BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
CONSTRUCTION OF BUS TERMINAL
IN
KATHMANDU

THE KINGDOM OF NEPAL

AUGUST 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to the request of His Majesty's Government of Nepal, the Government of Japan has decided to conduct a Basic Design Study on the Project for Constructing the Kathmandu Bus Terminal and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Nepal a survey team headed by Mr. Hiroomi Motozaki, Special Assistant to the Director of the Transport Promotion Division, Regional Transport Bureau, Ministry of Transport from January 30 to February 23, 1989.

The team exchanged views with the officials concerned of the Government of Nepal and conducted a field survey in Kathmandu area. After the team returned to Japan, further studies were made. Then, a mission was sent to Nepal in order to discuss the draft report and the present report has been prepared.

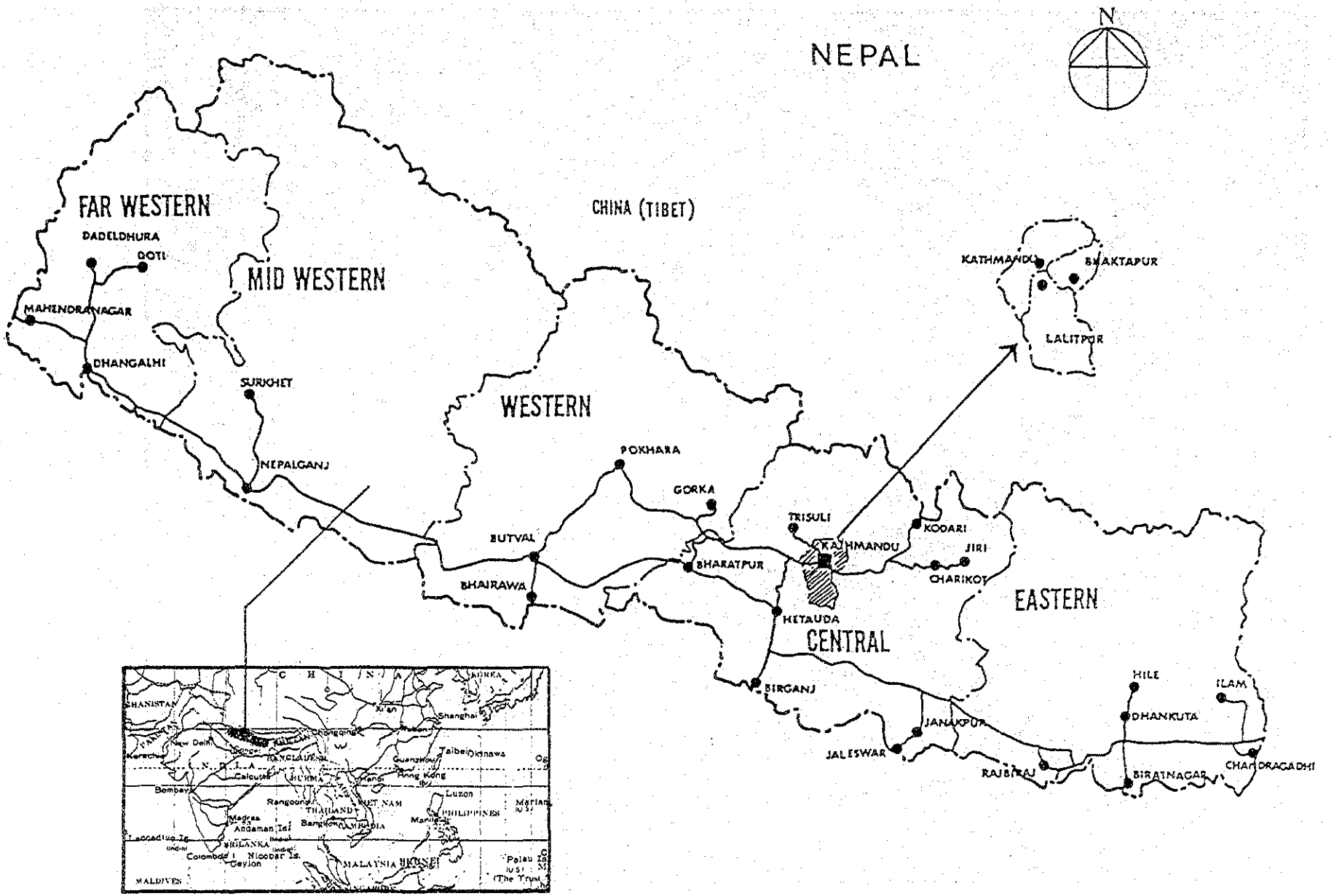
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

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

August 1989

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency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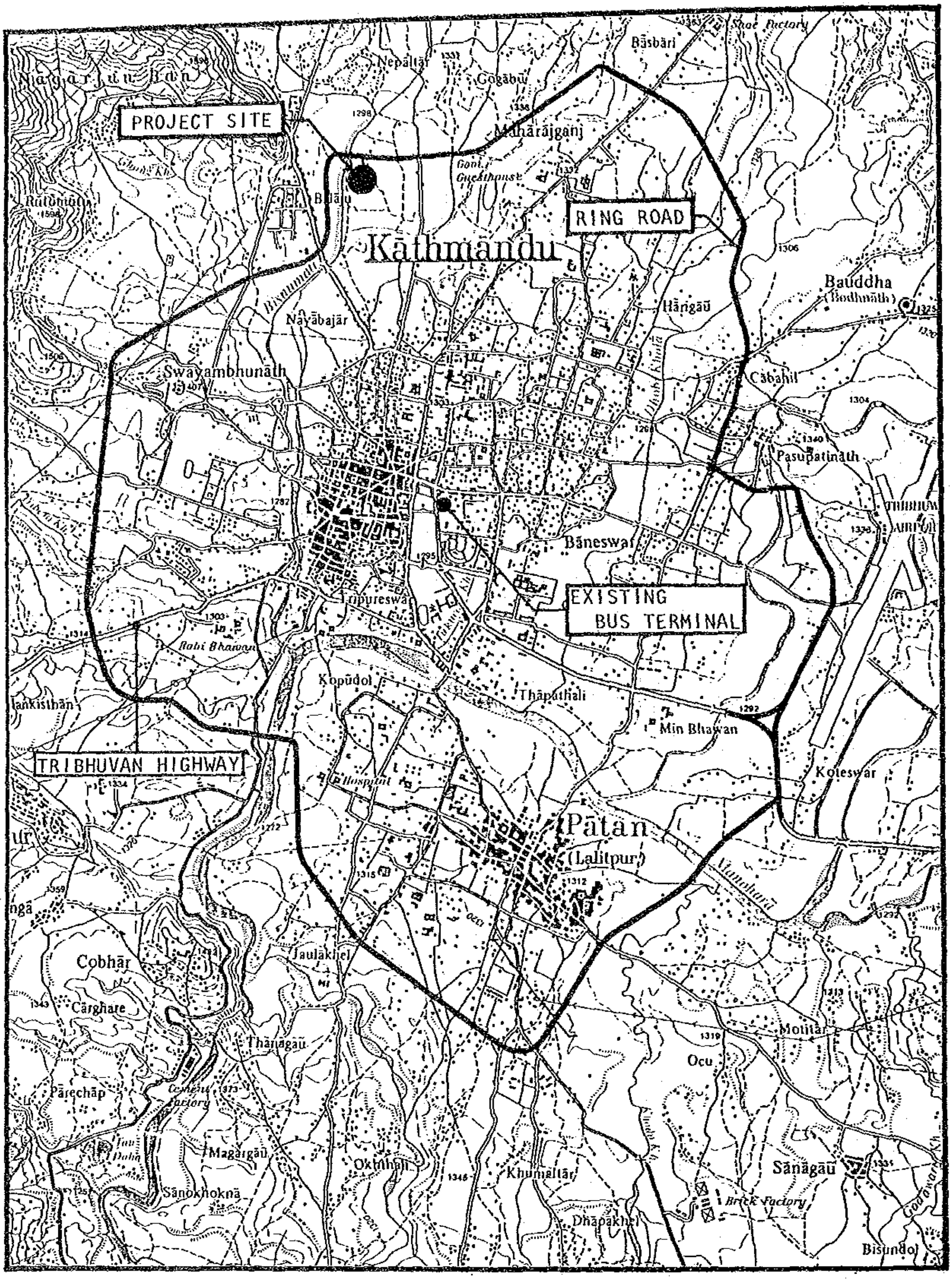

PROJECT SITE
RING ROAD
EXISTING BUS TERMINAL
TRIBHUVAN HIGHWAY
Kāthmāndu
Pātan
(Lalitpur)
Bāsbāri
Nepāltār
Gogābu
Mahārājganj
Bauddha
(Bodhnāth)
Hāngāū
Nayābajār
Swayambhunāth
Cābahil
Pasupatinath
Bāneswar
Tripureswar
Kopūdol
Thāpathali
Min Bhawan
Koteswar
Jaulākhel
Cobhār
Cārghare
Thānagāū
Pārechāp
Magargāū
Sānokhoknā
Okhahāli
Khumaltār
Dhapākhel
Ocu
Motitār
Sānāgāū
Brick Factory
Bisundol
Rabi Bhawan
Hospital
Shoe Factory

KATHMANDU

SUMMARY

SUMMARY

The transportation system in the Kingdom of Nepal relies mainly on road transportation, supplemented by air routes, owing to its geological condition of high steep mountains. In the five year plan of His Majesty's Government of Nepal, high priority is given to transportation, especially road transportation, as an important infrastructure of the country.

Among road transportation, the reliance on bus transport, which provides mass transport at low fares, is very high. His Majesty's Government of Nepal, recognizing this fact, has twice received grant aid from the Government of Japan for Sajha Bus Corporation and has also received technical assistance from the Government of China for a trolley bus route between Kathmandu and Bhaktapur to improve the bus transportation network in the Kathmandu Metropolitan area. Also the medium and long route buses network connecting the main cities in Nepal, with Kathmandu as the hub, is the principal bus transport in Nepal. This network with the improvement of roads and expansion of the Kathmandu metropolitan area has now developed to a stage where a daily 400 buses are arriving at and departing from Kathmandu carrying approximately 21,000 people. However, the present terminal, located in the city center, with a boarding/off-boarding area of roughly 7000 m^2 is congested with buses, taxies and tempos and its capacity is completely overtaxed. Now, some buses are off-boarding and parking on roads, which is a big reason for traffic congestion as well as exhaust gas pollution.

In view of this condition, His Majestry's Government of Nepal planned to construct a new Kathmandu bus terminal in order to provide smooth medium- and long-route bus operation as well as to improve the traffic condition in Kathmandu city and requested grant aid of Japan.

In response to this request the Government of Japan decided to conduct a basic study and the Japan International Cooperation Agency (JICA) sent a basic study team to Nepal headed by Mr. Hiroomi Motozaki, Special Assistant to the Director of the Transport Promotion Division, Regional Transport Bureau, Ministry of Transport for 25 days from January 30 to February 23, 1989. The team had discussions on the contents of the request with officials of His Majestry's Government of Nepal, conducted a survey and collected data on the transportation, construction site and construction condition in Nepal. The contents of the survey were mainly studies on the selection of a construction site, special conditions such as the necessity of land fill-up, topographical and geographical surveys, infrastructure, present terminal operation, traffic condition, operating and utilizing agencies of the new terminal. After returning to Japan, the team analyzed and studied the data and prepared a basic design consisting of an installation facility plan together with an operation and management plan and cost estimation. A basic design study draft final report was prepared, and JICA sent a study team to the Kingdom of Nepal from July 16 to July 23, 1989 to explain this report.

In this design, a medium- and long-route bus terminal will be constructed in the 29th district, Samakhusi district of the Kathmandu Metropolitan area along the ring road. This terminal shall be the main terminal for all medium- and long-route buses while the city transport facilities (buses, taxis, private cars) shall provide the connection to the city center. Boarding and off-boarding berths, a medium- and long-route bus parking lot, a terminal building and related installations shall be installed for the convenience of passengers.

The outline of the Project is as follows:

Site area: about 62,200 m²

(1) Facilities

1) Boarding & off-boarding for medium- & long-route buses:
8 off-boarding berths, 12 boarding berths, platform and roof

2) Boarding & off-boarding for city transport:
12 bus berths, 6 taxi berths, 4 private-car berths, taxi pool and private-car parking lot, platform and roof

3) Terminal building:
operation service; office, drivers rest room, electricity room, passenger service; ticket counter, baggage storeroom, information, first aid room, bank, telephone room, post office, kiosk, tea stand, waiting room

4) Parking lot for medium- & long-route buses:
space for 124 buses, car washing equipment, fuel supply stand

5) Other installation:
toilet, lighting installation, drainage facility, deep well water supply facility

6) Approach road from the ring road:
approach road to each facility from the ring road

(2) Equipment

1) Bus washing equipment:
For washing medium-, long-route buses

2) Fuel supply equipment:
For supplying fuel to medium-, long-route buses

3) Gates

For controlling buses at terminal fee collection stand

4) Signal

For providing safe traffic at intersection between the approach road and the ring road

The necessary construction period for the Project is expected to take about 5 months up to tender from the Exchange of Notes between the Government of Japan and His Majesty's Government of Nepal, including the signing of a consultant agreement, preparing a detailed design and preparing tender documents. For construction, 14 months is expected to be necessary for executing construction.

The execution of the work to be done by His Majesty's Government of Nepal including site preparation work and infrastructure work outside the site premises should be executed by the Nepalese side in a manner that will not affect the entire construction schedule.

The executing agency for the Project for the Kingdom of Nepal is Kathmandu Nagar Panchayat (KNP), which is under the jurisdiction of the Ministry of Panchayat and Local Development (MPLD). KNP will newly set up a bus terminal department for the execution of the construction and the operation and management after completion. Nepal Transport Entrepreneurs Association (NTEA), which is closely cooperating with KNP, is expected to contribute greatly to the operation of the terminal based on its rich bus operation experience and its organization. The bus terminal is expected to be self-supporting by paying its expenses with its operational income.

In order to execute the Project efficiently for maximum results, it is desired that His Majesty's Government of Nepal clearly state the objective of the new terminal and have all medium- and long-route buses operating out from Kathmandu use the new terminal, and also set up a new bus operating schedule as well as provide training for bus drivers and the operation management staff.

By the implementation of the Project, the reliability of the medium- and long-route bus operation will be greatly improved, and the congestion and confusion in the present terminal will be greatly reduced. Also, the traffic of the Kathmandu Metropolitan area will be improved by preventing medium- and long-route buses from entering the city and eliminating parking and repairing on the road. Therefore, the Project is expected to contribute to provide better bus service for the people of the Kingdom of Nepal, and is most suitable to be implemented under the Grant Aid Program of Japan. Early execution of the Project is desired.

NAME AND SYMBOL OF AGENCIES

Ministry of Panchayat and Local Development (MPLD)

Kathmandu Nagar Panchayat (KNP)

Ministry of Works and Transport (MOWT)

Department of Transport

Department of Road

Ministry of Finance

Ministry of Housing and Physical Planning

Kathmandu Town Development Committee

Bagmati Zonal Office

Sajha Yatayat

Nepal Transport Entrepreneurs Association (NTEA)

National Transport Corporation (NTC)

Water Supply and Sewerage Corporation

Nepal Electricity Agency (NEA)

Nepal Telecommunication Corporation

CONTENTS

CHAPTER 3 DESCRIPTION OF THE PROJECT

CHAPTER 4 BASIC DESIGN

CHAPTER 5 PROJECT EXECUTION PLAN

CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

In the Kingdom of Nepal, buses constitute the only scheduled transportation for passengers with the exception of air transportation between distant cities. Medium- and long-distance bus routes connecting main cities, with Kathmandu as the hub, serve as the trunk line for passenger transportation and, together with the bus routes in the Kathmandu Metropolitan area, are important passenger transportation means. The bus terminal operated by Kathmandu Nagar Panchayat is the hub of these bus routes. Recently, with the development of the Kathmandu Metropolitan area, the number of bus routes and number of buses have greatly increased. So the present terminal is overloaded and completely short of capacity.

Recently with the increase in population, the development of the Kathmandu Metropolitan area is progressing in a rather disorderly pattern. With the expansion of the city, traffic into the city has greatly enlarged while trunk roads have not been improved. Therefore, the improvement of the city traffic including the upgrading of public transportation is urgently required today. However, roads within the old city are narrow and travelled by pedestrians, bicycles and all types of vehicles including large buses aggravating congestion in the city. Now, large trucks are not permitted to enter the city, but large medium- and long-route buses entering the city and parking on roads for boarding and off-boarding contribute to traffic congestion in the city center.

In view of such condition, His Majesty's Government of Nepal planned a project to construct the Kathmandu bus terminal mainly for long- and medium-route buses in order to provide smooth bus operation service. For the execution of this project, His Majesty's Government of Nepal requested grant aid from the Government of Japan.

In response to this request, the Government of Japan decided to conduct a basic design study of this project and the Japan International Cooperation Agency (JICA) dispatched a basic design study team headed by Hiroomi Motozaki, Special Assistant to the Director of the Transport Promotion Division, Regional Transport Bureau, Ministry of Transport.

The team conducted a field survey during a period of 25 days from January 30, 1989 to February 23, 1989, and they surveyed the proposed sites and selection of them, studied special conditions such as necessity of land fill-up, conducted topographical and geological surveys, studied infrastructure, present terminal operation, traffic condition and operating and utilizing agencies. During this survey they also confirmed the content of the request with the Ministry of Panchayat and Local Development and Kathmandu Nagar Panchayat, verified the necessary facilities and equipment, and also conducted a survey of the planned construction site. The agreement resulting from discussion at the meeting with government officials was recorded in the minutes signed and exchanged between Joint Secretary Tiwari of the Ministry of Panchayat and Local Development and the team leader Motozaki on February 13, 1989.

After returning to Japan, the team conducted studies to determine the suitability of the Project as well as a project plan, equipment and material selection, an operation and administration plan and cost of the Project.

JICA compiled the results of this study into a Basic Design Study Final Report (Draft) and dispatched a Final Report (Draft) Study Team headed by Mr. Satoshi Machida, Deputy Director, Second Basic Design Study Division, Grant Aid Planning & Survey Department, Japan International Cooperation Agency, to explain the report to His Majesty's Government of

Nepal for a period of 8 days from July 16 to July 23, 1989. After the content of the report was verified and agreed upon by the parties, minutes containing the basic agreement between the parties were signed and exchanged.

The list of study team members, survey itinerary, list of visited parties and minutes are included in the appendix.

This report contains the results of the basic design study.

CHAPTER 2 BACKGROUND

CHAPTER 2 BACKGROUND

2.1 General Condition in Nepal

2.1.1 Country and Population

The Kingdom of Nepal is a long rectangular country, with an area of 147,181 km², located between east longitude 80°04' - 88°12' and north latitude 26°22' - 30°27'. It is bordered on the north by China and on the east, west and south by India.

Nepal according to its natural topography may be divided into three zones from north to south.

The northern Himalayan mountain zone consisting of mountain ranges of 8000 meter elevation extending to the Tibet highlands.

The central mountain zone lies between the Terai plain and the Himalayan mountain range consisting of the Mahabharat mountain range, with an elevation from 600 m to 2500 m, rivers, and valleys. The capital, Kathmandu, is located in one of these valleys, the Kathmandu valley.

The southern Terai plain zone lies along the Indian border with an elevation of about 100 m and continues to the Indian plain.

The climate of the northern Himalayan zone is a cold mountain climate, while the climate of the central valley is a temperate zone type while the climate of the southern zone is a subtropical type. A year may be divided into the dry season (October - May) and the monsoon or wet season (June - September).

The total population in 1985 was estimated as 16,630,000 and the average annual growth rate was estimated as 2.6%. According to the population census in 1981, population density was 113 persons/km², and the urban population was only 6.4% of the total population and most of the population lived in rural districts. The distribution of population was 43.7% in the Terai plain, 47% in the central mountain zone and 8.6% in the northern mountain zone. Population distribution from east to west was eastern 24.7%, central 32.7%, western 20.8%, mid western 13.0% and far western 8.8%. The total number of families was 2,585,154 with an average of 5.8 persons to each family. Among the total labor force of 7,400,000 people, approximately 93% or 6,900,000 people were engaged in agriculture.

2.1.2 National Economy

The economy of the Kingdom of Nepal is largely influenced by agricultural production which is approximately 60% of the GDP. The GDP during the year 1985/1986 was estimated as 50,124,000,000 rupees with an annual growth in real term of 4.0%, and the per capita GDP was 3,014 rupees which was about 160 US dollars.

Table 2-1 GDP at Current and Constant Price

(Unit: million rupies)

Description	1980/81	1981/82	1982/83	1983/84	1984/85 1)	1985/86 1)
GDP at current price	27,307	30,988	33,761	38,184	41,738	50,124
Agriculture	15,679	17,903	19,282	22,317	24,641	29,895
Non-agriculture	11,628	13,085	14,479	15,867	17,097	20,229
GDP at 1974/75 price	20,158	20,920	20,297	21,873	22,520	23,432
Agriculture	12,066	12,616	12,478	13,668	13,990	14,608
Non-agriculture	8,092	8,304	7,819	8,205	8,530	8,824
Growth rate (%)						
Total	—	3.8	-3.0	7.8	3.0	4.0
Agriculture	—	4.6	-1.1	9.5	2.4	4.4
Non-agriculture	—	2.6	-5.8	4.9	4.0	3.4
per capita GDP (rupee)	—	2,063	—	—	—	3,014

Source: Central Bureau of Statistics
Note: 1) Estimate

The largest trade partner of the Kingdom of Nepal is India, and the main export products are food products, principally agricultural products, while the main import products are fuel, chemical products, pharmaceutical products, and various industrial products. The present trade balance shows a deficit.

Table 2-2 Foreign Trade Balance

(Unit: million rupees)

	1979/80	1980/81	1981/82	1982/83	1983/84
Export (F.O.B)	1,150.5	1,608.6	1,491.5	1,132.0	1,703.6
Import (C.I.F)	3,480.1	4,428.2	4,930.3	6,314.0	6,514.3
Trade balance	-2,329.6	-2,819.6	-3,439.8	-5,181.9	-4,810.4

Source: Ministry of Finance

Table 2-3 Financial Balance

(Unit: million rupees)

	1979/80	1980/81	1981/82	1982/83	1983/84
Expenditure	3,470.7	4,092.3	5,361.3	6,979.2	7,437.3
Revenue	2,685.6	3,288.1	3,672.8	3,931.7	4,285.9
Balance	-785.1	-804.2	-1,688.5	-3,047.5	-3,151.4

Source: Ministry of Finance

The government financial balance is constantly showing a deficit since revenue cannot keep up with expenditure and the deficit is being covered by foreign loans and domestic loans. The reliance on loans is quite large, and low productivity, together with the foreign trade deficit and government financial deficit, is the weak point in the economy of the Kingdom of Nepal.

2.1.3 National Development Plan

The first 5 year plan was implemented in 1956, and now the seventh 5 year plan (1985/86 - 89/90) is under implementation. The objectives of the seventh 5 year plan are similar to those of the sixth 5 year plan consisting of (1) accelerating production expansion, (2) enlarging production employment opportunity and (3) satisfying minimum needs of the people. In order to achieve the above objectives, the following basic development strategies are being pursued: [1] agricultural development is given the first priority, [2] preservation of forest resources and soil, [3] development of water resources, [4] intensifying industrial development, [5] expanding export, [6] developing the tourist industry, [7] controlling population increase, [8] stimulating national economy coordination, [9] improving management by separating decision making and execution, and [10] strengthening development administration.

The total investment amounted to 50,410 million rupee (1984/85 price) and the government expenditure was 29,000 million rupee which was roughly 6.8% of GDP.

The GDP growth for the seventh 5 year plan period is targeted at 4.5% or a bit higher than the 4.3% of the sixth 5 year plan and the growth in the agricultural and non-agricultural sectors are respectively targeted at 3.5% and 5.7%.

The seventh 5 year plan is being developed along the line of the sixth 5 year plan to transfer authority to regional agencies. Especially, the implementation of Panchayat level projects is expected to increase the participation of local residents.

2.2 Outline of Cities and Transportation

2.2.1 General Transportation Condition

Since Nepal is a land-locked mountainous country with many mountains, the transportation system is based on road transportation supported by air transportation.

Ever since the first 5 year plan in 1956, the transportation sector was constantly given a high priority in investment allocation. This is because the government is fully aware that in order to promote national economy through industrial, agricultural or resource development, transportation and other basic economic infrastructure are critical factors, especially transportation, where most of the investment is directed to upgrading roads and constructing trunk roads.

Table 2-4 Investment of Development Plan (Public Sector) and Allocation to Transportation Sector

(Unit: million rupees)

5 Year Plan		Total investment	Allocation to transportation	(Percentage for road & bridges)
First	1956-1961	330	104.0 (31.5)	(48.1)
Second	1962-1965	600	137.5 (22.9)	(81.8)
Third	1965-1970	1,740	579.0 (33.3)	(86.4)
Fourth	1970-1975	2,550	1,010.0 (39.6)	(80.4)
Fifth	1975-1980	6,170	1,325.1 (21.5)	(85.4)
Sixth	1980-1985	21,750	3,880.0 (17.8)	(79.9)*1
Seventh	1985-1990	29,000	4,594.8 (15.8)	(81.2)

Note: The figures in parentheses show percentage of allocation.
*1 Total of roads, bridges, railways & ropeways

Source: National Planning Commission

The total length of the roads, which was only 624 km at the beginning of the first 5 year plan, was extended about 10 times totalling 6,306 km in 1986/1987. Within the total extension 2,794 km or 44% is paved roads.

Table 2-5 Total Extension and Type of Roads

(Unit: km)

Year	Total length	Paved road	Gravel road	Earth road
1951	376	5	83	288
1956	624	259		365
1965	1,926	289	249	1,390
1970	2,504	920	390	1,194
1974/75	3,173	1,575	416	1,182
1979/80	4,970	2,044	564	2,332
1980/81	5,021	2,167	703	2,151
1981/82	5,270	2,322	719	2,229
1982/83	5,546	2,484	830	2,232
1983/84	5,717	2,645	815	2,257
1984/85	5,836	2,670	858	2,308
1985/86	5,925	2,724	918	2,283
1986/87	6,306	2,794	1,180	2,332

Source: "Nepal Road Statistics 1987", Department of Roads

The number of registered vehicles in 1985/1986 was 27,073 consisting of jeep/passenger cars that account for 59%, trucks 27%, and buses 14%. Although the number of vehicles are still small, the rate of increase is quite high, for example, buses increased at an annual rate of 9.2%.

Table 2-6 Total Number of Registered Vehicles

(Unit: number of units)

Type	1964/65	1970/71	1975/76	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
Bus	290	541	1,233	2,218	2,376	2,561	2,946	3,407	3,721
Truck	1,352	3,072	4,651	5,289	5,567	5,801	6,369	6,938	7,469
Jeep/ Passenger	2,362	6,647	9,684	10,094	10,692	11,383	12,944	14,607	15,883
Total	4,004	10,262	15,568	17,601	18,635	19,745	22,259	24,952	27,073

Source: Police Headquarters

A traffic survey on vehicles is not conducted systematically, but traffic of the main trunk road between Kathmandu and Thankot[1/] where long and medium route buses travel was found to be as shown in the following table.

Table 2-7 Traffic Between Kathmandu and Thankot

(Unit: unit/day)

Type	1986[1)]	1988[2)]	Annual rate of increase (%)
Passenger car	327	729	49.3
Truck	611	756	11.2
Bus	463	495	3.4
Total	1,401	1,980	18.9

Sources: 1. Banepa-Sindhuli Road Construction Project, Final Report

2. MPLD data

1/ Name of village about 6 km west of ring road crossroad.

Although the number of unit is not large, the increase of traffic during the two years is quite significant especially for passenger cars which increased at an annual rate of 49.3% while buses increased at an annual rate of 3.4%.

2.2.2 Condition in the Kathmandu Metropolitan Area

The Kathmandu Metropolitan area consisting of the three cities of Kathmandu, Lalitpur (Patan), and Bhaktapur had a total urban population of 363,807 in 1981 and the average annual growth rate during the past 10 years was 3.8% which was considerably higher than the average annual growth rate of 2.7% for the entire nation. The metropolitan population broken down for the three cities are 235,160 for Kathmandu, 79,875 for Lalitpur and 48,472 for Bhaktapur, which shows that population is concentrated in Kathmandu.

Table 2-8 Urban Population of the Kathmandu Metropolitan Area

(Unit: person)

	1971	1981	Average Annual Rate of Increase(%)
All Nepal	11,555,983	15,022,839	2.7
Kathmandu	150,402	235,160	4.6
Lalitpur	59,049	79,875	3.1
Bhaktapur	40,112	48,472	1.9
Kathmandu Metropolitan	249,563	363,807	3.8

Source: Central Bureau of Statistics

The concentration of population in Kathmandu is caused by the high concentration of commercial, financial and public administration activities in Kathmandu which creates an influx of many people from countryside coming to seek employment. Since city infrastructure is not developed satisfactorily in the metropolitan area, many serious city problems such as traffic congestion, air pollution, and crowded buildings are created.

The sprawling expansion of the city as well as the population concentration in the old city are causing water supply and sewage facilities shortage and also educational facilities are lacking. Furthermore, with the extension of the city, the traffic load to the city center has increased, which raises the necessity for improving city traffic facilities and operation as well as trunk roads.

Since the increase in population in the old city aggravates the problem of population pressure, the improvement of city infrastructure is now much more serious. The roads in the old city are narrow and travelled by pedestrians, bicycles and large buses, therefore trucks are prohibited in the city center. The supply of most daily necessities rely on human labor, and the shortage of water supply and sewage facilities is becoming a serious sanitation problem.

The influx of population when city infrastructure is not developed creates problems at all levels, but especially it is most important to improve living environment, mainly through establishing a well organized city traffic system by upgrading city trunk roads and the public transportation system as well as installing facilities for water supply and sewage disposal.

2.3 Condition of Present Bus Transportation

2.3.1 Bus Transportation Condition

According to the urban city population statistics in 1981, cities with more than 50,000 people were only the Kathmandu Metropolitan area and Biratnagar. The main transport facilities are Riksha and Tanga, and modern bus transportation exists only in Kathmandu.

However, passenger transportation between main cities and within Kathmandu Metropolis rely entirely on bus transport. Large buses are used for this transportation while minibuses are mostly used in the city owing to road condition.

Public bus operation is conducted by the national agency NTC and Sajha, a public corporation, under the jurisdiction of MOWT.

NTC: Operates trolley bus transport between Kathmandu and Bhaktapur with 13 buses.

Sajha: Operates 14 routes within the metropolitan area and 5 routes outside the metropolitan area with 44 buses.

As can be seen from the above, the percentage of public buses is small and private bus operation provides the main passenger transportation (total registered buses in the country were 3,721 according to the 1985/86 statistics and in the metropolitan area 1,105 private buses according to the 1988 statistics). Private bus operation is mostly operated by small firms, but most of them are members of NTEA, which is a national bus operation supervision agency — described in section 3.3.1 — and Sajha also is a member. The standard bus fare is 0.22 Re/km.

2.3.2 Bus Operation

According to the survey conducted by NTEA, the route and number of medium- and long-distance route buses operating out of Kathmandu are as shown in Table 2-9.

In 1988, permission was granted to operate 443 buses a day for medium- and long-distant routes serving Kathmandu and various districts of the country. Among these buses, 274 buses or about 62% are nighttime buses departing at night and arriving in the morning. However, the actually operating buses are from 85-90% of the permitted buses or 375-400 buses a day serving the different routes as follows: western route (Pokhara, Bhairahwa, Nepalgunj, etc.) 233 buses a day, south-eastern route (Kakarbhita, Biratnagar, Janakpur, etc.) 96 buses a day, southern route (Birgunj, Gaur, Kalaiya, etc.) 58 buses a day, eastern route (Barbishe, Jiri, Charikot, etc.) 40 buses a day, and northern route (Trishuli) 16 buses a day.

According to the results of traffic survey on Feb. 20, 1989, 391 buses departed from and arrived at the present bus terminal. The peak time is 6 a.m. - 8 a.m. for arriving and 4 p.m. - 6 p.m. for departing, showing that nighttime buses were arriving in the morining and departing in the evening (refer to Table 2-10 and Fig. 2-2).

Note: Nighttime buses: Buses which depart from the originating points the preceding day and arrive at their destinations the next day. These buses travel 2 days.

Daytime buses: Buses which depart the originating points at daytime and arrive at their destinations on same day.

Table 2-9 Bus Operation Schedule

(Unit: Bus/Day)

Route		Daytime bus			Nighttime bus			km from Kathmandu
		Out	In	Total	Out	In	Total	
West	Waling	12	12	24	-	-	-	250
	Pokhara	33	34	67	18	18	36	200
	Nepalgunj	-	-	-	11	12	23	531
	Tansen	-	-	-	1	1	2	310
	Krishnanagar	-	-	-	1	1	2	350
	Bhairahwa	1	1	2	27	26	53	282
	Tulsipur	1	1	2	2	2	4	495
	Surkhet	-	-	-	2	2	4	600
	Gorkha	4	4	8	3	3	6	145
	Sub-Total	51	52	103	65	65	130	
Southeast	Kakarbhita	-	-	-	17	17	34	610
	Biratnagar	-	-	-	10	9	19	540
	Dharan	-	-	-	6	6	12	540
	Dhankuta	-	-	-	1	1	2	583
	Rajbiraj	-	-	-	1	1	2	456
	Katari	-	-	-	1	2	3	381
	Malangwa	-	-	-	2	2	4	330
	Janakpur	1	1	2	9	9	18	370
	Sub-Total	1	1	2	47	47	94	
South	Birgunj	4	4	8	23	23	46	270
	Gaur	-	-	-	1	1	2	307
	Kalaiya	-	-	-	1	1	2	280
	Sub-Total	4	4	8	25	25	50	
East	Barbishe	16	16	32	-	-	-	88
	Jiri	2	2	4	-	-	-	138
	Charikot	2	2	4	-	-	-	113
	Sub-Total	20	20	40	-	-	-	
North	Trishuli	8	8	16	-	-	-	73
	Sub-Total	8	8	16	-	-	-	
Total		84	85	169	137	137	274	

Source: Nepal Transport Entreprenuers Association

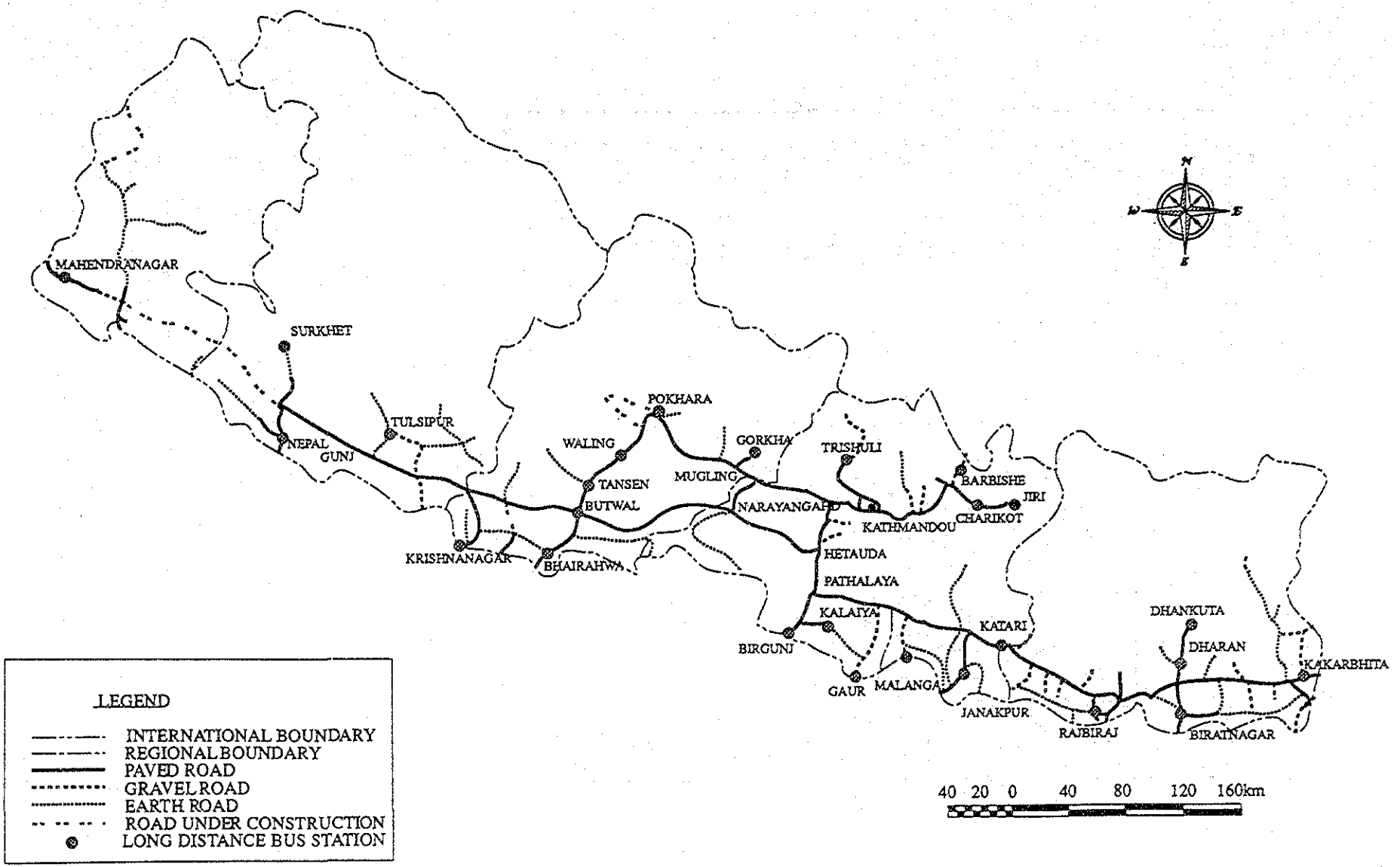


Fig. 2-1 Long Distance Bus Routes

Table 2-10 Bus Operation by Hour

(Unit: %)

Time	Incoming		Outgoing		Total	
	Buses	%	Buses	%	Buses	%
0- 1		0.0		0.0		0.0
1- 2		0.0		0.0		0.0
2- 3		0.0		0.0		0.0
3- 4		0.0		0.0		0.0
4- 5	3	1.8	2	0.9	5	1.3
5- 6	14	8.2	7	3.2	21	5.4
6- 7	20	11.7	7	3.2	27	6.9
7- 8	18	10.5	14	6.4	32	8.2
8- 9	12	7.0	4	1.8	16	4.1
9-10	11	6.4	11	5.0	22	5.6
10-11	4	2.3	11	5.0	15	3.8
11-12	10	5.9	12	5.4	22	5.6
12-13	9	5.3	9	4.1	18	4.6
13-14	7	4.1	9	4.1	16	4.1
14-15	14	8.2	12	5.4	26	6.7
15-16	10	5.8	18	8.2	28	7.2
16-17	15	8.8	34	15.4	49	12.5
17-18	10	5.8	31	14.1	41	10.5
18-19	8	4.7	18	8.2	26	6.6
19-20	5	2.9	14	6.4	19	4.9
20-21	1	0.6	7	3.2	8	2.0
21-22		0.0		0.0		0.0
22-23		0.0		0.0		0.0
23-24		0.0		0.0		0.0
Total	171	100.0	220	100.0	391	100.0

Survey date: Feb. 20, 1989

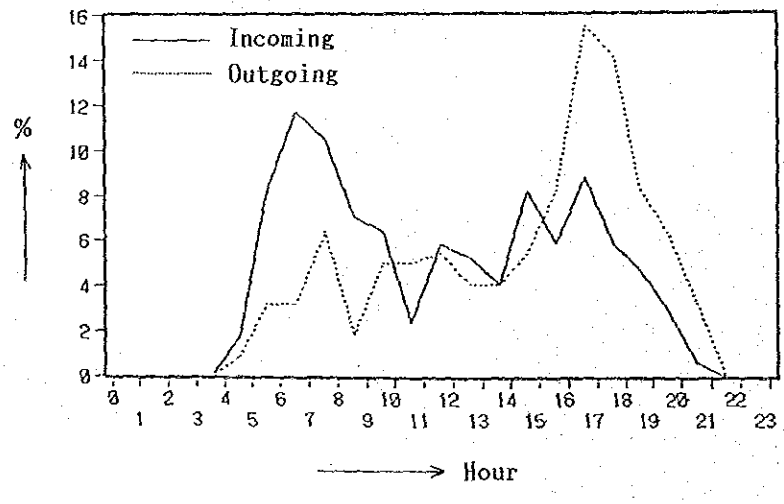


Fig. 2-2 Bus Operation by Hour

2.3.3 Outline of the Present Terminal

(1) Outline

The present terminal is located in the center of Kathmandu on the east side of Ratna park (refer to Map of Kathmandu), and it is the terminal for medium- and long-route buses between Kathmandu and the main local cities. Passengers utilizing this terminal arrive or depart from here by city buses, taxies, tempos or rickshaws. However, this terminal is so small that the city buses, the main transport, cannot enter this terminal and the bus stop is now located on the north side of Ratna park, a few hundred meters away from the present terminal, and hence passengers must walk this distance to transfer to city buses. During the peak rush hours in morning and night, the area is heavily congested with these different transport vehicles.

(2) Facilities

- Site area: about 10,000 m²
- Bus arrival/departure platform: about 7,000 m²
- Shops: about 360 m²
- Toilets: 2 toilets
- Office: 1 office
- Ticket stand and shops: Under construction
- Outdoor lights: Highway-2-lamp-pole type, high-voltage sodium lamp
- Ticket sale: Sold by each bus company at temporary ticket stands

. Baggage: Porters load and unload baggage from the bus roof and transport baggage for tips. There is no control and pieces of baggage are often lost or stolen.

. Amount of water used a day: 4 m^3/day, 6 x 1.0 m^3 tanks exist

. Along the boundary of bus terminal, hotels (1 room 4 beds about 10 Rs/day/person) and shops stand.

(3) Problems

There is space for 19 berths in the present terminal, but as will be described in section "4.2" this space is necessary to handle the arrival and departure of medium- and long-route buses and there is no space to handle connecting transport such as city buses, taxies and tempos. It is also difficult to modify the present terminal to handle all these transportation vehicles.

Owing to the recent increase in population in the Kathmandu Metropolitan area and development of suburban districts as well as improvement and extension of road networks, the demand for bus transportation is expected to increase.

Aside from insufficient space, the problems of the present terminal are as listed below.

* Congestion caused by unclear separation of arriving and departing bus berths.

* Traffic congestion caused by nighttime buses parking on streets until departure since private companies have no parking lots and owing to lack of parking space within the terminal.

* Bus operation is hindered by taxis, tempos and passenger cars entering the terminal owing to lack of space for a special entry area.

* Bus operation is hindered by loading and unloading baggage, because medium- and long-route buses also serve as transportation of daily necessities and time is taken to handle these large goods.

* Bus operation is hindered by buses parking at berths for a long time since there are no other parking spaces.

* Traffic danger caused by porters jumping on moving buses to start unloading baggage.

* The bus lane and the passenger pathway are not separated (a design problem).

* Ticket stands are not located orderly, which confuses passengers.

* Many street vendors are obstructing passenger traffic.

* Since route classification is not clear, miss-boarding occurs frequently.

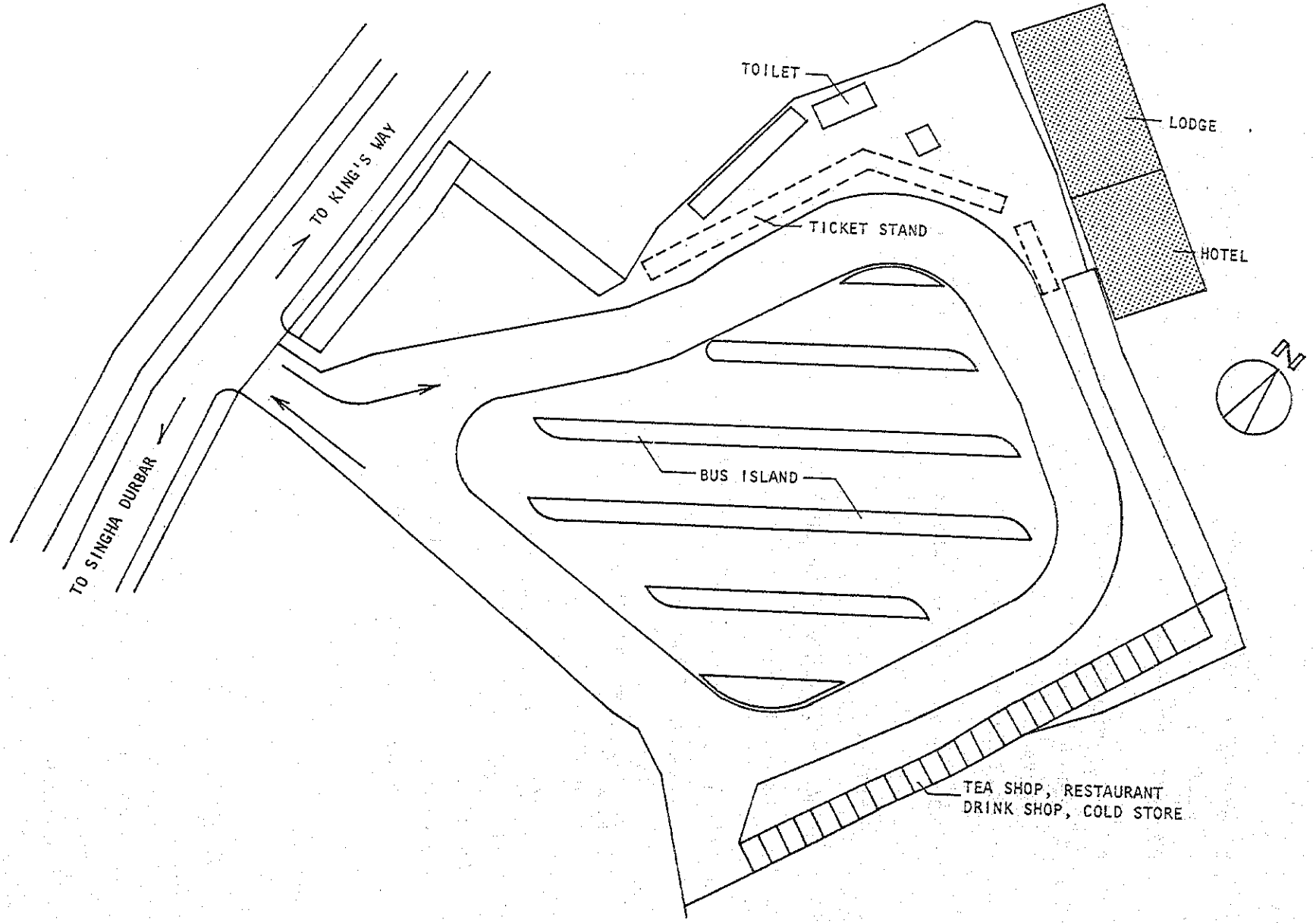


Fig. 2-3 Existing Bus Terminal Plan

2.3.4 Organization and Management

(1) Organization

The present bus terminal is operated and managed by Kathmandu Nagar Panchayat (KNP) (refer to the chart in Fig. 2-4) but there is no special organization for bus terminal management and presently the Tax Section is mainly responsible assisted by the Construction Planning Section and employees are dispatched to the bus terminal from the Tax Section.

(2) Management

The main management work at the terminal is to collect a terminal utilization fee from the buses and rents from the restaurants and shops.

Terminal utilization fee: Collected from each bus
Big bus: 20 Rs/bus (for fee/time)
Minibus: 10 Rs/bus (for fee/time)

Rents: 10 Rs/ft²/month
1 booth 10 ft x 15 ft = 150 ft²
10 Rs/ft²/month x 150 ft² = 1,500 Rs/month
Shop owners pay to the Tax Section of the municipality.

Metropolitan government employees at terminal (3 - 4 persons):
Main duty: Collect terminal utilization fee
Others: Maintain facilities and inform the metropolitan office of any serious troubles

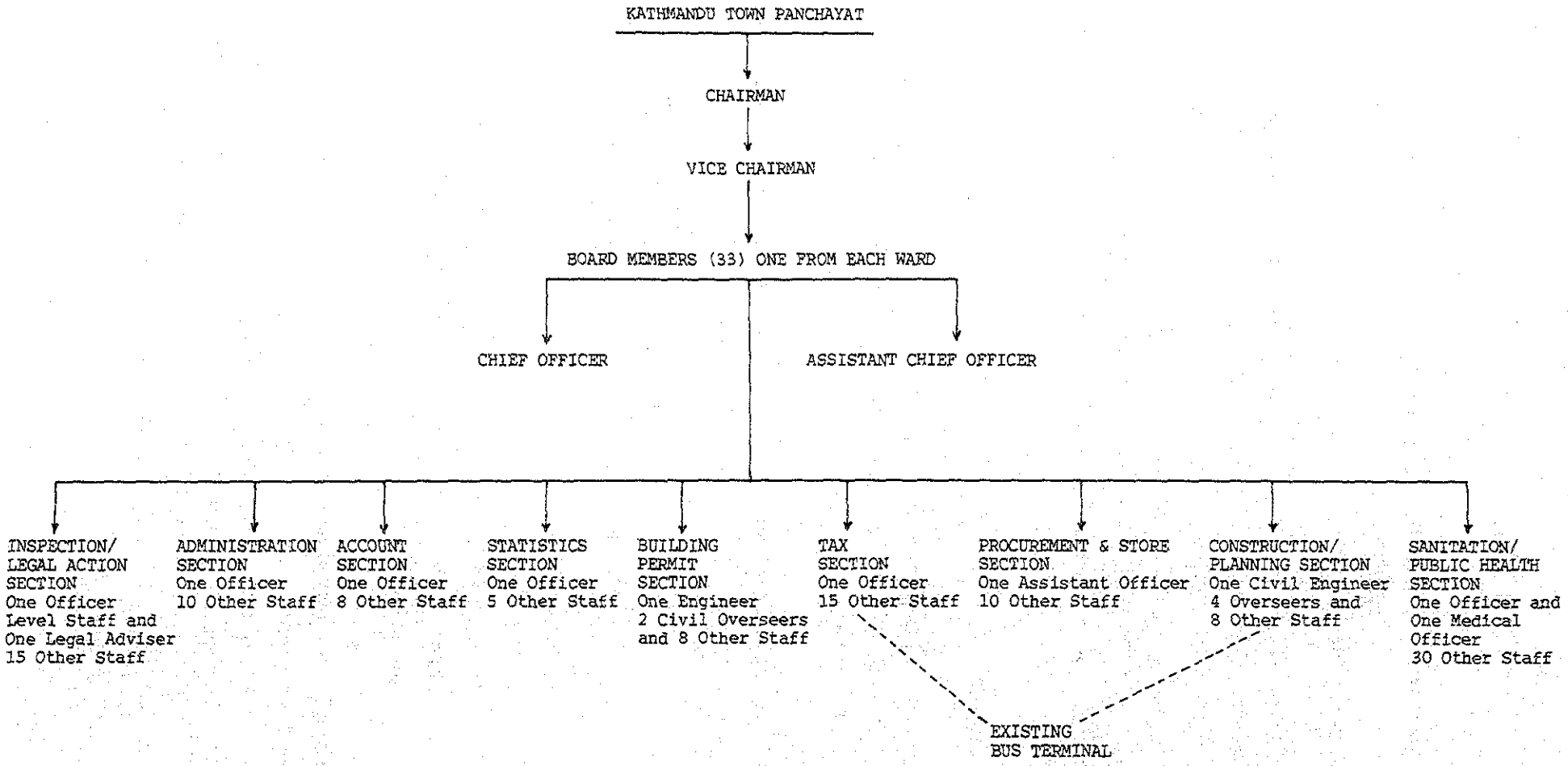


Fig. 2-4 Kathmandu City Organization Chart

2.4 Related Programs and International Cooperation

Up to now, international cooperation for public transportation has been provided for the following two projects.

(1) Grant aid from Japan for improving public transportation

Executing agency: Sajha Corporation under the supervision of MOWT

In 1979, 35 buses, construction of a maintenance shop and maintenance eguipment and materials were provided and another 47 buses were provided in 1984. Through this aid Sajha became the main transportation organization in the metropolitan area. Furthermore technical cooperation is being continued through dispatching employees and receiving trainees. A plan to construct a major maintenance plant in the Pulchowk district and a tire retreading plant and a body plant in Lagankhel is in progress.

(2) Assistance from China for constructing a trolley bus route

Executing agency: NTC under the supervision of MOWT

In 1976 a trolley bus route between Kathmandu and Bhaktapur was constructed under the economic and technical assistance of China and 22 buses of 63 person capacity each were provided of which 13 buses are still operating.

2.5 Background and Content of the Request

2.5.1 Background of the Request

Recently, the demand for bus service and utilization of the bus terminal by other vehicles are rapidly increasing with the increase in population in the Kathmandu Metropolitan area, development of suburban areas as well as improvement and extension of the road network. Today, there are 25 medium- and long-distance bus routes operating out of Kathmandu, and 443 buses have been registered to leave arrive at the present terminal daily.

The present bus terminal, with an area of 10,000 m^2, is located adjacent to Ratna park in the Kathmandu city center and is administered by Kathmandu Nagar Panchayat. However, since the terminal serves city and short-route buses, taxis, tempos and other vehicles as well as medium- and long-route buses, it is completely short of capacity.

In order to resolve this urgent problem, His Majesty's Government of Nepal drew up a plan to construct the Kathmandu Bus Terminal, a plan which consists of constructing a new bus terminal along the ring road for serving medium- and long-distance bus routes thereby assuring smooth medium- and long-distance bus operation as well as relieving traffic congestion within the city center, and His Majesty's Government of Nepal requested grant aid from the Government of Japan for executing this project.

In response to this request, the Government of Japan dispatched a basic design study team during January - February to conduct a basic design study of the Project, and verified the necessity of cooperation. Based on this study a basic design will be performed.

2.5.2 Content of the Request

(1) Executing agency

The executing agency of the Project is KNP under the jurisdiction of MPLD.

(2) Purpose of the Project

The purpose of the Project is to improve the public transport system in Nepal by constructing a new bus terminal to ease traffic congestion in Kathmandu city and to provide smooth operation of medium- and long-route buses.

(3) Requested items

1) Facilities

a) Boarding/off-boarding facilities for medium, long route buses

- platform
- bus lane

b) Terminal building

- operation office
- ticket counter
- attached facilities

c) Bus service station

- minor repair plant
- inspection facilities
- fuel supply stand

d) Parking lot

. parking space for medium-, long-route buses
. parking space for taxis and passenger cars

e) Boarding/off-boarding facilities for other transport (city buses, taxies, etc.)

2) Equipment (for bus service station)

a) Minor repair equipment

b) Inspection equipment (including bus washing equipment)

c) Fuel supply equipment

CHAPTER 3 DESCRIPTION OF THE PROJECT

CHAPTER 3 DESCRIPTION OF THE PROJECT

3.1 Objective of the Project

The objective of the Project is to achieve the under-mentioned items by constructing a bus terminal, exclusively for medium- and long-routes, along the ring road as a part of the "Public Transportation Service Improvement Program", which is one of the main policy of His Majesty's Government of Nepal.

(1) Improving operation service of medium- and long-route buses.

(2) Relieving congestion and providing safe orderly operation of the present congested bus terminal by limiting its service to short route and city buses.

(3) Relieving traffic congestion in the city center by eliminating medium- and long-route buses from the city center.

3.2 Study of the Requested Project

3.2.1 Study of the Planned Project

(1) Medium and long bus route network

The transportation between Kathmandu and local cities relies on bus transport with the exception of some air routes.

Since the Kathmandu Metropolitan area is the center of political, cultural and economical activities in Nepal, this bus route network (Fig. 2-1) serves as the principal means of communication for political, cultural and economic activities. Owing to the recent development of the Kathmandu Metropolitan area, the road network is being upgraded and development of local districts is being promoted, thus increasing bus utilization. As of 1988, the number of buses permitted to use the present terminal was 443 a day and the actual number of buses using the terminal was about 400.

(2) Present terminal

1) The present terminal covers a total area of 10,000 m^2 including a boarding/off-boarding area of 7000 m^2, with 19 boarding/off-boarding berths, but this area is now too small to cope with the present number of buses using the terminal.

As will be described in Section "4.2" 20 berths are necessary for boarding/off-boarding the daily number of medium- and long-route buses which are expected to use the terminal. Furthermore there is no space for connecting transport including city buses, taxies, and tempos in the present terminal and there is no room for improvement. At peak hours there is much congestion in the terminal and some buses are forced to off-board and park on the road.

2) Present terminal lacks flow planning and layout planning

The berths and platforms in the present terminal seem to have been planned for medium and long route

buses, but since boarding and off-boarding are not clearly separated taxis and tempos also use these berths and platforms, the traffic circulation is completely confused. Furthermore, since medium and long route buses board or off-board at unoccupied berths and are not regulated, the flow of people is not uniform and changes with the location of medium and long route buses.

City buses to which most medium and long route bus passengers transfer do not stop inside the terminal and stop at the north side of Ratona park, so passengers must walk over to this bus stop or use different transport. This is very troublesome when passengers have a large amount of baggage.

3) Bus operation control and passenger service

The services provided by the Kathmandu city, which is responsible for terminal administration, are limited to providing facilities for passengers and collecting fees. Bus operation is not controlled at all by the city and services to passengers are limited to selling tickets at a temporary booth. Loading and unloading baggage from buses are left to free individual negotiation between passengers and porters and contribute to confusion and theft.

4) Problem of location

According to the survey conducted by the study team, only 25% of the passengers off-boarding from medium and long route buses have their final destinations in the city and 75% have their destinations in the suburbs (refer to Appendix).

Since medium and long route buses entering the city is one main cause of traffic congestion and air pollution, if the terminal is located along the ring road, a good portion of congestion and pollution can be reduced, because only 25% of the passengers will enter the city.

5) Possibility of Modification

- The area of the present terminal is too small to serve as a transfer terminal from medium and long route buses to intercity transport for the number of vehicles which will be involved, and the buildings surround the area, making expansion practically impossible.

- In the original plan of the present terminal, another entrance/exit was planned in addition to the present entrance/exit to provide a smooth traffic circulation, but now, it is impossible to provide this additional entrance/exit in the present layout (refer to Fig. 2-3) owing to the buildings standing around the terminal area.

- Since the terminal is located in the center of the city, traffic congestion as well as pollution from exhaust gas cannot be reduced.

In view of the above reasons, no improvement can be expected even if modification is made on the present terminal.

(3) Necessity of a new bus terminal

Now, as described above, the present terminal cannot function as a transfer terminal and also there is practically no solution for an effective modification.

Therefore, it is necessary to construct a new terminal to resolve the traffic congestion at the present terminal and to secure a smooth operation of medium and long route buses. The new terminal site should be determined in consideration of the reduction of traffic congestion and air pollution in the city center and the terminal should be provided with basic conditions for a good bus terminal.

3.2.2 Study of Requested Facilities and Equipment

(1) Proposed terminal site

- The present medium and long bus routes, with the exception of a few bus routes, extend out from the Kathmandu Metropolitan area through the Tribhuvan highway.

- Medium and long route buses should be prevented from entering the city center in order to reduce traffic congestion and exhaust gas pollution.

- Among passengers of middle and long route buses, passengers whose destinations are not in the city center, arrive at their destinations via the ring road.

From the above viewpoints, it is desirable to locate the proposed terminal site along the ring road near the crossing of the Tribhuvan highway and the ring road.

For selecting the site, site area, land preparation work, soil conditions, environmental conditions and existing obstacles should also be considered.

(2) Study of facilities

1) Basic functions

A transfer terminal should provide the following functions.

- Boarding and off-boarding berths/platforms for medium and long route buses as well as boarding and off-boarding berths/platforms for city buses and other city transport in order to institute smooth transfer.

- Clearly separated boarding and off-boarding berths/platforms for medium and long route buses as well as separate berths/platforms for city buses and other city transport in order to provide smooth vehicle and passenger traffic flow for preventing confusion and congestion.

- A well managed bus operation and passenger service including ticket sale, baggage services, bus arrival/departure information and other services.

- Since private bus companies do not have their own parking space, a parking lot is provided to prevent parking on the road, a fuel supply stand and a bus washing stand are also provided for bus operation.

2) Boarding/off-boarding for intercity transportation

According to a survey quite a number of medium and long route bus passengers is expected to transfer to intercity transportation such as city buses, taxis, tempos (tricycle taxi). In order to provide smooth operation, the traffic flow of vehicles and passengers is laid out to prevent confliction and to make access to boarding/off-boarding platforms easy.

Separate berths/platforms are provided for city buses, taxis, tempos and passenger cars. Also, boarding/off-boarding platforms for each transport are separated. Roofs and handrails are provided for platforms, as precaution against rain and accidents.

3) Medium and long route bus boarding/off-boarding platform

Boarding and off-boarding platforms are completely separated by locating the terminal building between both platforms. Also this permits easy medium and long route bus operation control by operators as well as easy access to passenger services facilities by passengers.

By separating boarding and off-boarding platforms, a smooth flow of passengers is assured preventing confusion and congestion. Platforms are provided with roofs and handrails similar to platforms of the city transport.

4) Parking lot

A parking lot is provided for nighttime buses since private bus companies do not have their own parking space.

5) Terminal building

Offices for terminal administration and bus operation control as well as passenger service facilities are located inside the terminal building. The offices and facilities are as listed below.

i. Administration and bus operation facilities

- Offices for terminal administration and bus operation
- Bus drivers rest room
- Electricity room

ii. Passenger service facilities

- Ticket counters (ticket sale by personnel from 25 companies)
- First aid room, information, bank, post office, tea stand, kiosk, telephone room, police stand, baggage storage, waiting room

6) Related facilities

Facilities other than those in the terminal building are as follows.

- Public toilet
- Platform with roof
- Fee collection stand (terminal utilization fee, fuel charge and washing charge)

- Household storage (equipment and materials for terminal maintenance)
- Rubbish disposal (rubbish disposal area and incinerator)

7) Service area

In order to assure smooth bus operation, the following service facilities are provided.

- Fuel supply stand:

  A fuel supply stand is provided, since there is no facilities nearby.

- Bus washing stand, inspection pit:

  A washing stand and inspection pit is provided for washing buses and inspecting the body, owing to the poor road condition in Nepal.

8) Other facilities

- Deep well water supply facility

  Since city water supply capacity is low (abt. 10 m^3/day) a deep well is provided for supplying water for bus washing, toilet and sprinkling.

- City water supply facilities

  Since deep well water is not suited for drinking, city water supply is necessary for drinking and washing.

- Terminal lighting facilities

  Extensive lighting facilities which light the road inside the terminal, boarding/off-boarding platform, parking lot, service area, pedestrian pathway

and open space are provided for nighttime bus operation.

- Water discharge facilities
  - Water discharge facilities for discharging storm water on paved surfaces.
  - Industrial and waste water discharge facilities including oil strainer.
  - Sewage discharge facilities including a sewage treatment tank.

(3) Study of equipment

His Majesty's Government of Nepal requested the provision of maintenance facilities for maintaining buses including equipment to perform simple maintenance as well as regular scheduled inspection and maintenance together with fuel supply equipment and bus washing equipment. However, after studying the necessity of various materials and equipment, it was decided to delete vehicle maintenance equipment since the executing agency of the Project has no experience in the management of maintenance plant operation, and also it is not directly related to the objective of the Project, improving bus terminal functions. But since fuel supply equipment, bus washing equipment and high pressure washing equipment are necessary to improve bus terminal operation, they are provided. Although traffic safety equipment such as signal lights and gates is not included in the list of requested equipment, they are provided for traffic safety within the terminal. Baggage carts are also provided for relieving congestion during bus boarding/off-boarding and for the convenience of passengers.

3.3 Outline of the Project

3.3.1 Executing Organization

(1) Executing Agency

Since the execution agency of the Project is Kathmandu Nagar Panchayat - KNP, which is under the jurisdiction of the Ministry of Panchayat and Local Development of His Majesty's Government of Nepal, the facilities, equipment and materials provided under Japan's grant aid shall be government assets entrusted to Kathmandu Nagar Panchayat for management and administration.

The expenses to be borne by His Majesty's Government of Nepal for the Project shall be provided from the budget of Kathmandu Nagar Panchayat, which shall set up a new bus terminal section to operate the bus terminal after it is completed.

Although the bus terminal shall be administered directly by Kathmandu Nagar Panchayat, the actual operation such as provision of buses, bus operation, passenger service and service area operation shall be entrusted to Nepal Transport Entrepreneurs Association (NTEA) which is the central organization of transportation enterprises. The organization with its rich bus operation experience is expected to be an invaluable contribution to the operation of the new terminal.

(2) Operators permitted to utilize the terminal

Only medium and long route buses of 25 operators who are the members of NTEA will be permitted to utilize this terminal.

- NTEA

NTEA is a national organization under the jurisdiction of the Ministry of Works and Transport. It consists of 26 district associations and the numbers of buses and minibuses operated by its members are roughly 3,400 and 1,800. Truck operators also are members, and although taxi and tempo operators are being invited to join the association, none has responded so far. NTEA is a central organization and its main objectives are as listed below.

a) Providing good systematic passenger service.

b) Verifying scheduled arrival/departure of all buses.

c) Checking and verifying that all buses are in good working condition.

d) Fixing and announcing arrival/departure schedules of all buses at all bus terminals.

e) Fixing and announcing bus fares.

f) Installing communication installations where possible.

g) Supporting the policy of the Kingdom of Nepal to provide safe travel for travellers throughout the country.

h) Providing a ticket reservation system.

i) Providing equal opportunity for all operators to obtain a fair profit for their route based on their operating frequency.

j) Providing travel insurance facilities for passengers.

k) Setting official porter rates for handling passenger's baggage.

(3) Organization (refer to Fig. 3-1)

The Bus Terminal Section of KNP shall consist of the following three subsections.

1) Administration and Management Subsection (KNP administration)

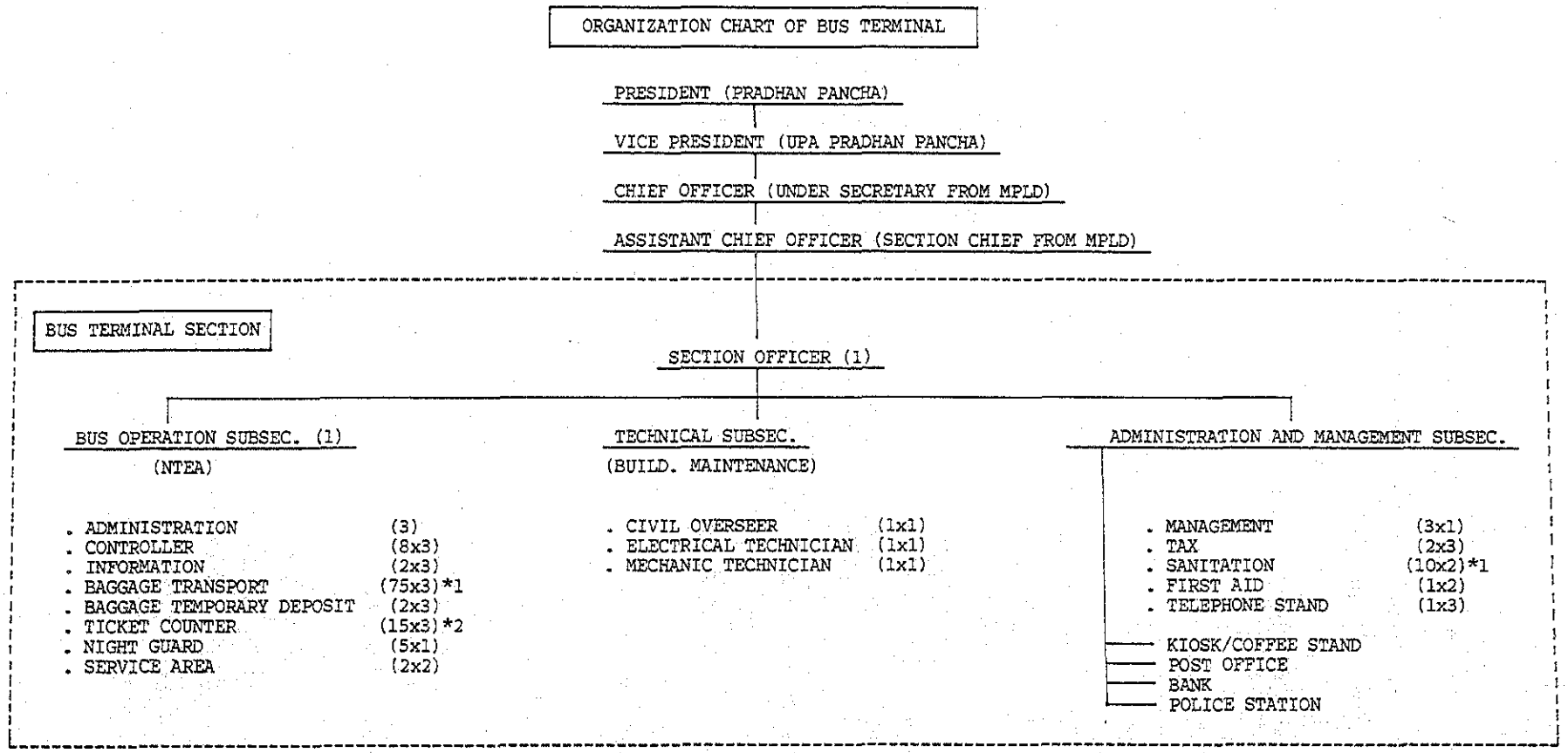
It collects terminal utilization fees and conduct administration of general affairs and general service facilities. However, kiosks, tea stands, post office, bank and police station operations are entrusted to respective parties.

2) Technical Subsection (KNP administration).

3) Bus Operation Subsection (entrusted to NTEA)

It includes bus operation, passenger and baggage services, and services for fuel supply and car washing.

This organization is administered by the Kathmandu city, but the main operation activities, bus operation control and passenger service are entrusted to NTEA and administered by the Bus Operation Subsection. Since the city has no experts in this field, this combination with NTEA is the best bus operation method in Nepal today. Needless to say, good coordination between the city and NTEA is necessary for smooth operation of the terminal.



*1: DAY WAGE BASE WORKER
*2: FROM EACH BUS COMPANY

Fig. 3-1 Organization Chart of Bus Terminal

3.3.2 Project Plan

(1) General

The terminal is designed to have sufficient capacity to accommodate all medium and long route buses which are operating from Kathmandu, and is provided with platforms for intercity transport to enable passengers to easily transfer from medium and long route buses to intercity transport.

A terminal building with surrounding open space is provided as a bus operation control center and passenger service center. Total bus operation control including scheduled operation and safe driving enforcement is provided within this building together with passenger services including ticket sale, baggage handling, a waiting room, arrival/departure information and other services. Also a bus washing stand, an inspection area and a fuel supply stand are provided as well as parking space for medium and long route buses. The bus operation control service is provided daily from 4:00 to 20:00 in three shifts.

The operation is executed by a newly organized bus terminal department of KNP which will conduct overall management and maintenance while entrusting all daily operation to NTEA under KNP supervision.

The organization chart shown in Fig. 3-1 may be summarized as follows.

Director	1	18	KNP	67
Management Subsection	14			
Technical Subsection	3			
Bus Operation Subsection		49	NTEA	

The terminal shall be a self paying operation with revenues from medium and long route buses, terminal utilization charges, bus service (washing, fueling) charges, sales, facility rents, public telephone charges and passenger car parking charges.

(2) Operation

The congestion at the present terminal is no doubt due to insufficient facilities and shortage of capacity, but it is also due to people being unfamiliar with general traffic rules or not observing them. Therefore, it is necessary to educate them and enforce traffic rules when constructing a well equipped bus terminal.

1) Vehicle operation in the terminal

Provide separate bus arrival/departure berths and enforce the rule of following the established traffic flow route.

- City buses

After passengers have got out of a bus at the off-boarding berth, the bus shall quickly move to the boarding berth and depart after passengers have boarded it. Buses must not be permitted to park long except for waiting until the scheduled time for departure.

- Taxis and tempos

Enforce boarding/off-boarding at specified berths, as well as orderly waiting for passengers.

- Passenger cars

  Enforce boarding/off-boarding at specified berths. Do not permit cars to wait at berths, but have them park at the specified parking lot.

- Medium and long route buses

  Have the bus operators observe the following flow route.

  Arrival → off-board at specified off-boarding berth → (bus washing) → (inspection) → fuel supply → parking lot → boarding at specified boarding berth → departure at specified time for departure (Announce departure by a public addressing system).

2) Passenger service

- Ticket sale

  Provide ticket counters for 25 companies which operate medium and long distance buses to sell tickets. Tickets are sold by representatives of each bus company.

- Baggage service

  Baggage accompanying passengers may be checked in at a ticket counter for a fixed fee, and after placing a claim tag, a porter shall load it onto a bus. When the baggage handling condition at the present terminal was observed, it was found that baggage loading was the main cause for a long delay (30-45 minutes) of bus departure. When off-boarding, porters shall unload baggage from buses. Baggage handling fees within the terminal shall be fixed.

- Baggage checking

  A baggage checking counter shall be provided for checking baggage at a fixed fee.

- Information service

  - A display board showing the bus arrival/departure time table for each route shall be provided.
  - A display board indicating bus arrival/departure shall be provided.
  - Public addressing service for announcing bus arrival/departure as well as paging shall be provided.
  - An information counter for providing general information, loss and found service, paging, first aid care, etc. shall be provided.

The operation for the aforementioned items 1) and 2) shall be provided by NTEA from 4:00 o'clock to 22:00 o'clock on a 3 shift service (4:00 - 10:00, 10:00 - 16:00, 16:00 - 22:00), but only guardmen shall be provided from 22:00 - 04:00.

3) Bus maintenance

In order to provide smooth operation of buses, all buses must be kept in good operating condition. For this purpose, a service area, including car washing equipment and fuel supply stand, shall be provided within the terminal. These services shall be operated by NTEA.

4) General administration and maintenance

- Collection of terminal utilization fee

  Utilization fees of medium and long route buses shall be collected from each bus at its entrance of the bus boarding gate, while utilization fees of facilities within the building shall be collected at the terminal office.

- General cleaning

- Maintenance of facilities

  Maintenance of civil works, building, water supply, sewage, sanitation and electrical facilities.

- Installation of a first aid clinic

  One nurse shall always be on duty.

- Telephone stand (Toll phone)

  An exchange-board-operated phone with one operator on duty at all time.

- Kiosk, coffee stand, post office and police station

  Operation shall be on a consignment basis.

- Install and upkeep signs

  Destination signs, guide boards, direction signs and other necessary signs shall be maintained at the bus boarding/off-boarding terminal, and inside and outside the terminal building.

This general administration and maintenance shall be conducted by KNP.

3.3.3 Outline of Facilities and Equipment

Facilities and equipment which should be supplied as grant aid from Japan for the Project are as outlined below.

(1) Facilities

1) Ground facilities

- Approach road from the ring road and road leading to each facility.
- Boarding/off-broading platform for city buses
- Boarding/off-broading platform for taxies and tempos
- Car pool for taxies and tempos
- Boarding/off-broading platform for passenger cars
- Parking area for passenger cars
- Off-boarding platform for medium and long route buses
- Boarding platform for medium and long route buses
- Parking area for medium and long route buses
- Pedestrian pathway between platforms and between the terminal building and the concourse.

2) Building and structures

a) Terminal building

Section	Facility	Function
Management Section	Office	Terminal management office including director room and conference room
	Drivers rest room	Restroom for drivers
	Electricity room	Substation for terminal facilities
Passenger Service Section	Ticket counter	Sale of bus tickets and baggage tags
	First-aid clinic	First aid for emergency patients
	Information	Terminal and arrival/ departure information
	Kiosk	Sale of snacks, newspapers and magazines
	Bank	Money exchange service
	Post office	Mailing service
	Telephone room	Operator-operated telephone service
	Police stand	Maintain security within terminal
	Tea stand	Sale of soft drinks
	Baggage storage	Provide temporary baggage storage
	Waiting room	Waiting room for passengers waiting buses and for people meeting passengers

b) Auxiliary building

- Public toilet and sewage treatment facilities

  These facilities are housed in an independent building for convenience and sanitation.

- Platform roof

  Roofs are provided in consideration of the monsoon season.

- Fare collection shed (3 places)

  Fares and fees for terminal usage, fuel supply and bus washing are collected.

- Storehouse

  Storehouse for terminal cleaning equipment.

- Garbage disposal

  Garbage discharged from terminal and medium and long route buses are burned and disposed.

c) Service Area

- Fuel supply stand

  Fuel may be supplied to medium and long route buses.

- Bus washing stand and inspection pit

  Medium and long route buses are washed and inspected.

3) Other facilities

- Water drainage facilities

  Drainage ditches and pipes are installed up to the drainage pit at the boundary of the terminal.

- Terminal lighting facilities

  Lights for passengers and buses arriving and departing at night.

- Deep well water supply facilities

  A deep well and water supply facility are provided for supplying water for bus washing, toilet and sprinkling.

- City water supply facilities

  Water supply facilities for drinking and washing.

(2) Equipment

Equipment necessary for the Project is guiding equipment to guide buses safely into the terminal and bus service equipment to maintain buses. The necessary pieces of equipment are as listed below.

1) Bus guiding equipment

a) Signal

Install a signal at the crossing between the main road and the approach road into the terminal for assuring safe traffic.

b) Crossing gate

A crossing gate is installed to assure safe vehicle traffic and to collect terminal utilization charges.

2) Bus service equipment

a) Bus washing equipment

Since road condition in Nepal is bad and buses are running mainly on mountain roads, buses easily get dirty. So washing equipment is installed to prevent corrosion of the bus body and raise inspection quality.

b) Fuel supply equipment

Providing kerosene supply service will make the bus terminal much more convenient.

3) Passenger service equipment

a) Baggage carts

In the terminal building, baggage carts for porters are provided for the convenience of passengers to reduce congestion during boarding/off-boarding.

3.3.4 Project Site

(1) Construction site

1) Selection of Proposed Site

Before starting the survey of proposed sites, MPLD proposed three sites; No.5, No.8 and No.9 along the ring road near the crossing between Tribhuvan road and the ring road.

As a result of a general survey of the three sites, site No.8 was selected and a topographical survey and boring tests were conducted, but owing to military considerations which later occurred, the proposed site was changed to the present Samakhusi site where a survey and a study were conducted.

Since this site as well as the three original proposed sites are within a flood danger district, quite an amount of land fill-up is required. Although this location is about 6 km away from the Tribhuvan cross-roads, the site is flat and the amount of land preparation work is smaller than for the other proposed sites. Since land substructure is stable and the number of private homes which must be removed is much smaller than in the other proposed site, this site was selected.

2) Location

The proposed site is located about 3.0 km north of the Kathmandu city center and about 10 km from the airport. It is on the outskirt of the city and inside the ring road and along the Vishumati River.

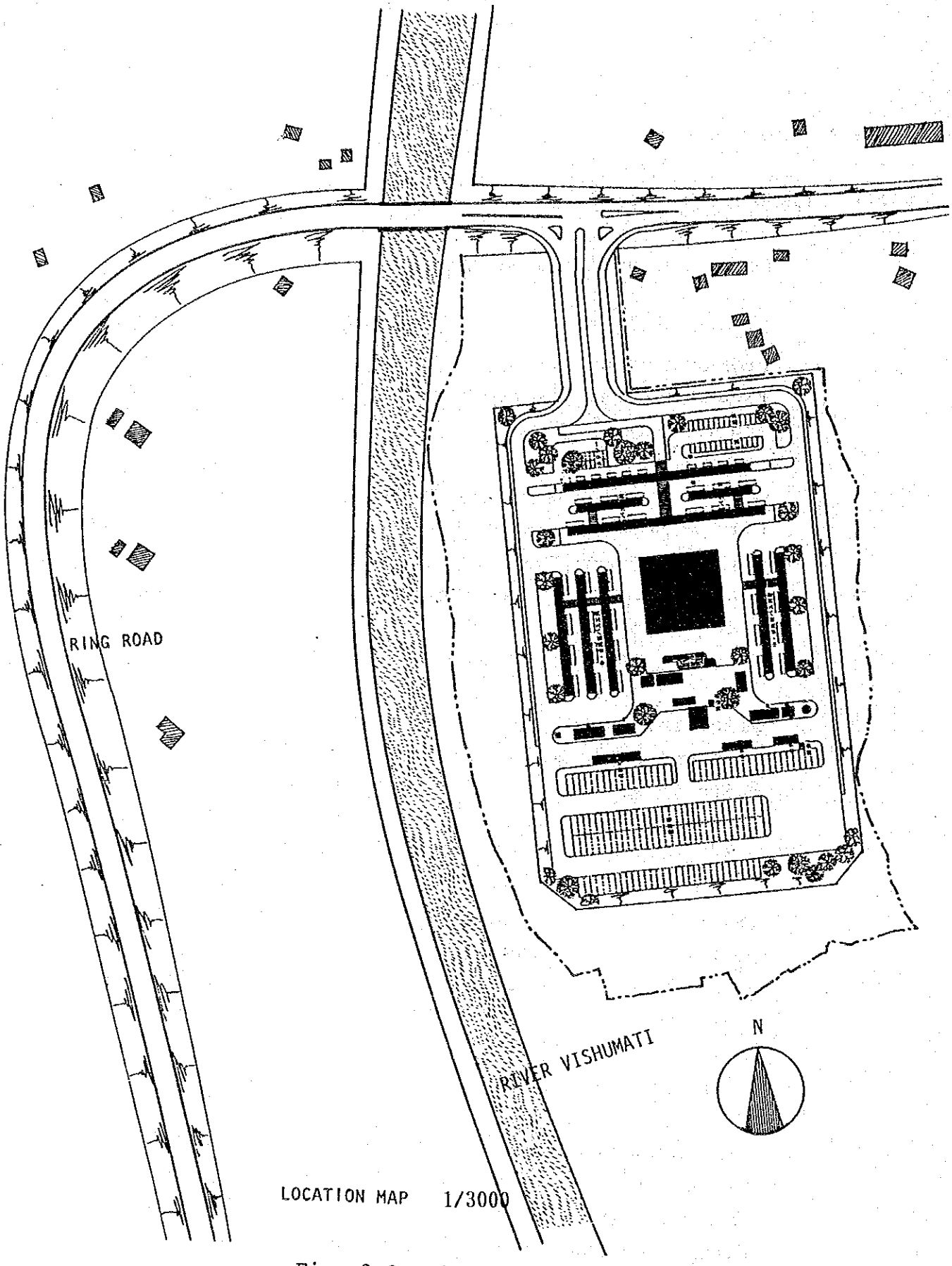


Fig. 3-2 Site Location Map

3) Configuration and area

The site is approximately rectangular and level with hardly no difference in elevation. It is 350 m north to south and 240 m east to west with an area of about 8.2 ha.

4) Land ownership

The proposed site is entirely privately owned land and KNP has provided funds in this year's budget to purchase the land.

5) Present site condition and elevation

The proposed site is presently farmland and about 5.0 m lower than the ring road surface on the north side of the site and within the flood zone designated by KNP. Elevations are, according to the data from KNP, 1296 m for the project site, 1301 m for the Ring Road, 1294 m for the river bed and 1296.5 m for the flood mark as shown in the follwoing figure. The water level height on the buttress of the bridge was observed and confirmed by residents.

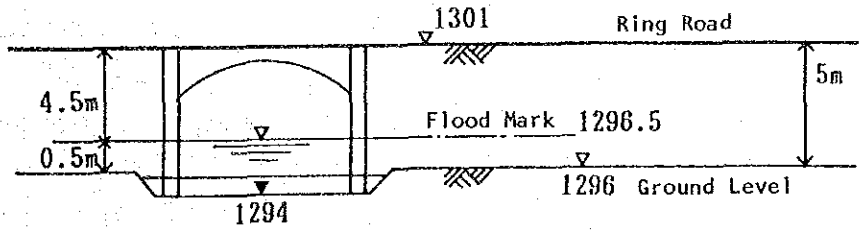


Fig. 3-3 Diagram of Site Level

6) Topography and geology

The site is located at the northwest of the Kathmandu valley and the soil is believed to be a fourth Piedmont-fan sedimentation caused by sedimentation of Precambrian Mesozoic soil flowing down from the hills on the north and west side of the valley. The soil is made up of a formation of a black, fine and coarse sand stratum, and medium to high plastic clayey silt stratums.

7) Load bearing capacity

According to the N value measured during the boring test, if the poor surface layer is replaced, the present soil formation is expected to be suitable as a bearing foundation even when considering that the boring test was conducted during the dry season.

8) Land preparation

Since the project site is in a flood area and is lower than the flood mark, the present ground level was decided to be filled up by 1.0 meter based on the flood level mark of the Vishumati river and the level of present buildings and the fact that water flows into the Kathmandu valley from the surrounding mountains and the water collection area is quite small. This ground level, in case of no remarkable change of the river bed, is 0.5 meter higher than the flood level and after fill-up, it is expected to be suitable both from the viewpoint of flooding or water discharging. Quite an amount of earth, about 75,000 m^3, will be necessary for this land fill up.

After considering effective land utilization for the bus terminal and easy access from the ring road, the slope of the approach road to the site was limited to -3%.

The fill-up level of the site was determined as shown in the following diagram.

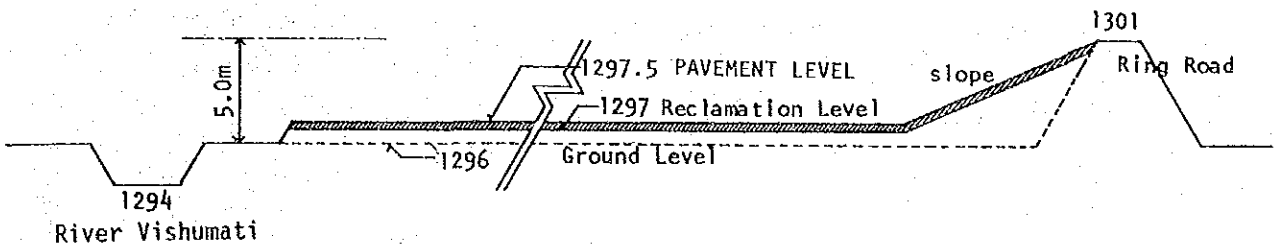


Fig. 3-4 Diagram of Fill-up

(2) Outline of Infrastructure

Power and telephone cables are running along the ring road adjacent to the project site.

- Power

  Power for the required maximum power capacity of 200 kVA can be received through an overhead cable at 11 kV.

- Telephone

  Telephone lines for three circuits for the office can also be received through an overhead line from the main cable. But for additional circuits, an application must be submitted to the Nepal Telecommunication Corporation for their decision. Coin/toll phones (public telephones) are not available in Nepal, and any pay telephone service must be directed through private exchange-boards.

- Water supply

  Water supply can be received from the water supply line running nearby the site. However, since there is a shortage of water supply, WSSC states that they can supply only up to 10 m^3 a day. Since this amount cannot cover the water requirement of the terminal, it is necessary to install a deep well (200 m) to cover the demand for bus washing etc. According to data on nearby deep wells, there seems to be no problem in obtaining water from deep wells.

- Water drainage

  Water drainage mostly relies on natural permeation into the ground, but since a large area of the site will be paved, storm water must be discharged into the Vishumati river.

- Heating

  There are no city gas facilities, so petroleum and liquefied petroleum gas (LPG), which are available locally at stores, are burned for fuel. Petroleum stoves are the main heating source.

(3) Other site environment

1) Surrounding Area

The site is located approximately 6 km north of the crossing between the ring road and the Tribhuvan road which is the main medium and long route bus road. The Trishuli road branches off northward from the ring road at a point on the opposite side of the Vishumati River.

Toward the west, on the opposite side of the Vishumati River, is the Balaju industrial park. The deep wells which are the source of city water is located north of the ring road along the Vishumati River.

2) Site location

The site is presently farmland with the ring road forming the northern boundary and the Vishumati River forming the western boundary. The surrounding scenery is still that of farmland, but recently the trend towards urbanization can be seen. The eastern and southern boundaries are mainly farmland with some residential houses. On the western and northern sides planting can be seen lining the neighboring land.

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4.1 Basic Policy

The Project is intended for providing principal facilities for city traffic, therefore the facilities were designed with the idea of providing easily usable facilities. Consideration was also given to the following items.

(1) An arrangement which can adapt easily to increase in transportation means and passengers.

(2) A green zone was provided to separate the site from the neighboring area in order not to impair harmony with the environment, since development along the ring road is expected with the growth of the city.

(3) Systematic facilities which provide necessary service to passengers and bus operation.

(4) Facilities which are easy to maintain and to operate efficiently.

(5) A construction plan which utilizes local materials and methods as much as possible.

4.2 Basic Condition

(1) Function and traffic flow of the bus terminal

The basic function of this terminal is to provide a transfer point to transfer from medium and long route buses to city transport such as buses, taxis and tempos. Since medium and long route buses are also utilized as transport means for daily necessities as well as passengers, the terminal also functions as a small materials distribution center.

Since many people and materials come in and out of this terminal, the arrival and departure of different means of transport are separated with flow separation for entering and leaving the terminal, also the flow of people is designed for smooth circulation.

(2) Medium and long route bus boarding & off-boarding platforms and parking lot.

In order to provide smooth bus operation and convenience for passengers, boarding and off-boarding platforms are separated.

The number of boarding and off-boarding platforms as well as the size of the parking lot were planned on present bus transportation condition. At present, permits are issued for a daily bus operation of 443 buses, but based on the observation of bus operation at the terminal on 20th of February, bus operation condition was set at 400 buses a day. (Refer to Section 2.3.2 Bus Operation). Scheduled bus traffic for different routes is shown in the following table.

Table 4-1 Scheduled Bus Traffic

Route	Daytime bus		Nighttime bus		Total	
	Departure	Arrival	Departure	Arrival	Departure	Arrival
West	46	46	59	59	105	105
Southeast	1	1	42	42	43	43
South	4	4	23	23	27	27
East	18	18	0	0	18	18
North	7	7	0	0	7	7
Total	76	76	124	124	200	200

The necessary number of berths was as described below based on the frequency of bus arrival and departure during the peak hour and capacity of arrival and departure handling for each berth.

Boarding berths:

Berths are separately provided for each route for the convenience of passengers. The hourly number of departing buses for different routes was determined as shown in Table 4-2 based on scheduled bus traffic Table 4-1 and bus operation diagram, Fig. 4-1, since there were no reliable data on bus traffic during the peak hour.

For example the hourly number of departing buses for the west route was estimated as follows:

Nighttime bus: The number of departing buses was estimated by dividing the total number of departing buses by the total hours.

$$59 \div 6 = 10$$

Daytime bus: The number of departing buses was estimated as two, since two daytime hours overlap with nighttime hours. The total number of departing buses divided by the total hours was as follows:

$$46 \div 13 = 3.54$$

Bus departure for other routes was estimated in the same way.

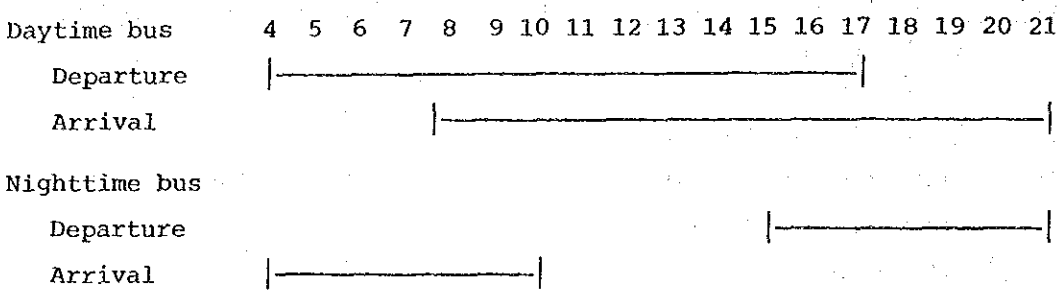


Fig. 4-1 Bus Operation Diagram

Table 4-2 Number of Buses Departing at Peak Hour

(Unit: bus/hour)

Route	Daytime bus	Nighttime bus	Total
West	2	10	12
Southeast	0	7	7
South	0	4	4
East	1	0	1
North	0	0	0
Total	3	21	24

The handling capacity of one berth for departing buses is estimated as two buses an hour, since it was observed that 30 minutes were required for boarding. The number of boarding berths necessary for different routes are estimated as shown in the following table. Since the number of buses for the east route is small, the buses for the east route and southeast route are planned to use the same berths.

Table 4-3 Number of Necessary Boarding Berths

Route	Necessary number of berths
West	6
Southeast, East	4
South, North	2
Total	12

Off-boarding berths:

Since off-boarding buses can be off-boarded in the order of arrival, regardless of the route, berths are not separated for different routes. The bus arrival at the peak hour is estimated to be as shown in Table 4-2, and the handling capacity of one berth for arriving buses is estimated as three buses an hour, since it was observed that 20 minutes were required for off-boarding. The number of necessary off-boarding berths are estimated as follows:

24 buses ÷ 3 bus/berth = 8 berths

The total number of boarding and off-boarding berths for medium and long route buses are 20, which is similar to the 19 in the present terminal.

Parking lot:

In order to park all nighttime buses arriving at the terminal, a total of 124 bus spaces are necessary, since private bus companies do not have their own parking lots.

(3) City buses, taxies and passenger cars boarding and off-boarding berths.

Passengers utilizing medium and long route buses either arrive or depart by city buses, taxis or passenger cars to and from their destinations. Therefore boarding and off-boarding berths for such city transportation must be provided.

The amount of necessary facilities shall be calculated from the number of medium and long route passengers using city buses, taxies and passenger cars at peak hours, the number of passengers riding each transport vehicle and the time required for boarding and off-boarding each vehicle.

The passengers boarding and off-boarding buses at peak hours were calculated from the numbers of buses departing and arriving at peak hours, and the number of passengers for each bus is as shown below:

Boarding passengers:
12 berths x [2 buses/berth] x 40 persons/bus = 960 persons

Off-boarding passengers:
8 berths x [3 buses/berth] x 40 persons/bus = 960 persons

Table 4-4 Number of Passengers for Different Means of Transport

(Unit: Persons/Day)

Bus	Taxi (including passengers cars)	Total
15,640 persons (73%)	5,613 persons (27%)	21,253 persons (100%)

According to observation, the percentages of taxi and passenger car users are estimated as being 20% and 10% respectively. The remaining 70% are believed to use buses or walk, but from the location of the new terminal, most of these people are expected to use city buses, therefore the percentage of passengers utilizing buses was estimated as 70%.

The necessary number of berths for different vehicles are estimated as shown in Table 4-5 and the number of persons using each means of transport is estimated as shown in Table 4-6.

Table 4-5 Necessary Berths for City Buses, Taxis and Passenger Cars

	City buses	Taxis	Private cars
Peak number of passengers (person/hr)	670(70%)	190(20%)	100(10%)
Persons riding each vehicle (person/vehicle)	30	2.8	2.8
Number of departing vehicles (vehicle/hour)	23	68	36
Boarding time (minutes)	15	2	2
Necessary number of berths (berth)	6	3	2

Table 4-6 Passenger for Each Vehicle

	Taxi			Tempo		
	Departure	Arrival	Total	Departure	Arrival	Total
Number (vehicle)	419	756	1,175	355	541	896
Number of boarding/off-boarding passengers	1,188	2,174	3,362	948	1,304	2,252
Passenger per each vehicle	2.9	2.9	2.9	2.7	2.4	2.5

Vehicle off-boarding space is the same as boarding space, the same number of berths was set for both cases, since boarding & off-boarding passengers, passengers for each vehicle and boarding & off-boarding time are the same.

At the taxi boarding space, a taxi pool must be provided for taxis waiting for passengers. The space for the necessary number of taxis was calculated from the number of off-boarding passengers at the peak arrival time as follows:

Number of Passengers off-boarding at peak time:

8 berths x 40 persons/berth = 320 persons

Number of taxies:

320 persons x 0.2/[2.8 persons/taxi] = 22.9 23 taxies

Taxi pool:

23 x 0.5 = 11.5 12 taxies
(For securing 50%)

A parking space must also be provided for passenger cars. The necessary space is calculated from the number of cars arriving at the peak time, parking lot utilization and parking time as follows:

Number of arriving cars at peak time:

for meeting, 36 cars, for seeing off, 18 cars (50% of meeting)

Parking lot utilization:

for meeting, 100%, for seeing, 50%

Parking time:

30 minutes

Necessary parking space:

$$\frac{36 \times 1.0 + 18 \times 0.5}{2} = 22.5 \qquad 23 \text{ cars}$$

(4) Terminal building

1) Rooms for each section

Section	Room	Content
Administration	Manager's office Assistant manager's office Typist room	The three rooms are set adjacent to each other. A guest corner is provided in the manager's and assistant manager's offices.
	Conference room	Sufficient space for conducting meeting on terminal management and operation.
	Office room	Administration and Management Section Administration and accounting of the entire terminal and sanitary management, first aid, management of tenants, public telephones, and the post office. Technical Section Maintenance management and rest room for technician Bus operation Section Management & scheduling of bus operation, checking baggage, selling tickets, guarding the terminal and general administration, and rest room for operation managers.
	Bus drivers rest room	Roll call before departure, providing instruction, verifying bus inspection before departure and after arrival.
	Electricity room	Substation facilities are installed.
	Others	Hallway, water heating room and toilet for employees

Section	Room	Content
Service for boarding and off-boarding Passengers	Ticket counter	Counters are provided for different routes to sell bus tickets and baggage claim tags
	First aid room	First aid room for emergency patients, light injury and bus sickness are treated and first aid is administered to seriously ill or injured patients until an ambulance arrives.
	Information counter	Information shall be provided for passengers in the terminal.
	Kiosk	Goods, souvenirs, snacks and drinks are provided.
	Banks	Exchange service is provided for foreign travellers.
	Post office	Postage stamps are sold and parcels are sent.
	Telephone room	Service through ordinary telephone services are provided since coin phones are not available in Nepal.
	Police stand	A police stand is provided to keep security in the terminal.
	Tea stand	Snacks and drinks are sold.
	Baggage room	Baggage of arriving passengers is checked.
	Waiting room	Benches are provided for passengers waiting for buses.

2) Determination of size

i) Administration and Management Section

The office size is medium size but in this plan, air conditioning equipment is not provided, but only fans are provided, so area calculation cannot be done only by Japanese standards. In a small space, especially a large volume of air is necessary.

The standard of the Japanese office area calculation is applied (data from Architectural Institute of Japan Architectural).

- The areas of the manager's room, assistant manager's room, typist room, conference room and office are calculated as follows:

Manager:
1 person x 25.0 m²/person = 25.0 m²
Assistant manager:
1 person x 18.0 m²/person = 18.0 m²
Section chief:
3 persons x 8.5 m²/person = 25.5 m²
Staff:
18 persons x 7.0 m²/person = 126.0 m²

Total	194.5 m²

- Bus driver room:
15 persons x 3.0 m²/person = 45.0 m²

- Toilet (refer to Fig. 4-2)

Male:	toilets	2
	urinals	3
	washing basins	2
Female:	toilets	2
	washing basins	2
Numbers of persons:		
	staff members	23
	drivers	15
	service members	17
	Total	55
		(male 50)
		(female 5)

ii) Passenger service section (standard room areas of the Japanese Railways were used as reference)

- Length of ticket counter

  Since there are 25 medium and long route bus companies, the ticket counter length was determined as 22 m providing 0.9 m for each company.

- First aid room

  Standard area for a first aid room in a hospital

	6 m x 3 m = 18 m²
Area for two beds	= 8 m²
Total	26 m²

- Information counter

  Counter window
  2 persons x 7 m²/person = 14 m²
  Public address system 2 m²

  Total 16 m²

- Kiosk

  Sales counter
  3 persons x 7 m²/person = 21 m²
  Storehouse 10 m²

  Total 31 m²

- Bank

  Counter window
  2 persons x 5 m²/person = 10 m²
  Number of staff members
  2 persons x 5 m²/person = 10 m²

  Total 20 m²

- Post office

  Counter window
  2 persons x 5 m²/person = 10 m²

- Telephone room

  Telephone exchange
  1 exchange = 6 m²
  Office desk
  1 desk = 3 m²
  Booths
  3 persons x 2 m²/person = 6 m²

Waiting space

2 persons x 1.5 m²/person = 6 m²

Total	21 m²

- Police stand

Police

2 policemen x 5 m²/person = 10 m²

- Tea stand

Attendants

3 persons x 3 m²/person = 9 m²

Cooks

3 persons x 5 m²/person = 15 m²

Total	24 m²

- Baggage counter

Average pieces of baggage handled daily are estimated as 25% of peak passengers

960 x 25% ÷ 6 pieces of baggage/m² = 40 m²

- Waiting room

Necessary space = area per person (c) x number of waiting persons (w)

c = 2.4 m²/person

w = 2/3 of maximum waiting persons

Area = 960 persons x 2/3 x 2.4 m²/person

= 1,536 m²

iii) Public toilet

The number of toilets is based on the "Air Condition Sanitary Engineering Handbook" published by the Air Conditioning and Sanitary Engineering Association. However, consideration shall be given to high toilet utilization in a short time and to only few toilet facilities being available during a bus trip.

Number of passengers:

960 persons/hour x 6 hours x 2 (arrival departure)
= 11,520 persons/day

Passengers using toilet:

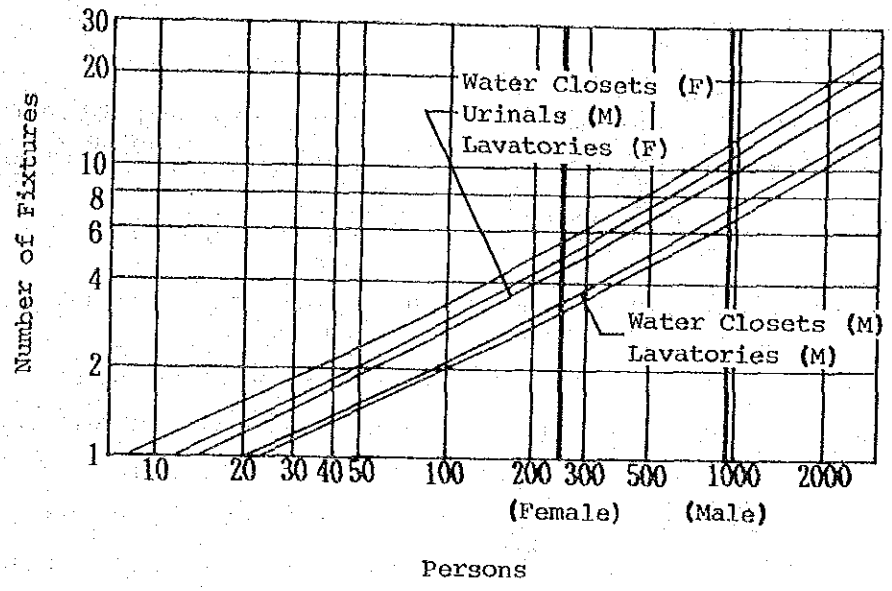
10% of the passengers is estimated to use the toilet

The ratio between male and female passengers is estimated as 8:2

	Male	920 persons
	Female	230 persons

Number of fixtures (refer to Fig. 4-2)

Male	toilet	7
	urinals	11
	washing basins ..	7
Female	toilet	6
	washing basins ..	5



ESTIMATION TABLE OF TOILET FIXTURES
IN PASSENGER TERMINAL

Fig. 4-2 Toilet Equipment Estimation Graph

(5) Other facilities

1) Necessary facilities

Platform roof	During the monsoon season, it rains more than 20 days in one month. Therefore, boarding & off boarding platforms for medium/long route buses, city buses, taxis and private cars shall be provided with roofs to prevent accident from using umbrellas.
Fee collection counter	Fee collection counters shall be provided for the medium/long route bus parking lot, bus washing equipment and fuel supply stand.
Administration storehouse	Equipment necessary to keep the terminal clean and a rest room for the administration staff is provided here.
Others	City water pump shed, well pump shed, rubbish incinerator shed and fuel supply shed.

(6) Selection of equipment

The equipment should be selected in consideration of the following matters especially for supplying equipment which is suitable for conditions in Nepal.

1) Consideration of technical level for equipment

The equipment for the Project should be suitable for the technical level in Nepal. Therefore equipment which is being used in Nepal is desirable. Equipment difficult to maintain and repair should be avoided. In order to avoid breakdowns, bus washing equipment should be of a simple mechanism so a stationary type was selected. Fuel supply equipment and its auxiliary equipment with anti-explosion equipment was selected.

2) Analysis of equipment capacity and determination of necessary equipment

In order to determine the number of pieces of equipment it is necessary to determine the number of buses using the equipment. The number of buses utilizing the equipment was determined as follows:

- Total number of buses using the terminal approximately 200 buses/day
- Bus washing equipment (estimated yearly average number of buses)
  25% of total buses approximately 50 buses/day
- Bus washing equipment (during the rainy season)
  60% of total buses approximately 120 buses/day

- Fuel supply equipment, estimated number of buses
  50% of total buses approximately 100 buses/day

- Bus washing equipment
  Capacity: about 2 minutes/bus
  Maximum capacity: about 360 buses/day
  (theoretical figure)
  Actual capacity: about 180 buses/day
  (necessary equipment 1)

- High pressure washing equipment
  Pit equipment or washing bus bodies 1 unit
  Bus body washing equipment 1 unit
  (necessary equipment 2)

- Fuel supply equipment
  Capacity: about 4 minutes/bus
  Maximum capacity: about 120 buses/day
  (theoretical figure)
  Actual capacity: about 60 buses/day
  (necessary equipment 2)
  Total: about 120 buses/day

- Traffic signal
  1 necessary location (T cross road)
  (necessary signals 3)

- Cross gate
  Necessary location 10 m width
  Length of arm 6 m (necessary unit 2)

- Baggage Carts
  1 cart for every 4 berths
  Necessary carts: 41/4 = 10

4.3 Basic Plan of Facilities

4.3.1 Layout

(1) Determining the level

Since the height difference between the ring road and the site is 5.0 m and because of consideration of flooding of the Vishumati river on the west side, pavement shall be 1.5 m higher than the present site level.

(2) Approach road

The terminal is to be located on the south side of residential houses to prevent interfering with them. An approach road is from the ring road. The approach road from the ring road extends horizontally up to 31 m from the center of the ring road and from there it slopes down-ward at a 3% incline. The road is separated into the entrance road on the east side and the exit road on the west side. A center division belt and footways separate the entrance and exit road.

(3) Arrangement of facilities

The terminal facilities will be arranged from north to south, and the main facilities in the terminal will be in the medium/long route bus terminal building zone.

① City transportation zone

Boarding and off-boarding platforms for city buses, taxis & tempos, and passenger cars are installed.

The flow of taxis, tempos and passenger cars is shown below.

East entrance road → off-boarding platform → parking lot → boarding platform → west exit road

The flow of bus is as shown below.

East entrance road → off-boarding platform → boarding platform → West exit road

Passengers are routed directly or through the footway to the space in front of the terminal building.

② Medium/long route buses and terminal building zone

Off-boarding platforms and boarding platforms will be located on both sides of the terminal building.

The flow of medium/long route buses is as shown below.

East entrance road → off-boarding platform → parking zone → boarding platform → west exit road

Passengers are routed to the space in front of the terminal building. The terminal building is located in the center of the facilities and serves as a landmark for passengers.

③ Water supply, drainage and sanitation facilities zone.

This zone serves as a separation belt for zone ② and ④, and water supply, drainage and sanitation facilities are concentrated here for better management.

④ Parking zone

A parking lot, bus washing equipment and fuel supply facilities for medium/long route buses are arranged in this zone. Night buses which arrived in the morning are washed, fueled, inspected and then parked in the parking lot until the time for departure.

The flow of medium/long route buses, city buses, taxis & tempos and passenger cars is completely separated from the ring road entrance to the ring road exit. Passengers flow as shown below:

City transport off-boarding platform → terminal building → medium/long route bus boarding platform and medium/long route bus off-boarding platform → terminal building front space → city transport boarding platform. The terminal building is at the center of the flow of passengers.

The terminal serves as the operation management center as well as passenger service center and is the function center of the facilities. Plants are planted on the separation belt and filled-up slope for protecting the site as well as providing a pleasant and harmonious environment.

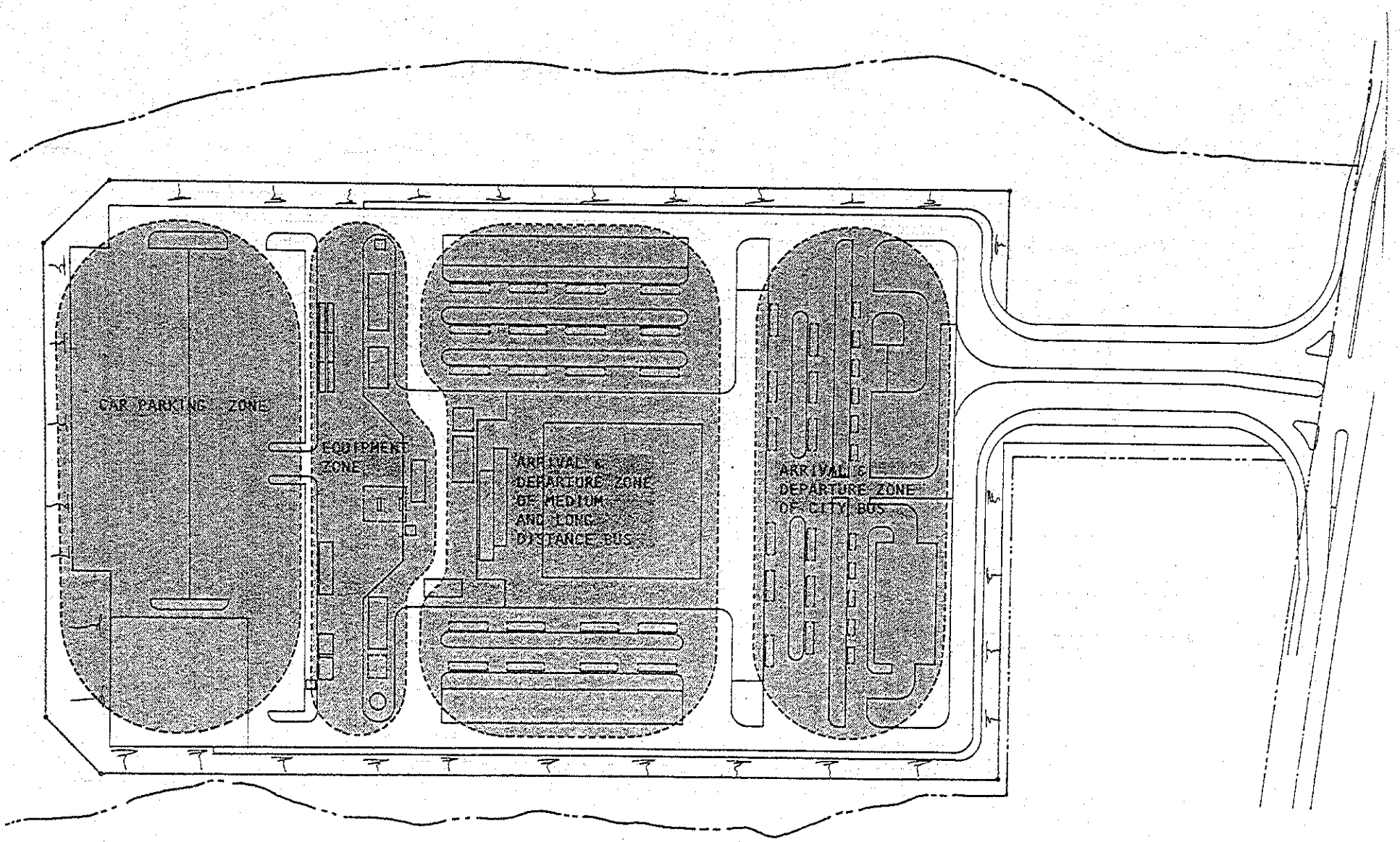


Fig. 4-3 Layout (Zoning)

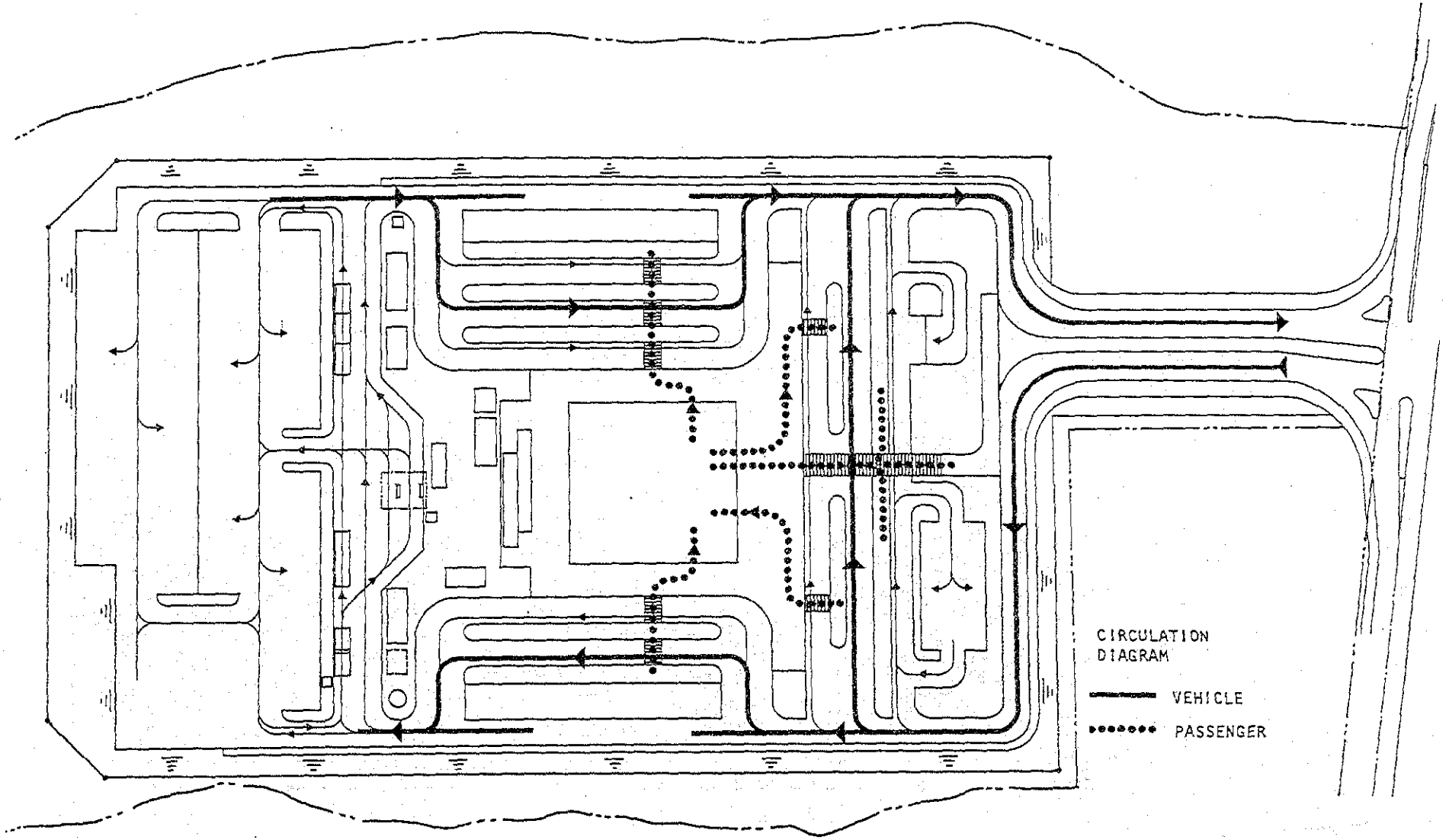


Fig. 4-4 Circulation Diagram