

9-3-6 Traffic Safety Education Program

School children usually walk in the roadside areas everyday near the project area, and this situation will not likely change in the near future. Therefore, educational programs regarding traffic safety will be necessary to avoid traffic accidents due to a lack of safety awareness. Compared with existing traffic conditions, future traffic speed will be higher and more vehicles will use the road. The main aim of the proposed traffic safety education program is to make children understand the situation that this will create.

Audio-visual materials will be effective for this purpose. The program shall include a specialist team that will make audio-visual tapes and visit all the schools along the planned road area, showing the tapes and giving instructions about traffic accidents and safety.

9-3-7 Roadside Planting in Urban Centers

In order to mitigate the negative impacts of air contamination and noise that will cause the increase in future traffic flow, roadside planting in urban centers will be necessary. This will create a beautiful urban landscape along the planned road.

The necessary locations for this purpose are Paraguarí, Caballero and Villarrica, where the right of way of the planned road will be as small as 20 m, representing an adjustment to the existing road width. The estimated quantities are as follows, and the species of trees planted shall be carefully selected to protect against air and noise pollution, as well as to beautify the urban townscape.

• Paraguarí - length of planting	1000 m × 2 (both sides)
- plant pitch	8 m
- total number of plants	250 trees
• Caballero - length of planting	1000 m × 2 (both sides)
- plant pitch	8 m
- total number of plants	250 trees
• Villarrica - length of planting	1500 m × 2 (both sides)
- plant pitch	8 m
- total number of plants	375 trees
• Total	875 trees

9-3-8 Construction of Connection Slopes with Communities

Most of the road sections of the planned road will be embanked to avoid inundation during the rainy season. Therefore, access roads to communities will be lower than the planned road, which is very inconvenient for pedestrians passing through junctions. Therefore, the

entrance points to the communities will have to be embanked at least at less than a 5 % gradient of the slope from the access road to the junction. The 43 points must be embanked, and the heights of their gaps are grouped as shown in Table 9.3.3. The design of the embankment is shown in Figure 9.3.2.

Table 9.3.3 Estimate of Quantities for Connection Slopes

Gap level	Point	Required earth (m ³)	Total volume (m ³)
less than 1 m	26	100	2,600
1 m to 3 m	15	480	7,200
more than 3 m	2	2,560	5,120
Total	43		29,840

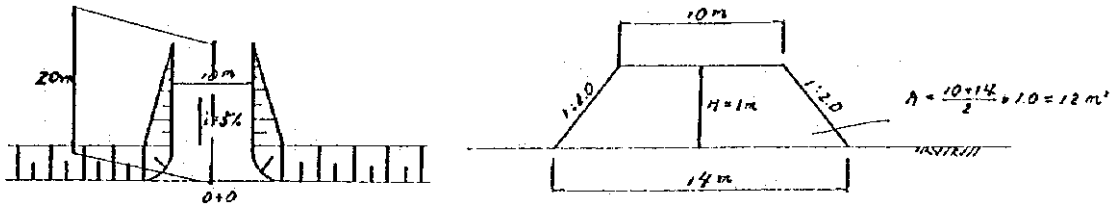


Figure 9.3.2 Design of Access Slope Sections with Embankments

9-3-9 Work Schedule

The Environmental Mitigation Program will be mainly finalized within the construction period, and will continue for 2 years after completion with respect to traffic education programs. The time schedule for each program is as follows:

Table 9.3.4 Work Schedule for the Environmental Auditory Program

Sub-Program	Year	1	2	3	4	5	6
		D/D	Construction			Operation	
1	Supervision of ETAGs		XXX	XXX	XXX		
2	Mitigatory Forestation	XXX	XXX	XXX			
3	Traffic Safety Facilities				XXX		
4	Traffic Safety Education	XXX				XXX	
5	Roadside Planting				XXX		
6	Smoothing Connections with Communities				XXX		

9-3-10 Cost Estimate

The costs for the program are estimated as follows:

Table 9.3.3 Cost Estimate for the Environmental Mitigation Program

(Unit : US\$)

	Sub-Program	Unit	Quant.	Unit Cost	Total Amount
1	Supervision of ETAGs				- *1
2	Mitigatory Forestation				
	Technical personnel	mm	6	5,000	30,000
	Assistant personnel	mm	12	1,800	21,600
	Equipment and materials	year	3	7,000	21,000
	Reports	time	2	1,000	2,000
	Travel	trip	9	500	4,500
	Planting	trees	10,000	10	100,000
	Sub Total				179,100
3	Traffic Safety Facilities				
	Traffic signals	point	2	50,000	100,000
	Pedestrian way	point	10	5,000	50,000
	Sub Total				150,000
4	Traffic Safety Education				
	Technical personnel for audio visual	mm	10	5,000	50,000
	Technical personnel for education	mm	12	5,000	60,000
	Assistant personnel	mm	12	1,800	21,600
	Production of audio-visual tapes	set	1	30,000	30,000
	Equipment and materials	set	1	10,000	10,000
	Reports	time	2	1,000	2,000
	Travel	trip	100	500	50,000
	Sub Total				223,600
5	Roadside Planting	tree	875	25	21,875
6	Connection Slopes with Communities	m ³	30,000	6	180,000
	Sub Total				754,575
	Contingency(10%)				75,458
	Total Amount				830,033

Note: *1 The cost for the Supervision of ETAGs will be included in the construction supervision cost.

9-4 Environmental Monitoring Program

9-4-1 Objectives

The Environmental Monitoring Program is necessary for understanding the environmental conditions before and after the project, and for examining unexpected environmental changes during the construction period.

9-4-2 Activities

The following items shall be monitored periodically.

- **Topography, geology and soil** - Periodical inspection of soil erosion and slope failure etc., five times before, during (once a year), and after construction
- **Cultural properties** - Periodical inspection of archaeological sites four times before, and during (once a year) construction
- **Air quality** - Periodical inspection and measurements of air quality in urban areas three times; before, during, and after construction
- **Noise level** - Periodical inspection and measurements of noise level in urban areas three times; before, during, and after construction
- **Water Quality** - Periodical inspection and measurements of water quality in major river points three times; before, during, and after the construction

9-4-3 Topography, Geology and Soil

It will be necessary to periodically inspect the conditions of the topographic features and soil for erosion, slope failure, etc., along the project road and quarry sites during the road construction period, especially during the rainy seasons and after construction is completed.

9-4-4 Cultural Properties

No cultural properties have been identified in the area to be directly influenced by the project, however, they may exist. It is necessary, therefore, to inspect periodically the excavation sites in order to ensure that valuable archaeological sites or historical properties in the area are not lost. A special team consisting of archaeologists and their assistants is required. The inspection work will start with the collection of information about cultural properties in the project area at the beginning of the year, and an inspection shall be carried out once every three months. In the final year, they shall summarize their activities in a final report.

9-4-5 Air

It will be necessary to observe and measure air quality at fixed points in urban areas before starting construction works in order to clarify the existing level. Moreover, it will be necessary to measure air quality during the construction period in order to determine the impact of construction machinery, as well as after construction is completed in order to determine the impact of traffic flow. Mechanical equipment for measuring air quality will therefore be required with training programs to teach personnel to use that equipment. The monitoring items of air quality are summarized in Table 9.4.1.

9-4-6 Noise Level

Just as in the case of air quality, it will be necessary to observe and measure noise levels at fixed points in urban areas before starting construction works in order to clarify the background noise level. Moreover, it will be necessary to measure the noise level during the construction period to determine the impact of construction machinery, as well as after construction is completed in order to determine the impact of traffic flow. Mechanical equipment for measuring noise levels will therefore be required together with training programs to teach personnel to use that equipment. The monitoring items of noise level are summarized in Table 9.4.1.

9-4-7 Water

As same as the air quality, it will be necessary to observe and measure water quality of rivers that are located downstream-side of the construction sites before starting construction works in order to make clear the existing water quality. Moreover, it will be necessary to measure water quality during the construction period to determine the impact of construction machinery, as well as after construction is completed in order to determine the impact of traffic flow. The monitoring items of water quality are summarized in Table 9.4.1.

Table 9.4.1 Necessary Measurement Components for Air, Noise and Water

Monitoring Items	Measurement Components
Air	1) NO ₂ 2) SO ₂ 3) CO 4) TSPM (Total suspended particular matter) - 2 measurements per day; 7:00 - 11:00 a.m. and 15:00 - 19:00 p.m. - One point for each construction section (3 in total)
Noise	1) Noise level 2) Traffic volume - 7 measurements per day at 5, 7, 10, 15, 18, 19 and 22 hours - one hundred times at intervals of five seconds - 2 points in Paraguari and Villarrica at the both sides of the road on the edge and 30m from the road.
Water	1) pH 2) Temperature 3) Conductivity 4) DO 5) TDS 6) SS 7) BOD 8) COD - 3 measurements for each point - 2 points for each construction section (6 in total)

9.4.8 Work Schedule for Environmental Monitoring

The Environmental Monitoring Program will be mainly finalized within the construction period, and will continue for 2 years after completion of construction work with respect to air quality, noise level, and water quality measurements. The time schedule for each program is as follows:

Table 9.4.2 Work Schedule for the Environmental Monitoring Program

Sub-Program	Year	1	2	3	4	5	6
	D/D	Construction			Operation		
1 Topography, geology and soil	XXX	X	X	X	XX		
2 Cultural properties	XXX	X	X	XX			
3 Air quality	XX		X				X
4 Noise	XX		X				X
5 Water quality	XX		X				X

9-4-9 Cost Estimate

The costs for the program are estimated as follows:

Table 9.4.3 Cost Estimate for the Environmental Monitoring Program
(Unit : US\$)

	Sub-Program	Unit	Quant.	Unit Cost	Total Amount
- 1	Topography, Geology, and Soil				
	Technical Personnel	mm	8	2,500	20,000
	Assistant Personnel	mm	8	900	7,200
	Equipment and materials	year	5	2,000	10,000
	Reports	time	2	1,000	2,000
	Travel	trip	5	1,000	5,000
	Sub Total				44,200
- 2	Cultural properties				
	Archeological Specialist	mm	4	3,000	12,000
	Technical Personnel	mm	7	2,500	17,500
	Assistant Personnel	mm	7	900	6,300
	Equipment and materials	year	4	2,000	8,000
	Reports	time	2	1,000	2,000
	Travel	trip	5	1,000	5,000
Sub Total				50,800	
- 3	Air Quality	point	3		
	Specialist	mm	0.5	10,000	5,000
	Technical Personnel	mm	1	5,000	5,000
	Assistant Personnel	mm	1	1,800	1,800
	Special equipment for air quality	set	1	5,000	5,000
	Equipment and materials	year	3	1,000	3,000
	Reports	time	3	500	1,500
	Travel	trip	3	500	1,500
	Sub Total				22,800
- 4	Noise	point	2		
	Specialist	mm	0.5	10,000	5,000
	Technical Personnel	mm	1	5,000	5,000
	Assistant Personnel	mm	1	1,800	1,800
	Special equipment for air quality	set	1	5,000	5,000
	Equipment and materials	year	3	1,000	3,000
	Reports	time	3	500	1,500
	Travel	trip	3	500	1,500
	Sub Total				22,800
- 5	Water	point	6		
	Specialist	mm	1	10,000	10,000
	Technical Personnel	mm	2	5,000	10,000
	Assistant Personnel	mm	2	1,800	3,600
	Special equipment for air quality	set	1	10,000	10,000
	Equipment and materials	year	3	2,000	6,000
	Reports	time	3	1,000	3,000
	Travel	trip	3	1,000	3,000
	Sub Total				45,600
	Sub Total				186,200
	Contingency(10%)				18,620
	Total Amount				204,820

9-5 Ybycui National Park Conservation Program

9-5-1 Objectives

Ybycui National Park is located 10 to 20 km south of La Colmena, in an area that will be indirectly influenced by the project. The planned road will have an indirect impact on park operations, including an a) increase in the number of tourists, b) increase in the possibilities of illegal deforestation and hunting, c) increase in the risk of fire, etc.

This aim of the Program is to minimize the negative impacts caused by the project, and to promote activities that will allow more people to enjoy the park's scenic beauty, as well as to recognize its ecological value.

9-5-2 Activities

To achieve the above objectives, the Program shall include the following activities:

- i) Improvement of visitors' service facilities in the Park.
- ii) Enrichment of basic equipment for inspection activities to prevent illegal activities in and around the Park.
- iii) Preparation of colored brochure for promoting environmental education.

9-5-3 Improvement of Visitors' Service Facilities

In order to promote tourism in the National Park, the following basic service facilities for park visitors shall be improved :

- i) Car parking
- ii) Visitors' center facilities
- iii) Gate facilities
- iv) Administrative office for park maintenance and inspection

The detailed space program shall be defined in the detailed design period of the project.

9-5-4 Enrichment of Basic Equipment for Inspection to Prevent Illegal Activities

It will be necessary to enrich basic equipment for inspection activities to prevent illegal deforestation in the park area. For the purpose, more equipment shall be needed. Since illegal activities are expected to increase after the project road is completed, this Program shall provide the basis for long-term activities, i.e., patrol cars, communication equipment, etc.

9-5-5 Preparation of Colored Brochure for Promoting Environmental Education

In order to avoid indirect but negative impacts on the National Park, educational efforts about environmental conservation and protection shall be enforced. In this project, it is proposed to prepare colored brochure and to distribute them to the public.

9-5-6 Work Schedule for Park Conservation Program

The Ybycui National Park Conservation Program will be mainly finalized within the construction period, and will continue for 2 years after completion with respect to patrol activities to prevent illegal deforestation and hunting. The time schedule for each program is as follows :

Table 9.5.1 Work Schedule for Park Conservation Program

Sub-Program	Year	1	2	3	4	5	6
		D/D	Construction			Operation	
1	Visitors' service facilities				XX		
2	Equipment for patrols and inspections equipment	XX				X	
3	Preparation of brochures		X	X	X		

9-5-7 Cost Estimate

The costs for the program are estimated as follows :

Table 9.5.2 Cost Estimate for Park Conservation Program

Sub-Program		Unit	Quant	Unit Cost	Total Amount
1	Visitors' Service Facilities		1	50,000	50,000
2	Equipment for Patrols and Inspections Activities				
	Patrol Vehicle including maintenance		1	50,000	50,000
	Tele-communication Equipment		1	40,000	40,000
	Sub Total				90,000
3	Preparation of Brochures		1	27,000	27,000
	Sub Total				167,000
	Contingency(10%)				16,700
	Total Amount				183,700

9-6 Promotion of Social Development Program

9-6-1 Objectives

The planned road will have great indirect positive impacts on the social and economic development of the project area. It is proposed that some measures be introduced in order to turn these indirect impacts into direct impacts to benefit the people in the affected communities. The aim of this Program is to realize the positive impacts of the road, which will provide better access to community facilities and equipment, and to promote social development. This Program is also intended to mitigate the burden on resettled households.

9-6-2 Activities

Among the several positive impacts of the road, the following have been selected as basic and effective items for realizing the direct effects of road development.

- i) Improvement of bus services
- ii) Improvement of Primary Care Services

To mitigate the negative effects on households relocated as a result of land acquisition for the new road, assistance activities shall be proposed.

- iii) Assistance to resettled households

9-6-3 Improvement of Bus Services

By improving the road, it will be possible to provide daily and punctual bus services. Therefore, the number of bus passengers will increase, and especially school children will have easy access to higher education facilities. To promote those positive impacts, if bus stops along the road are built with roofs, bus bays, and concrete surfaces to ensure convenience and safety, the number of users will increase even further, which will, in turn, increase the frequency of service. This will facilitate the movement of local peoples. Bus stops should be installed at 10 locations, and the required materials are estimated as follows :

- Roof : Wood
- Pillars and Walls : Brick and wood
- Floor : Concrete
- Chairs : Wood
- Space : 2m×4m

9-6-4 Improvement of Emergency Care Services

One of the most basic effects of the road will be the improvement in accessibility to hospitals in emergency cases. At the moment it is very difficult to access regional hospitals in Paraguarí or Villarrica from other towns and communities because of bad road conditions and blockade in heavy rainy days. Therefore, an ambulance with medical instruments such as stretchers, oxygen masks, etc. should be provided. At this moment, it is recommended that one ambulance with necessary medical equipment be allocated to a town located central area between Paraguarí and Villarrica for upgrading emergency service level in the vicinity.

9-6-5 Assistance to Resettled Households

According to the project plan, around 50 households will have to be relocated as a result of land acquisition for the expansion of the right of way. Sufficient compensation will be provided to them according to MOPC regulations. However, these households will be necessary assistance even after resettlement because they will have deal with several social and/or economic problems in rebuilding their lives at their new locations.

Social workers will be effective in assessing their problems, giving adequate advice or contacting the necessary officials. This Program shall start before resettlement and continue for at least two years after resettlement.

9-6-6 Work Schedule for Promotion of Social Development

The Promotion of Social Development Program will be mainly finalized within the construction period, and will continue for 2 years after completion to provide assistance to resettled households. The schedule for this program is as follows;

Table 9.6.1 Work Schedule for Promotion of Social Development

Year		1	2	3	4	5	6
Sub-Program		Construction			Operation		
1	Bus services				XX		
2	Primary health service				XX		
3	Assistance to resettled households	XX	XX				XX

9-6-7 Cost Estimate

The costs for the Program are estimated as follows :

Table 9.6.2 Cost Estimate for Promotion of Social Development

(Unit : US\$)

	Sub-Program	Unit	Quant.	Unit Cost	Total Amount
- 1	Improvement of Bus Services		10	1,000	10,000
- 2	Improvement of Emergency Services		1	80,000	80,000
- 3	Assistance to Resettled Households				
	Social Workers	mm	12	6,000	72,000
	Equipment and materials	year	3	2,000	6,000
	Reports		2	1,000	2,000
	Travel	trip	90	500	45,000
	Sub Total				125,000
	Sub Total				215,000
	Contingency (10%)				21,500
	Total				236,500

9-7 Summary of the Environmental Management Plan

9-7-1 Work Schedule

The work schedule for all the programs of the Environmental Management Plan is summarized in Figure 9.7.1.

9-7-2 Cost Estimate

An estimate of the costs for all the programs of the Environmental Management Plan is provided in Table 9.7.1.

9-7-3 Work Organization

The Environmental Management Plan shall be carried out under the control of the UA (Environmental Unit) of the MOPC, and progress reports shall be submitted to CI (Interministerial Committee). Each program under the Environmental Management Plan shall be carried out in close coordination with the following authorities :

- Environmental Auditory Program : UA
- Environmental Mitigation Program : UA, MAG
- Environmental Monitoring Program : SENASA, Ministry of Education
- Ybycui National Park Conservation Program : MAG
- Promotion of Social Development Program : Local Government, Municipality

Year Period	1	2	3	4	5	6
	Design	Construction			Operation	
Sub Program	Initial Investment			Aftercare Investment		
1 Environmental Auditory Program	■	■	■	■	■	■
2 Environmental Mitigation Program						
1 Supervision of ETAGs	■	■	■	■		
2 Mitigatory Forestation	■	■	■	■		
3 Traffic Safety Facilities				■		
4 Traffic Safety Education	■				■	
5 Roadside Planting				■	■	
6 Smoothing Connections with Communities				■	■	
3 Environmental Monitoring Program						
1 Topography, Géology, and Soil Conditions	■	■	■	■	■	
2 Cultural Properties						■
3 Air Quality	■	■	■			■
4 Noise Level	■					■
5 Water Quality	■					■
4 Ybycui National Park Conservation Program						
1 Visitors' Service Facilities	■			■	■	
2 Equipment for Patrols and Inspections	■				■	
3 Preparation of Educational Brochures		■	■	■		
5 Promotion of Social Development Program						
1 Improvement of Bus Services				■		
2 Improvement of Emergency Services	■	■	■		■	
3 Assistance to Resettled Households	■	■	■		■	

Figure 9.7.1 Work Schedule for Environmental Management Plan

Table 9.7.1 Summary of Cost Estimate of Environmental Management Plan

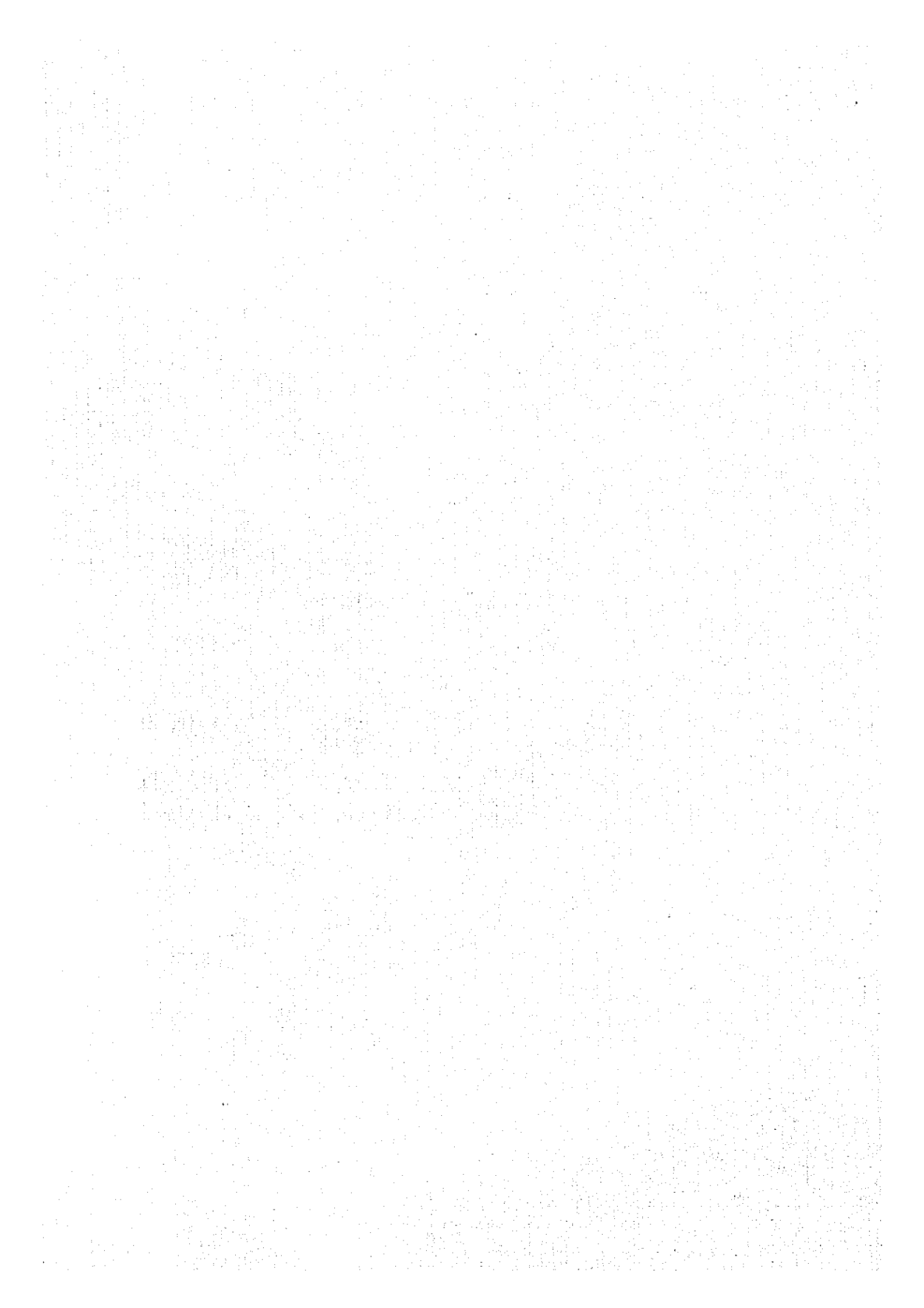
(Unit : US\$)

Sub-Program	Total Amount	Share	Initial Investment	Aftercare Investment
1 Environmental Auditory Program	260,700	15.2%	154,550	106,150
2 Environmental Mitigation Program	830,033	48.4%	756,553	73,480
- 1 Supervision of ETAGs	- *1	-	-	-
- 2 Mitigatory Planting	197,010	11.5%	197,010	0
- 3 Traffic Safety Facilities and Education	165,000	9.6%	165,000	0
- 4 Traffic Safety Facilities and Education	245,960	14.3%	99,000	73,480
- 5 Roadside Planting	24,063	1.4%	24,063	0
- 6 Smoothing Connections with Communities	198,000	11.5%	198,000	0
3 Environmental Monitoring Program	204,820	11.9%	176,660	28,160
- 1 Topography, Geology and Soil	48,620	2.8%	36,740	11,880
- 2 Cultural Properties	55,880	3.3%	55,880	0
- 3 Air Quality	25,080	1.5%	21,010	4,070
- 4 Noise Level	25,080	1.5%	21,010	4,070
- 5 Water Quality	50,160	2.9%	42,020	8,140
4 Ybycui National Park Conservation	183,700	10.7%	162,800	20,900
- 1 Visitors Service Facilities	55,000	3.2%	55,000	0
- 2 Equipment for Patrols and Inspections	99,700	5.8%	78,100	20,900
- 3 Preparation of Educational Brochures	29,700	1.7%	29,700	0
5 Promotion of Social Development	236,500	13.8%	190,300	46,200
- 1 Improvement of Bus Services	11,000	0.6%	11,000	0
- 2 Improvement of Emergency Services	88,000	5.1%	88,000	0
- 3 Assistance to Resettled Households	137,500	8.0%	91,300	46,200
Grand Total	1,715,753	100.0%	1,440,863	274,890
			84.0%	16.0%

Note: *1 The cost for the Supervision of ETAGs will be included in the construction supervision cost.

CHAPTER 10

CONCLUSION AND RECOMMENDATIONS



CHAPTER 10 CONCLUSION AND RECOMMENDATIONS

10-1 Project Outline and Environmental Issues

The project entitled "Arterial Road Development Project in the Central Eastern Area in the Republic of Paraguay" purposes the following:

- to develop an all-weather paved road along a route connecting national roads No.2 and No.8, through the districts of Paraguari and Guaira.
- to develop a branch road from the route above to La Colmena.

The project will :

- function as a bypass route for national roads No. 2 and No.7, along which much traffic is concentrated, because it is only a trunk road connects Asuncion and the Brazilian border.
- promote the agricultural development of the surrounding area, which has a great potential that has not yet been realized because of the poor road conditions, which make access to the region difficult during the rainy season.
- promote the social development of the surrounding area, which is isolated from regional service centers because of the long commute that is currently necessary.

The total length of the proposed alignment is estimated to be 121 km. The project will use mostly existing road areas, expanding the right of way to 30 -40 m. Therefore, the project will have only a very slight negative impact on the natural environment, and the major environmental issue in this case will be the project's impact on the social environment.

The project will require involuntary resettlement of around 50 households in some parts, but this is a very small number compared with other projects involving roads of the same length. Land and buildings will be acquired according to the fair compensation system of Paraguay, and they will find new lots in the same area, without any deterioration to the communities. A social survey of selected residents in the project area as well as the mayors of the 12 towns along the planned road revealed a strong desire to realize the project.

The major environmental issues in the project are :

- Negative impact on the social and living environment, including resettlement, traffic safety, air quality, and noise problems
- Negative impact on the natural environment, including small-scaled deforestation, water control, and landscape.
- Positive impact on the social environment, including economic activities and community facilities.

10-2 Environmental Impact

(1) Direct negative impact on the natural environment

Since the project road plans to mostly use the existing road, and since the road will be newly developed in only some small areas, the direct negative impact on the natural environment by the project road will be very small. The main impacts are expected to be :

- cleaving of roadside trees
- topographical changes in outside borrow pits and quarry sites
- landscape changes caused by cleaving trees, bridge construction and excavation of quarries

The impacts described above must be mitigated with countermeasures. Other items, identified as having negative impacts in similar projects, such as erosion of embankment slopes and insufficient drainage facilities shall be avoided according to the ETAGs (general specifications for environmental protection in road construction works in Paraguay).

Furthermore, the project expects positive impacts on the natural environment such as improvement of erosion control by the planting of vegetation along in embankment slopes and borrow pits, and beautification of the roadside landscape by said planting and continuous road shoulders.

(2) Direct and indirect negative impacts on the social and living environments

The Project is expected to have the following negative impacts on the social and living environments.

- Involuntary resettlement caused by land acquisition
- Decrease of agricultural lands
- Increase in the number of traffic accidents
- Splitting of communities by the road embankments
- Possibility of damaging unexcavated cultural properties
- Increase of risk of fire and illegal deforestation in Ybycui National Park located about 20km south from La Colmena, as a result of a general increase in traffic flow in the surrounding area
- Increased noise generation due to the increase in traffic flow and speed after completion of the road.

Some countermeasures must be implemented to mitigate these negative impacts, and continuous monitoring will be necessary.

As for the resettlement of residents, because alternative routes have been carefully selected the number of total houses that must be moved is estimated to be less than 50. The compensation system for resettlement is based on market prices, and relocation sites will be available within the same towns. To improve traffic safety, it is recommended that in sections where the planned road passes by a school, a safety pedestrian route should be secured for students.

(3) Direct and indirect positive impacts on the social environment

The development of the project road will improve socio-economic conditions in the surrounding area. The development of an all-weather road will permit economic activities to be conducted throughout the year without interruption. The following are the anticipated indirect positive effects of the project road.

- Agricultural development with the diversification of products that would be promoted by the improvement of distribution opportunities
- Increase in the number of industrial development opportunities for the same reason mentioned above
- Young people would have better access to higher education
- The mortality ratio would also decrease because of the improved availability of emergency services
- The migration of rural people seeking job opportunities in urban centers would decrease due to the improvement of commuting opportunities

Other direct positive impacts of the project include :

- Increase in the number of jobs and cash-earning opportunities in construction work
- Increase in the number of jobs and cash-earning opportunities in roadside industries
- Improvement in living conditions due to the shortening of traveling time to the major towns

In order to realize these impacts as direct effects as much as possible, promotional measures should be taken in line with the project.

10-3 Environmental Management Plan and Programs

The Environmental Management Plan was proposed to minimize the negative impacts while promoting the positive impacts. It includes the following programs;

(1) Environmental Auditory Program

Its purpose shall be carried out the comprehensive evaluation and management of all related works involving environmental issues from the design stage of the project to a few years after its completion. The auditors shall be selected from interdisciplinary fields covering the natural and social environment.

(2) Environmental Mitigation Program

The program shall focus on : a) supervision of ETAGs; b) mitigatory forestation; c) traffic safety facilities; d) traffic safety education; e) roadside planting in urban areas, and f) facilitating the connection of existing community roads with the planned road.

(3) Environmental Monitoring Program

This program shall be continued periodically. Before, during and after the project construction works, it will evaluate changes in : a) topography; b) the possible existence of unexcavated cultural properties at construction sites; c) air quality; d) noise levels along the planned road, and e) water quality.

(4) Environmental Conservation Program for Ybycui National Park

The Ybycui National Park requires special attention. Because of the increase in traffic flow and the improvement of accessibility, the possibility of illegal deforestation and fire risks will increase. Therefore, the improvement of equipment for a patrol system and introduction of environmental education program, as well as services for visitors are planned.

(5) Promotion of the Social Development Program

In order to realize the full benefits of the project, measures such as the improvement of :a) bus service facilities and b) emergency services shall be facilitated to promote social development in the project area. An assistance program for households that must be involuntarily resettled shall be included in the program, in addition to the compensation to be provided for their land and buildings.

10-4 Conclusion and Recommendations

(1) Conclusion

The environmental impact assessment study concluded that the project, with its environmental management measures, will have significant direct and indirect positive impacts on the social environment in the project area. There will be no negative consequences for the natural environment if the environmental management plan is completed and the construction work follows the regulations of the ETAGs (General specifications for environmental protection in road construction works established by MOPC in 1993).

(2) Recommendations

As further recommendations, in order to promote the indirect positive impacts of the project, the effects of an all-weather road, the items mentioned below should be planned in coordination with the authorities concerned.

- Improvement of educational facilities and availability of more teachers in major towns because punctual bus services will increase attendance to higher education.
- Promotion of agricultural development and technology transfer because transportation cost and time-saving effects will increase the potential to diversify agro-industrial opportunities.
- Promotion of tourism because the planned road will promote domestic tourism, while the utilization of untapped resources will promote regional development

Table 10.4.1 Summary of Environmental Assessment (I)

Environmental Items	Environmental Factors	Environmental Forecasts	Environmental Standards and Evaluation	Direct		Indirect		Environmental Management Plan
				P	N	P	N	
1. Topography	-Cleaving of Woods	- Most forest area is located on the flat land.	Standard : To avoid substantial changes of the existing topography, and to prevent natural disasters. Evaluation : The project will not cause any substantial topographical changes. But, the continuous monitoring is necessary in the construction period.					Monitoring Program - Periodical inspection of soil erosion and slope failure in the earth work sites and quarries
	- Earth Work	- Displacement of embankment on soft soil layer is estimated less than 20 cm and it will be additionally embanked. - Cutting slopes has stable gradient according to ETAGs - Average depth of side-borrow pit is 30 - 60cm - Total volume of rocky materials is 523,000 m3 from two sites - Average depth of cut from outside borrow is 2m						
2. Geology and Soil	-Cleaving of Woods	- Cleaved area is generally flat	Standard : To prevent soil erosion and to preserve the present soil conditions.					Monitoring Program - Periodical inspection of soil erosion and slope failure in the earth work sites and quarries
	-Construction Camp	- Construction camps will be separately located in 3 areas. All camps are in flat and unused area.	Evaluation : The project will not cause any large-scaled soil erosion if the work carried out according to ETAGs, therefore the monitoring is needed. The project will have positive impact to decrease existing erosion.	X				
	-Earth Work	- Embankment slopes shall be protected by vegetation						
	- Quarry sites	- Quarry sites shall be revegetated according to ETAGs.						
3. Water	- Drainage Facilities	- Road drainage facilities are planned on the basis of the adequate storm frequency period	Standard : To avoid causing any substantial hydrological changes of water stream.					
	- Bridge construction	- There are no structures in the river stream at Tebiucary Mi River	Evaluation : The project will not cause substantial changes of water stream on the conditions that road drainage facilities will be maintained sufficiently.					
	- Existence of Road Facility	- Road embankment will not blockade flood water because of adequate drainage facilities are planned						
4. Fauna and Flora	- Cleaving of Woods	- Total deforested area is 25ha. Riverside forest along the Tebiucary Mi River is mostly influenced.	Standard : To avoid substantially affecting fauna and flora.		X		X	Mitigation Program Mitigatory Forestation Park Conservation Program - Improvement of patrol system for illegal activities in the Park
	- Increase of Traffic Flow	- The possibilities of illegal deforestation will increase along with the increase of traffic in the surroundings	Evaluation : The project will cause decreasing existing forest area, and increase illegal deforestation indirectly.					
5. Landscape	- Cleaving of Woods	- Cleaving woods within the right of way area of 30 - 40m is marginal change for landscape	Standard : To conserve an excellent landscape by not creating any incongruities in the area.					
	- Earth Work	- Most part of planned road will use existing road area, therefore, changes of landscape is very limited.	Evaluation : The project will not greatly change the roadside landscape.					
	- Quarry sites	- The location of quarry sites is invisible from the road and local community areas						
	- Construction Plants	- The location of construction plants will be far from towns						
	- Existence of Road Embankment	- Road embankment height in low flood area is less than 2.5m, and slopes shall be vegetated, therefore landscape change is marginal.						
6. Resettlement	- Existence of Bridge	- The largest bridge structure will be hidden by gallery forest						Social Development Program - Assistance for resettled households
	- Land Acquisition	- Land to be acquired is about 50% of total, 226 ha. - 54ha of agricultural land and around 50 buildings shall be relocated.	Standard : To avoid serious influences on the living basis of inhabitants by resettlement. Evaluation : The project will affect around 50 households, therefore compensation and assistance are needed.		X			
7. Economic Activities	- Land Acquisition	- Income loss by acquired agricultural land shall be compensated by land acquisition procedure.	Standard : To promote a solid development of the economic activities without adversely affecting sustainable development.					Park Conservation Program - Improvement of visitors service facilities for tourism promotion
	- Construction Camp	- Various sales to construction camps will be expected.						
	- Increase of Traffic Flow	- Increase of traffic flow is 10 to 20 times of the existing. Various sales to passengers can be expected to increase.	Evaluation : The project will have great direct and indirect positive impact on local economy such as promoting agricultural development.		X	X	X	
	- Improvement of Transportation	- Travel time saving is around 60 min. in average. - Transportation cost saving will diversify the agricultural products.	The negative impact such as decreasing agricultural lands will be negligible.					

P=Positive, N=Negative

Table 10.4.1 Summary of Environmental Assessment (2)

Environmental Items	Environmental Factors	Environmental Forecast	Environmental Standards and Evaluation	Direct		Indirect		Environmental Management Plan
				P	N	P	N	
8. Traffic and Community Facilities	- Heavy Machinery and Dump Trucks	- Daily traffic volume of dump trucks in western area of the Tebicuary Mi River is estimated as 466 trucks.	Standard : To avoid substantial affection on the traffic safety and the tranquil environment of community facilities					Mitigation Program - Development of traffic safety facilities such as signals and pedestrian way near schools - Traffic safety education with audio visual materials
	- Increase of Traffic Flow	- Traffic volume and speed will increase rapidly, for example in section Sapucaí - Caballero, 94 to 3,230 vehicles in 2015	Evaluation : The project will increase quality of life through the all weather road services.	X	X			
9. Split of Communities	- Improvement of Transportation	- Several indirect positive influences are expected such as increasing school attendant ratio, decreasing death ratio, increasing living standard, etc.	The project will affect traffic safety.					Social Development Program - Improvement of bus services - Improvement of Emergency care services
	- Earth Work	- Detour routes in the construction period will be prepared.	Standard : To assist in the formation of harmonious and peaceful communities.					
	- Existence of Road Embankment	- Embankment of new road will make level gap with existing road to connect with communities.	Evaluation : The project will not make any serious split of existing communities, but will affect on connections with existing roads.			X		
10. Cultural Properties	- Increase of Traffic Flow	- A few towns shall be affected on the unity of community by increase of traffic flow.						Mitigation Program - Construction of connection slopes with local roads
	- Earth Work	- There are no sites registered as historic ruins along the planned road. But, the possibility of existence is unknown.	Standard : To avoid damaging ruins and cultural properties in the area. Evaluation : The project will not have large possibilities to damage cultural properties, but the unexcavated site is unknown.					
11. Waste	- Construction Camp	- Waste from construction camps will be very small volume.	Standard : To avoid affecting natural and living environment of the surroundings.					Monitoring Program - Periodical inspection avoiding opportunities to loose valuable cultural properties in the earth
	- Construction Works	- Waste from construction works will be reused and treated by the contractor.	Evaluation : The project will not cause any serious affection by waste.					
12. Risk of Hazard	- Increase of Traffic Flow	- Waste from ear passengers will be very limited.						Park Conservation Program - Improvement of patrol system for illegal activities in the Park
	- Existence of Road Embankment	- In the case that road embankment blockade flood waters, there is no communities to be affected in the surroundings.	Standard : To avoid affecting natural and living environment of the surroundings.					
13. Air Quality	- Increase of Traffic Flow	- Fire risk of mountain forest shall be increased generally.	Evaluation : The project will cause possibilities of risk of fire indirectly along with the increase of traffic volume				X	
	- Earth Work	- Dust will be exposed especially during the dry season, if the earth work will not follow ETAGs.	Standard : To avoid exceeding the standard level of the average air quality as follows: CO : 9 ppm (8hours) NOx : 0.05 ppm (year)					Monitoring Program - Measurement of the air quality at before, intermediate and after the construction work
14. Noise	- Heavy Machinery and Dump Trucks	- If the selection of machinery is adequate, the impacts shall be limited.	Evaluation : The project will not exceed the standard level of air quality. But, the monitoring work shall be carried out for data collection.					
	- Increase of Traffic Flow	- The concentration of CO and NOx are predicted at Paraguari for 2015 as follows in daily average ; CO : 0.0058 ppm, NOx : 0.0022 ppm.	Standard : To avoid exceeding the standard level of the average noise as follows ; Day time : 55dB Night time : 45 dB					Mitigation Program - Roadside planting in urban area for mitigating traffic noise
- Heavy Machinery and Dump Trucks	- There are no works to create heavy noise.	Evaluation : At the point having maximum traffic volume, there is a possibility to exceed the standard level of ETAGs, therefore some countermeasures are needed.			X			
	- Increase of Traffic Flow	- The noise levels by cars are predicted at Paraguari for 2015 as follows in 12 hours average ; Daytime : 61 dB, Nighttime : 50 dB ppm						Monitoring Program - Measurement of noise level at before, intermediate and after the construction work

P=Positive, N=Negative

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