Report No. 1917-BR

BRAZIL

URBAN TRANSPORT PROJECT

STAFF APPRAISAL REPORT

April 3, 1978

Urban Projects Department
CURRENCY EQUIVALENTS
(January 1978)

US$1.00 = 16.4 Cruzeiros
US$0.06 = 1.0 Cruzeiros
US$60,975 = 1 million Cruzeiros

MEASURES AND EQUIVALENTS

1 meter (m) = 3.28 feet (ft)
1 kilometer (km) = 0.62 mile (mi)
1 square kilometer (km²) = 3.386 square miles (sq mi)

ABBREVIATIONS AND ACRONYMS

BNH = Banco Nacional de Habitacao / National Housing Bank
CIP = Conselho Interministerial de Precos / Interministerial Price Council
CNPU = Comissao Nacional de Regioes Metropolitanas e Politica Urbana / National Commission on Urban Policy
CONDER = Companhia de Desenvolvimento da Regiao Metropolitana de Salvador / Salvador Metropolitan Development Agency
CTU = Companhia de Transportes Urbanos / Urban Transport Company (Recife)
DETRAN = Departamento de Transito / State Department of Transit
EBTU = Empresa Brasileira dos Transportes Urbanos / Brazilian Urban Transport Company
ETT = Escritorio Tecnico de Transportes / Technical Transport Office (Salvador)
FDTU = Fundo de Desenvolvimento de Transportes Urbanos / Urban Transport Development Fund
FIDEM = Fundacao de Desenvolvimento da Regiao Metropolitana de Recife / Recife Metropolitan Development Agency
FNDU = Fundo Nacional de Apoio do Desenvolvimento Urbano / National Urban Development Fund
GEIPOT = Empresa Brasileira de Planejamento dos Transportes / Brazilian Transport Planning Agency
IPPUC = Instituto de Pesquisa e Planejamento Urbano de Curitiba / Urban Planning and Research Institute of Curitiba
OCEPLAN = Orgao Central de Planejamento / Central Planning Agency (Salvador)
TOPICS = Traffic Operations Programs to Increase Capacity and Safety
TRANSCOL = Programa para Transportes Colectivos / Public Transport Program
URBS = Companhia de Urbanizacao de Curitiba / Urban Works Company of Curitiba
# BRAZIL
## URBAN TRANSPORT PROJECT

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This report is based on the findings of an appraisal mission that visited Brazil in October/November 1977. The mission consisted of C. Madavo (Chief of Mission), P. Watson, C. Goldfinger, E. Canessa, and R. Buhler (IBRD), and J. Cracknell, D. Westin (Consultants). Mr. P. Watson had primary responsibility for the report.
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I. SECTOR BACKGROUND

A. Urbanization and Urban Conditions

1.01 Urbanization Trends. Brazil’s urban growth in the last two decades has been rapid: the urban population (as measured by an international standard definition of 20,000 or more inhabitants) increased from 18.7 million in 1950 to 52 million in 1970. In the 1960-1970 decade, the growth rate was 5.6% per annum, compared to 2.9% for the rate of overall population growth in the country. The urbanized proportion of the total population increased from 16% in 1940 (low by world and Latin American standards) to nearly 40% in 1970. The bulk of the urban population increase (72% of the 1960-1970 increase) occurred in cities of 250,000 or more persons. Geographically, urbanization has been unevenly distributed. Growth rates have been highest in the central-western region due principally to the growth of Belo Horizonte and Brasilia and lowest in the northeast region, despite the rapid growth of this region’s three metropolitan areas: Fortaleza, Recife, and Salvador. The former dominance of the southeast (mainly Sao Paulo and Rio de Janeiro) in urban population has been somewhat offset by the growth of cities in the central-west and in the south, but not enough to overcome the large imbalance between the southeast and other regions and between the large and small cities.

1.02 Employment. Rio de Janeiro and Sao Paulo also dominate the regional distribution of industrial employment. In 1970 roughly 53% of Brazil’s urban industrial jobs were located in the Rio/Sao Paulo axis compared to 14% in the other metropolitan areas, 5% in the other large cities of between 250,000 and 1,000,000 inhabitants, and 28% in the remainder. The 1970 Rio/Sao Paulo percentage shares of salaries and value added were 62% and 63%, respectively. An alarming feature of recent urban growth is that employment in non-agricultural activities in the formal sector has failed to keep pace with the rapid growth of the urban labor force. Data from employment studies in selected cities show that, although open unemployment is low (3%-4%), between 25% and 50% of the urban labor force is employed in the informal sector. Informal sector jobs are low paying and, being outside the urban tax base, do not contribute significantly to the cities’ ability to finance needed infrastructure for fast growing populations.

1.03 Urban Poverty. Poverty is endemic in Brazilian cities. For a middle-income country like Brazil, the Bank uses the concept of "relative poverty" to establish a poverty income level to be used as a guideline in project preparation and evaluation. The poverty income level for an individual is calculated as one third of national per capita disposable income (adjusted for urban-rural price differences). For operational purposes, this guideline can be multiplied by average family size to obtain the poverty income level for a family. The most comprehensive data available are from the 1970 census, according to which the percentage of families in poverty...
(according to the Bank guidelines) was 69% in Salvador, 55% in Curitiba, and 77% in Recife: about three million people in these three metropolitan regions alone. It is clear, therefore, that poverty is common in Brazil, even in the apparently prosperous southern cities, like Curitiba. It is more widespread and more intense in the cities of the north east, and, within that portion of the population that falls below the relative poverty threshold, there are significant numbers in even more severe conditions of poverty. Although the Bank does not estimate an "absolute poverty" (subsistence) income level for Brazil, the degree of deprivation can be seen in the data on families whose available income is so low that it would constitute poverty for an individual. Eleven percent of families in Salvador and 16% in Recife fall into this category (compared with four percent in Curitiba). Lack of employment, inadequate urban services, and squalid malnutrition, and disease that characterize the living conditions of three-quarters of the population in a city like Recife. It is both the intensity of these problems and their awesome pervasiveness that distinguish Recife and other northeastern cities from their southern counterparts.

1.04 Shelter and Urban Services. Access to shelter and urban services is inadequate in most Brazilian cities. The situation in southern and southeastern cities is better than in the rest of the country with the noticeable exceptions in the peripheral areas of the large metropolitan areas where as much as half the population has sub-standard housing, and no water connection or sewerage. The north and northeast parts of Brazil are very poorly served with the peripheries of the large cities and the small cities being the worst off. Around 70% of the population lack sewerage facilities; around 40% have no access to safe water. Some cities are much worse off: for example, in Fortaleza, 93% of the suburban population and 86% of the central city population are without water connections.

1.05 Urban Transport. The rapid pace of urbanization triggered an even faster growth of demand for transport in urban areas. In the nine metropolitan areas, 1/ the number of daily trips by all modes increased by up to 9% a year between 1968 and 1975. The principal transport modes (apart from walking) are bus and automobile. 2/ In the nine metropolitan regions, the number of daily trips varies from 822,000 in Belem to 12 million in Sao Paulo. The share carried by bus public transport ranges from 52% in Sao Paulo to 81% in Rio de Janeiro. While the bulk of demand is carried by buses, their share of traffic has been falling at the expense of the car. Since 1965, the automobile fleet has grown at an average rate of 11% per annum, twice the rate of growth of the urban population. In 1975, private ownership in the metropolitan areas had reached 2.3 million (plus about 100,000 taxis).

1/ Sao Paulo, Rio de Janeiro, Belo Horizonte, Curitiba, Porto Alegre, Salvador, Recife, Belem, and Fortaleza.

2/ Rail urban transport is a significant factor only in Rio de Janeiro and Sao Paulo, carrying 450,000 and 500,000 passengers a day, respectively.
1.06 The provision of urban transport infrastructure, in particular construction and paving of roads, has lagged behind the growth of demand. The gap is most striking on the periphery of metropolitan regions where the majority of recent migrants settle. In some metropolitan regions such as Recife, as many as 30% of the urban dwellers lack adequate access to public transportation and have to walk an average of 5 km to work. In the central areas of metropolitan regions, an increasing number of vehicles competing for limited road space has resulted in increased congestion. This is particularly detrimental to bus operating speeds that frequently are as low as 5-8 kph. Also in some cities such as Sao Paulo and Rio, pollution has reached very high levels. Journey times in metropolitan areas average around one hour for the journey to work and can rise much higher. The poor are particularly at the mercy of bad transport. They tend to make longer trips so they suffer more from service delays. More important, an initial walk of several kilometers to a bus stop can seriously restrict their range of employment opportunities. Unless corrective action is taken, these problems can only get worse as car ownership and travel demand grow.

B. Urban Policy

1.07 In spite of the high visibility of the problems described above, formulation of an explicit urban policy began only with the preparation of the Second National Development Plan for the period 1975 to 1979 and the policy is still at a very formative stage. The diagnosis on which Government policy is based largely accords with the sketch of the problem presented above, placing primary emphasis on the problems caused by rapid metropolization and concentration of activities in the Rio/Sao Paulo axis, and disparities in the provision of economic and social infrastructure, both between and within regions.

1.08 Strategies. Detailed urban strategies have been formulated for Brazil’s five macro-regions. In the southeast, intra-regional dispersion is given priority, principally through efforts to avoid the excessive growth of Sao Paulo and Rio de Janeiro. Orderly expansion is the main objective in the remaining regional metropolitan centers (Belo Horizonte, Curitiba, and Porto Alegre) of the central-west, southeast, and south. In the northeast, measures will be taken to strengthen and diversify the urban economies of Recife, Fortaleza, and Salvador. Urbanization will be actively promoted in areas of recent settlement in the north by consolidating the position of the regional metropolitan center (Belem) and encouraging the growth of secondary cities. At the same time the Plan calls for the promotion of medium-sized cities and local centers in all regions to achieve a more balanced urban hierarchy in which the rapidly growing middle- and lower-rank cities will absorb an increasing share of rural-urban migratory flows and divert these away from the larger metropolitan centers. This recommendation is embodied in the Medium-Size City program recently initiated by the Government.
Urban Transport Policy. Until the mid-'70s, there was no explicit national policy toward urban transport. The major public investments in public transport in the early '70s were ambitious and costly mass transit programs in Sao Paulo and Rio de Janeiro. In recent years, a more comprehensive urban transport policy began to evolve, with four main features. First, experience with subway investments and a growing scarcity of resources led planners to start to limit the use of high-cost, high-technology solutions and adopt a policy of making more efficient use of existing infrastructure and transport systems, especially bus systems. Second, the Fall 1973 increase in oil prices, which resulted in an increase of the import bill for petroleum from US$711 million in 1973 to about US$2,840 million in 1974, prompted the adoption of a policy to slow down gasoline consumption and reduce the use of automobiles. The retail price of gasoline was doubled in 1974 and since then it has been increasing more rapidly than inflation. The current (February 1978) price is US$1.74 per gallon. As a result, the rate of growth of gasoline consumption was reduced to 3.6% in 1974 and 0.6% in 1975. Third, it became clear that the logical complementary policy would be to promote actively the use of public transport, through measures and investments to improve its quality. The government’s objective is to raise the percentage of trips made by the public transport from 60% to 80%. Finally, the simultaneous emergence of a national urban policy brought the realization that urban transport is an important tool for land-use control and planning. This stimulated a policy of planning and coordinating urban transport investments with other urban planning activities.

C. Urban Institutions and Investment Financing

In the Brazilian constitutional system, each level of government is autonomous and a federal agency has limited statutory authority to influence the decisions of state and local communities. It has to rely heavily on persuasion backed by financial and fiscal incentives to encourage adoption by local authorities of programs and projects designed to further its policies.

The salient feature of the Brazilian financing system is a high degree of centralization in the collection and distribution of revenues, together with their earmarking for specific uses. The states and municipalities receive only small (20%) shares of tax revenues, most of which are earmarked for sectoral uses which limits the local autonomy of investment decision-making. Thus, most investment decisions are the result of a compromise between local political autonomy and federal financing.

At the federal level, the Government created in June 1974 the Comissao Nacional de Regioes Metropolitanas e Politica Urbana (CNPU) to coordinate and oversee the development of plans for, and the flow of funds to, the urban sector. CNPU is a small interministerial commission with advisory and prescriptive functions within the Presidential Planning Secretariat. The
main responsibilities of CNPU are to supervise the system of metropolitan regions; to propose guidelines for national urban development policy, to formulate a strategy to ensure its implementation; and to propose regulations and operational instruments required for urban development.

1.13 CNPU works closely with the metropolitan planning agencies established between 1973 and 1975 under the authority of the states, and which promote their and CNPU objectives at the local level. Investment programs falling within CNPU’s area of competence are reviewed for consistency with its guidelines and priorities. Metropolitan regions and cities seeking access to federal urban development funds are required to submit their proposed investment plans for CNPU approval. However, CNPU has a limited capacity for individual project evaluation and usually operates at a more general level, attempting to ensure that the investment programs of sectoral institutions, metropolitan regions, and state governments meet its guidelines and objectives for urban development.

FNDU

1.14 A special fund to finance urban development projects was created in late 1975: The National Urban Development Development Fund (FNDU: Fundo Nacional de Apoio do Desenvolvimento Urbano). FNDU is financed from the fiscal revenues, primarily the vehicle registration and fuel and lubricants taxes. It is part of the National System of Funds for Urban Development (Sistema Nacional do Fundos para o Desenvolvimento Urbano). Total resources for urban development are estimated at US$5 billion equivalent for the period 1976-79, with US$1.5 billion for the FNDU. The FNDU resources are therefore small compared to those of the well-established institutions such as the National Housing Bank (BNH) which administers most of the remaining resources allocated to the urban sector. Through leverage, FNDU resources are intended to have a disproportionately large effect on investments for urban development. Approximately 75% of the FNDU is channeled into a sub-account destined for urban transport investment—the Urban Transport Development Fund (FDTU: Fundo de Desenvolvimento de Transportes Urbanos) (see para 1.16).

EBTU

1.15 The Empresa Brasileira dos Transportes Urbanos (EBTU) was established in 1976 with the task of developing and promoting a national urban transport policy and controlling federal investment in urban transport, including administering the FDTU. EBTU has a dual function within the public policy structure. On the one hand, it is an integral part of the national transportation planning system. On the other, it is a key participant in the national urban planning system. This duality is reflected in EBTU’s institutional setup. It is a government-owned corporation with administrative and financial autonomy, independent juridical personality, and its own assets and liabilities, under the overall responsibility of the Ministry of Transport, which is its legal overseer. Its main source of resources, the Urban Transportation Development Fund (FDTU), is a part of the National Urban Development
Fund (FNDU), managed by CNPU, which participates in EBTU's investment approval process in order to ensure the consistency of EBTU programs with broad urban planning strategies. This participation involves not only reviews of convenios, but also a detailed review of each metropolitan area's investment program and priorities.

1.16 Although EBTU is an independent corporation, with the legal authority to enter into a wide range of activities, its principal operation is the allocation of funds from the FDTU, which represent over 90% of its resources. 75% of the FDTU funds come from: (a) 0.5% surtax on the vehicle registration tax and (b) the federal government's share (60%) 1/ of the 12% surtax on lubricants and liquid and gaseous fuels. Other federal budget funds make up the balance. Since the majority (over 80%) of vehicles are registered and most fuels and lubricants are bought in urban areas, the incidence of these taxes falls most heavily on the largest urban areas. Forecasted FDTU revenues (in 1977 prices) for 1977-1980 period are US$1.1 billion equivalent. Given current EBTU participation rates, this will permit financing of urban transport investments totaling between US$3.6-4 billion equivalent during the 1977-1980 period.

1.17 EBTU has promoted and financed a wide range of activities, including preparation of long-term urban transport plans and medium-term public transport improvement programs (TRANSCOL); implementation of immediate action traffic and transportation programs, emphasizing optimal use of existing infrastructure through traffic engineering, funding improvements in the urban road system and its equipment; equity participation in public bus and metro companies; lines of credit for fleet renewal; graduate training and research programs in urban transport in leading Brazilian universities; R&D for new vehicle fuel such as alcohol and for electrically propelled vehicles; and standardization of bus equipment.

1.18 The process by which EBTU allocates funds involves two steps: the preparation of a policy document (EM: Exposicao de Motivos) for approval by the President of the Republic, which sets out the investment programs for a given area and their sources of financing, and the signing of an agreement (convenio) between each of the agencies and entities involved in program/project financing and implementation defining their duties and obligations.

1.19 The type of program for which EBTU has allocated funds in the past and their geographical distribution has been undergoing a change. In 1976-77, 35% of funds went to Rio/Sao Paulo, 34% of it for subway investments. Only 25% went to the northeast, largely for urban road investments. In the 1978-79 program, the Rio/Sao Paulo share has fallen to 24% (only 16% for subways) and the northeastern share had risen to 35%. In addition, the share going to smaller cities is high relative to their contribution to the Fund. Overall, the evidence is that EBTU is selecting investments that redistribute funds from Rio/Sao Paulo to the northeast and from large cities to smaller ones.

1/ 32% goes to the states and 8% to the municipalities.
1.20 It is important to note that, with the exception of loans for fleet renewal, FDTU funds are passed by EBTU to the municipalities and metropolitan regions as grants. It is this function of distributing tax revenues, in fact a form of revenue-sharing, that distinguishes EBTU from the more traditional Brazilian state-owned corporations. The FDTU funds are taxes collected in the cities and the cities perceive that they have a right to have at least some of the funds returned. The financial management of the FDTU funds before they are disbursed rests with the Treasury and EBTU has no control over the amount of revenues accruing to FDTU. By law, FDTU revenues and expenditures have to be balanced. EBTU's function is to redistribute the funds so that they are channeled towards projects that reflect both federal urban transport policy and local priorities.

1.21 EBTU is a young institution and its staff and operations reflect the learning process that it is going through. The early need to establish its presence resulted in commitment of FDTU funds to projects with less technical background, economic preparation, and attention to complementary policies and measures than would have been desirable. Some early convenios lacked precision and sometimes called for overly optimistic implementation schedules. These problems are being overcome. The quality of technical and economic evaluation work has improved markedly. EBTU staff collaborated with Bank missions and made efforts to assist local communities prepare for this project. Convenios are more precise. Standards and procedures have been developed and implemented for project supervision. Guidelines for project evaluation have been developed and are being tested. In the case of bus operations, EBTU now requires a full management study and a financial audit of any bus company which requests EBTU's capital participation. Internally, though the institution is still at a formative stage, there is evidence of greater cohesion and better coordination between different directorates.

1.22 Despite considerable progress, in order to develop into a strong institution capable of leadership in the field of urban transport EBTU still has to articulate an overall investment allocation strategy, define its functional and geographical priorities, and establish explicit criteria for accepting projects. In the absence of such criteria, EBTU will continue to be subject to strong political pressures for FDTU resources. EBTU will require strong direction and political support if it is to succeed in concentrating its investments in areas and projects with highest economic and social impact.

GEIPOT

1.23 An important complementary institution is the Empresa Brasileira do Planejamento dos Transportes Urbanos (GEIPOT), which functions as a consulting firm under the overall responsibility of the Ministry of Transport. GEIPOT can be hired directly by a city or metropolitan region, or indirectly through EBTU, to carry out studies of urban transport problems. The typical GEIPOT approach is to carry out a three-phase study: an immediate action plan, a medium-term public transport plan, and a long-term integrated transport plan. Since both EBTU and GEIPOT belong to the Ministry of Transport, a close working relationship has developed between them, which ensures that government policies on urban transport are quickly integrated into studies and plans at the local level.
D. Bank Involvement in the Urban Sector

1.24 The government's present policies in the urban sector are basically sound. However, the macroeconomic management of population distribution needs to be complemented by programs reaching directly the problems of the urban poor: the lack of employment opportunities, and of basic urban infrastructure and services. Furthermore, the policy institutions are recent and their strategies and policies are in the formative stage. Finally, given the scale of the problem in the largest country in Latin America, and the scarcity of funds available for investment, it is important to concentrate the resources in key sectors and areas and to develop strong intermediaries at the federal level. The Bank involvement focuses on two key aspects of the sector: (a) provision of badly needed services and employment opportunities to the urban poor and (b) strengthening of the institutions at the federal and local level. The Bank involvement in the sector is in its early stages. Up to now, the Bank has participated in the financing of a series of water supply and sewage projects in the States of Minas Gerais and Sao Paulo. In addition, two education projects are currently being executed and a vocational training project was recently approved by the Executive Directors. In addition to the Urban Transport Project (subject of this report), projects are under preparation in the sector of water supply and sewage; shelter and associated services; education; and assistance to small scale industry. These projects would involve federal intermediary institutions such as EBTU and BNH.

E. Rationale for the Project

1.25 The project has two institution-building objectives. The first is to assist EBTU to become a strong independent institution, capable of orchestrating urban transport policies and investments. The second is to improve the urban transport service delivery and management at the local level.

1.26 If the Bank is to have a significant impact on the urban transport policy, it is clear that Bank involvement in the sector should be through EBTU. As the government's resource allocation and policy setting agency, EBTU is in a unique position to influence urban transport development. Bank staff worked very closely with EBTU during project preparation in an attempt to strengthen the institution and Bank and EBTU staff also worked together at the local level to obtain acceptance for EBTU's policies. The presence of Bank staff has enabled EBTU, to a certain extent, to make project design decisions on more technical and economic grounds. The project also includes assistance to EBTU to strengthen its technical capacity and improve its internal procedures.

1.27 In addition to working with EBTU, it is important for the project to make a direct impact at the local level. The proposed project would, therefore, have components to improve transport services in five metropolitan regions—Belo Horizonte, Curitiba, Porto Alegre, Recife and Salvador—in five different states from the northeast to the south of Brazil. These cities were chosen because they represent the whole range of urban transport in
Brazil, covering the extreme poverty of Salvador and Recife, the explosive growth rate of Belo Horizonte, the growing regional industrial base of Porto Alegre, and the action-oriented urban planning approach of Curitiba, which is regarded as a model in Brazil.

1.28 The approach to project appraisal reflects the institution-building objective to strengthen EBTU. The Bank has fully appraised the projects in Salvador, Curitiba, and Recife. EBTU has responsibility for the appraisals in Porto Alegre and Belo Horizonte (see paras 5.07-5.10). The results of the Bank appraisals are presented in the body of this report. A summary of the results of the Porto Alegre appraisal is presented in Annex 1. The Belo Horizonte appraisal is expected to start in July. Basic background information and a tentative description of the potential project components in Belo Horizonte is presented in Annex 2.

II. TRANSPORT CHARACTERISTICS OF THE PROJECT CITIES

A. General Characteristics 1/

2.01 The three cities appraised by the Bank share many transport characteristics. Typically, transport problems are concentrated in the central areas. Trip patterns concentrate up to 60% of destinations in the center and growing traffic volumes have resulted in increasing levels of congestion. In general, cars, buses, trucks, and pedestrians all use the same space and the resultant conflicts cause delays, accidents, and pollution. What differs among cities is the attempts made and the success achieved in dealing with these problems. This is discussed below.

2.02 Outside the central area, each city has a few bottlenecks that hold up traffic, but the major problem lies in areas where the poor live. Most roads in these areas are unpaved, which creates very difficult operating conditions for buses and slow, uncomfortable traffic for the riders. In some areas, these roads are subject to flooding, resulting in prolonged interruptions in bus services. The resultant delays lead to extremely long trips to work (up to 3 hours in some cases) and constrain the number of jobs available to residents of these areas. To learn more about these problems and to pave the way towards specific solutions, the project will finance a study of the relationship between the level of transport service and employment among the urban poor (see para 3.44).

2.03 Public Transport Regulation. The regulation of bus operations in an urban area is the constitutional prerogative of the municipality. As a result, the number of bus companies in each city, the specific form of regulation and conditions of entry vary widely from city to city. The only constant appears to be some degree of competition and a generally satisfactory profit

1/ The basic socio-economic characteristics of the cities are shown in Table T1 (Annex 3).
picture, as indicated by the backlog of franchise requests in most cities. Salvador and Recife each have a municipal bus company. However, the majority of the passenger traffic in these cities is carried by private operators. Although the proportion of passenger traffic carried by rail in Recife and Salvador is small (less than 5%), proposals have been made for expanding rail services. This raises questions of how the different modes will be integrated and who will regulate and operate the services. A solution currently gaining support in Brazil is the creation in the major cities of a Metropolitan Urban Transport Enterprise--EMTU (Empresa Metropolitana de Transportes Urbanos)--to coordinate, regulate, and in some cases operate public transport services. EMTU's have already set up in three Brazilian cities. Given the importance of the coordination and regulatory issues raised by EMTU's and the necessity to address these issues in the light of the suburban rail project that the Bank has been asked to consider for financing, the project will finance a study (see para 3.44) to examine the institutional, organizational and financial aspects of EMTU's and to monitor the performance of those already in existence.

2.04 Bus fares are controlled at the federal level, by the Interministerial Price Council (CIP). CIP defines formulae for fare computation (with different coefficients for each metropolitan area and vehicle category), which take into account operating and administrative costs, depreciation, load factor, and allows for a reasonable rate of return (12%) on companies' investment. Fares are recomputed twice a year. There are no operating subsidies for any bus company, public or private, in the metropolitan regions.

2.05 Public Transport Operations. All three systems have many bus lines converging on the central area, where congestion is worst. Recife and Salvador use a series of terminals that are, in general, too small and badly located in the most congested parts of the center. Bus speeds in central areas average 8-12 kph and average journey times are around one hour.

2.06 Transport Planning. Each city has made an effort to develop plans and programs to improve public transport. In Curitiba, this was done through the city's urban planning and research institute (IPPUC); in Salvador and Recife, it was done by GEIPOT.

B. City-Specific Characteristics

Salvador

2.07 Within the city of Salvador, the topography is the major factor to be considered. The most prominent feature is the high bluff that separates the lower city (containing the port and the financial center of Salvador) and the upper city (that contains the historical center and much commercial activity). Although three pedestrian links--an elevator and two inclined planes--exist between the upper and lower cities, connections for vehicles are few, involving very circuitous routes that are heavily congested. The
rest of Salvador is very hilly and the original roads were built along the tops of escarpments. In many areas, especially poor areas, a single road serves a wide area and people are obliged to walk long distances—up to 5 kilometers—over difficult terrain to reach transport services. In the last decade, the local authorities constructed a series of "valley avenues" (four or six lane divided highways) along several of the valleys that converge on the central area. Transversal links between these avenues are limited with the result that cross-town movements are channelled towards the edges of the central area and out again. Nevertheless, the capacity available is sufficient to accommodate the demand for movements by cars and commercial vehicles except in the central area.

2.08 The center of Salvador (in the upper city) is completely saturated with traffic. Most of the streets are extremely old and narrow, with two-lane streets being used for two-way traffic and for parking. Under these circumstances, speeds frequently are as low as eight to ten kilometers per hour. Given the historical character of much of the central area, much of which dates from the seventeenth century, the problem is one of trying to reduce traffic to preserve the area.

2.09 Public Transport Demand. In Salvador, 47% of all trips and 65% of motorized trips are made by bus. This amounts to 959,000 bus trips per day in the city of Salvador. 11% of those trips are made in the morning peak (700-800 hours). Of all home-based bus trips, 52% are destined for the central area. Some attempt has been made to decentralize jobs and the new Administrative Center and the regional bus terminal/shopping complex at Iguatemi are now important generators of traffic. Although the central area is the biggest generator of traffic, it covers 5 km so destinations are spread out. This is exemplified by the number of bus passengers entering the center who do not travel all the way to the terminal. For all but one terminal, only 26% of passengers stay on the bus to the terminal. This means that, in the most congested part of the city, buses are operating at considerably less than full capacity and helping to create congestion.

2.10 Transport Policies. Salvador's local authorities are trying to discourage motorists from driving into the center by removing long-term (more than four hours) parking and releasing existing spaces for high turnover parking, together with reducing the amount of illegal parking. The city opened, in 1976, three fringe car parks (with 2,500 spaces) on the periphery of the central area, linked with the central area by air-conditioned minibuses. As a result of a low fee for parking and riding and an intensive publicity campaign, the service was accepted by motorists and is now extremely popular. In addition, the state and municipal authorities created a joint office—the Escritorio Tecnico de Transporte—which designed a program called PROBUS to improve transport. PROBUS includes measures to improve public transport and relieve central area congestion, a new inclined plane to link the low-income suburb of Libertade with the employment center of Calcada, a few critical road works, and a program of improvements in poor areas. The
program recognizes that recent road improvements have channeled benefits mainly to car users and attempts to redress the balance by concentrating on public transport improvements and program elements that benefit the poor.

2.11 **TRANSCOL.** To complement the PROBUS program, GEIPOT was commissioned to carry out a study of public transport--TRANSCOL (acronym for collective transport)--and to make recommendations for medium-term improvements to public transport services. The TRANSCOL Study recommended measures to (a) increase effective capacity and efficiency in the central area, (b) remove critical bottlenecks, and (c) improve bus services in low-income neighborhoods.

2.12 In the **central area,** expanding capacity by widening streets was out of the question. Thus, the measures proposed fall into the category of low-cost traffic engineering measures to increase the effective capacity of the existing infrastructure (roads and terminals) and to improve the operating efficiency of the existing bus fleet. The measures include introducing bus lanes, reorganizing terminals to reduce the number of buses circulating at less-than full capacity. A new circular bus service would be introduced to link the remaining terminals and act as a central area distributor system. A special transfer system would be introduced so that people using the circular bus system do not have to pay an additional fare.

2.13 Outside the central area, several **critical points** were identified as being particularly subject to congestion in peak periods and suitable for treatment by traffic engineering and management measures.

2.14 To improve bus services in **low-income areas,** TRANSCOL recommends a program of road paving to provide improved access for buses, together with the construction of neighborhood terminals with waiting areas and shelters.

2.15 **Rationale for the Project.** In the light of the above diagnosis and recommendations, the project is aimed at relieving pressure on the central area, improving existing public transport services, and expanding service into poor areas. The PROBUS and TRANSCOL programs provide the basis for the elements included in the proposed project (see para 3.06 - 3.22).

**Curitiba**

2.16 The most salient feature of the transport situation in Curitiba is the development of structural axes to make use of the relationships between land use and transport. The basic element is a "trinary" road system; i.e. three parallel roads, one block apart. The land fronting onto the central road is zoned for high-density commercial and residential development, and the central road facility is designed to serve these functions. The central two lanes form an exclusive busway, designed for a high-capacity bus mass transport system. Their physical separation from the other lanes means that they could, should future demand require it, be used for a more sophisticated mass transport system, such as trams or light rail. On either side of the bus-way are lanes for local access traffic, including parking to serve the commercial developments. The two lateral roads (four-lanes each) form a one-way pair for through traffic and for access to adjacent developments. Frontage areas on
the lateral roads are zoned for medium-density residential and commercial development on the inner side of the road and for low-density residential development on the outer side. Thus, development is oriented towards the high density corridors that are a prerequisite of a good mass transport system, and at the same time, the high level of accessibility provided by the transport system induces development to concentrate in the corridors.

2.17 Within Curitiba, three such structural axes have been brought into operation since 1974—Structural North, Structural South and the recently opened Boqueirao axis. The system has already been shown to lead to increased densification along the structural axes. From 1970 to 1974, the population of Curitiba grew by 22%; the population in the structural sectors grew by 67%. Commercial development has not been as rapid as expected, but is now beginning to pick up, especially near transfer points between the conventional and the express bus systems.

2.18 Public Transport. In Curitiba, two distinct bus operational systems exist. The bus system operated on the exclusive bus-ways built into the structural axes corridors comprises express buses to and from the city center. A feeder/collector network of conventional buses exists to connect the express bus system with adjacent residential areas. In 1977, the number of passenger trips carried on the express bus service was an average of 115,000 per day, 17,000 more than in 1976. In sectors not served by the express bus/feeder bus network, public transport in Curitiba is provided by conventional bus services. In 1976, the conventional bus fleet comprised 583 buses which carried an average of 611,000 passengers per day.

2.19 The high capacity transport corridors and the linear axes development policy have done much to prevent central area traffic congestion while virtually eliminating congestion elsewhere. Congestion has also been avoided through the introduction of extensive and well-planned traffic management schemes in the city center. An Area Traffic Control scheme integrating and coordinating 200 traffic signals is being implemented. A central area parking policy regulates on-street parking through no parking areas, loading/unloading areas, and restricted period waiting areas, the latter employing a disc system. As a result, it has been possible to introduce an extensive system of pedestrian streets. About 30% of all streets in the central business area are devoted to exclusive pedestrian use.

2.20 Rationale for the Project. The existing transport system in Curitiba does not present any fundamental operational problems, in the sense that congestion has by and large been avoided. There is a well-defined policy to assist public transport operation and while new facilities have and are being constructed for auto travel, it is evident that Curitiba is developing the most comprehensive public transport system in Brazil. Thus, the action required is to extend and improve the existing system. This implies physical extensions into areas not yet served and expansion of services on the existing structural areas. The proposed project encompasses both types of activity.
Recife

2.21 Transport problems in Recife are made worse by the geography of the city, which concentrates the central core of the city on two islands as well as the adjacent mainland. The bridges making these network connections are bottlenecks. In addition, traffic at most intersections is controlled by policemen who operate the traffic lights, frequently adding to existing congestion and delays.

2.22 Public Transport Regulation. The municipality of Recife in 1957 granted a 50-year monopoly services in the municipality of Recife to the public bus company—Companhia de Transportes Urbanos (CTU). For lines that CTU cannot or does not want to operate, it has the authority to issue "permissions" to other bus companies. Currently, 46 private bus companies operate services in the municipality of Recife (19 more operate in other parts of the metropolitan region). Two problems arise in this situation. A conflict of interest arises when one company is both a regulator and an operator. CTU has decided to issue no new "permissions" until it has an arbitrary 51% share of the urban bus fleet. Since it does not have the resources to increase significantly its current share of 37%, the result is to restrict the expansion of bus services. The second issue is that CTU is inefficient, especially in the areas of financial management and vehicle maintenance (on average, 40% of the fleet is out of service). The project will address both of these problems (see para 3.43).

2.23 Public Transport Demand. In 1976, public transport carried 76% of trips in the metropolitan region—1.2 million trips, of which 70% are within the city of Recife. Of all regional public transport trips, 37% had a destination in and a further eight percent passed through the very congested central core of Recife. 18% of trips using the central core involved a transfer. The demand is spread over 4 peaks, as many people return home for lunch.

2.24 To solve these problems, the metropolitan planning agency (FIDEM) and the municipality initiated a series of actions. The Avenida Agamenon Magalhaes (First Perimetral) is being upgraded to provide an inner cross-town route that avoids the city center. To make the center less attractive to motorists and more attractive to pedestrians, the municipality has introduced a number of pedestrian-only streets and central area parking charges that increase with the numbers of hours parked. At the same time, FIDEM commissioned GEIPOT to carry out a public transport study (TRANSCOL) and recommend medium-term solutions.

2.25 Strategy for Public Transport Improvement. The recommendations of the TRANSCOL study comprise policy measures (e.g., parking) to discourage the use of the center by motorists, traffic engineering and management measures (including bus priority) to increase the functional capacity of the center, and a program of TOPICS improvements and paving to improve bus operating conditions on radial routes and in poor areas, respectively. The TRANSCOL measures will be complemented by more street pedestrianization and the designation of certain streets on the periphery of the central nucleus as a city center ring route.
2.26 Regional Level Transport Problems. To complement the TRANSCOL proposals, transport problems at the regional scale have been analyzed by FIDEM and proposals drawn up for a longterm transport network. FIDEM is aware that these proposals cannot all be implemented immediately and gives priority to those that would take pressure off the center. The federal highway authority, DNER, has under construction an outer by-pass for Recife and the Municipality is currently completing the First Perimetral which will contain the expanded central area. The next priority is an intermediate cross-town route—the Second Perimetral—which would provide relief to the center by removing traffic from the center and by serving as a focus for the relocation of commercial and service activities that currently operate in the center. The second regional transport priority concerns the secondary roads that serve the smaller municipalities in the metropolitan area. State and Federal road programs have provided new roads that constitute good inter-regional linkages, but one result has been to throw into neglect the old roads which provide intra-regional linkages. Thus, a program is needed to rehabilitate some of these roads and restore them to adequate, safe operating conditions.

2.27 Rationale for the Project. The proposed project is made up of elements required to implement the recommendations of the TRANSCOL study together with elements from the FIDEMI program to improve the regional transport network. In this way, the project achieves a balance between the objectives of improving the existing situation, while at the same time looking towards the future with the aim of reducing the likelihood that today's problems will re-occur.

III. THE PROJECT

A. Project Objectives

3.01 The proposed project has three main objectives:

(a) to finance investments that will improve urban transport services, with emphasis on the provision of public transport, especially to the poor;

(b) to promote and support the development and implementation of appropriate urban transport policies;

(c) to strengthen municipal, state, and federal capacity to prepare, appraise, and execute sound urban transport projects.

3.02 In order to achieve the first objective the traditional technical and economic criteria were complemented by the systematic application of the following principles to the project design:
(a) project components should be consistent with regional and urban development strategies;

(b) priority should be given to traffic management and traffic engineering measures designed to increase the effective capacity and performance of the existing road network, together with organization measures to improve the efficiency of bus fleet operations;

(c) only when sufficient capacity cannot be created by such measures, when specific links in the road network are missing, or when special facilities, such as bus lanes, are required, should road construction be considered;

(d) priority should be given to measures that will improve public transport services, especially those in, or used by people from, low-income areas.

In many cases, project components that give priority to public transport or other high-occupancy vehicles will also tend to discourage car use. For example, the creation of an exclusive bus lane reduces the road capacity available to cars. The complementary parking policies will actively reinforce this tendency by reducing the number of spaces available and penalizing long-term parking. Together with measures already taken to increase the price of gasoline, these actions are expected to have a significant effect on car use. Nevertheless, as car ownership grows, the effectiveness of this type of measure will be gradually eroded and in the long term it will be necessary to introduce measures that will directly reduce the demand for car use in congested areas. To ensure that such measures are ready when the time comes, the project includes a study of the potential for applying "road pricing" schemes 1/ (such as Singapore’s Area License Scheme) in Brazilian cities.

3.03 During project preparation, the Bank had an extensive dialogue with government officials at both the local and federal levels on urban transport policy. In many cases, this resulted in changes in the proposed project, most notably a shift of emphasis away from road construction in the direction of traffic management. In addition, technical assistance is included in the project to provide expertise and to study new policies. Finally, the fact that the project will encompass five of Brazil’s nine metropolitan regions means that the policy dialogue will have a wide impact.

3.04 Although the projects differ among cities, certain types of components reflect the overall approach of the project and appear in several cities:

1/ "Road pricing" schemes impose additional costs on motorists, often through supplementary licenses to operate in congested areas, in an attempt to transfer to the motorist some of the costs he imposes on others through congestion, pollution, etc., with the objective of curbing demand and reducing traffic congestion.
(a) traffic engineering measures to improve circulation in the central area;

(b) the introduction of exclusive bus lanes;

(c) TOPICS (Traffic Operations Program to Improve Capacity and Safety) programs to alleviate critical congestion points; 1/

(d) the widening or construction of missing links in the network;

(e) the reorganization or construction of bus terminals; and

(f) paving of bus routes in low-income areas.

3.05 **Design Approach.** The design approach followed in the preparation of the project was to make every effort to reduce design standards and costs to the minimum level compatible with obtaining benefits. Attempts were made to reduce the scale of any project element whose design was based on unjustified expectations regarding future growth, either of the urban area or of traffic. This approach resulted in important project modifications and cost savings. In Curitiba, the selection of a very low-cost paving technique cut costs by 80% on half of the feeder road program. In Salvador, a poor area bus penetration road (Vale das Pedrinhas) was cut from the proposed four lanes to two. Overall, cost savings resulting from reducing the standards of proposed project elements were of the order of US$6.3 million in Salvador, US$32.0 million in Curitiba, and US$5.8 million in Recife—a total saving of US$45.1 million (about 15% of total project costs).

**B. Project Components—Salvador**

**Main Features**

3.06 The project comprises the following elements from the recommendations of the TRANSCOL study:

(a) exclusive bus facilities in six corridors (US$8.61 million 2/);

(b) modifications to bus terminals (US$6.75 million);

(c) TOPICS improvements in the central area and at critical points outside (US$0.79 million);

1/ The types of measures used include channelization of traffic, turn prohibitions, signal improvements, signing and marking, and turning radius modifications.

2/ All costs exclusive of contingencies.
(d) road paving and neighborhood bus terminals in poor areas (US$6.17 million); and

(e) equipment for traffic engineering and control (US$0.81 million).

Not all the measures recommended by the TRANSCOL Study are proposed for Bank financing. Some components that are urgent or easy to implement will be financed entirely by EBTU and the Municipality and carried out prior to the Bank’s participation. In this section, only the components proposed for Bank financing are described.

3.07 In addition, the following elements of the ETT PROBUS program are included:

(a) a program of paving in poor areas (US$1.45 million);

(b) a bus penetration road—Vale do Queimado (US$1.45 million);

(c) an integrated basic transport infrastructure program in Nordeste de Amaralina (US$4.66 million), including a bus penetration road—Vale das Pedrinhas (US$0.89 million); and

(d) the reconstruction of one critical road link—Avenida San Martin (US$2.76 million).

Detailed Features—TRANSCOL (See Map 13154)

3.08 Bus Corridors in the Central Area. Six corridors in the central area will receive special treatment to facilitate the movements of buses and pedestrians. The works on five corridors will be carried out within the existing rights-of-way. In general, long-term on-street parking will be eliminated and replaced with short-term, high-turnover spaces when the level of commercial frontage activity is high. Bus lanes will be introduced on the corridors to provide improved operating conditions for those conventional bus lines that continue to penetrate the center, for the shuttle buses that serve the fringe car parks, and for the new central area circular bus lines 1/. The bus lanes will be set out with semi-permanent physical separators, which can be crossed for loading, servicing, or in an emergency. The bus lanes will operate all day. Loading activities are currently restricted to the period from 2200 to 0600 hours. This regulation will be more strictly enforced.

1/ Within the overall bus lanes strategy (although not proposed for Bank financing), it is proposed to convert the shopping area (Baixa dos Sapateiros) into a street for buses and pedestrians only, to improve both public transport and pedestrian conditions in what is a major shopping center for low-income people. It is currently a two-lane road with heavy congestion, narrow sidewalks, and many accidents. It is also subject to flooding. Following drainage works that are already underway, half the road will be used as a one-way bus lane and the other half for pedestrians. Returning buses will be routed onto a parallel road.
To avoid congestion caused by taxis stopping in the corridors, special "taxi stops" will be introduced in side streets and taxis will be prohibited from stopping in the corridor. Intersections on the corridors will be widened where necessary. It was confirmed at negotiations that the Municipality would undertake a program of removing long-term parking spaces from the center of Salvador and would take all necessary steps to minimize illegal parking and to ensure the efficient operation of the exclusive bus lanes. It was also agreed at negotiations that the Municipality would make arrangements to purchase or lease the land required for the establishment of a fringe car park to serve the Comerco area.

3.09 The sixth corridor is made up of a two-lane, two-way street that links a national highway and the regional bus terminal with a heavily-used, low-income shopping area. Congestion is very heavy. In this case, it is proposed to duplicate the roadway to give a four-lane cross-section. The proposed scheme will include the channelization of a drainage culvert. Since much of the land adjacent to the culvert is vacant, land acquisition is limited. Some property has to be acquired, but it is largely commercial, so little relocation of families is involved. The design will include an all-day bus lane in each direction. The section closest to the center (Marta Vasconcelos-Dois Leoes) is proposed for the Bank project; the outer section will be carried out earlier with local financing.

3.10 **Bus Terminals.** Changes in three central area bus terminals are proposed. The works include reconstruction of the terminals to increase their capacity and improve their internal functioning, to enable them to serve as "turn-arounds" as opposed to terminals where buses spend long periods waiting, and to provide transfer points between the regular buses and the central area circular bus lines. All terminals will be at-grade with access to the surrounding street system controlled by traffic lights. Improvements will also be made to the regional bus terminal so that urban buses can stop within the terminal, thus allowing improved connections between the regional and urban bus systems.

3.11 **Critical Points.** Outside the central area, five critical congestion points have been identified. They will be subjected to TOPICS improvements, i.e., new road signs and markings, traffic islands and channelization, new curbs and sidewalks, coordination of small groups of traffic signals, banning of certain turning movements, etc.

3.12 **Paving in Low-Income Areas.** Improvements will be made to 32.4 km of bus routes in low-income areas to improve the operational efficiency of the buses and to allow service to be provided under all weather conditions. The works include new paving (9.4 km), resurfacing (22 km), surface water drainage, pedestrian facilities, and lighting. Since the roads already exist, minimum property acquisition is required.

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1/ Land and property acquisition procedures in Brazil permit an owner to dispute the price but not the sale. Thus, acquiring the required land will not be a problem in any of the project cities.
3.13 **Terminals in Low-Income Areas.** Eighty-four simple terminals will be constructed in low-income areas to provide minimum facilities for riders and operators. It was agreed at negotiations that the Municipality would implement the institutional reforms, including changes in bus lines, routes, and frequencies, that are specified by TRANSCOL as necessary to complement the physical works described above.

3.14 **Traffic Equipment.** The bus lanes and parking regulations to be implemented under the project risk being unsuccessful if the quality of enforcement of traffic regulations is not dramatically improved. To improve their capacity and performance in this important area, the project will include 12 tow-trucks to remove offending vehicles from bus lanes; vehicles required for patrolling bus lanes and no-parking areas; communications equipment to ensure that tow-trucks can be called and vehicles removed without delay; two pick-up trucks with extendable arms for traffic signal maintenance and six radar sets for speed control, and seven cars with radios. In addition, four shelters will be provided to the inspectors responsible for monitoring bus service standards (routes and headways).

3.15 Finally, given the complexity of the program of works to be introduced and the radical nature of some of the changes, a publicity campaign and promotional activities will be financed under the project.

3.16 **Design Status.** The designs for all the TRANSCOL components are at the preliminary engineering stage.

**Detailed Features - PROBUS (See Map 13154)**

3.17 **Paving Program.** In seven low-income neighborhoods, works will be carried out to extend the TRANSCOL program to 11.5 km of other bus routes and routes that could be used by buses if they were paved. The improvements include paving, drainage, small retaining walls, stairs, sidewalks, lighting, and signs. No land or property acquisition is required.

3.18 **Vale do Queimado.** The Vale do Queimado is a large area made up of five neighborhoods, containing about 190,000 people and totally devoid of public transport services. The project consists of a two-lane bus penetration road with drainage, sidewalks, and lighting and with the character of a neighborhood street, without through traffic. Much of the alignment makes use of land adjacent to a stream (that will be covered) to minimize land and property acquisition. Less than 100 families will have to be relocated, and the municipality will assist them to relocate within the same neighborhood.

3.19 **Basic Transport Infrastructure Program.** In one low-income neighborhood—Nordeste de Amaralina—containing about 60,000 people—a more comprehensive approach to transport infrastructure provision has been adopted and an integrated program developed. A 2.85 km bus penetration road (the

1/ 20 VW 1300 sedans and 30 125 c.c. motor scooters.
Vale das Pedrinhas) will be built on the site of an existing drainage channel that will be rechannelled into a culvert. Just over 4 km of existing dirt roads will be paved as access roads for service vehicles. To improve pedestrian access to public transport, 18 km of other tracks will be provided with paving and drainage and a series of stairs will be built.

3.20 It was confirmed at negotiations that the introduction of the transport infrastructure would be coordinated with a municipal program to provide water and sewerage (plus schools, a market, and a recreation ground). Land has been set aside in the same "bairro" for families that have to be relocated and assistance will be provided to help them move. The standards of the facilities have been designed so that they constitute a significant improvement for the current poor residents, while at the same time remaining unattractive to people with higher incomes. As an additional measure to ensure that the benefits of the project go to the current residents, it was confirmed at negotiations that a new zoning law would be passed establishing maximum lot sizes and densities for the area.

3.21 Avenida San Martin. Avenida San Martin is a 2.5 km stretch of four-lane road that carries heavy trucks to the port, over 50 buses an hour in the peak, and cars. The surface is so bad that only two lanes can be used. The problem is a lack of drainage so that the road is severely eroded during each rainy season and recapping is necessary every six months. The project will provide the necessary drainage works to protect the road-bed, rebuild the road-bed, and resurface it.

3.22 Design Status. Preliminary engineering exists for the paving program, the Vale do Queimado, and the Nordeste de Amaralina program. Final designs exist for the Avenida San Martin works.

C. Project Components – Curitiba

Main Features

3.23 The Curitiba element of the project consists of three basic components:

(a) the construction of a new structural axis—structural 5/Connector 5 (US$19.16 million);

(b) the construction of eight express bus/feeder bus passenger interchange terminals along the existing and proposed structural axes (US$18.62 million); and

(c) the improvement of roads to be used by feeder buses to connect low-income residential areas to the structural axes (US$9.51 million).
Detailed Features (See Map 13151)

3.24 **Structural 5/Connector 5.** The scheme included in the project consists of a structural axis in the north-west sector of the city comprising:

(a) Improvements to existing roads from the connection with the existing "Structural North" in the Sao Francisco area to the junction with Federal Highway BR 277 in the Campina Do Siqueira area. This section is termed Structural 5.

(b) New roads from the junction with Federal Highway BR 277 to the bus terminal at Campo Raso on the western periphery of the City. This section is termed Connector 5.

3.25 The central road of the "trinary" road system consists of a two directional, exclusive bus-way of 8 meter width. Road sections of 7 meter width will be provided on either side of the bus-way for parking and access to frontage properties. Each outer, unidirectional road of the axis is of four 3 meter lanes. The geometric design of Structural 5/Connector 5 is consistent with the function of the corridor as an urban road with a design speed of 60 kph, and signal-controlled intersections. The operational aspects of the design, such as junction layout, parking provision on the central road, integration of the bus-way into the road system, bus passenger waiting areas, bus overtaking procedures and so on, follow the principles already established on other structural axes in Curitiba.

3.26 It was initially proposed that the lateral, general traffic roads (which form the outside roads in the "trinary" system), should be provided with two lane service access roads in addition to the four lanes now proposed. It was concluded that there were no grounds for the inclusion of these four access lanes and that Structural 5/Connector 5 would have an adequate economic life and fulfill its land use development functions in the reduced form described above. To preserve the option of expanding the capacity of the system in the future, the authorities propose to establish by zoning controls a 10-meter set-back for buildings. This land could also be used by owners to provide their own service roads. It was confirmed at negotiations that the municipality would initially construct four lanes only on each of the lateral roads and would construct the extra lanes during the project implementation period only after the economic and financial justification of such lanes has been demonstrated to the satisfaction of the Bank.

3.27 **Bus Terminals.** Eight terminals are included in the project. In addition to their role as transport terminals, four of the terminals are designed to include local, social, commercial, and retail developments consistent with the structural axis development approach. Only the cost of infrastructure for the transport and social functions will be funded under the Bank Project.

3.28 The general operational design is similar in each case. The terminals are located on the central road of the structural axes on either side of the exclusive bus-way. Express buses are thus routed through the terminal on a direct route. Feeder buses follow loop routes through the terminal and passenger walking distance from express to feeder bus stop is short.
3.29 **Feeder Roads.** The project includes paving for 80 km of roads used by feeder bus lines in some of the poorer areas of Curitiba. During the appraisal mission, it was agreed that costs could be reduced for roads where the existing base levels are well compacted and soil conditions are adequate; using a low-cost construction method consisting of a surface layering technique (light tarmac treatment). This construction method has been employed previously in Curitiba and has proved to be successful and economic under the relatively light traffic flow conditions found on the feeder road network. Sixty-seven kilometers of road will be paved using the low-cost solution.

3.30 **Design Status.** Connector 5 and Structural 5 are at a detailed design stage. The terminal designs are at a preliminary engineering stage. Cost estimates are based on these designs and include estimates for pavements, drainage, lighting, traffic management works, passenger waiting shelters, and buildings for bus operations control and social/community purposes. Neither land nor construction costs attributable to commercial development are included in the cost estimates. The relatively high costs of land acquisition (compared to construction costs) reflect both the high cost of land in Curitiba and the simple nature of the construction to be undertaken. In addition, some of the construction costs, e.g., for social or medical facilities, will be borne by other agencies. The design for the feeder roads is at the detailed engineering stage for the southern sector of the city and costs have been derived for the remainder of the city on a unit length basis.

D. **Project Components - Recife**

**Main Features**

3.31 The Recife components fall into two categories: those recommended under the TRANSCOL study and those proposed by FIDEM as having a more regional impact. The TRANSCOL components are:

(a) **Central Area Improvements,** including exclusive bus facilities, reorganization and reconstruction of bus terminals, and traffic engineering measures (US$1.48 million);

(b) **Radial Bus Corridor Improvements,** consisting of traffic engineering measures and intersection improvements at critical bottlenecks (US$1.48 million); and

(c) **Paving of Feeder Roads:** consisting of paving to simple design standards of roads used by buses in poor areas (US$5.11 million).

The FIDEM components are:

(a) rehabilitation, widening, and construction of the Second Perimetral road (US$19.56 million);
(b) a program of TOPICS improvements on secondary roads serving peripheral municipalities (US$3.3 million); and

(c) new maintenance facilities and equipment for CTU (US$2.8 million).

In addition, a study of regional bus operations and regulation will be carried out in Recife (see para 3.44).

Detailed Features - TRANSCOL (See Map 13152)

3.32 Central Area Bus Terminal Reorganization. The distribution of buses within the central area will be rationalized by reducing the number of terminals and concentrating bus line destinations at four remodeled terminals. It was confirmed at negotiations that the Municipality would cause CTU to carry out appropriate changes in bus lines, routes, and frequencies. The physical works proposed consist of channelization, provision of passenger waiting areas, road marking, traffic signing, and signals. The high bus flows require that the remodeled terminals be used only for setting down and picking up passengers and not as crew rest or crew change points.

3.33 Central area bus priority measures will be introduced on the approaches to bus terminals on the road network inside Perimetral 1, and on the radial road approaches to the First Perimetral. The bus priority facilities depend on individual street conditions, available widths, etc., and will include curbside lanes, bus streets, one exclusive bus-way, and two bus-only bridges. Where possible, bus lanes are located in the center of the street to allow access to frontage activities. Works include new traffic signals, roadside signing, carriageway marking, refuges, physical separation, repairs to pavements, footway construction, bus shelters, and passenger waiting areas at bus stops.

3.34 Traffic engineering measures (TOPICS) will be undertaken in the central area, with the objective of maximizing network and junction capacity. In addition, a series of similar measures will be implemented at critical points on the radial roads approaching the center of Recife. They are mainly aimed at intersection improvements to facilitate bus through-put. The measures include channelization, turn prohibitions, new signals, and signing and marking.

3.35 In addition to the above elements that are proposed for Bank financing, the municipality will be responsible for the implementation of several complementary measures, which, although funded locally, are essential to successful functioning of the program as a whole. A central nucleus by-pass traffic route for cars using existing streets will be introduced, involving signing, new traffic signals, and some road re-surfacing. Five new cross-town bus lines will be introduced between strategic outlying centers. It should be confirmed during negotiations that the Municipality will cause CTU to operate these lines. Five fringe car parks with 4,150 spaces will be introduced at sites on the edge of the central area. In conjunction with the
provision of these peripheral car parks, the number of on-street parking places in the central area will be reduced from 6,500 to 2,500. The remaining places will only be available for short term parking on a paying basis. It was confirmed at negotiations that the Municipality will (a) construct the fringe car parks, (b) reduce the number of long-term parking spaces, (c) expand the system of short-term parking, (d) adopt measures to enforce parking regulations, and (e) construct the central nucleus by-pass routes prior to the introduction of the exclusive bus lanes. A shuttle bus service will connect the car parks with the CBD. It was confirmed at negotiations that CTU would operate or issue "permissions" to operate the shuttle bus services.

3.36 **Feeder Roads.** The TRANSCOL program includes the provision and rehabilitation of roads used by buses in poor outlying areas of the city. Paving, drainage, signs, and bus stops for 43 km of such roads will be provided and a further 14 km will be resurfaced. Along these routes, 86 bus stops and passenger shelters will be provided.

**Detailed Features - FIDEM Components** (See Map 13152)

3.37 **Second Perimetral Road.** The Second Perimetral is planned as a secondary arterial road forming part of the Metropolitan Road Network. The part of the Second Perimetral that is included in this project lies within the municipalities of Recife and Olinda and is 19.5 km long. Since some parts of the road exist while others have to be constructed, type of investment required depends on the specific section of road.

3.38 The first section is 7.7 km long and passes through a densely built-up part of the city with a large low-income population and growing commercial activity. To preserve the local area and to stimulate access to commercial frontage activity, existing streets have been used as much as possible to create a one-way pair. Two new stretches of new road have to be built because the existing streets have bends and junctions that are unacceptable on an arterial road. This will entail some land acquisition. Approximately 150 families will have to be relocated. They will be given priority in the housing program being carried out by COHAB, the state housing corporation. The second section is 3.2 km long, linked to the first section by the Torre-Parnamirim Bridge, currently under construction by the Municipality, which will also build the approach roads to the bridge. The project consists of rehabilitating existing streets with some widening to produce a consistent cross-section. The third section is 8.6 km long, the last 7 km of which will be a new road. The road passes through an area in which an extensive program of low-income housing is being developed. The first phase will be built as a two-lane, undivided facility in order to ensure the continuity of the Second Perimetral. Land will be acquired for the full facility (four lanes plus a wide median to permit future bus lanes) to avoid excessive land acquisition costs in the future. No relocation is required.

3.39 Preliminary engineering designs are complete for the first two sections and were used as a basis for the cost estimates. For the third section, costs were estimated on the basis of cross-section designs and preliminary borings.
3.40 TOPICS Improvements. This type of improvement will be carried out on three sections of two-lane road that link Recife with peripheral municipalities. The improvements consist of repaving, rebuilding shoulders, road signs and markings, pedestrian crossing signals, and, within the small towns, limited street widening, provision of parking spaces, curbs, gutters, and foot-ways. Designs are at the preliminary engineering stage.

3.41 Bus Maintenance Facilities and Equipment. In order to enable CTU to expand the proportion of its bus fleet that is actually operational, it will be provided with new maintenance workshops and the equipment necessary to repair and maintain its fleet of 433 buses. The investment in maintenance facilities will be accompanied by measures to improve CTU management and operations. A Bus Operations (Maintenance) Specialist will assist CTU in the implementation of the facilities. EBTU will finance from its own resources a management and financial study of CTU. Finally, FIDEM will be responsible for a Metropolitan Bus Operations and Regulation Study, financed under the technical assistance program (see para 3.44), to review present bus operations—demand, supply, and regulation—and measures to improve the system's performance. It was confirmed at negotiations that the Municipality would cause CTU to participate fully in the Metropolitan Bus Operations and Regulation Study. Finally, to ensure adequate fleet expansion outside CTU, it was agreed at negotiations that the Municipality would cause CTU to modify the policy ("51% rule") that ties the issuance of new franchises to CTU's share of the Recife bus fleet.

E. Technical Assistance Component

3.42 Technical assistance under the project is intended to (a) strengthen EBTU capability in the areas of project evaluation, traffic engineering, bus operations and management of public transport, (b) assist the cities, in particular Recife and Salvador, to implement this project and prepare future ones, (c) assist EBTU and project cities in monitoring and evaluation of the project, and (d) assist EBTU in developing an urban transport information system. The technical assistance component will comprise four elements:

(a) Experts: one Urban Transport Economist, two Traffic Engineers, two Bus Specialists, one Institutional Specialist, one Project Analysis Specialist, and one Urban Transport Information System Specialist, and a pool of short-term traffic engineering, bus operations and related specialists, for a total of 204 man-months. These experts will be hired by EBTU and will assist both EBTU and the project cities as required. The experts were costed using a man-month rate of US$7,000.¹/ Services may be procured from individuals or consulting firms. The latter would be more expensive because of overheads. This explains the relatively high man-month rate.

¹/ Total cost including allowances and overhead.
(b) **Studies:** five studies will be funded under the project:

(i) a bus operations and regulation study for the metropolitan area of Recife (36 man-months; see para 3.43);

(ii) a program of monitoring and evaluation of the project (107 man-months; see paras 5.22-5.25);

(iii) a study of the development of Metropolitan Urban Transport Companies—EMTU’s (29 man-months; see para 2.03);

(iv) a study of the relationships between employment, poverty, urban transport (36 man-months; see para 2.02); and

(v) a study of the potential for introducing urban road pricing in Brazil (36 man-months; see para 3.02).

(c) **Training:** in addition to the training to be provided by the experts, the project will finance short-term on-the-job training for the staff of EMTU, and such other federal or local agencies as may be appropriate, in cities that have successfully implemented innovative urban transport policies or measures. The objective is to provide early exposure to planning and implementation problems.

IV. **COST ESTIMATES AND FINANCIAL ARRANGEMENTS**

A. **Cost Estimates**

4.01 The total estimated cost of the project (including contingencies) is US$248.9 million (at January 1978 prices) of which US$66.2 million (27%) is foreign exchange. 1/ Land acquisition costs amount to US$50 million or 20% of total costs including contingencies. Project cost estimates are summarized in Table 4.1.

1/ The overall estimate is based on the following estimates of foreign exchange content: 35% for civil works, 45% for equipment, 60% for technical assistance, and 0% for land acquisition.
# Table 4.1: Summary of Project Cost Estimates

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4.02 Cost estimates are based on either final engineering designs or on preliminary engineering designs, as set out in Chapter III. Physical contingencies of 10% have been allowed on components with completed final designs and 15% where only preliminary designs exist. The estimates for Porto Alegre and Belo Horizonte are based on preliminary designs or on costs of similar works in other parts of the city. Physical contingencies for these two cities amount to 15% except for roadworks in Porto Alegre where a more advanced state of design and quantities merits a reduction to 10%.

4.03 Price contingencies represent the mission's best estimate of the requirements for Brazil and in 1978-1979 amount to 9% and 7.5% on the dollar equivalent of civil works and equipment costs, respectively. For 1980 and 1981 the rates are 8% and 7% for the respective categories. For technical assistance, price contingencies amount to 10% overall.

B. Financing Plan

4.04 A Bank contribution of 35% of the total project cost is proposed for the project, reflecting the orientation of the project towards the provision of public transport services, especially in response to the needs of the urban poor. The Federal Government, through EBTU, would match the Bank contribution. The balance would be provided by the States and Municipalities. For the technical assistance component the total foreign exchange costs (estimated at 60%) would be financed by the Bank, the balance being provided by the federal government through EBTU. Budgetary provisions have been made for the EBTU and local contributions. The Bank contribution would represent a total loan amount of US$88.0 million. The proposed financing plan is shown in Table 4.2.

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<td>51.5</td>
<td>45.0</td>
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<td>248.9</td>
</tr>
</tbody>
</table>

C. Financial Impact on Local Governments

4.05 During appraisal, the financial impact of the proposed investment program on local finances was reviewed. The three cities are all metropolitan regions with large budget and investment programs. The 1978 budget for the
city of Curitiba will be close to Cr$1.6 billion (US$100 million 1/), of which about 50% will be capital expenditures. The 1976/1977 urban transport investment program, financed in part by EBTU, amounted to Cr$340 million/US$35 million) and has been substantially completed.

4.06 The 1977 budget of the city of Recife was US$1.3 billion (US$100 million 2/), of which 56% were capital expenditures. The 1977/1979 investment program projects cumulative expenditure of Cr$2.7 billion (US$170 million). The FIDEM urban investment program for the metropolitan region for the 1978/1979 period is Cr$3.9 billion (US$240 million dollars).

4.07 The 1978 budget for the city of Salvador will be close to Cr$1.8 billion (US$110 million 1/), of which 45% will be capital expenditures.

4.08 The size of Bank project is in line with the current urban investment programs and with the urban transport investment programs in particular. In the Recife metropolitan region, for example, the project constitutes 13% of the total urban investment program over the next two years. In the five cities overall, the Bank project represents between 26% and 63% of the total urban transport investment effort over the same period. It should also be noted that the municipal and state financing of the program will come primarily from the funds earmarked for urban transport investment (see para 1.16).

4.09 The project will create new maintenance expenditures but these will not exceed 5% of the current maintenance budget of the project cities.

4.10 Thus, the project will not create a financial burden or a resource imbalance for any of the cities. On the contrary, the project will be a source of increased municipal revenues through the increases in land and property values resulting from the urban transport investments, and reflected in higher property tax assessments. It was confirmed at negotiations that the municipalities of the project cities will take all necessary steps to revise the assessments of properties whose values are affected by project components.

D. Procurement

4.11 Bank procurement guidelines for International Competitive Bidding would be followed for all contracts for civil works and equipment. The estimated amounts involved are US$130 million and US$6 million (excluding contingencies), respectively. Where possible, contracts will be packaged in such a way as to make bidding attractive to both large and small contractors. EBTU will issue at least twice yearly international notification of forthcoming contracts. Bidding periods of 45 days for civil works and 90 days for equipment will be used. In the interests of expediency, the Municipality of Curitiba will use force account for some minor paving works. The total amount involved will be less than US$1 million.

1/ At the end of 1977 conversion rate US$1 = Cr$16.

2/ At the end of 1976 conversion rate USS = Cr$13.
4.12 Bank prior review and approval of bidding documents and contracts will be required for all contracts estimated to cost US$1.5 million or more. 1/

For all other contracts, EBTU will analyze contracts signed during the preceding six months, together with the respective bids and recommendations for awards, and forward to the Bank a report on the analysis not later than three months following the end of each 6-month period. This was confirmed at negotiations. Should the Bank determine that the award of the contract was not consistent with the agreed-upon procedures, it would cancel an equivalent amount of the loan and deduct from a future withdrawal from the loan account an amount corresponding to any disbursement previously made for a contract which turned out to be ineligible. Manufacturers whose bids contain components manufactured in Brazil equal to at least 50% of the value of the bid would be given a margin of preference equal to 15% or the applicable import duty, whichever is less. Brazil has a well-developed civil works construction industry and all civil works contracts are expected to be won by local contractors. The Brazilian traffic signal industry is also growing rapidly and it is expected that local manufacturers will supply most of this type of equipment financed under the project, with the possible exception of the Area Traffic Control system for Belo Horizonte.

Disbursements

4.13 Disbursements will be for 100% of total expenditures (net of taxes) for equipment and 100% of foreign exchange costs for technical assistance and training. For civil works, disbursements would be for the following percentages of total costs (net of taxes): Salvador--37%; Curitiba--59%; Recife--35%. 2/ The civil works disbursement percentages are different because the Bank loan was calculated as a fixed percentage of total project costs per city. However, the amount and cost of land acquisition varies across cities and, hence, the Bank contribution is applied to a different civil works cost basis. Using a fixed Bank percentage would have implied a varying EBTU percentage, which was not feasible, since EBTU has also already made fixed budget allocations for each city. Disbursements would be fully documented. The estimated schedule of disbursements is shown below:

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1/ It is difficult to estimate precisely the number and value of such contracts, since it is not known exactly how contracts will be packaged. The best estimate is 19 contracts with a total value of US$70 million. If some smaller civil works are packaged together for contracting, the estimate could rise to 23 contracts with a total value of US$85 million.

2/ For Porto Alegre and Belo Horizonte the civil works disbursements percentages are estimated to be 53% and 30%, respectively.
Quarter Ending | Disbursements for each Quarter (US$ Million) | Cumulative Disbursements at end of Quarter (US$ Million) | % Cumulative Disbursement
--- | --- | --- | ---
March 31, 1979 | 1.4 | 9.5 | 11
June 30, 1979 | 8.1 | 18.0 | 20
September 30, 1979 | 8.5 | 26.6 | 30
December 31, 1979 | 8.6 | 35.2 | 39
March 31, 1980 | 8.6 | 43.8 | 50
June 30, 1980 | 10.0 | 53.8 | 61
September 30, 1980 | 10.0 | 63.8 | 73
December 31, 1980 | 8.2 | 72.0 | 82
March 31, 1981 | 8.2 | 80.2 | 91
June 30, 1981 | 3.9 | 84.1 | 96
September 30, 1981 | 3.9 | 88.0 | 100
TOTAL | 88.0 | 88.0

4.14 **Retroactive Financing.** The project includes drainage and improvement to the San Martín corridor (total cost US$3.1 million) in Salvador. The municipality commenced work on this corridor in early 1978 in order to secure the road bed before the next rainy season. In addition, if TRANSCOL programs in Recife and Salvador are to be completed according to the agreed timetable, the preliminary design and detailed implementation programs (total cost US$1.4 million) have to be carried out before July 1978 and the two municipalities are now in process of hiring consultants for this purpose. Finally, one terminal (total cost US$0.54 million) in Curitiba was started in early 1978, since it was required urgently to provide service to a new housing estate, close to Curitiba's growing industrial city. Thus, US$1.7 million to cover expenditures incurred after January 1, 1978 would be financed retroactively.

**E. Accounts and Audits**

4.15 It was agreed at negotiations that each local implementing agency shall maintain adequate project records and accounts and shall furnish them to EBTU. EBTU will maintain a consolidated project account. It was confirmed at negotiations that EBTU will arrange for annual audits of the accounts of all federal and local agencies involved in project execution and will submit them to the Bank not more than six months after the close of each fiscal year. EBTU will send to the Bank a copy of its annual financial statements certified by qualified independent auditors.
V. PROJECT IMPLEMENTATION

A. Institutional Arrangements

5.01 Implementation arrangements for the project will be similar to those used in other EBTU projects and will involve EBTU at the federal level, state agencies and metropolitan bodies, and municipalities and entities controlled by them. EBTU will oversee and coordinate the implementation of the project. Actual project execution will be the responsibility of the metropolitan and municipal entities.

Federal Responsibilities

5.02 In addition to the Porto Alegre appraisal already carried out by EBTU (see Annex 1), EBTU will be responsible for (a) appraising the project components in Belo Horizonte, (b) supervising project implementation in the five cities, and (c) channelling funds and exercising financial supervision and control over all project components, and (d) the execution of the technical assistance component of the project.

5.03 EBTU's operations are carried out by three directorates -- Technical, Institutional Relations and Operations, Finance and Administration -- with a professional staff of 72. The staff is generally competent and dedicated, and is sufficient to carry out its activities. The normal process of filling of vacancies should accommodate the planned increase in operations. There is a need, however, for more experienced and specialized personnel in specific areas, such as traffic engineering and bus operations. EBTU has difficulty hiring specialists in these areas due to their scarcity in Brazil. The technical assistance component of the project will enable EBTU to recruit outside experts to supplement and train their staff.

5.04 All three directorates will be involved in project implementation. The Technical Directorate will ensure the technical and economical feasibility of project components to be appraised by EBTU and review the final designs for all components. It will also be responsible for the design and supervision of monitoring studies. The Institutional Relations and Operations Directorate will be responsible for drafting the legal documents and for project supervision. The Finance and Administration Directorate will be responsible for disbursement of funds and project financial records.

5.05 This division of responsibilities between the three directorates follows usual EBTU procedures for project preparation and supervision. EBTU has designated the Director of Institutional Relations and Operations as Project Coordinator. His main functions will be to (a) facilitate exchange of information on project implementation between EBTU directorates, local agencies, and the Bank, and (b) ensure that all parties concerned have adequate and timely knowledge of the project implementation status. The coordinator

1/ See Chart No. 1.
will be responsible for the preparation of quarterly summary progress reports based on reports prepared at the local level. It was agreed at negotiations that EBTU will inform the Bank of any proposed change in the position of coordinator.

5.06 EBTU has adequate capability to supervise the physical implementation of the project. It has developed explicit supervision guidelines. Given the relative size of the project and its location in the cities where EBTU already has other programs, the supervision should not impose an undue burden on EBTU staff. The increased workload is estimated to be between 10% and 20% and should be accommodated without difficulty. There will be a specific need to strengthen EBTU's supervision capacity in the area of procurement including assistance in bid evaluation (see para 4.12). Until now, EBTU has not reviewed procurement contracts. It was agreed at negotiations that a procurement review unit will be created within EBTU.

5.07 Appraisal to be Carried out by EBTU. The components to be financed under the loan do not differ markedly from those already financed by EBTU, whose technical staff has the capacity to carry out the appraisals. However, there is a need for a better integration of the technical, economic, financial, and institutional aspects of the appraisal process and a more aggressive consideration of least-cost alternatives. During project preparation, EBTU has worked with Bank missions in the application of technical and economic evaluation standards. The appraisal process called for EBTU to appraise the projects in two cities, with the appraisals being carried out sequentially with appropriate opportunities for the Bank to review the results. This process forms the basis for the development and implementation of formal project evaluation guidelines by EBTU.

5.08 Porto Alegre. Using guidelines already prepared by the Technical Directorate, an interdepartmental team appraised the Porto Alegre project. The report was reviewed by the Bank and the recommended project components and complementary policies were discussed with EBTU and the Porto Alegre authorities. The results of the appraisal and discussions are summarized in Annex 1, together with agreements reached at negotiations on complementary policies.

5.09 Belo Horizonte. The second stage of the EBTU appraisal concerns Belo Horizonte. EBTU has sent a mission to Belo Horizonte to explain project preparation requirements and to establish with PLAMBEL a timetable for project preparation.

5.10 Following the Bank's review of the Porto Alegre appraisal, and additional discussions on the evaluation guidelines, EBTU prepared a preliminary report on the Belo Horizonte project, specifying likely project elements and accompanying policies. This report formed the basis of the project agreement for Belo Horizonte. It was agreed at negotiations that disbursement for the Belo Horizonte sub-project would be conditional upon (a) completion by EBTU of an appraisal report that is acceptable to the Bank 1/, and (b) signing by

1/ The appraisal is expected to start in July 1978.
the Bank, EBTU, and the competent authorities in Belo Horizonte of a supplemental letter specifying the details of the project components, their costs, an implementation schedule, and an acceptable statement of and timetable for the introduction of complementary policies.

5.11 **EBTU Project Evaluation Guidelines.** To strengthen EBTU's ability to make budget allocation and project selection decisions on more technical grounds, it would be desirable for the rigorous standards applied to the Bank project to be applied more widely by EBTU. It was agreed at negotiations that EBTU, in collaboration with the experts financed under the technical assistance component of the project, will by June 30, 1979, review and modify, if necessary, the existing draft guidelines, review the new guidelines with the Bank by December 31, 1979, and develop procedures for applying them to all EBTU projects by June 30, 1980. It is understood that non-technical considerations may often be important, but it is important that technical judgements only be over-ridden on the basis of an explicit consideration of the benefits of doing so. As steps towards this objective, it was agreed at negotiations that EBTU will inform the Bank of any major EBTU investments in the cities participating in this project during the project implementation period, provide information on the impact of the investment on the Bank project, and provide the Bank with adequate opportunity to comment on the investment. In addition, it was agreed that EBTU will, in the first quarter of each year from 1979 to 1982 (inclusive), submit to the Bank a report on its activities for the previous year for the Bank's comments.

**Local Responsibilities**

5.12 **In Curitiba,** overall responsibility for project execution will be with the municipality. IPPUC (Curitiba's Urban Planning and Research Institute) will be responsible for detailed design, engineering, and project supervision. The Secretariat of Public Works will be responsible for civil works, with the exception of terminals, for which the Urban Works Company of Curitiba (URB), a municipally-controlled corporation, will be responsible. These agencies have extensive experience in the similar type of projects. The implementation capacity of Curitiba is more than adequate and no outside assistance will be required.

5.13 **In Recife,** the Metropolitan Planning Agency (FIDEM), under the State Planning Secretariat, will be responsible for overall project coordination. It was confirmed at negotiations that FIDEM will provide from its own resources funds to hire consultants to carry out the final engineering designs for the Second Perimetral and the TOPICS schemes and for the supervision of works for the Second Perimetral. Responsibility for project design, engineering, contracting, and supervision will be divided between the Municipality of Recife for works in the city of Recife, and the State Highway Department for works outside Recife. The State Department of Transit will be responsible for the implementation of the traffic signals included in the TRANSCOL component. These agencies have been involved in similar types of projects. The Traffic Engineer and Bus Maintenance Specialist hired by EBTU under the technical assistance program will assist local agencies in the implementation of the TRANSCOL and CTU components respectively.
5.14 In Salvador, the Metropolitan Planning Agency (CONDER), under the authority of the State Government of Bahia, will have the responsibility for project coordination. Detailed design, engineering, and supervision will be the responsibility of the Technical Transport Office (ETT), created jointly in June 1977 by the state and the Municipality of Salvador to implement the metropolitan urban transport projects. During negotiations, assurances were obtained that the existence of ETT, currently coterminous with the term of the present administration (ending March 1979), would be extended to at least the Closing Date of the Project or that another entity, satisfactory to the Bank, would be commissioned. The responsibility for civil works and equipment will be with a special procurement commission under ETT, comprising staff from municipal Secretariat of Urbanization and Public Works, ETT, and the State Department of Transit. The Traffic Engineering Specialist and Institutional Specialist to be funded under the technical assistance program, will assist local agencies in project implementation.

5.15 Specific implementation arrangements for Porto Alegre were determined during the EBTU appraisal. Those for Belo Horizonte will be established during the EBTU appraisal. It is anticipated that they will be broadly similar to those in the other cities, involving municipalities and metropolitan planning bodies.

5.16 In each project city, a local coordinator has been designated, with duties analogous to those of the EBTU coordinator. In particular, the local coordinator will monitor the program of project implementation, collect relevant information, prepare monitoring program reports, and facilitate communication between different agencies at the local level.

B. Flow of Funds and Legal Structure

5.17 The Federal Government of Brazil would be the Borrower with EBTU acting as Financial Agent. Proceeds from the Bank loan would be passed by EBTU to the project cities as grants. The Municipal Secretariat of Finance in Curitiba, FIDEM in Recife, and CONDER in Salvador will be responsible for channelling funds in the respective cities. The Federal Government would be responsible for loan repayments using funds from either FNTU or general revenues.

5.18 The project's legal structure comprises the following agreements:

(a) Loan Agreement - between the Bank and the Federal Government;
(b) Project Financing Agreement - between the Bank and EBTU; and
(c) Project Executing Agreements (5) - between Bank, EBTU, metropolitan bodies, 1/ states 1/ and municipalities.

1/ In Curitiba, the State of Parana and the metropolitan planning body will not be parties to the agreement as the project will be carried out entirely within the city of Curitiba.
5.19 The five Project Executing Agreements would provide the Bank with a contractual link with agencies executing the project and would facilitate direct Bank contacts and supervision of project implementation at the local level. EBTU’s participation in the Agreements will strengthen its supervision and assistance functions. Following its normal procedures EBTU will also enter into agreements (convenios) with CNPU, metropolitan bodies, and municipalities.

C. Implementation Schedule

5.20 The implementation schedules for each city are shown in Charts 2-6 (Annex 3). Project implementation will take approximately three years, assuming a starting date of July 1, 1978. Care will be required in the coordination and phasing of implementation activities, especially in Salvador. The experts hired under the technical assistance component will assist in this process.

D. Monitoring

5.21 EBTU will design, coordinate, and supervise a program of monitoring the project cities (a) to provide a basis for making adjustments to the programs financed under the project; (b) to improve local understanding of the programs as a basis for designing follow-up programs; and (c) to evaluate the operational performance of the programs.

5.22 Functional Monitoring. This type of monitoring is aimed at providing rapid feedback to the implementing agencies on the functional and operating characteristics of the project components, specifically TOPICS programs, exclusive bus lanes, and traffic signals. For TOPICS the monitoring would include observations and counts to determine the effectiveness of channelization and the increase in capacity as well as measurements of any reductions in delay and accidents. For bus lanes, running speeds would be measured together with observations on the effectiveness of provisions for right turns, access to frontage activities, and enforcement. For signals, it will be necessary to monitor flows and delays to ensure that the signal timings are correctly set.

5.23 Monitoring of Service Standards. These programs will measure changes in travel service standards for both public transport and private car users. Specific variables monitored would be travel time (in-vehicle, walking, waiting), travel cost, frequency of bus services, failure to pick up waiting passengers, etc. Some measurements will be made on a route by route, corridor by corridor basis; others, due to the interactions that are expected among the effects of different project components especially in the central areas, should be monitored on the basis of a citywide sample of trips.

5.24 Macro-level Monitoring. One of the objectives of the project is to increase the proportion of trips currently carried by public transport. Thus, it is important to monitor the modal split in the project cities, particularly for trips entering downtown areas.
The experts (see para 3.44) will assist EBTU and local project agencies to define the details of the monitoring program. At negotiations, it was agreed that the EBTU will establish a monitoring program satisfactory to the dead line later than December 31, 1978.

VI. PROJECT JUSTIFICATION

A. Economic Justification

6.01 The project components in Salvador, Curitiba, and Recife are strongly justified. The components evaluated constitute 92% of project costs in those cities and give an overall internal rate of return of 31% (13% if only vehicle operating cost savings are taken into account). This confirms experience elsewhere that low-cost transport measures can give substantial rates of return. The projects remain strongly justified even under unfavorable hypotheses regarding urban growth rates and the value of time. The impact of the project on the urban poor is very important. The percentage of investments over the three cities that generate benefits directly to the urban poor is 73%, ranging from 64% in Recife to 87% in Salvador.

Approach to Evaluation

6.02 The evaluation approach adopted in this project reflects the two key objectives of the project: (a) to bring about urban transport improvements as economically as possible, and (b) to channel as many of the benefits as possible to public transport users, especially those falling into the category of the urban poor. The first objective resulted in all alternatives being scrutinized to ensure that the benefits could not be obtained at a lower cost. The second led to the evaluation effort being concentrated on identifying benefits to public transport users. In general, estimation methods or models have been limited to an examination of public transport networks. This is quite reasonable given the amount of exclusive bus capacity being proposed under the project. To ensure the channeling of benefits to public transport, an attempt has been made to show that the projects are justified on the basis of benefits to public transport alone. Estimates of benefits (or disbenefits) to car users are introduced where appropriate, but they have been estimated at a more aggregate level than the public transport benefits. This approach not only allowed efforts to be concentrated on public transport, it also permitted a greater emphasis to be placed on distinguishing different categories of bus users, so that the urban poverty impacts of the projects could be better identified.

6.03 The economic evaluation is based on quantified savings in vehicle operating costs, maintenance costs, and travel times. Given the objective of creating benefits for public transport users, equal emphasis has been placed

1/ For the Porto Alegre results, see para 6.16 and Annex 1.
on measuring and quantifying savings in travel times, since it is believed that these savings constitute an important indicator of the extent to which benefits are actually realized by bus riders and, thus, should be included along with vehicle operating cost savings in the economic evaluation. It is commonly accepted that savings in travel time may be valued at 30% of the average wage of the beneficiary. To avoid discriminating against projects that channel benefits directly to the urban poor, all time savings were valued at 30% of the average wage rate of the economically active population. The two types of saving are presented separately so that their relative importance can be easily distinguished.

6.04 In each city, the proposed project included certain programs—collections of inter-related measures—that had been designed to produce jointly benefits to public transport users. In each case, these programs were evaluated as packages to see whether the benefits from the package justified the cost of the package. In principle, it would have been desirable to identify the specific benefits from each component of the package. In practice, this would have involved an inordinate amount of analysis since each package included many distinct elements. To ensure that unreasonable elements had not been included in a package, each component was carefully examined from a transport planning and traffic engineering viewpoint. Having ascertained the reasonableness of including each element in the package, the scale of infrastructure provision was examined. This resulted in numerous reductions in standards and size. In this way, the mission was able to use the "package" approach to evaluation within the context of the Bank's standards of technical and economic feasibility.

B. Results by City

6.05 Table 6.1 shows Net Present Values, Benefit-Cost Ratios, and Internal Rates of Return.

Salvador

6.06 Economic evaluations were carried out for the Avenida San Martin reconstruction, the TRANSCOL package, and the Vale das Pedrinhas bus penetration road. These items constitute 80% of project costs (excluding contingencies).

6.07 Avenida San Martin. Benefits from the Avenida San Martin reconstruction are savings in bus, car, and truck operating costs, savings in maintenance costs, and savings in travel time for bus and car users. The benefit-cost ratio for the project including only maintenance and operating cost savings is 2.2; the Internal Rate of Return (IRR) is 30%. When time savings are included, the benefit-cost ratio is 2.7 and the IRR is 36%.

1/ Calculated using a discount rate of 11%, which represents the opportunity cost of capital in Brazil.
6.08 **TRANSCOL Package.** The TRANSCOL package should produce a reduction in bus operating costs of Cr$9.4 million (US$0.6 million) per year. These operating cost savings are more than offset by the additional costs of operating a larger system—a clear indication that cost savings are being returned to bus users in the form of improved service, with resulting time savings. 

The TRANSCOL project yields a benefit-cost ratio of 1.7 (IRR = 28%). Even under a no-growth sensitivity test, the B/C ratio is 1.3 (IRR = 19%). It should be noted that all these benefits go directly to bus riders.

**Table 6.1: Summary of Economic Evaluations**

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<th>Value Operating Cost Savings</th>
<th>Vehicle Operating Costs + Time Saving</th>
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<tr>
<td></td>
<td>NPV (US$m.)</td>
<td>B/C (%)</td>
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<td>1. Av. San Martin</td>
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<td>2. TRANSCOL</td>
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<td><strong>B. CURITIBA</strong></td>
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<td>4. Boqueirao Sector</td>
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</tr>
<tr>
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<td>3. TOPICS</td>
<td>n.e.</td>
<td>n.e.</td>
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**Notes:**
(a) discount rate = 11%.
(b) n.e. = not estimated.

6.09 **Vale das Pedrinhas.** This bus penetration road produces significantly increased accessibility. As a result, operating cost savings make up only 8% of the total benefits; the remainder are time savings. On this basis, the project is strongly justified with a benefit-cost ratio of 2.0 and an IRR of 25%. Even under a more conservative growth hypothesis, the cost-benefit ratio is 1.6 (IRR = 18%).
Curitiba

6.10 **West Sector Investments.** Connector 5/Structural 5 was evaluated as a package together with the related terminals and feeder roads. Using traffic growth rates projected by IPPVC, the project is justified on the basis of operating cost savings alone, with a benefit-cost ratio of 1.4 (IRR = 15%). When time savings are added, the benefit-cost ratio rises to 2.8 (IRR = 24%). It is worth noting that, including operating cost and time savings, the project is justified on the basis of benefits to public transport alone. The benefit-cost ratio is 1.7 (IRR = 19%). A sensitivity test was performed under the unlikely hypothesis that the west sector would only grow at the average growth rate for the city as a whole. The benefit-cost ratio is still 1.5 (IRR = 17%).

6.11 In addition to the benefits quantified for the economic evaluation, the project will enable the municipality to control and guide growth and provide urban services in one of the few vacant areas left in Curitiba. It will also reduce the number of buses in the central area, increasing general traffic speeds, reducing pollution, and increasing the space devoted to pedestrians. Finally, it is expected to produce an important reduction in accidents.

6.12 **North, South, and Boqueirao Sectors.** The North and South sector packages are justified on the basis of public transport operating cost savings alone. The benefit-cost ratios are 1.8 and 1.9, respectively (IRR = 20% and 22%). When time savings are added, the benefit-cost ratios rise to 8.3 and 3.9 (IRR = 50% and 41%). Both projects are still justified under more conservative growth hypotheses. The Boqueirao sector is less developed than the other two which have had Structural Axes in place for several years. Eighty-three percent of discounted costs are covered by operating cost savings alone. When time savings are added, the project is well justified with a benefit cost ratio of 1.9 (IRR = 23%).

Recife

6.13 **TRANSCOL Package.** The TRANSCOL package is well justified on the basis of bus operating cost savings alone, with a benefit-cost ratio of 1.5 and an internal rate of return of 28%. When time savings are added, the benefit-cost ratio rises to 3.0 (IRR > 50%). It is important to note that its component is totally justified by public transport benefits alone.

6.14 **Second Perimetral.** The bus and car operating cost savings for this component yield a benefit-cost ratio of 1.7 (IRR = 18%). If time savings are added, the benefit-cost ratio is 2.8 (IRR = 27%). If only cost and time savings for public transport are included, the benefit-cost ratio is 1.6 (IRR = 18%). Thus, on any criteria, the project is strongly justified.

6.15 **TOPICS Improvements.** Since TOPICS improvements are intended to increase capacity and safety, an innovative evaluation was carried out based on time savings and accident savings. The rates of return for the three sections were 40% or above.
Porto Alegre and Belo Horizonte

6.16 The appraisal and detailed economic evaluation for Porto Alegre has been carried out by EBTU. The project components are economically justified, with benefit/cost ratios ranging from 3.0 to 13.0 (including vehicle operating cost and time savings) for the bus corridors and from 2.0 to 5.9 for other works. 1/ The Belo Horizonte evaluation will be carried out by EBTU. The types of component chosen have been found to be justified in other cities and the project is expected to be strongly justified.

C. Impact on the Urban Poor

6.17 The approach used to measure the impact of the project was to determine for each project element the proportion of benefits channelled directly to people who are considered to be in poverty according to the Bank's guidelines (see para 1.03). The urban relative poverty guideline for 1976 was calculated to be US$450 per annum; equivalent to a monthly monetary income of US$34.60 equivalent per capita per month. 2/ For the average family of five, the guideline is roughly equivalent to three times the average minimum wage 3/— the income level that is commonly accepted in Brazil as the cut-off point for families in poverty. In some cases, the planning methodology used and the available household survey data enabled the estimates to be quite precise. For example, in Salvador, the urban poor constitute 82% of bus riders but, because they tend to make longer trips, receive 92% of all time savings. In other cases, rule-of-thumb estimates were used, as in the case of benefits from bus maintenance facilities in Recife. Certain projects, e.g. the PROBUS paving program in Salvador, were specifically designed for areas in which the average income was less than the poverty level. In such cases it has been assumed that 100% of benefits go to the urban poor. The results are presented below by city:

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1/ For details, see Annex 1.
2/ Brazilian workers are paid 13 monthly wages per year.
3/ The minimum wage varies by state depending on the cost of living.
% of Total Benefits Going Directly to the Urban Poor

(a) Salvador: TRANSCOL 92%
Avenida San Martin 5%
Vale das Pedrinhas 99%
Rest of PROBUS Program 100%

(b) Curitiba: South Sector 86%
Boqueirao Sector 87%
North Sector 88%
West Sector 54%

(c) Recife: TRANSCOL 89%
Second Perimetral 50%
TOPICS Improvements 68%
Bus Maintenance Facilities 82%

6.18 To summarize the above results and obtain an overall urban poverty impact for each project, a weighted average was calculated. This reflects the relative sizes of the different investments and the result is an estimate of the proportion of the investment in each city that generates benefits.

<table>
<thead>
<tr>
<th>City</th>
<th>Salvador</th>
<th>Curitiba</th>
<th>Recife</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Investment</td>
<td>33.94 US$m</td>
<td>47.29 US$m</td>
<td>33.73 US$m</td>
</tr>
<tr>
<td>Investment Generating Poverty Benefits</td>
<td>29.40</td>
<td>32.44</td>
<td>21.47</td>
</tr>
<tr>
<td>Percentage of Poverty Investment</td>
<td>87%</td>
<td>69%</td>
<td>64%</td>
</tr>
</tbody>
</table>

6.19 These figures demonstrate that the project will have a significant impact on the urban poor. It is particularly important to note the extent to which, with careful design, transport projects can be highly poverty oriented, even when road construction, as in Curitiba and Recife, is involved.

D. Risks

6.20 Two types of risk exist that might reduce the project’s effectiveness in meeting its objectives: risks associated with the preparation and appraisal of the sub-projects in the cities not appraised by the Bank (Porto Alegre and Belo Horizonte) and risks associated with the implementation and operation of project components.
Capacity to Prepare and Appraise Projects

6.21 In an attempt to strengthen preparation and appraisal capability at the federal and local levels, the appraisals in two of the five proposed project cities were to be carried out by EBTU. The sub-project in Porto Alegre has already been appraised, but the sub-project in Belo Horizonte remains to be prepared by the local authorities. Failure to prepare and appraise this subproject adequately would indicate that the institution-building objectives of the project are not being met. The following steps have been taken to minimize this risk: The Porto Alegre appraisal has been reviewed by the Bank and the main features included as an annex to the staff appraisal report. In addition, Bank and EBTU staff will examine any changes in EBTU's approach that should be made before the appraisal of the Belo Horizonte sub-project. In addition, guidelines for the Belo Horizonte appraisal have been set out in Schedule 3 to the EBTU Project Agreement. Given the basic technical competence of EBTU and the sequential appraisal program, the probability that EBTU will not be able to appraise the Belo Horizonte project is small. There is some risk that the local authorities in Belo Horizonte will be unable to prepare their sub-project adequately. However, the team in Belo Horizonte is judged to be professionally competent and the proposed project elements in Belo Horizonte are relatively simple. Thus, the risk is very small. Finally, there is a possibility that some proposed project elements in Belo Horizonte may not be acceptable to the Bank, either because of inadequate economic justification or design standards that are too high. The proposed project elements were screened by the appraisal mission, which concluded that, in general terms, the elements were likely to meet Bank criteria on economic and technical justification. Should individual elements be found to be unacceptable, the Bank will be able to, at its option, either re-allocate the funds to other elements that are justified or cancel the corresponding part of the loan.

Implementation Risks

6.22 Two implementation risks exist. The first is specific to the sub-project in Salvador and concerns the capacity of the Escritorio Tecnico de Transportes (ETT) to devise and follow an appropriate implementation program for the TRANSCOL components. The current tendency is for ETT to be over-enthusiastic and to under-estimate the difficulties of implementing a complicated program of road works and policy changes while maintaining adequate traffic conditions. The danger is that hasty, uncoordinated implementation will lead to public protest and bring the scheme into disrepute. To counteract this problem, ETT has hired consultants to produce a coordinated implementation schedule.

6.23 The second implementation risk concerns actions that local authorities are required to undertake to complement the physical measures. These include introducing new parking regulations, modifying bus routes, lines, and frequencies, constructing and opening fringe car parks, and introducing regulations and procedures to keep bus lanes free of cars. The main factor that indicates that this risk is small is the fact that the cities have already taken steps in these directions on their own initiative. Curitiba has introduced parking restrictions through zoning; Salvador has fringe car
parks and shuttle bus services; Recife has escalating parking charges to discourage long-term parking. To reduce the risk further, appropriate assurances were obtained at negotiations from the state and local authorities. In addition, the monitoring program will provide early warning of problems and enable corrective action to be taken.

VII. RECOMMENDATIONS 1/

7.01 At negotiations, it was agreed that:

(a) EBTU will, in collaboration with experts hired under the project, (i) review and modify as appropriate its guidelines for project evaluation by June 30, 1979, (ii) furnish such guidelines to the Bank for its comments by December 31, 1979, and (iii) develop procedures for applying them to EBTU projects by June 30, 1980 (para 5.11);

(b) EBTU will inform the Bank of any major proposed EBTU investments in the five cities participating in this project during the project implementation period; provide the Bank with information on the impact of the proposed investment on the Bank Project, and give the Bank a reasonable opportunity to comment on the investment (para 5.11);

(c) EBTU will, in the first quarter of each of the years 1979 through 1982, furnish to the Bank for its comments a report on EBTU's activities during the previous year (para 5.11);

(d) disbursement for the Belo Horizonte sub-project will be conditional upon (i) completion by EBTU of an appraisal report that is acceptable to the Bank and (ii) signing by the Bank, EBTU, and the competent authorities in Belo Horizonte of a supplementary letter specifying detailed project components, estimated costs, an implementation schedule, and a commitment to introduce an acceptable package of complementary policies according to a specified schedule;

(e) the Municipality of Curitiba will: (i) construct four lanes only on each of the Connector 5/Structural 5 lateral roads, (ii) only build the additional two service access lanes during the project implementation period after the economic and financial justification of such lanes has been demonstrated to the satisfaction of the Bank (para 3.26), and (iii) take all appropriate steps under existing legislation to revise the valuation for tax purposes of properties whose values are affected by the project (para 4.10);

1/ The recommendations for Porto Alegre are included in Annex 1.
(f) the Municipality of Recife will (i) construct and operate the fringe car parks, (ii) undertake a program, with targets, for the removal of long-term parking spaces from the central area, (iii) expand the system of high-turnover parking to discourage long-term parking in the center, (iv) provide for adequate measures to reduce illegal parking to a minimum and ensure the efficient operation of the exclusive bus lanes, (v) carry out the works required for the central nucleus bypass routes prior to the introduction of the exclusive bus facilities, all according to a timetable that is acceptable to the Bank (para 3.37); and (vi) take all appropriate steps under existing legislation to revise the valuations for tax purposes of properties whose values are affected by the project (para 4.10);

(g) the Municipality of Recife will (i) cause CTU to implement the changes in bus lines, routes, and frequencies specified by TRANSCOL (paras 3.34, 3.37) and participate fully in the study of bus operations and regulation, and (ii) take all action required under pertinent legislation to cause CTU to modify the policy that ties the issue of new bus permits (permissoes) to the CTU share of the Recife bus fleet, all according to a timetable that is acceptable to the Bank (para 3.43);

(h) FIDEM shall provide out of its own resources the funds required for the final engineering designs for the Second Perimetral and the TOPICS program and for the supervision of works for the Second Perimetral (para 5.13);

(i) the State of Bahia and the Municipality of Salvador will extend the mandate of the Escritorio Tecnico de Transportes to at least the Closing Date for the Project or will commission another entity satisfactory to the Bank (para 5.14);

(j) the Municipality of Salvador will (i) implement the institutional reforms specified by TRANSCOL, including changes in bus lines, routes, and frequencies (para 3.13), (ii) undertake a program to remove long-term parking from the center, to minimize illegal parking and to ensure the efficient operation of the exclusive bus lanes (para 3.08), (iii) ensure that the water supply and sewerage projects planned by the Social Development Program for Nordeste de Amaralina are coordinated with the integrated transport infrastructure program, (iv) pass zoning regulations to limit lot size and development density in Nordeste de Amaralina, all according to a timetable that is acceptable to the Bank (para 3.20), and (v) take all appropriate steps under existing legislation to revise the valuation for tax purposes of properties whose values are affected by the project (para 4.10);
(k) The Municipality of Salvador will make arrangements to purchase or lease the land required for the establishment of a fringe car park to serve the Comerco area (para 3.08);

(l) EBTU shall establish, by December 31, 1978, a monitoring program for each of the five cities that is satisfactory to the Bank (para 5.27);

(m) EBTU will establish a procurement unit in the Supervision Department by July 1, 1978 (para 5.06), which will carry out six-monthly reviews of bid evaluations and awards, and submit these reviews to the Bank not later than 3 months after the end of each six-monthly period (para 4.12);

(n) each local implementing agency shall maintain separate project records and accounts and shall furnish such records and accounts to EBTU. EBTU will maintain a consolidated project account. EBTU will have all accounts concerning the project audited in a manner satisfactory to the Bank and shall forward to the Bank the reports of such audits no later than six months after the end of each fiscal year (para 4.15); and

(o) EBTU will send to the Bank a copy of its audited financial statement no later than six months after the end of each fiscal year (para 4.15).

7.02 Subject to the above conditions, the project is suitable for a Bank loan of US$88 million to the Government of Brazil for a period of 15 years, including a grace period of 3 years.
1. Appraisal of the Porto Alegre sub-project was the responsibility of EBTU. A draft appraisal report has been submitted to the Bank on the basis of which it has been determined that the subproject is well-designed and economically justified. (The draft EBTU report formed the basis for this annex). However, during the EBTU appraisal, it was possible to simplify the engineering designs and, hence, reduce the costs, of one component. At negotiations, it was agreed that the resources saved could be used for (a) the paving of the second carriageway of an arterial road in Porto Alegre and (b) an expansion of the program of paving bus routes in poor areas. These changes have still to be incorporated into the EBTU appraisal report. In addition, a few minor clarifications are required on the economic evaluation. Therefore, formal submission of the final version of the appraisal report to the Bank by EBTU and its acceptance by the Bank will be conditions of disbursement for the Porto Alegre sub-project.

A. SECTOR BACKGROUND

2. Porto Alegre is the state capital of Rio Grande do Sul, the most southerly state in Brazil. It is the principal municipality of the Metropolitan Region of Porto Alegre (RMPA). The RMPA comprises 14 municipalities and contains a population of approximately 1,836,000 inhabitants (1975). The proportion of the Rio Grande do Sul population resident in the RMPA rose sharply from 13% to 23% between 1940 and 1970. This overall growth rate translates to a population growth in RMPA of about 6.0% per annum in the period 1950-1960 which reduced to about some 4.2% per annum in the period 1960 to 1970 and currently is estimated to be continuing at about 4% per annum. The major cause of the substantial overall growth of RMPA population in the 1960's was migration (81.5% increase by migration compared to 18.5% natural population growth), characterized by a high proportion of migrants, about 92%, with origins in the state of Rio Grande do Sul.

3. Within RMPA itself, Porto Alegre contained 57% of the population in 1975 compared to 62% in 1960. This latter situation is further illustrated by the population growth rate in the city of Porto Alegre which was some 3.3% per annum in 1960-70, compared to some 5.0% per annum in the peripheral municipalities. This spatial redistribution of the RMPA population is likely to be accelerated by the urban development policies adopted by local planning authorities.

4. The RMPA is the dominant economic center in the state. Estimates of gross output values suggest that the RMPA accounted for 48% of industrial production in the state and 40% of total output (1970 values). Manufacturing industry absorbs a significant proportion of the labor force (about 24% of employment) and about two out of every five jobs in this sector are located in the Porto Alegre municipality. The pre-eminence of the municipal-
ity of Porto Alegre is especially evident in terms of the distribution of tertiary employment. Some 72% of employment in the field of administration, commerce, finance, distribution, etc., are centered in Porto Alegre—a clear indication of its importance in performing the complex functions of a metropolitan, state and regional center. In total, the labor force in RMPA in 1970 was about 530,000 of which 322,000 were employed in Porto Alegre. Some 36% of the labor force earns less than the regional minimum wage (1970 survey).

5. The 1970 census showed that 8.3% of the RMPA population lived in improvised dwellings and such a figure represents only a narrowly defined estimate of substandard housing since it takes no account of other poor standard, over-crowded accommodation units, nor of substandard access to basic infrastructure services. In general, access to water and sewerage is good when measured in terms of connections to the network. However, a high proportion of the population suffers from a lack of service due to lack of maintenance of the basic water and sewerage networks.

6. The introduction of land use development controls in Porto Alegre in the early 1960's, combined with rapid population growth, encouraged the concentration of low income housing beyond the Porto Alegre municipal boundary. Such developments intensified heavy daily commuter movements from the peripheral municipalities to the metropolitan center. Conurbation tendencies have been further reinforced by the location of industries outside the Porto Alegre municipality, mainly along the main north-south transport corridor in the late 1960's (the BR 116 road and suburban rail line) and to some extent along an east-west axis, the BR 290 highway, in more recent years. However, the average population density of the metropolitan region as a whole is low with 2.7 inhabitants per hectare but the density of 18.6 in Porto Alegre itself again illustrates the importance of the city in the RMPA. The metropolitan planning authorities have adopted a development plan, the strategy behind which is to raise population densities and improve social infrastructure along the north-south axis and to promote both residential and economic growth along the east-west axis. While such measures may reduce commuter travel between the peripheral municipalities and Porto Alegre in the medium term, the proposed spatial reorganization of population and employment is to be achieved by reinforcing existing trends of development outside Porto Alegre rather than attempting to curtail the further growth of Porto Alegre itself.

7. Within the RMPA, bus is the predominant mechanized mode of travel. In 1975, about 1.5 million person journeys were made on an average day by all modes. Of these 1 million or 66.5% were made by bus and of these trips, journeys-to-work represented 65% of the total. As previously noted, the distribution of population and of employment opportunities together with the function of Porto Alegre as the administrative and commercial center for the metropolitan areas, result in a substantial travel demand to/from Porto Alegre from/to the suburban and surrounding areas. The demand is reflected in the high level of bus flows which occur on some major radial routes, as illustrated in Table 1 (1976 values):
Table 1: BUS FLOWS (MUNICIPAL AND REGIONAL) PER PEAK HOUR

<table>
<thead>
<tr>
<th>Corridor</th>
<th>AM Peak (inbound)</th>
<th>PM Peak (outbound)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Av. Farrapos</td>
<td>Max 447 Min 125</td>
<td>Max 476 Min 185</td>
</tr>
<tr>
<td>Av. Assis Brasil</td>
<td>Max 355 Min 94</td>
<td>Max 277 Min 48</td>
</tr>
<tr>
<td>Av. Bento Gonçalves</td>
<td>Max 297 Min 99</td>
<td>Max 325 Min 79</td>
</tr>
</tbody>
</table>

The road network on which these bus flows, together with the private vehicles flows, must be accommodated is predominantly radial in pattern and limited to six main corridors of approach to the central area of Porto Alegre. The concentration of travel movements onto the restricted network results in traffic congestion in general and in particular, low bus speeds as illustrated in Table 2.

Table 2: AVERAGE BUS JOURNEY SPEEDS (PEAK HOUR)

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Inbound (am)</th>
<th>Outbound (pm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Av. Farrapos</td>
<td>16.4 k/h</td>
<td>19.2 k/h</td>
</tr>
<tr>
<td>Av. Assis Brasil</td>
<td>10.8 k/h</td>
<td>16.0 k/h</td>
</tr>
<tr>
<td>Av. Protassio Alves</td>
<td>16.0 k/h</td>
<td>17.6 k/h</td>
</tr>
<tr>
<td>Av. Bento Gonçalves</td>
<td>20.0 k/h</td>
<td>16.0 k/h</td>
</tr>
<tr>
<td>Av. Joao Pessoa</td>
<td>18.0 k/h</td>
<td>16.4 k/h</td>
</tr>
</tbody>
</table>

The average speeds in Table 2 are for journeys of 8-10 km to and from the center of Porto Alegre. Average bus speeds reduce to about 13 k/h for journeys of about 5 km from the city center and on certain routes are as low as 10 k/h.

B. THE PROJECT

Recognizing the importance of public transport and the increasingly difficult bus operating conditions, the planning authorities in Porto Alegre have devised a project which

(a) places emphasis on the provision of assistance to public transport operations by the introduction of low cost bus priority schemes (termed "Pre-corridors") which can be implemented immediately;

(b) rectifies some weaknesses in the highway network;

(c) will improve bus access and penetration to some of the poorer, outlying areas of RMPA.

Pre-corridors (See Map 13153)

The concept of "Pre-corridors" (so termed since it is anticipated that the schemes will be the initial phase of more extensive public transport priority schemes) has been developed to give buses a significant

1/ Max represents the most heavily travelled link; min the least.
operational advantage over general traffic. The schemes consist of a continuous bus lane, in each direction, throughout the length of a corridor. The bus lanes will be centrally located in the carriageway and special provisions have been made for separation of buses from other traffic, passenger waiting areas, and for facilities to enable passengers to cross the general traffic stream. The schemes will be operated on an all-day basis and have been designed to be accommodated largely within the existing right-of-way to permit rapid implementation. During peak periods, all general traffic waiting and loading will be prohibited on the carriageway allocated to private vehicles outside the bus lanes. Servicing to frontage properties will generally be permitted in off peak periods by allowing curbside parking. An exception occurs where only two lanes remain for general traffic when it is intended to restrict parking for frontage servicing either to side streets and/or curbside night-time parking. The location and extent of the schemes are set out in Table 3:

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Av. Bento Gonçalves/Av. Joao Pessoa</td>
<td>8.00 km</td>
</tr>
<tr>
<td>Av. Protassio Alves</td>
<td>8.90 km</td>
</tr>
<tr>
<td>Av. Assis Brasil</td>
<td>4.55 km</td>
</tr>
<tr>
<td>Av. Farrapos 1</td>
<td>3.26 km</td>
</tr>
<tr>
<td>Av. Farrapos 2</td>
<td>1.64 km</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>26.35 km</strong></td>
</tr>
</tbody>
</table>

In conjunction with the pre-corridors, the project includes the introduction of 6 bus terminals at strategic points along the routes. The objective of the terminals is to provide facilities for rapid and convenient interchange between feeder bus lines to the Pre-corridors and the express bus lines on the Pre-corridors. The terminals also include adequate paved area for storage of Pre-corridor buses during off-peak periods.

Viaduto Osvaldo Aranha (See Map 13153)

10. Since the early 1970's, the municipality of Porto Alegre has been gradually constructing a ring route around the CBD, designated the 1st Perimetral. The construction of the Viaduto Osvaldo Aranha will form the final link to complete the 1st Perimetral. The scheme consists of a two level interchange connecting the existing Av. Osvaldo Aranha (at the western limit of the Av. Joao Pessoa Pre-corridor) with existing twin underpasses which continue the 1st Perimetral northwards. The total extent of the scheme is only some 200 m but the geometric design is complex in view of the constraints imposed by existing roads, buildings, and the need to integrate the Pre-corridor. A major benefit which will accrue from the construction of the overpass is the practicability of then introducing complementary private vehicle, bus, and pedestrian policies within the CBD area bounded by the 1st Perimetral.

The initial proposals for more sophisticated public transport corridors were rejected when an examination of alternatives revealed that most of the benefits could be obtained for significantly reduced expenditures.
Av. Bento Gonçalves and Av. Ipiranga (See Map 13153)

11. It is proposed to improve the existing Av. Bento Gonçalves to a divided carriageway for a distance of 5.59 km eastwards from the termination point of the Pre-corridor on the same route. The route forms a major traffic corridor to the east of Porto Alegre and will assume greater importance when the relocation of the University from its present site in the city center to the new site on the eastern periphery of the city is complete (scheduled for 1981). The road improvement is divided into two sections, namely dual 2 lanes east of, and dual 3 lanes west of, the Av. Antonio de Carvalho which forms a connection to the parallel east-west route of Av. Ipiranga. The traffic flows anticipated in the first year are 18,600 and 6,000 vehicles per day (1,700 and 14,000 buses per day) on the first and second sections, respectively. The improvement provides adequate right of way width for bus priority measures to be introduced in the future. In the same corridor, it is proposed to pave three kilometers of Avenida Ipiranga in order to achieve a consistent cross-section and eliminate a bottle-neck.

Paving in Poor Areas

12. It is proposed to pave about 58 km of road in the poorer, outlying municipalities of the Metropolitan region. The objective of the program is to allow bus penetration into and improvement of bus services within low-income areas. The form and type of pavement construction will vary depending on local circumstances (e.g., existing sub-bases and bases will be maintained where in good condition) and locally available materials, but the objective is to provide a surfaced, all weather road with surface water drainage to allow easy bus access at all times.

C. COST ESTIMATES

13. Cost estimates have been produced using the same approach and techniques as for the projects in the other cities (see Section IV). The cost estimates of individual project components for the Porto Alegre sub-project are set out in Table 4. See Section IV of the Appraisal Report for details on procurement, disbursement, and the proposed financing plan.

D. IMPLEMENTATION

14. The Prefeitura Municipal de Porto Alegre will assume responsibility for the overall project co-ordination, project design, engineering, contract procedures and supervision of all aspects of the Porto Alegre sub-project, with the exception of the paving of roads in poor areas. To exercise this function, the Prefeitura has recently appointed a Project Coordinator. It is anticipated that consultants will be appointed to carry out much of the detailed design and supervision work and thus relevant costs have been included in the project cost estimates. It is anticipated that relevant state agencies will be responsible for specialist tasks, e.g., State Department of Transit (DETRAN) for traffic signal implementation on the Pre-corridors. The program of paving in poor areas will be designed and co-ordinated by Metroplan. No direct design and supervision costs will be incurred since these functions will be performed by Metroplan, Prefeitura and Municipality staff.
Table 4: PORTO ALEGRE PROJECT COST ESTIMATES

<table>
<thead>
<tr>
<th></th>
<th>Local</th>
<th>Foreign</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Pre-Corridors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Av. Bento Gonçalves</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expropriation</td>
<td>5.34</td>
<td>0</td>
<td>5.34</td>
</tr>
<tr>
<td>Civil Works</td>
<td>2.13</td>
<td>0.91</td>
<td>3.04</td>
</tr>
<tr>
<td>Av. Protasio Alves</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expropriation</td>
<td>3.36</td>
<td>0</td>
<td>3.36</td>
</tr>
<tr>
<td>Civil Works</td>
<td>1.92</td>
<td>0.82</td>
<td>2.74</td>
</tr>
<tr>
<td>Av. Assis Brasil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expropriation</td>
<td>2.26</td>
<td>0</td>
<td>2.26</td>
</tr>
<tr>
<td>Civil Works</td>
<td>2.55</td>
<td>1.09</td>
<td>3.64</td>
</tr>
<tr>
<td>Av. Farrapos 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Works</td>
<td>0.94</td>
<td>0.40</td>
<td>1.34</td>
</tr>
<tr>
<td>Av. Farrapos 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expropriation</td>
<td>0.63</td>
<td>0</td>
<td>0.63</td>
</tr>
<tr>
<td>Civil Works</td>
<td>0.55</td>
<td>0.23</td>
<td>0.78</td>
</tr>
<tr>
<td>B. Roadworks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viaduto Osvaldo Aranha</td>
<td>1.51</td>
<td>0.65</td>
<td>2.16</td>
</tr>
<tr>
<td>Av. Bento Gonçalves (1 + 2)</td>
<td>3.57</td>
<td>0</td>
<td>3.57</td>
</tr>
<tr>
<td>Expropriation</td>
<td>2.26</td>
<td>0.97</td>
<td>3.23</td>
</tr>
<tr>
<td>Av. Ipiranga</td>
<td>0.97</td>
<td>0.42</td>
<td>1.39</td>
</tr>
<tr>
<td>Paving in low-income areas</td>
<td>4.91</td>
<td>2.11</td>
<td>7.02</td>
</tr>
<tr>
<td>Total Base Cost</td>
<td>32.90</td>
<td>7.60</td>
<td>40.50</td>
</tr>
<tr>
<td>C. Contingencies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical 1/</td>
<td>2.18</td>
<td>0.94</td>
<td>3.12</td>
</tr>
<tr>
<td>Price</td>
<td>6.39</td>
<td>1.50</td>
<td>7.89</td>
</tr>
<tr>
<td>TOTAL</td>
<td>41.47</td>
<td>10.04</td>
<td>51.51</td>
</tr>
</tbody>
</table>

1/ Based on 15% of the cost of civil works for items A, and 10% of the cost of civil works for items B.
V. PROJECT JUSTIFICATION

15. The philosophy adopted for the evaluation is set out in the Appraisal Report, Section VI. As for the schemes in other cities included in the project, the economic evaluation has quantified in monetary terms savings in vehicle operating costs and in travel times. In Porto Alegre, economic benefits were assessed for each of the Pre-corridors, for the proposed overpass on the 1st Perimetral, and for the highway improvement on Av. Bento Gonçalves. No economic evaluation was carried out for the roads to be included in the paving program. The project is strongly justified. The components evaluated represent 83% of project costs and yield a rate of return of 53%.

Pre-Corridors

16. The calculation of quantified benefits has been confined to those accruing to buses, although effects of the scheme on private vehicles were examined. The introduction of the recommended parking policies along the Pre-corridors will release road space to compensate approximately for that to be allocated exclusively to buses. Further, the removal of substantial bus volumes from the general traffic stream would result in increased private vehicle operating speeds. Thus, it was judged that the introduction of the Pre-corridors would not significantly alter the economic costs of private vehicle operation. The results of the analysis of benefits to riders and operators are shown in Table 5.

<table>
<thead>
<tr>
<th>Benefit/Cost Ratio</th>
<th>Benefit/Cost Ratio</th>
<th>I.R.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Operating Cost</td>
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<td>Time Savings)</td>
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<td>Av. Farrapos 1</td>
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<td>Av. Farrapos 2</td>
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<td>5.0</td>
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<td>7.1</td>
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<td>3.0</td>
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<tr>
<td>Av. Joao Pessoa/Bento Gonçalves</td>
<td>0.3</td>
<td>5.6</td>
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In the Porto Alegre analysis, the effects of institutional measures, such as reorganizing bus lines and promoting the use of larger buses in dense corridors were not included in the economic evaluation. Thus, the results presented above represent the marginal effects of the project over and above the effects of other changes. This explains the apparently low contribution of vehicle operating cost savings to total benefits. It should be noted that these benefits indicate a strongly justified project on the basis of benefits to public transport alone.

Av. Bento Gonçalves and Av. Ipiranga

17. Benefits were assessed separately for two sections of the proposed Av. Bento Gonçalves widening. Firstly, between the eastern end of the Av.
Joao Pessoa Pre-corridor and the junction with Av. Antonio de Carvalho (Section 1) and secondly, for the section between Av. Antonio de Carvalho and the eastern extent of the scheme (Section 2). The benefit-cost ratio of the project is 5.9 (IRR = 60+%) for Section 1 and 5.6 (IRR = 60+%) for Section 2, including vehicle operating cost and time savings for buses and cars. The B/C ratios are 0.8 and 0.7 respectively, if time savings are excluded, indicating the strong contribution of cost savings to total benefits. For the paving of Avenida Ipiranga, the preliminary estimate of the benefit-cost ratio is 3.60 (IRR = 39%). (This will be confirmed in the final EBTU Appraisal Report).

Viaduto Osvaldo Aranha

18. The bus and private vehicle operating cost and time savings for this component yield a benefit-cost ratio of 2.00 (IRR = 25%). If vehicle operating cost savings only are included, the ratio is 0.6. In addition to the quantified benefits, it is anticipated that, since the construction of this component will complete the 1st Perimetral, it will allow parking, bus penetration, and vehicle access policies to be introduced within the CBD—essentially the area bounded by the 1st Perimetral.

Sensitivity Tests

19. As with all economic appraisals concerned with the assessments of transport benefits over time, there exist areas of uncertainty in the determination of input parameters and in the assessment of resultant effects of the proposals. A sensitivity analysis has been completed on the assumption that the benefits have been overestimated by 50%. In this unlikely event, the schemes demonstrate benefit-cost ratios of between 1.5 and 6.5. Only the Viaduto Osvaldo Aranha becomes as low as 1.0. However, in this latter case, the areas of uncertainty are less since it is the closing link in the existing 1st Perimetral, the 50% reduction is unduly pessimistic. Further, as noted in Section 15 there are strong policy considerations for recommending the implementation of this closing link of the 1st Perimetral.

Impact on the Urban Poor

20. The 1970 census data indicate that 54% of Porto Alegre's population can be considered to be poor according to Bank guidelines (see para. 6.17 of the main text). As data on the distribution of benefits by income group were not available for Porto Alegre, it was not possible to carry out a detailed poverty impact analysis. Instead, it was assumed that two-thirds of public transport benefits would go directly to the urban poor together with 100% of the benefits from the paving program. Under these assumptions, the proportion of quantified benefits channeled directly to the urban poor is 67% for the pre-corridors, 55% and 43% for the two sections of Avenida Bento Gonçalves, 50% for Avenida Ipiranga, and 22% for the Viaduto Osvaldo Aranha. Overall, under the above assumptions, 67% of the investments to be financed under the project are estimated to generate benefits directly to the urban poor.
Risks

21. The risks associated with implementation of the components are similar to those described in Section 6.23 of the Appraisal Report. To implement the package of measures, it will be necessary for the Municipality to introduce such measures as parking policies, modification of bus routes, lines and frequencies, in addition to coordinate and control the detailed planning, design and implementation work. The risk is considered small in this case, particularly since the authorities in Porto Alegre have carried out innovative actions in transport operations in the last two years (e.g. shared minibus introduction) and have already appointed a full time Project Coordinator. Appropriate assurances will be sought at negotiations to ensure satisfactory project execution and operation.

F. COMPLEMENTARY POLICIES

22. The Pre-corridors form part of a comprehensive plan, based on an interpretation of the 1976 GEIPOT TRANSCOL study, to improve public transport in Porto Alegre. In addition and in conjunction with the Pre-corridors, it is intended to modify the bus services to respond more closely to travel demand such as the introduction of new services such as feeder bus lines to the Pre-corridor routes and new transversal bus lines to cater for orbital demand without the need for travel to the city center for transfer. The implementation of these policies will be necessary to gain full benefits from the proposals. It should be confirmed at negotiations that appropriate changes in bus lines, routes, and frequencies will be carried out.

23. To ensure the satisfactory operation of the Pre-corridors, it will be necessary to introduce complementary parking policies along the relevant radial routes. The objective will be to provide adequate road space for essential private vehicle movements. Servicing to frontage properties will be conducted at off-peak periods, at night in particularly restricted locations, or from side roads. With respect to parking in the central area, the Municipality has a good record of removing long-term parking spaces, particularly to create pedestrian streets. They are currently attempting to introduce paid, high-turnover parking in the center. It should be agreed at negotiations (a) that appropriate measures will be taken by the Municipality to control parking and loading/unloading in order to ensure the efficient operation of the pre-corridors, and (b) that the Municipality will take steps to facilitate the introduction of paid, high-turnover parking in the central area.

G. RECOMMENDATIONS

24. The general recommendations concerning the control of the project, the EBTU role and so forth are set out in Section VII of the Appraisal Report. The following additional recommendations are specific to Porto Alegre:
(a) Disbursement for the Porto Alegre sub-project will be conditional upon the acceptance by the Bank of a revised appraisal report to be completed by EBTU.

(b) The Municipality shall, pursuant to a timetable satisfactory to the Bank (i) develop and introduce a system designed to discourage long-term parking in the center of Porto Alegre and (ii) provide for adequate measures to reduce illegal parking to a minimum and keep the exclusive bus lanes free of both moving and parked cars.

(c) The Municipality shall take all necessary steps to carry out the modifications in bus lines, routes, and frequencies required to complement the introduction of the public transport Pre-corridors, including the introduction of feeder bus lines and transversal bus lines, such modifications to be derived from the recommendations of TRANSCOL.

(d) The Municipality shall take all appropriate steps under existing legislation to revise the valuation for tax purposes of properties whose values are affected by the project.
Background

1. Since the appraisal of the Belo Horizonte subproject will be carried out by EBTU, this description is limited to a brief outline to provide a background to the proposed project.

2. Belo Horizonte, the state capital of Minas Gerais, is Brazil's third largest city and the principal municipality of the Metropolitan Region of Belo Horizonte which is made up of 10 municipalities with a total area of nearly 3,700 sq km. It lies within a triangle formed by Rio de Janeiro, Brasilia and Sao Paulo, and about 250 miles inland from the coast. During the period 1950 to 1970, the metropolitan region population grew at a rate of 6.2% per annum, from 486,000 to 1,600,000. Migration accounted for nearly 60% of this growth, 90% of it being from within the state of Minas Gerais. The 1977 population is estimated at approximately 2,157,300 inhabitants. Over the past two decades, the population of the peripheral municipalities has grown at over twice the rate of that of the central municipality. 93.5% of the region's population is considered urban.

3. The estimated work force in 1970 was 495,000 persons, 31% of the total population of the metropolitan region. Of these, 27% were in the industrial sectors. A survey showed that just over 31% of the metropolitan area's active population was employed in the informal sector. 36% of the formal sector labor force earned less than the regional minimum wage (compared with 20% for Sao Paulo and 40% for Salvador and Recife).

4. The 1970 census showed that 8-1/2% of the metropolitan region's dwellings were of temporary "improvised" construction; 42% had no piped water supply, spring or well; 55% had no sewerage connection or septic tank; and 18% had no electric lighting. Seventy percent of the population uses public transport.

5. Within the Belo Horizonte region, the expansion of the built-up area of the city of Belo Horizonte, which now encroaches on neighboring municipalities, has resulted in the Greater Metropolitan Agglomeration. It is, in fact, one conurbation containing parts of various municipalities in which municipal boundaries lose significance. In it are concentrated the main urban problems of the Region. The region's rapid growth has been largely uncontrolled and has resulted in an imbalance in the city's distribution of activities, an inefficient spatial structure, and a serious deficiency in the provision of urban infrastructure and service. A Metropolitan Plan for Belo Horizonte (PLAMBEL) was recently completed and its proposals for addressing specific aspects of the development of the region
were accepted. For the long term, the plan calls for the development of subsidiary centers to relieve pressure on the center of the city of Belo Horizonte. In the meantime, the most important task in the region is the provision of urban services in the Greater Agglomeration. This emphasis on the Greater Agglomeration is justified by its great importance to the rest of the metropolitan area, given both its function as the only existing developed center for the provision of services and the impracticability of developing alternatives except in the long term.

6. The principal transport problems in the agglomeration are congestion in the central area and on radial corridors, with particularly detrimental effects on public transport services, and the absence of basic transport infrastructure in the poorer areas of the city.

Belo Horizonte - Potential Project Components

7. A definitive list of the project components will only be available following the EBTU appraisal. The following list is based on the preliminary findings of the appraisal mission.

8. TOPICS Improvements. These improvements will be carried out on basic transport channels in the central area, and in two major travel corridors, Avenidas Pedro II and Antonio Carlos, and include:

   (a) Roadworks. Repairs to, or provision of, paving along the main bus routes, modifications to intersections and provision of lay-bys at bus stops; implementation of the short-term aspects of a circulation plan, with emphasis on the central area, in accordance with already established policies for pedestrian ways, parking, loading and unloading, and preference to public transport;

   (b) Signaling. Implementation of traffic signaling with progressive green waves. Also provision of regulatory and informative signals, signs and illumination for public transport and pedestrians; and

   (c) Bus Transport. Bus-only lanes will be provided on the principal corridors, together with modifications to terminals, bus stops (with attendant facilities such as shelters, route maps, timetable, etc.) and itineraries. The terminals in the central area will be modified to improve facilities for transfers between routes.

The total length of road over which the component will be implemented is 80 km. Approximately half the work will be carried out in the central area, and the other half divided evenly between the corridors Antonio Carlos and Pedro 00.

9. Central Area Traffic Signal System. This will provide an Area Traffic Control system for the central area. It is complementary to the TOPICS improvements, and will seek to direct the circulation of vehicles
along specific routes, reducing idle times and numbers of stops. Its first objective will be to control flow rates to reduce speeds. The major benefits will be collective transport, since the signals will give preference to buses. The reduction in speed (from the present 50 kph average) will promote the safety of vehicles and pedestrians. The time savings and reduction in operating costs of the transport system will, it is expected, bring about a high rate of return on investment. Design of the system is completed for the East-West highway as far as the Amazonas Avenue. The equipment is already installed on the Amazonas corridor, but not yet programmed.

10. **Paving in low-income areas.** There are about 280 km of collectors, which are used by public transport, that are still unpaved. This component provides for the paving of the 140 km that are considered to be of higher priority. Most of these are in low-income areas. In addition to improving accessibility to public transport, the paved collectors will complement the road system by being able to function as neighborhood arterials.

11. **Avenida Cristiano Machado Improvements.** The Avenida Cristiano Machado is partly existing and partly under construction by the Municipality. Running in a north-south direction, it will form the main link to the future road and rail terminal (under construction) at Matodouro, and will relieve the Avenida Antonio Carlos. The latter is heavily trafficked but is in a densely built-up area so that the amount of expropriation required to widen it would make the social, economic, and financial costs of widening it too high by comparison with the cost of extending the Avenida Cristiano Machado. The proposals in this component include:

   (a) construction of a 0.4 km stretch of 6-lane dual carriageway south of Avenida Sumare;

   (b) upgrading of Avenida Sumare by paving approximately half its length, and of Avenidas Pedro I and Vilarinho with TOPICS-type improvements;

   (c) provision of two physically-separated bus-only lanes along 4.7 km of the existing Avenida Cristiano Machado by reducing the width of the central reservation
Table T1: SOCIO-ECONOMIC CHARACTERISTICS OF THE PROJECT CITIES

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<th></th>
<th>Salvador</th>
<th>Curitiba</th>
<th>Recife</th>
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<tr>
<td>Population:</td>
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<tr>
<td>- 1960 Census</td>
<td>740,000</td>
<td>525,000</td>
<td>1,240,000</td>
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<tr>
<td>- 1970 Census</td>
<td>1,148,000</td>
<td>821,000</td>
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<td>- 1975 Estimate</td>
<td>1,400,000</td>
<td>1,013,000</td>
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<td>- Growth 1960-70 (% p.a.)</td>
<td>4.5</td>
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<tr>
<td>Labor Force (1970)</td>
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<tr>
<td>- Unemployment</td>
<td>3.7%</td>
<td>1.8%</td>
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<td>Poverty (1970)</td>
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<tr>
<td>- Families below IBRD</td>
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<tr>
<td>poverty level 1/</td>
<td>68.6%</td>
<td>54.7%</td>
<td>76.5%</td>
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<td>- Families in extreme</td>
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<tr>
<td>deprivation 2/</td>
<td>11.2%</td>
<td>4.2%</td>
<td>16.5%</td>
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<td>Access to Services:</td>
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<tr>
<td>- % of &quot;improvised&quot;</td>
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<tr>
<td>dwellings</td>
<td>24</td>
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<tr>
<td>- % without water supply</td>
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<td>39</td>
<td>54</td>
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<tr>
<td>- % without sewerage</td>
<td>70</td>
<td>49</td>
<td>69</td>
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<tr>
<td>- % without electricity</td>
<td>11</td>
<td>23</td>
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</table>

1/ Poverty level for family income is calculated as 5.2 times the individual poverty level.
2/ I.e. where family income is less than the IBRD poverty level for an individual.


Note: All three cities have experienced very rapid population growth in the last two decades. The result has been dense uncontrolled and unserviced development on the peripheries of the principal cities of each region. In general, employment creation has lagged far behind population growth. In Salvador, and Recife, investment incentives for industries to locate in the Northeast have attracted industry but, nor surprisingly, capital incentives have resulted in capital-intensive industries that do little to help solve the unemployment problem. By contrast, Curitiba has succeeded in attracting to its new industrial city light and medium-scale industries with the capacity to absorb manpower.
BRAZIL
FIRST URBAN TRANSPORT PROJECT
EMPRESA BRASILEIRA DOS TRANSPORTES URBANOS (EBTU)
ORGANIZATION CHART

Board of Directors

President

Social Communications Adviser
Organization and Methods
Legal Adviser

DIRECTORATES
Technical
Institutional Relations and Operations
Finance and Administration

DEPARTMENTS
Plans and Projects
Technical Development and Data Processing
Institutional Relations
Supervision of Works
Administration
Finance and Economics

DIVISIONS
Project Analysis
Engineering and Research
Aid to Public Transport
Materials
Investment Control
Studies and Projects
Technological Development
Institutional Relations and Program Orientation
Programming and Control of Works
Personnel
Accounting
Plans and Programs
Electronic Data Processing
Institutional Relations and Program Orientation
Supervision of Works in Progress
Supervision of Works
General Services
Financing
Human Resource Development
Economics
### BRAZIL
FIRST URBAN TRANSPORT PROJECT
SALVADOR
Implementation Schedule

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**TRANSCOL**

1. **Corridors**
   - 1.1 Campo Grande / Praça da Sé
   - 1.2 Politeama / Piedade
   - 1.3 Piedade / Nazaré
   - 1.4 Marta Vasconcelos / Sete Portas
   - 1.5 França / Largo dos Mares
   - 1.6 J. J. Seabra / J. Angélica

2. **Transfer Stations**
   - 2.1 Praça da Sé
   - 2.2 Lapa
   - 2.3 Rodoviária
   - 2.4 Campo Grande

3. **Critical Points**
   - 3.1 Vasco da Gama
   - 3.2 Estrada da Rainha / Gal. Argolo
   - 3.3 Estrada da Rainha / Soledade
   - 3.4 Largo dos Gaéis
   - 3.5 Porto da Barra

4. **Terminals in “Bairros”**
5. **Paving in “Bairros”**
6. **Traffic Management Equipment**
7. **Public Relations**

**PROBUS**

1. **Paving in Low Income Areas**
   - 1. Nordeste de Amaralina
   - 2. Avenida San Martin
   - 3. Vale do Queimado
   - 4. Vale das Pedrinhas

**KEY**

- Engineering Design/Preparation
- Tendering/Selection and Bank Review
- Construction/Implementation
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**CONNECTOR 5**

**STRUCTURAL 5**

**PAVING IN LOW-INCOME AREAS**
1. Sector South
2. Sector Boqueirão
3. Sector West

**TERMINALS**
1. Pinheirinho
2. Capão Raso
3. Industrial City
4. Vila Hauer
5. Boqueirão
6. Cabral
7. Campina do Siqueira
8. Campo Comprido

**KEY**
- Engineering Design/Preparation
- Tendering/Selection and Bank Review
- Construction/Implementation
**ANNEX 3**
Chart No. C4

# BRAZIL
**FIRST URBAN TRANSPORT PROJECT**
**RECIFE**
Implementation Schedule

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**SECOND PERIMETRAL**
1. Largo da Paz/Torre
2. Pernamirim/Agua Fria
3. Agua Fria/Casa Caçada

**"TOPICS" IMPROVEMENTS**
1. Bicopeba/Caxangá
2. Cavaleiro/Moreno
3. Pontezinha/Ponte Carvalho

**TRANSCOL**
1. Paving in Low Income Areas
2. Urban Corridors
3. Corridors in expanded center

**CTU PROGRAM**
Maintenance Infrastructure and Equipment

---

**KEY**
- Engineering Design/Preparation
- Tendering/Selection and Bank Review
- Construction/Implementation
# Brazil

## First Urban Transport Project

### Porto Alegre

#### Implementation Schedule

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### Pre-Corridors
- 1. Av. Bento Gonçalves
- 2. Av. Protásio Alves
- 3. Av. Assis Brasil
- 4. Av. Farrapos I
- 5. Av. Farrapos II

### Roadworks
- 1. Oswaldo Aranha Bridge
- 3. Av. Bento Gonçalves
- 4. Paving in low-income areas

#### Key
- Engineering Design/Preparation
- Tendering/Selection and Bank Review
- Construction/Implementation

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*World Bank - 18438*
# BRAZIL
FIRST URBAN TRANSPORT PROJECT
BELO HORIZONTE
Implementation Schedule


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<th>&quot;TOPICS&quot; IMPROVEMENTS</th>
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**KEY**

- Tendering/Selection and Bank Review
- Construction/Implementation
BRAZIL

URBAN TRANSPORT PROJECT

Selected Documents and Data Available in the Project File

A1. The Emergence of Metropolitan Areas and their Institutional Structure, J. G. Franciscone, (President of CNDU).

A2. Transportes Urbanos, Speech given by the President of EBTU setting out EBTU's urban transport policy.

B. Selected Reports and Studies Relating to the Project


C. **Selected Working Papers**


C4. Selected EBTU Financial Data (Balance Sheets, Income Statements, etc.).
CITY OF RECIFE

DETAIL OF EXPANDED CENTER AREA

BRAZIL
Urban Transportation Project
CITY OF RECIFE
URBAN TRANSPORTATION PROJECT
City of Porto Alegre

PROJECT
- Pre Corridor Bus Priority Measures
- Road Improvements
- Bus Terminals

EXISTING
- Major Access Roads and Streets
- Secondary Access Roads and Streets
- Railroads
- Central Business Area
- Built-up Areas
- Green Areas
- Rivers

This map has been prepared by the World Bank's staff necessarily for the convenience of the readers of the report to which it is annexed. The designations used and the boundaries shown on this map do not imply, on the part of the World Bank and its affiliates, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.