

CHAPTER 7 EXISTING ROAD CONDITIONS

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7.1 General

7.1.1 National Road Route 2 and route 7

The existing road network between Asuncion Metropolitan Area and Ciudad del Este consists of only one trunk road. Asuncion and Ypacarai are connected by two principal roads ; one is a trunk road and another road is a secondary road. However, Ypacarai section to the western side of Ciudad del Este section, is only one principal road. Moreover, this section does not have a diversion road.

The above mentioned existing road network is shown in Figure 7.1.1.

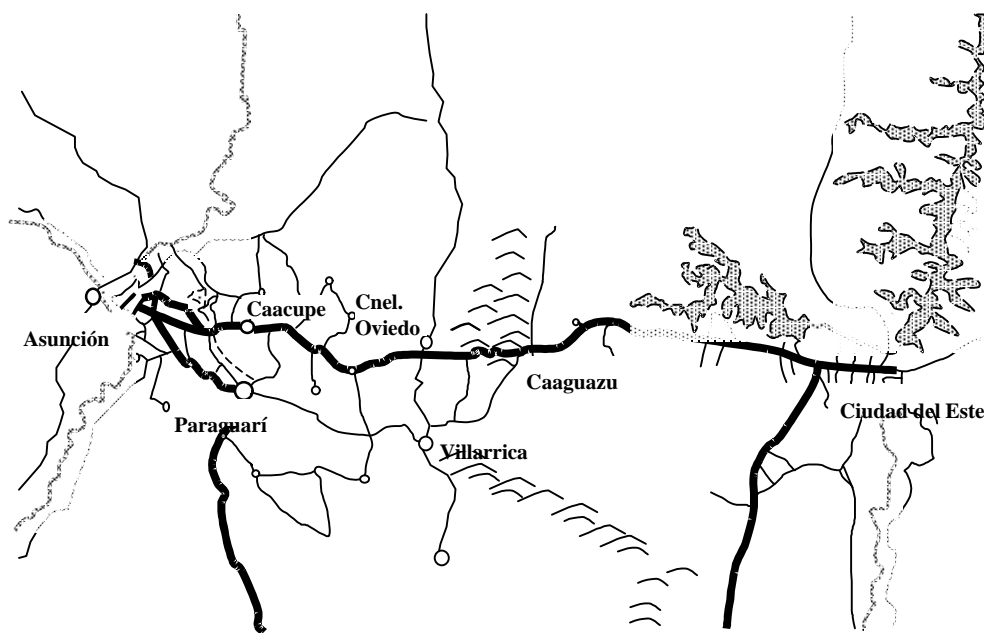


Figure 7.1.1 Location Map of the National Road Route 2 and Route 7

7.1.2 Road Classification

The road classification of Paraguay is shown below. It is classified into 3 kinds. These classifications are based on MOPC. National Route 2 and Route 7 is National Primary Road.

(1) National Primary Road (National Route 1 to 12)

National Primary Roads connect two or more provinces, and connect cities with the most important regions. It is defined as the most important area in the Republic of Paraguay. This principal road is the most important route of transportation. All these National Primary roads are paved with Asphalt Concrete except for Route 12. The right-of-way of primary road is almost 50.0m.

(2) Secondary Road

Secondary roads connect between local main cities, principal roads, railroad stations and the port. These roads are not paved.

(3) Local Road

Local Roads connect with Regional Secondary Roads, small villages, and main production area. Most of these roads are not paved.

Road length of Paraguay is about 2,300km. The rate of pavement is about 10%.

7.1.3 Traffic Accident on National Road Route 2 and Route 7

A traffic accident analysis was carried out for National Roads Route 2 and 7. Moreover, the results of the investigation provide an important reference data for the future road improvement plan. The main causes of traffic accident on National Roads Route 2 and Route 7 are shown below.

- 1) Accidents during dangerous overtaking
- 2) Accidents due to speeding up in long straight sections
- 3) Minor collisions with trucks and pedestrians in urban areas

Many of these accidents are caused by vehicles of different types sharing the same route.

Table 7.1.1 Number of Traffic Accidents

Route	Route Length	1995	/ km	1996	/ km	Note
Route 1	370	509	1.37	506	1.37	
Route 2	134	1,474	11.00	1,457	10.87	
Route 3	452	29	0.06	50	0.11	
Route 4	206	5	0.02	4	0.02	
Route 5	215	22	0.10	25	0.12	
Route 6	250	159	0.64	105	0.42	
Route 7	193	254	0.32	419	2.17	
Route 8	202	24	0.12	16	0.08	
Route 9	776	67	0.09	66	0.08	
Route10	396	13	0.03	34	0.09	
Route11	88	-	-	-	-	
Route12	162	6	0.04	-	-	
Total	3,444	2,562	0.74	2,683	0.78	

7.1.4 Traffic Congestion on National Road Route 2 and Route 7

The cause of traffic congestion on National Roads Route 2 and Route 7 can be judged from the following viewpoints.

- 1) from the viewpoint of road structure.
- 2) from the viewpoint of traffic flow conditions

(1) From Viewpoint of Road Structure

Traffic congestion rate is calculated by comparing the actual traffic volume and traffic capacity on certain road segments, as shown below :

$$\text{Traffic Congestion (V / C)} = \frac{\text{Traffic volume (v)}}{\text{Traffic Capacity (c)}}$$

Traffic capacity is calculated using the following formula :

For a two lane road

$$Sfi = Bc \times S \times Fd \times Fw \times Fr \times fhv$$

- Sfi* : Total service flow rate for level of service
- Bc* : Ideal capacity for free flow speed
- S* : Level of service (v/c)
- Fd* : adjustment factor for directional distribution of traffic
- Fw* : adjustment factor for narrow lane and restricted shoulder width
- Fr* : adjustment factor for the operational effect of grades on passenger cars
- fhv* : adjustment factor for presence of heavy vehicles in the traffic stream

For a multi-lane road

$$FFS = FFSI - Fm - Flw - Flc - Fa$$

- FFS* : free-flow speed
- FFSI* : free-flow speed for ideal conditions
- Fm* : adjustment for median type
- Flw* : adjustment for lane width
- Flc* : adjustment for lateral clearance
- Fa* : adjustment for access point

$$Sfi = Bc \times S \times Fhv \times n \times PHF$$

- Sfi* : total service flow rate for level of service
- Bc* : ideal capacity for free flow speed
- S* : Level of service (v/c)
- Fhv* : heavy vehicle adjustment factor
- n* : number of lanes
- PHF* : Peak hour factor
- Pcu* : passenger-car equivalent

The traffic capacity (C) on the sections of the existing National Road Route 2 and Route 7 are calculated based on the above formula. The actual existing traffic volume (V) at the various points of the National Road Route 2 and Route 7 were observed by the JICA Study Team in May 1999. The traffic congestion rates and Level-of-service are shown in Table 7.1.2 as a result of calculation.

Table 7.1.2 Traffic Congestion Rate and Level of Service

(Unit : pcu /day) Road Section	Traffic Volume(v)	Capacity(C)	V / C	Level-of-Service (* Reference 13-4)
San Lorenzo – Capiata	2,950	3,700	0.80	C
Capiata – Ypacarai	1,330	3,450	0.38	B
Ypacarai – Caacupé	760	800	0.95	E
Caacupe – Eusebio Ayala	540	770	0.70	E
Eusebio Ayala – Itacurbi	340	640	0.52	D
Itacurbi – San Jose	410	680	0.59	E
San Jose – Cnel Oviedo	450	650	0.70	E
Cnel Oviedo – Caaguazu	2000	960	0.20	C

(2) From the Viewpoint of Traffic Conditions

National Roads Route 2 and Route 7 are principal roads. There, the traffic of trucks focuses on the surrounding grain area. Fully loaded trucks use this road and their running speed on longitudinal gradients of more than 3% is less than 20 km/h. These fully loaded trucks cause traffic congestion and even traffic accidents.

7.2 Road Structure Conditions

7.2.1 Road Inventory Survey

A road Inventory Survey was conducted on National Roads Route 2 and Route 7 by the JICA Study Team with collaboration from the Paraguayan Counterpart Team in May 1999. The starting point of the survey is San Lorenzo, namely Station (STA.) No.14+00, and the end of the survey is Caaguazu, namely STA. No.183+00, and the total survey length is calculated to be 169.0 km. The road structure condition on National Roads Route 2 and Route 7 was surveyed at about 500 meters intervals. The main survey and measurement items for the road inventory survey are as follows :

- 1) Road Cross-section Elements
- 2) Pavement Conditions
- 3) Slope of Embankment Protection Conditions
- 4) Drainage Conditions
- 5) Underground facilities Conditions
- 6) Road facilities Conditions

7.2.2 Road Conditions and Its Problems

Based on the results of the road inventory survey, the existing road conditions and its problems are described below :

(1) Surface Conditions

National Roads Route 2 and Route 7 were constructed by the Paraguayan Government from 1900 to 1905, and about 30 years later, in 1930, full scale rehabilitation work was carried out by the World Bank. Since 1975, no full scale rehabilitation work has been done, however, small scale maintenance work has been executed by MOPC.

The surface condition from San Lorenzo to Ypacarai is comparatively good with a 4 lane divided road, the road surface condition from Ypacarai to Caaguazu is almost satisfactory with 2 lanes. The lane width from San Lorenzo to Caaguazu is 3.25m. The lane width required for a principal road is 3.65m. The vehicles are running at a speed exceeding 80km/h on the road. There is the risk that small driving errors result in going off the driveway. For this reason, traffic safety on the road is low.

(2) Horizontal Alignment

The minimum horizontal alignment adopted is 250 meters for the road segment between Cnel. Oviedo and Caaguazu which is classified as a mountainous area, and accidents occur especially in this section. In other sections, a comparatively large horizontal alignment of 500 or 700 meters was used in flat terrain. The design speed used in the mountainous section is approximately 40 km/h and 50 km/h according to the topographic conditions. However, the actual running speed is over 100 km/h.

(3) Vertical Alignment

National Roads Route 2 and Route 7 pass along at an altitude of about 150 to 250 meters and most sections are comparatively flat. The maximum longitudinal gradient adopted was about 5.0% at Caacupe. In this steep section, the running speed of heavy vehicles decreases to 15 to 20 km/h, and traffic congestion frequently occurs. Moreover, this also occurs in sections where the vertical alignment exceeds 3% and the running speed of heavy vehicles is reduced to 20 km/h or less.

Considering the above traffic conditions, a climbing lane or road widening should be constructed to maintain a smooth traffic flow and to ensure traffic safety.

7.3 The Situation of Road Maintenance

In order to use a road effectively, its operation and maintenance needs to be managed not only for new road construction. In view of the importance of operation and maintenance management, the Japanese government financed the upgrading of a principal road from 1993 to 1996. Improvement works for a 360 km national highway were executed to raise traffic safety, and 600 sets of road maintenance machinery were distributed.

However, there are the following problems related to road operation and maintenance management.

1) An inadequate investment scale :

The small scale of investment in Paraguay is a problem for road maintenance. If maintenance management is neglected this will lead to high cost maintenance and repairs in the future. And furthermore, it brings about a reduction in service level and transportation capacity. As a result, poor road conditions cause a decrease in economic activity.

2) Lack of recognition of the importance of maintenance management :

The maintenance management of a newly constructed road is not performed, and there is a lack of coordination between the various branches of the road department. This coordination needs to be improved so that road maintenance is properly carried out.

3) Cooperation with Other Departments:

Since the MOPC's organizational structure is inadequate, it has not taken the necessary steps to coordinate the departments.

(1) Cross-section

The existing cross-section from San Lorenzo to Caaguazu is shown below.

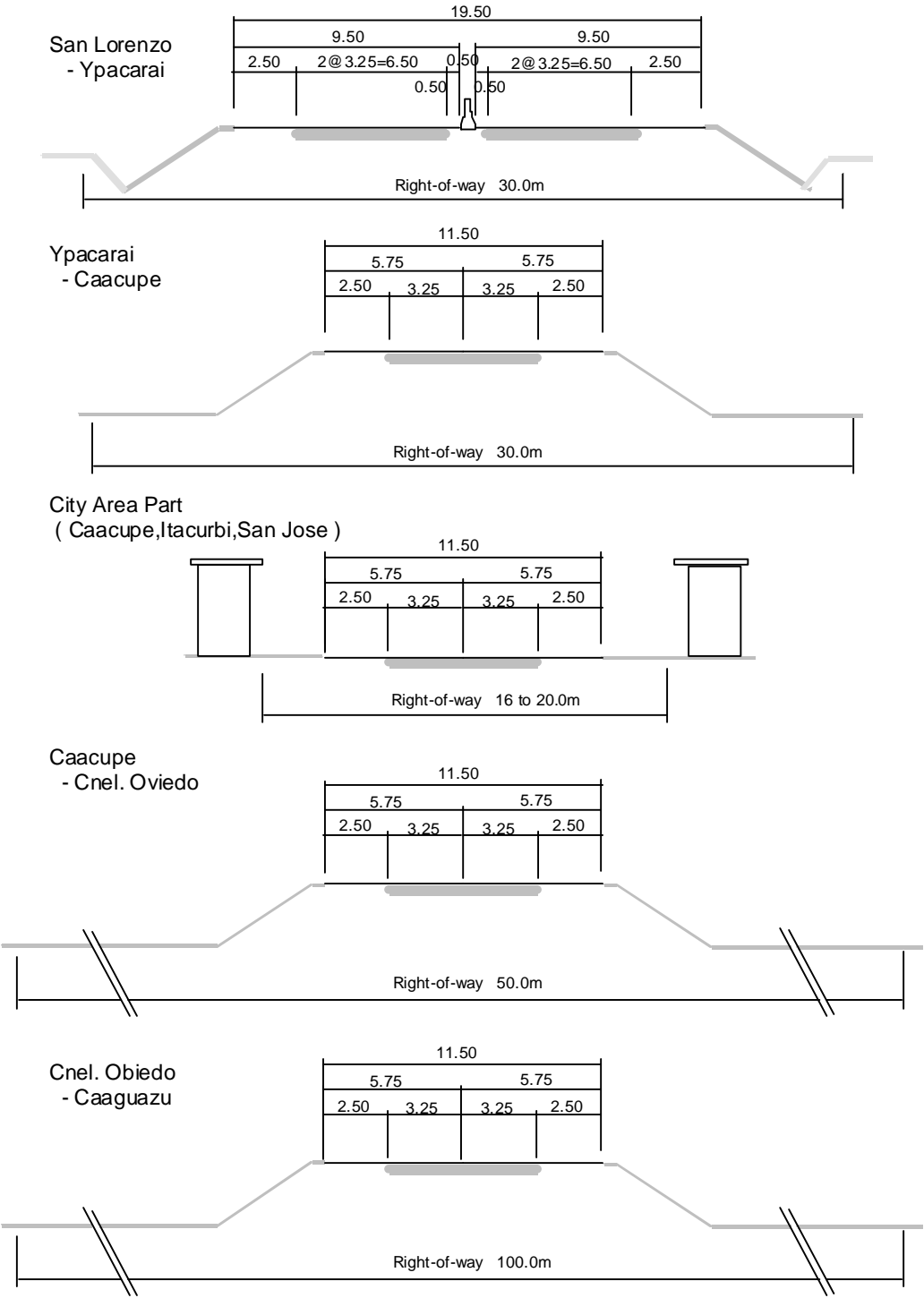


Figure 7.3.1 Existing Cross Section