

CHAPTER 4  
Road Facility Conditions and Traffic  
Characteristics

## **4. ROAD FACILITY CONDITIONS AND TRAFFIC CHARACTERISTICS**

### **4.1. ROAD FACILITY CONDITIONS**

#### **4.1.1. ROAD FACILITY ADMINISTRATION**

The province of Lima is conformed by 43 districts, plus the area of Cercado de Lima and 6 districts of the Constitutional Province of Callao. Lima and Callao metropolitan road facilities are progressively developed by each district independently, the structure of road facilities is quite well arranged in grids; at planning level but as a whole, the existent road network not always fulfills their functions, as arterial, collector and local roads.

The Metropolitan Lima Development Plan elaborated in 1988 ( Metropolitan Municipality of Lima ) and its later updated version, Strategic Plan of Urban Transport – Metropolitan Projects proposed the development of radial and ring roads considering downtown Lima as the center, utilizing the existing main roads. Some main roads are developed according to this proposal, however a road network based on the hierarchy of roads by specific function is not sufficiently established yet.

The Metropolitan Institute of Planning (IMP) of Lima classified the main roads of the metropolitan area, according to their functions, in Expressways, Arterial roads and Collector roads and elaborated a proposal for a Metropolitan Road Plan System determining rights of way. Said proposed plan, after being discussed at the Metropolitan Council, was approved through the Municipal Ordinance 341 of Dec 2001. The present Ordinance establishes the drawing up and the normative road section for each road comprehended in the Metropolitan area of Lima and determines the right of way to respect for the new constructions. The Municipality of Callao has its own rules.

According to the dispositions of the Law of Transport 27181, the Municipalities of Lima and Callao are responsible for planning, constructing, improving and maintaining the expressways, arterial roads and collector roads, including national roads at sections under the jurisdiction of these municipalities. The smaller local roads, not included above, are under the responsibility of each district municipality.

#### **4.1.2. ROAD FACILITY CLASSIFICATION**

##### **(1) Classification by Administrative Jurisdiction**

Road facilities could be classified according to the administrative jurisdiction roads are under, namely the central government, municipal government and district government, but national roads of the Metropolitan Road System are under the jurisdiction of the Metropolitan Municipality of Lima or the Municipality of Callao.

##### **(2) Classification by Function**

The Metropolitan Institute of Planning of Lima has classified roads according to four functions as shown below.

###### **1) Local Roads**

Local road serves to districts and their main function is to allow the access to urban properties. Mainly, local roads have two lanes for both directions and are usually called Calle or Jiron.

## **2) Collector Roads**

Collector roads are connected to local roads through at-grade intersections without traffic lights and their function is to connect the traffic of such roads to arterial roads. Mostly, are called Avenues and have 4 lanes for both directions.

## **3) Arterial Roads**

Arterial roads have the function of serving the traffic originated in collector roads and are called Avenidas or Road Corridors. At arterial roads with expressways or between two arterial roads the intersections are grade-separated. However, at present the majority of existing intersections are grade intersections, and although there are traffic lights placed there, they do not work satisfactorily, so transit police officers are in charge of traffic ordainment.

## **4) Expressways**

Expressways are for pass transit, high volumes and considerable speed in which, the entrances and exits are controlled by interchanges, being connected with other expressways or arterial roads by grade-separated intersections. According to the characteristics of use there are 3 types of expressways as explained below.

- National/Regional : Expressways of national or regional function that serve the traffic of heavy load cargo trucks between cities.
- Sub-Regional: Roads which, contour the metropolitan area in order to improve the access to the outside and also aiming to improve its development.
- Metropolitan: Expressways those connect important areas within the city.

### **4.1.3. EXISTING ARTERIAL ROAD NETWORK**

The existing arterial road network is shaped according to radial roads splitting from the central area of the city where the administration is concentrated and ring roads connect them (although not forming a complete shape).

#### **(1) Radial Road Network**

Radial road network: Av. Tupac Amaru runs parallel to Av. Panamericana Norte, Av. Argentina and 5 more avenues run parallel to the Rímac River on the West, 6 avenues namely Av. Brasil, Salaverry, Arequipa, Paseo de la República and Aviación run in the South and finally the radial roads Carretera Central and Autopista Ramiro Priale run towards the East.

#### **(2) Ring Road Network**

In order to alleviate traffic congestion concentrated at the central area due to the radial roads, the Metropolitan Development Plan of Lima (Metropolitan Municipality of Lima) considered 6 ring roads, including ring roads of the center of Lima. However, the totality of said roads join existing roads, overlapping the links of ring roads in some sections; also in many sections the links are too close and functions and characteristics of said roads are not clear. Due to the development of modern districts such as Miraflores, San Isidro and the development of industrial zones such as Callao, traffic concentration in downtown Lima tends to be reduced.

Although, on “The Master Plan of the Center of Lima”, this ring road network was modified, considering a more appropriated drawing according to the current urban development.

### **(3) Expressway Network**

In order to achieve traffic efficiency, the Metropolitan Planning Institute (IMP) introduced the concept of road hierarchy, and intends to implement 3 types of expressways according to their functions:

#### **1) National/Regional**

Four national roads, Av. Panamericana Norte, Av. Panamericana Sur, Av. Canta-Callao, Av. Nestor Gambetta and Autopista Ramiro Prialé, besides Av. Periferico Norte road to facilitate the access to the Callao Port and the Separadora Industrial road, totaling 7 roads, are considered. Of such, currently there are Av. Panamericana Norte, Av. Panamericana Sur, Av. Nestor Gambetta and a section of Autopista Ramiro Prialé.

Av. Panamericana crosses the city from South to North, and it is divided since Av. Evitamiento into Av. Panamericana Norte and Av. Panamericana Sur. In one point, Av. Panamericana Sur is connected to an arterial road by a grade intersection; however, it has expressway standards for the exclusive use of cars. Almost all intersections of Av. Panamericana Norte are grade intersection type. Towards the East, stretches Autopista Ramiro Prialé. It has a semi-expressway standard (entrances and exits are controlled; however, intersections with some arterial roads are grade intersection type).

#### **2) Sub Regional**

Road designated to stretch contouring the city limits, presently in project.

#### **3) Metropolitan**

There are four roads designated as such, namely the South-North transport axis road, the road to connect the airport to the downtown south-north transport axis, the road to connect the airport to the northern zone and the road along the coast in the southwest direction (Via Costa Verde). The South-North transport axis is Av. Paseo de la República (also known as Via Expresa), and actually this road was constructed with excavation type structure with 6 lanes, three for each direction, and two lanes at the center exclusively for buses. The roads connecting the airport to the south-north axis are Av. Faucett, Av. La Marina, Av. Javier Prado, among others. Presently the road between Av. Paseo de la Republica and Av. Panamericana Sur (Javier Prado Este) has a structure corresponding to that of an expressway. The road along the coast is in service but it is connected to access roads by grade intersections. In addition, there is a project to extend and improve the current Av. Via Costa Verde to transform it into an expressway but presently it is used only as an access road to the coast.

#### **4.1.4. ROAD FACILITY STANDARDS**

In Peru, there are regulation standards of design for national roads. For urban roads design also is used the National Regulation or Norms and Standards of Design for Urban Roads, July 1987 (Normas y Estándares de Diseño de Vías Urbanas, Julio 1987) prepared by the Municipality of Lima.

Table 4.1-1 shows the standards elaborated by the Municipality of Lima.

Table 4.1-1 Road Facility Standards of the Municipality of Lima

Items	Expressway	Arterial Road	Collector Road	Local Road
Design Speed (km/h)	80	60	50 (45)	40 (30)
Right of Way (m)	82	54	50 (32)	20 (15)
Pedestrians (m)	-	3.5	2.5	1.5
Lateral Clearance (m)	3.0	3.0	2.6	2.6
Vertical Clearance (m)	4.5	4.5	3.2	3.2
Width of Carriageway (m)	3.5 – 3.6	3.3 – 3.5	3.0 – 3.5	2.7 – 3.0
Min. Radium (m)	200	100	50	10
Tangent Longitude (m)	60	40	25	15
Distance of visibility (m)	560	420	350	270
Grade (%)	3	4	8	12
Medium (m)	12	2	1	-
Intersection Longitude	300	300	200	100

Reference : Norms and Standards Project of Design for Urban Roads, July 1987

#### 4.1.5. ROAD NETWORK EXTENSION AND ROAD WIDTH

##### (1) Road Network Extension

The extension of the road network in 1998 was 7500 km, of such 1,582.99 km corresponded to the existing Express, Arterial, and Collector roads; including the authorized road network the extension totaled 2,357.1 km. The unconcluded authorized road network is distributed in the center and at the periphery of the city, as shown in Table 4.1-2, authorized roads may have the number of lanes increased depending on the necessity.

Table 4.1-2 Road Facility Extension

Unit:Km

Items		Express	Arterial	Collector
<b>Northern Area</b>	Existing	8.60	62.30	70.25
	Plan	80.68	11.10	23.65
Ratio of construction (%)		9.63	84.88	74.81
<b>Southern Area</b>	Existing	34.80	61.66	63.53
	Plan	42.95	1.25	17.30
Ratio of construction (%)		44.76	98.01	78.60
<b>Central Area</b>	Existing	18.85	105.65	145.80
	Plan	39.25	5.30	3.35
Ratio of construction (%)		32.44	95.22	97.75
<b>Eastern Area</b>	Existing	8.60	62.30	70.25
	Plan	80.68	11.10	23.65
Ratio of construction (%)		9.63	84.88	74.81
<b>Callao Area</b>	Existing	0.65	35.35	42.90
	Plan	29.90	3.50	13.35
Ratio of construction (%)		2.13	90.99	76.27
<b>Total</b>	Existing	71.5	327.3	392.7
	Plan	273.5	32.3	81.3
Ratio of construction (%)		20.73	91.03	82.85

Reference: Diagnostic of the Metropolitan Urban Transport, July 1998

## **(2) Road Width**

The width of the existing expressways and arterial roads include more than 2-lane carriageways for each direction. Also, collector roads are arranged so as to have more than 2-lane carriageways for each direction except for some parts of the periphery. The width for the authorized road network is secured according to the values mentioned in the previous section 4.1.4, but in some sections of the existing roads, it is difficult to secure the right of way due to geographic feature restrictions or others.

### **4.1.6. ROAD STRUCTURE**

In some sections of the expressways at-grade intersections are used for entrance and exit, but basically on ramp and off ramp structures are used. Expressways are constructed by excavation and regular roads have flyover structures. Intersections of expressways with arterial roads are of clover leaf type or sometimes are interconnected by trumpet type interchanges.

Arterial roads have at-grade road structures and the section of the road is conformed in the center by 4 high speed carriageways for both directions, outside them 4 frontage roads for both directions. The high-speed carriageways are separated from the frontage roads by outside dividers. Sidewalks are disposed on both sides of the frontage roads and they have approximately 5 meters. There are no parking spaces at the frontage roads and parking spaces at commercial zones are disposed outside the right of the way. At residential areas parking on the road is prohibited, and each housing facility has a parking space.

### **4.1.7. CONDITIONS OF PAVEMENT AND DRAINAGE FACILITIES**

#### **(1) Pavement Conditions**

Lot of collector roads of the periphery are unpaved but at the central area all roads are paved, including district roads. At local district roads pavement is mostly of concrete, arterial roads are paved mainly with asphalt, but some parts are made of concrete. Asphalt deterioration due to rainfall is almost inexistent, so pavements conditions are comparatively good but in some areas conditions are fairly bad due to lack of funds for maintenance.

#### **(2) Drainage Facilities**

The volume of rainfall during the whole year is scarce (12 mm per year), so there is no need for drainage facilities on roads. During 1997 and 2001, the El Niño phenomenon occurred and there were some problems such as the overflow of the rivers, however, in the city of Lima drizzle is a little more intense but the volume of rainfall is not significant, so the installation of road drainage facilities is not needed.

### **4.1.8. INTERSECTIONS**

#### **(1) Intersection Facilities**

Crossings between expressways and crossings between expressways and arterial roads are grade separated crossings, and mostly they are cloverleaf or trumpet type interchanges. Crossings between expressways, like Av. Paseo de la República and Av. Javier Prado Este, with collector roads are of diamond type. Crossings between arterial roads are mostly at-grade intersections and for four leg intersections or more, they are of rotary type.

In the approved road network of Metropolitan Lima, there are 242 intersections in total among expressways and arterial roads. Of such, 109 intersections are located in places where urbanization is not developed yet but, to secure the terrain for future improvements

(grade separated intersections), procedures for the approval are presently in course. The remaining 133 places are located in built up areas where intersection improvement plans cannot be implemented and the terrain necessary for the developments cannot be secured because authorization on behalf of the metropolitan council would not be easily obtained, so they are not included in the authorized road network plan as authorized intersections.

## **(2) Traffic Light Facilities**

The majority of intersections that are not grade separated intersections between expressways and arterial roads, crossings between two arterial roads, arterial roads and collector roads, and between two collector roads are arranged as intersections controlled by traffic lights. However many of them are out of service, so traffic ordainment is carried out by police officers. Traffic lights are for vehicles and there are no traffic lights for pedestrians.

The administration of traffic light facilities, signaling and maintenance of road pavement is carried out by the General Direction of Transit of the General Direction of Urban Transport. They are also in charge of traffic regulation and control, issuing of driving licenses, among others.

### **4.1.9. CONDITIONS OF SIDEWALKS, PARKING SPACES**

#### **(1) Sidewalks**

Arterial roads have sidewalks at both sides with widths varying from 3 m to 5 m while the width of the same at collector roads varies from 1.5 m to 3.0 m. They are of mount up type and paved with concrete blocks; close to intersections, there are ramps of steep slopes to attenuate the differences of the grades between the sidewalks and carriageways, and these constitute facilities for the disabled persons.

#### **(2) Parking Spaces**

Parking at arterial roads and collector roads is prohibited. Commercial places facing such roads arrange parking spaces for their clients. Parking spaces in commercial areas administered by the municipality are few; also, there are not many private parking pools at open spaces so parking is a very difficult problem.

#### **(3) U Turn Facilities**

In some arterial roads have 4 to 6 carriageways for both directions separated by a central separator. The space between intersections at arterial roads is rather distanced from each other, taking into consideration traffic functioning and the fact that it is not allowed to make left turns at some points of the intersections between two arterial roads. In order to control left turns, accesses at the central separator have been created in some sectors to allow left turns, being this facility one of the causes for traffic congestion.

## **4.2. CURRENT ROAD TRAFFIC CHARACTERISTICS**

### **4.2.1. TRAFFIC VOLUME**

#### **(1) Traffic Survey**

As discussed in the previous chapter 3, the current origin-destination matrices were prepared as one of the important data for transport planning. One of traffic count survey's objectives is to provide information to calibrate the current origin-destination matrices obtained from the person trip survey in terms of vehicular and passenger traffic. In order to obtain the required data, the following two surveys were conducted at the road section.

- a) Screen Line Survey
- b) Traffic Survey at Principal Road

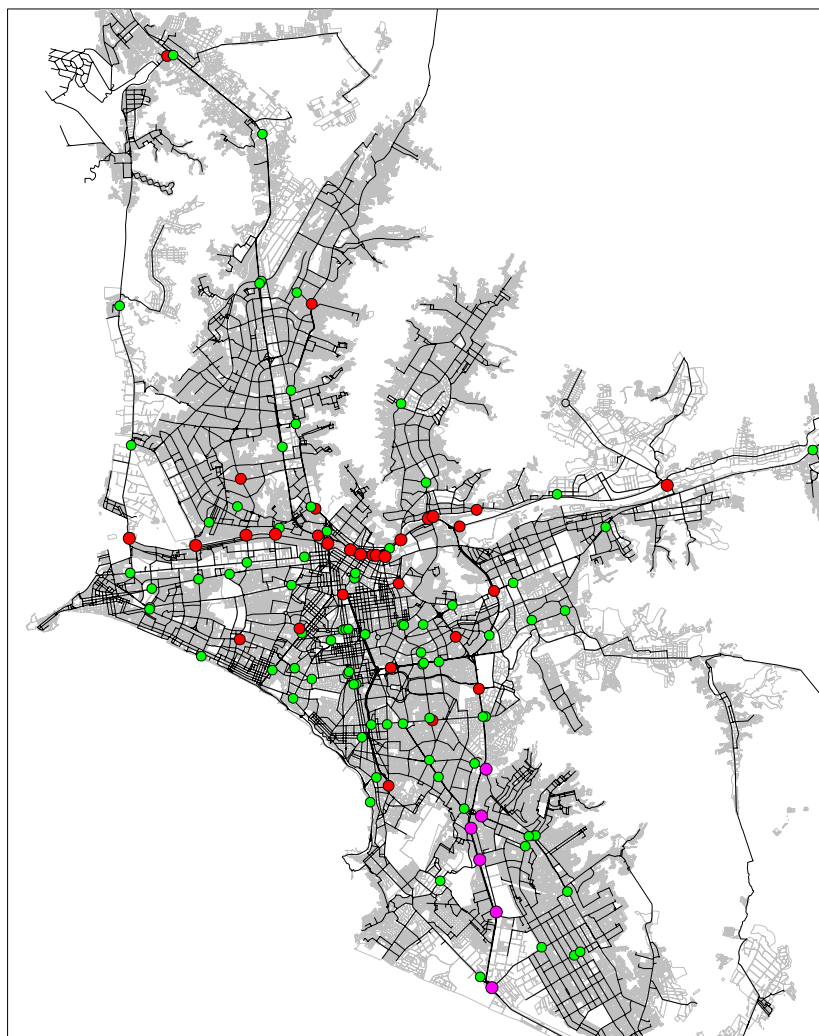


Figure 4.2-1 Traffic Survey Stations

Figure 4.2-1 illustrates all survey stations where both traffic surveys are conducted. At each station, traffic counting survey and vehicle occupancy survey are conducted with the different survey period as shown in Table 4.2-1.

Table 4.2-1 Outline of Traffic Survey

Type of Traffic Survey	No. of Survey Stations	Surveys	
		Traffic Count	Vehicle Occupancy
Screen Line Survey	13 stations at Rimac River	24 hours	24 hours
	7 stations along South Pan- American Highway	24 hours	24 hours
Traffic Volume Counting Survey at Principal Road	17 stations	24 hours	24 hours
	92 stations	4 hours (6:00 – 10:00)	4 hours (6:00 – 10:00)