

***INTERAMERICAN DEVELOPMENT BANK***



***BRAZIL***

***SECTION IV OF THE LINHA AMARELA TOLL ROAD  
RIO DE JANEIRO***

***ENVIRONMENTAL AND SOCIAL IMPACTS REPORT (ESIR)***

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## SUMMARY

I. INTRODUCTION .....	4
II. PROJECT DESCRIPTION .....	4
A. The Original Works to Construct Linha Amarela.....	4
B. The Expansion of Linha Amarela (Section IV) .....	5
C. The Sponsors .....	5
D. The Investment Program.....	6
III. INSTITUTIONAL AND LEGAL FRAMEWORK.....	6
A. Legal Framework.....	6
a. Federal.....	6
b. State of Rio de Janeiro .....	6
c. Municipality of Rio de Janeiro .....	7
B. Project Compliance Status.....	7
1. Linha Amarela.....	7
2. Section IV .....	7
IV. ENVIRONMENTAL AND SOCIAL CONDITIONS .....	8
A. The Original Construction of Linha Amarela.....	8
B. Section IV .....	9
V. ENVIRONMENTAL AND SOCIAL IMPACTS .....	9
A. Construction Phase .....	9
B. Operation Phase .....	10
C. Positive Impacts.....	10
VI. ENVIRONMENTAL AND SOCIAL MITIGATION AND MONITORING MEASURES .....	11
A. Environmental and Social Management Plan.....	11
1. Environmental control and mitigation measures during construction .....	11
2. Noise monitoring and control .....	12
3. Air emissions monitoring.....	13
4. Health and safety measures and monitoring.....	13
5. Bridges and viaducts monitoring .....	13
6. Revegetation and landscaping .....	13
7. User service and communication .....	14
8. Environmental education and community relations .....	14
B. Cost and Schedule.....	14
C. Supervision and Control of Project Mitigation and Monitoring Measures .....	15
VII. PUBLIC CONSULTATION AND DISCLOSURE OF INFORMATION .....	16

A. The Original Works to Linha Amarela .....	16
B. Linha Amarela Section IV.....	16
VIII. RECOMMENDATIONS .....	17
TABLES.....	
ATTACHMENTS.....	

## ACRONYMS AND INITIALS

CECA	State Commission for Environmental Control ( <i>Comissão Estadual de Controle Ambiental</i> )
CONAMA	National Environmental Council
CONEMA	State Environmental Council ( <i>Conselho Estadual de Meio Ambiente</i> )
EIA	Environmental Impact Assessment ( <i>Estudo de Impacto Ambiental</i> )
ESMP	Environmental and Social Management Plan ( <i>Plano de Gerenciamento Ambiental</i> )
FEEMA	Rio de Janeiro State Engineering and Environmental Foundation
IBAMA	Brazilian Environmental Institute
MRJ	Municipality of Rio de Janeiro
PROCAM	LAMSA Environmental Management Program
RIMA	Environmental Impact Report

## I. INTRODUCTION

- 1.1. Given the limited resources of the Municipality of Rio de Janeiro (“MRJ”) to construct a major toll expressway, the right to build and operate Linha Amarela was concessioned to the private sector in 1994. The 13.2-mile expressway had been envisioned by urban planners and the MRJ since the 1960’s as part of a “polychromatic system” that would consist of the Linha Vermelha beltway (The Red Line) and the Linha Amarela expressway (the “Project” of The Yellow Line). The Bank, through its private sector window, supported this privatization initiative of the MRJ by structuring a \$25 million A/B loan to support the construction and operation of Linha Amarela. The participation of the Bank provided private investors and creditors with the necessary comfort to participate in Linha Amarela, which represented Brazil’s first green-field toll road and first urban toll road concession.
- 1.2. Three major portions of the expressway (Sections I, II and III) were privatized. A consortium consisting of Construtora OAS, Ltd. and OAS Participações, Ltd. (the “Sponsors”) was awarded the concession to construct Section II, which also carried the rights and responsibilities for operating and maintaining all three privatized Sections once the works were complete (the “Concession”). In response to their successful bid, Linha Amarela S.A. (“LAMSA,” the “Company”) was created by the Sponsors as a special purpose company with the sole purpose of performing the operation and maintenance of Linha Amarela. All works were completed and LAMSA began commercial operations on January 1, 1998.
- 1.3. As operations began, it became obvious that Section IV of the road would also have to be privatized in order to eliminate a severe traffic bottleneck created where the upgraded Sections maintained by LAMSA empty into the less-modern Section IV, which was not privatized. In January 1999, the MRJ amended the Concession to include the upgrade and expand Section IV to complete Linha Amarela in exchange for extending the term of the Concession to 25 years. The proposed investment in Section IV will improve traffic flows by increasing the number of traffic lanes, widening and reinforce viaducts and accesses and constructing a system of bridges that will provide linkage to Linha Vermelha. LAMSA has requested the Bank provide financial assistance (loan) for the Section IV works.

## II. PROJECT DESCRIPTION

### A. The Original Works to Construct Linha Amarela

- 2.1. Linha Amarela is a high-speed urban toll expressway that connects suburban neighborhoods in southwest Rio de Janeiro to the downtown area. The 10-mile stretch of road between Ayrton Senna Avenue and the Sampaio-Correia Viaduct consists of three lanes of traffic in each direction including a tolling facility that charges passengers travelling in both directions. The road includes four tunnels which were constructed as part of the original project, as well as several bridges and viaducts necessary to traverse the complex geological and densely-populated landscape of the City of Rio de Janeiro.
- 2.2. The major characteristics are summarized below.

#### **MAJOR CHARACTERISTICS OF LINHA AMARELA**

<b>Components</b>	<b>Characteristics</b>
10 mile long lanes	A two-lane urban route, with 3 traffic lanes in each direction
1 Toll Plaza	16 manual toll collection booths, being 8 reversible booths 2 semi-automatic toll collection booths 2 automatic toll collection booths R\$ 1,90 toll in each direction

Special Road Structures	7 viaducts and bridges, 1.2 km in total length 3 false tunnels, 130 m in total length 4 tunnels, 2.5 km in total length
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- 2.3. In the first year of operations (1998), traffic volume on Linha Amarela exceeded preliminary estimates<sup>1</sup> and reached a daily average of approximately 62,000 vehicles per day counted at the toll plaza. Of the tolled vehicles, automobiles represented approximately 95% of the total volume, while trucks and mass transportation made up the remaining 5%. It is estimated that an additional 80,000 vehicles per day utilized the toll free sections of the road in the downtown area. Historical data show that the road has proven to be a “general use” facility rather just a commuter axis for those living in the suburban areas.

#### B. The Expansion of Linha Amarela (Section IV)

- 2.4 In 1994, Sections I,II and III were concessioned to private construction firms and operators. However, Section IV was not privatized and remained in the hands of the MRJ. The proposed loan associated with this ESIR consists of the expansion and upgrade of Section IV which will increase the traffic capacity of the final 3.2-mile portion of Linha Amarela between the Sampaio-Correia Viaduct and Ilha de Fundão including bridges and accesses to two major downtown avenues. The works also include the construction of two new access bridges to connect Linha Amarela to the Linha Vermelha beltway (see details below).

#### **SECTION IV: WORKS TO BE PERFORMED**

<b>SUBSECTIONS</b>	<b>ANTICIPATED INTERVENTIONS</b>
Sampaio Corrêa viaduct (225 m in length)	Widening of existing viaduct and lateral expansion of deck, from 4 traffic lanes (2 in each direction) to 7 (3 in each direction and one reversible) Structural reinforcement, changing from 36t class to 45t class
Lanes between Sampaio Corrêa and Manguinhos viaducts	Widening of lanes from 2 to 4 traffic lanes in each direction Reconstruction of pedestrian overpasses Pavement, signaling, and landscaping
Manguinhos viaduct	Deck expansion, from 2 to 3 traffic lanes in each direction Improvements on accesses to Brasil Avenue
Lanes between Manguinhos and Oswaldo Cruz viaducts	Rehabilitation of pavement and drainage systems Implementation of barriers, illumination, signaling, and relocation of bus stops Reconstruction of accesses to Favela da Maré and abutting developments
Oswaldo Cruz viaduct	Erecting of “new jersey” barriers, rehabilitation of guard rails, resurfacing, and improvements on road signaling and illumination
Linha Amarela/Red Line Connections	Construction of 3 viaducts, 1 grade crossing and accesses, with 2 traffic lanes Construction of 2 viaducts over Canal do Cunha (45t class)

#### C. The Sponsors

- 2.4. Linha Amarela S.A. has been incorporated by the Sponsors in Brazil as a public special purpose company formed by Construtora OAS, Ltd. and OAS Participações, Ltd. for the sole purpose of executing the Concession as granted by the MRJ. The Company is controlled by the Sponsors which hold 51% of the voting shares. Caixa de Previdência dos Funcionários do Banco do Brasil, through an (Investment Fund of Banco Do Brasil) purchased the remaining 49% of the controlling interest in addition to 100% of the preferred shares of the Company in February 1998. A turnkey, fixed-price

<sup>1</sup> Estimates made in the Rio de Janeiro Municipality Master Plan indicated 52,636 vehicles in 1998, and 57,846 vehicles in 2005.

date certain Engineering, Procurement and Construction Contract (EPC) has been provided by Constructora OAS to LAMSA.

#### D. Schedule and Costs

- 2.5. Improvements and expansion works related to Section shall be performed in 18 months and was initiated in February 1999. The estimated total project cost is US\$ 40 million, with a proposed IDB A and B loan of US\$ 10 million each.

### **III. INSTITUTIONAL AND LEGAL FRAMEWORK**

#### A. Institutional and Legal Framework

##### a. Federal

- 3.1. The Federal Constitution creates the general principles under which all concessions must operate. Normative standards and compliance measures are deferred to the relevant state authorities for concessioned works. The Constitution stipulates that it is incumbent upon the Government, directly or under concession or permission, the rendering of public services. Laws 8.987/95 and 9.074/95 regulate the concession of public services defining that when preceded by the performance of public works as the *“construction, total or partial, conservation, reconstruction, expansion, or improvement of any public-interest works, delegated by the granting power by way of competitive bidding to a corporate entity or consortium of companies that demonstrate the ability to perform them, on their account and risk, so as that concessionaire’s investment be compensated for and amortized by the development of the service or work for a determined period of time”*.
- 3.2. The National Environment Policy is governed by Federal Law 6.938/81 and by the Federal Constitution of 1988 that determines that, *“all have the right to an ecologically-balanced environment, which is an asset of common use and essential to the healthy quality of life, and the Government and the community have the duty to defend and preserve it for the present and future generations”*.
- 3.3. The National Environment Policy created the National Environment System (SISNAMA - Sistema Nacional de Meio Ambiente) which defines the different agencies that regulate environmental and social regulation at the federal, state and local levels. Resolution CONAMA 237/97 defines the authority of each agency in the environmental licensing proceeding. Federal Law 7.347/85 (as amended by Laws 7.804/89 and 8.028/90) governs the public civil liability suit for damage inflicted on environment, consumers, goods and rights of artistic, aesthetic, historical, tourism, and landscaping significance. Law 9.605/98 provides for criminal and administrative sanctions derived from conducts harmful to the environment.

##### b. State of Rio de Janeiro

- 3.4. Aside from creating the necessary regulatory jurisdictions, the Federal Constitution largely defers the relevant State authorities for the formulation and implementation of environmental and social norms. The Constitution of the State of Rio de Janeiro (promulgated in 1989) dedicates its Chapter VIII to Environment, and State Law 1.356/88 provides for procedures linked to the formulation, analysis, and approval of Environmental Impact Assessments (EIA).
- 3.5. At the state level there are two primary bodies. State Decree 39/75 designates CECA (State Commission for Environmental Control or *“Comissão Estadual de Controle Ambiental”*) as the administrative body to create normative standards. State Decree-Law 30/75 designates FEEMA (Rio de Janeiro State Engineering and Environmental Foundation) as the technical agency responsible for carrying out these norms under State Environmental Control Policy. FEEMA and CECA are linked to the State Secretariat for Environment in Rio de Janeiro. In addition, CONEMA, the State Environmental Council (Conselho Estadual de Meio Ambiente), was created by State Decree 12.687/89 as an advisory body for both.

- 3.6. Through a CECA-approved Normative Ruling, FEEMA has the responsibility to create the guidelines for the presentation and implementation of environmental assessments in the State of Rio de Janeiro. In general, FEEMA and CECA only require the licensing of new highways with more than two lanes of traffic to develop and submit a complete EIA to the satisfaction of FEEMA. For other types of projects, FEEMA and CECA require the submittal of a more generic type of environmental assessment or request for project authorization. FEEMA also establishes the procedures for community participation and follow up when a project requires an EIA. In the State of Rio de Janeiro, Deliberation CECA 2.555/91 regulates the holding of public hearings as part of the licensing of pollutant activities subject to submission of an EIA.
- 3.7. In order to proceed with the works as detailed under the Concession, the concessionaire must receive a series of licenses from the Granting Authority, which for this project is FEEMA. FEEMA requires that all environmental and social norms and regulations have been followed before the necessary approval is given. The licensing framework consists of three phases: 1) a Preliminary License that is to be applied for during the preliminary phase or design of the works, accompanied by an either an environmental assessment or a full EIA depending upon FEEMA requirements for a particular project; 2) an Installation License that is to be applied for prior to the implementation of the works which includes specifics on engineering and environmental and social mitigation and monitoring measures; and 3) an Operation License that must to be applied for after the completion of the construction works and prior to the actual commencement of highway operation. Federal Law also sets the terms for each of these licenses. Preliminary licenses are valid for no more than five years. Installation Licenses are valid for no more than six years. Operating Licenses are valid for no less than four years and no more than ten years.
- 3.8. FEEMA has established, in accordance with an updated environmental legislation, ambient air quality criteria for particulate material (annual geometric average of 80 ug/m<sup>3</sup>, daily average concentration of 240 ug/m<sup>3</sup>).
- c. Municipality of Rio de Janeiro
- 3.9. In City of Rio de Janeiro, the concession of public services is regulated by a local law that supported the Executive Branch decision on the concession of Linha Amarela to the free private sector in the section between Sampaio Corrêa viaduct and Ayrton Senna avenue.
- 3.10. Since project inception, LAMSA has worked with the Secretariats for Environment and Urbanism of the MRJ in order to obtain the technical guidelines to be followed in the implementation and operation of the works for Section IV.
- 3.11. Regarding noise pollution, Municipal Decree 5.412/85 sets the following parameters: 55 to 70 dB(A) during the day and 50 to 60 dB(A) during the night, depending on the urban zone (residential, commercial or industrial).

## B. Project Compliance Status

### 1. Linha Amarela (Sections I, II and III)

- 3.12. For the Linha Amarela Sections I, II and III, a full EIA was developed and submitted to FEEMA in 1994 and were approved by CECA, resulting in the granting of the necessary Preliminary and Installation Licenses. As part of this process, various public disclosure and consultation activities were performed (see Section VII for details). FEEMA subsequently issued the Operation License for the Linha Amarela Project in May 1999.

### 2. Section IV

- 3.13. Prior to commencing the works to Section IV, LAMSA prepared two environmental assessments and submitted both to FEEMA in order to obtain the necessary licenses. The two assessments are: 1) "Linha Amarela – Sampaio Corrêa/Red Line Stretch: Alternatives for Circulation Improvement" (June 1998); and 2) "Environmental Report – Linha Amarela S/A – Sampaio Corrêa viaduct/ Ilha do Fundão and Accesses" (August 1998).



- 3.14. Based upon technical studies, CECA did not require LAMSA to prepare a full EIA given the relatively small-scale expansion and upgrade associated with Section IV of Linha Amarela and since the original EIA included aspects related to this section and expansion. FEEMA subsequently issued in December 1998 a Preliminary License to LAMSA for the Section IV works, including some specific technical requirements to be fulfilled by LAMSA in order to obtain the Installation License.
- 3.15. Section VII presents a summary of the information disclosure and public consultation activities performed associated with Section IV of Linha Amarela.

## **IV. ENVIRONMENTAL AND SOCIAL CONDITIONS**

- 4.1. Given the inter-connection and association between the Section IV and the originally constructed road sections (I, II and III), a summary of the social and environmental conditions of both areas (i.e., the entire Linha Amarela road) are presented.

### A. The Original Construction of Linha Amarela

- 4.2. The road constructed by LAMSA commences at Baixada de Jacarepaguá, a moderately undulating plain of marine origin, confined between the ocean and the mountainous base of Serra dos Pretos Forros. After crossing such mountainous region through tunnels, the road ends in another moderately undulating plain of marine origin.
- 4.3. In terms of air quality, high concentrations of suspended particles are present in Bonsucesso due to both industrial facilities and the inconstant presence of scattering winds. Dispersion conditions are favorable in the southern region of the Linha Amarela, but less favorable in the northern region which includes the congested downtown area.
- 4.4. Geologically, more attention was focused on the section related to the crossing of Serra dos Pretos Forros, where 20% of the length thereof demanded special retaining works. A mineral water spring lies next to the northern segment of this Serra and to the Toll Plaza, however the works did not affect this resource. The quality of surface water resources in the area near Linha Amarela have been severely impact due to urban activities, including direct untreated sanitary and industrial waste waters. The construction of the road required the canalization of small portions of three surface waters, namely Farias, Faria-Timbó, and Banca da Velha.
- 4.5. Linha Amarela crosses four Administrative Regions of Rio de Janeiro City, comprising the neighborhoods of Cidade de Deus, Freguesia, Água Santa, Encantado, Engenho de Dentro, Abolição, Inhaúma, Del Castilho, Higienópolis, and Bonsucesso. The area under direct influence of the Linha Amarela encompasses approximately 600,000 inhabitants, 60% of whom report an income below US\$ 550.00 per month. Such neighborhoods feature a wide diversity of land use, constituting urban areas of peripheral characteristics where low-income residential use and local commercial activities prevail. Two large *favelas* (Parque Proletário and União) are located in the northern end, and one (Cidade de Deus) in the southern end. The implementation of Linha Amarela required the resettlement of approximately 3,000 families (see Section VI for details).
- 4.6. Linha Amarela connects significant regional centers that attract and generate traffic volumes, featuring on the one side, the service and recreation commercial complex developed proximal to Barra da Tijuca, accessing the beaches in the region; and on the other hand, Fundão neighborhood and the connection to Brasil avenue. It is believed the road handles approximately 30% of the average daily travel volume originated from Barra da Tijuca and Jacarepaguá, corresponding to an average volume of approximately 60,000 vehicles/day.
- 4.7. In the southern region, Linha Amarela crosses the Bairro da Freguesia Environmental Protection Area created by Municipal Decree 11.830/92, where assets of historic significance listed by Brazilian laws are located. However, the project implementation has not affected this area.

## B. Section IV

- 4.8. Section IV is also located at a moderately undulating plain of marine origin, including Ilha do Fundão, separated from the continent by Canal do Cunha. The region near Canal do Cunha includes some unfavorable geological conditions, such as low resistance and soft soils, demanding the replacement of materials in addition to subgrade reinforcement.
- 4.9. The following surface waters are located in this section: Faria-Timbó river; Canal da Vila do Pinheiro, and Canal do Cunha. The quality of their water has been fully degraded due to uncontrolled discharges of sanitary wastewater. The area corresponding to Canal do Cunha has been significantly impacted due to discharges of sewerage and solid waste.
- 4.10. Section IV traverses the neighborhoods of Bonsucesso, Del Castilho, and Higienópolis, featuring typical residential and local commercial use. In the general area near, but not within, the road there are several *favelas* (Maré, Rato Molhado, Águia de Ouro, and Favela do Guarda) where approximately 60,000 predominantly low-income people dwell in this region.
- 4.11. Major economic activities installed in the area include modest trade activities, informal trade, and modest industrial activities. The Comunidade Agrícola buildings are located immediately adjacent to the road, near Sampaio Corrêa viaduct, which determined the limits of the expansion. The University City is located at the other end of the road section.

## **V. ENVIRONMENTAL AND SOCIAL IMPACTS**

- 5.1. The principal environmental and social impacts for the Section IV works are associated with the project construction phase (see Section V.A). However, these impacts are quite localized and have relatively minor magnitude and thus can be easily mitigated via standard prevention and control measures (see Section VI for description).

### A. Construction Phase

- 5.2. The major potential impacts due to the construction works are primarily associated with interference with the existing in urban environment and an already congested road system (further described below) and potential impacts associated with the safety to workers and community during construction of viaducts over Canal do Cunha in view of water contamination and polluted sediments present in the Canal.
- 5.3. Circulation and Safety Conditions. Interference with pedestrian and vehicles circulation, with increased risks of accidents due to constant movement of vehicles and equipment in service areas, which may affect members of the local community, road workers, and road users.
- 5.4. Expropriations. Purchase of a portion of three properties along the existing road due to the need to relocate a pedestrian over-crossing and widen the existing road. The areas to be expropriated range from approximately 60 to 210 m<sup>2</sup> of residential or commercial property (values of properties range from approximately R\$ 66,000 to 100,000. There is no resettlement required for Section IV.
- 5.5. Removal of Vegetation. Removal of 36 mature trees and closure of a soccer field due to reconstruction of accesses to Brazil avenue.
- 5.6. Air Pollution. Increased particulate material emissions originating from demolitions of concrete walls, floors, over-crossings, sidewalks, guard rails, gutters, and sheds, and pollutant gases emissions originated from the use of equipment and machines.
- 5.7. Noise Pollution. Noise emissions due to the movement of vehicles and other equipment, especially compressors, causing annoyance to the surrounding population and road users.
- 5.8. Water Resources. Potential releases to surrounding drainage systems and water bodies of storm water runoff, sediments, and sanitary effluents from workers.
- 5.9. Risks of Accident. Introduction of risks of accidents involving fuels at work areas.

- 5.10. Contamination. Risk of contamination of areas and persons due to the handling of contaminated material and discharge of gases (e.g., hydrogen sulfide) at Canal do Cunha.
- 5.11. Employment. Generation of 600 direct jobs and 3,000 indirect jobs, prioritizing the engagement of workers dwelling in the area under road influence.

#### B. Operation Phase

- 5.12. In general for the operational phase, the positive impacts of expanding and upgrading Section IV are much more significant than the potential relatively minor negative impacts. The potential negative impacts are medium to long-term in nature, mainly related to the increase in the flow of vehicles and, consequently, in air pollution and noise emissions.
- 5.13. Air Quality. Overall air quality will be reduced due to better traffic flow patterns (e.g., less vehicle start and stopping, etc.) but may increase due to increased traffic volumes.
- 5.14. Noise. Improvement in noise levels should occur due more constant use speed of cars, but may increase due to larger vehicle flow.
- 5.15. Urban Landscape. Alteration in landscape due to the introduction of and improvement in structuring elements, landscaping of adjacent areas, and maintenance of re-vegetated areas, promoting a positive urban environment.
- 5.16. Real Estate Appreciation. Inducement of real estate appreciation in the area under road influence, especially in the region directly served by improvements added to Section IV. This is due to improved access conditions, with a sequential alteration on land use and urban landscape.
- 5.17. Water Resources. Hydrodynamics studies carried out by COPPETEC Foundation of Rio de Janeiro Federal University on Canal do Cunha have shown that columns of the bridges accessing Linha Amarela shall make no major alteration in the canal hydrodynamics.
- 5.18. Circulation and Safety Conditions. The elimination of congestion spots and improved movement alternatives, including new access options, shall offer Linha Amarela users a significant improvement in traffic, indirectly favoring the users of other important roadways in the city.

#### C. Positive Impacts

- 5.19. In general, Linha Amarela has resulted in significantly improved circulation and traffic conditions on other routes (Auto-Estrada Lagoa-Barra, Grajaú-Jacarepaguá, Alto da Boa Vista) in Rio de Janeiro City. That has allowed a fast and safe access from the southern to the northern region and vice versa, mitigating traffic conditions on already rather congested roads. The table below indicates the reduction in average daily traffic on such roads from Linha Amarela.

**AVERAGE DAILY TRAFFIC VARIATION**

<b>Competitive Routes</b>	<b>Before Linha Amarela</b>	<b>After Linha Amarela</b>	<b>Reduction</b>
Av. Cândido Benício	60,000	42,000	30%
Av. Menezes Cortes	55,000	40,000	27%
Estr. de Furnas/Av. Edson Passos	20,000	15,000	25%
Auto-Estrada/Niemeyer	120,000	115,000	4%

Source: Rio de Janeiro Municipal Transportation Secretariat

- 5.20. The reduction in congestion on Linha Amarela, Brazil Avenue, and Linha Vermelha due to the improvements to Section IV shall fortify the benefits created by the original works to create Linha Amarela and benefit approximately 150,000 passengers per day by reducing travel time and increasing safety conditions. Additionally, that shall reduce road users' stress, the wear and tear of vehicles, fuel consumption, and accidents, especially those involving vehicles and pedestrians in view of improved road safety conditions and installation of pedestrian overcrossings.

- 5.21. In addition to the pure traffic benefits, the implementation of improvements anticipated for Section IV should create additional urban development in the area surrounding Section IV which has already been observed for Sections I, II and III. This will especially apply to the Bonsucesso community, by promoting the revitalization of old and deteriorated settlement areas in the city and a resulting real estate appreciation.
- 5.22. Through the City Planning Secretariat, the MRJ has carried out studies to reassess and re-conform land use zoning along the whole Linha Amarela. Studies carried out are enumerated below.
  - (i) Urbanization Normative Plan for Linha Amarela (Plano Normativo de Urbanização da Linha Amarela) intended to define land use standards along the road.
  - (ii) Urban Structuring Projects (PEU – Projetos de Estruturação Urbana) for Méier and Taquara regions, involving almost all the neighborhoods served by Linha Amarela. The already completed studies, including proposals to change the zoning of such regions, have been forwarded to the City Council of Rio de Janeiro City for examination. Linha Amarela has already been incorporated into such zoning changing proposals.
  - (iii) Urban Structuring Project for Bonsucesso region: to be developed. Such region encompasses the neighborhoods directly served by Linha Amarela Section IV.
- 5.23. Another positive social impact worth mentioning is the facilitation of low-income population access to beaches located in southern Rio, allowing such population to access the most important form of recreation of people's culture in Rio de Janeiro. Such facility partly explains the significant traffic on Linha Amarela on weekends.
- 5.24. The implementation of Linha Amarela Section IV shall generate some 600 direct jobs and 3,000 indirect jobs. During the operation phase, 50 direct jobs shall be generated in addition to the 285 today related to the road operation, preferably engaged among those dwelling in its area of influence. For such purpose, LAMSA and SINE (an agency subordinated to the Secretariat for Labor in Rio de Janeiro) are to execute an agreement intended to recruit part of the labor force to be employed in the construction of Phase 2 in a region called Complexo da Maré. Recruitment has already started, and the selection shall be concluded in June 1999.

## **VI. ENVIRONMENTAL AND SOCIAL MITIGATION AND MONITORING MEASURES**

- 6.1. The Bank required LAMSA to develop and implement a specific Environmental and Social Management Plan (ESMP) for the project. The ESMP provides specific actions related to the management and control of environmental and social impacts and monitoring, and includes a defined time schedule, duties (responsibilities), and cost program. The ESMP was developed based upon the various project-related environmental studies, governmental requirements and comments, the mitigation measures and monitoring programs used during the construction of Sections I, II, and III of Linha Amarela including an analysis of their status and effectiveness performed as part of the Bank's environmental and social due-diligence for the Section IV project (see Table 6-1 for summary), and comments and recommendations from the Bank. The ESMP consists of the specific measures for the construction phase of Section IV and for all Sections (i.e., entire road) during the operational phase. The main components of the ESMP are described below.

### A. Environmental and Social Management Plan

1. Environmental control and mitigation measures during construction
- 6.2. This program looks to: 1) control the direct impacts associated to the road implementation; 2) ensure the fair expropriation of the real estate affected; 3) minimize the risks of contamination associated with activities at Canal do Cunha; and 4) comply with the legal requirements related to environmental and social issues.

- 6.3. Expropriations. The implementation of Section IV shall result in the partial expropriation of three properties adjacent to the road. LAMSA has negotiated with the owners envisaging the direct purchase of the real estate units. Such transaction expedites the process and is more beneficial to both the owners and LAMSA. Two of three units have been purchased under such conditions (R\$ 66,000 and R\$ 95,000) and the remaining is presently being negotiated (estimated at R\$ 100,000). There is no need to resettle population for Section IV.
  - 6.4. Emissions Control. This subprogram aims to control emissions of air pollutants, noise, liquid effluents, and solid waste originating with construction fronts and service sites with the aid of mitigating measures. Anticipated actions are: 1) monitoring of emission of suspended particles (24-hour readings every two days); 2) periodic de-siltation and cleaning of surface drainage system components; 3) sanitary control, daily cleaning, and monitoring of hygiene **conditions at worker facilities; and** 4) periodic monitoring of sewerage collection systems and connection to the public sanitary sewerage system.
  - 6.5. Risk Management. This subprogram aims to adopt measures intended to prevent and minimize the risks of accidents usually anticipated in works featuring these characteristics, which interference with the urban environmental heightens the risks of accidents. The following measures are included: 1) construction signaling; 2) implementation of temporary detours (for vehicles and pedestrians) featuring an operating standard equivalent to that of blocked roads and proper signaling; 3) conformity of works timetable so as to minimize the interruption of existing roads; 4) streamlining of works-generated traffic flows and minimization of impacts thereof on the urban network; and 5) previous disclosure to adjacent communities of all excavation activities or use of explosives (if any), or other constructive procedures that must be disclosed in advance.
  - 6.6. Control over Canal do Cunha. The high contamination levels of Canal do Cunha water and sludge deposited at its bottom demand proper occupational safety prevention and control measures at the work site as well as for the handling and disposal of the excavated material. Construction techniques to be used in this area shall utilize mechanized labor as often as possible, thus minimizing the presence of workers in the area and reducing their exposure to pollutants found therein. The sludge excavated from the bottom shall be disposed of at the Canal itself, and the overturn of sludge settled on the bottom shall be avoided. All the machines and equipment used at Canal do Cunha works shall be cleansed prior to their departure from the camp site and send-off areas so as to prevent the risk of dispersing any contaminated materials onto local streets. Actions anticipated include: 1) definition of protection measures for workers who shall perform directly in this area and for the continuous monitoring of emission levels; 2) analysis of the sludge composition (physical-chemical analysis, inclusive of heavy metals, volatile and non-volatile organic chemicals); 3) definition of protection measures for workers who shall perform in the area; and 4) monitoring of environmental conditions in areas in close proximity to interventions in Canal do Cunha.
  - 6.7. Relationship with Communities. Through the formulation of a Workers' Conduct Code, this subprogram intends to maintain a proper relationship between contractor and adjacent communities, thus avoiding all potential conflict. To cover all professional levels, such Code shall explain the forms of treatment and relationship with neighboring communities. In addition, various public relationship and consultation activities are being implemented (see Section VI.A.8 and Section VII).
  - 6.8. Closure of Works. The subprogram encompasses measures aiming the recovery of environmental conditions, such as: 1) rehabilitation of the temporary work areas, including the removal of debris, topographical grading and surface drainage; 2) rehabilitation of areas subject to erosion processes and spoiled gardens; 3) rehabilitation of silted water courses and cleaning of all surface drainage system components; 4) closure of provisional connections to the public sewerage system; and 5) rehabilitation of local road sections damaged by the works, closure of provisional detours, and removal of works signaling.
2. Noise monitoring and control
- 6.9. The program for noise levels monitoring includes the entire area under Linha Amarela influence and intends to ascertain any alteration in noise levels in the road throughout the time, assess the effectiveness of sound barriers, and suggest additional measures to abate noise levels if necessary.

Anticipated actions include: 1) mathematical modeling and measurement of current noise levels along the entire road and abutting areas; 2) identification of areas more exposed to roadway impacts and sites to be permanently monitored; 3) annual monitoring of noise levels on the busiest day of the week for 24 hours; 4) selective count of vehicles per type (cars, trucks, buses, motorcycles, etc.); and 5) suggestion of supplemental measures to reduce noise levels to ensure compliance with federal and urban laws.

### 3. Air emissions monitoring

- 6.10. This program intends to monitor air emissions resulting from Linha Amarela operation, and control air emissions inside the tunnels under LAMSA's responsibility. The following pollutants are to be monitored: carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), and suspended particles. The program comprises the following actions: 1) 24-hour monitoring of air quality in the tunnels; 2) air quality monitoring at four sites, being measurements taken in 24-hour periods at three-month intervals; and 3) a Road Cleaning Plan, comprising actions aiming the reduction and control of air pollutants, such as night washing with tank trucks and road sweeping in order to reduce the re-suspension of particles in the atmosphere.

### 4. Health and Safety Measures and Monitoring

- 6.11. The following health and safety related measures are proposed: 1) compliance with hazardous material transportation norms; 2) use of individual protection equipment for all workers and employees when necessary; 3) appropriate safety signaling indicating high accident risk areas; 4) implementation of a program encouraging safety in the work area in order to ensure appropriate health conditions for the workers; and 5) implementation of CIPA – Comissão Interna de Prevenção de Accidentes (Internal Accident Prevention Commission). The work safety program of LAMSA also includes the following measures: 1) workers training; 2) elementary health assistance and first-aid; 3) transportation services to hospitals and emergency services.

### 5. Bridges and Viaducts Monitoring

- 6.12. The bridges and viaducts monitoring intends to ascertain the stability and safety conditions of special road structures under LAMSA management. The procedure consists of carrying out preventive inspections for corrosion control. The monitoring of special road structures is a permanent activity, comprising all pre-stressed concrete structures and other structures. Inspections shall be carried out by qualified professionals using proper equipment, being them technically and legally liable for the results assessed. In addition to technical and structural aspects, the bridges and viaducts monitoring shall comprise other aspects related to the maintenance and conservation of the structures. This program is part of concessionaire contractual duties.

### 6. Revegetation and landscaping

- 6.13. The Linha Amarela's revegetation and landscaping program intends to further continue the seedling planting program initiated during the original works to Linha Amarela, by keeping and maintaining the rehabilitated areas, replanting of trees due to the removal of 36 tree specimens from the section corresponding to Section IV, rehabilitate and conserve the mangrove vegetation in the vicinities of the section to be affected by the construction of bridges over Canal do Cunha, and foster landscaping revitalization along the road and adjacent areas, thus contributing to the local landscaping rehabilitation.. Activities anticipated for such program are: 1) characterization of road-affected areas along its total length; 2) selection of areas for replanting purposes in view of the environmental and landscaping recovery of areas around the road, including the re-planting of the 36 arborous specimens removed, the rehabilitation of mangrove vegetation at Canal do Cunha, the recomposition of plant covering in the vicinities to tunnel ends, urban foresting for landscape revitalization and landscaping on areas abutting the roadway, cloverleaf interchanges, and accesses; 3) formulation of the replanting program covering all above-mentioned categories of interventions, providing for planting and follow up on the growth of species; 4) definition of area to which the soccer field to be closed shall be relocated, and formulation of implementation project and landscape of the new area assigned to the community facilities; 5) plantings and follow up on already rehabilitated areas and 6) implementation of the new soccer field and landscaping of surrounding areas. The compensating planting of specimens removed due to the works shall be at a ratio of five new specimens per



specimen removed (totaling 180 specimens), on an area to be determined and approved by the local government and FEEMA. LAMSA's goal is to plant 25,000 seedlings. Relocation of the soccer field shall be discussed with the communities affected, ensuring the maintenance and access to the leisure facility under proper safety conditions.

#### 7. User service and communication

- 6.14. User service and communication is part of concessionaire duties and it intends to ensure proper movement and safety conditions along the road, preventing accidents involving users, pedestrians, and other undesirable events. This program includes the implementation and operation of the following equipment and services such as traffic inspection, breakdown service, medical assistance, toll-free telephone service (0800), and electronic road signals and call-box facilities.

#### 8. Environmental education and community relations

- 6.15. The environmental education program intends to instruct and clarify the population about the works, inform the user and adjacent communities about safety issues and individual responsibility towards the preservation of public assets, and make the community aware of environmental issues. The environmental education program was formulated for the following audience: road users; communities adjacent to the area under works influence (Vila São Pedro and Comunidade Agrícola de Higienópolis, in Bonsucesso; and Vila dos Pinheiros, Conjunto Pinheiro, Vila do João, Bento Ribeiro Dantas, Baixa do Sapateiro, and Morro do Timba in Bairro Maré); community leaders, dwellers associations and the public school system.
- 6.16. Community Relations during Works. LAMSA's plan is to develop the above-mentioned communication, especially the follow up on expropriations, the soccer field relocation, disclosure of works-related information and respective timetables, already performed activities and events. All this in addition to safety-related issues. Actions comprise: 1) holding of community meetings; 2) assessment of characteristics of communities involved; 3) assessment of social facilities in the region; 4) formation of partnerships with government authorities; 5) identification, analysis, and forwarding of demands for possible response; 6) advisory services to community leaders in their relations with the government authorities; 7) follow up on the permanent commission for works monitoring and discussion; and 8) follow up on expropriation proceeding.
- 6.17. Educational Campaigns. Conduction of campaigns throughout the whole concession term will cover issues concerning the construction and operation of Linha Amarela.
- 6.18. Opportunities Center. It intends to offer greater conditions to the employment of the labor force available to market. It encompasses services such as employment desk, professional training courses, refreshment courses, and characterization of job vacancy/ professional relation. It shall be developed under a partnership with Centro Comunitário de Defesa da Cidadania - CCDC; State Secretariat for Labor and Social Work - SETRAB; and LAMSA, intending to open more employment opportunities for the low-income labor force dwelling in the vicinities of the roadway.

#### B. Cost and Schedule

- 6.19. The ESMP for Section IV includes the environmental programs related to the upgrade and expansion as well as the ongoing monitoring and operation of the original works. Their implementation shall last for the life of the Concession, currently set in 25 years. See Table 6-2 for cost and schedule breakdown for the ESMP.

**COST OF ENVIRONMENTAL AND SOCIAL PROGRAMS – ESMP (R\$)**

<b>Programs</b>	<b>Implementation</b>	<b>Operation</b>
Environmental Control during Works	520,000	
Noise Monitoring and Control		900,000
Air Emissions Control		8,350,000
Bridges and Viaducts Monitoring		Included *
Revegetation and Landscaping		245,000
User Service and Communication		Included *
Environmental Education and Social Communication	40,000	480,000
Environmental Management	150,000	3,630,000
<b>TOTAL</b>	<b>710,000</b>	<b>13,605,000</b>

\* included in Concession duties

- 6.20. LAMSA is responsible for implementing all programs. Agreements may be possibly executed with NGOs, universities, and other agencies aiming the development of the anticipated activities.

**C. Supervision and Control of Project Mitigation and Monitoring Measures**

- 6.21. An environmental management unit internal to LAMSA organizational structure shall coordinate the implementation of actions raised in the ESMP. The anticipated organizational structure shall be one coordinator, one environment professional and one administrative assistant. These individuals will perform the technical, managerial, administrative, financial, and operating tasks necessary to the attainment of the objectives proposed. Such structure shall last for the entire Linha Amarela concession term.
- 6.22. The environmental management unit to be created shall have the following tasks: 1) to implement the environmental management actions and programs proposed in ESMP, ensuring the material and human resources for the full development thereof; 2) to coordinate environmental management actions, setting the basic guidelines for the development thereof; 3) to ensure the relationship between LAMSA, government officials, and the population involved; and 4) to promote and consolidate LAMSA's image in terms of environmental protection for the community. Duties of such management unit are as follows: 1) to coordinate ESMP development in its several phases; 2) to establish the basic and conceptual guidelines for the several actions to be initiated, while trying to maintain the unity and coherence with the general environmental management goals; 3) to follow up on the performance of physical and financial schedules and assess the results achieved; 4) to set a results assessment system parallel to the environmental control model; 5) to keep a permanent relationship with local and state officials, NGOs, and local leaders; 6) to develop and coordinate community relations and environmental education campaigns; and 7) to keep the relationship with IDB and local and state public agencies concerned in terms of project-related environmental issues.
- 6.23. The environmental management unit to be created shall monitor ESMP implementation. Monitoring shall ascertain the achievement of goals on an annual basis, identifying problems encountered and the measures necessary to solve potential deviations. Additionally, the annual monitoring report shall include the assessment and consolidation of specialized technical reports produced in the scope of environmental programs (noise, air quality, bridges and viaducts monitoring).
- 6.24. At the end of the 10-year period, actions developed by ESMP and other actions that may be possibly incorporate shall be assessed, resulting in a ESMP review for the other years of concession. The assessment and review shall analyze the effectiveness and efficiency of measures and actions implemented, analyzing the need for their maintenance, re-conformity, or replacement of other actions, more adequate for the environmental reality then reported. ESMP review shall incorporate findings of both monitoring and annual assessment of actions implemented, in addition to the problems encountered in the attainment thereof. It shall try and eliminate the obstacles and redirect actions so as to ensure that the environmental quality of the area under roadway influence be maintained and improved.



- 6.25. At the end of the concession term, an environmental assessment report shall be written. Such report shall characterize the social and environmental status of the area of influence, its integration with the urban road system and local ordering, the existing conflicts between the road and its abutting area, and the effectiveness and efficiency of environmental programs and actions proposed and implemented.

## VII. PUBLIC CONSULTATION AND DISCLOSURE OF INFORMATION

### A. The Original Works to Linha Amarela

- 7.1. During the original construction of Linha Amarela and in compliance with the Bank's policies, the Rio de Janeiro Municipality released information related to the Project, including all existing environmental studies (e.g., EIA), to the relevant public entities and to the community directly affected by the highway. The disclosure of documents and reports had the purpose of informing the community about the construction program, environmental and social impacts expected to occur and the mitigation measures proposed.
- 7.2. During the permitting process various announcements were made regarding the availability of the EIA/RIMA reports, indicating place, time and period during which the documents were available for public examination. In addition a specific Public Hearing was held after the EIA was made available and before the installation approval permit was issued.

### B. Linha Amarela Section IV

- 7.3. In order to comply with the Bank's policies related to information disclosure, LAMSA implemented the actions listed below.
- Announcements were published in Rio de Janeiro State major circulation daily newspapers, under the headings "**Linha Amarela S/A – LAMSA - COMMUNICATION**" (dated October, 1998), which stated that environmental assessment information related to the project was available for review by the public and that LAMSA was requesting the Preliminary License.
  - Announcements were published in Rio de Janeiro State major circulation daily newspapers, under the headings "**Linha Amarela S/A – LAMSA - COMMUNICATION**" (dated March, 1999), which stated that additional environmental assessment information related to the project was available for review by the public and that LAMSA was requesting the Installation License.
  - At the request of the Bank, LAMSA published another announcement on Rio de Janeiro State major circulation daily newspapers under the headings: "**Linha Amarela S/A – LAMSA – COMMUNICATION**" (dated June 1999) informing that the following documents were available at LAMSA headquarters: Extension Project; Environmental and Social Management Plan and related documents; expropriation information; studies related to community interference and mitigation measures due to the construction and operation of the highway; and **the studies carried out to comply with the required licenses to proceed.**
- 7.4. In terms of direct public consultation, LAMSA has on several occasions met with the surrounding communities. Meetings with the communities were held to present the project and discuss social and environmental impacts associated to the construction of the Linha Amarela Extension. The following entities participated in the meetings: 1) FAF-Rio – Federação de Favelas do Rio de Janeiro; 2) Associações de Moradores da Vila Pinheiro, Morro Timbal, Bento Ribeiro, Conjunto Pinheiros, Vila São Pedro e Comunidade Agrícola; and 3) representatives from Rio de Janeiro Municipality (Região Administrativa da Maré). The issues discussed were interference from the works on traffic, urbanization, interference with community life, expropriation and community participation. The main result of this meeting was LAMSA commitment on creation of a Permanent Forum for Public Participation (Fórum Permanente de Discussão Comunitária).
- The table below shows the public meetings already performed by LAMSA.

**PROMOTED MEETINGS**

Months	Date	Communities	Number of participants
April	25	Agrícola de Higienópolis	106
May	02	Bento Ribeiro Dantas	107
	16	Conjunto dos Pinheiros	15
	29	Morro do Timbal	63
June	12	Vila do João, Comissão de Moradores	53
	19	Vila do João e Cj. Pinheiro	22
	26	Vila de São Pedro	82

- 7.5. LAMSA has also scheduled meetings to be held with the following communities: Vila São João, Comunidade Agrícola de Higienópolis, Baixa do Sapateiro, Vila São Pedro; and Vila Pinheiro.
- 7.6. As the construction works take place, a program of community relations shall be implemented in order to keep the population up-to-date with the progress of the works, the interference with urban areas and accesses, mitigation measures being adopted and further information concerning the project, as presented in the project ESMP.

**VIII. RECOMMENDATIONS**

- 8.1 The IDB will require, as part of the Loan Agreement, that LAMSA (the “Borrower”) comply with the following: (i) all applicable environmental, health and safety Brazilian regulatory requirements related to all sections of the Linha Amarela; (ii) all requirements associated with any environmental, health and safety related permits, authorizations, or licenses that apply to any section of Linha Amarela, the Project or the Company; (iii) all environmental, health and safety aspects of the Concession Contract and any subsequent modifications; (iv) all mitigation and control measures and monitoring programs in the overall project Environmental and Social Management Plan (ESMP); and (v) implementation of all actions and requirements in any project related environmental, health and safety document, including without limitation, project health and safety plans and procedures, risk management plan, contingency plan.
- 8.2 Prior to project financial closure, the Borrower must fulfill the following conditions:
1. A copy of the Installation License (LI) related to Section IV of the Linha Amarela;
  2. A report summarizing the specific measures taken by LAMSA to comply with the technical requirements defined in the Operation License for the original Linha Amarela project (Sections I, II, and III);
  3. A final version of the Environmental and Social Management Plan (ESMP), in form and content acceptable to the Bank which provides a detailed description of all programs and the associated estimated costs and time schedule, including in particular the program and measures related to health and safety during construction works in the area of the Canal do Cunha and that the scope of the communication program reaches informal workers and municipal authorities in areas affected by indirect impacts induced by urbanization of areas in the toll road area of influence; and
  4. Submit the finalized terms of reference and selected consultants, both of which are acceptable to the Bank, to perform an engineering analysis of actual technical conditions of the houses built as part of the Resettlement Program associated with the original Linha Amarela project in order to identify potential engineering or infrastructure related problems.

- 8.3 Prior to the first disbursement, the Borrower must fulfill the following conditions:
1. Submit evidence that the Environmental Management Unit of the project has been created as anticipated in the ESMP; and
  2. Submit a status report on the implementation of the ESMP.
  3. Submit evidence, in form and content acceptable to the Bank, that the construction has been completed of the second floor of those residential units (resettlement units) that had not been completed and were the specific responsibility of LAMSA.
- 8.4 Prior all disbursements of funds, the Borrower must fulfill the following conditions:
1. Certification of compliance with all environmental and social loan requirements;
  2. Description of any non-compliance with any environmental and social loan requirement and an action plan to correct such non-compliance; and
  3. Description of any additional or new environmental or social liabilities, including without limitation environmental claims, or material complaints, or unforeseen environmental, health or safety impact or risk.
- 8.5 The Borrower must fulfill the following requirements as part of the Project Technical Completion:
1. Submit, in form acceptable to the Bank, the report from the engineering analysis of the resettlement houses per the scope of work defined in paragraph 8.2 item 4.
  2. Submit a Final Report on the Construction Component of Environmental and Social Mitigation and Monitoring Measures, including the following: (i) certification by the Company that the project has successfully implemented and complied with all environmental and social requirements; (ii) certification by an independent consultant that all Resettlement Action Plan activities were implemented; (iii) any material deviation from the original construction plan, including a brief technical description and major reasons for such changes, as well as any adjustment to the relevant environmental and social measures that have been taken; (iv) description of any existing or anticipated environmental or social liability, risk or non-compliance; and (v) copies of any major environmental or social report or document prepared in order to satisfy regulatory requirements, except those already submitted with the reports during construction period.
- 8.6 During the life of the loan agreement, the Borrower must prepare and submit an Annual Environmental and Social Compliance Report, which will be due 60 days after the close of each Fiscal Year. The report must include, at a minimum, the following:
1. Certification that the Borrower is complying with all environmental and social loan requirements;
  2. Description of any material non-compliance with any environmental and social loan requirement that occurred and a description of any measures taken to correct the non-compliance.
  3. Description of any changes in the company's operations which may have a material environmental or social effect, the reasons for such changes and any actions taken to mitigate the impact of such change.
  4. Description of any material environmental or social problem (such as accident, unplanned event, etc.) and a description of the actions taken to resolve the problem and the measures taken to prevent the event from occurring in the future.
  5. Description of any contact by a third party (including governmental agency, public, non-governmental organization, company employee, etc.) regarding environmental, social or health and safety issue.
  6. Description of planned environmental and social related activities to be performed during the next year, including estimated cost, schedule, and responsibility, including specifically any environmental impact assessment or Brazilian environmental permitting requirement.

7. Summary of results of all environmental and social monitoring programs performed during the prior year.
  8. Copy of any environmental and social document or report written to comply with any governmental regulatory requirements.
- 8.7 During the life of the loan agreement, the Borrower must comply with the following requirements:
1. Consult with the Bank before implementing any action not covered by the project ESMP, which will have a negative environmental or social impact.
  2. Provide written notification, within 30 days after the Company becomes aware, of any non-compliance with environmental and social loan requirements, environmental health or safety material affect, environmental claim, or material complaint related to environment health or safety related to the Project, including a description of the situation (extent, magnitude, impact, etc.), the cause, proposed corrective or remedial actions, actions taken, and proposed schedule for future actions.
  3. Ensure compliance by construction contractors with all environmental and social requirements.
  4. Implement on-going information disclosure and public consultation related activities.
  5. Do not implement any activities which will directly or indirectly result in the resettlement of individuals or business until the Borrower has submitted to the IDB, and the IDB has approved, a specific plan (procedures) to deal with this situation which fully complies with the Bank's policy on involuntary resettlement.
  6. An independent environmental consultant shall be retained by LAMSA, reporting directly to the Bank, to assess project compliance with the environmental and social loan agreement requirements.

## TABLES

**TABLE 6-1**  
**SUMMARY OF ENVIRONMENTAL AND SOCIAL MANAGEMENT**  
**FOR THE ORIGINAL LINHA AMARELA PROJECT (SECTIONS I, II, AND III)**

The implementation of Linha Amarela was accompanied by a set of environmental control programs called PROCAM, encompassing control over air and noise emissions, risk assessment, public health, environmental education, revegetation, and archaeology. In addition, a specific Resettlement Plan was developed and implemented.

Air quality control

Objectives of the Air Quality Control Program - PROCAM/AR were: 1) to monitor air quality in the area of influence during construction; 2) to control particle emissions into the atmosphere due to excavations, demolitions, transport of material, access ways to the works, and embankment areas; 3) to watch trends towards air quality alterations during construction and operation phases.

In order to prevent the deterioration in air quality during construction, the following control measures were adopted: 1) use of tank trucks to moisten roads on which vehicles travel; 2) permanent moistening of camp sites and construction fronts through water sprays; and 3) moistening and covering of deposits of sand, crushed stone, etc., with a plastic coating.

An assessment of air quality at FEEMA monitoring stations located in the area under Linha Amarela influence was performed and consisted of the monitoring of air quality (suspended particles) at four stations along the road. Results from the **air quality analysis in the area under Linha Amarela influence (performed before the original works commenced)** indicated that concentrations of suspended particles were already (i.e., prior to initiation of construction) much above the maximum limits allowed for in the Brazilian law, reflecting poor ambient air conditions. Monitoring during construction did not show any significant increase.

Noise control

Objectives of the Noise Control Program – PROCAM/RUÍDOS were: 1) to control noise-generating sources, such as equipment and compressors located near residential buildings; 2) to monitor noise pollution levels in given points along the road; and 3) to assess and implement actions intended to neutralize noise to standards provided for by the law.

Actions programmed comprised an assessment of noise levels caused by the works at five points along the road. Measurements were made on a monthly basis at peak hours (from 8 to 9 AM, and from 5 to 6 PM). The definition of noise level sampling locations were made in conjunction with MRJ, through the City Planning Secretariat. Following the completion of works, an acoustic study was conducted along the road to ensure traffic noise was not affecting adjacent buildings. The study included the identification of sites where road noise levels would annoy either dwellers or adjacent facilities and then acoustic panels were sized and installed, combining opaque and transparent boards at the identified sites. A total of approximately 750 linear meters of acoustic barriers were installed at thirteen different sites.

**Findings of the noise monitoring conducted by LAMSA indicated that pre-construction noise levels were already in exceedence of the maximum (Lmax) and equivalent (Leq) noise levels pursuant to the municipal law of Rio de Janeiro. During road operation, the positioning of acoustic boards reduced noise levels by an average of 28.04 dB(A), reporting levels ranging from 59.96 to 71.96 dB(A) which are levels typically of pre-construction conditions.**

Risk assessment

Objectives of the Risk Assessment Program – PROCAM/RISCOS were: 1) to determine the most critical risk or hazardous situations associated to the works; 2) to identify neutralizing measures; and 3) to formulate an emergency contingency plan. PROCAM/RISCOS activities involved: a preliminary assessment of accident hypotheses resulting from works; an analysis of the occurrence of accidents hypotheses through a Preliminary Risk Analysis chart; an analysis of causes and possible internal unsafe situations in general works-related

procedures, especially in the handling, transport, and storage of hazardous products (dynamite, gasoline, diesel oil, kerosene, and other flammable liquids), heavy transportation, excavations, and interferences (Guandu water pipeline); an assessment of the population affected in each accident hypothesis and protection measures necessary; and an assessment of significant accidents hypotheses, and preventive and corrective measures necessary.

Tunnel excavation (especially the excavation of Eng. Raimundo de Paula Soares tunnel, only 14 meters below Guandu Water Pipeline) was among the major risk situations for the original works to construct Linha Amarela, resulting in the implementation of a specific monitoring program to ensure that blasting operations did not threaten structures located in the vicinities of the works. Prior to the commencement of works, a preventive technical inspection of the pipeline (using a microfilming camera) was conducted to evaluate the maintenance conditions. During the works, quarrying activities were subject to continuous monitoring with seismographs in order to ensure the environmental control of the works.

The mitigating measures taken to reduce the identified project risks were: 1) strict control over vehicles departing the works or bound for camp sites and construction fronts; 2) strict compliance with federal standards on transportation and handling of explosives; 3) inspection of each real estate property near blasting sites to ascertain the existing structural conditions prior to and after each blasting cycle, and repair of possible damage caused to them; 4) periodical recharging of fire extinguishers located at construction fronts and camp sites; 5) exact signaling and identification of water, electricity, and other lines, avoiding any operation in the vicinity thereof; and 6) formulation of an Emergency Plan, including motor teams on duty 24 hours a day and capable of assisting the population in case of floods or landslides.

In view of such measures, only one accident was reported during the works phase. It involved one tractor and one person living near the road. With regard to tunnels excavation, no interference in adjacent structures or Guandu Water Pipeline was detected.

No hazardous cargo can be transported on Linha Amarela per local laws and regulations, and thus no specific contingency or emergency plans were demanded for this type of risk.

#### Assessment of impacts on health

The Program to Assess the Impact on Health resulting from Higher Pollution Level – PROCAM/SAÚDE intended to prevent the proliferation of transmissible diseases and diseases related to noise, air, and water pollution as well as to instruct the labor force about the fundamentals of safety in order to minimize occupational accidents.

The following activities were developed within the scope of PROCAM/SAÚDE: 1) assessment and analysis of the hazardous substances in the area of influence; 2) assessment and analysis of diseases in the area and vicinities; 3) assessment and control over camp site sanitary conditions; 4) assessment of collection, transportation, and solid waste final disposal conditions, and control over the proliferation of disease-transmitting vectors; 5) selection of an area of significant importance for the servicing low-income population to which the Health Center (Posto de Saúde) located on Rua José dos Reis shall be relocated; and 6) assessment of possible consequences of works on the mentally-ill patients of Hospital Psiquiátrico Pedro II.

Because of the enforcement of control and accidents prevention and safety measures, the works neither affected health conditions nor overloaded health care facilities in the region. Diseases caused by the lack of basic sanitation and hygiene at the *favela* areas were addressed by the process of relocating families to sites where adequate hygiene and sanitation were provided.

#### Environmental education

Objectives of the Environmental Education Program – PROCAM/EDUCAÇÃO were to assure support to the several actions anticipated in the works, making the communities affected aware of the need to permanently participate in the control over environmental quality and of the importance of the express way.

PROCAM/EDUCAÇÃO was structured into seven modules: 1) *Community Enforcement*, intended to allow public discussion about the project and the relationship between communities, government authorities, and construction company; 2) *Ecology*, for the development of seven qualification courses for public school teachers; 3) *Reforest/Landscaping*, which planted nine community vegetable gardens, and seedlings in schools and day care centers; 4) *It's Cleaning Time*, a module that held fourteen garbage recycling workshops



that catered for over 1,500 students in addition to other actions focused on public cleaning and proper waste disposal; 5) *Children's Theater*, which gave 21 performances; 6) *Visits to Bosque da Freguesia*; and 7) *Environmental Monitors*, a module intended to qualify biology students of Rio de Janeiro University to work at Bosque da Freguesia in Jacarepaguá.

During the construction phase, GRUDE (Grupo de Defesa Ecológica), a non-government organization playing an important role in the Rio de Janeiro environmental education scenario, was responsible for the performance of PROCAM/EDUCAÇÃO. In the operation phase, the responsibility for implementing the program was transferred to LAMSA. Linha Amarela's Environmental Education Program directly involved 68 local schools, 112 teachers, and 5,600 public school students. In addition, GRUDE performed in 20 communities and associations with an estimated population of 10,000 people.

#### Re-vegetation

Objectives of the Re-vegetation Program – PROCAM/REVEGETAÇÃO were to: 1) foster plant covering (recovery) on areas near tunnel ends; 2) to compensate for the loss of vegetation through reforestation of clearcut slopes on Tijuca massif; and 3) road beautification/landscaping. PROCAM/VEGETAÇÃO implemented the reforestation of slopes abutting the north end of Eng. Raimundo de Paula Soares tunnel (Covanca) in Água Santa and the planting of other areas adjacent to the road. Seedlings of species native to Mata Atlântica were used. An effort was made to use labor from persons living adjoining to the road.

PROCAM/REVEGETAÇÃO allowed the planting of 63,500 seedlings in the first phase, and 22,000 in the second. The program was performed by Fundação Parques e Jardins of the Environment City Secretariat, with PCRJ funds.

#### Search and salvage of archaeological artifacts

The Archaeological Salvage Program, PROCAM/ARQUEOLOGIA, intended to comply with the law in force regarding the listing of the archaeological site in the vicinities of the site where Santa Cruz Mineral Water is produced.

Activities performed comprised: 1) formulation of salvage project; 2) project approval by the Institute of Historical and Artistic National Heritage (IPHAN – Instituto do Patrimônio Histórico e Artístico Nacional); 3) archaeological excavations; 4) setting of measures to ensure the safeguard of the material collected; 5) report writing; and 6) release of the area by IPHAN. The works, performed by the team from the National History Museum of Rio de Janeiro Federal University and duly accompanied by IPHAN, did not identify any archaeological evidence which value would justify the salvage.

#### Tunnel monitoring

The tunnels monitoring program intends to assess the air quality inside the tunnel in order to ascertain the need to activate the ventilation equipment. Such activity is one of the contractual obligations of the concession and shall remain in force throughout the whole concession term. Monitoring is performed by COPPETEC Foundation of Rio de Janeiro Federal University.

An automated continuous system making use of meters and CO (carbon monoxide) detection sensors was installed, all of which connected to the Operations Control Center located at the Toll Plaza for LAMSA. These levels are monitored 24 hours a day. When air quality inside the tunnels reaches levels deemed unsatisfactory, a system of fans is activated automatically. This system is also monitored by a system of closed circuit TV cameras that transmit images of the tunnels to the Operations Control Center.

#### Bridges and viaducts monitoring

The bridges and viaducts monitoring intends to ascertain the stability and safety conditions of special road structures under LAMSA management in order to identify possible corrosion spots in the pre-stressed concrete structures. The responsibility for the implementation of such program rests with LAMSA. The program has been developed through an agreement with the Metallurgical and Materials Engineering division of the COPPETEC Foundation of Rio de Janeiro Federal University.

#### User attendance and communication

User service and communication is part of concessionaire duties and it intends to ensure proper circulation and safety conditions along the road, thus preventing accidents involving users, pedestrians, and other



undesirable events. Such program includes the implementation and operation of traffic inspection, breakdown service, medical assistance, toll-free phone service and call-box facilities.

The full responsibility for the implementation of such program rests on LAMSA. A partnership with a private cellular carrier in the State of Rio de Janeiro has allowed the implementation of electronic boards and call-boxes.

### Resettlement

The original works for the Linha Amarela project required the resettlement of approximately 3,000 families. Pursuant to the Resettlement Plan formulated under the Bank's requirements, 53% of the families preferred to be resettled in houses distributed in four housing developments while 47% of the families chose financial compensation. The houses constructed have an average area of 22.6 square meters and are constructed on 35 square meter plots of land. A total of 1,721 houses were built. They were located in the following housing developments: Portus I, II e III (688 houses); Coimbra da Luz (102); Cunha Pedrosa (441); and Fazenda Palmeiras (490).

Resettlement was performed with the assistance of the MRJ in order to ensure good housing conditions and access to infrastructure. Nevertheless, the Bank's environmental and social due-diligence associated with the loan request for the Section IV road portion, identified that there have been some problems in the operation and maintenance of infrastructure services (primarily water and sewerage, drainage) and it was determined that these responsibilities fall under the utility companies and the MRJ. LAMSA has supported the resettled population in their demands that MRJ solve such deficiencies and has committed to perform a technical review of the housing units to determine and coordinate the necessary activities.

In addition, it was determined that the houses were to have a two-floor construction. This responsibility was identified as an oversight by LAMSA. At the Bank's request, LAMSA has committed to correct this problem adding the additional structures as originally specified.

The Bank's due-diligence indicate that there is a problem with the non-definition of responsibilities between the construction contractor, LAMSA, the MRJ and the utility companies pertaining to the maintenance and subsequent operation of the housing developments. It is clear that LAMSA is responsible for the original construction of the housing developments as specified as part of the original loan from the Bank. However, it is less clear which body is responsible for the ongoing maintenance of the dwellings to ensure that the facilities are adequate on an on-going basis. LAMSA has complied in creating the necessary structures for these relocated families. It is less clear which body is responsible when the utilities and safety of the dwelling areas are less than optimal.

### Supervision/Control

All the environmental and social programs related to the first phase of Linha Amarela (i.e., Sections I, II and III) were developed by multidisciplinary teams and achieved their objectives to minimize or prevent the magnitude of impacts during the construction phase, and to monitor and ensure safety conditions to users and a better quality of life to the population of adjacent areas during the operation phase.

Routine Progress Reports were prepared throughout the construction phase and included a description of activities performed under each program, results achieved, and problems found during the implementation thereof. These reports were forwarded to the environmental agency in the State of Rio de Janeiro for approval and inspection, thus complying with the provision set forth in the Environmental Impact Assessment.

During the operation phase, only the noise levels and vehicle emissions monitoring and control programs were not implemented as originally anticipated. These programs will be strengthened during the works to Section IV.

### Costs

The original costs presented to the Bank in 1995 included costs corresponding to R\$5.0 million. At the direction of the Bank, additional works were included in the development of the Social and Environmental Programs related to Linha Amarela. The costs incurred were as follows:

**COST OF ENVIRONMENTAL PROGRAMS – ORIGINAL WORKS TO CONSTRUCT THE ROAD (R\$)**

<b>Programs</b>	<b>Implementation</b>	<b>Operation</b>
Air quality control	150,000	
Noise control	140,000	462,000
Risks control	290,000	
Control over impact on health	90,000	
Environmental education	530,000	
Revegetation	190,000	
Archaeological survey	100,000	
Tunnels monitoring	7,248,000**	850,000
Bridges and viaducts monitoring		* 360,000
User service and communication	1,500,000	* 1,920,000
<b>Total</b>	<b>10,238,000</b>	<b>3,592,000</b>

\* annual costs

\*\* equipment implementation included.

**TABLE 6-2**  
**ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN COST AND SCHEDULE**

	Custos	1	anos 2 a 4	5	anos 6 a 9	
Controle Ambiental das Obras						
- desapropriações	260,000.00	260,000				
- controle das emissões	150,000.00	150,000				
- gerenciamento de riscos	50,000.00	50,000				
- controle do canal do cunha	50,000.00	50,000				
- relacionam. com a comunidade	10,000.00	10,000				
- desativação das obras	incluído	-				
Monit. e Controle de Ruído						
- monitoramento	24,000.00 /ano	24,000	24,000	24,000	24,000	24
- medidas de controle	30,000.00 /ano	30,000	30,000	30,000	30,000	30
Contr. de Emissões Atmosféricas						
- monitoramento dos túneis	100,000.00 /ano	100,000	100,000	100,000	100,000	950
- monitor. da qualidade do ar	50,000.00 /ano	50,000	50,000	50,000	50,000	50
- plano de limpeza	150,000.00 /ano	150,000	150,000	150,000	150,000	150
Monit. de Pontes e Viadutos	incluído	-	-	-	-	-
Revegetação e Paisagismo	245,000.00	200,000	15,000	-	-	-
Atendimento ao Usuário	incluído	-	-	-	-	-
Educação Ambiental						
- comunicação social	30,000.00	30,000	-	-	-	-
- campanhas educativas	20,000.00 /ano	-	20,000	20,000	20,000	20
- centro de oportunidades	10,000.00	10,000				
Gerenciamento Ambiental						
- unidade de gerenciamento	150,000.00 /ano	150,000	150,000	150,000	150,000	150
- revisão do PGA	30,000.00	-	-	-	-	30
<b>TOTAL</b>		<b>1,264,000</b>	<b>539,000</b>	<b>524,000</b>	<b>524,000</b>	<b>1,404</b>

## **ATTACHMENTS**

**RIO DE JANEIRO MAP AND LINHA AMARELA LOCATION**