central Kathmandu.</li> <li>- Land use pattern and population distribution pattern are different from Case-1, Case-2 and Case-3. Therefore, PTOD and VTOD are also different.</li> <li>- Person trip OD pattern related to KB development area was estimated by both the gravity model and present pattern method with reference to the existing OD pattern of the central area.</li> </ul>	<ul style="list-style-type: none"> <li>- In addition to Case-3 network, construction of Bhaktapur Ring Road and expansion of a part of Outer Ring Road would be completed to support KB development.</li> </ul>

Source: JICA Survey Team

**Table 8.4.2 Image of Urban Structure and Brief Contents of Four Cases**

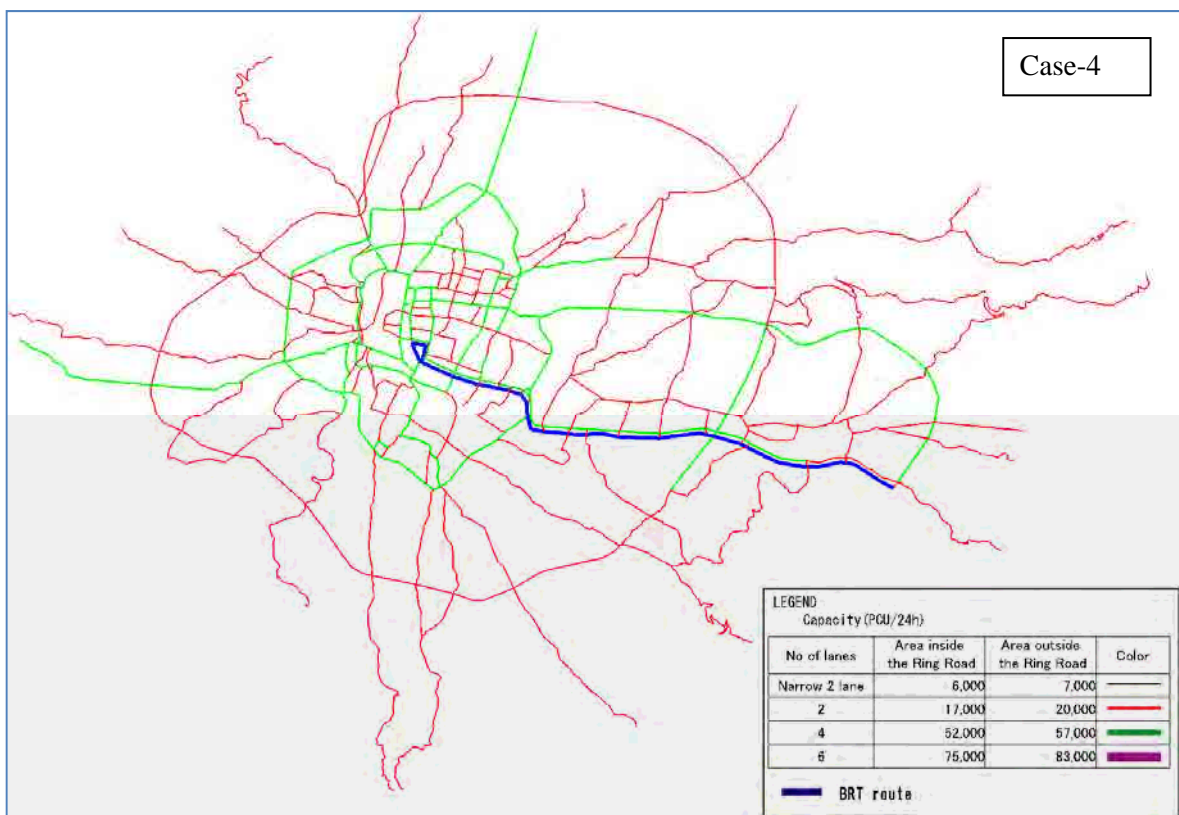
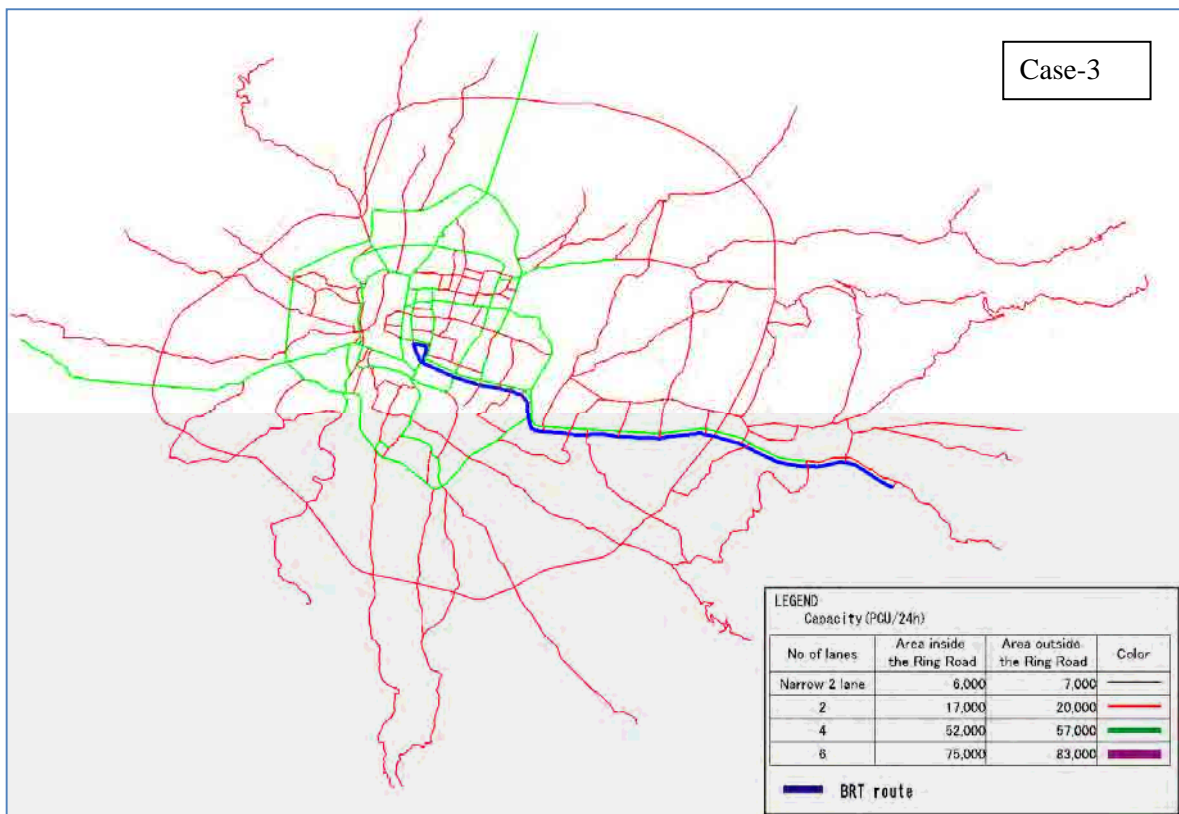
 <p>Case - 1</p>	<p><b>(Case-1)</b>-----</p> <p>-Case-1 assumes that ongoing road projects would be completed, as follows:</p> <ol style="list-style-type: none"> <li>1) Ring Road: expansion to 4 lanes</li> <li>2) Arniko Highway: expansion to 6 lanes</li> <li>3) Tribuvan Highway: expansion to 4 lanes</li> <li>4) All narrow roads would be improved to have a capacity of at least 2 lanes (feeder, urban roads) -F021, F022, F025, F026, F103 -KMU0002, KMU017, KMU016</li> <li>5) All roads with bad surface condition would be improved to have fair condition at least.</li> </ol> <p>-Land use pattern is assumed to be the same as the present pattern, which is expanding to suburbs.</p>
 <p>Case - 2</p>	<p><b>(Case-2)</b>-----</p> <p>-Case-2 assumes that Inner Ring Road (4-lane) and Outer Ring Road (2-lane) would be added to the Case-1 network.</p> <p>-Land use and population distribution patterns are same as in Case-1 in terms of population distribution, PTOD and VTOD.</p>
 <p>Case - 3</p>	<p><b>(Case-3)</b>-----</p> <p>-Case-3 assumes that BRT between the center of Kathmandu and Bhaktapur would be introduced to Case-2 network.</p> <p>-Land use and population distribution patterns are same as in Case-1. However, modal choice is different because BRT is introduced. Therefore, PTOD by mode and VTOD are different from Case-1 and Case-2.</p>
 <p>Case - 4</p>	<p><b>(Case-4)</b>-----</p> <p>-Case-4 assumes that Bhaktapur Ring Road (4-lane) and a part of Outer Ring Road expansion (4-lane) would be added to the Case-3 network.</p> <p>- KB development is suggested as a new subcenter.</p> <p>-Land use and population distribution patterns are different from Case-1, Case-2 and Case-3, which are based on the trend of expanding to suburb with one center. Therefore, PTOD and VTOD are also different.</p> <p>- Person trip OD pattern related to KB development area was estimated by both the gravity model and present pattern method with reference to the existing OD pattern of the central area.</p>

Source: JICA Survey Team



Source: JICA Survey Team

**Figure 8.4.1 Future Network for Case-1 and Case-2**



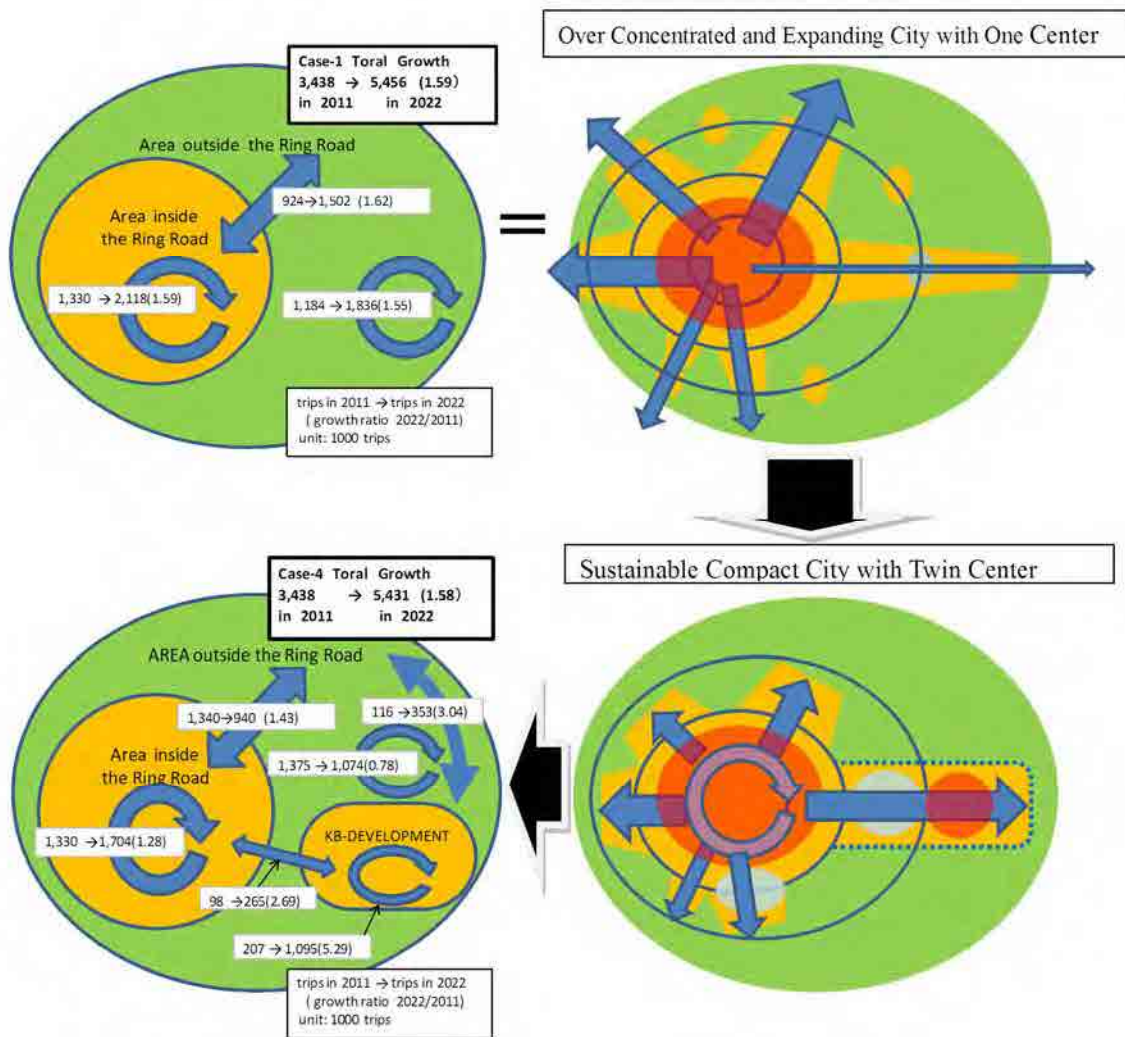
Source: JICA Survey Team

Figure 8.4.2 Future Network for Case-3 and Case-4



### 8.4.2 KB Development (Kathmandu-Bhaktapur Corridor Development)

It is assumed that KB development would change the trip distribution pattern in Kathmandu Valley as described in Figure 8.4.3. The target is to develop the area between Kathmandu and Bhaktapur along the Arniko Highway and contribute to reducing the concentration of traffic in central Kathmandu. The development area was firstly defined as a candidate sub-city center by the JICA Survey Team in this report. The area has a variety of advantages for new large scale development such as good location near the international airport and international highway, and suitable huge land to develop new working and living places.



< Comparison of trip flow >

	1,000 person trips/day		
	a. Case-1 in 2022	b. Case-4 in 2022	b/a
Intra Central Trips	2,118	1,704	80.5%
Inter trips between the central and suburb	1,502	1,205	80.2%
Intra Suburb Trips	1,836	2,522	137.4%
total	5,456	5,431	99.5%

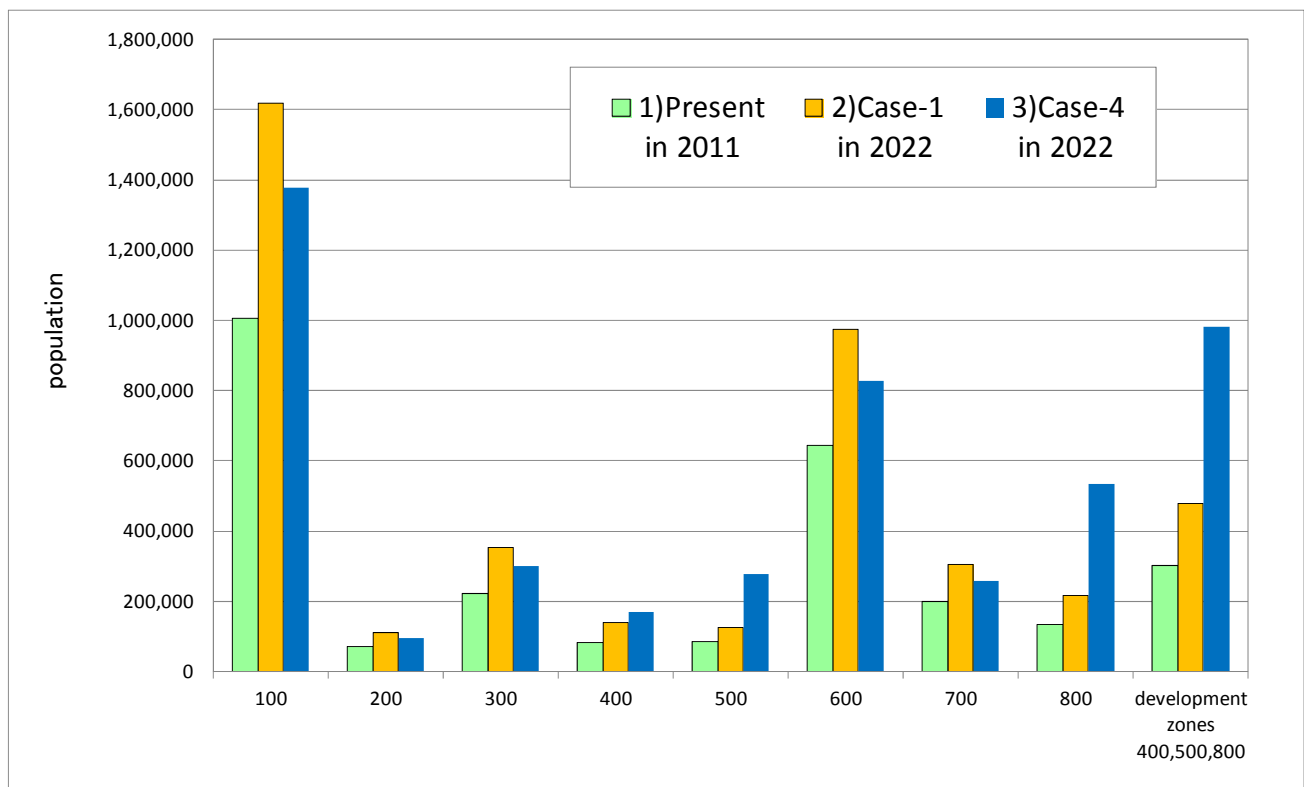
Source: JICA Survey Team

Figure 8.4.3 Estimated Future Trip Flow Pattern Change caused by KB Development

In this survey, two kinds of population distribution, namely, Case-1 and Case-4, were set up as shown in Table 8.4.3. In Case-4, the development area was set in Zones 400, 500 and 800. Total population of the three zones is assumed to be 981,400 in Case-4.

**Table 8.4.3 Framework of Four Cases (Population)**

Large Zone		1)Present in 2011	2)Case-1 in 2022	3)Case-4 in 2022	Growth Ratio 2)/1)	Growth Ratio 3)/1)
District	Zone No.					
Kathmandu N.P.	100	1,006,656	1,618,700	1,377,200	1.61	1.37
Kirtipur N.P.	200	70,118	110,800	94,200	1.58	1.34
Lalitpur N.P.	300	223,285	353,300	300,700	1.58	1.35
Bhaktapur N.P.	400	83,893	138,800	168,400	1.65	2.01
Madhyapur N.P.	500	84,259	125,000	277,700	1.48	3.30
Kathmandu Dist.	600	642,856	973,300	827,900	1.51	1.29
Lalitpur Dist.	700	198,209	304,300	259,000	1.54	1.31
Bhaktapur Dist.	800	134,875	216,200	535,300	1.60	3.97
total		2,444,151	3,840,400	3,840,400	1.57	1.57
development zones 400,500,800		303,027	480,000	981,400	1.58	3.24



**Figure 8.4.4 Population for Case-1 and Case-4 by Large Zone**

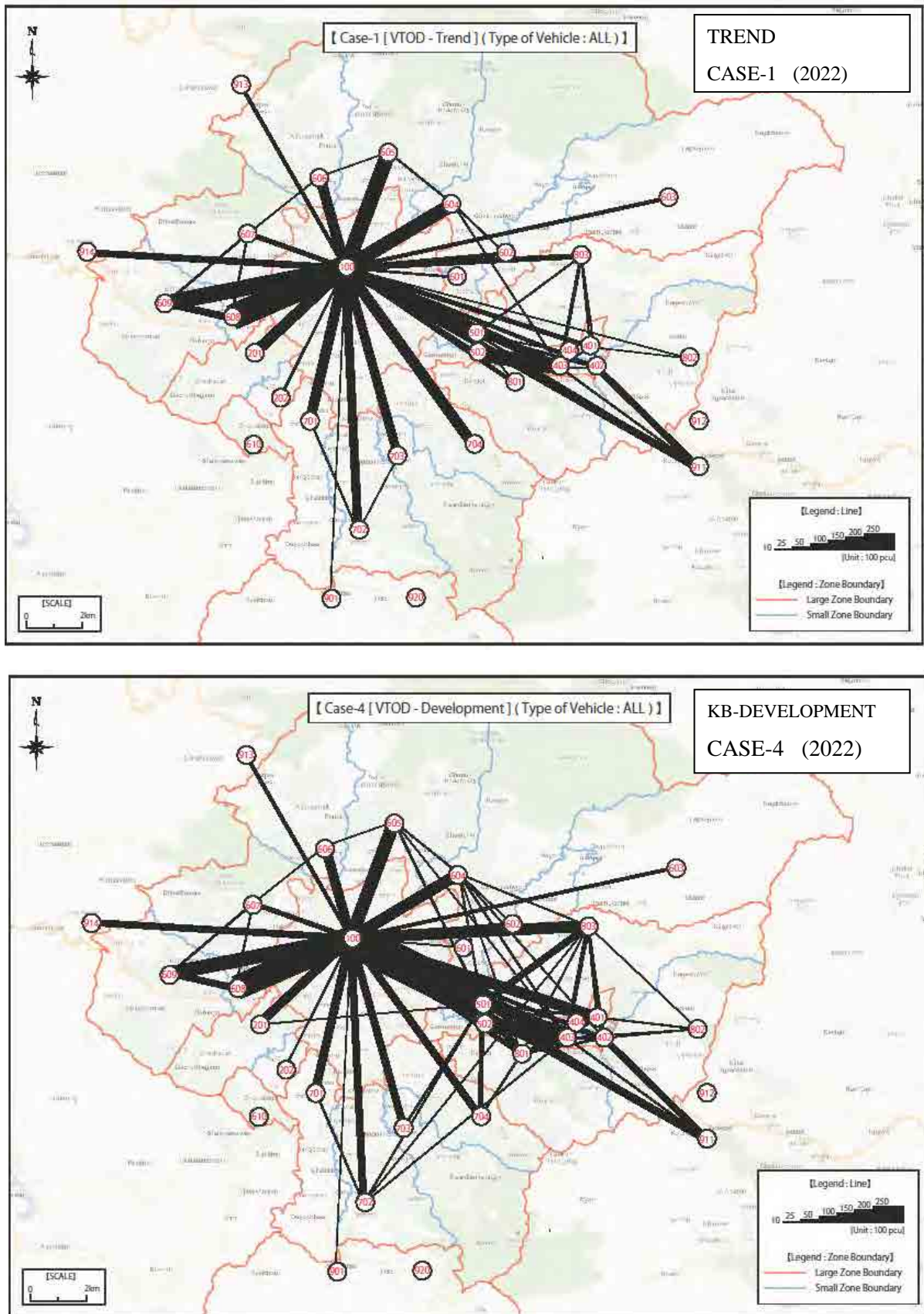


Figure 8.4.5 Estimated Future Trip Flow Pattern Change Between Small Zones

### 8.4.3 Evaluation of Four Cases

The evaluation of the traffic demand forecasting for the four cases was conducted in Table 8.4.4 and Table 8.4.5. Lots of relevant forecasting data are shown in Appendix 2.1 and Appendix 2.2.

- Case-2 and Case-3 seem to widely and efficiently improve the traffic congestion in Kathmandu Valley. But if further additional traffic flows into the central area from the suburbs continue to increase after 2022, these plans should be studied to assess whether these cases are appropriate options or not to address congestion inside the Ring Road.

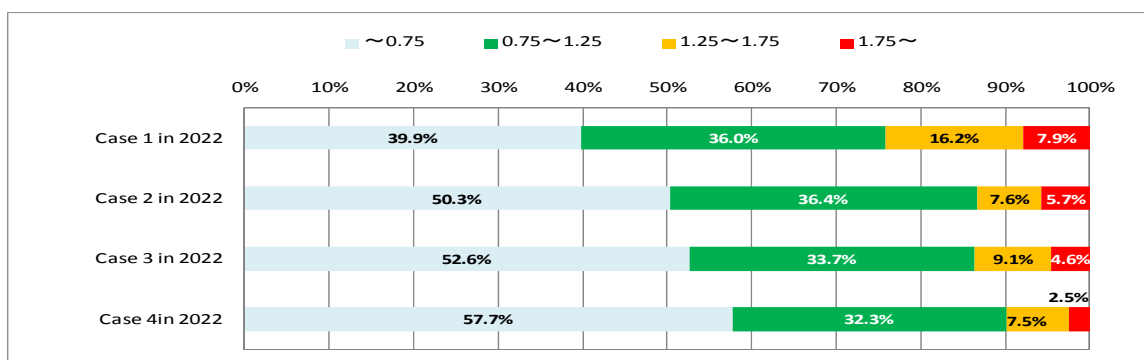
- Case-4 was estimated to reduce the demand both within the central area and between the central and suburbs by 20%. In contrast, trips within the suburbs would be increased by 37%. The new development area would have a share of 40% of trips within the suburbs. But these forecasted results should be studied further, focusing on the possibility and feasibility of making trips shorter and modal shift from private vehicle to bus.

- As a result, although it is difficult to conclude what is the most suitable strategy in the long term, it is fairly recommended that Case-4, where the additional road network is combined with a change of urban structure. A modal shift measure from private to public transport should also be studied as one of the promising alternatives for the future M/P.

**Table 8.4.4 Comparison of Four Cases**

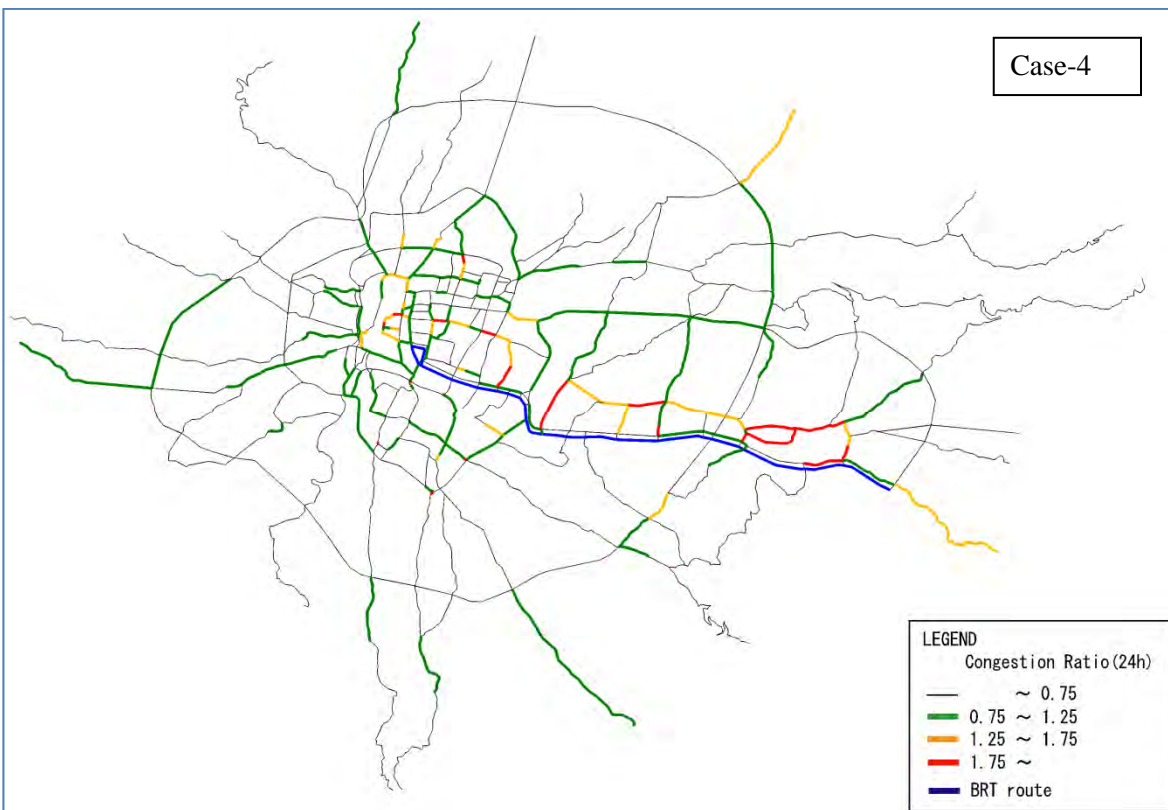
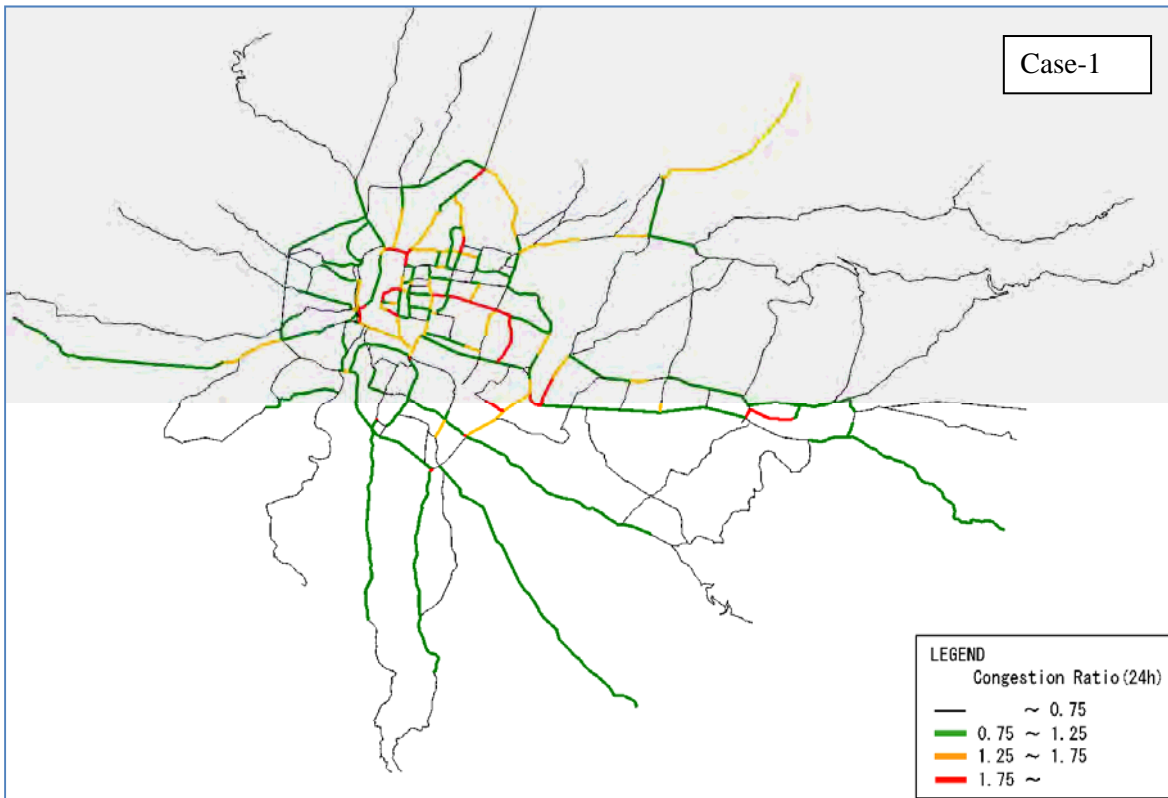
Indicators	Classification	Case 1 in 2022		Case 2 in 2022		Case 3 in 2022		Case 4 in 2022	
Average Congestion Ratio	Area inside The Ring Road	0.97		0.80		0.79		0.72	
	Total	0.70		0.59		0.58		0.58	
Ratio of length by congestion rank inside the Ring Road	Length(km)	Ratio	Length(km)	Ratio	Length(km)	Ratio	Length(km)	Ratio	
	~ 0.75	41.6	39.9%	57.0	50.3%	59.6	52.6%	65.4	57.7%
	0.75 ~ 1.25	37.6	36.0%	41.2	36.4%	38.2	33.7%	36.6	32.3%
	1.25 ~ 1.75	16.9	16.2%	8.6	7.6%	10.3	9.1%	8.5	7.5%
	1.75 ~	8.2	7.9%	6.5	5.7%	5.2	4.6%	2.8	2.5%
Vehicle*length	(thousand vehicle*km)	3,972	100	3,789	95	3,806	96	4,060	102
Average Vehicle Trip Length (km)		4.9	100	4.7	96	4.6	94	4.9	100
Generation of Vehicle	(thousand vehicles)	vehicle	Ratio	vehicle	Ratio	vehicle	Ratio	vehicle	Ratio
	motorcycle	1,186	100	1,186	100	1,118	94	1,122	95
	Car	346	100	346	100	334	97	337	97
	Truck	158	100	158	100	158	100	158	100
	Bus	184	100	184	100	196	107	191	104
	Total	1,874	100	1,874	100	1,806	96	1,807	96
Bus users on BRT route	(thousand people)	-	-	-	-	217	100	242	112
Modal Split of Person Trips in 2022		Share		Share		Share		Share	
	WALK	38.8%		38.8%		39.2%		39.8%	
	Bicycle	1.6%		1.6%		1.6%		1.5%	
	Motorcycle	29.3%		29.3%		27.6%		27.8%	
	Car	6.8%		6.8%		6.5%		6.6%	
	Bus	23.5%		23.5%		25.0%		24.3%	

Source: JICA Survey Team



Source: JICA Survey Team

**Figure 8.4.6 Comparison of Congestion Ratio inside the Ring Road**



Source: JICA Survey Team

**Figure 8.4.7 Comparison of Congestion Ratio (Case-1 and Case-4)**

Table 8.4.5 Comparative Evaluation of Four Cases as a Long Term Strategy

<p>Case - 1</p>	<p><b>(Case-1)</b>-----</p> <ul style="list-style-type: none"> <li>● Against the increase of 59% in traffic demand, several expansion projects such as the Ring Road will be very effective to maintain the mobility in central Kathmandu.</li> <li>● In addition, feeder roads access to the Ring Road, and mobility for working and accessibility to school in the suburbs will be improved greatly.</li> <li>● Nevertheless, population in the suburbs will continue to increase and the motorization of both families in the central and suburbs will progress more rapidly. Thus, it is difficult for the Case-1 network to appropriately deal with the growing demand inside the Ring Road after 2022 because the network cannot afford to have sufficient capacity.</li> </ul>
<p>Case - 2</p>	<p><b>(Case-2)</b>-----</p> <ul style="list-style-type: none"> <li>● Construction of the Inner and Outer Ring Roads could greatly improve the whole mobility in the valley and address the congestion inside the Ring Road.</li> <li>● To produce more such effects in the long run, a future M/P to utilize three ring roads effectively by all transport modes in conjunction with efficient land use and preservation of historical places should be planned.</li> </ul>
<p>Case - 3</p>	<p><b>(Case-3)</b>-----</p> <ul style="list-style-type: none"> <li>● In order to avoid stronger dependency on private vehicles, BRT introduction between Kathmandu and Bhaktapur would be one of the effective measures.</li> <li>● Although modal shift from private motorcycle and car to bus could be promoted by BRT, the introduction of BRT without any change of urban structure and incentives for modal shift would not be efficient and sufficient to capture the demand in the long run, under strong competition with private modes such as motorcycle and car.</li> <li>● In order to promote public transport use, not only BRT but also LRT and other measures should be studied in the future M/P.</li> </ul>
<p>Case - 4</p>	<p><b>(Case-4)</b>-----</p> <ul style="list-style-type: none"> <li>● In order to sustain urban mobility and vitality in the long run, Case-4 recommends to build a compact city with twin centers as one of the promising solutions.</li> <li>● Case-4 estimates to reduce the demand both within the central area and between the central and the suburbs by 20%. The estimation assumes that a new subcenter will have working and business places similar to central Kathmandu. In practice, it is not easy to build a compact city where people could make shorter trips, move by walking or using bicycle and public transport, and are not too dependent on private vehicles. It is desirable to build, for example, a new industrial park, cargo terminal and office area along Arniko Highway close to new residential towns.</li> <li>● Moreover, in order to manage land development and transport investment effectively at the same time, an area development guideline to be coordinated among stakeholders is necessary.</li> </ul>

## CHAPTER 9 RECOMMENDATION FOR FUTURE TRAFFIC MASTER PLAN

### 9.1 Issues and Problems on the Traffic Situation of Kathmandu Valley

#### 9.1.1 Issues from the Traffic Survey and Demand Forecast

##### (1) Traffic Demand and Transport System

In the current land use and road network systems, traffic demand concentrates on the urban area especially at the inside of the Ring Road where most urban functions, namely, commerce, business, administration, and tourism sites, are mostly located. In this trend, a monopolar concentration to Kathmandu and Lalitpur municipalities continues and urban area sprawls as the population increases.

According to the future traffic demand forecast, the total number of person trip will increase by 159% from 3.4 million to 5.4 million. The number of person trip of vehicles (motorcycle, car, and bus) also increases by 162%, from 2.0 million to 3.3million. To meet the increasing demand, the Survey Team has analyzed the existing and future traffic demand, and reached the following conclusions:

- 1) Network system of Kathmandu Valley may withstand the traffic demand by improving existing network system such as installation of flyover, construction of inner ring road, and widening of existing road until 2022.
- 2) After 2022, service level of road network will decline rapidly and introduction of new transport system/land use system will be inevitable to sustain the present mobility and urban activity.
- 3) For ten years until 2022 is the period for the introduction of a new system including establishment of implementation plan, implementation of pilot project, and reinforcement of relevant institution.

##### (2) New Public Transport System

The transport network system which the private vehicle depend upon will not meet the demand in the long-term. The future M/P shall make an intensive investigation for the introduction of new public transport system. The following are the required items to be scrutinized:

- 1) Type of new public transport system

New public transport system, namely MRT, BRT, LRT, etc., was introduced to developing countries. The most appropriate system will be selected based on the traffic demand, economic viability, land acquisition, and environmental condition. Procedures related to these items shall be included in the future M/P.



Figure 9.1.1 BRT (Transjakarta, Indonesia)



Figure 9.1.2 MRT (Bangkok)



Figure 9.1.3 LRT (Manila Light Rail Transit System)



Figure 9.1.4 LRT (Toyama Light Rail, Japan)

2) Route

Based on the traffic survey, the average trip length of motorcycle users and car users is around 6 km. In order to replace private vehicles, a new transport system should cover the trip characteristics of private vehicles. Case studies in this survey implied the following possible routes:

- North-south axis
- Circular route on the inner Ring Road
- Kathmandu-Bhaktapur corridor
- Circular route along the existing Ring Road

Selection of optimal route among alternatives should be closely connected to future land use policy and development strategy because transport system influences land development along the network. Therefore, together with the network plan, land use plan should be established simultaneously. The land use system which enhances public transport and thus reduces the use of private vehicles is called **Transit Oriented Development (TOD)** and has been introduced to many countries. Institution for land development control which enables to acquire public land for roads and parks like the existing land pool system should be prepared.

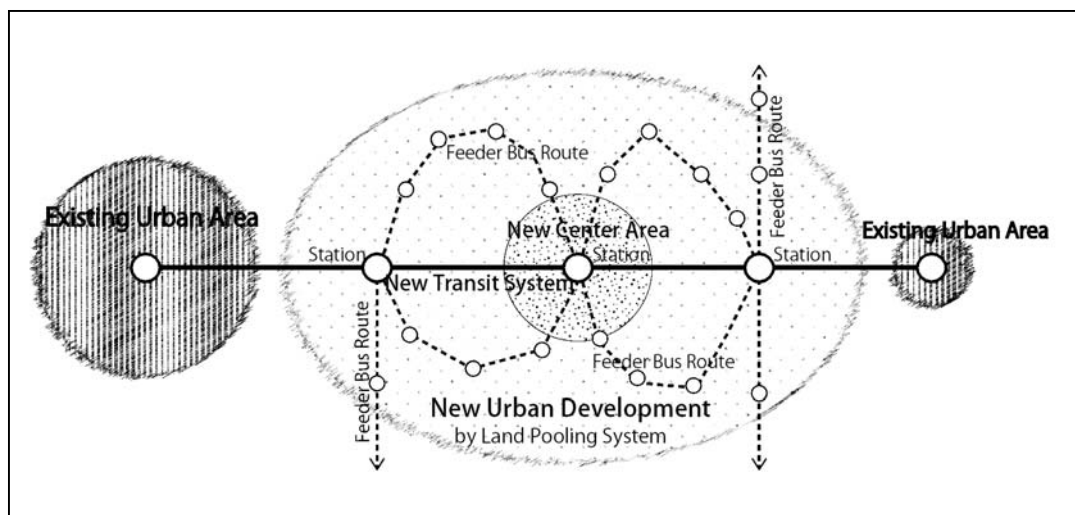


Figure 9.1.5 Conceptual Chart of TOD

(3) Road Network System

Through the traffic analysis and traffic demand forecast, the Survey Team acquired information on the relationship of traffic demand and road network. The following are the major findings and recommendations:



1) Traffic concentration inside the Ring Road

At present, person trip moving inside the Ring Road occupies around 50% of the total trips while the other 50% of the trips are generated outside the Ring Road. This shows that the trips inside the Ring Road occupy a large portion of the whole survey area. The forecasted traffic demand shows that this tendency will not change in the future even if the land use pattern is shifted.

Therefore, development of basic network such as inner Ring Road and its linking roads with arterial roads will be required continuously.

2) Effect of the Land Clearance of Right-of-way (ROW)

Land clearance of ROW is currently being conducted as shown in Section 3.3.6. Demolished areas of ROW remain as a vacant land which became a parking space for buildings along the roadside. According to the demand forecast, if the carriageway is constructed in the ROW, traffic flow will be improved to a great extent. This is true especially on the north-south axis which is weak and needs to be strengthened as compared to the east-west axis in the present network. Therefore, construction of carriageway and sideway of these roads should be started based on the implementation plan.

3) Feeder Road Improvement

According to the comparison of traffic volume between 1991 and 2012, traffic volume increased largely along the radial road outside the Ring Road. As the urban expansion continues, traffic volume of these roads will continue to increase until it will soon reach the road capacity. Expansion of capacity of these roads is required.

Inside the Ring Road, some areas such as south-eastern part of Lalitpur N.P. and north-eastern part of Kathmandu N.P. are not serviced sufficiently by feeder road. Development of feeder road which service these areas is required.

**(4) Public Bus**

1) Bus Park

Around 12,900 buses are operating from the City Center every day and the Old Bus Park which has exclusive land could not cover the concentration of bus demand. Other bus parks are located along the roadside of the City Center. In the near future, all these bus parks will not be able to meet the increasing passengers demand. In this situation, facilities for bus passengers such as timetable, waiting room are not provided. Therefore, the development of new bus parks with sufficient facilities for passengers is required.

Possible location for the bus parks is along the Ring Road at the north-east, west, and south areas. A circular route passing through the City Center is recommended to decrease the burden of the City Center.

2) Bus Route

Bus route covers all valley routes from the urban area to small villages in the mountainside. In the urban area, buses especially micro buses operate on the small road because passenger demand exists along the area of the small road. Therefore, expansion of feeder road network is needed to cover the urban area uniformly.

**(5) Motorcycle**

Modal share of motorcycle increased from 9.3% in 1991 to 26.0% in 2012. Average ownership is 0.72 motorcycles per household. The number of motorcycles is estimated to increase 1.72 times until 2022. Coexistence with motorcycles is inevitable for other traffic modes.

The motorcycle user shall be charged with appropriate cost for using motorcycle. In this sense, car users pay for parking and are prohibited to park in public spaces. On the contrary, motorcycle users are not charged for parking along the roadside or walkway. To be recognized as one transport mode, motorcycle user should bear the same responsibility as what the car users have.

During peak hours, 18% of the daily total motorcycle trip contributes to congestion, but before and after peak hours the concentration decreases by half. With the introduction of staggered working

hours, traffic during peak hours will be reduced. This measure can be applied to all other traffic modes.

**(6) Non-Motorized Transpor (NMT)**

1) Pedestrian

By the household interview survey in 2011, walking occupied largest modal share of 41%. Figure 9.1.6 shows the number of trips by walking and bicycle in 2011 and 2022. Walk will be also the primary mode in 2022. But in the current condition, rooms for pedestrians are not provided sufficiently. Even along the arterial road with abundant width, carriageway takes precedence over sidewalk. Pedestrian overflows from the sidewalk to avoid each other, and the road administrator installs fences to prevent traffic accident. If population increases and pedestrians grow larger, the Kathmandu Valley where tourism and shopping are fundamental attractions will not be a nice place for strolling or walking. Therefore, improvement of the environment for pedestrians is one of the key issues in Kathmandu Valley.

Pedestrian concentration in the central area of Kathmandu N.P. and Lalitpur N.P. are very high as shown in Figure 6.1.32. These areas are the center of commercial activities and tourism and symbolize the prosperity of Kathmandu Valley. ADB proposes “pedestrianization” as a component of the Kathmandu Sustainable Urban Transportation Project focusing on heritage area as the most crucial area for citizens and visitors. This challenge will be required in other areas where walking is the most important travel mode.

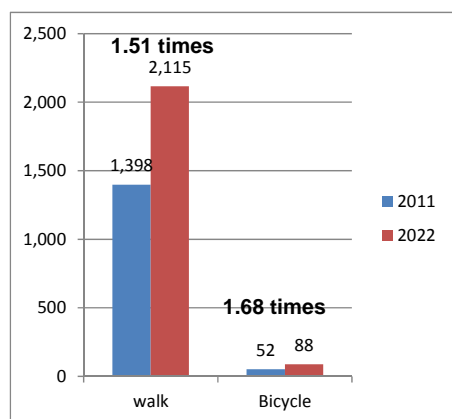
2) Bicycle

As bicycles has been replaced by motorcycles, modal share of bicycle dropped as shown in Chapter 6, Figure 6.1.24. The major reason for decrease of bicycle is diffusion of motorcycle, and the traffic condition in which bicycles are exposed to accidents is another reason. Considering that the gentle topography in the Kathmandu Valley is suitable for bicycle use and that the trip length of daily travel in the Kathmandu Valley is adequate for bicycle use, bicycle has potential to become citizens’ means of daily transportation. Therefore transportation plan shall take into account of latent possibility of bicycle use in the Kathmandu Valley.

3) NMT

Promotion of walking and bicycles will not only contribute to decreasing the vehicles but also contribute to improve environment in air quality and noise and to decrease the energy consumption. Especially in Kathmandu, air pollution is critical problem and the fuel is dependent on the import.

To this end, concept of environmentally sustainable transportation shall be introduced into the future M/P. The future M/P shall contain establishment of network and facilities for NMT including pedestrian and bicycle by scrutinizing the strategy.



Unit: 1,000 trips

**Figure 9.1.6 Increase in Number of Trips by Walk and Bicycle from 2011 to 2022**



**Figure 9.1.7 Comfortable Pedestrian Way (Omotesandou, Tokyo)**

## 9.2 Land Use Problem and Issues

### 9.2.1 Overall Observation of the Existing Land Use and Urban Development

#### (1) Population Issues

- 1) Rapid population growth: A 4.6% of annual population growth rate in KV and 5.0% in the Kathmandu District were recorded during the last decade. Madhyapur-Thimi Municipality recorded a 5.8% population growth.

At wards and VDC level, many VDCs just outside of the Ring Road recorded more than 10% annual population growth rate during the last decade. This rapid population growth is moving toward the outer VDCs of Kathmandu and Lalitpur.

Built up area expansion trend might go to east and south area due to land availability. Western side expansion might be slower because there is a limited land for development.

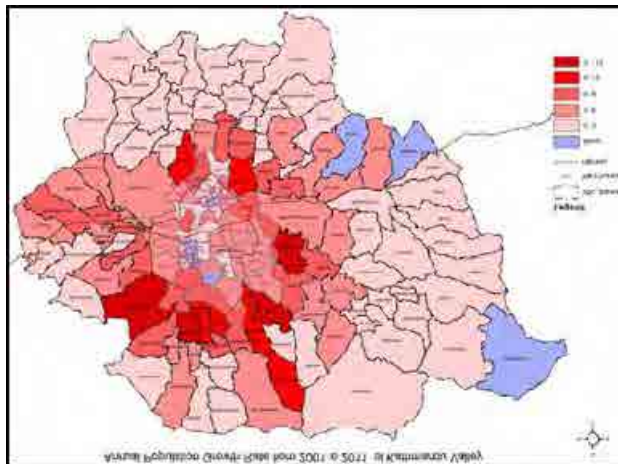


Figure 9.2.1 Population Growth Rate 2001-2011

- 2) Disorderly sprawling built-up area: Built-up area expansion trend until 2000 was linear along existing feeder roads. After 2000, built-up areas crawled over a large area outside the Ring Road without plans for certain road network expansions.

The KVBB 2007 stipulated a regulation of access road for new development. However, this rule does not contribute in strengthening road network in the valley.

- 3) High population concentration inside the Ring Road: Population density of core area around the old town reached 1000 persons/ha. Its surrounding area showed over 600 persons/ha density. Most of the areas inside the Ring Road have over 300 person/ha density. Monopole population concentration can be seen in the population density map.

Applying the high population density land use, KV can accommodate a certain volume of population in the near future.

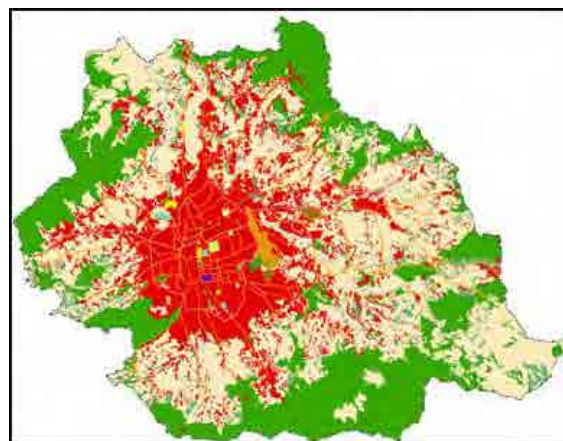


Figure 9.2.2 Existing Land Use 2011

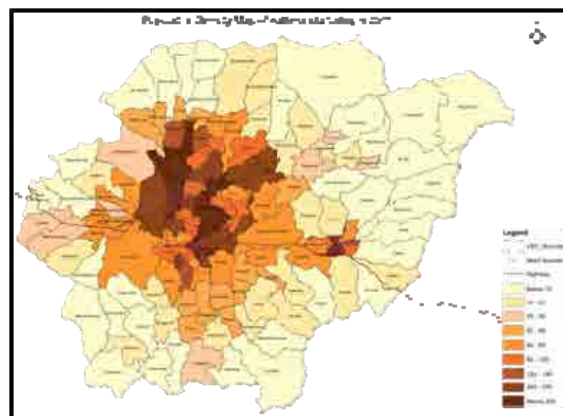


Figure 9.2.3 Population Density 2011

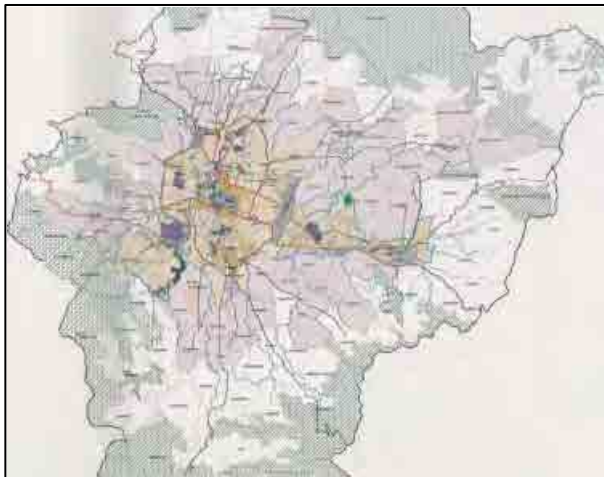


Figure 9.2.5 KVBB Land Use Plan



Figure 9.2.5 Land Pooling Plan

## (2) Land Use and Urban Development Issues

- 1) Inappropriate Land Use Plan especially outside of the Ring Road: The existing KV Land Use Plan was prepared in 1976 and only partially updated in the 1990's. The plan was not suitable with the existing urban situation. Before the KVBB 2007 implementation, the area outside the Ring Road suburban area does not have building control regulation. Existing land use definition outside of the Ring Road was just through identification of urban VDCs as "Urban Expansion Zone" only.
- 2) Inadequate use of the Land Pooling Project: Land Pooling (LP) Project is a popular urban development scheme in Nepal. LP schemes enable the enhancement of road networks with plans of wider roads in the area connecting to the arterial road network.

However, some LP projects in the valley were not contributing to strengthen the road network. For example, Khusinbu Nayabazar LP project is envisioned to build a connection road from Sorhakhutte to the Ring Road.

- 3) Inadequate urbanization control and environmental protection measure: Land use zoning outside the Ring Road is quite rough for control urbanization expansion. Mountain slopes, river banks, and agricultural fields should be clearly defined as protection or conservation zones.
- 4) Lack of cargo terminal plans:

Currently, there are no cargo terminal plans in Kathmandu Valley. Cargo trucks coming outside of the valley use the road side of the Ring Road as a transshipment yard. This causes traffic congestion along the Ring Road.

## (3) Regulation and Institutional Issues

- 1) Divided urban development management in KV: The Kathmandu Valley Development Authority (KVDA) was established as an upgraded institute from KVTDC. However, there are still unclear demarcation lines between the local governments (municipalities and VDCs) and KVDA.
- 2) Lack of manpower for building control: Building permission system is functioning only for large size private

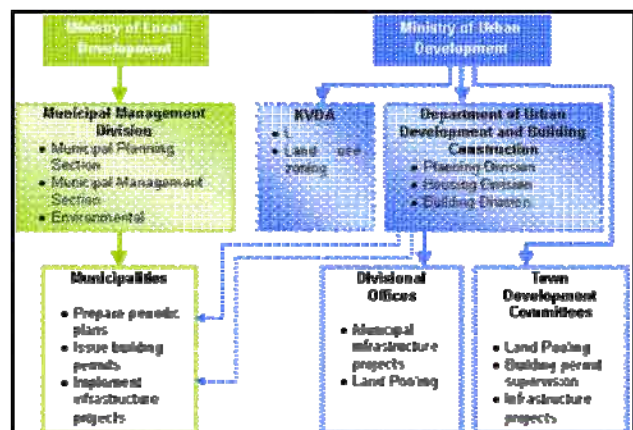


Figure 9.2.6 Divided Urban Management in KV

sector development projects, such as apartment, group housing, and land development. However, the system is not effective to private individual buildings.

- 3) Necessity of continuous training for professional staffs in the public sector: Knowledge and experience of young public servants are not sufficient to implement the project, especially in the municipality and VDC level. Continuous training for government staffs is not enough to keep a certain level of knowledge to implement projects appropriately.

**(4) Private Sector Issues**

- 1) Cool down of the boom of realty market: After the earthquake and policy changes in acquiring a housing loan, the realty market cooled down. But investments from the private sector are vital engines for economic growth.
- 2) Construction of individual buildings is still active: Construction work of individual buildings can still be seen anywhere in the valley. The public sector has to promote activities adequately.
- 3) Level of local consultants: Urban development related survey and design works are outsourced to local private consultants. However, outcome from the consultants are not sufficient and public servants cannot control consultant outputs adequately.

**(5) Housing Issues**

- 1) Insufficient supply of housing units and planned housing land: Although the population in KV has been rapidly increasing, supplies of housing units and land are not sufficient. The public sector has responsibility of providing housing for disadvantaged people. DUDBC does their effort on this issue, but cannot meet the required target because of limited manpower and budget.

### 9.3 Major Findings and Issues on Road Development

#### 9.3.1 Overall Observation of the Existing Road Network

##### (1) Need of road network reinforcement:

Apart from the quality of each road, the Kathmandu Valley is fairly well provided with road network and its hierarchy. However, in spite of the provisions for road network, the existing road network will be outdated in the near future due to low substandard road geometry and lack of connector roads. The existing road network will also be outdated if the recent trend in traffic volume will continue to increase.



Figure 9.3.1 Road Network System in Kathmandu Valley

##### (2) Need of the outer ring road leading to regional development:

In Kathmandu Valley, urbanization is rapidly expanding in the eastern, southern, and northern urban fringes outside the existing ring road.

Furthermore, due to lack of proper connectivity between the radial roads leading outwards from the existing Ring Road, the pressure of traffic flow is more concentrated in the existing Ring Road. The increasing unplanned settlement along radial roads has also created more problems in the valley.

Under such circumstances, the need of an outer Ring Road has been raised. Various studies for the outer Ring Road, including the feasibility study by NEPECON, have been conducted since the last decade. To realize the project, the Nepalese Government established the Outer Ring Road Development Project (ORRD) Office in 2004/2005.

Since the outer Ring Road plays a key role for facilitating the expansion of the urban area as well as guiding the present trend of fast urbanization considering its industrial and commercial promotion, it is recommended for DOR to prepare the concrete implementation plan at an early stage. Figure 9.3.2 shows the latest alignment of the outer Ring Road proposed by the ORRD in 2008 however, the alignment should be reviewed technically taking into consideration the expected role of the outer Ring Road, as well as the land use situation at present.



Figure 9.3.2 Need of an Outer Ring

**(3) Necessity of additional links between Kathmandu–Bhaktapur Corridor:**

The existing trend of urban expansion would continue along the Kathmandu-Bhaktapur corridor and the city of Bhaktapur would be completely integrated into the scarf of the Kathmandu and Laritpur cities in the near future.

The city of Bhaktapur will be exposed to the wave of urbanization and the city itself would expand its urban area.

Since the central area would be exclusively used for administrative, business, and commercial purposes as a capital of the nation, its surrounding area will be used rather for residential and industrial purposes.

In these circumstances, it is recommended for the DOR to examine the additional links between Kathmandu and Bhaktapur corridor to enhance the economic activities, as well as to prevent urban sprawl and disordered land-use development in those areas.



**Figure 9.3.3 Need of Additional Link between K-B**

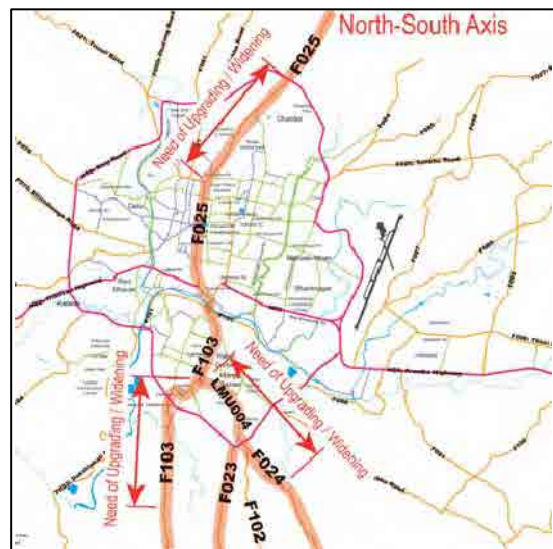
- 1) 2nd Kathmandu–Bhaktapur Road
- 2) Kathmandu–Bhaktapur Bypass (long term)

**(4) Weakness of north-south axis inside the Ring Road:**

The north-south axis inside the Ring Road is provided by the Kanthipass (F025) in Kathmandu City side and Pulchouk (F103, LMU004, F023, F024) in Lalitpur City side.

The north-south axis however is extremely weak due to insufficient road capacity. The axis is carrying heavy traffic density of 50,000-94,000 ADT, which has the highest traffic volume among all roads inside the Ring Road according to the latest traffic count survey. The section from the Royal Palace to the Ring Road of Kanthipath as well as Lagankhel Road Junction to the Ring Road of Pulchouk Road has only two traffic lanes, which is considerably short to the traffic demand.

Weakness of the north-south axis causes chronic traffic congestion in the surrounding area. Widening of these roads is expected to be implemented in the earlier stage of development.



**Figure 9.3.4 Weakness of North-South**

**(5) Low standard of feeder roads:**

Although the feeder road network system is fairly developed, the quality of road is still far below standard with insufficient traffic capacity. Most feeder roads with the exception of major feeder roads have narrow carriageway with 1.5-lane or less and some of the roads are unpaved and have no facility of side drainage.

Since the feeder roads are an important infrastructure supporting the social and economic activities of inhabitants in the regional areas, its improvement or upgrading to a higher standard with more traffic lanes are necessary, especially for those located in the northern and eastern parts of Kathmandu Valley where population is increasing which recorded a high rate in recent years.

### 9.3.2 Specific Issues on Existing Road Network

#### (1) Issue of Tribuban National Highway:

The Tribuban National Highway has heavy traffic and the section between the Ring Road and Thankot is chronically congested. This is due to the existing towns located along the road and new settlements are continuously developing.

To cope up with the increasing traffic demand to and from areas outside Kathmandu Valley, the improvement of road might be necessary in the near future, however, widening of the existing road might be difficult due to the location of houses and buildings encroaching on the ROW.

Therefore, the construction of a substitute route should be examined in the future M/P.

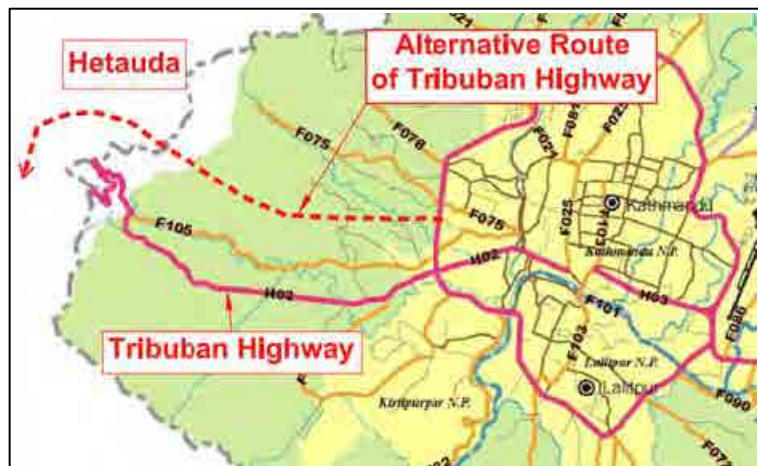


Figure 9.3.5 Alternative Route of Tribuban

#### (2) Need of upgrading Bhaktapur –Dhulikhel (Arniko Highway):

Arniko Highway is the main road running east from Kathmandu to eastern Nepal and running up to the Tibetan border. The Kathmandu-Bhaktapur road, a part of the Arniko Highway, was upgraded to 4-lane with a high design standard last year in 2012 to meet the increasing traffic demand between Kathmandu and Bhaktapur.

According to the past trend of urban expansion and availability of land, the expansion of urban area to the eastward would continue and proceed even in the eastern part of Bhaktapur. Since Banepa and Dhulikhel are located within the influence area of Kathmandu Valley, it will be integrated as a satellite city of the Kathmandu City in the future. Furthermore, Kathmandu will be directly connected with Terai after the full opening of Sindhuli Road in 2015. Therefore, the traffic demand beyond Bhaktapur up to Dhulikhel will be increased with a remarkable rate in the near future.

In these circumstances, the upgrading of the existing road between Bhaktapur and Dhulikhel should be examined in the future M/P.



Figure 9.3.6 Upgrading of Bhaktapur – Dhulikel Road

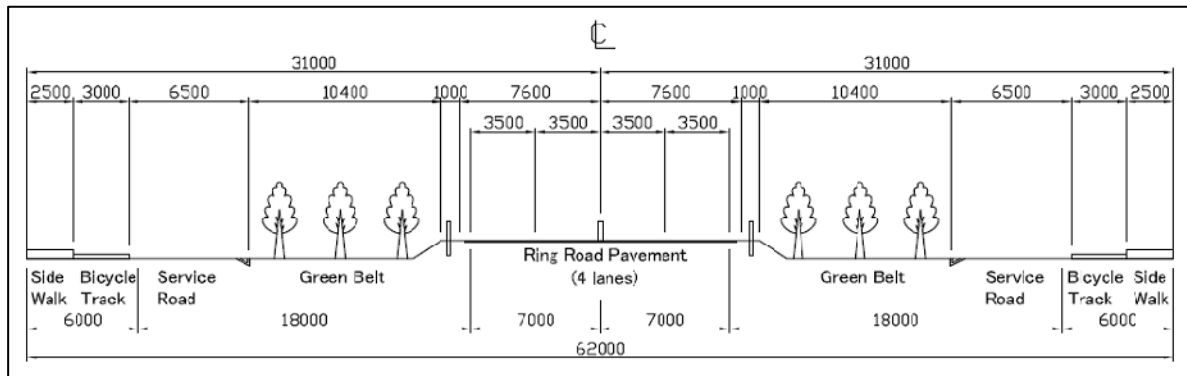


**(3) Necessity of widening the existing Ring Road:**

The Ring Road is one of the vital arterial roads in Kathmandu Valley with a function of dispersing the through traffic in the central area. The road is well engineered with a 10 m–15 m wide double carriageway and the ROW being reserved along the road is 40 m to 60 m wide. However, heavy traffic congestion are observed frequently at the major highway and feeder road intersections due to rapid increase of traffic volume as well as the encroachment of settlements along the road, which resulted to significant reduced vehicular travel speed.

The existing widening plan as shown in Figure 9.3.7 should be implemented without delay.

In addition, a number of large vehicles and buses are being parked along the shoulder of the road near major intersections due to the restriction of entrance to the city during the time. These vehicles interfere with the smooth traffic flow on the Ring Road, therefore, adequate parking lots such as track cargo terminals and bus terminals should be examined in the future M/P.

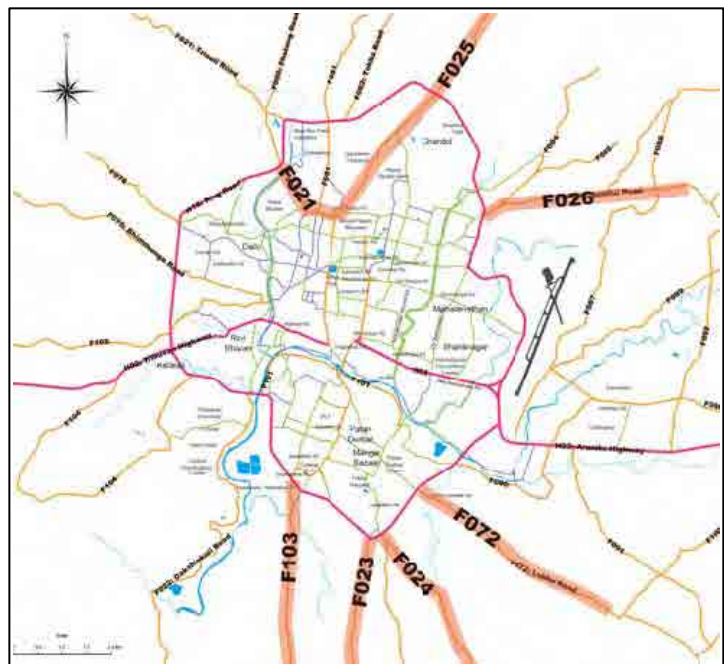


**Figure 9.3.7 Proposed Widening Plan of Ring Road**

**(4) Need the dissolution of bottleneck on the feeder roads:**

The feeder road, except for some major feeder roads, is generally a 1 to 1.5-lane road having low grade design standards. The traffic survey however revealed that some feeder roads (F021, F023, F024, F025, F026, F072 and F103) carry the traffic volume of 10,000-20,000 ADT or more, which resulted in severe traffic jam during peak hours and became the bottleneck of traffic flow.

The DOR should examine the upgrading of road standards including road widening in the future M/P to solve the traffic jam of these feeder roads.



**Figure 9.3.8 Need of Dissolution of Bottleneck on Feeder Road**

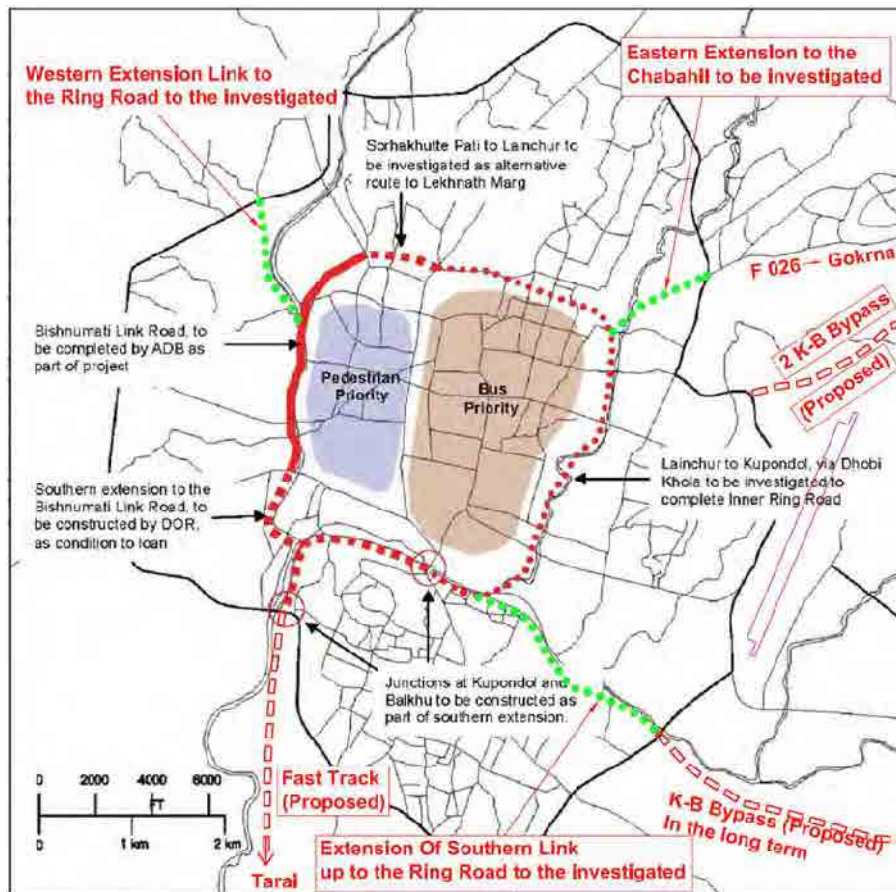
**(5) Need of the inner ring road with a high standard:**

The inner Ring Road was recommended in the previous M/P (in 1993) as a core arterial road inside the Ring Road. It was planned to disperse the traffic in the central areas of the city avoiding excessive concentration as well as to reduce the traffic load on the existing arterial urban roads located inside the Ring Road.

It recommended the realization of the inner Ring Road utilizing the riverbed of Bishnumati, Dhobi, and Bagumati rivers as much as possible due to limited available construction site for the new road inside the Ring Road. Based on the recommendation, DOR has implemented the construction and completion of the western link along the Bishnumati River with the support of ADB.

The remaining sections of the southern link along the Bagumati River and eastern link along Dhobi Khola are under implementation by DOR as shown in Figure 9.3.9.

Since the function of the proposed inner ring road becomes more valid today than it was planned in 1993 due to an excessive increase of traffic demand, the inner ring road in the southern part should be implemented with high standard having large traffic capacity.



**Figure 9.3.9 Proposed Inner Ring Road**

**(6) Necessity of flyover at main intersections:**

Intersection survey identified that nine intersections on the main roads inside the Ring Road were at saturated level. The traffic volume passing on these intersections far exceeds the capacity of signal control, therefore, these have to be improved by either provision of alternative road or construction of grade separated flyover.

Among the nine intersections identified by the Survey, five intersections (A, B, E, G, and F) are planned by DOR to be improved as grade separated intersections of flyover as follows:

Old Baneshwar Chowk, New Baneshwar Chowk, Thapathali Chowk, Tripuriswar Chowk, and Kalimati Chowk.

However, it is advised for DOR to examine the flyover linking the Maithighar Chowk with Tripureswar Chowk directly, instead of two flyovers at Thapataili Chowk and Tripuriswar Chowke, since the construction of the flyover at Thapathali Chowk and Kalimate Chowk would be very difficult due to a narrow existing road width and a large traffic volume on the road.



Figure 9.3.10 Heavily Saturated

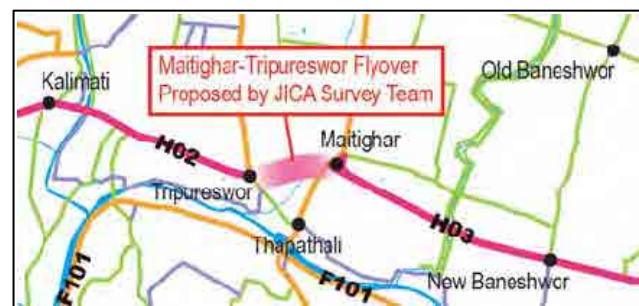


Figure 9.3.11 Alternative Flyover Proposed by JICA Survey Team

**(7) Shortage of bridge capacity inside the Ring Road:**

Most of the existing bridges built over Bishnumati Khola, Dobhi Khola, and Bagmati rivers have narrow and small traffic capacity. The traffic screen survey revealed that bridges crossing these rivers are extremely short and insufficient as shown in Figure 9.3.12.

The shortage of bridge is one the major reasons of traffic congestion on the city roads inside the Ring Road. Additional bridges over these rivers are indispensable for solving the bottleneck on urban roads. Earlier realization of the inner ring road is one of the solutions to this problem.

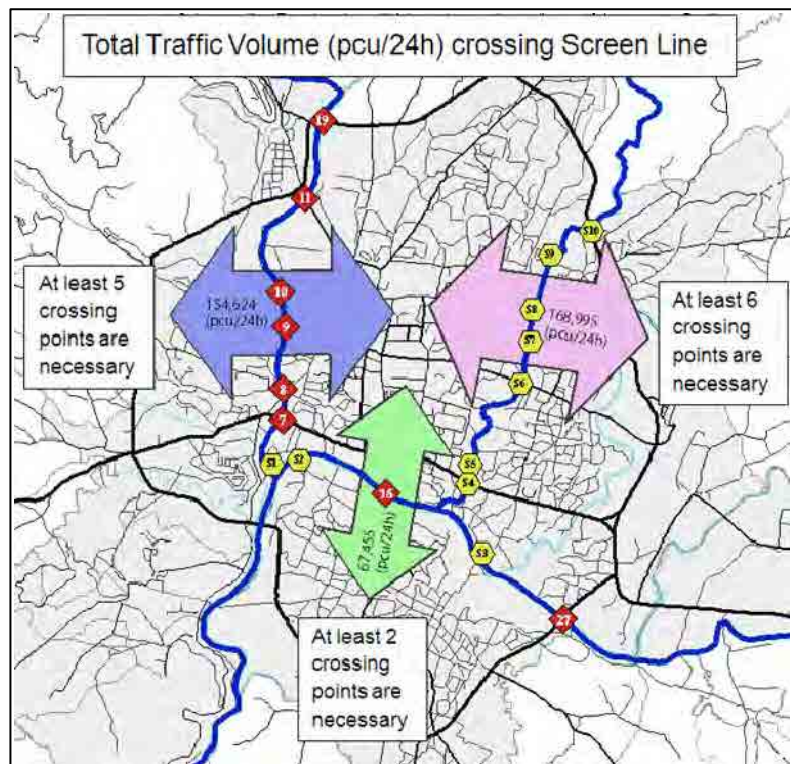


Figure 9.3.12 Need for Additional Bridges

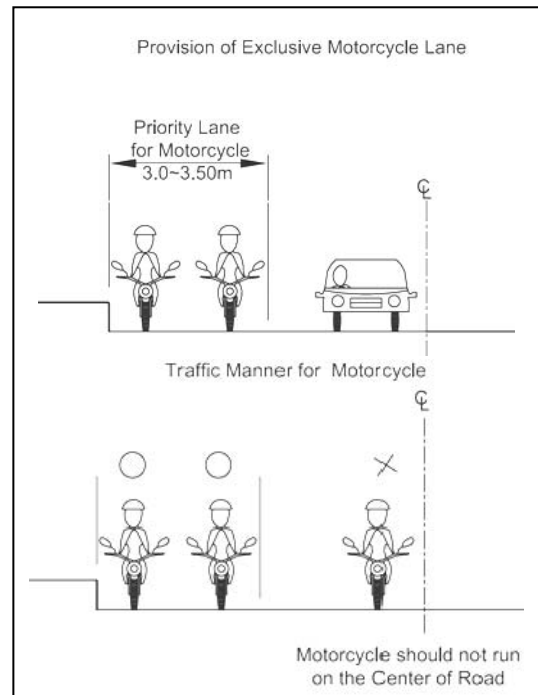
### 9.3.3 Issues on Road Structure and Design

#### (1) Measures for an increasing motorcycle:

According to the statistic data in Kathmandu, motorcycles contribute 74.4% of the total registered number of vehicles as of year 2010 and the traffic volume of motorcyclist on the road accounted for 50% to 70 % of the total traffic volume according to the traffic count survey in 2011.

Since the motorcycle has increased at an alarming rate, it is essential to take proper measure to ensure a smooth traffic flow as well as to reduce vehicle accidents. The provision of exclusive use of motorcycle lane is one of the options or solutions if the ROW is available as shown in Figure 9.3.13. It is suggested for DOR to examine the standardization of motorcycle lanes in road design and apply it to the widening and/or new construction road project.

In addition to such an improvement of hardware, education on the traffic manners of the drivers, especially for motorcycles, are also quite effective for decreasing traffic accidents. Drivers should know the traffic rules that motorcycle should use the left side of road but not the center of the road.



**Figure 9.3.13 Measures for an Increasing Motorcycle**

#### (2) Provision of sidewalk for pedestrian safety:

Walking is still the main means of commuting to school in Kathmandu Valley. Therefore, provision of sidewalk separated to the roadway, pedestrian bridge, pedestrian crossing, setting of the signal for exclusive use of pedestrians, etc. is indispensable for securing safety and these facilities should be standardized as incidental institution, especially for city road.

#### (3) Need of bicycle lane and road:

Persons who uses bicycles for commuting are decreasing and is less than 5% of the whole commuters according to the result of the traffic survey. However, the use of bicycle will contribute not only to the health of people but also to the improvement of air quality in the valley. The use of bicycles should be encouraged and supported by the government.

The bicycle road is also considered as an effective measure to the development of tourism in the valley. There are many roads suitable for cycle road including the riverside road in the Kathmandu Valley. Thus, the development of bicycle road should be discussed in the future M/P.

#### (4) Parking lot:

Traffic survey revealed that many trucks and buses are parking during night time within the ROW along the Ring Road. One of the reasons is the shortage of parking lots in the Kathmandu Valley. Provision of parking bay within the ROW along the Ring Road is one of the effective solutions and measures for an orderly parking system as the first step. DOR may collect a parking fee from these vehicles and allot the collected fees to the maintenance and administrative expense.

### **9.3.4 Traffic Management Issues**

#### **(1) Necessity on Traffic Management**

The data collection survey did not cover the survey on traffic management at this time. However, traffic management is one of the major means for solving the traffic problems which should be discussed in the future M/P.

At present, a variety of traffic management measures are being undertaken in the Kathmandu Valley. However, in spite of these measures, overall situation of road traffic is getting worse which is evident with the increase of traffic accidents and degradation of the environment.

It is essential not only to widen the road and construct flyovers, but also to improve the traffic management solve the transportation problem of Kathmandu. Proper traffic management, such as provision of traffic light in main intersections and busy road sections, proper operation of signal timing of traffic light based on the degree of congestion at a particular lane, backup energy like solar power against load shedding, provision of traffic sign, etc., are essential for traffic improvement.

The traffic management measures should be discussed in the future M/P from the following view points:

- 1) Engineering measures (provision of traffic signal, pedestrian bridge and crossing, etc.)
- 2) Physical measures (more parking space, zebra crossing, safety fence, etc.)
- 3) Legal measures (traffic regulation, penalty system, etc.)
- 4) Administrative measures (one-way system, parking control, etc.)
- 5) Educational measures (awareness program for better driving, TV, etc.)

#### **(2) Need of Traffic Control System**

A traffic control system by a traffic control center with sensors and cameras should also be examined in the future M/P either in the medium-term or long-term plan.

## 9.4 Recommendations to the Future M/P Study

### 9.4.1 Necessity of the Future M/P Study

The urbanization of the Kathmandu Valley would continue at rather high speed accompanied by the population increase with a high growth rate.

This data collection surveys including road inventory survey, traffic survey, and land-use survey identified the following facts:

- (1) **Traffic congestion occurs everywhere in major roads and is becoming chronic due to rapid increase of traffic demand.**
- (2) **Insufficient public transport services that cannot support the increasing traffic demand.**
- (3) **Urbanization is proceeding in disorderly manner due to lack of proper land-use policy and road network system as well.**

In order to solve the above problems radically, it is indispensable to conduct the future M/P which unifies with the road development, public transport development, and land-use development plans.

Furthermore, it is suggested that the future M/P should be developed taking into consideration the following:

- 1) To clarify the practical city image which Kathmandu should aim
- 2) To draw up a future urban traffic policy corresponding to the future image of Kathmandu
- 3) To devise a concrete enforcement plan to realize the future urban traffic policy

### 9.4.2 Issues to be Considered in the Future M/P Study

#### (1) **Balanced traffic development plan:**

It is expected that the population in the Kathmandu Valley will come to about 4 million within ten years or so according to the estimation made by the Survey Team. A well balanced future M/P shall be developed by the introduction of three basic polices, that is: strengthening of road network, traffic management, and public transport including the introduction of mass transit.

#### (2) **Greater Kathmandu covering Banepa and Dhulikhel:**

According to the past trend of urban expansion and availability of land, the expansion of urban area to the eastward will continue and proceed even beyond the Kathmandu Valley up to Banepa and Dhulikhel in the long-term.

It may be considered in the future M/P the integration of Banepa and Dhulikhel into Kathmandu Valley which will be called as "Greater Kathmandu".

#### (3) **Examination of mass transit system:**

The feasibility study on Railway and Metro Development Project is being conducted by the DOR, MOPPWTM, which is expected to be completed in October 2012.

The realization of the mass transit makes a big influence on the transport policy and road development network as well, it is necessary to share information in conjunction with the study results in making the future M/P.

#### (4) **Consideration of disaster prevention for earthquake:**

It is expected that an earthquake will hit the Kathmandu Valley in the near future. Since the core areas of Kathmandu City is densely populated and developed with small roads and old houses, it is necessary to make a proper evacuation system in the future M/P plan from the viewpoint of disaster prevention.

Evacuation routes with sufficient space for the inhabitants living in the core areas should be considered.

**(5) Needs of extension links connecting the proposed inner ring road with the existing Ring Road:**

In addition to the southern extension link proposed by ADB, northern extension, eastern extension and south-eastern extension links connecting the proposed inner ring road with the existing Ring Road should be examined in the future M/P Study to decrease the traffic congestion of city roads inside the Ring Road

**(6) Surface water drainage system**

The appropriate drainage system is indispensable for maintaining the road structure. Therefore, basic plan for the surface drainage network of the Valley shall be examined in the future M/P study.

**(7) Need of supplemental road and traffic surveys:**

To proceed to the future M/P stage, following two supplemental surveys will be needed.

1) Road survey:

- Re-survey on the urban roads inside the Ring Road where the KVDA is now performing the widening of ROW.

2) Traffic survey:

- Parking survey at the central area of Kathmandu to clarify the parking condition.
- Preference survey (PS) to capture the factor for promotion of envisaged traffic mode.
- Survey for goods movement between survey area and outside to identify location of cargo terminal and logistic center.

**(8) Review on the Role of Bhaktapur in the Kathmandu Valley:**

The previous M/P (1993) recommended the valley's integrated development of three core cities such as Kathmandu, Lalitpur, and Bhaktapur. However, population and economic activities are still concentrated in Kathmandu and Lalitpur, but not enough in Bhaktapur area. After the completion of the Kathmandu-Bhaktapur Road construction project in 2010, it is time to reformulate the development plan of Bhaktapur area in the future M/P.

The scenarios should consider population distribution by population density planning to accommodate increasing population in the limited land in the valley.

**(9) Concept of the Kathmandu Valley Land Use and Zoning Plan:**

Land use/zoning classifications and supporting regulations and building by-laws would be designed (amongst others) to support all aspects of improved transportation planning, especially the relative location of residential, commercial and industrial areas, as well as the increase in development densities around public transport nodes. Strengthened environmental management provisions are also needed.

It is necessary to review the direction and outline of existing Kathmandu Valley Land Use and Zoning Plan (2007). Detailed revision of the land use zoning should be discussed in the next phase.

**(10) Necessity of Bus and Cargo Terminals:**

The Survey revealed insufficient capacity of bus and cargo terminals. Although it is difficult to find an open space, these facilities are essential for facilitating the increasing traffic demand including public transport buses and cargo trucks.

The bus terminal plan should be developed in the surrounding areas along the arterial road or the Ring Road taking into consideration the future urban development scheme.

Cargo terminals and logistic center should be discussed in the future M/P to serve the existing cargo movement as well as to encourage economic and social development in Kathmandu Valley.

**(11) Need on Traffic Management Study:**

The survey on traffic management was not included in the data collection survey. Since the traffic management is one of the main means for solving the traffic problems, it should be discussed in the future M/P. Traffic management can expect an effect for few expenses in the short-term, therefore, it should be examined as an immediate action plan in the future M/P.

A traffic control system by a traffic control center with sensors and cameras should also be examined as an improvement plan in the medium or long-term plan.

**(12) Application of the JICA Guideline for Environmental and Social Considerations**

During the future M/P study, the measures for environmental and social considerations should be applied in the plan by ensuring a wide range of meaningful stakeholder participation and transparency of decision-making, as well as by working for information disclosure and ensuring efficiency.