

## CHAPTER 4 DEVELOPMENT PLAN

### 4.1 Background

A great number of development plans for both national and regional level have been compiled in Nepal since the 1950s. Although they have attained a remarkable achievement in the vitalization of the national foundation, further development plans are to be developed for the overall level up of national's economy. Nepal still belongs to the least developed countries with per capita income of less than 150 dollars annually, and for all a great number of development plans in the past, the overall living standards are extremely low.

### 4.2 Review of the Nation's Past Development Plans

Since Nepal has assumed modernization policy in the middle of 1950s, great emphasis has been put on the vitalization of its national foundation. Especially great portion of nation's investment was assigned for the vitalization projects of communication and transportation networks. But from the beginning of the First Five Year Plan, major focuses were confined to the Kathmandu Valley and the Terai Plain.

As for the road construction of the nation, major focus of development was placed on the east-west corridor in the Terai Plain and on the access road between the Kathmandu Valley and the Terai Plain, and most of the other parts of the nation have long been remained untouched. But this kind of uneven allocation of investment has resulted in unbalanced provision of socio-economic and industrial foundations among regions and has promoted regional gap.

The above could be found in the following unfavorable aspects in national economy:

- Lack of interdependence among industries in different regions, due to the hindered transports of industrial materials and products.
- Limited scope of market area, especially for consumption goods and agriculture products.
- Incessant migration from Hilly and Mountain areas to the Kathmandu Valley and to the Terai, and resultant devastation in the former and over population in the latter.
- Lack of national unity.

Of course, the lack of sufficient investments, historical reasons and strong geographical constraints are another reasons behind the above phenomena, but it could be said that the skewed incentives taken by the first three of the initial Five Year Plans (1955-1970) had led the situation to serious one.

The 4th Five Year Plan (1970-1975) came up with the vision of "hinterland development plan" aimed at the correction of the regional unbalanceness. In this plan, strategy of integrating the industrially developed regions with backward parts of the nation was first proposed in the concept of "North-south Growth Axis" (Fig. 4.1). It could be said that Nepal has moved on to the second phase of national development with this 4th Five Year Plan.

But contrary to the concept spelled out in the plan, implementation was slow in progress, due to the strong

constraints of geography, inadequate budget and technical reasons.

But it seems inevitable for national economy to build up uniform foundations for regional socio-economic activities, in which smooth distribution of industrial products, material and consumption goods are ensured. These foundations are to promote the creation of homogeneous national economy in a long term, in which overall regional differences are held minimum.

Succeeding the basic concept of Five Year Plans, the current Five Year Plan (1985-1990) has come up with the following targets of development.

- To increase production at a higher rate
- To increase opportunities for productive employment
- To fulfil the minimum basic needs of the people

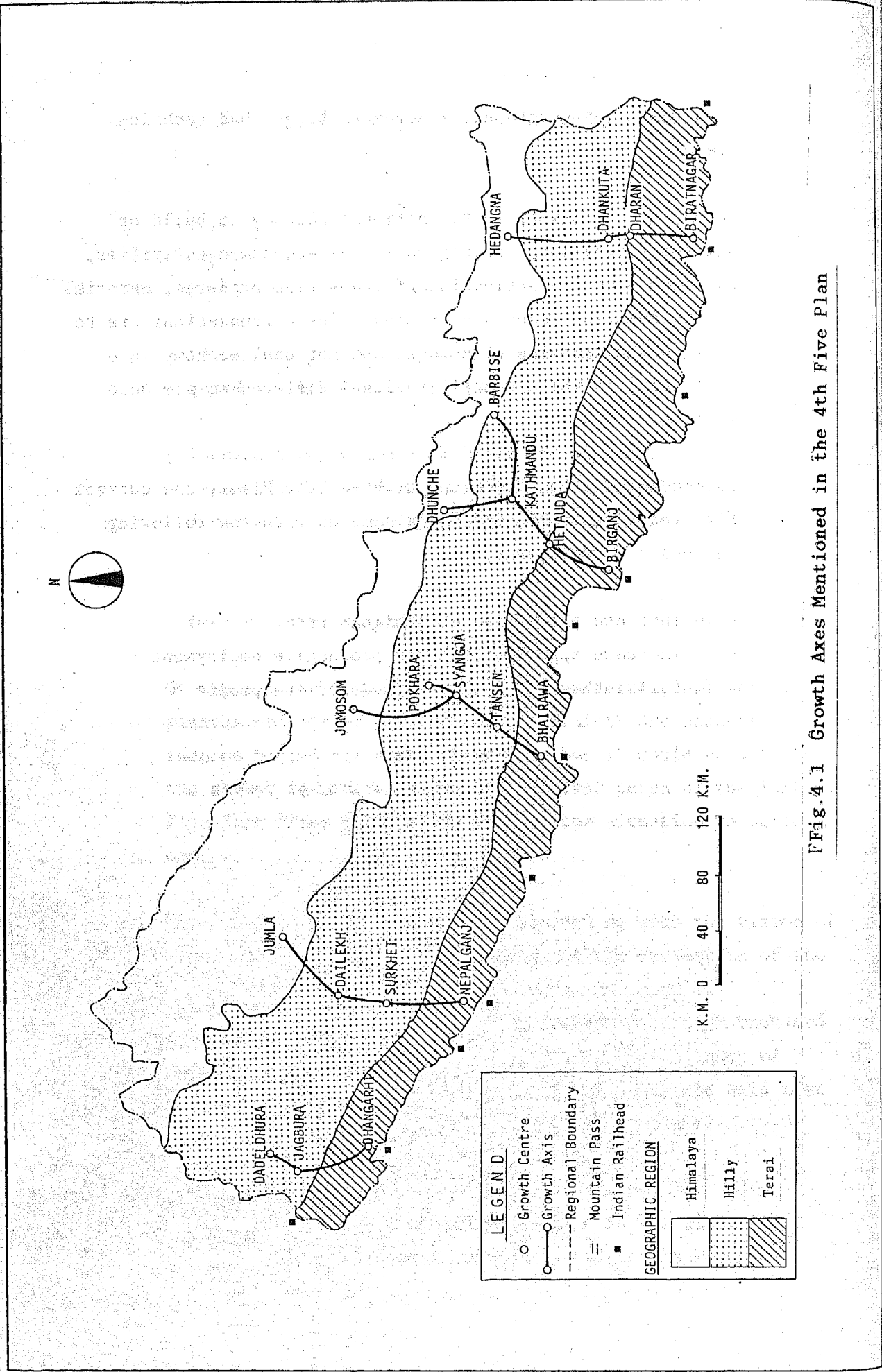


Fig. 4.1 Growth Axes Mentioned in the 4th Five Plan

#### 4.3 Direction of Future Development Plan

##### 4.3.1 General

Any project can not stand alone by itself, as the factors which compose project are strongly related to those of others. It is a principle in formulation of development plan that the benefit from a certain project should be maximized in the interdependent relation with other projects. Especially in the compilation of development plans in Nepal, greater emphasis is requested to be placed on the following points, reflecting on the failures in the past:

- Comprehensiveness among projects
- Consideration on regional interdependence
- To be realistic

##### 4.3.2 Functional Role to be Played by the Project Road

The Project Road will be first full-fledged motorable road which penetrates the nation along the north-south direction in a short-cut. The north-south connection which passes through the hilly area in the Central Development Region in Nepal has long been envisaged by planners and policy makers, because of its anticipated great impact on the regional development.

Judging from the nature of economy in Nepal, which is heavily oriented in agriculture, it is desired to work out road development plan in line with the agriculture vitalization project. Opening of a motorable road in such an isolated area as the hilly area in the Central Development Region would change the pattern of agriculture and would contribute to the overall level up of the

industry. Furthermore, the level up of agriculture would encourage the other sectors of industry in the nation through "acceleration principle" in the economy.

On the other hand, the industrial interdependence strengthened by the road would lead the economic system to more efficient and competitive one. The traditional systems in industrial activities (production, employment and transportation) will be modernized.

These changes, in a long term, would contribute to the creation of higher living standard of the nation, which exactly coincides with the goals articulated in the current Five Year Plan. In addition to this, the Project Road is expected to induce other infrastructure development plans such as new roads construction, irrigation and multipurpose dam projects.

#### 4.4 Road Development Plan

##### 4.4.1 Introduction

Considerable efforts have been spared in the field of road development since Nepal has launched her 1st Five Year Plan. Total road length of the nation as of the 4th year of Sixth Five Year Plan was about 5.7 thousand kilo meters which are almost nine times as long as those of 1955/56 as shown in Table 4.1. But for all the drastic increase in the overall length in the past 30 years, there exist some issues relative to the road sector in Nepal.

Broadly speaking, issues of the present road sector in Nepal are classified into two types according to their natures: One is the issue attributed to networks which is defined as the assembly of individual roads, and the other

is the issue related to the service standard of individual road.

#### 4.4.2 Development of Road as a Network

Despite of many road facility vitalization programs in the past, Nepal's road network system seems to be not functioning well. This fact seems to come from lack of functional balance between arterial roads and feeder roads as a whole. In Nepal there still exist those districts and/or villages that have no motorable feeder road linking to arterial roads, although the geographical condition and lack of sufficient budget for these feeder roads are main reasons behind the fact. But for the realization of well-functioning road network as a system, provision of feeder roads which co-function with trunk roads is significantly important.

Relative to the Project Road, construction of such access road as one which links to the town of Ramechhap, zonal center of Ramechhap zone having no motorable road in it, is strongly proposed.

Road development, in which the "functional balance" among arterial roads and feeder roads is well planned, will not only strengthen the transportation sector but also will activate the regional economy. In this respect, the construction plan of Jiri-Ramechhap access road is highly appreciated.

#### 4.4.3 Grade up of Individual Roads

Although the total length of roads has increased drastically for the last 20 years, most of the roads are sub-standard in alignment, designing of curvature, and in the capacity of bridges. Besides, most of the roads are

poorly maintained to the detriment of forcing tremendous diseconomy to the national economy.

With the opening of the Project Road, the roads, of which function are supplemental to the Road, at least, are requested to be improved. These improvements combined with the opening of new road would induce more users on the Project Road and would bring about greater socio-economic impact on the surrounding regions.

#### 4.4.4 Vision of Road Development in the 7th Five Year Plan

The goals of future road development articulated in the current Five Year Plan are almost same as those of previous Five Year Plans. Practical and steady implementation program for the attainment of these goals are requested.

The goals articulated in the current Five Year Plan are listed below:

- to consolidate national integrity by linking different regions of the country.
- to launch economically more productive roads projects, to raise the national growth rate, generate productive employment and fulfill basic requirements of people.
- to bolster tourism besides maintaining regional balance and economic unification by the development of suitable roads.
- to bolster urbanization.
- to develop rural transportation system so as to facilitate the people of backward and remote areas with secure transportation and easy accessibility, thereby bolstering the development of rural sector.



Table 4.1 Situation of Roads in Development Regions at the End of Different Periodic Plans, 1955/56 - 1983/84

(Unit: km)

Development Region	First Plan 1955/56	Third Plan 1969/70	Fifth Plan 1979/80	Sixth Plan* 1983/84
<b>E.D.R.</b>				
1) Black-topped	-	63	447	570
2) Gravelled	-	184	140	388
3) Rough trail	48	458	465	364
Total	48	705	1,052	1,322
<b>C.D.R.</b>				
1) Black-topped	137	515	887	429
2) Gravelled	116	228	291	1,109
3) Rough trail	197	419	727	571
Total	450	1,162	1,905	2,109
<b>W.D.R.</b>				
1) Black-topped	-	237	607	670
2) Gravelled	-	-	39	63
3) Rough trail	120	256	300	364
Total	120	493	946	1,097
<b>M.W.D.R.</b>				
1) Black-topped	-	6	103	226
2) Gravelled	6	23	94	68
3) Rough trail	-	341	840	431
Total	6	370**	1,037**	725
<b>F.W.D.R.</b>				
1) Black-topped	-	-	-	58
2) Gravelled	-	-	-	74
3) Rough trail	-	-	-	332
Total	-	-	-	464
<b>NEPAL TOTAL</b>	<b>624</b>	<b>2,730</b>	<b>4,940</b>	<b>5,717</b>

\* Up to the fourth year of the plan period

\*\* Far-western Development Region is included.

Source: The 7th Five Year Plan.

## 4.5 Agriculture Development

### 4.5.1 General

Agriculture plays substantial role in the economic development in Nepal. Agriculture has been the prime source of income and employment to the nation. Development of agriculture sector is essential for the industrialization of the country and promotion of export as well as for the enhancement of living standard of the nation.

### 4.5.2 Issues in Agriculture in the Study Area

The study area makes a substantial contribution to the nation's agricultural production, supplying some 40% of national foodgrains. Production of commercial crops like potato, sugarcane, tobacco and jute are mostly concentrated in the Central and Eastern Development Regions.

Approximately 72% of potato, 68% of sugarcane, 95% of tobacco and almost 100% of jute are produced in the study area. From the above it could be said that the agriculture in the study area is the most fundamental industrial section in the nation. But as seen in 2.2.2 of chapter 2, there exists distinct differences in agricultural pattern between the Terai area and the Hilly areas. The agriculture in Terai area is rich in variety with plantation of many cash crops. On the other hand, the agriculture in the hilly area is monoculturistic depending mostly upon grain production. This fact results in great gap in agricultural income levels between those two areas.

### 4.5.3 Direction of Future Agricultural Development

Agricultural development is given the first priority in the on-going Seventh Plan. Many agricultural development

projects, mainly based upon irrigation improvement projects, are being conducted now. First of all, these projects are requested to be conducted on schedule. As mentioned in the previous section, the agriculture in the Central and Eastern Development Regions is the most fundamental industry for the nation. The future agricultural development should be considered in the scope of national economy, e.g. agricultural development ought to be planned so that it can encourage national economy. In other words, agriculture development should be compiled in the total balance of national economy. In this context, the agriculture development in line with roads construction project will be significantly important. As a matter of fact, well planned highway would work as the incentive for activating regional economies and would expand the sphere of market for agricultural products. It also works as a catalyst for creation of new demand for agricultural products, which will result in creation of more productive land use pattern as well as absorbing unemployment in the surrounding areas. In a long term, the land use pattern in the central area, most of which is now used for plantation of grains, will change into for cash crop plantation. Junar plantation in Sindhuli district is typical example in this respect. As the demand for these kinds of products increases, the more plantation of this kind of products will be prevailed. At the same time it will contribute to the reduction of unemployment through the creation of new jobs. In conclusion, the agriculture in the study area will be transformed to more prouductive one with the more plantation of high value-added crops such as fruits, vegetables and herbal plants. The above scenario for agricultural development seems to coincide with the vision envisaged in on-going irrigation and rural development projects.

#### 4.6 Other Infrastructure Development Plan

In view of the importance of water resources for the foundation of the nation, development priority is to be given to water resources development plans which are formulated for the purpose of supplying electric power, irrigation water, industrial and living water and for the flood control. At present, main projects nearby the Project Road are listed in Table 4.2 and Table 4.3.

Table 4.2 Hydro-Electricity Project

Name of Project	Target of Completion	Capacity
1. Kulekhani II Hydro-electricity Project	by 1986/87	32 MW, 104.6 million kWh
2. Marsyangdi Hydro-electricity Project	by 1991/1992	66 MW, 450 GWh

Table 4.3 Irrigation Project

Name of Project	Target of Completion	Area
1. Bagmati Irrigation Project	by 1986/87	68,000 ha.
2. Sunsari Morang Irrigation Project	by 1990/91	66,000 ha.
3. Narayani Irrigation Project	by 1987/88	31,400 ha.

In addition to the above, following groundwater development projects are being implemented in the vicinity of the Project Road;

- Rajbiraj Pump-up;           Command area 16,450 ha.  
  (Lifting type)            Complete by 1987/88
- Kosi River Canal         Command area 15,000 ha.  
  (Gravity type)

Cheap energy and water supplies are inevitable for the development of the nation. Corresponding to these needs, "The Master Plan Study on the Kosi River Water Resources Development" has been conducted in 1984/85 by HMG/N in cooperation with JICA. This study has launched a number of project plans. Among more than 13 project plans, higher priority was given to the Sun Kosi Multipurpose Scheme and Arun No.3 Scheme.

The Sun Kosi No.2 scheme, 6th priority, is proposed at a site between Nabughat and Salpathan. This plan is designed as a storage type of a hydro-electricity project, equipped with installed capacity of 1,110 MW, providing a concrete gravity dam in height of 166 m. The Sun Kosi Multipurpose Scheme is developed in three stages. The scheme provides a intake dam and a diversion tunnel in length of about 16.6 km. The water diverted from the Sun Kosi River will be used for irrigation purpose to command 174,000 ha. and for power generation by using the diverted water. Total 93.4 MW of power is expected on completion.

These infrastructure development projects are to be proceeded in coordinating manner with the proposed road construction project so that individual project might be encouraged mutually.



## 5.1 General

### 5.1.1 Outline of Traffic Survey

For the purpose of understanding characteristics of highway traffic and for the preparation of basic materials for future traffic demand forecast, traffic survey which is comprised of the following contents is conducted:

- Roadside OD survey and traffic counts
- Vehicle running speed survey
- Road inventory study

### 5.1.2 Traffic Zone

#### (1) Study Area

Study area is established for the study of traffic demand forecast and analysis of the impact on regional economy.

Central and Eastern Development Regions are designated as the study area as shown in Fig. 5.1, since great impact on economic activities and social activities by the Project Road are anticipated in these regions.

#### (2) Traffic Zone

Traffic zones for OD survey and succeeding traffic demand forecast are set up as shown in Fig. 5.2. The Central Development Region is divided into 16 zones, and the Eastern and the Western Development Regions are divided into 3 zones respectively. The Central Development region

is finely divided since it contains direct influenced area of the Project Road. The total number of traffic zones set up in this study is 25 including the zones outside the study area as shown in Fig. 5.2.

(3) Vehicle Type

Vehicle types for OD survey and traffic counts are defined as the below:

Table 5.1 Definition of Vehicle Type

Vehicle Type	Definition
Passenger Car	Including van, jeep and pick up
Mini Bus	With number of seats less than 26
Bus	With number of seats 26 and over
Light Truck	Less than 2.5 ton
Medium, Heavy Truck	2.5 ton and over
Tractor	Include light, medium and heavy tractor
Motorcycle	Include bicycles with engine
Others	Include vehicles for army, fire engine, ambulance and so on



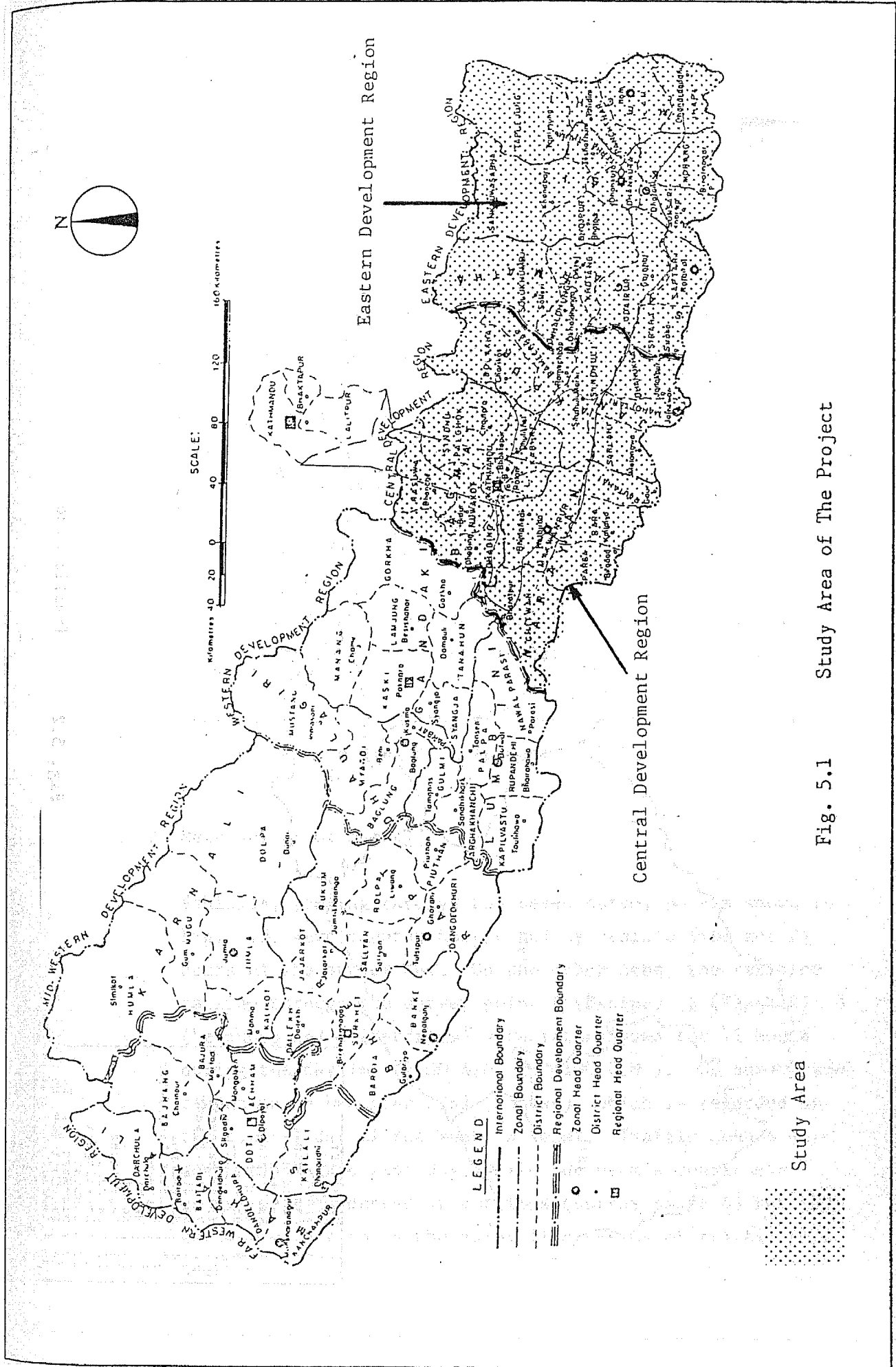
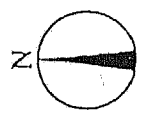
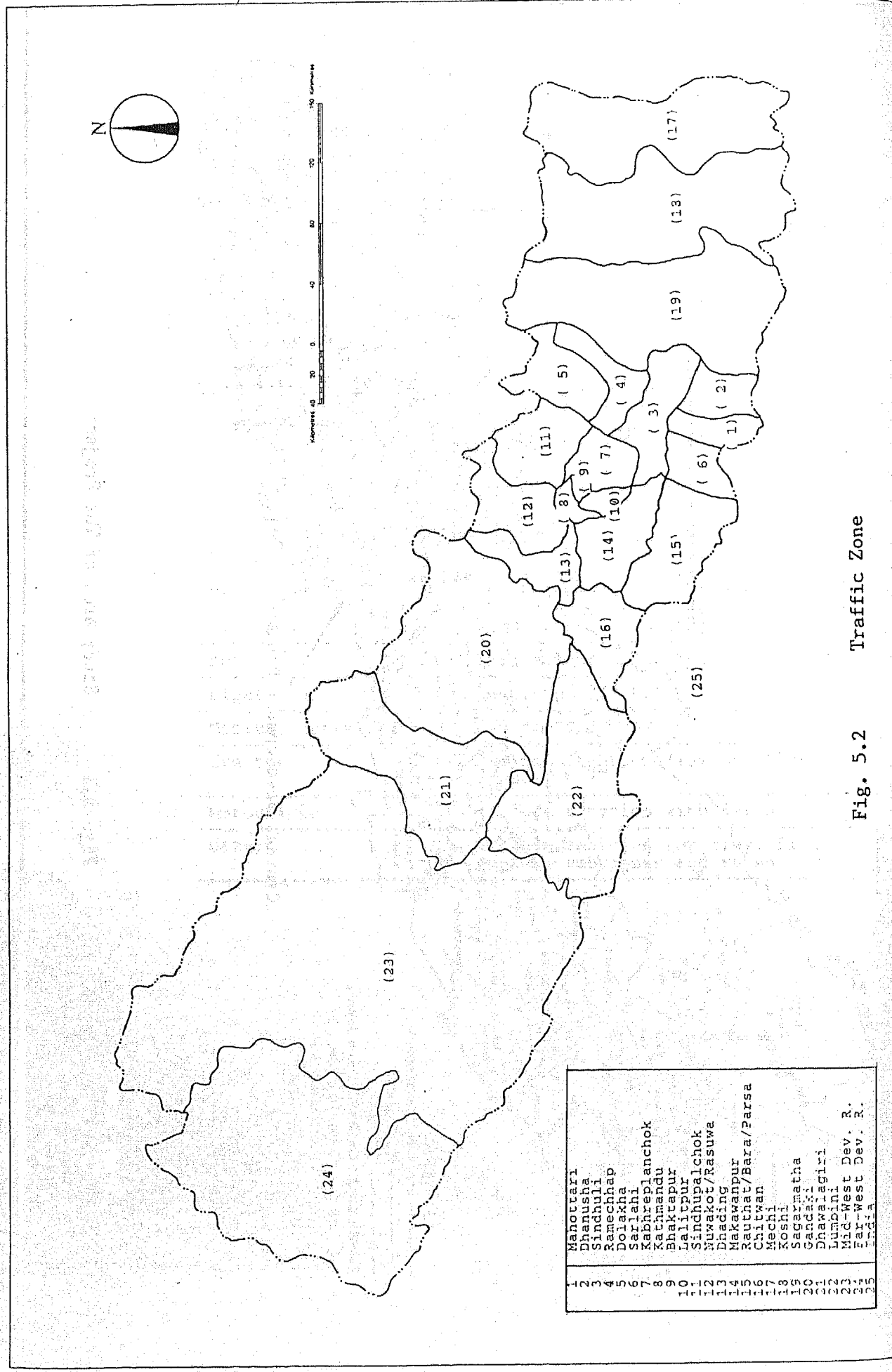


Fig. 5.1 Study Area of The Project



1	Manottari
2	Dhanusha
3	Sindhuli
4	Ramechhap
5	Dolekha
6	Sarlahi
7	Kabrepanchok
8	Kanchandu
9	Bhaktapur
10	Lalitpur
11	Sindhupalchok
12	Mukhot/Rasuwa
13	Dhading
14	Madhyanpur
15	Rautahat/Bara/Parsa
16	Chitwan
17	Mechi
18	Koshi
19	Sagarmatha
20	Gandaki
21	Dhawalagiri
22	Lumbini
23	Mid West Dev. R.
24	Far West Dev. R.
25	

Fig. 5.2 Traffic Zone

## 5.2 Roadside OD Survey/Traffic Counts

### 5.2.1 Contents of Survey

Roadside OD survey and traffic counts were conducted on the major highways in the study area.

Items interviewed in the OD survey are as follows:

- Origin and destination of vehicle
- Purpose of trip
- Number of passengers
- Kind of commodities loaded
- Loading condition

In traffic counts, vehicles passing through the survey points were counted by vehicle type and by time band.

Questionnaires for OD survey, counting sheet for traffic counts area are listed in Appendix 5.2.1.

### 5.2.2 Methodology of Survey

Vehicles, passing through the seven survey points shown in Fig. 5.3, were counted hourly and by vehicle type for 24 hours of the survey day. On the other hand, the vehicles passing through the survey point 1 (Banepa), 2 (Thankot), 3 (Hetauda) and 4 (Bardibas) were interviewed for 12 hours during the daytime (6:00 A.M. to 6:00 P.M.). OD survey was conducted on December 22nd (Monday), which is regarded as the typical day of the week in Nepal. Traffic counts were conducted on the same day, while one week's continuous counts were conducted at Bardibas (survey point 4) for the purpose of examining the daily fluctuation of traffic in a week.

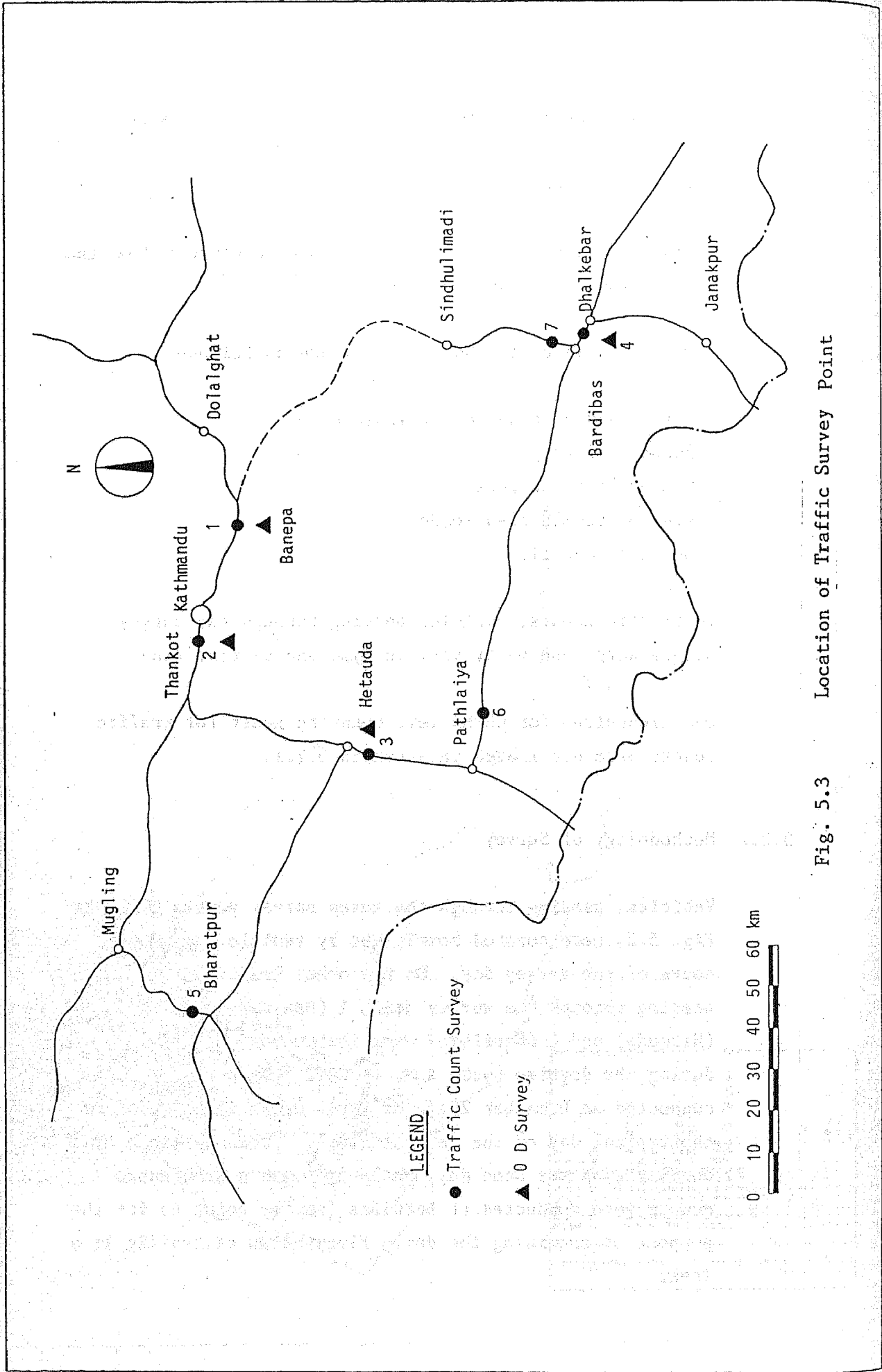


Fig. 5.3 Location of Traffic Survey Point

### 5.2.3 Present OD Table

Main purpose of OD survey is to establish present OD table of the study area. For the estimation of present OD table, raw information gathered by the OD survey was modified so that it could represent typical one day's traffic of the year. This work involves expansion to 24 hours traffic, eradication of seasonal variation and so on. Fig. 5.4 illustrates the total flow of this work.

#### (1) Expansion to 24 Hours Traffic

The result of OD survey (12 hours survey) was modified to one day traffic through expansion factors obtained by the information of traffic counts. Expansion factors here were defined by the following equation;

$$\lambda_{ijk} = \frac{T_{ijk}}{t_{ijk}}$$

where,

$\lambda_{ijk}$  : Expansion factors set up by survey point (i), direction (j) and vehicle type (k)

$T_{ijk}$  : 24 hours traffic along the above categories, (i), (j) and (k)

$t_{ijk}$  : Number of vehicles interviewed excluding invalid samples along the above categories, (i), (j) and (k)

$i.j.k$  : Suffix which denotes survey point, direction and vehicle type in order.

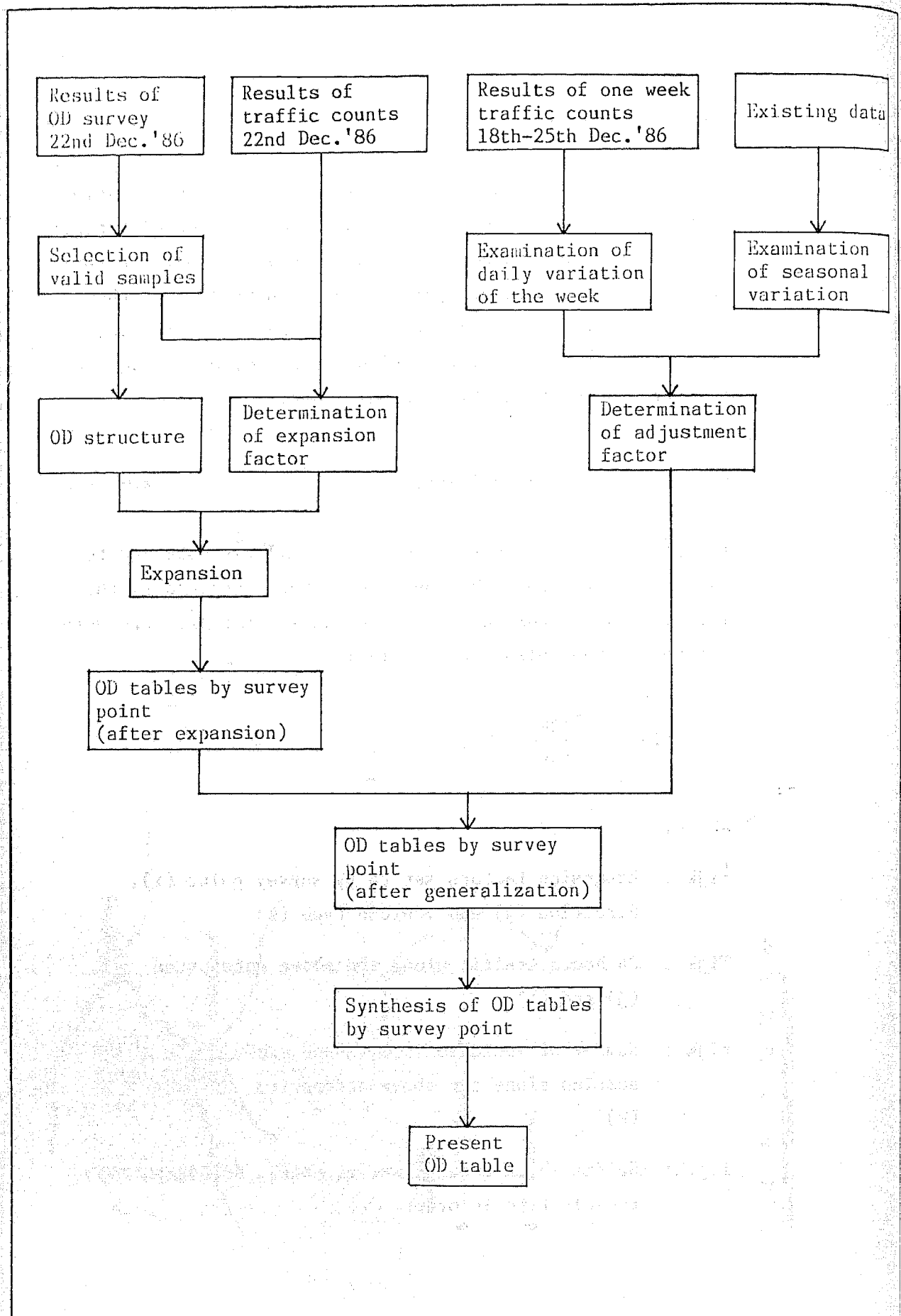


Fig. 5.4 Process for Establishing Present OD Table

(2) Adjustment factor for Average Daily Traffic

Traffic volumes recorded on the survey day were generalized into traffic of an average day of the year getting rid of daily bias of the week and seasonal bias of the year. Conclusively, adjustment factor 1.08 was applied based upon the information obtained by one week's continuous traffic counts at Bardibas and other information by DOR, which are shown in Fig. 5.5 and 5.6.

(3) Synthesis OD Tables of All the Survey Points

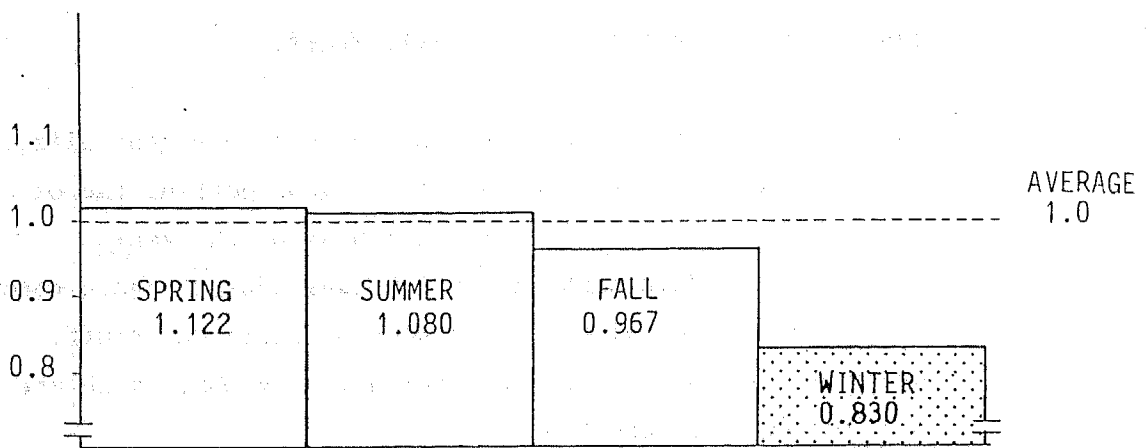
OD tables by each survey point were synthesized into total OD table so that it could represent structure of vehicle movements in whole of the study area. This work was proceeded in a manner which avoids duplication of traffic among survey points.

5.2.4 Results of OD Survey/Traffic Counts

From the results of the roadside OD survey and traffic counts, following characteristics in present highway traffic are pointed out;

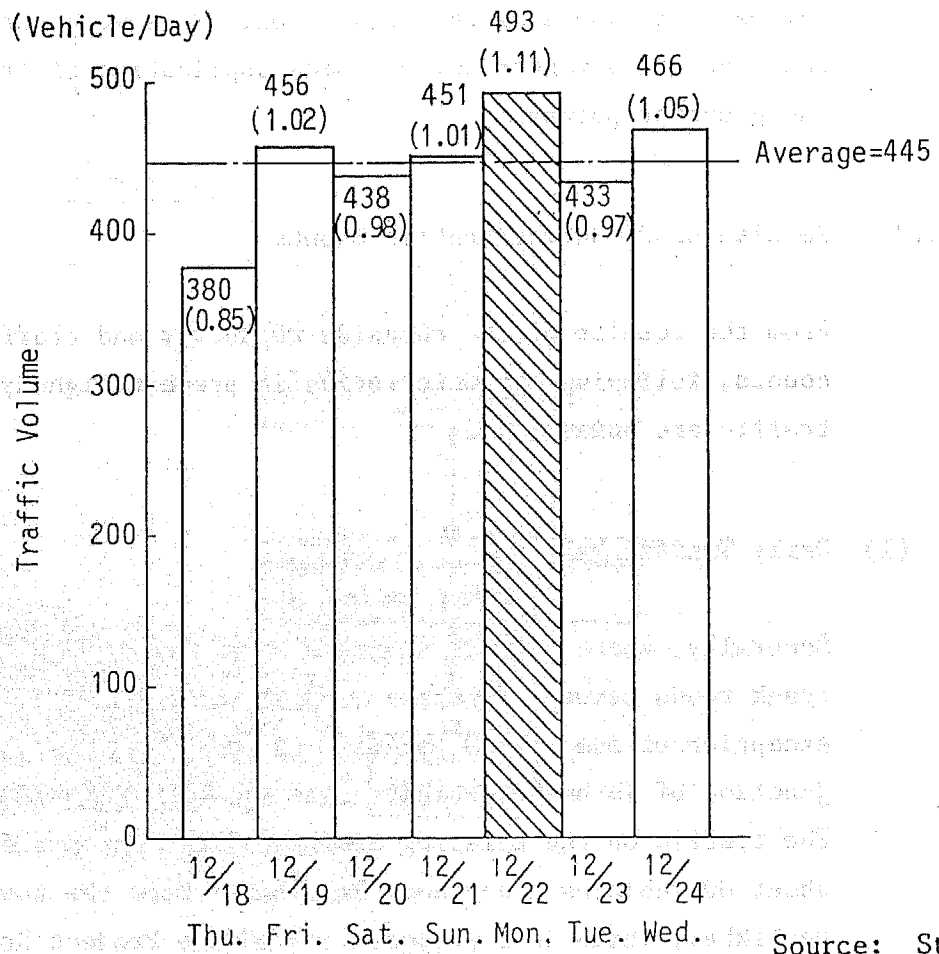
(1) Daily Traffic Volume

Generally, about 500-800 vehicles were recorded along the trunk roads between Janakpur to Kathmandu with the exception of some 1,400 vehicles at Thankot, near the junction of Kathmandu-Pokhara Road and Tribhuvan Highway. The traffic on the existing Sindhuli Road was very few with about 80 vehicles a day near Bardibas. Near the town of Dhulikhel, which is a proposed end of the Project Road on



Source: Department of Road

Fig. 5.5 Seasonal Variation of Traffic



Source: Study Team

Fig. 5.6 Daily Variation of Traffic



the side of Kathmandu Valley, about 700 vehicles were recorded (Fig. 5.7).

(2) Traffic Composition

Throughout the trunk roads from Kathmandu to Janakpur, the share of truck is considerably high with the share of about 50%. Followed it, the share of bus is 30%. The share of passenger cars including jeeps and pick-ups is around 10 to 30% (Table 5.2).

(3) Characteristics in Highway Traffic

Daylight traffic ratio, which is a ratio of 24 hours traffic to 12 hours traffic during the daytime, is relatively high along the route from Janakpur to Kathmandu. This fact, along with the fact that relatively large number of trucks are seen on this route, shows that this route is used as an inter-regional trunk road. No remarkable peak-traffic can be seen throughout survey points in the study area (Table 5.3).

(4) OD Structure

The desired lines of present highway traffic (A.D.T for all vehicles) are shown in Fig. 5.8, and 5.9. Relatively large volume of OD traffic can be seen in such OD pairs as Kathmandu-Birgunj (240), Kathmandu-Pokhara (216) and Kathmandu-Dhading (131). The traffic between Eastern Terai in C.D.R. including E.D.R. and the Kathmandu Valley is approximately 200 a day.

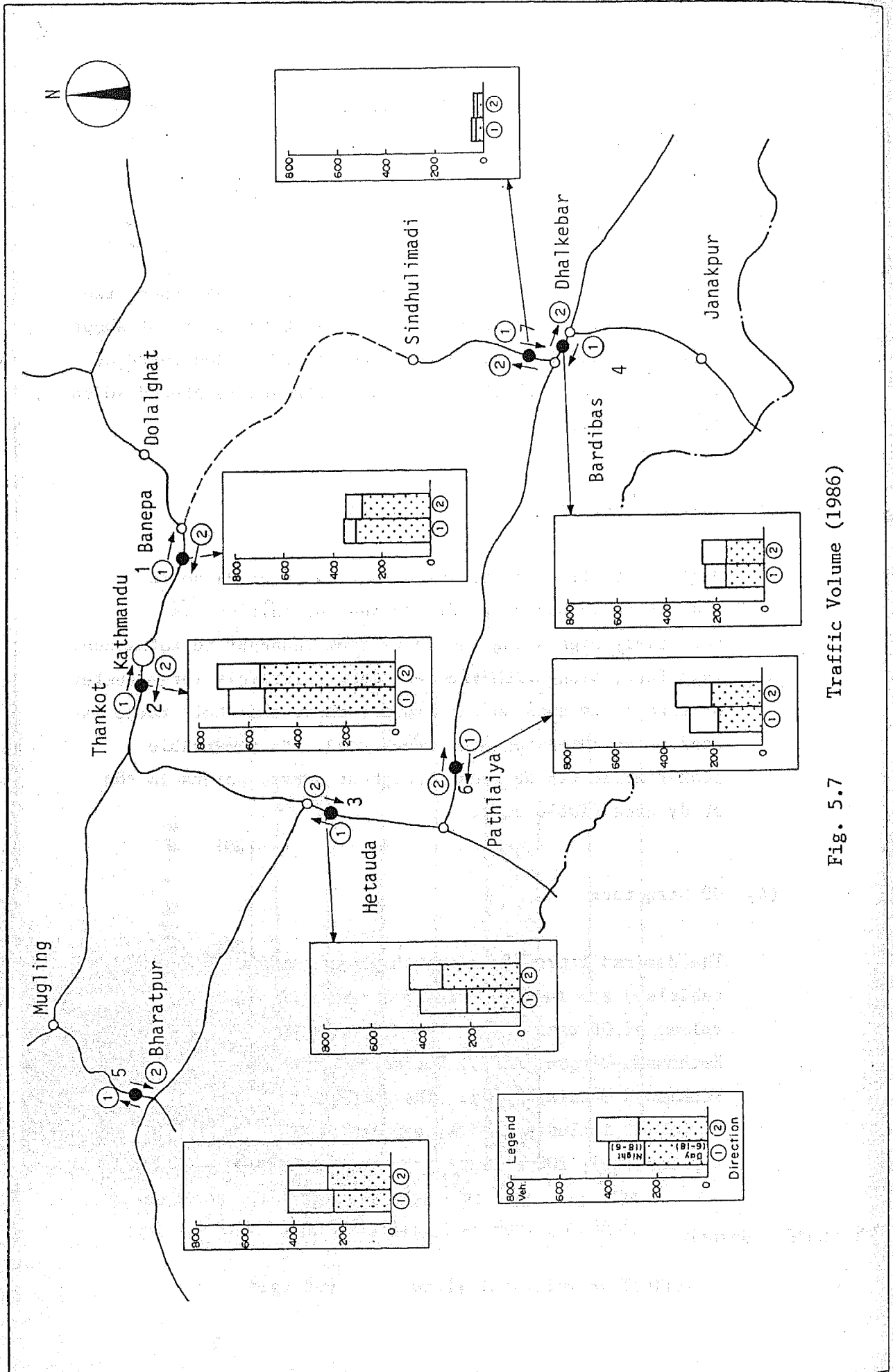


Fig. 5.7 Traffic Volume (1986)

(5) Trip Purposes

Most of the trip purposes of passenger vehicles are related to business and commuting. Trips with sightseeing purpose amount to about 12% of the total trips. Passenger cars are more used for sightseeing and leisure than buses as shown in Table 5.4.

(6) Kind of Commodity Loaded

Some 44% of trucks interviewed are loaded. A little over 20% of trucks are loaded with agriculture products followed by construction materials (9.1%) and mineral (5.8%). Oil accounts for 4.4% of total cargoes transported as shown in Table 5.5.

(7) Average Number of Passengers

Average number of passengers by vehicle type is listed in Fig. 5.8. Average numbers of passengers for passenger car, mini bus, bus and motorcycle are 4.4, 21.9, 43.3 and 1.76 including drivers respectively. From the above, it could be said that vehicles in the study area are rather heavily loaded with passengers.

Table 5.2 Result of Traffic Counts

Unit: Vehicle  
: ( % )

Point	Hours	Passenger Car	Mini Bus	Bus	Light Truck	Medium Heavy Truck	Tractor	Motorcycle	Others	Total	Ratio of Heavy Vehicle (%)
1	12h	180 (30.9)	154 (26.5)	105 (18.0)	14 (2.4)	45 (7.7)	7 (1.2)	66 (11.3)	11 (1.9)	582 (100.0)	25.8
	24h	210 (30.2)	186 (26.8)	113 (16.3)	18 (2.6)	72 (10.4)	7 (1.0)	74 (10.6)	15 (2.2)	695 (100.0)	26.6
2	12h	217 (20.0)	117 (10.8)	224 (20.7)	83 (7.7)	372 (34.3)	13 (1.2)	43 (4.0)	14 (1.3)	1083 (100.0)	55.0
	24h	265 (18.9)	142 (10.1)	321 (22.9)	113 (8.1)	482 (34.4)	16 (1.1)	47 (3.4)	15 (1.1)	1401 (100.0)	57.3
3	12h	86 (16.6)	6 (1.2)	60 (11.6)	79 (15.3)	244 (47.1)	3 (0.6)	40 (7.7)	0 (0.0)	518 (100.0)	58.7
	24h	99 (11.8)	6 (0.7)	179 (21.4)	80 (9.6)	422 (50.5)	3 (0.4)	47 (5.6)	0 (0.0)	836 (100.0)	71.9
4	12h	67 (21.8)	2 (0.7)	81 (26.4)	14 (4.6)	105 (34.2)	2 (0.7)	28 (9.1)	8 (2.6)	307 (100.0)	60.6
	24h	88 (17.8)	3 (0.6)	153 (31.0)	17 (3.4)	185 (37.5)	3 (0.6)	34 (6.9)	10 (2.0)	493 (100.0)	68.6
5	12h	116 (23.4)	10 (2.0)	65 (13.1)	60 (12.1)	222 (44.8)	1 (0.2)	21 (4.2)	0 (0.0)	495 (100.0)	58.0
	24h	152 (18.1)	10 (1.4)	206 (24.5)	85 (10.1)	359 (42.6)	4 (0.5)	23 (2.7)	1 (0.1)	842 (100.0)	67.1
6	12h	55 (14.4)	6 (1.6)	54 (14.1)	27 (7.1)	199 (52.1)	8 (2.1)	28 (7.3)	5 (1.3)	382 (100.0)	66.2
	24h	64 (10.0)	7 (1.1)	146 (22.8)	28 (4.4)	344 (53.8)	11 (1.7)	34 (5.3)	5 (0.8)	639 (100.0)	76.7
7	12h	32 (56.1)	0 (0.0)	8 (14.0)	5 (8.8)	10 (17.5)	0 (0.0)	2 (3.5)	0 (0.0)	57 (100.0)	31.6
	24h	46 (58.2)	0 (0.0)	9 (11.4)	8 (10.1)	12 (15.2)	0 (0.0)	4 (5.1)	0 (0.0)	79 (100.0)	26.6
Total	12h	753 (22.0)	295 (8.6)	597 (17.4)	282 (8.2)	1,197 (35.0)	34 (1.0)	228 (6.7)	38 (1.1)	3,424 (100.0)	52.4
	24h	924 (18.5)	356 (7.1)	1,127 (22.6)	349 (7.0)	1,876 (37.6)	44 (0.9)	263 (5.3)	46 (0.9)	4,985 (100.0)	60.2

Remarks: 12h: From 6:00 to 18:00

Table 5.3 Highway Traffic Characteristics

Survey Point	Traffic Volume		Daylight Traffic Ratio	Traffic Volume	Peak Hour		
	12h	24h			Time	Ratio /24h (%)	Bias of Direction (%)
1	582	695	1.19	67	12-13	9.6	58.2
2	1,083	1,401	1.29	103	14-15	7.4	55.3
3	518	836	1.61	61	9-10	7.3	68.9
4	307	493	1.61	31	14-15	6.3	58.1
					16-17		64.5
5	495	842	1.70	53	16-17	6.3	58.5
6	382	639	1.67	43	9-10	6.7	55.8
					16-17		
7	57	79	1.39	10	18-19	12.7	60.0

Table 5.4 Composition of Trip Purpose

Purpose	Passenger Car	Mini Bus	Motorcycle	Total
1. To Work Place	252 (46.6)	64 (30.6)	73 (46.5)	389 (42.9)
2. Business	55 (11.2)	64 (30.6)	34 (21.7)	153 (16.9)
3. Home	63 (11.6)	13 (6.2)	16 (10.2)	92 (10.1)
4. Sightseeing	85 (15.7)	8 (3.8)	14 (8.9)	107 (11.8)
5. To School	0 (0.0)	0 (0.0)	1 (0.6)	1 (0.1)
6. Shopping/Entertainment	38 (7.0)	3 (1.4)	4 (2.5)	45 (5.0)
7. Others	20 (3.7)	19 (9.1)	4 (2.5)	43 (4.7)
8. No Answer/Not Clear	28 (5.2)	38 (18.2)	11 (7.0)	77 (8.5)
Total	541(100.0)	209(100.0)	157(100.0)	907(100.0)

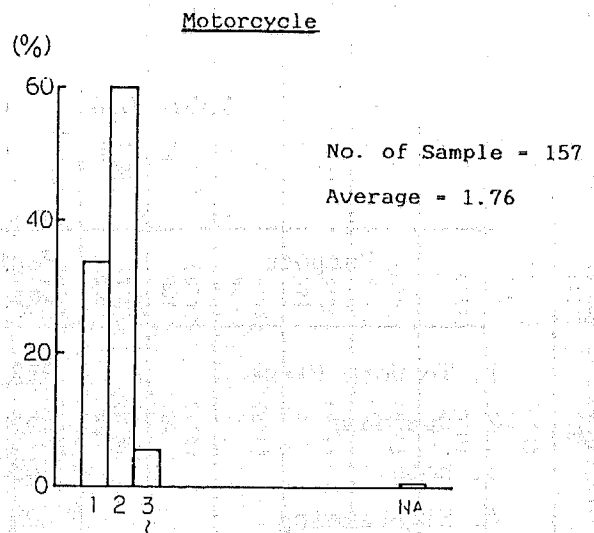
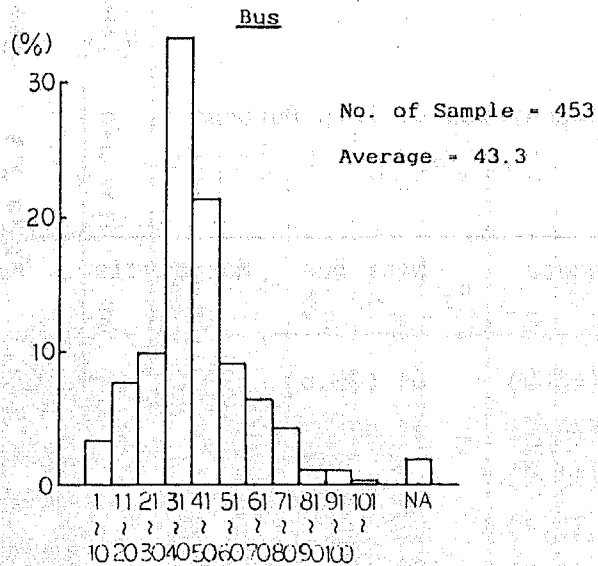
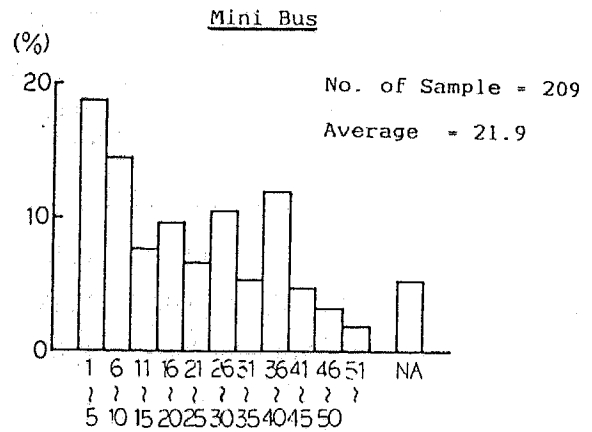
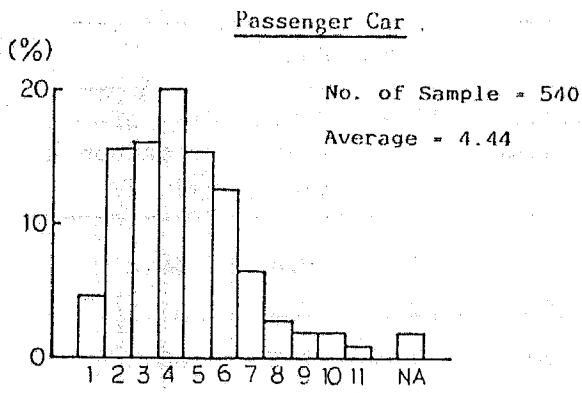


Fig. 5.8 Average Number of Passengers by Vehicle Type\*

\* Including drivers

Table 5.5 Kinds of Commodity Loaded

Commodity	Light Truck	Medium, Heavy Truck	Tractor	Total
1. No Luggage	147 (80.3)	266 (38.2)	3 (20.0)	416 (46.5)
2. Jute	1 (0.5)	2 (0.3)	0 (0.0)	3 (0.3)
3. Rice	3 (1.6)	61 (8.8)	1 (6.7)	65 (7.3)
4. Timber	1 (0.5)	33 (4.7)	0 (0.0)	34 (3.8)
5. Other Agricultural	3 (1.6)	61 (8.8)	1 (6.7)	65 (7.3)
6. Oil	1 (0.5)	36 (5.2)	2 (13.3)	39 (4.4)
7. Mineral	2 (1.1)	50 (7.2)	0 (0.0)	52 (5.8)
8. Machinery	1 (0.5)	8 (1.1)	0 (0.0)	9 (1.0)
9. Light Industrial	2 (1.1)	29 (4.2)	1 (6.7)	32 (3.6)
10. Chemical	1 (0.5)	7 (1.0)	0 (0.0)	8 (0.9)
11. Construction Material	2 (1.1)	79 (11.4)	0 (0.0)	81 (9.1)
12. Miscellaneous	10 (5.5)	43 (6.2)	0 (0.0)	53 (5.9)
13. Others or No Answer	9 (4.9)	21 (3.0)	7 (46.7)	37 (4.1)
Total	183(100.0)	696(100.0)	15(100.0)	894(100.0)

Table 5.6 Loading Condition

Condition	Light Tank	Medium, Heavy Truck	Tracter	Total
1. Full	22 (12.0)	371 (53.3)	2 (13.3)	395 (44.2)
2. 3/4 Full	1 (0.5)	8 (1.1)	1 (6.7)	10 (1.1)
3. 1/2 Full	2 (1.1)	18 (2.7)	1 (6.7)	22 (2.5)
4. 1/4 Full	2 (1.1)	3 (0.4)	1 (6.7)	6 (0.7)
5. Empty	147 (80.3)	266 (38.2)	3 (20.7)	416 (46.5)
6. Not Clear	9 (4.9)	29 (4.2)	7 (46.7)	45 (5.0)
Total	183(100.0)	696(100.0)	15(100.0)	894(100.0)

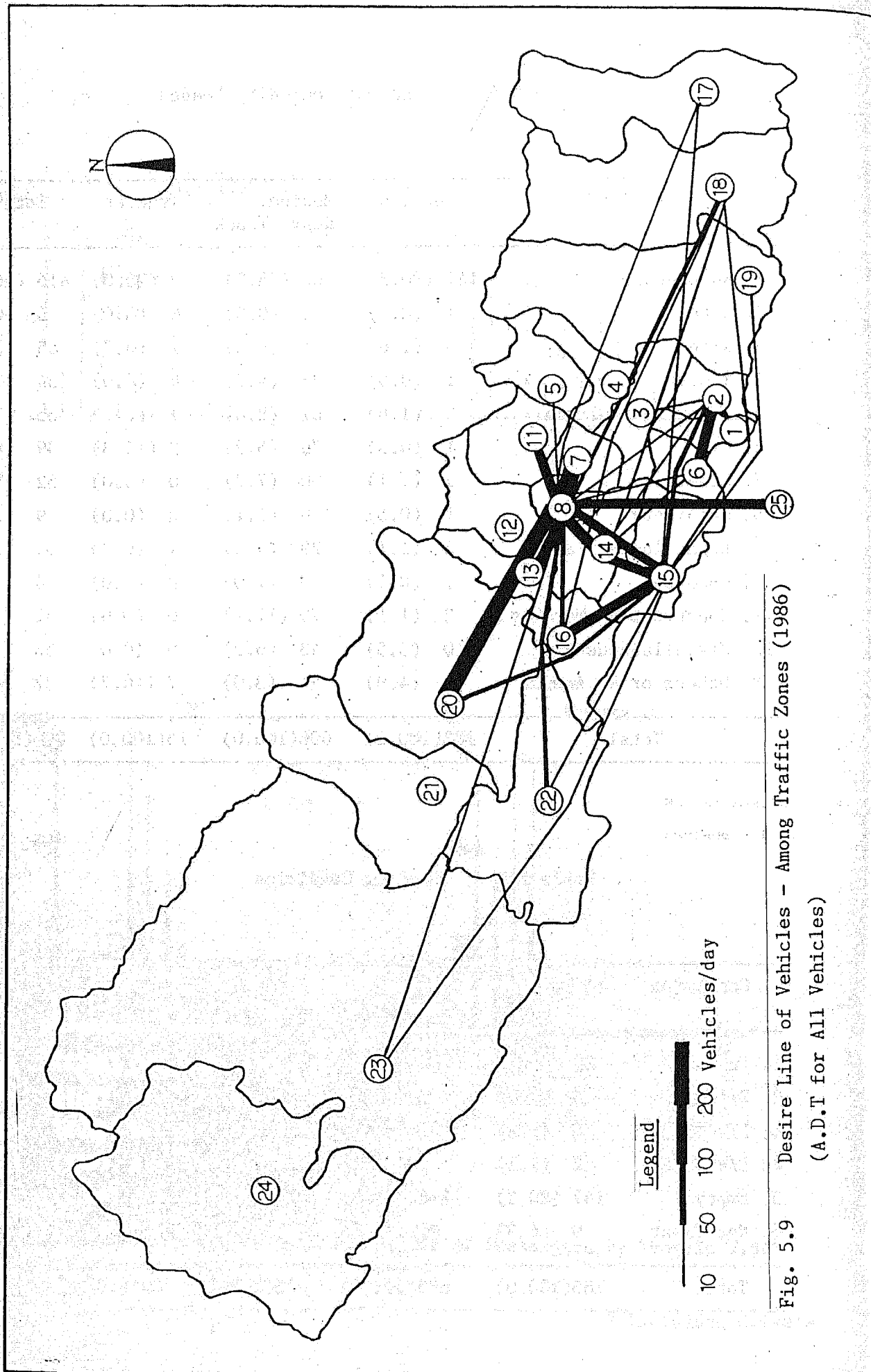


Fig. 5.9 Desire Line of Vehicles - Among Traffic Zones (1986)  
 (A.D.T for All Vehicles)



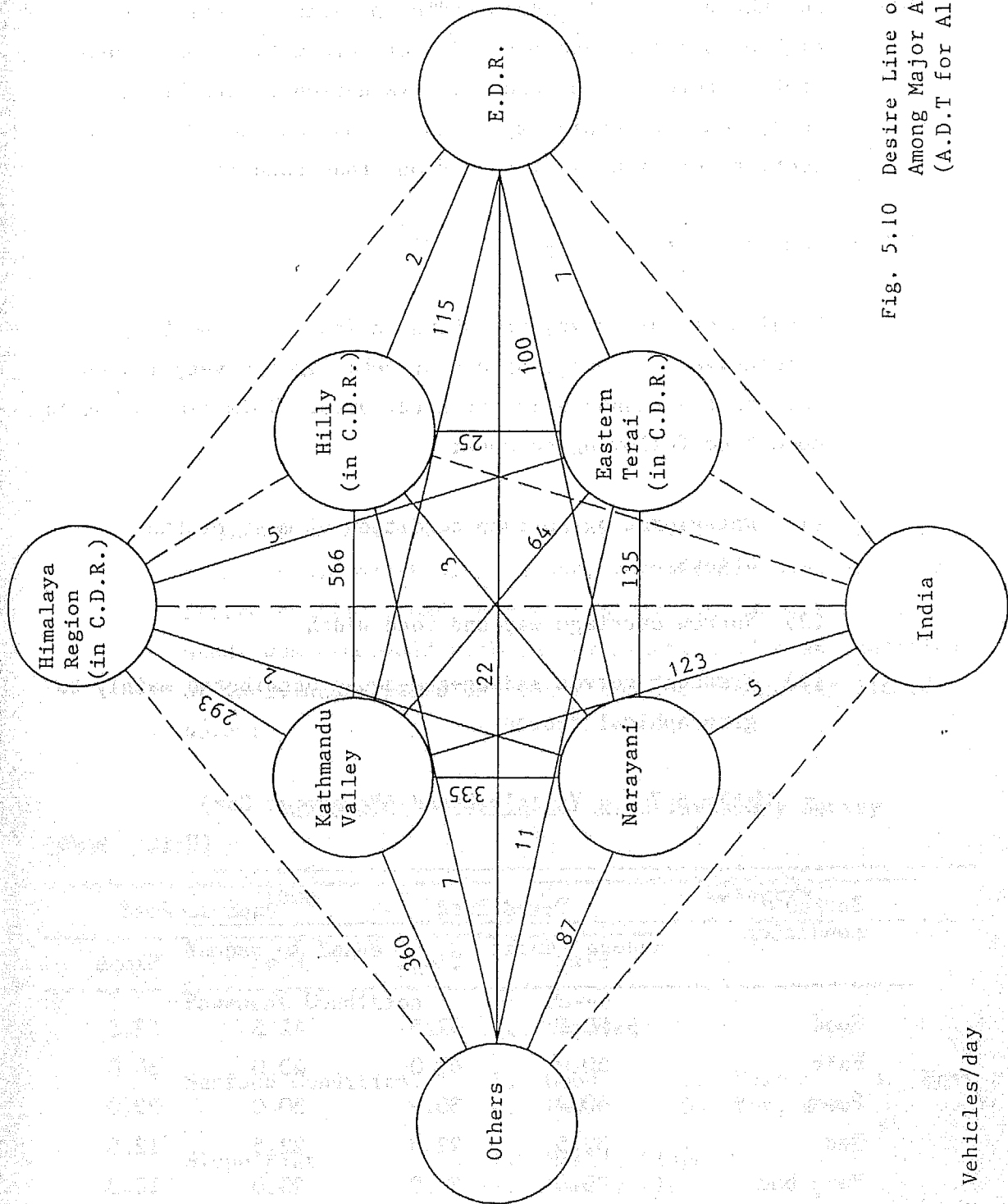


Fig. 5.10 Desire Line of Vehicles -  
Among Major Areas (1986)  
(A.D.T for All Vehicles)

Unit: Vehicles/day

### 5.3 Vehicle Running Speed Survey

#### 5.3.1 Outline

For the purpose of understanding present situation of highway services and preparing of information for future traffic forecast and economic evaluation of the Project Road, vehicle running speed survey was conducted on some sections of highways with various road conditions.

#### 5.3.2 Results of the Survey

Results of the survey are shown in Table 5.7 and 5.8, conclusively, average speeds of vehicles are very low on most of the highways in the study area. This fact seems to come from following reasons;

- (1) Deteriorating surface condition of most of the highways
- (2) Narrow carriage way and road width
- (3) Frequent curves and up-and-downs attributed mainly to geographical reasons.

Table 5.7 Vehicle Speed (Passenger Car)

(Unit: km/h)

Surface condition	Paved Road		Unpaved Road	
	Flat	Slope	Flat	Slope
Good	52.5	42.5	42.5	32.5
Fair	50.0	40.0	40.0	30.0
Poor	40.0	30.0	30.0	20.0
Bad	32.5	22.5	22.5	12.5
Very bad	25.0	20.0	20.0	10.0

Table 5.8 Vehicle Speed (Bus & Truck)

(Unit: km/h)

Surface condition	Paved Road		Unpaved Road	
	Flat	Slope	Flat	Slope
Good	47.3	38.3	38.3	29.3
Fair	45.0	36.0	36.0	27.0
Poor	36.0	27.0	27.0	18.0
Bad	29.3	20.3	20.3	11.3
Very bad	22.5	18.0	18.0	9.0

#### 5.4 Road Inventory Study

##### 5.4.1 Outline

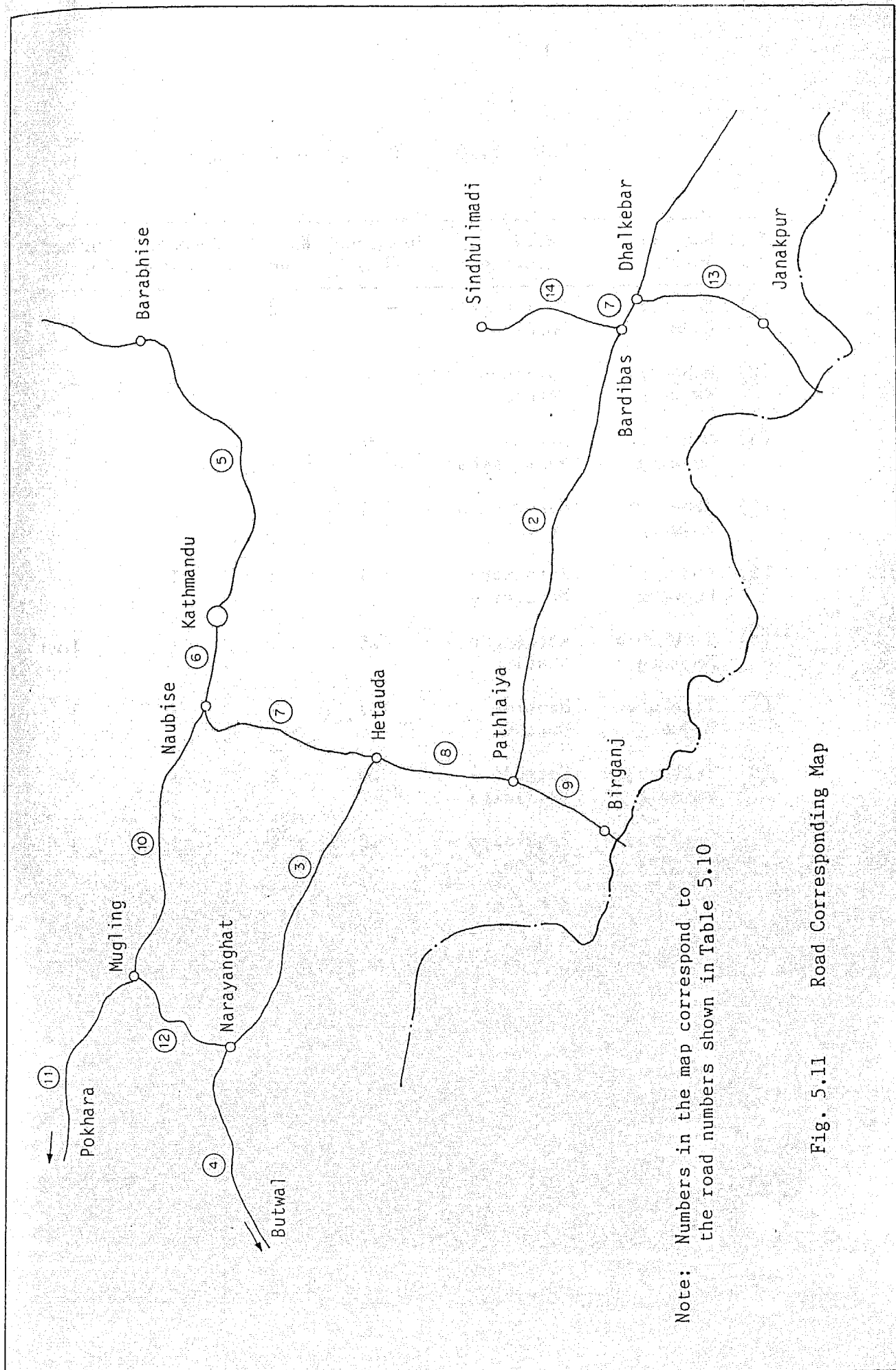
In order to classify the present conditions of roads and to obtain basic material necessary for network simulation of future traffic, road inventory study was conducted. The study was proceeded with the examination of road condition of individual road along the items and categories listed below:

Table 5.9 Items for Road Inventory Survey

Item	Category
Number of Lanes	Actual number
Pavement Condition	1. Paved 2. Unpaved
Surface Condition	1. Good      2. Fair      3. Poor 4. Bad      5. Very Bad
Slope/Flat	1. Mostly Slope 2. Mostly Flat

#### 5.4.2 Result of the Study

Result of present road condition survey is shown in Table 5.10 and Fig. 5.11. Generally, highway network in the study area is not well developed to the extent that provides satisfactory service to road-users. Most of the highways are two-laned with narrow width of carriageways and deteriorating pavement. The roads which go from north to south, have a great number of curves and up-and-downs due to geographical reasons. On the other hand, highways in the Terai Plain have more flat and straight sections. Surface condition of most sections of highways are far from satisfactory standard. Especially, pavement condition of the most arterial roads is deteriorating because of slow pace of maintenance works.



Note: Numbers in the map correspond to the road numbers shown in Table 5.10

Fig. 5.11 Road Corresponding Map

Table 5.10 Present Road Condition

No.	Name of Road	Road Section	Distance (km)	No. of Lanes	Pavement Condition	Surface Condition	Slope/Flat
①	Mahendra Rajmarg	Dhalkebar - Bardibas	9	2	1	2	2
②	Mahendra Rajmarg	Bardibas - Pathlaiya	100	2	1	2	2
③	Mahendra Rajmarg	Hetauda - Narayanghat	76	2	1	1	2
④	Mahendra Rajmarg	Narayanghat - Butwal	117	2	1	4	2
⑤	Araniko Rajmarg	Kathmandu - Barabhise	87	2	1	2	2
⑥	Tribhuban Rajmarg	Kathmandu - Naubise	26	2	1	1	2
⑦	Tribhuban Rajmarg	Naubise - Hetauda	107	2	1	3	1
⑧	Tribhuban Rajmarg	Hetauda - Pathlaiya	29	2	1	3	2
⑨	Tribhuban Rajmarg	Pathlaiya - Birganj	26	2	1	3	2
⑩	Prithibi Rajmarg	Naubise - Mugling	84	2	1	3	2
⑪	Prithibi Rajmarg	Mugling - Pokhara	90	2	1	3	2
⑫	Gorkha-Narayanghat Rajmarg	Mugling - Narayanghat	38	2	1	1	2
⑬	Janakpur-Jaleshore Road	Dhalkebar - Janakpur	22	2	1	1	2
⑭	Sindhuli Road	Bardibas - Sindhulimadi	37	2	2	5	1

Remarks: Pavement condition; 1. Paved, 2. Unpaved  
 Surface condition ; 1. Good, 2. Fair, 3. Poor, 4. Bad, 5. Very Bad  
 Slope/Flat ; 1. Mostly Slope, 2. Mostly Flat



