CHAPTER 8
EXISTING TRAFFIC CONDITIONS

8 EXISTING TRAFFIC CONDITIONS

Various traffic surveys have been carried out in order to analyze existing traffic condition in the study area. Traffic survey location map is shown in Figure 8.1.1.

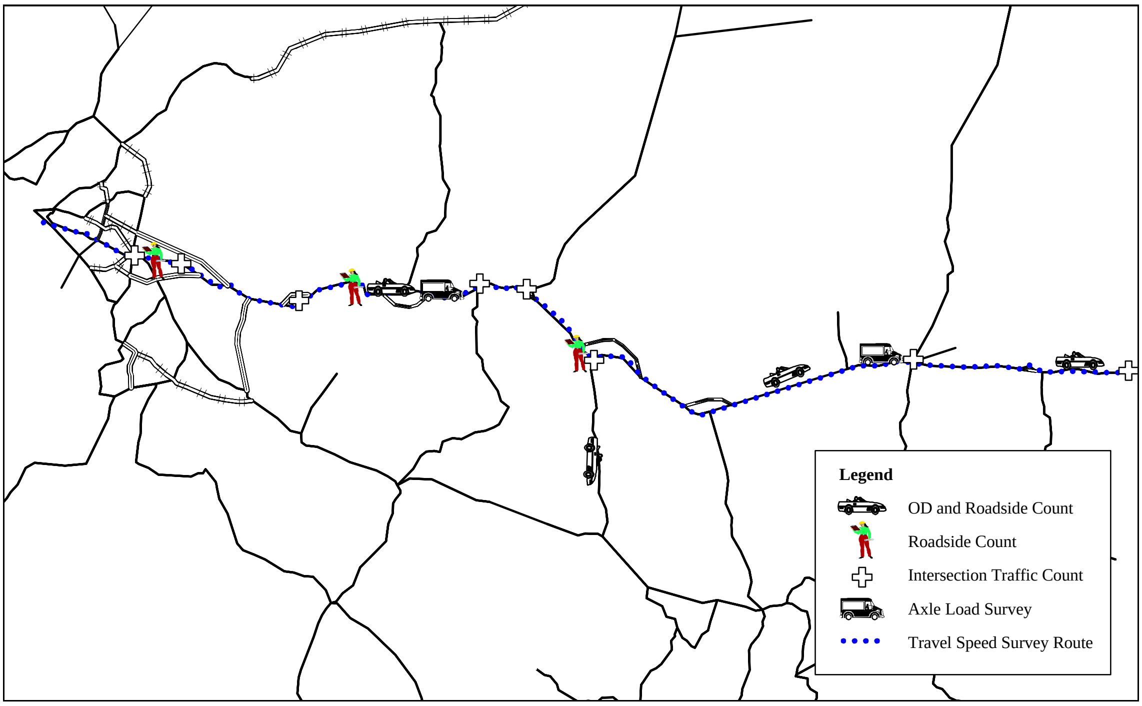


Figure 8.1.1 Traffic Survey Location Map

8.1 Roadside Traffic Count Survey

8.1.1 Result of Roadside Traffic Count

Existing traffic volume was counted at 8 locations in total and they were classified into two types; at 5 locations (same as the Roadside Origin-Destination survey locations) over a 12 hour period from 6:00 a.m. to 6:00 p.m. on a weekday, and at 3 independent locations over a 12 hour period on a weekday. Heavy Vehicle Ratio at each survey point is shown in Table 8.1.1.

Table 8.1.1 12 hours Heavy Vehicle Ratio of Roadside Count

Location Number	Location Name	No. of Heavy Vehicles	Heavy Vehicle Ratio
1	San Lorenzo –Capiatá Section	6,258	26.0%
2	Capiatá – Itauguá Section	4,047	29.4%
3	Ypacarai – Caacupe Section	3,084	40.4%
4	Eusebio Ayala – Itacurubi Section	2,440	41.7%
5	Caacupé – Piribebuy Detour Section	1,728	43.0%
6	San Jose – Cnel. Oviedo Section	2,071	44.3%
7	Cnel. Oviedo – Caaguazú Section	1,728	51.3%
8	Villarrica – Cnel. Oviedo Section	596	34.5%

8.2 Roadside OD Survey

8.2.1 Present OD Volume

A roadside Origin-Destination (OD) survey was conducted by interviewing drivers at 5 locations over a 12 hour period from 6:00 a.m. to 6:00 p.m. on a weekday. The number of samples checked is tabulated in Table 8.2.1. Vehicle movements by vehicle type obtained from the results of OD survey are illustrated under "Desired Lines" in Figure 8.2.1.

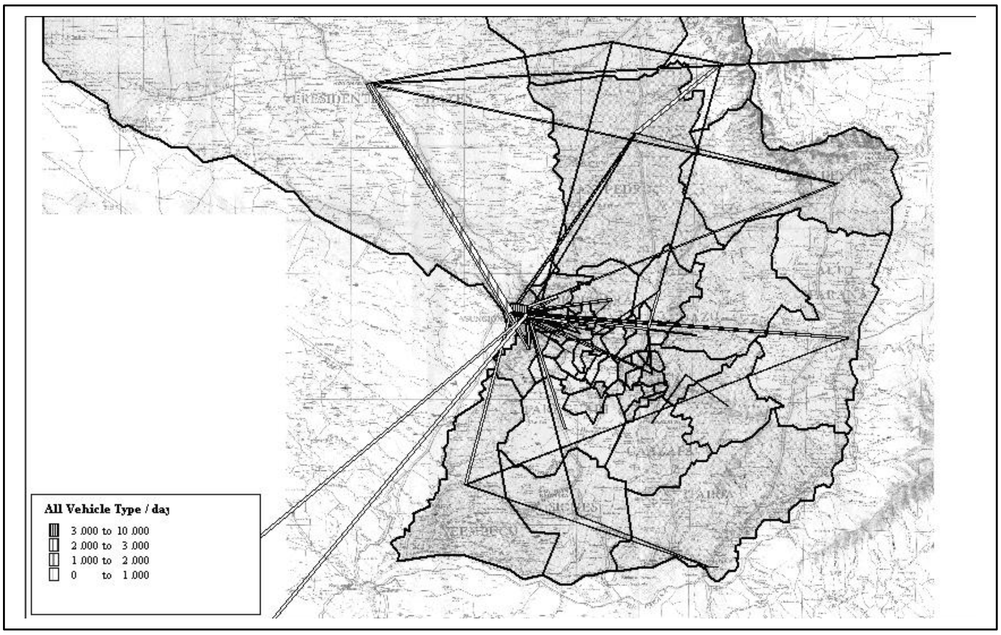


Figure 8.2.1 Desired Lines

8.2.2 Present Traffic Generation and Attraction by Vehicle Type

The present traffic generation/attraction volume by traffic zone, which was developed both by the OD survey results, roadside traffic count results, the review of "Estudio del Plan Maestro del Transporte Nacional (1992; JICA)" (hereinafter referred to as ETNA study) and "The Feasibility Study on Arterial Road Development project in the Central Eastern Area in The Republic of Paraguay (1997; JICA)" (hereinafter referred to as PARAGUARI-VILLARRICA study), is tabulated in Table 8.2.2.

Table 8.2.1 Sample Number of Roadside Origin-Destination Survey

Loc.	Dir	Survey	Coche	Bus	Truck	Total
1	de Asuncion	Count	8,724	1,230	2,032	11,986
		OD sample	—	—	—	—
		Ratio %	—	—	—	—
	a Asuncion	Count	9,128	1,317	1,679	12,124
		OD sample	—	—	—	—
		Ratio %	—	—	—	—
2	de Asuncion	Count	4,923	715	1,336	6,974
		OD sample	672	82	371	1,125
		Ratio %	13.7	11.5	27.8	16.1
	a Asuncion	Count	4,813	707	1,289	6,809
		OD sample	804	59	283	1,146
		Ratio %	16.7	8.3	22.0	16.8
3	de Asuncion	Count	2,355	457	1,174	3,986
		OD sample	—	—	—	—
		Ratio %	—	—	—	—
	a Asuncion	Count	2,187	480	973	3,640
		OD sample	—	—	—	—
		Ratio %	—	—	—	—
4	de Asuncion	Count	1,748	241	1,008	2,997
		OD sample	444	65	354	863
		Ratio %	25.4	27.0	35.1	28.8
	a Asuncion	Count	1,670	247	944	2,861
		OD sample	509	65	241	815
		Ratio %	30.5	26.3	25.5	28.5
5	de Asuncion	Count	1,196	154	752	2,102
		OD sample	—	—	—	—
		Ratio %	—	—	—	—
	a Asuncion	Count	1,096	152	670	1,918
		OD sample	—	—	—	—
		Ratio %	—	—	—	—
6	de Asuncion	Count	1,311	179	873	2,363
		OD sample	435	70	367	872
		Ratio %	33.2	39.1	42.0	36.9
	a Asuncion	Count	1,293	177	842	2,312
		OD sample	467	77	304	848
		Ratio %	36.1	43.5	36.1	36.7
7	de Cnel. Oviedo	Count	567	72	204	843
		OD sample	376	31	163	570
		Ratio %	66.3	43.1	79.9	67.6
	a Cnel. Oviedo	Count	565	79	241	885
		OD sample	425	40	146	611
		Ratio %	75.2	50.6	60.6	69.0
8	de Asuncion	Count	819	168	698	1,685
		OD sample	423	39	337	799
		Ratio %	51.6	23.2	48.3	47.4
		Count	820	153	709	1,682
		OD sample	441	63	371	875
	a Asuncion	Ratio %	53.8	41.2	52.3	52.0

Table 8.2.2 Daily Traffic Generation and Attraction in 1999

Zone No.	Zone Name	P. Car		Bus		Truck		Total	
		Generation	Attraction	Generation	Attraction	Generation	Attraction	Generation	Attraction
1.	PARAGUARI	445	277	72	34	110	123	627	434
2.	ESCOBAR	32	76	4	14	12	77	48	167
3.	SAPUCAI	43	65	4	11	11	45	58	121
4.	ACAHAY	77	90	0	33	18	6	95	129
5.	CARAPEGUA	176	181	24	14	78	43	278	238
6.	YAGUARON	169	168	0	0	78	128	247	296
7.	PIRAYU	139	235	21	46	78	100	238	381
8.	CABALLERO	15	59	16	11	9	17	40	87
9.	YBYTIMI	16	57	7	13	4	35	27	105
10.	TEBICUARY MI	37	32	4	0	26	18	67	50
11.	LA COLMENA	104	62	24	8	11	0	139	70
12.	YBYCUI	45	70	18	6	10	9	73	85
13.	VILLARRICA	327	331	71	74	482	456	880	861
14.	YATAITY	105	62	5	0	19	11	129	73
15.	MBOCAYATY	158	118	2	2	68	35	228	155
16.	NUMI	84	56	2	0	57	37	143	93
17.	SAN SALVADOR	49	48	0	7	13	24	62	79
18.	ITURBE	76	64	11	15	41	153	128	232
19.	BORJA	66	72	3	9	6	55	75	136
20.	ITAPE	33	39	7	3	29	1	69	43
21.	CORONEL MARTINEZ	31	48	0	0	14	46	45	94
22.	FELIX PEREZ CARDOZO	74	52	0	15	12	11	86	78
23.	CAACUPE	1,148	1,500	222	186	731	660	2,101	2,346
24.	EUSEBIO AYALA	498	388	35	7	352	221	885	616
25.	PIRIBEBUY	661	513	55	55	245	177	961	745
26.	ITACURUBI DE LA CORDILLERA	381	161	0	0	288	75	669	236
27.	VALENZUELA	43	50	21	15	51	68	115	133
28.	CORONEL OVIEDO	601	563	27	74	1,230	985	1,858	1,622
29.	NUEVA LONDRES	91	82	0	0	41	25	132	107
30.	SAN JOSE DE LOS ARROYOS	99	81	0	0	142	156	241	237
31.	ASUNCION	6,478	6,715	1,498	1,388	2,061	1,384	10,037	9,487
32.	CONCEPCION	140	341	81	80	1,704	1,448	1,925	1,869
33.	SAN PEDRO	241	294	98	200	1,521	2,233	1,860	2,727
34.	CORDILLERA OESTE	526	581	42	91	189	445	757	1,117
35.	CORDILLERA ESTE	343	449	251	154	386	415	980	1,018
36.	GUAIRA	314	150	21	9	310	329	645	488
37.	CAAGUAZU OESTE	25	75	0	0	142	616	167	691
38.	CAAGUAZU ESTE	432	469	24	7	712	849	1,168	1,325
39.	ITAPUA	226	205	48	30	297	287	571	522
40.	CAAZAPA ESTE	130	138	19	27	280	365	429	530
41.	ITAPUA	279	328	4	14	2,776	2,492	3,059	2,834
42.	MISIONES	5,874	5,371	157	226	1,750	1,976	7,781	7573
43.	PARAGUARI SUR	207	140	17	8	282	255	506	403
44.	ALTO PARANA	613	652	192	180	837	721	1,642	1,553
45.	CENTRAL NORTE	2,303	2,679	85	64	1,561	2,816	3,949	5,559
46.	CENTRAL SUR	682	767	54	57	699	770	1,435	1,594
47.	NEEMBUCU	62	233	11	50	263	620	336	903
48.	AMAMBAY	2,303	2,679	85	64	1,561	2,816	3,949	5,559
49.	CANINDEYU	682	767	54	57	699	770	1,435	1,594
50.	CHACO	62	233	11	50	263	620	336	903

8.3 Intersection Traffic Count Survey

8.3.1 Result of Intersection Traffic Count Survey

Existing intersection traffic volume was counted at 8 major intersections over a 12 hour period from 6:00 a.m. to 6:00 p.m. on a weekday. Heavy Vehicle Ratio at each survey intersection is shown in Table 8.3.1.

Table 8.3.1 12 hours Heavy Vehicle Ratio of Intersection Count

Intersection Number	Intersection Name	No. of Heavy Vehicles	Heavy Vehicle Ratio
1	San Lorenzo - Intersection of Roads 1 and 2	4,509	24.7%
2	Capiata – Detour to Aregua	5,589	32.7%
3	Ypacarai – Detour to San Bernardino	2,065	39.9%
4	Caacupe – Detour to Piribebuy	2,707	44.9%
5	Eusebio Ayala – City entry	1,975	38.0%
6	Itacurubi – Detour to Valenzuela	1,753	42.1%
7	Cnel. Oviedo – Rotonda of Road 7	2,904	31.1%
8	Caaguazu – Intersection of the Road to Yhú	2,728	39.2%

8.4 Travel Time Survey

8.4.1 Result of Travel Time Survey

Travel speed was examined by registering trip distance and travel time at major intersections along the target route between San Lorenzo and Caaguazu on national roads 2 and 7. One surveyor recorded the distance, by using the trip meter in his vehicle, and the time, by using his watch. This survey was carried out 3 times in each direction.
The travel time survey results are shown in Figure 8.4.1.

Figure 8.4.1 Travel Time Survey Results

8.5 Axle Load

The purposes of the Axle Load survey are to obtain data to calculate Equivalent Single Axle Load (ESAL) factors used in the design of flexible pavements. The AASHTO method was applied to calculate the ESAL factors.

8.5.1 Procedure

Procedure to determine the axle load distribution pattern is shown in Figure 8.5.1. Based on the axle load data, axle load distribution pattern by type of axle (Bus and Trucks) was established, then the axle load distribution pattern for all types of truck was developed on percentage shares of empty and loaded trucks as well as truck types. This chapter discussed axle load distribution pattern as shown in Figure 8.5.1

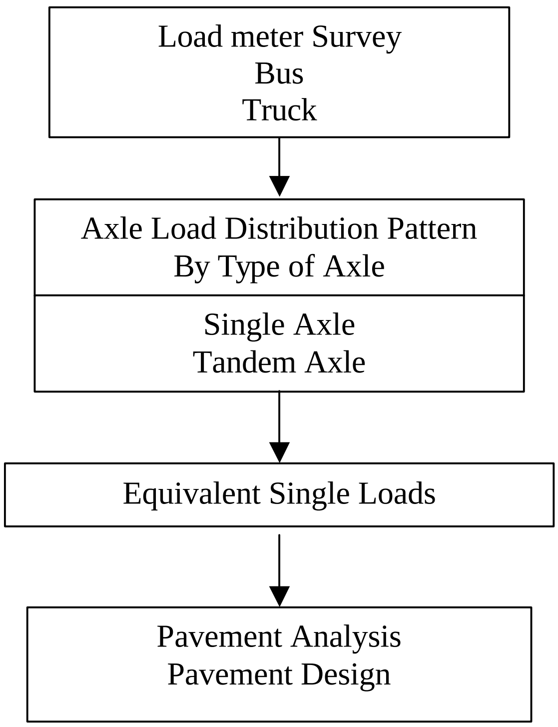


Figure 8.5.1 Procedure to Determine Axle Load

8.5.2 Axle Load Distribution Pattern by Type of Axles

As shown in Table 8.5.1, the following four(4) types of axle load distribution pattern by type of axle were developed.

Trucks (Loaded / Empty)

- Single axle load distribution pattern for 2-axle load
- Single axle distribution pattern for trucks with 3 more axles
- Tandem axle load distribution pattern

Table 8.5.1 Axle Load Distribution Pattern by Type of Axle

Vehicle type	Axle Composition	Axle Load Distribution Pattern by Type of Axle
Trucks		
2-Axle Truck	2 Single Axle	single axle load distribution
		Pattern for 2-axle truck
		(2 single-axle loads combined)
3-Axle Truck	1 Single Axle	Single axle load distribution
	1 Tandem Axle	Pattern for Truck with 3 or more axles
4-Axle truck	2 Single Axles	(All single axle loads of 3,
	1 Tandem Axle	4 & 5 axle truck combined)
5-Axle truck	1 Single Axle	Tandem axle load distribution
	2 Tandem Axles	Pattern
		(All tandem axle load of 3,4 and
		5 axle trucks combined)
Buses		Single axle load distribution pattern
All type		

8.5.3 Survey Results

The information collected in the survey forms was tabulated by vehicle type and the weight for each axle was inputted. The axles were then grouped according to the recommended AASHTO weight groupings and the total number of axles in each group was calculated. The average weight of the group was also calculated. Using the AASHTO Traffic Equivalency Factor tables, the prorated factor was obtained for each group. Then the 18kips ESAL was calculated for each group and the ESAL factor for each vehicle type was established. Table 8.5.2 shows truck factors.

Table 8.5.2 Axle Load Equivalency Factors

Survey Station	Direction	Tuck Factor			
		2· Axle Truck	3· Axle Truck	Trailer	All Trucks
Km 66	1	1.003 (54%)	0.727 (21%)	3.730 (25%)	1.625 (51%)
	2	0.344 (60%)	2.485 (10%)	2.735 (30%)	1.274 (49%)
Km 123	1	1.142 (48%)	2.352 (28%)	4.013 (24%)	2.169 (47%)
	2	0.251 (41%)	2.121 (12%)	4.511 (47%)	2.476 (53%)

8.6 Observation on Factors Affecting Traffic Flow

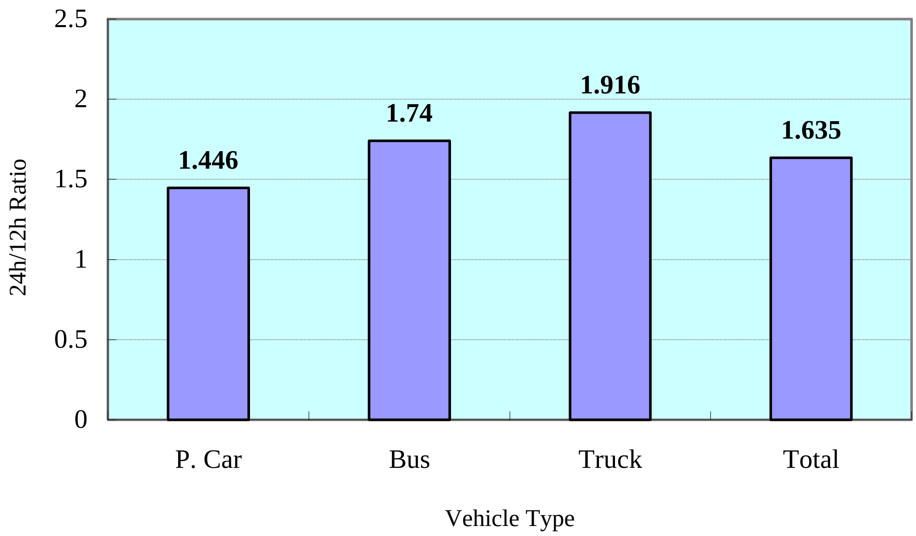
8.6.1 Present Traffic Condition on Target Route

Demand forecasting process is based on 24 hour annual average traffic. Then 12 hour traffic volume is required to convert 24 hour annual average traffic volume. In this study, the 12 hour traffic volume was converted by permanent traffic count point data of M.O.P.C-O.P.I.T and survey data of "Paraguarí-Villarrica" study. These data are shown in Table 8.6.1, Figure 8.6.1 and Figure 8.6.2. 24 hour annual traffic volume on target route is shown in Figure 8.6.3.

Table 8.6.1 24h/12h Traffic Volume Ratio on National Road 2 at San Jose

	Item	P. Car	Bus	Truck	Total
Both	24h Volume	2,495	468	2,042	5,005
	12h Volume	1,726	269	1,066	3,061
	24h/12h Ratio	1.446	1.740	1.916	1.635

Source by "Paraguarí-Villarrica study"



by "The Feasibilityu Study on Arterial Road Development Project in the Central Eastern Area in the Republic of Paraguay (1996; JICA)

Figure 8.6.1 24h/12h Traffic Volume Ratio on National Road 2 at San Jose

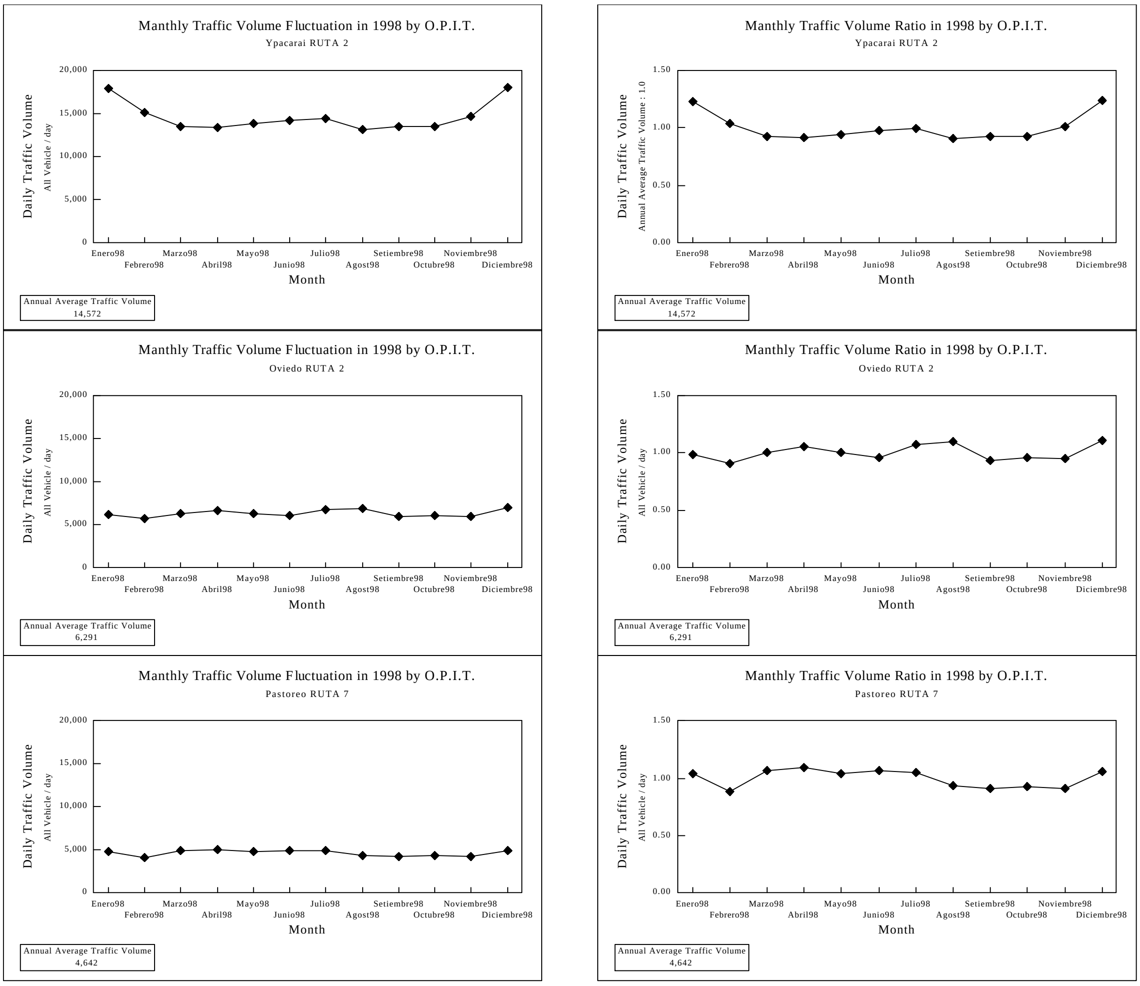


Figure 8.6.2 Annual Traffic Volume Fluctuation on Target Route

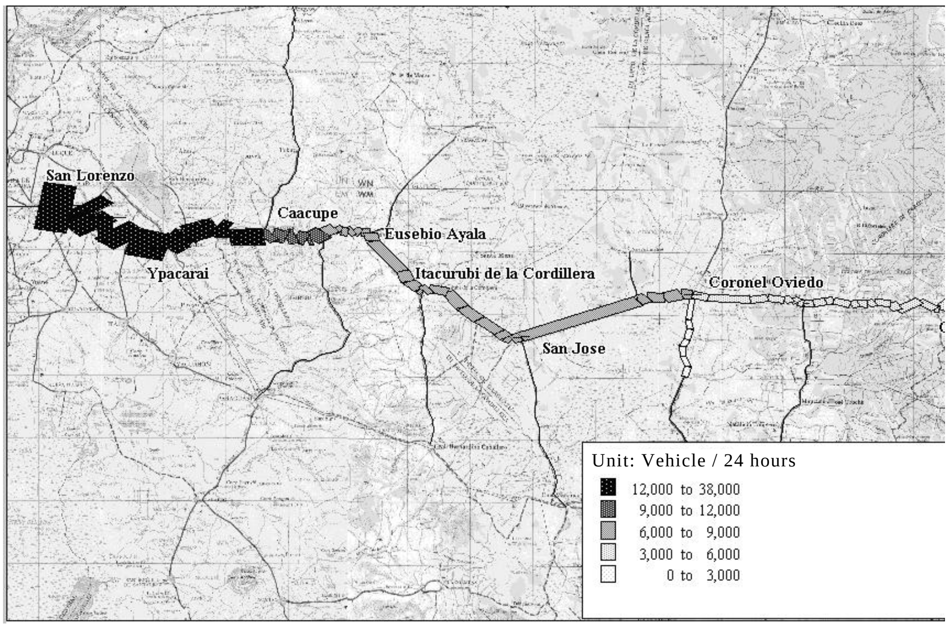


Figure 8.6.3 24 hours Annual Average Traffic

8.6.2 Characteristics of Present Traffic Conditions on Target Route

Existing traffic could be classified into three types; between San Lorenzo and Ypacarai, Ypacarai and Cnel. Oviedo, Cnel. Oviedo and Caaguazu. The characteristics were as follows.

(1) San Lorenzo - Ypacarai

The target route is basically an inter city route connecting the metropolitan area and Ciudad del Este. But the traffic in this section is not only inter-city traffic. It includes commuting traffic between CBD area and residential areas. The reason is as follows;

1) Traffic volume is higher than other sections.
2) Heavy vehicle volume is less than other sections.
3) High density residential area has moved from CBD towards San Lorenzo in the last few years.

The daily volume of traffic in the built-up area of San Lorenzo is currently 38,000, and it decreases on the section between San Lorenzo and Ypacaraí, or 28,000. This difference mostly stems from commuter traffic generated and attracted by the built-up area of San Lorenzo. Although the traffic is mainly inter-city in character, in-in and in-out traffic of this zone account for 40% of the total. This zone contains highly urbanized areas, and further housing developments will lead to an increase in access traffic and access points along the national route.

The peak hour of the inter-city traffic is around seven o'clock in the morning, but the peak rate is actually rather small or 6.3%. The direction distribution during peak hours is 55/45, which means that the traffic flow is characterized as an urban type. On the other hand, however, the truck ratio is found to be high, or 30.1% for the daily average and 22.6% during peak hours. These characteristics show that the section can be classified as an inter-city trunk road.

(2) Ypacaraí - Cnel. Oviedo

The characteristics of this section are moderate between the San Lorenzo - Ypacarai section and the Cnel. Oviedo - Caaguazu section.
The farther away from Asuncion, Ypacaraí – Caacupé, Caacupé- Desvio a Piribebuy, Eusebio Ayala – Itacurubí, Capiatá – Itauguá, and San Jose – Cnel. Oviedo, the lower the traffic volume becomes, from 23,000 to 8,000. To the contrary, the truck ratio increases from 35% to 51%. Peak traffic occurs between 2:00 to 4:00 p.m., and the peak rate ranges from 5.8% to 6.6%. The direction distribution during peak hours is 60/40 in San Jose and 58/42 in Capiatá, and they show a significant disparity. In other areas, however, it is 52/48, the difference is rather small.

Ratios of nighttime traffic to 12-hour daytime of truck, bus, and auto are relatively high, or 0.91, 0.74, and 0.45, respectively. This implies that the road improvement plan needs to take into account safety during the night.

Those intersections in urbanized areas contain local traffic and thus show lower truck ratios, ranging from 37 to 50%, than the inter-city sections. However, the absolute number of trucks is still significant. Peak traffic occurs between 3:00 to 5:00pm, and the peak rate is 6.1 to 7.1%.

Since inter-city traffic is usually long-distance, road improvements require considerations for long-distance freight transport.

The cities along National Route 2 are developed mostly on roadside areas. There are many access roads to Route 2, and they have narrow road widths. The lateral clearance of road traffic is also small. In two-lane roads in CBDs, the traffic capacity at the service level of D is only 1,400PCU. With the existing traffic volume, the capacity is easily saturated, and thus it is necessary to take some measures to resolve this problem.

Roads on rolling terrain do not have large cuts or embankment structures, and their vertical alignments simply follow natural terrain. Because of this, there are sections where topographic features negatively affect the traffic capacity of roads. Currently, this poses little problem, but in future when traffic volume increases, it will be necessary to increase the road capacity.

(3) Cnel. Oviedo - Caaguazú

The traffic in this section is mainly inter city traffic. The reason is as follows;

1) Traffic volume is lower than in other sections.
2) Heavy vehicle volume is higher than other sections.
3) Cargo vehicle volume ratio is higher in heavy vehicle traffic.

In this section, the daily volume of traffic is between 3,000 to 6,000, many of which are long-distance trips. The composition of trucks is relatively high and accounts for 40.5 to 57.9%. Peak traffic occurs from 4:00 to 5:00 p.m., and the peak rate is rather low, ranging from 6.7% to 7.1%.

The direction distribution during peak hours remains at a similar level throughout the section, or 52/48. Like the section between Ypacaraí and Cnel. Oviedo, the ratio of nighttime to daytime traffic is fairly significant, and thus it is necessary to take some measures to insure safety during nighttime as well.

The right-of-way is reserved for about 100m in width even in urban areas. There are almost no factors that pose constraints to traffic capacity in this section, and it is not difficult to secure the capacity of handling 2,400 vehicles per day. However, the vertical alignment of the sections on rolling terrain has been designed without correcting the natural topography, and there are sections where steep slopes lower the road capacity. It is important, therefore, to prepare for an increase in future traffic volume and insure the safety of long-distance operations of heavy trucks.

At intersections in the cities along Route 7, local traffic is added to inter-city traffic, and the volume reaches 1,100 to 1,500. This is over three times more than the volume on the inter-city sections, and many urban places are congested on a daily basis. Peak hours in the cities are between 4:00 to 5:00 p.m., and the rate ranges from 5.9% to 6.3%. The truck ratio during the peak hours is as high as 31.8% to 38.7%. It is thus critical to improve those intersections by taking into account large vehicles, traffic accidents, and daily local traffic.

8.7 Level of Service by Road Section and Intersection

8.7.1 Present Service Level on Target Route

The level of service by road section is almost reasonable excluding some inner city area sections. This has been confirmed by the travel time survey results. The target route is almost able to pass traffic at more than 60 km/h. The speed is reduced only in some city area sections to 50 km/h and 60 km/h.

The level of service at intersections are also not so bad. The main direction is of course along national roads 2 and 7, but cross traffic is quite low compared to the main direction volume. This has been confirmed by an intersection traffic count survey.