STAFF APPRAISAL REPORT

BRAZIL

BELO HORIZONTE METROPOLITAN TRANSPORT DECENTRALIZATION PROJECT

JUNE 5, 1995

Environment and Urban Development Operations Division
Country Department I
Latin America and the Caribbean Regional Office
CURRENCY EQUIVALENTS

Currency Unit = Brazilian Reais (R$)

US$1 = .83 to .90 R$ (March 15-31, 1995)

WEIGHTS AND MEASURES

Metric System

FISCAL YEAR

January 1 - December 31

PRINCIPAL ABBREVIATIONS AND ACRONYMS

ABNT - Brazilian Association for Technical Standards
(Associação Brasileira de Normas Técnicas)
AGLURB - Urban Conglomerate Program (Programa de Alglomerados Urbanos)
AMBEL - Metropolitan Assembly of the Belo Horizonte Metropolitan Region
(Assembleia Metropolitana da Região Metropolitana de Belo Horizonte)
ATC - Automatic Train Control
BHMR - Belo Horizonte Metropolitan Region
BHTRANS - Belo Horizonte Municipality Transport and Transit Company
(Empresa de Transporte e Trânsito de Belo Horizonte)
BNDES - National Economic and Social Development Bank
(Banco Nacional de Desenvolvimento Econômico e Social)
CBD - Central Business District
CBTU - Brazilian Urban Train Company
(Companhia Brasileira de Trens Urbanos)
CCTV - Close Circuit Television
CEMIG - Electric Company of Minas Gerais
(Companhia de Electricidade de Minas Gerais)
CIF - Cost, Insurance, Freight
CNG - Compressed Natural Gas
CO - Carbon Monoxide
COFIEX - External Financing Commission (Comissão de Financiamento Extern)
CPTM - Companhia Paulista de Trens Metropolitanos
CTC - Centralized Traffic Control
DEMETRÔ - Popular name of the Belo Horizonte Train Subdivision of CBTU
DER-MG - Minas Gerais State Roads Directorate
(Direção de Estradas de Rodagem do Estado de Minas Gerais)
DETRAN-MG - Minas Gerais State Traffic Administration
(Departamento de Trânsito do Estado de Minas Gerais)
DIEESE - Social and Employment Statistics Directorate of the State of São Paulo
EA - Environmental Assessment
EBTU - Brazilian Urban Transport Company
(Empresa Brasileira de Transportes Urbanos)
EMU - Electric Multiple Unit
FEAM - State Foundation for the Environment
(Fundação Estadual do Meio Ambiente)
FEPASA - São Paulo State Railroad
(Ferroviárias Paulista S.A.)
GEIPOT - National Transport Planning Agency
(Empresa Brasileira de Planejamento dos Transportes)
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPPI</td>
<td>Permanent Integrated Planning Group (Grupo Permanente de Planejamento Integrado)</td>
</tr>
<tr>
<td>HC</td>
<td>Hydrocarbons</td>
</tr>
<tr>
<td>IBGE</td>
<td>Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística)</td>
</tr>
<tr>
<td>ICB</td>
<td>International Competitive Bidding</td>
</tr>
<tr>
<td>ICMS</td>
<td>Circulation Tax on Goods and Services (Imposto de Circulação sobre Mercadorias e Serviços)</td>
</tr>
<tr>
<td>IERR</td>
<td>Internal Economic Rate of Return</td>
</tr>
<tr>
<td>I/M</td>
<td>Inspection and Maintenance System</td>
</tr>
<tr>
<td>LRT</td>
<td>Light Rail Transport</td>
</tr>
<tr>
<td>LUCI</td>
<td>Land Use Change Indicator</td>
</tr>
<tr>
<td>KV</td>
<td>Kilovolt</td>
</tr>
<tr>
<td>MB</td>
<td>Municipality of Betim</td>
</tr>
<tr>
<td>MBH</td>
<td>Municipality of Belo Horizonte</td>
</tr>
<tr>
<td>MC</td>
<td>Municipality of Contagem</td>
</tr>
<tr>
<td>MDU</td>
<td>Urban Development Ministry (Ministério de Desenvolvimento Urbano)</td>
</tr>
<tr>
<td>MG</td>
<td>Minas Gerais</td>
</tr>
<tr>
<td>MR</td>
<td>Metropolitan Region</td>
</tr>
<tr>
<td>MT</td>
<td>Ministry of Transport</td>
</tr>
<tr>
<td>NATM</td>
<td>New Austrian Tunnelling Method</td>
</tr>
<tr>
<td>NCB</td>
<td>National Competitive Bidding</td>
</tr>
<tr>
<td>NOx</td>
<td>Nitrogen Oxide</td>
</tr>
<tr>
<td>PAR</td>
<td>Performance Audit Report</td>
</tr>
<tr>
<td>PCR</td>
<td>Project Completion Report</td>
</tr>
<tr>
<td>PIU</td>
<td>Project Implementation Unit</td>
</tr>
<tr>
<td>PM10</td>
<td>Particulate Matter less than 10 microns in diameter</td>
</tr>
<tr>
<td>PMIC</td>
<td>Project Management and Implementation Consultant</td>
</tr>
<tr>
<td>PMTI</td>
<td>Integrated Metropolitan Transport Plan (Plano Metropolitano de Transporte Integrado)</td>
</tr>
<tr>
<td>PMU</td>
<td>Project Management Unit</td>
</tr>
<tr>
<td>ppm</td>
<td>Parts per million</td>
</tr>
<tr>
<td>PROPAV</td>
<td>Pavement Program in Low-Income Areas (Programa de Pavimentação de Baixo Custo em Areas de Baixa Renda)</td>
</tr>
<tr>
<td>RTCC</td>
<td>Regional Transport Coordination Commission</td>
</tr>
<tr>
<td>SEAIN</td>
<td>State Secretariat for Foreign Affairs</td>
</tr>
<tr>
<td>SITURB</td>
<td>Integrated Urban Transport System (Sistema Integrado de Transporte Urbano)</td>
</tr>
<tr>
<td>SMA</td>
<td>Secretariat for the Environment (Secretaria do Meio Ambiente)</td>
</tr>
<tr>
<td>SMG</td>
<td>State of Minas Gerais</td>
</tr>
<tr>
<td>SMMA</td>
<td>Municipal Secretary for the Environment (Secretaria Municipal do Meio Ambiente)</td>
</tr>
<tr>
<td>SOx</td>
<td>Sulfur Oxide</td>
</tr>
<tr>
<td>STU-BH</td>
<td>Belo Horizonte Subdivision of CBTU</td>
</tr>
<tr>
<td>TRENURB</td>
<td>Porto Alegre Metropolitan Rail Mass Transit (Trens Urbanos de Porto Alegre)</td>
</tr>
<tr>
<td>VOC</td>
<td>Volatile Organic Compound</td>
</tr>
</tbody>
</table>
# BRAZIL
## BELO HORIZONTE METROPOLITAN TRANSPORT DECENTRALIZATION PROJECT
### STAFF APPRAISAL REPORT
#### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOAN AND PROJECT SUMMARY</strong></td>
<td>i</td>
</tr>
<tr>
<td><strong>I. URBAN TRANSPORT IN THE BELO HORIZONTE METROPOLITAN REGION</strong></td>
<td>1</td>
</tr>
<tr>
<td>A. Background</td>
<td>1</td>
</tr>
<tr>
<td>B. Urban Transport in the BHMR: An Overview</td>
<td>1</td>
</tr>
<tr>
<td>C. Institutional Responsibilities for Urban Transport in the BHMR</td>
<td>2</td>
</tr>
<tr>
<td>D. Key Sectoral Issues</td>
<td>4</td>
</tr>
<tr>
<td>E. Lessons from Experience in the Sector</td>
<td>5</td>
</tr>
<tr>
<td>F. The Bank's Strategy for the BHMR</td>
<td>6</td>
</tr>
<tr>
<td><strong>II. THE PROJECT</strong></td>
<td>8</td>
</tr>
<tr>
<td>A. Project Background</td>
<td>8</td>
</tr>
<tr>
<td>B. Rationale for Bank Involvement</td>
<td>8</td>
</tr>
<tr>
<td>C. Project Objectives</td>
<td>8</td>
</tr>
<tr>
<td>D. Project Description</td>
<td>8</td>
</tr>
<tr>
<td>E. Project Cost and Financing</td>
<td>10</td>
</tr>
<tr>
<td>F. Project Benefits and Risks</td>
<td>11</td>
</tr>
<tr>
<td>G. Tariff Setting and Affordability by Low-Income Users</td>
<td>13</td>
</tr>
<tr>
<td>H. Project Economic Evaluation</td>
<td>13</td>
</tr>
<tr>
<td>I. Project Financial Evaluation</td>
<td>14</td>
</tr>
<tr>
<td>J. Environmental Impact of the Project</td>
<td>15</td>
</tr>
<tr>
<td>K. Private Sector Participation</td>
<td>19</td>
</tr>
<tr>
<td><strong>III. PROJECT IMPLEMENTATION</strong></td>
<td>20</td>
</tr>
<tr>
<td>A. Institutional Responsibilities</td>
<td>20</td>
</tr>
<tr>
<td>B. Contractual Arrangements</td>
<td>20</td>
</tr>
<tr>
<td>C. Implementation Schedule</td>
<td>20</td>
</tr>
<tr>
<td>D. Implementation Arrangements</td>
<td>21</td>
</tr>
<tr>
<td>E. Decentralization Process</td>
<td>21</td>
</tr>
<tr>
<td>F. Procurement</td>
<td>22</td>
</tr>
<tr>
<td>G. Disbursement and Special Account</td>
<td>24</td>
</tr>
<tr>
<td>H. Auditing</td>
<td>25</td>
</tr>
<tr>
<td>I. Monitoring and Special Account</td>
<td>25</td>
</tr>
<tr>
<td>J. Project Supervision</td>
<td>26</td>
</tr>
<tr>
<td><strong>IV. PROJECT AGREEMENTS AND RECOMMENDATION</strong></td>
<td>27</td>
</tr>
</tbody>
</table>

This report is based on the findings of an appraisal mission which visited Brazil during March 1995. The mission comprised Messrs. Jorge Rebelo (Task Manager and Sr. Transport Planner, LA1EU), Jose Baigorria (Sr. Railway Engineer, LA1IN), Moazzam Mekan (Financial Analyst, LA1IN), Daniel Gross (Resettlement Specialist, LA1EU), and Kenneth Knight (Metro Infrastructure Consultant). Messrs. Jose Carvalho (Sr. Counsel, LEGLA), Roberto Lever (Sr. Counsel, LEGLA), Gerhard Menckhoff (Sr. Transport Planner, LA1EU) and Wagner C. Martins (Transport Demand Specialist) also participated in the preparation of the project. Mr. John Flora (TWUTD) was the Peer Reviewer. Mr. Craig Leisher edited the report and Ms. Marcella Schiappacasse helped prepare the report. Messrs. Asif Faiz, Orville Grimes and Gobind T. Nankani are respectively the managing Division Chief, Projects Adviser and Department Director for the operation.
ANNEXES:

1. Bank Assistance to the Urban Transport Sector in Brazil and Lessons Learned .......... 30
2. Project Coordination and Executing Agencies ................................................. 38
3. Regional Transport Coordination Commission .................................................. 41
4. Private Sector Participation in the Project ....................................................... 45
5. Infrastructure and Equipment Component ....................................................... 46
6. Environmental and Safety Component ............................................................ 52
8. Detailed Project Costs, Procurement and Disbursement Arrangements ................. 59
9. Economic Evaluation ......................................................................................... 65
10. Financial Evaluation ......................................................................................... 80
11. Project Implementation Schedule, Monitoring, Evaluation and Supervision Plan ....... 92
13. Selected Documents Available in the Project File ............................................ 106

MAP:
IBRD No. 26914
BRAZIL
BELO HORIZONTE METROPOLITAN TRANSPORT DECENTRALIZATION PROJECT

LOAN AND PROJECT SUMMARY

<table>
<thead>
<tr>
<th>Borrower:</th>
<th>Federative Republic of Brazil.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beneficiaries:</td>
<td>Residents of the Belo Horizonte Metropolitan Region, particularly low-income households who are major users of public transport.</td>
</tr>
<tr>
<td>Poverty:</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Amount:</td>
<td>US$99 million equivalent (including up to US$9.9 million in retroactive financing).</td>
</tr>
<tr>
<td>Terms:</td>
<td>Repayment in 15 years, at the Bank's standard variable rate, with a grace period of five years and loan amortization based on level repayments of principal.</td>
</tr>
<tr>
<td>Commitment Fee:</td>
<td>0.75 percent on undisbursed loan balances, beginning 60 days after signing, less any waiver.</td>
</tr>
<tr>
<td>Onlending Terms:</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Rate of Return:</td>
<td>31 percent for the infrastructure and equipment component which represents 98 percent of the total cost of the project.</td>
</tr>
<tr>
<td>Map:</td>
<td>IBRD No. 26914</td>
</tr>
<tr>
<td>Project ID:</td>
<td>BRPA6564</td>
</tr>
</tbody>
</table>
I. URBAN TRANSPORT IN THE BELO HORIZONTE METROPOLITAN REGION

A. Background

1.1 This project has its origins in two major developments at the Federal and State level: (a) the decision of the Government of Brazil (GOB) to decentralize and transfer several subdivisions of the Brazilian Urban Train Company (Companhia Brasileira de Trens Urbanos, CBTU) from the Federal to the State/Municipal Governments as mandated by the 1988 Constitution; (b) the willingness of the State of Minas Gerais (SMG) and the Municipality of Belo Horizonte (MBH) to takeover the Belo Horizonte subdivision of the CBTU (STU-BH) and better integrate it with the privately-owned bus transport system. GOB started by decentralizing the two largest CBTU subdivisions (São Paulo and Rio de Janeiro) and once that was successfully accomplished, it decided to proceed with the decentralization of the Belo Horizonte and Recife subdivisions.

1.2 As in the case of São Paulo and Rio de Janeiro, the GOB requested assistance from the Bank to help in completing the STU-BH network and effectively integrating it with the other modes. The SMG and MBH agreed to takeover the system as long as the GOB would extend the system to Vilarinho and São Paulo stations (see map) and build the accesses to facilitate integration at the system’s main stations. The identification mission took place in early 1994, and based on its findings, the Bank agreed to proceed with the evaluation of the project provided the SMG and MBH would incorporate in its urban transport strategy the following two elements: (a) an effective coordination between the state and municipal governments of the BHMR; and (b) a formal financing mechanisms considered crucial to create an enabling environment for the long-term financial sustainability of the Belo Horizonte Metropolitan Region’s urban transport systems. SMG and MBH moved swiftly and diligently to include these elements in its strategy.

B. Urban Transport in the BHMR: An Overview

1.3 Background: The Belo Horizonte Metropolitan Region (BHMR), with 5,850 sq. km, has 3.5 million inhabitants spread unevenly over 18 municipalities which are dominated by the Municipality of Belo Horizonte with 2.1 million inhabitants. Annual population growth of the BHMR and MBH averaged 2.6 percent and 1.3 percent respectively in the last five years. The BHMR generates roughly 51 percent of the GDP of the State of Minas Gerais and is considered the third most important economic region of the country. Each day, 3.2 million person trips take place in the BHMR of which 68.0 percent are by bus (all privately operated), 25.0 percent by private automobile, 1.7 percent by rail (CBTU’s Belo Horizonte subdivision popularly known as DEMETRO) and the remaining 5.3 percent by other modes (mainly bicycle and walking).

1.4 The road network is radial and all its main corridors intersect the beltway around the BHMR. Bus routes penetrate to the BH neighborhoods and adjoining municipalities through ten main corridors of which the most heavily travelled are Amazonas Avenue (9 km), Antônio Carlos Avenue (7.2 km), and Cristiano Machado Avenue (12.5 km). Only the latter has a reserved bus lane. The commercial speed of the buses in the segregated busways is around 25 km/hr but drops to 9 km/hr in the central business district. At peak period, most highway corridors are clogged with bumper to bumper buses. Bus services are generally of low speed, unreliable and infrequent at peak hours due to the congestion. Although they are privately operated, the municipal bus routes are allocated on the basis of competitive bidding and regulated by the Empresa de Transporte e Transito de Belo Horizonte (BHTRANS), a municipal agency; the intermunicipal bus services, also privately operated, are managed by the Minas Gerais State Roads Directorate (DER-MG). Tariffs are set by those agencies and there are no subsidies paid to bus operators.

1.5 The STU-BH (DEMETRO) system consists of a single line of 16.1 km, inaugurated in 1986, which parallels the main east-west highway and presently serves about 50,000 passengers/day,
instead of the 250,000 originally planned. One of the main reasons for this very low ridership is its short length since the originally planned network was never completed due to budget problems. Despite the fact that most of the systems, rolling stock, and equipment for the completion of the line were already acquired through bilateral funding, the permanent way and the stations were not completed because the Federal Government ran out of funds. As it stands today, the DEMETRÔ line is not useful to alleviate the heavy traffic congestion in the BHMR and, instead, it is a financial burden to the GOB which must contribute US$15 million/year to keep it afloat, since its revenues cover only 23 percent of the operating costs without depreciation.

1.6 At present, the DEMETRÔ is integrated with 74 bus lines in only one terminal (Eldorado) which generates about 60 percent of its demand at an integrated tariff. CBTU estimates that with an additional extension of only 6.5 km (São Paulo to Vilarinho), more frequent services, construction of four stations, two intermodal integration terminals and a number of pedestrian crosswalks, demand would increase substantially. For passengers who have their origins and destinations within walking distance of the stations, the DEMETRÔ offers the most comfortable and reliable mode of transport. However, if the origins and destinations are beyond a reasonable walking distance, the lack of good integration, and the lack of stations at important demand generation centers, makes the use of the system awkward and more expensive. This lack of integration between DEMETRÔ and buses discourages more rail trips and encourages bus and automobile usage, thereby increasing the heavy congestion during peak hours and significantly increasing home-to-work trip time. In its program to decentralize the responsibility of operation of its metropolitan systems from the Federal Government to the State and Municipal Governments, CBTU is proposing to extend the line by 6.5 km and provide the most important stations with the appropriate transfer terminals and access, which would allow effective modal integration, decrease the number of bus trips per day, and improve personal mobility in the BHMR. Finally, since traffic congestion is growing at 20 percent per year and the number of accidents grew by 30 percent from 1991 to 1994 (with 8.2 deaths/10,000 vehicles), BHMR needs to modernize its traffic engineering and control equipment and introduce traffic safety measures to cope with the growing number of road-based vehicles.

1.7 The low-income households (56 percent earn less than four minimum salaries, i.e., less than US$400/month) are the main users of public transport and bear the brunt of its problems: (a) shortage of capacity at peak hours resulting in overcrowded (> 12 pass/m2), often unsafe conditions; (b) long work journeys (2.5 hours/day) from the metropolitan periphery to the urban centers, often with more than two modal transfers; and (c) paying over a fifth of their income in fares. Until recently the lack of coordination among the three levels of government responsible for urban transport, particularly between the SMG and the MBH, has led to poor tariff and modal integration, lack of prioritization in urban transport investments, and no common policy on pricing and subsidies. Fortunately, the recent establishment of a Metropolitan Council (Assembleia Metropolitana) which has a Transport Commission, is a major step towards ensuring coordination between the several agencies and modal policies.

C. Institutional Responsibilities for Urban Transport in the BHMR

1.8 There are four government bodies responsible for overseeing the urban transport sector in the BHMR: (a) the State Roads Directorate (Direção de Estradas de Rodagem do Estado de Minas Gerais, DER-MG), which regulates all the intermunicipal bus services and road network of the region; (b) the Belo Horizonte Transport and Transit Company (Empresa de Transporte e Transito de Belo Horizonte, BHTRANS) which is the agency that regulates municipal bus services and is also responsible for traffic management and control in the MBH; and (c) the Companhia Brasileira de Trens Urbanos (CBTU) which through its Belo Horizonte subdivision (STU-BH), known as DEMETRÔ, operates the metropolitan train, presently under Federal Government jurisdiction.
1.9 In 1993 the State established the BHMR Metropolitan Council (Assembleia Metropolitana da Região Metropolitana de Belo Horizonte, AMBEL). AMBEL’s functions are, among others, to foster the integration of metropolitan services, to oversee the metropolitan bodies, to approve the Metropolitan Master Plan and supervise its implementation, to approve the multi-year investment plans for the BHMR and its budget guidelines, to establish the guidelines for the tariff policies on metropolitan public services including transport, and to administer the Metropolitan Development Fund. AMBEL has a number of Sectoral Technical Committees, amongst which there are the Intermunicipal Transport and Road Committee, the Land Use Committee, and Water Resources and Environment Committee. Unfortunately, so far the only task performed by the Intermunicipal Transport Committee is to discuss the increases in metropolitan bus tariffs. Nevertheless, AMBEL provides the basic institutional framework required to create a Regional Transport Coordination Commission.

1.10 Both BHTRANS and DER-MG have a clearing house (Camara de Compensação) for bus tariffs, and they pay bus services according to a standard cost formula which they approve. This way, they compensate bus companies which operate with tariffs below the estimated cost of the formula. BHTRANS’ clearing house had a surplus of US$12 million in 1994. Of these funds, BHTRANS transfers 10 percent to DER-MG whose clearing house has a deficit.

1.11 Since three levels of government have been formulating policies and regulating urban transport without a formal coordinating arrangement, there has been a lack of consistency in the fares charged by similar or competing modes, duplication of investments, absence of criteria to prioritize investments, and only an embryonic modal integration system. This has led to bus services continuing to operate in corridors where the DEMETRÔ operates, expensive and time-consuming disagreements on whether to build a light rail transport, the lack of promotion of hub and spoke services, disparate subsidy policies which are often based on non-economic considerations, and the absence of user representation in the urban transport decision-making process. Recently, there has been a very fruitful cooperation between BHTRANS, DER-MG and STU-BH. The creation of a Regional Transportation Coordination Commission (RTCC) would ensure that this cooperation would not depend on the political parties in power.

1.12 In summary, although the extent and quality of urban transport coordination and planning vary among the different regions, all are faced with a similar problem: how to plan and manage a transport system in a metropolitan region consisting of many municipalities, each with its own administrative powers, when the necessary inputs for, and effects of, this transport system extend well beyond the administrative boundaries of any one municipality. One solution would be to create a region-wide transport coordinating and regulatory agency, which sometimes requires a state law. In some Brazilian metropolitan regions, adaptations of this type of institution already exist and, in others, plans (or, in some cases, draft laws) exist to create them. The examples provided by the Madrid, Toronto, San Francisco and Washington metropolitan regions, which have some type of coordinating entity, should be studied and adapted for the specific institutional constraints of the BHMR. It is clear that one of the most urgent issues to be addressed in Brazilian urban transport is its sector organization at the three levels of government.

1.13 The lack of a coordinating entity with a unified approach to cost-recovery policies and the lack of effective oversight by the State and the Municipality, have resulted in the poor definition of priorities in the BHMR, limited modal and tariff integration, and operating agencies which have no pre-set operational and financial targets. As required by the proposed project, SMG, MBH, the Municipality of Betim and the Municipality of Contagem signed a convênio to create a Permanent Integrated Planning Group (GPPI) which will function as a precursor of the RTCC. A formal RTCC will be established prior to the transfer of STU-BH to the state.
D. Key Sectoral Issues

1.14 A number of key issues must be addressed to improve the supply of urban transport services in the BHMR and to guarantee their orderly development and sustainability in the long term. They are: (a) capacity and safety issues; (b) institutional issues; (c) cost recovery and financial management issues; (d) targeting of subsidies; (e) environmental issues; and (f) transport planning issues.

1.15 Capacity and Safety Issues. The most important concern is the need to increase the supply of adequate cost-efficient peak-hour capacity in order to guarantee an acceptable level of service to the average commuter under reasonable safety conditions. This can be done by: (a) rehabilitating and restructuring existing systems and by building new ones which are justified from a technical, economic and, especially, financial standpoint. Rail and bus rapid transit offer the best alternatives in this respect; (b) improving traffic management through appropriate traffic engineering equipment in order to better manage available road space and reduce congestion; and (c) reducing accidents through transit safety education campaigns, law enforcement, and traffic engineering. The STU-BH extension to Vilarinho and the traffic management and control program address these issues.

1.16 Institutional Issues. The most critical institutional issues are: (a) the fine-tuning of relations between state and municipal governments and a clear definition of their respective roles in the financing, planning and operation of urban transport services in accordance with the 1988 Constitution; (b) the creation of a regional coordination entity empowered by the BHMR for planning, coordinating and setting priorities for new investments and modal integration; and (c) the appropriate modification of regulations, including the elimination of regulatory barriers which might prevent free entry and/or competition in the market for provision of public transport services. The project addresses these issues by requiring the establishment of a RTCC for the BHMR.

1.17 Cost Recovery and Financial Management Issues. The need to address cost recovery from a more commercially oriented standpoint by: (a) setting tariffs which, when added to subsidies, cover at least the long-run variable costs (defined as out-of-pocket costs plus depreciation of equipment and cost of capital) of the service provided; (b) controlling fare evasion; (c) setting appropriate peak and off-peak pricing; (d) improving the financial management of the systems through wide-ranging cost cutting measures, staff rationalization policies, and by appointing more financial managers to run the mass transit systems; and (e) revamping funding mechanisms in order to guarantee adequate financing for the implementation of new mass transit systems and the sustainability of the existing systems. The proposed project addresses these issues by the Institutional Development and Policy component.

1.18 Targeting of Subsidies. Any remaining blanket subsidies paid to operators ought to be eliminated. Urban households have been devoting increasingly large proportions of their incomes to transport. Further, transport-related expenditures have become a considerable burden on local government budgets. The appropriate targeting of urban transport subsidies and their extension to the informal sector which is not presently covered by mechanisms such as the vale-transporte is a major issue which must be addressed in the short term. ('Vale-transporte' is a mechanism by which employers are required to provide their employees with a wage subsidy that covers any amount above 6 percent whenever the total costs of monthly "home to work" trips exceed 6 percent of their salaries.) Appropriate mechanisms for financing such subsidies (tariff differentiation, contractual budgetary transfers, etc.) and channelling them to target groups through tokens, multi-modal passes, and differential tariffs need to be designed. The financing mechanisms and the cost and tariff studies proposed in the Institutional Development component address these issues.
1.19 **Environmental Issues.** Air pollution, noise, traffic congestion, and road accidents are major environmental issues to be addressed in the BHMR. The reduction of the environmental impacts of urban transport, traffic congestion, and noise pollution in the urban area could be done through: (a) the allocation of responsibilities across government levels for the enforcement of existing laws and definition of tougher standards; (b) the use of cleaner and quieter transport systems; (c) where appropriate, the use of non-motorized transport; (d) the improvement of traffic management and control; and (e) the strengthening of traffic safety education and the enforcement of the traffic regulations. In the long run, assessment of the potential role of market-based incentives to address pollution and the implementation of the polluter pay principle to minimize the fiscal burden implied by de facto government subsidies to polluters ought to be considered. The proposed project starts addressing these issues by requiring the design of an inspection/maintenance program for motor vehicles.

1.20 **Transport Planning Issues.** The need to strengthen BHMR’s transportation planning, traffic data base, traffic management, and evaluation of new investments could be met if there is a formal coordinating agency for urban transport in the metropolitan region. This agency should be equipped with a battery of sketch planning, demand and supply models that would test different land use, air quality, and urban transport scenarios. Furthermore, an integrated land use, urban transport, and air quality strategy should be designed and periodically revised. As part of the proposed project, the Institutional Development component includes provisions for the preparation of an Integrated Land Use, Urban Transport and Air Quality strategy and the updating of BHMR’s Master Plan.

1.21 In the future, urban transport policies in the BHMR would be geared toward the efficient and equitable provision of urban transport services, in particular for low-income groups which have traditionally received less attention. Policies would be consistent with broad transport sector objectives, as well as with the objectives of the urban subsector. In accordance with the 1988 Constitution, the policies would support the decentralization of urban transport services from the Federal Government to the States to facilitate modal and tariff integration and respond quickly to local needs. The policies would simultaneously address the need for institutional coordination and an integrated urban transport, land use, and environmental strategy. The general approach is to restore the incentives which exist when privately-owned systems operate under competitive conditions. Re-designed regulations and concessionary agreements, and improved bidding processes will promote competition in the provision of bus services. Rates would be liberalized in the corridors where there is effective competition. Urban and metropolitan train operations would be decentralized through the reorganization of CBTU and the gradual transfer of the operation and ownership of the systems to newly-created commuter train companies, managed either directly by the state and/or local governments or by private interests operating under concessionary arrangements. Appropriate tariffs and financing mechanisms would enable the efficient operation and development of the systems. Local governments would continue to be responsible for traffic regulation and management but would improve their capacity to manage the demand for road use, improve traffic management and street maintenance, protect the environment, monitor the effects of regulations and taxation, promote integration of the various transport systems, and coordination with land-use development.

**E. Lessons from Experience in the Sector**

1.22 Initial Bank support for the urban transport sector in Brazil was provided through four urban transport projects totalling US$540 million, of which the First, Second and Third Urban Transport Projects (Loans 1563-BR, 1839-BR, 1965-BR) have been completed. The Fourth Urban Transport Project which continued the work started in the Third project was canceled because the government abolished the federal agency in charge of urban transport (EBTU). Additional urban transport projects financed by the Bank (Loans 3457-BR and 3633-BR for US$126 million and US$128 million respectively) support the rehabilitation and decentralization of the CBTU from the federal to the state
To build upon the experience of past urban transport projects for the design of the proposed project, an analysis of "lessons learned" was undertaken (Annex 1). The review was based on Project Completion Reports and Performance Audit Reports (PCR/PAR) in urban transport and urban development worldwide. Recognition was made of trends and changes in project design since the PCRs/PARs were completed. The main lessons identified and incorporated in the design of the proposed project are:

(a) **Institutional Strengthening.** The organizations dealing with urban transport at the federal, state and municipal levels should be reorganized and strengthened. Studies included in the institutional component must be carefully monitored and translated in action plans which the Borrower must implement;

(b) **Lack of counterpart funding** has greatly influenced the pace of project implementation and in some cases has led to cancellation of components. An effort must be made to ensure that adequate provision of counterpart funds are included in the annual budgets of federal and state enterprises;

(c) **Slow implementation** has been a frequently occurring theme. The reasons have included: lack of familiarity with Bank procedures, over-optimistic scheduling at appraisal, lack of final engineering designs at appraisal, changes in political commitment, and lack of counterpart funds. These problems would be mitigated in the proposed project by such measures as: strengthening capacity of operating agencies for financial management and application of Bank procedures; and requiring final engineering design of the first year’s works, for which technical assistance should be contracted if need be with retroactive financing; and

(d) **Weak institutional capacity** for the planning, design and implementation of traffic and highway projects has been a common feature of many projects. In the proposed project, all agencies have demonstrated adequate capacity to carry out the required planning, design and implementation functions.

**F. The Bank’s Strategy for the BHMR**

1.24 **Subsector strategy.** In view of the issues stated above, the Bank’s strategy will be aimed at: **In the short term:** (a) assisting the state and municipal governments in formulating and implementing an urban transport policy consistent with the above goals; (b) strengthening the institutional framework and the decision-making process in the sector through adequate coordination between the two levels of government and proper technical, economic and especially, financial evaluation of projects and their prioritization by a regional coordination agency; (c) supporting a program to decentralize, rehabilitate and extend existing services such as metro lines and busways, which can more readily increase their efficiency and peak-hour capacity; (d) managing the demand for road use through improved traffic management and road-user taxes, in order to reduce existing congestion and the demand for travel by private single-occupancy automobiles; (e) decreasing the number of fatalities and accidents due to urban transport; (f) introducing better cost-recovery mechanisms including adequate cost-based peak-hour tariffs and fare evasion control in order to strengthen their financial base; and (g) improving the targeting of subsidies to those who need them.
In the medium term, the Bank’s strategy will focus on promoting a more efficient and financially sustainable market-oriented supply of public transport services, through: (a) an appropriate reform of regulations which will facilitate market entry, fare deregulation and public bidding in route allocation; (b) promoting service differentiation especially in the bus systems; (c) defining eligibility requirements and strengthening funding mechanisms for urban transport to cover operating deficits (based on pre-agreed targets in contract-plans) and finance major investments; (d) supporting the evaluation and, if justified, the introduction of new investments such as reserved busways and light rail transport; (e) reducing the environmental impacts of urban transport by setting standards for air quality, noise pollution, and visual intrusion along with indicating who would pay for them and how; (f) assisting in projects which improve the data base required for appropriate planning such as origin/destination surveys and preparation of master plans which study land use and urban transport alternatives; and (g) creating an enabling environment to increase private sector participation in the investment and operations of urban transport systems. In the long term, the Bank’s strategy will aim at reducing the travel demand and increasing the effectiveness of transport facilities by integrating land use and transport planning based on significant input or management by locally affected parties.
II. THE PROJECT

A. Project Background

2.1 As mentioned in section I, this project has its origins in two major developments at the Federal and State level: (a) the decision of the Government of Brazil to decentralize and transfer the several subdivisions of the Brazilian Urban Train Company (Companhia Brasileira de Trens Urbanos, CBTU) from the Federal to the State/Municipal Governments as mandated by the 1988 Constitution; (b) the willingness of the State of Minas Gerais and the municipality of Belo Horizonte to takeover the Belo Horizonte subdivision of the CBTU (STU-BH) to better integrate it with the predominantly public bus transport system. The GOB started by decentralizing the two largest CBTU subdivisions (São Paulo and Rio de Janeiro), and once that was successfully accomplished, it decided to proceed with the decentralization of the Belo Horizonte and Recife subdivisions.

B. Rationale for Bank Involvement

2.2 The Bank's country assistance strategy for Brazil, discussed by the Board on June 29, 1993, is to support policies and investments that will encourage economic growth and social development in a context of macroeconomic stability. The emphasis is on efficient resource allocation, increased efficiency in the public sector and the appropriate targeting and delivery of support systems to the poor. The proposed project is fully consistent with this assistance strategy since it is designed to: (a) promote reforms and financial viability of public enterprises, including decentralization from federal to state and municipal levels; (b) foster private sector participation in the development of new infrastructure and its operation; (c) increase the efficiency of infrastructure investments; (d) contribute to poverty alleviation; and (e) reduce Government subsidies through improved tariff policies and financial management. The proposed project is also a follow-up to the efforts started with the São Paulo Metropolitan Transport Decentralization Project (Ln. 3457-BR) and the Rio de Janeiro Metropolitan Transport Decentralization Project (Ln. 3633-BR) which are decentralizing the federally-owned CBTU to the States of São Paulo and Rio to allow for more effective modal and tariff integration.

C. Project Objectives

2.3 The objectives of the proposed project are: (a) the development of an integrated urban transport system for the BHMR under a Regional Transportation Coordination Commission (RTCC) established to coordinate and recommend common policies on pricing, regulation, financing, project evaluation and selection; (b) the completion and decentralization of the STU-BH from the federal to the state and municipal levels; (c) the reduction of the environmental (mainly air quality and noise) impacts on the BHMR due to motor vehicles and the promotion of non-motorized transport modes; and (d) the development of special strategies and actions to improve the accessibility of the low-income population to employment centers, health and education facilities.

D. Project Description

2.4 The project would consist of three inter-related components: (a) an Infrastructure and Equipment component (98 percent of total project cost) to help build: (i) the rail extension of the STU-BH and the additional stations required to enhance modal integration; (ii) the transfer terminals and physical accesses required for the actual integration between buses, rail, pedestrians, automobiles and bicycles; and (iii) a centralized road traffic signal control system to improve traffic control at some 250 intersections; (b) an Environmental and Traffic Safety component (0.2 percent of total project cost) to support: (i) the design of an inspection and maintenance (I/M) program for vehicle emissions and
noise; and (ii) a traffic management and safety program; and (c) an Institutional and Policy Development component (1.8 percent of total project cost) to help in: (i) creating the RTCC for the BHMR; (ii) preparing an integrated Transport Policy, Land Use, and Air Quality Management strategy for the BHMR to meet both transport and air quality targets and to introduce sound cost-recovery, tariff, regulatory and subsidy policies; (iii) implementing a cost-based financial management system in the STU-BH; (iv) developing an enabling environment and financial instruments for more substantial participation of the private sector in the investment and operation of the operating agencies; and (v) strengthening air-quality planning and monitoring of vehicle-based emissions.

Part A - Infrastructure and Equipment Component

2.5 This component is designed to improve the infrastructure and equipment of STU-BH to a level which will allow it to meet the operational and financial targets set for the proposed project (Annex 11) and are summarized below.

2.6 The Civil Works Program would consist of: (a) intermodal integration works which would include: (i) construction of three integrated bus-to-rail terminals; (ii) improvements to road accesses to STU-BH stations; (iii) construction of sidewalks and pedestrian over/underpasses; and (iv) provision of a centralized traffic signal control system and bus locator; (b) passenger stations works for the construction of nine new stations and enlargement/improvements of São Paulo station; (c) bridges, road viaducts, and pedestrian over/underpasses, which would include the construction of four bridges, two road viaducts, and six over/underpasses for pedestrians; and (d) the construction of a building for STU-BH administration.

2.7 The Permanent Way Program would include: (a) provision of track materials for a 5 km line from Santa Inês to São Paulo; and (b) construction of a 6.5-km line extension from São Paulo to Vilarinho (Map IBRD 26914), including the construction of a 225 m tunnel for which detailed geological studies have already been completed.

2.8 The Systems Program would consist of: (a) electrification, including the installation of 7 km of overhead catenary, 7 km of transmission cables, one sub-station and one sectionalizing cabin; (b) signaling, consisting of: (i) the replacement of the existing Central Traffic Control (CTC) from Eldorado to São Paulo; (ii) the installation of vital interlocking relay circuits in the 5-km section from Santa Inês to São Paulo with materials and equipment in stock; and (iii) supply and installation of a new signaling system in the 6.5-km extension; and (c) telecommunications, including the provision of a central station, an integrated telecommunication system on the São Paulo - Vilarinho extension, and ticketing control equipment in all 20 stations.

2.9 The Workshop Program includes the provision of miscellaneous equipment for the new Matadouro workshop, and of equipment for general maintenance of the permanent way and systems. The Rolling Stock program would consist of: (a) the general overhaul of five existing electrical multiple units (EMUs); and (b) the acquisition of ten new EMUs.

Part B - Environmental and Traffic Safety Program

2.10 The environmental and traffic safety program will consist of: (a) the design of an inspection and maintenance (I/M) program for vehicle emissions and noise; and (b) the development of a traffic management and safety program.
Part C - Institutional Development and Policy

2.11 CBTU’s decentralization is not by itself a guarantee that the individual subdivisions will be better managed than its predecessors. A package of institutional and policy reforms are needed to induce modernization changes and motivate management and staff. The financial management and administration, especially in regard to cost-recovery mechanisms must also be reformed. Otherwise, the cycle for another emergency program of rehabilitation will repeat itself with negative impacts on the ridership and on the metropolitan region as a whole. Furthermore, actions are needed to change the environment in which CBTU operates in order to facilitate the modal integration and sustainability desired in the long term. The basic sub-components of the institutional and policy package proposed are described in detail in Annex 7 and are summarized below:

(a) Decentralization. The first set of Actions Plans concerns the actual decentralization process: (i) institutional and organizational arrangements; (ii) patrimonial agreement on the valuation and assets to transferred; (iii) aspects relating to transfer of personnel, pension benefits, and miscellaneous human resource-related issues; and (iv) legal and administrative aspects for decentralization;

(b) Management. The second set of Action Plans are designed to improve the management of the STU-BH subdivision: (i) preparation and implementation of a manpower development plan to streamline the management and operations staff of the STU-BH that would propose concise job descriptions and staff it accordingly; (ii) study and implementing of cost accounting, management information systems, and financial management so that timely and adequate cost management is possible; (iii) preparation of an action plan to improve inventory management since lack of spares is one of the main causes for the low rolling stock availability rates; (iv) preparation of an action plan to subcontract maintenance and other operations to the private sector; (v) preparation of an action plan to increase non-operating revenues by renting station space, advertising, and development of the STU-BH’s real estate; and (vi) technical assistance and training for staff at all levels as proposed in the manpower development plan.

(c) Modal Integration. The objective of the third set of Action Plans is to support the policy framework and provide practical recommendations for implementing modal integration. This will include studies of existing transport agencies with a view to reducing intermodal inefficiencies, namely: (i) a financing mechanism study focused on achieving formal sources of funds for the urban transport sector, including a tariff study focused on achieving multi-modal tariff integration and its operationalization; (ii) updating of the Transport, Land Use, and Air Quality portion of the Master Plans of the BHMR with emphasis on route rationalization and modal and tariff integration; and (iii) a BHTRANS/DER-MG route management and rationalization study.

E. Project Cost and Financing

2.12 The total cost of the project is estimated at about US$197.3 million including physical and price contingencies, with an estimated foreign component of US$98.8 million or about 50 percent of total cost. Taxes and duties are expected to account for about 13.5 percent of total costs or US$26.7 million equivalent. Physical contingencies add up to US$16.6 million, or 10 percent of the base cost, and price contingencies are estimated at US$15.0 million or 8.2 percent of the base cost
plus physical contingencies. The contingencies were estimated on the basis of the disbursement schedule (an estimated implementation period of six years), and on the following forecast of price escalation for both local and foreign expenditures expressed in US dollars: 1.5 percent in 1995, 1.8 percent in 1996, 2.6 percent in 1997, 2.5 percent in 1998, 2.5 percent in 1999, 2.5 percent in 2000 and 2.5 percent in 2001. Base costs correspond to March 1995 prices. The costs of goods are based upon supplier quotations for similar Brazilian-made items and recent prices of imported items. The cost of several components of the works program such as, permanent way, two new stations, and the administrative building are based upon detailed engineer designs and prevailing unit prices; the cost of other components of the works program are based upon preliminary engineering designs and prevailing unit prices from recent tenders under loans 3457-BR and 3633-BR. Final engineering designs for the remaining components under the project are underway. Cost estimates for consultant services are based upon prevailing local and foreign staff-months rate; they provide for the cost of local transportation, office equipment and other minor items and, where appropriate, international travel and per diem.

2.13 The project would be financed from the proposed Bank loan of US$99.0 million (50 percent of the project cost) and GOB contributions of about US$98.4 million equivalent, including US$26.69 million in taxes and duties (50 percent of the project cost). During loan negotiations, agreement was be reached on: (a) the project financing plan; and (b) the guarantee of the GOB regarding all necessary counterpart funds for the project.

F. Project Benefits and Risks

2.14 Project Benefits. Quantifiable and non-quantifiable benefits are expected from the provision of an integrated rail and bus network including cost savings, time savings for the users, fewer accidents and fatalities and employment generation through better spatial integration of markets. Important effects on the urban structure are expected if the STU-BH network becomes an axis fed by the major bus routes. In addition, there will be a positive environmental impact through the reduction of fossil fuel consumption, reduction of motor-vehicle related emissions, and a reduction in road congestion, with a consequent improvement in air quality and noise pollution. The project will facilitate access to employment and services, particularly for the poor. Development of an integrated public transport system under a regional coordination body in charge of combining state and municipal pricing and subsidy policies, prioritizing major investments and proposing common demand management measures in the BHMR, are also important non-quantifiable benefits. Finally, by encouraging greater private sector participation in the development of aerial and ground station space, the proposed project will be a first step towards decreasing the investment burden on the state.

2.15 Project Risks. The main risks involved are the delays in the dialogue between the two levels of government for the actual start of operations of the RTCC, the political reluctance to introduce regulatory and air quality related policies which are politically unpopular, the possible delays in the procurement process, the delays in the actual transfer of STU-BH to the local authorities, and the timely availability of counterpart funds. Negotiations among the Federal, State and Municipal Governments have progressed very well for modal and tariff coordination and a forerunner of the RTCC has already been established. All parties have agreed on the need for an integrated project and the risks are more associated with their reluctance to relinquish some of the powers they have to the RTCC. At this stage, there is strong commitment to the environmental and safety program from the governments involved. The delays in the procurement process were minimized by starting at pre-appraisal the pre-qualification for lots in the critical path of project implementation, by the use of standard bidding documents, and by requiring the borrower to produce the major tender documents by negotiations. The timely availability of counterpart funds will be addressed by seeking assurances that they are included in GOB’s CY95 budget and future budgets projections.
Table 2.1: STU-BH Project Cost Estimates and Bank Financing  
(U$ million)

<table>
<thead>
<tr>
<th>STU-BH PROJECT</th>
<th>Local</th>
<th>Foreign</th>
<th>Excl. Duties</th>
<th>Duties</th>
<th>Total</th>
<th>Value</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 - LAND EXPROPRIATION</strong></td>
<td>4.60</td>
<td>--</td>
<td>4.05</td>
<td>0.55</td>
<td>4.60</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>2 - CIVIL WORKS</strong></td>
<td>32.77</td>
<td>21.46</td>
<td>47.72</td>
<td>6.51</td>
<td>54.23</td>
<td>31.02</td>
<td>65.00</td>
</tr>
<tr>
<td><strong>2.1 - Modal Integration</strong></td>
<td>7.35</td>
<td>7.77</td>
<td>13.31</td>
<td>6.51</td>
<td>15.13</td>
<td>8.65</td>
<td>65.00</td>
</tr>
<tr>
<td><strong>2.2 - Stations</strong></td>
<td>12.35</td>
<td>6.65</td>
<td>16.72</td>
<td>2.28</td>
<td>19.00</td>
<td>10.87</td>
<td>65.00</td>
</tr>
<tr>
<td><strong>2.3 - Bridges and Pedestrian O/P</strong></td>
<td>11.64</td>
<td>6.27</td>
<td>15.75</td>
<td>2.15</td>
<td>17.90</td>
<td>10.24</td>
<td>65.00</td>
</tr>
<tr>
<td><strong>2.4 - Administrative Building</strong></td>
<td>1.43</td>
<td>0.77</td>
<td>2.20</td>
<td>1.14</td>
<td>3.34</td>
<td>1.26</td>
<td>65.00</td>
</tr>
<tr>
<td><strong>3 - PERMANENT WAY</strong></td>
<td>20.35</td>
<td>10.96</td>
<td>27.54</td>
<td>3.76</td>
<td>31.30</td>
<td>18.06</td>
<td>66.00</td>
</tr>
<tr>
<td><strong>3.1 - Infrastructure</strong></td>
<td>19.21</td>
<td>10.34</td>
<td>26.00</td>
<td>3.55</td>
<td>29.55</td>
<td>16.90</td>
<td>65.00</td>
</tr>
<tr>
<td><strong>3.2 - Superstructure</strong></td>
<td>1.14</td>
<td>0.51</td>
<td>1.54</td>
<td>0.21</td>
<td>1.75</td>
<td>1.16</td>
<td>75.00</td>
</tr>
<tr>
<td><strong>4 - SYSTEMS</strong></td>
<td>6.75</td>
<td>4.30</td>
<td>9.72</td>
<td>1.33</td>
<td>11.05</td>
<td>7.29</td>
<td>75.00</td>
</tr>
<tr>
<td><strong>4.1 - Electrification</strong></td>
<td>1.53</td>
<td>0.83</td>
<td>2.36</td>
<td>0.28</td>
<td>2.63</td>
<td>1.56</td>
<td>75.00</td>
</tr>
<tr>
<td><strong>4.2 - Signaling</strong></td>
<td>4.57</td>
<td>3.05</td>
<td>7.62</td>
<td>0.91</td>
<td>8.53</td>
<td>5.03</td>
<td>75.00</td>
</tr>
<tr>
<td><strong>4.3 - Telecommunications</strong></td>
<td>0.64</td>
<td>0.43</td>
<td>0.97</td>
<td>0.13</td>
<td>1.07</td>
<td>0.71</td>
<td>75.00</td>
</tr>
<tr>
<td><strong>5 - ROLLING STOCK</strong></td>
<td>4.29</td>
<td>17.18</td>
<td>17.90</td>
<td>3.57</td>
<td>21.47</td>
<td>0.86</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>5.1 - Revision of EMUs</strong></td>
<td>0.30</td>
<td>1.20</td>
<td>1.50</td>
<td>0.18</td>
<td>1.68</td>
<td>0.86</td>
<td>65.00</td>
</tr>
<tr>
<td><strong>5.2 - Assembling of EMUs</strong></td>
<td>3.99</td>
<td>15.98</td>
<td>16.58</td>
<td>3.39</td>
<td>19.97</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>6 - GOODS</strong></td>
<td>6.19</td>
<td>24.53</td>
<td>25.49</td>
<td>5.22</td>
<td>30.72</td>
<td>20.77</td>
<td>81.00</td>
</tr>
<tr>
<td><strong>6.1 - Equipment for Stations</strong></td>
<td>0.32</td>
<td>0.74</td>
<td>0.88</td>
<td>0.18</td>
<td>1.06</td>
<td>0.88</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>6.2 - Materials for Permanent Way</strong></td>
<td>2.19</td>
<td>8.76</td>
<td>9.95</td>
<td>1.86</td>
<td>10.81</td>
<td>6.82</td>
<td>75.00</td>
</tr>
<tr>
<td><strong>6.3 - Materials for Catenary</strong></td>
<td>1.03</td>
<td>2.41</td>
<td>2.65</td>
<td>0.58</td>
<td>3.23</td>
<td>2.14</td>
<td>75.00</td>
</tr>
<tr>
<td><strong>6.4 - Materials for Substations</strong></td>
<td>0.03</td>
<td>0.07</td>
<td>0.08</td>
<td>0.02</td>
<td>0.10</td>
<td>0.06</td>
<td>75.00</td>
</tr>
<tr>
<td><strong>6.5 - Materials for Signaling</strong></td>
<td>0.76</td>
<td>4.32</td>
<td>5.08</td>
<td>0.86</td>
<td>5.94</td>
<td>3.16</td>
<td>75.00</td>
</tr>
<tr>
<td><strong>6.6 - Materials for Telecom</strong></td>
<td>0.48</td>
<td>2.73</td>
<td>3.22</td>
<td>0.55</td>
<td>3.77</td>
<td>2.00</td>
<td>75.00</td>
</tr>
<tr>
<td><strong>6.7 - Equipment for Workshops</strong></td>
<td>1.37</td>
<td>5.50</td>
<td>6.87</td>
<td>1.17</td>
<td>8.04</td>
<td>5.70</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>7 - CONSULTANT</strong></td>
<td>7.92</td>
<td>4.52</td>
<td>12.44</td>
<td>1.49</td>
<td>13.92</td>
<td>5.47</td>
<td>50.00</td>
</tr>
<tr>
<td><strong>7.1 - Studies and Projects</strong></td>
<td>1.47</td>
<td>0.79</td>
<td>2.26</td>
<td>0.27</td>
<td>2.53</td>
<td>0.99</td>
<td>50.00</td>
</tr>
<tr>
<td><strong>7.2 - Institutional Development</strong></td>
<td>1.97</td>
<td>1.31</td>
<td>3.28</td>
<td>0.36</td>
<td>3.64</td>
<td>1.44</td>
<td>50.00</td>
</tr>
<tr>
<td><strong>7.3 - Project Management</strong></td>
<td>1.43</td>
<td>0.77</td>
<td>2.20</td>
<td>0.26</td>
<td>2.46</td>
<td>0.97</td>
<td>50.00</td>
</tr>
<tr>
<td><strong>7.4 - Supervision</strong></td>
<td>3.06</td>
<td>1.65</td>
<td>4.70</td>
<td>0.56</td>
<td>5.26</td>
<td>2.07</td>
<td>50.00</td>
</tr>
<tr>
<td><strong>BASE COSTS</strong></td>
<td>82.86</td>
<td>82.94</td>
<td>165.80</td>
<td>83.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PHYSICAL CONTINGENCIES</strong></td>
<td>8.29</td>
<td>8.29</td>
<td>16.58</td>
<td>8.35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PRICE CONTINGENCIES</strong></td>
<td>7.39</td>
<td>7.57</td>
<td>14.96</td>
<td>7.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>98.54</td>
<td>98.80</td>
<td>170.66</td>
<td>26.68</td>
<td>197.34</td>
<td>99.00</td>
<td></td>
</tr>
</tbody>
</table>
G. Tariff Setting and Affordability by Low-Income Users

2.16 **Poverty, Affordability and Subsidies.** The growing crisis in urban transportation in Brazil, especially in the MRs, demands a close look at alternatives for financing services in a more predictable and sustainable way while, at the same time, targeting subsidies more directly to low-income ridership. The various initiatives already underway within CBTU to improve efficiency through tariff increases, service improvements, and trip reliability, as well as efforts focused on reducing operating costs, are planned to continue.

2.17 Approximately 56 percent of the urban population earns less than four minimum salaries (US$400/month). If successfully implemented, the project will primarily benefit the poor in the participating cities, since they depend mainly on bus, metro and suburban rail services to commute to and from work, especially those living in the *favelas* for whom access to the areas of employment is a daily ordeal.

2.18 To make urban transport affordable to the poor, it is necessary to strengthen and expand the eligibility of the *vale-transporte* program to low-income residents which are not formally employed, to substantially promote integrated (bus-rail) fares, which should be always lower than the sum of individual modal fares, and to increase the overall level of service provided to the users. This will result in lower travel times due to higher frequencies and operating speeds, reduction of waiting time, much higher reliability and safety, bringing down therefore, the overall generalized (tariff, time and safety) transport cost to the user and thus alleviating the burden that urban transportation imposes on low-income households. It is noteworthy that annual bus and train passenger surveys indicate even low-income riders are willing to pay higher tariffs if the service provided is faster, waiting times are less, and the system is more reliable.

2.19 **Review of Financing Mechanisms.** In conclusion, it was agreed that efforts should be focused on seeking a solution(s) that would: (a) generate sufficient resources to maintain stable and predictable funding for urban transport investments; (b) establish mechanisms to generate adequate operating cross-subsidies from within transport related taxes, user charges, etc., to provide adequate support for normalization (operating deficits) transfers; and (c) contract with an independent consultant to provide a structured leadership to a Tariff and Financial Policy study, to conduct discussions at the federal, state and local levels, and to help in drafting the appropriate legislation to implement such policy reforms at the national level.

2.20 In the meantime, agreement was reached at negotiations so that: (a) prior to the transfer of STU-BH to the State, the GOB will meet the cost of capital investments plus debt service (interest and amortization) of the STU-BH, incurred before the transfer; (b) during the period prior to the transfer, the GOB will cover the difference between the working costs and operating revenues of STU-BH; (c) and that after the transfer is effected, the GOB operating subsidy (shortfall between operating revenues and working expenses) will be discontinued.

H. Project Economic Evaluation

2.21 A standard cost-benefit analysis was performed to evaluate the economic impact of the implementation of the proposed Investment and Equipment program, which together represent 98 percent of the total proposed project. Direct user benefits include travel time and operating costs savings; indirect benefits arise from the reduction of negative externalities such as accident and air pollution costs. Investments which will be avoided due to the implementation of the proposed project are also considered as benefits. Investment costs comprise civil works, land expropriation, operational systems, rolling stock and project studies.
2.22 Substantial direct benefits are expected to arise from travel time savings, operating cost savings, bus system control savings, and road maintenance cost savings. Travel time savings result mainly from the transfer of bus passengers into the modernized system and from existing STU-BH passengers who can save time in their trips by taking advantage of the new transport facility. Travel time savings also result from the increased operating speeds and shorter trips of the buses and cars which will be feeding the rail system. Operating cost savings for the non-rail modes derive principally from the improved commercial and traffic speeds, which can be achieved by buses and cars, respectively. In addition, indirect benefits will arise from the reduction in negative externalities, such as accidents and air pollution.

2.23 The IERRs obtained in the economic evaluation are summarized in the Table 2.2. The sensitivity analysis on traffic forecasts, increased investment costs, deferral of benefits, etc., produced acceptable results which ranged from 14.2 percent (case in which the incremental traffic was 50 percent lower than estimated) to 32.3 percent (case in which the value of time savings is 10 percent higher). A more detailed description of the economic evaluation is given in Annex 9.

<table>
<thead>
<tr>
<th>Corridors</th>
<th>IERR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base Case</td>
</tr>
<tr>
<td>São Paulo - Vilarinho</td>
<td>31</td>
</tr>
</tbody>
</table>

I. Project Financial Evaluation

2.24 STU-BH. STU-BH’s sources and uses of funds for operations shows that internally generated funds are low and fixed personnel costs are high. During 1990-94, the cost recovery from internally generated funds varied between 6-15 percent. Besides low tariffs, the main reason for low revenues is a lack of ridership due to the short length of the network. In 1994, the actual ridership was one-fifth of what the system was designed to carry had it been fully completed; the length of the system is less than one-third of the original network used for that forecast. It is no surprise, therefore, that the personnel cost accounted for three-fourths of the total working costs\(^1\) in that year and the resulting working ratio\(^2\) was a humble 6.87.

2.25 Upon completion of the new capital projects, the length of the network would be expanded by 67 percent and the traffic is expected to grow seven-fold during 1994-2001. This increase in traffic is expected to result from a longer network, shorter headways, more intensive operations, and a higher number of integrated stations which will be fed by redesigned bus routes. A combination of higher demand, increases and changes in the tariff structure, and less than proportional increase in costs is expected to result in a revenue cost coverage of 100 percent (a working ratio of 1.05) in 2001. In addition to the measures outlined above, about 5 percent of the operating income is expected to come from advertisement and rental of properties. Consequently, the system is expected to be free from public subsidy for its normal operations starting in 2001. Performance targets to monitor STU-BH’s financial situation during the project are given below.

---

1/ Operating costs exclusive of depreciation and interest.
2/ Ratio of Working Costs to Operating Income. A low number is desirable.
Table 2.3: Performance Targets for STU

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of passengers carried per year (millions of linked trips)</td>
<td>35</td>
<td>38</td>
<td>41</td>
<td>44</td>
<td>48</td>
<td>105</td>
<td>106</td>
</tr>
<tr>
<td>Staff costs as a % of total revenue</td>
<td>142%</td>
<td>134%</td>
<td>156%</td>
<td>160%</td>
<td>161%</td>
<td>69%</td>
<td>69%</td>
</tr>
<tr>
<td>Revenue Cost Coverage</td>
<td>50%</td>
<td>51%</td>
<td>42%</td>
<td>43%</td>
<td>44%</td>
<td>100%</td>
<td>101%</td>
</tr>
<tr>
<td>Working Ratio</td>
<td>2.00</td>
<td>1.98</td>
<td>2.43</td>
<td>2.39</td>
<td>2.39</td>
<td>1.05</td>
<td>1.04</td>
</tr>
</tbody>
</table>

2.26 State of Minas Gerais. Sound fiscal and financial management over the last several years places the State of Minas Gerais in a relatively stable financial condition, despite recession and macroeconomic difficulties at the national level. The State relies on own sources (ICMS and other taxes) for about 71 percent of its total current receipts. As of the end of 1993, current revenues were US$3.4 billion, comprised of: US$2.4 billion own-source tax revenues and US$790 million (23 percent) from federal government transfers. On the expenditure side, 1993 current expenses were about 66 percent of all expenditures (current and capital including amortization), with personnel costs accounting for 36 percent. The remaining 37 percent went towards capital expenditures including amortization payments of US$514 million (11 percent). In 1993, personnel expenditures amounted to 63 percent of the net current revenue (current revenue less contractual transfers) compared to a constitutional limit of 65 percent.

2.27 In response to increasing amortization and interest payments which in 1992 topped US$1.1 billion, the State has severely curtailed new borrowing. Net borrowing which became negative in 1991 continued being so for three straight year and the 1993 debt service of US$767 million was about 31 percent lower than that of 1992. The state successfully rescheduled its long-term contractual debt obligations in 1994 (contractual debt is about 65 percent of total debt) in order to lower the annual debt service burden.

2.28 Current low cost recovery of STU-BH will oblige the State to make operational subsidies of an average US$19 million between 1996-2000 with the maximum subsidy of US$26 million in 2000. With the extended network operational in 2001, STU-BH is not expected to rely on any public subsidy for its normal operations except for the replacement of assets. Nonetheless, even with the expected level of subsidy until 2000, the total State transfers will increase only by 2.5 percent. In comparison to the current surplus, the increase in transfers would account to about 6 percent of the current account surplus (US$432 million) in 1993. The State is also expected to compensate STU-BH US$3-4 million for carrying gratuitos (free riders). This compensation should, however, not be considered a subsidy as it is sales of services by STU-BH to the government.

J. Environmental Impact of the Project

2.29 Since the main objective of the proposed project is to increase the capacity offered by the BHMR rail system, it is expected that a substantial percentage of the passengers now carried by bus will return to their original mode of transportation, that is, rail. This is especially true for passengers who live within walking distance from the stations, who switched to bus because in the last five years the capacity and safety offered by the trains decreased considerably. However, it is not so obvious for those passengers who are not within walking distance. Nevertheless, theoretically it is estimated that by project completion about 316 fewer buses/day will be required in the streets of the BHMR, because integration with the metro system will shorten bus trips. The main expected positive environmental impacts stem from this reduction in bus services, given their present negative impact
on the air quality, noise levels, traffic congestion, and road accidents. As discussed below, other positive impacts include the effect of the rail system rehabilitation on passenger safety at the stations, on the land use around the right-of-way, and the decrease of fatal accidents resulting from lack of fencing along the right-of-way.

2.30 The impact on air quality is due to a reduction of emission by the buses which will be removed from circulation or which will have their route-kms shortened because they will be operating feeder services for the rail system rather than duplicating their routes. The impact on air quality was conservatively estimated at US$1.2 million per year in BHMR. A positive impact on noise levels is also due to the removal of buses, especially in Belo Horizonte, where the older vehicles predominantly owned by the private sector are noisy and when bunched together, cause very high decibel (dB) levels, which hardly allow people to speak at normal voice levels on the street. The impact on traffic congestion was estimated at US$37.0 million per year in Belo Horizonte and is mainly due to the shorter waiting time for commuters using their automobiles and buses. The effect on road accidents is based on statistics which suggest that, in the metropolitan region, the number of bus accidents is a function of the number of buses on the road. It is conservatively estimated that the savings due to fewer accidents are US$0.7 million per year in Belo Horizonte. In addition, the fencing of the right-of-way is expected to decrease the number of fatal accidents due to people crossing the tracks. Even if the benefits estimated were cut in half because the bus operators would, in some cases, continue to run the buses at lower load factors, the project would contribute positively to the environment. Benefits which were not quantified are those related to the improved living environment which will result from safer and cleaner stations, crossovers from the sidewalks to the stations, space for queuing up at the wickets, ramps for the handicapped, and in some cases, modal integration with taxis, buses and private automobiles. Other non-quantified benefits are those related to the structuring effect of a revamped rail system which will attract housing in the surrounding areas. Furthermore, real estate development on the air space above the stations and on land owned by CBTU is also expected. Additional non-quantified benefits relate to the diminished stress which the road system and congestion will impart on the road users and the better ambience expected in trains. Shorter trip times and faster home-to-work trips will also have a positive effect on the rail users’ welfare.

J1. Environmental Impact of the Construction

2.31 The proposed extension of the system would have only limited negative environmental impacts. Most materials used will not affect the environment; the contractors will be responsible for proper disposal of old materials; the earthworks are mainly in CBTU’s existing right-of-way. Concrete ties will be used. The visual impact of the stations will be enhanced with appropriate architectural designs which will blend with the environment, and the same will be done with the overhead catenary, wherever possible. Assurances will be sought that the project will be executed, and the system subsequently operated in accordance with Bank guidelines and good environmental practices.

2.32 An environmental impact assessment of the São Paulo - Vilarinho link undertaken by independent consultants is required by Brazilian law. A preliminary analysis following Bank guidelines was provided during the Bank mission in March 1995 and has subsequently been reviewed and approved by the Bank. During pre-appraisal, the following were made available: (a) a typology of the affected population and of proposed solutions; (b) the institutional matrix, which supports the expropriation process, specifying for each activity the responsibilities of CBTU’s various units as well as those of other agencies and the relationship of social and environmental management within the overall project coordination arrangements; (c) a chronogram of all activities pertaining to expropriation and related activities to be carried out by CBTU or other agencies, including consultations with the affected population and the possibilities of delays in beginning of construction if compensation offered to the affected population were to be rejected; and (d) a budget estimate and sources of funds required for expropriation and other related activities.
2.33 The terms of reference for preparing the final engineering designs for future stations and proposed terminals require that existing environmental (noise and visual intrusion) conditions be reviewed and that the final designs include specific measures for alleviating conditions where they fail to meet existing or proposed standards. In addition, an environmental assessment will be required on all proposals for new works, indicating any adverse environmental consequences and proposing measures to eliminate them or at least reduce their impact to acceptable levels. These assessments and proposals will relate principally to vehicle emissions, vehicle noise, and visual intrusion.

2.34 To ensure that environmental impacts are properly evaluated and adequate mitigating measures are proposed, CBTU's Project Implementation Unit (PIU) would hire a firm of experienced professionals in resettlement as well as have environmental specialists in charge of reviewing and monitoring all phases of project preparation and implementation. CBTU has accumulated considerable experience with land expropriation during the construction of the existing line. More specifically, these divisions would: (a) ensure that terms of reference (TOR) for feasibility studies include a preliminary environmental impact evaluation or screening of the proposed solutions; (b) review the feasibility studies and determine, according to good environmental practices, whether a specific and detailed environmental impact assessment and development of mitigation measures, such as a relocation plan, are required; (c) hire consultants to carry out appropriate analyses and propose mitigation measures; (d) in the latter case, seek the Bank's approval for the proposed measures; (e) include the proposed measures in the TOR for final engineering design, review the final engineering design from an environmental standpoint, and clear the project for implementation; and (f) supervise the implementation of the project to ensure that the participating operating agencies carry it out in accordance with the design approved by CBTU. Since all the project designs will be financed and approved by CBTU, it is expected that this arrangement will ensure that subcomponents are carried out according to environmental practices acceptable to the Bank.

J2. Population Relocation

2.35 This project has been rated "B" by the Bank for environmental assessment (EA) purposes. As such, only selective evaluation and proposals for mitigation of environmentally or socially relevant impacts are required by the Bank for appraisal. However, in accordance with Brazilian legislation, a full EA was prepared. TORs were developed by CBTU in consultation with the municipal licensing agency (Secretaria Municipal do Meio Ambiente, SMMA). In fact, in Belo Horizonte the state licensing agency (Fundação Estadual do Meio Ambiente, FEAM) delegates the approval of environmental impact statement to SMMA. The full extension of São Paulo - Vilarinho link (6.5 km, 8 stations) was analyzed by an independent consulting firm. CBTU has also hired an independent resettlement and environmental assessment specialist to assist in project preparation.

2.36 CBTU is an experienced company and engineering designs are well advanced. Preparation of assessments and the design of programs addressing environmental and social impacts have only recently begun due to the requirements of the project cycle, which calls for these activities to be carried out only after an expropriation decree is issued. This decree in turn depends on a precise definition of the location and area requirements of all facilities.

2.37 At-grade or elevated structures will be used along the full extent of the line except for approximately 225 meters of NATM tunnel, significantly reducing expropriation requirements and environmental impacts as compared to traditional cut-and-cover methods. Stations have similarly been designed with special attention to reducing expropriation requirements and to blend them with the surrounding environment. Locations (i.e., buildings and plots) which need to be acquired to implement the Bank-financed segment are at this point clearly identified. Table 2.4 summarizes their distribution by site and use.
Table 2.4: Expropriation Requirements (buildings and plots)

<table>
<thead>
<tr>
<th>&quot;Favela&quot;</th>
<th>Residential</th>
<th>Commercial</th>
<th>Vacant</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>houses</td>
<td>houses</td>
<td>(shops)</td>
<td>Lots</td>
<td></td>
</tr>
<tr>
<td>292</td>
<td>84</td>
<td>30</td>
<td>12</td>
<td>418</td>
</tr>
</tbody>
</table>

Source: CBTU Resettlement Report

2.38 Whereas the initial layout at-grade called for acquisition of more buildings and plots, alternative sites, designs and a tunnel of 225 meters were sought in an attempt to minimize public acquisition. The current proposal has clearly managed to minimize project impact. Of the 406 locations to be expropriated, 84 are middle-to-low income houses, 292 are favela houses, 30 are small shops, and 12 are vacant lots. The total affected population is estimated to be under 1,880 people.

2.39 CBTU’s usual practice in the case of middle-income residences is to expropriate at market value, which is established according to criteria defined by ABNT (Associação Brasileira de Normas Técnicas) in accordance with local real estate transactions. The CBTU’s Civil Works Department follows a standard set of internal procedures, comprising preparation of a physical cadastre, calculation of the asset’s value, and presentation of CBTU’s purchase proposal to the proprietor. The Legal Department carries out the purchase if the stipulated price is accepted by the proprietor, or takes the case to court if an agreement is not reached. Over the past 20 years, CBTU has carried out over 5,000 expropriations. In roughly 70 percent of these, the proposed buying price was accepted. The adequacy of compensation at market value is not difficult to establish since monitoring and evaluation studies to verify how the affected population relocated were carried out for the line which is in operation. In case of "favela" houses, the practice adopted is either to resettle the affected population to houses which are equal or better than the ones expropriated—preferably to sites which are close to the ones being affected—or to offer a financial compensation for those families which prefer to receive money instead of being relocated. The company also provides, in the case of low-income families, assistance in finding replacement housing, logistical support for moving, legal support to regularize property titles, relocation grants and other services. The total amount for resettlement and expropriation was estimated at US$5.1 million. This amount was included in the project costs and will be fully financed by the GOB.

2.40 An Environmental Assessment Report was prepared in April 1995 according to Bank Guidelines, including a detailed relocation plan wherever it is applicable, and has been approved by the Bank. To prepare the report: (a) a meeting with residents was held to present and discuss project characteristics, expropriation requirements and other relevant impacts, expropriation procedures and timing, proposed valuation criteria and other forms of compensation and assistance (see para. (d) below); (b) minutes of the meeting were sent to the Bank; (c) the exact number and socio-economic profile of affected families was determined; (d) a clear policy statement pertaining to the concession of other grants and services which CBTU will make available to the affected population was completed; (e) the final version of the expropriation program, including compensation and mitigation actions, institutional matrix, chronogram, budget, funding arrangements, reflecting agreements reached with the affected population, was made available prior to negotiations; and (f) a monitoring and evaluation program was also presented prior to negotiations, to be carried out until the conclusion of the relocation process of all households. Evidence that the State licensing agency has approved the environmental impact statement and has issued the license to build the São Paulo - Vilarinho link is a condition of loan disbursement.
K. Private Sector Participation

2.41 To examine the financial instruments which can encourage private participation in the construction and operation of selected parts of the mass transit systems, CBTU has created a high-level working group of entrepreneurs and financiers. Many aspects of this program appear to be appropriate for private or joint public/private development, which could result in considerable savings. Station development is the most obvious, but consideration should also be given to leasing of some existing stations and transfer points for private sector development and operation. Disposition of excess railway land, and air rights would also be explored. CBTU has invited a high-level group including respected outsiders such as elected officials, investment bankers, prominent developers, civil works contractors and Chamber of Commerce representatives, to explore this as well as other ways to "capture" some of the added value of railway real estate development and prepare proposals for inclusion in the program.

2.42 It was agreed between CBTU and the Bank that to foster the participation of the private sector in the system, the Shareholders' Agreements will contain a clause which will require that the State shall cause the MG Entity to offer to the private sector through at least four invitations to bid, satisfactory to the Bank, the exploitation of trains, station space, aerial space, parking areas, automatic ticket collection, and other areas. The first bid should be launched not later than one year after the transfer of STU-BH.
III. PROJECT IMPLEMENTATION

A. Institutional Responsibilities

3.1 The Government of Brazil will be the Borrower. CBTU will be responsible for implementing the project, in accordance with: (a) contractual arrangements; (b) the implementation schedule; (c) implementation arrangements; (d) the decentralization implementation process; (e) procurement arrangements; (f) disbursement arrangements; (g) auditing arrangements; and (h) monitoring and reporting arrangements. These arrangements were confirmed during negotiations, and detailed guidelines, satisfactory to the Bank, were prepared by CBTU. The Bank will monitor the implementation of the project in accordance with a monitoring and supervision plan (Annex 11).

3.2 The overall coordination and supervision of the proposed project will rest with the CBTU which has established a Project Implementation Unit (PIU) supported by consultants. CBTU and the State agreed that the PIU will continue to manage the execution of the project after the transfer of the STU-BH system to the State. This will ensure the continuity of project management experience acquired with the ongoing CBTU-SP and CBTU-RJ projects and will prevent delays which could occur due a change of the project implementation team before the conclusion of the project. To manage and guide the "non-hardware" aspects (political, legal, administrative, institutional, and so forth) through the transition and until December 1996, an intergovernmental General Coordination Committee will coordinate the work of a number of task forces, which will carry out strategic studies on terms of reference agreed with the Bank during negotiations.

B. Contractual Arrangements

3.3 In order to ensure a smooth transition to decentralization, (the formal legal transfer and start of operations by the SMG Operating Corporation), and to support its subsequent consolidation, the following legal arrangements will apply:

With the Bank:
Bank and GOB (Borrower) Loan Agreement
Bank and CBTU (Executing Agency) Project Agreement
Bank and SMG/MBH (State of SMG & Municipality of BH) Shareholders' Agreements

Between Governments and agencies:
GOB and SMG (Convénio Basico and Termos Aditivos)
CBTU and MG Entity (Decentralization Contract)

C. Implementation Schedule

3.4 The implementation of this project has been tentatively scheduled over a six-year period (1995-2001). The project would start on July 1, 1995 and be completed by June 30, 2001, with a closing date of December 31, 2001. The Bank has recommended that STU-BH should take special care in finalizing the project implementation schedule, which is directly linked to the procurement process, and indicated that according to the Bank's experience, the bidding process for each bid may take from 7 to 12 months, including the approval of bidding documents, advertisement in Development Business and local press, bid evaluation, recommendations for award, contract signature, and contract effectiveness.
D. Implementation Arrangements

3.5 **Project Implementation Unit.** CBTU will establish and maintain a Project Implementation Unit (PIU) headed by a Project Coordinator to manage the implementation of the several components of the Bank project. The Project Coordinator would report directly to CBTU’s President. Project Management and implementation consultants financed under Part A of the project would act as full-time advisers to the Project Coordinator to provide the technical support and cross-country experience required for managing the project. These consultants should be hired immediately after pre-appraisal. In addition to the Project Coordinator who will be responsible for the overall financial management of the project, the PIU will include: (a) a transport economist and policy studies coordinator responsible for overseeing the execution of all the studies and transport economics aspects of Parts B and C of the project; (b) an engineer, with experience in procurement, to coordinate Part A of the project; (c) a management information systems specialist responsible for the reporting and supervision of the project; and (d) a resettlement specialist. The PIU will be supported by a small secretariat which will include an accountant responsible for project accounts and disbursements.

3.6 **MG Entity’s Project Management Unit.** This Project Management Unit (MGE/PMU) will be the counterpart of the PIU in STU-BH, and will follow closely the procurement, implementation and supervision of the STU-BH’s related works and acquisition of goods and coordinate system operation.

E. Decentralization Process

3.7 The transfer of the STU-BH subdivision from the GOB to the State of Minas Gerais and the Municipality of Belo Horizonte has been agreed through the execution of an Agreement of Intent (*Convênio Basico*) on June 1, 1995.

3.8 **Transitional Phase to Decentralization.** As the successful decentralization transfer will be subject to detailed negotiations, and will involve some political considerations in addition to financial and technical issues, the detailed steps and transition to decentralization are viewed as a dynamic process involving the full and transparent participation of all levels of government. In order to support this process, joint and parallel strategic studies, administrative and legal actions, organizational changes, and key political decisions will have to be undertaken in a logical and sequential manner, and synchronized with the timetable for processing and executing the proposed Bank Loan and eventually for transfer of the system to SMG and MBH not later than the target date of December 31, 1996. The following steps should be included:

(a) **General Coordination and Completion of Strategic Studies.** Immediately following the signing of the *Convênio Basico*, the General Coordination Committee (CG) will manage and guide the decentralization process. The CG will incorporate a number of task forces. The CG, with representatives from the CBTU, SMG and MBH, will report to the *Conselho Director* through the *Representantes Executivos*. The task forces will work on the strategic studies and Actions Plans outlined in the *Convênio Basico*.

(b) **Transfer to Public Corporation.** In accordance with the Federal Government’s policy for modernization of the economy, and SMG and MBH’s long-standing tradition for efficiency, the STU-BH will be transferred to a Public Corporation (*Sociedade Anonima de Economia Mista*) called the MG Entity. Assurances were sought at negotiations that not later than June 30, 1996 SMG and MBH would set up such Public Corporation, under an independent Board and management autonomy, and thereafter, not later than December 31, 1996, the STU-BH will be fully transferred to the Corporation. The articles of
incorporation would include, among other things, that: (i) the Corporation will be managed by professionally-trained Chief Executive Officers; (ii) the management will adhere to specific operating financial and performance targets set forth in annual contract plans; (iii) management will abide by agreed personnel and administrative policies; and (iv) the Corporation will follow sound commercial practices. Draft Articles of the Corporation will be reviewed by the Bank.

3.9 **Timetable and Phasing for Decentralization.** The project has been prepared to take into account the Federal Government’s objective to complete the legal and institutional transfer (Decentralization) of the STU-BH by the target date of December 31, 1996, or when 60 percent of the loan funds have been disbursed, whichever date is earlier, although the proposed project is expected to continue until 2001. The term "transfer" means the transfer of ownership and operational responsibilities of the STU-BH System to the MG Entity including the enactment and execution of all legal, contractual and administrative acts and documents required under the legislation of the Borrower and the State for these purposes.

**F. Procurement**

3.10 All project components financed under the proposed Bank loan would be procured in accordance with Bank’s Guidelines for Procurement (January 1995).

3.11 Procurement procedures would be as follows:

(a) contracts for goods estimated to cost more than US$350,000 equivalent, and contracts for works including civil works, systems, permanent way and rolling stock, estimated to cost more than US$5.0 million equivalent, would be procured through ICB procedures in accordance with Bank guidelines. In ICB procurement of goods, domestic manufacturers may be granted a margin of preference by adding 15 percent (or the applicable custom duties, whichever is lower) to the CIF value of the foreign bids. The procurement of some goods valued below US$350,000 could be through National Competitive Bidding (NCB) procedures up to an aggregate amount of US$0.5 million;

(b) works of US$5.0 million equivalent or less, up to an aggregate amount of US$17.6 million (Table 3.1) would be awarded through NCB procedures and foreign bidders would have the opportunity to compete. In addition: (i) project components such as, civil works and systems, permanent way, and rolling stock have been packaged and would be procured under supply and installation procedures; and (ii) pre-qualification procedures would be followed for the procurement of the signaling component; and

(c) consultants, which are expected to aggregate to about US$14.7 million (including supervision of investment under the project), would be selected and engaged following the Bank’s Guidelines for the use of Consultants (August 1981) and using the Bank’s standard contract form for complex assignments.

---

3/ A local bidder is a Brazilian firm (or a consortium) offering goods containing components manufactured in Brazil that represent at least 50 percent of the value of the goods.
3.12 All procurement aspects were confirmed during negotiations, in particular the use of:
(a) standard bidding documents for NCB procedures for the procurement of goods or civil works
satisfactory to the Bank; and (b) standard contract forms for consulting services issued by the Bank
for complex, time-based consulting assignments. The procurement schedule for major contracts is
shown in Annex 8, Table 8.5.

3.13 Procurement Review. All contracts for goods estimated to cost the equivalent of
US$350,000 or more, and all contracts for works estimated to cost US$5.0 million or more, would
be subject to the Bank’s prior review of the procurement documentation (advertising, bidding
documents, bid evaluation and contract award). The total value of these contracts would be US$136.7
million or about 83 percent of all Bank-financed goods and civil works. The procurement thresholds
are summarized in Table 3.2. CBTU’s management has the capabilities to handle adequately the
procurement processes required for this project. Procurement information would be recorded as
follows: (a) prompt reporting of contract award by the borrower; and (b) comprehensive biannual
reports to the Bank by the borrowers, indicating: (i) revised cost estimates for individual contracts and
the total project, including best estimates of allowances for physical and price contingencies; (ii)
revised timing of procurement actions, including advertising, bidding, contract awards, and completion
time for individual contracts; and (iii) compliance with aggregate limits on specified methods of
procurement.

Table 3.1: Procurement Arrangements a/
(Estimated cost in US$ million)

<table>
<thead>
<tr>
<th>Expenditure Category</th>
<th>ICB</th>
<th>NCB</th>
<th>Other</th>
<th>N.B.F. g/</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. WORKS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Works</td>
<td>88.90</td>
<td>4.77</td>
<td>28.39</td>
<td>122.06</td>
<td>(53.23)</td>
</tr>
<tr>
<td>(50.50)</td>
<td>(2.73)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road Traffic Control System</td>
<td>7.85</td>
<td>7.85</td>
<td></td>
<td>7.85</td>
<td>(4.51)</td>
</tr>
<tr>
<td>(4.51)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rolling Stock Refurbishment</td>
<td>1.75</td>
<td>1.75</td>
<td></td>
<td>1.75</td>
<td>(0.99)</td>
</tr>
<tr>
<td>(.99)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permanent Way and Systems</td>
<td>32.02</td>
<td>10.92</td>
<td>42.94</td>
<td>42.94</td>
<td>(27.12)</td>
</tr>
<tr>
<td>(20.12)</td>
<td>(7.00)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. GOODS</td>
<td>7.96</td>
<td>.12</td>
<td>8.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6.60)</td>
<td>(.10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. CONSULTANT'S SERVICES</td>
<td>13.5</td>
<td>(5.94)</td>
<td>13.5</td>
<td></td>
<td>(5.94)</td>
</tr>
<tr>
<td>Technical Assistance b/</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training</td>
<td>.35</td>
<td>.35</td>
<td>.35</td>
<td></td>
<td>(.15)</td>
</tr>
<tr>
<td>(1.15)</td>
<td>(1.15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel and Expenses c/</td>
<td>.81</td>
<td>.81</td>
<td>.81</td>
<td></td>
<td>(.36)</td>
</tr>
<tr>
<td>(1.36)</td>
<td>(1.36)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consultants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>136.73</td>
<td>17.56</td>
<td>14.66</td>
<td>28.39</td>
<td>197.34</td>
</tr>
<tr>
<td>(81.73)</td>
<td>(10.82)</td>
<td>(6.45)</td>
<td></td>
<td></td>
<td>(99.00)</td>
</tr>
</tbody>
</table>

a/ Figures in parentheses are the respective amounts financed by the Bank loan.
b/ Services to be procured in accordance with World Bank Guidelines: Use of Consultants by World Bank Borrowers and by the
c/ Items not involving procurement.
d/ Not Bank Financed (includes land expropriations and resettlement).
Table 3.2: Procurement Thresholds (US$ '000)

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of Procurement</th>
<th>Prior Review Limit</th>
<th>Contract Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WORKS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Works</td>
<td>ICB/NCB</td>
<td>All ICB and First NCB contract</td>
<td>ICB &gt; 5,000 NCB 500 to 5,000</td>
</tr>
<tr>
<td>Systems</td>
<td>ICB/NCB</td>
<td>First NCB contract</td>
<td></td>
</tr>
<tr>
<td>Permanent Way</td>
<td>ICB/NCB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rolling Stock &amp;</td>
<td>NCB</td>
<td>First NCB contract</td>
<td>&lt; 5000</td>
</tr>
<tr>
<td></td>
<td>Price Quotations</td>
<td>None</td>
<td>&lt; 500</td>
</tr>
<tr>
<td></td>
<td>at least three Bidders</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GOODS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICB</td>
<td>All</td>
<td>&gt; 350</td>
</tr>
<tr>
<td></td>
<td>NCB</td>
<td>First two contracts</td>
<td>50 to 350</td>
</tr>
<tr>
<td></td>
<td>Price Quotations</td>
<td>None</td>
<td>&lt; 50</td>
</tr>
<tr>
<td></td>
<td>at least three Bidders</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CONSULTING SERVICES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firms</td>
<td>Local &amp; Foreign</td>
<td>All</td>
<td>&gt; 100</td>
</tr>
<tr>
<td>consulting firms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individuals</td>
<td>Local &amp; Foreign</td>
<td>All</td>
<td>&lt; 50</td>
</tr>
<tr>
<td>consulting</td>
<td>individual consultants</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

G. Disbursement and Special Account

3.14 All disbursements under contracts of less than US$5.0 million equivalent for works, such as systems, permanent way and assembly of rolling stock, and of less than US$350,000 equivalent for goods would be made on the basis of certified statements of expenditures (SOEs) prepared by CBTU. SOE limits for consultant service contracts will be US$100,000 for firms and US$50,000 for individuals. Supporting documentation for the SOEs would be retained by CBTU and made available for examination by Bank staff during supervision missions. To expedite project execution, a Special Account would be opened in a commercial bank under terms and conditions acceptable to the Bank with an authorized allocation of up to US$6.0 million equivalent. This account will be replenished for the amount of withdrawals on account of eligible expenditures. Authorization is sought for retroactive financing of up to US$9.9 million equivalent (10 percent of loan funds) in accordance with the Bank's standard guidelines. This retroactive financing would be for expenditures made after March 31, 1995, but no later than three months after loan effectiveness and cover items such as the preparation of final engineering designs which must be carried out to complete the project preparation (Annex 5). Claims for retroactive financing would have to be made no later than three months after loan effectiveness. The disbursement arrangements were discussed and agreed upon during negotiations. Table 3.3 presents the percentage to be disbursed by loan category.
Table 3.3: Disbursement by Category

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount (US$)</th>
<th>Disbursement Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Works</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Civil Works</td>
<td>45,000,000</td>
<td>65% of total expenditures</td>
</tr>
<tr>
<td>(b) Road Traffic Control Systems</td>
<td>3,500,000</td>
<td>65% of total expenditures</td>
</tr>
<tr>
<td>(c) Rolling Stock</td>
<td>1,000,000</td>
<td>65% of total expenditures</td>
</tr>
<tr>
<td>(d) Permanent Way and Systems</td>
<td>22,500,000</td>
<td>75% of total expenditures</td>
</tr>
<tr>
<td>2. Goods</td>
<td>6,500,000</td>
<td>100% of foreign expenditures and 100% of local expenditures (ex-factory costs) and 80% of local expenditures for other items procured locally.</td>
</tr>
<tr>
<td>3. Consultant’s Services and Training</td>
<td>5,500,000</td>
<td></td>
</tr>
<tr>
<td>(a) Training abroad</td>
<td></td>
<td>100% of foreign expenditures</td>
</tr>
<tr>
<td>(b) Training in Brazil</td>
<td></td>
<td>50% of local expenditures</td>
</tr>
<tr>
<td>(c) Consultants</td>
<td></td>
<td>50% of local expenditures for services of consultants domiciled within the territory of the Guarantor and 100% of foreign expenditures for services of other consultants</td>
</tr>
<tr>
<td>4. Unallocated</td>
<td>15,000,000</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>99,000,000</td>
<td></td>
</tr>
</tbody>
</table>

H. Auditing

3.15 CBTU would prepare financial statements, the Special Account audits, and SOEs audits using external auditors acceptable to the Bank. The Bank would review the external auditors’ terms of reference. CBTU in turn, would require the MG Entity to engage external auditors satisfactory to the Bank to audit their subproject accounts, which should be maintained separately. CBTU would review the audits of the subprojects and report to the Bank on the status and any remedial actions taken, if required. CBTU’s and the SMG Entity’s audit reports would be presented to the Bank no later than April 30 of each year. The project auditing arrangements were discussed and agreed during negotiations.

I. Monitoring and Reporting

3.16 Annual Review and Project Plan of Action. In November of each year, the Bank and the SMG would conduct a formal joint review of the progress made in reaching the objectives and in the implementation of the proposed project. The annual review would provide an opportunity to discuss project issues, in particular: compliance with covenants; technical assistance; institutional development advancements and performance of CBTU; execution and analysis of further needs of the training program; the quality of subproject implementation, including environmental analyses; implementation of studies, sector policies and actions; and the implementation of a monitoring program.
(proposed monitoring indicators are presented in Annex 11). The discussion and analysis of the issues addressed during the year under review would lead to the formulation of adjustments and, if necessary, remedial actions satisfactory to the Bank. The timing and scope of the annual review were confirmed during negotiations.

3.17 The project places great emphasis on institutional development in the sector and as such, implementation must be closely monitored and evaluated. It is proposed that a Mid-term Review of the project be held 24 months after loan effectiveness. At the review, the performance of the project would be assessed and the second period implementation program would be amended as necessary based on the results of that evaluation.

3.18 Reporting. It was agreed during appraisal, and was confirmed at negotiations, that CBTU with the assistance of participating operating agencies, would prepare biannual progress reports on June 30 and December 31 of each year and submit them within 60 days. The reports would cover past institutional development and project execution achievements and compare them with the appraisal projections and goals set forth in the Action Plan (Annex 11). They would present a critical assessment of problems and issues arising during project execution. The reports would also discuss compliance with dated covenants and other conditions by each agency and actions taken to enforce compliance. In cases of unsatisfactory progress, the reports would also describe proposals for adjustments and remedial actions. The case for more periodic (quarterly) reporting would be reviewed at the Mid-term Review. To facilitate adequate monitoring of the project, CBTU has agreed to install no later than 90 days after loan signing a management information system to track the physical, financial and environmental status of each component of the project.

J. Project Supervision

3.19 The responsibilities for supervising project implementation and a supervision plan are shown in Annex 11. It is expected that at least three supervision missions per year staffed by an urban transport engineer/planner, a railway engineer, a metro infrastructure engineer, and a financial analyst/transport economist will be required to supervise the proposed project during the first three years of execution. In addition, specialists in resettlement, traffic engineering, air quality and procurement would accompany the supervision missions as required. Supervision requirements are expected to be intensive, particularly in the initial years, as Bank missions would aim to visit every operating agency at least once a year. For the first three years, the supervision requirements are estimated at about 15 staff weeks, reducing to 13 staff weeks in the fourth year, and 12 staff weeks in the fifth, sixth and seventh years.
IV. PROJECT AGREEMENTS AND RECOMMENDATION

4.1 The following Project Management assurances were obtained at appraisal and confirmed at negotiations:

(a) that the Project Implementation Unit (PIU) will be structured and adequately staffed and otherwise supported in the implementation of its responsibility under the project. CBTU provided the Bank with the names and *curricula vitae* of the staff assigned to the PIU (para. 3.5);

(b) that procurement will be carried out in accordance with Bank guidelines, including: (i) the use of standard bidding documents for the procurement of goods and works, under NCB and ICB procedures; (ii) use of Bank's guidelines for the selection of consultants; and (iii) the procurement limits (para. 3.11);

(c) that a Special Account in a commercial bank will be opened and maintained (para. 3.14);

(d) that the Special Account and Statements of Expenditures (SOEs): (a) will be audited according to procedures, and by independent auditors acceptable to the Bank; and (b) audits will be submitted by April 30 of each year (para. 3.15);

(e) that: (i) within 90 days of loan signing a Project Management Information System satisfactory to the Bank will be installed; and (ii) pre-agreed operational and financial performance targets will be included in the biannual progress reports to the Bank (para. 3.18);

(f) that the project will be executed, and the system subsequently operated in accordance with good environmental practices (para. 2.31); and

(g) that the Environmental Assessment for the São Paulo - Vilarinho link be submitted to the Bank and State and Municipal Authorities (para. 2.35).

4.2 The *Convénio Básico* satisfactory to the Bank and completion of final engineering and technical specifications of works and goods for the first year of the program were submitted to the Bank for review during negotiations.

4.3 The following is a Condition of Loan Effectiveness: the registration of the Loan Agreement by the Central Bank.

4.4 The following is a Condition of Disbursement for the São Paulo - Vilarinho link: the approval by the State and Municipal environmental authorities of the Environmental Assessment of the São Paulo - Vilarinho link and the granting of the necessary licenses for the works (para. 2.40);

4.5 Dated covenants to be included in the Legal Agreements are:

(a) Decentralization and Operational Efficiency:

(i) that the transfer of STU-BH will be completed by the target date of December 31, 1996 or when 60 percent of the loan funds have been disbursed, whichever date is earlier, in accordance with a phased program previously agreed with the Bank (para. 3.9);
(ii) that not later than June 30, 1996 SMG and MBH establish or designate a juridically independent public corporation (the MG Entity) with sufficient powers and authority to accept the transfer of STU-BH and to own and operate all assets included therein. That SMG and MBH not later than December 15 each year after the transfer and until December 15, 2001 execute agreements with the MG Entity, satisfactory to the Bank (the Contract Plans), including specific performance targets for the following fiscal year and the financial contributions and other actions required from the State to enable the MG Entity to attain such targets (para. 3.8); and

(iii) that CBTU will actively pursue actions to meet the agreed basic performance targets until the transfer of STU-BH and cooperate with the MG Entity thereafter to achieve the targets agreed until the end of the project by ensuring that implementation of the project is on schedule (para. 3.18).

(b) Financial Policy and Modal Integration:

(i) that prior to the transfer of STU-BH to the State, the GOB will be responsible for the cost of capital investments plus debt service (interest and amortization) of the STU-BH incurred before the transfer and the costs of the proposed loan (para. 2.20);

(ii) that during the period up to December 31, 1996, the GOB: (i) will cover the difference between the working costs and operating revenues of the STU-BH; and (ii) that after the transfer is effected, the GOB operating subsidy (shortfall between operating revenues and working expenses) to the MG Entity will be discontinued (para. 2.20);

(iii) that the CBTU, SMG and MBH undertake to ensure completion of the financing mechanisms study (under terms of reference approved by the Bank) at least one month before the Mid-term Project Review, so that an Action Plan on the agreed recommendations can be prepared (para. 2.19);

(iv) that not later than 12 months from the date of signing of the Loan Agreement, SMG and MBH will present a plan (financial, technical and institutional) and a timetable, satisfactory to the Bank, for the transfer, integration and consolidation of the municipal and metropolitan bus system with the STU-BH (para. 2.11); and that SMG and MBH will be responsible for implementing this integration plan not later than 30 days after the entry in operation of each link of the São Paulo - Vilarinho line; and

(v) that SMG and MBH will create a Regional Transport Coordination Commission not later than one year after loan effectiveness (para. 1.13).

(c) that a Mid-term Project Review will take place 24 months after project effectiveness to review pre-agreed institutional, operational and financial performance indicators, and compliance with covenants (including tariffs, subsidies, and progress on studies) of the Loan and Project Agreements to assess project performance and progress on decentralization, and as necessary, agree on remedial actions. Particular importance will be given, during the Mid-term Review, to the agreed working ratios and the status of the studies and action plans required to ensure a smooth transfer of STU-BH (para. 3.17); and
(d) **Private Sector Participation:** the State shall cause the MG Entity to offer to the private sector, through at least four invitations to bid, satisfactory to the Bank, the exploitation of trains, station space, aerial space above stations, parking terminals, automatic fare collection and other investments. The first bid should be launched not later than one year after the transfer of STU-BH (para. 2.42).

4.6 **Retroactive Financing.** Retroactive financing of up to US$9.9 million equivalent (10 percent of loan funds) for expenditures made after March 31, 1995 (but no later than three months after loan effectiveness) is recommended because certain project activities, such as preparation of final engineering designs, will have to be undertaken immediately.

4.7 **Recommendation.** With the above Agreements and Conditions, the proposed project would be suitable for a Bank loan of US$99 million equivalent, to be repaid in 15 years, at the Bank’s standard variable rate, with a grace period of five years and loan amortization based on level repayments of principal.
BRAZIL
BELO HORIZONTE METROPOLITAN TRANSPORT DECENTRALIZATION PROJECT

BANK ASSISTANCE TO THE URBAN TRANSPORT SECTOR IN BRAZIL AND LESSONS LEARNED

1. This Annex outlines the Bank's past support for the Brazilian urban transport sector and the experience gained. The lessons learned can be summarized as: (a) the coordination between the three levels of government in urban transport should be dealt with very carefully at the project preparation level and reviewed in detail during the Mid-term Project Review; (b) policy for the sector should be strengthened to minimize distortions resulting from inefficient physical and financial coordination between modes and to promote multi-modal integration; (c) the tariff levels should allow for significant cost recovery of working costs and should be complemented by financing mechanisms which cover the shortfall; (d) demand levels are often overestimated and should therefore be carefully scrutinized; and (e) more attention should be given to the management of infrastructure maintenance.

A. First Urban Transport Project (Ln. 1563-BR, US$88 million, May 1978)

2. Project Objectives. The objectives were to: (a) finance investments that would improve urban transport services, with emphasis on the provision of public transport, especially to the poor; (b) promote and support the development and implementation of appropriate urban transport policies; and (c) strengthen municipal, state, and federal capacity to prepare, appraise, and execute sound urban transport projects.

3. Project Content. The project was broad in scope and included traffic engineering and management measures in central urban areas and at critical points, the introduction of exclusive bus lanes and segregated busways, widening of critical links, or construction of missing links in the road network, reorganization or construction of bus terminals, paving of bus routes in low-income areas, and training, technical assistance and institutional strengthening to improve the delivery of transport services. Project beneficiaries included five metropolitan regions (Belo Horizonte, Curitiba, Porto Alegre, Belo Horizonte and Salvador). Nine different agencies were involved in implementation and overall coordination was the responsibility of the Brazilian Urban Transport Company (EBTU).

4. Implementation Experience. The project experienced various delays due to: (a) lack of institutional support to the cities from EBTU, and Government changes in 1979 which led to staff changes in the various implementing agencies; (b) the preparation of final engineering designs and tendering; (c) land acquisition; (d) availability of counterpart funds; (e) local level coordination; and (f) quality control of the works. The closing date for the project was extended twice, resulting in the implementation period changing from three years to five years and nine months. This suggests that the appraisal schedule estimate was overly optimistic. Even so, the implementation period was still substantially shorter than both worldwide and LAC region profiles which were above eight years. The only specific covenant not met was the one requiring the five municipalities to take the necessary steps to revise the valuation for tax purposes of properties whose values had been affected by the project. In the early stages of the project, EBTU staff were less forceful than expected in solving local problems and bringing difficulties to the attention of decision-makers. It must be recognized, however, that EBTU was in its formative stages. This was a first project for them and there was a learning process involved. As part of this process, and in order to achieve institutional improvement, EBTU prepared several operational manuals to assist in the appraisal and supervision processes. These manuals and the experience gained by EBTU (and the Bank) provided the basis for the development procedures applied in the Third Urban Transport Project (1981), which did much to improve the quality and efficiency of EBTU's operations.
5. **Results.** The project was timely and helped to focus the Government's growing concern about urban transport problems. The support given to the institutional development of EBTU, following its creation in 1976, improved federal-level urban transport planning. The project was successful in providing improved urban transport services, particularly public transport to serve the poor. The OED concluded that "the project was successful in implementing some of the most imaginative and radical bus priority measures carried out anywhere in the world. These experiences have relevance for Bank-financed urban transport projects worldwide." The bus priority measures included the development of the bus corridor concept. Bus corridors were designed to accommodate passenger demand levels which were difficult to satisfy by conventional bus services. Schemes involved segregated busways introduced into the existing road system, facilities for passengers and pedestrians, bus system reorganization (usually trunk/feeder), traffic management measures and integrated bus fare systems. The project was also generally successful in providing institutional support at the metropolitan region (MR) level where there has been a significant improvement in the capacity of the agencies to tackle urban transport issues. The success was most particularly noted in those cities in which plans for future urban transport investments existed, not necessarily financed by the Bank, which provided the scope for continued institutional support. Finally, the studies and institutional strengthening financed under the project, coupled with the successful implementation of the physical components, have led to policy changes affecting urban transport in Brazil as whole and, in particular, have resulted in increased emphasis on public bus transport and greater attention to cost-effective policies of traffic management.

6. **Sustainability.** Institutional, technical and financial resources are required to sustain the types of investments included in the First Urban Transport Project. Although there were some institutional and technical weaknesses, the project clearly provided support to strengthen EBTU and the local agencies. In the case of EBTU, this support was continued in the Third Urban Transport Project. The major constraint with respect to sustainability has been the lack of provision for cost recovery, or other funds to cover maintenance of the physical schemes implemented under the project. The failure to make provision for maintenance of the investments is seen in practically all the city projects.

7. However, the project had a substantial institutional impact overall. It assisted EBTU at a critical and formative stage of its development, by providing strong technical and financial support, which enabled it to play a catalytic role in transport improvements in urban areas. EBTU subsequently took increasing responsibility in the appraisal and supervision of Bank-financed urban transport projects, a process which began with the five metropolitan regions included in the First Urban Transport Project, and which culminated with full responsibility for appraisal and supervision of eleven of the fourteen urban centers included in the Third Urban Transport Project.

8. The institutional support resulting from the technical assistance and studies, coupled with the experience gained generally from the successful implementation of the physical components included in the First Urban Transport Project, have led to urban transport policy changes which affect Brazil as a whole. These include more emphasis on traffic management, on the provision of public bus transport, and on the functioning of coordinating bodies at the local level to implement urban transport policy.


9. **Project Objectives.** The objectives were: (a) to establish a new company to own, manage, and operate a suburban rail mass transit system on a commercial basis without operating subsidies; (b) to achieve a significantly more efficient modal distribution of traffic and use of all transport facilities in the metropolitan region's North-South corridor; and (c) to promote the
development of selected employment growth poles in the North-South corridor near urban railway stations.

10. **Project Content.** The project consisted of the construction of a surface suburban rail mass transit system using electric unit trains between the central business area in Porto Alegre and the municipality of Sapucaia, 26.7 km to the north, the establishment of a new company to own, manage and operate this service, and a complementary program of policies and studies.

11. **Implementation Experience.** Despite some serious problems of procurement, passenger services started in March 1985, one year after the originally planned starting date. The railway company, TRENSURB, was successfully established and during the course of project implementation changed its nature from a construction organization to a railway operating company. The project closing date was extended once by one year to December 31, 1986.

12. **Results.** The Project Completion Report sums up well the principal lessons:

   (a) It is not sufficient that the railway service has been successfully implemented. The success of the project depends upon the service attracting sufficient passengers to make the investments economically viable and the railway profitable. This will be highly contingent upon the resumption of economic growth in Porto Alegre and in the evolution of the fares for the users of alternative transport modes. In addition, the attractiveness of the system would be enhanced by the implementation of the recommendations of the studies carried out under the project (bus integration, car parking restrictions, etc.).

   (b) One major lesson to be learned from this project is that, in cases in which there is a need for substantial policy decisions and the implementation of measures involving different Government agencies subject to conflicting pressures, their commitment should be realistically assessed during project preparation. The steps to ensure that these policies are implemented on time should be carefully identified at the same time. In the particular case of the Second Urban Transport Project, a more detailed action program including specific policy implementation targets and appropriate measures for its enforcement should have been agreed upon during appraisal.

   (c) Regarding the original objective of TRENSURB covering its working costs, the appraisal was unrealistic to expect that this would take place during the initial operation period. Only after the system has demonstrated its reliability to the users, will the application of a revenue maximizing policy be feasible. In the meantime, TRENSURB should review its staff needs in order to streamline costs and carry out a tariff study to determine the optimal user charges. The Bank should closely follow-up the implementation of these tasks in the context of its ongoing and future involvement in the sector and continue to impress upon the Government the benefits to be gained from a financially healthy public enterprise as well as the existence of tools much more effective than transport subsidies to achieve income distribution objectives."


13. **Project Objectives.** The objectives were: (a) to improve the quality and efficiency of EBTU’s operations through changes in its structure, procedures, and staff allocation; (b) to improve transport infrastructure and operations in 14 medium-sized cities and conurbations (AGLURB); and (c)
to pave bus routes in low-income areas in medium-sized cities, state capitals, and metropolitan regions (termed PROPAV).

14. **Project Content.** The project consisted of three subprojects: (a) the institutional subproject included EBTU’s reorganization, training, technical assistance and studies; (b) the AGLURB subproject consisted of the establishment and operation of an urban transport management unit in each of the 14 cities and various components in low-cost improvements to existing urban transport infrastructure, with emphasis on public transport operations and improvements of planning and operation of urban transport infrastructure and services at the local level; and (c) the PROPAV subproject included the paving of about 850 km of bus routes in low-income areas.

15. **Implementation Experience.** Project implementation delays were experienced as a result of numerous political changes, limited counterpart funds, the transfer of EBTU to the Ministério de Desenvolvimento Urbano (MDU) from the Ministério dos Transportes (MT) and, soon thereafter, the Federal Government’s Economic Package, which delayed the signing of the 1986 Convênios by about six months. The project was amended twice, which included the addition of four cities to the AGLURB subproject and of 350 km of bus routes in low-income areas to the PROPAV subproject, and resulted also in an extension in the implementation period from four years and three months to five years and nine months. EBTU was in compliance with all loan covenants.

16. **Results.** The AGLURB subproject has done much to create a realistic and effective transport planning environment in Brazilian medium-sized conurbations. The design of the physical components drew heavily on the successful experience of the First Urban Transport Project. Emphasis of the project was placed on cost-effective, traffic management-based schemes in which assistance to public transport (buses) has been the primary objective in the majority of components. The institutional development of the AGLURB areas was achieved through the establishment of management units specifically to coordinate project implementation. Transport companies were formed to coordinate transport planning and operation. Retention of the management units would depend on decisions by individual cities, but selected personnel would be transferred from the management units to the transport companies. At the time of project completion, the implementation delays arising from the political, financial, and organizational factors meant that comprehensive ex-post evaluations were not yet available. As with the First Urban Transport Project, there is a risk that the institutional gains may not be sustained unless a flow of funds is made available to AGLURB cities to continue purposeful transport planning.

17. The PROPAV program was innovative and was a significant step in EBTU’s development. PROPAV was essentially a subsectoral component and EBTU was responsible for all aspects of the program. The program utilized local materials and labor-intensive construction methods to the maximum practical extent, with the result that the costs were initially overestimated. This permitted a greater than targeted program to be undertaken, and to date all 850 km of paving have been implemented. The PROPAV program is regarded as a highly successful program. To an extent, the success of the program is demonstrated by the fact that similar paving programs have been undertaken in other countries in Latin America.

18. The institutional strengthening comprised two main aspects: (a) EBTU reorganization; and (b) training and studies. The reorganization of EBTU proposed under the Third Project was completed in 1984. In general, the reorganization was judged to have increased EBTU’s effectiveness. However, with the changing demands arising from federal government policy on decentralization and from the needs of the Fourth Urban Transport Project, additional changes were considered necessary.

19. The training program comprised a conventional approach (of courses, seminars, etc.) to transport planners and an imaginative training program for bus operators and personnel. The latter
program has been successful in lowering bus operating costs, reducing accidents, and improving public acceptability for bus services.

20. The general delays in project implementation affected the commencement of the studies proposed for inclusion in the project. Furthermore, EBTU did not initially give high priority to the studies. However, in the last year of the project, the study program was revised and additionally provided inputs to the preparation of the Fourth Urban Transport project. In particular, the Financial Study enabled EBTU to form a policy for on-lending, the vehicle operating cost study (carried out by GEIPOT) provided data for incorporation in the EBTU Operations Manual (OM), and the bus information system program (SITURB) furnished an initial data base for evaluating bus operating costs.


21. Project Objectives. The objectives were: (a) improve the operating efficiency of the urban transport systems in the nine metropolitan regions (MRs) through savings in transport costs and time; (b) seek to pass savings from improvements in the urban transport systems on to users, many of whom were among the urban poor, in the form of lower tariffs and/or improved levels of service; (c) conserve energy and encourage substitution of diesel fuel by promotion of domestic energy sources, wherever economically justified; (d) strengthen the role of financial aspects in urban transport policy; (e) strengthen the major institutions, in particular for coordinated investment planning for the sector as a whole; and (f) increase the responsiveness of transport planning to local needs.

22. Project Content. The proposed project would have financed components selected from EBTU’s rolling urban transport investment plan (1986-1990) in Brazil’s nine MRs (Belo Horizonte, Belém, Curitiba, Fortaleza, Porto Alegre, Recife, Rio de Janeiro, Salvador and São Paulo). Components would include a Corridor Program, comprising investments, including design and supervision, to improve public transportation (mainly bus systems, but also some trolley bus and ferry systems) and to correct weaknesses in road networks. The Corridor Program would include infrastructure (including extensive rehabilitation and reconstruction), traffic management measures and supporting organizational improvements; and a system-wide Maintenance Program, including civil works, equipment, the establishment of maintenance management systems, and institutional strengthening. The project would also finance a sector-wide Institutional Program which would involve EBTU, MRs, MDU, and CBTU. This component would include technical assistance and training for improved planning and operational practices, studies and organizational measures to strengthen and improve sector coordination, financial planning and urban transport policy development and pilot technological development programs.

23. Results. There was a considerable delay in declaring the project effective. Institutional problems at the level of the Federal Government resulted in a very poor environment for the project’s implementation. The Fourth Urban Transport Project was canceled when the EBTU was abolished by the Government in 1989.


24. This project was signed in September 1992, became effective in February 1993, and its closing date is June 30, 1996. The project is underway and several major institutional hurdles, such as a federal law to transfer the assets of the railway from the Federal to the State, have been overcome. The rehabilitation of CBTU-SP, the São Paulo subdivision of the CBTU, is underway. São Paulo established a new company (CPTM) to take over the decentralized CBTU-SP and also the FEPASA metropolitan train. So far, the main problems of the project have been associated with problems at the Federal level, including delays in the opening of special accounts, and several changes
in ministers and their immediate advisors. These constant changes delayed the signing of 'convênios' which regulate the transfer of operations and assets. The actual takeover of CBTU by CPTM took place on May 27, 1994. The project is now disbursing very well and some of the infrastructure and equipment components have been completed. As of February 21, 1995, 68 percent of the total project cost had been committed.

F. Rio de Janeiro Metropolitan Transport Decentralization Project (Ln. 3633-BR, US$128.5 million, October 1993)

25. This project was signed in October 1993 and became effective on March 14, 1993. Most of the bids for track work and rolling stock rehabilitation are underway. The actual decentralization which involves the takeover of CBTU-Rio de Janeiro by the State and of the Metro by the Municipality of Rio de Janeiro took place on January 1, 1995.

G. Conclusions and Lessons Learned

26. Despite the considerable achievements of the First Urban Transport Project and the success of the Third Urban Transport Project, the projects have led to the conclusion that several specific issues in the urban transport sector require attention and should be addressed within the context of overall sector reform. The main issues are discussed below.

27. **Cost Recovery.** Direct cost recovery is difficult in the urban transport sector, other than for self-financing infrastructure and passenger vehicles and vessels. Therefore, transportation infrastructure investments (urban and interurban) conventionally recover costs indirectly through transport-related taxes. In the First Urban Transport Project, it was envisaged that partial cost recovery would take place by the revaluation of properties whose values were affected by the project. No such revision in valuation, however, has apparently taken place in any of the five MRs, partly because of the difficulties in assessing an increase in property values through the low-cost improvement schemes provided under the project, when alternative policies or conditions encourage the provision of essential municipal infrastructure, at little or no cost to the beneficiaries. In retrospect, the project should have also addressed the indirect cost recovery mechanisms.

28. **Maintenance.** Lack of maintenance is clearly a problem in each of the five MRs in the First Project, and is now apparent in the components implemented early in the Third Urban Transport Project. Problems apply to a wide range of components. Maintenance covenants were included in the agreements for both projects, but this has proved an ineffective mechanism for ensuring adequate maintenance levels. While there is increasing awareness of the problem and while improved maintenance standards are an objective of the Federal Government, there is a need to develop an institutional and financial framework and capability to provide the necessary funding and to carry out the appropriate maintenance. In hindsight, this problem probably reflects the limitation of addressing narrow sectoral issues, in isolation of a broader policy framework for the urban sector as a whole.

29. **Bus Regulation.** There has been a trend in some cities toward the creation of integrated bus systems, controlled and regulated by a central, public authority. The central authority plans the system and contracts with operators to provide services according to standard cost schedules. "Excess revenue" is taken from operators on profitable routes to cross subsidize those operating unprofitable routes. The feeder/trunk concept may make this increased regulation easier to achieve. There are several areas of concern. First, there are signs that the determination by the central authority of all operating parameters is tending to lead to standardized solutions which may stifle innovation and reduce passenger choice. Secondly, the contribution of the private sector is limited. Thirdly, the needs of the passenger do not always receive adequate attention; for example, feeder/trunk systems force passengers to change buses and in cases where full integration has not been achieved, passengers can
be worse off since they have to pay twice and are further inconvenienced by the change. A thorough
review of the regulatory framework is urgently required, to ensure improved accessibility, greater
equity and efficiency, and a stronger role for private sector operators of public transport.

H. Lessons Learned and the Proposed Belo Horizonte Metropolitan Transport Decentralization
   Project

30. The proposed urban transport project is the seventh to be considered in Brazil. Thus,
there is considerable “in-country” experience to draw upon. In addition, the design of the proposed
project has attempted to recognize the findings and experience from similar projects outlined in this
Annex. The main features of the proposed project which respond to the lessons learned are described
in the following paragraphs.

31. **Institutions.** A successful institutional arrangement will be the key to project success
and project sustainability. In the past in Brazil, there has been little incentive for cities/municipalities
to undertake cost-effective transport planning and investment. Cities have been starved of resources
for transport investment. The creation of the Belo Horizonte Regional Transport Coordination
Commission (RTCC) will be a major advance. In addition to insuring that major projects are in line with
an approved integrated air quality, land use and urban transport strategy, RTCC’s key role will be to
facilitate service and tariff integration between the several modes. It is expected that no urban
transport project in the BHMR will be considered in the future by the Bank without prior approval by
the RTCC.

32. To further support the long-term development of traffic and transport planning, the
project will include funding for the preparation of an Integrated Air Quality, Land Use and Urban
Transport strategy and the updating of the metropolitan data base. Staff from participating
implementing agencies will benefit from this work.

33. **Counterpart Funding.** In Brazil, lack of timely counterpart funding is often the main
cause of delays in project implementation. Several steps were taken to mitigate this problem. The
Governor, as a condition of negotiations, will indicate in writing that in case of scarcity of counterpart
funds the proposed project will have priority over other transport projects. Although an analysis of the
State finances reveals that the sources of funds exist, the challenge will be to ensure that they are
available when the system is decentralized.

34. **Implementation Schedule.** Long implementation, and thus slow disbursements, have
been problems in previous projects. This may be traced to:

   (a) **Lack of familiarity of local staff with Bank procedures.** A training program is proposed
       but training programs take time for benefits to be realized and, even then, there is no
       substitute for practical application. CBTU’s PIU has gained considerable experience
       with the ongoing São Paulo and Rio de Janeiro Metropolitan Transport Decentralization
       loans (Lns. 3457-BR and 3633-BR).

   (b) **Uncertain political commitment.** The establishment of the RTCC gives grounds for
       confidence that all levels of government of the metropolitan region are committed to
       the project. During preparation the level of support was excellent.

   (c) **Lack of final engineering designs for physical works.** It is proposed that participating
       agencies should have the first year of final engineering designs (including bidding
documents) available at negotiations.
Environment. In the past, urban transport projects with the exception of the Mexico Transport Air Quality Management Project (Ln. 3543-ME) and the Teheran Transport Emissions Reduction Project (TF 028642-GET) have had few or no specific measures to improve air quality project. The proposed project contains an Air Quality and Traffic Safety component which together with the infrastructure components is expected to set the foundation for further development in these areas in the Belo Horizonte Metropolitan Region.
The overall coordination and supervision of the proposed project rests with the CBTU which has established a Project Implementation Unit (PIU). To assist CBTU to carry out its obligations, the PIU will be supported by a Project Management and Implementation Consultant (PMIC). CBTU will be the implementing agency for all components but will be helped in some cases by the State/Municipal Agency in charge of the specific area addressed by the component.

### Table 2.1 Implementing Agency for Each Component

<table>
<thead>
<tr>
<th>Component</th>
<th>Implementation Agency</th>
<th>Assisting Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>PART A - Infrastructure and Equipment</td>
<td>CBTU</td>
<td>CBTU</td>
</tr>
<tr>
<td>PART B - Environmental and Safety</td>
<td>CBTU</td>
<td>---</td>
</tr>
<tr>
<td>Part B1 - Air Quality subcomponent</td>
<td>CBTU</td>
<td>SMMA</td>
</tr>
<tr>
<td>Part B2 - Traffic Safety and Control subcomponent</td>
<td>CBTU</td>
<td>BHTRANS</td>
</tr>
<tr>
<td>PART C - Institutional Development and Policy</td>
<td>CBTU</td>
<td>BHTRANS/DER-MG</td>
</tr>
</tbody>
</table>

All procurement will be the responsibility of CBTU and will be carried out by the PIU until the completion of the proposed project.
Figure 2.1: Flow of Funds

Federal Government

IBRD

Commercial Bank

National Treasury

CBTU

Figure 2.2: Legal Agreements

IBRD

Loan Agreement

Federal Government

Project Agreement

CBTU

Shareholders' Agreements

Convenio Basico

MG MBH
Fig. 2.3: Management and Coordination Arrangements

ANNEX 2
REGIONAL TRANSPORT COORDINATION COMMISSION

A. The Establishment and Role of a Regional Transport Coordination Commission (RTCC)

1. To facilitate coordination of investment and operation among the major providers of urban transport services, the proposal to create a regional coordinating body is being given priority. This would not be a new level of government and would not usurp the powers of the State or the Municipality. It would provide a forum, however, to formally review all proposals with respect to their compliance with an agreed-upon transport strategy, evaluate alternatives, and make recommendations based on a regional, intermodal point of view. The RTCC will include representatives of the Governor of the State and Mayors of the BHMR, in particular the Mayor of the Belo Horizonte Municipality, as well as DEMETRÔ, BHTRANS, DER-MG, DETRAN and bus operator associations and those agencies responsible for municipal and regional planning. An Executive Secretariat in charge of actually developing and/or evaluating proposals and carrying out day-to-day activities would be established. RTCC would be responsible for developing an integrated urban transport and air quality strategy for the BHMR that is compatible with the land use policies jointly developed with the land use agencies of the BHMR.

2. The following questions must be asked when defining the functions of the RTCC: (a) How are transport plans prepared, and how often are they updated? Is a single entity responsible for their preparation across all modes (highways, metro, suburban rail, bus/busways) and the entire region, or are separate plans prepared by the respective municipalities, building and operating companies and then put together by a coordinating agency? (b) Who monitors the condition and performance of the transport systems, and how do the results of the monitoring feed into the planning process? (c) What is the relationship between the transport plan(s) and the respective land use plans developed by the municipalities? (d) What is the relationship between the plan(s) developed under question (a) above, and the multi-year capital program developed by the various implementing authorities? Is the project flow top-down (i.e., emanates from the plan), bottom-up (generated by the implementers/operators), or both? and (e) Do the various operating companies have direct access to funding or should their capital budgets be approved either by the SMG or the new RTCC?

3. At the suggestion of the Bank, SMG, MBH, MB and MC have created a forerunner of the RTCC, the Grupo Permanente de Planejamento Integrado (GPPI), and with the support of the MBH, it has launched studies to define the role, responsibilities, composition and funding of the RTCC. As a condition of negotiations, the GPPI should be established by an implementation agreement “convênio” signed by the SMG and MBH.

B. RTCC’s Proposed Structure, Composition and Role

4. The general structure of an entity in charge of coordinating transport policy, prioritizing major investments, and defining air quality and traffic safety objectives and policies pertaining to urban transport in the 18 municipalities that make up the BHMR is outlined below. This report highlights the basic features of a proposed solution which attempts to comply with the objectives described above.

Institutional Background

5. The BHMR comprises 18 independent municipalities, each with its own Mayor and Municipal Council (Câmara de Vereadores), of which the Municipality of Belo Horizonte (Prefeitura),
also the State Capital, is by far the largest and most important from the economic and political standpoints. The State Constitution indicates that public transport of regional interest is to be planned and coordinated by the State Government together with the Municipalities involved. Such is the case with many transport routes in the BHMR. In fact, even some transport services within the boundaries of a specific Municipality can be of regional interest and, as such, should be planned jointly. The DER-MG has been entrusted with the task of fostering joint transport planning efforts within the BHMR, with assistance from a local strategic transport planning body which would include representatives from the State and from municipal governments.

6. Metropolitan Regions in Brazil have been defined but have not been legally established. For that reason, a level of government hierarchically superior to city governments but below the State level does not exist in practice. In parallel, the 1988 Federal Constitution has strongly enhanced the independence of Municipal authorities in many functions, one of them being transport policy and regulation. Therefore, discussions towards metropolitan transport coordination must be accompanied by the provision of an adequate State-level institutional framework, which should be simple but should also have the leverage to elicit effective interest from Municipalities, as benefits from joining the common planning effort become more clearly outlined.

Basic Concepts

7. In light of the aforementioned legal constraints, local (BHMR and elsewhere in Brazil) experiments in metropolitan transport coordination have continued, some with a reasonable degree of success. These indicate that the key elements for the sustainability of the proposed coordination are as follows: (a) it should be conceived as a permanent structure, designed to outlive executive or legislative mandate periods; (b) it should be accepted by the parties as an additional asset and not as a threat to their autonomy or decision-making powers (even though the power balance may, and probably will, shift at its inception); (c) it will not interfere with jurisdictions which belong to those parties, notwithstanding the fact that it will be granted a specific political status, and its own specific powers; and (d) it should not assume the functions of a Public Company (Empresa), nor should it be in charge of operations of any kind. These conditions for long-term sustainability of an entity of this type may restrict the scope of work to only a few basic functions, which will, however, constitute the basis upon which to develop further coordinating responsibilities. The proposed coordinating body will hereafter be referred to as the Regional Transport Coordination Commission (RTCC). Experience in other countries, such as that of the United States, indicates that the planning function is the best support for actions aimed at transport coordination. Such planning aims at the establishment of a fully integrated public transport system, and this concept should always be present as a basic guideline for coordination proposals and for the implementation of the related institutional framework.

8. Within the planning function, priorities should be appropriately defined. Actions might begin, for example, with investment policy and fare policy coordination, and later encompass physical planning, traffic management, and system operations. Such phasing-in would be supported by a common strategic vision of the metropolitan transport system. RTCC would have an important role in the decision-making process regarding the transfer of transport-related funds from the State and Federal levels to the municipalities. Projects submitted to the World Bank and other multilateral agencies should first be prioritized by the RTCC. It should be noted that granting such powers may be one of the most difficult points to be agreed upon. If, however, the final investment decisions are left out from RTCC attributes, RTCC would become little more than a forum for discussions (and eventual decisions) on metropolitan transport matters, with little or no coordinating role. Budget control by RTCC would be more naturally accepted by the parties involved, given a set of political mechanisms, such as: (a) assuring an adequate balance between state and municipal points of view concerning planning decisions; (b) active involvement of the Federal government, considering that good transport performance in large urban areas is to be viewed as a matter of national interest, and not only as a
concern of local government entities; and (c) implementation of a permanent planning process, continuously incorporating relevant new information as it is made available, with emphasis on socio-economic and environmental changes and proposed improvements to the transport system, always from a strategic point of view.

9. DER-MG and BHTRANS’s role will be crucial for a successful RTCC. The Metropolitan Transport Secretary would represent the State Government and preside over the Executive Secretariat. Also, BHTRANS would provide RTCC with the necessary technical and administrative support. In the event that BHMR becomes a legally recognized entity, RTCC would naturally be absorbed into a fuller metropolitan planning structure, and this possibility should be taken into account from the earliest phases of its conception by MBH. The establishment of the RTCC as a permanent body, as mentioned before, will require a search for the most suitable legal framework. Also, RTCC components would be designed with that in mind, giving priority to stable relations with all government levels, while maintaining sound political and technical supporting structures. When the RTCC is established, existing bodies with related functions would be terminated or absorbed into it. Based on the above discussion, the CBTU has proposed an implementation agreement or "convênio" to establish the RTCC. Highlights of the "convênio" are given below.

General Description of RTCC

10. **Objective.** As stated in the draft *convênio* to establish the RTCC, its overall objectives are to carry out transport planning of the BHMR, in order to ensure that transport plans and programs by the State and related Municipalities are compatible with metropolitan plans, to define transport policy and standards, to prioritize investments and to coordinate transport investment expenditures.

11. **Composition.** RTCC will be chaired by a State Secretary, and will include the Secretary of Transport of the Municipality of BH and the Mayors of the BHMR who will adhere to the "convênio". The *convênio* includes a specific clause to be signed by the mayor of each of the participating BHMR municipalities. Adherence to the convênio will facilitate future State funding in the municipalities.

12. **Organization.** RTCC’s structure will include two bodies: (a) an Executive Committee (EC) composed of the State Secretary of Metropolitan Transport who will act as the Chairman or President, the Secretary of Transport of the Municipality of BH who will act as secretary of the EC, the State Coordinator for Assistance to the Municipalities for Public Transport, and the State Coordinator for Planning and Management, the mayors representing the municipalities in each of the six sub-regions defined in the *convênio*, and the presidents of the operating agencies STU-BH, BHTRANS, DER-MG and bus operator associations; and (b) the *Grupo Permanente de Planejamento Integrado* (GPPI) which will act as the technical secretariat for the RTCC. GPPI would be headed by a permanent Executive Secretary. It will be the responsibility of the president to convene the EC’s meetings. GPPI would organize the meeting and prepare their agenda based on suggestions received from EC’s members.

13. **Municipal Subregions.** As mentioned above, up to six groups of municipalities would be formed, consisting of neighboring cities with common transport interests. Each group would deliberate about transport and traffic management issues within their respective areas, and would elect a mayor to represent it at the EC.

14. **State/City Permanent Planning Committee.** (*Grupo Permanente de Planejamento Integrado* - GPPI). Composed of representatives from CBTU and from the "Prefeitura" of Belo Horizonte transport and traffic management agencies, the planning committee would deal with selected items affecting City and State. Meetings would be held every two weeks, or more frequently if needed.
Representatives from other areas or agencies and independent professionals may be invited for discussion on specific issues.

15. **Executive Secretary.** The role of the Executive Secretary will be to provide support to the RTCC and to see that decisions are properly implemented. This function would be carried out by a SMG-appointed representative. Revisions of the Transport Plan, tactical studies concerning specific items within the transport system, periodic checking of plans and programs against strategic guidelines, promotion of specific events for information interchange with other sectors of the metropolitan administration, and execution of surveys and studies to support RTCC decisions, are some of the tasks to be managed by the Executive Secretary.

16. The RTCC structure would be funded through State (50 percent) and Municipal (50 percent) grants. Total funding requirements would be defined by the Executive Secretary no later than August of each year, to be submitted for General Assembly approval or modification at its regular meeting in September. Decisions by consensus would be preferred, with decision by voting as necessary. Mayors would rotate as Chairpersons of the municipal groups.

17. It will be a dated covenant that SMG and MBH establish a formal Regional Transport Coordination Commission not later than a year after loan effectiveness. It was agreed that BHTRANS/DER-MG will ensure that bus routes will be re-routed to the stations of the system and that such re-routing will occur as each new station or segment of the Santa Inês - São Paulo - Vilarinho link becomes available for operation. It was also agreed that BHTRANS/DER-MG will curb the use of illegal bus operations especially if they serve routes parallel to the rail lines. Finally, it was agreed that the State should not later than 12 months after effectiveness, submit evidence to the Bank that financing mechanisms are in place to ensure coverage of the MG Entity’s operating subsidy if any.

![Figure 3.1: Institutional Framework of the Urban Transport Sector in BHMR](image-url)
PRIVATE SECTOR PARTICIPATION IN THE PROJECT

A. Background

1. In an effort to increase private sector participation in the project, CBTU has met with the Chamber of Commerce, associations of civil works contractors, equipment manufacturers and real estate specialists. The latter indicated that they are interested in exploring mechanisms for developing real estate in and around the stations, and have initiated a series of meetings with CBTU and STU-BH personnel to examine the most suitable sites. In general, the associations indicated that there is need for some changes in municipal legislation to capitalize on the additional floor space created by new buildings in the aerial space of the right-of-way and surrounding areas. STU-BH already has a few tentative programs of rental of station space and advertising but this should be given more attention as a revenue source.

2. Although there are at least two projects for the development of shopping areas and for apartment buildings, the participants indicated that they are reluctant to commit themselves until they see some progress in the works of the Sao Paulo - Vilarinho link. The general consensus was also that in view of the very high cost of credit to buy houses, it is unlikely that there would be a substantial number of buyers. Participants asked the pre-appraisal mission whether the Bank could help with housing credits as it was done in previous urban development loans. The representatives of the associations indicated that they are interested in exploring mechanisms to develop real estate in and around the stations and asked STU-BH personnel to provide them with more detailed data on the most interesting sites. They also indicated that in the past the long delays in the completion of STU-BH works make any substantial investments in real estate in the surrounding areas very risky. Bank financing of the proposed project changes the picture and will create incentives for private sector participation but they want to wait until the project is in progress.

B. Recommendations

3. To examine the financial instruments which can encourage private participation in the construction and operation of selected parts of the mass transit systems, CBTU has created a high-level working group of entrepreneurs and financiers. Many aspects of this program appear to be appropriate for private or joint public/private development, which could result in considerable savings. Station development is the most obvious, but consideration should also be given to leasing of some existing stations and transfer points for private sector development and operation. Disposition of excess railway land and air rights would also be explored. CBTU has invited a high-level group including respected outsiders such as elected officials, investment bankers, prominent developers, civil works contractors, and Chamber of Commerce representatives, to explore this as well as other ways to “capture” some of the added value of railway real estate development and prepare proposals for inclusion in the program.

4. Since the project involves a decentralization and therefore a change of asset ownership, it was agreed that any concessions to the private sector should be made preferably after the transfer of ownership. On the basis of the above, it was agreed between CBTU and the Bank that to foster the participation of the private sector in the system, the State/municipality shareholder’s agreement will contain a clause which will require that the State shall cause the MG Entity to offer at least four invitations to bid for private sector exploitation of trains, station space, aerial space, parking areas, automatic ticket collection and other areas within one year of the transfer.
1. **General.** The CBTU Belo Horizonte subdivision system (STU-BH) has a network of 18.2 km of trackage (Map IBRD 26914) organized in one corridor from Eldorado to Santa Inês which was inaugurated in stages starting in August 1986. It is electrified, with double, broad gauge (1.60 m) track for exclusive passenger services. The 5.0 km extension from Santa Inês to São Paulo is currently under construction, infrastructure works are expected to be completed by December 1995. The project has been designed to foster intermodal integration of STU-BH system with the bus network. It consists of the construction of four new stations in the Eldorado to São Paulo section and of a 7.0 km extension of the electrified system from São Paulo to Vilarinho, with five new stations. It also includes the addition of bus transfer facilities and road accesses to stations to enhance intermodal integration in the area of influence of STU-BH. A brief description of the investments included in the project is presented in the next paragraphs.

2. **Civil Works.** A summary of the main works is shown in Table 5.1 and described below:

(a) **Intermodal Integration.** The works to be implemented under this program consist of: (i) the Integrated Terminals program designed to improve the intermodal integration of STU-BH system with urban buses serving the metropolitan region, and entails the construction of three integrated terminals (Jose C. Silveira, São Paulo and Vilarinho). The terminals will facilitate and speed the transfer of passengers between bus and rail modes thus minimizing overall passenger trip times. They consist of bus roadways, parking and passenger queuing areas and are an integral part of the rail stations; (ii) the Road Accesses program, aimed at improving the road accesses to all STU-BH stations, consisting of: (a) traffic engineering measures such as signals, signs and revised intersection layouts; and (b) bus access improvements such as construction of short road links missing in the existing network, busways, bus lanes, and shelters for bus passengers; (iii) the Accesses for Pedestrians Program would consist of the construction of sidewalks and pedestrian over/underpasses to improve convenience and reduce walking times to and from STU-BH stations; and (iv) the Road Traffic Control Program includes: (a) an area-wide traffic circulation scheme (a centralized signal control system) controlling some 350 signalized intersections; (b) the provision of a radio operated bus locator control system; and (c) upgrading of Route 710, providing improved road access to the Jose C. Silveira terminal. The proposed works, including contingencies, amount to about US$18.6 million or 9 percent of the total cost of the project.

(b) **Passenger Stations.** The existing 11 passenger stations in the Eldorado-Santa Inês section, which were built during the period 1983-1994, are functional and of modern design, they are well maintained and can cope with the existing and projected passenger demand. The passenger stations program calls for the construction of nine new stations. This component envisages expenditures, including contingencies, of about US$24.0 million or 12 percent of total project cost.
(c) **Bridges, Road Viaducts and Pedestrian Over/underpasses.** The existing right-of-way of the STU-BH is fenced and is not subject to road traffic interferences. This program is designed to eliminate road and pedestrian interferences in the new section to Vilarinho and entails the construction of four bridges, two road viaducts (one in the Horto-São Paulo section) and six pedestrian over/underpasses (one in Eldorado-Santa Inês section). The cost of these works, including contingencies, has been estimated at about US$21.3 million or 11 percent of total project cost.

(d) **Administrative Building.** The program includes the construction of a building for STU-BH administration. Currently, STU-BH rents office space in various buildings for its activities. The cost of these works has been estimated at US$2.6 million including contingencies.

3. **Permanent Way.** The double, broad gauge (1.60 m) track in the existing Eldorado-Santa Inês Line has a minimum radius of 160 m, maximum grades of 3 percent, and is laid with 57 kg/m welded rails. Sleepers are monoblock of pre-stressed concrete with elastic rail fastenings laid on crushed stone ballast. The track is in good condition and permits speeds up to 90 km/h. The Permanent Way program included in the project entails: (a) the provision of track materials for the section from Santa Inês to São Paulo (5.0 km); and (b) the construction of 7.0 km of electrified, double, broad gauge (1.60 m) track extension from São Paulo to Vilarinho. The track layout also calls for the construction of a 225 m tunnel. The track would have maximum grades of 3 percent, minimum radius of 300 m, and the same standards as the existing track in operation. These works also include the construction of fences along the new right-of-way. The realization of these works would require land expropriation and resettlement to be able to carry out the proposed works in the São Paulo, Dona Clara and Vilarinho areas. The proposed works, including contingencies, have been estimated to cost about US$51.6 million or 26 percent of the total project cost.

4. **Systems.** A summary description of the systems currently operated by STU-BH and related components included in the project are presented below:

(a) **Electrification Program.** The electric energy is generated and distributed by CEMIG which in turn feeds two sub-stations for the operations of the STU-BH system. The network of overhead contact lines with power supplied at 3.0 kV DC is well maintained. The two sub-stations are strategically located in the Cidade Industrial and Carlos Prates areas. There are section cabins to reduce the effects of voltage drops and sectionalize the line. The entire system is telecommanded through the operational control center (CCO). The electric systems are well maintained. This program includes: (i) the installation of 7.0 km of overhead catenary (double line) with 3 kV DC and motorized switches; (ii) 7.0-km transmission cables of 6.6 kV; and (iii) the construction of one sub-station close to Vilarinho station, and one sectionalizing cabin at São Paulo. These works, including contingencies, have been estimated to cost US$7.1 million or 4 percent of total project cost.

(b) **Signaling Program.** The existing signaling system in the corridor includes the following components: (i) the Centralized Traffic Control (CTC), which allows a Central Operator to set routes for trains by controlling eight remote interlocks and to monitor headways and train positions; (ii) Relay Interlocks, consisting of ten signaling relay rooms located at selected passenger stations that confirm the vital interlocking relay circuits for the traffic safety of STU-BH’s trains are correct and would allow local control of switches in case of failure in the link.
to the CTC; and (iii) the Automatic Train Control (ATC), consisting of special
equipment such as transmitters along the track and a cab signaling system on
board of the Electric Multiple Units (EMUs) that controls train speeds within
safety limits. The existing signaling system is not reliable, however, due to
problems of old design and equipment with limited capacity. As a result, traffic
is supplement-controlled via telephone communications. This program includes:
(i) the replacement of the existing CTC system from Eldorado to São Paulo; (ii)
the installation of vital interlocking relay circuits in the 5.0-km section from
Santa Inês to São Paulo with materials and equipment already in stock and
specific connections to the new Entroncamento and Vila Oeste stations; and
(iii) the supply and installation of a new system in the 6.5-km extension São
Paulo - Vilarinho, including CTC, ATC and interlocking relays. The cost of these
works, including contingencies, have been estimated at US$15.6 million or 8
percent of total project cost.

(c) Telecommunications Program. The telecommunications are carried out by a
special underground cable along the right-of-way. A radio system links the CCO
with trains, stations, and maintenance workshops. In addition, the system
provides telephone communications for general administration and operations,
CCTV (Closed Circuits TV) at 11 stations, and supports clock and public
address sub-systems in the stations. All communications are recorded. The
project includes the installation of: (i) a telephone central station;
(ii) a telecommunication system for the section São Paulo - Vilarinho, with the same
characteristics of the existing system operating in the corridor; and (iii) a
ticketing control systems in all 20 stations from Eldorado to Vilarinho. Including
contingencies, this program has been estimated to cost US$5.3 million or 3
percent of total project cost.

5. Workshop Equipment. The STU-BH network is served by workshops strategically
located at Eldorado and Carlos Prates terminals and provide light maintenance and one year revisions
to the EMU fleet. A maintenance facility for heavy overhaul of the EMUs is under construction at
Matadouro, close to the São Paulo terminal. This program includes the provision of miscellaneous
equipment for this workshop and maintenance equipment for the permanent way and systems (Table
5.2). Including contingencies, this component is estimated to cost US$8.3 million or 4 percent of total
project cost.

6. Rolling Stock. The existing passenger train fleet of STU-BH’s EMUs consists of seven
broad gauge (1.60 m) units. There is another new unit being tested, and seven more units are being
manufactured. These units are expected to be delivered early in 1997. Each unit is composed of four
cars (two with motors and two trailers). The units are of stainless steel and have 60 and 71 seats (cars
with motors and trailer cars respectively) with a maximum capacity of 1,278 passengers per EMU.
Their main characteristics are: 276 kw per engine (2.2 Megawatts), electric controlled, 3 kv overhead
feeder, dynamic brakes and designed to run at a maximum speed of 90 km/h. Currently, there are six
units in service. There is an average fleet availability of 86 percent. Five of these units have an average
of 1.0 million travelled km, well over the 0.6 million km recommended by the manufacturers. These
units have never had general overhauls. It has been established that in order to cope with the forecast
demand of 322,000 passengers per day soon after project opening, and operate with train schedules
and head-ways of four and eight minutes during rush and non-rush hours, STU-BH would need a fleet
of 25 EMUs. The rolling stock program has been designed to increase the transport capacity of the
system. To complement the existing fleet, the program includes: (a) the general overhaul of 5 EMUs;
and (b) the acquisition of 10 EMUs. This component, including contingencies, is estimated to cost
US$25.6 million or 13 percent of total project cost.
7. **Engineering Designs.** Final engineering designs for the construction of permanent way and the two new stations at Jose Silveira and Minas Shopping in the Santa Inês-São Paulo section have been completed. Design works for the new stations at Vila Oeste and Entroncamento in the Eldorado-Santa Inês section and for the extension from São Paulo to Vilarinho, as well as those required for the Intermodal Integration Program (under the responsibility of BHTRANS) are underway. It is scheduled that by appraisal, STU-BH would have final engineering designs available for all components included in the first year of project implementation. Technical specifications for the acquisition of rolling stock is already available, and those required for the provision of the electrification, signaling, and telecommunications systems, and maintenance equipment are programmed to be ready by mid-1995.

8. **Supervision.** The project includes the provision of consultants (2,350 staff/months) for the implementation and supervision of each of the project components mentioned above. The cost of these services have been estimated at US$5.6 million including contingencies or 3 percent of total project cost.
Table 5.1: Main Civil Works

<table>
<thead>
<tr>
<th>Program</th>
<th>Stations</th>
<th>Road Access</th>
<th>Pedest. Access</th>
<th>Terminals</th>
<th>Traffic Control</th>
<th>Bridges</th>
<th>Road Viaducts</th>
<th>Overpasses</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) ELDORADO - SAO PAULO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELDORADO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CIDADE INDUSTRIAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VILA OESTE</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GAMELEIRA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENTRONCAMENTO</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CALAFATE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARLOS PRATES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAGOINHA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CENTRAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SANTA EFIGENIA</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SANTA TEREZA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HORTO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SANTA INÉS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J.CÂNDIDO DA SILVEIRA</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MINAS SHOPPING</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAO PAULO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(B) SAO PAULO - VILARINHO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAO PAULO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DONA CLARA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heliopolis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLORAMAR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VILARINHO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.2: List of Workshop Equipment

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Estimated Cost (US$ 000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overhead Crane</td>
<td>3</td>
<td>300</td>
</tr>
<tr>
<td>Truck Turntable</td>
<td>12</td>
<td>300</td>
</tr>
<tr>
<td>Underground Lathe</td>
<td>1</td>
<td>1,600</td>
</tr>
<tr>
<td>Mechanical Lathe</td>
<td>1</td>
<td>400</td>
</tr>
<tr>
<td>Axle Press</td>
<td>1</td>
<td>200</td>
</tr>
<tr>
<td>Compressor</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Audio System</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Ramp Spring Tester</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Radio Frequency Generator</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Motorized Rail Car w/ Crane</td>
<td>1</td>
<td>700</td>
</tr>
<tr>
<td>Tamping Aligner and Leveling Unit</td>
<td>1</td>
<td>1,400</td>
</tr>
<tr>
<td>Trolleys</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Lathe</td>
<td>1</td>
<td>300</td>
</tr>
<tr>
<td>Jacks</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Washing Cabin for EMU’s</td>
<td>1</td>
<td>150</td>
</tr>
<tr>
<td>Track Mobile</td>
<td>2</td>
<td>800</td>
</tr>
<tr>
<td>Ballast Regulator</td>
<td>1</td>
<td>500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,870</strong></td>
<td></td>
</tr>
</tbody>
</table>

\* Without contingencies.
Figure 5.1: Existing and Proposed Stations

<table>
<thead>
<tr>
<th>STATIONS</th>
<th>DISTANCE BETWEEN STATIONS - km</th>
</tr>
</thead>
<tbody>
<tr>
<td>● ELDORADO</td>
<td>1.609</td>
</tr>
<tr>
<td>● CIDADE INDUSTRIAL</td>
<td>1.627</td>
</tr>
<tr>
<td>○ VILA OESTE</td>
<td>2.225</td>
</tr>
<tr>
<td>● GAMELEIRA</td>
<td>1.115</td>
</tr>
<tr>
<td>○ ENTRONCAMENTO</td>
<td>1.006</td>
</tr>
<tr>
<td>● CALAFATE</td>
<td>1.650</td>
</tr>
<tr>
<td>● CARLOS PRATES</td>
<td>1.678</td>
</tr>
<tr>
<td>● LAGOINHA</td>
<td>1.564</td>
</tr>
<tr>
<td>● CENTRAL</td>
<td>1.550</td>
</tr>
<tr>
<td>● SANTA EFIGÊNIA</td>
<td>1.047</td>
</tr>
<tr>
<td>● SANTA TERESA</td>
<td>1.677</td>
</tr>
<tr>
<td>● HORTO</td>
<td>1.846</td>
</tr>
<tr>
<td>● SANTA INÊS</td>
<td>1.364</td>
</tr>
<tr>
<td>○ JOSÉ C. SILVEIRA</td>
<td>1.793</td>
</tr>
<tr>
<td>○ MINAS SHOPPING</td>
<td>1.112</td>
</tr>
<tr>
<td>○ SÃO PAULO</td>
<td>1.020</td>
</tr>
<tr>
<td>○ DONA CLARA</td>
<td>1.380</td>
</tr>
<tr>
<td>○ HELIÓPOLIS</td>
<td>1.540</td>
</tr>
<tr>
<td>○ FLORAMAR</td>
<td>1.800</td>
</tr>
<tr>
<td>○ VILARINHO</td>
<td></td>
</tr>
</tbody>
</table>

● - Existing Stations  ○ - Proposed Stations
BRAZIL
BELO HORIZONTE METROPOLITAN TRANSPORT DECENTRALIZATION PROJECT

ENVIRONMENTAL AND TRAFFIC SAFETY COMPONENT

A. Background

1. This section describes the environmental and traffic safety component of the proposed project which includes:

   (a) the design of a vehicle inspection and maintenance program;
   (b) the development of a comprehensive traffic management and control program for the BHMR with emphasis on the area of influence of the STU-BH; and
   (c) the installation of a centralized traffic control system.

In addition, the proposed project includes studies and technical assistance to support improvements in motor vehicle emissions control and the development of an integrated transport/environmental strategy for the BHMR.

2. The electrification of the São Paulo - Vilarinho link would result in direct and indirect benefits concerning air quality. Direct benefits would result from the reduction in auto and bus traffic due to the new train links; the design of an inspection/maintenance program will set the foundations for the implementation of a comprehensive program which will be the first step towards curbing vehicle emissions in the BHMR. The development of a traffic management, control, and safety program would also have a beneficial effect on vehicle emissions and accidents especially in and around existing at-grade crossings which would be grade separated. Indirect air quality benefits would result from the development and implementation of an integrated transport and air quality strategy, and from strengthening of vehicle emissions planning, regulation and enforcement.

B. The Environmental Sub-Component

3. Inspection and maintenance (I/M) serves two purposes in a vehicle emissions control program. First, it helps to identify vehicles in which maladjustments or other mechanical problems are causing higher emissions than necessary. Second, it ensures that the emission control equipment on vehicles so equipped remains in place and operational, so that the emissions benefits of that equipment are realized. The first purpose applies mostly to older vehicles without emission controls; for emission-controlled vehicles, the second is much more important. An effective I/M program is essential to ensure that the emissions benefits projected for the adoption of new vehicle emissions standards are actually attained. The project finances the design of an I/M program and will recommend how the I/M program can be implemented through concessions to the private sector.

C. The Traffic Safety Program

4. The objective of the traffic management component is to design and put in place a number of traffic management and safety policies and investments which, when coupled with the rail and air quality component, will enhance the quality of public transport, reduce congestion, and greatly improve safety.

5. The Traffic management component of the proposed project would comprise the design of: (a) the Traffic Control subcomponent; and (b) the Traffic Safety subcomponent. They are described below in detail.
C1. The Traffic Control Subcomponent

6. **Semi-actuated Traffic Lights.** Electro-mechanical "old style" traffic light controllers make coordination among separate locations difficult without interconnections. In some locations the causes of accidents have been traced to this limitation. Such is the case, for example, with the intersection between a main road with high traffic volume and a very low volume secondary road, which however presents significant flows at peak periods. During off-peak hours, long periods of red for the main road, without a corresponding traffic flow from the side street, often prompt drivers to "go through" the red light, which will eventually lead to an accident. There are about 75 such locations across the city area, which require replacement of the existing traffic signal controller by a semi-actuated model, with loop detectors, which will be able to adequately handle demand variations throughout the day. Twenty other unsignalized intersections require implementation of semi-actuated traffic light systems, some with a cycle that will include phases to accommodate pedestrian crossing movements.

C2. The Traffic Safety Subcomponent

7. **Traffic Management and Safety.** An important objective of the project is to reduce congestion and improve safety. A new traffic signal system is proposed. However, a more definitive safety program needed to be defined to complement the on-going efforts of the Municipality. As a minimum, this program includes:

(a) a description of current safety activities;

(b) identification of most serious accident locations and their deficiencies, and selection of those to be included in the project;

(c) definition of a program to specifically address the high rate of pedestrian accidents;

(d) approximate costs and implementation schedule to correct the deficiencies in (b) and implement the program in (c). Identify the agency responsible for implementation of the program(s); and

(e) prepare designs for any civil work required.

This program is summarized in documents which were submitted to the Bank and the proposed component was based on that program.

C3. Policy Issues

8. The importance of appropriate policy measures to achieve the ultimate objective of reducing the rate of motorization in BHMR and consequent delays, pollution, and excessive use of fuel was emphasized by the Bank. BHTRANS will develop an action plan and TOR for studies which call for (among other issues identified in the appraisal process) the following:

(a) a parking policy and implementation plan which correctly charges for the use of valuable downtown space for "automobile storage" and provides a disincentive for people to drive to the central area rather than use public transport. This implies the need for a comprehensive, safe and comfortable public transport system into which the public and private sector are currently investing hundreds of millions of dollars. The action plan calls for specific
implementation of the recommendations of the parking plan by the third or fourth year of the project with some measures beginning earlier;

(b) pricing mechanisms which will ultimately be the only real deterrent to continued automobile traffic growth in the central area. Experience throughout the world indicates that the effect of metros is temporary if at all; the metro provides the alternative mode which allows appropriate pricing and provides some disincentive to drive into the central area. Without the ultimate achievement of a reduction in the growth of automobile traffic in the city, the investment in the metro is questionable. A pricing policy and plan of implementation is to be developed as part of the project, and implementation will begin as the metro is nearing completion; and

(c) frequently circulating vehicles (taxis, buses, government vehicles) contribute to pollution in the city and provide a controllable environment within which to test the value of alternative fuels as a measure of reducing harmful emissions. A pilot program using Compressed Natural Gas (CNG) will be developed and initiated, with the objective of testing the proposal of not allowing buses or taxis to operate in the city center unless they use clean-burning fuels.
INSTITUTIONAL DEVELOPMENT AND POLICY STUDIES

1. This Annex describes the studies and training to be undertaken as a basis for the policy and institutional development action plan. The studies will be divided in three categories: (a) studies which are only CBTU related; (b) studies to enhance modal integration; and (c) studies which examine the decentralization and financing mechanisms aspects. The training component should contribute to the skill upgrading of staff at all levels through recycling, as well as training in-house and abroad.

2. A list of the proposed studies and training is presented below. Draft Terms of Reference for each study were agreed at appraisal and were ready by negotiations.

A. CBTU Related Studies

3. Preparation and implementation of a manpower development and organization plan with staff rationalization. This study will review the organization of each of the new systems by functional area and as a whole. It will provide job descriptions for each of the main posts and a strategy to rationalize the staff. It will review the salary scale and benefits and, based on equivalent positions in the private sector, propose a new salary scale and a chronogram for its implementation. It will also define the training requirements and recycling to be undertaken under the training component. Finally, it will propose a new admissions policy based on the needs of the new companies.

4. Preparation of a cost accounting, tariff, management information systems, and financial management study. At this stage, it is clear that the existing systems need a good costing group which is capable of determining the long-run variable costs of the system and for that purpose separate the fixed costs from the variable costs. In addition, the accounting and finance directorate should be equipped with the required management information systems to allow a timely analysis of the costs. Finally, the Planning Department should be prepared to estimate and operate on a regular basis the tariff schedule, integrated tariffs, multi-trip tariffs, etc., using the information from the cost systems, information from the competitive modes, and socio-economic constraints.

5. Preparation of an action plan (and its implementation) to improve the management of stocks. The system should have a computerized inventory management which will allow internal control and prevent lack of spares due to poor programming. This action plan should be implemented soon and will contribute to better rolling stock availability.

6. Preparation of proposals to subcontract maintenance and other operations to the private sector. This study should examine the operational activities which could be subcontracted to the private sector at competitive prices (at least two competing sources) and indicate the staff reductions which can be achieved and potential operating savings if those activities are subcontracted.

7. Action and revenue plan through promotion of station space, advertising and real estate development on CBTU’s real estate and action plan for their implementation. This plan should indicate very clearly what are the non-operating revenues which each of the CBTU new systems can earn through promotion of station space, advertising and real estate development. The study should provide a detailed estimate of income and costs and suggest how the proposed plan should be implemented, i.e., in-house or through outside parties.
8. **Marketing STU-BH’s Image.** After the system is decentralized, management must undertake a marketing campaign to improve STU-BH’s image and attract new ridership. This study will discuss proposals to improve STU-BH’s image, the marketing plan to implement them, and the incentives to attract new ridership.

**B. Modal Integration Studies**

9. **A study to update the Transport portion of the Master Plan for BH with emphasis on route rationalization, modal and tariff integration.** The BHMR Master Plan should be updated to account for the BH Municipality Master Plan and recent changes in land use. Basic guidelines for the development of future systems must be prepared.

10. **Feasibility study and preliminary design of integration terminals in the BHMR, with identification of private sector participation.** Modal integration is one of the main priorities of this project. The lack of integration terminals has not facilitated modal integration. Exploration of integration terminals by the private sector may induce rerouting of buses to the railway stations, thereby reducing congestion. This study will examine main integration terminals in the BHMR and identify opportunities for their management by the private sector.

**C. Financing Mechanisms**

11. **Financing mechanisms study with recommendations on how to cover operating deficits and capital investment, action plan and chronogram for implementation.** This study will identify the financing mechanisms available and those proposed to cover the operating subsidies and capital investment requirements of STU-BH. Federal, State and Municipality contributions should be clearly identified. The study should make concrete recommendations and prepare a draft of Decrees to be discussed by the State legislature to provide the funds required. The study should also discuss how these funds should be allocated and the role of the RTCC in assigning these subsidies.

**D. Decentralization Studies**

12. **Preparation and implementation of a plan to hand over the subdivisions, including the legal, financial and institutional arrangements.** This study will produce a detailed action plan for the transfer of the CBTU subdivision to the State. In the action plan, all legal, financial and institutional arrangements to be undertaken at each step will be identified. Preparatory work, such as inventory of assets of the subdivision, will be done at this stage.

**E. Management Information Systems**

13. This component is intended to provide the new CBTU system with the basic software and hardware required to perform the needed accounting, financial management and planning functions.

**F. Training**

14. **Training will take place at all levels of the organization as proposed in the recommendations of the Manpower Development studies.** The training may consist of in-house, on-the-job training, or visits and courses abroad in specific areas.
G. Implementation Program

15. Policy and Institutional Development Action Plan:

(a) Decentralization Action Plan of the STU-BH System. In carrying out the decentralization of the system, CBTU and the State shall:

(i) no later than September 30, 1996 complete a study and an action plan for the transfer of the STU-BH system to the State. In the action plan, all legal, financial and institutional arrangements to be undertaken, as well as the inventory of assets of STU-BH, will be included (CBTU, State);

(ii) no later than September 30, 1996 complete a study which will determine the long-run variable costs of the STU-BH system, using the most appropriate methods available, and will propose the creation of a data base for more accurate costing and recommend a tariff system which is cost-based and takes into account modal integration and affordability issues (CBTU, State);

(iii) no later than October 31, 1996 complete a study and an action plan for the setting up of a cost accounting system and management information systems for the STU-BH system (State, CBTU);

(iv) no later than October 31, 1996 complete a study on the financing mechanisms required to cover operating deficits and capital investment and propose an action plan and chronogram for their implementation in the STU-BH system. Federal, State and Municipal contributions should be clearly identified (CBTU, State); and

(v) no later than October 31, 1996 complete the preparation of contract plans between STU-BH or its successors and the State. This study is intended to prepare a detailed contract plan document with basic performance and financial targets and note the obligations of each of the parties (State).

(b) Management Action Plan of the STU-BH System. In carrying out a management action plan to improve the performance of the system, CBTU and the State shall:

(i) no later than June 30, 1996 prepare and implement a manpower development and organization plan to streamline the management and operations staff in STU-BH, to propose concise job descriptions, and to staff them accordingly (State, CBTU);

(ii) no later than June 30, 1996 prepare and implement an action plan to improve the management of stocks for STU-BH which will include a computerized inventory management to improve internal control and prevent lack of spares due to poor programming (State, CBTU);

(iii) no later than December 31, 1996 prepare and implement an action plan to subcontract maintenance and other operations to the private
sector. This study should examine the operational activities which could be subcontracted to the private sector at competitive prices (at least two competing sources) and indicate the staff reductions which can be achieved and potential operating savings if those activities are subcontracted (State, CBTU);

(iv) no later than December 31, 1996 prepare and implement an action and revenue plan through promotion of station space, advertising and real estate development on the STU-BH. This plan should indicate clearly what are the non-operating revenues which STU-BH can earn through promotion of station space, advertising and real estate development. The study should provide a detailed estimate of income and costs and suggest how the proposed plan should be implemented, i.e., in-house or through outside parties (State); and

(v) no later than December 31, 1996 prepare an action plan to market the STU-BH. After the system is decentralized, management must undertake a marketing campaign to improve the STU-BH system’s image and attract new ridership. This study will discuss proposals to improve the system’s image, the marketing plan to implement them and the incentives to attract new ridership (State).

(c) **Modal Integration Action Plan of the STU-BH system.** In carrying out the modal integration component of the project, the CBTU and the State shall:

(i) no later than March 31, 1996 complete a study and plan of action to integrate STU-BH and the bus system. CBTU’s integration with the bus system is an objective already set by the State. This study will propose alternatives for the physical, organizational, and financial merger of the two systems. It will make recommendations to the State on how to proceed with the merger (State, CBTU); and

(ii) no later than December 31, 1996 complete a study to update a proposed master plan for integration of transport services in the BHMR (the Master Plan) with emphasis on route rationalization, modal and tariff integration. The Master Plan will be updated to emphasize the integration between buses and the rail system. If need be, an origin-destination traffic survey will also be included. Basic guidelines for the development of new systems and integration terminals must be outlined.

(d) **Training Action Plan of the STU-BH system.** In carrying out the training action plan of the project, the CBTU and the State shall:

(i) no later than June 30, 1996 initiate a training action plan at all levels of the STU-BH organization taking into account the recommendations of the manpower development and organization study.
BRAZIL
BELO HORIZONTE METROPOLITAN TRANSPORT DECENTRALIZATION PROJECT

DETAILED PROJECT COSTS, PROCUREMENT AND DISBURSEMENT ARRANGEMENTS

(see following pages)
<table>
<thead>
<tr>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost (US$)</th>
<th>Base Cost</th>
<th>Total Including Contingencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. LAND ACQUISITION</td>
<td>% 60% 40% 20%</td>
<td>4,600,000</td>
<td>1,664,000</td>
<td>967,024</td>
</tr>
<tr>
<td>2. CIVIL WORKS</td>
<td>% 40% 20% 10%</td>
<td>572,000</td>
<td>228,000</td>
<td>137,000</td>
</tr>
<tr>
<td>3. PERMANENT WAY</td>
<td>% 20% 10% 5%</td>
<td>1,800,000</td>
<td>720,000</td>
<td>450,000</td>
</tr>
<tr>
<td>4. SYSTEMS</td>
<td>% 10% 5% 2.5%</td>
<td>600,000</td>
<td>240,000</td>
<td>150,000</td>
</tr>
<tr>
<td>5. WORKSHOPS</td>
<td>% 5% 2.5% 1.25%</td>
<td>1,200,000</td>
<td>480,000</td>
<td>300,000</td>
</tr>
<tr>
<td>6. ROLLING STOCK</td>
<td>% 2.5% 1% 0.5%</td>
<td>300,000</td>
<td>120,000</td>
<td>75,000</td>
</tr>
<tr>
<td>7. STORES AND PROJECTS</td>
<td>% 0.5% 0.25% 0.125%</td>
<td>75,000</td>
<td>30,000</td>
<td>15,000</td>
</tr>
<tr>
<td>8. INVENTORY</td>
<td>% 0.125% 0.0625% 0.03125%</td>
<td>37,500</td>
<td>15,000</td>
<td>7,500</td>
</tr>
<tr>
<td>9. TOTAL BASE COST</td>
<td>% 52.63% 26.32% 13.16%</td>
<td>8,630,000</td>
<td>3,452,000</td>
<td>2,128,000</td>
</tr>
</tbody>
</table>

**Breakdown of Contingencies**

<table>
<thead>
<tr>
<th>Foreign</th>
<th>Local Cont.</th>
<th>Local Duties</th>
<th>Ph. For Tax</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5%</td>
<td>1.3%</td>
<td>2.0%</td>
<td>0.8%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

**Total Contingencies**

- 2.5% of Base Cost
- 1.3% of Local Cont. Cost
- 2.0% of Local Duties
- 0.8% of Ph. For Tax
- 0.0% of Parameters

**Construction Cost**

- 8,630,000
- 3,452,000
- 2,128,000
- 1,418,000

**Cost Distribution**

- 52.63% of Total Cost
- 26.32% of Total Cost
- 13.16% of Total Cost
- 0.8% of Total Cost
- 0.0% of Total Cost

**Table 9.1: Detailed Cost Estimates (US$ million)**
### Table 8.2: Allocation of Loan Proceeds (US$ millions)

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>AMOUNT OF THE LOAN ALLOCATED (EXPRESSED IN US$ EQUIVALENT)</th>
<th>% OF EXPENDITURES TO BE FINANCED</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) WORKS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Civil Works</td>
<td>45,000,000</td>
<td>65%</td>
</tr>
<tr>
<td>(b) Road Traffic Control System</td>
<td>3,500,000</td>
<td>65%</td>
</tr>
<tr>
<td>(c) Rolling Stock</td>
<td>1,000,000</td>
<td>65%</td>
</tr>
<tr>
<td>(d) Permanent Way and Systems</td>
<td>22,500,000</td>
<td>75%</td>
</tr>
<tr>
<td>(2) GOODS</td>
<td>6,500,000</td>
<td>100% of foreign expenditures and 100% of local expenditures (ex-factory cost) and 80% of local expenditures for other items procured locally</td>
</tr>
<tr>
<td>(3) CONSULTANT’S SERVICES AND TRAINING</td>
<td>5,500,000</td>
<td>100% of foreign expenditures</td>
</tr>
<tr>
<td>(a) Training Abroad</td>
<td></td>
<td>50% of local expenditures</td>
</tr>
<tr>
<td>(b) Training in Brazil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(c) Consultants</td>
<td></td>
<td>50% of local expenditures for services of consultants residing within the territory of the Guarantor and 100% of foreign expenditures for services of other consultants</td>
</tr>
<tr>
<td>(4) UNALLOCATED</td>
<td>15,000,000</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>99,000,000</td>
<td></td>
</tr>
</tbody>
</table>

### Table 8.3: Estimated Disbursements (US$ million)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual</td>
<td>13.0</td>
<td>25.5</td>
<td>30.0</td>
<td>18.0</td>
<td>7.5</td>
<td>5.0</td>
</tr>
<tr>
<td>Cumulative</td>
<td>13.0</td>
<td>38.5</td>
<td>68.5</td>
<td>86.5</td>
<td>94.0</td>
<td>99.0</td>
</tr>
</tbody>
</table>

*a/ Including initial deposits into the Special Accounts totaling US$6.0 million.
<table>
<thead>
<tr>
<th>IBRD FISCAL YEAR SEMESTER</th>
<th>ESTIMATED DISBURSEMENTS PER SEMESTER</th>
<th>ESTIMATED CUMULATIVE DISBURSEMENTS</th>
<th>ESTIMATED CUMULATIVE AS % OF TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>December 31, 1995</td>
<td>10.0</td>
<td>10.0</td>
<td>10</td>
</tr>
<tr>
<td>June 30, 1996</td>
<td>3.0</td>
<td>13.0</td>
<td>13</td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>December 31, 1996</td>
<td>8.0</td>
<td>21.0</td>
<td>21</td>
</tr>
<tr>
<td>June 30, 1997</td>
<td>17.5</td>
<td>38.5</td>
<td>39</td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>December 31, 1997</td>
<td>17.5</td>
<td>56.0</td>
<td>57</td>
</tr>
<tr>
<td>June 30, 1998</td>
<td>12.5</td>
<td>68.5</td>
<td>69</td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>December 31, 1998</td>
<td>12.5</td>
<td>81.0</td>
<td>82</td>
</tr>
<tr>
<td>June 30, 1999</td>
<td>5.5</td>
<td>86.5</td>
<td>87</td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>December 31, 1999</td>
<td>5.5</td>
<td>92.0</td>
<td>93</td>
</tr>
<tr>
<td>June 30, 2000</td>
<td>2.0</td>
<td>94.0</td>
<td>95</td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>December 31, 2000</td>
<td>2.0</td>
<td>96.0</td>
<td>97</td>
</tr>
<tr>
<td>June 30, 2001</td>
<td>3.0</td>
<td>99.0</td>
<td>100</td>
</tr>
</tbody>
</table>
### Table 8.5: Procurement Schedule for Major Contracts a/  

<table>
<thead>
<tr>
<th>Component</th>
<th>Contract Value (US$ '000)</th>
<th>Type of Contract</th>
<th>N° of Contracts</th>
<th>Type of Bidding</th>
<th>Documents Ready</th>
<th>Bids Prop. Invited</th>
<th>Contract Signature</th>
<th>Delivery of Goods b/</th>
<th>Initiation of Works</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CIVIL WORKS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Lot A</td>
<td>18,364</td>
<td>Works</td>
<td>1</td>
<td>ICB</td>
<td>1/96</td>
<td>2/96</td>
<td>5/96</td>
<td>6/96</td>
<td></td>
</tr>
<tr>
<td>* Lot B</td>
<td>21,229</td>
<td>Works</td>
<td>1</td>
<td>ICB</td>
<td>1/96</td>
<td>2/96</td>
<td>5/96</td>
<td>6/96</td>
<td></td>
</tr>
<tr>
<td>* Lot C</td>
<td>14,775</td>
<td>Works</td>
<td>1</td>
<td>ICB</td>
<td>1/96</td>
<td>2/96</td>
<td>5/96</td>
<td>6/96</td>
<td></td>
</tr>
<tr>
<td>* Lot D</td>
<td>11,193</td>
<td>Works</td>
<td>1</td>
<td>ICB</td>
<td>1/96</td>
<td>2/96</td>
<td>5/96</td>
<td>6/96</td>
<td></td>
</tr>
<tr>
<td>* Buildings</td>
<td>14,962</td>
<td>Works</td>
<td>1</td>
<td>ICB</td>
<td>11/95</td>
<td>12/95</td>
<td>3/96</td>
<td>4/96</td>
<td></td>
</tr>
<tr>
<td>* Viaducts</td>
<td>4,767</td>
<td>Works</td>
<td>1</td>
<td>ICB</td>
<td>11/95</td>
<td>12/95</td>
<td>3/96</td>
<td>4/96</td>
<td></td>
</tr>
<tr>
<td>* Road Traffic Control</td>
<td>7,883</td>
<td>Works</td>
<td>1</td>
<td>NCB</td>
<td>8/97</td>
<td>9/97</td>
<td>12/98</td>
<td>1/99</td>
<td></td>
</tr>
<tr>
<td>* Road Accesses</td>
<td>8,300</td>
<td>Works</td>
<td>1</td>
<td>ICB</td>
<td>7/96</td>
<td>8/96</td>
<td>12/96</td>
<td>1/97</td>
<td></td>
</tr>
<tr>
<td><strong>PERMANENT WAY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Superstructure</td>
<td>6,644</td>
<td>Supp./Works</td>
<td>1</td>
<td>ICB</td>
<td>5/96</td>
<td>6/96</td>
<td>9/96</td>
<td>10/96</td>
<td></td>
</tr>
<tr>
<td><strong>SYSTEMS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Electrification</td>
<td>5,205</td>
<td>Supp./Works</td>
<td>1</td>
<td>ICB</td>
<td>7/96</td>
<td>8/96</td>
<td>12/96</td>
<td>1/97</td>
<td></td>
</tr>
<tr>
<td>* Signaling</td>
<td>11,783</td>
<td>Supp./Works</td>
<td>1</td>
<td>ICB</td>
<td>1/96</td>
<td>2/96</td>
<td>5/96</td>
<td>6/96</td>
<td></td>
</tr>
<tr>
<td>* Telecommunication</td>
<td>2,802</td>
<td>Supp./Works</td>
<td>1</td>
<td>NCB</td>
<td>11/95</td>
<td>12/95</td>
<td>3/96</td>
<td>4/96</td>
<td></td>
</tr>
<tr>
<td><strong>WORKSHOPS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Light Equipments</td>
<td>3,902</td>
<td>Supply</td>
<td>Several</td>
<td>ICB</td>
<td>6/95</td>
<td>7/95</td>
<td>10/95</td>
<td>11/95</td>
<td></td>
</tr>
<tr>
<td>* Heavy Equipments</td>
<td>4,171</td>
<td>Supply</td>
<td>Several</td>
<td>ICB</td>
<td>6/95</td>
<td>7/95</td>
<td>10/95</td>
<td>11/95</td>
<td></td>
</tr>
<tr>
<td><strong>ROLLING STOCK</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Refurbishment of EMUs</td>
<td>1,745</td>
<td>Supp./Works</td>
<td>1</td>
<td>NCB</td>
<td>8/95</td>
<td>9/95</td>
<td>12/95</td>
<td>1/96</td>
<td></td>
</tr>
<tr>
<td>* Assembling of EMUs</td>
<td>23,128</td>
<td>Supply</td>
<td>1</td>
<td>ICB</td>
<td>6/95</td>
<td>7/95</td>
<td>11/95</td>
<td>12/95</td>
<td></td>
</tr>
<tr>
<td><strong>TECH. ASSISTANCE</strong></td>
<td>13,475</td>
<td>Services</td>
<td>Several</td>
<td>Other c/</td>
<td>6/95</td>
<td>6/95</td>
<td>9/95</td>
<td>10/95</td>
<td></td>
</tr>
</tbody>
</table>

a/ Of items to be financed under the Bank Loan.
b/ Start of delivery.
c/ Bank's Guidelines for Selection of Consultants.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - LAND EXPROPRIATION</td>
<td>2,068</td>
<td>2,113</td>
<td>1,083</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5,264</td>
</tr>
<tr>
<td>2- CIVIL WORKS</td>
<td>11,859</td>
<td>37,509</td>
<td>33,309</td>
<td>12,502</td>
<td>3,832</td>
<td>2,417</td>
<td>101,528</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot A</td>
<td>2,464</td>
<td>7,124</td>
<td>6,005</td>
<td>2,771</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot B</td>
<td>3,081</td>
<td>9,805</td>
<td>7,367</td>
<td>976</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot C</td>
<td>2,141</td>
<td>6,665</td>
<td>5,069</td>
<td>900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot D</td>
<td>1,465</td>
<td>4,457</td>
<td>3,823</td>
<td>1,448</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buildings</td>
<td>2,052</td>
<td>4,678</td>
<td>4,748</td>
<td>3,484</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14,962</td>
</tr>
<tr>
<td>Viaducts</td>
<td>606</td>
<td>1,884</td>
<td>1,448</td>
<td>779</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4,767</td>
</tr>
<tr>
<td>Road Traffic Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,534</td>
</tr>
<tr>
<td>Road Accesses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3,932</td>
</tr>
<tr>
<td>4 - PERMANENT WAY</td>
<td>2,917</td>
<td>4,487</td>
<td>7,665</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15,069</td>
</tr>
<tr>
<td>Superstructure</td>
<td>1,286</td>
<td>1,978</td>
<td>3,380</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6,644</td>
</tr>
<tr>
<td>Materials</td>
<td>1,631</td>
<td>2,509</td>
<td>4,285</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8,425</td>
</tr>
<tr>
<td>5 - SYSTEMS</td>
<td>241</td>
<td>2,624</td>
<td>5,461</td>
<td>5,658</td>
<td>7,383</td>
<td>3,231</td>
<td>3,310</td>
<td>27,908</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrification</td>
<td>920</td>
<td>2,460</td>
<td>1,557</td>
<td>2,129</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7,066</td>
</tr>
<tr>
<td>Substations</td>
<td>920</td>
<td>941</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,861</td>
</tr>
<tr>
<td>Signaling</td>
<td>1,458</td>
<td>2,244</td>
<td>3,066</td>
<td>3,929</td>
<td>2,416</td>
<td>2,475</td>
<td>15,588</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Catenary</td>
<td>1,102</td>
<td>1,696</td>
<td>2,318</td>
<td>2,970</td>
<td>1,826</td>
<td>1,871</td>
<td>11,783</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Substations</td>
<td>356</td>
<td>548</td>
<td>748</td>
<td>959</td>
<td>590</td>
<td>604</td>
<td>3,805</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3 - TELECOMMUNICATIONS</td>
<td>241</td>
<td>246</td>
<td>757</td>
<td>1,035</td>
<td>1,325</td>
<td>815</td>
<td>835</td>
<td>5,254</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable &amp; Radio Network</td>
<td>241</td>
<td>103</td>
<td>175</td>
<td>204</td>
<td>167</td>
<td>238</td>
<td>404</td>
<td>1,532</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Address &amp; Clock Systems</td>
<td>12</td>
<td>49</td>
<td>92</td>
<td>105</td>
<td></td>
<td></td>
<td></td>
<td>258</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ticketing Control System</td>
<td>131</td>
<td>533</td>
<td>739</td>
<td>1,053</td>
<td>346</td>
<td></td>
<td></td>
<td>2,802</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telephone Central Station</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>231</td>
</tr>
<tr>
<td>6 - WORKSHOPS</td>
<td>780</td>
<td>780</td>
<td>4,855</td>
<td>1,658</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8,073</td>
</tr>
<tr>
<td>6.1 - Light Equipments</td>
<td>480</td>
<td>369</td>
<td>2,276</td>
<td>777</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3,902</td>
</tr>
<tr>
<td>Lot 1</td>
<td>70</td>
<td>70</td>
<td>439</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>729</td>
</tr>
<tr>
<td>Lot 2</td>
<td>292</td>
<td>299</td>
<td>1,837</td>
<td>627</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3,055</td>
</tr>
<tr>
<td>Lot 3</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>59</td>
</tr>
<tr>
<td>Lot 4</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Lot 5</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>47</td>
</tr>
<tr>
<td>6.2 - Heavy Equipments</td>
<td>300</td>
<td>411</td>
<td>2,579</td>
<td>881</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4,171</td>
</tr>
<tr>
<td>Lot 1</td>
<td>120</td>
<td>742</td>
<td>254</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,116</td>
<td></td>
</tr>
<tr>
<td>Lot 2</td>
<td>300</td>
<td>291</td>
<td>1,837</td>
<td>627</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3,055</td>
</tr>
<tr>
<td>7 - ROLLING STOCK</td>
<td>4,488</td>
<td>7,743</td>
<td>12,642</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24,873</td>
</tr>
<tr>
<td>Refurbishment of EMUs</td>
<td>4,488</td>
<td>862</td>
<td>863</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,745</td>
</tr>
<tr>
<td>Assembling of EMUs</td>
<td>4,488</td>
<td>862</td>
<td>863</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,745</td>
</tr>
<tr>
<td>8 - TECHNICAL ASSISTANCE</td>
<td>1,784</td>
<td>4,045</td>
<td>3,179</td>
<td>2,366</td>
<td>1,147</td>
<td>643</td>
<td>311</td>
<td>13,475</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervision</td>
<td>214</td>
<td>1,031</td>
<td>1,744</td>
<td>1,630</td>
<td>528</td>
<td>326</td>
<td>149</td>
<td>5,622</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T.A. &amp; Studies</td>
<td>1,570</td>
<td>3,014</td>
<td>1,435</td>
<td>736</td>
<td>619</td>
<td>317</td>
<td>162</td>
<td>7,853</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 - TRAINING</td>
<td>337</td>
<td>459</td>
<td>354</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,150</td>
</tr>
<tr>
<td>Travel &amp; Expenses</td>
<td>101</td>
<td>138</td>
<td>106</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>345</td>
<td></td>
</tr>
<tr>
<td>Consultants</td>
<td>236</td>
<td>321</td>
<td>248</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>805</td>
<td></td>
</tr>
<tr>
<td>TOTALS</td>
<td>9,698</td>
<td>32,540</td>
<td>69,570</td>
<td>50,656</td>
<td>21,032</td>
<td>7,806</td>
<td>6,038</td>
<td>197,340</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(US$ million)
ECONOMIC EVALUATION

A. Background

1. A standard cost-benefit analysis was performed to evaluate the economic impact of the implementation of the proposed infrastructure and equipment component (Eldorado - Vilarinho link), which represents 98 percent of the total proposed project. This Annex describes the demand analysis and the set of benefits and costs that have been considered in the economic evaluation, as well as the assumptions adopted regarding key inputs, such as the value of time. Direct user benefits include travel time, operating cost savings, and the investments avoided due to the proposed project; indirect benefits arise from the reduction of negative externalities (accident and air pollution costs). Investment costs comprise civil works, land expropriation, operational systems, rolling stock and project studies. Both benefits and costs are defined as incremental compared to the situation without the project. Throughout the analysis, and for illustrative purposes, the proposed investments were evaluated with and without the accident and air pollution externalities. A more detailed description of the data and assumptions supporting the economic evaluation summarized in this annex can be found in Reports 8 and 9 in the Project Files.

2. This economic evaluation estimates the discounted expected present value of the infrastructure investment’s net benefits, the expected internal economic rates of return, as well as the expected benefit/cost ratios for a set of discount rates, which includes the 10 percent discount rate, which has been defined by SEAIN (Secretary of Planning for the Federative Republic of Brazil), as well by its Commission of External Financing (COFEX) for the project appraisal of foreign investments. In addition, the sensitivity analysis included in this annex provides an idea of how the economic rates of return would change due to deviations from the value of benefits and costs used in the base case. The analysis is then complemented by a table of impacts of the project which are evaluated on a qualitative basis.

B. Choice of a Project Base Case

3. Mass Transit Options. Following current Bank policy recommendations for the appraisal of mass transit investments contained in the Urban Transport Policy Paper (World Bank, 1986) the proposed investments were compared against two total segregated busways with regular buses and a total segregated busways with articulated buses. In all cases, the analyses showed that the proposed investments had a higher internal rate of return.

C. Demand Analysis

4. Current Demand Levels. The peak-hour demand levels in the main avenues in the area of influence of the system in 1994 were: (a) Cristiano Machado, 10,500 bus passengers/hour/inbound; (b) Antonio Carlos, 16,600 bus passengers/hour/inbound; and (c) Amazonas, 7,850 bus passengers/hour/inbound.
Demand Modelling

5. The demand estimates used in the economic evaluation are the result of a simulation of the Belo Horizonte Metropolitan Region transport network, performed with the Mantra System microcomputer program. The urban transport demand model used by this program is a classical aggregate four-stage transport planning model, which comprises trip generation, trip distribution, modal split, and trip assignment. This model estimates peak (6 hours) and off-peak (10 hours) periods of public transport demand, which are assigned to bus and Metro lines.

6. The model Mantra is integrated with a Geographic Information System, GisPlus. In order to use the model, it was necessary to create a GIS database for Belo Horizonte Metropolitan Region, which comprises a Zoning layer and a Transport network layer (made up of line and node layers). To develop the databases for the demand study, the team benefitted by the existence of existing GIS software (APIC), managed by the municipality of Belo Horizonte.

7. The zoning system adopted is based in the BH sub-regions, which were defined in the Belo Horizonte Urban Development Plan and are already defined in the BH/APIC.GIS system. This layer was exported by APIC and then imported by MANTRA.

8. The present demand study used as primary data the 1993 Origin/Destination (OD) survey performed by BHTRANS in all the bus lines in the BHMR. With the data, public transport demand is available on a daily/hourly basis. Initially the OD survey was processed for each bus line. The breakdown into peak and off-peak periods was done using information from BHTRANS. This authority also provided information for each bus line on the number of passenger being transported per hour of day. Peak hour periods considered were the following: 06:00 a.m. to 09:00 a.m. and 16:00 p.m. to 19:00 p.m. The number of trips in this period corresponds to 48 percent of the weekday ridership.

9. The OD matrix breakdown into trip purposes was based in a survey carried out by CBTU/Belo Horizonte, showing that 80 percent of trips are commuting and business and 20 percent are related to other trip purposes.

10. The steps in the demand modelling exercise were:

   (a) **Trip Generation.** This step consists of the estimation of the number of trips which will be produced by and attracted to the area of influence of the projects considered in the study. In the present study it was conservatively assumed that the 1993 OD matrix is a good estimate up to the year 2001. After this year, a yearly demand increase of 1 percent per year was considered. Car and walking trips were not considered at all.

   (b) **Trip Distribution.** This step consists of the determination of the origin zone and destination zone for each trip based on the types of trips produced by and attracted to each zone and the interzonal "impedance" values (typically travel times). Also in this case there is the assumption of using the current matrix as an estimate up to the year 2001.

---

4/ Mantra Computer System was developed by Logit - Logística Informática e Transportes, Brazil, and SDG - Steer Davies Gleave, England.

5/ GisPlus is a Geographic Information System developed by Caliper Corporation, USA.
Modal Choice consists of the calculation of which trips will use the bus network and the metro system. The Mantra model allows the competition between single modes and combined modes. The modal choice model used is the multinomial Logit model. It is important to point out that for each zone pair of interest, for the area of influence of the Metro line, there will always be competition between bus and metro+bus. The model utility functions considered the same values of travel time used in the economic evaluation.

Trip assignment consists of the "loading" of the passenger trips onto the multi-modal public transport network. The method used to assign the trips made within each model, is the "all or nothing" procedure, with no capacity restraint iterations. The reason for this is the fact that car trips were not considered in the present transport demand modelling exercise.

The model was applied for the situation "without" and "with" the project, in both cases using the Vilarinho - Eldorado link. The outputs obtained from the application of the model are the number of trips, passenger-kms and passenger-hours by each individual mode: bus and metro. By running the model for the situation "without" and "with," data were obtained on the additional trips in the metro mode, and also the decrease in bus trips which result from the construction of the proposed projects. The following paragraphs summarize the situation "without" and "with" project for the above link and the results in terms of passenger-trips, passenger-kilometers, passenger-hours and average speeds are summarized below:

(a) Situation "Without Project" (Year 2001). The main traffic characteristics of the study area in the situation "without" the project on a daily basis are: average peak-hour bus speeds of 16.01 km/hour with a total of 1,565,597 passengers, with 16,251,083 passenger-kms generated by bus trips with origins or destinations in the BHMR. The corresponding number of passenger hours is 777,758. The metro trips generated for daily origins/destinations in the study area a total of 113,895 passengers with 924,520 passenger-kms, corresponding to 21,132 passenger-hours. The transit modal choice in terms of trips generated by the study area would be 93.2 percent bus, and 6.8 percent metro.

(b) Situation "With Project" (Year 2001). On a daily basis, the average peak-hour bus speeds in the study area would rise to 16.26 km/h and daily demand for bus transportation would go down to 1,356,656 passengers with 14,189,262 passenger-kms and 852,599 passenger-hours. The daily demand for metro trips in the study area (with Eldorado - Vilarinho Link) will go up to a total of 322,832 passengers with 3,102,015 passenger-kms and 70,903 passenger-hours. The transit modal choice will then be, in terms of passenger-kms, 80.8 percent bus, 19.2 percent metro.

The demand estimates for the metro line in the year 2001 indicate: (a) a peak-hour inbound volume of about 16,201 passengers; (b) a peak-hour outbound volume of 4,291 passengers; (c) a total of about 2,033,841 week-day boardings; and (d) an annual ridership of more than 104 million passengers.
Table 9.1: Demand Levels in the Metro Line (Eldorado-Vilarinho)

<table>
<thead>
<tr>
<th></th>
<th>Year 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak-Hour Inbound Passengers</td>
<td>16,209</td>
</tr>
<tr>
<td>Peak-Hour Outbound Passengers</td>
<td>4,291</td>
</tr>
<tr>
<td>Average Weekday Boardings</td>
<td>322,832</td>
</tr>
<tr>
<td>Average Annual Ridership</td>
<td>104,597,568</td>
</tr>
</tbody>
</table>

D. Benefits

Value of Time

13. Mass transit projects can hardly be economically justified without accounting for the real resource savings that economies of time represent. The monetary value of time by which the time savings are multiplied to obtain the benefits from time savings is a key input in the economic evaluation of the infrastructure components of this project. Individual values of time are traditionally considered to be a function of income, in particular a function of the individual wage level. Thus, the value of time used in the calculation of time savings is derived from the income distribution of users, disaggregated by transport mode and trip purpose, and from information on wage levels. Table 9.2 shows the income of public transport users in the zone of influence of the STU-BH and is disaggregated by mode. The information was obtained from the Bus and CBTU surveys of their users conducted in 1993.

14. The base minimum wage used was R$70 which at the shadow price of foreign exchange of 1 is equivalent to US$70. From this minimum wage base, the value of fringe benefits was considered separate from payroll taxes. Fringe benefits in Brazil include vacation and the 13th month of salary; both entail scaling the base salary by a factor of 1.25. Commuting and other purpose trips are valued as a proportion of net wages. This implies subtracting direct taxes paid by the employee from the base wage, which includes fringe benefits. The employee is subject to a payroll tax that varies between 8 percent and 10 percent. In addition, the income tax should be subtracted. By assuming that one-third of passengers are not tax-exempt and do not evade taxes, the net wage deflating factor will be in the 0.92-0.88 range. An average factor of 0.9 was used. Business trips are valued at gross wages, where fringe benefits and payroll taxes are taken into account. Payroll taxes in Brazil vary between 38 percent and 45 percent and about 35 percent are paid by the employer. By combining fringe benefits and employer contribution on payroll taxes, the base wage must be scaled by a factor of 1.60 (1.25 plus 0.35).

15. Hourly wages for each transport mode users are estimated by multiplying the individual wage (in minimum wages) by the value of the minimum wage and dividing the result by 157, the assumed average number of hours worked in a given month. Common practice in the appraisal of urban transport projects is to use a proportion of the hourly wage rate to approximate the value of time saved. This proportion as well as the wage rate base chosen for the calculation—whether gross or net wages—depend on the type of trip. Three types of trip can be distinguished for the purposes of the analysis: home-to-work trips (or commuting trips), work-related trips (or business trips), and non-work related trips (or other trips), for example shopping or visiting the doctor. Economic theory indicates that both commuting trips and other trips should be valued as a proportion of the net wage. Empirical evidence suggests that this proportion may vary between 20 and 100 percent. The value adopted in the economic evaluation was a value of 17.5 percent based on a study undertaken a few years ago for a similar city of the northeast with the same type of population. A 20 percent value was tested as part of the sensitivity analysis. Economic theory also indicates that business trips during working hours
be valued at 100 percent of the gross wage rate.\textsuperscript{5} The resulting values of time used in the economic evaluation are summarized in Table 9.3 and the proportion of passenger-hours spent travelling by type of trip is summarized in Table 9.2.

**Direct Benefits**

16. Direct benefits estimated in the economic evaluation are travel time savings, operating cost savings, bus system control savings, and road maintenance cost savings:

(a) **Travel time savings** result mainly from the transfer of bus passengers into the new lines, and from existing metro and rail passengers who can save time in their trips by taking advantage of the new transport facility. Travel time savings also result from the increased operating speeds of the buses that continue operation and, to a lesser extent, of car traffic. The program used to model the demand works with an origin-destination matrix where the number of trips is fixed. The number of "legs" comprising those trips may vary. When the new link is introduced in the network, the modal split is affected and some trip itineraries change. Thus, the demand model estimates the diverted demand, but it does not estimate the so-called generated demand, that is, the additional trips that will be potentially generated throughout the BHMR, but particularly in the corridors directly affected by the investment. Omission of generated demand yields a conservative level of demand and, consequently, results in a lower rate of return. Travel time savings are measured for each mode by the difference between the total number of morning peak passenger-hours spent without the project and those spent with the project. These peak-hour estimates are converted to annual values and then multiplied by the assumed value of time to obtain a monetary value of time savings. The net change in travel time across the four modes is considered to be the overall measure of the travel time savings:

\[
\{[(\text{Pass-hr (w/o)} - \text{Pass-hr (w)}) \times \text{VoT} \times \text{PHF} \times \text{ND}] \div 1,000, \text{ where Pass-hr are passenger-hours, VoT is the value of time, PHF is the peak-hour factor, and ND is the number of operating days in a year.}
\]

(b) **Operating cost savings** for the non-rail modes derive principally from the improved commercial and traffic speeds, which can be achieved by buses and cars, respectively. Operating cost savings are measured for each mode by the difference between the morning peak passenger-kilometers carried without the project and those carried with the project. All trips were considered irrespective of their purpose. These peak-hour estimates are converted to annual values and then multiplied by the assumed values of operating cost per passenger-kilometer for each mode to obtain a monetary value of operating cost savings. The net change in operating costs across the four modes is considered to be the overall measure of operating cost savings. Operating cost savings include wages and salaries, materials, energy and general expenditures. An alternative method to estimate these savings was to calculate the actual number of buses

\textsuperscript{5} In developed countries, estimates of the value of time for journey to work ranges from 20 to 100 percent of the gross wage rate. A recent review of the literature concludes that a reasonable average value of time for journey to work is 50 percent of the gross wage rate. See Kenneth Small, *Urban Transportation Economics*, Harwood Academic Publishers 1992; page 44.
eliminated at peak hour due to the construction of the line and estimate the savings due to the elimination of the buses and reduction in bus kilometers produced. Table 9.3 shows the calculations used.

\[
\frac{\{\text{Pass-km (w/o)} \times \text{OC (w/o)}\} - \{\text{Pass-km (w)} \times \text{OC (w)}\} \times \text{PHF} \times \text{ND}}{1,000}
\]

where OC are operating costs per passenger-kilometer.

(c) **Bus system control cost savings** depend critically on the reduction of the bus vehicle fleet, which is assumed to follow from the reduction in bus patronage after the metro line opens. Bus system control cost savings are measured by a given percentage (8 percent) of bus operating costs.

(d) **Road maintenance cost savings** derive from the possibility of delaying periodic maintenance mainly because of reduced bus traffic on the corridors under consideration. The benefits from reduced vehicle operating costs resulting from reduced pavement damage are not considered.

\[
\frac{\{\text{Pass-km (w/o)} - \text{Pass-km (w)}\} \times \text{RMC} \times \text{PHF} \times \text{ND}}{1,000}
\]

where RMC are road maintenance cost savings per passenger-kilometer.

**Indirect Benefits**

17. Indirect benefits arise from the reduction in externalities, such as accidents and air pollution:

(a) **Accident cost savings** are measured for each mode by the difference between the morning peak passenger-kilometers carried without the project and those carried with the project. These peak-hour estimates are converted to annual values and then multiplied by the assumed values of accident costs per 1,000 passenger-kilometer for each mode to obtain a monetary value of accident cost savings. The net change in accident costs across the four modes is considered to be the overall measure of accident cost savings. Accident costs include property damage, injuries and loss of life.

\[
\frac{\{(\text{Pass-km (w/o)} - 1,000) - (\text{Pass-km (w)} - 1,000)\} \times \text{ACC} \times \text{PHF} \times \text{ND}}{1,000}
\]

where ACC are accident cost savings per 1000 passenger kilometer.

(b) **Air pollution cost savings** are measured for bus and cars by the difference between the morning peak passenger-kilometers carried without the project and those carried with the project. These peak-hour estimates are deflated by the average vehicle occupancy (to obtain costs per vehicle-kilometer) then converted to annual values, and finally multiplied by the assumed values of air pollution costs per vehicle-kilometer to obtain a monetary value of air pollution cost savings. The air pollution factor (US$/gram) of emission reduction represents the total health and welfare benefits associated with the reduced pollution emissions resulting from the proposed investments. Health benefits include reduced morbidity and mortality whereas welfare benefits include the reductions in soiling and corrosion of buildings and other structures. The net change in air pollution costs in the bus and car modes is considered to be the overall measure of air pollution cost savings. The set of air pollutants considered include carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx), sulphur oxides (SOx) and fine particulate matter (PM10).
ANNEX 9

{[(Pass-km (w/o) - Pass-km (w)) x APC x PHF x ND) ÷ AOF} ÷ 1,000 x where APC are air pollution cost savings per passenger-kilometer and AOF is the average vehicle occupancy factor.

E. Costs

18. **Investment Costs.** Investment cost components were grouped for the economic evaluation into land expropriations, civil works, operating systems, rolling stock, and costs of projects and studies. Annex 8 contains a detailed breakdown of the capital cost structure. To obtain the economic cost stream for both links, taxes were subtracted from the total costs (including physical and price contingencies) shown in Annex 8 and multiplied by a shadow value factor of 0.9.

19. **Operating Costs.** The incremental operating costs due to the investments are wages and salaries, materials, energy and general expenditures (e.g., auditing, legal costs, transport, and cleaning services).

20. **Discount Rate.** In calculating the net present value for the underground and rail integration components of the project a discount rate must be selected which represents the opportunity cost of capital in Brazil. The discount rate used as "benchmark" by SEAIN (Secretary of Planning) for foreign investments, as well as COFIEX (Commission of External Financing) is 10 percent.

F. Results of Economic Evaluation

21. Internal economic rates of return (IERR), net present values (NPV), and Benefit/Cost ratios (B/C) were calculated. The assumed project life is 25 years. Residual values were estimated at the end of the project life for the civil works, operating systems and rolling stock. These residual values were calculated following CBTU accounting procedures that assume a linear depreciation rate, which vary according to the expected operational life of the components.

Distribution of Costs and Benefits

22. Table 9.5 shows the annual series of expected benefits and costs for the proposed project in the base case scenario.

Net Present Values

23. The discounted expected present value of benefits for both investments net of costs, are positive in the relevant range, which includes the discount rate of 10 percent are given in Table 9.5.

Internal Economic Rates of Return

24. The estimated IERR for the base case is given in Table 9.5.

First-year Benefit Test

25. A "first-year" benefit test was performed to assess whether the investments are premature. Tables 9.7 show the results of the test for discount rates of 10 percent and 12 percent. For both discount rates the proposed investments have benefits larger than the rate of discount multiplied by the net present value of total investment costs in the planned year of start-up of operations. This suggests that there are no additional net benefits to be gained if the implementation of the project is delayed from the schedule assumed in the base case scenario.
Sensitivity Analysis

26. A sensitivity analysis was performed to estimate the variance of the IERR in relation to the calculated value (base case) if deviations occur in the major benefit and cost components (travel time savings, operating cost savings, wages and salaries, general expenditures, investment costs). Table 9.6 shows the results.

Qualitative Analysis of the Infrastructure and Equipment Component

27. Table 9.8 is an impact matrix which summarizes the impact of the proposed investment on a number of aspects which could not be quantified in the standard benefit cost analysis.
Table 9.2: Basic Inputs Eldorado - Vilarinho

### PRELIMINARY ECONOMIC EVALUATION OF THE BELO HORIZONTE CBTU PROJECT

#### BASIC INPUTS

<table>
<thead>
<tr>
<th>Basic Inputs</th>
<th>BELO HORIZONTE</th>
<th>IRR = 31.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak-hour factor (HOURS)</td>
<td>work</td>
<td>other</td>
</tr>
<tr>
<td>Metro</td>
<td>10.98</td>
<td>10.98</td>
</tr>
<tr>
<td>Rail</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>Bus</td>
<td>13.03</td>
<td>13.03</td>
</tr>
<tr>
<td>Auto</td>
<td>12.87</td>
<td>12.87</td>
</tr>
<tr>
<td>Peak-hour factor (VEHICLE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metro</td>
<td>10.98</td>
<td>10.98</td>
</tr>
<tr>
<td>Rail</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>Bus</td>
<td>13.03</td>
<td>13.03</td>
</tr>
<tr>
<td>Auto</td>
<td>12.87</td>
<td>12.87</td>
</tr>
</tbody>
</table>

#### Year 1994 (peak hour) BASICA4

<table>
<thead>
<tr>
<th>Year 1994 (peak hour) BASICA4</th>
<th>METRO</th>
<th>RAIL</th>
<th>BUS</th>
<th>AUTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASS-HOURS Work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without/p</td>
<td>1624.6</td>
<td>79484.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With/p</td>
<td>8015.2</td>
<td>67322.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net change</td>
<td>4380.4</td>
<td>-12152</td>
<td>-7761.6</td>
<td></td>
</tr>
<tr>
<td>Other Without/p</td>
<td>406.2</td>
<td>19871.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With/p</td>
<td>1503.3</td>
<td>16833.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net change</td>
<td>1097.6</td>
<td>-3038</td>
<td>-1940.4</td>
<td></td>
</tr>
<tr>
<td>PASS-KMS Work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without/p</td>
<td>71086.4</td>
<td>1272797.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With/p</td>
<td>263148.8</td>
<td>1094648.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net change</td>
<td>192062.4</td>
<td>-178148.8</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Operating costs (w/o)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metro</td>
<td>0.043347</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rail</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating costs (w/with)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metro</td>
<td>0.046114</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rail</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accident costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metro</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rail</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs of air pollution</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus</td>
<td>1/8 OF SP</td>
<td>0.0084608</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto (includes ALC, FLEET)</td>
<td>1/8 OF SP</td>
<td>0.019876</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**NOTE:** Auto volumes were not used although auto speeds will increase with the project increasing therefore the time savings and reducing operating costs. The model used tested only the demand between buses and the metro and therefore the benefits are conservative.
Table 9.3: Estimation of Buses Saved With and Without Eldorado - Vilarinho

<table>
<thead>
<tr>
<th>Hours of oper./day</th>
<th>peak</th>
<th>off-peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>WITHOUT PROJECT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pass-km</td>
<td>1,520,997</td>
<td>670510</td>
</tr>
<tr>
<td>Pass-hr</td>
<td>99,356</td>
<td>38170</td>
</tr>
<tr>
<td>Speed</td>
<td>18.01</td>
<td>24.24</td>
</tr>
<tr>
<td>Pass-hr/3</td>
<td>596,136</td>
<td>381699</td>
</tr>
<tr>
<td>Pass/bus</td>
<td>48</td>
<td>40</td>
</tr>
<tr>
<td>Bus-hr/3</td>
<td>12,420</td>
<td>9542</td>
</tr>
<tr>
<td>Bus-km/3</td>
<td>198,875</td>
<td>231279</td>
</tr>
<tr>
<td>Bus-km/hr/3</td>
<td>33,146</td>
<td>23128</td>
</tr>
<tr>
<td>Buses/3</td>
<td>2,070</td>
<td>3954</td>
</tr>
</tbody>
</table>

| WITH PROJECT      |      |          |
| Line and Formula  | peak | off-peak |
| Hours of oper     | 17   | 6        |
| Pass-km           | 18   | =L13+L16 | 1,368,311 |
| Pass-hr           | 19   | =L4+L7   | 84,186    |
| Speed             | 20   | =B18/B19 | 18.26     |
| Pass-hr/3         | 21   | =B19*B17 | 504,998   |
| Pass/bus          | 22   | 48       | 48        |
| Bus-hr/3          | 23   | =B21/B22 | 10,521    |
| Bus-km/3          | 24   | =B23*B20 | 171,039   |
| Bus-km/hr/3       | 25   | =B24/B17 | 28,506    |
| Buses/3           | 26   | 1,753    |
| Factors           | 27   |          |
| Pass-hr           | 28   | 12.97    |
| Bus-km/3          | 29   | 13.03    |
| Totals            | 30   |          |
| Pass-hr/3         | 31   | 1083216  |
| Bus-km/3          | 32   | 371439   |
| Bus-km/bus-yr     | 33   | 69259    |
| Off-peak          | 34   |          |
| Hours             | 35   | 10       |
| Pass-km/hr/3      | 36   | 597940   |
| Pass-hr/hr/3      | 37   | 35812    |
| Speed             | 38   | 16.70    |
| Pass-hr/3         | 39   | 178816   |
| Pass/bus          | 40   | 40       |
| Bus-hr/3          | 41   | 4465     |
| Bus-km/3          | 42   | 74558    |
| Bus-km/hr/3       | 43   | 74558    |
| Buses/3           | 44   | 447      |

<table>
<thead>
<tr>
<th>km/hr</th>
<th>peak</th>
<th>off-peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of buses</td>
<td>w/o</td>
<td>16.01</td>
</tr>
<tr>
<td>Without project</td>
<td>with</td>
<td>16.26</td>
</tr>
<tr>
<td>With project</td>
<td>1753</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>318</td>
<td></td>
</tr>
<tr>
<td>Fixed cost per bus-year</td>
<td>44,420</td>
<td>peak</td>
</tr>
<tr>
<td>Inflation</td>
<td>1,000</td>
<td>w/o</td>
</tr>
<tr>
<td>Fixed cost savings</td>
<td>$14,057,079</td>
<td>with</td>
</tr>
<tr>
<td>Operating cost savings</td>
<td>$10,453,876</td>
<td></td>
</tr>
<tr>
<td>Total annual cost savings</td>
<td>$24,510,955</td>
<td>w/o</td>
</tr>
<tr>
<td>$m total</td>
<td>11.21</td>
<td></td>
</tr>
<tr>
<td>MAR 28, 1995</td>
<td>with</td>
<td>9.37</td>
</tr>
<tr>
<td>Operating costs based on hdm relations</td>
<td>diff</td>
<td>-1.85</td>
</tr>
</tbody>
</table>

Operating costs based on hdm relations
### Table 9.4: Estimation of Other Benefits Eldorado - Vilarinho

**Benefits (US$ 1000)**

<table>
<thead>
<tr>
<th>Mode</th>
<th>House Size (m²)</th>
<th>House Size (m²)</th>
<th>Wage Rate (w/h)</th>
<th>Hours/Week</th>
<th>Hours/Month</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BUS</strong></td>
<td>2,183.00</td>
<td>12.50</td>
<td>2.163</td>
<td>167</td>
<td></td>
</tr>
<tr>
<td><strong>AUTO</strong></td>
<td>2,183.00</td>
<td>12.50</td>
<td>2.163</td>
<td>167</td>
<td></td>
</tr>
</tbody>
</table>

**Legend:** (w/o) = without project; (w) = with project

**Conversion:**

- W = w/a/hour
- $\$ = US$1000
- Waoe/hour = Wage rate/hour

**TRAVEL TIME SAVINGS (TTS) in US$1000:**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Commuting</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>METRO</strong></td>
<td>Commuting</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>2.163</td>
<td>2.163</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td><strong>RAIL</strong></td>
<td>Commuting</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>2.163</td>
<td>2.163</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
</tbody>
</table>

**OPERATING COSTS SAVINGS (OCS) in US$1000:**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Commuting</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>METRO</strong></td>
<td>Commuting</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>2.163</td>
<td>2.163</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td><strong>RAIL</strong></td>
<td>Commuting</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>2.163</td>
<td>2.163</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
</tbody>
</table>

**ACIDENTS COSTS SAVINGS (ACS) in US$1000:**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Commuting</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>METRO</strong></td>
<td>Commuting</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>2.163</td>
<td>2.163</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td><strong>RAIL</strong></td>
<td>Commuting</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>2.163</td>
<td>2.163</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
</tbody>
</table>

**AIR POLLUTION COSTS SAVINGS (APCS) in US$1000:**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Commuting</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>METRO</strong></td>
<td>Commuting</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>2.163</td>
<td>2.163</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td><strong>RAIL</strong></td>
<td>Commuting</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>2.163</td>
<td>2.163</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
</tbody>
</table>

**BUS SYSTEM CONTROL COSTS SAVINGS (BSCCS) in US$1000:**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Commuting</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>METRO</strong></td>
<td>Commuting</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>2.163</td>
<td>2.163</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td><strong>RAIL</strong></td>
<td>Commuting</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>2.163</td>
<td>2.163</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
</tbody>
</table>

**ROAD MAINTENANCE COSTS SAVINGS (RMCS) in US$1000:**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Commuting</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>METRO</strong></td>
<td>Commuting</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>2.163</td>
<td>2.163</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td><strong>RAIL</strong></td>
<td>Commuting</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>2.163</td>
<td>2.163</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td></td>
<td>167</td>
<td>167</td>
</tr>
</tbody>
</table>

**INVESTMENT COSTS (US$1000):**

<table>
<thead>
<tr>
<th>Year</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Investment Costs:**

<table>
<thead>
<tr>
<th>Year</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

- Operating costs for the metro were obtained from Joao Ricardo and are already economic costs.
- Inflation Factor: 0.60% - 1.80% - 2.60% - 2.60% - 2.50% - 2.60% - 2.60%
## Table 9.5: Benefits and Costs of Eldorado - Vilarinho Metro (US$ THOUSANDS)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>DIRECT BENEFITS</th>
<th>EXTERNALITIES</th>
<th>INVESTMENT COSTS</th>
<th>OPERATING COSTS</th>
<th>BENEFITS</th>
<th>PLUS</th>
<th>COSTS</th>
<th>MINUS</th>
<th>COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TRAVEL TIME</td>
<td>OPERATING</td>
<td>ROAD</td>
<td>BUS</td>
<td>TOTAL</td>
<td>WAGES</td>
<td>SALARIES</td>
<td>OPERATING</td>
<td>COSTS</td>
</tr>
<tr>
<td></td>
<td>SAVINGS</td>
<td>COST</td>
<td>MAINTENANCE</td>
<td>SYSTEM</td>
<td>BENEFITS</td>
<td>COSTS</td>
<td>COSTS</td>
<td>COSTS</td>
<td>COSTS</td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- NPV @ 10% = 231137.8086
- Ben PV @ 10% = 379465.7179
- Cos PV @ 10% = 148317.8114
- B/C @ 10% = 2.56

**Growth rate:**
1.010 → 1994-2010
1.01 → 2011-2018

**ERR = 31.0**
### Table 9.6: Sensitivity Analysis of Eldorado - Vilarinho Metro

<table>
<thead>
<tr>
<th>Value of time</th>
<th>BASE CASE</th>
<th>BV = Value of time 10% higher</th>
<th>BV = Value of time 10% lower</th>
<th>BV = Value of time 50% lower</th>
<th>BV = Value of time 60% lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRR (%)</td>
<td>NPV (US$ million)</td>
<td>B/C ratio</td>
<td>IRR (%)</td>
<td>NPV (US$ million)</td>
<td>B/C ratio</td>
</tr>
<tr>
<td>BASE CASE</td>
<td>31.02</td>
<td>231.14</td>
<td>2.56</td>
<td>10% higher</td>
<td>32.30</td>
</tr>
<tr>
<td>Benefits Value of time</td>
<td></td>
<td></td>
<td></td>
<td>10% lower</td>
<td>31.90</td>
</tr>
<tr>
<td>Operating cost savings</td>
<td></td>
<td></td>
<td></td>
<td>10% higher</td>
<td>31.90</td>
</tr>
<tr>
<td>Externalities</td>
<td></td>
<td></td>
<td></td>
<td>10% lower</td>
<td>30.30</td>
</tr>
<tr>
<td>Growth rate</td>
<td></td>
<td></td>
<td></td>
<td>5% higher 1999-2010</td>
<td>31.30</td>
</tr>
<tr>
<td>Incremental Traffic</td>
<td></td>
<td></td>
<td></td>
<td>10% higher</td>
<td>34.20</td>
</tr>
</tbody>
</table>

### COSTS

<table>
<thead>
<tr>
<th>Construction costs</th>
<th>BASE CASE</th>
<th>50% higher</th>
<th>179.40</th>
<th>1.90</th>
</tr>
</thead>
<tbody>
<tr>
<td>(including physical and price contingencies)</td>
<td>18.30</td>
<td>148.36</td>
<td>1.64</td>
<td></td>
</tr>
<tr>
<td>Operating costs</td>
<td>100% higher</td>
<td>28.00</td>
<td>186.29</td>
<td>1.96</td>
</tr>
<tr>
<td>230% higher</td>
<td>23.50</td>
<td>128.00</td>
<td>1.51</td>
<td></td>
</tr>
<tr>
<td>Start-up of operations</td>
<td>Investment costs stream (US$ 1000)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>one year delay</td>
<td>1995 7399</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(benefits start accruing in 2001)</td>
<td>1996 22228</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997 43654</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998 36050</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999 19988</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000 8870</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001 4329</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002 2438</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>two-year delay</td>
<td>1995 7399</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(benefits start accruing in 2002)</td>
<td>1996 20993</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997 39741</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998 35679</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999 22523</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000 10302</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001 3109</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002 2977</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003 2032</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NPV (US$ million)</th>
<th>B/C ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.30</td>
<td>341.29</td>
</tr>
<tr>
<td>22.80</td>
<td>170.22</td>
</tr>
</tbody>
</table>
Table 9.7: First-Year Return Test for the Eldorado-Vilarinho Link

<table>
<thead>
<tr>
<th>Year</th>
<th>Calendar Year</th>
<th>Investment Costs</th>
<th>Discount Rate at 10%</th>
<th>Discount Rate at 12%</th>
<th>NPV in year 6 at 10% ($1000)</th>
<th>NPV in year 6 at 12% ($1000)</th>
<th>Benefits in Year 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1995</td>
<td>7,399</td>
<td>1.772</td>
<td>1.974</td>
<td>13,107</td>
<td>14,604</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1996</td>
<td>24,698</td>
<td>1.611</td>
<td>1.762</td>
<td>39,777</td>
<td>43,527</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1997</td>
<td>51,480</td>
<td>1.464</td>
<td>1.574</td>
<td>75,372</td>
<td>81,004</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1998</td>
<td>36,791</td>
<td>1.331</td>
<td>1.405</td>
<td>48,969</td>
<td>51,689</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1999</td>
<td>14,917</td>
<td>1.210</td>
<td>1.254</td>
<td>18,050</td>
<td>18,712</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2000</td>
<td>5,406</td>
<td>1.100</td>
<td>1.120</td>
<td>5,947</td>
<td>6,055</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>2001</td>
<td>4,064</td>
<td>1.000</td>
<td>1.000</td>
<td>4,064</td>
<td>4,064</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL**: 205,285 219,654

Annual: 20,528 26,359 53,425
<table>
<thead>
<tr>
<th>TYPE OF IMPACT</th>
<th>PROJECT IMPACT</th>
<th>CAPTURED BY STANDARD COST-BENEFIT ANALYSIS?</th>
</tr>
</thead>
</table>
| A. Accessibility and creation of new opportunities | 1. Promotes the interconnection between residential and employment areas and social equipment (hospitals, schools) facilities.  
2. Strengthens existing subcenters.  
3. Creates new employment poles in the periphery.  
4. It favors the development of new employment and housing poles.  
5. It softens the effects of the radial concentric structure of the city.  
6. It will alter the distribution of the destinations which were previously concentrated in the central business district and shift them to the north, south, east and west of the BHMR.  
7. It will encourage new subcenters of economic activity which otherwise would not be started. | 1. No  
2. No  
3. No  
4. No  
5. No  
6. No  
7. No |
| Land Use and Value            | 1. It increases land values due to lower generalized travel costs by public transport and by auto even without changes in the zoning law.  
2. It increases the dynamics of the real estate market which is reflected by the occupation of empty lots and the renewal of older buildings in the area of influence of the existing line. | 1. Partially through the operating cost savings  
2. No |
| Employment Generation         | 1. It will promote the creation of jobs with multiplier effects in several sectors of the economy, with an estimate of 7000 direct and indirect jobs. | 1. No |
| Trip Quality                  | 1. It will improve trip quality insofar as reliability, comfort and safety are concerned. | 1. No. It can be by considering a saving of four minutes for each new metro trip. |
| Road Use                      | 1. It will reduce congestion by eliminating a great number of buses from the area of influence.  
2. It will increase the average vehicle speed in the BHMR.  
3. It will reduce the number of road accidents. | 1. Yes, through the time savings  
2. Yes, through the operating cost savings  
3. Yes |
| Air Quality                   | 1. It contributes to a reduction of 14 percent in bus emissions. | 1. Yes |
| Noise                         | 1. It will reduce the level of noise in the area of influence of the new line from 70 dB to 55 dB which is the level recommended by the WHO. | 1. No |
| Fuel Consumption              | 1. It will be reduced by 14 percent. | 1. Yes |
FINANCIAL EVALUATION

1. **Past Financial Performance.** Since its beginning in 1986, STU-BH has depended upon subsidies to meet its operating deficits, to service its debt, and to undertake capital investments. With about 13 million trips in 1994, STU-BH received about US$14 million in operational subsidies that year to cover its working expenditures of US$18.5 million. The resulting working ratio was thus 6.87 and the internally generated revenues were barely enough to cover 15 percent of the working costs. Personnel expenses were responsible for about 77 percent of the working costs with the parts and materials costs equal to 11 percent of the working cost. The remainder of the working cost covered administrative expense, energy cost, and other miscellaneous expenditures. The financial situation, however, has improved compared to previous years when revenue-cost-coverage barely reached 11 percent during the best years.

2. The basic reasons for such weak performance can be traced to: (a) a low tariff structure; (b) lack of ridership; and (c) high personnel costs. In 1994, farebox revenue per trip was only US$0.22 compared to US$1.40 needed to cover the working costs. On the other hand, high working costs compared to revenues can be blamed on under-utilization of the system since the current traffic is only one-sixth of what the system was originally designed to carry. Low volumes of demand can be partially explained due to the short length of the network since the originally planned network could not be completed due to resource constraints. Had the anticipated demand materialized, working cost coverage could have been about 65 percent given the current tariff structure. That would have been in line with most of the systems of this type.

3. STU-BH’s cost structure is dominated by high fixed costs made up of personnel which amounted to 77 percent of working cost in 1994. At a level of production of 3 million car/km per year in 1994, car-km per employee excluding administration were 7.7 which is on the low side given the age and the length of the system. Similarly, working cost per car-km also was high at US$6.2 compared to less than US$4.0 observed in the case of more efficient systems, and hence points to high cost of labor in the total cost structure. However, STU-BH has made extensive efforts to improve throughput and the car-km/operational employee have increased every year since 1989. Likewise cost performance has improved during 1990-1994 in relation to the total car-km operated.

4. On the revenue side, farebox revenues are the main source of internally generated funds which have traditionally been insufficient to cover working costs. Reliance on extra operational sources such as rental income and revenue from selling advertisement is marginal. STU-BH, however, has collaborated with the private sector to develop some of its stations (e.g., Minas Shopping) but these joint ventures have been so far restricted to capital investments. These joint-ventures have helped STU-BH improve the network without using its own capital budget and should be fostered.

5. **Financial Projections.** Completion of the new capital projects will expand STU-BH’s operations by almost 67 percent—from 16.8 km to 28.1 km in length. Growth in demand is expected to be even higher since besides the increased size of the network, the new system will operate with shorter headway and a higher number of integrated stations. The bus routes will be redesigned by
BHTRANS and DER-MG to feed the system. Both the operating costs and operating revenues can be expected to grow accordingly.

Table 10.1: STU-BH’s Projected Income Statement

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Income</td>
<td>2,688</td>
<td>14,608</td>
<td>18,044</td>
<td>19,502</td>
<td>46,190</td>
<td>47,689</td>
</tr>
<tr>
<td>Working Expenses</td>
<td>18,460</td>
<td>35,427</td>
<td>43,038</td>
<td>46,539</td>
<td>48,479</td>
<td>49,509</td>
</tr>
<tr>
<td>Working Ratio</td>
<td>6.87</td>
<td>2.43</td>
<td>2.39</td>
<td>2.39</td>
<td>1.05</td>
<td>1.04</td>
</tr>
<tr>
<td>Non-Operating Income</td>
<td>1,757</td>
<td>358</td>
<td>589</td>
<td>796</td>
<td>2,310</td>
<td>2,384</td>
</tr>
<tr>
<td>Working Cost Coverage</td>
<td>24%</td>
<td>42%</td>
<td>43%</td>
<td>44%</td>
<td>100%</td>
<td>101%</td>
</tr>
<tr>
<td>Passengers (mil.)</td>
<td>13</td>
<td>41</td>
<td>44</td>
<td>48</td>
<td>105</td>
<td>106</td>
</tr>
</tbody>
</table>

6. Projected costs and revenues show a continuing improvement in cost recovery as the current investment program of expanding the network is first implemented until the São Paulo terminal followed by another extension of about 6.5 km to Vilarinho. By 2001, one year after the last of the scheduled capital programs is completed, total revenues (operating + non-operating) are projected to cover all of working costs. The increase in the cost coverage is achieved by a 1,618 percent improvement in operating revenues versus a 163 percent increase in working costs. The total revenue during this period is projected to increase by about 991 percent.

7. Between 1995-2001, STU-BH’s operating revenues are expected to increase by 61 percent annually largely because of new demand resulting from the extension of the network, better integration between bus lines and the metro system as well as a 73 percent increase in the value of average tariff—from US$0.28 (1995) to US$0.50 (2001). Non-operational income made up from the rental of advertisement space and rental of properties is also expected to increase every year from 1995 until it is about 5 percent of the operational income by the year 2001. From there on, it is expected to maintain similar participation in the total revenue.

8. Operating expenses are also expected to increase during 1995-2001 period but at a lower rate than revenues. Working costs are expected to increase at about 17 percent annually. The slower rate of operating expenses is justified on the basis of the current system having very low ratio of variable cost to fixed cost: the number of employees is expected to double during 1995-2001 whereas total traffic is expected to increase eight times during this period. Furthermore, average tariff is projected to increase at more than twice the rate of increase in personnel cost. On the other hand, spare parts and materials costs are expected to increase by 30 percent every year between 1994-2001 in order to replenish current low levels of inventory.

9. Financial Forecast Assumptions. The financial forecasts are based on March 1995 US$. To develop the financial forecast, the following major assumptions have been considered in addition to STU-BH’s past financial performance.

- During the period 1994-2001, demand is expected to increase with the commencement of operations to the following stations by the end of the respective years: (a) Santa Inês in 1995; (b) Minas Shopping in 1996; (c) São Paulo in 1997; (d) Heliópolis in 1998; (e) Laranjeiras in 1999; and (f) Vilarinho in 2000. Accordingly, traffic would increase as these stations open. Starting in 2002, traffic is expected to grow at 1 percent per annum;
Tariffs are expected to increase in real terms during 1995-2005. Average tariff is expected to increase by 73 percent between 1996-2001 and another 11 percent during 2001-2005. Since average tariff is derived after discounting for promotional and incentive tickets, integrated tickets, and multi-passes, the selling prices of tickets (face-value) may be different from the average tariff;

Students are expected to pay half of the full fare ticket. The other half will be compensated to STU-BH by the government along with the compensation for gratuitos based on the full face-value of one-way tickets;

Non-operational incomes is expected to be about 5 percent of the operational income by 2001, including income from advertisement. These results are similar to those observed in other rapid transit systems;

Personnel expenses are expected to rise by 3 percent during the projection period. This is in addition to the increase in the personnel cost due to added employment.

Energy cost is assumed to vary in direct proportion to car-km during the projection period.

Spare and material cost is expected increase at 20 percent more than the change in car-km to enhance their participation in the working costs. The increased expenses associated with materials is in response to currently low maintenance expenditure.

10. **Sensitivity Analysis.** The financial forecast is most likely to be affected by changes in total revenue due to: (a) STU-BH’s inability to raise the average tariff above the level of 1994; (b) delays in the construction of new projects, especially the proposed São Paulo - Vilarinho line; and (c) less-than-expected growth in traffic volume. The financial forecast assumes an increase in the average tariff of 54 percent between 1995-2001; however, STU-BH may find it difficult to raise tariffs in real term beyond the expected increase to US$0.39 in order to match the prevailing bus tariff. Maintaining the average tariff at US$0.36 would cost the state treasury an additional US$73 million in operational subsidies (not including depreciation) between 1997-2005 and would increase the working ratio in 2001 to 1.35 (instead of 1.05).

11. Assuming there is a delay of one year in the completion of the São Paulo - Vilarinho section, average annual subsidy during 1995-2005 would increase from US$8.8 million to US$11 million. Similarly, year 2001 working ratio would worsen to 2.31 but would bounce back to near 1.00 due largely to new traffic the following year. Similarly, less-than-estimated traffic volumes realized during 2001-2005 would adversely effect the profitability of STU-BH. Assuming that the realized traffic during 2001-2005 is 20 percent less than the forecast, working ratio in 2001 will worsen to 1.31 and will cost the state treasury an additional US$52 million in subsidies.

12. Further, to assess a possible decrease in revenue, additional sensitivity tests were based on increasing the working costs. An increase of 20 percent in the working costs over those projected under the base case show similar results to those observed in the case of a fall in revenue, that is, working ratio worsens, in this case to 1.26 in year 2001. However, as the underestimation in costs would be uniform over the years, the state will need to put in an additional US$75 million in subsidies. In the worst of all cases, if all of the above mentioned scenarios are realized, working ratio in 2001 would worsen to 3.45 and the cost coverage would decrease to 29 percent. This performance, although very pessimistic, would still be better than the 1994 financial results.
13. On the other hand, the project could benefit from a reduction in employment due to possible outsourcing of services. While no comparisons were made of the cost of outsourcing versus in-house provision of services such as maintenance, ticket sales, security, etc., it is assumed that the costs realized through outsourcing would be at the most as much as the provision of these service in-house. Any savings, therefore, would further improve the financial performance of STU-BH.
Table 10.2: Income Statement 1990-1994  
*(Thousands of US$)*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING REVENUE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farebox Revenue</td>
<td>1,135</td>
<td>1,574</td>
<td>1,622</td>
<td>1,652</td>
<td>2,688</td>
</tr>
<tr>
<td>Gratuitos Imposed by Govt.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total Operating Revenue</td>
<td>1,135</td>
<td>1,574</td>
<td>1,622</td>
<td>1,652</td>
<td>2,688</td>
</tr>
<tr>
<td><strong>NON-OPERATING INCOME</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rental &amp; Other</td>
<td>4</td>
<td>15</td>
<td>34</td>
<td>32</td>
<td>38</td>
</tr>
<tr>
<td>Advertisement Space</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other †</td>
<td>237</td>
<td>377</td>
<td>1,412</td>
<td>1,690</td>
<td>1,719</td>
</tr>
<tr>
<td><strong>Total Non-operating Income</strong></td>
<td>241</td>
<td>392</td>
<td>1,446</td>
<td>1,722</td>
<td>1,757</td>
</tr>
<tr>
<td><strong>Total Income</strong></td>
<td>1,376</td>
<td>1,966</td>
<td>3,068</td>
<td>3,374</td>
<td>4,445</td>
</tr>
<tr>
<td><strong>OPERATING EXPENSES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>12,949</td>
<td>10,919</td>
<td>12,161</td>
<td>17,405</td>
<td>14,259</td>
</tr>
<tr>
<td>Spares and Materials</td>
<td>2,187</td>
<td>1,574</td>
<td>1,282</td>
<td>2,282</td>
<td>1,952</td>
</tr>
<tr>
<td>Electricity</td>
<td>574</td>
<td>410</td>
<td>435</td>
<td>539</td>
<td>665</td>
</tr>
<tr>
<td>Administration/Other</td>
<td>1,837</td>
<td>1,294</td>
<td>985</td>
<td>2,062</td>
<td>1,585</td>
</tr>
<tr>
<td><strong>Total Working Costs</strong></td>
<td>17,546</td>
<td>14,197</td>
<td>14,862</td>
<td>22,287</td>
<td>18,460</td>
</tr>
<tr>
<td><strong>Net Working Income</strong></td>
<td>(16,411)</td>
<td>(12,623)</td>
<td>(13,240)</td>
<td>(20,635)</td>
<td>(15,772)</td>
</tr>
<tr>
<td>Depreciation</td>
<td>954</td>
<td>1,743</td>
<td>1,510</td>
<td>1,505</td>
<td>1,682</td>
</tr>
<tr>
<td>Deferred Expenses</td>
<td>553</td>
<td>701</td>
<td>1,180</td>
<td>986</td>
<td>2,874</td>
</tr>
<tr>
<td><strong>Total Operating Expenses</strong></td>
<td>19,053</td>
<td>16,641</td>
<td>17,552</td>
<td>24,778</td>
<td>23,016</td>
</tr>
<tr>
<td><strong>Net Operating Income</strong></td>
<td>(17,918)</td>
<td>(15,067)</td>
<td>(15,930)</td>
<td>(23,126)</td>
<td>(20,328)</td>
</tr>
<tr>
<td><strong>Income for the Year</strong></td>
<td>(17,677)</td>
<td>(14,675)</td>
<td>(14,484)</td>
<td>(21,404)</td>
<td>(18,571)</td>
</tr>
<tr>
<td><strong>FINANCIAL INDICATORS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working Ratio</td>
<td>15.46</td>
<td>9.02</td>
<td>9.16</td>
<td>13.49</td>
<td>6.87</td>
</tr>
<tr>
<td>Working Cost Coverage</td>
<td>6%</td>
<td>11%</td>
<td>11%</td>
<td>7%</td>
<td>15%</td>
</tr>
<tr>
<td><strong>Personnel Cost:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of Total Revenue</td>
<td>941%</td>
<td>555%</td>
<td>396%</td>
<td>516%</td>
<td>321%</td>
</tr>
<tr>
<td>% of Working Costs</td>
<td>74%</td>
<td>77%</td>
<td>82%</td>
<td>78%</td>
<td>77%</td>
</tr>
</tbody>
</table>

† Mainly monetary fluctuations due to inflationary changes.
Table 10.3: Annual Passenger Trips 1990-1994

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DAILY TRAFFIC</strong></td>
<td>40,317</td>
<td>41,677</td>
<td>33,135</td>
<td>36,767</td>
<td>40,709</td>
</tr>
<tr>
<td><strong>Total Passengers ('000)</strong></td>
<td>13,063</td>
<td>13,503</td>
<td>10,736</td>
<td>11,913</td>
<td>13,190</td>
</tr>
<tr>
<td>Full Fare Passengers</td>
<td>8,771</td>
<td>9,183</td>
<td>5,165</td>
<td>5,394</td>
<td>4,545</td>
</tr>
<tr>
<td>Free Riders Imposed by Govt.</td>
<td>3,846</td>
<td>3,834</td>
<td>5,046</td>
<td>5,718</td>
<td>7,879</td>
</tr>
<tr>
<td>Students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gratuitos</td>
<td>446</td>
<td>486</td>
<td>525</td>
<td>801</td>
<td>766</td>
</tr>
<tr>
<td><strong>Average Tariff (US$)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Fare Passengers</td>
<td>$0.12</td>
<td>$0.15</td>
<td>$0.28</td>
<td>$0.25</td>
<td>$0.28</td>
</tr>
<tr>
<td>Transfers</td>
<td>$0.08</td>
<td>$0.09</td>
<td>$0.10</td>
<td>$0.09</td>
<td>$0.19</td>
</tr>
<tr>
<td>Students</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

Trips refers to "linked trips" only, i.e., from origin to final destination is considered one single trip.
### Table 10.4: Personnel Costs

*(Thousand of US$)*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>261</td>
<td>229</td>
<td>233</td>
<td>228</td>
<td>226</td>
</tr>
<tr>
<td>Gratuitos Imposed by Govt.</td>
<td>180</td>
<td>159</td>
<td>173</td>
<td>175</td>
<td>172</td>
</tr>
<tr>
<td>Administration</td>
<td>223</td>
<td>200</td>
<td>174</td>
<td>177</td>
<td>178</td>
</tr>
<tr>
<td><strong>Total Workforce</strong></td>
<td>664</td>
<td>588</td>
<td>580</td>
<td>580</td>
<td>576</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>2,811</td>
<td>2,304</td>
<td>2,990</td>
<td>4,001</td>
<td>3,446</td>
</tr>
<tr>
<td>Operations</td>
<td>2,108</td>
<td>1,603</td>
<td>2,093</td>
<td>3,501</td>
<td>2,495</td>
</tr>
<tr>
<td>Administration</td>
<td>3,212</td>
<td>3,005</td>
<td>2,492</td>
<td>3,501</td>
<td>2,971</td>
</tr>
<tr>
<td><strong>Total Workforce</strong></td>
<td>8,131</td>
<td>6,912</td>
<td>7,576</td>
<td>11,003</td>
<td>8,912</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>1,706</td>
<td>1,402</td>
<td>1,794</td>
<td>2,301</td>
<td>2,020</td>
</tr>
<tr>
<td>Operations</td>
<td>1,205</td>
<td>902</td>
<td>1,196</td>
<td>2,101</td>
<td>1,426</td>
</tr>
<tr>
<td>Administration</td>
<td>1,907</td>
<td>1,703</td>
<td>1,595</td>
<td>2,001</td>
<td>1,901</td>
</tr>
<tr>
<td><strong>Total Workforce</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>4,517</td>
<td>3,706</td>
<td>4,785</td>
<td>6,302</td>
<td>5,466</td>
</tr>
<tr>
<td>Operations</td>
<td>3,313</td>
<td>2,504</td>
<td>3,289</td>
<td>5,602</td>
<td>3,921</td>
</tr>
<tr>
<td>Administration</td>
<td>5,119</td>
<td>4708.193</td>
<td>4,087</td>
<td>5,502</td>
<td>4,872</td>
</tr>
<tr>
<td><strong>Total Workforce</strong></td>
<td>12,949</td>
<td>10,919</td>
<td>12,161</td>
<td>17,405</td>
<td>14,259</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>17,307</td>
<td>16,185</td>
<td>20,535</td>
<td>27,640</td>
<td>24,186</td>
</tr>
<tr>
<td>Operations</td>
<td>18,403</td>
<td>15,751</td>
<td>19,014</td>
<td>32,009</td>
<td>22,798</td>
</tr>
<tr>
<td>Administration</td>
<td>22,957</td>
<td>23,541</td>
<td>23,488</td>
<td>31,082</td>
<td>27,370</td>
</tr>
<tr>
<td><strong>Total Workforce</strong></td>
<td>19,502</td>
<td>18,570</td>
<td>20,967</td>
<td>30,009</td>
<td>24,755</td>
</tr>
</tbody>
</table>

### Table 10.5: Energy Costs

*(Thousand of US$)*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2,131</td>
<td>2,109</td>
<td>2,354</td>
<td>2,715</td>
<td>2,993</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>116</td>
<td>120</td>
<td>95</td>
<td>106</td>
<td>117</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>574</td>
<td>410</td>
<td>435</td>
<td>539</td>
<td>665</td>
<td></td>
</tr>
</tbody>
</table>
### Table 10.6: Income Statement 1995-2005
**Thousands of March 1995 US$**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING REVENUE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farebox revenues</td>
<td>3,363</td>
<td>11,673</td>
<td>12,617</td>
<td>13,637</td>
<td>16,846</td>
<td>18,209</td>
<td>42,987</td>
<td>44,382</td>
<td>46,287</td>
<td>48,005</td>
<td>49,802</td>
</tr>
<tr>
<td>Gratuitos Imposed by Govt.</td>
<td>277</td>
<td>832</td>
<td>898</td>
<td>970</td>
<td>1,198</td>
<td>1,293</td>
<td>3,203</td>
<td>3,307</td>
<td>3,449</td>
<td>3,577</td>
<td>3,711</td>
</tr>
<tr>
<td>Students</td>
<td>0</td>
<td>119</td>
<td>128</td>
<td>139</td>
<td>171</td>
<td>185</td>
<td>458</td>
<td>472</td>
<td>493</td>
<td>511</td>
<td>530</td>
</tr>
<tr>
<td><strong>Total Operating Revenue</strong></td>
<td>3,640</td>
<td>12,505</td>
<td>13,515</td>
<td>14,608</td>
<td>18,044</td>
<td>19,502</td>
<td>46,190</td>
<td>47,689</td>
<td>49,736</td>
<td>51,582</td>
<td>53,513</td>
</tr>
<tr>
<td><strong>NON-OPERATING INCOME</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rental &amp; Other</td>
<td>0</td>
<td>61</td>
<td>132</td>
<td>215</td>
<td>354</td>
<td>478</td>
<td>1,386</td>
<td>1,431</td>
<td>1,492</td>
<td>1,547</td>
<td>1,605</td>
</tr>
<tr>
<td>Advertisement Space</td>
<td>0</td>
<td>41</td>
<td>88</td>
<td>143</td>
<td>236</td>
<td>318</td>
<td>924</td>
<td>954</td>
<td>995</td>
<td>1,032</td>
<td>1,070</td>
</tr>
<tr>
<td><strong>Total Non-operating Income</strong></td>
<td>0</td>
<td>102</td>
<td>221</td>
<td>358</td>
<td>589</td>
<td>796</td>
<td>2,310</td>
<td>2,384</td>
<td>2,487</td>
<td>2,579</td>
<td>2,676</td>
</tr>
<tr>
<td><strong>Total Income</strong></td>
<td>3,640</td>
<td>12,607</td>
<td>13,736</td>
<td>14,966</td>
<td>18,633</td>
<td>20,298</td>
<td>48,500</td>
<td>50,073</td>
<td>52,223</td>
<td>54,161</td>
<td>56,189</td>
</tr>
<tr>
<td><strong>OPERATING EXPENSES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td>14,687</td>
<td>17,922</td>
<td>19,460</td>
<td>22,929</td>
<td>28,392</td>
<td>33,980</td>
<td>41,427</td>
<td>43,828</td>
<td>46,287</td>
<td>48,005</td>
<td>49,802</td>
</tr>
<tr>
<td>Spares and Materials</td>
<td>2,985</td>
<td>3,916</td>
<td>4,847</td>
<td>7,699</td>
<td>8,417</td>
<td>8,897</td>
<td>9,615</td>
<td>9,615</td>
<td>9,615</td>
<td>9,615</td>
<td>9,615</td>
</tr>
<tr>
<td>Electricity</td>
<td>848</td>
<td>1,112</td>
<td>1,376</td>
<td>2,186</td>
<td>2,390</td>
<td>2,526</td>
<td>2,730</td>
<td>2,730</td>
<td>2,730</td>
<td>2,730</td>
<td>2,730</td>
</tr>
<tr>
<td>Contract Work</td>
<td>370</td>
<td>459</td>
<td>494</td>
<td>664</td>
<td>813</td>
<td>881</td>
<td>920</td>
<td>940</td>
<td>960</td>
<td>982</td>
<td>1,004</td>
</tr>
<tr>
<td>Administration/Other</td>
<td>1,585</td>
<td>1,585</td>
<td>1,585</td>
<td>1,585</td>
<td>1,585</td>
<td>1,585</td>
<td>1,585</td>
<td>1,585</td>
<td>1,585</td>
<td>1,585</td>
<td>1,585</td>
</tr>
<tr>
<td>Depreciation</td>
<td>6,152</td>
<td>8,799</td>
<td>11,446</td>
<td>13,446</td>
<td>13,446</td>
<td>18,762</td>
<td>16,202</td>
<td>16,202</td>
<td>16,202</td>
<td>16,202</td>
<td>16,202</td>
</tr>
<tr>
<td>Deferred Expenses</td>
<td>890</td>
<td>890</td>
<td>890</td>
<td>435</td>
<td>0</td>
<td>0</td>
<td>(430)</td>
<td>(430)</td>
<td>(430)</td>
<td>(430)</td>
<td>(430)</td>
</tr>
<tr>
<td><strong>Total Operating Expenses</strong></td>
<td>27,517</td>
<td>34,683</td>
<td>39,098</td>
<td>49,309</td>
<td>56,484</td>
<td>59,986</td>
<td>66,812</td>
<td>66,314</td>
<td>67,206</td>
<td>68,557</td>
<td>70,000</td>
</tr>
<tr>
<td><strong>Net Operating Income</strong></td>
<td>(23,876)</td>
<td>(22,179)</td>
<td>(25,583)</td>
<td>(34,701)</td>
<td>(38,440)</td>
<td>(40,483)</td>
<td>(40,363)</td>
<td>(40,176)</td>
<td>(39,785)</td>
<td>(39,567)</td>
<td>(40,050)</td>
</tr>
<tr>
<td><strong>Income for the Year</strong></td>
<td>(23,876)</td>
<td>(22,077)</td>
<td>(25,362)</td>
<td>(34,343)</td>
<td>(37,851)</td>
<td>(39,687)</td>
<td>(41,312)</td>
<td>(41,207)</td>
<td>(41,118)</td>
<td>(41,271)</td>
<td>(41,368)</td>
</tr>
</tbody>
</table>

**FINANCIAL INDICATORS**
- **Working Cost Ratio**: 5.62%
- **Working Cost Coverage**: 69%
- **% of Total Revenue**: 40%
- **% of Working Costs**: 69%
### Table 10.7: Passenger Trips 1995-2005

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DAILY TRAFFIC</td>
<td>43,966</td>
<td>107,791</td>
<td>116,414</td>
<td>125,728</td>
<td>135,786</td>
<td>146,649</td>
<td>322,832</td>
<td>326,060</td>
<td>329,321</td>
<td>332,614</td>
<td>335,940</td>
</tr>
<tr>
<td>Total Passengers ('000)</td>
<td>14,245</td>
<td>34,924</td>
<td>37,718</td>
<td>40,736</td>
<td>43,995</td>
<td>47,514</td>
<td>104,596</td>
<td>105,644</td>
<td>106,700</td>
<td>107,767</td>
<td>108,845</td>
</tr>
<tr>
<td>Full Fare Passengers</td>
<td>6,125</td>
<td>13,791</td>
<td>13,571</td>
<td>13,226</td>
<td>12,740</td>
<td>12,091</td>
<td>20,920</td>
<td>21,129</td>
<td>21,340</td>
<td>21,553</td>
<td>21,769</td>
</tr>
<tr>
<td>Transfers</td>
<td>7,123</td>
<td>18,951</td>
<td>22,075</td>
<td>25,577</td>
<td>29,499</td>
<td>33,884</td>
<td>76,356</td>
<td>77,120</td>
<td>77,891</td>
<td>78,670</td>
<td>79,457</td>
</tr>
<tr>
<td>Gratuitos</td>
<td>748</td>
<td>1,834</td>
<td>1,980</td>
<td>2,139</td>
<td>2,310</td>
<td>2,494</td>
<td>5,491</td>
<td>5,546</td>
<td>5,602</td>
<td>5,658</td>
<td>5,714</td>
</tr>
<tr>
<td>Students</td>
<td>249</td>
<td>611</td>
<td>660</td>
<td>713</td>
<td>770</td>
<td>831</td>
<td>1,830</td>
<td>1,849</td>
<td>1,867</td>
<td>1,886</td>
<td>1,905</td>
</tr>
<tr>
<td>Transport Tariff (US$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Fare</td>
<td>$0.28</td>
<td>$0.39</td>
<td>$0.39</td>
<td>$0.39</td>
<td>$0.44</td>
<td>$0.44</td>
<td>$0.50</td>
<td>$0.51</td>
<td>$0.53</td>
<td>$0.54</td>
<td>$0.56</td>
</tr>
<tr>
<td>Transfer Fare (Metro's share)</td>
<td>$0.23</td>
<td>$0.33</td>
<td>$0.33</td>
<td>$0.33</td>
<td>$0.37</td>
<td>$0.37</td>
<td>$0.42</td>
<td>$0.43</td>
<td>$0.44</td>
<td>$0.46</td>
<td>$0.47</td>
</tr>
<tr>
<td>Student Fare</td>
<td>$0.00</td>
<td>$0.19</td>
<td>$0.19</td>
<td>$0.19</td>
<td>$0.22</td>
<td>$0.22</td>
<td>$0.26</td>
<td>$0.26</td>
<td>$0.26</td>
<td>$0.27</td>
<td>$0.28</td>
</tr>
<tr>
<td>Average Tariff</td>
<td>$0.26</td>
<td>$0.36</td>
<td>$0.36</td>
<td>$0.36</td>
<td>$0.41</td>
<td>$0.41</td>
<td>$0.44</td>
<td>$0.45</td>
<td>$0.47</td>
<td>$0.48</td>
<td>$0.49</td>
</tr>
</tbody>
</table>

### ASSUMPTIONS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Fare</td>
<td>$0.25</td>
<td>$0.35</td>
<td>$0.35</td>
<td>$0.35</td>
<td>$0.40</td>
<td>$0.40</td>
<td>$0.45</td>
<td>$0.46</td>
<td>$0.46</td>
<td>$0.48</td>
<td>$0.49</td>
</tr>
<tr>
<td>Integrated Fare</td>
<td>$0.35</td>
<td>$0.49</td>
<td>$0.49</td>
<td>$0.49</td>
<td>$0.56</td>
<td>$0.56</td>
<td>$0.63</td>
<td>$0.64</td>
<td>$0.67</td>
<td>$0.68</td>
<td>$0.70</td>
</tr>
<tr>
<td>Students</td>
<td>$0.00</td>
<td>$0.18</td>
<td>$0.18</td>
<td>$0.16</td>
<td>$0.20</td>
<td>$0.20</td>
<td>$0.23</td>
<td>$0.23</td>
<td>$0.24</td>
<td>$0.24</td>
<td>$0.25</td>
</tr>
<tr>
<td>Exchange Rate</td>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Days/Year</td>
<td>324</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Growth Factors:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994-1995</td>
<td>6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001-2010</td>
<td>1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fare sharing ratio</td>
<td>60%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Discount</td>
<td>50%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger Types:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Fare</td>
<td>43%</td>
<td>39%</td>
<td>36%</td>
<td>32%</td>
<td>29%</td>
<td>25%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Integrated</td>
<td>50%</td>
<td>54%</td>
<td>59%</td>
<td>63%</td>
<td>67%</td>
<td>71%</td>
<td>73%</td>
<td>73%</td>
<td>73%</td>
<td>73%</td>
<td>73%</td>
</tr>
<tr>
<td>Gratuitos</td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>Students</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
</tr>
</tbody>
</table>
### Table 10.8: Personnel Costs 1995-2005  
(Thousands of March 1995 US$)

<table>
<thead>
<tr>
<th>Year</th>
<th>WORKFORCE (count)</th>
<th>TOTAL SALARY</th>
<th>TOTAL BENEFITS</th>
<th>TOTAL PERSONNEL EXPENSE</th>
<th>COST PER EMPLOYEE (US$)</th>
<th>ASSUMPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maintenance</td>
<td>Operations</td>
<td>Administration</td>
<td>Maintenance</td>
<td>Operations</td>
<td>Salary Increase/Year</td>
</tr>
<tr>
<td>1995</td>
<td>226</td>
<td>172</td>
<td>178</td>
<td>3,549</td>
<td>1,669</td>
<td>3.00%</td>
</tr>
<tr>
<td>1996</td>
<td>294</td>
<td>189</td>
<td>200</td>
<td>4,756</td>
<td>2,620</td>
<td>3.00%</td>
</tr>
<tr>
<td>1997</td>
<td>294</td>
<td>254</td>
<td>200</td>
<td>6,401</td>
<td>3,685</td>
<td>3.00%</td>
</tr>
<tr>
<td>1998</td>
<td>373</td>
<td>373</td>
<td>215</td>
<td>7,972</td>
<td>4,805</td>
<td>3.00%</td>
</tr>
<tr>
<td>1999</td>
<td>451</td>
<td>415</td>
<td>231</td>
<td>8,703</td>
<td>5,105</td>
<td>3.00%</td>
</tr>
<tr>
<td>2000</td>
<td>478</td>
<td>415</td>
<td>231</td>
<td>8,964</td>
<td>5,575</td>
<td>3.00%</td>
</tr>
<tr>
<td>2001</td>
<td>478</td>
<td>415</td>
<td>231</td>
<td>9,233</td>
<td>5,742</td>
<td>3.00%</td>
</tr>
<tr>
<td>2002</td>
<td>478</td>
<td>415</td>
<td>231</td>
<td>9,510</td>
<td>5,914</td>
<td>3.00%</td>
</tr>
<tr>
<td>2003</td>
<td>478</td>
<td>415</td>
<td>231</td>
<td>9,795</td>
<td>6,081</td>
<td>3.00%</td>
</tr>
<tr>
<td>2004</td>
<td>478</td>
<td>415</td>
<td>231</td>
<td>10,089</td>
<td>6,258</td>
<td>3.00%</td>
</tr>
<tr>
<td>2005</td>
<td>478</td>
<td>415</td>
<td>231</td>
<td>10,384</td>
<td>6,436</td>
<td>3.00%</td>
</tr>
</tbody>
</table>

### Table 10.9: Energy Costs 1995-2005  
(Thousands of March 1995 US$)

<table>
<thead>
<tr>
<th>Year</th>
<th>ELECTRIC SERVICE</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Car Km ('000)</td>
<td>Pass-km (millions)</td>
<td>Total Electric Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>3,816</td>
<td>126</td>
<td>548</td>
<td>2,186</td>
<td>2,390</td>
<td>2,730</td>
</tr>
<tr>
<td>1996</td>
<td>5,006</td>
<td>309</td>
<td>1,112</td>
<td>2,136</td>
<td>2,340</td>
<td>2,670</td>
</tr>
<tr>
<td>1997</td>
<td>6,196</td>
<td>334</td>
<td>1,376</td>
<td>2,166</td>
<td>2,360</td>
<td>2,690</td>
</tr>
<tr>
<td>1998</td>
<td>9,841</td>
<td>361</td>
<td>2,186</td>
<td>2,390</td>
<td>2,730</td>
<td>2,730</td>
</tr>
<tr>
<td>1999</td>
<td>10,759</td>
<td>390</td>
<td>2,186</td>
<td>2,390</td>
<td>2,730</td>
<td>2,730</td>
</tr>
<tr>
<td>2000</td>
<td>11,372</td>
<td>421</td>
<td>2,186</td>
<td>2,390</td>
<td>2,730</td>
<td>2,730</td>
</tr>
<tr>
<td>2001</td>
<td>12,290</td>
<td>1,005</td>
<td>2,186</td>
<td>2,390</td>
<td>2,730</td>
<td>2,730</td>
</tr>
<tr>
<td>2002</td>
<td>12,290</td>
<td>1,015</td>
<td>2,186</td>
<td>2,390</td>
<td>2,730</td>
<td>2,730</td>
</tr>
<tr>
<td>2003</td>
<td>12,290</td>
<td>1,025</td>
<td>2,186</td>
<td>2,390</td>
<td>2,730</td>
<td>2,730</td>
</tr>
<tr>
<td>2004</td>
<td>12,290</td>
<td>1,036</td>
<td>2,186</td>
<td>2,390</td>
<td>2,730</td>
<td>2,730</td>
</tr>
<tr>
<td>2005</td>
<td>12,290</td>
<td>1,046</td>
<td>2,186</td>
<td>2,390</td>
<td>2,730</td>
<td>2,730</td>
</tr>
</tbody>
</table>
## Table 10.10: Balance Sheet 1994-2005
(Thousands of March 1995 US$)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ASSETS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Assets</td>
<td>3,346</td>
<td>2,943</td>
<td>2,943</td>
<td>2,943</td>
<td>2,943</td>
<td>2,943</td>
<td>2,943</td>
<td>2,943</td>
<td>2,963</td>
<td>3,508</td>
<td>4,598</td>
<td>5,444</td>
</tr>
<tr>
<td>Permanent Assets</td>
<td>367,271</td>
<td>434,076</td>
<td>471,814</td>
<td>527,964</td>
<td>584,739</td>
<td>572,324</td>
<td>586,884</td>
<td>554,389</td>
<td>538,817</td>
<td>522,845</td>
<td>507,073</td>
<td>491,300</td>
</tr>
<tr>
<td>Net Fixed Assets</td>
<td>25,685</td>
<td>204,842</td>
<td>288,697</td>
<td>369,905</td>
<td>428,459</td>
<td>413,012</td>
<td>390,568</td>
<td>558,255</td>
<td>542,063</td>
<td>525,851</td>
<td>509,650</td>
<td>493,448</td>
</tr>
<tr>
<td>Fixed Assets</td>
<td>30,003</td>
<td>215,312</td>
<td>307,968</td>
<td>400,620</td>
<td>470,820</td>
<td>470,820</td>
<td>470,820</td>
<td>668,071</td>
<td>668,071</td>
<td>668,071</td>
<td>668,071</td>
<td>668,071</td>
</tr>
<tr>
<td>Work in Progress</td>
<td>338,480</td>
<td>227,019</td>
<td>181,791</td>
<td>157,624</td>
<td>138,280</td>
<td>159,312</td>
<td>167,118</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other Assets</td>
<td>3,106</td>
<td>2,216</td>
<td>1,325</td>
<td>435</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3,866</td>
<td>3,436</td>
<td>3,007</td>
<td>2,577</td>
<td>2,148</td>
</tr>
<tr>
<td>Net Deferral Assets</td>
<td>8,903</td>
<td>8,903</td>
<td>8,903</td>
<td>8,903</td>
<td>8,903</td>
<td>8,903</td>
<td>8,903</td>
<td>4,608</td>
<td>4,608</td>
<td>4,608</td>
<td>4,608</td>
<td>4,608</td>
</tr>
<tr>
<td>Acc. Deferred Expense</td>
<td>(5,797)</td>
<td>(6,687)</td>
<td>(7,578)</td>
<td>(8,468)</td>
<td>(8,903)</td>
<td>(8,903)</td>
<td>(8,903)</td>
<td>(8,474)</td>
<td>(8,044)</td>
<td>(7,815)</td>
<td>(7,185)</td>
<td>(6,756)</td>
</tr>
<tr>
<td>Total Assets</td>
<td>370,617</td>
<td>437,019</td>
<td>474,757</td>
<td>530,907</td>
<td>567,822</td>
<td>575,267</td>
<td>569,827</td>
<td>557,353</td>
<td>542,125</td>
<td>527,443</td>
<td>512,517</td>
<td>497,648</td>
</tr>
<tr>
<td><strong>LIABILITIES AND EQUITY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Liability</td>
<td>9,999</td>
<td>10,000</td>
<td>10,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Equity</td>
<td>360,618</td>
<td>427,019</td>
<td>464,757</td>
<td>528,907</td>
<td>565,682</td>
<td>573,267</td>
<td>567,827</td>
<td>555,353</td>
<td>540,125</td>
<td>525,443</td>
<td>510,517</td>
<td>495,648</td>
</tr>
<tr>
<td>Additional Contribution</td>
<td>332,235</td>
<td>422,512</td>
<td>482,429</td>
<td>572,162</td>
<td>643,837</td>
<td>689,663</td>
<td>689,663</td>
<td>689,663</td>
<td>689,663</td>
<td>689,663</td>
<td>689,663</td>
<td></td>
</tr>
<tr>
<td>Total Liabilities and Equity</td>
<td>370,617</td>
<td>437,019</td>
<td>474,757</td>
<td>530,907</td>
<td>576,822</td>
<td>584,267</td>
<td>577,827</td>
<td>565,353</td>
<td>542,125</td>
<td>527,443</td>
<td>512,517</td>
<td>497,648</td>
</tr>
</tbody>
</table>
Table 10.11: Sources and Applications of Funds 1994-2005  
(Thousands of March 1995 US$)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SOURCES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal Cash Generation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Operating Revenue</td>
<td>(20,328)</td>
<td>(23,876)</td>
<td>(22,179)</td>
<td>(25,583)</td>
<td>(34,701)</td>
<td>(38,440)</td>
<td>(40,483)</td>
<td>(20,622)</td>
<td>(17,592)</td>
<td>(16,604)</td>
<td>(15,850)</td>
<td>(15,044)</td>
</tr>
<tr>
<td>Net Non-Operating Income</td>
<td>1,757</td>
<td>0</td>
<td>102</td>
<td>221</td>
<td>358</td>
<td>589</td>
<td>796</td>
<td>2,310</td>
<td>2,384</td>
<td>2,487</td>
<td>2,579</td>
<td>2,676</td>
</tr>
<tr>
<td>Depreciation</td>
<td>1,682</td>
<td>6,152</td>
<td>8,799</td>
<td>11,446</td>
<td>13,446</td>
<td>13,446</td>
<td>13,446</td>
<td>18,762</td>
<td>16,202</td>
<td>16,202</td>
<td>16,202</td>
<td>16,202</td>
</tr>
<tr>
<td>Deferred Expense</td>
<td>2,874</td>
<td>890</td>
<td>890</td>
<td>890</td>
<td>435</td>
<td>0</td>
<td>0</td>
<td>(430)</td>
<td>(430)</td>
<td>(430)</td>
<td>(430)</td>
<td>(430)</td>
</tr>
<tr>
<td><strong>Total from Operations</strong></td>
<td>(14,015)</td>
<td>(16,834)</td>
<td>(12,387)</td>
<td>(13,026)</td>
<td>(20,462)</td>
<td>(24,404)</td>
<td>(26,241)</td>
<td>20</td>
<td>565</td>
<td>1,655</td>
<td>2,501</td>
<td>3,404</td>
</tr>
<tr>
<td>Other Sources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Subsides</td>
<td>37,777</td>
<td>43,778</td>
<td>49,540</td>
<td>69,570</td>
<td>50,656</td>
<td>21,032</td>
<td>7,806</td>
<td>6,038</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBRD Loan</td>
<td>0</td>
<td>3,882</td>
<td>17,381</td>
<td>35,022</td>
<td>25,500</td>
<td>10,587</td>
<td>3,929</td>
<td>3,040</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counterpart Funds</td>
<td>0</td>
<td>5,816</td>
<td>15,159</td>
<td>34,548</td>
<td>25,156</td>
<td>10,445</td>
<td>3,777</td>
<td>2,998</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Capital Invest.</td>
<td>37,777</td>
<td>34,080</td>
<td>17,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Operating Subsidy</strong></td>
<td>14,015</td>
<td>16,834</td>
<td>12,387</td>
<td>13,026</td>
<td>20,462</td>
<td>24,404</td>
<td>26,241</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Sources of Funds</strong></td>
<td>37,777</td>
<td>43,778</td>
<td>49,540</td>
<td>69,570</td>
<td>50,656</td>
<td>21,032</td>
<td>7,806</td>
<td>6,058</td>
<td>565</td>
<td>1,655</td>
<td>2,501</td>
<td>3,404</td>
</tr>
<tr>
<td><strong>APPLICATIONS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investment Program</td>
<td>37,777</td>
<td>43,778</td>
<td>49,540</td>
<td>69,570</td>
<td>50,656</td>
<td>21,032</td>
<td>7,806</td>
<td>6,038</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To São Paulo</td>
<td>37,777</td>
<td>34,080</td>
<td>17,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To Vilanova</td>
<td>0</td>
<td>9,698</td>
<td>32,540</td>
<td>69,570</td>
<td>50,656</td>
<td>21,032</td>
<td>7,806</td>
<td>6,038</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Change in Working Capital</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>565</td>
<td>1,655</td>
<td>2,501</td>
<td>3,404</td>
<td></td>
</tr>
<tr>
<td><strong>Total Applications of Funds</strong></td>
<td>37,777</td>
<td>43,778</td>
<td>49,540</td>
<td>69,570</td>
<td>50,656</td>
<td>21,032</td>
<td>7,806</td>
<td>6,058</td>
<td>565</td>
<td>1,655</td>
<td>2,501</td>
<td>3,404</td>
</tr>
</tbody>
</table>
BRAZIL
BELO HORIZONTE METROPOLITAN TRANSPORT DECENTRALIZATION PROJECT

PROJECT IMPLEMENTATION SCHEDULE, MONITORING, EVALUATION
AND SUPERVISION PLAN

A. Project Implementation Schedule

1. The implementation schedule for individual components are shown in Annex 8. Those schedules and the detailed cost tables of Annex 8 provide the basis for project monitoring and for the disbursement profile.

2. The project would consist of three inter-related parts. Part A comprises two main works: (a) the São Paulo - Vilarinho link; and (b) the access works to the stations. Part B comprises two studies and one civil work: (a) the inspection/maintenance study; (b) the traffic management, safety and control study; and (c) the acquisition and installation of the centralized traffic control. Part C comprises a series of studies described in detail in Annex 7.

3. **Implementation Monitoring.** CBTU will monitor compliance with the individual implementation schedules by defining target dates for key actions. The target dates for key actions for the first two years of the project (to about mid-1997) are shown in the Action Plan in this Annex. In November of each year CBTU will prepare, with the agreement of the Bank, a similar action plan for the following year of implementation, and so on throughout the life of the project. In the event of delays, CBTU will be responsible for identification of the constraints and for devising and executing policies to resolve problems.

4. Financial progress will be monitored by CBTU in the same manner as implementation progress. Estimates of costs of Part A have been made but final costs will be dependent on consultants’ final engineering designs and on bid prices (for equipment etc.). Thus, it will be the responsibility of CBTU to update cost schedules as contracts and bids are finalized and to monitor financial progress in relation to the updated schedules.

5. CBTU will report on both implementation and financial progress in the biannual progress reports.

6. Evaluation of Part A of the project will attempt to determine the extent to which original construction schedules and costs are respected.

B. Monitoring and Evaluation of Project Components

7. **Monitoring** would identify the physical, institutional and financial status of each subproject component, as appropriate, on a periodic basis. The aim would be to identify implementation problems and the extent of deviation from the targets proposed at appraisal. The results of the monitoring program (the comparison of achieved performance with appraisal targets) will be presented in the biannual Progress Reports prepared and coordinated by CBTU. The results of each subcomponent monitoring program will provide the basis and information for implementing agencies to prepare measures and actions to resolve implementation problems, if any, and at the same time, to update project costs, disbursement and implementation schedules if necessary. Monitoring indicators to be employed will vary by type of component but the general guidelines are set out in the following paragraphs.
8. The general guidelines given below would be followed:

(a) each implementing agency would prepare, as part of its component preparation report, an implementation schedule which sets out target dates for key actions for physical works, equipment supply and institutional components. Where components are not fully prepared at appraisal, it would be a condition of their subsequent inclusion that an implementation schedule be prepared as an integral part of the component;

(b) for physical works (and equipment) progress the implementation schedule will define target dates (to the nearest quarter) for the start and finish of key actions involved in the implementation of physical works (and supply of equipment). Thus indicators are likely to include:
   (i) start/finish dates for final engineering design and documents for works (or equipment);
   (ii) date of issue of bid documents;
   (iii) date of contract signature; and
   (iv) start/finish dates for works (or supply of equipment).

(c) for financial performance since works (or supply of equipment) are likely to extend over some time, the component implementation schedule will also be required to give target "percentage completed" by quarter. Thus target expenditures can be estimated and will be used to monitor financial (disbursement) performance on a quarterly basis;

(d) for institutional measures (technical assistance, training and studies), the monitoring targets will be the progress reports and the dates of completion indicated in the implementation plan of Annex 7; and

(e) monitoring of resettlement and property values in the area of influence of the STU-BH before, during and after construction.

9. **Ex-post evaluation** would be aimed at determining the effectiveness and efficiency of measures in meeting the objectives determined at appraisal. In the event that objectives are not met and previously anticipated improvements in performance are not achieved, the data would be used:
   (a) to identify why components had not been fully successful; and (b) to modify future components proposed for subsequent implementation which were based on similar premises. Furthermore, the ex-post evaluation would be used as a major input to the Project Implementation Report.

10. **Quantitative performance targets** have been established for STU-BH and are shown below.

<table>
<thead>
<tr>
<th>Table 11.1: Quantitative Performance Targets for STU-BH</th>
</tr>
</thead>
<tbody>
<tr>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>Total number of passengers carried per year (millions of linked trips)</td>
</tr>
<tr>
<td>Staff costs as a % of total revenue</td>
</tr>
<tr>
<td>Revenue Cost Coverage</td>
</tr>
<tr>
<td>Working Ratio</td>
</tr>
</tbody>
</table>
11. The **qualitative monitoring indicators** will be: (a) the date of the establishment of the Regional Transport Coordination Commission as compared to the agreed date in Section IV of the main text and its effectiveness in meeting the basic objectives described in Annex 3; (b) the completion of a financing mechanisms study and an action plan to carry out its recommendations which should take place before the Mid-term Project Review; (c) the pace of the implementation of the bus integration plan after the entry into operation of each link of the São Paulo - Vilarinho link and the completion of any of the proposed accesses to the stations of the Eldorado - São Paulo link; this should be done no later than 30 days after the entry of operation of the link or stations; and (d) the results of a train user survey, to be carried out every two years after effectiveness until project completion, by an independent firm, to gauge the satisfaction of the users with the level of service offered by the system. All the above qualitative monitoring indicators would be rated on a scale of 0 (unsatisfactory) to 5 (excellent).

12. **Bank Supervision.** The main emphasis during the initial project phase would be to: (a) review the development and implementation of the project monitoring system; (b) make certain that CBTU's staff is familiar with Bank procurement guidelines, Bank disbursement procedures (i.e., Special Account transactions), and Bank independent auditing requirements; (c) ensure that all steps towards decentralization of STU-BH to the State are being taken; and (d) help CBTU/RTCC's development of a strategy to properly promote the project to the BHMR public. Many of these items would be addressed in the first supervision mission scheduled for November 1995. During project implementation, the supervision missions would need to conduct the following activities in the field on a regular basis in addition to monitoring project progress: (a) review a sampling of contract bids and awards; (b) inspect disbursement procedures and record-keeping; (c) inspect adequacy of supervision and monitoring of the implementing agencies and respective subprojects; (d) review performance and accuracy of the Project Monitoring System; and (e) complete a Mid-term Review 24 months after project effectiveness to examine the progress made, especially in the Integrated Land Use, Urban Transport, and Air Quality Strategy and policies to assess the relevance of project objectives and actions, and recommend appropriate revisions (as needed). Supervision missions in the field should attempt to visit all the agencies dealing with the project during each trip. A preliminary schedule of supervision missions including key activities is indicated in the table on the following page. The key activities shown are in addition to the regular supervision needs, which include a review of: (a) progress reports; (b) procurement issues; (c) disbursements; (d) Project Implementation Plan; (e) project costs; (f) yearly independent audits; (g) correspondence; and (h) unforeseen issues.

13. The Bank project team would consist of the Task Manager (Sr. Transport Planner/Economist), a Railway Engineer, a Metro Infrastructure Specialist, a Resettlement Specialist and a Financial Analyst. Consultants are anticipated to be required on a short-term basis to assist in specific areas, such as analysis of monitoring system, and review of institutional development programs. Supervision requirements for the project are expected to be high due to: (a) the complexity of the institutional arrangements; (b) the anticipated large number of small-scale subprojects; and (c) the institutional weakness of CBTU (requiring significant training and technical assistance). Supervision requirements are anticipated to be about 20 staff-weeks during the first year and about 12-15 staff-weeks thereafter. A summary of key inputs is provided on the following page.

14. **Borrower’s Contribution to Supervision.** CBTU is expected to: (a) be responsible for project monitoring and coordination, to keep the Project Monitoring System accurate, and to follow-up and address all issues which are "signaled" by the system; (b) be responsible for properly managing all procurement and disbursement considerations, keeping procurement and disbursement records up to date; (c) prepare progress reports in June and December of each year; and (d) be responsible for coordinating arrangements for the Bank supervision missions.
Table 11.2: Bank Supervision Input into Key Activities

<table>
<thead>
<tr>
<th>Approx. Dates</th>
<th>Key Activities</th>
<th>Expected Skill Requirements</th>
<th>Staff Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/95</td>
<td>Supervision Mission—Project Effectiveness (Review: (i) conditions for project effectiveness - PIP, POM, and Monitoring system; (ii) special coordinating arrangements devised among several sectoral agencies participating in project implementation; and (iii) existing financial and accounting systems/procedures)</td>
<td>Transport Planner Railway Specialist</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metro Inf. Specialist Resettlement Specialist</td>
<td></td>
</tr>
<tr>
<td>12/95</td>
<td>Supervision Mission (Project launch workshop, review Project Monitoring System, selection of consultants)</td>
<td>Transport Planner Disbursement Specialist Procurement Specialist</td>
<td>5.0</td>
</tr>
<tr>
<td>3/96</td>
<td>Supervision Mission (Review Project Monitoring System, Training/Implementation, institutional development including training programs)</td>
<td>Transport Planner/Economist Railway and Metro Engineer Resettlement Specialist</td>
<td>5.5</td>
</tr>
<tr>
<td>6/96</td>
<td>Supervision Mission (Review results of first year Independent audit)</td>
<td>Transport Planner Railway and metro Engineer</td>
<td>8.0</td>
</tr>
<tr>
<td>11/96</td>
<td>Supervision Mission (Concentrate on subprojects: (i) contracts; (ii) eligibility/limits; (iii) costs; and (iv) status)</td>
<td>Transport Planner Railway and metro Engineer</td>
<td>7.0</td>
</tr>
<tr>
<td>1/97</td>
<td>Supervision Mission (Concentrate on disbursements, financial status, Institutional development, public transport studies)</td>
<td>Transport Planner Railway and metro Engineer Consultant</td>
<td>8.0</td>
</tr>
<tr>
<td>6/97</td>
<td>Supervision Mission (Concentrate on subproject status and implementation of recommendations of public transport study)</td>
<td>Transport Planner Railway and metro Engineer</td>
<td>7.0</td>
</tr>
<tr>
<td>1998</td>
<td>Two Supervision Missions</td>
<td>Transport Planner Railway and metro Engineer Consultant</td>
<td>13.0</td>
</tr>
<tr>
<td>1999</td>
<td>Three Supervision Missions (Begin negotiations of follow-up loan, if Mid-term Review is favorable)</td>
<td>Transport Planner Railway and metro Engineer Consultant</td>
<td>12.0</td>
</tr>
<tr>
<td>2000 to 2001</td>
<td>Two Supervision Missions—Loan Closing (Project closing, final negotiations for follow-up loan)</td>
<td>Transport Planner Railway and metro Engineer</td>
<td>12.0</td>
</tr>
</tbody>
</table>

E. Action Plan

15. The Action Plan is based on the assumption that Negotiations will be held in May 1995, Board Presentation in June 1995, and Effectiveness in October 1995. The Action Plan represents key actions to be taken in the first year; the second year action plan will be developed in March 1996.
Table 11.3: FY96 Action Plan

<table>
<thead>
<tr>
<th>Action</th>
<th>Date</th>
<th>Status</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submission to Bank of &quot;Convénio Básico&quot;</td>
<td>April 30, 1995</td>
<td>Done</td>
<td>&quot;Convénio&quot; must be updated</td>
</tr>
<tr>
<td>Confirmation of engineering designs/costs for first year</td>
<td>April 15, 1995</td>
<td>Done</td>
<td></td>
</tr>
<tr>
<td>Submission of draft resettlement report</td>
<td>April 15, 1995</td>
<td>Done</td>
<td></td>
</tr>
<tr>
<td>Submission of draft environmental impact statement</td>
<td>April 15, 1995</td>
<td>Done</td>
<td></td>
</tr>
<tr>
<td>Negotiations</td>
<td>May 22, 1995</td>
<td>Done</td>
<td></td>
</tr>
<tr>
<td>Board Presentation</td>
<td>June 29, 1995</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loan Effectiveness</td>
<td>October 25, 1995</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Table 11.3: Project Implementation Schedule

**STU - BH**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
<td>I</td>
<td>II</td>
<td>III</td>
</tr>
</tbody>
</table>

### 1 - LAND EXPROPRIATION

- Bidding
- Works

### 2 - CIVIL WORKS

- **Lot A**
  - Preparation of Bidding Documents
  - Bidding
  - Works

- **Lot B**
  - Preparation of Bidding Documents
  - Bidding
  - Works

- **Lot C**
  - Preparation of Bidding Documents
  - Bidding
  - Works

- **Lot D**
  - Preparation of Bidding Documents
  - Bidding
  - Works

- **Buildings**
  - Preparation of Bidding Documents
  - Bidding
  - Works

- **Viaducts**
  - Preparation of Bidding Documents
  - Bidding
  - Works
Table 11.3: Project Implementation Schedule (Con’t)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Road Traffic Control</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Road Accesses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PERMANENT WAY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Superstructure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply/Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SYSTEMS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ELECTRIFICATION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Catenary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply/Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Substations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply/Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SIGNALLING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Signaling</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply/Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CTC &amp; CPC</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply/Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td><strong>5.3 - TELECOMMUNICATIONS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Cable &amp; Radio Network</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply/Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Public Address &amp; Clock Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply/Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Ticketing Control System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply/Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Telephone Central Station</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply/Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>6 - WORKSHOPS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>6.1 - Light Equipments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Lot 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Lot 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>-------------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Lot 3</td>
<td>Preparation of Bidding Documents</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot 4</td>
<td>Preparation of Bidding Documents</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot 5</td>
<td>Preparation of Bidding Documents</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.2 - Heavy Equipments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot 1</td>
<td>Preparation of Bidding Documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot 2</td>
<td>Preparation of Bidding Documents</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - ROLLING STOCK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refurbishment of EMUS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply/Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 11.3: Project Implementation Schedule (Con’t)

STU - BH

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
<td>I</td>
<td>II</td>
<td>III</td>
</tr>
<tr>
<td>* Assembling of EMUs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 - TECHNICAL ASSISTANCE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Supervision</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* T.A. &amp; Studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 - TRAINING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Consultants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of Bidding Documents</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. This Annex contains basic socio-economic and transport data on the BHMR and provides a snapshot of the modal split and involvement of each agency in the urban transport sector.

**A. Demographic Data**

**Table 12.1: Population Growth in Brazil**

(Thousands of Inhabitants)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BHMR</td>
<td>888</td>
<td>6.5</td>
<td>1,650</td>
<td>6.1</td>
<td>2,610</td>
<td>4.7</td>
<td>4,941</td>
<td>2.0</td>
<td>5,160</td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>70,119</td>
<td>2.9</td>
<td>93,139</td>
<td>2.5</td>
<td>113,003</td>
<td>1.9</td>
<td>143,449</td>
<td>2.2</td>
<td>183,627</td>
<td>223,673</td>
</tr>
</tbody>
</table>

Source: PLAMBEL/IBGE/CEDEPLAR

\(g/\) CBTU Estimate.

**Table 12.2: Population of the Municipality of Belo Horizonte and BHMR**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Belo Horizonte Municipality</td>
<td>1,780</td>
<td>2,020</td>
<td>2,952</td>
<td>3,197</td>
</tr>
<tr>
<td>Belo Horizonte Metropolitan Region</td>
<td>2,610</td>
<td>3,461</td>
<td>5,160</td>
<td>5,954</td>
</tr>
</tbody>
</table>

Source: IBGE/CEDEPLAR

**B. Individual and Household Income of STU-BH Ridership**

**Table 12.3: STU-BH Ridership Income Profile**

<table>
<thead>
<tr>
<th>Min. Salaries</th>
<th>Monthly Income Range in %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Individual</td>
<td>8.9</td>
</tr>
<tr>
<td>Household</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Source: CBTU, 1992

Minimum Salary/Month = US$61.74 (Aug. 1992)
<table>
<thead>
<tr>
<th>Municipality</th>
<th>Population</th>
<th>Annual Growth</th>
<th>Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1980</td>
<td>1991</td>
<td></td>
</tr>
<tr>
<td>BELO HORIZONTE</td>
<td>1,780,855</td>
<td>2,048,861</td>
<td>1.28</td>
</tr>
<tr>
<td>BETIM</td>
<td>84,183</td>
<td>170,616</td>
<td>6.63</td>
</tr>
<tr>
<td>BRUMADINHO</td>
<td>17,984</td>
<td>19,316</td>
<td>0.66</td>
</tr>
<tr>
<td>CAETE</td>
<td>30,634</td>
<td>33,440</td>
<td>0.80</td>
</tr>
<tr>
<td>CONTAGEM</td>
<td>280,477</td>
<td>448,822</td>
<td>4.37</td>
</tr>
<tr>
<td>ESMERALDAS</td>
<td>16,206</td>
<td>24,402</td>
<td>3.71</td>
</tr>
<tr>
<td>IBIRITE</td>
<td>39,970</td>
<td>91,760</td>
<td>7.85</td>
</tr>
<tr>
<td>IGARAPÉ</td>
<td>16,563</td>
<td>27,366</td>
<td>4.67</td>
</tr>
<tr>
<td>JUATUBA</td>
<td>---</td>
<td>9,546</td>
<td>---</td>
</tr>
<tr>
<td>LAGOA SANTA</td>
<td>19,508</td>
<td>29,707</td>
<td>3.90</td>
</tr>
<tr>
<td>MATEUS LEME</td>
<td>18,657</td>
<td>17,574</td>
<td>3.43</td>
</tr>
<tr>
<td>NOVA LIMA</td>
<td>41,223</td>
<td>52,202</td>
<td>2.17</td>
</tr>
<tr>
<td>PEDRO LEOPOLDO</td>
<td>29,999</td>
<td>41,586</td>
<td>3.01</td>
</tr>
<tr>
<td>RAPOSOS</td>
<td>11,810</td>
<td>14,167</td>
<td>1.67</td>
</tr>
<tr>
<td>RIB. DAS NEVES</td>
<td>67,257</td>
<td>143,874</td>
<td>7.16</td>
</tr>
<tr>
<td>RIO ACIMA</td>
<td>5,069</td>
<td>7,063</td>
<td>3.06</td>
</tr>
<tr>
<td>SABARA</td>
<td>64,204</td>
<td>89,679</td>
<td>3.08</td>
</tr>
<tr>
<td>SANTA LUZIA</td>
<td>59,892</td>
<td>137,602</td>
<td>7.86</td>
</tr>
<tr>
<td>SÃO JOSE DA LAPA</td>
<td>---</td>
<td>6,841</td>
<td>---</td>
</tr>
<tr>
<td>VESPASIANO</td>
<td>25,049</td>
<td>47,747</td>
<td>7.34</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>2,609,520</td>
<td>3,461,877</td>
<td>---</td>
</tr>
</tbody>
</table>

Source: Brazilian Demographic Census 1991 - IBGE
### Table 12.5: BHMR's Urban Transport Modal Split

<table>
<thead>
<tr>
<th>Mode</th>
<th>Number of Trips (000's)/day and % of Total Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1993</td>
</tr>
<tr>
<td>Public Transport</td>
<td>2,146</td>
</tr>
<tr>
<td>Bus</td>
<td>2,102</td>
</tr>
<tr>
<td>Metro</td>
<td>44</td>
</tr>
<tr>
<td>Rail</td>
<td></td>
</tr>
<tr>
<td>Private Transport</td>
<td>903</td>
</tr>
<tr>
<td>Automobile</td>
<td>746</td>
</tr>
<tr>
<td>Taxi and Jitney</td>
<td>21</td>
</tr>
<tr>
<td>Others</td>
<td>137</td>
</tr>
<tr>
<td>Walking Trips</td>
<td>2,104</td>
</tr>
<tr>
<td>Total</td>
<td>5,153</td>
</tr>
</tbody>
</table>

Source: CBTU/STU-BH

### Table 12.6: BH Municipality Motorization Rate

<table>
<thead>
<tr>
<th>Motorization Rate</th>
<th>Actual</th>
<th>Forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autos per 1000 Inhabitants</td>
<td>132</td>
<td>184</td>
</tr>
</tbody>
</table>

Source: DETRAN-MG/IBGE

### Table 12.7: Number of Autos in BH Municipality

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Belo Horizonte Municipality</td>
<td>280,897</td>
<td>404,483</td>
<td>637,292</td>
<td>713,093</td>
</tr>
</tbody>
</table>

Source: DETRAN-MG
<table>
<thead>
<tr>
<th>YEAR</th>
<th>PARAMETER</th>
<th>UNIT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>12,736,818</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>112,180,000</td>
</tr>
<tr>
<td>1990</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>13,062,838</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>115,736,000</td>
</tr>
<tr>
<td>1991</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>13,503,233</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>119,638,000</td>
</tr>
<tr>
<td>1992</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>10,735,804</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>95,119,000</td>
</tr>
<tr>
<td>1993</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>11,913,007</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>105,549,242</td>
</tr>
<tr>
<td>1994</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>13,189,841</td>
</tr>
<tr>
<td></td>
<td>(BASE YEAR) PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>116,861,991</td>
</tr>
<tr>
<td>1996</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>34,924,349</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>309,429,729</td>
</tr>
<tr>
<td>1998</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>40,735,760</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>360,918,836</td>
</tr>
<tr>
<td>2000</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>47,514,191</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>420,975,731</td>
</tr>
<tr>
<td>2001</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>104,597,568</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>926,734,452</td>
</tr>
<tr>
<td>2002</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>105,643,544</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>1,015,103,457</td>
</tr>
<tr>
<td>2003</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>106,699,979</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>1,025,254,491</td>
</tr>
<tr>
<td>2004</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>107,766,979</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>1,035,507,036</td>
</tr>
<tr>
<td>2005</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>108,844,649</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>1,045,862,107</td>
</tr>
<tr>
<td>2010</td>
<td>PASSENGER/YEAR</td>
<td>PASS.</td>
<td>114,396,820</td>
</tr>
<tr>
<td></td>
<td>PASSENGER.KM/YEAR</td>
<td>PAS.KM</td>
<td>1,099,211,585</td>
</tr>
</tbody>
</table>

Growth Factor
- 1994-2001: 1.08
- 2001-2010: 1.01
BRAZIL  
BELO HORIZONTE METROPOLITAN TRANSPORT DECENTRALIZATION PROJECT

SELECTED DOCUMENTS AVAILABLE IN THE PROJECT FILE

1. Projeto BIRD-1: Metrô de Belo Horizonte, DEMETRÔ, CBTU, March 1995
2. Rede de Transporte Integrada de Belo Horizonte, BHTRANS, 1993.
IMAGING

Report No: 14265 BR
Type: SAR