11.2.4 Vehicle Operation Cost Saving

(1) Basic Concept

As mentioned in Table 11-2-1, transportation between San Borja and Trinidad during the rainy season depends on air transportation and water transportation; however, during dry season, vehicles can circulate along the whole road section between San Borja and Trinidad. After the completion of the road improvement project, vehicles will be able to circulate along the whole road during both seasons. Additionally, the 10.5 km section from Trinidad to the right bank of Mamoré river will be paved with asphalt.

Consequently, the difference in vehicle operation costs caused by alteration of the road surface conditions will be one of the benefits during dry season. On the other hand, during rainy season, the benefits will be measured as the difference between vehicle operation costs on the project road and transportation costs of alternative transportation modes. At the present, air transportation between San Borja and San Ignacio (138 km), and water transportation between San Ignacio and Trinidad (84 km) serve as alternative transportation means during the rainy season. Only this combination of transportation means is found in this road section. The cost of this combination of transportation means is adopted as the transportation costs during the rainy season in the "without case".

In order to calculate vehicle operation costs from the commencement of services in 2001 to 2020, future traffic volume must be forecasted . In this Study, an Origin-Destination (O-D) survey was conducted at three points on the project road, as indicated in Figure 11-2-1. Existing traffic volume and estimated future traffic volume are shown in Table 11-2-2.

- Future traffic volume of the project road was projected by estimating traffic based on the present traffic volume and converted traffic volume.
- Future traffic volume based on present traffic volume was estimated by a regression analysis based on the trinomial shifting average of traffic volume data from 1989 to 1995.
- Converted traffic volume was estimated by converting from air transportation to large truck transportation of beef and wheat transported between La Paz and Trinidad, which is estimated based on the analysis in the Phase-I study of the road improvement.

Table 11-2-2 Future Traffic Volume on the Project Road by Sections

(San Borja - San Ignacio Section)

(Unit : vehicles/day)

Year	Passenger Car	Bus	Large Bus	Small Truck	Medium Truck	Large Truck		Total	
1995	37	3	1	6	8	19	(0)	74	(0)
2001	77	6	2	13	17	39	(8)	154	(8)
2005	115	9	3	19	26	59	(9)	231	(9)
2010	192	15	5	31	42	98	(11)	383	(11)
2015	318	25	8	52	69	163	(12)	635	(12)
2020	526	42	14	85	115	270	(14)	1,052	(14)

(San Ignacio - Puerto Varador Section)

(Unit : vehicles/day)

Year	Passenger Car	Bus	Large Bus	Small Truck	Medium Truck	Large Truck		Total	
1995	42	5	-	15	3	6	(0)	71	(0)
2001	68	7	-	25	5	9	(8)	114	(8)
2005	89	10	-	32	7	12	(9)	150	(9)
2010	126	14	-	45	9	17	(11)	211	(11)
2015	177	20	-	63	12	25	(12)	297	(12)
2020	248	29	-	89	17	35	(14)	418	(14)

(Puerto Varador - Trinidad Section)

(Unit : vehicles/day)

Year	Passenger Car	Bus	Large Bus	Small Truck	Medium Truck	Large Truck		Total	
1995	198	7	-	52	12	19	(0)	288	(0)
2001	391	13	-	103	24	37	(8)	568	(8)
2005	500	17	-	132	30	48	(9)	727	(9)
2010	681	24	-	179	42	65	(11)	991	(11)
2015	928	32	-	244	57	89	(12)	1,350	(12)
2020	1,265	44	-	332	78	121	(14)	1,840	(14)

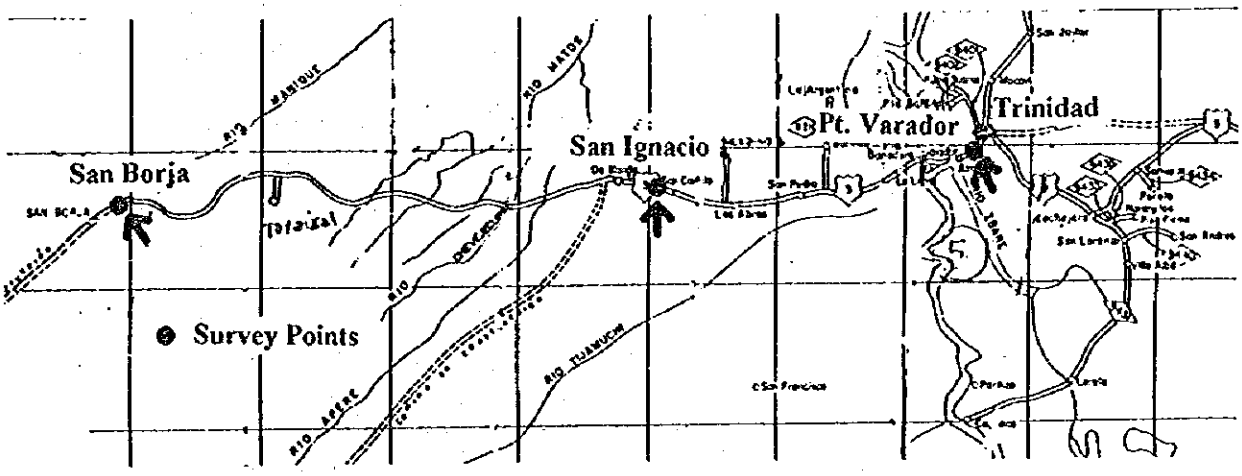

Figure 11-2-1 Traffic Survey Points

- Numbers in parenthesis in Table 11-2-2 shows the converted traffic volume calculated by converting air transportation of beef and wheat between La Paz and Trinidad into transportation by truck.

(2) Calculation Method for VOC Saving Benefits

$$Be = \{C_{wor} + C_{wod}\} - C_w$$

$$C_w = T[I] \times VOC[I] \times RD \times 365 \text{ days}$$

$$C_{wor} = T[I] \times VOC[I] \times RD \times 365 \text{ days} \times 3/4$$

$$C_{wod} = (T[I] \times VOC[I] \times RD \times 365 \text{ days} \times 1/4) + (A \times TC_p[I] + B \times TC_c[I])$$

where;

Be : VOC saving benefits

Cw : Vehicle operation cost in With-case

Cwor : Vehicle operation cost in Without-case (rainy season)

Cwod : Vehicle operation cost in Without-case (dry season)

T[I] : Future traffic volume (vehicles per day)

VOC[I] : Vehicle operation cost by vehicle type and by type of pavement (Refer to Table 11-2-3)

RD : Running distance (Refer to Table 11-2-4)

A : Number of passengers transported by vehicle
Average number of passengers by vehicle type multiplied by future traffic volume by vehicle type. (Refer to Tables 11-2-5 and 11-2-6)

$TC_p[I]$: Passenger transportation costs.
Passenger transportation costs between San Borja and Trinidad during the rainy season are shown in Table 11-2-7 with the site survey results.

B : Cargo volume transported by vehicles between San Borja and Trinidad (Refer to Tables 11-2-8 and 11-2-9)
B = T[I] × Participation of cargo vehicles × Average live load

$TC_c[I]$: Cargo transportation costs
Cargo transportation costs between San Borja and Trinidad during the rainy season are shown in Table 11-2-10 with the results of site survey.

Table 11-2-3 Vehicle Operation Cost by Vehicle Type and Pavement Type

Type of Vehicle	Type of Pavement		
	Asphalt	Gravel	Earth
Passenger car	0.2249	0.4934	0.6778
Bus	0.2907	0.4648	0.5860
Large bus	0.5423	0.9511	1.2091
Small truck	0.3335	0.5095	0.6999
Medium truck	0.4028	0.6768	0.8532
Large truck	0.5186	0.8939	1.1363

Note - 1. The above mentioned values are adopted from plain sections of the road project.
2. The value for earth was estimated by the proportion between the earth value against that of gravel value shown in the project plan from CONFITAL CAHUASI in 1987.
3. The figures in Asphalt and Gravel were provided by SNC. (Refer to Appendix)

Table 11-2-4 Running Distance by Section

Case	Type of Pavement	Distance	Section
Without project	Earth	221.0 km	San Borja - Trinidad
With project	Gravel	210.5 km	San Borja - Pto. Varador
	Asphalt	10.5 km	Pto. Varador - Trinidad

Table 11-2-5 Average Number of Passengers by Vehicle Type

Type of Vehicle	No. of Passengers
Passenger car	4.99
Bus	16.17
Large bus	25.55
Small truck	3.63
Medium truck	3.63
Large truck	6.39

*Figures were obtained by a survey conducted in this study

Table 11-2-6 Number of Passengers Transported by Vehicle Type
(San Borja - San Ignacio Section)

(Unit : persons/day)

Year	Passenger Car	Bus	Large Bus	Small Truck	Medium Truck	Large Truck	Total
2001	384	97	51	47	61	249	889
2005	573	145	76	68	94	377	1,333
2010	958	242	127	112	152	626	2,217
2015	1,586	404	204	188	250	1,041	3,673
2020	2,624	679	357	308	417	1,725	6,110

(San Ignacio - Puerto Varador Section)

(Unit : persons/day)

Year	Passenger Car	Bus	Large Bus	Small Truck	Medium Truck	Large Truck	Total
2001	339	113	-	90	18	57	617
2005	444	161	-	116	25	76	822
2010	628	226	-	163	32	108	1,157
2015	883	323	-	228	43	159	1,636
2020	1,237	468	-	323	61	223	2,312

(Puerto Varador - Trinidad Section)

(Unit : persons/day)

Year	Passenger Car	Bus	Large Bus	Small Truck	Medium Truck	Large Truck	Total
2001	1,951	210	-	373	87	236	2,857
2005	2,495	274	-	479	108	306	3,662
2010	3,398	388	-	649	152	415	5,002
2015	4,630	517	-	885	206	568	6,806
2020	6,312	711	-	1,205	283	773	9,284

Note : * The figures don't include number of persons due to the converted traffic

Table 11-2-7 Passenger Transportation Costs

Section	Distance	Transportation Mode	Unit Cost
San Borja - San Ignacio	127 km	By airplane	US$ 20.42
San Ignacio - Trinidad	84 km	By ship	US$ 4.16

Source : Data was collected by the site survey

Table 11-2-8 Participation of Cargo

Participation (Share in %)		80 %
Average live load	Small truck	1.17 tons
	Medium truck	2.62 tons
	Large truck	3.71 tons

Source : Data was obtained from O-D survey in this study

Table 11-2-9 Volume of Load Transported by Vehicle Type
(San Borja - San Ignacio Section)

(Unit: tons/day)

Year	Small Truck	Medium Truck	Large Truck	Total
2001	15	45	144	204
2005	22	68	219	309
2010	36	110	364	510
2015	61	181	605	390
2020	99	301	1,002	1,402

(San Ignacio - Puerto Varador Section)

(Unit: tons/day)

Year	Small Truck	Medium Truck	Large Truck	Total
2001	29	13	33	75
2005	37	18	45	100
2010	53	24	63	140
2015	74	31	93	198
2020	104	45	130	279

(Puerto Varador - Trinidad Section)

(Unit: tons/day)

Year	Small Truck	Medium Truck	Large Truck	Total
2001	121	63	137	321
2005	154	79	178	411
2010	209	110	241	560
2015	285	149	330	764
2020	388	204	449	1,041

Note : Figures don't include converted traffic cargoes

Table 11-2-10 Cargo Transportation Costs

Section	Distance	Transportation Mode	Unit Cost
San Borja - San Ignacio	127 km	By airplane	US$ 214.0
San Ignacio - Trinidad	84 km	By ship	US$ 130.0

Source : Data was collected by the site survey

(3) Results of the Calculation of VOC Saving Benefits

The results of the calculation of benefits by the above-mentioned method are summarized in Table 11-2-11.

Table 11-2-11 Total VOC Saving

(Unit : Thousands of US$)

Year	Total VOC Saving
2001	7,136
2005	9,776
2010	16,712
2015	24,567
2020	38,542

11.2.5 Travel Time Saving

(1) Basic Concept

Travel time will be saved by the increase in running speed resulting from improvement of the road surface. In addition, the completion of the project will decrease to zero (0) the waiting time for ferry boats at the river crossing points, where ferry transportation is provided. Bridges will replace ferry transportation over the Maniqui, Cuberene, Apere, Tijamuchi and Ibare Rivers. During the rainy season, the waiting time saving at each point fluctuates depending on the situation of the ferry boats; however, in this Study, the establishment of travel speed was taken into account.

The benefit of travel time saving is calculated multiplying the total travel time saved by the personal travel time cost.

(2) Calculation Method for Travel Time Saving Benefits

Travel time saving benefits is calculated by using the following formula:

$$Be = \{T_{wor} + T_{wod}\} \times HC - T_w \times HC$$

$$T_w = T[I] \times (N-2) \times RD \times 1/V_w \times 365 \text{ days} \times HC$$

$$T_{wor} = T[I] \times (N-2) \times Tt \times 365 \text{ days} \times 1/4$$

$$T_{wod} = T[I] \times (N-2) \times RD \times 1/V_{wo} \times 365 \text{ days} \times 3/4 \times HC$$

where;

Be : Travel time saving benefits

Tw : Travel time cost in With-case

Twor : Travel time cost in Without-case (rainy season)

Twod : Travel time cost in Without-case (dry season)

T[I] : Future traffic volume by vehicle type (vehicles per day)

N :Average number of passengers indicated in Table 11-2-5.
This number of passengers includes the crew; however, for the calculation of travel time saving benefits, it must be deducted. From the results of the site investigation, an average of one person per car and two persons per other types of vehicles were considered as crew members.

RD : Distance indicated in Table 11-2-4.

V_w : Travel speed by vehicle type in "with project" cases

V_{wo} : Travel speed by vehicle type in "without project" cases. The travel speed was established as shown in Table 11-2-12 by the site investigation, taking into account the waiting time at the ferry transportation service points.

HC : Time value

Time value is a conversion coefficient for evaluating time in a monetary point of view based on conditions shown in Table 11-2-13. Using these data, the average salary per capita per hour is calculated as follows:

$$A \times B \times 12/(C \times F) \times 1/D \times 1/E$$

Consequently, the time value in Bolivia was estimated in US$0.1254 in 1995.

Tt : Travel time between San Borja and Trinidad during the rainy season. With the results of the site investigation, the following travel time between San Borja and Trinidad during the rainy season was obtained as shown in Table 11-2-13.

Table 11-2-12 Travel Speed

(Unit: km/h)

Type of Vehicle	Type of Pavement		
	Asphalt	Gravel	Earth
Small	70	50	30
Medium	70	50	30
Large	70	50	30

Note : These figures was assumed by study team referring to data provided by SNC.

Table 11-2-13 Conversion Coefficient for Evaluating Time Value

	Items	Amount	Unit
A	Number of employees	585,854*	persons
B	Average salary	1,311*	Bs/month
C	Weekly working hours	44	hours
D	Total population of Bolivia	6,835*	1,000 persons
E	Exchange rate in 1995	4.7	Bs./US$
F	Number of weeks/year	52	weeks

Note : * These values were estimated using 1992 data

Table 11-2-14 Travel Time during Rainy Season

Road Section	Travel Time	Transportation Mode
San Borja - San Ignacio	0.5 hours	By airplane
San Ignacio - Trinidad	6.0 hours	By ship

(3) Results of the Calculation of Travel Time Saving Benefits

The results of the calculation of benefits by the above-mentioned method are summarized in Table 11-2-15.

Table 11-2-15 Benefits of Travel Time Saving

(Unit: Thousands of US$)

Year	Total Travel Time Benefits
2001	68
2005	89
2010	141
2015	200
2020	298

11.2.6 Transportation Cost Saving

(1) Basic Concept

At present, beef is transported from Trinidad to La Paz, and wheat is transported from La Paz to Trinidad by airplane. In the "without project" case, this expensive type of transportation will continue. On the other hand, in the "with project" case, 97 % of the all air transportation will be replaced by land transportation using trucks, due to the continuous circulation of traffic from Trinidad to La Paz throughout the year. Figure 11-2-2 schematically shows the relation between the travel distance along the road and the split of cargo transportation for road transportation. The difference in transportation costs resulting from the replacement of transportation means was counted as a benefit.

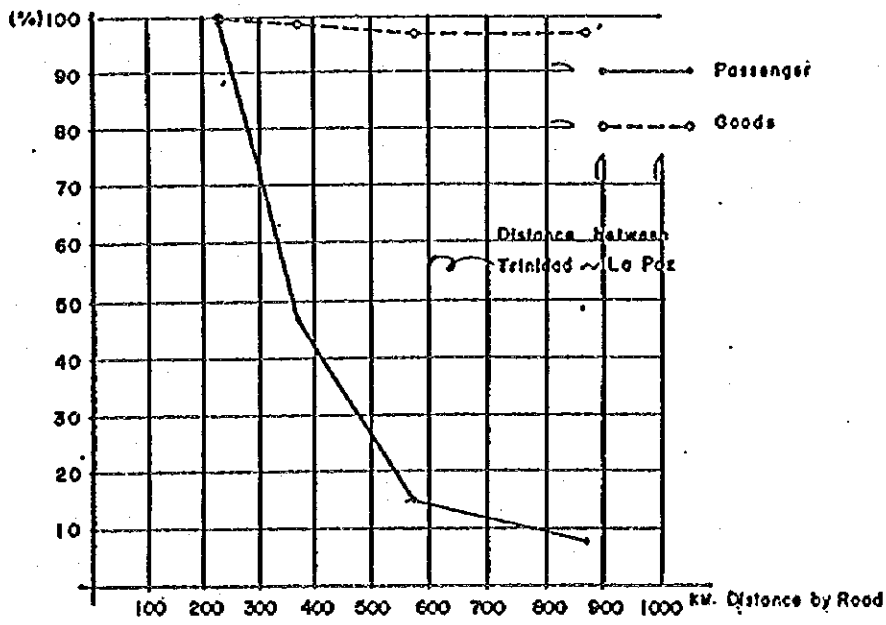

Figure 11-2-2 Share of Land Transport from/to La Paz

In the case of beef, "Análisis del Proceso de Comercialización de la Carne Bovina del Departamento del Beni con la Ciudad de La Paz" reports that the Provinces of Ballivian, Yacuma and Moxos in the Beni Department supply beef continuously to La Paz at a certain level.

This analysis estimates that 99,914 heads of cattle, which is equivalent to 14,142 tons of beef, were brought to the market of La Paz in 1992. In this report, the proportion of beef consumption supplied to La Paz by the Beni Department was also estimated as 69.5% of the total beef consumption of La Paz in 1992, while the past average rate was estimated as 65%. The influenced area of this road was estimated to be 34.5% in Phase 1 of the Study (1987); therefore, about 22% of the consumption of beef in La Paz is expected to be transported along the project road. Taking those figures into account, the beef volume transported from the influenced area to La Paz from 2001 to 2020 is estimated according to the estimated population growth rate in La Paz.

In the case of wheat, the volume of wheat to be transported to Trinidad was estimated based on the projection shown in the Phase I study report (1987) and the estimated population growth rate in Trinidad. The volume of beef and wheat to be transported between La Paz and Trinidad is estimated to be as shown in Tables 11-2-16 and 11-2-17.

Table 11-2-16 Estimated Volume of Beef Transported to La Paz

(Unit : tons)

Year	Population Growth Rate in La Paz Every 5 Years (%)	Estimated Volume of Beef to Be Transported to La Paz from the Influenced Area in Beni
2000	19.66	12,207
2005	18.10	14,416
2010	16.40	16,781
2015	15.41	19,366
2020	13.84	22,046

Table 11-2-17 Estimated Volume of Wheat Transported to Trinidad

(Unit : tons)

Year	Population Growth Rate in La Paz Every 5 Years (%)	Estimated Volume of Wheat to Be Transported to Trinidad from La Paz
2000	21.57	10,361
2005	19.86	12,418
2010	17.99	14,653
2015	16.90	17,129
2020	15.19	19,731

(2) Calculation Method of the Transportation Cost Saving

$$Be = TC_w - TC_{wo}$$

$$TC_w = (TV_b + TV_w) \times 1/D \times AC \times AT$$

$$TC_{wo} = TV_b \times 0.97 \times 1/E \times VOC[I] \times F \times RD + TV_w \times 0.97 \times 1/G \times VOC[I] \times RD + (TV_b \times TV_w) \times 0.03 \times 1/D \times AC \times AT$$

where;

Be : Transportation cost Benefits

TC_w : Transportation costs in "with project" cases

Tc_{wo} : Transportation costs in "without project" cases

TV_b : Volume of transported beef

TV_w : Volume of transported wheat

D : Average freight of airplanes (Refer to Table 11-2-18)

AC : Unit cost of air transportation
Unit cost of air transportation was obtained from the National Department of Roads in Trinidad, as shown in Table 11-2-19.

AT : Flight time required (3 hours)

E : Average load of a refrigerator car
After the completion of the project road, beef will be transported by land and refrigerated trucks will be needed. The results of on-site interviews with drivers of refrigerated trucks show that each vehicle can be expected to carry 10 tons.

VOC[I] : VOC unit
Of the VOC by vehicle type shown in Table 11-2-3, the VOC of large vehicles is applied to refrigerated trucks.

F : Conversion factor to determine the VOC of a refrigerated truck
The VOC of a refrigerated truck is expected to be more expensive than that of an ordinary truck. Based on the results of interviews with executives of a private manufacture company of refrigerated trucks, the following conversion factors were chosen:

Refrigerated truck loaded with 10 ton of beef : 1.4

RD : Transportation distance between La Paz and Trinidad (595 km.)

G : Average live load of cargo vehicles
1.8 ton/vehicle and 4.5 ton/vehicle were adopted as the average live load for wheat and beef, respectively, based on the results of the site investigation.

Table 11-2-18 Average Load Transported by Airplane

Road Section	Product	Amount
La Paz - Trinidad	Wheat	1.8 ton/plane
Trinidad - La Paz	Beef	4.5 ton/plane

Source : These figures were obtained by site survey

Table 11-2-19 Unit Cost of Air Transportation

Road Section	Product	Value
La Paz - Trinidad	Wheat	US$ 214.0
Trinidad - La Paz	Beef	US$ 128.0

Source : These figures were obtained from SNC in Trinidad

(3) Results of the Calculation of Transportation Cost Saving Benefits

The results of the transportation cost saving benefits calculation using the above-mentioned transportation modes are summarized in Table 11-2-20.

Table 11-2-20 Transportation Cost Saving Benefits

(Unit: Thousands of US$)

Year	Beef	Wheat	Total Saving
2001	1,344	1,404	2,748
2005	1,557	1,608	3,165
2010	1,841	1,877	3,718
2015	2,157	2,169	4,326
2020	2,491	2,475	4,966

11.2.7 Benefit of Income Generated by Development

(1) Basic Concept

After the completion of road improvement, access from Trinidad and San Ignacio to La Paz will be greatly improved and the volume of agricultural and forestal products such as rice, banana, yucca, wood, etc. transported into La Paz, the largest center of consumption in Bolivia, will increase. The volume of other agricultural products in Beni Department, such as cacao, fish and sugar cane are also expected to increase; however, they are not dealt with in this analysis because of a lack of detailed data or information.

(2) Estimation Method for the Calculation of Income Generated by Development

$$Be = K \times P \times X_j$$

Be : Benefits generated by development, representing producer's income resulting from a price increase in agricultural products.

K : Volume of products transported to La Paz from the area affected by the project, as summarized in Table 11-2-21. This volume was estimated based on an analysis conducted in phase 1(1987) regarding the volume of banana, rice and yucca transported to La Paz from Trinidad. The volume was estimated according to the increase in population in La Paz, which is the main destination of products.

P : Price of each product.

Xj : Percentage of profits relative to consumer prices. The percentages adopted for banana, rice and yucca were 66%, 50% and 66%, respectively, based on the results of interviews in La Paz.

Table 11-2-21 Volume of Products Transported to La Paz

(Unit : tons/year)

Year	Rice	Banana	Yucca
2001	4,802	13,606	14,807
2005	5,473	15,508	16,876
2010	6,371	18,051	19,644
2015	7,353	20,833	22,671
2020	8,370	23,716	25,809

(3) Results of Development Benefits

Table 11-2-22 shows the results of the estimated development benefits.

Table 11-2-22 Results of Development Benefits

(Unit: Thousands of US$)

Year	Agricultural Development Benefits
2001	784
2005	926
2010	1,048
2015	1,211
2020	1,382

11.2.8 Ferry Cost Saving Benefits

Six main rivers (Maniqui, Cuberene, Apere, Tijamuchi, Mamoré and Ibare) and other small rivers cross the project road. At present, ferry transportation services are provided at the crossing points over four main rivers and over Los Puentes. After the completion of the project, all ferry services except the one for the Mamoré River will be closed. Road users will not have to pay a tariff in the "with project" case, except to cross the Mamoré River. This saving on ferry transportation costs is considered one of the benefits of the project. The tariff for each river's ferry transportation service is shown in Table 11-2-23. The estimated benefits of ferry transportation cost saving are shown in Table 11-2-24.

Table 11-2-23 Ferry Transportation Service Tariffs

(Unit : Bs.)

Case	Type of Vehicle	Maniqui*	Cuberene	Apere	Tijamuchi	Los Puentes	Mamoré	Ibare*
Without project	Passenger car	5	5	5	5	10	25	5
	Wagon	7.5	7.5	7.5	10	20	25	7.5
	Bus, truck	20	20	18	20	30	80	20
	Trailer	25	25	25	30	40	80	25
With project	Small	0	0	0	0	0	20	0
	Medium	0	0	0	0	0	20	0
	Large	0	0	0	0	0	80	0

Note : * The bridges over the Maniqui and Ibare Rivers will be completed in 1995. For this evaluation, their tariffs were established on the same level as other places.

Source : The figures shown above were obtained through interviews at each ferry point.

Table 11-2-24 Ferry Transportation Cost Saving Benefits

(Unit: Thousands of US$)

Year	Maniqui	Cuberene	Apere	Tijamuchi	Los Puentes	Mamoré	Ibare
2001	51	51	51	56	56	0	373
2005	69	69	69	75	75	0	503
2010	99	99	99	107	107	0	718
2015	131	131	131	141	141	0	946
2020	176	176	176	191	191	0	1,282

11.2.9 Maintenance Cost Saving

Gravel road maintenance costs are lower than maintenance costs for earth roads. However, extra maintenance costs will be incurred for inundated sections, where a few maintenance works have been carried out up to this time, during the rainy season. Therefore, in this Study, the difference in maintenance cost between mud roads and gravel roads is not counted as a benefit. However, for the section from Puerto Varador to Trinidad, which will be paved with asphalt, maintenance cost saving can be taken into account. Maintenance cost saving of the Puerto Varador-Trinidad section was estimated according to figures obtained during the Feasibility Study of the Pavement Project of the Access Road from Trinidad to Puerto Varador ("Proyecto de Pavimentación de la Vía de Acceso de Trinidad al Puerto Varador") carried out by CORDEBENI in 1993. Annual maintenance cost saving is converted using consumer price increase rates, which are shown in Table 11-2-25.

Table 11-2-25 Annual Maintenance Cost Saving

(Unit: Thousands of US$)

Year	With Project Case	Without Project Case	Maintenance Cost Saving
1994~2013	76,620	275,036	198,416
1995~2020			215,331

11.2.10 Economic Cost

Economic project costs for the economic evaluation were calculated by deducting taxes from the project costs estimated in Section 11.1. For the evaluation, the construction costs of seven bridges, which have been already completed or will be completed by IDB or USAID, were included as project costs. Annual economic costs during the construction period are shown in Table 11-2-26.

Table 11-2-26 Economical Costs

(Unit: Thousands of US$)

Year	Financial Costs	Economical Costs		
		Economical Costs	Construction Costs of 7 Bridges	Total
1997	10,696	8,350	5,436	13,786
1998	17,555	13,672	-	13,672
1999	18,535	14,439	-	14,439
2000	11,277	8,832	-	8,832

11.2.11 Economic Evaluation Results

The evaluation results by evaluation indicator are as follows:

- IRR : 22.32 %
- NPV : US$53,018,334.-
- B/C : 2.35

The above-mentioned evaluation results indicate that the project is feasible.

11.2.12 Sensibility Analysis

A sensibility analysis was conducted for the fluctuation of total costs, from 10% to 30%, and total benefit, from -10% to -30%. The results of this analysis are shown in Table 11-2-27.

Furthermore, in the worst case of a 30% cost increase and a 30% benefit reduction, IRR remains 14.51%, which means that the project is still feasible enough to execute. This means that the project is still feasible, given the 12 % IDB interest rate.

Table 11-2-27 Sensibility Analysis Results

(IRR)

(Unit : %)

Cost	Benefit			
	0%	-10%	-20%	-30%
0%	22.32	20.84	19.27	17.58
10%	20.98	19.57	18.05	16.43
20%	19.81	18.44	16.99	15.41
30%	18.76	17.44	16.03	14.51

(NPV)

(Thousands of US$)

Cost	Benefit			
	0%	-10%	-20%	-30%
0%	53,018	43,792	34,567	25,341
10%	49,094	39,868	30,642	21,417
20%	45,170	35,944	26,718	17,492
30%	41,246	32,020	22,794	13,568

11.2.13 Summarized Benefits and Costs

The summarized benefits and costs of this project are shown in Table 11-2-28.

Table 11-2-28 Summary of Costs and Benefits

(Unit : US$)

Year	Benefits							Costs		Cash Flow
	VOC Saving	Travel Time Saving	Transportation Cost Saving	Agricultural Development	Ferry Transportation Cost Saving	Maintenance Cost Saving	Total of Benefits	Construction Costs	Monitoring Costs, etc.	
1997	-	-	-	-	-	-	-	13,785,120	-	-13,785,120
1998	-	-	-	-	-	-	-	13,671,840	-	-13,671,840
1999	-	-	-	-	-	-	-	14,438,580	-	-14,438,580
2000	-	-	-	-	-	-	-	8,831,940	-	-8,831,940
2001	7,136,205	67,655	2,748,009	784,274	638,915	215,331	11,590,391	-	64,600	11,525,791
2002	7,792,827	73,075	2,852,187	812,665	694,203	215,331	12,440,288	-	26,600	12,413,688
2003	8,455,324	78,494	2,956,366	841,056	749,490	215,331	13,296,060	-	34,600	13,261,460
2004	9,116,905	83,914	3,060,544	869,446	804,777	215,331	14,150,917	-	56,600	14,094,317
2005	9,776,329	89,333	3,164,722	897,837	860,064	215,331	15,003,617	-	14,600	14,989,017
2006	10,439,641	94,753	3,268,900	926,228	915,351	215,331	15,860,204	-	6,600	15,853,604
2007	12,007,829	106,411	3,381,248	956,608	993,706	215,331	17,661,133	-	44,600	17,616,533
2008	13,582,841	118,070	3,493,597	986,988	1,072,060	215,331	19,468,887	-	6,600	19,462,287
2009	15,148,015	129,728	3,605,946	1,017,369	1,150,414	215,331	21,266,802	-	14,600	21,252,202
2010	16,711,551	141,386	3,718,295	1,047,749	1,228,768	215,331	23,063,080	-	36,600	23,026,480
2011	18,295,309	153,045	3,830,643	1,078,129	1,307,122	215,331	24,879,579	-	14,600	24,864,979
2012	19,856,765	164,703	3,954,360	1,111,357	1,385,476	215,331	26,687,993	-	6,600	26,681,393
2013	21,426,620	176,361	4,078,078	1,144,585	1,463,830	215,331	28,504,805	-	44,600	28,460,205
2014	22,985,476	188,020	4,201,795	1,177,813	1,542,184	215,331	30,310,619	-	6,600	30,304,019
2015	24,566,806	199,678	4,325,512	1,211,041	1,620,538	215,331	32,138,907	-	14,600	32,124,307
2016	26,128,676	211,336	4,449,229	1,244,269	1,698,892	215,331	33,947,734	-	36,600	33,911,134
2017	29,229,611	232,977	4,578,367	1,278,710	1,822,282	215,331	37,357,278	-	14,600	37,342,678
2018	32,330,228	254,618	4,707,504	1,313,152	1,945,671	215,331	40,766,504	-	6,600	40,759,904
2019	35,441,654	276,259	4,836,641	1,347,593	2,069,060	215,331	44,186,539	-	44,600	44,141,939
2020	38,542,271	297,900	4,965,778	1,382,034	2,192,450	215,331	47,595,765	-	6,600	47,589,165
Total	378,970,882	3,137,717	76,177,722	21,428,903	26,155,252	4,306,625	510,177,100	50,727,480	502,000	509,675,100
									IRR	22.32%
									NPV	53,018,334
									Discount Rate	12%
									B/C	2.35

CHAPTER 12

CONCLUSION AND RECOMMENDATION

CHAPTER 12 CONCLUSION AND RECOMMENDATION

12.1 Conclusion

The road between San Borja and Trinidad is an important section of National Road No3. connecting a major center of production with Bolivia's capital, La Paz, the country's major center of consumption. In the rainy season, 50 km of the road near Trinidad becomes flooded and impassable, while in other sections vehicles cannot pass easily because of the bad conditions of the road surface. Therefore, improving the road will not only develop the Beni Department's farming and livestock industries, but will also facilitate the transport of products, thereby increasing the population and promoting the development of this area.

This project will be financed by international organizations like IDB, which require that an environmental assessment be conducted before releasing funds for any project. This study was undertaken to meet this requirement.

If improvement of this road is realized according to the design in "The Study of Road Improvement Between San Borja and Trinidad (Phase II)" and adequate assistance is provided by the relevant governmental organizations, it will be possible to make this road passable all year, and thereby provide direct and indirect economical benefits. At the same time, the likelihood of adversely affecting the environment will be minimized. Of course, after completion of the road improvement work, it will be necessary to monitor potential problems such as illegal cutting of woods, indiscriminate hunting of wild animals, and conflicts between natives and owners of stock farms or new settlers.

This study considered the positive and negative impacts of road improvement on the environment assuming completion of the road according to its design.

Our conclusion was that road improvement would be possible only if the design were altered somewhat, certain countermeasures were implemented, and impacts were monitored after completion of the work.

12.2 Results of Consideration of Environmental Aspects

During the environmental impact study, real conditions during both the dry season and the rainy season were considered. In addition, a wide range of effects were considered, including those on the natural environment, those on the economic activities of communities, and those on ruins near the road. As explained above, some negative effects of road improvement can be foreseen, but this study concluded that they would not be too serious. Nevertheless, because of the importance of the flora, fauna and forests of this area, in particular to the native people living here, we proposed some measures to monitor and protect the environment. By minimizing the negative aspects, such measure would highlight the positive effects of improving this road, a project which would greatly promote the development of Bolivia as a whole.

12.3 Results of Consideration of Economic Aspects

The results of our study of the economic impact of the project indicate that it will be necessary to install eco-roads and road signs to promote environmental protection, to hire monitors to prevent the illegal cutting of woods, and to measure air quality and noise levels on a regular basis. Moreover, our study considered the feasibility of the project, taking into consideration project costs including the costs of the above-mentioned measures and comparing these to the benefits to be derived by road improvement. The results indicated that the road improvement project was feasible after applying IRR, B/C, and NPV analysis methods..

12.4 Recommendations

To limit the negative aspects of improvement, the above recommendations are indispensable.

(1) Protection of Fauna and Flora

Cutting trees near the road (100 m from the center of the road on each side) as per the plan will adversely affect vegetation in the area. In particular, if the forests of the EBB where wide variety of flora and fauna live, the Yacuma National Park, and in the protected area of Chimanes are cut, the negative environmental impact will be great

indeed. Therefore, to protect the flora and fauna, the original plan should be changed to minimize the number of trees to be cut during the work, and to prevent any cutting in the area between the Maniqui and Apere Rivers.

To decrease the number of traffic accidents involving for animals, tunnels that will permit animals to cross safely must be constructed, and road signs that will warn drivers of crossing animals must be posted. In addition, artificial ponds formed by side-borrows will have to be preserved as habitats for fish and aquatic fowl.

Finally, after the project is completed, monitoring of the entire area will be required.

(2) Prevention of Illegal Deforestation and Poaching

Illegal deforestation and poaching will likely be promoted by road improvement. Therefore, the Ministry of Sustainable Development and Environment will have to implement concrete measures to prevent such activities. Such measures may include establishing a local office in Beni Department or the Public Corporation of Forests, and hiring guards to patrol the area. This responsibility should not be passed on to local entities.

(3) Prevention of Conflicts Between Inhabitants about Land Ownership

It is expected that conflicts between inhabitants with respect to land ownership will increase, especially with the arrival of new settlers. To prevent such conflicts, it will be necessary to force local residents, especially the natives in the area, to register their ownership with the relevant organizations.

(4) Increase of Land Prices

Another possible indirect impact of the project is an increase in land prices. To prevent this, the relevant authorities will have to pass special capital gains tax regulations.

(5) Environmental Protection Near Urban Areas

Although serious problems are not foreseen, the use of machinery and dump trucks during the work will have to be strictly controlled to prevent air pollution and noise, and gasoline and oils will have to be carefully controlled to prevent water pollution.

In addition, signs will have to be posted to prevent traffic accident on the road, the roads near communities will have to be filled to make then level with the main road, and a periodic sprinkling will have to be done to prevent excessive dust in the air in urban centers, especially during the dry season.

After the work is completed, air quality and noise will have to be monitored (at least once every two years) in urban centers such as San Borja, San Ignacio, and Trinidad.

(6) Conservation of Ruins and Cultural Properties

During the construction period, periodic inspections should be conducted by experts to prevent the destruction of ruins by side borrows work.

(7) Others

Once the most suitable species of plant for sodding the slopes is selected, it should be as work on the road progresses. Culvert inlets and outlets should be protected by concrete to prevent soil erosion.

Additionally, after the completion of the road improvement work, periodic inspections of slopes (erosion, possibility of breakage, etc.,) and drains should be conducted twice a year, once in the rainy season and once in the dry season). If any part collapses, repair work must be done immediately.

An improved road will be beneficial for a number of reasons. To realize the full benefits of this project, the following plans should be done by the relevant organizations :

① Improvement of medical facilities

A new hospital should be constructed in San Ignacio and a sufficient number of doctors and nurse should be hired.

② Improvement of educational facilities and availability of teachers

Educational facilities should be improved and a sufficient number of teachers should be hired.

③ Promotion of regional industry

- Promotion of timber industry

  To prevent illegal deforestation, the timber manufacturing industry should be supported and carefully monitored.

- Utilization of tourism resources

  To attract tourists to the Beni Biological Station, Yacuma Regional Park, etc., low interest loans and special tax privileges should be granted to restaurants and hotels along the project road.

④ Periodic investigations for the conservation of ruins

To prevent the destruction of ruins by the construction of private roads and houses, the movement of animals, and cultivation, as well as to discover new ruins, periodic investigations should be conducted by the relevant agencies.

Summary of environmental assessment in this study is shown in Table 12-4-1.

Table 12-4-1 Summary of Environmenta Assessment (1)

Impact by	Environment Factors	Results of Forecasting	Aims of Environmental Conservation	Evaluation Results	Environmental Management Plan			Monitoring Plan		
					Plan	Cost	Assigning	Plan	Cost	Assigning
Cleaving of woods	Topography and geology	If the cleaving area is limited within the right of way area, neither topography nor geology is changed much by the cleaving of woods.	Not to change remarkably the present topography and geology, and to prevent natural disasters related to both topography and geology such as large-scale landslide and slope collapse.	The present conditions of topography and geology is not changed much.	-	-	-	-	-	-
	Soil	Only the cleaving of woods in the limited area of the road sides does not cause a large-scale soil erosion.	To prevent the soil erosion and the soil flow out, and to conserve the present soil.	The cleaning of woods has no possibility of a large-scale soil erosion.	-	-	-	-	-	-
	Hydrology	Only the cleaning of woods in the limited area of the road sides does not cause a large-scale hydrological change.	Not to cause a remarkable hydrological change of rivers, underground water and flooded area.	The cleaning of woods has no possibility of a remarkable hydrological change such as expansion of the flooded area.	-	-	-	-	-	-
	Flora	The existing forest zones along the project road, such as the forest of the EBB, the forest of Chimarea, gallery forests, etc., are generally cleaved within the right of way area (100 m wide). The cleaving area of forests is estimated in 579 ha.	Not to give a remarkable influence to the existing flora.	If the woods along the project road is cleaved according to the Design, the existing flora will be remarkably influenced.	The woods should not cleave in the forests between Maniqui and Apero rivers. Accordingly, the original plan that the woods within the right of way area (100 m wide) are cleaved and stripped during the road improvement should be changed.	-	-	To monitor impacts to the flora along the road, studies of species and situation of growing of flora. The study should be realized two time in dry and rainy season (a time per about 3years)	$3,800	SENAC
	Fauna	The decrease of the forest area along the project road might be accompanied by a decrease of the existing fauna which has its habit located along the road.	Not to give a remarkable influence to the habitat of fauna.	If the forests along the project road which play a important role in the movement of fauna are cleaved, it will give a remarkable negative impact to the fauna inhabits.		-	-	To monitor impacts to the wild animals, studies of species, inhabitat and diet of fauna along the road such as mammals, reptiles, amphibian, birds. The study should be realized two time in dry and rainy season (a time per about 3 years)	$6,600	SENAC
	Landscape	If the forests along the road project are cleaved with a width of 100 m, according to the Design, the landscape will remarkably change.	To conserve an excellent landscape and not to give an incongruity sense to the surroundings.	The cleaving of woods is the negative impact destorrying an excellent landscape. Accordingly, it is necessary to avoid the cleaving of woods.		-	-	-	-	-

Table 12-4-1 Summary of Environmenta Assessment (2)

Earth work (cutting, embankment, etc.)	Topography and geology	The safety analysis of the embankment slope occupying most part of the road shows that the safety factor of a circular arc sliding is 1.7 in minumum and the embankment slope is stable. Some edges and bare-slopes of the road are eroded by rainfall.	Not to change remarkably the present topography and geology, and to prevent natural disasters related to both topography and geology such as large-scale landslide and slope collapse.	Neither topography nor geology is remarkably altered by the earth works such as embankment and side-borrow pitting. The bare surface of the embankment, however, has a possibility to suffer a gully erosion.	After the most suitable species of plant for the slope protection to sod is studied before the road improvement, it should be planted on the slope with the process of the improvement.			Regular inspectation and maintenance for erosion and slide of slope (2 times/year, before and after the rainy season) in all sections of the road.	-	SENAC
	Soil	The area flooded by the Tijamuchi, Mamore and Ibare rivers may not expanded since sufficient number of culverts to drainage the water is installed under the road embankment. Consequently, the soil may not flow out.	To prevent the soil erosion and the soil flow out, and to conserve the present soil.	The surface soil of the embankment and the soil at the lowerstream side of the culverts may suffer a erosion.	-	-	-	-	-	-
	Hydrology	The area flooded by the Tijamuchi, Mamore and Ibare rivers may not expanded since sufficient number of culverts to drainage the water is installed under the road embankment. Consequently, the existing hydrology may not change remarkably.	Not to cause a remarkable hydrological change of rivers, underground water and flooded area.	the hydrology in the area may not change remarkably. The maintenance of the culverts is necessary because the culverts will not function if its are blockaded by driftwoods and others.	-	-	-	-	-	-
	Fauna	The road embankment will be an obstacle for the small animals inhabiting near the project road to across the road. The borrow pits will be very useful habitat for the wild animals, especially in the dry season since these are a source of water supply.	Not to give a remarkable influence to the habitat of fauna.	As the ponds formed by the side-borrow pitting become useful habitats for the wild animals, they should be left in good conditions.	The ponds formed by the side-borrow pitting should be left for habitats of wild animals in good condition.	-	-	Monitoring about impacts to wild animals	Monito-ring about impacts to wild animals	Monito- ring about impacts to wild animals
	Landscape	Although most part of the project road will be embanked, it is still left a gravel road. Accordingly, the road itself gives little change to the landscape.	To conserve an excellent landscape and not to give an incongruity sense to the surroundings.	The formation of artificial ponds is a positive impact since they will, in the future, become harmonized with the surroundings as well as the existing ponds. So that they should be left after the road improvement.	-	-	-	-	-	-

Table 12-4-1 Summary of Environmenta Assessment (3)

	Air quality	By the earth works mainly of embankment and side-borrow pitting, the dust will be scattered from bare ground during the road improvement in the dry season.	Not to exceed the present air quality or the standards for the purpose of health protection in National Ambient Air Quality Standards of USA	The dust scattering by the earth works is feared during the dry season, so that proper countermeasure for prevention of the scattering should be done during the road improvement	-	-	-	-	-	-
	Water quality	An increase of the suspended solids in the river may be caused by the earth works. Also , it may be caused by the erosion of the embankment slope , if the slope protection is not done.	Not to exceed the present water quality revels or the water quality standards by the Ministry of Urban Affair.	The earth works may increase the suspended solid in river water, so that proper countermeasure should be done during the road improvement.	The drained water containing suspended solids should be discharged through the borrow pits to the existing water courses. In this case, the borrow pit is used as settlement ponds.	-	-	-	-	-
Using heavy machines and dump truck	Air quality	The concentration of SOx ranges from 0.00001 ppm (0.000029 mg/m3) to 0.00073 ppm (0.00066 mg/m3). The concentration of NOx ranges from 0.00016 ppm (0.00031 mg/m3) to 0.00335 ppm (0.00658 mg/m3).	Not to exceed the present air quality or the standards for the purpose of health protection in National Ambient Air Quality Standards of USA	The forecasting concentrations from heavy machines at the stage of road construction are 0.0 ppm□'0.00014 ppm and 0.0 ppm□' 0.00026 ppm, less than that of the environmental standards.	When using heavy machines and dump truck ve engines should not be idled for the prevention of air contamination and noise.	-	-	-	-	-
	Water quality	Gasoline, engine oil, etc., which are used by heavy machines and dump tracks during the road improvement, may permeate into underground or flow into river, and contaminate underground water or river water.	Not to exceed the present water quality revels or the water quality standards by the Ministry of Urban Affair.	Gasoline, engine oil, etc., used by heavy machines and dump-tracks may contaminate underground water or river water, so that proper countermeasure should be done during the road improvement.	Gasoline, engine oil, etc., used by heavy machines and dump-tracks should be managed not to contaminate underground water or river water, during the road improvement.	-	-	-	-	-
Drainage facilities	Soil	The soil erosion at the drainage facilities is thought to occur during the wet season.	To prevent the soil erosion and the soil flow out, and to conserve the present soil.	As the flood water is drained by numerous culverts established under the embankment of the project road, the flood area will not be expanded more than the present conditions.	The flow-in and flow-out of the culverts should be protected by concrete for the prevention of the soil erosion.	-	-	-	-	-
	Hydrology	The area flooded by the Tijamuchi, Mamore and Ibare rivers may not expanded since sufficient number of culverts to drainage the water is installed under the road embankment. Consequently, the existing hydrology may not change remarkably.	Not to cause a remarkable hydrological change of rivers, underground water and flooded area.	the hydrology in the area may not change remarkably. The maintenance of the culverts is necessary because the culverts will not function if its are blockaded by driftwoods and others.	-	-	-	Regular inspection of sufficient function and maintenance of irregular parts of drainpipes (2 times/year, before and after the rainy season)	-	SENAC

Table 12-4-1 Summary of Environmenta Assessment (4)

	Landscape	No serious change may occur for the landscape, since culverts under the road are usually not seen, although corrugated steel pipes for the culverts are not matched with the surroundings.	To conserve an excellent landscape and not to give an incongruity sense to the surroundings.	Many culverts may give a little negative impact to the surroundings, so that proper countermeasures are neecsaary.	-	-	-	-	-	-
	Water quality	The soil near the flow-out and flow-in of culverts may be eroded and increase suspended solid in river water.	Not to exceed the present water quality revels or the water quality standards by the Ministry of Urban Affair.	The soil near the flow-out of culverts may increase the suspended solid in river water, so that proper countermeasure should be done during the road improvement.	The flow-in and flow-out of the culverts should be protected by concrete for the prevention of the soil erosion.	-	-	-	-	-
Waste	Flora	A volume of the waste regarding to the action of the road improvement is quite limited, so that no serious impact may occur for flora.	Not to give a remarkable influence to the existing flora.	The volume of the waste regarding to the road improvement and thrown away from vehicles during the road use is not serious impact to flora.	-	-	-	-	-	-
	5.Fauna	A volume of the waste regarding to the action of the road improvement is quite limited, so that no serious impact may occur for fauna.	Not to give a remarkable influence to the habitat of fauna.	With an increase of the traffic volume, animals such as deers and monkeys will have more chance to eat the waste thrown away from the vehicles. In this case, the waste may give a negative impact to the fauna habitats.	-	-	-	-	-	-
	Landscape	A volume of the waste regarding to the road improvement is quite limited, so that no serious change may occur for the landscape.	To conserve an excellent landscape and not to give an incongruity sense to the surroundings.	An increase of the waste thown away from vehicles is the negative impact destroying an excellent landscape. But it may be not serious problem.	-	-	-	-	-	-
	Water quality	The waste oil which was exhausted by heavy machines and dump tracks during the road improvement, may permeate into underground or flow into river, and contaminate underground water or river water.	Not to exceed the present water quality revels or the water quality standards by the Ministry of Urban Affair.	The waste oils exhausted by heavy machines and dump-tracks may contaminate underground water or river water. Proper countermeasure should be done during the road improvement.	The waste oils exhausted by heavy machines and dump-tracks should be managed not to contaminate underground water or river water, during the road improvement.	-	-	-	-	-

Table 12-4-1 Summary of Environmenta Assessment (5)

Facilities for work	Water quality	The living water discharged from the worker's camp or workshop may contaminate river water.	Not to exceed the present water quality revels or the water quality standards by the Ministry of Urban Affair.	The living water discharged from the worker's camp or workshop may locally contaminate river water but the degree is not remarkable, so it is enough to follow the SENAC standard.	The living water discharged from the worker's camp or workshop should be properly drained according to the SENAC standard.	-	-	-	-	-
Bridge	Landscape	The landscape will be changed. The degree of the change depends on coloring of bridgepiers and girders.	To conserve an excellent landscape and not to give an incongruity sense to the surroundings.	The artificial building such as a bridge may give a negative impact to the surroundings more or less, so that it is necessary not to give more incompatible sense to the surroundings.	The bridge should not be painted by an incompatible color with the surroundings.	-	-	-	-	-
Traffic and traffic safety	Fauna	With increase of quantity of traffic, a traffic accident for the animals crossing the road will increase. Especially, on the road across the gallery forest between the Matos and Apere rivers, where a lot of mammal animals are observed to inhabit.	Not to give a remarkable influence to the habitat of fauna.	An increase of the traffic accidents for the animals gives a negative impact to the fauna habitats.	For avoidance of the traffic accident for animals, road signs should be set up and eco-road (tunnels) should be installed at the sites of high embankment more than 2 meters high.	Road sign $3,000 Tonnel for wild animals $120,000	SENAC	-	-	-
	Air quality	The forecast concentration for the years 2020 varies from 0.0 ppm (0.0 mg/m3) to 0.00014 ppm (0.00027 mg/m3) and from 0.0 (0.0 mg/m3) to 0.00026 ppm (0.00032 mg/m3) respectively.	Not to exceed the present air quality or the standards for the purpose of health protection in National Ambient Air Quality Standards of USA	The forecasting concentrations of NO2 and CO from vehicles for the years 2020 are 0.0011 ppm□'0.0029 ppm and 0.000 ppm□'0.055 ppm less than that of the environmental standards.	For the prevention of the dust scattering around the town areas, asphalt road or watering should be done.		SENAC	Monitoring of air quality around the cities(1time/2year), regular measurement of aire quality in 3 points such as San Borja, San Ignacio, Trinidad.	$2,000	SENAC
	Noise	The forecasting noise levels at San Borja, San Ignacio and Trinidad for the years 2020, which are based on the forecasting traffic volume and the existing noise levels, range from 44.2 dB(A) to 61.3dB(A).	Not to exceed the present noise level	The forecasting noise levels at San Borja, San Ignacio and Trinidad are only 3 dB(A) in maximum higher than that of the present noise levels. Therefore, the influence to the noise is considered to be very small.	-	-	-	Monitoring of noise around the cities(1time/2year), regular measurement of noise in 3 points such as San Borja, San Ignacio, Trinidad.	$2,000	SENAC

Table 12-4-1 Summary of Environmenta Assessment (6)

Earth work (cutting, embankment, etc.)	Ruin and cultural properties	As considered the character of the improvement, there is little possibilty to destroy other new ruins. But pits will be excavated by side borrow in same places for the elevation of road, then other ruins can be excavated and destroyed	Ruins and cultural properties should be conserved without the devaluation	Respect to the possibilty to discover and destroy other ruins, some measurement should be taken during the work	Distribution study before the work and regular observation during that by specialists should be taken place to avoid the destruction of unconfirmed ruins.	Distribution study before the work $17,120 Regular observation $28,800	SENAC	-	-	-
Road facilities (road, bridge, culvert, etc.)		As considered the increase of population in future, there is possibility of the destruction of ruin and cultural properties by constructing private road and house, and cultivating farms	Ruins and cultural properties should be conserved without the devaluation	The improvement can not be direct reason for the destruction. But it is necessary to deliberate the measurement for avoid a little damage, too.	-	-	-	Regular observation study for the conservation of ruinCi,P timeC^yearCj, that is realized for preventing the destruction of ruin and cultural properties by constructing private road and house, and cultivating farms	$4,000C^"N	Institute of ruin
Elevation of movement	Community	Positive impacts; easy reflection of politics, quick medical treatment, easy attendance to high education, regular bus operation Negative impacts;illegal residence, illegal woods cutting, poaching, conflict of landownership	Development with harmony and peace should be given to society and eminent negative impact should not be given to life environment.	Hospital, facilities for high grade education and traffic facilities should be expanded. Some measurement for illegal action and conflict of landownership should be taken.	Bus stop, minimum emergency medical equipment should be installed. Local office and guardian should be prepared.	Busstop $6,500 emergency medical equipment $80,000	SENAC Welfare Ministry	Monitoring system arrangement for mediation of conflict by illegal action $89,938 (early stage $37,938) Every year $2,600	$2,600	Public corporation of Forest
Earth work (cutting, embankment, etc.)		Level difference between the objective road and access road to community can be obstacle for traffic.	Development with harmony and peace should be given to society and eminent negative impact should not be given to life environment.	Some measure should be taken to avoid obstacle element for communication between communities, transportation of goods, and security	The low part should be filled up as high as objective road	Fill up $16,000	SENAC			
Passage in whole year	Economic activity	Activation of distribution of goods, development of agriculture and farming, creation of new industry, illegal woods cutting, elevation of land price, extension of economic difference between landowner and who does not own a land	Development with harmony and peace should be given to regional economy and eminent negative impact should not be given to sustainable development.	It is necessary to arrange distribution facilities, to grow timber processing and tourism industry, and to order a monitoring system for illegal woods cutting.	Local office and personal for monitoring should be installed			(See Community above mentioned)		Public corporation of Forest