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POLICY RESEARCH WORKING PAPER

1633

# Essentials for Sustainable Urban Transport in Brazil's Large Metropolitan Areas

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Four pillars for sound  
development and long-term  
sustainability of the urban  
transport sector in large  
metropolitan areas

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## Summary findings

Before financing major urban transport projects, decisionmakers should attempt to put in place the basic elements for long-term sustainability of the sector. Specifically, contends Rebelo, each large metropolitan area in Brazil should incorporate into its urban transport strategy, and pursue vigorously, the following four-point agenda:

- Create a regional transport coordination commission in charge of coordinating policies among federal, state, and municipal governments, giving highest priority to major urban transport investments in the metropolitan region and promoting modal integration—all to the end of improving the sector's economic efficiency and long-term sustainability.

- Adopt an integrated land use, urban transport, and air quality strategy that provides a framework in which the community and decisionmakers can evaluate future urban transport investments and policies.

- Enact into law formal financing mechanisms that would ensure that long-run variable costs of urban transport systems are covered by operating and non-operating revenues from the systems and by appropriate user charges.

- Promote private sector participation in the operation, maintenance, and construction of urban transport systems—through concessions or management contracts—as a way to lessen the financial burden on the government.

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# Essentials for Sustainable Urban Transport in Brazil's Large Metropolitan Areas

Jorge M. Rebelo



## ESSENTIALS FOR SUSTAINABLE URBAN TRANSPORT IN BRAZIL'S LARGE METROPOLITAN AREAS\_

by Jorge M. Rebelo<sup>1/</sup>

This note describes four main pillars for sound development and long-term sustainability of the urban transport sector in large metropolitan areas, and suggests how they can be introduced. The largest Brazilian metropolitan regions are presently working to introduce these pillars to ensure that urban transport will not be hostage to local and state politics, and will be able to maintain and develop its equipment and infrastructure through reliable financing mechanisms.

1 Before financing major urban transport projects in large metropolitan regions (MR) it is important to examine whether they have the basic elements or pillars for long-term sustainability of their urban transport sector. In Brazil, these basic elements are: a) a Regional Transport Coordination Commission (RTCC) in charge of coordinating major investments and operations, promote integration and define common cost-recovery policies and financing mechanisms for the financial sustainability of the sector; b) An Integrated Urban Transport, Land Use and Air Quality Strategy which provides the basic guidance and vision for future development of the MR's urban transport sector; c) Financing Mechanisms to ensure the financial sustainability and expansion of the sector; and d) Private sector participation in the investment and operation of the urban transport systems. Next we examine each of these elements.

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## **A. Regional Transport Coordination Between the State and the Municipalities of the MR**

1.2 To facilitate coordination of investment and operations among the major providers of urban transport services, a regional coordinating body should be created. This would not be by any means an attempt to have central planning of urban transport. Neither would this be a new level of government or usurp the powers of the State or the Municipality. Instead, it would provide a much needed forum to informally review all bottom up proposals, first and foremost from an *economic efficiency and financial sustainability* standpoints and with respect to their compliance with an agreed-upon transport strategy, evaluate alternatives, and make recommendations based on a regional, intermodal point of view. For that purpose it is proposed the establishment of a Regional Transport Coordination Commission (RTCC) which is described in A1 below. In addition, and since the RTCC would be responsible for developing an integrated urban transport, land use and air quality strategy which would be periodically updated and revised, RTCC must develop a strategy and the tools required to update it on a periodic basis. The basic elements of this strategy are described in part A2 below. **The MRs of Madrid (Spain), Recife (Brazil) and Toronto (Canada) have some sort of RTCC. São Paulo, Rio de Janeiro and Belo Horizonte have set up this type of coordination commission and are in the process of formalizing it.**

## **A1. The Establishment and Role of a Regional Transport Coordination Commission**

1.3 The RTCC will consist of representatives of the Governor of the State and Mayors of the MR, in particular the Mayor of the main Municipality, as well as urban transport operating agencies and those agencies responsible for municipal and regional planning. The State department in charge of urban transport could serve as the Executive Secretariat, which would develop and evaluate proposals and carry out day-to-day activities. RTCC would be responsible for developing an integrated urban transport, land use and air quality strategy for the MR. The following questions were asked when defining the role and functions of the proposed RTCC:

- Are the proposals for investment feasible from an economic efficiency and financial sustainability standpoints or are they just another third or fourth best solutions which demand ever increasing subsidies from all levels of government?
- How are transport plans currently prepared, and how often are they updated? Is one entity responsible for their preparation across all modes (highways, metro, suburban rail, bus/busways) and the entire region, or are plans prepared by the respective municipalities, building and operating companies and then put together by a coordinating agency?

- Is any agency monitoring the condition and performance of the transport systems, and if so, how do the results of the monitoring feed into the planning process?

In Brazil there is only one formal RTCC, the Empresa Metropolitana de Transportes Urbanos (EMTU) in the city of Recife, which was established in 1981. So far EMTU is mainly active in the coordination of municipal and intermunicipal buses and is funded both by the State and by the Municipality of Recife. The major test as a real RTCC will come when the metropolitan railway of Recife (METROREC), which soon will be transferred from the Federal to the State Government is also brought under EMTU.

In Rio de Janeiro, the State and the Municipality have started a precursor of the RTCC as a forum to discuss metropolitan projects and prioritize them, and also define common tariff and subsidy policies.

In São Paulo, a precursor of a RTCC has also been established and has served as forum for discussion of projects, to test a sketch-planning integrated urban transport, land use and air quality strategy for different scenarios and to help the municipality and the State to agree on a standard transit ticket which can be used in buses and the subway and the suburban railway systems.
- What is the relationship between the transport plan developed above and the respective land use plans developed by the municipalities?

In Belo Horizonte, State and the Municipalities of Belo Horizonte and Contagem have set up a RTCC which is being instrumental in providing guidance in the decentralization of the suburban metropolitan rail system (DEMETRO) from the Federal to the State, and to integrate it with the bus system, as well as discussing integrated tariffs. In this metropolitan area where in recent past, there were so many rivalries between the State and the Municipality of Belo Horizonte, this informal forum has been a great consensus maker.
- What is the relationship between the transport plans developed under question (a) above, and the multiyear capital program developed by the various implementing authorities? Is the project flow top-down (i.e. emanate from the plan), bottom-up (generated by the implementers/operators), or both? and

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Examples of Regional Transport Coordination Commissions in Brazil

- Do the various operating companies have direct access to funding or must their capital budgets be approved either by the State or the new RTCC?

To lend some strength to this informal fora which have no deliberative powers, multilateral agencies should only consider financing for projects which were thoroughly discussed and prioritized by them. The Bank is following this approach in Brazil, and this has generated a healthy discussion of transport projects between the three levels of government.

## **A2. An Integrated Urban Transport, Land Use and Air Quality Strategy**

1.4 In a large metropolitan region as those where the megacities are inserted, any decisions on major transport investments and/or policies are likely to have a direct impact on land use and air quality. Similarly, different patterns of land use will also determine the type of transportation systems which can better serve the metropolitan population. The State and the main municipality must be well aware of the inter-relationships between urban transport, land use and air quality and should explore different scenarios for the MR urban transport systems with the support of specialized technical assistance. The evaluation of different packages of infrastructure investments and policies (such as higher fuel taxes and parking fees, area traffic restraint schemes and integrated multimodal fares) were crucial to arrive at an integrated urban transport, land use and air quality strategy. Furthermore, the MR

decision-makers know that while the interlinking of the rail-based network would attract bus and auto users, therefore reducing road congestion, it is necessary to ensure that the rail stations are accessible through a combination of infrastructure which includes not only roadways and busways but also bicycle ways and safe walkways. Indeed, the role of non-motorized transport cannot be underestimated since high percentages of all trips in large MRs are made on foot, and there is a high accident rate among pedestrians. Decisions to use quieter and cleaner vehicles have a direct impact on noise and air quality. Likewise, decisions to

enforce the inspection and maintenance of road vehicles are likely to impact the air quality of the MR.

1.5 The main elements of a MR's integrated urban transport, land use and air quality strategy include:

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São Paulo has developed an integrated urban transport, land use and air quality model which helps in testing several scenarios proposed by community leaders. This model is similar to one used in Edinburgh, London and Birmingham, UK and was developed as a "sketch planning tool".

Rio de Janeiro developed a Mass Transport Plan which together with a Strategic Plan developed by the Rio Municipality provides an excellent tool to identify the main corridors and the best transport technologies for these corridors. Work is being undertaken to complete an air quality model which will be later added to the model.

Both Recife and Belo Horizonte are preparing similar models.

Although an integrated urban transport, land use and air quality strategy may sound as a panacea for all planning problems nothing is far from the truth. It is well known that one can use land use scenarios to justify projects supported by special lobbies, and utmost care ought to be exercised to avoid this type of pitfall. Rather this tool should be used to test scenarios quickly and to obtain an impact matrix taking into account the three areas. The emphasis here is to show that the three areas are intimately related and they can shape the type of transport required.

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Integrated Urban Transport, Land Use and Air Quality Strategies

- Transport demand management. Measures to discourage private car and motorcycle use and encourage use of public transport are essential to reducing traffic congestion and controlling urban sprawl. Few cities in the world such as Singapore and Gottenberg have successfully introduced some sort of area traffic restraint. But several cities have sound parking policies which are a good start in demand management. In Brazil, the lack of very good public urban transport has delayed effective road demand management policies. Congestion Pricing is now being used in some cities as a form of demand management.
- Strengthening public transport. As an essential complement to transport demand management, public transport should be made faster, safer, more comfortable, and more convenient. The objective should be as much as possible to make public transport attractive not only to lower-income classes but also to middle-income users, who are the main users of the automobile. So far, only Curitiba and São Paulo have been able to do that. In Brazil, public urban transport especially suburban rail is still seen as a low-income transportation mode.
- Traffic engineering. Appropriate design of roads, intersections, and traffic controls can eliminate bottlenecks, accommodate public transport, and smooth traffic flow at moderate cost. Both São Paulo, Rio de Janeiro

are quickly realizing that any subway or busway development must be done in conjunction with effective traffic management. Otherwise the road space saved is occupied by more automobile traffic and there is no reduction in traffic congestion.

- Road building. Some new roads, carefully targeted to relieve bottlenecks and accommodate public transport, are probably essential, but should be funded only as part of an integrated plan.
- Land use planning and zoning. Planning should encourage urban forms which minimize transport needs, encourage non-motorized transport (cycling, walking) and allow for efficient public transport service. Land-use will determine the most adequate urban transport mode and Curitiba is a good example of that.
- Technical Measures involving vehicles and fuels. These can dramatically reduce air pollution, noise and other environmental impacts of road transport. Rio de Janeiro and São Paulo have been experimenting with CNG fueled buses. Problems have been more with supply than with vehicle performance. Inspection/maintenance programs are being introduced in São Paulo and their impact on PM10 reduction is expected to be significant.

- Monitoring and Evaluation. The strategy should also provide for continuous updating and monitoring of effectiveness, by means of an ongoing process of vehicle emissions and traffic measurement, updating of emissions inventory, and transport and air quality modeling.

1.6 An integrated program, incorporating all of these elements, will be required to achieve the long-term goals set by the State and MR's urban transport sector. For example, building new roads, in the absence of measures to limit transport demand and improve traffic flow, may simply result in more roads full of traffic jams. Similarly, strengthening public transport will be ineffective in the absence of transport demand management to discourage car and motorcycle use, and traffic engineering to give priority to public transport vehicles. Both new road construction and efforts to strengthen public transport must, moreover, be coordinated with land use planning and regulation, to ensure efficient use of new networks. The strategy must take into account the land use patterns and zoning regulations defined in the MR's master plan and test the impact of different land use plans.

1.7 Disincentives to the continued growth of automobile use in the city (which in the long-run, along with other measures, is the only sustainable way to achieve reductions in air pollution) such as the introduction of congestion pricing and other demand management measures, will require a parallel improvement in public transport service. Since road transport is a major source of pollution, all proposed

transport-related actions (policies and investments) should be evaluated based on their contribution to reduction of noise, air pollution, and accidents as well as moving people. For instance, reduction in noise and air pollution could be supported by transport proposals that would preclude the circulation within the central business district of environmentally inefficient buses by an agreed target date. This, in turn, would require the development of transfer points at the fringes of this area to allow the older buses to continue to operate from the outlying areas, discharge their passengers, and return.

1.8 To test different scenarios, a model which integrates urban transport, land use and environmental impacts and is capable of assessing the overall benefits and costs of different urban transport programs must be developed. This type of **sketch planning** uses a multicriteria analysis which will allow decision-makers to evaluate the contribution of the different "packages" of projects and policies towards pre-defined policy objectives. The analysis will be useful to the RTCC in order to rank various metropolitan schemes, to test integration and subsidy policies and to guide the overall metropolitan region program. This tool is expected to be a starting point for a more detailed evaluation. Several feedback loops are required to arrive at conclusions which are less aggregated and which provide a more accurate numerical analysis. The concept of integrated planning put forward during preparation is being embraced by the **São Paulo Metropolitan Region and was used in Birmingham, Edinburgh (Ref.1) and London**. The development of a coherent environmental strategy, and proposals

for specific actions related to the integrated transport plan is essential for the justification of any major urban transport project such as a subway line or a major beltway.

## **B. Financing Mechanisms to Ensure Long-Term Financial Sustainability**

1.9 Since suburban rail and subway tariffs in the largest MRs of the developing world are set by the State and are often below their long-run variable costs, these systems depend heavily on government subsidies<sup>2/</sup>. While the difference between farebox revenues and operating costs (exclusive of depreciation and cost of capital) is normally covered by a subsidy (hereby called working subsidy) prescribed by law, the main problem is to ensure that depreciation and cost of capital are covered by formal financial mechanisms which will prevent irreversible deterioration of infrastructure and equipment. Furthermore, since another way to reduce the heavy burden on government, would be to encourage private sector participation in the construction, operation and maintenance of the existing and new systems, the promotion of private sector participation is also discussed as part of a possible financing mechanism. The recent experience of concessions of the metropolitan

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<sup>2/</sup> Few subways in the world cover their working costs (i.e. operating costs without depreciation and cost of capital). Amongst them are the São Paulo Metro (which in 1995 started covering its working costs), the Santiago Metro, and of course the Hong Kong, Singapore and Pusan (Korea) Metros. Most of the Metros of other megacities hardly reach 60% of their working costs. The problem, however, is that for flows of more than 25,000 passengers per hour per direction in the CBDs of most megacities, a better solution than a subway is yet to be found. This one more reason why predictable financing mechanisms are needed where a subway alternative is the best solution from the economic standpoint. The author does not know of any commuter/suburban rail operation that cover its working costs.

railway systems of the Buenos Aires, Argentina metropolitan region to the private sector is showing that operating subsidies can be drastically reduced and even eliminated. The next paragraphs examine financing mechanisms and private sector participation in the context of the MR urban transport systems.

## **B1. Financing Mechanisms**

1.10 Most **bus systems** in Brazil are privately operated and do not receive subsidies. On the contrary, **suburban railways and subways** have generally an operational deficit because their farebox revenues do not cover the long term variable costs of operation. While the volume of paying passengers is high, tariffs are regulated by government which wants to ensure that low-income riders are not constrained from traveling to and from work. Most State transport operating agencies have annual contract plans with the State, in which they agree on a number of targets including the volume of paying passengers. As tariff levels are externally imposed, the State covers the shortfall between farebox revenues and operating costs through a formal legal mechanism. In addition, in general the State finances the construction of infrastructure and the replacement of equipment plus the cost of capital. The argument for the State to pay for depreciation and cost of capital, as in most suburban rail-based systems in the world, is that the breakeven tariff would be very

high given the huge infrastructure costs involved and would be a financial burden for the main users of the system who, in general, are low-income riders. The economic argument for the Government to pay for depreciation and cost of capital are the positive externalities generated by a rail based system in terms of less congestion, fewer accidents, and lower levels of air and noise pollution. If the net economic benefits of externalities are commensurate with the government contribution to the system, then there is an economic justification for the subsidy. However, this type of argument although well founded, has created a disincentive to economic efficiency of suburban railways and subways, especially in the reduction of their fixed costs. Recent concessions of suburban railways and subways in Argentina have shown that higher economic efficiency can be achieved by lean structures which decrease fixed costs by contracting out several activities.

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In Brazil, most bus systems do not receive subsidies and they are, with few exceptions, operated by the private sector.

Metropolitan railways and subways, however, with the notable exception of the Sao Paulo subway system have an operating deficit which must be covered with a government subsidy.

The problem is, while operating subsidies are normally paid (main expense ticket item is generally payroll which sometimes is 80%-90% of costs ) depreciation and cost of capital contributions by government are not paid in a predictable manner. This leads to a vicious circle of maintenance backlogs which in turn affects level-of-service and demand.

In Brazil, earmarking is unconstitutional. On the other hand, there is very little discipline to program general tax revenues for rail based transport.

Betterment taxes and other property taxes normally fall under the jurisdiction of the municipalities which are not in the majority of cases responsible for rail. Therefore, they do not feel that they should help the State in the financing of the rail systems. This could be changed if the RTCCs would work well. Fuel taxes are only the responsibility of the Federal and Municipal Governments.

Some States are proposing amendments to the Federal constitution to bring back Highway Trust funds similar to the US Highway Trust Fund with a contribution to Mass Transit.

1.11 The principal issue, however, is where and how does the government raise the revenues required to pay for the operating subsidy, depreciation and cost of capital of the rail-based systems. In some countries, funds are linked to gasoline taxes, polluter-pays taxes and municipal betterment taxes which, when added to other Government tax revenues, provide sufficient resources to carry out the annual investment programs. For example, in the State of São Paulo, Brazil, the rail-based systems rely solely on Government tax revenues without any earmarking because the latter is unconstitutional. While the payment of the operating subsidy has always been made on time, the availability of funds for replacement of equipment and new extensions have been erratic and determined mainly by local politics. Based on recent experience (e.g., the unavailability of funds to pay for trainsets which are already available for delivery), the promise that resources will be made available from Government general revenues is not enough to ensure the long-term financial sustainability of the system.

1.12 In view of the above, the State Governments should enact a legal instrument defining the financing mechanisms that they intend to use to cover the depreciation and cost of capital of the system on a timely and reliable basis. Possible sources of funds are revenues from advertising, savings generated from the commercialization of the "weekly passes", sale of air space development rights in the area of influence of the rail rights-of-way, revenues from taxes on civil works and goods supplied to the systems and joint ventures with the private sector for

construction of facilities in exchange for concessions (Ref.2) to operate them over a number of years at agreed tariffs. A study of the sources and applications of funds for the urban transport sector based on a multi-year investment plan of the systems should be undertaken. Any shortfalls will be identified and adequate taxes or user charges recommended to cover the gap. Operating agencies would create a reserve account where revenues from non-operating sources would be deposited for use in new investments or critical replacements. **The Hong Kong and Singapore subways have such reserve accounts and considerable revenues from real estate operations. The Rio de Janeiro private bus operators commercialized the sale of their "weekly pass" called "vale-transporte" and, in an highly inflationary environment, generated substantial savings by depositing the product of their sales for a few days. This in turn allowed them to keep the tariffs low, transport students for half price and the elderly for free and avoid subsidies. France uses the "versement transport" a tax on all salaries to be used on urban transport operations and investments. Madrid has very defined financing mechanisms which are entrusted to their RTCC.**

## **B2. Private Sector Participation**

1.13 In an effort to increase private sector participation in the sector, the State should be encouraged to meet with the associations of civil works contractors,

equipment manufacturers and real estate specialists. The latter should indicate whether they are interested in exploring mechanisms to develop real estate in and around the stations. In general, those three associations are able to indicate whether there is need for some changes in municipal legislation to capitalize on the additional floor space created by new buildings in the aerial space above the right-of-way and surrounding areas. Most transit users in São Paulo today utilize transit services or facilities that are provided by or managed by private companies. The best prospects for private sector participation appear to lie with area development near the stations and build-operate concessions for busways.

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In Brazil, the most significant achievement in eliminating working subsidies has been the State operated Sao Paulo subway system which has a ridership of 2.4 million passengers a day. However, this was mainly achieved due to the very high ridership of the system and there is considerable room for more gains if the subway organization is streamlined. The São Paulo subway has launched a number of private sector initiatives such as concessioning out the use of subway facilities for advertising, concessioning out the construction and operation of electric substations. Faced with the scarcity of State funds the São Paulo subway is preparing bids to invite the private sector for a BOT for the construction, operation and transfer of its 9 km fourth line under a 20 year concession.

The metropolitan railways in Brazil (Rio, Sao Paulo, Belo Horizonte and Recife) have now either been decentralized to the respective States or will be soon decentralized. Once that happens the States are seeking options to increase the private sector participation in these systems, in order to reduce the operating deficits. Rio de Janeiro has set March 1997 as the date to concession out to the private sector its subway and expects to eliminate its working subsidy from us\$100 million per year over a 3 year period. It has equally set January 1998 as the date to concession out its suburban rail system (Flumitrens) to the private sector and expects to reduce its annual subsidy of us\$180 million by two thirds over a 3 year period.

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Urban Rail Systems Can Cover their working Costs, especially in the hands of the Private Sector

1.14 Subway intercity bus terminals are often rented to the private sector. In São Paulo, the São Paulo subway company (METRÔ) has recently called for bids for

the construction and operating concession for twenty years of an electric substation estimated at US\$20 million. The private sector would build the substation and associated equipment. The METRÔ would buy the energy from the primary source. The private sector would then transform the energy from 138 KV to 22 KV at an agreed tariff and transport it to the line. The METRÔ saves the initial investment costs and over a 20 year period the private sector would have a good return on investment.

1.15 To carry out the private sector participation strategy, the State should evaluate the prospects for privatization with respect to real estate market conditions, costs of capital, tax laws, and other important factors. A committee for private sector involvement should be convened, and the parameters defined for private sector financial support for potential projects. An analysis of specific privatization mechanisms, should be conducted taking into account the risks to be faced in implementing the project (e.g., income risk) and identifying mitigative mechanisms (e.g., loan guarantees). The results should then be presented to public and private groups in the MR having an interest in the project. Finally, recommendations should be developed for bidding, financial guarantees, contract mechanisms and other procedural and legal aspects that may affect the private sector's willingness to participate in the project. MRs where the participation of the private sector is important are **Hong Kong (air space development), Singapore (stations and malls),**

Montreal (stations and malls), São Paulo (busways, electric substations), Madrid (rolling stock maintenance). Full concessions of suburban rail systems are in place in Buenos Aires and in Manchester (Metrolink) and in trunk-line busways in São Paulo. In Argentina, the metropolitan railway concessions to private sector have demonstrated that these systems can be operated at much lower subsidies if payroll is brought under control, fare evasion is controlled and level-of-service reliability is restored. One year after concession to the private sector of the Buenos Aires Metropolitan rail system, revenue passengers per staff quadrupled, the operating subsidy per paying passenger was halved and the subsidy per car-km was reduced by 35%. The concessionaires are supposed to zero the subsidies in 5-7 years from start of the operation. The Argentinean success has spurred a series of similar initiatives in Brazil.

## Conclusions

1.16 In summary, MRs should incorporate in its urban transport strategy and pursue vigorously the following four-point agenda:

- a) The creation of a Regional Transport Coordination Commission (RTCC) in charge of coordinating policies amongst the state and municipal governments, prioritizing major urban transport investments in the MR,

and promoting modal integration, all this seeking economic-efficiency and long-term financial sustainability of the sector;

- (b) The adoption of an Integrated Land Use, Urban Transport and Air Quality Strategy which would provide a framework for the community and decision-makers to evaluate future urban transport investments and policies;
- (c) The enactment into law of formal financing mechanisms which would ensure that long-run variable costs of the urban transport systems are covered by operating and non-operating revenues from the systems and by appropriate user charges; and
- (d) promotion of the private sector participation in the operation and construction of urban transport systems as a means to decrease the financial burden of the government.

These are pillars for sound development and long-term sustainability of the urban transport sector in large metropolitan areas.

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