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THE STUDY OF ROAD IMPROVEMENT
BETWEEN SANTA BARBARA AND BELLA VISTA
IN
THE REPUBLIC OF BOLIVIA

FINAL REPORT

VOLUME II
(ECONOMY, TRANSPORTATION AND ECONOMIC EVALUATION)

MARCH 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

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The Study of Road Improvement
between Santa Bárbara and Bella Vista

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A. SOCIO-ECONOMIC ANALYSIS

A. SOCIO-ECONOMIC ANALYSIS

A.1 Existing Conditions in Bolivia

A.1.1 Population

(1) Population in Bolivia

A population census was carried out in Bolivia in 1950 and 1976, however, since 1976 no further surveys have been undertaken. As a result, it hasn't been possible to determine the precise size of the population since 1977. However, as the INE (Instituto Nacional de Estadística) has estimated the existing population each year together with a small size of supplementary survey, the analysis on the population in recent years has been performed based on the INE data. According to the population information from the INE, as shown in Table A.1-1, the total population in Bolivia was about 6.4 million in 1985. This has increased at an average annual growth rate of 2.8 percent since 1980. The annual growth rate of the population in urban areas and rural areas during the same period was 4.3 percent and 1.6 percent, respectively. As a result, the share of urban population had increased to 47.7 percent in 1985, up from 44.4 percent in 1980, however, the number of people living in rural area was still larger than that living in urban areas.

Table A.1-1 Population in Bolivia (1980 - 1985)
(Unit : Person)

Year	Total	Urban	Rural
1980	5,599,592 (100%)	2,488,628 (44.4%)	3,110,964 (55.6%)
1981	5,755,072 (100%)	2,595,237 (45.1%)	3,159,835 (54.9%)
1982	5,915,844 (100%)	2,706,626 (45.8%)	3,209,218 (54.2%)
1983	6,081,722 (100%)	2,822,546 (46.4%)	3,259,176 (53.6%)
1984	6,252,720 (100%)	2,942,944 (47.1%)	3,309,776 (52.9%)
1985	6,429,226 (100%)	3,068,051 (47.7%)	3,361,175 (52.3%)
Average Growth Rate 1980-1985	2.8%	4.3%	1.6%

Source : INE

(2) Population by Department

Population by department is shown in Table A.1-2. Among the nine departments, Santa Cruz shows the highest growth at 3.6 percent, followed by Pando with the growth rate of 3.4 percent during 1980 - 1985. La Paz which includes the Bolivian capital (La Paz city), shows a 3.0 percent growth rate, however, the population in La Paz is the largest among the nine departments. As of 1985, its population was 2.1 million, followed by Santa Cruz with a population of 1.0 million.

The size of the population in the capital city, La Paz, (not shown in Table A.1-2) was about 992,600 in 1985, which accounted for 15.4 percent of the total Bolivian population. The second largest city was Santa Cruz (441,700), and the third was Cochabamba (317,300).

(3) Population in 1989

The population in 1989 (the year of this study) was estimated on the basis of the growth rate indicated in "Estrategia de Desarrollo Económico y Social 1989 - 2000" (Ministerio de Planeamiento y Coordinación).

According to the above mentioned report, population by department in 1988 and its annual average growth rate from 1988 to 2000 were estimated for both urban and rural areas, therefore, population by department in 1989 was estimated by multiplying population in 1988 by the growth rate. Table A.1-3 shows the estimated population by department in 1989.

Table A.1-2 Population by Department

Department	(Unit: Person)							Growth Rate (%)
	1980	1981	1982	1983	1984	1985		
La Paz (%)	1800269 32.2	1854060 32.2	1913184 32.2	1969261 32.4	2029008 32.5	2091429 32.5	2091429 32.5	3.0
Cochabamba (%)	864577 15.4	886281 15.4	908674 15.4	931112 15.3	954790 15.3	979171 15.2	979171 15.2	2.5
Chuquisaca (%)	422209 7.5	429904 7.5	436406 7.4	446398 7.3	454573 7.3	462904 7.2	462904 7.2	1.8
Oruro (%)	367893 6.6	376382 6.5	385121 6.5	394096 6.5	403301 6.5	412756 6.4	412756 6.4	2.3
Potosí (%)	788983 14.1	805710 14	823485 13.9	841102 13.8	859749 13.7	878232 13.7	878232 13.7	2.2
Santa Cruz (%)	879136 15.7	910452 15.8	942986 15.9	976725 16.1	1011690 16.2	1047964 16.3	1047964 16.3	3.6
Tarija (%)	232383 4.1	239411 4.2	246691 4.2	254216 4.2	261989 4.2	270027 4.2	270027 4.2	3.0
Beni (%)	204385 3.6	211211 3.7	217703 3.7	225024 3.7	231976 3.7	239810 3.7	239810 3.7	3.2
Pando (%)	39757 0.7	40861 0.7	42584 0.7	43788 0.7	45645 0.7	46933 0.7	46933 0.7	3.4
Total (%)	5599582 100	5765072 100	5915944 100	6061722 100	6252721 100	6429226 100	6429226 100	2.8

Source: INE

Table A.1-3 Population by Department in 1989

	Population (1988)* (1,000 persons)			Growth Rate (1988-2000)** (%)			Population (1989)*** (1,000 persons)		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
La Paz	1145.3	1033.9	2179.2	3.7	1.4	2.7	1187.6	1047.9	2235.5
Cochabamba	462.8	599.1	1061.9	4.2	1.6	2.8	482.1	608.5	1090.6
Chuquisaca	130.7	396.5	527.2	3.1	1.7	2.1	134.8	403.3	538.1
Oruro	210.2	181.2	391.4	2.0	1.2	1.6	214.4	183.3	397.7
Potosi	251.5	628.1	879.6	1.8	1.0	1.2	255.9	634.3	890.2
Santa Cruz	877.4	457.0	1334.4	6.3	1.5	4.9	932.6	463.7	1396.3
Tarija	124.2	163.4	287.6	4.2	1.3	2.6	129.4	165.5	294.9
Beni	163.8	116.4	280.2	5.2	1.0	3.7	172.3	117.6	289.9
Pando	6.5	44.5	51.0	4.2	0.2	0.8	6.8	44.6	51.4
Total	3372.4	3620.1	6992.5				3515.9	3668.7	7184.6

* ** "Estrategia de Desarrollo Economico y Social 1988-2000" (Ministerio de Planeamiento y Coordinacion)

*** Estimated by Study Team

The population in 1989 was estimated to be 7.2 million, of which 3.5 million (49 percent) live in the urban areas and the remaining 3.7 million (51 percent) which live in rural areas. Comparing the population of 1980, 1985, and 1989 in Tables A.1-3 and A.1-4, the recent change in the population growth rate can be obtained. The average growth rate of the total population between 1985 and 1989 shows an identical figure of 2.8 percent between 1980 and 1985, however, the growth rate by department differed considerably from the estimated growth rate by INE, which indicates that the future population growth pattern by department diverges from the existing pattern.

Looking at population growth changes in Table A.1-4, the population growth rate in urban areas is 1.3 percent higher than that in rural areas. As for the departmental population growth, Santa Cruz shows the highest growth rate of 7.4 percent, in particular, the population growth rate of urban area in this region is 10.6 percent. Beni follows with a growth rate of 4.9 percent (the growth rate in the urban area is 7.2 percent). The population growth rate of La Paz was 1.7 percent, of which the population has been estimated to be about 2.2 million. On the other hand, in Oruro and Potosi, the urban population decreased 2.9 percent and 2.8 percent, respectively, reflecting the decline in the mining industry.

Table A.1-4

Population in 1985 and 1989

Unit: Population thousand
Growth Rates %

Departament	1985			1989			Growth Rate (1985 - 1989)		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
La Paz (%)	1127.5	964.0	2091.5	1187.6	1047.9	2235.5	1.3	2.1	1.7
	35.6	27.9	32.0	33.8	28.6	31.1			
Cochabamba (%)	420.8	558.3	979.1	482.1	608.5	1090.6	3.5	2.2	2.7
	13.3	16.1	15.0	13.7	16.6	15.2			
Chuquisaca (%)	114.7	348.2	462.9	134.8	403.3	538.1	4.1	3.7	3.8
	3.5	10.1	7.1	3.8	11.0	7.5			
Oruro (%)	240.8	172.0	412.8	214.4	183.3	397.7	-2.9	1.6	-0.9
	7.5	5.0	6.3	6.1	5.0	5.5			
Potosi (%)	286.9	591.3	878.2	255.9	634.3	890.2	-2.8	1.8	0.3
	9.1	17.1	13.5	7.3	17.3	12.4			
Santa Cruz (%)	623.0	425.0	1048.0	932.6	463.7	1396.3	10.6	2.2	7.4
	19.7	12.3	16.1	26.5	12.6	19.4			
Tarija (%)	118.6	151.4	270.0	129.4	165.5	294.9	2.2	2.3	2.2
	3.7	4.4	4.1	3.7	4.5	4.1			
Beni (%)	130.7	109.1	239.8	172.3	117.6	289.9	7.2	1.9	4.9
	4.1	3.2	3.7	4.9	3.2	4.0			
Pando (%)	5.0	42.0	47.0	6.8	44.6	51.4	8.0	1.5	2.3
	0.2	1.2	0.7	0.2	1.2	0.7			
Total	3068.0	3361.3	6429.3	3515.9	3668.7	7184.6	3.5	2.2	2.8

Source: Population 1985 INE

1989 Estimated by Study Team

A.1.2 Employment

It is more difficult to gauge the number of employed than the population. The report "Estrategia de Desarrollo Económico y Social 1989 - 2000" estimated the number of employed from 1980 to 1986, however, compared with the total population, it is understood that the number was assumed to be about 30 percent of the total population as indicated in Table A.1-5.

Table A.1-5 Employment and Rate of Employment

Year	Population* (1,000 persons)	Employment** (1,000 persons)	Percentage of total population employed (%)
1980	5599.6	1736.7	31.0
1981	5755.1	1781.3	31.0
1982	5915.8	1805.3	30.5
1983	6081.7	1829.1	30.1
1984	6252.7	1881.4	30.1
1985	6429.2	1928.7	30.0
1986	6609.2	1983.4	30.0

* Source INE

** Source Estrategia de Desarrollo Económico y Social (1989 - 2000)

Assuming that the number of employed in 1989 is 30 percent of the population in 1989 (7,184,600), the number of employed in 1989 is estimated to be 2,155,400. The average growth rate in employment from 1980 - 1989 was found to be 2.4 percent, the same as the growth in total population. According to the above same report, employment by sector during 1980 to 1986 is estimated as shown in Table A.1-6.

Table A.1-6 shows that employment in primary and tertiary sectors has been increasing, on the other hand, employment in secondary sectors has been decreasing due to the drastic deduction of workers in the construction industry, and a ramification of the stagnated domestic economic during 1983 to 1985. However, comparing employment in 1985 with that in 1986, the latter shows a tendency of increasing.

From the fact that about half of the employed work in the agricultural sector, it can be said that Bolivia still is

an agricultural society.

With the growth rate between 1984 - 1986 listed in the far right column of Table A.1-6, the structure of employment by sector in 1989 was estimated, and is shown in Table A.1-7. According to this estimation, the share of the primary, secondary, and tertiary industries were 52.9, 10.2, and 36.9 percent, respectively.

Table A.1-6
Employment by Sector

Unit: Employment thousand
Growth Rate

	1980	1981	1982	1983	1984	1985	1986	80-86	84-86
PRIMARY									
-Agriculture (%)	884.1	907.7	918.4	953.5	965.7	1021.7	1042.7	2.8	3.9
-Mining (%)	50.9	51.0	50.9	52.1	51.3	52.9	52.6		
-Petroleum (%)	807.7	825.6	837.8	867.3	875.2	934.1	972.1	3.1	5.4
	48.5	46.4	48.4	47.4	46.5	48.4	49.0		
	69.5	75.3	72.9	77.6	81.3	78.1	60.9	-2.2	-14.0
	4.0	4.2	4.0	4.2	4.3	4.0	3.1		
	6.9	6.8	7.6	8.6	9.2	9.5	9.7	5.8	2.7
	0.4	0.4	0.4	0.5	0.5	0.5	0.5		
SECONDARY									
-Manufacture (%)	281.3	271.1	231.8	232.3	239.7	225.7	233.7	-3.0	-1.3
-Construction (%)	16.2	15.2	12.8	12.6	12.8	11.7	11.8		
-Electricity (%)	178.9	179.7	184.5	163.7	169.1	168.2	173.4	-0.5	1.3
	10.3	10.1	9.1	8.9	9.0	8.7	8.7		
	95.5	84.1	59.8	60.4	61.9	48.2	50.6	-10.0	-9.6
	5.5	4.7	3.3	3.3	3.3	2.5	2.6		
	6.9	7.3	7.6	8.2	8.7	9.3	9.7	5.8	5.6
	0.4	0.4	0.4	0.4	0.5	0.5	0.5		
TERTIARY									
-Transportation (%)	571.3	602.5	658.3	643.3	675.9	681.4	707.1	3.6	2.3
-Commerce (%)	32.9	33.8	36.3	35.1	35.9	35.4	35.7		
-Finance (%)	93.8	100.5	103.2	103.2	104.0	107.2	110.3	2.7	3.0
	5.4	5.6	5.6	5.6	5.5	5.6	5.6		
	128.5	132.2	136.1	137.4	141.1	142.9	152.7	2.9	4.0
	7.4	7.4	7.5	7.5	7.5	7.4	7.7		
	10.4	14.4	14.8	15.5	16.0	17.0	17.7	9.3	5.2
	0.6	0.8	0.8	0.8	0.9	0.9	0.9		
-Others (%)	338.6	355.4	404.2	387.2	414.8	414.3	426.4	3.9	1.4
	19.5	20.0	22.4	21.2	22.0	21.5	21.5		
TOTAL	1736.7	1781.3	1808.5	1829.1	1881.3	1928.8	1983.5	2.2	2.7

Source: IINE

Table A.1-7 Employment in 1989

Sector	Employment (1,000 persons)	Share (%)
PRIMARY	1140.2	52.9
Agriculture	1070.1	49.7
Mining	58.2	2.7
Petroleum	11.9	5.5
SECONDARY	220.6	10.2
Manufacture	170.6	7.9
Construction	38.1	1.8
Electricity	11.9	5.5
TERTIARY	794.3	36.9
Transportation	121.7	5.6
Commerce	167.6	7.8
Finance	23.5	1.1
Others	481.8	22.4
TOTAL	2155.1	100.0

Source : "Estrategia de Desarrollo Economico y Social (1989 - 2000)

A.1.3 Number of Vehicles Registered

As shown in Table A.1-8, the number of vehicle registered has steadily increased to 275,000 in 1988 from 146,000 in 1980. The growth rate of the total number of vehicles indicates a figure of 8.3 percent during that period, however, the growth rate during 1985 - 1988 was slightly decreased, down to 7.9 percent due to a considerable deduction in motorbikes and a slight deduction in the number of official government cars. Excluding motorbikes, the growth rate increased to 11.3 percent during the same period.

Among all vehicles registered, the number of passenger cars account for 29.6 percent (82,000) in 1988, which has been increasing from 21.1 percent in 1980. The number of truck has also increased to 40,000 in 1988 from 20,000 in 1980. On the other hand, the number of motorbikes has decreased to 37,000 in 1988 from 55,000 in 1985.

Table A.1-8

Total Number of Vehicles Registered by Type of Vehicle

Unit: The number of vehicles

Vehicles %

	Growth Rate										Growth Rate	
	1980	1981	1982	1983	1984	1985	1986	1987	1988	80-88	85-88	
Passenger Car	30787 21.1	37703 23.1	40638 22.9	43050 23.1	46086 23.7	58441 26.7	68806 26.7	—	81568 29.6	13.0	11.8	
Wagon	25983 17.8	26981 16.5	27063 15.2	27542 14.8	28124 14.4	28819 13.2	33925 13.1	—	41540 15.1	6.0	13.0	
Truck	20137 13.8	21851 13.4	22670 12.8	24182 13	25978 13.3	29281 13.4	34476 13.4	—	40105 14.6	9.0	11.1	
Jeep	10281 7.0	11346 7.0	12174 6.8	12782 6.9	13318 6.8	14577 6.7	17159 6.7	—	19480 7.1	8.3	10.1	
Station Wagon	9096 6.2	11670 7.2	14153 8.0	15676 8.4	18837 8.6	22333 10.2	26292 10.2	—	32155 11.7	17.1	12.9	
Bus	6485 4.4	7066 4.3	8988 5.1	9220 5.0	9378 4.8	9466 4.3	11145 4.3	—	14128 5.1	10.2	14.3	
Motorbicycle	35346 24.2	38434 23.6	43054 24.2	44524 23.9	45698 23.5	46723 21.3	55009 21.3	—	37487 13.6	0.7	-7.1	
Official Car	7900 5.4	8094 5.0	9054 5.1	9233 5.0	9355 4.8	9485 4.3	11173 4.3	—	9002 3.3	1.6	-1.7	
Tractor	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	2 0.0	0 0.0	—	5 0.0		35.7	
Total	146015	163145	177794	186209	194774	219127	257985	—	275470	8.3	7.9	

Source: Command Department of Police

Not available

Looking at the distribution of vehicles registered by department in Table A.1-9, La Paz and Santa Cruz account for 29.4 (80,900) and 29.2 percent (80,400), respectively. Cochabamba is followed with 24.7 percent. The growth rate from 1980 to 1988 is seen to be highest in Santa Cruz (13.4 percent), however, from 1985 to 1988 Cochabamba recorded the highest rate of 14.1 percent.

On the other hand, the number of vehicles per 1000 people has increased to 39.4 in 1988 from 26.1 in 1980 as shown in Table A.1-10. Among the departments, Cochabamba shows the highest of 64.0, followed by Santa Cruz with 60.3. Compared the figure of 39.4 in 1988 with other South American countries, the figure is considerably lower than Argentina (171.9 vehicles per 1000 population) and Chile (74.8), however, it is almost the same as Colombia (43.0).

A.1.4 Economy

(1) Gross Domestic Products (GDP)

The Bolivian economy recorded a negative growth through 1981 to 1986 from the viewpoint of gross domestic product (GDP) as shown in Table A.1-11. During these five years the GDP decreased by 14 percent to Bs 107,211 thousand from Bs 124,083 thousand (at a 1980 base price). Since 1986 the Bolivian economy has started to recover gradually and recorded a growth rate of 2.1 percent in 1987 and 3 percent in 1988, however, production has not reached the 1980 levels yet. According to the report "Evaluación Económica 1987", the government planned a target growth rate of 3 percent for the year of 1987, however, the actual growth rate was 2.1 percent. Judging from the significant past slump in the Bolivian economy, a lower actual growth rate of 1987 than the target rate could be said not to be unfavorable.

Looking at the Bolivian economy by sector in the same Table A.1-11, the agricultural sector can be seen to account for 22 percent of GDP in 1988. The share of the agricultural sector increased to 24.3 percent in 1985 from 18 percent in 1980, but, it has been gradually decreasing during the recent past four or so years. On the other hand, the share of the manufacturing sector decreased to 9.8 percent in

Table A.1-9 Number of Vehicles Registered by Department

	(Unit: Vehicle)										Growth Rate	
	1980	1981	1982	1983	1984	1985	1986	1987	1988	80-88	85-88	
	(Unit: Growth Rate %)											
La Paz	55685	60736	63546	65081	66555	71666	75688	---	80967	4.8	4.2	
Santa Cruz	29449	35792	40579	45318	50487	61778	73368	---	80430	13.4	9.2	
Cochabamba	32825	36305	37458	38314	39167	45792	67612	---	68012	9.5	14.1	
Oruro	8374	9181	11251	11522	11683	12023	12403	---	13141	5.8	3.0	
Potosi	5346	5707	6891	7151	7273	7477	7615	---	7783	4.8	1.3	
Chuquisaca	4221	4700	5724	5894	6092	6380	6710	---	8546	9.2	10.2	
Tarija	4873	4947	5744	5877	6019	6158	6534	---	7184	5.0	5.3	
Beni	5206	5728	6107	6395	6604	6913	7078	---	8331	6.1	6.4	
Pando	36	49	494	657	794	940	977	---	1076	52.9	4.6	
Total	146015	163145	177794	186209	194774	219127	257985	---	275470	8.3	7.9	

Source: Command Department of Police
 --- : Not available

Table A.1-10 Number of Vehicles Registered per 1000 persons

	1980			1985			1988		
	Number of Vehicles Registered	Population (Unit 1000)	Number of Vehicles Registered/Population	Number of Vehicles Registered	Population (Unit 1000)	Number of Vehicles Registered/Population	Number of Vehicles Registered	Population (Unit 1000)	Number of Vehicles Registered/Population
La Paz	55685	1800	30.9	71666	2091	34.3	80967	2179	37.2
Santa Cruz	29449	879	33.5	61778	1048	58.9	80430	1334	60.3
Cochabamba	32825	864	38.0	45792	979	46.8	68012	1062	64.0
Oruro	8374	368	22.1	12023	413	29.1	13141	391	33.6
Potosi	5346	789	6.8	7477	878	8.5	7783	880	8.8
Chquisaca	4221	422	10.0	6380	463	13.8	8546	527	16.2
Tarija	4873	232	21.0	6152	270	22.8	7184	288	24.9
Beni	5206	204	25.5	6913	240	28.8	8331	280	29.8
Pando	36	40	0.9	940	47	20	1076	51	21.1
Total	146015	5598	26.1	219121	6429	34.1	275470	6992	39.4

Unit: Number of Vehicles
 Population: 1,000 persons
 Number of vehicles registered/population vehicle/1,000 persons
 Command Department of Police

Table A.1-11

Gross Domestic Products by Sector

Unit: Bs.100,000 at base year of 1980

	1980	1981	1982	1983	1984	1985	1986	1987	1988	Growth Rate	
										80-88	86-88
PRIMARY	41970	42493	43428	36595	40887	41073	37596	37738	39652	-0.7	2.7
-Agriculture (%)	34.2	34.2	36.6	34.8	37.0	37.1	35.0	34.5	35.2	1.4	-0.6
-Petroleum (%)	22563	22354	23900	19981	24552	26789	25534	25483	25204	0.3	3.1
-Mining (%)	6728	7072	7476	6838	6869	6735	6468	6564	6881	-5.2	16.3
	5.5	5.7	6.3	6.2	6.2	6.1	6.0	6.0	6.1		
	12679	13067	12050	11776	9466	7549	5594	5681	7567		
	10.3	10.5	10.2	10.6	8.6	6.8	5.2	5.2	6.7		
SECONDARY	22495	20639	18229	17502	15480	14083	13956	14318	15276	-4.7	4.6
-Manufacture (%)	18.3	16.7	15.3	15.8	14.0	12.8	13.0	13.0	13.6	-4.8	4.9
-Construction (%)	17974	16581	14531	13863	10925	10915	11038	11423	12142	-4.5	3.6
	14.6	13.4	12.2	12.5	10.8	9.9	10.3	10.4	10.8		
	4521	4058	3698	3639	3555	3168	2918	2895	3134		
	3.7	3.3	3.1	3.3	3.2	2.9	2.7	2.6	2.8		
TERTIARY	58481	60951	57019	54846	54244	55380	55659	57423	57562	0.3	1.8
-Electricity (%)	47.7	49.0	48.0	49.4	48.9	50.1	51.9	52.5	51.3	2.4	-0.5
-Transportation (%)	806	907	930	938	936	948	987	926	978	1.7	5.5
	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.8	0.9		
	7321	8174	7799	7659	7204	7337	7557	7971	8410		
	6.0	6.6	6.6	6.4	6.5	6.6	7.0	7.3	7.5		
-Commerce (%)	13261	14418	13464	11796	11652	12110	12895	13534	13421	0.2	2.0
	10.8	11.6	11.3	10.6	10.5	11.0	12.0	12.4	11.9		
-Others (%)	20865	20506	19987	19790	18969	18424	18328	18417	18519.0	-1.5	0.5
	17.0	16.5	16.8	17.8	17.1	16.7	17.1	16.8	16.5		
-Public (%)	12940	13193	13749	14836	15149	15634	14646	15171	15027	1.9	1.3
	10.5	10.6	11.6	13.4	13.7	14.1	13.7	13.9	13.4		
-Import (%)	3288	3753	1090	427	332	927	1246	1404	1207	-11.8	-1.6
	2.7	3.0	0.9	0.4	0.3	0.8	1.2	1.3	1.1		
TOTAL	122946	124083	118674	110943	110611	110536	107211	109479	112490	-1.1	2.4

Source: Banco Central de Bolivia

1985 from 14.6 percent in 1980, however, it gradually increased after this. As was pointed out in the report "Evaluación Económica 1987", at the moment many factories hold a lot of underutilized facilities, estimated to be 60 percent. Therefore, it is expected that a raise in operation and investment in this sector should occur with the recovery of economic activities.

Considering the Bolivian economy from the viewpoint of per capita GDP as shown in Table A.1-12, it was seen to decrease by 27 percent to Bs 1610 in 1988 from Bs 2196 in 1980. Therefore, the important issue for the government would be to raise not only the GDP but also the per capita income as soon as possible.

Table A.1-12 Per Capita GDP
(in 1980 price)

Year	GDP (Bs 100,000)	Population (Person)	Per Capita GDP (Bs)
1980	122,946	5,599,592	2196
1981	124,083	5,755,072	2156
1982	118,674	5,915,844	2006
1983	110,943	6,081,722	1824
1984	110,611	6,252,721	1638
1985	110,445	6,429,226	1718
1986	107,211	6,611,722	1622
1987	109,479	6,799,397	1610
1988	112,553	6,992,400	1610

Source : Boletín Estadístico No.261
(Banco Central de Bolivia)

(2) GDP by Type of Expenditures

Judging from the GDP from expenditure as shown in Table A.1-13, both private and public consumption account for 84.8 percent of total spending. On the other hand, investment including the inventory accounts for only 10 percent in 1988. In particular, the share of consumption increased by 5% from 1980, but investment decreased by 5%. Decreasing investment has resulted from a decreasing trend in savings, which in turn interrupts economic growth due to a

Table A.1.13

Gross Domestic Products From Expenditure

	(Unit: Bs 10,000)									
	1980	1981	1982	1983(p)	1984(p)	1985(p)	1986(p)	1987(p)	1988(e)	
CONSUMPTION	98,162	99,777	95,829	92,369	90,326	94,088	93,195	94,736	95,435	
Government (%)	79.85	80.41	80.75	83.26	81.66	85.19	86.93	86.53	84.79	
Private (%)	15,904	17,236	16,734	18,106	18,523	19,152	17,927	17,586	17,287	
	12.94	13.89	14.10	16.32	16.75	17.34	16.72	16.06	15.36	
INVESTMENT	82,258	82,541	79,095	74,263	71,803	74,936	75,268	77,150	78,148	
Fixed Capital (%)	66.91	66.52	66.65	66.94	64.91	67.85	70.21	70.47	69.43	
Inventory (%)	18,058	20,762	12,162	12,273	10,933	14,545	8,683	11,840	10,912	
	14.69	16.73	10.25	11.06	9.89	13.17	8.10	10.81	9.69	
FOREIGN TRADE	17,514	17,085	12,149	12,227	11,534	10,475	10,155	10,646	11,257	
Export (%)	14.25	13.77	10.24	11.02	10.43	9.48	9.47	9.72	10.00	
Import (%)	544	3,677	13	46	(601)	4,070	(1,472)	1,194	(345)	
	0.44	2.96	0.01	0.04	-0.54	3.89	-1.37	1.09	-0.31	
FOREIGN TRADE (%)	6,726	3,544	10,683	6,301	9,352	1,812	5,333	2,903	6,206	
	5.47	2.86	9.00	5.68	8.45	1.64	4.97	2.65	5.51	
Export (%)	31,521	32,534	31,522	27,786	27,180	24,934	27,943	28,375	31,820	
	25.64	26.22	26.56	25.05	24.57	22.58	26.06	25.92	28.27	
Import (%)	(24,795)	(28,990)	(20,839)	(21,485)	(17,828)	(23,122)	(22,610)	(25,472)	(25,614)	
	-20.17	-23.36	-17.56	-19.37	-16.12	-20.94	-21.09	-23.27	-22.76	
GDP	122,946	124,083	118,674	110,943	110,611	110,445	107,211	109,479	112,553	
(%)	100	100	100	100	100	100	100	100	100	

Source :

1980 - 1982 Banco Central de Bolivia

1983 - 1988 INE

Banco Central de Bolivia

(p) : Preliminar

(e) : Estimate

shortage of capital. Therefore, it is expected that an increase in investment, whether public or private, will occur in the future.

(3) Export

Table A.1-14 shows exports categorized by product from 1980 to 1988. The amount of exports had decreased to \$US 569.5 million in 1987 from \$US 1,036.2 million in 1980. In 1988 the export increased a little to \$US 600.5 million, however, the amount was only half of that of 1980. The drastic decrease in exports was caused by a decrease of mineral products such as tin, silver, etc., meaning that, the export of mineral products in 1987 decreased to almost one-third of exports in 1980. In particular, the export of tin in 1987 was reduced enormously to only 18 percent of its level in 1980. On the other hand, the export of hydrocarbon resources such as petroleum, natural gas, etc., increased to \$US 420.1 million in 1983 from \$US 245.2 million in 1980, but in 1988 the level of this export decreased to almost the same level as 1980.

As for agricultural products, the export in 1984 and 1985 slumped to only almost one fifth of 1980, however, it has gradually recovered to the 1980 level since then. The above-mentioned slump in Bolivian exports was mainly caused by outside factors such as the recent stagnated worldwide economy and price slumps in primary industry products, which suggests the weak Bolivian economic structure is intensively dependent on the export of these products. Therefore, it is especially expected to promote investment and development in the agro and manufacturing industry.

Looking at the export countries in 1987 and 1988 in Table A.1-15, South American countries account for 56.5 percent in 1987 and 51.2 percent in 1988, respectively, followed by European countries. The main export to South American countries is natural gas, however, to European countries it mainly consists of minerals such as zinc, silver, tin, etc.

Table A.1-14 Export by Sector

(Unit: \$US Million)

Products	1980 (%)	1981 (%)	1982 (%)	1983 (%)	1984 (%)	1985 (%)	1986 (%)	1987 (%)	1988 (%)	1989 (%)					
MINERALS															
Iron	371.1	61.0	555.8	58.0	419.4	48.7	347.3	283.7	38.3	186.8	30.8	207.1	38.5	276.5	45.1
Antimony	378.1	36.5	343.1	34.5	278.3	31.0	207.9	186.6	27.8	104.1	18.3	68.3	12.1	74.6	12.4
Vanadium	28.4	2.8	34.3	3.5	17.8	2.0	16.3	15.9	2.4	14.5	2.3	22.8	4.0	17.8	3.0
Woolsten	47.4	4.8	43.0	4.3	33.8	3.8	29.0	10.3	1.5	6.6	1.0	5.0	0.9	5.8	1.0
Lead	14.5	1.4	11.5	1.2	6.5	0.7	4.0	0.5	0.1	5.0	0.8	4.2	0.7	6.1	1.0
Zinc	38.7	3.5	40.0	4.1	38.4	4.3	38.4	29.5	4.4	28.0	4.4	32.8	5.8	55.8	9.2
Silver	118.3	11.4	71.7	7.2	37.1	4.1	58.3	10.2	1.5	27.3	4.3	33.3	5.9	46.8	7.8
Cold	-	-	-	-	-	-	-	-	-	7.2	1.1	37.5	6.6	61.0	10.2
Others	19.7	1.8	12.0	1.2	7.5	0.8	7.4	10.7	1.8	4.1	0.8	2.8	0.5	3.0	0.5
AGRICULTURE															
Wheat	245.2	23.7	348.5	34.8	308.4	44.4	420.1	374.5	55.7	332.5	51.8	256.0	44.9	218.9	36.5
Wheat or meslin	-	-	-	-	-	-	29.3	0.1	0.0	3.4	0.5	7.5	1.3	3.7	0.8
Natural Gas	220.9	21.3	338.7	33.8	381.8	42.5	378.2	43.0	55.4	328.6	51.2	248.5	43.6	214.9	35.8
Liquid Gas	22.8	2.2	3.3	0.3	4.5	0.5	4.0	-	-	-	-	-	-	-	-
Purpura & Balsa	1.7	0.2	6.5	0.7	12.3	1.4	7.7	0.6	0.3	0.5	0.1	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OTHER PRODUCTS															
Dolls	150.0	14.8	92.8	9.4	80.8	9.1	50.1	3.7	4.8	108.5	17.2	106.3	18.7	111.1	18.5
Wool	20.8	2.0	15.8	1.6	15.5	1.7	12.9	0.8	2.1	13.2	2.1	11.5	2.0	20.4	3.4
Woolen	4.9	0.5	5.2	0.5	3.2	0.4	0.8	0.1	0.2	6.2	1.0	6.1	1.4	18.0	3.0
Woolen	2.9	0.3	2.5	0.3	2.2	0.3	1.8	0.3	0.2	3.5	0.2	6.7	1.2	5.6	0.9
Wool	4.7	0.5	3.2	0.3	4.2	0.5	2.7	0.5	0.1	3.8	0.3	1.9	0.3	1.8	0.3
Sugar	51.2	5.0	5.7	0.5	6.1	0.9	12.3	1.8	0.1	4.9	0.3	8.6	1.5	10.5	1.8
Dolls	31.1	3.0	18.0	1.8	11.8	1.3	7.8	0.8	0.8	22.7	3.8	30.9	5.4	21.5	3.6
Dolls	1.3	0.1	0.9	0.1	0.6	0.1	1.2	0.2	0.2	13.4	2.1	6.7	1.2	1.0	0.2
Soybean	6.1	0.8	3.6	0.4	7.4	0.8	4.8	-	-	18.7	2.9	19.2	3.4	26.7	3.5
Handicrafts	4.2	0.4	4.8	0.5	1.1	0.1	0.3	0.3	0.0	4.9	0.3	1.0	0.2	1.8	0.3
Other products	22.8	2.2	33.1	3.3	26.5	3.0	5.4	8.1	1.2	17.2	2.7	11.7	2.1	9.8	1.5
TOTAL (CP)	1038.3	100	934.9	100	898.4	100	817.5	872.5	100	837.8	100	586.4	100	806.3	100

Source: Instituto Mexicano de Estadística y Censos (1980-1986)

Table A.1-15

Export Countries

In Million of Dollars

	EUROPA		ASIA		AFRICA		SOUTH AMERICA		CENTRAL AMERICA		NORTH AMERICA		SOCIALIST COUNTRIES		IN TRANSIT		TOTAL	
	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988
MINERALS	115.2	121.2	4.8	6.1	0.0	0.0	15.2	43.9	0.0	0.3	57.2	83.2	5.6	8.8	7.9	6.8	207.2	220.5
Fu	32.7	15.9	3.6	2.1			6.5	22.6			17.7	30.1	0.7	3.8	5.7	3.8	68.9	74.6
Znc	39.5	49.7		1.8			0.7	11.1			0.1	0.1	0.1	1.4		1.0	32.8	35.8
Anthracite	7.4	3.9	1.2	0.8			4.3	5.5			2.9	6.7	0.1	0.8		0.8	22.9	17.8
Silver	23.8	36.4			0.5						6.7	7.1	2.3	3.0		0.1	39.3	46.5
Gold	17.9	20.6		2.0				0.1			18.9	38.3			0.7		37.5	61.0
Others	2.0	3.8			0.2		1.7	4.6	0.6	0.3	3.9	0.8	2.4	4.5	0.1	0.8	11.8	14.9
MANUFACTURES	0.0	0.0	0.0	0.0	0.0	0.0	259.8	214.9	0.0	0.0	5.2	4.0	0.0	0.0	0.0	0.0	256.0	218.9
Natural Gas							248.6	214.9			5.2	4.0					248.6	214.9
Others							2.2										7.4	4.0
NON-FERROUS METALS	18.4	32.8	1.9	4.8	0.4	0.1	55.8	48.6	1.2	0.1	30.6	24.7	0.0	0.0	0.0	0.0	106.3	111.1
Copper	8.8	14.1	0.3	0.8	0.4	0.1	5.9	4.7			2.6	3.8					11.7	10.5
Zinc	3.1	2.4					0.2	0.5			1.3	5.4					15.1	20.4
Nickel	2.1	2.7	1.4	1.2			15.0	15.8	1.0	0.1	0.1						19.1	20.9
Lead	1.6	9.7	0.1	0.5			12.9	10.8	0.1		14.4	8.8					23.3	21.5
Others	0.8	3.9	0.1	0.2			6.4	7.6	0.1		11.7	0.2					6.3	18.9
TOTAL EXPORT	191.8	154.1	6.7	11.1	1.1	0.1	321.8	307.4	1.8	0.4	93.0	111.8	5.6	8.9	7.9	6.8	569.5	600.5

Note: The number corresponding to 1988 are preliminary.

(4) Import

Imports in Bolivia has fluctuated around \$US 600.0 million except for 1981 during past nine years as shown in Table A.1-16. In 1988 the import level was \$US 578.6 million, which was slightly less than the level of 1980 (\$US 665.4). From the viewpoint of import composition, the capital import increased 40 percent in 1988 from 36.4 percent in 1980, on the other hand, the import of consumption goods and intermediate goods has fluctuated from 1980 to 1988, in particular, the import of consumption goods has considerably dropped to only 11.4 percent in 1983, reflecting again economic depression in Bolivia.

As shown in Table A.1-17, import countries are mostly in South America and occupy almost half of the total import, followed by the U.S.A.

Summarizing the trade balance in Table A.1-18, exports have constantly decreased from 1980 to 1988 (except 1987), however, imports have increased during the period of economic depression. As a result, export exceeded import from 1980 through 1985, but since 1986 the trade balance has been in the red. In particular, the trade balance recorded a large loss (\$US 196.8 million) in 1987, however, a small profit (\$US 21.9 million) was made in 1988, due to the successful economic performance in Bolivian economy.

Table A.1-16 Import by Sector

(Unit: Million of Dollars)

CLASSIFICATION	1980	1981	1982	1983	1984	1985	1986	1987	1988 (U)	1988 (P)
	PARTIC- PACON %	PARTIC- PACON %	PARTIC- PACON %	PARTIC- PACON %	PARTIC- PACON %	PARTIC- PACON %	PARTIC- PACON %	PARTIC- PACON %	PARTIC- PACON %	PARTIC- PACON %
1. CONSUMPTION GOODS	188.9	253.6	254.0	65.6	94.9	133.4	133.7	190.2	24.8	130.0
Non-durable goods	104.5	115.9	56.8	46.4	42.0	46.0	81.9	92.8	12.1	70.1
Durable goods	84.3	117.7	99.2	18.2	52.9	87.4	71.8	97.5	12.7	59.9
2. INVESTMENT GOODS	250.5	341.9	248.4	282.3	203.1	278.0	255.3	306.5	40.1	203.2
Food and Inhabitation CM	1.7	0.3	9.0	4.1	1.5	2.4	2.7	2.0	0.3	1.4
For Agriculture	11.2	14.7	7.3	11.2	17.5	16.4	15.3	11.3	1.5	7.4
For Industry	203.6	264.0	196.6	223.7	152.4	231.0	183.2	256.0	33.4	175.4
For Construction	32.0	49.3	35.5	43.3	31.7	28.2	33.6	37.2	4.9	19.0
3. CAPITAL GOODS	242.5	334.8	198.8	222.2	136.1	253.0	281.6	262.6	34.4	240.4
For Agriculture	13.6	20.4	5.1	7.3	13.5	27.3	40.1	24.2	3.2	20.7
For Industry	148.0	185.3	138.9	158.3	103.4	136.7	151.7	133.3	17.5	123.7
Equipment and Transportation	80.9	118.1	54.8	58.6	60.2	89.0	89.8	104.6	13.7	96.0
4. OTHERS	3.5	6.8	11.1	6.6	5.4	20.5	23.4	6.9	0.2	5.0
TOTAL OF PAGE	685.4	917.1	554.1	578.7	489.5	800.9	874.0	788.5	100.2	578.6
	100	100	100	100	100	100	100	100	100	100

Source: Banco Central de Bolivia
Banco Central de Bolivia
Preliminary numbers

Table A.1-17

Import Countries

Unit: Value \$US Million
Share %

Country	1982		1983		1984		1985		1986		1987		1988(p)	
	Value	Share	Value	Share	Value	Share	Value	Share	Value	Share	Value	Share	Value	Share
S. AMERICA	172.5	31.1	241.4	41.8	219.5	45.0	309.1	44.8	257.2	38.2	299.2	39.6	221.9	43.3
Argentina	75.0	13.5	95.8	16.6	70.8	14.5	117.4	17.0	75.6	11.2	103.9	13.7	80.7	18.9
Brazil	53.3	9.6	77.6	13.5	98.5	20.2	134.5	19.5	124.4	18.5	148.7	19.7	117.7	20.3
Chile	16.5	3.0	18.1	3.1	16.1	3.3	23.8	3.4	34.3	5.1	26.9	3.6	5.9	1.0
Peru	16.5	3.0	18.5	3.2	25.0	5.1	25.4	3.7	14.9	2.2	14.8	2.0	9.1	1.6
Others	11.2	2.0	31.4	5.4	9.1	1.9	8.0	1.2	8.0	1.2	4.9	0.6	8.5	1.5
CANADA	6.8	1.2	4.2	0.7	4.3	0.9	5.3	0.8	4.7	0.7	8.4	1.1	3.8	0.7
U.S.	163.7	29.5	165.4	28.7	106.2	21.8	140.6	20.4	150.0	22.3	184.1	24.4	120.8	20.9
COMMON	9.9	1.9	8.2	1.4	24.1	4.9	9.2	1.3	22.7	3.4	11.5	1.5	8.7	1.5
EEC	94.4	17.0	89.5	15.6	77.9	15.9	120.4	17.4	132.8	19.7	149.6	20.0	99.4	17.1
Germany	45.3	8.2	31.7	5.5	35.2	7.2	52.1	7.5	45.9	6.8	50.3	6.7	40.0	6.9
France	7.8	1.4	20.3	3.5	9.7	2.0	10.8	1.6	6.2	0.9	7.2	1.0	5.4	0.9
Holland	6.6	1.2	7.4	1.3	8.3	1.7	10.6	1.5	5.8	0.9	8.8	1.2	6.6	1.1
England	22.3	4.0	19.4	3.4	13.8	2.8	30.2	4.4	31.0	4.6	23.2	3.1	17.6	3.0
Others	12.4	2.2	10.7	1.9	10.9	2.2	16.7	2.4	43.9	6.5	60.1	8.0	29.8	5.2
OTHER EEC	16.0	2.9	12.8	2.2	9.3	1.9	12.0	1.7	15.9	2.4	19.3	2.6	10.8	1.9
ASIA	68.6	12.4	43.9	7.6	34.3	7.0	72.5	10.5	73.3	10.9	78.2	10.3	66.6	11.5
Japan	58.7	10.6	39.2	6.8	30.3	6.2	66.2	9.6	65.3	9.7	71.9	9.5	57.6	10.0
Others	9.9	1.8	4.7	0.8	4.0	0.8	6.3	0.9	8.0	1.2	6.3	0.8	9.0	1.5
OTROS	22.2	4.0	11.3	2.0	12.9	2.6	21.8	3.2	17.4	2.6	5.5	0.7	16.1	2.8
TOTAL	554.1	100.0	576.7	100.0	488.5	100.0	690.9	100.1	674.0	100.0	755.8	100.2	548.1	100.0

Source: Banco Central de Bolivia
Note: (p) Estimated

Table A.1-18 Trade Balance
(Unit : US\$ million)

	Export	Import	Balance
1980	1036.3	665.4	370.8
1981	995.3	917.1	78.2
1982	898.2	554.1	344.1
1983	817.5	576.7	240.8
1984	782.1	488.5	293.6
1985	672.5	690.9	-18.4
1986	637.8	674.0	-36.2
1987	569.5	766.3	-196.8
1988	600.5	578.6	21.9

(5) Revenue and Expenditure

The government financial balance has been in the red every year as shown in Table A.1-19. In particular, during the business depression between 1982 and 1985, the government revenue was only 8-15 percents of expenditure. In recent three years, however, the deficit has decreased sharply and the revenue and expenditure became balanced for 1987 and 1988.

Table A.1-19 Revenue and Expenditure
(Unit : Boliviano)

Year	Revenue(A)	Expenditure (B)	A/B
1980	11,603.50	19,879.50	0.58
1981	14,069.20	22,976.30	0.61
1982	19,315.80	112,849.60	0.17
1983	38,856.30	301,101.40	0.13
1984	560,405.20	7,142,466.00	0.08
1985	205,764,731.00	1,383,805,490.00	0.15
1986	841,031,379.94	966,876,126.86	0.87
1987	1,026,877,865.02	1,058,366,028.63	0.97
1988	1,247,333,602.29	1,297,090,154.41	0.96

Source : Banco Central de Bolivia

Table A.1-20 and A.1-21 show items of revenue and expenditure, respectively. Among the revenue items, a huge amount of revenue comes from license fees, in particular, oil exploitation, which accounts for 55 percent of the total revenue in 1988. On the other hand, the wage payment for government staff accounts for almost 50 percent, though the payment for the government bonds and foreign loan accounts was 14 percent.

Table A1-20 Government Revenue

Unit: Bs Million

PERIOD	R E V E N U E										TOTAL REVENUE
	TAX	IMPORT TAX	COMMUNICATION	CONSULAR		PATENT AND LICENCE		MISCELLANEOUS	TOTAL	TOTAL	
				Mineral	Petro	Mineral	Petro				
1980	4,382.00	2,501.90	87.00	244.00	1,771.10	1,882.10		3,853.20	863.70	11,603.50	
1981	5,981.10	3,150.00	30.00	405.00	888.00	2,405.70		3,294.50	2107.4	14,069.20	
1982	7,950.10	3,700.50	77.40	542.00	1,775.00	4,186.30		5,961.00	384.9	19,315.80	
1983	22,554.10	5,820.40	172.00	1,083.00	1,502.30	4,540.00		6,141.30	3,078.90	38,856.30	
1984	216,456.70	122,881.10	1,075.00	21,184.20	83,290.50	78,500.00		161,791.40	37,015.00	569,405.20	
1985	22,146,486.20	22,076,487.00	158,613.40	7,261,900.50	5,959,729.00	121,987,112.10		127,946,841.00	25,574,309.40	205,784,731.00	
1986	174,182,318.05	96,562,954.72	698,410.38	14,880,383.44	1,453,809.39	313,198,242.06		314,650,141.45	238,067,171.00	841,031,379.94	
1987	274,747,394.57	145,082,684.49	1,184,678.05	88,905.50	5,367,284.04	505,520,837.03		510,888,071.07	62,988,463.54	1,028,877,865.02	
1988	567,239,109.07	140,379,939.55	621,695.30	22,091.70	7,561,040.50	888,122,496.18		895,703,536.68	42,367,209.99	1,247,333,802.28	

Source: Tesoro General de la Nación
 Banco Central de Ecuator
 Until December of 1985, the monetary unit was millions
 of Pesos Ecuatorianos

Table A.1-21

Government Expenditure

(Unit: Bs Million)

PERIOD	PERSONAL SERVICES (1)	NON PERSONAL SERVICES	MATERIAL & SUPPLY	FINANCIAL AND FIXED ASSETS	PUBLIC BOND AND LOAN			TOTAL	CONTRIBUTIONS AND TRANSFERS	TOTAL EXPENDITURE
					INTERNAL	EXTERNAL	INTEREST (2)			
1980	9,706.30	946.40	1,512.40	1,345.30	1,112.10	1,223.40	1,479.30	3,816.30	2,332.30	19,879.50
1981	11,930.60	1,147.40	2,532.30	1,598.60	1,224.80	887.20	981.10	3,093.10	2,674.30	22,978.30
1982	23,515.40	2,567.20	3,339.70	1,563.60	43,597.80	3,521.70	28,924.40	75,953.90	5,909.80	112,849.60
1983	77,883.40	4,742.10	10,502.90	5,445.90	10,131.40	82,040.90	79,590.10	171,762.40	30,764.70	391,101.40
1984	1,729,567.90	106,628.70	174,541.70	109,895.00	66,731.70	157,294.70	322,679.70	548,706.10	4,461,126.60	7,142,466.00
1985	144,787,156.60	19,606,954.70	179,270,319.10	19,966,297.90	13,255,192.20	131,176,525.80	308,237,751.60	452,669,409.60	567,495,352.20	1,383,805,498.00
1986	369,142,986.70	49,816,028.40	114,837,368.88	52,126,976.64	36,387,629.99	63,353,254.42	45,834,556.63	145,575,440.04	244,343,316.20	966,836,126.86
1987(P)	516,506,838.38	67,045,244.91	122,660,968.28	43,389,314.62	6,996,881.12	45,568,569.47	91,882,674.06	144,448,124.65	164,315,537.79	1,058,366,026.63
1988(P)	546,080,824.12	96,579,990.45	114,066,002.54	45,429,293.37	16,189,909.44	69,912,397.93	99,129,752.13	195,232,039.50	197,956,102.07	1,195,090,154.41
JAN88(P)	43,417,054.03	5,369,531.35	7,107,800.24	2,189,117.23	470,158.45	0.00	0.00	470,158.45	11,748,398.97	74,869,734.02
FEB88(P)	41,493,208.07	10,440,476.14	10,175,259.45	980,208.47	273,618.97	0.00	0.00	273,618.97	11,915,586.00	76,104,659.04
MAR88(P)	45,906,564.07	6,792,925.18	8,820,605.54	1,693,877.91	6,139,562.40	19,814,536.74	17,121,995.50	43,076,094.64	9,723,733.34	121,597,677.06
APR88(P)	39,780,357.05	11,738,613.18	9,568,338.92	1,111,652.00	1,254,437.91	9,861,484.48	18,971,607.40	30,087,529.79	10,234,518.29	101,784,303.46
MAY88(P)	49,291,741.30	6,223,469.70	9,285,669.61	305,147.54	2,333.01	3,379,648.62	8,240,276.99	11,622,259.62	15,518,445.00	91,079,424.87
JUN88(P)	52,554,065.04	3,827,905.59	8,914,105.50	7,111,284.00	2,323,477.39	1,318,017.37	2,544,188.70	6,185,693.46	11,441,629.64	86,394,615.37
JUL88(P)	54,737,762.78	7,423,370.93	9,639,103.20	39,152.03	523.42	5,135,209.83	27,384,716.09	32,500,449.34	15,376,694.13	125,999,028.91
AUG88(P)	57,268,649.55	11,187,441.17	9,524,257.06	5,456,089.46	755,644.88	4,757,031.14	2,792,394.71	8,305,010.73	15,964,120.58	187,002,658.51
SEP88(P)	53,092,858.02	8,355,598.71	12,022,850.84	6,527,395.05	36,171.99	8,181,028.80	9,548,100.29	17,765,301.08	920,254.53	116,632,277.94
OCT88(P)	51,627,107.86	7,280,299.45	11,110,275.11	4,557,307.81	3,342,139.09	2,151,085.23	5,604,228.14	11,097,482.46	24,853,356.14	109,433,692.15
NOV88(P)	43,870,786.72	10,248,288.47	8,985,186.59	11,933,034.59	1,598,350.53	2,083,690.28	(16,092,037.93)	(12,469,997.02)	25,253,047.05	95,130,978.59
DEC88(P)	109,040,269.63	7,692,080.58	6,922,452.48	3,515,837.39	33,292.50	13,250,665.44	23,034,342.14	36,318,300.08	29,956,553.22	189,040,307.49

Source : Tesoro General de la Nación
 Elaborated : Banco Central de Bolivia
 (1) : Include reserves
 (2) : Include commission
 (P) : Preliminar

A.2 Existing Conditions in the Project Area

The influence of the project is considered to spread over not only along the project road, but also Beni, La Paz, and Pando departments. In this section, the population and regional gross domestic product (RGDP) are reviewed for the above three departments.

A.2.1 Population

(1) La Paz Department

The provincial population in the La Paz department is publicized by the INE from 1983 to 1985. In 1985, the total population in the La Paz department was 2.1 million, of which Murillo province accounted for almost 50%. Population of Nor Yungas, where the project road is located, was 61 thousand, 2.9 % of the total population of La Paz department.

The provincial population from 1986 to 1989 was estimated by the following process:

Step 1 Estimation of population in the La Paz department from 1986 to 1989

Population of the La Paz department from 1986 to 1989 was estimated using the growth rate indicated in the report "Estrategia de Desarrollo Economico y Social 1989 - 2000" (referred to in Table A.1-4).

Step 2 Provisional population estimation from 1986 to 1989

Provisional population expanded until 1989 along with the annual growth rate between 1983 and 1985.

Step 3 Determination of Provincial Population

Population of each province obtained in Step 2 was modified in order that the summation of population for every province coincided with a figure of the La Paz department population shown in Table A.1-3.

As the population in La Paz department was estimated as 2.2

million in 1989 (as shown in Table A.1-4), the population in Nor Yungas was estimated as 66 thousand in 1989 up from 61 thousand in 1985. On the other hand, the population in Murillo was estimated as 1.1 million in 1989, which increased by 60 thousand persons from 1985. Provincial population is shown in Table A.2-1.

Table A.2-1 Population in La Paz Department by Province
(Unit : person)

Province	1983	1984	1985	1986	1987	1988	1989
Murillo	971728	1012744	1055543	1062031	1068573	1075200	1113528
Pacajes	83249	84796	86417	88232	90088	91990	93424
Camacho	88853	90319	91857	93914	96017	98173	99530
Mūnecas	26964	27383	27821	28462	29118	29791	30177
Larecaja	57367	59418	60521	62350	64237	66189	67769
Franz Tamayo	20477	20794	21127	21614	22111	22622	22915
Ingavi	110487	112668	114951	117281	119662	122101	124124
Loayza	54884	55903	56971	58169	59393	60647	61592
Inquisivi	98531	100801	103177	105046	106954	108908	111019
Nor Yungas	58668	59982	61355	62492	63654	64843	66063
Los Andes	77536	78739	80001	81846	83733	85666	86779
Aroma	83924	85511	87173	88986	90839	92737	94209
Sud Yungas	61547	62806	64125	65394	66690	68018	69187
Iturrealde	6393	6492	6596	6748	6903	7063	7154
Saavedra	12899	13159	13430	13699	13973	14255	14495
Manco Kapac	29992	30577	31189	31826	32477	33144	33686
Villarroel	19920	20229	20553	21027	21511	22008	22294
Omasuyos	104842	106687	108622	110975	113380	115845	117555
Total	1968261	2029008	2091429	2120092	2149313	2179200	2235500

Source : 1983-1985 INE
1986-1989 Estimated by the Study Team

(2) Beni Department

The provincial population of the Beni department was also published by the INE from 1983 to 1985. As of 1985, the total population of the Beni department was 240 thousand, of which Cercado including Trinidad accounted for 23%. The provincial population of the Beni department from 1986 to 1989 was also estimated by the same method as that of the La Paz department. The Beni department reached 290 thousand

in 1989, which had increased by 50 thousand from 1985. Table A.2-2 shows the population by province.

Table A.2-2 Population in Beni Department by Province
(Unit : person)

Province	1983	1984	1985	1986	1987	1988	1989
Cercado	48493	50363	52431	55964	59761	63834	66702
Vaca Diez	57944	60057	62405	66361	70606	75154	78329
Ballivian	32920	33901	35011	36775	38656	40660	42004
Yacuma	20631	21175	21799	22750	23758	24828	25523
Moxos	19395	19823	20321	21027	21769	22550	23026
Marban	14590	14820	15101	15430	15767	16113	16279
Mamore	12401	12769	13168	13810	14494	15223	15708
Itenez	18650	19077	19574	20289	21043	21838	22330
Total	225024	231976	239810	252406	265854	280200	289901

Source : 1983-1985 INE
1986-1989 Estimated by the Study Team

(3) Pando Department

The provincial population of Pando from 1986 to 1989 was estimated based on provincial population data from 1983 to 1985 by the same method explained above. The population growth rate was smaller than that of La Paz and Beni, therefore, provincial population increased by only a few. The Pando provincial population is shown in Table A.2-3.

Table A.2-3 Population in Pando Department by Province
(Unit : person)

Province	1983	1984	1985	1986	1987	1988	1989
N. Suarez	15609	16274	16733	17474	18265	18956	19286
Manuripi	10567	11014	11325	11601	11884	12016	12043
Madre de D.	11350	11830	12164	12460	12764	12906	12935
Abuna	3914	4079	4194	4296	4400	4449	4458
G.F.Roman	2348	2448	2517	2579	2642	2671	2678
Total	43788	45645	46933	48410	49955	50998	51400

Source : 1983-1985 INE
1986-1989 Estimated by the Study Team

A.2.2 Regional Gross Domestic Products (RGDP)

Tables A.2-4 to A.2-6 show RGDP of the La Paz, Beni, and Pando departments. RGDP in these three departments was estimated on the basis of data obtained from UDAPE from 1980 to 1985, however, from 1986 to 1989 were estimated by the following method:

Step 1 Estimation of GDP by sector

GDP by sector from 1980 to 1988 is shown in Table A.1-11, however, the GDP by sector in 1989 was estimated using the growth rate by sector shown in Table A.3-4, which was indicated in "Estrategia De Desarrollo Economico y Social, 1989-2000".

Step 2 Dissolution of GDP in 1989 into the departments with the following share was indicated in "Estrategia de Desarrollo Economico y Social 1989 - 2000".

Region	Share of RGDP (%)
La Paz	26.1
Santa Cruz	24.9
Cochabamba	17.8
Potosi	7.0
Chuquisaca	7.0
Oruro	5.9
Tarija	5.9
Beni	4.6
Pando	0.9

Step 3 Provisional estimation by sector of RGDP based on the trend between 1980 and 1985 by UDAPE data

Step 4 Provisional RGDP by summing up sectorial values

Step 5 Modification of Provisional RGDP with the rate of provisional RGDP and total RGDP estimated in Step 2

Estimated RGDP of La Paz, Beni, and Pando are summarized as follows:

RGDP of La Paz was estimated to be BS 30.46 million in

1989, which increased with an annual growth rate of 1.8% from 1985. Among all the sectors the manufacturing industry was seen to be the greatest, which accounted for 19.7%, followed by commerce and finance (18.7%), then government services (15.3%).

Beni's RGDP was estimated to be Bs 5.39 million in 1989. The agricultural industry was the biggest sector, which accounted for 33.1%, followed by commerce and finance with share of 19.6%.

RGDP of the Pando was estimated to be Bs 1.79 million, which was only 6% of the La Paz RGDP. There was no prominent sector, however, commerce and finance occupied the largest portion, accounting for 22.4%.

Table A.2-4 RGDP of La Paz
(Unit : Bs. thousand)

Sector	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Agriculture	3435	3363	3231	1719	2237	2184	2096	2084	2046	2129
Mining	3256	3149	2803	2671	2148	2071	1546	1566	2067	2257
Oil & others	0	0	0	0	0	0	0	0	0	0
Industry	7333	7263	6463	6048	5327	5078	5171	5331	5625	5990
Construct	1646	1674	1319	1289	1148	1078	1000	988	1062	1020
Energy	429	465	462	461	471	454	476	445	466	492
Transport	2469	2576	2341	2395	2237	2099	2178	2288	2397	2403
Commerce	6440	6548	6067	5926	5768	5589	5590	5719	5660	5867
Government	3152	5081	4814	1759	4620	4425	4427	4529	4482	4646
Housing	3256	3327	3133	3009	2942	2865	2866	2931	2901	3008
Service	2361	2433	2341	2425	2531	2525	2526	2584	2557	2651
Total	33777	35879	32974	30702	29429	28368	27876	28465	29263	30463

Source : 1980-1985 UDAPE
1986-1989 Estimated by the Study Team

Table A.2-5 RGDP of Beni

(Unit : Bs. Thousand)

Sector	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Agriculture	1674	1608	1620	1291	1329	1310	1686	1683	1699	1782
Mining	0	0	0	0	0	0	0	0	0	0
Oil & others	0	0	0	0	0	0	0	0	0	0
Industry	258	250	231	194	174	163	223	230	250	268
Construct	65	65	59	53	42	41	51	51	56	54
Energy	22	17	8	8	4	4	6	5	6	6
Transport	581	587	571	526	517	508	707	746	803	811
Commerce	762	773	768	735	733	720	966	992	1010	1055
Government	224	220	218	202	193	189	253	260	265	277
Housing	314	320	311	286	276	275	369	379	386	403
Service	404	406	411	514	510	501	672	690	702	734
Total	4304	4246	4197	3809	3778	3711	4933	5036	5177	5390

Source : 1980-1985 UDAPE

1986-1989 Estimated by the Study Team

Table A.2-6 RGDP of Pando

(Unit : Bs. Thousand)

Sector	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Agriculture	166	167	161	187	190	188	178	176	177	186
Mining	0	0	0	0	0	0	0	0	0	0
Oil & others	0	0	0	0	0	0	0	0	0	0
Industry	50	48	43	47	44	43	43	44	48	52
Construct	26	26	24	26	24	24	22	22	24	23
Energy	9	9	7	6	5	5	5	5	5	6
Transport	174	175	170	204	2602	197	201	211	226	229
Commerce	182	184	183	224	223	220	216	221	224	235
Government	94	94	94	113	113	109	107	109	111	116
Housing	82	83	81	98	96	94	92	94	96	105
Service	74	77	789	76	104	103	102	100	102	104
Total	860	864	839	1009	3400	982	964	984	1015	1056

Source : 1980-1985 UDAPE

1986-1989 Estimated by the Study Team

A.3 Future Socio-economic Framework

As shown in Chapter B , the future traffic demand was projected by a regression model with the following socio-economic variables as explanatory variables: population, RGDP, and the number of vehicle registered. As the influenced area by the project ranges over the La Paz, Beni, and Pando departments, future values of these three variables were projected only for the above three departments.

A.3.1 Population

Future population was forecast from the population growth rate indicated in "Estrategia de Desarrollo Economico y Social 1989-2000" up to the year 2000. Population projection after 2000 was also forecast with the same rate above due to the reason described in the following section (2).

(1) Projection up to 2000

Since 1976 a population census has not been conducted in Bolivia, however, as shown in Table A.1-2 , the INE has published an estimate of the population complemented with a small scale population survey. According to this population estimate, the population in Bolivia has grown at a rate of 2.8% per annum in spite of the past social and economic fluctuation. Therefore, the future population is expected to continue to grow at almost the same growth rate in the near future. This idea is supported by the official population projection represented in " Estrategia de Desarrollo Economico y Social 1989-2000" (Ministerio de Planeamiento y Coordinacion), in which the future population is assumed to gross at the growth rate of 2.8% per annum until 2000 as shown in Table A.1-3. As a result, the population projection up to the year 2000 was performed in line with this idea. The future population by department was also projected with growth rates listed in the above report, which is shown in Table A.1-3.

(2) Projection after 2000

There are no authorized population projection after the year of 2000, however, some studies estimated a decreasing population growth rate in the future. In this study, the

future population is assumed to continue to grow with the same growth rate of 2.8% per annum even after the year of 2000. The reason is as follows; The future population is said to be able to be forecast by the Cohort-Survival Model with a significant degree of accuracy. The Cohort-Survival Model can be represented as the following function;

$$p^t = [BR * MR * IMR * IR * ER]^t [P^0]$$

Here, p^t = Population in t year after the base year
 P^0 = Population in the base year
 BR = Birth rate
 MR = Mortality rate
 IMR = Infant mortality rate
 IR = Immigration rate
 ER = Emigration rate
 t = Period of estimation

Considering the whole population of Bolivia, IR and ER can be considered not to change significantly. In addition (according to the statistics published by the Ministerio de Salud), BR is also considered not to change drastically from the existing level, since this value has already become close to that of other advanced Latin American countries as shown in Table A.3-1. However, IMR (infant mortality per live birth) and MR (mortality rate) show two to three times bigger than those of other South American countries.

Table A.3-1 Statistical Profile in Major Latin American countries

Country	Birth rate (1,000 person)	Mortality per 1000 inhabitants	Infant mortality per 1,000 live births	Life expectancy at birth (years old)
Argentina	23.2	8.6	32.2	71.0
Bolivia	44.0	15.8	124.4	50.7
Brazil	30.6	8.4	70.7	60.1
Chile	24.2	6.7	22.8	71.3
Colombia	31.0	7.7	53.3	63.6
Ecuador	36.8	8.1	69.6	64.3
Paraguay	35.8	6.8	53.0	66.4
Peru	36.7	10.7	98.6	58.6
Uruguay	19.5	10.2	37.6	70.3
Venezuela	33.0	5.6	38.7	69.0
Average	28.4	8.9	60.1	64.5

Source : Economic and Social Progress in Latin America 1989 Report (IDB)

Considering strong government efforts to stabilize the growth of the domestic economy, the rapid spread of medical treatment and necessary medicines throughout the country, increase of per capita income, and so on, the infant mortality and mortality rate are expected to decrease significantly hereafter, which would be a key factor in the growth of the population. There are no negative factors to decrease the future population at the moment, therefore, it is assumed that population in Bolivia continues to increase at the rate of 2.8% after 2000. Table A.3-2 shows the future population.

Table A.3-2 Future Population by Department
(Unit : 1,000 persons)

Department:	1989			2000		
	Urban	Rural	Total	Urban	Rural	Total
La Paz	1187.6	1047.9	2235.5	1769.0	1215.6	2984.6
Cochabamba	482.1	608.5	1090.6	755.4	722.3	1477.7
Chuquisaca	134.8	403.3	538.1	189.4	485.9	675.3
Oruro	214.4	183.3	397.7	265.8	208.4	474.2
Potosi	255.9	634.3	890.2	310.2	706.5	1016.7
Santa Cruz	932.6	463.7	1396.3	1824.4	544.6	2369.0
Tarija	129.4	165.5	294.9	202.6	190.3	392.9
Beni	172.3	117.6	289.9	299.6	131.4	431.0
Pando	6.8	44.6	51.4	10.6	45.4	56.0
Total	3515.7	3668.7	7184.4	5627.0	4250.4	9877.4

Department:	2010			2020		
	Urban	Rural	Total	Urban	Rural	Total
La Paz	2541.4	1391.2	3932.6	3651.0	1592.1	5243.1
Cochabamba	1136.3	844.1	1980.4	1709.3	986.5	2695.8
Chuquisaca	258.0	575.6	833.6	351.5	681.9	1033.4
Oruro	323.2	234.2	557.4	393.0	263.1	656.1
Potosi	369.5	779.3	1148.7	440.0	859.5	1299.5
Santa Cruz	3357.8	630.3	3988.1	6180.0	729.5	6909.5
Tarija	304.6	216.1	520.7	458.0	245.3	703.3
Beni	495.5	145.4	640.9	819.6	160.8	980.4
Pando	15.9	46.2	62.1	23.9	46.9	70.8
Total	8802.2	4862.2	13664.5	14026.3	5565.7	19592.0

(3) Provincial Population in La Paz, Beni, and Pando Department

The provincial population in the three departments, La Paz, Beni, and Pando was forecast in the following two steps:

step 1 First projection of provincial population

First projection of provincial population was forecast with the past trend of population growth rate in each province. The existing provincial population is available from the INE statistics.

step 2 Modification of the first projection by the department population.

The first population projection for each province was modified by expanding or reducing at a constant rate of the future department population and the summation of the first provincial population projection in its department.

The projected provincial population is shown in Table A.3-3(1) to Table A.3-3(3) together with the existing population.

Table A.3-3(1) Provincial Population in La Paz
(persons)

Province	1989	2000	2010	2020
Murillo	1113528	1638954	2334380	3330581
Pacajes	93424	111183	131065	155618
Camacho	99530	115924	133921	153926
Muñecas	30177	34782	39551	44945
Larecaja	67769	87957	111630	141875
Franz Tamayo	22915	26405	30020	34107
Ingavi	124224	149461	138429	214972
Loayza	61592	73289	86382	102545
Inquisivi	111019	138131	170541	213201
Nor Yungas	66063	81667	100180	124379
Los Andes	86779	100023	113792	129260
Aroma	94209	112488	133083	158681
Sud Yungas	69187	83920	100956	122686
Iturrealde	7154	8245	9374	10650
Saavedra	14495	17517	20986	25381
Manco Kapac	33686	40463	48177	57867
Villarroel	22294	25694	29216	33200
Omasuyos	117555	138497	161469	189227
Total	2235500	2984600	3932600	524310

Table A.3-3(2) Provincial Population in Beni
(persons)

Province	1989	2000	2010	2020
Cercado	66702	109276	174129	280715
Vaca Diez	78329	125243	196346	312805
Ballivian	42004	61478	90302	136767
Yacuma	25523	35421	49764	72538
Moxos	23026	29542	38529	52277
Marban	16279	18184	20117	22243
Mamore	15708	22715	33099	49665
Itenez	22330	29142	38665	53390
Total	289901	431000	640900	980401

Table A.3-3(3) Provincial Population in Pando
(persons)

Province	1989	2000	2010	2020
N. Suarez	19286	23306	28826	37018
Manuripi	12043	12261	12480	12671
Madre de Dios	12935	13168	13402	13606
Abuna	4458	4535	4611	4678
G.F. Roman	2678	2730	2782	2827
Total	51400	56000	62100	70800

A.3.2 Projection of GDP and RGDP

(1) Projection of GDP by Sector

The future gross domestic product by sector was projected on the basis of the growth rate presented in "Estrategia de Desarrollo Economico y Social 1989-2000" until 2000, in which the growth rate was projected by year from 1989 to 2000 as shown in Table A.3-4. The estimated growth rate fluctuates year to year due to the government's investment strategies such as large scale development of natural gas, thermoelectricity, chemical plant, and so on, however, at the last year of the 20th century, the growth rates are estimated to have stabilized. Therefore, the GDP after 2000 is projected with an average growth rate taken from 1998 to 2000.

Table A.3-4 The Growth Rate of GDP by Sector
(Unit : %)

Sector	1988	1989	1990	1991	1992	1993	1994
Agriculture	-0.2	3.8	3.9	4.2	4.5	3.9	4.0
Mining	8.0	8.9	9.7	12.9	12.9	11.8	14.1
Factory	5.3	6.2	6.9	7.4	7.7	12.5	6.3
Chemical	12.2	10.7	9.9	5.2	1.9	4.1	35.2
Electric	4.7	5.2	9.1	9.8	8.4	6.0	63.0
Transport	-1.5	0.0	1.4	2.5	3.4	4.3	6.1
Construct	2.6	-4.2	10.0	16.4	4.7	2.3	5.1
Services	4.0	3.4	2.5	1.9	1.4	1.1	0.8
GDP(Pro- ducer)	3.6	4.1	4.5	4.6	3.9	4.4	7.2
GDP(Mar- cket)	2.7	4.3	4.7	4.7	4.4	4.6	7.1

Sector	1995	1996	1997	1998	1999	2000	1980-2000
Agriculture	4.2	4.4	4.6	4.6	3.8	3.8	3.8
Mining	14.1	14.2	14.2	14.1	13.1	13.1	12.4
Factory	6.0	5.6	4.9	9.8	9.4	9.1	7.4
Chemical	4.4	7.2	8.0	5.9	5.9	5.9	8.7
Electric	33.8	28.9	2.5	2.6	2.8	3.0	12.7
Transport	6.2	6.4	6.7	7.1	7.2	7.4	4.4
Construct	1.2	2.0	0.0	2.3	1.2	2.7	3.5
Services	0.6	0.5	0.4	0.3	0.2	0.2	1.3
GDP(Pro- ducer)	4.5	5.0	4.5	5.1	5.0	5.1	4.7
GDP(Mar- cket)	4.7	4.9	4.3	4.8	4.7	4.9	4.7

Source : "Estrategia de Desarrollo Economico y Social 1989-2000" (Ministerio DE Planeamiento y Coordinacion)

(2) Projection of RGDP

Based on the existing RGDP in La Paz, Beni, and Pando, the future RGDPs of these three departments were projected. The estimation process is as follows:

- Step 1. The future GDP projected with the growth rate listed in Table A.3-4 was distributed among the three departments with the weights estimated from "Estrategia De Desarrollo Economico y Social, 1989-2000" shown in Step 2 of Section A.2.2.

Step 2 The sectorial RGDP of the three departments was projected with an existing trend at first, then, the projection was modified by the following equation:

$$SCT_{ij} = SCT_{Bij} * \frac{RGDP_j}{SCT_{Bij}}$$

where,

SCT_{ij} i sector of j department after modification

SCT_{Bij} i sector of j department before modification

$RGDP_j$ RGDP of j department

Tables A.3-5(1) to Table A.3-5(3) show the future sectorial RGDP in La Paz, Beni, and Pando Department, respectively.

Table A.3-5(1) RGDP by Sector in La Paz
(Bs. Thousand)

Sector	1989	2000	2010	2020
Agriculture	2129	3350	4835	7097
Mining	2257	8502	21923	46103
Oil & others	0	0	0	0
Industry	5990	13556	26511	44493
Construct	1020	1672	2039	2691
Energy	492	1983	2649	3599
Transport	2403	4155	8126	16160
Commerce	5867	5691	6786	6999
Government	4646	5299	5374	5542
Housing	3008	3430	3479	3588
Service	2651	3023	3066	3162
Total	30463	50661	84788	139434

Table A.3-5(2) RGDP by Sector in Beni
(Unit : Bs. thousand)

Sector	1989	2000	2010	2020
Agriculture	1782	3305	5532	8870
Mining	0	0	0	0
Oil & Others	0	0	0	0
Industry	268	716	1623	2976
Construct	54	98	148	213
Energy	6	29	45	66
Transport	811	1654	3751	8149
Commerce	1055	1418	1667	1878
Government	277	372	438	493
Housing	403	542	637	717
Service	734	987	1160	1307
Total	5390	9121	15001	24669

Table A.3-5(3) RGDP by Sector in Pando
(Unit : Bs. thousand)

Sector	1989	2000	2010	2020
Agriculture	186	348	577	904
Mining	0	0	0	0
Oil & Others	0	0	0	0
Industry	52	139	311	558
Construct	23	42	63	89
Energy	6	26	40	59
Transport	229	471	1058	2245
Commerce	235	318	371	408
Government	116	158	184	202
Housing	100	136	158	174
Service	109	147	172	189
Total	1056	1785	2934	4828

A.4 Agricultural Products and Livestock Farming

A.4.1 Agricultural Products

(1) Existing Agricultural Products

As the Bolivian topography ranges from mountainous areas to low flat areas, a wide range of cereals, vegetables, and fruits can be cultivated. The existing characteristics of current agricultural products are explained, based on the 1988 data listed in Table A.4-1 to Table A.4-4.

1) Cereals and Tubercules

Maize, yuca, and rice are the three main cereal products as shown in Table A.4-1. The major maize producing areas are Santa Cruz and Chuquisaca, which account respectively for 32.0% and 23.0% of the total maize production of 445.6 thousand tons in 1988. Yuca production was 430.0 thousand tons, of which 36.5% was cultivated in Santa Cruz and 32.6% was cultivated in Beni. Rice production was 171.5 thousand tons, however, 70.0% was produced in Santa Cruz, followed by Beni with 10.8%.

Table A.4-1 Cereal Production in 1988
(unit : ton)

	Chuqui- saca	La Paz	Santa Cruz	Cocha- bamba	Oruro	Potosi	Tarija	Beni	Pando	Total
RICE	770	12000	120000	10000	-	-	2240	18600	7875	171484
	0.4	7.0	70.0	5.8			1.3	10.8	4.6	100.0
MAIZE	102560	24345	142690	70275	200	25862	56630	18320	6688	445570
	23.0	5.5	32.0	15.8	0.0	5.8	12.7	3.7	1.5	100.0
YUCA	10300	44315	157130	34400	-	-	3790	140065	40000	430000
	2.4	10.3	36.5	8			0.9	32.6	9.3	100.0
POTATO	3160	1010	2500	3450	-	1500	1800	120	-	13540
	23.3	7.5	18.5	25.5		11.1	13.3	0.9		100.0
CHOCLO	14300	5200	5600	22000	70	8150	2500	180	-	58000
	0.2	0.1	9.7	37.9	0.1	14.1	4.3	0.3		100.0

Source : MACA

2) Fruits

Bananas, many kinds of oranges, grapefruits, etc. are produced in Bolivia. In particular, banana production is the largest with 478.0 thousand tons in 1988. The main banana producing areas were Santa Cruz (26.2%), La Paz (25.1%), and Cochabamba (21.3%), followed by Beni (18.7%). As for oranges, lima, and mandarin are popular, producing 170.2 thousand tons. About 60% of the oranges were produced in La Paz, followed by Cochabamba. Papaya, grapefruits, and mango were mainly produced in Santa Cruz. Table A.4-2 shows the fruit production by department.

Table A.4-2 Fruit Production in 1988
(Unit : ton)

	Chuqui- saca	La Paz	Santa Cruz	Cocha- bamba	Oruro	Potosi	Tarija	Beni	Pando	Total
BANANA	-	120000	125000	102000	-	-	4700	89300	37000	478000
		25.1	26.2	21.3			1.0	18.7	7.7	100
ORANGE	10355	101210	18600	28880	-	-	7120	3365	670	170200
ETC.	6.1	59.5	10.9	17.0			4.2	2.0	0.4	100
PAPAYA	-	3660	6980	2760	-	-	-	1800	900	16100
		22.7	43.4	17.1				11.2	5.6	100
GRAPE	410	4500	10560	4240	-	-	1560	3350	680	25300
FRUIT	1.6	17.8	41.7	16.8			6.2	13.2	2.7	100
MANGO	-	1110	1790	1050	-	-	150	1180	420	5700
		19.5	31.4	18.4			2.6	20.7	7.4	100

Source : NACA

3) Vegetables

Most vegetables are produced in Santa Cruz, in particular, the tomato captured 73.4% of total production in 1988. Watermelon and beans were also produced with approximately 60% in Santa Cruz, however, cucumber was produced mostly in Cochabamba. Table A.4-3 shows vegetable production in each region.

Table A.4-3 Vegetable Production in 1988
(unit : ton)

	Chuqui- saca	La Paz	Santa Cruz	Cocha- bamba	Oruro	Potosi	Tarija	Beni	Pando	Total
WATER	930	800	9020	1910	-	-	1580	660	300	15200
MELON	6.1	5.3	59.3	12.6			10.4	4.3	2.0	100
TOMATO	1550	2900	29000	2700	-	960	2200	190	-	39500
	3.9	7.3	73.4	6.8		2.4	5.6	0.5		100
BEANS	1250	980	5040	220	-	30	500	320	280	8500
	14.7	11.5	59.3	2.6		0.4	5.9	3.8	3.3	100
CUCUMBER	290	170	1290	1665	-	-	360	115	-	3890
	7.5	4.4	33.2	42.8			9.3	3.0		100

Source : MACA

4) Other agricultural products

Sugar cane, coffee beans, cacao, and tobacco are also very popular products in Bolivia. In particular, 2,141.3 thousand tons of sugar cane were produced in 1988, with the majority coming from Santa Cruz (69.1%). Coffee beans and cacao were produced in La Paz, of which the share was 95.1% and 52.4%, respectively. Tobacco was mostly produced in Santa Cruz (66.3%). Table A.4-4 shows the production of these products by department.

Table A.4-4 Other Agricultural Product by Department
(Unit : ton)

	Chuqui- saca	La Paz	Santa Cruz	Cocha- bamba	Oruro	Potosi	Tarija	Beni	Pando	Total
SUGAR	18300	20000	1480000	9900	-	-	509950	95370	7800	2141320
CANE	0.9	0.9	69.1	0.5			23.8	4.5	0.4	100
COFFEY	-	24925	670	40	-	-	150	358	77	26220
BEAN		95.1	2.6	0.2			0.6	1.4	0.3	100
CACAO	-	1950	640	100	-	-	233	680	120	3723
		52.4	17.2	2.7			6.3	18.3	3.2	100
TOBACCO	100	20	630	25	-	-	120	35	20	950
	10.53	2.1	66.3	2.6			12.6	3.7	2.1	100

Source : MACA

The past trend in main agricultural products is summarized in Table A.4-5. A fluctuation can be seen in the first half of the 1980s, however, each production has been increasing in general except for sugar cane. In particular, rice, yuca and banana recorded more than 7% increase in the annual growth rate. Sugar cane production decreased to two-third of the 1980 production level with a negative growth rate of -4.4%.

Table A.4-5 Past Trend of Main Agricultural Products
(Unit : ton)

Year	RICE	MAIZE	YUCA	BANANA	SUGAR CANE	VEGETABLE	FRUIT	OTHERS
1980	95225	383365	219065	275570	3080135	106255	132865	24625
1981	101225	503710	191430	283400	3103070	83925	132295	24975
1982	86660	449605	287962	252470	3000630	108466	149420	24626
1983	61725	337190	180385	256070	2747965	60064	147333	24570
1984	163832	496612	280328	269924	2837152	94932	106556	25759
1985	173151	553938	376198	366514	3158516	92637	101396	27857
1986	136760	457380	420000	395000	2919900	104390	126126	27990
1987	164230	480694	425000	450000	2413846	104850	140640	29730
1988	171485	445570	430000	478000	2141320	109890	149333	30893
GROWTH RATE '80-'88	7.6	1.9	8.8	7.1	-4.4	1.5	2.5	2.9

Source : MACA

(2) Projection of Agricultural Products

Projection of agricultural production was made only for departments influenced by the project road, that is , Beni, Pando, and La Paz. The classification of agricultural products is rice, maize, yuca, banana, sugar cane, fruits, vegetables, and others. The last three categories include the following products:

- a. Fruits: lima, lemon, mandarin, orange, mango, water melon, pineapple, avocado, papaya

b. Vegetables: tomato, beans, cucumber, maize

c. Others: tobacco, cacao, coffee bean

1) Projection of total production

The future growth rates of agricultural products are presented in "Estrategia de Desarrollo Economico y social 1989-2000". Using these growth rates, future agricultural production is forecast as shown in Table A.4-6.

Table A.4-6 Growth Rate and Future Production

(Unit : ton)

	RICE	MAIZE	YUCA	BANANA	SUGAR CANE	FRUIT	VEGETABLE	OTHERS
1988	171485	445570	430000	478000	2141320	149333	109890	30893
1989	176801	459338	443459	492675	2201277	154021	114165	31783
	(1.031)	(1.031)	(1.031)	(1.031)	(1.028)	(1.031)	(1.039)	(1.029)
2000	247360	641970	622427	687093	2982827	216387	173717	43434
	(1.442)	(1.441)	(1.448)	(1.437)	(1.393)	(1.449)	(1.581)	(1.406)
2010	335673	870322	847108	929690	3931245	294754	254437	57695
	(1.957)	(1.953)	(1.970)	(1.945)	(1.836)	(1.974)	(2.315)	(1.868)
2020	455516	1179900	1152893	1257942	5181568	401503	372665	76639
	(2.656)	(2.648)	(2.681)	(2.632)	(2.420)	(2.689)	(3.391)	(2.481)
Growth Rate(%)	3.1	3.09	3.13	3.07	2.8	3.14	3.89	2.88

Note : () Expansion rate from 1988

Source MACA

2) Agricultural production by department

The above total production was divided into the three departments, Beni, Pando, and La Paz, with an average share for the past five years. Table A.4-7 shows the share for each department and Table A.4-8 shows the future production by department. The share is assumed to remain the same in the future.

Table A.4-7 Share of Production by department

	La Paz (%)	Beni (%)	Pando (%)
Rice	7.94	12.82	4.69
Maize	9.48	3.45	10.71
Yuca	26.24	18.36	8.42
Banana	9.06	0.55	0.55
Sugar Cane	0.95	3.70	0.29
Fruit	32.35	6.78	2.64
Vegetable	9.06	0.55	0.55
Others	87.20	3.71	0.73

Table A.4-8 Future Production by department
(Unit : ton)

Year	RICE	MAIZE	BANANA	YUCA	CANE	FRUIT	VEGETABLE	OTHERS	
LA PAZ	1989	14040	21125	128216	42044	20853	49829	10342	27707
	2000	19843	29524	178812	59012	28255	70006	15736	37864
	2010	26656	40026	241947	80314	37242	95360	23049	50297
	2020	36173	54263	327373	109305	49086	129895	33758	66812
BENI	1989	22672	16985	90137	139448	81339	10435	633	1179
	2000	31721	23739	125707	195726	110210	14661	963	1611
	2010	43046	32189	170091	266378	145262	19970	1411	2139
	2020	58414	43631	230146	362534	191462	27203	2066	2842
PANDO	1989	8290	6781	41502	52752	6430	4061	626	233
	2000	11598	9477	57880	73569	8712	5705	953	318
	2010	15739	12848	78316	99545	11483	7771	1396	422
	2020	21358	17419	105967	134692	15135	10586	2045	561

3) Future demand for agricultural product

Future demand for agricultural products was projected using the current per capita consumption of the agricultural products. Unfortunately, per capita consumption data is not available for Bolivia, and so a figure was derived by dividing the total production (adjusted for

export and import) by the total population. However, this value has fluctuated in the past decade. Therefore, the per capita consumption of agricultural products was set up as the average value over the past five years(1984-1988). Table A.4-9 shows the per capita consumption per year.

Table A.4-9 Per Capita Consumption

(Unit : kg)

	RICE	MAIZE	YUCA	BANANA	FRUIT	VEGETABLE	OTHERS
1980	17.0	68.5	39.1	49.2	23.7	19.0	4.4
1981	17.6	87.5	33.3	49.2	23.0	14.6	4.3
1982	14.6	76.0	48.7	42.7	25.3	14.6	4.2
1983	10.1	55.4	29.7	42.1	24.2	9.9	4.0
1984	26.2	79.4	44.8	43.2	17.0	15.2	4.1
1985	26.9	86.2	58.5	57.0	15.8	14.4	4.3
1986	20.7	69.2	63.5	59.7	19.1	15.8	4.2
1987	24.2	70.7	62.5	66.2	20.7	15.4	4.4
1988	24.5	63.7	61.5	68.4	21.4	15.7	4.4
Per Capita Consump- tion (Average)	24.1	72.4	61.5	62.8	19.2	15.3	4.3

Using this per capita consumption data, the demand for agricultural products was projected by department, which is shown in Table A.4-10.

**Table A.4-10 Future Demand of Agricultural Products
by Department**
(Unit : ton)

	Year	RICE	MAIZE	BANANA	YUCA	CANE	FRUIT VEGETABLE	OTHERS	
LA PAZ	1989	56124	141762	156073	141539	684663	42931	9615	27707
	2000	95819	179996	261486	257904	914007	57312	45671	12836
	2010	126249	237160	344531	339811	1204285	75514	60175	16912
	2020	168300	316153	459287	452995	1605407	100666	80218	22545
BENI	1989	7279	18386	20242	18357	88798	5568	4437	1247
	2000	13835	25989	37756	37238	131972	8275	6594	1853
	2010	20576	38652	56152	55382	196274	12307	9807	2756
	2020	31458	59094	85848	84672	300076	18816	14994	4214
PANDO	1989	1280	3233	3560	3228	15616	979	780	219
	2000	1798	3377	4906	4838	17147	1075	857	241
	2010	1990	3739	5431	5357	18984	1190	949	267
	2020	2279	4281	6220	6134	21740	1363	1086	305

4) Comparison of future demand and supply for agricultural products

The above projected future demand and supply for agricultural products was compared by department. As shown in Table A.4-11, La Paz will import almost all agricultural products except "others" (coffee beans, tobacco etc.). They would import mainly from Beni, Pando, or, Santa Cruz. On the other hand, Beni, and Pando can have extra production to export to La Paz.

**Table A.4-11 Balance of Agricultural
Products by Department**
(Unit : ton)

	Year	RICE	MAIZE	BANANA	YUCA	CANE	FRUIT	VEGETABLE	OTHERS
LA PAZ	1989	-42084	-120637	-27857	-99495	-663810	6898	-23869	18092
	2000	-76176	-150472	-82674	-198892	-885752	-41751	-29934	25029
	2010	-99593	-197134	-102584	-259497	-1167043	-58118	-37126	33385
	2020	-132127	-261890	-131914	-343690	-1556320	-80809	-46459	44267
BENI	1989	15393	-1401	69895	121091	-7459	70903	-3804	-68
	2000	17886	-2250	87951	158488	-21762	95549	-5631	-243
	2010	22470	-6463	113939	210996	-51012	125291	-8396	-617
	2020	26956	-15463	144298	277862	-108614	164259	-12928	-1372
PANDO	1989	7010	3548	37942	49524	-9186	2369	-154	13
	2000	9800	6100	52974	68731	-8435	3007	96	77
	2010	13749	9109	72885	94188	-7501	3712	447	156
	2020	19079	13138	99747	128558	-6605	4550	958	255

A.4.2 Livestock Farming

(1) Number of Cattle

As shown in Table A.4-12, livestock farming is a very active part of the Bolivian economy. In particular, as meat is an important staple food as in other South American countries, livestock like cows, pigs, sheep, goats, etc. have been bred for food. Other than meat, llama and alpaca have been raised for wool and fur products.

Table A.4-12 Number of Livestock bred in Bolivia
(Unit :1,000 head)

	Cow	Sheep	Pig	Llama	Alpaca
1980	4669	9057	1600	1885	247
1981	4488	9308	1647	1913	254
1982	4601	9680	1706	1946	263
1983	4781	10087	1843	1926	249
1984	4730	6593	1662	1391	179
1985	4890	6798	1700	1388	170
1986	5055	6034	1788	1405	171
1987	5239	7246	1902	1432	172
1988	5402	7505	2019	1466	174
Annual Growth Rate(1980 -1988)	1.6	-2.0	3.1	-2.8	-3.8

Source : MACA

As shown in Table A.4-12, the number of livestock had increased until 1983 or 1984, however, due to the economic slump, the number began to decline except for cows. In line with the recovery of the economy, the number began to increase up until now. However, except for cows and pigs, the existing number has not yet reached the 1980 level.

The number of each type of livestock by department is shown in Table A.4-13. According to this Table, cows and pigs have mainly been bred in the low flat lands. Beni is the No.1 department for the breeding of cows with a share of 45.3%, followed by Santa Cruz with a share of 24.9%. Pigs have been bred in Santa Cruz and Chuquisaca, which account for 28.5% and 21.3%, respectively. On the other hand, sheep, llama, and alpaca have been bred in mountainous areas with plateaus, like La Paz, Oruro, Potosi, etc.. Especially, pigs have mostly been bred in La Paz, which accounts for 28.8% of the total.

Table A.4-13 Existing Number of Livestock by Department
in 1988

(Unit :1000 head)

	Cow	Sheep	Pig	Llama	Alpaca
La Paz	315 (5.83)	2,158 (28.75)	230 (11.40)	-	-
Cochabamba	285 (5.28)	1,236 (16.47)	270 (13.38)	37 (2.52)	4 (2.30)
Chuquisaca	532 (9.85)	483 (6.43)	429 (21.26)	-	-
Oruro	49 (0.91)	1,712 (22.81)	32 (1.59)	406 (27.69)	57 (32.76)
Potosi	120 (2.22)	1,477 (19.68)	90 (4.46)	523 (35.68)	22 (12.64)
Santa Cruz	1,343 (24.87)	162 (2.16)	576 (28.54)	-	-
Tarija	298 (5.52)	268 (3.57)	257 (12.74)	-	-
Beni	2,444 (45.25)	7 (0.09)	109 (5.40)	-	-
Pando	15 (0.28)	3 (0.04)	25 (1.24)	-	-
Total	5,402	7,505	2,019	1,466	174

Note : - indicates not available. Data in () are in per-
cent.

Source : MACA

(2) Meat Production

Among the above livestock, cow, pig, and sheep are mainly used as food. As shown in Table A.4-14, before 1983 the meat production for each group was fluctuated, however, the meat production has been steadily increasing since 1984, reflecting economic recovery. As a result, meat production has increased to 131.1 thousand tons for beef, 15.6 thousand tons for lamb, and 40.5 thousand tons for pork. The growth rate in meat production was 5.5% for cattle, 15.2% for sheep, and 7.4% for pig.

Table A.4-14 Meat Production by Year
(unit:1,000 tons)

Year	Cow	Sheep	Pig
1980	111781	19625	37229
1981	105333	19978	38399
1982	112052	22269	33208
1983	124831	20044	33587
1984	105891	8879	30376
1985	110876	10717	32016
1986	115017	13204	34365
1987	121195	14438	37731
1988	131054	15667	40521
Annual Growth Rate 1984 to 1988	5.5	15.2	7.4

Source : MACA

Table A.4-15 shows the meat production in each department for 1988. Beni accounts for the largest portion at 43.6% for cow, La Paz accounts for 25.4% for sheep, and Santa Cruz accounts for 33.4% for pig.

Table A.4-15 Meat Production by Department in 1988
(unit:1,000 tons)

	Cow	Sheep	Pig
La Paz	6496 (4.96)	3981 (25.41)	3244 (8.01)
Cochabamba	6952 (5.30)	2471 (15.77)	4401 (10.86)
Chuquisaca	14177 (10.82)	1008 (6.43)	9884 (24.39)
Oruro	983 (0.75)	3945 (25.18)	386 (0.95)
Potosi	2496 (1.90)	3329 (21.25)	1233 (3.04)
Santa Cruz	3581 (27.36)	323 (2.06)	13548 (33.43)
Tarija	6581 (5.02)	590 (3.77)	5139 (12.68)
Beni	57178 (43.63)	14 (0.09)	2189 (5.40)
Pando	340 (0.27)	6 (0.04)	497 (1.23)
Total	131054 (100.00)	15667 (100.00)	40521 (100.00)

Source : MACA

(3) Future consumption of beef

As shown in Table A.4-13, Beni is breeding a lot of cattle, of which the meat is currently being carried mostly to La Paz by airplane. In the near future the beef is expected to be carried by refrigerated trucks to La Paz along the existing road whether the existing road is improved by the project or not, judging from the current too old airplanes used for beef transport to La Paz. In this section, the future production and consumption of beef were projected.

1) Consumption of beef

There are several different data relating to meat consumption, however, Comite Nacional De Carnes has collected data up to 1985 with the purpose of analyzing meat consumption in Bolivia (Comite Nacional De Carnes is now abolished). Therefore, the data published by the Comite Nacional De Carnes was used for the following analysis. Using the beef production data and population data, beef consumption per capita was estimated as shown in Table A.4-16.

Table A.4-16 Per Capita Beef Consumption

Year	Consumption (1,000 ton)	Population (1,000 person)	Consumption Per Capita (kg)
1976	97.0	5,023	19.3
1980	111.9	5,600	20.0
1981	107.1	5,755	18.6
1982	109.9	5,916	18.6
1983	132.5	6,082	21.8
1984	141.9	6,253	22.7
1985	139.2	6,429	21.7

From the "Estrategia de Desarrollo Economico y Social" the beef consumed per person was estimated to be 31.2kg in 1989 and 41.3kg in 2000. With the following logistic type model, the future beef consumption per capita was projected as:

$$C = \frac{M}{1 + e^{a+bt}}$$

Here ,

C : Per capita beef consumption

t : Year

M : Upper Limit of per capita beef consumption

a,b : parameters

Before estimating parameters, a and b, the value of the upper limit of per capita beef consumption (M) should be determined. Judging from the examination of meat consumption in countries, where meat is the main staple, shown in Table A.4-17, the maximum meat consumption per capita can be assumed to be 120kg/person.

Table A.4-17 Per Capita Meat Consumption in Developed Countries

	Consumption* (1,000t)	Population (1,000 person)	Consumption Per Capita(kg)
New Zealand	334	3176	105.2
U.S.A	25755	226546	113.7
Australia	1691	14576	116.0
Canada	2333	24343	95.8
France	4095	49155	83.3
England	5919	54335	108.9

* Source OECD

Considering 120kg as being the maximum limit for meat consumption of an average Bolivian, 70.3% of 120kg can be estimated to be beef. The figure of 70.3% was the average value from 1986 to 1988 as shown below:

Year	Beef Meat (A)	Lamb Meat (B)	Pork Meat (C)	Total (D)	A/D (%)
1986	115	13	41	188	71.0
1987	121	14	38	173	70.0
1988	131	16	41	188	70.0
Average					70.3

(Unit : Kg/Person)

AS a result, the value of the upper limit of beef consumption was assumed to be 84.4 kg/person ($120 * 0.703 = 84.4$).

Using the above estimated upper limit and data listed in Table A.4-16, the parameters were estimated showing a good fit with a correlation coefficient of 0.939, by regression analysis. The results were as follows;

	Parameter	T-value
a	113.0084	7.86
b	- 0.056465	7.80

With these parameters, the future beef consumption per capita was projected to be 55.1kg by 2010 and 69.5kg by 2020. Therefore, the future beef consumption was estimated to be 753 thousand tons in 2010 and 1362 thousand tons in 2020. Table 4.4-18 summarized the future beef production, population, and beef consumption per capita.

Table A.4-18 Future Beef Consumption

	Total Consumption (1,000 ton)	Total Population (1,000 person)	Per Capita Consumption (kg/person)
1989	224.0	7184.8	31.2
2000	407.5	9877.4	41.3
2010	753.0	13664.5	55.1
2020	1362.0	19592.0	69.5

According to the Comite Nacional De Carnes, the beef consumption per capita in La Paz city was 24.8 kg in 1985, however, in this study the national average was calculated to be 21.7 kg in 1985 as shown in Table A.4-16. This means that beef consumption in urban areas is higher than that in rural area. Assuming that beef consumption in rural areas is estimated as follows:

$$\begin{aligned} &\text{Beef consumption in an urban area} \\ &= \text{population in urban area} \times \text{beef consumption} \\ &\hspace{15em} \text{in urban area} \end{aligned}$$

$$= 3068.0 \times 24.8 / 1,000 = 76.1 \text{ ton}$$

(thousand (kg)
persons)

Per capita beef consumption in a rural area
 = (total beef consumption - beef consumption in
 urban area) / population in rural area

$$= (139.2 - 76.1) / 3361.3 \times 1000 = 18.8 \text{ kg}$$

ton ton (thousands
persons)

Therefore, the beef consumption per capita in rural areas is considered to be 18.8kg. Judging from this estimate, the per capita beef consumption in urban areas is 14.3% higher than that of the average consumption, on the other hand, the per capita beef consumption in rural areas is 13.4% lower than that of the average consumption. Using these two figures of 14.3% and 13.4%, the above estimates for the per capita beef consumption was modified. With the modified per capita consumption and population by area, the future beef consumption was projected as show in Table A.4-19.

Table A.4-19 Future Beef Consumption in Bolivia

	Per Capita Consumption:			Population		Beef Consumption		
	(kg)			: (1,000 persons):		(1,000 tons)		
	Average	Urban	Rural	Urban	Rural	Urban	Rural	Total
1989	31.2	35.7	27.0	3515.7	3668.7	125.5	99.1	224.6
2000	41.3	47.2	35.8	5627.0	4250.4	265.6	152.2	417.8
2010	55.1	63.0	47.7	8802.2	4862.2	554.4	232.0	786.4
2020	69.5	79.4	60.2	14026.3	5565.7	1114.2	335.0	1449.2

As a result, the future beef consumption in the whole of Bolivia was projected to 786.4 thousand ton in 2010 and 1449.2 thousand ton in 2020. Considering that La Paz is the biggest market for beef, the future beef consumption in La Paz can be estimated as shown in Table A.4-20.

Table A.4-20 Future Beef Consumption in La Paz

	Per Capita Consumption:		Population :		Beef Consumption			
	(kg)		(1,000 persons):		(1,000 tons)			
	Average	Urban	Rural	Urban	Rural	Urban	Rural	Total
1989	31.2	35.7	27.0	1187.6	1047.9	42.4	28.3	70.7
2000	41.3	47.2	35.8	1769.0	1215.6	83.5	43.5	127.0
2010	55.1	63.0	47.7	2541.4	1391.2	160.1	66.4	226.4
2020	69.5	79.4	60.2	3651.0	1592.1	290.0	95.8	385.9

From Table A.4-20, the beef consumption in La Paz is projected to 127.0 thousand tons in 2000, 226.4 thousand tons in 2010, and 385.9 thousand tons in 2020. On the other hand, Beni, a big source of beef supply, was projected to produce beef by the following steps:

Step 1 Projection of Future Number of Cows

According to the data from the MACA, the number of cow bred in Beni is increasing year by year as shown in Table A.4-21. As the number of cow in Beni has a close correlation with the agricultural products in Beni, the following regression model was made. The parameters of this model were estimated utilizing applied data listed in Table A.4-21.

$$NO = -126928.4 + 0.145748 \times AGPR + 64.9361 \times YEAR$$

(-3.92) (0.58) (4.00)

$$R = 0.8096$$

Here, NO : Number of Cows in Beni
 AGPR : Agricultural Products in Beni
 YEAR : Year
 () : T-value
 R : Correlation Coefficient

Table A.4-21 Number of Cow and Agricultural Products in Beni

Year	No. of Cow (head)	Agricultural Products (BS. 1,000)
1980	2,105,500	1674
1981	1,800,000	1608
1982	1,805,000	1620
1983	2,026,231	1291
1984	2,119,119	1329
1985	2,195,407	1310
1986	2,274,442	1686
1987	2,359,051	1683
1988	2,443,977	1699

Source : MACA

With the above model, the future number of cows in Beni was projected as show in Table A.4-22.

Table A.4-22 Future Number of Cow in Beni

Year	Future No. of Cattle (head)	Expansion Rate
1988	2,443,977	1.000
1989	2,489,268	1.079
2000	3,425,534	1.402
2010	4,399,466	1.800
2020	5,535,319	2.265

Step 2 Projection of Future Beef Production

As shown in Table A.4-23, the average quantity of beef production obtained from cow breeding in Beni was around 0.023 ton/head. Therefore, the future beef production was projected by multiplying 0.023 by the future number of cow. The future beef production was shown in Table A.4-24.

Table A.4-23 Existing Beef Production and Number of Cow in Beni

Year	Beef Production A(ton)	No.of Cow B (head)	A/B (ton/head)
1980	47811	2105500	0.023
1981	40635	1800000	0.023
1982	40469	1805000	0.022
1983	49947	2026231	0.025
1984	46832	2119119	0.022
1985	49375	2195407	0.022
1986	51152	2274442	0.022
1987	53454	2359051	0.023
1988	57178	2443977	0.023
Average			0.023

Source : MACA

Table A.4-24 Future Beef Production in Beni

Year	Beef Production (ton)	No.of Cow (head)
1989	57253	2489268
2000	78787	3425534
2010	101188	4399466
2020	127312	5535319

Among the future beef production in Beni estimated above, some quantity is consumed within Beni. Using data listed in Table A.4-25, the self-support quantity was projected to be 15.4 hundred tons in 2000, 30.6 hundred tons in 2010 and 58.6 hundred tons in 2020.

Table A.4-25 Future Beef Consumption in Beni

Year	Population (1,000 person)	Beef Consumption Rural (kg)	Total Beef Consumption (1000 ton)
1989	289.9	27.0	7.8
2000	431.0	35.8	15.4
2010	640.9	47.7	30.6
2020	980.4	60.2	59.0

Judging from the demand and supply of beef as shown in Table A.4-26, Beni can continue to have a large surplus of beef to export to La Paz.

Table A.4-26 Surplus of Beef in Beni
(unit:1,000 tons)

Year	Demand in La Paz	Production of Beef	Quantity of self-support	Surplus
1989	70.7	57.3	7.8	49.5
2000	127.0	78.8	15.4	64.3
2010	210.8	101.2	30.6	70.6
2020	338.7	127.3	59.0	68.3

As a result, the Beni department was forecast to export 64.3 thousands tons in 2000, 70.6 thousands tons in 2010, and 68.3 thousands tons in 2020.

(4) Demand and supply of beef in Beni by province

It is very difficult to project the future demand and supply of beef by province in Beni because of the scarce data available. Using the number of cow and population by province in 1984, the future demand and supply of the beef by province were projected.

1) Future beef production by province

Assuming that the share of the number of cow by province

is same as that in 1984, future beef production can be obtained by multiplying the future number of cows in each province by 0.023. Future beef production by province is shown in Table A.4-27.

Table A.4-27 Future Beef Production By Province

Province	No. of Cattle		No. of Cattle				Beef Production			
	1984	Share %	1989	2000	2010	2020	1989	2000	2010	2020
Vaca Diez	69904	3.4	84681	116531	149663	188303	1948	2680	3442	4331
Ballivian	463238	22.5	561161	772225	991781	1247839	12907	17761	22811	28700
Yacuma	399729	19.5	484227	666355	855810	1076763	11137	15326	19684	24766
Mamore	227427	11.1	275502	379125	486916	612627	6337	8720	11199	14090
Itenez	144260	7.0	174755	240484	308857	388598	4019	5531	7104	8938
Cercado	247484	12.0	299799	412560	529857	666655	6895	9489	12187	15333
Marban	268322	13.1	325042	447297	574471	722787	7476	10288	13213	16624
Moxos	234525	11.4	284101	390957	502112	631747	6534	8992	11549	14530
Total	2054889		2489268	3425534	4399466	5535319	57253	78787	1011188	127312

2) Future Beef Consumption by Province

Future beef consumption by province was obtained by multiplying the provincial population by the per capita beef consumption figures. The result is shown in Table A.4-28.

Table A.4-28 Future Beef Consumption By Province

Province	POP Share		Population				Beef Consumption			
	(1000 person)	%	1989	2000	2010	2020	1989	2000	2010	2020
Vaca Diez	60057	25.8	75.1	111.6	165.9	253.8	2028	3995	7913	15279
Ballivian	33801	14.6	42.4	63.0	93.7	143.3	1145	2255	4469	8627
Yacuma	21175	9.1	26.5	39.3	58.5	89.5	716	1407	2790	5388
Mamore	12760	5.5	15.9	23.7	35.3	53.9	429	848	1684	3245
Itenez	18077	8.2	23.8	35.4	52.7	80.6	643	1267	2514	4852
Cercado	50363	21.7	62.9	93.8	139.1	212.8	1698	3351	6635	12811
Marban	14820	6.4	18.5	27.5	40.9	62.6	500	985	1951	3769
Moxos	19823	8.5	24.8	36.8	54.8	83.8	670	1317	2614	5045
Total	231976		289.9	431.0	640.8	980.4	7827	15426	30571	59014

3) Future Beef Surplus by Province

From the above projection of beef production and consumption by province, the beef surplus by province was obtained as shown in Table A.4-29. According to this Table, only Vaca Diez Province will be an insufficient producer of beef, however, other provinces will have a surplus of beef to export to other departments.

Table A.4-29 Surplus of Beef

(Unit : tons)

Province	1989	2000	2010	2020
Vaca Diez	- 80	-1315	-4471	-10948
Ballivian	11762	15506	18342	20073
Yacuma	10421	13919	16894	19378
Mamore	5908	7872	9515	10845
Itenez	3376	4264	4590	4086
Cercado	5197	6138	5549	2522
Marban	6976	9303	11269	12855
Moxos	5864	7675	8935	9485
Total	49424	63362	70615	68292

B. TRAFFIC STUDY

B. TRAFFIC STUDY

B.1 Existing Traffic Conditions In Study Area

In the past years the SNC has conducted traffic volume counting surveys once a month at many points on major roads. Four points among those traffic survey points are on or near the project road. According to the latest data (1987), the traffic volume on the section between Santa Barbara and Caranavi (The major section of the project road) was 268 vehicles per day. Among these vehicles, heavy trucks accounted for 43%, followed by light trucks with 27.6%. However, the above counting survey data by the SNC does not give any information on the OD pattern of the vehicles (OD is an abbreviation for Origin/Destination). In order to forecast the future traffic volume using the project road, it is important to obtain an OD pattern for the traffic, since it is necessary to specify the origin and/or destination of the traffic as the project road is considered to influence the impact on areas far away from the project road. Therefore, the following comprehensive traffic survey was carried out in this Study.

B.2 Traffic Survey

B.2.1 Survey Procedure

In order to obtain detailed traffic data on the project road, a comprehensive roadside OD survey was conducted with the kind cooperation of the SNC and Police offices near the survey stations. The roadside OD survey was carried out from 8:00 A.M. on September 20 to 8:00 A.M. on September 21 in 1989, at five stations selected by the Study Team, between Santa Barbara and Bella Vista. All vehicles (except military vehicles) were requested to stop and were interviewed by surveyors under the supervision of policemen, SNC staff, or members of the Study Team. The location of survey stations for this roadside OD survey was as follows:

Station 1 In front of the police inspection office at
Yolosa

- Station 2 In front of the police inspection office at Caranavi on the road to La Paz
- Station 3 On the exit from downtown Caranavi to Guanay (near the Market)
- Station 4 In front of the police inspection office on the road to Bella Vista
- Station 5 On the road near the SNC office at Bella Vista

B.2.2 Questionnaire

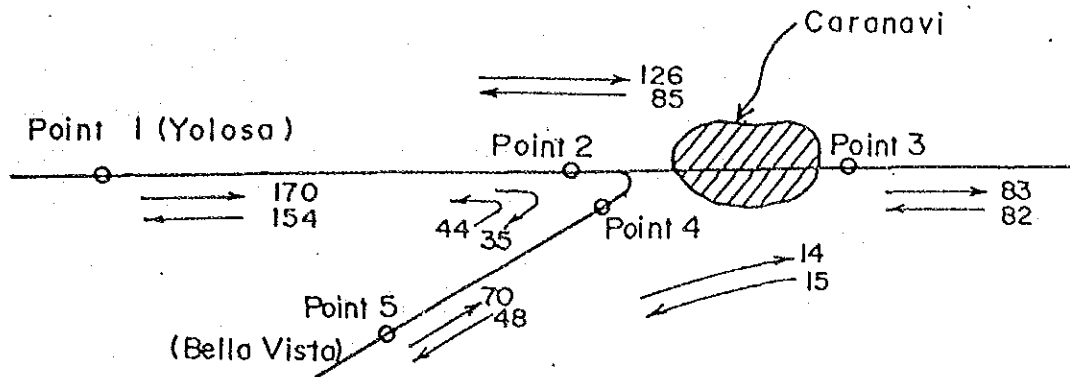
A questionnaire for the roadside OD survey was designed to be as simple as possible, in order to allow the drivers to understand the questions easily, with the purpose of obtaining precise answers for the interview. The questions asked included the following items:

- Trip origin and destination
- Trip purpose
- Type of vehicle
- Number of goods carried
- Volume of goods
- Interview time

The questionnaire sheet, surveyor's manual, and type of vehicle are shown in Appendix B-1 to B-3.

B.2.3 Number of Surveyed Vehicles

Basically, 8 to 10 interviewers were assigned to each survey station. The interview was conducted for all vehicles passing through the five survey stations except military vehicles. As a results, the vehicles shown in Fig. B.2-1 were interviewed at the five survey stations.



(Unit : Vehicle)

Fig. B.2-1 Number of Surveyed Vehicle

B.2.4 Compilation of Collected Data

After the compilation of the OD survey, filled questionnaires with answers were checked manually, then respective zone codes were assigned to both an origin and a destination of each trip. The traffic zone was determined by dividing the area influenced by this Project into 10 traffic zones as shown in Fig. B.2-2. Finally, these data were input into a personal computer for data processing.

Traffic Zone	Major cities
1	La Paz
2	Yolosa
3	Coroico
4	Choro
5	Caranavi, Alcoche
6	Bella Vista, Carrasco
7	Alto Beni (Mayaya, Sapecho)
8	Beni
9	Guanay
10	Apolo, Mapiri, Pando

Fig. B.2-2 Traffic Zone Code

B.3 Results of Traffic Survey

B.3.1 Vehicle Composition

The total number of vehicles surveyed and the composition of vehicle type are shown in Table B.3-1. Among the 926 vehicles surveyed, the number of heavy trucks accounted for 48.2% (446 vehicles), followed by light trucks at 32.2% (298 vehicles). Other types of vehicle accounted for less than 10%.

Table B.3-1 Vehicle Composition

	Passen- ger Car	Bus	Light Truck	Medium Truck	Heavy Truck	Total
Total Vehicles (Vehicle)	72	35	298	75	446	926
Vehicles Composition (%)	7.8	3.8	32.2	8.1	48.2	100.0

B.3.2 Trip Purpose

As shown in Table B.3-2, 76% of all surveyed vehicles used the existing road for the purpose of business. Other trip purposes were very few except for the purpose of going to the working place. Different from the traffic survey within the urban area, the trip purpose of going back home was rare, since many vehicles were on a long trip.

Table B.3-2 Trip Purpose
(Unit : Vehicle)

Purpose	No. of vehicle	share (%)
Business	704	76.02
Go to working place	125	13.50
Go to school	4	0.43
Social intercourse	12	1.30
Tourism & recreation	12	1.30
Shopping	5	0.54
Go back home	9	0.97
Others	14	1.51
No answer	41	4.43
Total	926	100.00

B.3.3 Average Occupancy by Vehicle Type

The average occupancy by vehicle type is shown in Table B.3-3. The average number of bus passenger was 23 , however, the average number for other types of vehicles ranged from 4 to 6 persons.

Table B.3-3 Average Occupancy by Vehicle Type

	Passen- ger Car	Bus	Light Truck	Medium Truck	Heavy Truck	Total
Total Vehicles ¹⁾	72	35	298	75	446	926
Total Passenger ²⁾	291	805	1747	317	2247	5407
Average Occupancy ³⁾	4.04	23.00	5.86	4.23	5.04	5.84

Unit : 1) Vehicle, 2) Person, 3) Person

B.3.4 Kind and Volume of Freight Carried

Goods carried on the existing road is shown by kind of goods and road sections classified below.

Category	Kind of goods
1. Agricultural products	Fruit, Cocoa, Rice, Vegetable, Wheat
2. Livestock	Cattle
3. Construction materials	Cement, Timber, Brick
4. Food	Beer, Juice, Processed food
5. Oil products	Gasoline, Diesel oil, Gas cylinder
6. Miscellaneous	

Road Section

1. Santa Barbara-Caranavi
2. Caranavi-Bella Vista
3. Caranavi-Guanay

As shown in Table B.3-4, a high volume of goods was carried from the North (Beni, Guanay, etc.) to the South (La Paz) except for oil products. In particular, among these goods,

carried on the existing road.

Table B.3-4 Kind and Volume of Goods carried
(Unit : Quintal)

Road Section	Un-known	Kind of Goods						Total
		1	2	3	4	5	6	
Section 1								
N<-S	0	818	220	3367	3865	3234	2171	13675
N->S	0	21366	2935	10441	1652	155	307	36856
Average	0	11092	1578	6504	2759	1695	1239	25266
Section 2								
N<-S	0	75	0	408	669	1146	502	2800
N->S	400	7365	2585	6451	868	52	785	18506
Average	200	3720	1293	3430	769	599	644	10653
Section 3								
N<-S	0	399	50	899	406	588	479	2821
N->S	0	343	0	0	116	48	0	507
Average	0	371	25	450	261	318	240	1664
Total								
N<-S	0	1292	270	4674	4940	4968	3152	19296
N->S	400	29074	5520	16892	2636	255	1092	55869
Average	200	15183	2895	10783	3788	2612	2122	37583

Note : 1 Quintal = 46kg

S South direction

N North direction

B.3.5 Average Freight Tonnage Carried

Average freight tonnage by vehicle type is shown in Table B.3-5. The average freight tonnage (including empty vehicles), was 0.87 ton/vehicle for all vehicles, 1.93 ton/vehicle for heavy trucks, and 0.85 ton/vehicle for small and medium trucks. If empty vehicles are excluded, the average freight tonnage is 2.27 ton/vehicle for all vehicles, 5.41 ton/vehicle for heavy truck, 1.78 ton/vehicle for small and medium trucks.

Table B.3-5 Average Freight Tonnage
(Unit : Ton)

	Passen- ger Car	Bus	Light & Medium Truck	Heavy Truck	Total
N<-S	0.05	0.0	0.81	1.31	0.75
	0.50	0.0	1.38	4.47	1.60
N->S	0.05	0.0	0.91	2.53	1.04
	0.81	0.0	3.06	6.04	3.86
Average	0.05	0.0	0.85	1.93	0.87
	0.60	0.0	1.78	5.41	2.27

Note : Upper Including empty truck
Lower Excluding empty truck
"Average" is the average weighted by
traffic volume

B.4 Establishment Of Present OD Table

B.4.1 Procedure in Making Present OD table

The existing OD table was established by the procedure shown in Fig B.4-1.

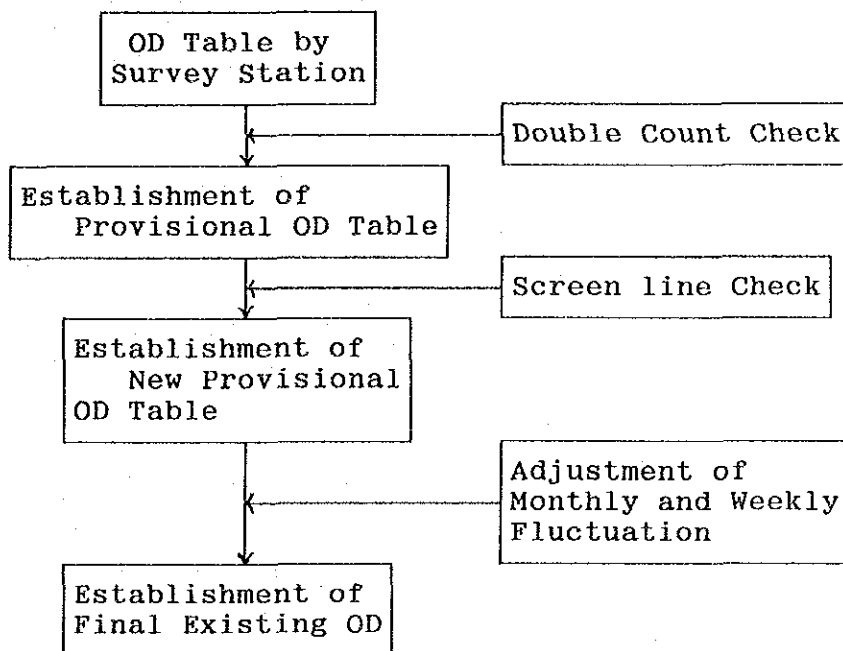


Fig. B.4-1 Procedure of Making the Existing OD Table

The detailed steps are as follows:

Step 1. OD Table by Survey Station

The OD table for each survey station was made by aggregating each OD trip of the data collected at each station. As a result, five OD tables were made.

Step 2. Provisional OD Table

Most vehicles surveyed at each survey station may have been interviewed more than twice, because survey stations were set up at main entrance/exit of the project road. Therefore, in order to avoid double counting by summing up the above five OD tables into one OD table, vehicles interviewed more than twice should be deleted. This was done by checking the number of the license plate of vehicles surveyed. After deleting double counted vehicles, five OD tables were summed up into one OD table to form the first provisional OD table.

Step 3. Screen Line Check

The traffic on the provisional OD table was assigned to the project road and was checked against the actual traffic volume at each survey station. This process is called a screen line check. At each station, there was a small difference between the actual traffic volume and that on the provisional OD table, therefore, the new provisional OD table was obtained by adjusting the provisional OD table closer to the actual traffic volume.

Step 4. Establishment of the OD Table

The final existing OD table was established by modifying the new provisional OD table, taking into account monthly and weekly fluctuations.

The monthly and weekly adjustment were made in the following steps, with the SNC traffic counting data surveyed in the past years.

1. Weekly fluctuation was calculated.
2. Monthly traffic volume by the SNC was converted into a weekly average volume, because the monthly volume represents the traffic volume in one specific day. Then, the monthly fluctuation was calculated.
3. The weekly fluctuation from Step 1 and monthly fluctuation from Step 2 were multiplied by the new provisional OD table. The weekly and monthly fluctuations were calculated as follows from traffic count data at the four stations listed below:

- SNC Survey Station No.1810 Yolosita
- SNC Survey Station NO.1820 Puerto Leon
- SNC Survey Station No.1000 Camp. km 53
- SNC Survey Station No.1840 Tajliwi
(Route No.1732)

Weekly fluctuation

The weekly fluctuation was calculated, based on past SNC traffic data, which is shown in Table B.4-1. According to this data, the weekly fluctuation ranged from 1.04 to 1.11, therefore, the average fluctuation was adopted as a weekly fluctuation in order to establish the existing OD table. The average fluctuation was calculated as 1.08 on Wednesday (the survey day was Wednesday).

Table B.4-1 Weekly Fluctuation

	SUN	MON	TUE	WED	THU	FRI	SAT
1988	1.01	0.64	1.07	1.07	0.87	1.37	0.96
1987	1.02	0.78	1.05	1.08	0.95	1.33	0.91
1986	1.10	0.70	1.01	1.04	0.90	1.50	0.84
1985	0.96	0.52	1.06	1.11	1.02	1.41	0.95
AVERAGE	1.02	0.66	1.05	1.08	0.94	1.40	0.92

Monthly Fluctuation

The monthly fluctuation was calculated from previously collected data from the following SNC survey stations.

Station No. 1810	1.01
Station No. 1820	0.99
Station No. 1000	1.08
Station No. 1840	1.14

B.4.2 Present OD Table

Using the above weekly and monthly fluctuation, the existing OD table was established, and is shown in Table B.4-2. The total traffic volume generated/attracted was 770 vehicles.

Table B.4-2 Established OD Table (Vehicles/day)

	La Paz	Yolo	Coroi	Choro	Cara navi	Bella Vista	Alto Beni	Beni	Guanay	Pando	Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	1	140	8	5	44	98	5	301
2		0	0	0	0	0	0	0	1	0	1
3			0	0	2	1	0	0	0	0	3
4				0	0	0	0	0	0	0	1
5					31	15	3	8	28	4	231
6						0	3	0	1	0	28
7							0	0	6	0	17
8								0	1	0	45
9									0	0	134
10										0	9
Total											770

Comparing the traffic volume of the established OD table with the past actual data on the road section between Santa Barbara and Caranavi (as shown in Table B.4-3), the total traffic volume increased by 33 vehicles to 301 vehicles over the previous year. The number of light truck increased by 1.4 times to 105 vehicles over previous year, however,

the number of passenger car decreased to 17 vehicles from 33 vehicles in 1988. The reason is as follows: The Study Team conducted the survey during 24 consecutive hours including midnight, (which showed almost no passenger cars), however, the SNC survey was limited to the daytime and the sampled data extrapolated into the night with the parallel rate of volume/hour of the daytime. Therefore, the traffic volume during the night time for the SNC survey is considered to be overestimated. Judging from these circumstances, the results of traffic surveys conducted by the Study Team were considered sufficiently reliable.

Table B.4-3 Traffic Volume
(Santa Barbara-Caranavi) (Vehicles/Day)

Year	Passenger Car	Bus	Light Truck	Medium Truck	Heavy Truck	Total	Growth Rate
1984	18	13	32	31	36	130	
1985	13	50	33	33	66	194	1.49
1986	25	12	52	31	61	181	0.93
1987	32	15	71	20	108	246	1.36
1988	33	17	74	19	115	268	1.09
1989	17	14	105	16	149	301	1.12

B.5 Projection of Future Traffic Volume

The projection of future traffic volume was considered under the following three categories:

1) Increase in Normal Traffic

The normal traffic volume is the traffic growing at the rate parallel to the social and economic growth.

2) Generation of Refrigerated trucks

The refrigerated trucks are the traffic carrying beef from the Beni department to La Paz city. At present the beef produced in the Beni department is carried by mainly airplanes, however, judging from their significantly aged machines, it is reasonable that these existing aged airplanes are very diffi-

cult to continue the operation even in the near future. Therefore, instead of these airplanes, in the future the refrigerated trucks will be used to carry beef through the project road, whether the project is improved or not.

3) Development Traffic

In Bolivia the Beni department, the Pando department, and the northeast of the La Paz department have significantly large potentiality for agriculture. Therefore, this agricultural potentiality can be developed if the access to the large market (La Paz city) from these areas is improved. There is no doubt that the project road contributes to make the access considerably improved together with the completion of road sections for Cotapata-Santa Barbara and San Borja-Trinidad. Therefore, the agricultural products in the above areas, specially in the influenced area as shown in Fig. B.5-2(1) to Fig B.5-2(3), are expected to increase after the completion of the project. As the newly increased products are also carried by trucks to the market through the project road, these traffic can be defined the development traffic. In other words, the development traffic is the traffic newly generated and/or attracted in the influenced areas.

B.5.1 Projection of Increase in Normal Traffic

The normal traffic growth rates were estimated by a regression model. The model structure is as follows:

$$TV = a + b \times (RGDP/POP) + c \times Y$$

TV : Traffic volume for Santa Barbara and Caranavi

RGDP : RGDP of La Paz, Beni and Pando

POP : Population of La Paz, Beni and Pando

Y : Year

a, b, c : Coefficient

The estimated parameters are shown in Table 5.5-1.

Table B.5-1 Regression Parameters

	a	b	c	r ²
Passenger Car	-2193.95 (-0.719)	0.9845 (0.622)	19.285 (1.937)	0.8317
Bus	-1218.117 (-1.046)	0.5926 (0.981)	4.0108 (1.055)	0.7308
Light & Medium Truck	-14951.38 (-3.827)	7.4689 (3.685)	14.6978 (1.152)	0.9494
Heavy Truck	31038.18 (4.902)	15.3317 (4.668)	48.3673 (2.340)	0.9750

Note : () T-value

Applying the estimated growth rates with the above model, the future volume was forecast, which is shown in Table B.5-2. As a result, the future total traffic volume was projected to increase by 2.8 times in 2000, 4.6 times in 2010, and 6.6 times in 2020 from the existing level.

Table B.5-2 Traffic Growth Rate

Year	Passenger Car	Bus	Light & Medium Truck	Heavy Truck	Total
1989	1.000	1.000	1.000	1.000	1.000
2000	3.000	2.167	2.183	3.322	2.791
2010	5.195	3.444	3.365	5.705	4.628
2020	7.634	4.833	4.609	8.255	6.598

With the above growth rates, the future OD table was established, and is shown in the Tables B.5-4(1) to B.5-4(3). With the future OD table, the future traffic volume between Santa Barbara and Caranavi and also between Caranavi and Bella Vista were projected as shown Table B.5-3(1) and Table B.5-3(2), respectively. The future Traffic volume between Santa Barbara and Caranavi was projected as 840 in 2000, 1393 in 2010, and 1986 in 2020. On the other hand, the future traffic volume between Caranavi and Bella Vista was projected as 308 in 2000, 521 in 2010, and 748 in

2020. AS shown in the Tables, the Caranavi-Bella Vista section shows a higher growth rate than that of Santa Barbara-Caranavi.

Table B.5-3(1) Future Traffic Volume
Between Santa Barbara-Caranavi
(Normal Traffic volume) (Unit : Vehicles/Day)

	Passen- ger Car	Bus	Light & Medium Truck	Heavy Truck	Total	Growth Ratio (1989=1)
1989	17	14	121	149	301	1.00
2000	51	30	264	495	840	2.79
2010	88	48	407	850	1393	4.63
2020	130	68	558	1230	1986	6.60

Table B.5-3(2) Future Traffic Volume Between
Caranavi-Bella Vista
(Normal traffic volume) (Unit : Vehicles/Day)

	Passen- ger Car	Bus	Light & Medium Truck	Heavy Truck	Total	Growth Ratio (1989=1)
1989	3	1	22	75	101	
2000	9	2	48	249	308	3.05
2010	16	3	74	428	521	5.16
2020	23	5	101	619	748	7.41

Table B.5-4(1) Future OD Table of 2000 (Vehicles/day)

	La Paz	Yolo	Coroi	Choro	Cara navi	Bella Vista	Alto Beni	Beni	Guanay	Pando	Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	3	391	22	14	123	273	14	840
2		0	0	0	0	0	0	0	3	0	3
3			0	0	6	4	0	0	0	0	10
4				0	0	0	0	0	0	0	3
5					87	51	10	27	78	14	664
6						0	8	0	4	0	89
7							0	0	21	0	53
8								0	4	0	154
9									0	0	383
10										0	28
Total											2227

Table B.5-4(2) Future OD Table of 2010 (Vehicles/day)

	La Paz	Yolo	Coroi	Choro	Cara navi	Bella Vista	Alto Beni	Beni	Guanay	Pando	Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	5	648	37	23	204	454	23	1393
2		0	0	0	0	0	0	0	5	0	5
3			0	0	2	6	0	0	0	0	15
4				0	0	0	0	0	0	0	5
5					143	90	18	48	130	24	1101
6						0	14	0	6	0	153
7							0	0	36	0	91
8								0	6	0	258
9									0	0	637
10										0	47
Total											3705

Table B.5-4(3) Future OD Table of 2020 (Vehicles/day)

	La Paz	Yolo	Coroi	Choro	Cara navi	Bella Vista	Alto Beni	Beni Beni	Guanay	Pando	Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	7	924	53	33	290	647	33	1986
2		0	0	0	0	0	0	0	7	0	7
3			0	0	13	9	0	0	0	0	22
4				0	0	0	0	0	0	0	7
5					205	131	26	69	185	34	1560
6						0	20	0	9	0	222
7							0	0	52	0	131
8								0	9	0	368
9									0	0	909
10										0	67
Total											5279

B.5.2 Generation of Refrigerated Trucks

As already explained in the first paragraph of B.4, the future beef transportation is expected to go through the project road by the refrigerated trucks between the beef producing area, Beni, and the consumption area, La Paz, since current airplanes carrying beef are getting old and the replacement of the new airplanes is practically impossible because of significantly high purchase cost. As already shown in Table A.4-29, there is a high beef surplus in the Beni department. Amongst this beef surplus, only the beef surplus produced within the area influenced by the project road is expected to be transported through the project road to La Paz city. The influenced area was determined as shown in Fig. B.5-1.

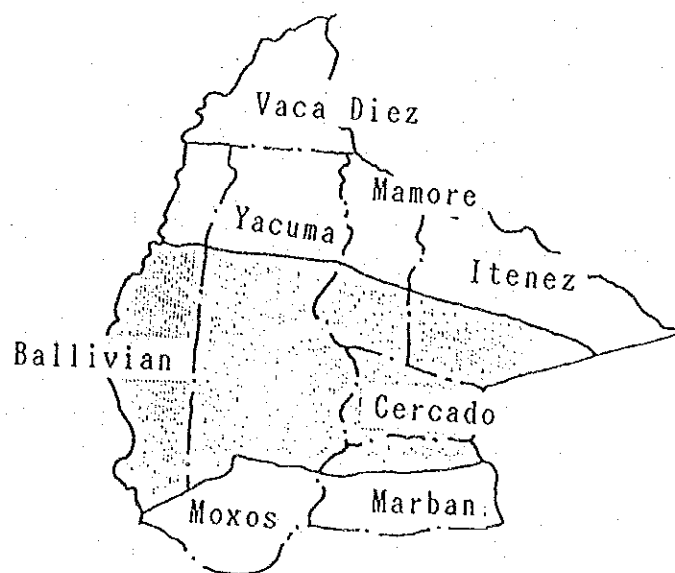


Fig. B.5-1 Influenced Area in Beni for Beef Production

The volume of beef in each province transported through the project road is assumed to be proportional to the ratio of the influenced area to the total provincial area. Therefore, using Table A.4-29 the exported beef from each province of Beni to La Paz was projected to as shown in Table B.5-5. As a result, the total beef export from Beni to La Paz was projected 39.4 thousand tons in the 2000, 45.1 thousand tons in 2010, and 46.3 thousand tons in 2020.

Table B.5-5 Exported beef from provinces in Beni
(Unit : Ton)

Province	Share (%)	1989	2000	2010	2020
Vaca Diez	0	0	0	0	0
Ballivian	75	8822	11630	13756	15055
Yacuma	75	7816	10439	12670	14534
Mamore	50	2954	3936	4758	5423
Itenez	50	1688	2132	2295	2043
Cercado	100	5197	6138	5489	2522
Marvan	30	2093	2791	3379	3857
Moxos	30	1759	2303	2681	2846
Total		30329	39369	45087	46279

As it is not reasonable to assume that almost all beef be transported by the refrigerated trucks, some portion of beef is assumed to continue to be carried by airplanes. Based on the Study titled "The Study of Road Improvement Between San Borja and Trinidad", the conversion rate from airplanes to the project road was assumed to be 97% by previous Bolivian experience, which means that the remained 3% of this export beef continues to be carried by airplane. In addition, the beef export is assumed to be carried by refrigerated truck with an average load of 10 tons. Therefore, the necessary number of refrigerated truck to carry the beef was estimated as shown in Table B.5-6.

Table B.5-6 The Number of Refrigerated Truck

	2001	2010	2020
Export Beef	39907*	45087	46279 (ton)
No. of Ref. Truck Per Year	3991	4509	4628 (vehicle)
No. of Ref Truck Per Day	11	12	13 (vehicle)

* Estimation by linear interpolation between 2000-2010

As a result, after the completion of the project, the number per day of refrigerated trucks passing through the project road between Santa Barbara and Bella Vista would be 11 in 2001 (opening year), 12 in 2010, and 13 in 2020.

B.5.3 Development Traffic

As explained in A.4, Beni, Pando and the northeast of La Paz have a lot of surplus for agricultural products such as rice, banana, yuca, and so on. This surplus would be expected to be exported to La Paz. However, this surplus was projected through only the overall economic growth, so not includes the product increase through development. According to "Estrategia de Desarrollo Economico y Social 1989-2000", the productivity of agriculture is estimated to increase in the future as indicated in Table B.5-7.

Table B.5-7 Existing and Future Productivity

Product	Productivity		Annual Growth (%)
	1988/1989 (ton/ha)	1999/2000 (ton/ha)	
Rice	1.485	3.169	7.13
Maize	1.556	2.137	2.93
Banana	9.008	9.085	0.08
Yuca	10.370	10.400	0.03
Sugar Cane	41.393	42.054	0.14
Fruit	8.444	8.553	0.12
Vegetable	2.668	3.111	1.41
Others	0.924	1.598	5.11

Generally the increase of the productivity of agricultural products brings about the save of agricultural land, however, after the completion of the project road, the saved land only within the influenced area is expected not to be left vacant but to continue to be used in order to increase the agricultural products as much as possible up to the limit of demand because of the expansion of market by the road improvement and/or the demand in the consumption area. Based on this idea, the increase of agricultural products obtained through cultivation of the saved land in La Paz, Beni and Pando departments is projected, using the productivity data shown in Table B.5-7. The following steps are procedures of estimating the development traffic:

Step 1 Necessary cultivation land in case of unchanged productivity

The future production of agricultural products was forecast as shown in Table A.4-8. If the productivity is unchanged as it is, the necessary cultivation land is calculated by dividing the volume of production shown in Table A.4-8 by the existing productivity indicated in the second column of Table B.5-7. The necessary land in this case is shown in Table B.5-8.

Table B.5-8 Necessary Cultivating Area
under Unchanged Productivity
(Unit : Ha)

	Rice	Maize	Banana	Yuca	S.Cane	Fruit	Vegetable	Others
La Paz								
1989	9455	13576	14234	4054	504	5901	3876	29986
2000	13228	18974	19850	5691	683	8291	5898	40978
2010	17950	25724	26859	7745	900	11293	8639	54434
2020	24359	34873	36342	10541	1186	15383	12653	72307
Beni								
1989	15267	10916	10006	13447	1965	1236	237	1276
2000	21361	15256	13955	18874	2663	1736	361	1744
2010	28987	20687	18882	25687	3509	2365	529	2315
2020	39336	28040	25549	34960	4625	3222	774	3076
Pando								
1989	6007	4358	4607	5087	155	481	235	252
2000	7810	6091	6425	7094	210	676	357	344
2010	10599	8257	8694	9599	277	920	523	457
2020	14382	11195	11764	12989	366	1254	766	607

Step 2 Necessary cultivation land in case of improvement of productivity

Improvement of productivity leads to the save of the cultivation land. Therefore, the cultivation land in case of productivity improvement is calculated by dividing the volume of products shown in Table A.4-8 by the improved productivity indicated in the third column of the aforementioned Table. The necessary land is estimated as shown in Table B.5-9. The future productivity after the year of 2000 is assumed to be same as that of 2000/1999.

**Table B.5-9 Necessary Cultivating Area
under Improvement of Productivity
(Unit : Ha)**

	Rice	Maize	Banana	Yuca	S.Cane	Fruit	Vegetable	Others
La Paz								
1989	9455	13576	14234	4054	504	5901	3876	29986
2000	6198	13816	19682	5674	672	8185	5058	23695
2010	8411	18730	26631	7723	886	11149	7409	31475
2020	11415	25392	36036	10510	1167	15187	10851	41810
Beni								
1989	15267	10916	10006	13447	1965	1236	237	1276
2000	10010	11109	13837	18820	2621	1714	310	1008
2010	13583	15063	18722	25613	34547	2335	454	1339
2020	18433	20417	25333	34859	4553	3181	664	1778
Pando								
1989	6007	4358	4607	5087	155	481	235	252
2000	3660	4435	6371	7074	207	667	306	199
2010	4967	6012	8620	9572	273	909	449	264
2020	6740	8151	11664	12951	360	1238	657	351

Step 3 Calculation of saved cultivation land

The cultivation land saved through the productivity improvement is calculated by subtracting figures on Table B.5-9 from those on Table B.5-8. Table B.5-10 shows the saved cultivation land.

Table B.5-10 Saved Cultivated Land

(Unit : Ha)

	Rice	Maize	Banana	Yuca	S.Cane	Fruit	Vegetable	Others
La Paz								
2000	7029	5159	168	16	11	106	840	17284
2001	7247	5318	173	17	11	109	873	17782
2010	9539	6994	228	22	14	144	1230	22959
2020	12944	9481	308	30	19	196	1802	30498
Beni								
2000	11351	4148	118	54	42	22	51	735
2001	11703	4276	122	56	43	23	53	756
2010	15404	5624	160	74	55	30	75	976
2020	20903	7624	217	101	73	41	110	1297
Pando								
2000	4150	1656	54	20	3	9	51	145
2001	4279	1707	56	21	3	9	53	149
2010	5632	2245	74	28	4	12	75	195
2020	7643	3044	100	37	6	16	109	256

Step 4 Calculation of saved cultivation land within the influenced area by the completion of the project road

The saved land indicated in Table B.5-10 includes the saved land other than the influenced area. As it is assumed that the increase of agricultural production can be promoted only in the saved cultivation land within the influenced area of the project, the share of saved land within the influenced area to the total saved land should be determined. This share was assumed to be determined with the ratio of potential within the influenced area to that of the whole area of each department. The potential was obtained by the product of population and area as shown in Table B.5-11 (1) through Table B.5-11 (3). The influenced area of each department is shown in Fig. B.5-2 (1) through Fig. B.5-2(3). As a result, the percentage of the influenced area to the each department's area is calculated 15.3% for La Paz, 56.2% for Beni, and 73.4% for Pando department (hereafter, called "percentage share").

Table B.5-11 (1) Percentage of Influenced area
to La Paz Department

Province	Area Population		AxB Share of C			DxE**
	(A)	(B)	(C)	(D)	(E)*	
Murillo	4705	1113528	5239149	0.488	0.1	0.049
Pacajes	6500	93424	550420	0.051	0	0.000
Camacho	2080	99530	207022	0.019	0	0.000
Muñecas	4965	30177	149829	0.014	0	0.000
Larecaja	8110	67769	549607	0.051	0.3	0.015
Franz Tamayo	19590	22915	448909	0.042	0.75	0.031
Ingavi	5410	124124	671511	0.063	0	0.000
Loayza	3370	61592	207565	0.019	0	0.000
Inquisivi	6430	111019	713852	0.066	0	0.000
Nor Yungas	5120	66063	338243	0.031	0.5	0.016
Los Andes	1658	86779	143880	0.013	0	0.000
Aroma	4510	94209	424883	0.040	0	0.000
Sud Yungas	5770	69187	399209	0.037	0.75	0.028
Iturrealde	42815	7154	306299	0.029	0.5	0.014
Saavedra	2525	14495	36600	0.003	0	0.000
Manco Kapac	367	33686	12363	0.001	0	0.000
Villarroel	1935	22294	43139	0.004	0	0.000
Omasuyos	2065	117555	242751	0.023	0	0.000
Jose Pando	6060	8744	53989	0.005	0	0.000
Total	133985	2235500	10738213	1.000		0.153***

Note : * Percentage of the influenced area to the provincial area, based on Fig. 5.5-2(1)
 ** Percentage of weighted influential area to the provincial area
 *** Percentage of influential area to La Paz department

Table B.5-11 (2) Percentage of Influenced area
to Beni Department

Province	Area Population		AxB Share of C			DxE**
	(A)	(B)	(C)	(D)	(E)*	
Cereado	66702	12276	818834	0.112	0.5	0.056
Ballivian	42004	40444	1698810	0.233	1	0.233
Yacuma	25523	34386	877634	0.120	1	0.120
Moxos	23026	33616	774042	0.106	0.3	0.032
Mamore	15708	18706	293834	0.040	0	0.000
Marban	16279	15126	246236	0.034	0	0.000
Itenez	22330	36576	816742	0.112	0	0.000
Vaca Diez	78329	22434	1757233	0.241	0.5	0.121
Total	289901	213564	7283364	1.000		0.562***

Note : * Percentage of the influenced area to the provincial area, based on Fig. 5.5-2(1)
 ** Percentage of weighted influential area to the provincial area
 *** Percentage of influential area to Beni department

Table B.5-11 (3) Percentage of Influenced area
to Pando Department

Province	Area Population		AxB Share of C			DxE**
	(A)	(B)	(C)	(D)	(E)*	
N. Suarez	19286	9818	189350	0.283	0.5	0.141
Abuna	4458	7468	33292	0.050	0.2	0.010
G. F. Roman	2678	13200	35350	0.053	0.2	0.011
Manuripi	12043	22461	270498	0.404	1	0.404
Madre de D.	12935	10879	140720	0.210	0.8	0.168
Total	51400	63826	669210	1.000		0.734***

Note : * Percentage of the influenced area to the provincial area, based on Fig. 5.5-2(1)
 ** Percentage of weighted influential area to the provincial area
 *** Percentage of influential area to Pando department

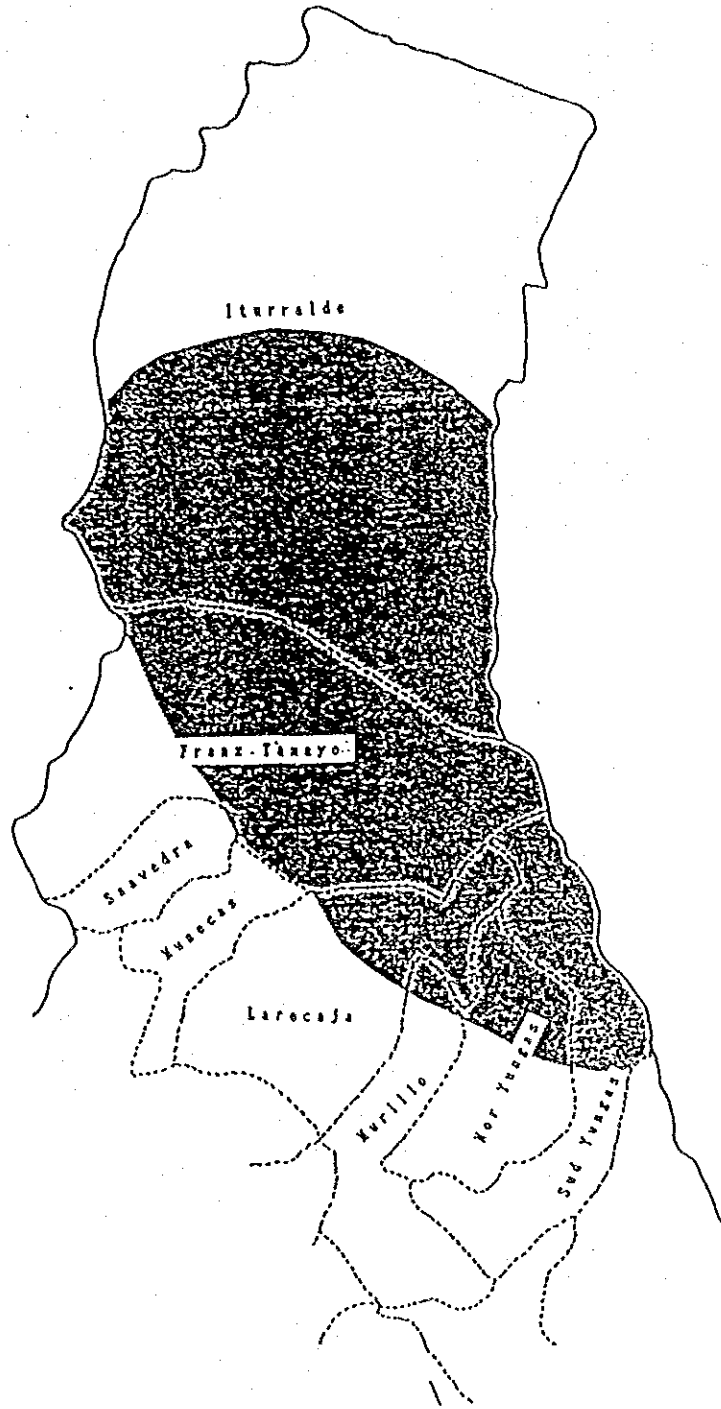


Fig. B.5-2(1) Influenced Area In La Paz Department

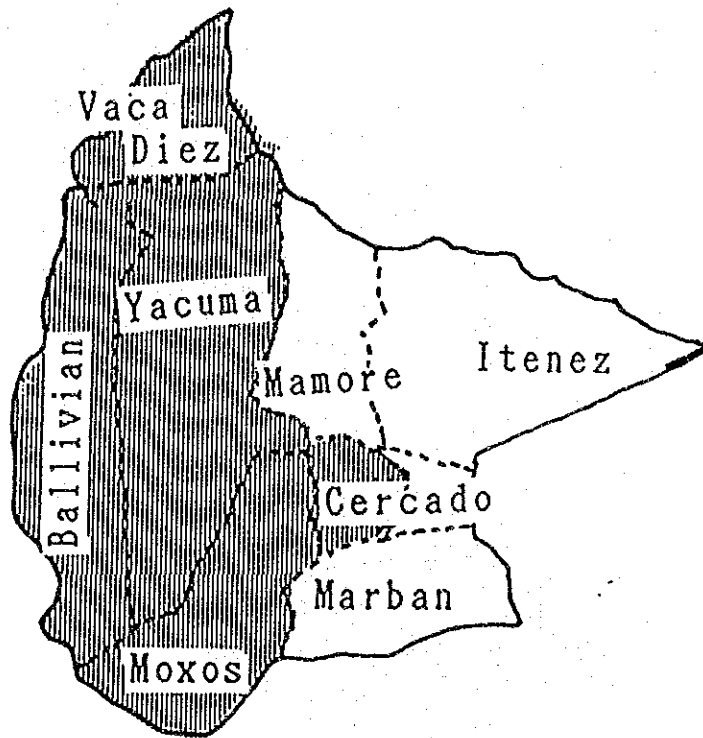


Fig. B.5-2(2) Influenced Area In Beni Department

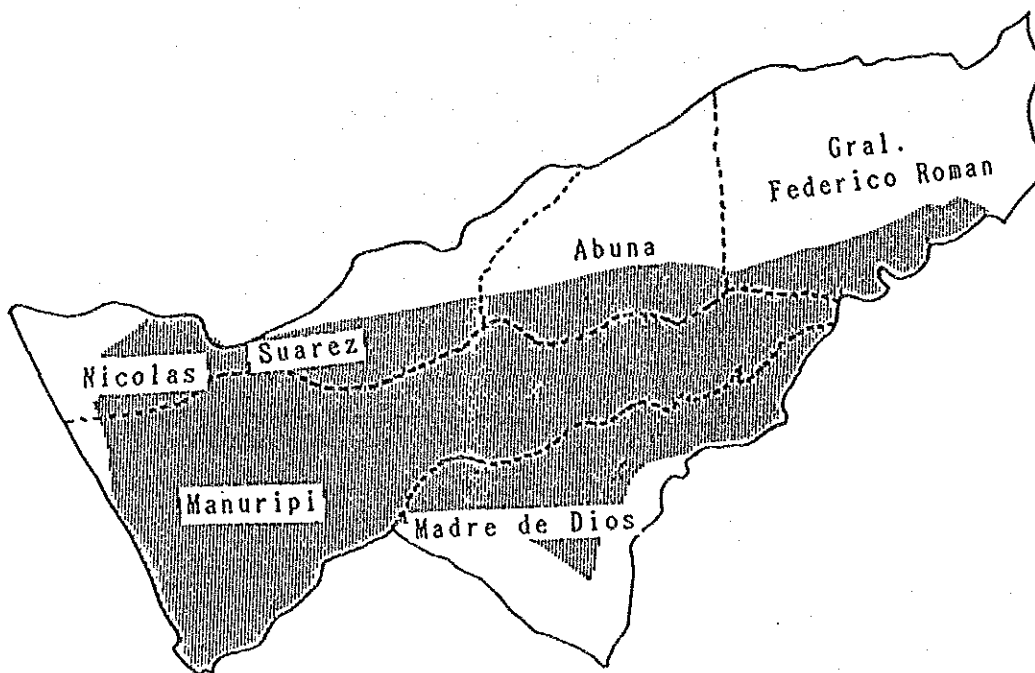


Fig. B.5-2(3) Influenced Area In Pando Department

Consequently, the saved land to be cultivate was obtained by multiplying figures on Table B.5-10 by the aforementioned "percentage share". The results is shown in Table B.5-12. All these saved land are assumed to be cultivated completely up to 2020. However, as the project road is scheduled to be completed in 2000, it is assumed that only one fifth of the saved land will be cultivated in 2001. Because it is reasonable to assume that the cultivation will be proceeded gradually.

Table B.5-12 Saved Cultivated Land
to be Developed

(Unit : Ha)

	Rice	Maize	Banana	Yuca	Cane	Fruit	Vegetable	Others

La Paz								
2001	111	81	3	0	0	2	13	272
2010	1459	1070	35	3	2	22	188	3513
2020	1980	1451	47	5	3	30	276	4666
Beni								
2001	658	240	7	3	2	1	3	42
2010	8657	3161	90	42	31	17	42	549
2020	11748	4284	122	57	41	23	62	729
Pando								
2001	314	125	4	2	0	1	4	11
2010	4134	1648	54	21	3	9	55	143
2020	5610	2234	73	28	4	12	80	188

Step 5 Agricultural production from the saved land

The agricultural production in the saved cultivation land can be calculated by multiplying the saved land shown in Table B.5-12 by the future productivity indicated in the third column of Table B.5-7. The productivity of 2010 and 2020 is assumed to be same as that of 2000. The future agricultural production in the saved land is shown in Table B.5-13.

Table B.5-13 Future Agricultural Production
in Saved Cultivated Area (Unit : Ton)

	Rice	Maize	Banana	Yuca	Cane	Fruit	Vegetable	Others	Total
La Paz									
2001	351	174	24	3	7	14	42	435	1050
2010	4625	2287	317	35	90	188	585	5813	13741
2020	6276	3100	428	48	122	256	858	7457	18545
Beni									
2001	2084	574	62	33	102	11	9	68	2883
2010	27434	6754	817	433	1300	144	131	877	37890
2020	37228	9156	1108	590	1725	197	192	1165	51362
Pendo									
2001	995	268	37	16	9	6	12	17	1361
2010	13100	3521	493	214	123	75	171	229	17928
2020	17778	4775	667	282	185	100	249	300	24337

Step 6 Traffic volume generating from the development Area

As already explained, the development traffic is assumed to generate/attracted from the development area in the saved land. Table B.5-13 shows the production of the agricultural products cultivated in the saved land. The development traffic generates to transport these products to the market, that is, the capital city of La Paz. Therefore, the agricultural products in Table B.5-13 should be converted into the number of freight vehicle required for transportation. According to the results of the traffic survey by the Study Team, the average load of vehicles is estimated 4.70 tons under the following calculation:

Type of Truck	No. of Vehicle* (vehicle)	Average Load** (ton)
Light & Medium	121	3.06
Heavy	149	6.04

$$\text{Average Load} = \frac{(121 \times 3.64) + (149 \times 6.04)}{270}$$

Note : * See Table B.5-4 (1989's traffic)
 ** See Table B.3-5 (N<-S)

Using the above average load per vehicle, the development traffic generating from the saved cultivation land was estimated as shown in Table B.5-14.

Table B.5-14 Volume of Development Traffic

	Year	Production From Development Area (ton/year)	Generated Traffic (vehicle/day)
La Paz	2001	1050	1 (2)*
	2010	13741	9 (18)
	2020	18545	11 (22)
Beni	2001	2883	2 (4)
	2010	37890	23 (46)
	2020	51362	30 (60)
Pando	2001	1361	1 (2)
	2010	17928	11 (22)
	2020	24337	15 (30)

Note : Bracket () indicates the round trip.

From the above results, the total development traffic (only freight traffic) was estimated 8 vehicle/day in 2001, 86 vehicle/day in 2010, and 112 vehicle/day in 2020.

On the other hand, the development traffic for passenger car and bus is estimated under the assumption that passenger car and buses generate according to the constant rate of total number of freight traffic. According to the results of the traffic survey indicated in Table B.4-3, the generating rates of passenger car and bus to truck was as follows:

Type of Vehicle	No. of Vehicle (vehicle)	Rate to Truck (%)
Passenger car	17	6.3
Bus	14	5.2
Truck	270	100.0

The development traffic for passenger car and bus is summarized as shown in Table B.5-15.

Table B.5-15 Development Traffic for Passenger car and Buses
(Unit : vehicle/day)

	Year	Passenger Car	Bus
La Paz	2001	1	1
	2010	2	1
	2020	2	2
Beni	2001	1	1
	2010	3	2
	2020	5	4
Pando	2001	1	1
	2010	2	1
	2020	3	2

B.5.4 Projection of Future Traffic Volume on Project Road

From the above traffic projection for the trend growth traffic (natural growth), refrigerated trucks, and development traffic, the future traffic volumes on the road section between Santa Barbara and Caranavi, and between Caranavi and Bella Vista road was projected as shown in Table B.5-16 and Table B.5-17, respectively. In this traffic assignment on both the above road sections, all the development traffic generated from Beni and Pando departments run through the road section between Bella Vista and

Santa Barbara. The development traffic generated from Iturralde province of La Paz department also pass through the same road section , however, the development traffic generated from other provinces of La Paz department run through only the road section between Caranavi and Santa Barbara. The share was calculated 9.2% for the former and 90.8% for the latter, using the data shown in the last column of Table B.5-11 (for example, the former can be obtained the following calculation : $0.014/0.153=0.092$).

In order to break down the total number of trucks into light truck, medium truck, and heavy truck, the following two steps are applied:

Step 1 The total number of truck is divided into two types, that is, light & medium truck and heavy truck with the share of the traffic projection by trend on each road section (see Table B.5-3 and Table B.5-4). The share is as follows:

	Light & Medium Truck	Heavy Truck
Santa Barbara - Caranavi		
2001	34.8%	65.2%
2010	34.4%	65.6%
2020	31.2%	68.8%
Caranavi - Bella Vista		
2001	16.2%	83.8%
2010	14.7%	85.3%
2020	14.0%	86.0%

Step 2 Light & Medium truck is divided into light truck and medium truck with the existing share obtained from the traffic survey. The share is 86.8% for light truck and 13.2% for medium truck on the road section between Santa Barbara and Caranavi. 86.4% and 13.6% are the same share on the road section between Caranavi and Bella Vista.

Table B.5-16

Future Traffic Volume
Between Santa Barbara-Caranavi

Unit: Vehicles/Day

Year	Type of Traffic	Passenger Car	Bus	Light Truck	Medium Truck	Heavy Truck	Total	Growth Rate (1989=1)
1989		17	14	105	18	149	301	1.0
2001	Trend	54	31	239	37	523	884	3.0
	Refrigerated Truck	0	0	0	0	20	20	
	Developed	3	3	2	1	5	14	
	Total	57	34	241	38	548	918	
2010	Trend	88	48	353	54	850	1393	5.0
	Refrigerated Truck	0	0	0	0	24	24	
	Developed	7	4	27	4	57	99	
	Total	95	52	380	58	931	1518	
2020	Trend	130	68	484	74	1230	1986	7.1
	Refrigerated Truck	0	0	0	0	28	28	
	Developed	10	8	30	4	74	128	
	Total	140	78	514	78	1330	2138	

Table B.5-17

Future Traffic Volume
Between Caranavi-Bella Vista

Unit: Vehicles/Day

Year	Type of Traffic	Passenger Car	Bus	Light Truck	Medium Truck	Heavy Truck	Total	Growth Rate (1989=1)
1989		3	1	19	3	75	101	1.0
2001	Trend	10	2	44	6	263	325	3.5
	Refrigerated Truck	0	0	0	0	20	20	
	Developed	2	2	1	0	5	10	
	Total	12	4	45	6	288	355	
2010	Trend	18	3	64	10	428	521	6.2
	Refrigerated Truck	0	0	0	0	24	24	
	Developed	5	3	8	2	60	78	
	Total	21	6	72	12	512	623	
2020	Trend	23	5	88	13	619	748	8.7
	Refrigerated Truck	0	0	0	0	26	26	
	Developed	8	6	14	2	79	109	
	Total	31	11	102	15	724	883	

The above traffic projection shows that the traffic volume on the road between Santa Barbara and Caranavi increases to 2138 vehicles per day in 2020 (7.1 times the existing level), of which 5.9% of traffic comes from the development of the influenced area affected by the project. On the other hand, the traffic volume on the road between Caranavi and Bella Vista increases to 880 vehicles in 2020 (8.7 times). About 12.0% of traffic is forecast to generate from the development area. Among traffic through the project road, almost all of them are freight traffic, 90% for the former section and 95% for the latter section, which composition is almost same as that of the existing traffic.

Comparing the traffic projection of this Study with that of the Cotapata-Santa Barbara Project, it is indicated that there is no big difference between both projections as shown below:

Year	Projection By* This Study (Santa Barbara-Caranavi)	Projection By** Cotapata-Santa Barbara Project
1995	-	632
2001	920	-
2005	-	1329
2010	1516	-
2015	-	2477
2020	2138	-

Unit : Vehicles Per Day

- : Not projected

Source: * Estimated by the Study Team

** Estimated in "Project Cotapata- Santa Barbara
Informe Socio-Economico Final Volume-6"

C. ECONOMIC ANALYSIS AND EVALUATION

C. ECONOMIC ANALYSIS AND EVALUATION

C.1 Setting Up Alternatives

Prior to performing the economic analysis, the proposed alternatives were examined in order to determine which would make the project viable. From the viewpoint of decreasing the initial project cost, firstly alternatives were broken into two categories, they are the paved surface case (nominated as "P") and the unpaved surface case (nominated as "U"). A paved surface refers to an asphalt concrete or an asphalt macadam. An unpaved surface refers to a gravel surface. Consecutively the foremost category was broken down into seven cases, depending on the year when the project road is paved or whether the pavement is an asphalt concrete or an asphalt macadam. As a result, the alternatives examined here contain a total of the following eight cases:

CASE P-1	Paved asphalt concrete surface from 2001
CASE P-2	Paved asphalt concrete in 2003
CASE P-3	Paved asphalt concrete in 2006
CASE P-4	Paved asphalt concrete in 2011
CASE P-5	Paved asphalt macadam surface from 2001
CASE P-6	Paved asphalt macadam in 2003
CASE P-7	Paved asphalt macadam in 2003 and asphalt concrete in 2008
CASE U	Unpaved surface

The following economic analysis is performed for the above alternatives, however, it must kept in mind that benefit accrued from an asphalt concrete pavement and that from an asphalt macadam pavement are same.

C.2 Economic Benefit

The completion of the project road is expected to result in many kinds of benefits (whether quantitative or qualitative) not only to the influenced area but also to the whole country through the increase of the national income. In this part the quantitative benefit is estimated for the purpose of calculating the economic indicators, such as the