CHAPTER 6
ROAD NETWORK OF THE STUDY AREA

6 ROAD NETWORK OF THE STUDY AREA

6.1 Transportation System

(1) Main Ports

Inland water transport uses the Parana River and its tributary, the Paraguay River, connecting to the La Plata River on the downstream side. These rivers are the boundaries with Brazil and Argentina and most of the waterways are under joint management. This inland water transport is mainly used for international trade cargo. Principal export/import ports are described below:

- Concepción Port: Located 1,940 km from Buenos Aires and in the independent management section of the Paraguay River running through Paraguay. This port is mainly used to load beans on vessels.
- Asuncion Port: Located 1,630 km from Buenos Aires, this port is used for cotton export and principal everyday commodities, such as general cargoes and automobiles, are imported in containers via the Paraguay River.
- Villeta Port: Located 37km to the south of Asuncion Port and used for export of beans and cotton.
- Villa Hayes Port: Located near Asuncion and used for the import of steel making raw materials.
- Villa Elisa Port: Located near Asuncion and used for the import of oils.
- San Antonio Port: Located near Asuncion and used for the export of beans.
- Vallemi Port: Port to import cement raw materials.
- Encarnación: Located on the Parana River, 1,583km from Buenos Aires, and used for the export of beans.

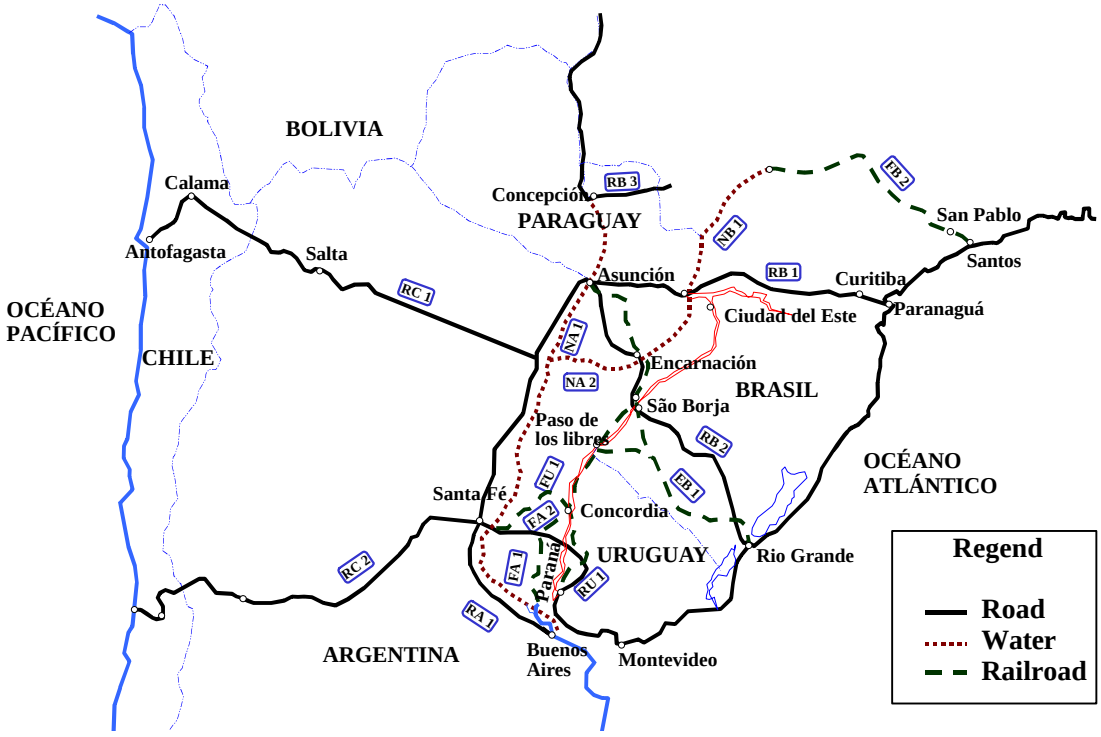

Figure 6.1.1 Paraguay's Export Route

Inland water transport may often face a problem of critical water depth and channel width in time of drought. Though accounting for most of the conventional export of cargoes, water transport has suffered a decrease in its handling ratio, resulting in a ratio as low as 40.5 % in 1997. Such a decrease in the handling quantity can be attributed to the shipment of most of the increase in agricultural exports by truck to Paranagua from Paraguay.

Table 6.1.1 International transportation by mode in 1997

Unit: Tonnage

	River	Road	Railway	Total
Import	1,278,020	1,212,844	54,121	2,544,985
Export	1,447,576	2,648,901	85,600	4,182,076
Total	2,725,596	3,861,745	139,721	6,727,061
Share (%)	40.5	57.4	2.1	

(2) Trunk Road System

In 1954, 12 routes were designated as national highways to make up a framework of roads for the nation. Today these are approximately the current road network of Paraguay (Figure 6.1.2).

The roads of the network are connected to a triangular road network connecting the principal cities of Asuncion, Ciudad del Este, and Encarnacion, and road improvement proceeded mainly on these road networks. After the motorization in the 1980s, the annual average growth rate of motor vehicles was as high as 7.85% and has remained high up to now.

The land of this triangular area is flat or hilly, and it is a cultivated area where cattle breeding, cotton and bean cultivation take place. There are agro-industries distributed alongside the roads, and the population and social capital are accumulated here.

The three cities at the corners of this triangle, Asuncion, Ciudad del Este, and Encarnacion, are near the border with Brazil and Argentina, functioning as gateways for Paraguayan imports and exports. The two roads connecting Ciudad del Este at the apex of this triangle with Asuncion and Encarnacion have been recently used to cope with an increase in the demand for transport to Brazil.

In particular, the Asuncion-Ciudad del Este road, which is covered by this Study, is a principal route in the export corridor from Paraguay to the port of Panaragua, Brazil. This road is also used for traffic due to roadside development, with an increased demand on transport. There is no substitute mass transport mode (railway) and no substitute road there. At present, a section improvement and widening project is underway about 40km to the west of Ciudad del Este.

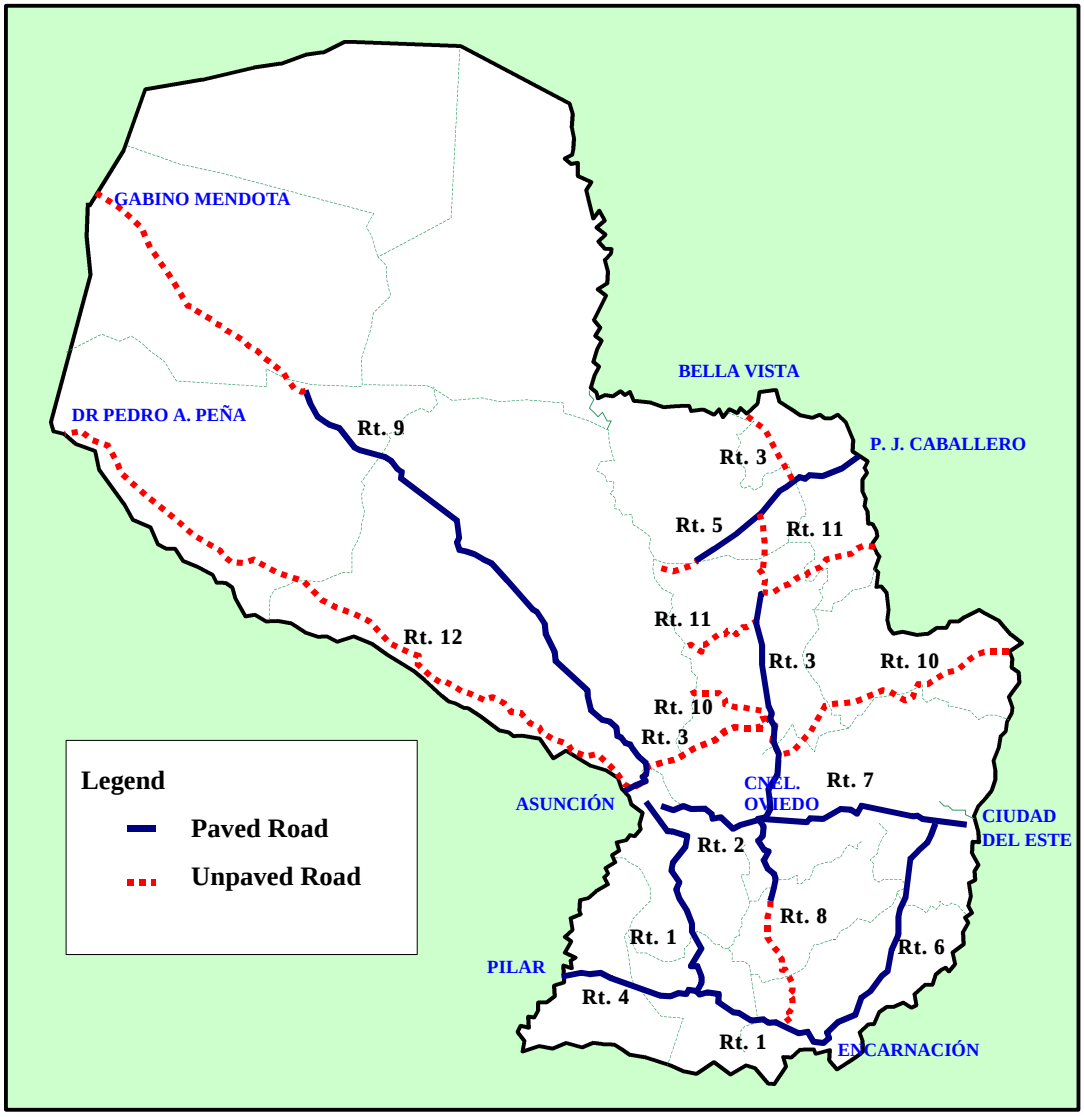

Figure 6.1.2 Trunk Road Network

6.2 Function of National Roads of Paraguay

Paraguay is separated into an Oriental area and an Occidental area with the Paraguay river as the boundary. From the viewpoint of major highway networks, Paraguay is separated into the following three areas by dividing the Oriental area into south and north sections using as a border the line between Asuncion, the capital, and Ciudad del Este, the second largest city in the country.

1) Southern Oriental Area (Asuncion, Guaira, Caazapa, Itapua, Misiones, Paraguari, Central, Neembucu)
2) Northern Oriental Area (Concepcion, San Pedro, Cordillera, Caaguazu, Alto Parana, Amambay, Canindeyu)
3) Occidental Area (Chaco Area) (Pdte.Hayes, Boqueron, Alto Paraguay)

And concerning the function of the National Road Route, it will be established according to the socio-economic framework shown below.

(1) Socio-economic Framework

Table 6.2.1 Population, Industry and Number of cars owned

Area	Population	Agriculture and Livestock Farming			Number of Cars Owned
		Major Agricultural Products (ton)	Livestock (head) × 10^3		
			Poultry	Cows, Pigs, etc.	
Southern Oriental Area	3,522,779 (70%)	3,197,748 (45%)	12,019 (53%)	3,728 (30%)	246,073 (78%)
Northern Oriental Area	1,436,332 (28%)	3,771,351 (54%)	10,243 (46%)	5,496 (44%)	60,895 (19%)
Oriental Area Total	4,959,111 (98%)	6,969,099 (99%)	22,262 (99%)	9,224 (74%)	306,968 (97%)
Occidental Area (Chaco Area)	126,214 (2%)	90,851 (1%)	238 (1%)	3,197 (26%)	9,190 (3%)
Total	5,035,325 (100%)	7,059,950 (100%)	22,500 (100%)	12,421 (100%)	316,158 (100%)

Major agricultural products: Cotton (Algodón), Sugarcane (Caña de azúcar), Maize (Maíz), Soybean (Soja), and Wheat (Trigo)

Table 6.2.2 Nature, Recreation and Culture

(Unit: number of area)

Area	National parks	Nature conservation districts	Recreational areas such as waterfalls and lakes	Historical sites	Museum/ Polytechnic Museum	Dams	Total (number of locations)
Southern Oriental Area	5	2	5	4	5	1	22
Northern Oriental Area	2	6	3			1	12
Total of Oriental Area	**7**	**8**	**8**	**4**	**5**	**2**	**34**
Occidental Area (Chaco Area)	3				2		5
Total	**10**	**8**	**8**	**4**	**7**	**2**	**39**

Table 6.2.3 Import / Export Freight by Means of Transportation

(Unit: 1,000 tons)

Year		Railways	Ships	Roadways	Total (1000 tons)
Volume of export	1995	157 (5%)	706 (21%)	2,449 (74%)	3,312 (100%)
	1996	7 (0%)	696 (24%)	2,163 (76%)	2,866 (100%)
	1997	86 (2%)	1,448 (35%)	3,649 (63%)	4,183 (100%)
Volume of import	1995	62 (3%)	1,238 (64%)	620 (32%)	1,920 (100%)
	1996	78 (3%)	1,198 (50%)	1,101 (47%)	2,377 (100%)
	1997	54 (2%)	1,278 (50%)	1,212 (48%)	2,544 (100%)

Railways: Encarnación
Ships: Asuncion, Villeta, private ports
Roadways: Asuncion, Ciudad del Este, Encarnación, Jose Falcón, Pedro Juan Caballero, Salto del Guairá

(2) Function of the National Roads

The National Roads that form a framework for Paraguay (each area below) are the following.

a. Southern Oriental area

- National Roads Route 2 and.7, which connect Asuncion - the capital city - and Ciudad del Este, the second largest city.
- National Road Route 1, which connects Asuncion - the capital city - and Encarnación, a major city in the south.
- National Road Route 6, which connects Ciudad del Este and Encarnación
- National Road Route 4 that gives access to the National Road Route 1
- National Road Route 8 that gives access to National Roads Route 2 or 7.

b. Northern Oriental area

- National Road Route 3 roughly runs through the center of the area to access the Transchaco Road, a major highway in the Asuncion metropolitan area.
- National Road Route 5 crosses the area and connects to the Occidental area.
- National Road Route 10 and 11 both cross the area.

c. Occidental area (Chaco area)

- National Road Route 9 crosses the area.
- National Road Route 5 connects to the Oriental area and the north.
- National Road Route 12 runs along the Pilcomayo to access the areas of national parks and petroleum and natural gas development.

Table 6.2.4 Function of National Road Route

National Road Route	Domestic flow					International wide-area flow	
	Passenger flow	Freight flow		Tourist flow	Developing area flow	Import/ export flow	Tourist flow
		Agricultural products	Livestock products				
No.1	◎	◎	◎	◎	△	◎	◎
No.2	◎	◎	◎	◎	○	◎	◎
No.3	○	◎	◎	○	△	○	○
No.4	△	○	△	○	△	△	△
No.5	○	○	○	○	△	◎	△
No.6	○	◎	○	◎	△	◎	◎
No.7	○	◎	◎	◎	○	◎	◎
No.8	△	○	○	△	△	○	△
No.9	△	△	◎	○	◎	○	△
No.10	△	△	△	△	△	○	△
No.11	△	△	△	○	△	△	△
No.12	△	△	△	○	○	△	△

Developing areas: petroleum and natural gas
◎ factor with major effect ○ factor with effect △ factor with less effect

6.3 Road Situation

6.3.1 Road Classification

The roads under the control of the MOPC are classified into three categories: national, departmental, and regional roads (caminos vecinales). In addition, national highways and departmental roads are classified as primary and regional primary road is classified as secondary, and regional secondary road is classified as tertiary.

1) National highways
   National highways are roads starting or terminating at the Capital and connecting to regions or roads crossing two or more prefectures (departamentos) to connect to railway stations or ports. There are 12 designated routes.
2) Departmental roads
   Departmental roads cover most of the prefecture. They connect to other prefectures. They connect to national highways, railway stations, and ports.
3) Regional roads
   Regional roads connect villages or branch roads.

In this way, the road network controlled by the MOPC is classified into three categories, and the MOPC is in charge of the construction and maintenance of all of them. Except for designated national highways number 1 to 12, all roads are considered regional roads. There is no clear distinction between roads subject to the control of the MOPC and those controlled by local authorities.

The width of the right of way is 50m for national highways, 30m for departmental roads, and 20m for regional roads. In urban districts, there are many sections whose width is not the specified one. The MOPC registers start/end points, length, etc. on the road register, but there is no definition of branch and regional roads.

6.3.2 Road Development Plan

The Paraguay Overall Traffic Plan prepared by JICA in 1992 is a master plan for long- and medium-term road development. Current road development is implemented according to this master plan. This plan sets forth the following subjects for road development from the viewpoint of the existing road traffic problems:

1) Reduction of road traffic expenses
2) Development and improvement of the import/export corridor
3) Development and improvement of agricultural support roads
4) Accessibility
5) Clear definition of roads under direct control

On the other hand, the road development policy proposes, for future development policy, the following five subjects to proceed positively with road development and improvement:

1) Roads should be classified into national highways and regional roads, with the control of regional roads transferred to the local authorities. For national highways, the 12 conventional highways will be designated as primary, while branch roads will be designated as secondary, all of which will be controlled by the MOPC.
2) For national highway development and improvement, the trunk road network will consist of 6,420km, including primary and secondary national highways. Four types of development and improvement, including maintenance, rehabilitation, improvement and widening, new construction, will be made.
   - Maintenance of existing assets
   - Rehabilitation of sections in bad condition
   - Improvement and widening
   - Construction of new roads with developmental roads receiving priority over missing links in the road network
3) The trunk road network will be classified into links, which will be paved to meet link transport volumes determined from link evaluation. All of the 12 national highways will become all-weather roads from beginning to end. Any road with large traffic volume will be widened to four lanes.
4) For regional roads, road development will be made based on three categories of new road construction, improvement, maintenance. It is proposed to add the new length to existing 31,000km to develop a total length of 8,300km of roads.
5) To maintain existing roads, it is proposed to operate an maintenance organization in charge of controlling the existing roads directly and to employ a method to outsource the maintenance operation.

According to the plan, 6,466km of trunk road network will be divided into links and the trunk road maintenance level will be rated and evaluated from four standpoints: traffic volume, bus service, cargo quantity, and regional service at each link. The medium and long-term plans set the target of pavement ratio of the trunk road network at 80.4% (current 32%). Accordingly, trunk road maintenance will involve road pavement for 3,650km, pavement or widening and improvement of existing roads for 1,323km, and development of all-weather-roads of 711km, totaling 5,684km (3,208km for primary and 2,476km for secondary). The total length will include a new road construction project of 2,746km (237km for primary and 1,243km for secondary).

6.3.3 Road Condition

The national road network administered by the MOPC includes 25,901km, of which 3,333km are paved (12%) 2,149 km have a primary surface of gravel or other selected materials and 20,419km are soil, as show in Table 6.3.1.

Table 6.3.1 Road Length by Pavement Type

Unit: km

		Pavement	Stone	Gravel	Soil	Total
Primary	National	2,609	1	1,167	2,394	6,171
	Department	437	196	421	4,547	5,601
Secondary	Region Primary	21	69	561	13,478	14,129
Subtotal		3,067	266	2,149	20,419	25,901
Tertiary	Region Secondary	0	0	0	35,000	35,000
Total		3,067	266	2,149	55,419	60,901

6.4 Existing Road Network

There are three routes running in radial direction from Asuncion. They are Route 1 to Encarnacion, Routes 2 and 7 to Ciudad del Este diverted from Route 1 at San Lorenzo, and Route 9 to Region Occidental.

There are two ring roads in the vicinity of Asuncion. One is Madam Lynch from Cuatro Mojones along the city border, while the other one connects Luque, San Lorenzo and Ñemby with Asuncion as a center.

In the study area, many roads are branching from Routes 2 and 7 in shape of fish bone and connecting to make up the road network. The road network is relatively long in length and may well affect the traffic flow in the study section on Routes 2 and 7.

The National and Departmental road development in Paraguay can be classified into the following four schemes, with their development in progress for each scheme.

(1) New road Development

Planning, design, and construction of new roads

(2) Road Improvement

Improvement of road conditions from the critically unstable to less unstable or stable. Work contents are improvement of road alignment, new construction of bridges and widening of roads.

(3) Road Rehabilitation (periodic maintenance)

Periodic maintenance and administration to maintain stable road conditions and refurbishment of shoulders, improvement and installation of drainage facilities, replacement of pavement, overlay.

(4) Routine Maintenance

Daily and small maintenance works which include patching of road surfaces, cleaning of gutters, and general maintenance.

6.5 Future Road Network

The future road network of the study area will be made according to the ongoing projects and already financed projects in the new road development and improvement projects.

The new road development and improvement projects are:

– Route 3 Emboscada - Estanislao	Improvement and new construction
– Route 3 Limpio - Emboscada	Improvement
– Cuatro Mojones - Ita-Paraguari	Improvement and new construction
– Cuatro Mojones - Route 9	Improvement
– Remanso Bridge to Luque	New construction
– Luque - San Lorenzo and Ñemby	Improvement
– Paraguarí - Villarrica	Improvement and new construction

Figure 6.5.1 shows the overall future road network in the study area

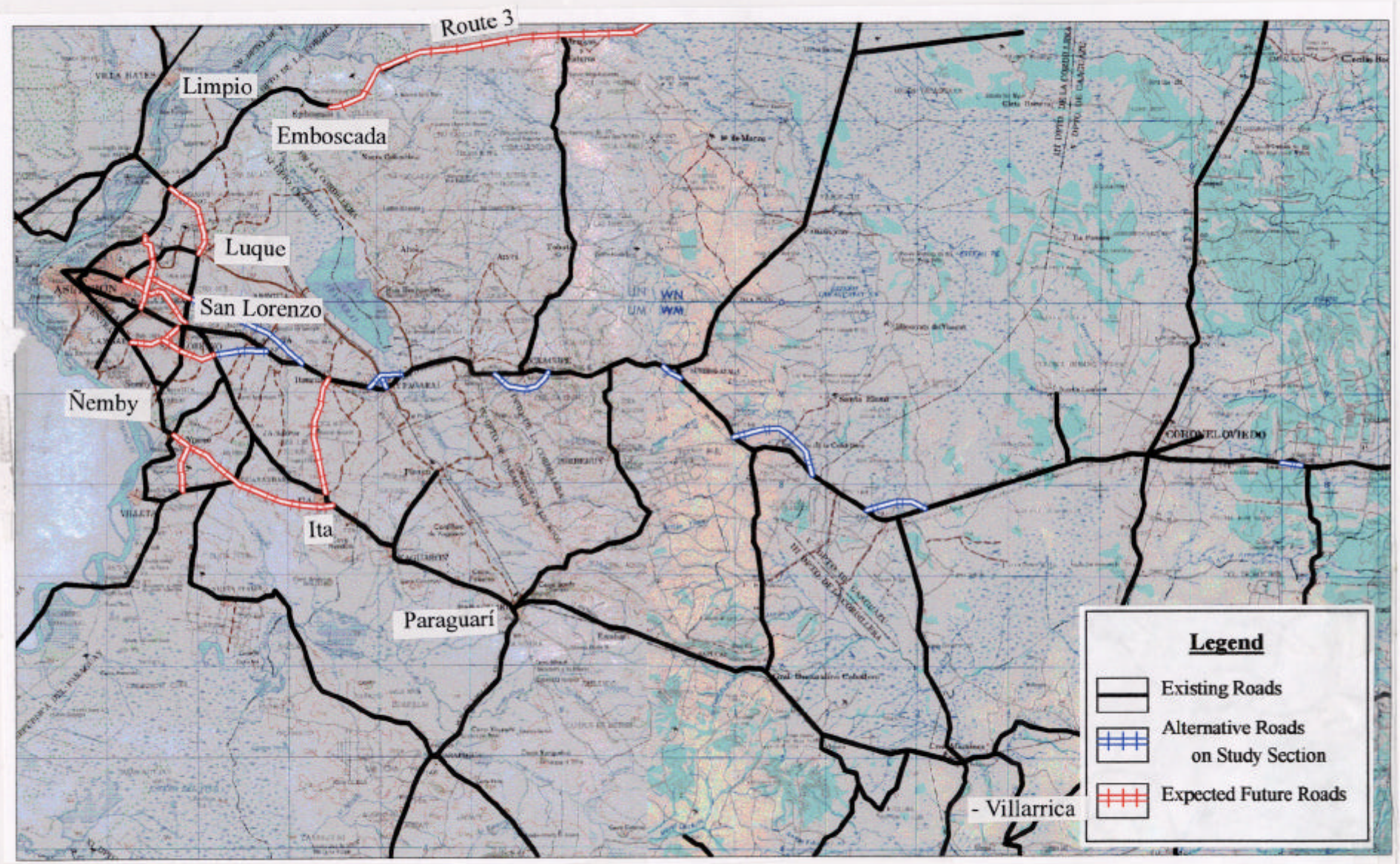

Figure 6.5.1 Road Network