2-1-4 Transportation

(1) Transport Modes and Network

There are four (4) different transport modes serving different objectives and area in Paraguay; that is, road, railway, river, and air. (see Figure 2.1.3) The importance of roads is much greater than that of the other transport modes, as conceptually illustrated below.

		Transportation Mode			
		Road	Rail	River	Air
National	Cargo	XXXX	X	XX	-
	Passenger	XXXX	-	X	X
International	Cargo	XXXX	XX	XXX	X
	Passenger	XXX	-	-	XXX

Note - X: Conceptual weight of importance, -: Negligible

Figure 2.1.2 Conceptual Role of Transportation by Mode

(2) Road

Though road transport is essential mode of transport in the country, there is no sufficient information/statistics of road inventory, traffic volume, transport industry, etc. Most of trunk roads are administrated by MOPC, and the total length of 59,160 km is classified by two categories; function and surface condition. As the ratio of paved road is less than 5% to the total, it has increased steadily by 60 - 110 km per year.

Table 2.1.4 Total Road Length, 1996

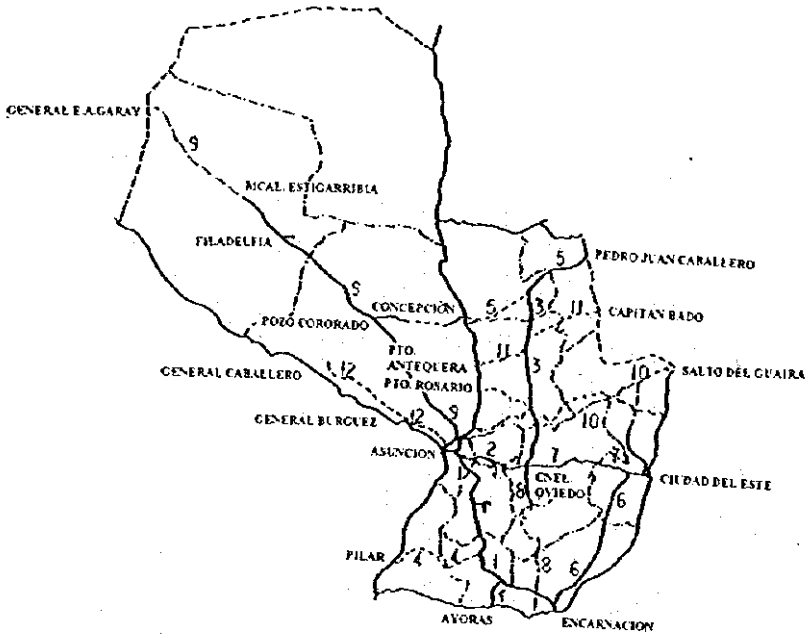
(Unit : km)

Classification by Importance	Classification by Administration	Type of Surface				
		Paved	Stone-paved	Cobbled	Dirt	Total
Primary Road	National	2,413.2	1.0	6.5	2,394.0	4,814.7
	Departmental	403.5	27.2	356.1	4,547.0	5,333.8
Secondary Road	Primary Local	20.7	25.4	488.2	13,478.0	14,012.2
Sub-total		2,837.4	53.7	850.8	20,419.0	24,160.7
Tertiary Road*	Secondary Local	-	-	-	35,000.0	35,000.0
Total		2,837.4	53.7	850.8	55,419.0	59,160.7

Source : MOPC
Note : * estimated without inventory

The existing national arterial road network, shown in Table 2.1.5, consists of 12 routes, totaling 3,444 km, as listed in the table below. Now, there is a plan to revise the national arterial route network under the National Road Maintenance Plan proposed by IDB and it might be completely modified by 14 national route systems.

(1) Road Network



(2) River Transport

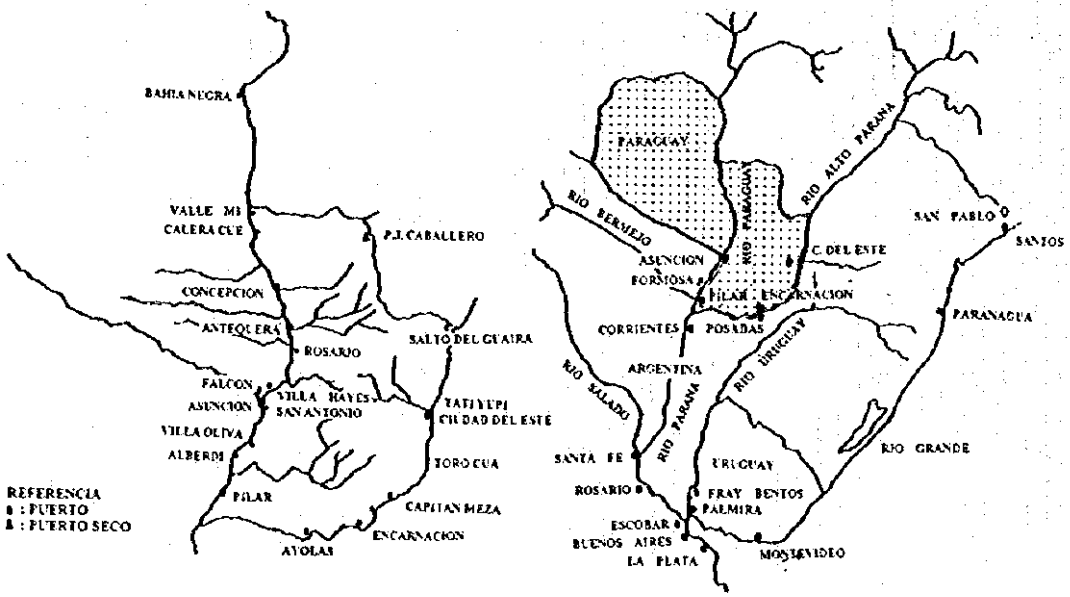
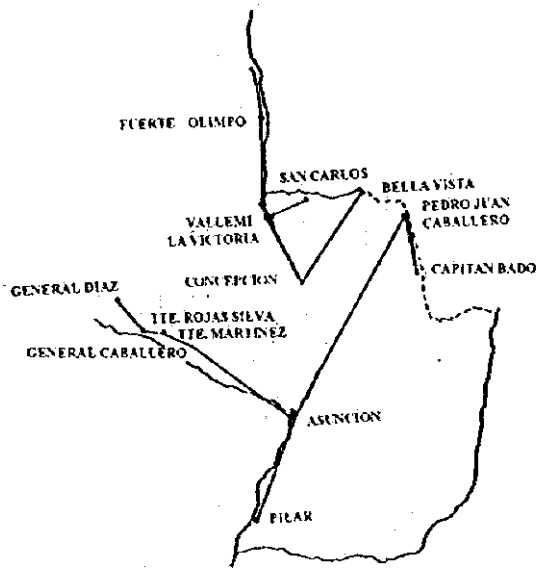


Figure 2.1.3 Major Transport Network (1)

(3) Air Transport



(4) Railway

Figure 2.1.3 Major Transport Network (2)

Table 2.1.5 Present National Routes

Route No.	Origin	Destination	Length (km)
1	Asunción	Encarnación	370
2	Asunción	Coronel Oviedo	134
3	Limpio	Bella Vista	452
4	San Ignacio	Itapiru	206
5	Concepción	Pedro Juan Caballero	215
6	Encarnación	Ciudad del Este	250
7	Ciudad del Este	Coronel Oviedo	193
8	Coronel Oviedo	Coronel Bogado	202
9	Asunción	Eugenio A. Garay	776
10	Rosario	Salto del Guairá	396
11	Antequera	Cerro Torin (Cap. Bado)	88
12	Chaco-i	Esteban Martínez	162
Total			3,444

Source : MOPC

(3) Number of Vehicles

The number of registered vehicles has rapidly increased since recording over 100 thousand in 1983, and as of 1994, the number is 323 thousand registered vehicles. Vehicle registration is concentrated in Asunción and its vicinity, 67% of the total is registered in the capital and Central Dept.

Table 2.1.6 Number of Registered Vehicles, 1994

Department	Total	Composition by Dept.	Type of Vehicle					
			Car & Taxi	Pick-up	Truck	Bus & Others	Unknown	Machinery
Asunción	89,149	27.6%	60,056	20,691	3,944	2,346	1,898	214
Cordillera	11,629	3.6%	7,578	2,408	1,118	319	161	45
Guairá	4,038	1.3%	2,061	979	748	134	13	103
Caaguazú	6,409	2.0%	2,388	1,757	1,540	496	126	102
Caazapá	996	0.3%	357	340	204	67	14	14
Itapúa	20,227	6.3%	9,596	5,723	3,074	538	199	1,097
Misiones	3,087	1.0%	1,591	944	401	131	12	8
Paraguarí	4,810	1.5%	2,260	1,459	728	245	88	30
Alto Paraná	36,012	11.2%	21,054	9,910	3,763	731	237	317
Central	124,389	38.5%	76,730	31,446	10,857	3,793	1,112	451
Ñeembucú	813	0.3%	289	259	172	51	30	12
Overall Study Area	301,559	93.5%	183,960	75,916	26,549	8,851	3,890	2,393
(Other Eastern Region)								
Concepción	1,919	0.6%	561	796	402	131	5	24
San Pedro	3,518	1.1%	1,176	1,061	666	245	28	342
Amambay	4,313	1.3%	1,196	1,592	1,260	234	8	23
Canindeyu	1,655	0.5%	467	567	483	53	15	70
Western Region	9,717	3.0%	4,346	4,118	820	217	121	95
Nation Total	322,681	100.0%	191,706	84,050	30,180	9,731	4,067	2,947

Source: Annual Statistics, 1994

(4) Traffic Volume

There are no systematic traffic censuses which indicate the historical trends of general traffic activity, but rather individual traffic count surveys classified by purpose. In addition to those results, some stations on major national routes keep their own records from toll collection. Some of the characteristics, historical trends, and vehicle classifications of traffic volume can therefore be summarized in Table 2.1.7.

(5) Road Administration and Investment

1) Organization and road administration

The government administration on transportation in Paraguay is in the charge of the Ministry of Public Works and Communications (MOPC). There are four (4) secretaries under the Minister; Secretary for Public Works and Communications, Secretary for Transportation, Secretary for Mining and Energy, and Secretary for Administration and Finance. Development and maintenance of trunk roads are in the charge of the Director of Trunk Roads under the Secretary for Public Works and Communications, and this organization consists of the following department/sections, as illustrated in Figure 2.1.4.

Table 2.1.7 Summary of Traffic Volume at Major Points

1) Yearly Trend

Year	Route 1- 23km Ybyraro (1)	Route 1- 160km Villa Florida (2)	Route 2- 38km Ypacarai(5)	Route 2- 124km Cnel. Oviedo (6)	Route 7- 201km Pastoreo (7)	Route 9- 50km Cerrito (14)
1992	3,678	1,386	5,924	2,396	1,376	282
1993	5,942	1,354	9,420	3,943	2,792	800
1994	8,248	1,467	10,734	4,351	3,373	854

Note: ( ) = Station No.

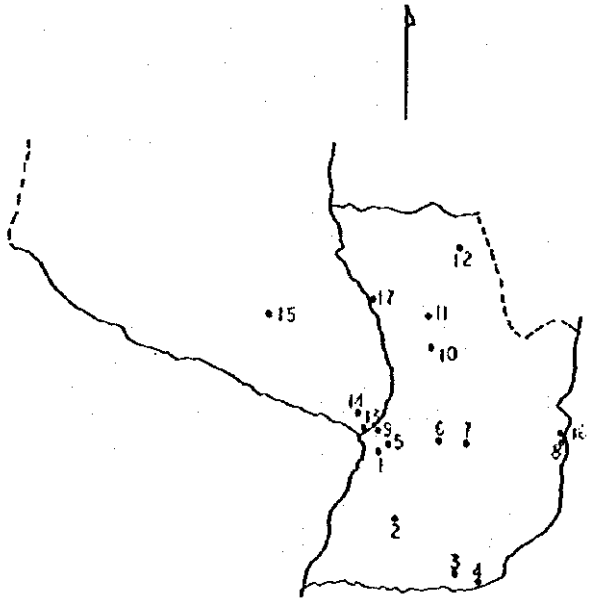
2) Traffic Volume at Toll Station by Vehicle Type, 1992 (both directions)

St. No	Route	Traffic Volume by Vehicle Type					Vehicle Composition (% by Type)			
		Total	A	B	C	D	A	B	C	D
1	1	3,679	3,275	357	47	-	89.0%	9.7%	1.3%	0.0%
2	1	1,386	1,177	152	57	-	84.9%	11.0%	4.1%	0.0%
3	1	748	632	87	29	-	84.4%	11.7%	3.9%	0.0%
4	1	1,791	1,607	150	34	-	89.7%	8.3%	1.9%	0.0%
5	2	5,924	4,490	600	150	685	75.8%	10.1%	2.5%	11.6%
6	2	2,396	1,933	331	132	-	80.7%	13.8%	5.5%	0.0%
7	7	1,376	1,125	167	84	-	81.8%	12.1%	6.1%	0.0%
8	7	1,425	1,086	212	102	79	76.2%	14.9%	7.1%	5.6%
9	3	278	206	72	0	-	74.0%	25.9%	0.1%	0.0%
10	3	369	256	73	39	-	69.4%	19.8%	10.7%	0.0%
11	3	295	196	66	33	-	66.4%	22.3%	11.3%	0.0%
12	5	259	213	39	7	-	82.1%	15.2%	2.8%	0.0%
13	9	4,405	3,796	443	166	-	86.2%	10.1%	3.8%	0.0%
14	9	282	218	38	26	-	77.2%	13.6%	9.2%	0.0%
15	9	287	217	25	46	-	75.4%	8.7%	15.9%	0.0%
16	-	483	421	42	21	-	87.0%	8.7%	4.3%	0.0%
17	5	21	16	3	1	-	78.7%	15.4%	5.9%	0.0%

Note - A:Regular Vehicles, B:Trucks with 3 axles, C:Trucks with more than 3 axles, D:Special Buses

3) Location of Survey Station

No.	Station	(km)	Route No.
1	Ybyraro	23	1
2	Villa Florida	160	1
3	Cnel. Bogado	329	1
4	Encarnación	4	1
5	Ypacarai	38	2
6	Cnel. Oviedo	124	2
7	Pastoreo	201	7
8	Ciudad del Este	30	7
9	Limpio	30	3
10	Pte. Jejui Guazu	292	3
11	Aguaray Guazu	325	3
12	Chiriguelo	191	5
13	Pte. Remanso	18	9
14	Cerrito	50	9
15	Pozo Colorado	269	9
16	Hernandariaz	7	-
17	Pte. Concepción	0	5



Source : MOPC

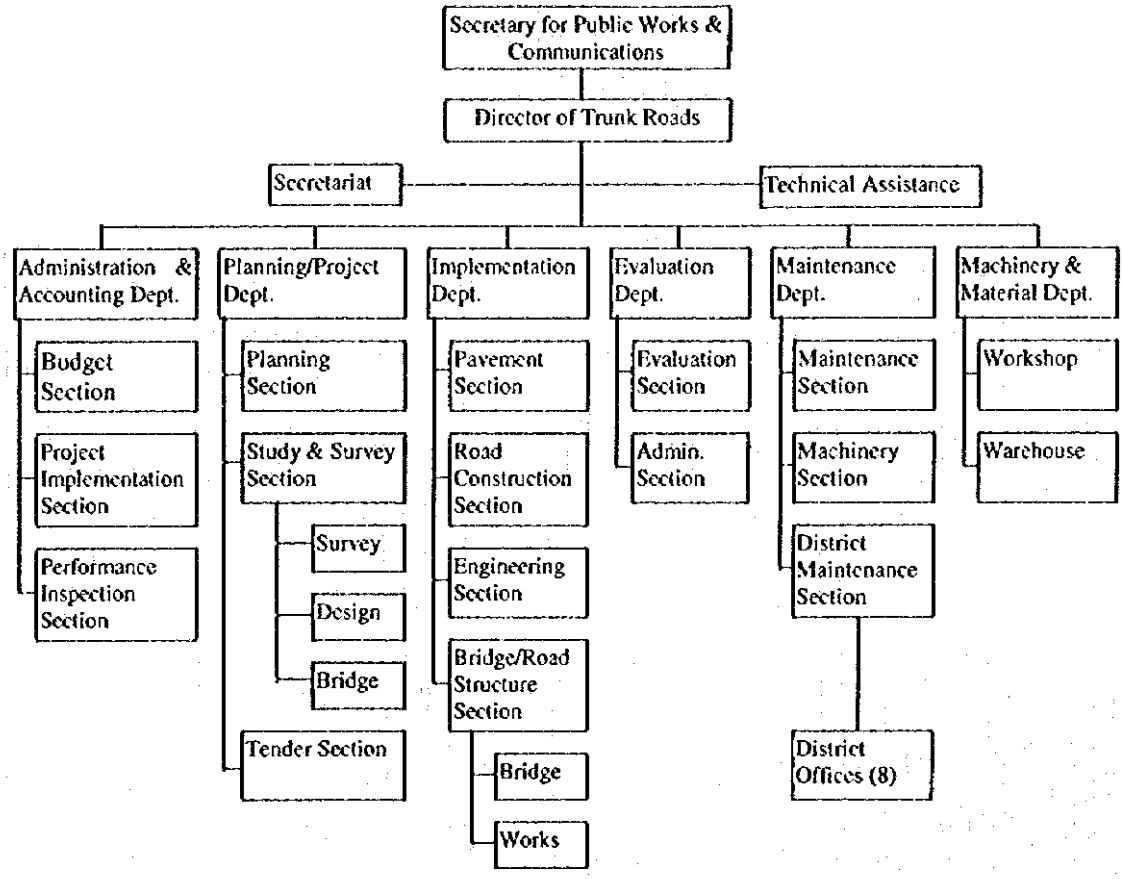


Figure 2.1.4 Organization Chart of the Director of Trunk Roads, MOPC

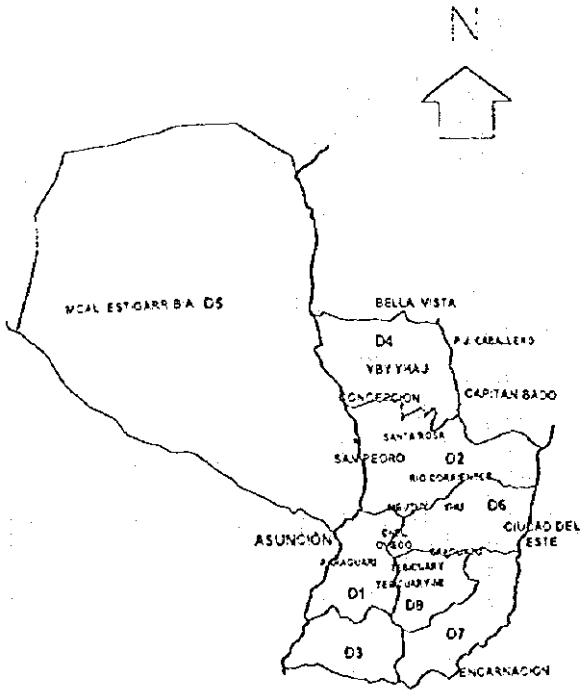
Road development/construction works are usually conducted by the private sector under the administration of Planning/Project and Implementation Department, while maintenance work is conducted under the Maintenance Department, which has 8 district offices covering the whole nation. Figure 2.1.5 shows the administrative borders of the 8 districts, and Table 2.1.8 indicates the total road length in each district in 1995.

2) Investment for road development

The importance of the road sector can be seen in Table 2.1.9. Its share has increased since 1990 (more than 60% greater than previous years) and the share in the budget of MOPC transport sector has reached 78.5%, in contrast with the decrease in the railway sub-sector.

3) Road development plan

Though there is no certain road improvement master plan, such as a Five Year Road Development Plan, road development has been conducted steadily as shown in Table 2.3.4, in spite of budgetary constraints. The major directions of road development are:



Source : MOPC

Figure 2.1.5 Administration Districts of Road Maintenace, MOPC

Table 2.1.8 Road Length by District, 1995

(Unit : km)

District	Road Class	Paved	Stone-paved	Unpaved	Total
1	National Rd.	401.8	-	323.5	725.3
	Departmental Rd.	306.9	14.1	672.3	993.3
	Others	-		1,458.0	1,458.0
	Total	708.7	14.1	2,453.8	3,176.6
2	National Rd.	171.3	-	472.0	643.3
	Departmental Rd.	-	-	926.3	926.3
	Others	-	-	2,995.0	2,995.0
	Total	171.3	-	4,393.3	4,564.6
3	National Rd.	130.6	-	136.6	267.2
	Departmental Rd.	11.4	11.4	404.4	427.2
	Others	4.3	-	936.7	941.0
	Total	146.3	11.4	1,477.7	1,635.4
4	National Rd.	191.5	-	308.1	499.6
	Departmental Rd.	-	-	382.1	382.1
	Others	-	-	921.3	921.3
	Total	191.5	-	1,611.5	1,803.0
5	National Rd.	600.0	-	795.3	1,395.3
	Departmental Rd.	14.8	-	1,177.0	1,191.8
	Others	-	-	2,659.0	2,659.0
	Total	614.8	-	4,631.3	5,246.1
6	National Rd.	109.3	-	38.8	148.1
	Departmental Rd.	11.2	-	306.4	317.6
	Others	-	-	1,482.0	1,482.0
	Total	120.5	-	1,827.2	1,947.7
7	National Rd.	376.0	1.0	226.1	603.1
	Departmental Rd.	1.7	1.7	368.4	371.8
	Others	11.4	11.4	1,973.0	1,995.8
	Total	389.1	14.1	2,567.5	2,970.7
8	National Rd.	62.7	-	99.1	161.8
	Departmental Rd.	57.6	-	666.2	723.8
	Others	5.0	-	962.6	967.6
	Total	125.3	-	1,727.9	1,853.2
Total	National Rd.	2,043.2	1.0	2,399.5	4,443.7
	Departmental Rd.	403.6	27.2	4,903.1	5,333.9
	Others	20.7	11.4	13,387.6	13,419.7
	Total	2,467.5	39.6	20,690.2	23,197.3

Source : MOPC

Table 2.1.9 Trends of Investment for Transport/Road Sector

	1987	1988	1989	1990	1991	1992
1. Budget to Total GDP						
GDP*	799,382	850,207	899,500	927,317	950,208	967,312
Transport Sector (%)	0.6	0.5	0.3	0.5	0.8	1.3
Road Sector (%)	0.4	0.4	0.2	0.4	0.6	1.0
2. Budget to Total Investments						
Total Investment*	160,990	166,951	184,771	203,471	215,354	201,580
Transport Sector (%)	2.9	2.6	1.6	2.3	3.6	6.4
Road Sector (%)	1.9	1.8	1.0	1.7	2.7	5.0
3. Budget for Roads within MOPC Transport Sub-sector						
Total MOPC Transport Sub-sector*	4,695	4,370	2,986	4,615	7,813	12,820
Percentage Share of Roads	64.9	70.3	61.9	73.4	73.2	78.5
River/Pots	3.5	1.1	3.1	3.7	7.5	7.5
Air	30.1	27.4	34.3	22.1	18.9	14.0
Rail	1.5	1.2	0.6	0.8	0.4	0.0
4. Investment for Road*	3,047	3,072	1,849	3,389	5,720	10,070
Comparison to previous year	-	1.01	0.60	1.83	1.69	1.76

Source : Diagnostico del Sector Transport, 1994
Note : * Million Gs. in 1982 prices

- Completion of the paved national trunk route network
- Improvement/Rehabilitation of paved roads
- Development of the rural road network for local activity
- Development of international transport routes for "MERCOSUR"

The budget allocation for the road sub-sector in the previous National Transportation Plan, 1991-1995 indicates the significant role of road transport. As summarized in Table 2.1.10, one of the biggest problems is that almost half of the total budget for road investment must rely on foreign funds.

Table 2.1.10 Investment Program, National Transportation Plan 1991-1995

(Unit : Million Gs.)

Sub-sector	1991			1992			1993		
	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total
Road	41,460.0	51,726.8	93,186.8	59,486.3	94,923.1	154,409.4	69,157.9	121,992.9	191,150.8
	44.5%	55.5%	100.0%	38.5%	61.5%	100.0%	36.2%	63.8%	100.0%
River	6,449.2	-	6,449.2	5,603.0	-	5,603.0	5,619.3	-	5,619.3
Air	149.2	48,140.0	48,289.2	41.0	1,146.0	1,187.0	-	-	-
	0.3%	99.7%	100.0%	3.5%	96.5%	100.0%			
Railway	2,064.0	-	2,064.0	2,270.4	-	2,270.4	2,497.4	-	2,497.4
Total	50,122.4	99,866.8	149,989.2	67,400.7	96,069.1	163,469.8	77,274.6	121,992.9	199,267.5

Sub-sector	1994			1995			1991-95Total			Share (%)
	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	
Road	81,119.9	58,568.5	139,688.4	70,928.1	14,014.0	84,942.1	322,152.2	341,225.3	663,377.5	88.8%
	58.1%	41.9%	100.0%	83.5%	16.5%	100.0%	48.6%	51.4%		
River	1,821.2	-	1,821.2	2,003.3	-	2,003.3	21,496.0	-	21,496.0	2.9%
Air	-	-	-	-	-	-	190.2	49,286.0	49,476.2	6.6%
							0.4%	99.6%		
Railway	2,747.2	-	2,747.2	3,022.0	-	-	12,601.0	-	-	1.7%
Total	85,688.3	58,568.5	144,256.8	75,953.4	14,014.0	89,967.4	356,439.4	390,511.3	746,950.7	100.0%

Source : National Transportation Plan, 1991-1995

(6) Road Maintenance System

As mentioned before, the Maintenance Department and eight District Offices of MOPC are in charge of maintenance work on all the nation's roads. (see, Figures 2.1.4, 2.1.5 and Table 2.1.8.)

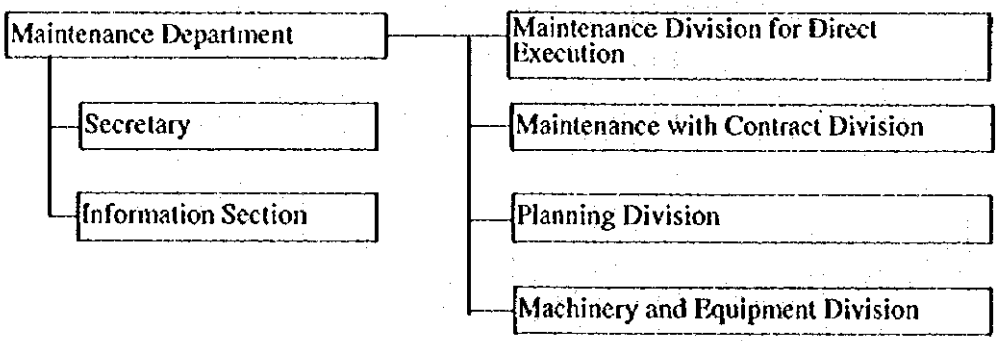
Since their actual activity has sometimes been accused of not being efficient, the MOPC contracted in 1994 with the consulting firms to conduct a study on the road maintenance system. The study named "Consulting Service for Establishment of Road Network Maintenance Plan (Servicio de Consultoría para la Elaboración del Plan de Conservación de la Red Vial Nacional)" was finished in 1995, and its results are abstracted as follows:

1) Findings and issues of the actual system

- The amount of work done during the same period by different offices differs greatly.
- Insufficient usage and overusage of equipment were found; some equipment was not appropriately distributed and combined, and some work plans were made without properly considering existing equipment.
- Work not involving road maintenance, which is normally requested of the private sector is being executed very often in some district offices.
- Physical and financial control by the central office (Maintenance Dept.- MOPC) of the district offices is neither sufficient nor effective.
- Although there is sufficient man-power and material, the required work is sometimes not executed for no reason.
- The system to collect the information on the activity of the district office is very poor.
- The responsibilities of the Machinery Section in the Maintenance Department and the Machinery and Material Department are not clear.

2) Recommendation

- Some part of road maintenance work shall be assigned to some private company under a contract with the MOPC
- The Maintenance Department shall be re-organized as follows:



- A new integrated administration system shall be developed for road maintenance work, aiming at especially rapid collection of correct data and information, and appropriate work planning based on this information.

3) Output

- The consulting firms developed a computer software called "SIAMV" during the study for the purpose of improving the road maintenance system according to the above-mentioned recommendation, and handed it over the MOPC.
- The SIAMV (Sistema Integral de Administración del Mantenimiento Vial) consists of the following six modules:
  ① Information system including road inventory
  ② Cost evaluation system
  ③ Pavement preservation system (based on HDM III and Expenditure and Budgeting Model - World Bank)
  ④ Maintenance administration system for establishing an annual work program
  ⑤ Report system
  ⑥ Software maintenance system

The study, the results of which are summarized above, was completed and the software SIAMV is now owned by the MOPC; however, the utilization of the SIAMV to date has been partial and on a trial basis. Consequently, no benefits have yet been obtained.

Independently from the above-mentioned study, the development of a system for better usage of the equipment in the district office has been carried out as a part of consulting services for the rehabilitation of the existing road network financed by the Japanese Government. (Loan No. PG-P9) The purpose here was to improve the management and utilization of equipment. Therefore, efforts were concentrated on developing an information transfer system regarding the equipment for use by all the districts offices, the central office, and the central workshop, simplifying the parts purchase system, and clarifying the duties and responsibilities of each office, workshop and parts deposits for conducting maintenance and repair work on the equipment, and required transaction on equipment.

The results of those independent studies are expected to supplement each other, and help improve the road maintenance system in the near future.

Incidentally, even in the MOPC, some believe that a part of the road maintenance work must be transferred to relevant municipalities or departmental governments. If the

MOPC, dividing its staff, endows those local organizations with a group consisting of equipment, operators, mechanics and engineers, this plan might prove successful. Otherwise, it would not be realistic nor rational, that is, there are no municipalities which have the required resources and capabilities to carry out road maintenance work on their own at present. However, this idea could be realized in the future if the necessary preparatory steps are taken.

2-2 Central Eastern Area and Transport Network

2-2-1 Demographic Features of the Central Eastern Area

Some basic demographic features are summarized in the table below:

Table 2.2.1 Some Demographic Indices of the Central Eastern Area

Department	Capital	No. of District	Area (km^2)	Population (1992)	Population Density ($Pop./km^2$)	Population (1982)	Population Growth (1982-92)
Asunción		1	117	500,938	4,281.5	454,881	1.0%
Cordillera	Caacupé	20	4,948	198,701	40.2	194,011	0.2%
Guairá	Villarrica	16	3,846	161,991	42.1	143,510	1.2%
Caaguazu	Cnel. Oviedo	19	11,474	386,412	33.7	299,437	2.6%
Caazapá	Caazapá	10	9,496	129,352	13.6	109,452	1.7%
Itapúa	Encarnación	29	16,525	377,536	22.8	262,680	3.7%
Misiones	San Juan Bautista	10	9,556	89,018	9.3	77,475	1.4%
Paraguarí	Paraguarí	17	8,705	208,527	24.0	204,399	0.2%
Alto Paraná	Ciudad del Este	18	14,895	406,584	27.3	199,644	7.4%
Central	Aregua	19	2,465	866,856	351.7	497,388	5.7%
Ñeembucú	Pilar	16	12,147	69,770	5.7	70,338	-0.1%
Overall Study Area		175	94,174	3,395,685	36.1	2,513,215	3.1%
Comparison with the Nation		77.1%	23.2%	81.8%	353.5%	82.9%	95.6%
Eastern Region		217	159,827	4,046,955	25.3	2,972,998	3.1%
Western Region		10	246,925	105,633	0.4	56,832	6.4%
Nation Total		227	406,752	4,152,588	10.2	3,029,830	3.2%

Source : 1992 Census, Summary

2-2-2 Regional Structure

(1) Paraguay Triangle

The central eastern area is referred to as the "Paraguay Triangle" with 3 urban centers, Asunción, Encarnación and Ciuded del Este, acting as the apexes. The development directions dominating the triangle area (Figure 2-2-1 Regional Structure in the Triangle) can be summarized as follows :

1) Triangle Development Direction

The three urban centers listed above dominate socio-economic and industrial activities, and stretch mainly along the sides of the triangle.

They play a variety of roles as urban centers, as gateways to foreign trade , centers of financial service and agricultural product distribution/collection, centers of social services, etc.

2) Capital Centered Development Mechanism

Of the three urban centers, the capital of Asunción exerts the greatest influence over the country and the area as well. In this respect, the area can be structured as follows, according to distance from the center of Asunción.

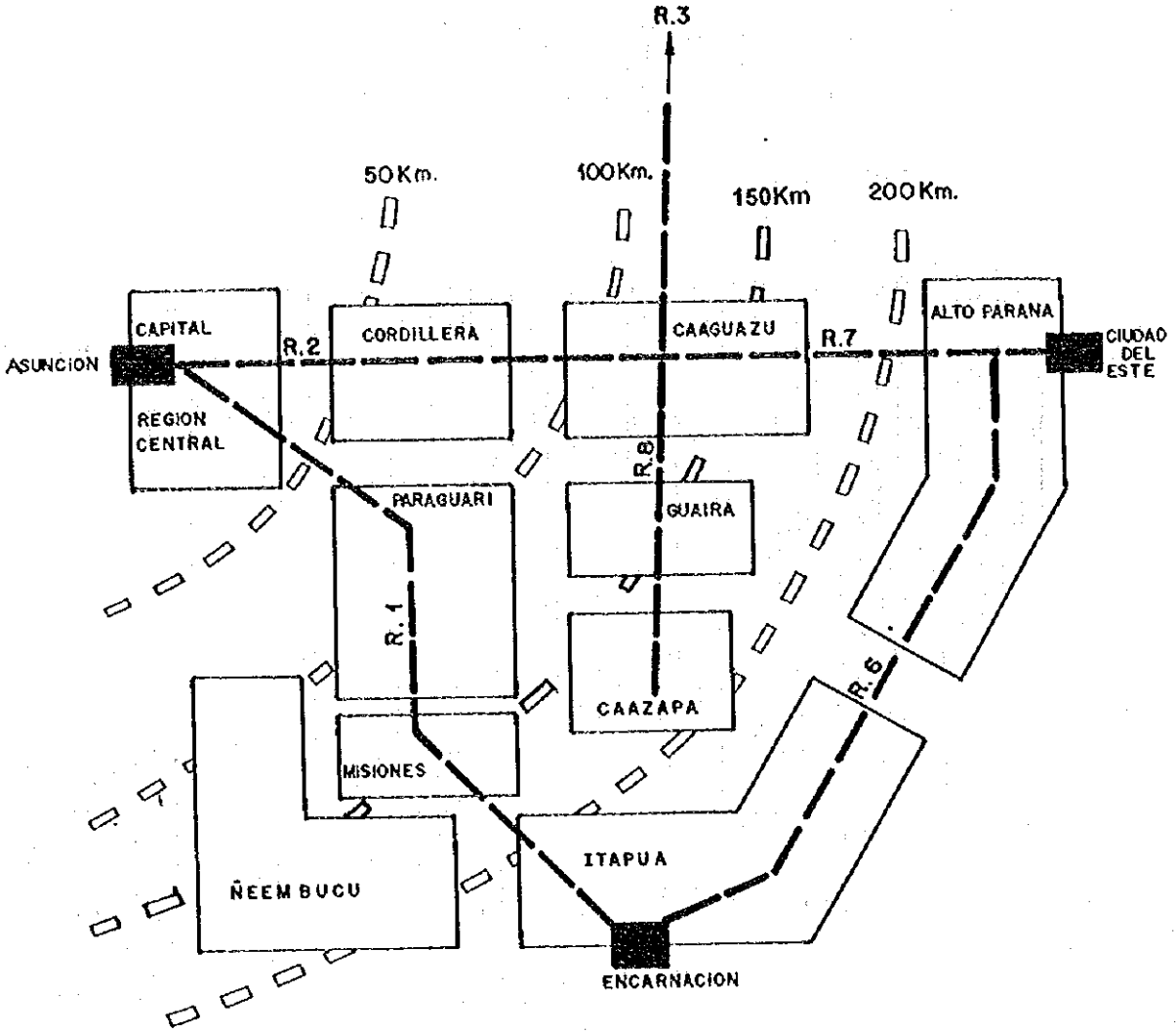


Figure 2.2.1 Regional Structure in the Triangle

i) The capital region(Approximately a 50 km radius): Asunción and the Central department.

ii) 100 km radius :Cordillera and Paraguarí.

iii) 200 km radius : Caaguazú, Guairá, Caazapá, Misiones, Ñeembucú.

iv) 300 km radius : Alto Paraná and Itapúa .

3) East-West and North-South Corridor Development Direction

i) Of the three sides of the triangle, the most intensive development corridor is found along the line connecting Asunción and Este (East-West), the country's capital and the main gateway to Brasil, respectively.

ii) The North-South corridor along national roads R.3 and 8, is another development corridor.

iii) The North-South corridor along the railway between Asunción and Encarnación is the oldest development in Paraguay, dating back to the Spanish Era. However these areas, including Guairá and Caazapá, have been left behind in the advent of the triangle development resulting from improvements in road transport .

iv) The North-South connection between Encarnación and the northern part of Paraguay and Bolivia or Argentine and Chile will be highlighted by the progress of MERCOSUR since it has been designed as a candidate route to connect the Atlantic and Pacific Oceans, Its development is eagerly anticipated in MERCOSUR.

v) The crossroads of north-south and east-west at the Cnel. Oviedo gives a strategic importance to the province of Caaguazú.

(2) Land Use and Physical Conditions

Existing land use, as shown in the Figure 2.2.2, consists of low and high pasture lands, agricultural lands including farming areas as well as the pasture land (mixed agricultural use), forest land, and lands deforested between 1984 and 1991. This land use map shows the historical background of agricultural and land development, and the natural conditions of the region.

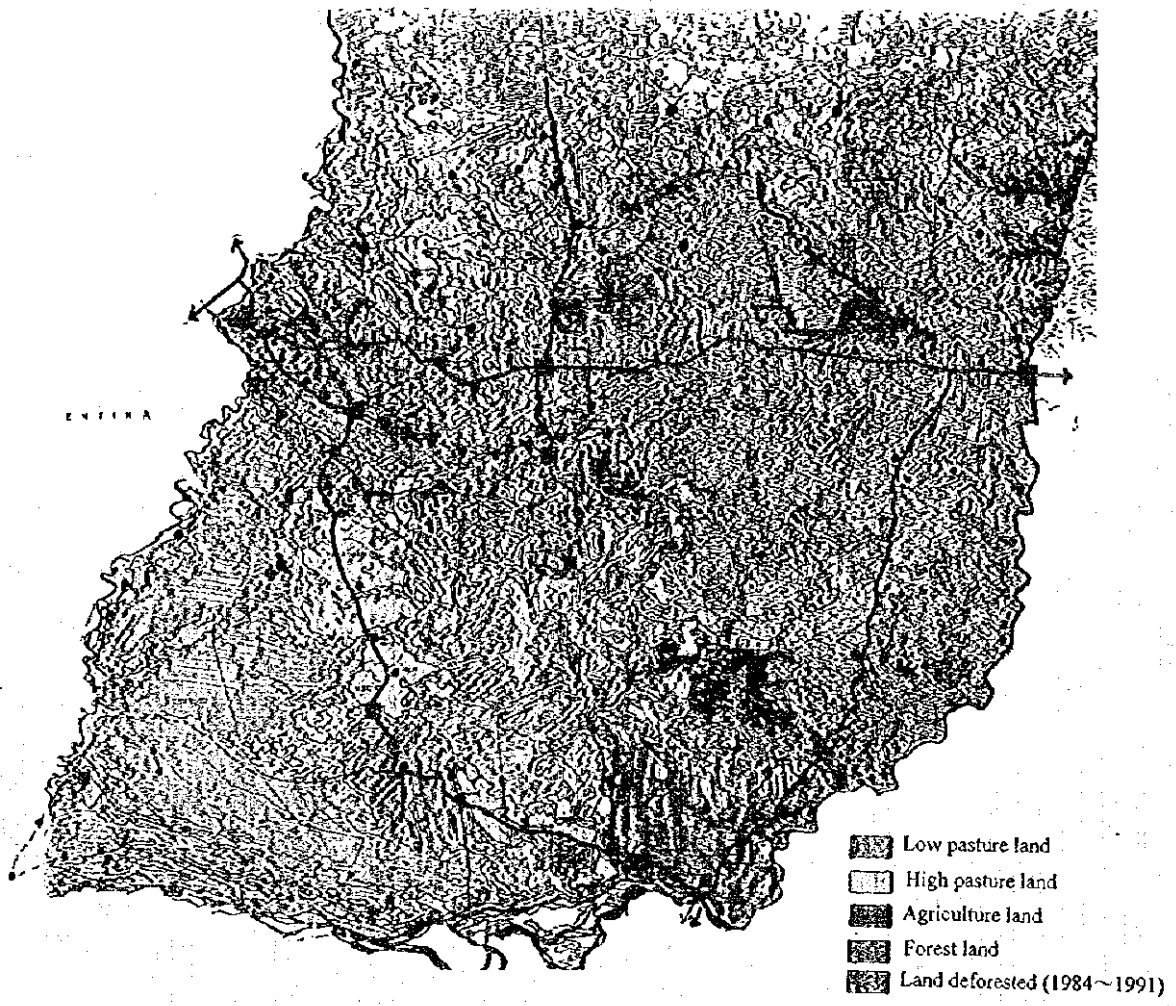
i) Land use seems to show the history of agricultural development leading to the rise of Asunción and Encarnación, which have been main export gateway in the Spanish colonial era. The land cleared for cultivation, as of 1966 (Figure 2.2.3), corresponds mostly to agricultural land except the eastern part of the triangle region.

ii) Agricultural and human settlement development proceeded eastward to Alto Paraná and Itapúa. The lands deforested in the period between 1984 and 1991, shown in the land use map of Figure 2.2.2, indicate this trend. The major factors which facilitated the eastward development are summarized as follows:

- Commercially valuable logging in the Alto Paraná forest (for export)
- Pavement of national roads R.2 and 7, between Asunción and Este, and Paraná bridge access to Brasil.
- Natural conditions for agriculture. (rainfall and drainage)

The area deforested from 1984 to 1991, shown on the land use map, has been primarily devoted to the production of soy bean, which is now the main export agricultural crop of Paraguay.

iii) Cattle-grazing pasture consists of lowlands (flooded) and highlands. Thus in Paraguay even flooded areas are used for livestock farming, although productivity in those areas is low.



Source : Map of land use 1994 and progress of deforestation from 1984 to 1991

Figure 2.2.2 Existing Land Use

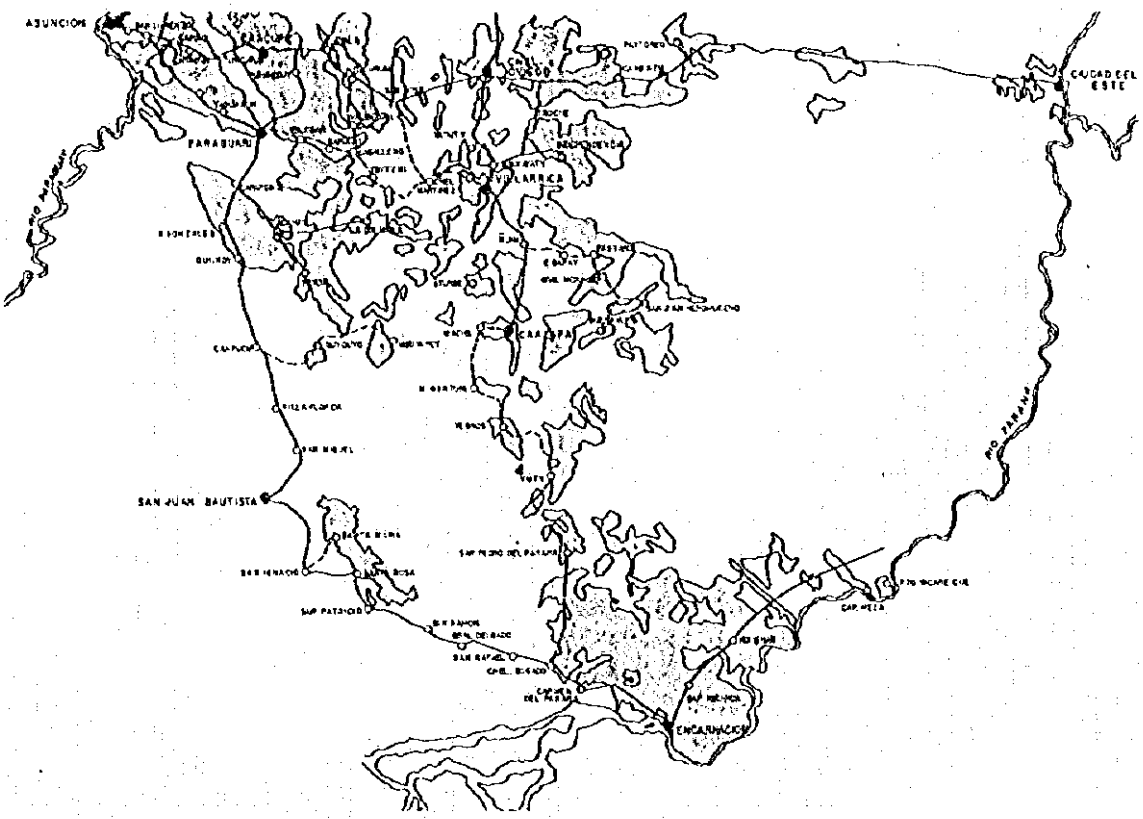
The exiting land use area illustration (Table 2.2.2) shows the basic features of land use in Paraguay to be follows:

i) Most of the land in Eastern Paraguay is used for pasture.

ii) Agriculture lands classified in the land use category occupy a large area of land. However, the net ratio of farmland to agricultural land is quite low. (The maximum is 44%, which is found in Itapúa and Alto Paraná.)

iii) The low occupancy rate of farmland can be attributed to the large portion of pasture, non-arable land, and forest land which remains.

iv) Natural lands have been cleared for cultivation or logging, resulting in a scarcity of natural lands and forest (see the figures on the area of natural forest land in the Table 2.2.2, and compare Figures 2.2.3 and 2.2.2). Therefore, it is imperative that agricultural development aim at improving existing farmland (productivity and variety of crops), so that no more forest will be cleared.



Source : Plan Triangle

Figure 2.2.3 Land Cleared for Cultivation 1966

Table 2.2.2 Existing Land Use Area

(Unit : ha)

Department	Total	Net Farmland			Agriculture Land (Mixed)	Pasture	Forest		Net Ratio of Farmland to Agricultural Land (%)
		6 Main Crops	Others	Plantation			Natural	Degraded	
Concepción	1,805.1	53.3	18.3	4.8	410.4	870.1	482.4	42.1	18.6
San Pedro	2,002.2	150.1	16.5	11.7	758.8	781.1	355.0	105.3	23.5
Cordillera	494.8	36.0	15.8	10.2	213.9	252.5	-	26.0	29.0
Guairá	384.6	59.9	5.7	4.9	285.2	45.6	24.8	29.1	24.7
Caaguazú	1,147.4	190.4	20.2	5.1	698.4	182.0	118.4	116.1	30.9
Caazapá	949.6	66.3	11.2	2.0	398.5	339.7	153.9	57.5	19.9
Itapúa	1,652.5	411.9	25.9	27.2	1,051.1	335.7	185.3	80.5	44.2
Misiones	955.6	25.3	8.2	1.3	244.0	695.2	-	16.9	14.3
Paraguarí	870.5	53.6	11.4	1.3	277.8	553.7	-	33.4	23.9
Alto Paraná	1,489.5	412.4	38.4	4.4	1,031.4	51.3	295.1	95.1	44.1
Central	246.5	13.3	4.3	0.9	131.4	116.1	-	5.4	14.1
Ñeembucú	1,214.7	12.6	3.4	1.0	6.4	1,216.8	-	7.7	?
Amambay	1,293.3	37.6	6.7	3.6	535.8	315.1	313.2	92.6	8.9
Canindeyu	1,466.7	134.5	12.7	5.3	772.2	24.5	635.2	34.8	19.7
Región Oriental	15,982.7	9.9	198.7	83.7	6,815.3	5,779.4	2,563.3	742.5	
Región Occidental	24,692.5	1,657.2	36.8	0.5	-	-	-	-	
Total	40,675.2	1,667.1	235.5	84.2					

Source : Annual 1994 and statistic

(3) Socio-Economic Conditions

1) Population Growth and Distribution

The population growth in the area (Table 2-2-3) has been lopsided, with an exceptionally high increase in the departments of Central and Alto Paraná, followed by Caaguazú and Itapúa. These departments belong to the vertexes of the triangle, and include the crossroads between north-south and east-west (Caaguazú). All other departments recorded very low population increases or decreases.

The highest increase of Alto Paraná can be attributed to the urban growth of Este, which is the main trading center with Brasil. The main factors causing an increase in the population of the Central department can be identified as follows:

i) Spillover of population from Asunción, that is, housing developments for commuters.

ii) Commercial development represented by cities such as San Lorenzo, etc.

iii) Industrial (especially agro- industrial) development in the vicinity of the capital. The population increase in Itapúa and Caaguazú can be attributed to the agricultural development described in the following section.

The share of employment by sector (Table 2.2.3) is lowest in the primary industry in Asunción and the Central Department, and the highest in Caazapá.

Table 2.2.3 Population Growth and Characteristics

Department	1972	1982	1992	Annual Increase (%)			Employment (%)			Urban Population (%)
				72/82	82/92	72/92	Primary	Secondary	Tertiary	
Asunción	388,958	454,881	500,938	1.5	1.0	1.3	1.4	21.1	77.5	100.0
Central	310,390	497,388	866,856	4.8	5.7	5.3	7.1	35.3	57.7	79.6
Cordillera	194,218	194,011	198,701	0.0	0.2	0.2	48.7	24.7	26.6	30.9
Paraguarí	211,977	204,399	208,527	-0.1	0.2	-0.1	56.7	22.9	20.4	21.3
Guairá	124,799	143,510	161,991	1.4	1.2	1.3	60.5	16.8	22.7	29.2
Caaguazú	210,858	299,437	386,412	3.6	2.6	3.7	66.1	13.0	20.9	27.4
Caazapá	103,139	109,452	129,352	0.6	1.7	1.1	81.6	6.7	11.7	12.9
Alto Paraná	88,607	199,644	406,584	8.5	7.4	7.9	36.0	16.1	47.9	56.7
Itapúa	201,411	262,680	377,536	2.6	3.7	3.2	56.0	13.6	30.3	29.3
Misiones	69,246	77,475	89,018	1.1	1.4	1.3	47.4	21.4	31.2	49.6
Ñeembucú	73,098	70,338	69,770	-0.4	-0.1	0.2	49.9	19.1	31.0	45.0
Sub total	1,976,701	2,513,215	3,395,685	2.4	3.1	2.7				
Others	351,256	516,615	756,903	3.9	3.4	3.9				
Total	2,327,957	3,029,830	4,152,588	2.5	3.2	2.9	37.6	20.5	41.9	50.3
Amendment		3,357,717	4,452,800							43.5 (excluding Asunción)

Source: National Census on Population and Housing 1992, 1994

2) Agricultural Industry

a) Agricultural product growth in Paraguay

The major agricultural products in Paraguay are crops such as soy bean, wheat, cotton, sugar cane, cassava and corn. The growth of these 6 main crops in the cultivation area

is shown in Table 2.2.4 below.

i) Three crops (soy bean, corn, wheat) have achieved a very high increase in the past 15 years, between 1980 and 1995, while other crops (cotton, sugar cane, cassava) have increased at a lower rate. Especially cotton showed a decrease both in terms of cultivated area and annual production from 1990 to 1995. Moreover, sugar cane production dropped with no substantial increase in cultivated land from 1990. There seems to be great contrast between expanding crops and stagnating crops.

ii) The highest increases of land productivity (production ton / ha) were in the soy bean (1.56) corn (1.57) production. This may be attributable to the large-scale farming systems of Alto Paraná and Itapúa, resulting from their topographical, meteorological and other natural conditions, as well as land scale.

iii) The area cultivated for agricultural production is estimated at 1.986.800 ha., of which the 6 main crops occupy 83.9% as follows.

Table 2.2.4 Cultivated Land Area and Production

Product	1980/81	1990/91	1991/92	1992/93	1993/94	1994/95
Soy Bean (ha)	396,902	552,657	594,811	634,993	694,117	735,503
(t)	769,185	1,032,675	1,192,074	1,793,644	1,795,792	2,212,109
(t/ha)	1.93	1.87	2.00	2.82	2.59	3.01
Cotton (ha)	242,802	414,691	437,322	235,454	381,186	332,280
(t)	316,940	631,728	391,380	420,772	379,877	461,239
(t/ha)	1.31	1.52	0.89	1.79	1.00	1.39
Sugar Cane (ha)	48,108	55,879	55,910	55,940	55,637	56,000
(t)	2,297,864	2,817,091	2,788,210	2,811,460	2,799,318	2,576,000
(t/ha)	47.80	50.40	49.90	50.30	50.30	46.00
Cassava (ha)	178,008	175,572	179,350	183,829	174,278	211,406
(t)	2,139,831	2,584,906	2,591,320	-	-	-
(t/ha)	12.00	14.70	14.40	-	-	-
Corn (ha)	262,782	243,215	258,000	249,081	218,385	330,961
(t)	413,080	401,339	449,700	439,145	461,665	816,166
(t/ha)	1.57	1.65	1.74	1.76	2.11	2.47
Wheat (ha)	49,404	153,837	156,498	182,760	174,786	172,497
(t)	61,328	240,538	259,337	328,406	425,421	208,617
(t/ha)	1.24	1.56	1.66	1.77	2.43	1.21
	1980/81	1991	1992	1993	1994	1995
Cattle	6,457,329	7,626,617	7,886,000	9,861,163	9,779,316	9,788,439

Source: National Census on Agriculture and Livestock 1980 ~ 1995.

Table 2.2.5 Production of 6 Crops from 1980 to 1995.

Product	Expansion of Production	Expansion of Cultivated Land	Increase in Land Productivity
Soy Bean	2.88	1.85	1.56
Cotton	1.46	1.37	1.07
Sugar Cane	1.12	1.16	0.97
Cassava	-	1.14	-
Corn	1.89	1.26	1.57
Wheat	3.40	3.49	1.03

Source: National Census on Agriculture and Livestock

Table 2.2.6 Cultivated Area of Paraguay (1000 ha)

Land Area	6 main Crops	Other Crops	Plantation
	1,667.1	235.5	84.2
(%) 100	83.9	11.8	4.2

Source: National Census on Agriculture and Livestock

The other crops include vegetables, fruit, etc., while plantation includes coffee, oranges, pineapples, grapes, mate, tea, and so on.

b) Geographical distribution of agricultural products

Table 2.2.7 shows the cultivated area and production of the 6 main crops by department in 1990/91 and 1994/95. These figures show the basic features of the geographical distribution of agricultural production to be as follows.

i) In the central eastern area of Paraguay, there seems to be a distinctive pattern/trend of agricultural product by department.

ii) The production of crops (soy bean, corn, wheat) tend to be greatly concentrated in only 2 departments, of Alto Paraná and Itapúa .

iii) The traditional and inactive crops (cotton, cassava, sugar cane) tend to stretch throughout the department with the highest share of cotton and sugar cane production in Caaguazú and Guairá 18.9%, 36.8 % in 1994 /95, respectively.

iv) In general, above mentioned crops (cotton, sugar cane, cassava) are likely to be produced in the department closer to Asunción, such as Cordillera, Paraguarí, Caaguazú, and Guairá. On the other hand, the new cash crops (soy bean, corn, which are the main export agricultural products), are likely to be grown in the departments along the Paraná River. This seems natural because the cultivation of the traditional crops started close to the Asunción and has continued for hundreds of years. During that time the lands were already subdivided into small parcels, which did not allow the large-scale farming necessary for crops such as soy bean and corn.

v) Under the general pattern of crop distribution, as stated above, Caaguazú department is very unique and quite rich in agricultural production as follows:

- The agricultural land or farmland of this department is the third largest in the central eastern area, after the departments of Alto Paraná and Itapúa. (Table 2.2.2 Existing Land Use Area)
- A variety of crops containing traditional and new cash crops are produced with a substantial amount of output in this department.
- Caaguazú is located strategically at the crossroads of north - south and east - west.
- The large area for crops other than the 6 main crops have been cultivated in the department. It is the most diversified agricultural department in Paraguay.

Table 2.2.7 Cultivated Area and Product of 6 Crops by Department

Department	Year	Cultivated Area (1,000 ha)						Production (1000 ton)					
		Soy Bean	Cotton	Sugar Cane	Cas-sava	Corn	Wheat	Soy Bean	Cotton	Sugar Cane	Cas-sava	Corn	Wheat
Región Oriental	1990/91												
	1994/95												
Concepción	1990/91	0.2	23.7	0.8	9.4	10.0	0.1	0.4	30.0	24.5	152.6	14.6	0.1
	1994/95	0.2	28.8	0.8	11.0	12.5	-	0.4	23.8	24.6	-	22.1	-
San Pedro	1990/91	17.4	78.2	2.0	22.8	27.6	14.3	26.8	124.8	106.2	378.0	45.0	19.8
	1994/95	22.0	56.6	2.3	28.7	40.5	3.0	39.6	65.6	110.6	-	76.9	2.3
Cordillera	1990/91	0.0	9.3	5.2	11.4	9.4	0.1	0.0	10.8	244.0	109.3	8.9	0.1
	1994/95	0.0	4.5	5.3	13.9	12.3	-	0.0	7.2	231.0	-	24.3	-
Guairá	1990/91	0.2	16.7	20.1	11.8	10.4	0.0	0.4	23.8	1,151.7	143.2	13.9	0.0
	1994/95	0.3	12.4	20.6	14.6	12.0	-	0.5	15.7	1,048.0	-	16.6	-
Caaguazú	1990/91	21.8	80.0	8.3	31.0	30.3	6.7	41.9	130.2	469.7	453.7	45.1	11.2
	1994/95	30.5	61.4	7.5	42.7	48.3	20.1	57.9	98.2	357.6	-	119.2	31.7
Caazapá	1990/91	8.9	27.3	2.0	13.5	17.7	0.4	16.4	39.5	97.0	234.3	30.9	0.5
	1994/95	10.7	19.4	2.0	15.4	18.8	2.5	19.6	30.6	84.0	-	34.2	3.7
Itapúa	1990/91	210.5	55.7	0.9	25.5	39.5	64.0	364.1	88.4	28.8	407.8	78.1	100.0
	1994/95	277.5	40.1	0.9	32.4	61.0	66.4	863.1	80.9	28.3	-	185.5	60.0
Misiones	1990/91	0.2	11.4	0.5	3.8	7.5	0.6	0.2	14.9	16.2	46.0	7.6	0.9
	1994/95	0.3	11.6	0.5	4.7	8.2	1.0	0.5	15.2	15.7	-	14.0	1.6
Paraguarí	1990/91	0.4	25.4	6.0	15.8	15.7	0.4	1.2	32.5	260.7	183.8	15.0	0.6
	1994/95	-	16.4	6.2	14.2	16.4	-	-	22.9	262.9	-	18.3	-
Alto Paraná	1990/91	228.5	34.7	0.8	14.1	38.1	53.6	456.3	60.2	30.0	268.2	79.7	84.1
	1994/95	303.6	31.5	0.8	14.0	62.5	68.1	1,044.8	43.9	31.1	-	225.9	93.8
Central	1990/91	0.0	3.1	5.3	3.3	1.7	0.0	0.0	3.9	253.2	15.3	1.6	0.0
	1994/95	-	3.0	5.3	3.0	2.0	-	-	4.6	245.7	-	2.2	-
Ñeembucú	1990/91	0.0	10.4	0.2	1.8	5.5	0.0	0.0	11.5	6.4	12.6	4.9	0.0
	1994/95	-	6.0	0.2	2.7	3.7	-	-	5.3	5.7	-	4.3	-
Amambay	1990/91	15.3	5.2	0.8	4.3	8.2	7.4	30.4	9.0	20.7	61.2	15.0	13.3
	1994/95	19.3	7.3	0.8	3.2	7.0	4.0	36.6	6.0	22.3	-	21.7	6.0
Canindeyu	1990/91	49.0	22.7	1.0	6.8	21.0	6.0	82.0	40.0	33.1	116.1	39.9	9.4
	1994/95	71.0	26.4	1.0	11.0	25.1	7.5	149.1	31.7	33.7	-	50.1	9.6
Región Occidental	1990/91	0.2	10.8	1.8	0.2	0.7	0.3	0.4	12.3	74.8	2.8	1.0	0.4
	1994/95	-	6.9	1.8	0.2	0.8	-	-	9.7	74.8	-	0.9	-
Paraguay	1990/91	552.6	414.7	55.9	175.6	243.2	153.8	1,032.7	631.7	2,817.1	2,584.9	401.3	240.5
	1994/95	735.5	332.3	56.0	211.4	331.0	172.5	2,212.1	461.2	2,576.0	-	816.2	208.6

Source : National Census on Agriculture and Livestock.

vi) Despite the limited cultivated land and production of the 6 main crops in Central and Cordillera, these 2 departments can be defined as the main agricultural areas providing subsistence crops (vegetables, fruit, and so on) to the urban population centering around Asunción.

The agricultural production of the 5 departments (Central, Cordillera, Paraguaí, Guairá and Caaguazú) related to the planning area shall be discussed in detail in the following section.

2-2-3 Socio-Economic Framework

(1) Population Projection

1) Past Studies of National and Departmental Population Projections

Two sets of population projections for Paraguay as a whole and by department (Table 2.2.8) have been made in previous studies. These should be taken into consideration in this study as follows:

a) JICA study : ENTA Master Plan Study 1992

- Population projections by department are presented, covering the years from 1990 to 2010.
- In 1986 DGEEC projected the total population of the country to be 4.28, 5.54, and 6.93 million as of 1990, 2000, and 2010, respectively, based on an evaluation of the 1982 census. The JICA study adopted these DGEEC projections as its socio-economic frame-work for the transport study.
- Population by department was estimated by the extrapolation based on growth trends from 1960 to 1982 by department, which was adjusted so as to total the national population projected above.

b) DGEEC : Population estimation and projection by department, 1990-2010, DGEEC1995 (Bureau of Statistic Survey and Census).

In 1995, DGEEC made a population projection for both the country and departments based on an evaluation of the 1992 population census, thus modifying the 1986 census-based population projections as follows.

	1990	2000	2010
1986 DGEEC Pop projection (ENTA M/ P)	4.28	5.54	6.93
1995 DGEEC Pop Projection	4.22	5.50	6.98

2) Population 2005, 2015

- The 1995 DGEEC population projection shall be applied as the socio-economic frame work in this study because it was made based on the latest population information, and is officially used by the Paraguayan government.
- The population projections for 2010 of JICA ENTA M/P and the 1995 DGEEC were compared and showed that there were no large differences in the departmental populations of 2010 of the two, except in the case of some departments such as Caaguazú. This difference seems to be due to the fact that the ENTA estimation was made higher because the higher population growth of the department before the year 1982 was used. The 1995 DGEEC corrected this problem.

• The population for 2015 is estimated through the extrapolation of growth rates for each department from 2005 to 2010. (Shown in the Table 2.2.8)

3) Demographic Structure

The DGEEC population projections indicate that only 4 departments (Central, Caaguazú, Alto Paraná, and Itapúa) will show large population increases, meaning that other departments will show a stagnant population growth or even a decrease. Especially, Central and Alto Paraná are expected to become departments with over one million people.

Table 2.2.8 Population Projections in the Previous Studies

Department	Census	Adjusted	1995 DGEEC Projection				JICA ENTA M/P		This Study	
	1992	1992	1995	2000	2005	2010	1992	2010	2005	2015
Asunción	500,938	529,049	541,714	561,386	576,731	586,232	-	-	576,731	595,890
Central	866,856	938,042	1,076,686	1,333,889	1,623,886	1,944,035	1,458,135	2,166,480	1,623,886	2,327,301
Cordillera	198,701	214,025	215,394	215,516	213,173	208,514	223,438	221,277	213,173	203,957
Paraguarí	208,527	245,242	247,589	247,175	242,355	233,736	230,638	215,157	242,355	225,424
Guairá	161,991	169,731	172,413	175,121	175,811	174,572	185,040	225,173	175,811	173,342
Caaguazú	386,412	407,364	428,718	461,937	491,740	517,156	499,681	889,149	491,740	543,886
Caazapá	129,352	136,440	139,791	143,889	146,412	147,376	134,180	145,165	146,412	148,346
Alto Paraná	406,584	442,991	530,812	705,137	917,609	1,170,650	417,283	911,815	917,609	1,493,470
Itapúa	377,536	396,893	431,376	490,969	552,908	615,929	392,209	578,092	552,908	686,133
Misiones	89,018	94,872	97,273	100,385	102,387	103,326	100,351	121,798	102,387	104,274
Ñeembucú	69,770	83,845	85,948	88,285	89,021	88,183	84,257	86,903	89,021	87,353
Subtotal	3,395,685	3,658,494	3,967,664	4,523,689	5,132,033	5,789,709	3,725,166	5,561,009	5,132,033	6,589,376
Concepción	167,289	173,702	181,030	191,911	201,121	208,350	189,764	260,377	201,121	215,839
San Pedro	280,336	287,553	314,446	361,786	411,619	462,441	303,538	494,660	411,619	519,538
Amambay	99,860	110,568	120,606	136,910	152,366	166,583	100,832	165,907	152,366	182,127
Canindeyu	103,785	112,743	124,978	145,841	166,837	187,214	134,419	287,670	166,837	210,080
Pte. Hayes	64,417	67,205	73,235	83,193	92,583	101,075	R. Occ.	R.Occid.	92,583	110,346
Boquerón	29,060	30,161	33,191	38,451	4,545	48,224	69,330	158,802	43,545	53,406
Alto Paraguay	12,156	12,374	13,277	14,669	15,843	16,725			15,843	17,656
Subtotal	756,013	794,306	860,813	992,761	1,082,708	1,190,612	797,928	1,367,915	1,082,708	1,308,992
Total	4,152,588	4,452,800	4,828,477	5,496,450	6,215,947	6,928,424			6,215,947	7,898,308
M/P		4,523,094	4,892,687	5,537,639	6,214,741	6,928,424	4,523,094	6,928,424		

Note : Estimation and projection of population per department by sex and group, 1990-2010 (Bureau of Statistic, Survey and Census.)

The East- West corridor from Asunción to Este along the national roads R. 2 and 7 will accommodate a population of 4.4 million in 2010 or 64% of the national population. The DGEEC projection appears to indicate that the major future population increases will be settled in urban areas, not agricultural areas.

(2) Agricultural Production Projection

1) ENTA M/P

a) Comparison of estimated and actual production

ENTA M/P projected agricultural production for 1990, 2000, and 2010. The M/P study indicates that "Ministry of Agriculture and Livestock" presented an original estimation of agricultural production at the request of MOPC for that study. It seems that this

projection is the result of calculations realized through the long-term extrapolation of the past growth trends of production during the period from 1981 to 1989.

The past records of production by crop before 1989, relied upon by ENTA M/P, production statistics for the most recent years of 1990 to 1995, and ENTA projections for 1990, 2000, and 2010, are shown in Figure 2.2.4

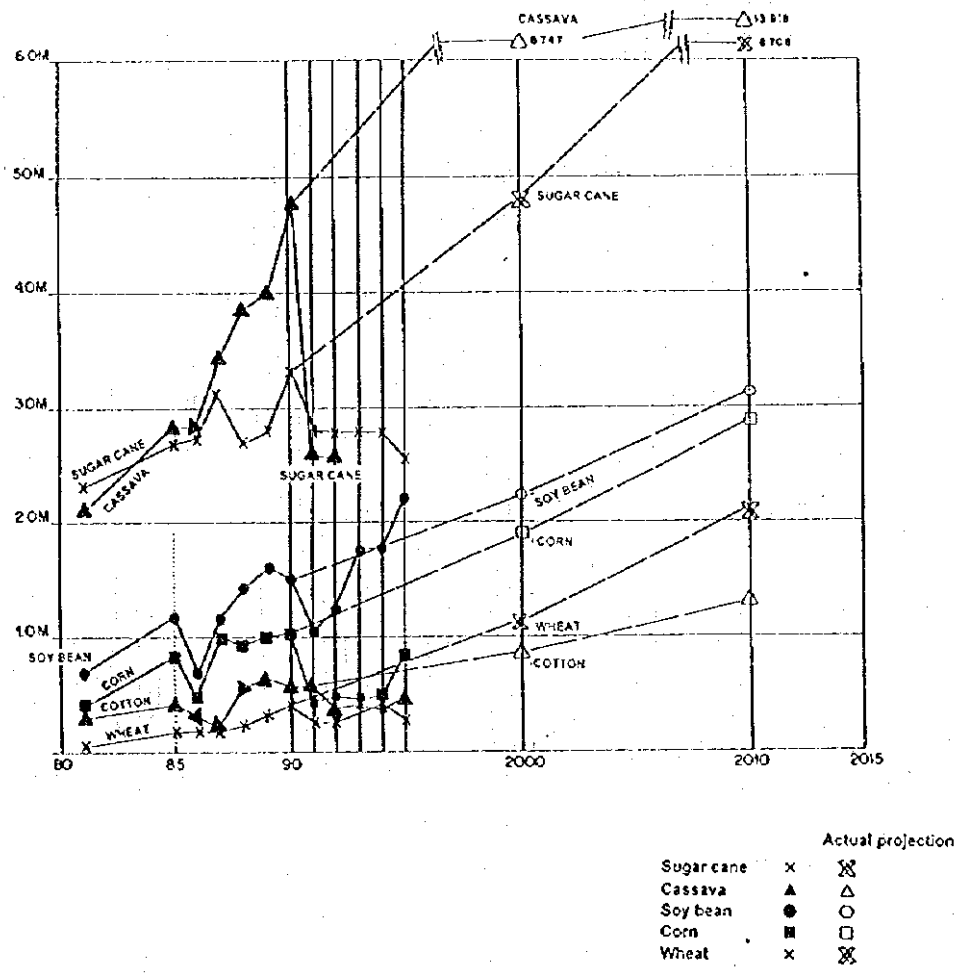


Figure 2.2.4 ENTA Projected and Actual Crop Production

The following conclusions may be drawn:

i) A larger volume of crop production is estimated, reflecting the high increase rate of production in the past (before 1989).

ii) A sharp drop in crop production took place after 1990 according to recent post-1990

statistics. Crop production, except for soy bean, appears to be decreasing from 1991 to 1995.

iii) The difference between projected and actual crop production seems to be getting larger.

In order to show the magnitude of the difference between estimated and actual production, the estimated production volumes (1990, 2010) are divided by the actual figures of 1990/91, and the results are shown in Table 2.2.9 below .

Table 2.2.9 Comparison Between Estimated Production (1990-2010) and Actual Production 1990/91

Production	ENTA estimation (1000 ton)			Actual	Estimation/Actual	
	1,990	2010	2010/1990	1990/91 (1000 ton)	1990/1990/91	2010/1990/91
1. Soy Bean	1,497	3,115	2.08	1,033	1.45	3.02
2. Cotton	539	1,280	2.37	632	0.85	2.03
3. Sugar Cane	3,284	6,706	2.04	2,817	1.17	2.38
4. Cassava	4,753	13,918	2.92	2,585	1.84	5.38
5. Corn	1,081	2,910	2.69	401	2.70	7.26
6. Wheat	453	2,171	4.79	241	1.88	9.01
Total	11,607	30,100	2.59	7,709	1.51	3.90

First of all, it must be stated that the benchmark data 1990 (Estimation) is already quite larger than the actual data, by 2.7 times for corn and 1.5 times total production. The ENTA predicted that the total tonnage of production would increase by 2.59 times by 2010. In order to achieve this total tonnage, however, it must increase by as much as 3.9 times based on actual production in 1990/91.

b) Evaluation of Statistics

Agricultural production statistics must be evaluated, taking into consideration the following facts:

i) Official agricultural censuses were conducted in 1956, 1981, and 1991. Statistics for the intermediate years between 1981 and 1991 were provided by MAG (annual statistics of Paraguay).

ii) It is generally admitted that the accuracy of the statistics provided before 1990 is questionable because of the inadequacy and inaccuracy of the survey technique/staff/ logistics, and data processing. It was not until JICA Experts in the Ministry of Agriculture and Livestock assisted the Paraguayan government conducting the 1991 agricultural census, that the accuracy and reliability of the census survey and statistics was remarkably improved.

iii) The sudden drop in annual production in 1990/91 may be due to the failure of crops caused by natural disasters (frost, long rainy season, and so on.). However, it is reported that there was no such crop failure or natural disaster in 1990. Moreover, it

must be noted that even if such a crop failure had been caused by such a natural disaster, this could not account for 4 years from 1991 to 1995. Any evaluation of agricultural statistics must conclude that the annual crop production statistics covering the years before 1990, which formed the basis of the agricultural production estimation in the ENTA JICA M/P study, are doubtful.

c) Necessity of modification of agricultural production projections for ENTA M/P

Since the difference between the estimated production, on which the master plan was formulated, and actual production is great, it is necessary to modify the agricultural production projection of ENTA M/P by taking into consideration the limits imposed by the statistics available, as stated above.

2) Basic policy of the crop production projection for this F/S.

In spite of the necessity to modify as stated above, this study will not include the modification for the following reasons:

i) This review is aimed at including the in-depth studies and analyses covering policy matters on long-term agricultural development (each crop and each department), international market strategies, and so on, which are all beyond the scope of work and time framework of the study.

ii) It would be risky to include the future agricultural development, especially in the long term, associated with the policy matters, that have not been confirmed in a feasibility study such as this one. (In the course of contact with the Ministry of Agriculture and Livestock, it has been confirmed that the long-term policies on crop production, especially those based on an estimate of the influence of MERCOSUR, have not yet been established .)

iii) Excluding the uncertainties and risks stated above, a feasibility study should be conducted in a realistic and conservative manner.

3) Production projection by crop for the F/S

In line with the basic policy stated above, crop production is statistically (linear regression analysis) estimated using only reliable data (the statistics for the years 1980/81, and 1990/91 to 1994/95). The results are summarized in Table 2.2.10 and Figure 2.2.5.

4) Production projection by department

The basic policy of production projections in this study, which is aimed at examining the feasibility of the planned road section, is that the projections should be based on the existing agricultural structure. In this respect, crop production by department is to be calculated in line with the present geographical distribution pattern of agriculture

products discussed in the preceding chapter. Table 2.2.11 shows crop production by department

Table 2.2.10 Crop Production Projection

(Unit : ton)

Production	1994/5	2005	2010	2015	Estimation 2010 (% to ENTA)
Soy bean	2,212,109	2,945,767	3,402,998	3,860,230	109.2
Cotton	461, 239	506,915	547,227	587,539	42.8
Suger cane	2,576,000	3,291,572	3,497,358	3,703,144	52.2
Cassava	2,735,824	3,160,308	3,372,550	3,584,792	24.2
Corn	816,166	488,049	503,766	519,483	17.3
Wheat	208,617	614,460	733,195	851,929	33.8
Cattle	9,788,439	11,961,665	13,174,232	14,386,799	109.0

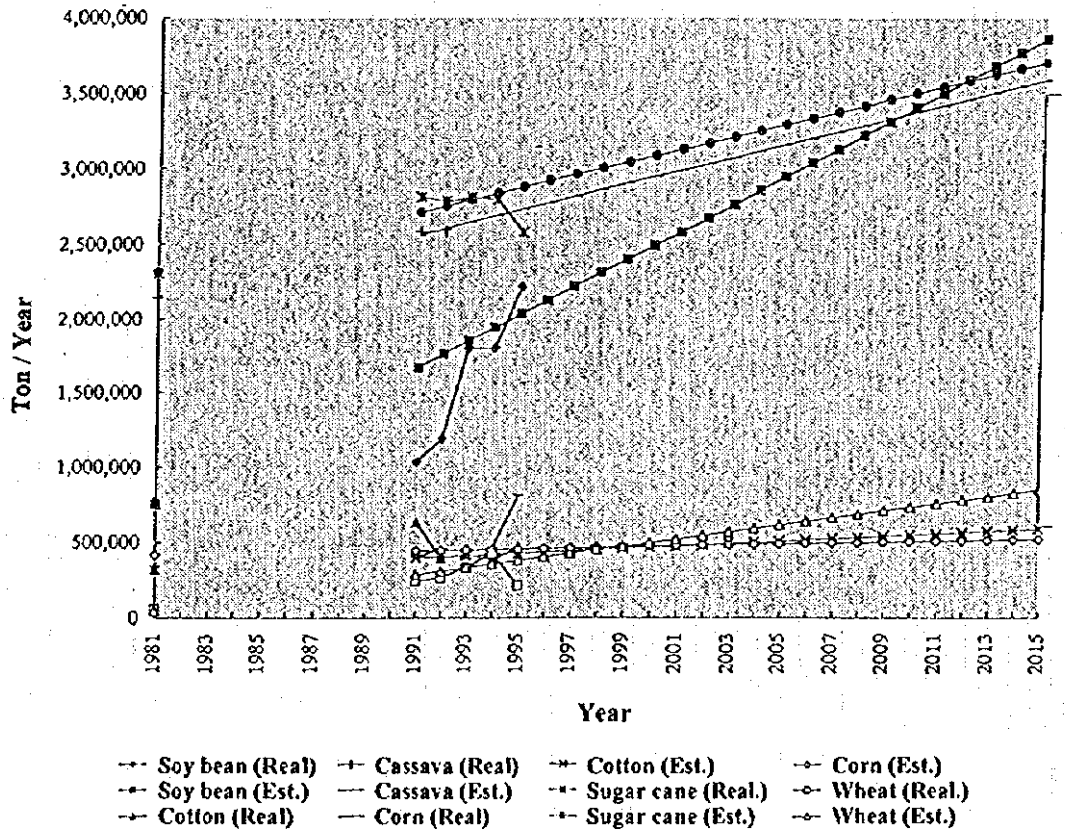


Figure 2.2.5 Crop Production Projection

Table 2.2.11 Crop Production by Department

(Unit : 1000 ton)

Department	Soya Bean			Cotton			Sugar Cane			Cassava			Corn			Wheat			Cattle		
	1995	2005	2015	1995	2005	2015	1995	2005	2015	1995	2005	2015	1995	2005	2015	1995	2005	2015	1995	2005	2015
Concepción	0.4	0.6	0.8	23.8	26.2	30.3	24.6	31.3	35.2	152.6	186.5	211.5	22.1	13.2	14.1	0.0	0.0	0.0			
San Pedro	39.6	52.7	69.1	65.6	72.1	83.5	110.6	141.2	158.9	378.0	461.4	523.3	76.4	46.0	48.9	2.3	6.8	9.4			
Cordillera	0.0	0.0	0.0	7.2	7.9	9.2	231.0	295.2	332.2	109.3	133.7	151.6	24.3	14.5	15.5	0.0	0.0	0.0			
Guairá	0.5	0.6	0.8	15.7	17.2	20.0	1,048.0	1,338.8	1,506.4	143.2	175.1	193.6	16.6	9.9	10.5	0.0	0.0	0.0			
Caaguazú	57.9	77.2	101.1	98.2	107.9	125.1	357.6	456.8	511.0	453.7	554.6	624.1	119.2	71.3	75.8	31.7	93.4	129.5			
Caazapá	19.6	26.2	34.4	30.6	31.9	39.0	84.0	107.3	120.7	234.3	286.3	324.7	34.2	20.5	21.8	3.7	10.9	15.1			
Itapúa	869.1	1,148.9	1,505.5	80.0	88.9	103.0	28.3	36.2	40.7	407.8	498.7	565.7	185.5	110.9	118.1	60.0	176.7	245.0			
Misiones	0.5	0.6	0.8	15.2	16.7	19.4	15.7	20.1	22.6	46.0	56.3	63.8	14.0	8.4	8.9	1.6	4.7	6.6			
Paraguarí	0.0	0.0	0.0	22.9	25.1	29.1	262.9	336.0	378.1	183.8	224.7	254.9	18.3	10.9	11.6	0.0	0.0	0.0			
Alto Paraná	1,044.8	1,391.3	1,823.2	43.9	48.3	55.9	31.1	39.8	44.8	268.2	327.7	371.7	225.9	135.1	143.8	93.8	276.3	383.1			
Central	0.0	0.0	0.0	4.6	5.1	5.9	245.7	314.0	353.3	15.3	18.6	21.2	2.2	1.3	1.4	0.0	0.0	0.0			
Ñeembucú	0.0	0.0	0.0	5.3	5.8	6.8	5.7	7.2	8.1	12.6	15.5	17.6	4.3	2.6	2.8	0.0	0.0	0.0			
Amambay	36.6	48.6	63.7	6.0	6.6	7.6	22.3	28.6	31.8	61.2	74.9	85.0	21.7	13.0	13.8	6.0	18.6	25.7			
Canindeyu	149.1	198.5	260.2	31.7	34.8	40.4	33.7	43.1	48.5	116.1	141.9	161.0	50.1	30.0	31.9	9.6	28.3	39.2			
Western Region	0.4	0.6	0.8	9.7	10.6	12.3	74.8	95.4	107.4	2.8	3.2	3.6	0.9	0.5	0.6	0.0	0.0	0.0			
Paraguay	2,212.1	2,945.8	3,860.2	461.2	506.9	587.5	2,576.0	3,291.6	3,703.1	2,735.8	3,160.3	3,584.8	816.2	488.1	519.5	208.6	614.5	851.9	9,788.4	11,961.7	14,386.8

Source : Annual Statistics 1994/95

2-3 Review of Relevant Studies/Plans

Before analyzing the present conditions of the planning area, the relevant studies/plans will be briefly reviewed in order to have some background knowledge of the area/project, and of how it relates to national or regional plans of greater importance.

There are various transport plans, development policies, feasibility studies, etc. The three major ones are summarized below:

- Plan Triangulo
- JICA National Transport Master Plan Study, 1992
- Road Development Studies

Finally, this section briefly describes past studies carried out on the objective road of the Study, i.e., from Paraguarf to Villarrica.

2-3-1 Plan Triángulo

In the 1960's, there were several studies conducted on regional development cum road development in Paraguay. These studies were aimed at national socio-economic growth through agricultural development and were conducted by UNDP/IBRD/IDB. The study entitled "Plan Triángulo, 1966" is a typical example. The basic directions for the regional/road development, which were the main recommendations in the study, have governed development until now. This study can be summarized as follows:

i) The purpose of this study was to select highway locations to support the most promising land within the Triangular Area (formed by the vertexes of three major cities; Asunción, Encarnación and Puerto Presidente Stroessner (Ciudad del Este) : approximately 51,000 km^2) for development based on the area's agricultural and forestry potential.

ii) This study consisted of three phases; Phase I called for obtaining aerial photos of the Plan Triángulo Area; in Phase II an area of 12,000 km^2 was selected as the best potential for development and location of roads following an analysis of the reconnaissance photos; and in Phase III a detailed study of the road requirements was carried out for the recommended area of 7,200 km^2, which was ultimately to be developed.

iii) In phase II, some highway segments are chosen to be considered for improvement, of which the following are closely related to our study.

The development potential for the planning area was indicated in the figure entitled "Land for Cultivation in relation to Present Transportation and Roads Proposed for F/S, 1966". This figure was modified and is shown as Figure 2.2.3.

Table 2.3.1 Features by Road Segment, 1966

Section of Highway	Distance (km)	Population (000)	Population Growth Rate (%)	Gross Area of Colonies (000ha)	Estimated Traffic, Round Trips per Year					Estimated Construction Cost (1000 US$)
					Passenger Car (000)	Truck (000)	Total (000)	No. of Passenger (000)	Volume of Cargo (000)	
Mbocayaty - Independencia & Troche	37	28	5.3	90	3,6	20,8	24,4	139,6	41,5	1.000
Villarica to Ñumí	22	n.a.	1.7	n.a.	10,6	9,6	20,2	346,0	33,0	850
Carapegua to La Colmena	68	n.a.	3.5	n.a.	11,2	9,8	21,0	167,0	22,0	1.650
Ñumí to San J. Nepomuceno	51	31	-0.8	180	2,3	2,4	4,7	82,0	7,5	1.000
Villarica to Caazapá	52*	31	1.8	108-131	5,4	6,3	11,7	201,0	20,6	1.450
Villarica to Coronel Bogado	130**	72	15-2.0	310	-	-	-		-	2.600

Note : * = this includes section 2)
** = this includes section 5)
Source : Plan Triángulo, 1966

Apart from the road section summarized in the above table, the final engineering design of the objective road of the Study, from Paraguarí to Vilarrica, was completed in Phase III of the Plan Triánglo. However, it did not proceed to implementation. The reason for this is given in 2-3-4.

2-3-2 JICA Master Plan Study on National Transport (ETNA 2010)

(1) Outline

JICA conducted the Study on National Transport Master Plan in Paraguay in order to establish comprehensive transport policies for the long and medium terms, as well as transport infrastructure development plans for all modes. The overall study flowchart is shown in Figure 2.3.1.

(2) Socio-economic Framework

Various socio-economic frameworks were analyzed/forecasted in order to estimate transport demand in terms of inter-regional (between Departments) and international movements. The figures for 1990 were selected as benchmarks, and the target years were 2000 and 2010. Some of them are be reviewed in this study and compared with actual performance up to 1995 for reference, as shown in Table 2.3.2.

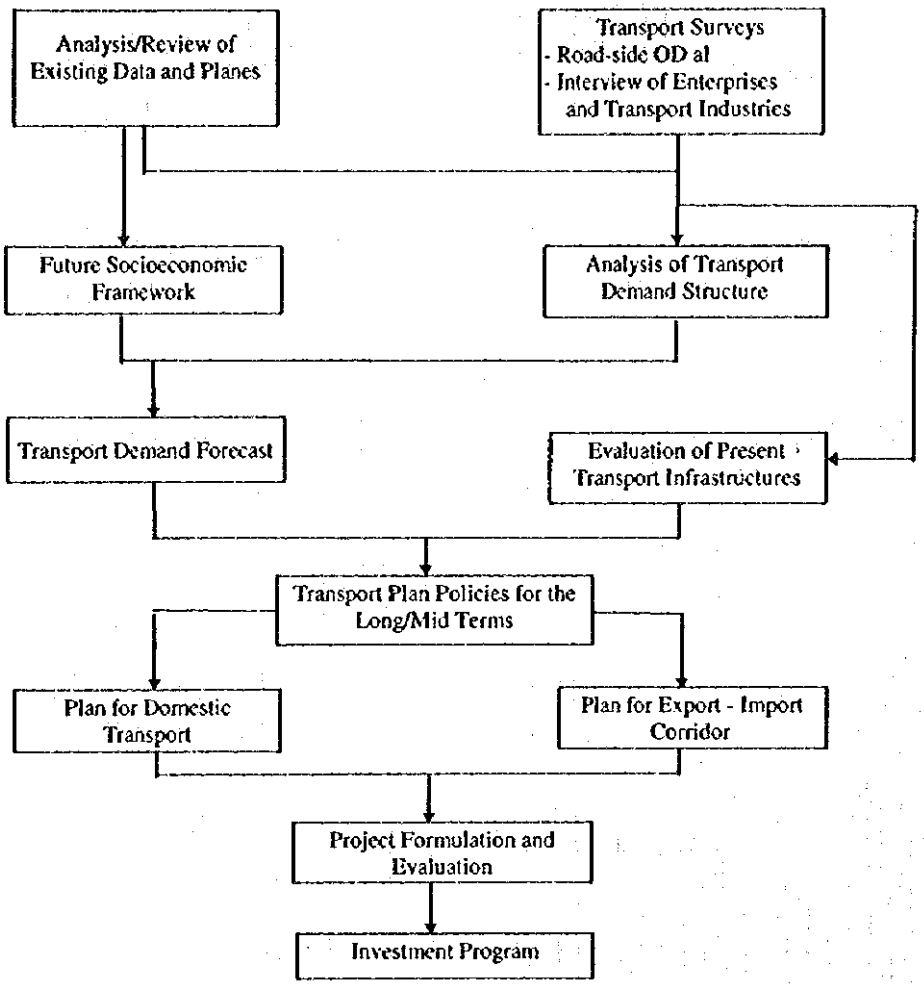


Figure 2.3.1 Overall Work Flowchart of the ETNA Master Plan

(3) Transport Development Policy

The following are general targets for transport development;

- to promote both regional and industrial development,
- to strengthen export corridors,
- to reduce transport costs and energy consumption,
- to propose a realistic available investment program, and
- to strengthen organizations/institutions governing transport.

(4) Transport Demand and Flow

Cargo and passenger transport demand is estimated as shown in Table 2.3.3 and Figure 2.3.2.

Table 2.3.2 Major Socio-economic Frameworks in ETNA

Items	Unit	1990	2010	2000/1990
Population	(1000)	4,276.7	6,928.4	1.62
GDP	(mill. Gs.)	6,075,832	14,143,412	2.33
GDP per capita	(1000 Gs.)	1,421	2,041	1.44
No. of Vehicle	(1000)	128	472	3.69
Ownership Ratio	(person/veh.)	33.4	14.7	2.27
Agriculture Production				
(1) Agriculture	(1000 ton)			
a) Soya bean		1,497	3,115	2.08
b) Wheat		453	2,171	4.79
c) Corn		1,081	2,910	2.69
d) Cotton		539	1,280	2.37
e) Cassava		4,753	13,918	2.93
f) Sugar cane		3,284	6,706	2.04
g) Potato		126	276	2.19
(2) Livestock	(1000)			
a) Cattle		8,084	12,068	1.49
b) Pig		2,331	5,784	2.48
c) Chicken		17,552	32,148	1.83
d) Goat		146	242	1.66
e) Duck		468	714	1.53
f) Sheep		447	677	1.51
g) Guineas		296	361	1.22
(3) Forest	(1000 ton)			
a) Firewood		2,677	1,436	0.54
b) Timber		1,898	1,459	0.77
c) Wood		292	157	0.54

Source : ENTA Master Plan

1) Future Road Traffic (2010) in Proposed Network

2) Export Flow of Major Crops (2010)

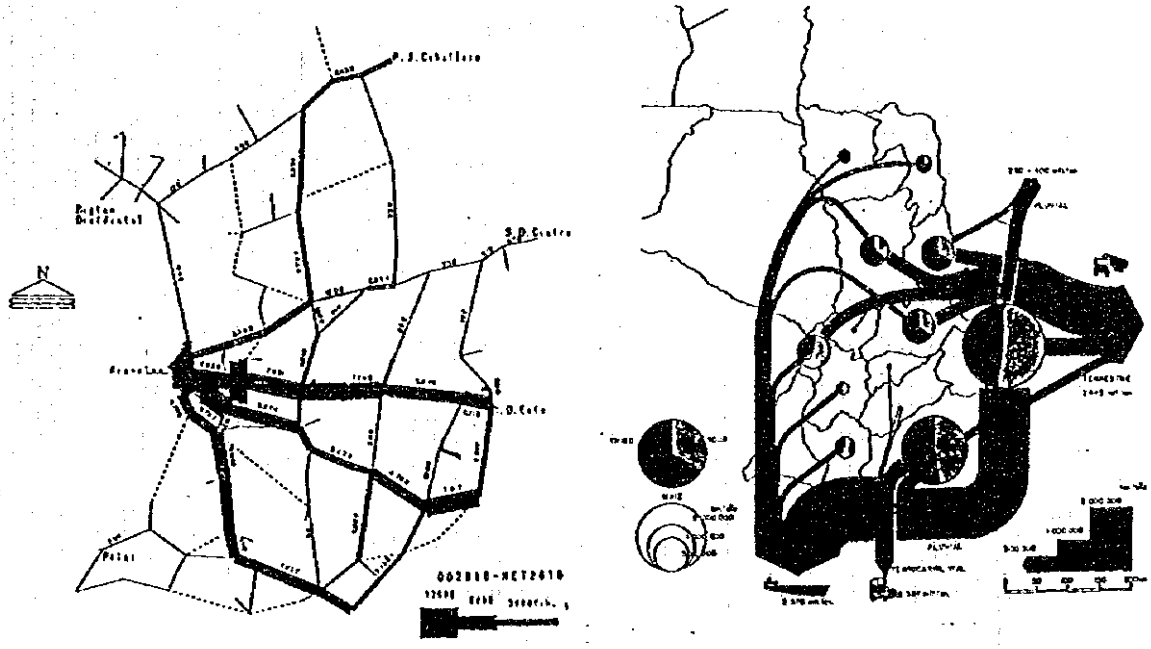


Figure 2.3.2 Major Traffic Flow

Table 2.3.3 Overall Traffic Demand Forecast in M/P

	Unit	1990	2010	2010/1990
Cargo Transport	1000 ton/year			
Intra-National		20,480	34,464	1.68
International				
Export		3,182	7,582	2.38
Import		1,690	2,867	1.70
Passenger Transport	person/day			
By Car		9,600	37,100	3.86
By Bus		51,500	65,600	1.27
By Railway		200	400	2.00

Source : ENTA Master Plan

(5) Project Implementation Performance

It is very difficult to clarify overall performance of the forecasts/proposed projects in the Master Plan five (5) years since its completion, since the range of the term is quite short; 5 versus 20 years, and because insufficient data is available for verification.

Meanwhile, M/P recommendations might basically be followed in the road development sector, according to MOPC officials. The status of the proposed M/P road projects in M/P is shown in Table 2.3.4.

2-3-3 Other Road Development Studies

There are two (2) results of road development studies closely related to this Study, and they are summarized as follows:

- Rural Road Development Plan, First Phase 1991-94 (IDB),
- Feasibility Study on Improvement of Route 8; Section Cnel. Bogado - Caazapá

(1) Rural Road Development Plan

This is a plan to improve rural roads in line with regional/agricultural development being financed by IDB. The studies, a feasibility study and a detailed engineering study, were conducted from 1990, and the first stage will be implemented starting at the end of this year.

The major processes and results of the studies, a feasibility study in 1990 and a program for the improvement and rehabilitation of rural roads (phase one), are summarized as follows:

Table 2.3.4 Status of Proposed M/P Road Projects (1)

NATIONAL ROAD DEVELOPMENT PROGRAM & PRESENT SITUATION

(*) under request to OECF. : (**) in process of Loan Agreement : (***) in process of "concesion" :1/junio/1996

No. Route	Section	From	To	Work to be executed	Planned in ETNA	Finance source & expected finish year F/S	Final Design	Execution
1	1-1	Asuncion	Ita	New construction		IBRD	IBRD	IBRD
						1992	1992	1999
	1-2	Ita	Paraguari	Overlay & pav. of shoulder		IBRD	IBRD	IBRD
						1992	1992	1999
	1-3	Paraguari	San Juan Bautista	Overlay & pav. of shoulder				BID
								1996
	1-4	San Juan Bautista	Encarnacion	Overlay & pav. of shoulder			(*)	(*)
2	2-1	San Lorenzo	Eusebio Ayala	No plan to develop			IBRD	IBRD
							1984	1987
	2-2	Eusebio Ayala	Cnel. Oviedo	Overlay & pav. of shoulder				OECF
								1996
3	3-1	Limpio	Emboscada	New construction	1996 - 2000		IBRD	IBRD
							1992	1999
	3-2	Emboscada	Santani	New construction	1996 - 2000		IDB	IDB
							1995	(**)
	3-3	Santani	Santa Rosa	New construction			IDB	IDB
								1996
	3-4	Santa Rosa	Yby Yau	New construction	1992 - 1996	IDB	IDB	IDB
						1990	1992	1996
4	4-1	San Ignacio	KM 30	New construction (2nd time)	1992 - 1995 (2006 -2010)	Local Fund	Local Fund	Local Fund
						1991	1994	1996
	4-2	KM 30	Pilar	New construction (2nd time)	1992 - 1995 (2006 -2010)	Local Fund	FONPLATA	FONPLATA
						1991	1994	1997
5	5-1	P. J. Caballero	Cuero Fresco	Overlay			Brasil (bi-lateral	Brasil (bi-lateral)
							1981	1988
	5-2	Cuero Fresco	Concepcion	New construction	1992 - 1995		IDB	IDB
							1994	1998
	5-3	Concepcion	Pozo Colorado	New construction			Local	Local
								1998
6	6-1	Encarnacion	Bella Vista	Overlay & pav. of shoulder			Local	OECF
								1994
	6-2	Villa Vista	KM 148	Overlay			(*)	(*)
	6-3	KM 148	Empalme Ruta 7	Overlay				
							1996	1998
7	7-1	Cnel. Oviedo	Caaguazu	Overlay & pav. of shoulder			OECF	OECF
								1996
	7-2	Caaguazu	Cruce Ruta 6	Preparing "consesion"	1992 - 1995		(***)	
	7-3	Cruce Ruta 6	Ciudad del Este	Preparing "consesion"			(***)	
8	8-1	Santani	Cnel.Oviedo	Overlay & pav. of shoulder			(*)	(*)
	8-2	Cnel. Oviedo	Villarrica	No plan to develop				
	8-3	Villarrica	Numi	New construction			FONPLATA	FONPLATA
						1985	1985	1991
	8-4	Numi	Caazapa	New construction	1996 - 2000	Local	Local	Local
						1992	1992	1995
	8-5	Caazapa	Cnel. Bogado	New construction	1996 - 2000	Local	IDB	
						1995	(**)	
9	9-1	Villa Hayes	50Km antes de Rio Negro	No plan to develop			(*)	(*)
	9-2	50Km antes de Rio Negro	Rio Negro	Overlay				OECF
								1996
	9-3	Rio Negro	Rio Verde	Overlay				OECF
								1996
	9-4	Rio Verde	Empalme Filadelfia	New construction				Local
								1988
	9-5	Empalme Filadelfia	Mcal. Estigarribia	New construction (2nd time)	1992 - 1995 (2001 -2010)			FONPLATA
								1994
	9-6	Mcal. Estigarribia	Sargento Rodriguez	New construction (2nd time)	1992 - 1995 (2001 -2010)	F. Local	FONPLATA	FONPLATA
						1995	1997	2000
10	10-1	Puerto Rosario	Santani	New construction		BID	BID	
						1997	(**)	
	10-2	Tacuara	Salto del Guaira	New construction (2nd time)	1992 - 1995 (2001 -2010)	BID	IDB	IDB
						1995	1995	(**)
11		Santa Rosa	Pto. Antequera	New construction	1992 - 1995			
12	12-1	Chaco-i	KM 42	New construction	1996 - 2005	FONPLATA	FONPLATA	FONPLATA
						1995	1995	2000
	12-2	KM 42	Gral. Bruguez	New construction (solo Terraplen)	1996 - 2005	FONPLATA	FONPLATA	Local
						1995	1995	2000

Nota: 1) New construction means construccion of paved National Road.

Table 2.3.4 Status of Proposed M/P Road Projects (2)

Chronogram and Actual Situation of Projects Listed in ENTA 2010 (June/1996)

Road	Projected by ENTA 2010			Year of Conclusion				
	Code	Section	Period	Contents of Work	F/S	D/F	Implemantation	Finance
Primary	R-1-3A	Limpio - San Estanislao		see previous table				
	R-1-3B	Santa Rosa -Yby Yau	1996-00					
	R-1-4	San Ignacio - Pilar	1992-95					
		- do -, 2nd. overlay	2006-10					
	R-1-5	Concepcion - Cuero Fresco	1992-95					
	R-1-7	Empalme c/Ruta 6 - empalme c/acceso Itaipu	1992-95					
	R-1-8	Numi - Cnel Bogado	1996-00					
	R-1-9	Filadelfia - Frontera	1992-95					
		- do -, 2nd. overlay	2001-10					
	R-1-10B	Mubty - Salto del Guaira	1992-95					
		- do -, 2nd. overlay	2001-10					
	R-1-11A	Antequera - Santa Rosa	1992-95					
	R-1-12	Puerto Falcon - Gral Diaz	1996-05					
Secondary	R-1-101	San Lorenzo - Limpio (Limpio - Luque)	1992-95	Overlay			1996	Local
		- do -, 2nd. overlay	2006-10					
	R-1-102	Villeta - S. J. de Neembucu	1996-05					
	R-1-103A	Nueva Italia - Carapegua	2006-10	High embankment			1995	Local
	R-1-103B	Rosada - M.S.Bertoni	1996-05					
	R-1-104	La Colmena - Ruta 8	2006-10		1997	(*)	(*)	JICA
	R-1-106	Ruta 2 Km 48 - Emboscada	2006-10					
	R-1-107	Paraguari - Villarrica	2001-10		1997	(*)	(*)	JICA
	R-1-108	Numi - San Rafael del Parana (S.J.Nepomuceno)	1996-05	Pavement			1998	Local
	R-1-109	Pilar - Cruce Guarani	1992-05					
	R-1-110	San Pedro (R8) - Ruta 10	1996-10					
	R-1-111	Ruta 10 - Pedro Juan Caballero	2001-10					
	R-1-112	Tacuara - Corrientes	1996-05					
	R-1-114	Rosario - Belen	2001-05					
	R-1-115	Pto Militar - Pozo Colorado (km56 - km75)	2006-10	Embankment			1998	Local
	R-1-116	Concepcion - Valle Mi	1992-95					
	R-1-117	R Verde - Pto Carlos Pfannl	2001-10					
	Other national routes		2006-10					
	R-2	Improvement plan of vicinal roads	1996-10					
	R-3	Expansion of Amistad Bridge	1996-10					

(*) : To request OECF

i) Priority areas (10 districts) for the first stage of the project were selected in accordance with various considerations on agricultural development potential and present road conditions, and the following five (5) project packages were formulated:
   - Salto - Corpus,
   - Villarrica - San José,
   - San Pedro - Elizardo Aquino,
   - Concepción,
   - Encarnación - Villa Vista.

ii) Project benefits were estimated on the basis of the growth of agricultural production by increases in cultivated area, unit volume, and value for 10 years after the completion of the project. In case of Villarrica - San José, cotton and sugar cane were selected as representative crops, and the estimated production increases (2005/1990) were:

   cotton : 1.25 (without project), 1.54 (with project),
   sugar cane : 1.33 (without project), 1.67 (with project).

iii) The proposed rural road development includes 122 sections with a total length of 1,309 km. Total costs are estimated at Gs. 131.23 million for improvement and 0.65 million/year for maintenance (1990 prices).

iv) The results of an economic evaluation indicated 1.3 to 2.6 by sub-project in B/C and 19.4 to 44.4 % in EIRR.

v) Following the above-mentioned general F/S, the first stage program was examined in 1995. More detailed studies on the implementation were conducted by sub-project; e.g. the improvement of 32 sections with a total length of 289 km was proposed as part of the Villarica-San José project.

(2) Feasibility Study on the Improvement of Route 8; Cnel. Bogado-Caazapa

This section is a part of north-south trunk national route connecting R. 1 in the south, R. 2 and 7 in the center, and R. 3 and 5 in the north. Since this section (160 km) is unpaved, alignment is not adequate, especially with the Yuty - Caazapá section. Moreover, excessive rainfall causes the section to be closed 100 days per year. Therefore, the feasibility of constructing an all-weather paved road was examined.

i) Total length will be approximately 130 km because of the realignment between the Yuty and Caazapá sections.

ii) The proposed structure will be a 6.20 m carriageway and a 2.50 m shoulder; with an asphalt-concrete surface of 6 cm, a gravel base of 20 cm and a sub-base of 18 cm.

iii) Traffic demand is estimated both in terms of normal and induced traffic based on the present volume and potential regional development.

- i) Cnel Bogado - S.Pedro Paraná : 232 (1994) 368 (2000) 1,053 (2020)
- ii) S.Pedro Paraná - Yuty : 232 (1994) 366 (2000) 1,053 (2020)
- iii) Yuty - Caazapá : 197 (1994) 303 (2000) 871 (2020)

iv) Total cost will be Gs.52,938.1 million for construction, and Gs.11,621.1 million for 10 years of maintenance/re-pavement.

v) The economic evaluation results show quite a sound conclusion:

without time value: B/C 1.62, EIRR 17.11%

with time value: B/C 1.65, EIRR 17.37%

2-3-4 Past Studies on the Road Development between Paraguarí and Villarrica

As described in 2-3-1, the final design of the development of the captioned road section was completed as part of the Plan Triánglo. Then, in 1989, the Office of Coordination and Integrated Planning of Transport (Oficina de Coordinación y Planificación Integral del Transporte-MOPC) conducted a feasibility study on the development of the same road section.

However, the development was not implemented in either case. There are believed to be two reasons for this:

- Higher priority was not given to said project than to various other road sections to be developed.
- Good coordination or arrangement with investment to improve the railway running in parallel to the road was not possible.

It is understood that the above-mentioned two reasons, especially the conflict with the railway improvement, will no longer create a problem.

CHAPTER 3

PRESENT CONDITION AND FUTURE POTENTIAL OF PLANNING AREA

CHAPTER 3 PRESENT CONDITION AND FUTURE POTENTIAL OF PLANNING AREA

3-1 Location and Area

The location of the planning area is shown in the Figure 3.1.1. The features of the planning area can be summarized as follows:

i) The planning area is located within a 50 to 150 km radius of the center of Asunción, just in the vicinity of the capital region of the 50 km radius area.

ii) The planning area is located at the gateway leading from the capital to the rest of the country. Almost all the national arterial roads coming from the country side converge into the planning area. National roads number 2 and 7 of the east-west corridor, number 3 and 8 of the north-west corridor and number 1 of the triangular development corridors enter into this planning area.

iii) The planning area includes the 4 departmental capitals of Cordillera, Caaguazú , Paraguarí, and Guairá.

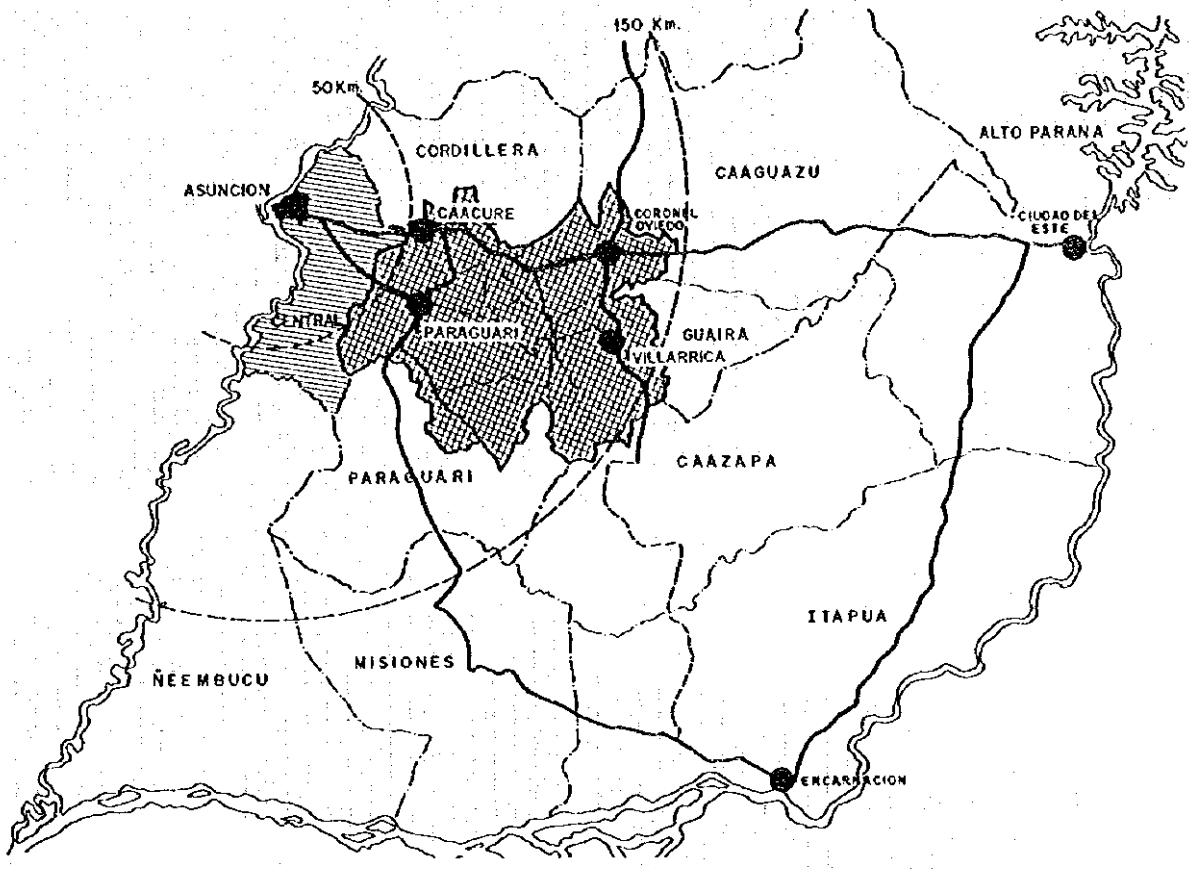


Figure 3.1.1 Location of Planning Area

3-2 Basic Features of the Planning Area

3-2-1 Administrative System and Human Settlements

Figure 3.2.1 indicates the administrative system and human settlements in the planning area. The area consists of the some parts of each of the 4 departments, including their departmental capitals. Under the departmental system, all the districts have a district center or urban center. Human settlements have developed under this administrative system. The rural population has spread correspondingly with agricultural development throughout the planning area. Rural communities have developed along with district urban centers and department capitals.

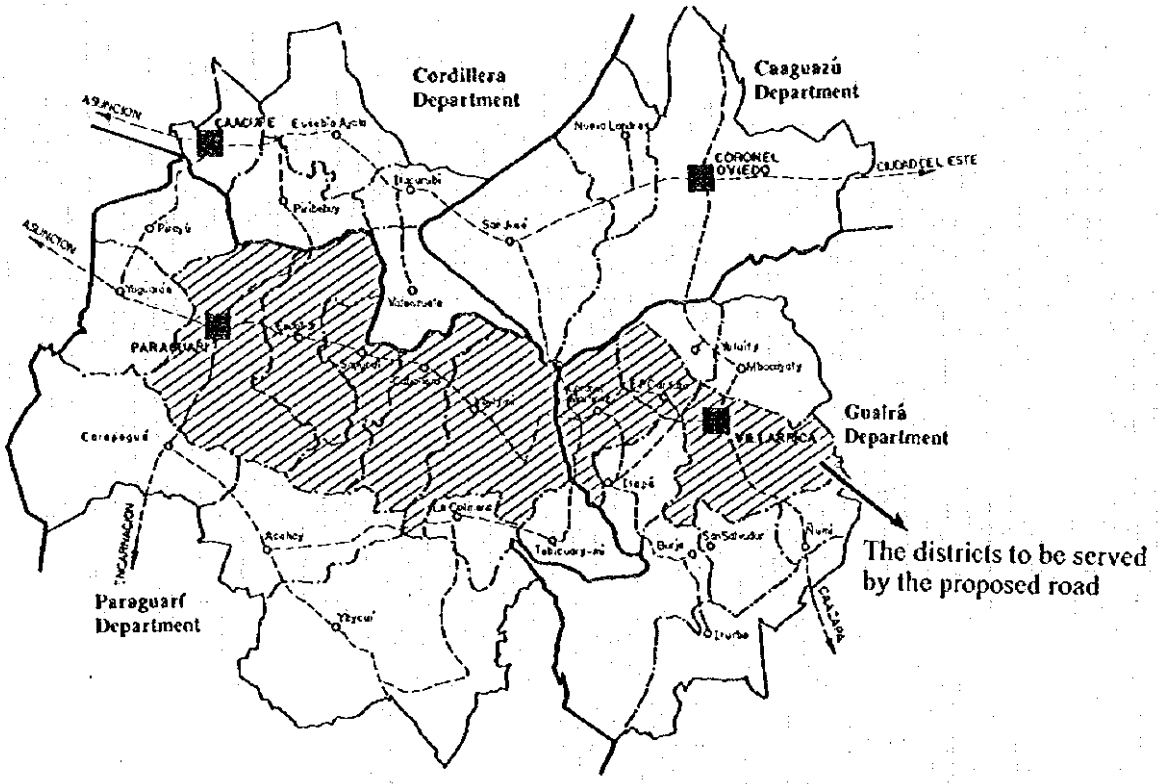


Figure 3.2.1 Administrative System and Human Settlements

3-2-2 Land Uses and Physical Conditions

(1) Basic Structure of the Existing Land Use Zone

The existing land use map (Figure3.2.2) shall be interpreted with a clear understanding of the agricultural structure of Paraguay as follows:

The farmers are generally classified in accordance with the size of their farmland (Table 3.2.1).

Table 3.2.1 Agricultural Structure

Category	Share (%) to the Country		Major Agricultural Activities
	Number	Land Area	
Large farmer (over 200 ha, Latifundium over 1000 ha)	2.7	85.8	Cattle grazing Large-scale grain cultivation
Medium-size farmer (20 ha to 200 ha)	14.1	8.1	Machinery farming of soy bean.
Small farmer (Less than 20 ha) (Family farm 5~20 ha)	73.5	6.1	Cotton (and some vegetables for the urban market)
(Minifundio; 1~5 ha) (Farmers without land)			Subsistence (corn, cassava, and the like)

Reflecting this agricultural structure, land use is roughly divided into 2 categories as follows:

1) Intensive Agricultural Land Zone

This sort of land includes the land cultivated by small and medium-size farmers. The prominent features of this category are outlined as follows:

a) Mixed agriculture land use

Farmers tend to divide their properties into sections for cultivating different kinds of crops , and grazing cattle, resulting in mixed agricultural land use. Therefore, it is almost impossible to create a map that covers the planning area, and divides all the land according to crops grown.

b) Human settlements

Farmers tend to build their houses on their farmland, so that they do not need to commute from their residence (for instance, in the urban center) to their farmland. In this respect, agricultural lands stretching throughout rural areas are equivalent to human settlement areas. The houses can be found scattered all over the agricultural lands on the topographical maps.

c) Major harvest

The major harvests are those that can be cultivated in a small to medium-size or on a family scale. These include cassava, cotton, sugar cane, vegetables, fruits and so on, as well as soy beans, wheat, and corn.

Figure 3.2.2 The Existing Land Use

2) Extensive Agricultural Land Zone

Pasture land is classified into the following two types:

- High land pasture.
- Flood -prone pasture.

It should be noted that in Paraguay, even lowlands that tend to flood are used for livestock grazing. In this regard, the usage rate of land is quite high, notwithstanding its high or low productivity. These pastures are usually owned and operated by large-scale farmers as listed above, especially latifundium.

The basic structure of the existing land use in the planning area can be generalized with a focus on intensive and extensive land use as stated above. Intensive land uses were developed especially on higher or hilly land, while extensive land uses exist in relatively lower lands along the main rivers of Tebicuary-mf and Arroyo Cañabe. It may be said that intensive use lands differ from extensive use land as shown in the Figure 3.2.3, or that the intensive use lands seem to float like islands in a sea of extensive use or low lands.

The future potential for expanding crop production rests only in existing intensive land use zones. The intensive agricultural lands include the followings major farming lands.

i) The plateau running from the north-west to the south through the planning area. This plateau starts around Caacupé, goes down through Escobar (north), Sapucaf, Caballero to La Colmena, and Ybycuf. On this plateau, intensive, mixed or small/medium scale farming has developed.
ii) Farmland along national road number 1 centering around Carapegué, Acahay, etc.
iii) Farmland centering around Coronel Oviedo in Caaguazú province.
iv) Farmland centering around Villarrica including the southern part of the Guairá Department.

It is interesting to know that the farmlands listed above mostly correspond to land cleared for cultivation as early as 1966, as shown in the Figure 3.2.4. This implies that the land in the planning area has already been mostly developed, leaving very little room for agricultural expansion.

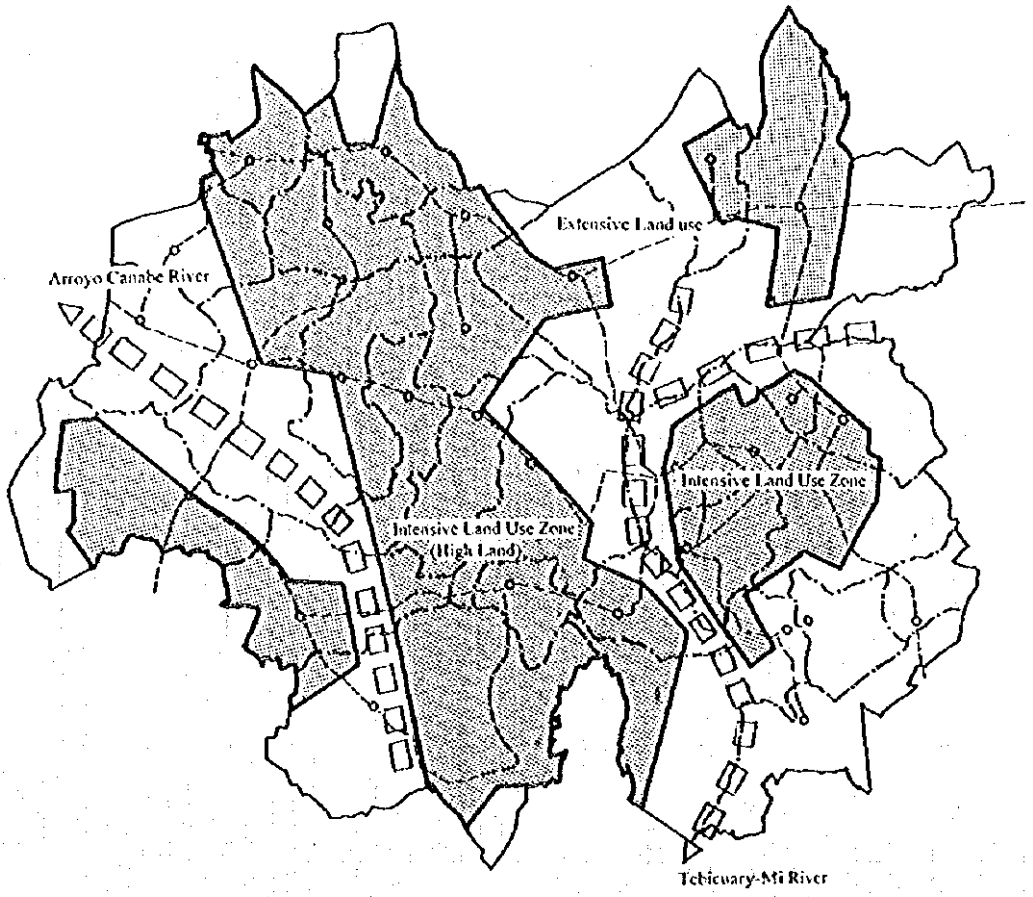


Figure 3.2.3 Basic Land Use Structure

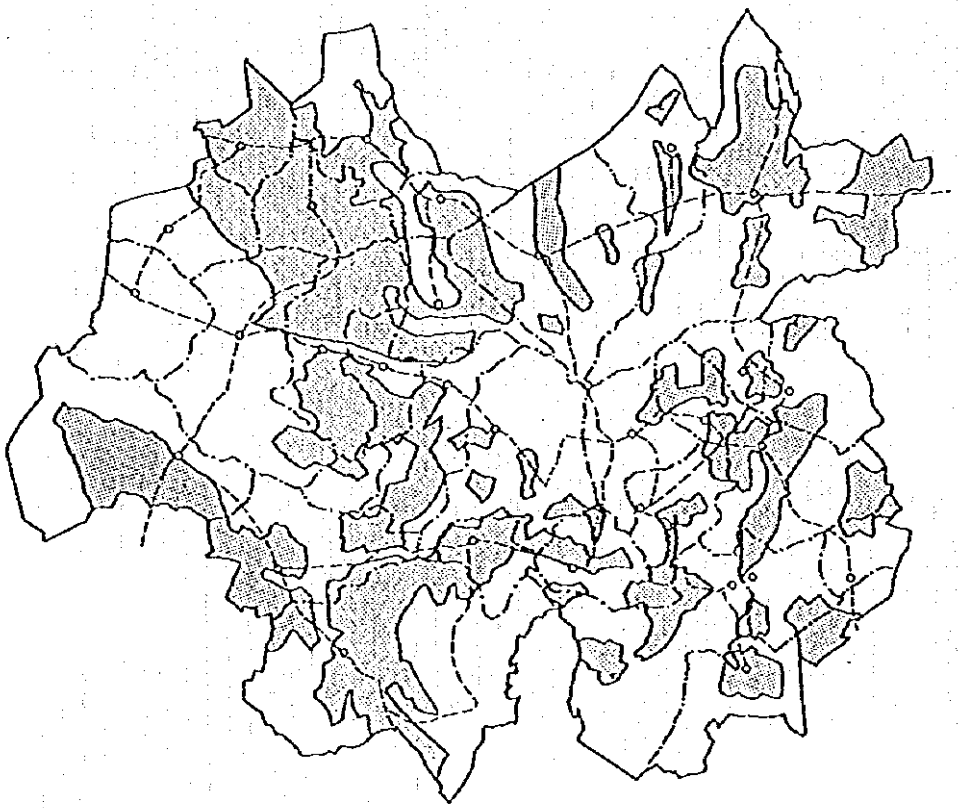


Figure 3.2.4 Land Cleared for Cultivation 1966

3-2-3 Demographic Structure

The planning area lies within the densely populated East-West corridor along national routes 2 and 7 between Asunción and Este, as shown in the Figure 3.2.5 of the population density map by department (as of 1992).

The population distribution as shown in Figure 3.2.6 indicates that a relatively large segment of the population is found along arterial roads such as national routes 1, 2, 7, and 8, especially in the departmental capital.

The population growth from 1982 to 1992 (Figure 3.2.7) shows the demographic trend of the planning area. The population increased only in a few districts, that is, basically those in which departmental capitals are located. This clearly indicates that people have been migrating from rural areas to urban areas or capitals.

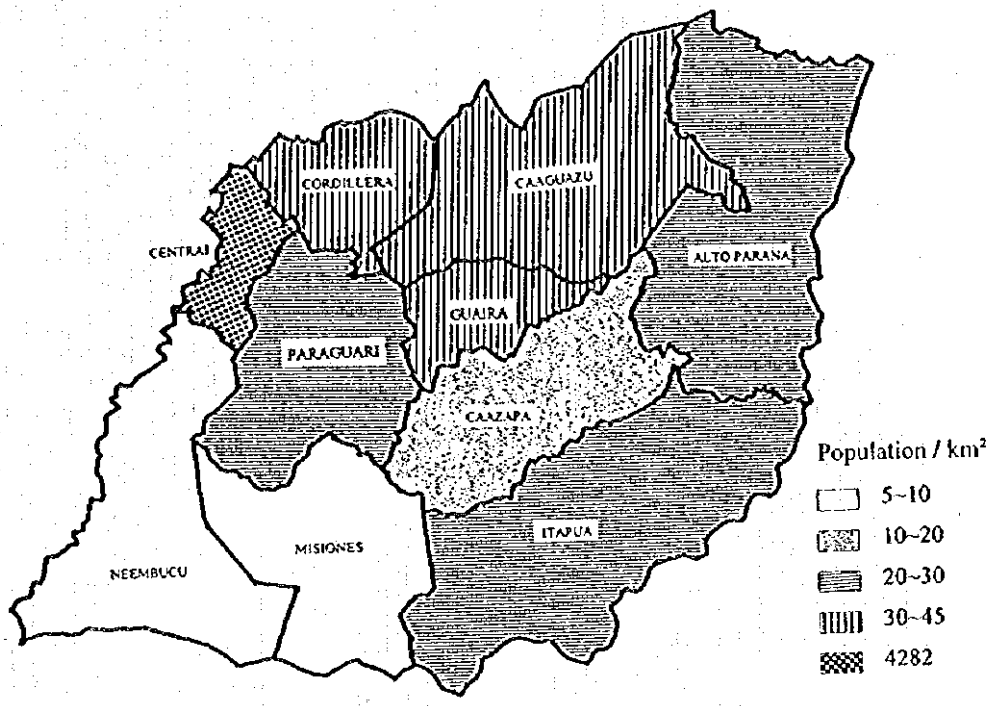


Figure 3.2.5 Population Density by Province

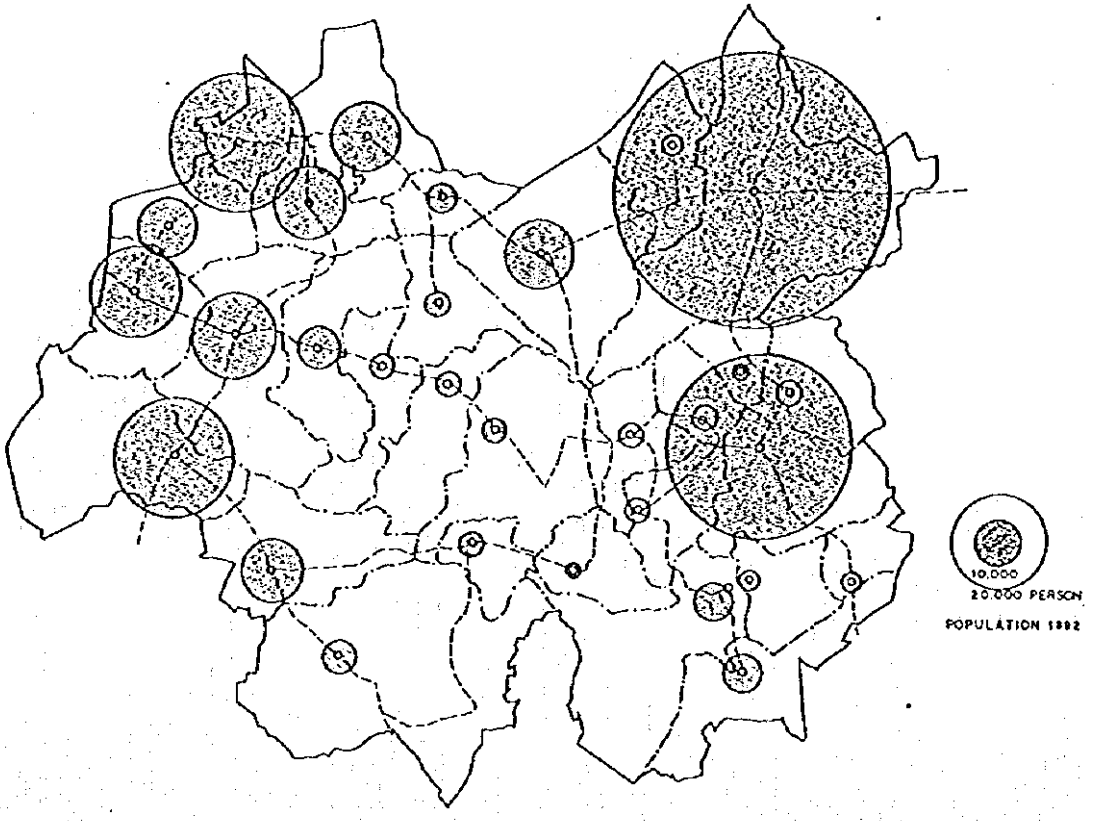


Figure 3.2.6 Population Distribution 1992

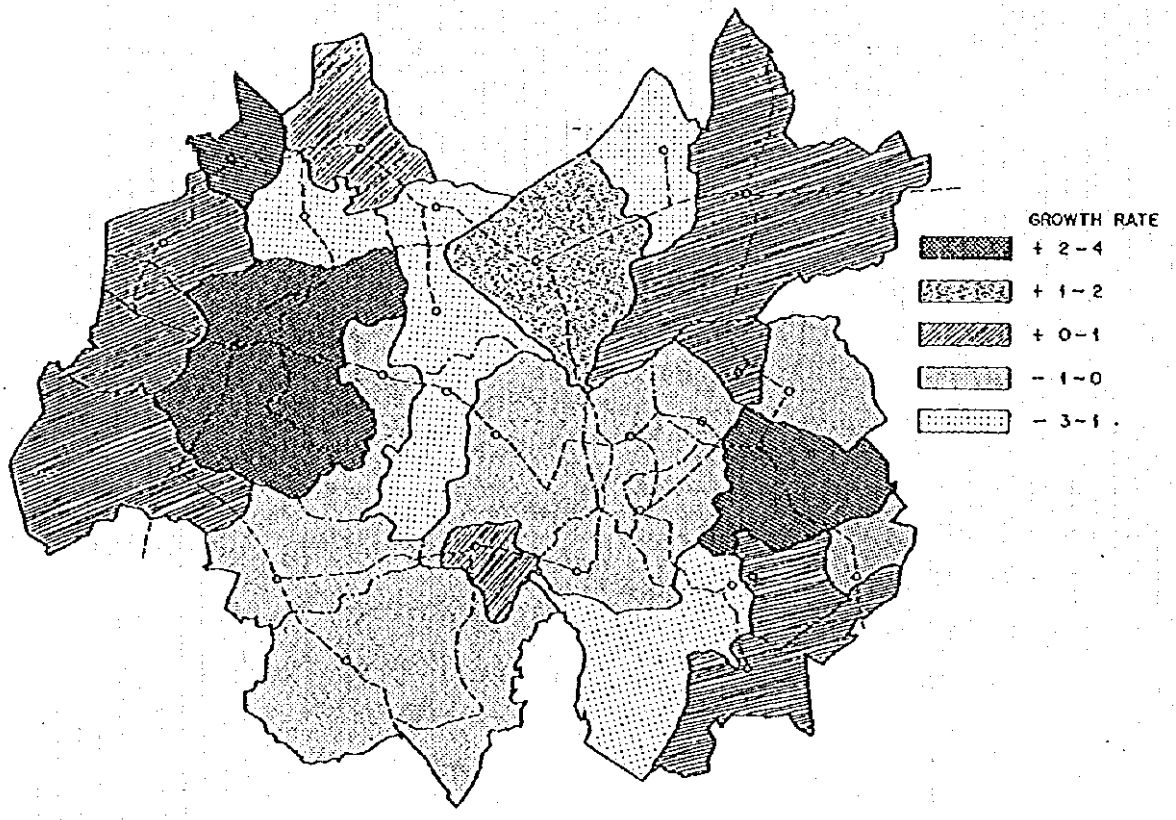


Figure 3.2.7 Annual Population Growth (1982~1992)

3-2-4 Agriculture

(1) The Existing Agricultural Conditions in the 4 Departments Related to the Planning Area

An examination of the agricultural products listed in the Table 3.2.2 indicates that the prominent features of agricultural development in the 4 departments can be summarized as follows:

i) Caaguazú appears to be the most affluent of the 4 departments in terms of agricultural development and production. Although Alto Paraná and Itapúa specialize mainly in the production of the export crops like soy bean and wheat, this province balances such production with traditional crops such as sugar cane, cotton, cassava, and so on. In addition, vegetables, fruits, etc. are aimed at the urban market. Therefore, these are likely to be cultivated in the vicinity of urban centers like Asunción, and tend to be quite productive.

ii) As for the 6 main crops listed above, it may be said that Guairá produces the largest amount of sugar cane in Paraguay, while other crops are harvested evenly throughout the departments on a very small scale.

iii) Agricultural production in Cordillera and Paraguarí has no special dominant feature.

iv) Attention must be paid to the ratio of the cultivated land area to the total land area of each department. This ratio is more than 70% in Cordillera, Paraguarí and Caaguazú.

Table 3.2.2 Agricultural Product in the Department Related to the Planning Area

(Unit : ton; 94/95)

Product	Central	Cordillera	Paraguarí	Guairá	Caaguazú
Soybean	-	35	-	461	57,893
Cotton	4,559	7,237	22,891	15,673	98,195
Sugar Cane	245,690	231,000	262,940	1,048,000	357,600
Cassava	-	-	-	-	-
Corn	2,231	24,288	18,280	16,558	119,173
Wheat	-	-	-	-	31,727
Onion	82	218	1,845	206	3,020
Carrot	69	89	59	-	3,082
Tomato	14,253	3,496	2,440	195	9,309
Bean	499	7,722	6,313	1,621	8,488
Green Pepper	959	294	210	14	843
Potato	39	23	97	51	648
Grapefruit	4,842	5,150	11,338	2,764	7,149
Strawberry	1,370	218	41	-	129
Pineapple	1,433	17,039	1,032	352	507
Orange	1,694	57,824	9,711	7,883	37,639
Grape	71	331	714	6,418	144
Banana	1,501	9,885	5,026	2,797	9,840
Cattle	133,000	331,000	591,000	250,000	630,000
Area exploited (ha)	125,250	358,668	638,086	250,020	897,045
Area exploited (%)	50.8%	72.5%	73.3%	65.0%	78.2%
Land Area of Department (ha)	246,500	494,800	870,500	384,000	1,147,400

Source : Annual Statistics 1994/95

(2) Geographical Distribution of the Production of the Six Main Crops

The geographical distribution of the production of the 6 main crops in the planning area is shown in Table 3.2.3 and Figures 3.2.8 to 3.2.12. The distribution pattern can be summarized by focusing on the basic feature of agricultural production in the planning area as follows:

Three distinctive distribution patterns of crop production can be observed.

1) Corn and cotton = Concentration in a few districts

The crop production of corn and cotton seem to be concentrated in a few districts such as Coronel Oviedo on the route 2, Carapeguá, Acahay, and Ybycuí in the southwest part of the planning area.

2) Sugar cane = Concentration in the eastern part of the planning area

As previously discussed, the department of Guairá is the largest producer of sugar cane in Paraguay. Sugar cane is harvested, primarily in this department, especially in the southern part of Guairá, that is, Borja and Iturbe.

3) Cassava = Widespread

The production of cassava seems to be widespread throughout the planning area, no matter how large the production volume in the various districts. It may be said that roughly larger amounts of cassava is harvested in the districts along the arterial roads. This distribution pattern is also applicable to the distribution of cattle gazing.

4) General pattern of mixture

It is a general tendency for each district to produce a variety of crops regardless the production volume. This is a typical characteristic of small/medium-scale farmers who tend to diversify agricultural production by including both crops and livestock farming on their property.

Table 3.2.3 Production Distribution of the Six Main Crops

(Unit : ton; 94/95)

District	Soya Bean	Cotton	Sugar Cane	Cassava	Corn	Wheat
Paraguarí	-	353	2,527	390	248	-
Escobar	-	994	4,002	485	543	-
Sapucaí	-	1,078	2,645	444	557	2
Acahay	1	3,145	8,347	1,379	1,468	2
Carapeguá	-	3,467	28,752	2,457	1,572	-
Yaguarón	-	1,089	4,781	1,148	743	2
Pirayu	-	418	983	697	833	-
Caballero	2	1,515	2,270	694	784	-
Ybytimí	-	1,517	54,383	712	857	132
Tebicuary-mí	-	495	89,456	381	182	-
La Colmena	-	936	16,876	257	350	-
Ybycuí	885	7,705	12,463	2,108	3,299	481
Villarrica	2	1,497	84,046	1,470	928	-
Yataity	1	102	11,905	374	185	-
Mbacayaty	1	486	46,707	374	306	-
Ñumí	0	797	937	385	501	-
San Salvador	3	693	34,158	386	184	1
Iturbe	9	1,254	138,929	827	388	-
Borja	4	2,366	274,438	1,148	886	-
Itapé	0	471	75,155	560	181	-
Coronel Martínez	-	37	84,536	383	68	-
Félix P. Cardozo	0	125	27,988	396	165	-
Caacupé	13	352	3,913	684	407	5
Eusebio Ayala	-	916	892	290	667	-
Piribebuy	-	1,022	76,624	1,646	1,219	-
Itacurubi de la Cordillera	-	795	6,293	715	706	-
Valenzuela	-	1,308	38,170	735	692	100
Coronel Oviedo	21	7,274	93,283	2,962	2,628	33
Nueva Londres	-	630	2,469	391	314	-
San José de los Arroyos	-	1,592	123,582		706	-

Source : Annual Statistics 1994/95

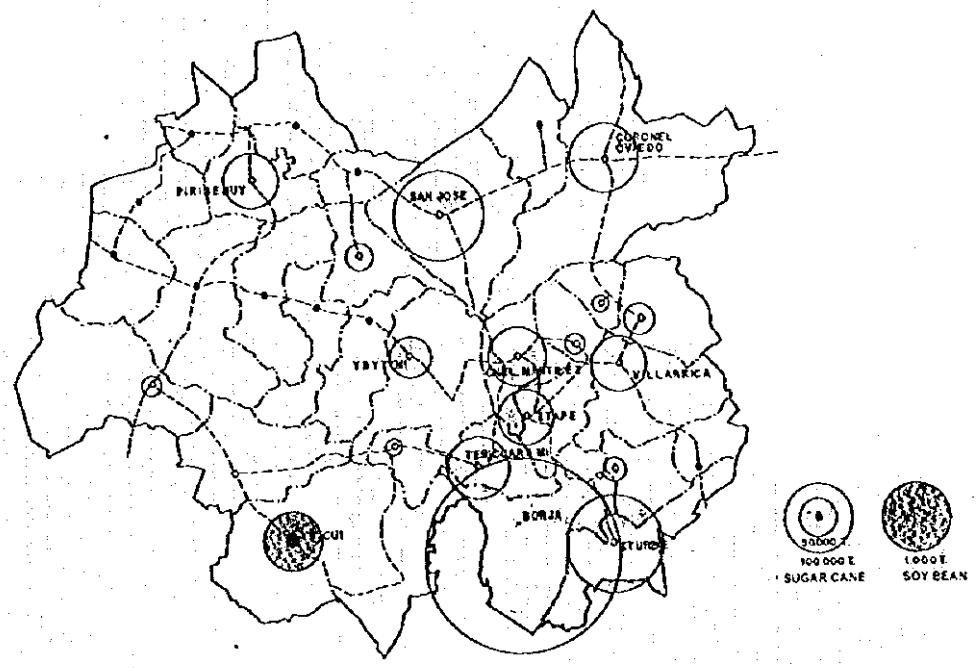


Figure 3.2.8 Distribution of Sugar Cane Production

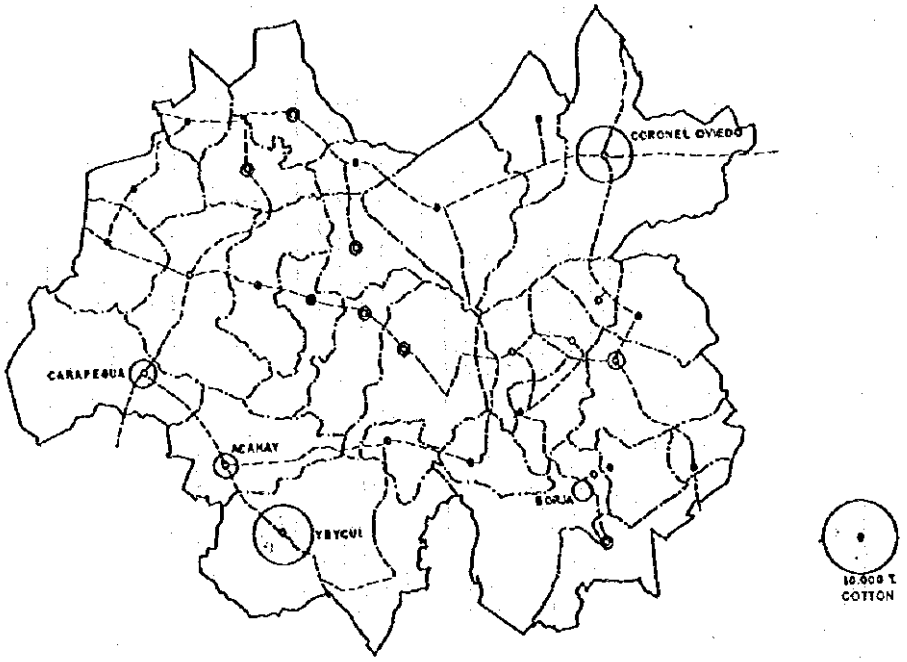


Figure 3.2.9 Distribution of Cotton Production

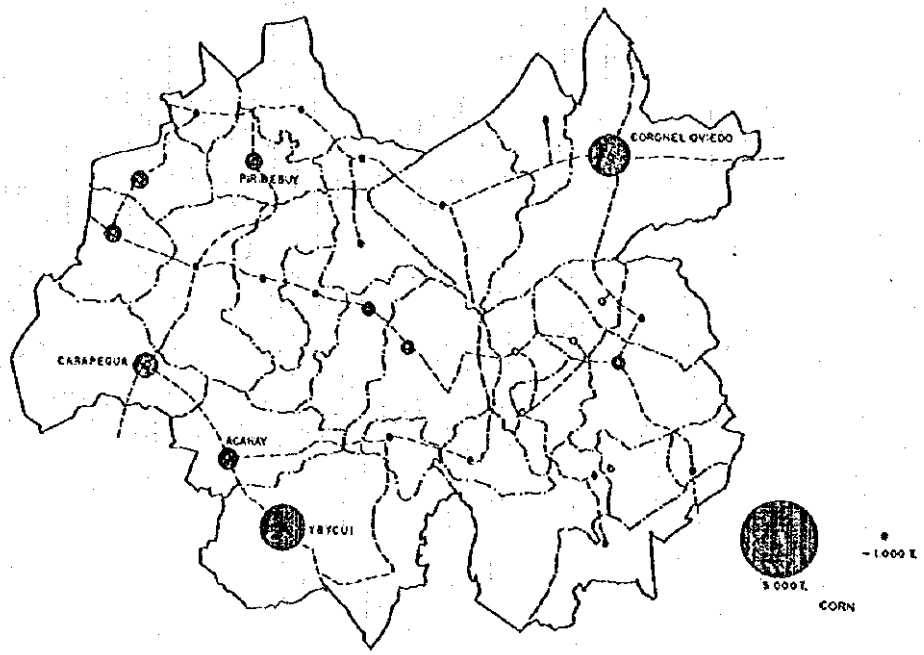


Figure 3.2.10 Distribution of Corn Production

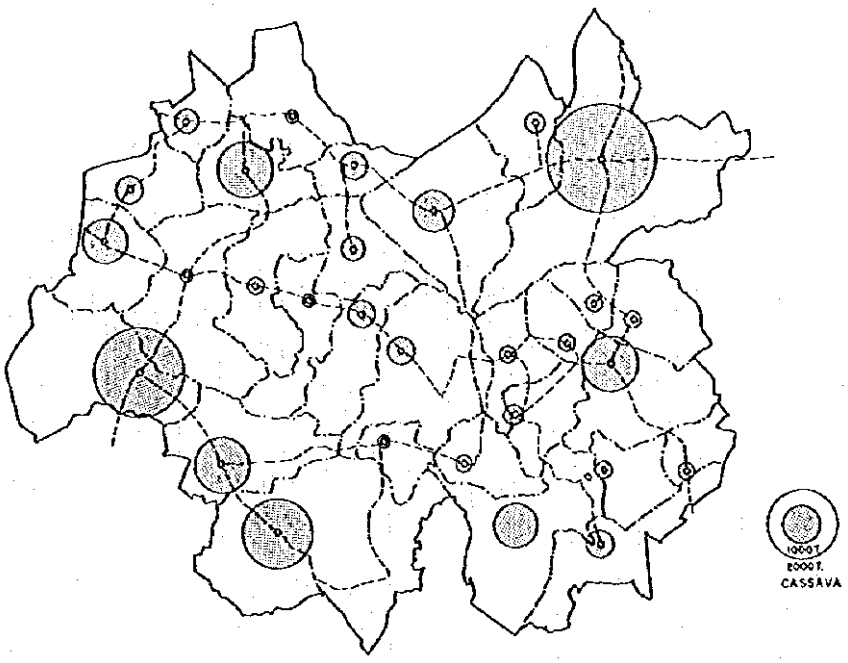


Figure 3.2.11 Distribution of Mandioca

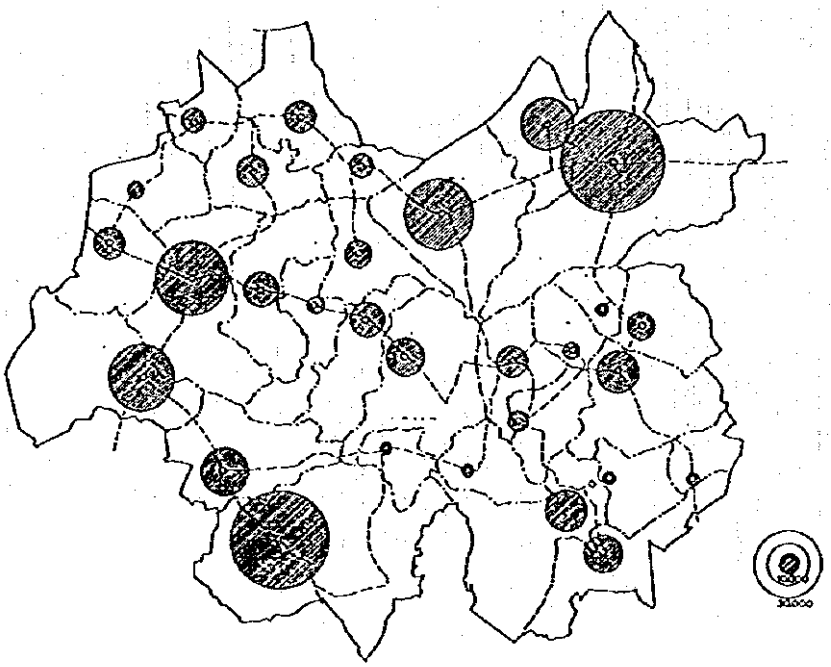


Figure 3.2.12 Distribution of Cattle

3-2-5 Transport Network

Transport of passengers and cargo in the planning area depends completely on road transport, even though there is an existing railway. The railway which runs from west to east almost across the center of the area, transports passengers and cargo only once or twice a week because of deteriorated facilities and decreased demand.

(1) Road Network and Conditions

As mentioned in other parts of the report, the planning area is served by three major national routes along its fringes; Route 1 (from Asunción to Encarnación, via Itá, Yaguarón, Paraguarí and Carapeguá) along the western fringe, Route 2 (from Asunción to Coronel Oviedo, via Ypacaraí, Caacupé, Eusebio Ayala, and San José) along the northern fringe, and Route 8 (from Coronel Oviedo to Encarnación, via Mbocayaty, Villarrica, and Ñumí) along the eastern fringe. These national routes are paved all-weather roads sufficiently wide to permit two lanes (both directions). Moreover, they are relatively well maintained.

In contrast with these national routes, there are no sufficiently paved roads within the heart of the planning area except one; Acahay - La Colmena road, which was developed by Japan's ODA in 1980.

Since most of the roads within the area are open for agricultural activity and have dirt surfaces with insufficient drainage facilities, the condition of these roads becomes especially bad after a heavy rainfall. Therefore, ordinary cars often cannot pass. Because of the rain, some of there may be closed 90 days per year. The existing road network in the planning area and its facilities are summarized in Figure 3.2.13 and Table 3.2.4.

(2) Railway

There is a railway service through the planning area, running from west to east. This railway system was built in 1861, the first in South America. The deterioration of the facilities is quite severe and its decreasing transport capacity has almost bottomed out, since no major investments for its improvement has been made since the 1910's. Some figures on present railway transport are provided in Table 3.2.5.

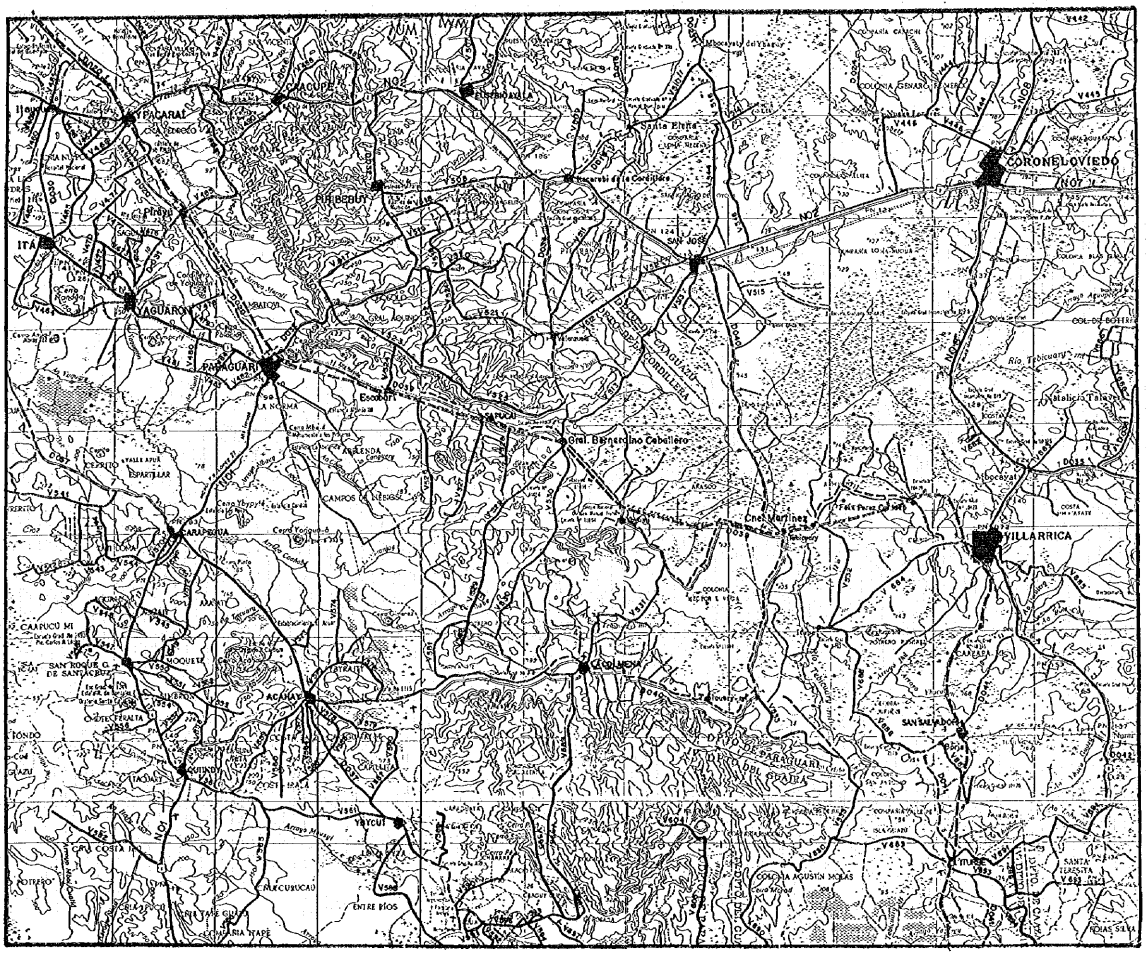


Figure 3.2.13 Existing Road Network in the Planning Area

Table 3.2.4 Road Network Inventory in Planning Area (1)

New	Route			Sub-Section		Length	Surface	AADT
Code	Origin	Destination	No.	between		(km)		in '94,'95
N01	Asuncion	Encarnacion	4	Guarambare	Yaguaron	4.7	P	4,498
			5	Yaguaron	Paraguari	17.8	P	2,789
			6	Paraguari	Carapegua	17.7	P	2,581
			7	Carapegua	Roque Gonzalez	13.5	P	2,210
			8	Roque Gonzalez	Quindy	13.5	P	2,147
			9	Quindy	Caacupe	31.7	P	1,838
				Sub-total(6)		98.8		
N02	Madam Lynch	Ciudad del Este	4	Itaugua	Ypacarai	5.3	P	13,990
			5	Ypacarai	Caacupe	19.9	P	13,990
			6	Caacupe	Eusebio Ayala	7.0	P	13,990
			7	Eusebio Ayala	Itacurubi Cordillera	14.9	P	13,990
			8	Itacurubi Cordillera	San Jose	14.4	P	13,990
			9	San Jose	Cnel Oviedo	30.8	P	13,990
			10	Cnel Oviedo	Caaguazu	21.6	P	13,990
				Sub-total(7)		113.9		
N08	Bella Vista	Cnel Bogado	9	Carayao	Cnel Oviedo	33.5	P	2,084
			10	Cnel Oviedo	Mbocayaty	33.0	P	686
			11	Mbocayaty	Villarrica	8.8	P	681
			12	Villarrica	Numi	28.8	P	545
			13	Numi	Caazapa	27.3	P	223
				Sub-total(5)		131.4		
D016	Caacupe	Arroyos y Esteros	1	Caacupe	Tobati	10.8	P	586
D018	Arroyos y Esteros	Sta Elena	3	Caraguatay	Sta Elena	21.0	T	103
			4	Sta Elena	Itacurubi Cordillera	9.1	T	66
				Sub-total(2)		30.1		
D020	Autopista	Paraguari	2	Luque	Ypacarai	26.6	P	4,048
			3	Ypacarai	Pirayu	11.7	G	392
			4	Pirayu	Cerro Leon	9.2	T	79
			5	Cerro Leon	Paraguari	8.3	T	130
				Sub-total(4)		55.8		
D022	N02	San Bernardino	1	N02	San Bernardino	10.0	P	4,803
			4	Atyra	Caacupe	12.2	T	72
				Sub-total(2)		22.2		
D023	E Ayala	Mbocayaty	1	E Ayala	Isla Pucu	11.6	P	170
D024	N02	La Pastora	1	N02	Nueva Londres	8.2	P	106
D027	Fdo de la Mora	Ita	2	San Lorenzo	Ita	?		
D030	Ita	Patino	1	Ita	Itaugua	13.4	P	591
			2	Itaugua	Patino	5.1	G	591
				Sub-total(2)		18.5		
D031	Yaguaron	Prayu	1	Yaguaron	Prayu	9.5	G	110
			2	N02	Prayu	27.1	G	87
				Sub-total(2)		36.6		
D032	Paraguari	N02	1	Paraguari	Piribebuy	29.4	P	287
			2	Piribebuy	N02	11.0	P	604
				Sub-total(2)		40.4		
D033	Ita. Cordillera(N2,86km)	Valanzuela	1	Ita. Cordillera(N2,86km	Valanzuela	5.3	P	52
			2	Valanzuela	Caballero	13.0	T	58
				Sub-total(2)		18.3		
D035	Mbocayaty	Caaguazu	1	Mbocayaty	Col. Independencia	26.1	P	357
D036	Desv Col Independencia	M J. Troche	1	Naville	Natalicio Talavera	7.9	P	169
D037	Desvio Nueva Italia	Carapegua	1	Desvio Nueva Italia	Nueva Italia	18.1	P	462
			2	Nueva Italia	Yuquyry	7.4	T	130
			3	Yuquyry	Carapegua	23.7	T	130
			4	Carapegua	Acahay	27.1	P	679
			5	Acahay	Ybycui	16.8	P	417
			6	Ybycui	La Rosada	24.7	P	27
				Sub-total(6)		117.7		
D039	Paraguari	Tebicuary	1	Paraguari	Escobar	12.0	G	182
			2	Escobar	Sapucai	10.5	G	135
			3	Sapucai	Caballero	11.2	G	87
			4	Caballero	Ybytimi	10.0	G	57
			5	Ybytimi	Tebicuary	24.2	T	42
				Sub-total(5)		67.9		
D040	Quiindy	San Jose	1	Quiindy	Acahay	16.5	T	42
			2	Acahay	La Colmena	26.2	P	267
			3	La Colmena	Tebicuarymi	17.7	T	52
			4	Tebicuarymi	Tebicuary	16.8	T	52
			5	Tebicuary	San Jose	29.9	T	78
				Sub-total(5)		107.1		
D041	N08(Itaibu)	Maciel	1	N08(Itaibu)	San Salvador	12.9	T	50
			2	San Salvador	Borja	2.6	T	51
			3	Borja	Iturbe	26.5	T	55
			4	Iturbe	Maciel	30.4	T	45
				Sub-total(4)		72.4		
D042	Numi	Ao Charara(N06)	1	Numi	Gral Garay	17.2	T	239

Table 3.2.4 Road Network Inventory in Planning Area (2)

New	Route			Sub-Section		Length	Surface	AADT
Code	Origin	Destination	No.	between		(km)		in '94,'95
V442	N 08 - Cruce RI Corrales	Tacua Cora				1.34	T	18
444	Leon Cue	Pindoty				9.11	T	10
445	N 08 - Cruce RI Corrales	N 02				22.1	T	46
455	N 02	Calle 6(RI Corrales)				13.6	T	46
455	Ruta Ybyraro	Ypane				7.0	P	82
456	Posta Ybyraro	Capiata				4.7	T	70
457	Km 26 N01 p Toledo	Km 24 N02 Capiata				9.0	T	89
458	Ita-Las Piedras	Capiata				12.1	T	72
459	N02	Aldama Canada				8.0	T	110
460	N01	Mbocayaty del Sur				6.0	T	43
461	N02	Mbocayaty del Norte				5.5	T	40
463	Ita	Itaugua				6.0	T	54
465	N01	Potrero				4.5	T	77
466	Itaugua	Potrero				6.5	T	64
467	Itaugua	Guazu Vira				5.0	T	31
468	Ypacarai	Punta Estrella				5.0	T	102
470	Mbotovi	Jhopua Saiju				7.5	T	56
471	Senda-Ita	Potrero				3.1	T	21
472	Ita Potrero	Zayas				3.4	T	33
473	Ita Potrero	Zaguazu				3.5	T	9
474	Carungua	Mbariru				2.9	T	29
475	Zaguazu	Zambonini				5.2	T	28
476	Zaguazu	Caaguy Poti				4.5	T	17
477	Zambonini	Guayaibi				1.0	T	13
478	N01	Cerro Leon				4.6	T	18
479	Peguajo	Cerro Leon				6.7	T	14
480	N01	Nuati Guazu				3.6	T	26
481	Desvio Nuati Guazu	Potrerito				2.2	T	6
482	N01(Km 60)	Jhugua Pol				3.7	T	18
483	Jhugua Pol	Nuatu'i				2.1	T	16
484	Nuatu'i	N01				3.6	T	43
485	N02	Pirayu p/ Jhugua				9.8	T	28
486	N02	Atyra				16.4	T	31
487	Caacupe	N02				6.0	T	107
488	N02	Ytumi				16.4	T	27
489	N02	Aguayty				5.6	T	19
490	Caacupe	Azcurra				7.0	T	24
507	Eusebio Ayala	Acosta Nu				17.0	T	38
508	N02	Piribebui				14.7	T	605
509	Itacurubi	Rubio Nu				8.4	T	26
510	Mbocayaty	Santa Elena				12.0	T	68
511	N02	Valenzuela				12.0	T	22
512	S. Jose de los Arroyos	Valenzuela				17.4	T	101
513	S. Jose de los Arroyos	Caballero				22.5	T	45
514	S. Jose de los Arroyos	San Blas				17.2	T	22
515	S. Jose de los Arroyos	San Patricio				22.0	T	28
516	San Jose(N02)	Mbocayaty				20.5	T	62
517	p/ Naranjito	p/ Naranjito				14.0	T	21
518	Ita Moroti p/ Col Ojopoi	Ita Moroti-C.Ojopoi				5.0	T	27
519	Ita Moroti	Ita Moroti				6.0	T	22
520	Pirareta	Pirarete				10.0	T	27
521	Ita Moroti	Valenzuela				14.0	T	27
522	Ybaroty	Costa Irala				4.0	T	18
523	Cerro Roke	Cerro Roke				29.9	T	28
524	Mbopi cua	Escobar				6.4	T	18
525	Cerro Roke	Valenzuela				10.0	T	16
526	Chircal	Guazu Cua				14.0	T	14
527	Sapucai	Santa Isabel				10.0	T	22
528	Caballero	Ybaca				7.3	T	28
529	La Colmena-Chaura	Caballero				28.9	T	34
530	Caballero-Isla Seguro	Chaurio				25.5	G	16
531	A.L. Vera	La Colmena				11.7	T	28
532	Coronel Martinez	Itape				13.2	T	26
533	Tebicuarymi	E Rojas				5.3	T	44
535	Nueva Italia	Pindoty p/ Ygatimi				12.0	T	82
536	Nueva Italia	Isla Guavirami				4.0	T	79
541	Espertillador-Ndavaru	Pacheco				14.0	T	34
542	Ndavaru	Caacupemi				16.5	T	16
543	Beni Loma	Aguay				9.6	T	29
544	Beni Loma	Tahy Loma				5.2	T	47
545	Rincon	Arasaty				8.8	T	15
546	Matechi	Aguay-mi				1.9	T	10
547	R. Gonzales	C. Aguay				7.1	T	13
548	Cerrito	Lago Ypoa				3.0	T	8
549	San Roque	Moquete B				2.5	T	5

Table 3.2.4 Road Network Inventory in Planning Area (3)

New Code	Route Origin	Route Destination	No.	Sub-Section between		Length (km)	Surface	AADT in '94,'95
550	San Roque	Moquete A				4.2	T	6
551	San Roque	Tobatipua				14.0	T	8
552	Mbocayaty	Valle Pucu				5.1	T	16
553	Simbron	Canada				3.1	T	15
554	Ita Cajon	26 de Junio				1.9	T	4
555	N 01	Emp. Sta Maria mi				2.1	T	18
556	Km 102-N01	Isla Alta				4.0	T	6
557	N01 Km 101	Peralta				5.6	T	14
558	N01 Km 104	Ita Cajon				6.0	T	12
559	Balmori	Laguna Pyta				3.3	T	2
560	Balmori	Costa Irala				8.5	T	4
561	Quindy	Ybycui				21.4	G	9
562	Valle Apu'a	Lago Ypo'a				33.5	G	16
565	Costa Irala	Curucau				7.5	G	11
566	N01 Km 130	Curucau				8.0	G	10
570	Calixtro	Arasaty				4.6	T	6
571	Cerro Pindo	Cerro Pe				4.7	G	5
573	Yepuarizo	Valois Rivarola				3.8	T	11
575	Ytapytanpua	Yarigua'a				6.0	T	6
576	Ybyrayty	Isleria				4.2	T	12
577	Balmori-Yuguayty	Costa Baez				3.5	T	12
578	Zanjita	Recoleta				2.5	G	9
579	Acahay	Caraguatay mi				17.9	T	7
581	Tuyu Hu	Arce Chaurie				9.6	T	6
582	Tuyu Hu	Cerro Ice				3.5	T	2
584	Acahay	Costa Baez				4.6	T	18
586	Paso Pared	Arazaty				4.9	T	17
587	Boliche Cue	Capillita				3.5	T	12
589	Rincon Guazu	Rincon'i				5.0	T	36
590	Tacuary	Palacio Cue				7.2	T	4
591	Santa Angela	Isla Praccion				2.1	T	37
593	Caaguy Cupe	Santa Angela				4.4	T	13
595	Caaguy Cupe	Carbon Cue				5.0	T	16
596	Minas Cue	Cesar Barrientos				19.0	T	4
597	Minas Cue	Larrosa				3.3	T	6
604	Isla Naranja	Nuai'i				2.5	T	21
606	N02	Calle 6				13.6	T	46
666	Natalicio Talavera	Dr. Botrell				7.1	T	20
682	N08	Yataity				2.4	P	29
683	Mbocayaty	Santa Barbara				8.3	T	10
684	Villarrica	Itape				19.4	T	42
685	Villarrica	C. Polilla				16.0	T	4
686	Desvio Boqueron	Boqueron				4.5	T	35
688	Boqueron	Itape				15.9	T	34
689	Boqueron-Iturbe	Rojas Potrero				21.9	T	40
690	R. Potrero-Cia. Rincon	Isla Naranja				16.3	T	32
691	Concepcion mi	Iturbe				21.0	T	63
692	Santa Lucia	Canada Guazu				5.1	T	13
693	Guavira	Iturbe				15.5	T	26
694	Cabayu Reta	Iturbe(Caaty-mi)				12.5	T	23

Note: P = Paved road, G = Gravel road, T= Dirt road

Table 3.2.5 Outline of Railway Transport

1) Revenues and Expenditures

(Unit : mil. Gs.)

	1990	1991	1992	1993	1994
Expenditure	**6,669.3**	**8,230.5**	**10,173.6**	**10,607.2**	**8,651.4**
i) Maintenance	1,507.6	1,726.0	1,959.8	2,001.3	1,834.4
ii) Operation	1,491.7	2,477.2	3,127.0	3,302.3	1,856.1
iii) Administration	670.6	809.6	1,185.7	1,247.1	1,270.4
Revenue	**1,338.9**	**1,302.1**	**1,588.4**	**942.4**	**1,422.0**
i) Passenger	127.2	149.1	198.0	85.4	57.4
ii) Percels	32.9	33.3	30.7	19.8	19.9
iii) Luggage	4.6	4.8	3.8	1.2	.
iv) Telegram	0.6	0.3	0.3	0.2	135.4
v) Cargo	1,032.4	1,002.4	1,021.1	710.9	900.2
vi) Storage	48.0	55.9	56.1	32.4	106.6
vii) Leasing	29.0	44.9	46.4	52.0	57.9
viii) Others	64.2	11.4	231.9	40.5	144.6
Balance	**-5,330.4**	**-6,928.4**	**-8,585.2**	**-9,664.8**	**-7,229.4**

2) Cargo handled at stations, 1994

Station of Origin	Tonne
Asunción	408.9
Luque	13.4
Aregua	1.4
Ypacaraí	7.7
Paraguarí	2.8
Sapucaí	4.1
Caballero	1.2
Villarrica	66.4
San Salvador	5.6
Iturbe	453.1
Maciel	8.3
M. Bertoni	1.7
Fulgencio Yegros	3.3
Isla Saca	4.7
Yuty	196.5
Santa Rosa	2.1
Jose L. Oviedo	1.4
San Pedro	0.7
Gnel. Artigas	51.8
Cnel. Bogado	10.1
Carmen	169.2
Encarnación	171.4
Total	1,586.1

Source : López Railway

3-3 Distribution of Population and Agricultural Products

3-3-1 Population

The population for 1995, 2005, and 2015 by district is estimated by dividing the future populations of the 4 relevant departments, listed in the preceding chapter, into corresponding districts. The estimation results are shown in Table 3.3.2.

i) The population for the year 2000 by district is estimated by DGEEC assuming that road improvement will have no effect before the year 2000. Therefore, DGEEC's projection is used in this study.

ii) The population growth rate in the districts which will be directly affected by the improved road are as follows:

Table 3.3.1 Population Growth Rate in Districts Directly Affected by the Road

District	2000-2005	2005-2010	2010-2015
Paraguarí (Escobar, Sapucaí, Caballero, Ybytimí)	1.0%	2.0%	3.0%
Guairá (Martínez, Cardozo)	0.5%	1.0%	2.0%

The result of estimation is shown in Table 3.3.2.

Table 3.3.2 Distribution of Population by District

District	1995	2000	2005	2015
Paraguarí	22,214	22,843	22,108	19,279
Escobar	9,492	9,472	9,955	12,742
Sapucaí	7,361	7,315	7,688	9,840
Acahay	17,150	16,897	16,353	14,261
Carageguá	33,340	33,408	32,333	28,196
Yaguaron	26,004	25,871	25,039	21,835
Pirayu	15,107	15,093	14,607	12,738
Caballero	8,002	7,895	8,298	10,621
Ybytimí	8,282	8,157	8,573	10,973
Tebicuary-mí	4,600	4,605	4,457	3,887
La Colmena	5,739	5,755	5,570	4,857
Ybycuí	26,484	26,350	25,502	22,239
Villarrica	47,877	50,935	50,968	49,812
Yataity	3,814	3,800	3,803	3,715
Mbocayaty	5,986	5,974	5,978	5,842
Ñumí	3,647	3,665	3,667	3,584
San Salvador	3,521	3,472	3,474	3,395
Iturbe	8,731	8,690	8,696	8,498
Borja	9,315	9,170	9,176	8,968
Itapé	6,516	6,468	6,472	6,325
Coronel Martínez	6,366	6,324	6,484	7,524
Félix P. Cardozo	4,841	4,808	4,928	5,719
Caacupé	34,321	35,614	35,227	33,704
Eusebio Ayala	16,746	16,529	16,349	15,642
Piribebuy	19,184	18,716	18,513	17,712
Itacurubí	7,739	7,658	7,575	7,247
Valenzuela	6,045	4,840	5,777	5,527
Coronel Oviedo	71,216	75,697	80,581	89,126
Nueva Londres	4,147	4,314	4,592	5,079
San José de los Arroyos	17,579	17,976	19,136	21,165

3-3-2 Crop Production

Production of the 6 main crops must be estimated by district in the planning area for traffic demand forecast. Crop production by department is estimated in the preceding chapter, and each department must be divided into its corresponding districts. In spite of the fact that the planning area is endowed with a high development potential, as discussed in the preceding section , the present distribution pattern is used to distribute the departmental framework into districts for the following reasons.

i) The most conservative method for F/S.

ii) Vegetable and fruit priority products in the planning area account for a small share in terms of traffic volume on the network.

iii) The production of sugar cane is estimated to increase greatly in Guairá and Paraguarí department. The increase by district may reflect the present pattern.

The results are shown in Table 3.3.3.

Table 3.3.3 Distribution of Crop Production

(Unit : ton)

District	Soya Bean			Cotton			Sugar Cane			Cassava			Corn			Wheat		
	1995	2005	2015	1995	2005	2015	1995	2005	2015	1995	2005	2015	1995	2005	2015	1995	2005	2015
Paraguarí	0	0	0	247.3	768.1	314.3	2,550.1	3,259.2	3,667.6	4,540.0	5,550.0	6,296.0	302.0	179.9	191.4	0	0	0
Escobar	0	0	0	700.7	768.1	890.5	4,048.7	5,174.4	5,822.7	5,661.0	6,920.8	7,850.9	662.5	394.6	419.9	0	0	0
Sapucai	0	0	0	760.3	833.3	966.0	2,681.6	3,427.2	3,856.6	5,183.2	6,336.5	7,188.2	678.9	404.4	430.4	0	0	0
Acahay	0	0	0	2,219.0	2,432.2	2,818.9	8,439.1	10,785.6	12,137.0	16,082.5	19,661.3	22,303.8	1,791.6	1,067.1	1,135.6	0	0	0
Carrpegua	0	0	0	2,443.4	2,678.2	3,105.0	28,997.9	37,060.8	41,704.4	28,654.4	35,030.7	39,738.9	1,919.7	1,143.4	1,216.8	0	0	0
Yaguaron	0	0	0	801.5	878.5	1,018.5	4,811.1	6,148.8	6,919.2	13,399.0	16,380.6	18,582.2	907.7	540.6	575.4	0	0	0
Pirayu	0	0	0	295.4	323.8	375.4	999.0	1,276.8	1,436.8	8,124.0	9,931.7	11,266.6	1,015.7	605.0	643.8	0	0	0
Caballero	0	0	0	1,067.1	1,169.7	1,356.1	2287.2	2,923.2	3,289.5	8,087.2	9,886.8	11,215.6	957.1	570.1	606.7	0	0	0
Ybytimí	0	0	0	1,069.4	1,172.2	1,359.0	54,840.9	70,089.6	78,871.7	8,307.8	10,156.4	11,521.5	1,044.9	622.4	662.4	0	0	0
Tebicuary Mí	0	0	0	348.1	381.5	442.3	90,201.0	115,281.6	129,726.1	4,448.0	5,437.7	6,168.6	221.4	131.9	140.4	0	0	0
La Colmena	0	0	0	659.5	722.9	838.1	17,009.6	21,739.2	24,463.1	2,995.9	3,662.6	4,154.9	426.4	254.0	270.3	0	0	0
Ybycui	0	0	0	5,431.9	5,953.7	6,902.5	12,566.6	16,060.6	18,073.2	24,592.0	30,064.9	34,105.6	4,027.8	2,399.1	2,553.2	0	0	0
Villarrica	8	9	12	1,226.2	1,343.3	1,562.0	75,665.6	96,661.4	108,762.0	19,761.6	24,163.8	26,716.8	1,434.2	855.4	907.2	0	0	0
Yataity	4	5	6	83.2	91.2	106.0	209.6	267.8	301.3	5,026.3	6,146.0	6,795.4	285.5	170.3	180.6	0	0	0
Mbocayati	4	5	6	398.8	436.9	508.0	42,024.8	53,685.9	60,406.6	5,026.3	6,146.0	6,795.4	473.1	282.2	299.3	0	0	0
Numí	0	0	0	653.1	715.5	832.0	838.4	1,071.0	1,205.1	5,169.5	6,321.2	6,989.0	773.6	461.3	489.3	0	0	0
San Salvador	11	14	18	568.3	622.6	724.0	3081.1	3,936.1	4,428.8	5,183.8	6,338.6	7,008.3	283.9	169.3	179.6	0	0	0
Iturbe	34	41	55	1,026.8	1,124.9	1,308.0	125,131.2	159,852.7	179,864.2	11,112.3	13,587.8	15,023.4	599.3	357.4	379.1	0	0	0
Borja	15	18	24	1,939.0	2,124.2	2,470.0	247,223.2	315,822.9	355,359.8	15,422.6	18,858.3	20,850.7	1,369.5	816.8	866.3	0	0	0
Itapé	0	0	0	386.2	423.1	492.0	67,700.8	86,486.5	97,313.4	7,532.3	9,210.2	10,183.4	280.5	167.3	177.5	0	0	0
Cnel. Martínez	0	0	0	29.8	32.7	38.0	76,189.6	97,330.8	109,515.3	5,140.9	6,286.1	695.3	104.6	62.4	66.3	0	0	0
Félix P. Cardozo	0	0	0	102.1	111.8	130.0	25,256.8	32,265.1	36,304.2	5,312.7	6,496.2	7,182.6	254.0	151.5	160.7	0	0	0
Caacupe	0	0	0	234.7	257.5	299.9	371.9	475.3	534.8	6,875.0	8,410.0	9,535.6	1,112.9	664.1	709.9	0	0	0
Eusebio Ayala	0	0	0	611.3	670.7	781.1	831.6	1,062.0	1,195.9	2,918.3	3,569.8	4,047.7	1,822.5	1,087.5	1,162.5	0	0	0
Piribebuy	0	0	0	681.8	748.1	871.2	72,534.0	92,692.8	104,310.0	16,559.0	20,255.6	22,967.4	3,329.0	1,986.5	2,123.5	0	0	0
Itacurubí	0	0	0	529.9	581.4	677.1	5959.8	7,616.2	8,570.8	7,202.9	8,810.8	9,990.4	1,919.7	1,145.5	1,224.5	0	0	0
Valenzuela	0	0	0	871.9	956.7	1,114.1	36,128.4	46,169.3	51,956.1	7,388.7	9,038.1	10,248.2	1,890.0	1,128.0	1,205.9	0	0	0
Cnel Oviedo	29	0	0	5,479.6	6,248.2	7,255.8	71,019.4	90,720.5	101,484.6	43,237.6	52,853.4	59,953.2	6,937.0	4,149.7	4,411.6	91.9	270.9	375.6
Nueva Londres	0	0	0	471.1	517.9	600.5	1859.5	2,375.4	2,657.2	5,716.6	6,988.0	7,925.7	822.5	492.0	523.0	0	0	0
San Jóse de los Arrollos	0	0	0	1,198.0	389.2	475.8	94,084.6	120,184.1	134,444.1	17,875.8	21,851.2	24,786.5	1,859.5	1,112.3	1,182.5	0	0	0

3-4 Regional Development Scenario for Road Network Improvement

3-4-1 Possible Roles and Effects of the Improved Road

(1) Possible Roles

The proposed road between Paraguarí and Villarrica is supposed to serve 3 kinds of transport functions, that is, national road service, regional road service and district service along the road.

1) District Service Road

Figure 3.4.1 shows the districts which are at present served and not served by paved arterial roads. Apparently, the proposed road will serve those districts that are not yet served by a paved road, that is, Escobar, Sapucai, Caballero, Ybytimí, Cnel. Martínez, and F. P. Cardoza. However, it must be noted that even after the improvement of the proposed road there will still be districts that are not served by any paved arterial roads. These are mainly the districts along the Río Tebicuary-mí, Tebicuary on the west side of the Río Itapé, and San Salvador, Borja, and Iturbe on the other side.

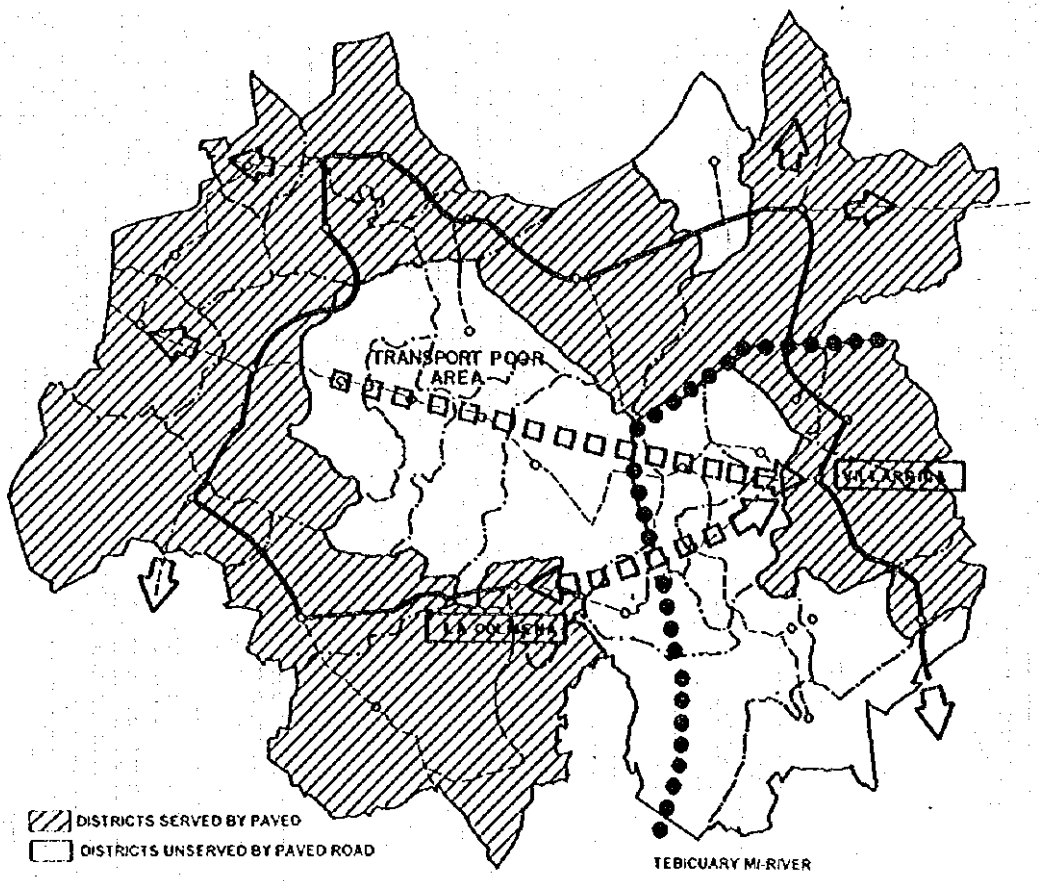


Figure 3.4.1 District Served by the Paved Roads

As shown in the preceding chapter, those districts are the major production centers of sugar cane, which is an important crop in the planning area as well as in the department of Guairá. The improvement of transport service, especially the transport (collection) of sugar cane in those districts will be an important planning item of the road network improvement proposed in this study.

2) Regional Arterial Road

The most important function of the proposed road will definitively be the provision of regional transport services. The present road transport conditions in the planning area can be described as follows:

i) In short, at the national transport level roads are very convenient, but at the regional and district levels, they are very inconvenient.

ii) Paved roads serving the planning area are classified mainly as national roads (Routes 1, 2, 3, 8), which are designed to serve traffic between regions, not traffic within in the region. Given this situation, regional traffic and transport, which is basically generated by the collection of agricultural products, the distribution of consumer goods, shopping, etc., must be limited to national roads, often entailing long detours, or existing unpaved roads, which means that travel time will be long. This is mainly due to the lack of a regional road network that can meet intra-regional transport needs and demands.

iii) An assessment has concluded that the proposed Paraguarí - Villarrica road is best located either geographically or within the road network so that it will serve as an effective regional arterial road in the planning area.

iv) In general, roads consisting of a road network are often classified into three categories; principal highway (inter-regional road), secondary trunk road, and penetration or feeder (collector) road. A road classified as a secondary trunk road sometimes plays a supplemental role with respect to the relevant principal highways in the road network, and sometimes works to handle intra-regional traffic. Also, movement of traffic from the feeder road to the principal highway is via the secondary trunk road. Given this, the objective roads of this Study are surely secondary trunk roads, since they have to cope with all functions described above. Hence, they are called regional arterial roads.

v) Figure 3.4.2 shows the travel time from Asunción and Villarrica, respectively, to various parts of the planning area with/without the proposed Paraguarí - Villarrica road. As compared to the 113 minutes of travel time from San Lorenzo to Villarrica along the existing National road routes 2 and 8, via Cnel. Oviedo, the travel time will be cut down to 88 minutes along the National road, route 1, and the proposed road via Paraguarí.

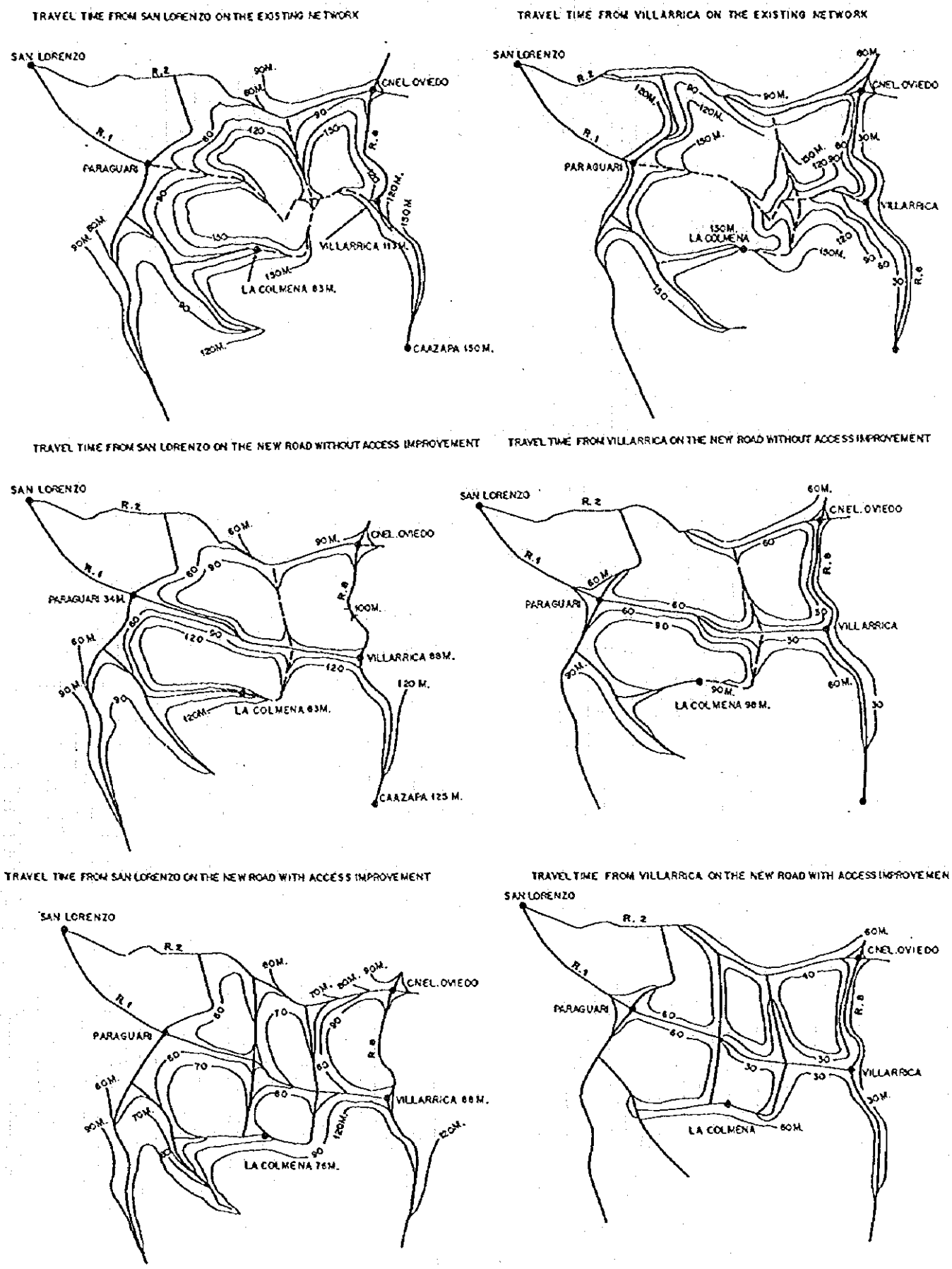


Figure 3.4.2 Travel Time With/Without the Proposed Road

vi) With the improvement of the proposed road, Villarrica and Paraguarí can be connected each other so that they are within one hour of travel. This means that the proposed road will also serve as an important regional road in the planning area.

vii) Figure 3.4.2 also indicates the travel time from Asunción and Villarrica, respectively, in the planning area with/without access road improvement. The proposed road will provide better access from the major parts of the planning area than the existing national roads from either Villarrica or Asunción. Therefore, it is very likely that the existing traffic pattern will change radically with the improvement of the proposed road in the planning area.

Although at present, the major regional traffic flows are on the existing national roads and in the districts which they access, traffic may shift to the proposed road when it is improved so that traffic in the districts will follow the pattern illustrated below.

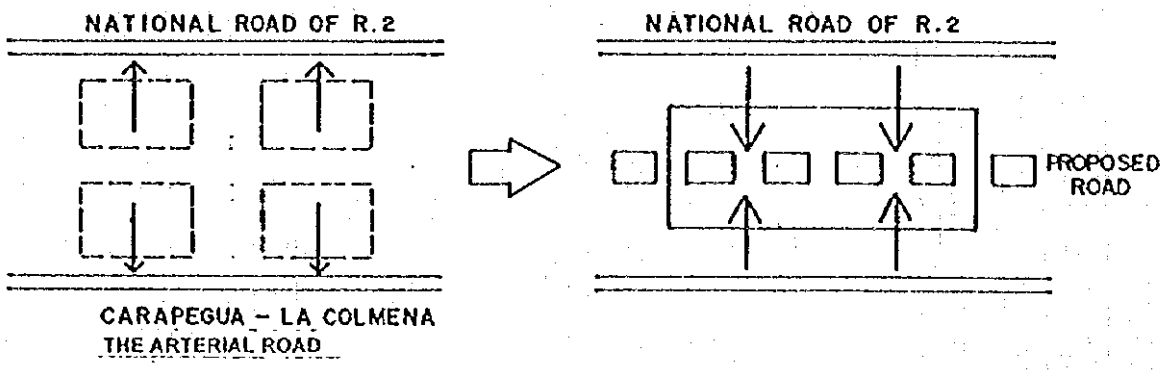


Figure 3.4.3 Change in Traffic Pattern.

This means that the proposed road will play a significant role as a regional arterial road transporting people and goods throughout the planning area and connecting with national roads 1, 2, 3, and 8.

It must finally be stressed that in order to fulfill the expected function and service defined above, that is, to improve the regional road network and support balanced regional development in this area, it will be indispensable to develop other regional, access and/or feeder (collector) roads in the near future, following the implementation of the roads proposed in the Study. In this way, all the roads, including the proposed roads, would work more effectively. In this context, establishment of a comprehensive road development program in the region following this project is recommended.

(2) Possible Effects of Road Improvement in the Planning Area

Paraguay has already experienced the great effects of road improvement on agricultural development. One example of this is the agricultural development along routes 2 and 7 between Asunción and Este, which was greatly boosted by the pavement of those national roads, making them gateways of export to Brazil. Another example is the extensive farm development of soy bean and wheat in Alto Paraná and Itapúa, which was accelerated by the opening of national road route 6. It is apparent that such great effects as in above-mentioned cases, that is, routes 2, 7, and 6 cannot be expected in the area along the proposed road.

In addition, it must be noted that the areas along the proposed road are already served by though not paved, all-weather roads, and they have already been agriculturally developed, though productivity varies. Taking into consideration of these circumstances of these areas (or districts) along the proposed road, the possible effects of road improvement in the planning area, especially in the districts along the road, can be summarized as follows:

1) Expansion of farm production

In the past, farm production was limited by lack of transport because the collectors of the agricultural products were reluctant to transport products over such poor road conditions, and therefore offered farmers generally lower prices. The new road would eliminate the transport barrier, and thereby stimulate the expansion of existing crop production. A similar change caused by a paved road in an agricultural area can be seen in La Colmena, and in the Departments of Cordillera, Caaguazú, and Itapúa.

2) Diversification of crop production

It is commonly known that since the new paved road will ensure the reliable and fast transport of products to the market, farmers will likely attempt to cultivate new crops in pursuit of greater income. Thus the new road will enhance agricultural diversification. Especially, unpaved roads are likely to damage fragile agricultural products such as fruits and vegetables in the course of transport to the market, as well as spoil them during if transport is suspended for several days due to flooding of the roads. Therefore, a paved road, all-weather road will make it possible to cultivate vulnerable products that must be of high quality to be sold on the market.

In relation with the improvement of the market system in Asunción, strongly supported by the Ministry of Agriculture and Livestock, some farmers, cooperatives based in

regions that already have a paved road, such as Colonel Oviedo and La Colmena, are studying crop diversification based on information received from urban markets. In this respect, the proposed road is expected to enhance the production of vegetables, fruits and flowers, targeting the urban markets of the capital and Este (urban-market targeted products).

3) Location of collection/shipping and storage facilities for agricultural products

One of the possibilities of the development along the proposed road will be the possibility of a new location for collection/shipping facilities of agricultural products in the planning area, since the proposed road is the region's arterial road, which is the most-convenient in the area for collecting agricultural products from the entire region, and shipping them to Asunción and other urban centers in Paraguay.

Once the quantity of products shipped from the region to the market increases, such products will naturally be transported all together. For that purpose, some collection facilities will certainly be constructed along the paved road. Such facilities are already found in the above-mentioned advanced area, and most of them are managed by the farmers, cooperatives.

The collection facility, such as described above, located along the proposed road with good access to the major points in the planning area can cover both the northern and southern parts of the planning area. Transport facilities for agricultural products can be found in the vicinity of Asunción, and along the national roads in the planning area. It can be expected that the new location of those transport/storage facilities will further stimulate the expansion of agricultural land and products, as defined above, along the proposed road.

4) New Location of Agro-Industries and Food Processing Industries

It is recommendable to promote the relocation of agro-industries and food processing facilities along the proposed road, taking into consideration the advantageous location of the planning area, its proximity to the capital of Asunción, and the fact that they have been producing in the area relatively many fruits and vegetables, which have the potential to have value added their value by agro-industrial processing. Incidentally, this direction is considered to be one of the measures for the future of agriculture here under the MERCOSUR system. The idea of the existing sugar refinery at Iturbe to open a fruit canning plant as described later is one example.

3-4-2 Regional Development Goals

In relation to the road development in the area, regional development goals should be clarified taking into consideration local features and potential.

(1) Development of an Integrated Agricultural Zone

In spite of the fact that the planning area is divided into 4 departments, it should be developed as one integrated agricultural zone for the following reasons.

i) The planning area is strategically located in front of the capital region, the country's center in various aspects, and near connecting points with the rest of the country. In other words, the location of the area is relatively preferable from the viewpoint of its relation to the market and the facility of product transport. In this respect the economy of the area is expected to develop as an integrated agricultural zone transcending administrative division.

ii) The districts in the planning area have been separately developed to date. For instance, the four departmental capitals developed independently, and the districts along route 1 and route 2 grew without being linked to each other. Integration is imperative for maximizing the development potential of the planning area. In fact, one of the major planning issues of the proposed road improvement, including the improvement of access roads, is how to connect existing urban centers, agricultural production centers, and so on. Once, the area is integrated, it will play a great role in the future development of not only agriculture but also the agro-industry, thereby contributing to the national economy.

iii) The planning area is already agriculturally developed with a considerable accumulation of people and farmland of both low and high productivity. The basic policy of agricultural development in Paraguay is the improvement/reactivating of existing farmland. It is necessary to promote intensive agricultural development in the planning area, where an integrated agricultural production/transportation system must be established. Based on this system, the preferable location, and proper diversification responding to market requirements, productivity in the area could be increased in the future, corresponding to the national policy.

(2) Promotion of Agricultural Improvement

Historically, agricultural production in Paraguay has expanded at the cost of natural/forest lands. The basic policy of the agricultural growth for the next generation will be to improve and rehabilitate existing agricultural land by taking the following measures.