

### **3 PRESENT CONDITION OF ROADS AND TRANSPORT**

#### **3.1 Condition of Road Facilities**

##### **3.1.1 Existing Road Network and Classification of Roads**

###### **(1) Primary Road Network in the Study Area**

As shown in Figure 3.1.1, the existing Primary Road network in the Study Area considers the Tianfu Square as its center and is made up of ring roads and radial roads. There are 5 ring roads at present including the existing roads and roads under construction. The existing roads include the Inner Ring Road with a radius of 2 km, the 1st Ring Road with a radius of 3 km, and the 2nd Ring Road with a radius of 4 km. There are two roads under construction, namely the 3rd Ring Road with a radius of 7 km, and the Outer Ring Road with a radius of 11 km. The construction of these two roads is underway, and most exits for expressways and main carriageway have been constructed already. It is expected that the 3rd Ring Road and the Outer Ring Road will be completed by 2001 and 2002, respectively. The Inner Ring Road has four lanes for both directions with a total road width of 25 m. The 1st Ring Road and 2nd Ring Road have not only four lanes for both directions but also a segregated bicycle lane on both sides with a total width of 40 m. Furthermore, the 3rd Ring Road and the Outer Ring Road under construction have 8 lanes and 6 lanes for both directions, respectively, with a total width of 80m.

The radial road network is made up of roads crossing the whole city, including the East-West Primary Road, North-South Primary Road, 13 other Primary Roads, and Secondary Roads. It also includes five expressways. The East-West Primary Road is Shudu Road, having four lanes (both directions), with bicycle lanes and pedestrian lanes on both sides and a total width of 40-50 m. The North-South Primary Road consists of Renmin Bei-Lu, Renmin Zhong-Lu and Renmin Nan-Lu, crossing the city from north to south. The two primary roads cross with each other at the Tianfu Square at the center of the city.

The existing Expressways are managed by toll system. They all have eight lanes for both directions and are separated at the center. The entry points or terminals of these Expressways are at the 2nd Ring Road. However, after the completion of the 3rd Ring Road, these entry points will be moved to the new Ring Road.

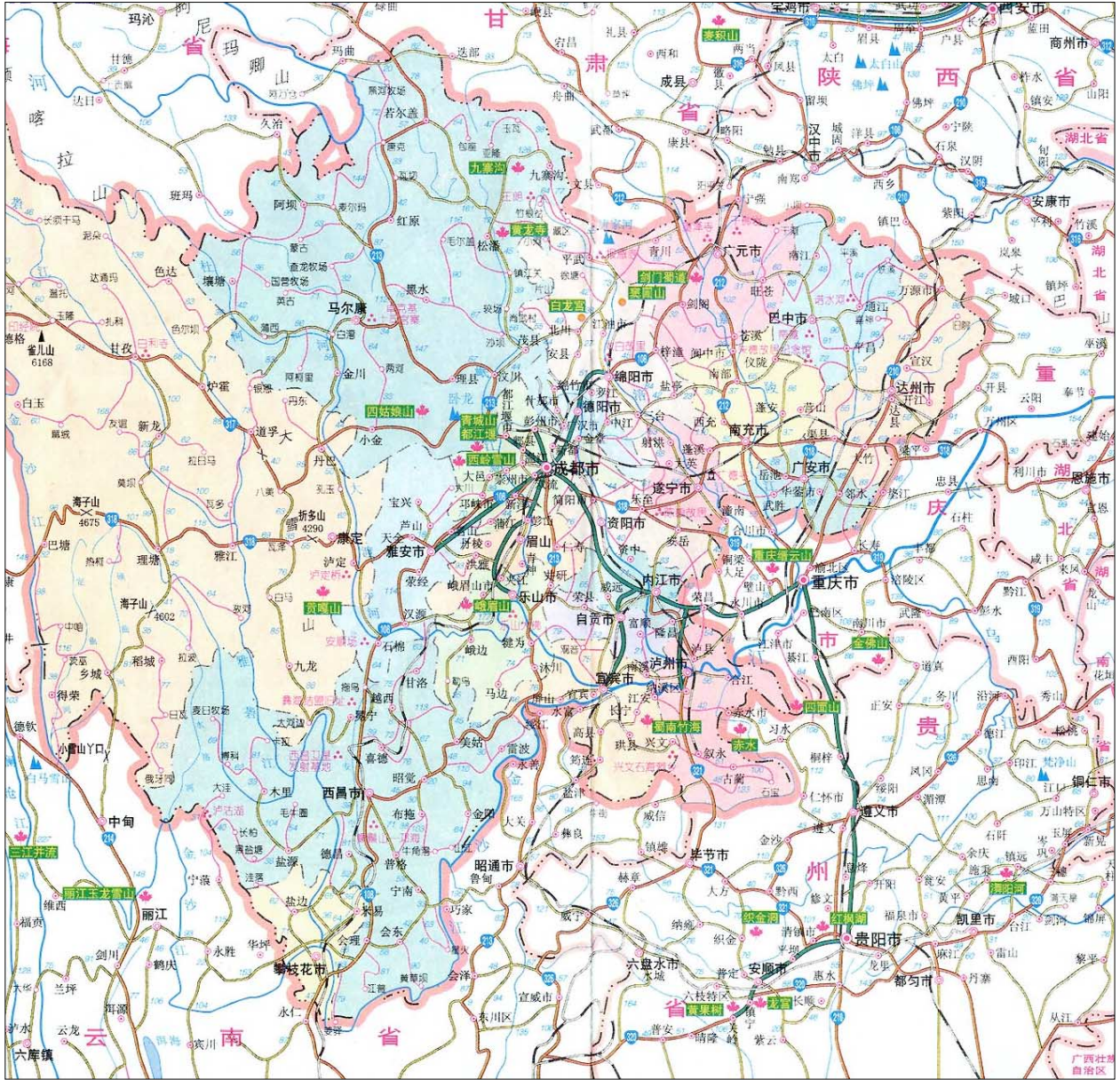
In addition, Chengdu and the local cities are linked by provincial roads, national roads and local roads, as shown in Figure 3.1.2.

Figure 3.1.1 The Primary Road Network in the Study Area





Figure 3.1.2 Intercity Road Network around Chengdu



## **(2) Classification of Roads**

### **1) Functional Road Classification**

In the “Design Standards for City Roads and Bridges” published by the Chinese Construction Industry Publishing House, the functional classification of roads falls under four types:

- a) Expressway;
- b) Primary Road;
- c) Secondary Road;
- d) Local Road.

The standards were developed by a committee composed of experts invited by the Chinese Government in 1996, and this became the design standards for roads and bridges in the whole country. The Expressway performs the important function of connecting main cities in the country and takes care of the long distance traffic between cities. At the same time, it eases the flow of traffic to and from the primary road. There are at present five expressways around Chengdu City with an additional new expressway being planned.

The Primary Road is the main basic road facility that makes up the skeletal structure of cities. This type of road ensures traffic flow and can handle relatively long distance traffic. In addition, it can handle the traffic flow from the Primary Road to the Secondary Road. In Chengdu City, the radial roads such as East-West Primary Road, North-South Primary Road and Chuan-Shan Highway belong to this type and so with the Ring Roads such as the 1st, 2nd, 3rd and the Outer Ring Road.

The Secondary Road is the basic road facility that services the local society in cities. Its functions include the following: to ensure the traffic flow, to ensure the city space, and to form the social area. At the same time, it can also handle both long-distance and short-distance traffic. In addition, it can also handle the traffic flow from the Secondary Road to a road at the next level. Among the existing roads in the urban area, the Hongxing Lu, Jiefang Lu and Dashi Lu are considered Secondary Roads.

In the functional classification of roads, the local road deals with the road space that is related closely to the community and mainly handles short-distance traffic. At the same time, it can receive the traffic flow from the Secondary Road. In the urban area, roads with widths of 5 -8 m belong to this type.

## 2) Road Classification On Management and Maintenance

In China, there are five types of roads based on construction size, road length and regional coverage, as well as their management and maintenance, namely: Expressway, National Road, Provincial Road, City Road, and County Road (or Local Road).

### a) Expressway

The expressway connects the main cities in the whole country or province and is managed as a toll road with complete in-out restriction. At present, there are 5 expressways in Chengdu City, which are managed by different agencies according to their length and characteristics. For example, since the Airport Expressway, which connects the airport and urban city, is shorter than others, it is managed by the Transport Bureau of Chengdu. On the other hand, Cheng-Yu Expressway, which crosses two provinces, is managed by the Planning Division of Central Government. As to the maintenance and operation of an expressway, a joint-venture company established by the investor-partners will take charge.

### b) National Road:

National roads form the primary road network, which connects the main cities in China, thus making up the skeletal structure of traffic in the whole country. In addition, it is the long-distance road crossing at least two provinces. Because of this, the project conceptualization, planning and design of national roads is planned by the Planning Department of the Central Government and Traffic Department of the provinces concerned. The construction, management and maintenance are handled by the Central Government.

### c) Provincial Road:

The entire China is made up of 34 provinces or provincial cities. A provincial road means that its entry point and terminal are in the same province. It connects the main cities in one province and make up the primary road network of a province. The permission of the Central Government is not necessary for the project development, planning, designing, management and maintenance of a provincial road since the Provincial Government can take care of that.

### d) City Road:

The Study Area is the urban area of Chengdu City. At present, the roads inside the 3rd Ring Road belong to the city roads. If national roads or provincial roads extend into the 3rd Ring Road, the extended part will become city roads. The responsibility of project development, construction, management and maintenance of these roads will belong to the City Government.

The following presents the classification of roads in the Study Area and surrounding

regions, based on the management and maintenance of roads:

**Expressways** (5 existing roads and 1 planned road)

- (1) Cheng-Mian Expressway-----Chengdu—Mianyang (GZ40)
- (2) Cheng-Yu Expressway-----Chengdu—Chongqing (GZ55)
- (3) Cheng-Nan Expressway-----Chengdu—Liangping (GZ55-1) (planned)
- (4) Cheng-Ya Expressway-----Chengdu—Leshan
- (5) Airport Expressway-----Chengdu—Airport
- (6) Cheng-Guan Expressway-----Chengdu—Dujiangyan

**National Roads**

- (1) Cheng-Ya Highway-----Chengdu—Ya'an (G108)
- (2) Cheng-A Highway-----Chengdu—Mao County (G213, G317)
- (3) Cheng-Zhao Highway-----Chengdu—Mingshan (G318)
- (4) Chuan-Shan Highway-----Chengdu—Deyang (G108)
- (5) Cheng-Ren Highway-----Chengdu—Renshou (G213)
- (6) Cheng-Yu Highway-----Chengdu—Jianyang (G313, G319, G321)

**Provincial Roads**

- (1) Tang-Ba Highway-----Chengdu—Nanjiang (S101)
- (2) Cheng-Xin Highway-----Chengdu—Meigu (S103)
- (3) Cheng-Le Highway-----Chengdu—Leshan (S104)
- (4) Cheng-Peng Highway-----Chengdu—Qingchuan (S105)

**The Main City Roads**

- (1) 1st Ring Road and 2nd Ring Road (Ring Primary Road)
- (2) Renmin Bei-Lu (Radial Primary Road)
- (3) Renmin Zhong-Lu (Radial Primary Road)
- (4) Renmin Nan-Lu (Radial Primary Road)
- (5) Shudu Road (Radial Primary Road)
- (6) Chuan-Zang Highway (Radial Sub-Primary Road)

### **3) Classification Based on Number of Traffic Lanes and Road Width**

As earlier discussed, based on functions, roads in urban areas are classified as Expressways, Primary Roads, Secondary Roads and Local Roads. Primary roads consist of the radial East-West Primary Road, North-South Primary Road, and the 1st and 2nd Ring Roads.

The typical cross-section of these roads has four lanes for both directions without center separation. Both sides have bicycle lanes of 6-7 m wide and sidewalks segregated by sub-separations. The total width (from one end of sidewalk to the other end) of these roads, or just the width of the area occupied by roads, varies slightly depending on section but should at least be 40-50 m. The Secondary Roads include radial roads like Jiefang Lu, Jianshe Lu, Hongxing Lu and Chuan-Zang Highway. The typical cross-section of these roads has four lanes for both directions with segregated sidewalks on both sides with an assured width of 20-30 m. Local roads are small streets that have only one or two lanes for both directions and an assured width of about 10 m.

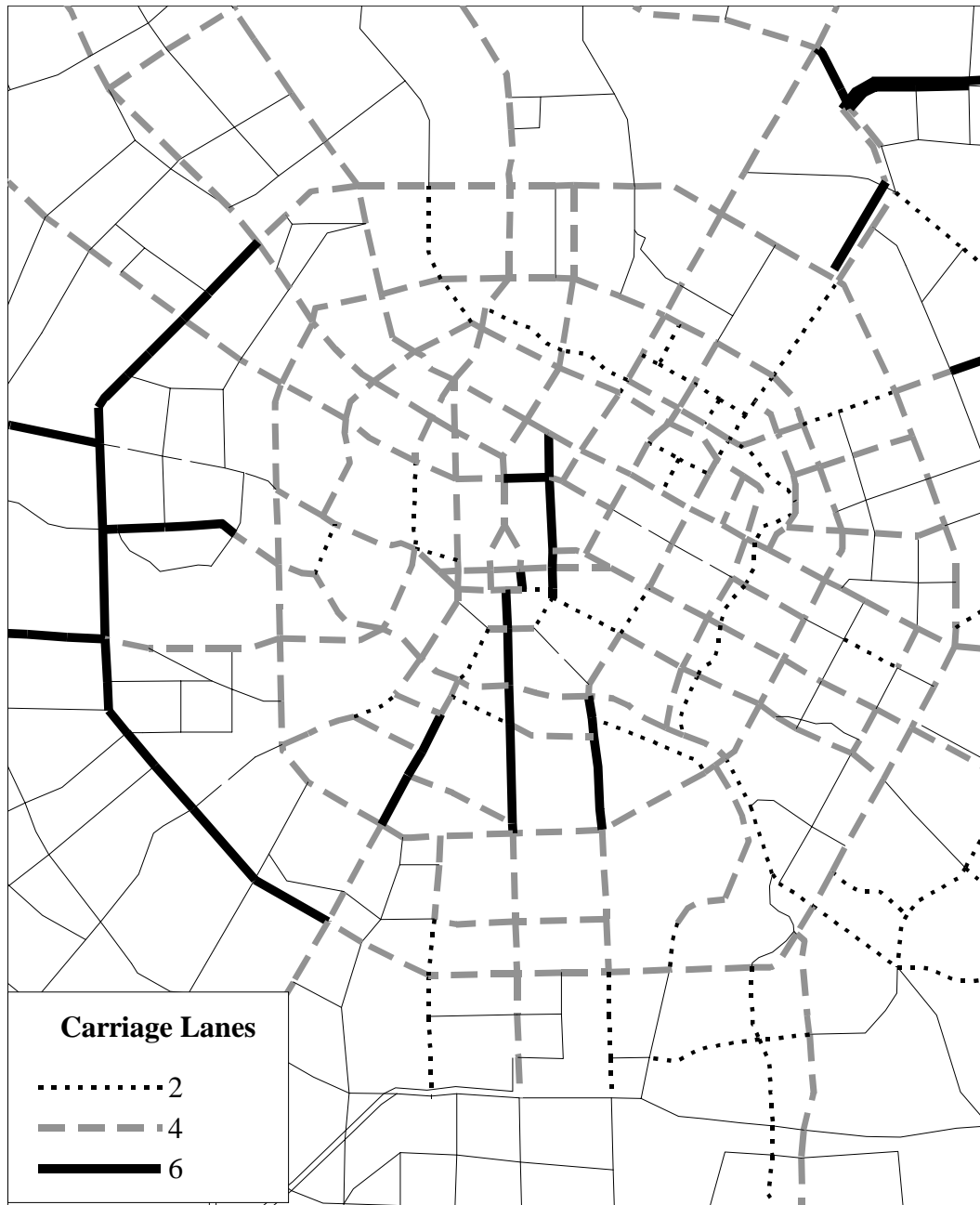
The road network according to number of lanes, as mentioned above, is illustrated in Figure 3.1.3, and the network according to road width is shown in Figure 3.1.4.

### **4) Classification Based on Road Utilization**

The road facilities include traffic space and devices that control traffic. There are many ways of using these facilities. For instance, construction of a subway under the road, overhead railway above the road, railway on the road, exclusive roads for buses and bicycles and sidewalks for pedestrians. The prevailing conditions concerning the utilization of existing roads in the Study Area are as follows:

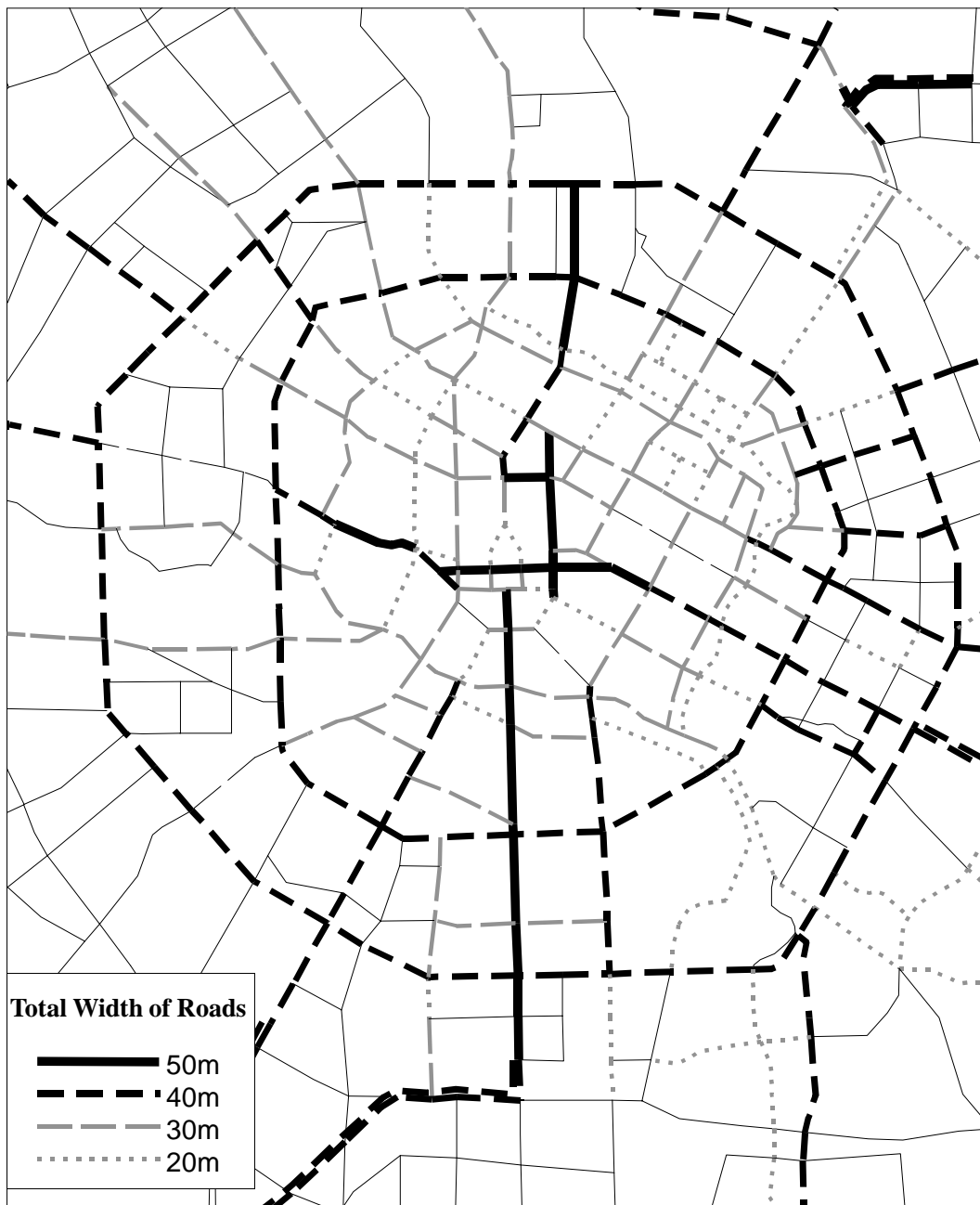
- a) There are no subways, overhead railways or on-road railways in Chengdu City. Currently there are 5 subway routes in the urban area that are being planned now. The 1st subway will be operational in 2010 and will be under existing roads (Renmin Bei-Lu, Renmin Nan-Lu and Renmin Zhong-Lu).
- b) Since there are no exclusive roads for buses at present, the buses and other vehicles are running on the same road.
- c) In Chengdu City, many people travel by bicycles. According to the surveys, during rush hours in the morning, the traffic volume of bicycles is 3,000-4,000 per hour on many of the Primary Roads. The traffic flow is concentrated on 7 m-wide bicycle lanes that are segregated on both sides of the Primary Roads. In the urban area, there are a number of these segregated bicycle lanes beside the carriageway lanes. Figure 3.1.5 shows the network of segregated bicycle lanes accompanying the carriageway lanes.

**Figure 3.1.3 Existing Road Network by Number of Lanes**

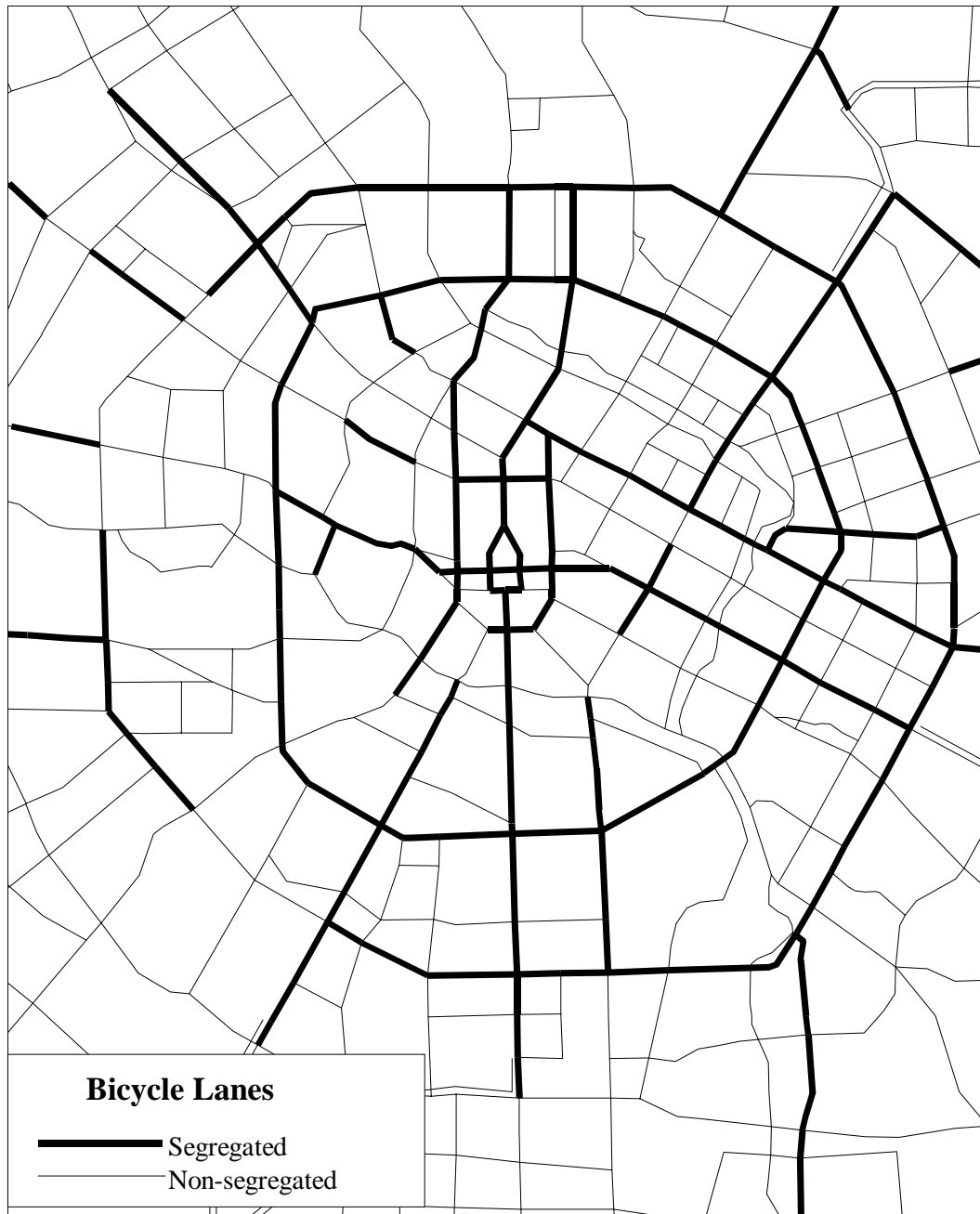




**Figure 3.1.4 Existing Road Network by Road Width**



**Figure 3.1.5 Network of Segregated Bicycle Lanes**



### **3.1.2 Primary Road Facilities and Traffic Conditions**

The JICA Study Team did some inventory surveys on the main roads in the Study Area in June 2000, and evaluated the information about the facilities and section condition of existing roads. Based on the survey results, the conditions of main road facilities are described as follows:

#### **(1) Typical Cross-Section of the Primary Road**

Based on the results of the surveys, the facility sizes of some main roads are shown in Table 3.1.1. Furthermore, the typical cross-section of Primary Road and Secondary Roads are shown in Figure 3.1.6. These are described in the following sections.

##### **1) Carriageway**

The Primary Roads have four lanes for both directions and the ensured width of one lane is 3.0-3.5 m. Most of the road surface is made of concrete pavement. Since there are no provisions for drainage on road shoulders that could protect the concrete pavement when it rains, water flows out along the length-direction and gathers at a lower place. The pavement conditions of Primary Roads are well maintained although there are some cracks and holes on the surface of Secondary Roads. The management and maintenance of these roads have not been perfected.

##### **2) Median Strip**

In Chengdu City, most roads are not separated in the center. This is true even for the Primary Roads that have over four lanes for both directions. Only the first and second sections of Renmin Bei-Lu are separated in the center. The ensured width of separations of these roads is 6-7 m with beautiful trees planted. Considering environmental protection, it is difficult to cut down these trees. On the first sections of Renmin Nan-Lu, a road having 6 lanes for both directions and without a center separation, movable fences were placed in the middle of the road to ensure safety.

##### **3) Outer Strip**

As mentioned above, there are segregated bicycle roads on both sides of some Primary Roads, such as East-West Primary Road, North-South Primary Road, and the 1st and 2nd Ring Roads. Both vehicle and bicycle lanes are divided by a 1.5-2 m wide outer strip. Within the outer strip, there are some trees such as Ginkgo and Conifer that are planted. Planted in the outer strip at the first, second and third section of Renmin Nan-Lu are big Conifer trees that are 20 meters high and have a trunk radius of 20-25 cm.

#### 4) Exclusive Bicycle Lane

The bicycle lanes on both sides of the road are 6-7 m wide with an outer strip. The one-way traffic rule is followed for each direction (but you can push the bicycle if you want to go on the opposite direction). In July 2000, traffic rules were partly modified. Previously, vehicles were prohibited to enter bicycle lanes. Now they can use these roads to turn right near some main intersections (borrow lanes to turn right).

#### 5) Sidewalk

Most of the roads in the urban area have sidewalks, except for some small streets. In spite of the difference in widths different by section, the sidewalk of the Primary Road is about 5 m wide and that of the Secondary Road is 3-4 m wide. Along the sidewalk, there are plant belts maintaining the green natural environment, with such trees as European Horse Chestnut, Willow, Crape Myrtle, Elm and Ginkgo.

### (2) Intersection Facilities

The number of existing intersections in the urban area inside the 2nd Ring Road is as follows:

- a) Grade Separated Intersection-----8 locations
- b) At-Grade intersections with traffic signal-----109 locations  
(some signals not functioning)
- c) Flyovers (Non access)-----2 locations
- d) At-Grade (Round about type)-----7 locations

Eight grade-separated intersections are all built at the intersections of the 2nd Ring Road and major radial roads. Each intersection is built with three levels. The 1st level is used for pedestrians and bicycles with a height limit of about 3 m. The 2nd and 3rd level, which connect to each other for vehicles, have an ensured height limit of 4.5 m, set according to basic standards. All of the interlacing systems use the half clover-leaf design, and part of the traffic flow is induced by the crossings on viaducts. The structure of most viaducts uses the PC concrete bridge, and there is almost no steel bridge. Furthermore, the viaduct in front of the South Railway Station is under construction. Now that the lower structure is already finished, the work on the upper structure is going to be started.

The 3rd and the Outer Ring Roads are designed as access control roads. At present, the viaducts of the ring roads and other roads are being constructed as well as the exits to the other main roads at intersections. These structures are almost all made of concrete.

### **(3) Traffic Condition**

#### **1) Bicycle Roads**

As mentioned above, there are bicycle lanes on both sides of carriageway in the East-West Primary Road, North-South Primary Road, 1st Ring Road and 2nd Ring Road. Secondary roads are ensured with a width of 20-30 m and have 4 lanes on both directions without bicycle lanes. Buses and cars use the inner two-lane carriageway of these secondary roads, while bicycles use the outer two lanes. So, the bicycle lanes and vehicle lanes are in the same section with no separation structure. Because of this, traffic flows on only two lanes of the carriageway while in fact there are four lanes.

#### **2) Bus Traffic**

As to bus traffic, buses are running on the same roads together with other private vehicles since there are no exclusive bus lanes at present. Bus stops are set at the outer strip on the bicycle roads or at sidewalks. When using the bus stops set at sidewalks, buses often mix with bicycles and that causes traffic jams since they take up a part of the bicycle lanes. The encroachment on bicycle lanes forces the bicycles out on the vehicle lanes, thus making traffic more complicated.



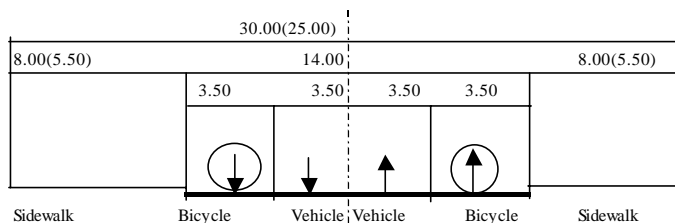
**Table 3.1.1 Cross-Section of Primary Roads**

Road Name	Road Classification of	Carriage Lanes Right Left	Width of Lanes (m) Right Left	Width of Median Strip (m)	Width of Bicycle Roads (m) Right Left	Width of Outer Strip (m) Right Left	Width of Sidewalk (m) Right Left	Total Width of Roads (m) Right Left	Possibility for Road Widening
Primary Road North-South	Primary	2	8.8	6.6	5.6	2.0	4.8	49.3	Very
Renmin Bei-Lu (2)	Road	2	9.5		5.6	2.0	4.3		Difficult
Primary Road North-South	Primary	2	9.2	6.8	5.6	2.0	4.3	48.9	Very
Renmin Bei-Lu (1)	Road	2	9.3		5.6	2.0	3.9		Difficult
Primary Road North-South	Primary	2	7.1	—	6.1	1.5	4.5	38.9	Very
Renmin Zhong-Lu	Road	2	7.1		6.1	1.5	4.8		Difficult
Primary Road North-South	Primary	3	8.5	0.4	7.0	3.4	4.7	49.6	Very
Renmin Nan-Lu (1)	Road	3	9.1	Fence	7.0	3.4	6.0		Difficult
Primary Road North-South	Primary	3	9.1	0.4	7.0	3.2	6.5	51.5	Very
Renmin Nan-Lu (2)	Road	3	8.8	Fence	7.0	3.2	6.2		Difficult
Primary Road North-South	Primary	2	9.2	—	7.0	3.5	8.8	56.6	Very
Renmin Bei-Lu (3)	Road	2	8.8		7.0	3.5	9.9		Difficult
Primary Road East –West	Primary	2	7.1	—	7.0	1.5	4.5	36.9	Very
Dongfeng Lu	Road	2	7.1		7.0	1.6	4.8		Difficult
Primary Road East –West	Primary	2	7.0	—	7.0	2.0	9.8	51.0	Very
Renmin Dong-Lu	Road	2	7.2		6.6	1.8	9.5		Difficult
Primary Road East –West	Primary	2	6.9	—	7.0	2.0	9.1	48.9	Very
Jinhe Lu	Road	2	7.0		7.0	2.0	7.6		Difficult
Primary Road East –West	Primary	3	12.8	—	4.8	2.0	—	38.9	Very
Qingjiang Dong-Lu	Road	3	11.8		5.1	2.0			Difficult
Inner Ring Road	Primary	2	7.1	—	—	—	—	25.0	Very
	Road	2	7.0						Difficult
1st Ring Road	Primary	2	7.0	—	6.0	1.5	5.7	41.0	Very
	Road	2	7.2		6.0	1.5	5.7		Difficult
2nd Ring Road	Primary	2	7.0	—	6.0	1.6	5.8	40.0	Very
	Road	2	7.1		6.0	1.6	4.6		Difficult
Hongxing Lu	Secondary	2	7.0	—	—	—	4.0	25.0	Very
	Road	2	7.1				4.3		Difficult
Xin Renmin Nan-Lu	Secondary	2	6.8	—	6.0	1.5	6.7	40.6	Very
	Road	2	7.1		6.0	1.5	5.0		Difficult
Jiefang Lu	Secondary	2	6.5	—	—	—	4.0	21.5	Very
	Road	2	6.5				4.1		Difficult

**Figure 3.1.6 Typical Cross-Section of Existing Road**

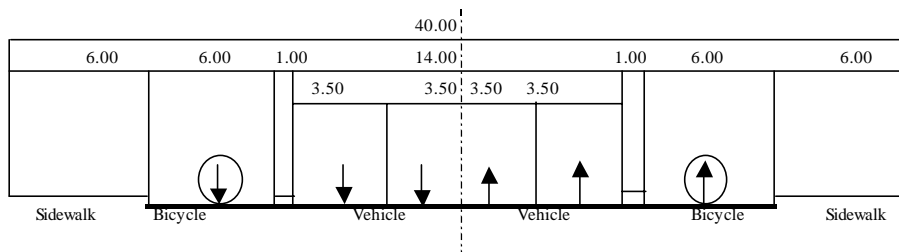
**1. Road width 30m (Secondary Road)**

Inner Ring Road, Hongxing Lu, etc.



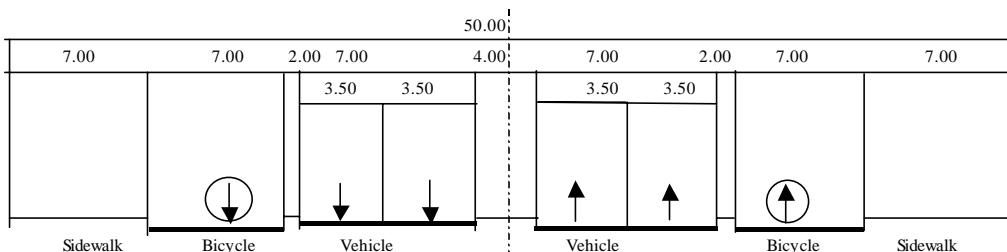
**2. Road width 40m (Primary Road)**

1st Ring road, 2nd Ring Road, Renmin Zhong-Lu, etc.

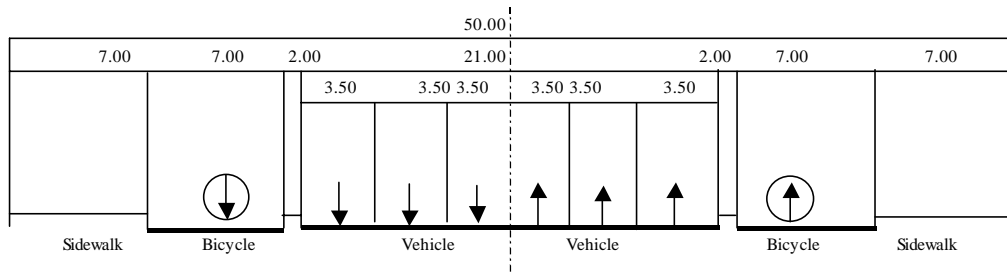


**3. Road width 50m (Primary Road)**

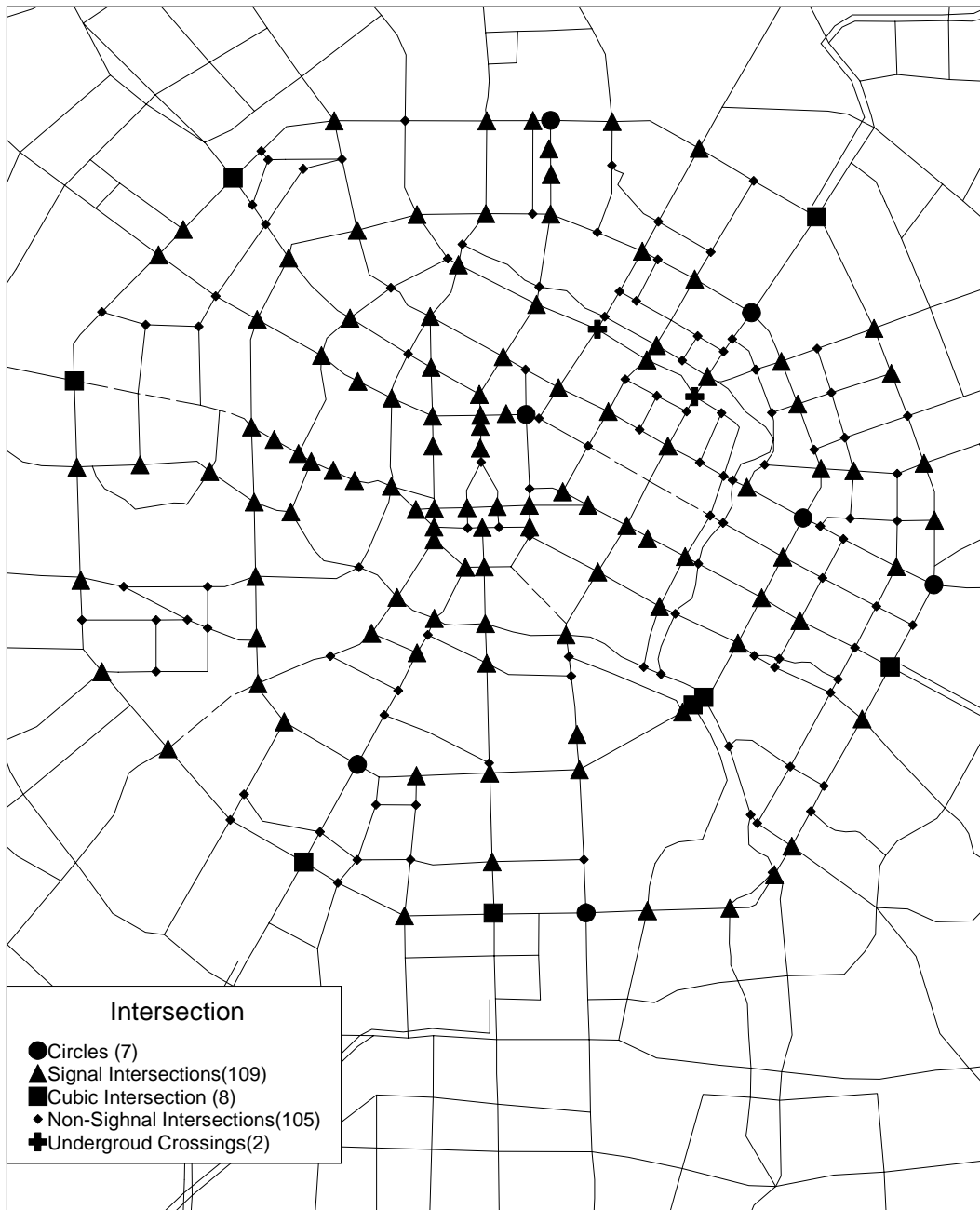
Primary road--Renmin Bei-Lu, etc.



Primary road--Renmin Nan-Lu, Shudu Road, Cheng-Guan Expressway, etc.



**Figure 3.1.7 Location of Intersections**



### **3.1.3 Problems of Primary Road**

#### **(1) Problems on Primary Road Facilities**

As earlier discussed, the basic road network in urban areas is made up of Primary Roads and Secondary roads, most of which are ring or radial type. While constructing this effective network, the main roads are maintained and the natural environment is preserved. Based on the road inventory surveys and observations in other places, the following problems on road facility can be pointed out:

##### **1) Road Cross Section not Developed According to Road Hierarchy**

To make the use of existing primary and secondary roads safe and effective, there is a need to formally construct cross-sections based on the road hierarchy. However, the difference between cross-sections of primary and secondary roads in Chengdu City is not so clear. For example, since there is no distinct structure for primary and secondary roads at main intersections, the cars crossing the intersections are caught up in the complicated traffic flow. This situation results in accidents and traffic jams. This points to the need to distinguish the primary and secondary roads at intersections and to establish a system that can ensure the smooth flow of traffic.

##### **2) Shortage of Grade Separated Intersections**

There are five grade-separated intersections located at the intersections of the 2nd Ring Road and radial roads. Primary roads have over four carriageway lanes handling large traffic volume of cars and a much larger volume of bicycles. Since intersections on these roads are dealing with complicated traffic flow, the building of flyovers is suggested to form a highly effective network. The main places with congested traffic are the regions around bus terminals, short distances between two intersections of main roads, shopping centers, and at the intersections of main roads. Based on the information gathered, it was revealed that the main reason causing the congested traffic were the vehicles taking the at-grade crossing at intersections. Therefore, it is suggested that a grade-separated structure be used as much as possible to ease the flow of traffic at congested intersections.

##### **3) Shortage of Traffic Safety Facility**

Regarding the traffic safety facilities on roads having over four lanes carriageway, the setting up of median strips and fences to prevent traffic accidents is suggested to ensure smooth traffic flow and rationalize the flow of bicycles. There are almost no safe facilities and median strips on existing roads in Chengdu City, except for part of Renmin Bei-Lu. Incidents occur that cause traffic accidents and decrease traffic capacity, such as cars turning back, people crossing the road and changing routes unreasonably.

#### **4) Inadequate Bus Stop Facilities**

At present, most bus stops are at sidewalks and stop-lines are using vehicle lanes. When a bus stops, it occupies a portion of a vehicle lane, blocking traffic. So therefore, it is important to ease up traffic congestion by providing proper bus stops and increasing traffic capacity of roads. To set bus bay areas, width of sidewalks need to be decreased and some trees need to be moved to the green belts. Investigations on bus bay areas need to be conducted as soon as possible.

#### **(2) Other Problems**

##### **Poor Traffic Discipline**

There is no connection between the problems of traffic rules and road facilities. Even with safe and highly effective road facilities, without good traffic discipline, traffic accidents will still occur. The traffic discipline in Chengdu City is not too good. For instance, there are violations that occur everywhere such as changing traffic lane unreasonably, overtaking, turning back of cars, exceeding speed limits, parking cars on prohibited places, turning left at prohibited crossings, beating the red light at controlled intersections, and people or bicycles crossing roads at places without pedestrian or bicycle lanes. This is the biggest reason for traffic accidents and the decrease in traffic capacity. In fact, there are many traffic accidents everyday, and after it has been dealt with, traffic has already mounted up. Therefore, policies and measures should be taken such as: enhancing traffic control, establishing training schools, and re-educating drivers when changing their license.

### **3.1.4 Road Network Development Plan of Chengdu City**

#### **(1) Organization of Road Administration in Chengdu City**

In China, the trunk roads crossing over two provinces are classified as national roads. The project development, planning, design, construction and maintenance of national roads are controlled by the Traffic Department in the Central Government. Furthermore, the road with starting point and terminal located in the same province is regarded as provincial road. The Traffic Department of the Province controls its project development, planning, design, construction and maintenance.

Chengdu is the capital of Sichuan Province. The responsibility for development, construction and maintenance of the roads in Chengdu City are with the city government. The main departments administering the roads in Chengdu City are the Construction Administration Committee of City, Project Department of the City, Public Affairs Department, and Road Construction Headquarters that belong to the Construction Administration Committee of the City.



The Construction Administration Committee of the City is the department that confirms and makes budgets for infrastructure projects such as roads, railways, buildings, water pipelines and electric devices implemented by relative units. It is the overall administrative department for all construction. When evaluating large projects, the Construction Administration Committee must get the approval of the city government. As to the construction of roads, the Project Department of the City will make a project study first and send it to the Construction Administration Committee for approval. They make the detailed design according to the submitted project, after which they will transfer the construction task to the assigned departments such as the Public Affairs Department, Traffic Department and Road Construction Department.

The Traffic Department of the City is the department responsible for the construction of roads according to the projects made by the Project Department. The administrative range of the department is restricted to the management of existing roads out of the 3rd Ring Road. Furthermore, the sub-construction works such as those for electrical devices and water pipelines accompanying the road are performed by the Power Department and the Water Company that belong to the Public Affairs Department. The construction of roads outside the Outer Ring Road needs to be consulted with the Traffic Department of Sichuan Province to decide on which unit will take control. Ongoing construction works performed by the Traffic Department of the City are the west part of the Outer Ring Road and the radial roads extending out of the Outer Ring Road. The Traffic Department of Sichuan Province, on the other hand, controls the east part of the Outer Ring Road.

The Trunk Road Construction Department that belongs to the Construction Administration Committee of the city takes control of road construction inside the 3rd Ring Road (including electric and water devices). The material project performed by the Road Construction Headquarters is the 3rd Ring Road, other new roads inside the 3rd Ring Road, and the reconstruction of existing roads. In addition, the Traffic Department of the City and the Trunk Road Construction Department are separate units of the Construction Administration Committee of the City, and they established the “Construction Office of 5 Roads and 1 Bridge”. This is an office established for special projects, in which the “5 roads” include the Extension Lines of Renmin Nan-Lu, the 3rd Ring Road, Cheng-Long Highway and Cheng-Luo Highway. The “1 bridge” refers to the construction of a flyover in front of the South Railway Station.

## **(2) On Going or Committed Road Development Project by Chengdu City**

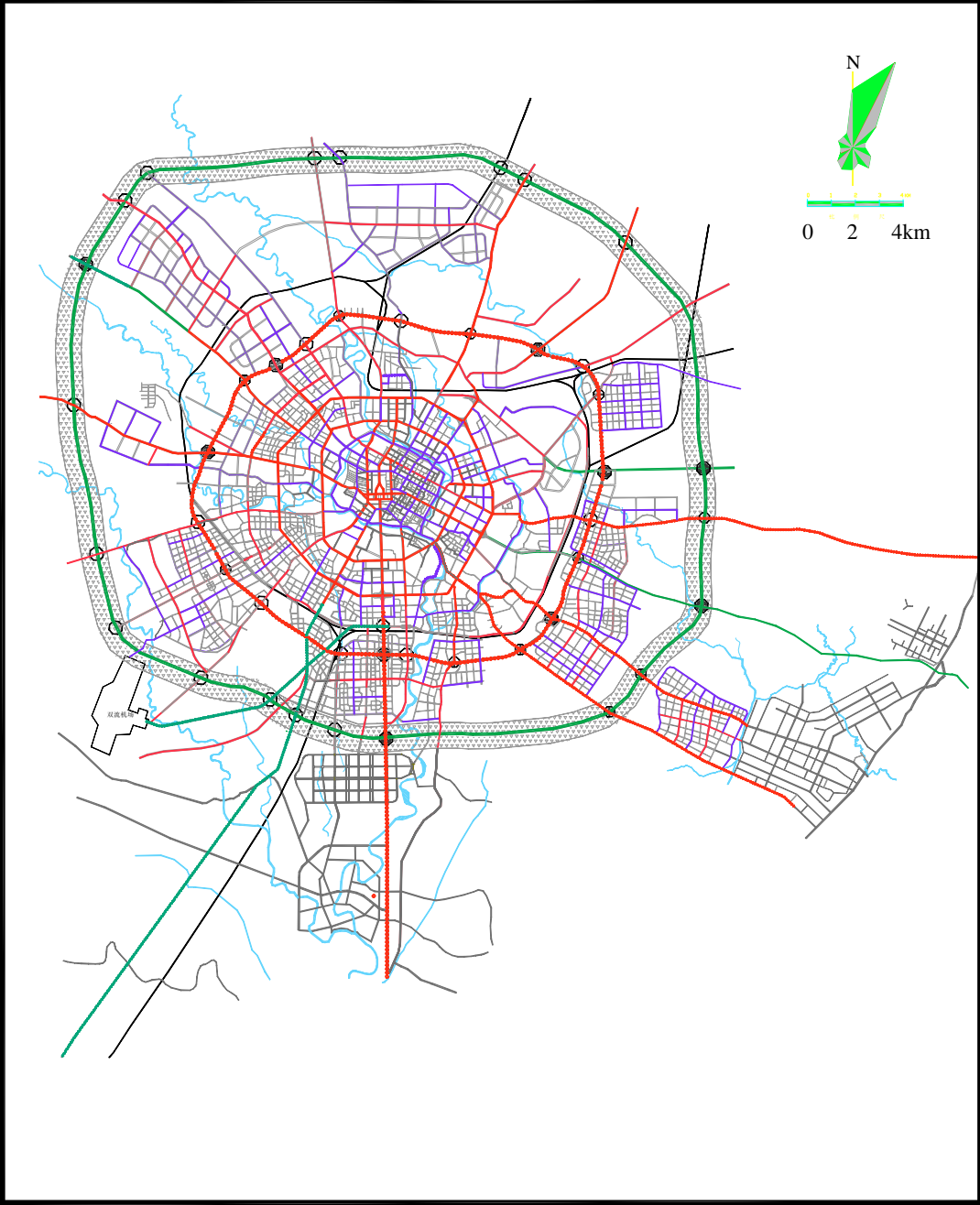
In 1996, the Government of Chengdu made a long-term program until 2020 for the region inside the Outer Ring Road. In addition, they also made the 2010 Road Project according to that long-term program. This Road Project (until 2010) got the approval of the City Government in 1999. The target date of the Study is the same as that of the




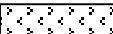
Road Project approved by the government. Considering that the project was already approved, the study regards it as a committed project. The network of planned roads in the Committed Road Project by the Government of Chengdu City is shown in Figure 3.1.8, and the summary information about planned roads in that network are shown in Table 3.1.2.

**Table 3.1.2 Planned Roads by Chengdu City (Committed)**

Name of Planned Roads	Road Type	Carriage Lanes	Total Width (m)	Administrate Department	Target Completion	Process State
Cheng-Guan Expressway	Expressway	6	33.5	Center Government Sichuan Province	2010	Under Planning
Cheng-Yu Expressway	Expressway	6	33.5	Center Government Sichuan Province	—	Finished
Cheng-Ya Expressway	Expressway	6	33.5	Center Government Sichuan Province	—	Finished
Airport Expressway	Expressway	6	33.5	Traffic Department	—	Finished
Cheng-Guan Expressway	Expressway	6	33.5	Sichuan Province Traffic Department	—	Finished
Cheng-Mian Expressway	Expressway	6	33.5	Center Government Sichuan Province	—	Finished
Cheng-Luo Highway	Primary Road	4	31.0	Office of 5 Roads and 1 Bridge	2003	Under Construction
Old Cheng-Yu Highway	Primary Road	4	35.0	Office of 5 Roads and 1 Bridge	2003	Under Construction
Cheng-Long Highway	Primary Road	4	35.0	Office of 5 Roads and 1 Bridge	2003	Under Construction
Extended Renmin Nan-Lu	Primary Road	4	80.0	Office of 5 Roads and 1 Bridge	2003	Under Construction
3rd Ring Road	Primary Road	8	80.0	Office of 5 Roads and 1 Bridge Road Headquarters	2003	Under Construction
Outer Ring Road	Primary Road	6	80.0	Traffic Department Sichuan Province	2002	Under Construction
Old Chuan-Zang Highway	Primary Road	4	31.0	Traffic Department	2003	Under Construction
New Chuan-Zang Highway	Primary Road	4	35.0	Traffic Department	2003	Under Construction
Caojin Lu	Primary Road	4	35.0	Traffic Department	2003	Under Construction
Extended Shawan Lu	Primary Road	—	—	—	2010	Under Planning
Cheng-Qi Highway	Primary Road	4	31.0	Traffic Department	2003	Under Construction
Old Cheng-Wen Highway	Primary Road	4	33.5	Traffic Department	2003	Under Construction
Reconstruction of Roads inside 3rd Ring Road	Secondary Road	2-4		Trunk Road Construction Department	2003	Under Planning Under Construction
Construction, Reconstruction between 3rd-Outer Ring Road	Secondary Road	2-4		Local Road Division	2010	Under Planning Under Construction

**Figure 3.1.8 Planned Road Network for the Study Area**



Legend	
	Primary Road
	Secondary Road
	Expressway
	Greenery

### **3.1.5 Design Criteria of Roads**

#### **(1) Design Standards of Roads**

In China, there are many design standards and codes used in the project development, design and construction of civil structures and buildings. Within the set range, especially the range of roads, the main design standards and codes are as follows:

##### **1) Design Standards for City Roads and Bridges**

- a) Design Standards for Local Roads: GBJ22—87
- b) Specialized Work Standards for Road Construction: J124—88
- c) Specialized Work Standards for Road Construction Drawing: GB50162—92
- d) Design and Project Standards for Development of Urban Residence: GM50180—93
- e) Design and Project Standards for Traffic in Urban Roads: GB50220—95
- f) Design Essentials for Urban Bridges: CJJ11—93
- g) Design Standards for Urban Roads: CJJ37—90
- h) Design Essentials for Urban Illumination: CJJ45—91

##### **2) Design Standards for Public Transportation**

##### **3) Design Standards for Road Drainage: JTJ018—97**

##### **4) Administrative Standards for Construction of Urban Roads and Bridges**

##### **5) Design Standards for Road Lines: JTJ011—94**

##### **6) Concrete Standards for Roads: JTJ012—94**

##### **7) Pitch Standard for Roads: JTJ014—97**

The design standards closely related to the Study are the Design Standards for Urban Roads, Design Essentials for Urban Bridges, and Standards for Public Transportation. The Design Standards for Urban Roads includes the rules on project and design, enumerated below.

- a) Standards on design speed, vehicles and building regulation;
- b) Standards on traffic capacity of roads;
- c) Standards on cross-section elements of roads;
- d) Standards on plane design and profile design;
- e) Standards on design of intersections;
- f) Standards on pavement and construction of road-bed;
- g) Standards on design of road drainage; and
- h) Standards on design of structure of roads.

## (2) Design Standards and Geometric Design Standards

The standards for the geometric design of urban roads are prescribed in the “Design Standards for Urban Roads (CJJ37—90)” which is mentioned above. The standards used in the Study are all according to the “Design Standards for Urban Roads.” The main design standard and geometric design standards values, which are given by the above standards, are described as follows:

### 1) Design Speed Corresponding to Road Types

The design speed of roads is set according to their functional classification. As discussed in the earlier sections, roads are classified based on functions as Expressway, Primary Road, Secondary Road and Local Road. To set the design speed, it needs to consider the efficiency of road investment. In order to conform with the variation of landform, except expressway, all the other roads are divided into Level 1, Level 2 and Level 3 to set design speed, respectively. The design speed, which is set by road types, is shown in Table 3.1.3.

**Table 3.1.3 Road Classification and Design Speed**

Road Class	Expressway	Primary Road			Secondary Road			Local Roads		
Road Level		1	2	3	1	2	3	1	2	3
Design Speed (km/h)										
(max)	80	60	50	40	50	40	30	40	30	20
(min)	60	50	40	30	40	30	20	30	20	-

### 2) Building Regulation

When constructing buildings near carriageway lanes, bicycle lanes, pedestrian lanes and railways, the basic building regulation to these road facilities must correspond to the following measurements:

- a) Building regulation to Carriageway Lanes = 4.5 m
- b) Building regulation to Tram Lanes without Electric Cables = 5.0 m
- c) Building regulation to Tram Lanes with Electric Cables = 5.5 m
- d) Building regulation to Bicycle Lanes and Passenger Lanes = 2.5 m



### 3) Cross-Section Elements

The width of cross-sections elements are shown in Table 3.1.4, which are set corresponding to design speed.

**Table 3.1.4 Width of Cross Section Elements**

Constituting Element	Width (m)	Remarks
Width of Carriageway Lane (m)	3.75	Design Speed > 40km/h
	3.50	Design Speed < 40km/h
	3.00	Bus Bay
Width of 1 Bicycle Lane (m)	1.0	
Width of 1 Triple-Bicycle Lane (m)	2.0	
Width of Sidewalk (m)	3.0	Common Roads
	5.0	High Density Area
Width of Median Strip (m)	3.00	Design Speed = 80km/h
	2.50	Design Speed = 60, 50km/h
	2.00	Design Speed = 40km/h
Width of Outer Strip (m)	2.00	Design Speed = 80km/h
	1.50	Design Speed = 60km/h
Width of Road Shoulder (m)	1.00	Design Speed = 80km/h
	1.75	
	0.75	Design Speed = 60, 50km/h
	1.50	
	0.50	Design Speed = 40km/h
	1.25	
Longitudinal Grade (%)	1.0	Concrete Pavement
	2.0	
	1.5	Asphalt Pavement
	2.0	

### 4) Geometric Design Standards

The necessary standard values of geometric in road design are shown in Table 3.1.5, corresponding to the design speed.

**Table 3.1.5 Major Geometric Design Standards**

Elements / Design Speed	80	60	50	40	Remarks
Min. Radius of Curvature (m)	250	150	100	70	
Min. Length of Vertical Curves (m)	70	50	45	35	
Min. Radius of Vertical Curvature (m)	2000	1000	700	500	
Maximum Vertical Gradient (%)	4	5	5.5	6	
Ultimate Vertical Gradient (%)	6	7	7	8	
Sight Distance (m)	110	70	60	40	

### 3.1.6 Traffic Capacity on Road

Traffic capacity on the road depends on traffic characteristics, land use of roadside area, road facilities and so on. Thus, even for the roads that have the same cross-section, capacity differs from each other. Therefore, it is not very meaningful to discuss in detail the typical capacity of roads. In this section, road capacity is dealt with as one of the criteria to roughly determine the number of lanes required in the future for project planning and evaluation.

Based on this understanding, capacity of several representative roads existing in Chengdu was estimated. Capacity for exclusive bus roads and bicycle roads are also discussed in the following sections.

#### (1) Capacity of Multi-Lane and Two-Lane Roads

##### 1) Methodology for Calculating Capacities

The definition of traffic capacity is three-fold, i.e.: Basic Capacity, Possible Capacity and Design Capacity. It is expressed as the number of vehicles (or in PCU) per hour, per direction and per lane. Basic capacity is the theoretical capacity when free flow is guaranteed, and possible capacity is the practical capacity applied to specific roads considering physical road structure and traffic characteristics. Design capacity is determined based on possible capacity taking into account the future levels of service (A, B, C, etc.).

This section focuses on possible capacity, which is expressed in the following formula that multiplies various factors with basic capacity:

$$C = C_b * F_s * F_y * F_t * F_e$$

Each component of this formula is briefly described below.

##### a) Possible Capacity (C)

This is calculated by multiplying a series of factors with basic capacity.

##### b) Basic Capacity (C<sub>b</sub>)

Basic Capacity was originally determined in several countries including USA and Japan by measuring traffic volume and physical structure of roads. Its value is 2,500 PCU/hour/lane in the case of multi-lane roads. However, in Tokyo, the value is set at higher 2,800 PCU/hour/lane based on actual surveys (due to shorter headway on urban streets).

In the case of two-lane roads, basic capacity becomes smaller at 1,250 PCU/hour/lane due to the possible friction between directional flows.

**c) Lane Width Factor (Fs)**

The minimum lane width that ensures smooth traffic flow without any friction with the neighboring lanes is 3.50 m. The factor is 1.0 at 3.50 m or above, 0.94 at 3.25 m and 0.85 at 3.00 m.

**d) Lateral Clearance Factor (Fy)**

Lateral clearance is the distance from the edge of the carriageway to the roadside obstacles such as trees, streetlights, traffic signs and guardrails. The minimum distance that gives no hindrance to traffic flow is empirically set at 1.75 m. The factor is 1.0 at 1.75 m or above, 0.98 at 1.00 m and 0.90 with no lateral clearance .

**e) Heavy Vehicle Factor (Ft)**

Heavy vehicles such as trucks and buses occupy a large space of roads and reduce running speed at rising/falling sections, thus reducing road capacity. This factor is determined depending on the proportion of heavy vehicles in traffic flow and longitudinal gradient. In the case of multi-lane roads, the factor at 5% of heavy vehicles' share is 0.96 and 0.91 for flat roads and mountainous roads, respectively.

**f) Roadside Activity Factor (Fe)**

Depending on roadside activities, road capacity also differs. For instance, road capacity decreases considerably in urban areas due to crossing pedestrians and other roadside activities. This factor was determined by roadside land use as shown in Table 3.1.6.

**Table 3.1.6 Capacity Correction Factor by Roadside Activity**

Area	Factor
Rural	1.0-0.9
Suburban	0.9-0.8
Urban	0.8-0.7

**2) Estimate of Road Capacity of Existing Roads**

According to the methodology explained above, road capacity was estimated for several existing roads based on their carriageway structure, traffic characteristics and roadside conditions. The result is shown in Table 3.1.7. In addition, the data used in this calculation were obtained by the road inventory survey conducted by the Study Team.

However, some four-lane roads including Hongxing Lu and Inner Ring Road are actually two-lane roads for vehicles because bicycles use the two outer lanes. As

stated earlier, the capacity of two-lane roads is 1,250 PCU/hour/lane. If this is applied, capacity of roads of this type decreases to 600 PCU/hour/lane or 11,000 PCU/day (both directions).

In China, road capacity is estimated based on “Design Standards for City Roads and Bridges.” Its representative values are shown in Table 3.1.8.

**Table 3.1.7 Capacity of Selected Existing Roads**

Road Name	Lane Width (m) and Its Factor	Lateral Clearance (m) and Its Factor	% of Heavy Vehicles and Its Factor	Roadside Activity and Its Factor	Basic Capacity (PCU/lane/hour)	Possible Capacity (PCU/lane/hour)	Number of Vehicle Lanes	Estimated Road Capacity (PCU/day)
East-West Trunk Line	3.5	0	5-7%	Bicycle Road	2,500	1600	4	58000
	1.00	0.81	0.93	0.85				
Renmin Bei-Lu	4.0	0	5-7%	Bicycle Road	2,500	1600	4	58000
	1.00	0.81	0.93	0.85				
Renmin Nan-Lu	3.0	0	5-8%	Bicycle Road	2,500	1360	6	74000
	0.85	0.81	0.93	0.85				
Xin Renmin Nan-Lu	3.5	0	5-7%	Bicycle Road	2,500	1600	4	58000
	1.00	0.81	0.93	0.85				
Inner Ring Road	3.3	0	3-5%	Urban	2,500	1240	4	45000
	0.94	0.81	0.93	0.70				
First/Second Ring Road	3.3	0	10%	Bicycle Road	2,500	1500	4	54000
	0.94	0.81	0.93	0.85				
Hongxing Lu	3.3	0	3-5%	Urban	2,500	1240	4	45000
	0.94	0.81	0.93	0.70				
Jiefang Lu	3.0	0	5-8%	Urban	2,500	1120	4	40000
	0.85	0.81	0.93	0.70				
Yingmenkou Lu	3.3	0	5-8%	Urban	2,500	1240	4	45000
	0.94	0.81	0.93	0.70				
Qinghua Lu	3.5	0	5-8%	Urban	2,500	1320	6	72000
	1.00	0.81	0.93	0.70				

Note : 1) Excludes bicycle roads (lanes).  
2) Hourly capacity is assumed at 11% of daily capacity.

**Table 3.1.8 Possible Capacity of Roads Applied in China**

Design Speed (Km/h)	50	40	30	20
Possible Capacity (PCU/lane/hour)	1,690	1,640	1,550	1,380

Source: “Design standard of Urban Road”(JJ-37-90)

By comparing road capacities applied in China and Japan, it may be concluded that the ordinary value of road capacity is 1,300 to 1,600 PCU/hour/lane although it differs depending on actual conditions of roads.

## (2) Capacity of Exclusive Bus Lanes

The development of exclusive bus lanes segregated from other vehicle lanes is one of the candidate measures to improve the running condition for buses. Capacity of bus exclusive lanes can be calculated in the same manner as explained above.

### 1) Assumptions

The assumptions and conditions for estimating capacity of exclusive bus lanes are:

- a) Completely segregated from other modes of transport;
- b) 4-lane road with 2 lanes for each direction;
- c) Lane width of 3.00 m and 3.50 m (two types);
- d) Lateral clearance at 0.50 m;
- e) Ratio of heavy vehicles at 100%;
- f) No roadside obstacles;
- g) Basic capacity is 1,250 PCU/hour/lane and 2,500 PCU/hour/lane for 2-lane and multi-lane road, respectively; and
- h) PCU of buses at 2.5.

### 2) Capacity Calculation

Based on the assumptions/conditions above, the capacity of bus exclusive lanes was calculated as shown in Table 3.1.9. The formula used is:

$$C = C_b * F_s * F_y * F_t * F_e / PCU$$

**Table 3.1.9 Capacity of Roads with Exclusive Bus Lanes**

	Lane Width	
	3.00 m	3.50 m
Basic Capacity (Cb) (PCU/hour/lane)	2,500	2,500
Lane Width Factor (Fs)	0.85	1.00
Lateral Clearance Factor (Fy)	0.75	0.75
Heavy Vehicle Factor (Ft)	0.75	0.75
Roadside Activity Factor (Fe)	1.00	1.00
PCU of Buses	2.5	2.5
Capacity per Lane (Buses/hour)	480	560
No. of Lanes per Direction	2	2
Capacity per Direction (Buses/hour)	960	1,120

The above calculation shows that the capacity of two-lane exclusive bus roads is 960-1,120 vehicles per hour assuming a headway of 3.2-3.8 seconds. However, the actual bus operation requires a far longer headway, reducing the practical capacity of roads with exclusive bus lane. For instance, only 120 buses can pass the road in an hour if each bus stops for 30 seconds at the same bus stop. Thus, the practical capacity of exclusive bus roads is determined largely by design and function of bus stops rather than by the capacity of roads.

### (3) Capacity of Bicycle Roads

The Chinese “Design Standards for City Roads and Bridges” describes the methodology for calculating the capacity of bicycle-lane roads as follows:

The width of bicycle lane is 1.0 m and its capacity is calculated by the following formula:

$$N_{pb} = 3,600 * N_{bt} / (T_i * (W_{pb} - 0.5))$$

where

$N_{pb}$ : Possible capacity of bicycle lane (bicycles/hour/lane)

$T_i$  : Duration of survey (seconds)

$N_{bt}$  : No. of bicycles counted

$W_{pb}$ : Width of bicycle road

The recommended value for  $N_{pb}$  above is 2,100 for segregated bicycle-lane road and 1,800 for non-segregated bicycle road. However, considering the influence of intersections, this value is reduced to 1,200 and 800 for segregated and non-segregated bicycle-lane road, respectively.

## 3.2 Characteristics of Existing Road Traffic

### 3.2.1 Traffic Volume

Analysis was undertaken based on the traffic count surveys on the screen line and cordon line, which divided the study area into three; namely: the CBD, outskirts of CBD and suburban areas. Figure 3.2.1 shows the 24-hour traffic volume at the survey locations. Table 3.2.1 shows the characteristics of road traffic in the three areas. Table 3.2.2 shows the directional peak-hour traffic volume at 20 main intersections.

Among various different transport modes, people prefer bicycle the most. Its volume is very substantial especially on major trunk roads of the CBD and outskirts of CBD, ranging from 60,000 to 70,000 per day, and it reaches 10,000 even in the suburban areas. This would be equivalent to 35,000 cars or 3,500 buses provided average occupancy is 2 persons for a car and 20 persons for a bus.

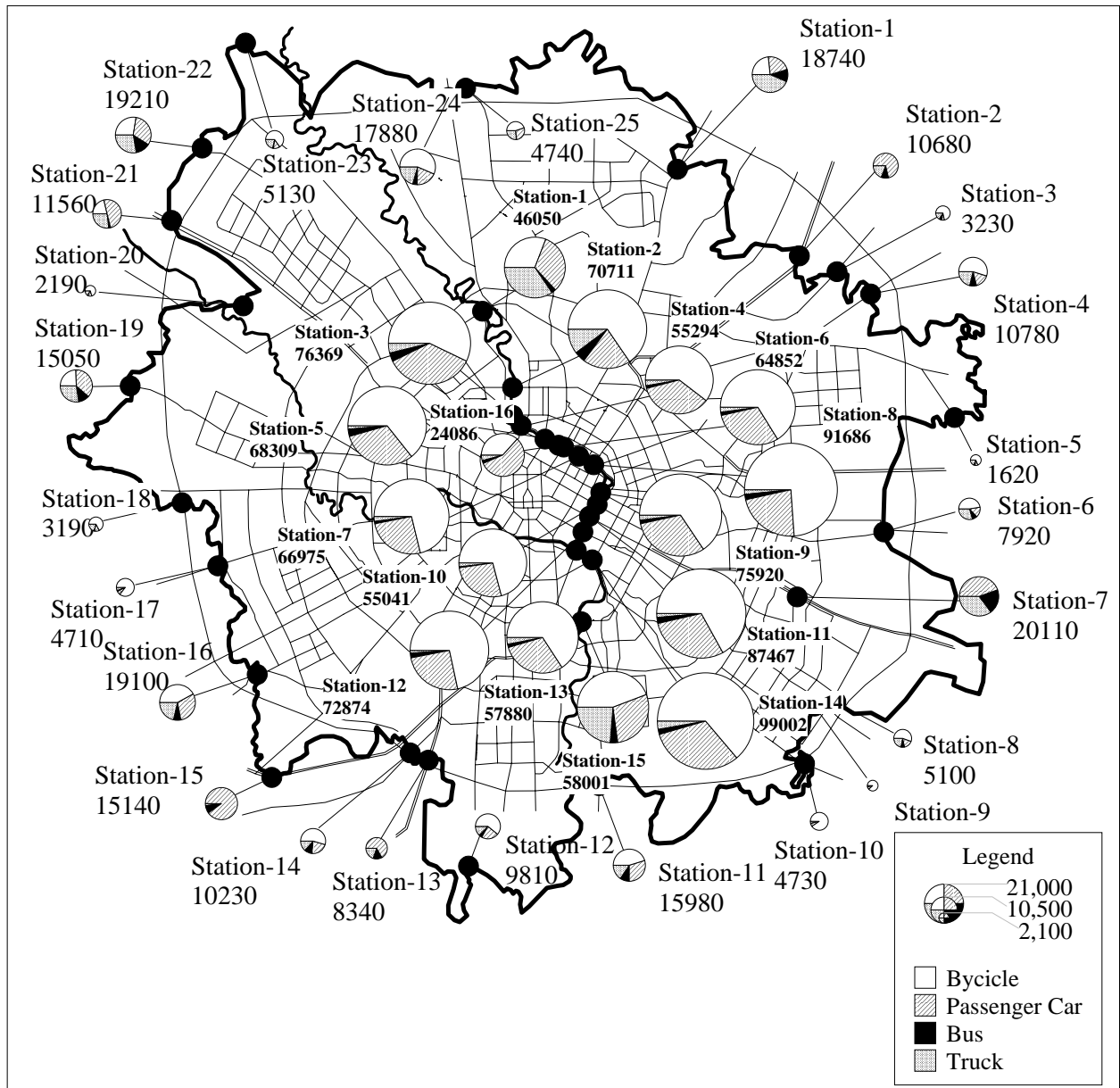
Regarding car traffic, intersection directional traffic count survey reveals that traffic volume amounts to 3,800 cars per hour at maximum in the Shuncheng Street. In terms of daily traffic, about 25,000 cars appear on the radial trunk roads and about 30,000 cars on the 1st Ring Road. Judging from the size of the city, the usage of car has been at a low level but the potential for the increase in car traffic is high.

The trucks are not allowed to enter the area within the 2nd Ring Road but a small number of trucks are noted in the area. There appear about 15,000 trucks outside the 2nd Ring Road area. Usage of truck is expected to increase in the future according to the development of industries in the suburban areas.

**Table 3.2.1 Regional Characteristics of the Traffic Volume by Vehicle Type**

Type	CBD (Inside of Inner Ring Road)	Outskirts of CBD (1 <sup>st</sup> and 2 <sup>nd</sup> Ring Roads)	Suburban Area
Bicycle	According to traffic count surveys, there are 50,000 to 70,000 bicycles on the major roads in CBD, e.g.68,000 bicycles on the Hongxing bridge and 59,000 bicycles on the Dongfeng bridge.	Also in outskirts of CBD, a large number of bicycles are observed. For example, there are 63,000 bicycles in Jiuyanqiao on the 1st Ring Road, 43,000 bicycles in Beiierduanxibeiqiao and more than 25,000 bicycles on the south sections of the 2nd Ring Road	As compared to the urban areas, the traffic volume substantially reduced to about 8,000 to 10,000 bicycles and also 2,000 to 3,000 bicycles in some sections.
Passenger Car	According to traffic count surveys, there are 20,000 to 25,000 passenger cars on trunk roads.	There is a large number of passenger cars, ranging from 25,000 to 30,000 passenger cars on the 1st Ring Road and averaging about 15,000 passenger cars on the 2nd Ring Road	There is a number of passenger cars between Shuangliu airport and the city , showing 9,000 cars in the Chengyu highway, 8,000 cars in the Chengmian highway and 6,000 cars in the Chengguan.
Trucks	Trucks are not allowed to enter the area within the 2 <sup>nd</sup> Ring Road. However, a small traffic volume of truck is noted in the area (on major trunk roads), averaging 1,500 trucks.	In spite of traffic entry control of truck on the 1 <sup>st</sup> Ring Road, its demand reaches 3,000 trucks due mainly to the industrial development along the 1 <sup>st</sup> Ring Road. Whereas more than 15,000 trucks are observed outside the 2 <sup>nd</sup> Ring Road without traffic control.	Like passenger car, higher demands are counted on the inter-city trunk roads. For example, there are 8,000 trucks Sinto(North) bound, 7,000 trucks on Chongmian Highway and 5,000 trucks on Chengguan Highway.

Figure 3.2.1 24-Hour Traffic Volume at Survey Locations





**Table 3.2.2 Peak Hour Directional Traffic Volume at Major Intersections**

Intersection	Road Name	Time Period (Mor/Eve)	Peak Hour Survey Time	Peak Hour Traffic Volume (Vehicles or Persons/Hour/Direction)					
				Car/Taxi	Bus	Cargo Vehicle	Vehicle Total	Bicycle/Motorcycle	Pedestrian
Jiangnan Lu	Beijiaochang Xi-Lu	Mor	8:00-9:00	759	33	27	819	1,278	220
		Eve	16:00-17:00	555	33	42	629	722	89
	Tongjinqiao Lu	Mor	8:00-9:00	990	43	9	1,042	1,278	128
		Eve	16:00-17:00	813	37	30	880	1,032	138
	Jiangnan Lu	Mor	10:00-11:00	753	27	39	819	1,080	125
		Eve	17:00-18:00	897	27	7	931	1,716	180
	Dongchenggen Xia-Jie	Mor	9:00-10:00	703	26	36	765	661	206
		Eve	16:00-17:00	700	40	54	794	925	147
Ningxia Jie	Mor	9:00-10:00	127	0	3	130	576	66	
	Eve	17:00-18:00	89	1	0	90	483	12	
Renmin Xi-Lu	Shaocheng Lu	Mor	8:00-9:00	278	43	5	325	2,351	318
		Eve	17:00-18:00	227	55	1	283	1,196	313
	Dongchenggen Xia-Jie	Mor	7:00-8:00	980	90	50	1,120	1,423	155
		Eve	19:00-20:00	910	60	56	1,026	722	293
	Renmin Xi-Lu	Mor	8:00-9:00	1,392	136	18	1,546	2,534	211
		Eve	17:00-18:00	1,258	142	16	1,416	2,340	193
	Dongchenggen Nan-Jie	Mor	8:00-9:00	1,230	54	26	1,310	2,515	300
		Eve	17:00-18:00	1,278	84	16	1,378	1,640	315
Renmin Department Store	North Intersection of Shuncheng Da-Jie	Mor	9:00-10:00	1,210	93	30	1,333	2,155	400
		Eve	17:00-18:00	1,296	114	10	1,420	2,653	683
	Renmin Dong-Lu	Mor	9:00-10:00	735	78	26	839	3,400	692
		Eve	8:00-9:00	705	61	15	781	2,730	422
	Zhongfu Lu	Mor	8:00-9:00	1,396	67	43	1,506	4,680	504
		Eve	16:00-17:00	1,406	133	59	1,598	2,256	887
	South Intersection of Shuncheng Da-Jie	Mor	9:00-10:00	1,300	78	68	1,446	3,146	1,312
		Eve	17:00-18:00	1,327	79	48	1,454	1,877	3,214
Hongxing Lu, Dong Da-Jie	Hongxing Lu San-Duan	Mor	9:00-10:00	670	77	16	763	1,680	124
		Eve	19:00-20:00	812	64	11	887	1,920	243
	Dong Da-Jie	Mor	8:00-9:00	692	40	29	761	4,041	207
		Eve	16:00-17:00	525	39	25	589	1,136	239
	Hongxing Lu Si-Duan	Mor	8:00-9:00	785	78	10	873	2,494	181
		Eve	16:00-17:00	832	82	32	946	1,502	396
	Chengshou Dong Da-Jie	Mor	8:00-9:00	436	36	6	478	976	165
		Eve	8:00-9:00	487	35	20	542	1,757	324
Renmin Zhong-Lu	Taian Xi-Lu	Mor	10:00-11:00	957	21	84	1,062	277	374
		Eve	17:00-18:00	940	22	20	982	426	260
	Wudu Lu	Mor	10:00-11:00	977	25	75	1,077	618	372
		Eve	17:00-18:00	810	14	31	855	632	243
	Renmin Zhong-Lu San-Duan Bei	Mor	10:00-11:00	1,377	85	61	1,523	1,832	207
		Eve	17:00-18:00	1,186	53	9	1,248	1,024	126
	Renmin Zhong-Lu San-Duan Nan	Mor	9:00-10:00	962	87	30	1,079	1,459	256
		Eve	16:00-17:00	905	80	43	1,028	1,405	188
Tonghuimen, Qintai Lu	West Intersection of Tonghuimen	Mor	10:00-11:00	1,191	126	63	1,380	1,328	196
		Eve	18:00-19:00	1,045	138	33	1,216	2,553	197
	East Intersection of Tonghuimenlu	Mor	9:00-10:00	1,094	95	37	1,226	2,157	207
		Eve	18:00-19:00	1,096	92	18	1,206	3,689	234
	Qingtai Lu	Mor	8:00-9:00	694	13	9	716	3,372	117
		Eve	18:00-19:00	724	28	6	758	1,443	150
Renmin Nan-Lu	Renming Nan-Lu Er-Duan	Mor	9:00-10:00	2,076	85	51	2,212	1,320	612
		Eve	18:00-19:00	1,700	103	17	1,820	2,328	844
	Renmin Nan-Lu San-Duan	Mor	10:00-11:00	1,712	118	21	1,851	1,250	232
		Eve	17:00-18:00	1,581	114	6	1,701	2,640	306
	Binjian Dong-Lu	Mor	10:00-11:00	1,085	112	36	1,233	833	480
		Eve	19:00-20:00	754	77	36	867	818	608
	Binjian Xi-Lu	Mor	10:00-11:00	993	70	41	1,104	991	146
		Eve	17:00-18:00	916	64	26	1,006	1,106	141
Qingyanggong Temple	West 2nd Part of 1st Ring Road	Mor	10:00-11:00	1,485	213	53	1,751	1,324	185
		Eve	18:00-19:00	1,555	215	32	1,802	2,558	306
	Section1 of the 1st Ring Road West	Mor	8:00-9:00	955	150	61	1,166	2,133	97
		Eve	18:00-19:00	1,029	160	60	1,249	2,070	126
	Qingyang Zheng-Jie	Mor	10:00-11:00	738	25	31	794	475	134
		Eve	17:00-18:00	695	26	36	757	902	123
	Qingyang Jie	Mor	10:00-11:00	613	89	38	740	899	408
		Eve	17:00-18:00	755	121	14	890	1,230	492

(Cont. Table 3.2.2)

Renmin Nan-Lu	Renming Nan-Lu San-Duan	Mor	10:00-11:00	1,241	92	43	1,376	1,844	724
		Eve	18:00-19:00	1,706	60	4	1,770	1,880	866
	Renming Nan-Lu Si-Duan	Mor	10:00-11:00	1,180	72	51	1,303	1,677	375
		Eve	16:00-17:00	1,298	91	91	1,480	1,063	250
	Secdion3 of the 1st Ring Road South	Mor	9:00-10:00	1,215	110	71	1,396	2,484	505
		Eve	16:00-17:00	1,235	111	77	1,423	1,476	437
Secdion2 of the 1st Ring Road South	Mor	9:00-10:00	1,055	77	80	1,212	2,047	291	
	Eve	19:00-20:00	1,049	115	68	1,232	1,480	288	
Dongfeng Lu	Secdion3 of the 1st Ring Road South	Mor	8:00-9:00	979	111	71	1,161	2,079	575
		Eve	18:00-19:00	1,216	104	132	1,452	1,532	500
	Secdion3 of the 1st Ring Road South	Mor	9:00-10:00	1,318	75	162	1,555	1,772	583
		Eve	18:00-19:00	1,331	90	196	1,617	1,804	485
	Shuimianhe Lu	Mor	10:00-11:00	1,115	46	51	1,212	1,327	671
		Eve	18:00-19:00	1,157	66	44	1,267	1,120	402
	Dongfeng Lu	Mor	9:00-10:00	840	145	22	1,007	1,244	584
		Eve	19:00-20:00	773	191	20	984	2,703	558
Shawan Lukou	Shawan Lu	Mor	10:00-11:00	731	70	42	843	766	36
		Eve	17:00-18:00	769	58	90	917	1,464	89
	Section1 of the 2nd Ring Road North	Mor	9:00-10:00	575	138	166	879	780	220
		Eve	18:00-19:00	747	104	311	1,162	1,563	245
	Jiaoda Lu	Mor	9:00-10:00	819	43	167	1,029	616	32
		Eve	16:00-17:00	760	44	147	951	642	98
	Section2 of the 2nd Ring Road North	Mor	8:00-9:00	1,004	135	188	1,327	3,153	123
		Eve	16:00-17:00	906	122	232	1,260	522	389
Yangshi Jie	Section1 of the 2nd Ring Road West	Mor	9:00-10:00	1,285	138	247	1,670	1,620	223
		Eve	16:00-17:00	1,472	144	312	1,928	610	128
	Yangxi Xian	Mor	8:00-9:00	1,153	46	123	1,322	1,840	383
		Eve	18:00-19:00	1,000	56	111	1,167	307	984
	Fuqin Xi-Lu	Mor	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
		Eve	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	Section3 of the 2nd Ring Road West	Mor	9:00-10:00	1,227	159	198	1,584	1,435	168
		Eve	18:00-19:00	1,591	128	303	2,022	1,710	267
Shuncheng Da-Jie	Yulong Jie	Mor	10:00-11:00	3,790	224	181	4,195	3,556	235
		Eve	16:00-17:00	3,350	208	234	3,792	2,824	183
	Wenwu Lu	Mor	9:00-10:00	472	1	16	489	1,782	156
		Eve	16:00-17:00	399	0	24	423	1,032	78
	Yuxinliang	Mor	9:00-10:00	2,064	66	60	2,190	2,868	92
		Eve	17:00-18:00	1,481	68	7	1,556	4,056	90
	Luoguo Xiang	Mor	10:00-11:00	535	27	53	615	1,156	34
		Eve	16:00-17:00	450	19	32	501	949	144
1st Ring Road, Shuanglin Lu	Shuanglin Lu	Mor	8:00-9:00	1,292	76	90	1,458	6,159	296
		Eve	19:00-20:00	1,222	47	52	1,321	1,051	188
	Sanhuaishu Lu	Mor	10:00-11:00	758	52	80	890	1,560	291
		Eve	18:00-19:00	887	37	24	948	3,480	216
	North Intersection, Section3 of the 1st Ring Road East	Mor	10:00-11:00	876	54	87	1,017	1,062	279
		Eve	18:00-19:00	843	90	121	1,054	1,516	284
	South Intersection, Section3 of the 1st Ring Road East	Mor	10:00-11:00	1,075	60	72	1,207	1,073	228
		Eve	16:00-17:00	1,093	70	99	1,262	1,183	281
North Railway Station	Section3 of the 2nd Ring Road North	Mor	7:00-8:00	423	130	75	628	2,427	1,386
		Eve	16:00-17:00	539	110	108	757	1,482	136
	Section2 of the 2nd Ring Road North	Mor	10:00-11:00	527	261	202	1,090	1,766	1,753
		Eve	17:00-18:00	673	230	117	1,020	1,162	1,759
	Renming Bei-Lu Er-Duan	Mor	9:00-10:00	697	192	41	930	843	1,860
		Eve	17:00-18:00	794	172	39	1,005	641	1,080
	Railway Station	Mor	7:00-8:00	550	118	15	683	299	1,697
		Eve	17:00-18:00	526	153	17	696	1,592	306
2nd Ring Road, Shuanglin Lu	Section3 of the 2nd Ring Road East	Mor	10:00-11:00	755	152	391	1,298	1,030	144
		Eve	17:00-18:00	545	117	613	1,275	1,539	336
	Shuangqin Lu	Mor	8:00-9:00	315	28	88	431	2,920	87
		Eve	18:00-19:00	307	30	96	433	624	46
	Shuanglin Lu	Mor	10:00-11:00	949	118	481	1,548	816	92
		Eve	18:00-19:00	937	78	419	1,434	1,768	86
	Shuangqiaozi	Mor	9:00-10:00	637	115	92	844	384	228
		Eve	17:00-18:00	674	126	46	846	624	264
Hejiangting	Lao Dongmen	Mor	9:00-10:00	872	22	84	978	541	98
		Eve	18:00-19:00	1,017	29	43	1,089	1,017	25
	West Intersection of Binjian Dong-Lu	Mor	8:00-9:00	614	40	21	675	1,950	0
		Eve	18:00-19:00	1,045	58	42	1,145	2,403	0
	East Intersection of Binjian Dong-Lu	Mor	8:00-9:00	512	19	31	562	2,408	1
		Eve	19:00-20:00	615	20	28	663	492	72
1st Ring Road	West Intersection, Section2 of the 1st Ring Road North	Mor	9:00-10:00	1,102	109	126	1,337	1,951	143
		Eve	17:00-18:00	1,059	133	208	1,400	197	1,900
	Beizhan Xiyi Lu	Mor	8:00-9:00	129	48	26	203	345	57
		Eve	17:00-18:00	163	28	19	210	555	161
	1st Ring Road	Mor	9:00-10:00	127	1	12	140	461	102
		Eve	17:00-18:00	104	2	30	136	792	102
	East Intersection, Section2 of the 2nd Ring Road North	Mor	8:00-9:00	1,154	139	80	1,373	2,073	45
		Eve	17:00-18:00	1,242	119	130	1,491	1,764	99

(Cont. Table 3.2.2)

Jinhua Lu	Shuonianhe Dong-Lu	Mor	9:00-10:00	1,153	129	160	1,442	2,521	340
		Eve	17:00-18:00	1,115	137	128	1,380	1,237	241
	Shuonianhe Xi-Lu	Mor	9:00-10:00	845	59	97	1,001	868	669
		Eve	16:00-17:00	947	53	83	1,083	1,082	643
	Jinghua Nan-Lu	Mor	8:00-9:00	89	65	6	160	1,980	265
		Eve	16:00-17:00	117	58	6	181	540	240
	Jinghua Bei-Lu	Mor	8:00-9:00	301	85	12	398	1,105	190
		Eve	17:00-18:00	308	89	12	409	718	24
Yangshi Jie, Dongchenggen Jie	Section Yongling of Fuqin Xi-Lu	Mor	8:00-9:00	2,092	216	37	2,345	3,335	396
		Eve	17:00-18:00	1,726	139	10	1,875	1,560	540
	Dongchenggen Xia- Jie	Mor	8:00-9:00	1,207	68	8	1,283	1,680	357
		Eve	18:00-19:00	1,048	43	11	1,102	650	270
	Yangshi Jie	Mor	8:00-9:00	0	0	0	0	2,635	140
		Eve	17:00-18:00	0	0	0	0	2,586	580
	Dongchenggen Dong- Jie	Mor	8:00-9:00	1,252	62	10	1,324	2,160	576
		Eve	18:00-19:00	1,200	39	24	1,263	1,826	366

### 3.2.2 Hourly Fluctuation of Traffic Volume

Table 3.2.3 and Figure 3.2.2 show the regional characteristics of the hourly fluctuation of traffic volume based on the 16-hour or 24-hour traffic survey on the screen lines along Funan river and cordon lines along the boundary of the Study Area.

One of the traffic characteristics noted is that only the bicycle has an obvious peak time while the car and truck have no significant hourly fluctuation. This is attributed to the fact that most of the trips strongly depends on the bicycle. In addition, comparison of the bicycle traffic between CBD and the outskirts of CBD shows that the hourly fluctuation is more obvious in the former than in the latter due mainly to the active use of bicycles not only for commuting but also for other trip purposes such as business, shopping, private, etc.

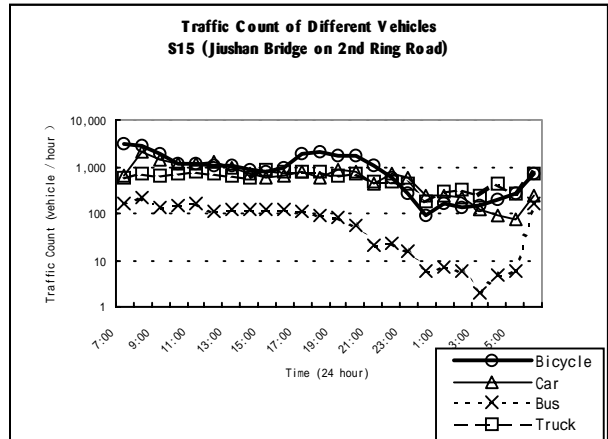
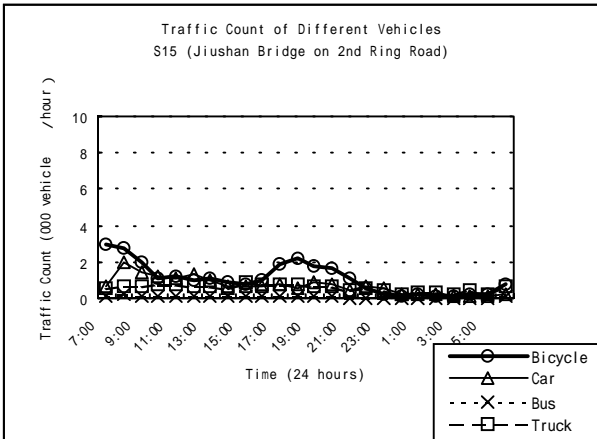
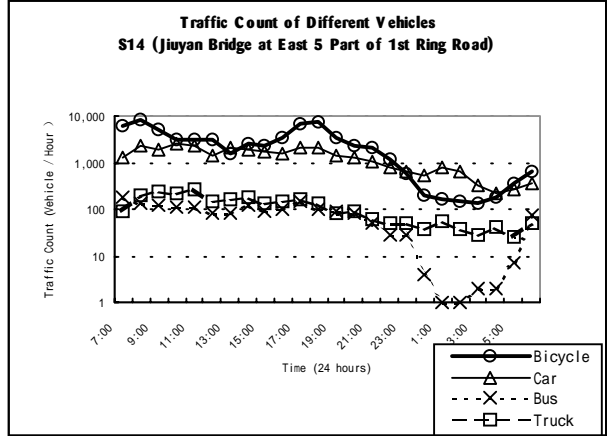
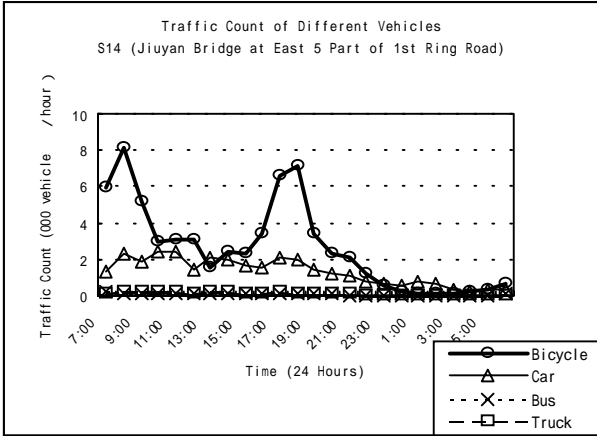
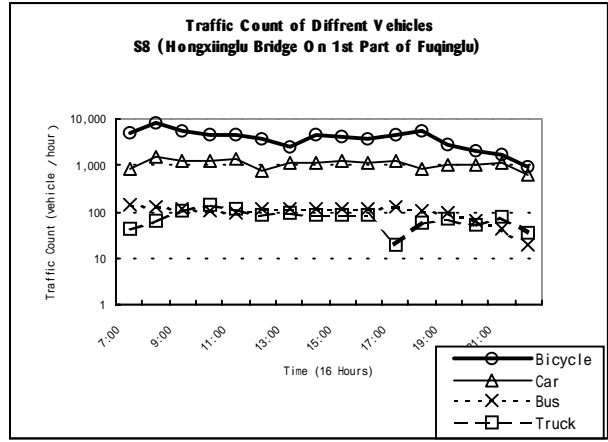
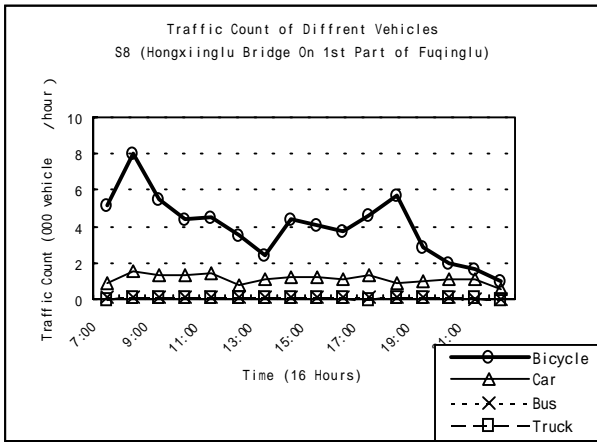
As car ownership is quite low in the city, hourly fluctuation of passenger car seems to strongly depend on the movement of taxi. According to Figure 3.2.3 showing the hourly fluctuation of car and taxi, two peaks are seen in the morning and evening. Figure 3.2.4 shows the hourly fluctuation of bus. Highlighting the operation system of buses, the traffic volume of bus substantially decreases between 7 pm and 8 pm. This strengthens the an issue that bus does not provide services enough to meet transport demand especially during the evening time.

A number of trucks can be found not only in the morning but also in the evening. Figure 3.2.5, showing the hourly fluctuation between small truck and large truck, reveals that more demand of small truck can be found in the morning because most goods seem to be transported to the urban area by small truck.

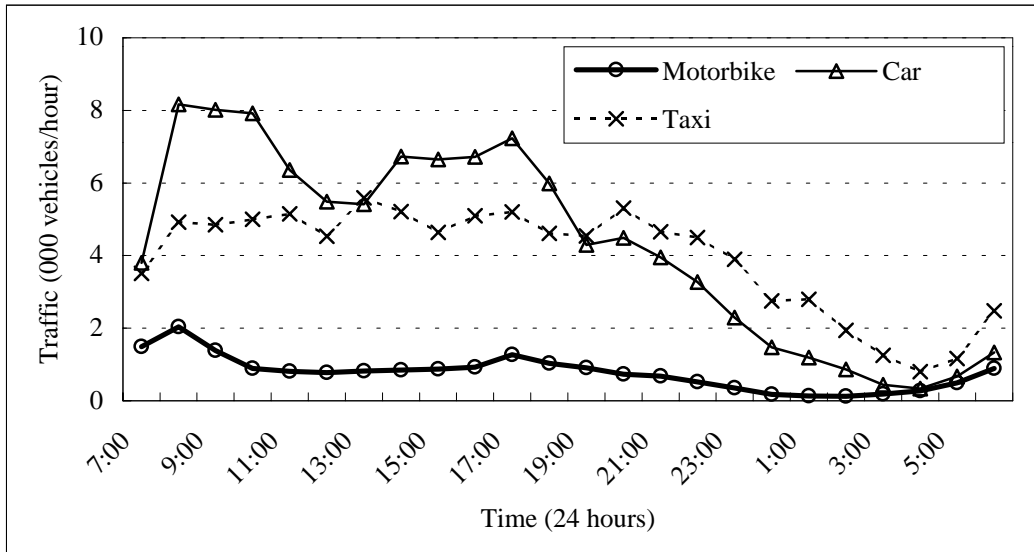
**Table 3.2.3 Regional Characteristics of Hourly Fluctuation of Traffic Volume**

Type of Vehicle	CBD (Within Inner Ring Road)	Outskirt of CBD (1st and 2nd Ring Roads)	Suburban Area
Bicycle	Morning and evening peaks are significant especially in the morning (8:00 - 9:00). Bicycles seem to be used also for business, shopping, private etc. Evening peak takes place between 5 pm and 6 pm.	Peaks become more serious than in CBD. Substantial difference is seen between peak and off-peak time. Bicycles seem to be used for many trip purposes.	In suburban area, pattern of hourly fluctuation is quite different depending on land use and development. Peaks are observed in the urbanized area but none in the rural area.
Passenger Car	Hourly fluctuation is relatively flat throughout the day. Minor peaks are seen in the morning (10am – 11am) and in the afternoon (3pm – 4pm). This would be caused mainly by small proportion of cars and large proportion of taxi.	Hourly fluctuation is similar with traffic in the CBD, showing virtually little fluctuation.	There are two types of areas, one with peak in the morning and the other with peak at noon. Morning and night peaks are seen where usage of car is evident, which seems to be mostly composed of long distance trips.
Truck	Traffic volume is quite small due mainly to truck entry restriction. Therefore, it is difficult to look into the hourly fluctuation.	A lot of trucks are seen on the 2nd Ring Road. No difference between day and night time is seen. Note that the demand is relatively high at night time	Traffic volume is not so large. Hourly fluctuation is comparatively flat throughout the day and at night. Some demands are seen on inter-city trunk road even at night and early in the morning.

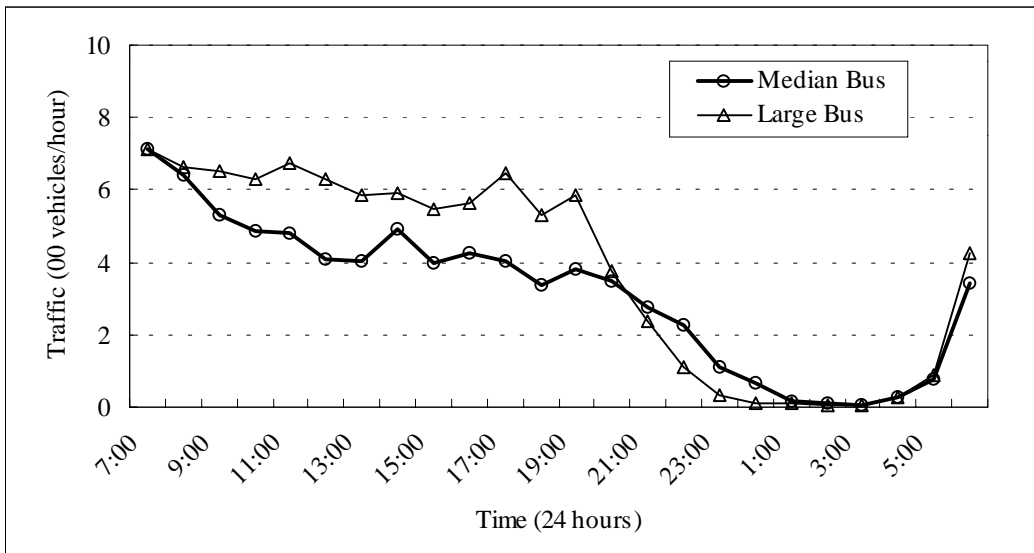
**Figure 3.2.2 Hourly Fluctuation of Traffic Volume by Vehicle Type**



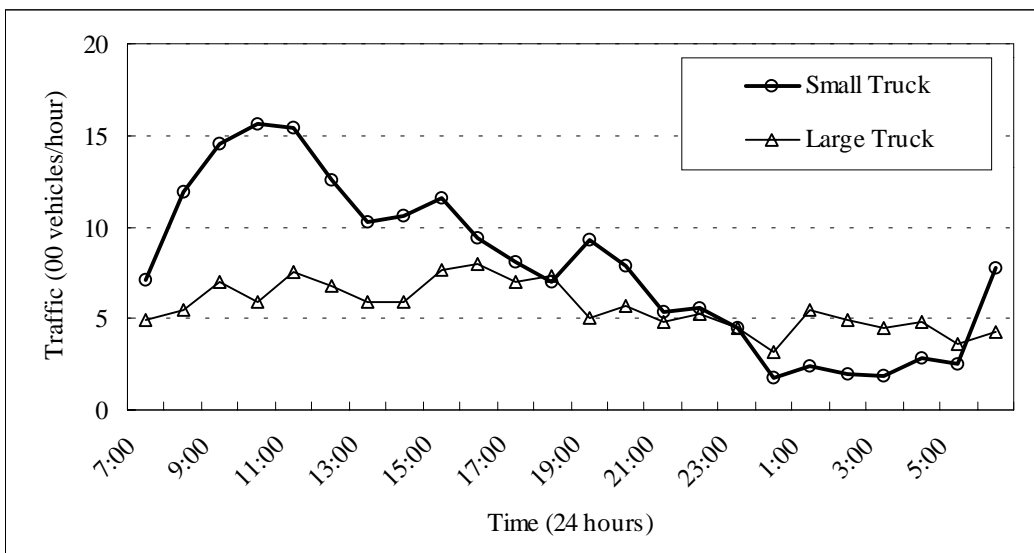
**Figure 3.2.3 Hourly Fluctuation of Passenger Cars and Taxis**



**Figure 3.2.4 Hourly Fluctuation of Buses**



**Figure 3.2.5 Hourly Fluctuation of Trucks**

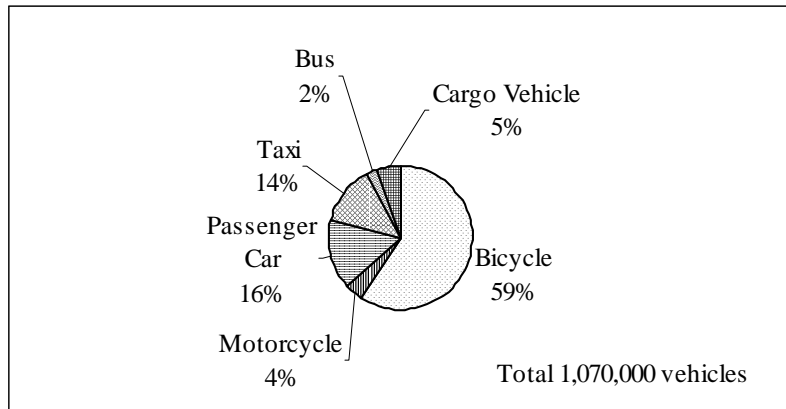


### 3.2.3 Composition of Vehicle Type

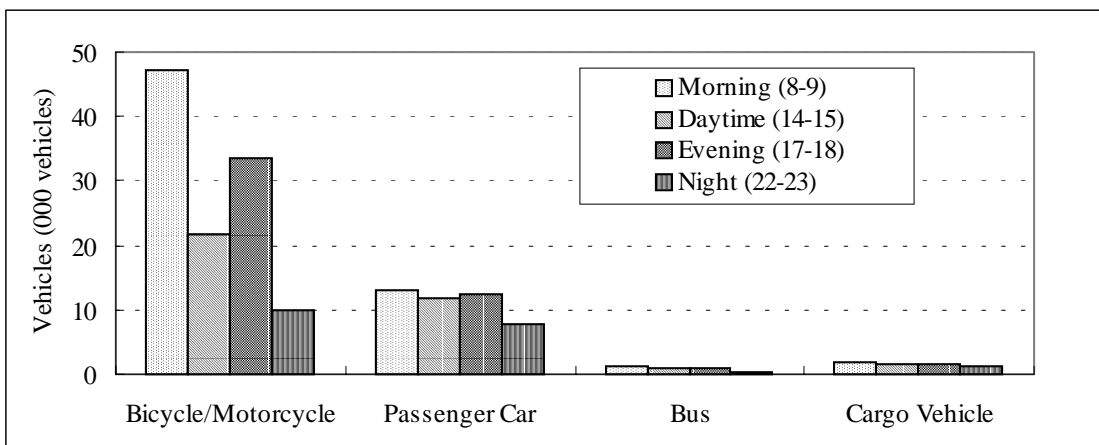
Figure 3.2.6 shows the traffic composition by vehicle type on screen line. More usage of bicycle is seen in CBD while usage of car is higher in the suburban area. Due to entry restriction on trucks within the 2<sup>nd</sup> Ring Road area and incomplete road network outside the 2<sup>nd</sup> Ring Road, trucks are just concentrated on limited roads, especially on the 2<sup>nd</sup> Ring Road.

Figures 3.2.7 shows composition of traffic by vehicle type and by peak hour based on volume counted on the screen line. It should be noted that traffic volume of bicycle substantially changes depending on time period of the day.

**Figure 3.2.6 Composition of Vehicle Type on Screen Line**



**Figure 3.2.7 Composition of Vehicle Type by Time of the Day**



### **3.2.4 Travel Speed**

Travel speed survey was undertaken on 12 major bus routes. Table 3.2.4 summarizes characteristics of selected routes and average travel speed survey. The speed of car is 20~30km/h in the CBD while that of bus is below 20km/h. The speed of bus is 10~13km/h where different modes are mixed, which is about the same as that of bicycle.

Figure 3.2.8 shows relation of time and distance by mode on the routes. The following are the common characteristics.

#### **The Routes across the City Center**

- (1) Due to the traffic congestion in the central area, car speed is seriously down below 30 km/h.
- (2) Bus speed is also below 20 km/h and close to bicycle speed at 15 km/h.
- (3) Bicycles run at an average speed of 12km/h to 15km/h. As bicycle routes are provided on the main routes, bicycle travel is quite smooth avoiding congestion of motor vehicles.

#### **Route on the Ring Road**

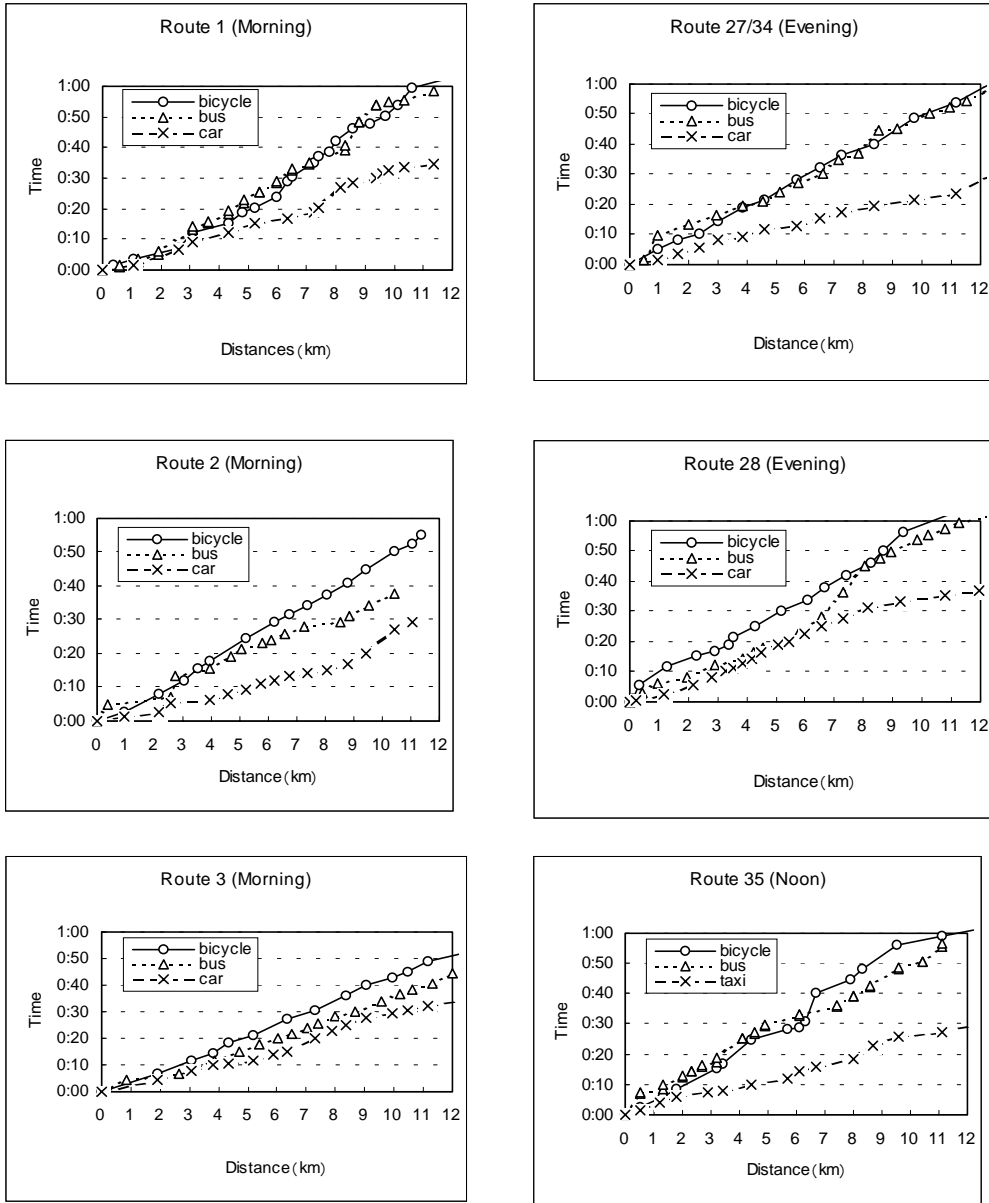
Traffic jam is seen even on the 1st Ring Road route (Route 27/34) due mainly to the substantial traffic demand. As exclusive bicycle lane protects bicycle from traffic congestion, the speed of bus is, as a result, almost the same as that of bicycle.



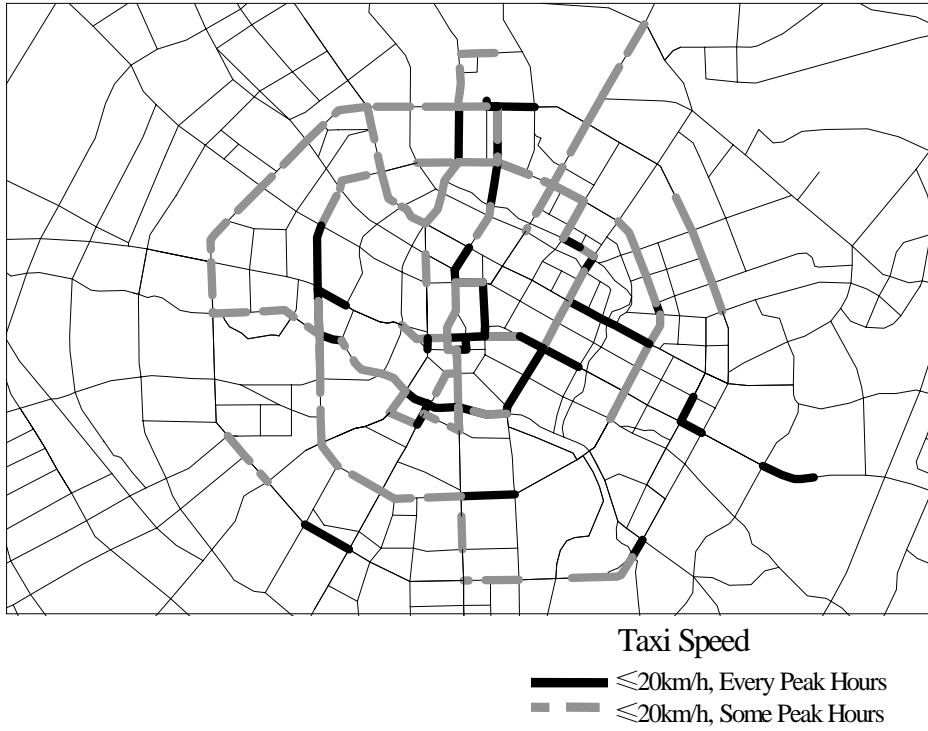
**Table 3.2.4 Summary of Travel Speed Survey**

Line No	Starting and Ending Stop	Route Configuration	Average Travel Speed			Summary of Investigation
			Car	Bus	Bicycle	
1	Qinglongchang → Wuhouci	Penetration of central area	25-30	12-17	12	The route starts from Qinglongchang to Wuhouci, penetrates the 1st and 2nd Ring Roads and Tianfu Square and ends in Wuhouci. It is basically composed of 2 lanes except 6 lanes in urban center. Industrial land use is largely seen outside the 2 <sup>nd</sup> Ring Road whereas business and commercial land use inside the 2 <sup>nd</sup> Ring Road
2	Wuguiqiao → North Railway Station	Circulation of The 2nd Ring Road	25	15	13	The route starts from Wuguiqiao, runs along the 2 <sup>nd</sup> Ring Road and ends in North Railway Station, passing through industrial area with construction factories and commercial facilities near railway station. It is basically composed of 4 lanes with exclusive bicycle lane.
3	Xiangxieli → Cheng-dong	Penetration of central area	20	13	10	The route runs between the northwest and the southeast areas traversing the urban center. The new residential area is located outside the 2nd Ring Road whereas business and commercial facilities inside it. It is composed of 4 lanes with exclusive bicycle lane inside urban area whereas 2 lanes outside urban area.
5	Baihua → 97 High School	Radial Pattern	25	12-18	12	The route runs between the east and the west, passing through urban area, along which business and commercial facilities are located. It is mainly composed of 4 lanes except for some sections with exclusive bicycle lane.
16	North Railway Station → South Railway Station	Penetration of central area	20-25	12-15	12	The route runs between north and south stations, penetrating the urban area, along which major business and commercial facilities are located. It is composed of over 4 lanes with exclusive bicycle lane.
27/34	North Railway Station → North Railway Station	Circulation of The 1 <sup>st</sup> Ring Road	20	13	12	The route circulates along the 1 <sup>st</sup> Ring Road, being composed of 4 lanes with exclusive bicycle lane. Business and commercial land use is seen in the north, west and south whereas mixed land use with industrial land use in the east.
28	North Railway Station → Gaopengzi	Penetration of central area	20	13	11	The routes runs between north station and Hongxinglu, passing through the North Railway Station. Mixed land use of commercial and residential areas is seen in the section of north station to Hongxinglu with 2 lanes whereas new business area in the section of Hongxinglu to the North Railway Station with 4 lanes including exclusive bicycle lane.
35	Dufucaotang → Chengdong	Penetration of central area	20	12	12	The route runs along Nanhe and Fufe with 2 lanes, along which mixed land use of commercial and residential facilities is seen.
51	Shuangnan Xiaogu → Xiaolongqiao	circulation of the 2nd Ring Road	25	13	13	The route runs along a half of the 2 <sup>nd</sup> Ring Road in the south with 4 lanes including exclusive bicycle lane or 5m shoulder. Industrial facilities are distributed in the east and commercial and research facilities between the south and the east.
52	Hongpailou → North Railway Station	circulation of the 2nd Ring Road	25	15-20	15	The route runs along a half of the 2 <sup>nd</sup> Ring Road in the east with 4 lanes including exclusive bicycle and 5m shoulder. Various facilities are seen, e.g., industrial facilities, university, research facility and commercial facility.
57	Wukuaishi → Gaoshengqiao	Penetration of central area	20-25	15	13	The route runs southward from the Dongchenggen Jie with 2 lanes, along which the mixed land use of business and residential facilities are seen.
85	Jingsha → Wuguiqiao	Penetration of central area	20	10	10	The route runs along the west-east axis, traversing urban area with 4 lanes including exclusive bicycle lane, along which commercial and business areas are located.

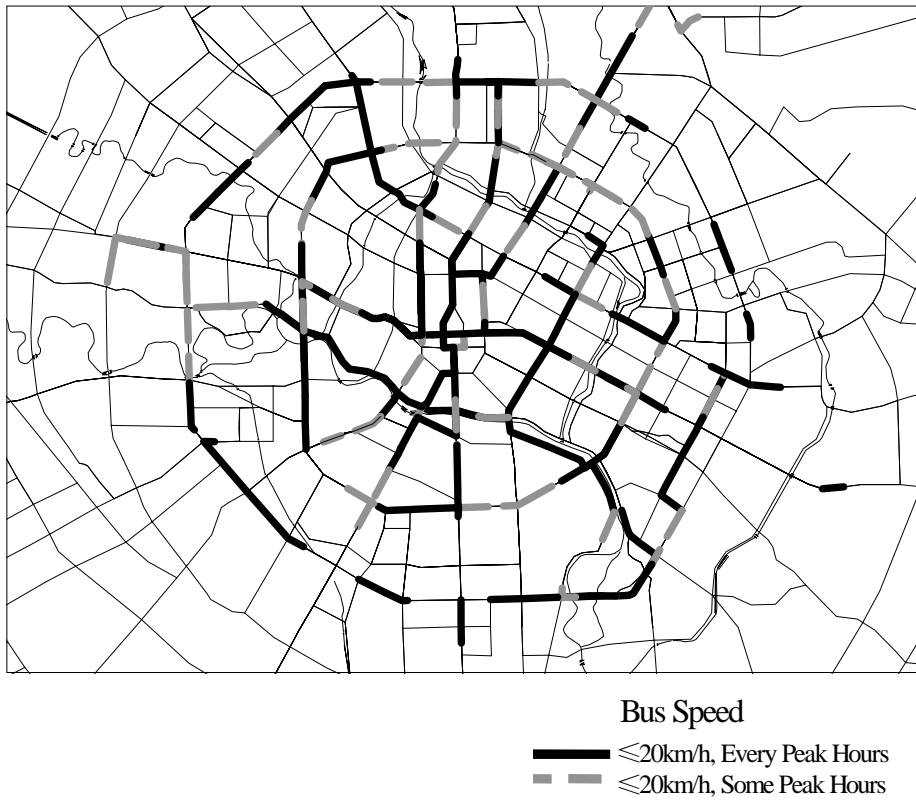
**Figure 3.2.8 Time-Distance Relation on Major Routes by Mode**



**Figure 3.2.9 Road Sections with Car Speed Below 20km/h**



**Figure 3.2.10 Road Sections with Bus Speed Below 20km/h**



### **3.3 Public Transportation System**

The Public Transport Company of Chengdu has already started its partial privatization by introducing private capital since January 2000. As of February 2001, however, the private sector has not completely separated yet as an independent entity with respect to management, operational and administrative aspects and then, the matter of privatization of public transport is not dealt with here in this section, but in Chapter 11.

#### **3.3.1 General Aspects of Public Transportation in Chengdu**

##### **(1) Inter-Regional Transportation**

Chengdu lies in the center of Sichuan province and in the west of Sichuan Basin. It is the hub center of the aviation, railway, expressway and national highway networks of the province. The long-distance transportation of over 1,000km between provinces mainly relies on railway and aviation, and minimally depends on bus. On the other hand, buses play a lead role in transportation between counties and cities within Sichuan.

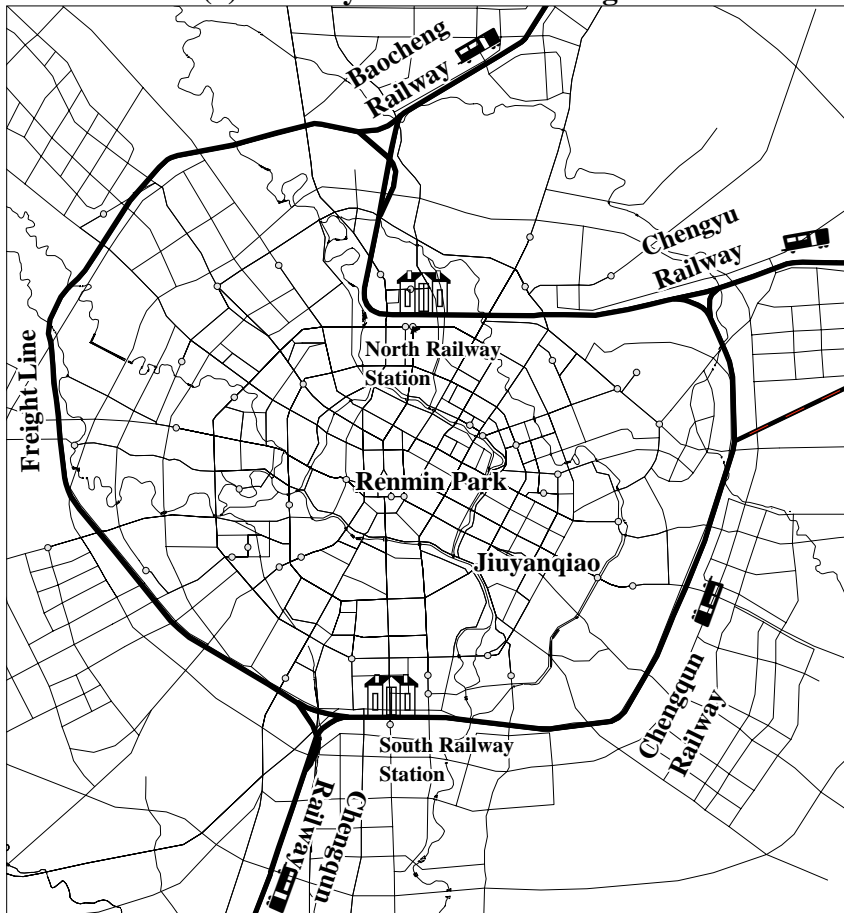
The Northern Railway Station is located at the intersection of the north of Renmin Bei-Lu and the 2nd Ring Road. It is the beginning of the Baoji-Chengdu Line, the Chengdu-Kunming Line and the Chengdu-Chongqing Line, being connected to the national railway network. Eighteen express trains, 12 semi-express and 13 local trains start from the Northern Railway Station a day. The railways connect with Chongqing, Jinyang, Wuchang, Urumchi, Kunming, Xi'an, Beijing, Guangzhou, Shanghai and Qingdao. People can also use the train at the Southern Railway Station as the Chengdu-Kunming Route runs along the eastern 3rd Ring Road (refer to Figure 3.3.1(1)).

The Shuangliu International Airport lies in the southwest of Chengdu outside the Outer Ring Road. The airport expressway connects the airport with the city in about 30 minutes by car. There are about 80 to 90 outgoing flights from the Shuangliu International Airport a day. It also has flights to Singapore and some 44 other cities in China (refer to Figure 3.3.1(2))

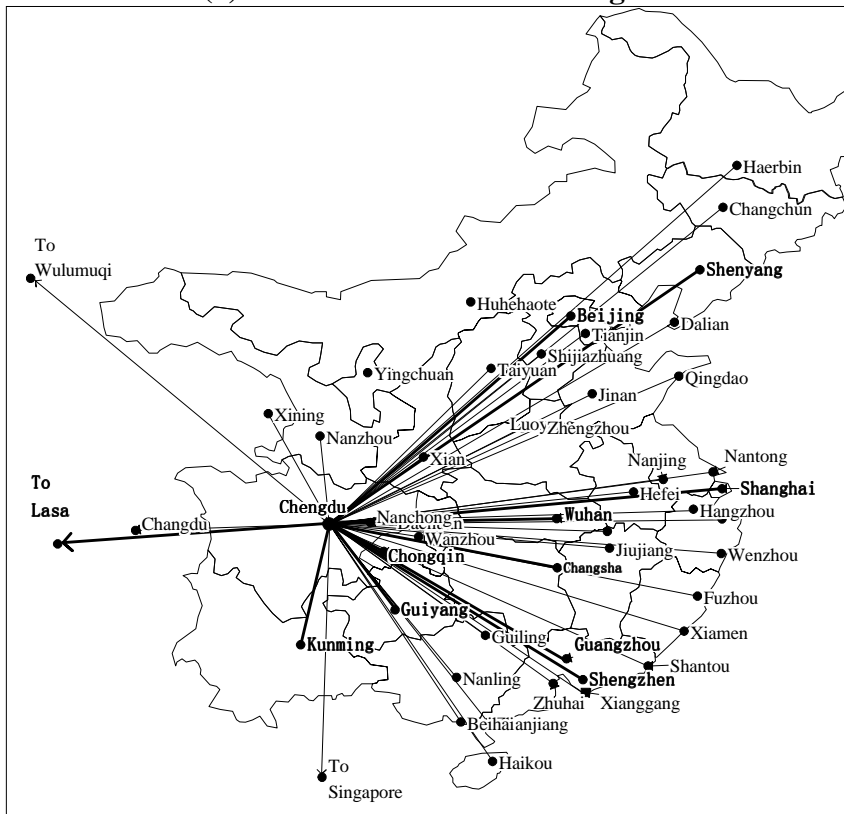
Table 3.3.1 compares the travel time and the fare of different means of transportation mode between Chengdu and other cities. The cost of travel by plane is about 8 times of train or by long-distance bus and for short distance trips about 2~3 times of bus. The fare of a sleeping accommodation on train in case of a soft and lower bed is equal to that by bus with about the same travel time. From Chengdu to Chongqing, travel time by bus is 1/3 of train while the price by bus is more than twice of a train.

**Figure 3.3.1 Inter-Regional Transportation in Chengdu**

**(1) Railway Network in Chengdu**



**(2) Aviation Lines from Chengdu**



Note: On thick lines, there is at least one flight everyday.

**Table 3.3.1 Service Level of Different Transportation Mode between Chengdu and Other Main Cities**

CITY	AIR			RAILWAY			BUS		
	Distance (km)	Travel Time (hr.)	Fare (RMB)	Distance (km)	Travel Time 1/ (hr.)	Fare (RMB)	Distance (km)	Travel Time (hr.)	Fare (RMB)
BEIJING	1,697	2	1,150	2,042	32	129 - 407	*	*	*
SHANGHAI	1,782	2.3	1,290	2,351	41	144 - 477	*	*	*
ZHENGZHOU	1,039	1.5	760	1,353	27	94 - 299	*	*	*
GUANGZHOU	1,390	1.8	1,040	2,527	46	151 - 477	2400	60	150 - 200
CHONGQING	313	0.7	190	504	11	40 - 132	360	4	92 - 103
KUNMING	711	1	560	1,100	21	77 - 248	1200	24	260
XIAN	647	1.2	500	842	20	62 - 201	999	20	240
LAZER	1,307	2	1,200	-	-	-	2000	80	150 - 200

Source: Air and Railway Timetable, 2000 and Transport Bureau of Chengdu

Note: \*There is no direct service

1/ Express service without air-condition; left—hard seat, right—soft seat

## (2) Transportation in the City

As of the year 2000, there is no urban railway system and buses and taxis are the dominant mode of public transportation in Chengdu. In some parts of the city, the tricycles and motorized tricycles serve local trips. Buses are classified by their structure and capacity into: the articulated buses, the double-deckers, the ordinary buses, the medium-sized buses and the mini-buses (refer to the Figure 3.3.2).

Buses run on fixed routes. The urban buses start from and arrive inside the areas surrounded by the 3rd Ring Road. The suburban buses start from and arrive at the areas out of the 3rd Ring Road but inside Chengdu. The inter-city buses serve the areas outside of Chengdu. The Section of Transportation Management in the Public Utilities Bureau is in charge of the urban buses. The Chengdu Transportation Bureau takes charge of the suburban buses, while the Sichuan Transportation Bureau takes charge of the inter-city buses. The suburban buses and the inter-city buses set out from the bus terminals around the 2nd Ring Road but cannot go into the city center.

**Figure 3.3.2 Public Transport Vehicle in Chengdu**

Articulated Bus (38 seater)



Double-decker Bus (80 seater)



New Ordinary Bus (36 seater)



Old Ordinary Bus (36 seater)



Medium Minibus (26 seater)



Small Mini Bus (19 seater)



Taxi



Tricycle

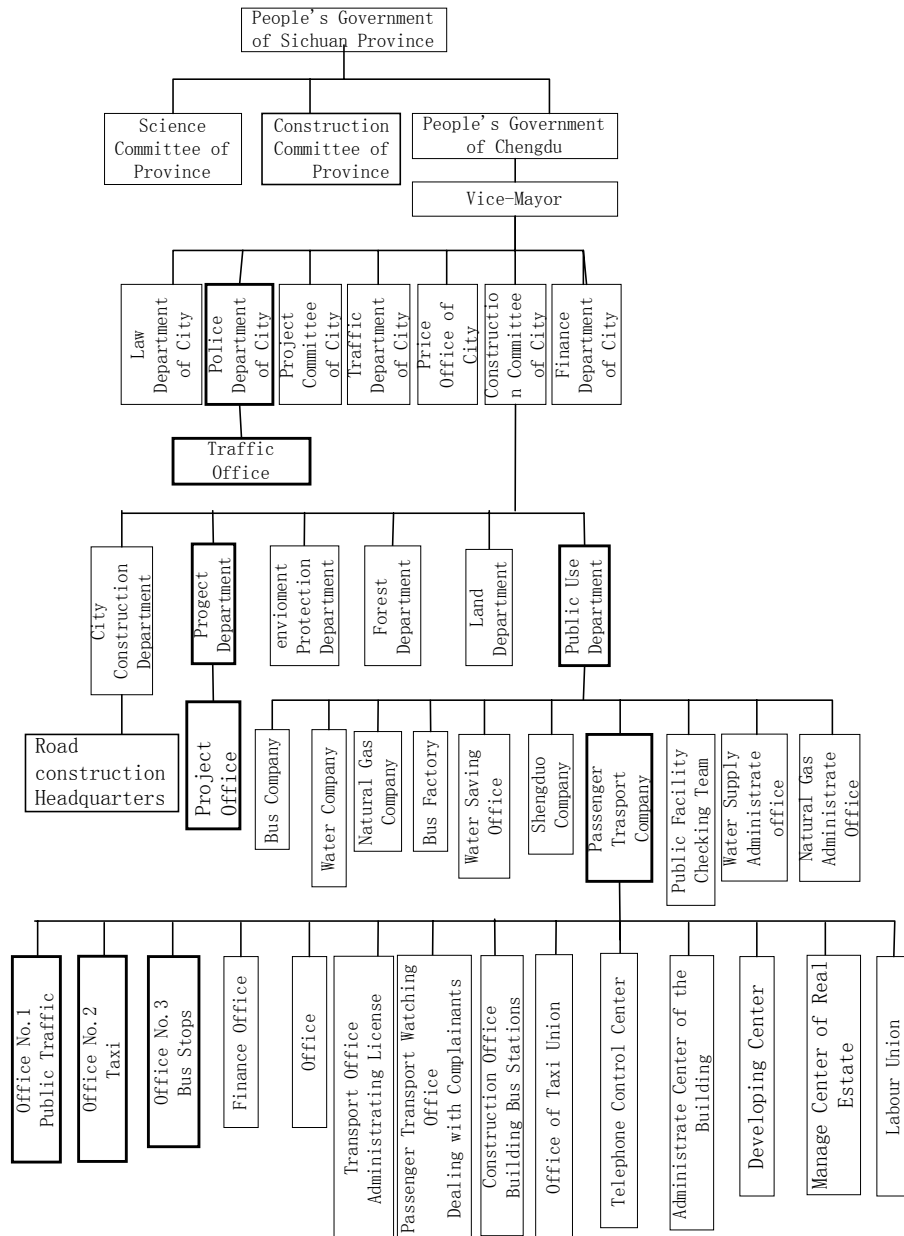


### 3.3.2 Administration of Public Transportation

#### (1) Administrative Organization of the Public Transportation

The Transportation Management Section in the Public Utility Bureau manages and supervises public transportation. Figure 3.3.3 shows its organizational set up. The Chengdu Transportation Bureau takes charge of suburban buses, inter-city buses, bus terminals and taxis. The Public Securities Bureau takes charge of controlling bus operation, traffic accidents and vehicle inspection. The Planning Bureau and the Planning Section take charge of road network planning, bus terminal location planning, subway planning and other public facilities planning.

**Figure 3.3.3 The Administrative Organization of the Public Transportation**





The Public Utility Bureau takes charge of three utility sectors; namely: public transportation, water and natural gas. About 120 supervisors of the bureau inspect the facilities and services in those three sectors and when they find problems, they take counter-measures. There are 71 employees and 240 contractual workers in the Section of Management of Transportation. They are in charge of the management and control of bus operation.

## **(2) Subsidy to Public Transportation**

The subsidy covers the operational deficit of the public transportations, mainly of public buses. The total amount was over RMB 60 million in 1998. It was sourced from the budget of the Finance Bureau and the Construction Committee and the independent financial source of the Public Utility Bureau. All subsidies are disbursed through the Public Utility Bureau. The main financial source of the Public Utility Bureau is the concession fee of taxi operation and income from bus terminals. The following are the main subsidies given for public transportation .

- The subsidy for new bus purchase:, RMB12 million for 120 buses per year
- The subsidy for operational performance: RMB 25 million per year
- The subsidy for bus terminal construction: RBM 20 million per year
- The subsidy for conversion to CNG Engine: RMB 4 million per year
- The subsidy for welfare (residence): RMB 2million per year

### **3.3.3 State-operated Buses in Cities**

#### **(1) Routes**

The Chengdu Public Transportation Company operates 97 bus lines as of September 2000, of which, there are 76 urban lines and 21 suburban lines (refer to Table 3.3.2 and Figure 3.3.4). Other than these lines, there are 21 mini-bus routes operated by the private sector (refer to Section 3.3.5). Bus network covers most of the primary and secondary roads in the central part of Chengdu City. From the viewpoint of route configuration, bus lines can be classified into two types; one is the radial lines through the city center and the other is the circular lines, passing the 1st or the 2nd Ring Road.

**Table 3.3.2 Routes Operated by Chengdu Public Transportation (as of September 2000)**

Route No.	Road Name (O and D)	Operating Body	Road Length (km)	No. of Stops Including O and D	No. of Allocated Units	Service Frequency/Day/Direction	Operating Hours		No. of Passengers Carried in 1999
						Direction	From	To	
1	Qinglongchang Bus Terminal → Wuhouci	Company No.6	11.50	19	30	209	600	2200	8,746,188
2	North Railway Station → Wuguiqiao	Company No.2	12.75	17	22	176	545	2130	4,586,645
3	Chengdong Bus Terminal → Jiaodaluxi	Company No.1	13.20	20	26	127	545	2130	6,581,030
4	Wuguiqiao → Ximen Bus Terminal	Company No.3	12.15	21	36	169	700	1900	7,770,382
4 Part	Wuguiqiao → Chadianzixikou	Company No.3	15.20	24		65	600	2200	
5	Chengdu 97 Middle School Cheng-Luo Highway ) → Baihua Bus Terminal	Company No.3	12.80	19	31	110	600	2200	7,910,524
5 Part	Chengdu 97 Middle School Cheng-Luo Highway ) → Dongfang Building Material Market	Company No.3	15.20	26		85	630	2000	
6	Guixi Bus Terminal → Train Factory	Company No.1	12.50	20	17	125	630	2200	4,721,753
7	Wenhuagong → Erxianqiao	Company No.1	8.20	13	12	124	600	2130	2,194,382
7 Part	Wenhuagong → Qinglongchang Bus Terminal	Company No.1	9.80	15	10	80	700	1930	
8	Huangjiahuyuan → Science and Technology College	Company No.1	19.80	15	29	125	600	2130	3,898,663
9	North Railway Station → Tianhui Town	Company No.5	10.40	15	16	135	600	2030	4,723,967
9 Part	North Railway Station → Zhiwuyuan	Company No.5	11.70	16	6		730	1700	
10	Wuhouci → Jinhua Town	Company No.6	12.00	15	10	87	700	2100	1,895,685
11	North Railway Station → Yulin Nan-Jie	Government	13.40	19			700	1900	
12	Jiuyanqiao → Gaodianzi	Company No.1	8.70	10	13	104	600	2030	2,590,627
13	Renmin Park → Huangtianba	Company No.3	11.15	15	10	80	610	2030	1,497,897
16	North Railway Station → North Railway Station	Company No.2	11.13	16	32	231	545	2200	10,118,861
17	Baihua Bus Terminal → Supoqiao	Company No.3	6.80	11	8	84	615	2100	1,372,378
18	Jiuyanqiao → Liulichang	Company No.1	5.40	6	5	49	610	2030	958,360
19	Jiuyanqiao → Sanwayao	Company No.1	5.20	11	6	78	610	2045	1,259,535
20	Niushikou → Kuangjichang	Company No.1	12.90	15	7	58	600	2030	1,158,491

(Cont. Table 3.3.2)

23	Ximen Bus Terminal	→ Sichuan Industry University	Company No.3	14.60	9	11	80	640	1900	2,939,942
24	North Railway Station	→ Chongyiqiao	Company No.5	12.00	22	16	96	600	1930	2,721,461
25	Baihua Bus Terminal	→ Balixiaoqu	Company No.3	11.80	22	10	66	700	1900	1,072,335
26	Yanshikou	→ Guofangleyuan	Company No.6	14.50	18	10	56	600	2000	1,278,158
27	Jiuyanqiao	→ Jiuyanqiao (1st Ring Road)	Company No.1	22.40	29	39	207	545	2130	7,782,873
28	North Railway Station	→ Gaopengzi	Company No.6	13.90	20	33	175	600	2130	5,644,604
32	North Railway Station	→ Zoo	Company No.5	5.00	8	7	40	800	1815	
33	Caojiaxiang	→ Wuguiqiao	Company No.1	9.60	19	9	72	700	2030	1,637,222
34	North Railway Station	→ North Railway Station(1st Ring Road)	Company No.2	22.20	29	29	211	545	2130	6,259,556
35	Chengdong Bus Terminal	→ Dufucaotang Park	Company No.1	12.80	21	15	99	610	2115	2,254,790
36	North Railway Station	→ Ligong University	Company No.2	8.00	10	11	104	600	2100	2,925,286
38	Sichuan Teacher-training University	→ Yanshikou	Company No.1	10.90	16	21	156	630	2100	4,874,951
42	Youleyuan	→ Shuangnanyiyuan	Company No.3	13.00	20	16	120	600	2100	3,443,610
43	Tuqiao	→ Tianfu Square	Company No.3	11.55	18	29	123	610	2030	3,331,432
44	North Railway Station	→ Huangzhong Xiaoqu	Company No.2	11.30	13	8	82	615	2000	1,608,243
45	Youleyuan	→ Shuangnan Xiaoqu	Company No.6	13.80	19	24	140	600	2100	4,886,103
47	Niushikou	→ Jinsha Bus Terminal	Company No.1	11.10	19	20	144	600	2140	3,267,922
48	Yanshikou	→ Southwest Jiaotong University	Company No.3	9.00	21	20	108	615	2200	3,773,531
48 Part	Yanshikou	→ Jianjichang	Company No.3	14.20	26		41	700	1900	
49	North Railway Station	→ Wuguiqiao	Company No.1	10.60	20	14	98	630	2100	2,770,741
50	North Railway Station	→ Dongzikou	Company No.2	14.20	26	48	100	700	1900	
51	Xiaolongqiaolubeikou	→ Shuangnan Xiaoqu	Company No.1	14.65	23	35	106	600	2130	5,196,323
52	North Railway Station	→ Hongpailou	Company No.5	11.60	14	24	199	610	2030	7,104,872
53	Renmin Park	→ Jitou Town	Company No.6	11.50	18	30	135	640	2000	2,474,205
53	Renmin Park	→ Shayan Village	Company No.6		20			700	2000	

(Cont. Table 3.3.2)

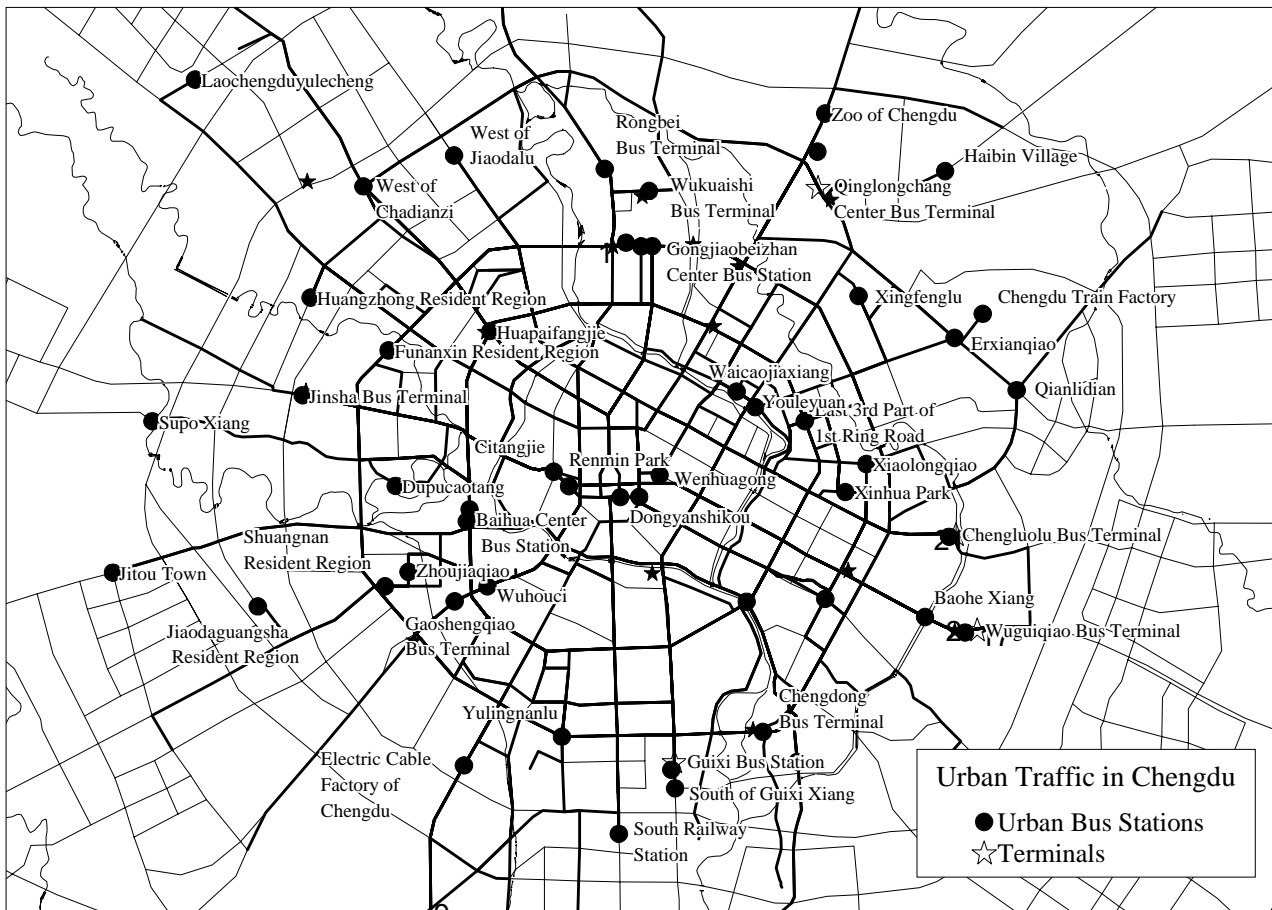
54	North Railway Station	→ Huachaoshichang	Company No.4	11.70	22	30	134	600	2100	4,869,491
55	North Railway Station	→ Guixi Bus Terminal	Company No.2	10.30	18	23	186	600	2100	2,379,103
56	Jiuyanqiao	→ Ximen Bus Terminal	Company No.4	8.60	12	20	117	630	2030	3,062,833
57	Wukuaishi Bus Stion	→ Gaoshengqiao Bus Terminal	Company No.4	9.30	16	17	112	700	1900	2,064,920
58	Baihua Bus Terminal	→ Wuguiqiao	Company No.3	12.45	16	18	122	700	2000	4,697,745
59	Wuhouci	→ Rongbei Bus Terminal	Company No.3	11.90	14	16	96	630	2000	2,346,259
60	Politic Collage of Province	→ Jiuyanqiao	Company No.5	14.10	22	16	104	700	2100	2,612,678
61	Shiyangchang Center Bus Terminal	→ Huaxia Hospital (Xinhua Park)	Government	12.50	27		108	700	1900	
62	Jiuyanqiao	→ Funanxinqu	Company No.4	12.10	19	24	144	600	2130	4,965,820
63	Qinglongchang Center Bus Terminal	→ Songxianqiao Art City	Longquan Travel Company	23.30	25		104	700	1930	
64	North Railway Station	→ Funanxinqu	Company No.4	11.00	20	26	150	630	2130	4,185,123
65	North Railway Station	→ Jiuyanqiao	Company No.4	13.00	22	19	126	430	2200	2,430,228
68	Niushikou	→ Zhuguoshi	Company No.1	9.20	13	4	36	700	1900	654,956
69	Qinglongchang Center Bus Terminal	→ Jinsha Bus Terminal	Company No.5	12.50	18	26	90	700	1900	2,873,304
70	Qinglongchang Center Bus Terminal	→ North Railway Station	Company No.4	8.30	12	11	68	700	1900	1,198,181
71	Qinglongchang Center Bus Terminal	→ Wuguiqiao	Company No.2	13.50	18	14	80	700	1900	1,841,604
72	Youleyuan	→ Jiaodaguangshaxiaoqu	Company No.1	16.20	28	12	76	630	1700	916,507
73	SichuanJianjichang	→ Wenhuaogong	Company No.2	12.80	25	14	75	700	1930	1,538,691
75	Guanrongxiaoqu	→ Dongguang Xiaoqu	Service Company	17.20	30		155	700	1900	
76	Bali Xiaoqu	→ Shiyangchang Center Bus Terminal	Company No.1	17.30	29	15	75	700	1900	
77	Jinsha Bus Terminal	→ Hongrijiasicheng (Liulichang)	Longquan Travel Company	18.80	28		108	700	1900	
78	Jinsha Bus Terminal	→ Guofangleyuan	Service Company	18.60	22		140	700	1900	
80	Qinglongchang Center Bus Terminal	→ Cheng-Luo Highway Bus Terminal	Company No.4	12.20	19	15	84	700	1900	
81	Wuguiqiao	→ Jingsha Bus Terminal	Company No.1	13.45	21	32	192	740	1940	
82	Chengrenlukou	→ Huangzhong Xiaoqu	Company No.2	15.50	26	14	72	700	1900	

(Cont. Table 3.3.2)

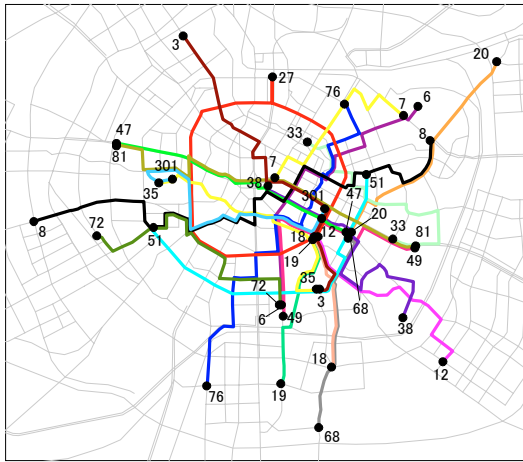
83	Qinglongchang Center Bus Terminal	→ Huangzhong Xiaoku	Company No.2	13.00	21	10	84	700	1900	
84	Supoqiao	→ Guofangleyuan	Company No.3	17.00	21	14	70	700	1900	
85	North Railway Station	→ Shiyangchang Center Station	Company No.5	21.50	26	24	96	700	1900	
93	Xiangxieli	→ Zijing Nan-Lu		19.20	30		84	700	1930	
301	Cheng-Luo Bus Terminal	→ Dufucaotang Park	Company No.1	15.10	22	15		700	1900	
302	Qinglongchang Center Bus Terminal	→ Wuhouci	Company No.5	5.00	23	15		700	1900	814,070
302 Part	Qinglongchang Center Bus Terminal	→ Panda Base (Saturday,Sunday only)	Company No.5		9			800	1840	
Minhang	North Railway Station	→ Shuangliu Airport	Company No.1	24.05	15	23		700	1900	742,713

**Figure 3.3.4 Bus Routes of the Chengdu Public Transportation Company (as of September 2000)**

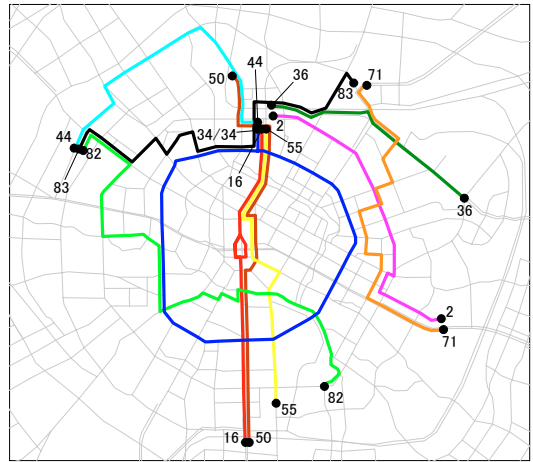
**(1) Bus Route Coverage**



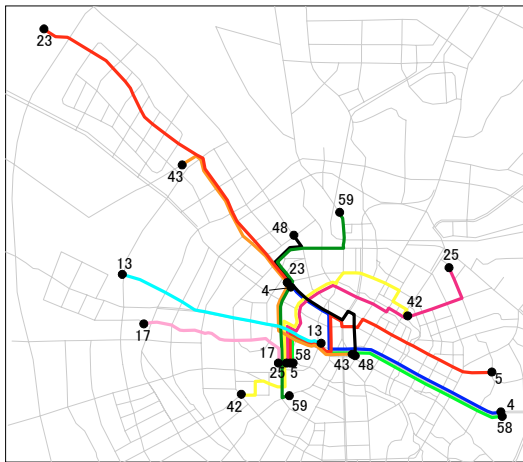
**(2) Bus Lines by Operating Company**



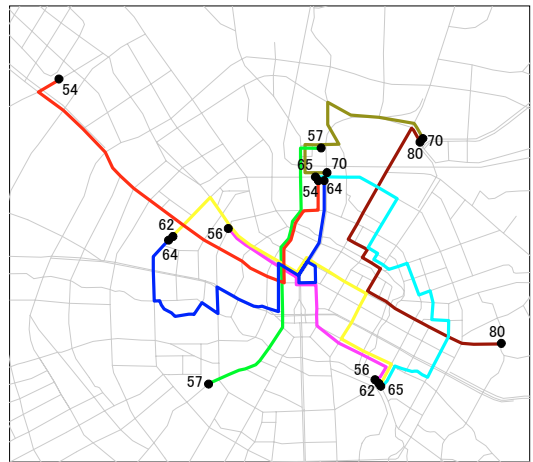
First Bus Company



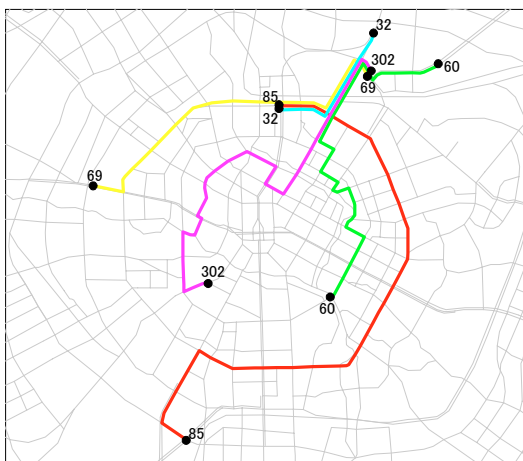
Second Bus Company



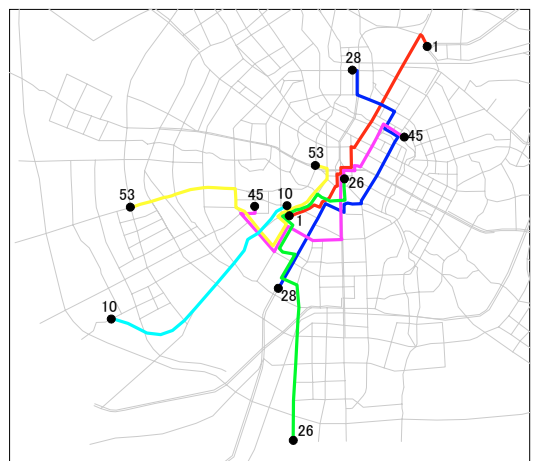
Third Bus Company



Forth Bus Company

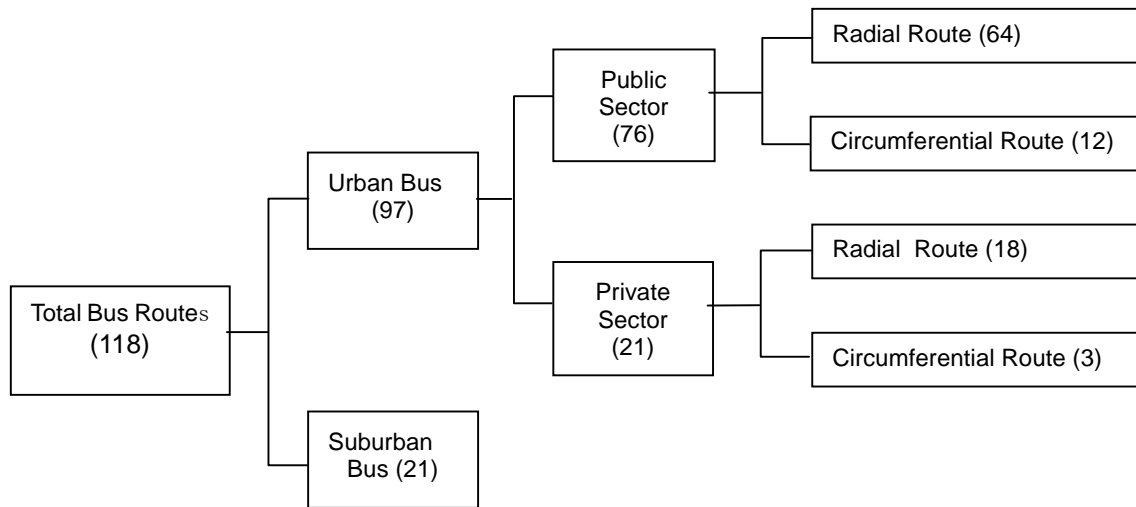


Fifth Bus Company



Sixth Bus Company

**Figure 3.3.5 Number of Routes (as of September 2000)**



There are 9 lines on the first and the second sections of the 1st Ring Road, 8 lines on the section from Tonghuimen Lu to Jinhe Lu, 7 lines on Renmin Nan-Lu, 7 lines on Tianzuo Zhong-Jie and Nan-Jie, 4 lines on Zongfu Lu, Dacisi Lu and Hongxin Lu, 6 lines on Wuhouci Da-Jie and 5 to 6 in Xin Nan Lu and the Kehua Bei-Lu.

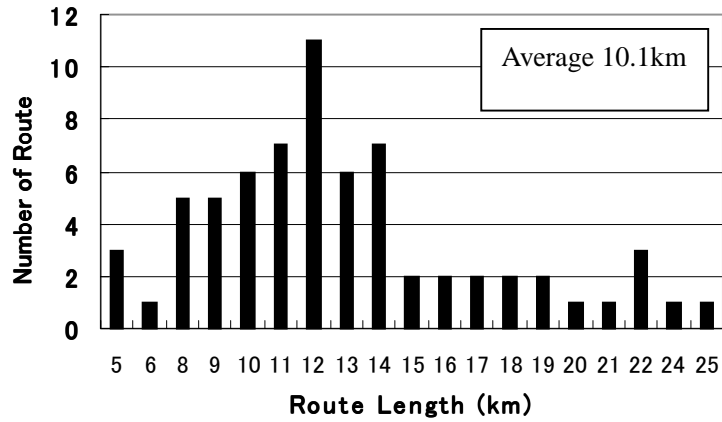
In the suburbs, there are many urban cores locating at the intersections of the radial and ring roads, from where many bus lines start. The Northern Railway Station is an important hub point, and there are 10 lines starting from there.

Radial trunk roads from the north to the center also have many bus lines. There are 8 lines on Rongbei-Shangmao Dadao and 6 lines on Simaqiao Jie, most of which have the terminal at the Northern Railway Station.

The total length of bus routes is 800km. The individual length varies from 5km to 25km and the average is 10.1km (refer to Figure 3.3.6). The average distance between bus stops is 0.5km in urban areas and about 0.8km in the suburbs.

In the central area where trunk roads have many bus lines, several bus lines use the same bus stop. The names of the same stop can be different due to different lines. On the other hands, two or three stops located near-by have the same name. These are confusing to strangers. In order to make bus transfers smooth, the name of the bus stop should be uniform. The facilities should be improved or relocated, especially in the central area.

**Figure 3.3.6 Distribution of Bus Route Length**



**(2) Operation Time and Frequency**

According to the Chengdu Public Transportation Company, 1,121 buses are distributed in 98 lines serving a total of 2,235km. The number of buses dispatched daily is 7,679 buses and the total length of operation is 188,580km as of October 1999, including the urban and the suburban ones. On the average, a bus makes seven (7) one-way trips and operates 170km a day, which means 8.5 hours of operation, assuming an average travel speed of 20km/hour.

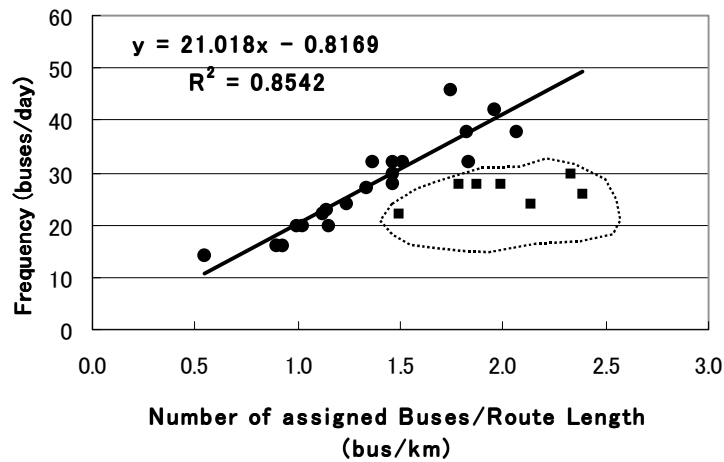
The frequency differs much by line and the maximum is 200 buses a day in one direction. The minimum is 10~20 buses except for the suburban buses.

The operating time is from 5:00~7:00 to 19:00~22:00. However, some routes stop operating at 17:00~18:00, which is comparatively early.

The frequency of trips will increase with more buses assigned to a route. However, the longer a bus line length, the lower the frequency of trips. Figure 3.3.7 shows the strong relation between these variables. The square dots surrounded by dot line stand for the lines on Renmin Nan-Lu, Renmin Bei-Lu, Zongfu Lu, Renmin Xi-Lu, Hongxin Lu and other roads in the busy areas.



**Figure 3.3.7 Correlation between Frequency and Number of Allocated Buses divided by Line Length**



### (3) The Fare Structure

The fare was increased to RMB 1 since April 1, 2000. Prior this date, the fare was 5 Jiao or RMB 0.5 within 5 bus-stops and RMB 1.0 for a longer ride. There is no discount for students and no rides at night. Rides are free for the blind and disabled servicemen approved by government and persons below 1.1m tall. Passengers must prepare the exact fare when they take a non-conductor bus.

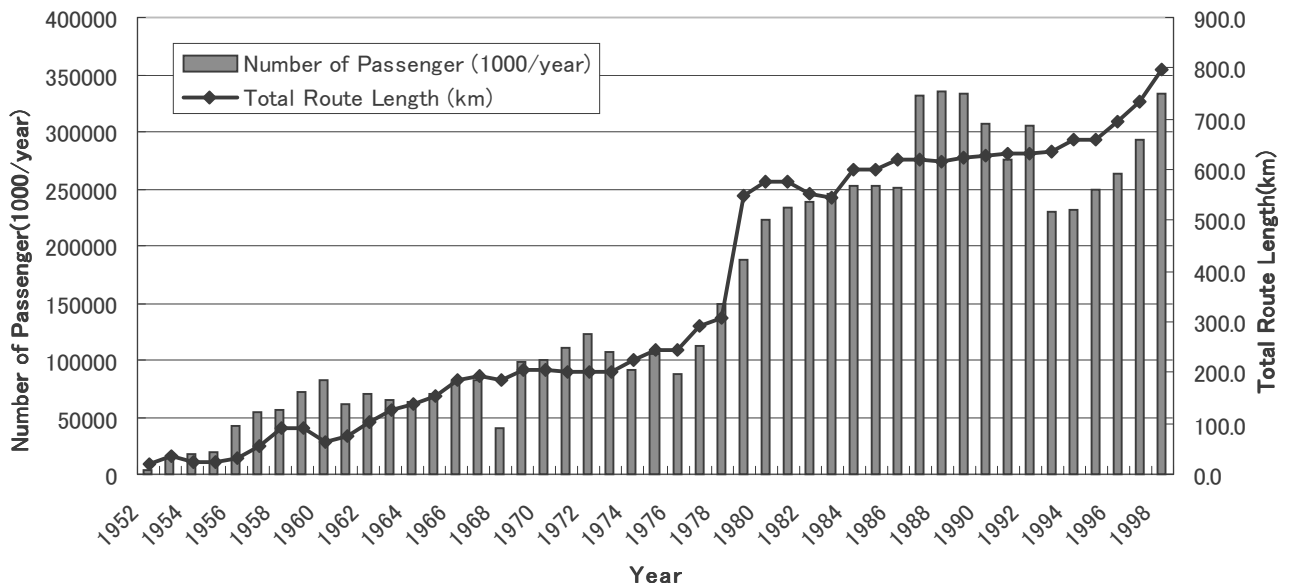
A monthly ticket costs RMB 35 for adults and RMB 15 for students. It is sold by the calendar month and cannot be bought in the middle of a month. The ticket is valid for all lines except Route 301 and 302, which are served by tourist buses (with fare of RMB 2.0), and lines served by mini-buses. The ticket can be bought at ticket offices located at 15 places in the city, by showing an identification card and with a photo.

### (4) Ridership

The annual passengers ridership shows an increasing trend in parallel with the increase in total operation length. Figure 3.3.8 shows the past trend. The number of passengers was 330 million at the end of the 1980s but dropped to 230 million in 1990-1993. In the later part of the 1990s, the number climbed back to 330 million.

Figure 3.3.9 shows the relationship between the number of passengers and the population after Longquanyi District and Qingbaijiang District were included. In 1985, the number of the passengers decreased. In 1998, the population increased 10% while the number of the passengers increased 1.5 times. Here, population includes the long-term residents only. It is estimated that the temporary residents increased rapidly after 1993. Today, as the total population is about three million, one resident takes the bus 110 times a year on the average.

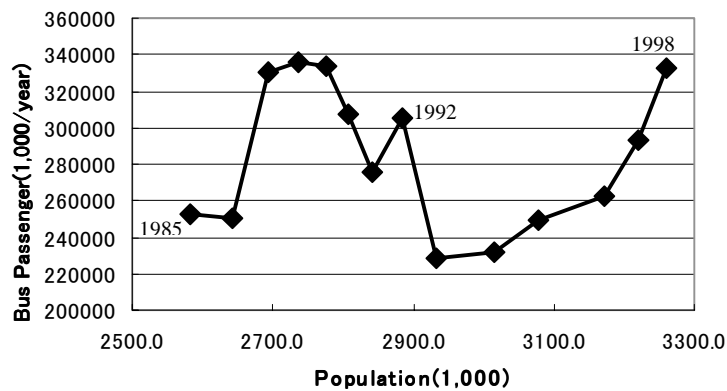
**Figure 3.3.8 Change in Ridership and Route Lengths**



Source: Chengdu city Construction statistics, 1998

According to the Public Transportation Company’s statistics, the daily number of passengers is about 1,100,000 (January to June 2000) and according to this rate, it will be 400 million for the entire year 2000. The sales of monthly tickets is about 100,000 wherein fifteen percent of the buyers are students. The regular passengers using monthly ticket account for 25% of the total if they use the ticket for 2.7 trips (the rate of 2.7 trips is set by the Central Government for planning purposes).

**Figure 3.3.9 Relation between Passengers and Population (1982-1998)**



Source: Chengdu city Construction statistics, 1998

### **3.3.4 Organization of the Public Bus Company**

#### **(1) Organization**

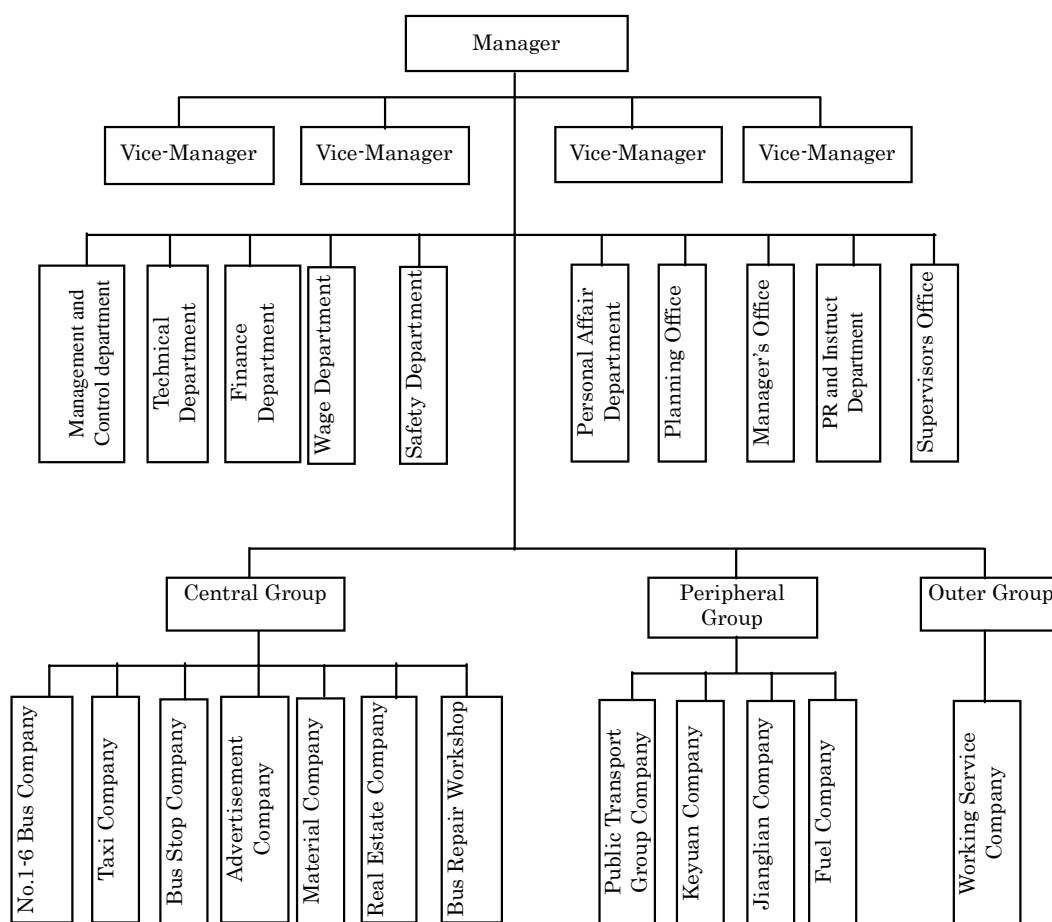
Figure 3.3.10 shows the organization of the state-owned Public Transportation Company. It consists of the various relevant agencies and affiliated companies. The first to the sixth bus companies operate the urban buses. In the past, there were only 3 bus companies and they were divided due to the increase of scale and complexity in bus routes. This Public Transportation Company is under the control of the Section of Transportation Management Department in the Public Utility Bureau.

Other companies included in the organization are: the Taxi Company, the Terminal Company, the Advertisement Company, the Material Company, the Real Estate Company and the Repair Workshop.

The headquarters takes charge of the purchase, repair and abolition of buses; the designation, alteration and abandonment of routes and lines; the personnel affairs and welfare of vice managers and the higher-rank employees. The bus companies take charge of the daily operation, inspection and minor repair.

The bus companies are financially semi-independent. According to the contract, the bus companies cover the deficit by themselves. The salary is decreased if the bus-companies do not reach the contract amount of sales. On the contrary, if they exceed their quota, then the excess is divided into 2 parts: 20% go to the headquarters and the rest 80% to bus companies. The income from monthly tickets goes to the headquarters and some part of the income is refunded to the bus companies based on the average rate of the monthly ticket usage (2.7 times a day).

**Figure 3.3.10 Organization of State-owned Public Transport Company**



**(2) Bus Fleet**

The Public Transportation Company owns 1493 buses as of May 2000 (Table 3.3.3). The ordinary buses accounted for 75%, the double-deckers 10% and the minibuses 10%. The buses with gasoline engine account for 55%, CNG 31%, and diesel oils 14%. Due to depreciation, 45 units of articulated buses and 13 double-deckers are to be abolished in 2000.

**Table 3.3.3 Bus Fleet of Public Transport Company in May 2000**

Type	Fuel/Aircon	Units	(%)
Ordinary Bus	Gasoline (without aircon)	580	38.9
	Gasoline (with aircon)	35	2.3
	GNG (without aircon)	354	23.7
	Diesel (with aircon)	155	10.4
	Subtotal	1,124	75.3
Double-decker		160	10.7
Articulated Bus		45	3.0
Mini Bus		164	11.0
Total		1,493	100.0

Buses less than 5 years old are 918 units, accounting for 61% of the fleet, 6 to 10 years old 28%, and more than 11 years old 11% (Table 3.3.4). The legal life of buses is 10 years, but buses more than 10 years old can still be used until 14 years at longest. The general inspection is carried out once a year but buses that more than 10 years old have to be inspected in every 3 months. Therefore, the Company has a policy to dispose buses more than 10 years old.

The articulated buses are operable only on wide streets although the capacity is 1.7 times that of ordinary buses. Double-deckers are tall and, therefore, there is need to cut low branches of street trees along the routes. Since it costs a lot, the company decided to increase ordinary buses instead.

**Table 3.3.4 Number and Age of Bus Fleet of Public Transport Company**

Year of make	Age (Years)	No. units		%	
Before 1989	11 or more	161	161	10.8	10.8
1990	10	41	414	2.7	27.7
1991	9	42		2.8	
1992	8	68		4.6	
1993	7	172		11.5	
1994	6	91		6.1	
1995	5	94	918	6.3	61.5
1996	4	124		8.3	
1997	3	189		12.6	
1998	2	168		11.3	
1999	1	243		16.3	
2000 (Up to March)	Less than one year	100		6.7	
Total		1,493	1,493	100.0	100.0

Air conditioned buses are only 17% of ordinary buses and seats are mostly built with iron inlaid with wood or plastic. It is easy to clean but not comfortable. The buses are mainly made in the Chengdu Passenger Vehicle Factory owned by Chengdu City. It's production capacity is about 2500 per year and sells its products not only to Chengdu but also to other regions. The market share between the private and the public is approximately 6 to 4.

The price of a large size CNG bus is about RMB 150,000 while the price of a bus with a diesel engine is about RMB13,5000. If a bus with gasoline engine is transformed to CNG bus, it costs RMB 12,000 and a bus with diesel engine to CNG bus costs RMB 20,000. The medium-sized CNG bus can run about 300 km without filling. The Public Transportation Company in Chengdu is subsidized to buy new buses. The Company plans to transform the old engines to the CNG ones as well as buy new CNG buses.

Currently, there are 3 gas-supplying stations for the CNG buses in Chengdu. There will be 20 stations more in 2000. The construction cost for such a station is about RMB 5 million.

### (3) Inspection of Buses

The Public Security and Transportation Bureau inspect buses officially once a year but once every 3 months for buses over 10 year old. There are 4 classes of inspection according to running mileage. The first is for buses running 4,000 km, the second is for those running 16,000 km, the third is for those running 64,000 km, the fourth is for those running 100,000 ~130,000 km. Buses running over 240,000 km should be inspected comprehensively at appointed places. The law obligates the inspections of the first to the third types of buses. Buses are inspected at the workshop of the Public Transport Company or at the workshops of the Bus Company in the presence of appointed inspectors.

### (4) Financial Conditions

There are almost 10,000 employees in the Public Transportation Company in Chengdu as of the late 1999 (Table 3.3.5). The number of drivers and conductors is twice the number of buses due to the 2-shifts system a day. There are a large number of managing and technical employees. The Company has many branches as shown in Figure 3.3.10. There are 6 affiliated bus companies with their own repair workshops.

**Table 3.3.5 Employees of Chengdu Public Transportation Company**

Type		No. of Employees	%
Administrative	Clerical	799	8.2
	Supervisory	870	8.9
Driver		2,841	29.2
Conductor		2,311	23.8
Maintenance		1,472	15.1
Technical		579	6.0
Others		852	8.8
Total		9,724	100.0

Source: Public Transportation Company in Chengdu (by December 2000)

Table 3.3.6 shows the revenue and expenditure of the Company. The operating income is about RMB 170 million and the expenditure for operation and repair is RMB 220 million in 1998. There is a serious deficit in balance. The deficit was at RMB 50 million in 1996 and 1997. The losses were filled up by subsidies.

**Table 3.3.6 Financial Statement of the Public Transportation Company in Chengdu**

(Unit: RMB million)

Item	1996	1997	1998
A. Annual operating revenue	111.8	133.2	170.6
B. Revenue Subsidy	10.0	20.0	10.0
<b>Total Revenue</b>	<b>121.9</b>	<b>153.2</b>	<b>180.6</b>
C. Tax (3.4% of A)	3.8	4.5	5.8
D. Operating Expense	138.0	167.4	199.2
E. Purchase of New Bus units	10.0	10.0	12.0
F. Maintenance	19.2	20.7	25.1
<b>Total Expenses</b>	<b>171.0</b>	<b>202.6</b>	<b>242.1</b>
<b>Balance</b>	<b>-49.2</b>	<b>-49.3</b>	<b>-61.6</b>

Source: the Public Transportation Company in Chengdu

### 3.3.5 Mini-bus

#### (1) General

Mini-buses are operated by 7 companies (refer to Table 3.3.7). The Public Transportation Company in Chengdu and the Mini-bus Company are state-administrated. The other 5 companies are private ones. The 2 state-administrated companies have 461 units out of the total number of 521.

The Mini-bus Company (hereinafter abbreviated as the Company) is set up to manage private bus owners and operators. The Company manages 341 mini-buses with 332 buses owned by private persons. The managerial persons are officers borrowed from the Taxi Service Company in Chengdu. The services provided by the Company are the following:

- The Company allocates the mini-buses to lines assigned to the Company. They employ willing private owners. When there are many candidates, they choose the private owners by means of drawing lots.
- The Company appoints the bus supplier where the private owners buy mini-buses, but does not force this upon the owners.
- The Company levies the taxes including business tax, city construction tax and planning tax. It also educates the private owners, deals with traffic accidents and receives fines.
- The Company does not control the mini-bus operation. (Owners run the services by themselves.)

- The Company inspects the privately owned mini-buses with the help of the Public Transportation Company in Chengdu.
- The 5 private companies also run taxi business, concurrently. The largest one is Sino-Japan Taxi Company in Sichuan province (abbreviated as the Sino-Japan Company).

**Table 3.3.7 Mini-Bus Companies in Chengdu**

Company Name	Company Characteristics	No. of Mini Buses
The Bus Combine Company of Chengdu	Public Company operated by Chengdu City	125
Mini-Bus Company	Aggregation of individual companies under the conduct of the Chengdu taxi service company	341
Sichuan (Chinese and Japanese) Taxi Company	China-Japan joint venture, private	25
Public Bus Company	Aggregation of individual; Companies	10
Wuhong Industry and Business Company	Aggregation of individual; Companies	18
Jinniu Passenger Transport Company	Aggregation of individual; Companies	10
Passenger Transport Company for Travel	Aggregation of individual; Companies	5

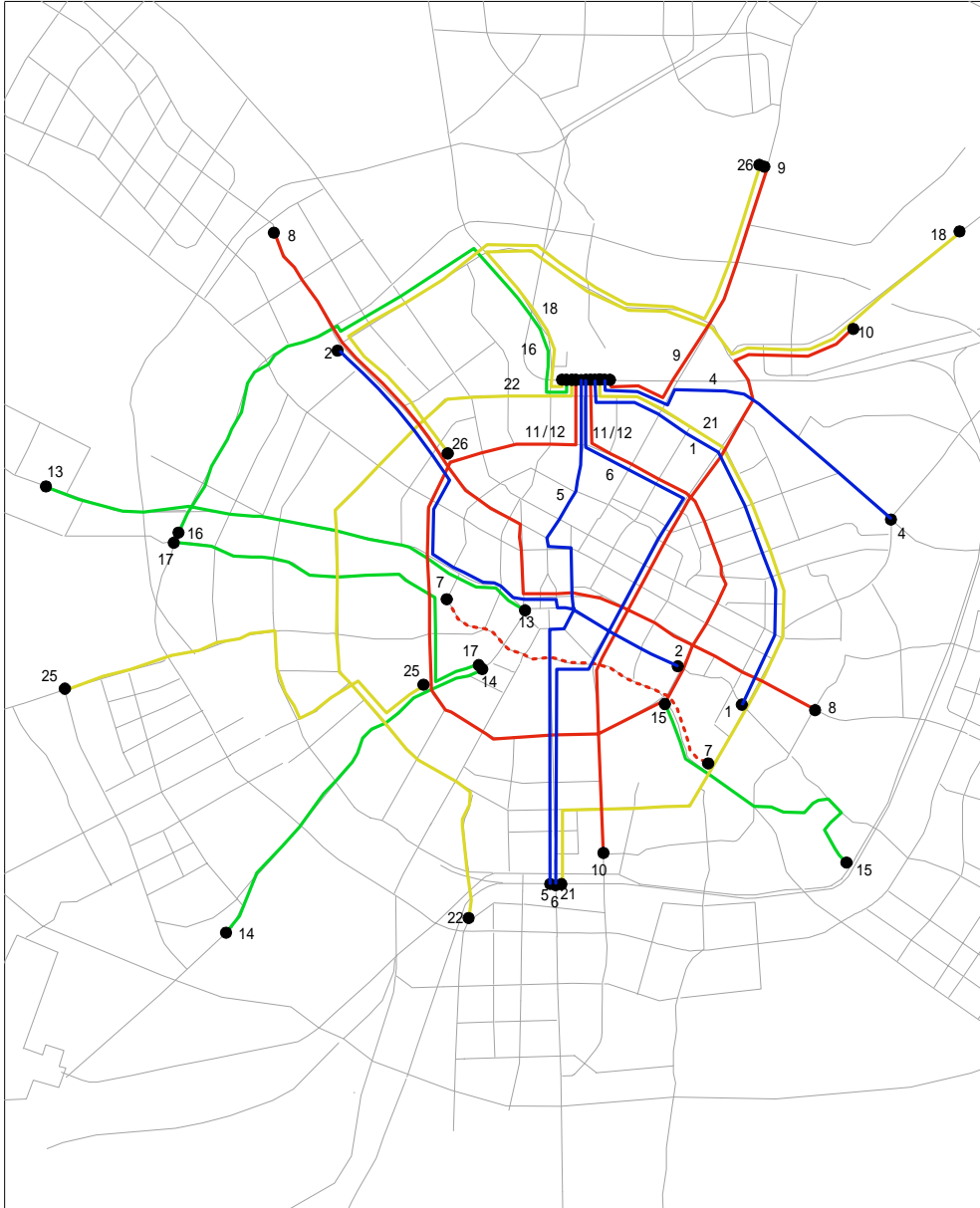
## (2) Mini-bus Routes

There are 20 mini-bus routes under operation with an aggregate route length of 293.1 km. and 444 units of mini-buses in service. Figure 3.3.11 shows the mini-bus line and Table 3.3.8 presents the particulars of these routes. As evidently shown in the same Figure, the mini-bus is not operated efficiently by developing its advantages. The total number of units given in Table 3.3.7 is 534. The following states why there are differences in the data of units reflected:

- The 444 mini-buses were allocated in 1999. There were no new ones added later.
- All of the 125 mini-buses of the Public Transportation Company were not allocated to the mini-bus routes in Chengdu. Some of them are running on the ordinary bus routes.
- Thus, it is estimated that there are 35 units operated in the mini-bus routes and 90 units operated in the bus routes.



Figure 3.3.11 Mini-bus Routes in Chengdu



**Table 3.3.8 Particulars Mini-bus Routes**

Route No.	Origin	Destination	Route	Km	No. of Buses	The Class of Road
1	North Railway Station	Niushikou	Fuqing Lu Flyover, Xinhong Nan-Lu	10.0	27	4
2	Chadianzi	Niushikou	Zhongyifuyuan, Yanshikou, Dongmengdaqiao	12.0	21	4
4	North Railway Station	Dizhi College	Qinglongchang	8.0	7	3
5	North Railway Station	South Railway Station	Renmin Bei-Lu, Zhongxi Shuncheng Jie, Rennansiduanbei	12.0	30	1
6	North Railway Station	Di'ao Zhiyao	Renming Bei-Lu, Yihaoqiao, Rennansanduan	14.0	34	3
7	Baoyun'an	Section5 of the 2nd Ring Road East	Nanmendaqiao, Anshunqiao, Wangjiangqiao	8.0	Suspended	3
8	Tuqiao	Xibu Market	Yangshi Jie, Shuangqiaozi	18.5	25	1
9	North Railway Station	Tianhui Town	Hehuachi, Zoo	9.0	7	3
10	Guixi Gas Station	Politic College of Province	Xinnanmen, Youleyuan, Qinglongchang	18.4	15	4
11	North Railway Station	North Railway Station	1st Ring road (Clock Wise)	19.2	60	2
12	North Railway Station	North Railway Station	1st Ring road (Counter Clock Wise)	19.2	56	2
13	Citang Jie	Huangtianba	Tonghuimen, Qingjiang Dong-Lu, Xiejiaci	11.0	27	2
14	Wuhouci Park	Cuqiao	Gaoshengqiao, Hongpailou	6.0	12	3
15	Jiuyanqiao	Laijiaxinqiao	Shahedaqiao	7.0	4	3
16	Supoqiao	North Railway Station	Majia, Wufuqiao	15.5	13	3
17	Wuhouci Park	Supoqiao	Gaoshengqiao, Caotangsi	10.0	7	3
18	North Railway Station	Longtansi Bus Terminal	Rongbei Bus Terminal, Qinglongchang, Sichuan Liangshi School	23.8	10	4
21	North Railway Station	South Railway Station	Gaosuntang, Mashiqiao, Chengrenlukou	14.0	10	4
22	North Railway Station	Shiyanchang	Southwest Jiaotong University, Section1 of 2nd Ring Road West, Shenxianshu	18.5	51	4
25	Gaoshengqiao	Tongjiang Dong-Jie	Wuhoudaodaobeikou, Jinghua Town, Hongpailou	25.0	18	4
26	Ximen Bus Terminal	Zhiwuyuan	102 Xinxiang, Tianhui Town	22.0	10	4

### (3) Financial Conditions of Mini-Bus Business

Table 3.3.9 is the result of the financial analysis on the privately operated mini-bus business. Some numbers in the table are estimates or assumptions for carrying out the calculation.

**Table 3.3.9 Financial Conditions of Privately Operated Mini-Bus**

Item	The case of Line No.5 <sup>1/</sup>	The case of Line No.1 <sup>1/2/</sup>	The case of Private Line No.8
REVENUE	313,170	303,680	279,616
EXPENDITURE	120,877	119,797	155,589
Vehicle cost <sup>3/</sup>	13,121	13,121	40,133
Vehicle insurance <sup>4/</sup>	4,200	4,200	6,300
Personnel insurance <sup>5/</sup>	4,800	4,800	10,000
Vehicle repair cost <sup>6/</sup>	6,000	6,000	3,600
Fuel and oil cost <sup>7/</sup>	24,000	24,000	36,000
Direct labor cost <sup>8/</sup>	38,400	38,400	30,000
Indirect cost <sup>9/</sup>	18,000	18,000	18,000
Business tax <sup>10/</sup>	1,980	900	5,376
City construction tax <sup>11/</sup>	360	360	360
Road repair tax <sup>12/</sup>	416	416	300
Urban value added tax <sup>13/</sup>	6,600	6,600	5,400
Corporation management cost <sup>14/</sup>	2,880	2,880	0
ISOC tax <sup>15/</sup>	120	120	120
PROFIT	192,293	183,883	124,027

1/ It is 12 km from the northern railway station to the South Station, which is the second class. A mini-bus runs from 6:00 a.m. to 12:00 p.m.

It takes 42 minutes one way and returns after 5 minutes. It goes and returns for 11 times a day. The average number of passengers once is 84 (according to the investigation).

2/ It is 10 km from the northern railway station to the Niushikou, which is the fourth class. A mini-bus runs from 6:00 a.m. to 12:00 p.m. It takes 32 minutes one way (according to the passengers getting in and off the buses). It goes and returns for 11 times. The average number of passengers once is 64 (according to the investigation).

3/ The price of a mini-bus is RMB 70,000 for the companies and RMB 160,000 for the mass. It can be used for 8 years by the company and for 4 years by the private line case. The interest is 10%. The private line case can get the average interest of 30% returned.

4/ The company pays 6% of the price (annual amount). The private line case depends on the reality.

5/ The price for the companies is RMB 4,800.

6/ The price for the companies is RMB 6,000.

7/ The price for the companies is RMB 24,000.

8/ In the Complex, drivers get RMB 1,000 /m and conductors get RMB 600 /m. They work on 2 shifts a day.

9/ The price for the companies is RMB 1,500.

10/ The sales volume is estimated as RMB 5,500 / m in the first class, while that is RMB 2,500 / m. 3% of that is the business tax. The private line case depends on the reality.

11/ The price for the companies is RMB 360.

12/ The company gets RMB 416 / m.

13/ The estimate is 10% of the sales volume for the state-owned company. The private company case depends on the reality.

14/ RMB 225 / m is levied on the Company.

15/ RMB 10 / m is levied on the Company.

### (4) Policy of the Chengdu Public Transport Management Department

The Chengdu Public Transport Management Department plans to ban the mini-buses from entering the area within the 2nd Ring Road to avoid congestion. To make up for the ban, the Department also plans to convert the mini-buses to ordinary buses or to replace the license of mini-buses with that of taxis.

### 3.3.6 Suburban Buses

There are two kinds of public transport services between the urban area of Chengdu and the suburbs (outside the 3rd Ring Road). One is the suburban routes owned by the Chengdu Public Transport Company that operates the urban buses. The other is the short-distance suburban routes for inter-cities operated by the private sector.

The 22 routes presented in Table 3.3.10 belong to the first category. There are some long-distance routes traveling beyond 100km. These long routes are those of inter-city buses and the Transport Department should have managed these routes. However, for some reasons in the past, they have been operated by state-owned companies and managed by the Public Utility Bureau. All the buses on these routes are normal sized buses with 45 seats.

There are five inter-city bus routes with around 20km route length from Chengdu to Huayang, Xindu, Wenjiang, Longquanyi and Pi County.

Basically, fares of suburban buses bound outside the 3rd Ring Road is proportional to distance. However, when an expressway is considered, the fare should include the expressway toll and load fee of road preservation. If buses come to the bad section of the road, the fare is also increased. The relationship between the distance of state-owned suburban routes and fare is presented in Figure 3.3.12. The average fare is RMB 0.42 as the base fare and RMB 0.126/km as the distance based fare. The point on fare increase due to road condition is represented in the Yurjia line (18 km) at RMB14. The fare is relatively higher than other longer routes since the road is in bad condition.

**Table 3.3.10 Suburban Bus Routes Operated by State-owned Company**

Route No.	Route Name (Origin and Destination)	Operating Company	Distance (km)	Number Of Buses Allotted	Fare (RMB)		Annual Passengers (1999)
					Common road	Highway	
14	Chengbei Bus Terminal--Longquanyi	No.1 company	19.50	11	-	-	367,561
15	Gaosuntang Bus Terminal—Chuanhua (Qingbaijiang)	No.5 company	35.00	18	-	8.0	940,347
21	Wuguiqiao—Luodai (Share operation)	No.1 company	25.30	N.A.	4.0-4.5	-	n.a.
29	Wuguiqiao—Shibantan	No.1 company	22.65	6	2.0-3.0	-	352,911
31	Jiuyanqiao—Wanxingqiao	No.1 company	14.10	3	-	-	298,843
37	Wuguiqiao—Longquanyi (Share operation)	No.1 company	18.40	8	-	-	384,141
39	Longquanyi—Shijingsi	No.1 company	20.20	1	-	-	35,034
103	Tonghuimen—Yueliangwan	No.6 company	17.00	8	1.0	-	689,325
201	Gaosuntang Bus Terminal--Jintang	No.5 company	53.00	7	7.0	11.0	191,923
202	Gaosuntang Bus Terminal--Earth Bridge	No.5 company	120.00	3	15.5	-	118,440
203	Gaosuntang Bus Terminal—Baoban	No.5 company	88.00	3	11.0	-	118,633
204	Gaosuntang Bus Terminal--Huaikou	No.5 company	79.00	1	10.0	-	44,949
205	Gaosuntang Bus Terminal--Shifo	No.5 company	110.00	1	12.0-13.0	-	71,274
206	Gaosuntang Bus Terminal--Shiqing	No.5 company	92.00	1	12.0-13.0	-	39,762
207	Gaosuntang Bus Terminal--Zhuli	No.5 company	102.00	2	13.0	-	84,731
208	Gaosuntang Bus Terminal--Yurjia	No.5 company	80.50	2	14.0	-	65,471
209	Chengluo Bus Terminal--Beidianzi	No.1 company	16.80	3	-	-	80,304
210	Chengluo Bus Terminal--Huayang	No.1 company	17.00	6	-	-	28,975
212	Chengluo Bus Terminal--Taiping	No.1 company	37.10	5	-	-	260,206
213	Wuhouci—Shuangliu	No.6 company	15.80	8	2.5-3.0	-	1,312,050
214	Wuhouci—Yanggong	No.6 company	34.30	3	-	-	403,172
216	Chengluo Bus Terminal--Sanlie	No.5 company	84.50	0	-	-	40,371

Source: Chengdu Public Transport Company

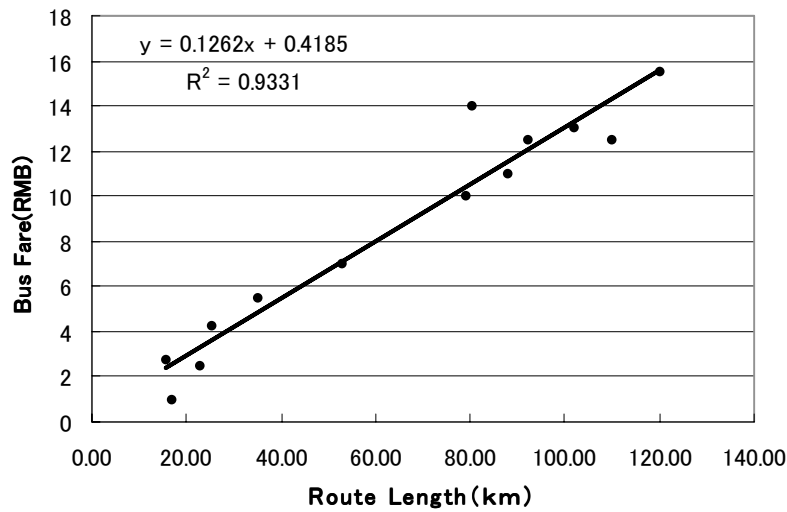
**Table 3.3.11 Privately Operated Suburban Routes**

Line name (Origin to Destination)	Distance (km)	No. of Buses vehicles (buses/ per day)	Fare (RMB/one way)
Chengdu City—Huayang	13	70	2.5
Chengdu City—Xindu	18	78	2.0
Chengdu City—Wenjiang	22	157	3.5
Chengdu City—Longquanyi	19	48	3.5
Chengdu City—Pi	22	98	3.0

Source: Results from the survey at bus terminals.

Note: The number of buses is a one-direction number.

**Figure 3.3.12 Bus Fares of Suburban Routes**



### 3.3.7 Bus Terminal

#### (1) Urban Bus Terminal

There are 97 operational bus routes (urban bus only excluding mini-buses) with total number of units at 1,128. On the other hand, there are 20 routes for the 444 mini-buses. Their origin and destination points are mostly located in the periphery areas around Chengdu. Figure 3.3.13 shows the location of the origin and the destination points and bus terminals. The origin and destination points are similar to the other bus stops without any particular facilities.

The main terminal is in the square in front of the Northern Railway Station. Most people go there to take bus instead of train due to low frequency of trains. Most of the buses in these stations are CNG buses.

The main terminal in Wuguiqiao is neighboring with the Chengdu-Chongqing terminal (Suburban bus terminal). There are 9 bus routes that are using the terminal efficiently.

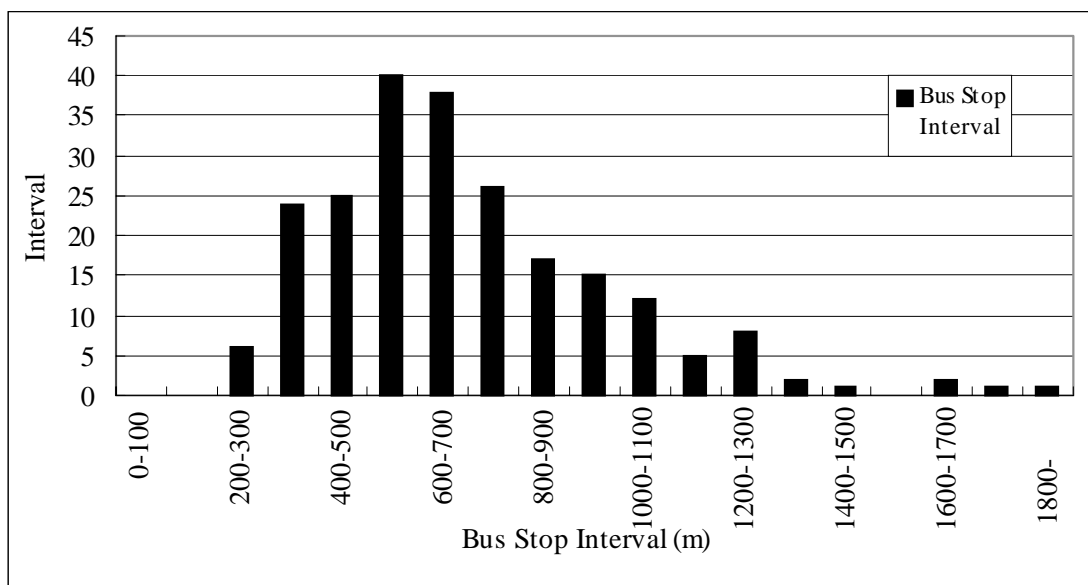


## (2) Urban Bus Stop

The Public Transportation Company is in charge of the urban bus stops in the city with the government subsidizing the cost. The bus stops in the central area are well managed. In several arterial streets, cars and buses run on the central carriageway and bicycles run on the side roads. In such a place, people must cross the bicycle lanes to reach the bus stops.

Bus stop locations were surveyed on 13 main bus routes at the same time of the travel speed survey was conducted. The distance intervals of bus stop is shown in Figure 3.3.14, where most intervals are in the range of 500m~700m.

**Figure 3.3.14 Interval between Stations (Investigated for 13 routes)**



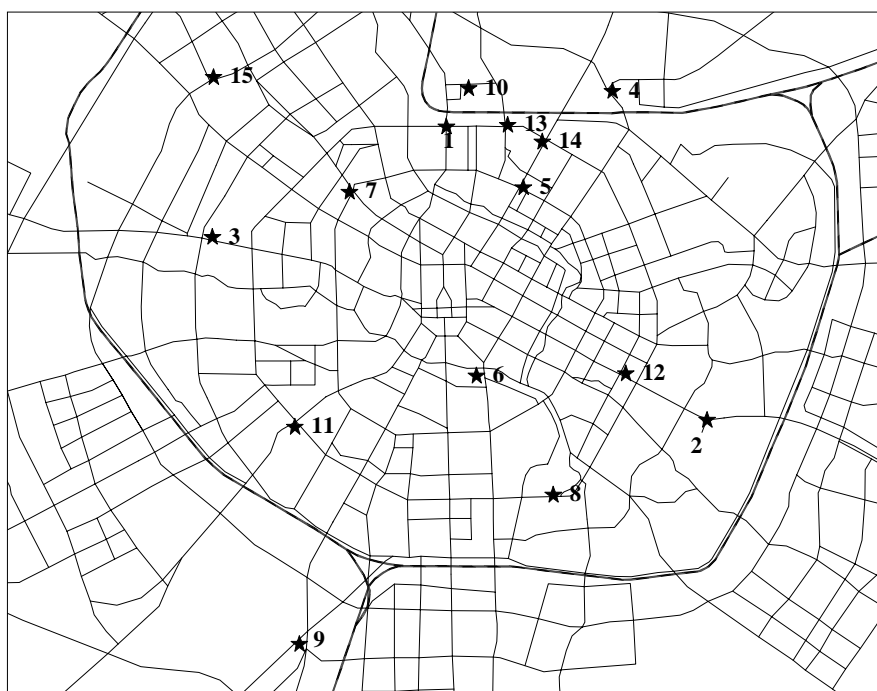
The bus stops in the central area are small in number and also in size. They just function as bus transfer points with no special facilities. Operating time or schedule is adjusted at terminals

## (3) Suburban Bus Terminals

There are 15 terminals for suburban buses, including those currently under planning. The Transport Department is trying to move the old terminals out of the 2nd Ring Road and reorganize them. Locations of suburban bus terminals are shown in Figure 3.3.15 and their present situation is summarized in Table 3.3.13.



**Figure 3.3.15 Locations of Suburban Bus Terminals**



**Table 3.3.13 Situation of Suburban Bus Terminals**

No.	Name	Status of Management	Area	Number of Buses (estimate)
1	Chengbei Center Terminal	Joint-stock company	31	700
2	Chengyu General Terminal	The joint venture company of Foreign capital	52	300
3	Jinsha Terminal	Limited company	77	1000
4	Zhaojuesi Terminal	Limited company	50	350
5	North Gate Bus Terminal	Company belonging to country	34	600
6	Chengdu Travel Center	Joint-stock company	26	500
7	Ximen Terminal	Joint-stock company	16	600
8	Chengdong Center Terminal	Joint-stock company	10	400
9	Shiyang Terminal	Joint-stock company	80	100
10	Wukuaishi Bus Terminal	Joint-stock company	30	400
11	Hongpailou Bus Terminal	Joint-stock company	20	400
12	Shuangqiaozi Center Terminal	Limited company	16	200
13	Hehuachi Terminal	Joint-stock company	24	500
14	Gaosuntang Terminal	Joint-stock company	17	464
15	Chadianzi Terminal	Limited company	40	Under construction

The terminals are operated as a financially independent business. The income includes the terminal fee charged on passengers (RMB 0.5 ~ RMB 2.0, depending on terminals) and the facilities' fee charged on bus companies (6~10% on total sales minus

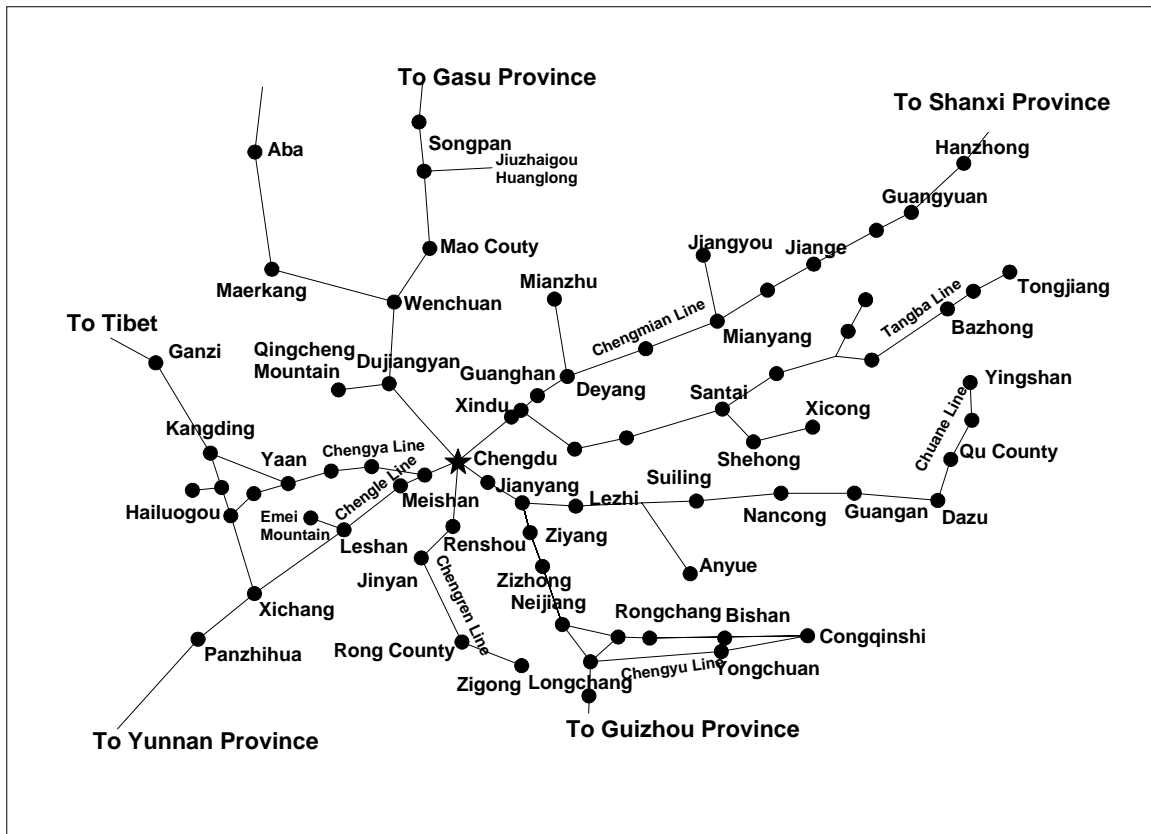
expressway toll, depending on terminals) and the income from side business such as the rent and income of the restaurants, kiosks, and hotels.

The bus terminals are distributed around Chengdu. Most terminals are located along inter-city radial roads. However, all the buses dispatched from a terminal do not run on the radial road where the terminal is situated. Table 3.3.14 shows the number of daily dispatched buses by inter-city roads. With this, the main direction of service can be determined for each terminal. Figure 3.3.16 illustrates the network of suburban bus route.

**Table 3.3.14 Number of Daily Suburban Bus Operation by Terminal and by Direction**

No.	Terminal	Chengluo Lu	Chengyu Lu	Tangba Lu	Chengren Lu	Chuane Lu	Chengya Lu	Dujiang -yan Lu
1	Chengbei Central Terminal	88	26	41	0	165	106	33
2	Chengyu General Terminal	0	290	0	0	6	0	0
3	Jinsha Terminal	10	46	0	0	25	300	18
4	Zhaojuesi Terminal	0	0	0	0	257	0	0
5	Beimen Bus Terminal	4	30	175	0	8	2	0
6	Beimen Bus Terminal	146	0	0	0	119	0	0
7	Ximen Terminal	33	0	0	0	395	64	95
8	Chengdong Central Terminal	0	40	0	53	0	53	0
9	Shiyang Terminal	50	0	0	0	0	50	0
10	Wukuaishi Bus Terminal	0	0	48	0	44	0	0
11	Hongpailou Bus Terminal	35	125	0	40	0	300	0
12	Shuangqiaozi Central Terminal	0	130	0	42	6	0	0
13	Hehuachi Terminal	13	350	50	13	50	13	13
14	Gaosuntang terminal	11	5	240	0	204	4	0
15	Gaosuntang terminal	Construction is still in the planning stage						

**Figure 3.3.16 Suburban Bus Route Map**

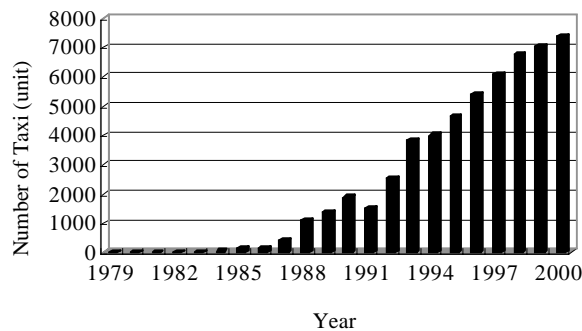


**3.3.8 Taxis and Tricycles**

**(1) Taxis**

There are 7,330 taxis as of June 2000. These are operated by 121 taxi companies, among which about 10% are state-owned and the rest are private companies. The Public Utility Bureau controls these taxis. Beside these, the Transportation Bureau manages other 2,000 taxis operating outside the Outer Ring Road. The fleet of taxis rose in the early 1980s and has steadily increased since the middle of 1980s. (Figure 3.3.17)

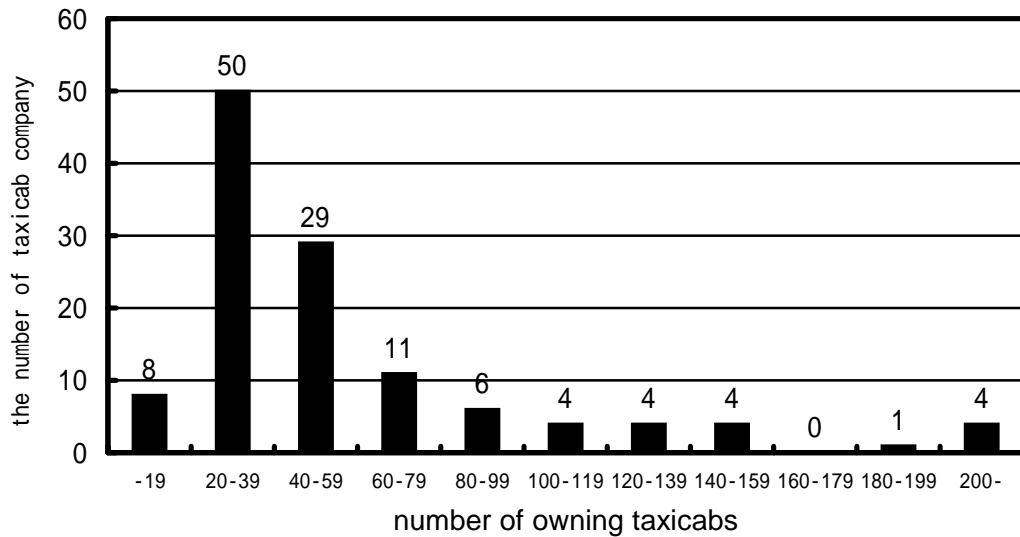
**Figure 3.3.17 Increase of Taxis in Urban Chengdu**



Source: the Almanac of City Construction in Chengdu

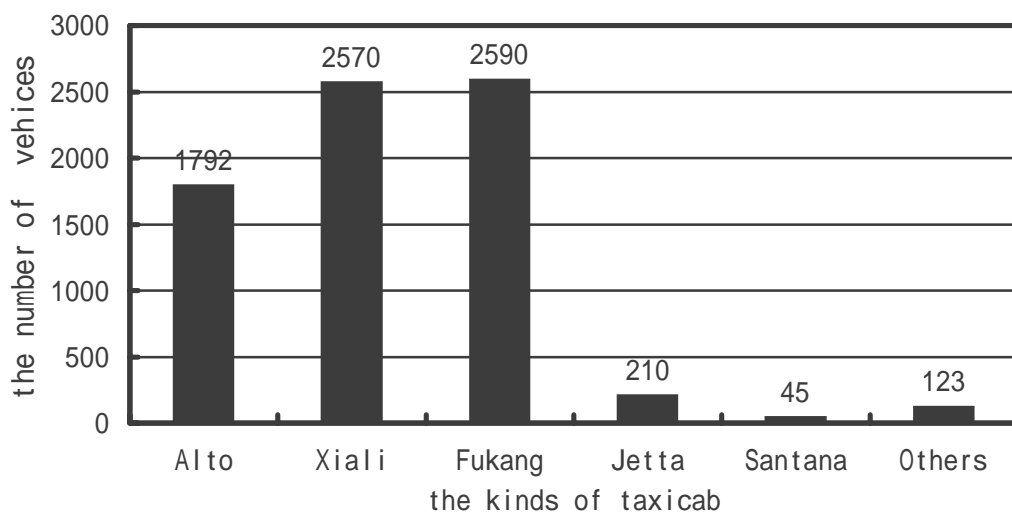
The average number of taxis owned by the companies is 61 units. Most companies have 30 to 40 taxis. Four companies have more than 200 units. The largest one (Working and Services Company) has 812 units (refer to Figure 3.3.18).

**Figure 3.3.18 Distribution of Taxi Companies by Fleet Size**



Fukang-branded and Xiali-branded taxis are the most common units. The third is tiny taxis, Autuo-branded (seating 3 persons at most except the driver, with the starting fare of RMB 4.8). There are only a few large taxis (refer to Figure 3.3.19).

**Figure 3.3.19 Number of Taxis by Models**



The Government of Chengdu has controlled the number of taxis annually by bidding since the end of the 1980s, as other main cities are doing. Currently, taxi operators are selected among bidders based on technical qualification instead of prices which used to be the key for the selection in the past. The winning bidders have to pay RMB 30,000 to 40,000 for the license of one taxi. The license is valid for 20 years and while

being valid, it is salable. The demand for taxi license is quite large. In 1999, the number of applicants is 100 times of issued licenses (500). The revenue from the taxi license is the major resource of subsidies for public transportation.

The taxi company sometimes operates its own taxicab but usually entrusts a private or a group by contract basis. For example, in the Sino-Japan Taxis Limited Cooperation, about a half are company-employed drivers while others are contract drivers. The term of the contract is 3 years. When the contract expires, the taxi is to be renewed. The drivers have to shoulder operating cost of fuel, repair and a partial insurance (partially paid by the company) in addition to the capital cost for the vehicle. The contractor usually hires other drivers, seldom drives the taxi himself. Thus, the taxi license becomes a right of interest now.

The Chengdu Taxi Services Company is a large state-owned company. It owns about 125 taxis itself. Its members (the joint enterprises, the collectivities and the private) run over 1000 taxis. The company manages taxi fleet (to purchase, repair, buy spare parts and conduct insurance), educates drivers, collects taxes, deals with claims, and negotiates with the government and so on.

The vehicles used for taxis are small such as Xiali made in Tianjin and Fukang. The price of new vehicles are RMB 78,000 for Xiali and RMB 135,000 for Fukang, including registration fee. Taxi fares are different by vehicle size. Table 3.3.15 shows the taxi fare system as of October, 2000.

**Table 3.3.15 Taxi Fare System Table**

Fare		Unit	1 <sup>st</sup> rank	2 <sup>nd</sup> rank	3 <sup>rd</sup> rank	4 <sup>th</sup> rank
day	Fare by distance	RMB/km	3.00	2.50	1.40	1.30
	Basic fare	RMB	12.00	10.00	5.00	4.80
	Return fare w/o passenger	RMB/km	1.50	1.25	0.70	0.65
	Fare when stopping	RMB/5min	3.00	2.50	1.40	1.30
night	Fare by km	RMB/km	3.30	2.80	1.70	1.60
	Basic fare	RMB	13.00	11.00	6.00	5.80
	Return fare w/o passenger	RMB/km	1.65	1.40	0.85	0.80
	Fare when stopping	RMB/5min	3.30	2.80	1.70	1.60

The following is a general estimation of the profit/loss of taxi operation. According to the information by a taxi company, a taxi runs about 400 km by two shifts a day and daily sales is at RMB 400 to 500. The rate of running distance with passenger is over 80%. The monthly income is RMB 12,000 to 15,000. The cost for vehicle purchase and deposit depend on the models. The cost for Xiali is RMB 83,000 (RMB 30,000 for deposit). In addition, the driver must pay RMB 6,000 monthly to the company. The driver has also to shoulder running cost of about RMB 3,400 including such cost as fuel, repair and repayment of debts at purchasing a vehicle, which is about RMB 1,900

per month. The driver can get RMB 300 to 1,800 a month as a cash flow base. The taxi drivers answered that their income is about RMB 2,000 to 3,000 because they seem to ignore debts of RMB 1,900/month.

The amount for the taxi license of RMB 300,000 is recovered in 50 months with the monthly income of RMB 6,000. Assuming the cost of a taxi for the company is RMB 2,000, the net income is RMB 4,000. Considering the payment and receiving of the RMB 30,000 deposit, the internal rate of return is estimated at 21% (initial capital: RMB 300,000, annual income for 20 years: RMB 48,000 (the first year: RMB 78,000, the last year: RMB 18,000)).

The Chengdu City Government has a policy to convert the gasoline engine of taxis to the CNG-engine. It will reduce pollution and fuel cost but will increase the price of taxis. It costs about RMB 2,000 to convert gasoline engines to CNG for a taxi.

There are two taxi associations; one is the state-organized Chengdu Association of Taxis and the other is the Chengdu Individual Association of Taxis organized by the private sector. They deal with the regulations of taxi business and negotiations and adjustments between the Government, taxi companies and operators. The Chengdu Association of Taxis was reportedly set up following the Hiroshima Association of Taxis in Japan.

## **(2) Tricycles**

As of October 2000, there are 1,620 registered tricycles in the 6 central districts of Chengdu. The number has not changed since late 1980s. The owners register the tricycles in the Administration Department of the Non-motored Vehicles in their district. Most of the owners are unemployed and farmers. Except for the group owning tricycles, the owners are the drivers. In the past, one person owned one tricycle but now 2 or 3 persons own one. The lanes for tricycles are the same for bicycles. The tricycles can run but cannot pick-up or drop passengers on the main arterials.

The passengers can negotiate the fare or pay on the basis of the usual practice (for example, RMB 1 from Jiuyanqiao to Hejiangting). The driver's income is not high. The price of a new tricycle is about RMB 2,000. There is only one private factory producing tricycles.

The transport mode in suburbs is the auto-tricycle (motorized tricycle). The number has been increasing since the 1990s although the current number is unclear. The motored tricycles cannot enter into the urban areas. Three agencies of the Public Utility Bureau, the Transportations Bureau and the Public Security Bureau supervise the motorized tricycles jointly.

### 3.3.9 Plan for Subway Development

There is no formal and authorized plan of the Chengdu subway although different agencies studied different routes. Figure 3.3.20 is a proposal as of May 2000 by the Planning and Designing Institute and is still for discussion. The plan proposes to build up 6 railway lines of 75 km long by the year 2020. All the lines are planned as an underground subway within the 3rd Ring Road and as an elevated or surface railway beyond that road.

- No.1 line: from the zoo to the southern 3rd Ring Road (14.7km), with 14 stations.
- No.2 line: from the Renjiateng to the Bus Terminal center of Chengdu-Chongqing Expressway (11.5km) with 15 stations.
- No.3 line: along the 2nd Ring Road (28.3km) with 24 stations.
- No.4 line: from Tuqiao to the Sichuan Agriculture Institute (17.5km) with 16 stations.
- Suburban line: the west extension of No.2 line and the east extension of No.4 line.
- Airport line: from the Hongpailou in No.3 line to Shuangliu International Airport along the Sichuan-Tibet road.

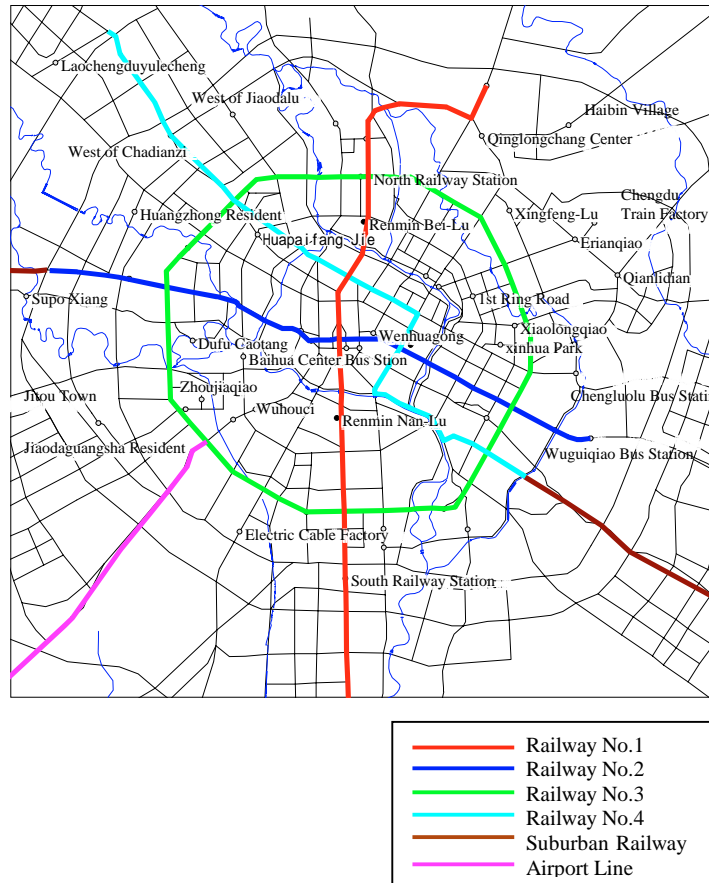
No.1 line has been already approved by the Chengdu City Government. The proposal is already submitted to the Central Planning Committee. A feasibility study will be needed after its ratification. Afterwards the Planning Department will design and implement the project. The Chengdu City Government has entrusted the Second Supervision and Planning Institute to investigate its feasibility.

The municipality organized the Promotion Section for the Subway in 1999 in order to promote No.1 line. The organization consists of personnel from the Plan Committee, the Construction Committee, and the Planning Bureau. It also enlisted technical persons from the Land Bureau, the Transportations Administration Bureau, the People's Anti-aircraft Bureau, the universities, the research institute and other relevant organizations. The Promotion Section is to take the procedure to get the approval of the Central Government and prepare the tender documents.

The No.1 line is presumed to be completed by the year 2010 at the latest. A car is supposed to have the capacity of 310 passengers (290 passengers for the motor car). Assuming the same type of a subway as in Shanghai, overall speed is planned at 33 km/hr. Four-car trains will be operated every four minutes at the beginning and when the demand increases, six-car trains in every two minutes.

The funds considered are to be raised from the foreign loans through the Central Government, from the Local Government and from the sales of public owned land.

**Figure 3.3.20 Rail Transit Network Plan, as of May 2000**





## **3.4 Traffic Management**

### **3.4.1 General Situation of Traffic Management**

The U.N. Commission on Human Settlement and Ministry of Construction in China held a Joint Seminar on the International Urban Transportation in September 1995 in which the action plan of traffic demand management in the large cities in China was presented. The City of Chengdu has also drafted regulations for transportation and reorganized the capital infrastructure program with the objective of easing up traffic, promoting traffic safety and addressing environmental problems. The traffic management regulations have also been reorganized greatly based on The Regulations of Transportation in People's Republic of China established by central government. Chengdu government drafted the regulations for the city incorporating detailed measures to be adopted.

The following are regulations related to traffic management:

- (1) The Regulations of Transportation in People's Republic of China (Public Security and Management of Transportation Bureau in the Ministry of Transportation)
- (2) The Management Measures for Expressway
- (3) The Regulations of Public Security and Management Penalty
- (4) The Road Signals and Signages
- (5) The Safety Requirements for Vehicle Operation
- (6) The Regulations for Vehicle Drivers' License in People's Republic of China
- (7) The Regulations of Ratification of Vehicle Drivers' License in People's Republic of China
- (8) The Law of Road in People's Republic of China
- (9) The Regulations for Non-motorized Vehicles of Chengdu

### **3.4.2 Traffic Regulation**

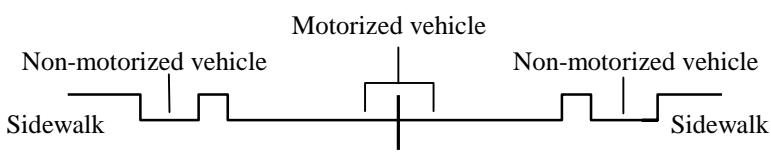
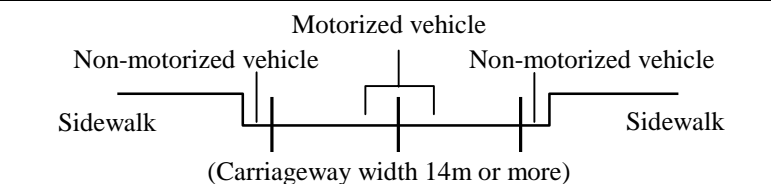
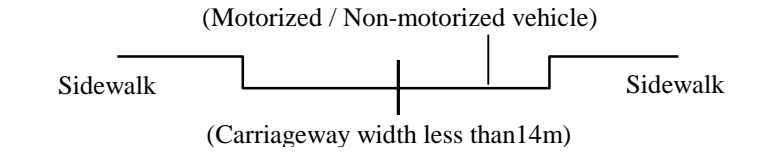
The increase in the number of motorized vehicles and bicycles in Chengdu was accompanied by the increase in the number of traffic accidents and heavy traffic jams in recent years. In order to solve the problem, Chengdu government has adopted various traffic management measures. They established the one-way routes and banned large trucks on routes entering to the center of the city (Funan River – Inner Ring Road) in order to avoid congestion in the center of the city.

The subsequent sections describe the current situation on regulations for transportation based on available materials, the interviews with local agencies and field surveys.

### (1) Speed Limit

The speed limit on the urban roads is decided based on existing road condition or road design standard. This is usually under 60 km/h. The relation between road design standard and speed limit is as follows: firstly, the speed limit on primary roads with segregated lanes for motorized and non-motorized vehicles is 60km/h; secondly, the speed limit on primary and secondary roads where both motorized and non-motorized vehicles are not segregated is 40 km/h; and finally, the speed limit on other roads is below 30 km/h.

**Table 3.4.1 Road Structure and Speed Limits**

Road Structure		Speed Limit
1	 <p>Motorized vehicle Non-motorized vehicle Non-motorized vehicle Sidewalk Sidewalk</p>	<b>60km/h</b>
2	 <p>Motorized vehicle Non-motorized vehicle Non-motorized vehicle Sidewalk Sidewalk (Carriageway width 14m or more)</p>	<b>40km/h</b>
3	 <p>(Motorized / Non-motorized vehicle) Sidewalk Sidewalk (Carriageway width less than 14m)</p>	<b>Below 30km/h</b>

The speed limit signs are often found at intersections. However, intervals of setting them up are irregular. Figure 3.4.1 illustrates a typical setting of speed limit signs.

**Figure 3.4.1 Speed Limit Signs**

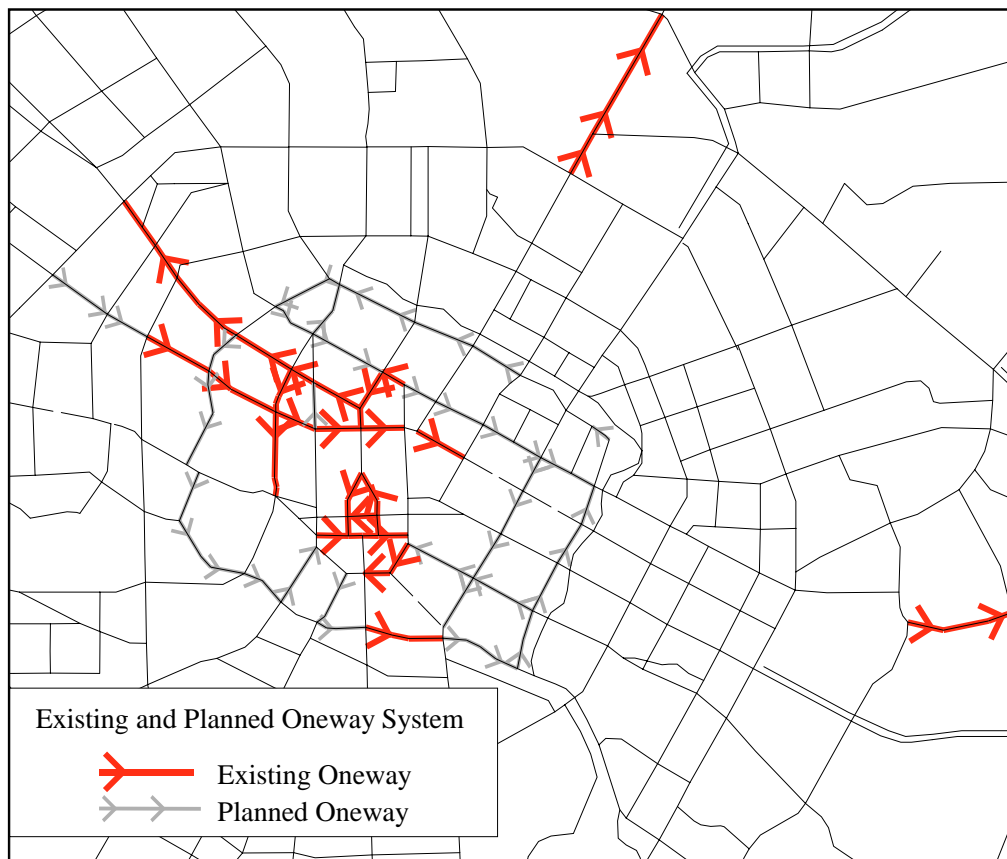


## (2) One-way System

One-way system has been introduced in Chengdu for the efficient use of the road network. Today, areas that have recently adopted the one-way scheme are Xi Da-Jie, Yangshi Jie, Xiyu Jie, Renmin Xi-Lu, etc. Figure 3.4.2 shows these regulated one-way routes.

There are other areas being considered and discussed for the adoption of the one-way system. However, many residents and shop-owners along the street have opposed the one-way route. It was just this year that the Yangshi Jie to Xiyu Jie and Xi Da-Jie introduced the one-way system. Considering residents' opinions along the street, measures have been adopted for these streets to be one-way only during peak hours in the morning and afternoon. This is a kind of a reversible one-way lane, with in-bound traffic allowed at 7:00~10:00 up-Yangxi Xian and out-bound traffic allowed at 17:00~20:00 down-Yangxi Xian. It reflects the difficulty in implementing the one-way traffic management and how hard concerned agencies are pursuing actions to alleviate traffic congestion.

**Figure 3.4.2 Existing and Planned One-way System**



### **(3) Traffic Control**

In order to alleviate traffic congestion in urban area, traffic entering into city center from suburban areas has been restricted especially for roads within the 2nd Ring Road. This entails the following:

- Trucks, motorcycles and motor-tricycles are prohibited to enter the city center during daytime (7am-7pm) without permission;
- Agriculture-related vehicles such as tractors are banned from entering the urban area at all times; and
- Pedicaps are prohibited to enter into city center during the daytime. In addition, some major roads in the city center don't allow rickshaws to enter into the city center while some road sections are exclusively open to pedestrians.

### **3.4.3 Intersection Management**

The variety of size, speed and shape of motorized vehicles, bicycles and rickshaws in Chengdu has brought about an increase in traffic congestion and accidents at major intersections. Chengdu City government has made efforts to improve traffic situation by providing grade separated intersections and signals and implementing bicycle/motorized vehicle separation projects at major intersections.

#### **(1) The Grade Separation, Roundabout and At-grade Intersections**

The grade separation of intersections has been done for primary roads, particularly the 1st, 2nd and 3rd Ring Roads and the Renmin Nan-Lu. Moreover, full scale directional interchanges will be provided on the 3rd Ring Road and the Outer Ring Road.

The grade separation of intersections projects includes not only the separation of motorized vehicles but also the separation of pedestrians/bicycles from the motorized vehicles. For example, the intersection of Renmin Xi-Lu and Wenwu Lu introduced grade separation, with the elevated level for motorized vehicles and the ground level for bicycles, non-motorized vehicles and pedestrians.

Roundabouts are adopted in some intersections. But due to their limited traffic capacity, the roundabouts are becoming bottlenecks causing traffic congestion. At times, drivers' competing attitude could result in a traffic accident. For these reasons, concerned agencies have indicated their intention to gradually remove the roundabouts. Such an intersection in the 1st Ring Road has been already removed (September 2000).

The geometric design of intersections is related to various requirements such as traffic movement, vehicle classification, traffic volume, signage, priority traffic flow and the radius of turning angle. These elements should be taken into account in setting up the design. Existing issues and problems on the geometric design of 20 intersection surveyed can be summarized as follows.

- Mixed traffic flow turning left or right and going straight sometimes cause congestion especially for the left-turning movement. Also, the right-turning movements allow motorized vehicle to use exclusive lane for non-motorized vehicle but it may obstruct the movements of bicycles and pedestrians.
- There is no preferable arrangement on the number of lanes between entering and exiting an intersection so that vehicles often happen to cut in.

**Figure 3.4.3 Grade Separation for Motorized Vehicles and Bicycles**



- Road signs are not clear in many places due to the coexistence of the new and old signs.
- Too wide intersection makes traffic flow disturbing and requires too much time for bicycles and pedestrians to cross the intersection (refer to (3) The Separation of Motorized Vehicles and Bicycles).
- The radius is so wide that it is difficult to control vehicle speed. This is dangerous for bicycle users and pedestrians.

## (2) The System of Signals

As of June 2000, signal lights are installed at 13 intersections. Signals set up in city center or operated along main streets are controlled by lane for the straight, left or right turn traffic flow while others are controlled by direction. Most of the signal systems are fix phasing, but traffic lights have been changed to LED (lighting) bulbs, which are easier to recognize and for introducing Area Traffic Control System.

**Figure 3.4.4 Existing Signal Systems**



Lane Control (LED)



Directional Control (Conventional)

Based on the intersection survey, the characteristics and issues on the existing signal system are examined as follows.

- 1) The cycle of signal is from 60 to 270 seconds with an average of 150 to 180 seconds, which is quite long. (In Japan 120 seconds is often used as the maximum cycle time) For the Zongfu Street to Southern Tianzuo Street intersections, the cycle is 270 seconds resulting in the long queue of cars. This lowers the efficiency of signals and may influence the performance of nearby intersections. Besides, the longest delay time at intersections is 220 seconds.
- 2) The signal phasing at 4 cross intersections are mainly 2 phasing and the directional lane arrangement are mainly mixed with straight traffic and left or right turn traffic so that its capacity is near the maximum with an increase in demand. Subsequently, left turn lane can be provided at the intersection with high left-turn demand in the main traffic signal operating with 3 to 4 phasing.
- 3) The signal controls are basically composed of green, yellow, red and the arrow-sign lights that give priority to a direction in order to make traffic flow smoother and more efficient. The arrow-signal is recommendable to avoid traffic flow crossing but, in fact, it is seen in some signal operations.
- 4) Time differences in the opposite in-flow: with the control of 3 or 4 signal phasing, the turning left of the opposite in-flow often cannot be executed fully due to the pre-mature change of the lights to green in the opposite in-flow. Figure 3.4.5 shows the current phasing of movements at intersections and the proposed phasing plan. In general, left-turning movements can be prioritized if the volume of discharge is small.

- 5) Management of signals for vehicles and bicycles and pedestrians in several intersections does not work well so that the light for vehicles turns green even before the light for pedestrians turns red. Coordinated control system must be done with accuracy and thoroughness to secure the safety of pedestrians. Also, it is necessary to periodically adjust the phasing time of the lights to respond to the changes in traffic flow/discharge.

**Figure 3.4.5 Example of Current Signal Phasing at Intersections and Possible Improvement**

	Phase1		Phase2	Phase3
Current Phasing				
Improved Phasing Plan				

**(3) Separation of Motorized Vehicles and Bicycles**

The mixture of vehicles and bicycles is one of the factor contributing to traffic congestion and accidents. It is often taken up as the main issue in transport related projects. The separation of motorized vehicles and bicycles has been actively done in Chengdu by way of setting up bicycle lanes on main roads. However, left-turn movement of vehicles still causes traffic congestion and accident.

**Figure 3.4.6 Example of Separation of Bicycles from Cars**





In order to settle this kind of problem, Chengdu city government began to try a new approach to the separation of motorized vehicles and bicycles in a way that bicycles should use crossing for bicycles set up along pedestrian crossing. This contributed to the great improvement in avoiding collision of motorized vehicles and bicycles. It requires, however, enough space for bicycles.

#### (4) Traffic Police and Instructor

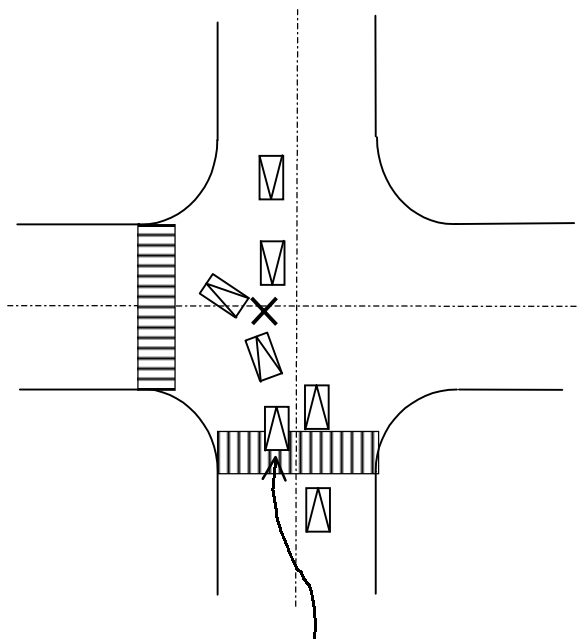
The traffic police from the Public Security Bureau and instructor from Chengdu Central Office play a role in supervising, guiding, penalizing and educating drivers, bicycle users and pedestrians especially during peak hours at the main intersections.

Basically, the traffic police's roles are of supervising and guiding while female-dominated instructor's role are of inspecting or instructing those disobeying the law. It is expected that this kind of activity could help everyone to realize the importance of obeying traffic regulations.

#### (5) Traffic Flow and Traffic Discipline

With the help of traffic police and instructors, drivers, bicycle users and pedestrians have gradually obeying traffic regulations. However, there still exist reckless behaviors, e.g., overtaking, cutting in and so on. The separation of vehicles and bicycles is seen in most of the major intersections but collision between vehicles and bicycles are often noted in other intersections without separation. The situation gets worse at the intersection with no traffic police or instructor.

**Figure 3.4.7 Traffic Problem Caused by Reckless Left Turning**





### 3.4.4 Car and Bicycle Parking Facility and Control

The basic idea for public parking facility in China is as follows:

- 1) The public parking facilities include car and bicycles parking facilities. The car parking facilities can be especially divided into two, i.e., one for cars entering from the rural area and the other for cars moving into the intra-urban area. The former, particularly dominated by trucks, are located in areas near the outer ring road or main radial road.
- 2) There are no regulations about the parking facilities for office and commercial buildings but as a target, 0.8 – 1.0 square meters per urban population may be recommendable. 80 – 90 % of the parking area is dominated by motorized vehicles and 10%~20% by bicycles.
- 3) The service area for parking facilities is 200m for city center and 300m for other areas. Regarding bicycle parking, below 200m will be required in central cities.

Even though motorized vehicles have been a key transport mode especially in urban area, supply of parking facilities failed to follow the increasing demand and, as a result, spaces nearby buildings would be used as parking lots and streets or parked cars would occupy exclusive lanes for non-motorized vehicles.

As it is strictly prohibited to park vehicles on primary and secondary roads, illegal vehicles are scarcely found on the trunk road. There are, however, many parking lots on the tertiary roads in commercial areas, which are basically operated by the staff of the Transportation Management Bureau. In order to use these facilities, drivers should pay the parking fee of 2 RMB.

The bicycle parking facilities are located everywhere in the urban area such as office and shopping centers. Most of them can especially be found on the sidewalk marked by white lines or fences, which are also operated by the staff of the Transportation Management Bureau. In order to use these facilities, users should pay a parking fee of 2 Jiao. A penalty of 10 RMB is imposed on illegal users. Most of the offices and commercial buildings have provided proper bicycle parking spaces and they are comparatively well managed.

**Figure 3.4.8 Motor Vehicle and Bicycle Parking**



Motor Vehicles Parking on Bicycle Lane



Bicycle Parking on Sidewalk

### **3.4.5 Traffic Management for Public Transport**

The traffic regulations for public transport such as bus and taxi are basically similar to those of the private vehicle. Presently, there is no bus exclusive and priority lane in the city, however, priority is sometimes given to the bus system. For example, public buses can turn left where turning left is prohibited, as noted at the intersections of Qintai Street and Tonghuimen Street.

In recent years, the number of taxis increased greatly so that picking up passengers and cutting in has caused traffic problems such as congestion and accidents. Now, the stations for taxis are set in the main roads in order to decrease disorderly stopping.

### **3.4.6 Existing Pedestrians and Bicycle Facilities in City Center**

The Chengdu government has developed public facilities suitable for the capital city of Shichuan Province. Bicycle lanes, wide sidewalks and planting trees have been provided along the main streets. In 1998, as a result of the Funan River Comprehensive Development Project, more parks and green parks have been provided along the River, which were able to provide important recreational spaces.

In the city center, pedestrian bridges were constructed in line with adjacent commercial building, providing safety and comfort to the pedestrians. In addition, several streets are connected to the pedestrian walk. The need for pedestrian environmental development has gradually gained recognition.

Areas inside the 1st Ring Road, especially inside the Inner Ring Road, being a place of historical buildings and parks such as Tianfu Square and People's Square, are becoming a key element for public facilities.

**Figure 3.4.9 The Green Path by the Funan River Cleaning Project**



### **3.4.7 Existing Measures on Traffic Demand Management**

The following are the current regulations concerning ownership and purchase of cars, motorcycles and bicycles:

- 1) Although there are no specific regulations on purchasing a car but only few people can afford to purchase one due mainly to its expensive price range.
- 2) The number of motorbikes that can be purchased is limited to 2,000 per year. People should get permission from the city before buying one.
- 3) There is no specific regulation on purchasing a bicycle but it should be registered within a month after purchasing.

Various different regulations on the purchase of car or motorbike and number plate have been introduced and implemented around cities in China. For example, in Shanghai, number plate of a car can be gained through auctions, which sometimes gives some control on car ownership.

The driving license can be classified as the general license, the practice license and the temporary license. The general license can be acquired by individuals of at least 21 years of age for large buses or 18 years of age for other vehicles after holding a practice license for two years. The general license obtained later must be renewed every six year. Moreover, an individual with 3 years of experience in driving large vehicles could secure a license for driving the large buses and trucks. The temporary license is issued to foreigners or Hong Kong people or Taiwanese staying in China for over 3 months but under 1 year.

### 3.4.8 Traffic Safety

With the increase in motorized vehicles, traffic accidents and fatalities have risen greatly. From the statistics reported by the Public Securities Bureau, the number has increased from 2,500 in 1996 to 42,000 in 1999 and the fatalities have tripled from 577 in 1996 to 1,348 in 1999. Likewise, the number of injuries have increased to over 10,000 in 1999 about 6 times that in 1996.

**Table 3.4.2 Trend in Traffic Accidents and Casualties in Chengdu**

Year Item	1996	1997	Increase/ Decrease %	1998	Increase/ Decrease %	1999
No.of Accidents Reported	2,496	3,094	23.95	3,562	15.13	41940
No.of Deaths	577	570	-1.21	585	2.63	1348
No.of Injuries	1,697	2,204	29.87	2,801	27.09	10578
Economic Loss (RMB)	10,914,455	12,152,426	11.34	10,864,639	-10.59	21,413,265

Source: Public Securities Bureau

The average number of fatalities per 10,000 motorized vehicles in China is over 30 compared to 1.0~2.0 in the developed countries and 27 that in Chengdu city. Over 90% of the accidents are due to the carelessness of drivers, riders and pedestrians among which over 80% are caused by the negligence of drivers. The other reasons are related to the mishandling of cars, the bad maintenance of roads and the problems of transport regulations.

Of the accidents caused by drivers' mistakes, most are due to driving behavior of drivers (taxi and public bus). This implies the importance of education or training. Regarding vehicle inspection, many car owners do not follow the regulation on having their vehicle inspected every year, especially the taxi, bus and truck.

Whoever violates traffic regulation is punished according to The Regulations of Penalty and Punishment in Public Security and Management in PRC and The Regulations of Transportation and Roads in PRC and The Regulations of Non-motorized Vehicles in Chengdu city. There were over 3,000,000 violations reported in 1998 among which 267 drivers' licenses were revoked, 198 persons were detained and 36 persons were taken into custody for criminal offenses.

On this occasion, the Chengdu government set and adopted relevant measures as follows (refer to 1999 almanac) as follows:

- 1) Ensure smooth traffic flow and avoid traffic congestion and danger by trying to rationalize movements at the intersections on the basis of clear lanes.
- 2) Strengthen the education on traffic safety and broadcast relevant policies.
- 3) Enhance the patrolling of auto-bikes (police auto-bike) and prevent unlawful actions of citizens.
- 4) Strengthen the organization of traffic police.
- 5) Learn new technologies and improve the ability of traffic police in order to realize the objective of “Order, Less Accidents, Fewer Congestion, More Satisfaction”.

### **3.4.9 Existing Problems and Issues on Traffic Management**

#### **(1) Expansion and Modernization of the Signal System**

With the increasing number of motorized vehicles, it is necessary to install new and inductive signal devices at successive intersections. As such, the central control and area traffic central system should be introduced in the central urban area.

#### **(2) Proper Channelisation for At-grade Intersections**

It is important to ensure smooth traffic flow for safety. It is necessary to produce efficient channelization for the left turn traffic and to define the pedestrian crossings and bicycle ways. Likewise, it is also necessary to produce a balanced traffic in-flow and out-flow in the geometric design of at-grade intersections.

#### **(3) Separation of Motorized Vehicles and Bicycles**

In the secondary roads, bicycles and motorized vehicles are not clearly separated which causes serious traffic jams and accidents. Therefore, it is urgent to rationalize this.

#### **(4) Development of Bicycle Road Network**

Bicycles share over 40% of all transport modes in Chengdu. Their dominance will continue in the future despite the fact that more people will take other transport modes. Therefore, it is essential to reorganize the bicycle lanes to form a bicycle route network by setting up the green path along Funan River and preserving historical sites.

**(5) Development of Pedestrian Road Network**

It is also essential to reorganize the areas for pedestrians to make them comfortable. The main task is to set up a network of pedestrians' areas and open spaces especially in the bustling shopping centers and nearby bus stations.

**(6) Strengthening TDM (Traffic Demand Management)**

The reality in developing countries is that developing market economics, expanding city boundary and the promotion of car use will contribute to more traffic congestion and pollution of environment. Although the conditions in Chengdu are better than those in other cities, the pollution is expected to get worse due to the demand for cars and the climate that is characteristically that of a basin area. It is necessary to control the use of private cars and motorcycles. The study aims at formulating relevant measures based on public transportation.

**(7) Improvement in Traffic Safety**

It is urgent to set up signal devices for pedestrians and to spread the mentality of "Pedestrians First" based on the 5-year plan in Traffic Safety Regulations in the long term especially in educating the drivers of taxis and public buses.