A Critical Look at Major Bus Improvements in Latin America and Asia: Case Study Metrobús-Q, Quito, Ecuador

CASE STUDY METROBUS-Q, QUITO, ECUADOR
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SUMMARY

Quito has developed three BRT corridors with feeder integration: Trolebús, Ecovía and Central Norte. Trolebús, implemented in 1995, is a 17 km, 90% longitudinally segregated corridor, with three integration terminals and 28 stations. It has 113 articulated electric trolleybuses and integrates 78 feeder buses, transporting 246,000 pax/day. Trolebús is publicly operated by a local government agency (UOST).

Ecovía, implemented in 2001, is a 9.7 km, 95% longitudinally segregated corridor, with 2 terminals and 16 intermediate stations. It has 42 articulated diesel buses and integrates about 30 feeder buses, with a ridership of 81,000 pax/day. Ecovía is currently operated by UOST, after a failed contract with traditional transport companies in the corridor. Negotiations were ongoing during the first semester 2006 to sign a new contract and turn operations to the historic private operators of the corridor.

Central Norte, implemented in late 2005, is a 11.5 km segregated corridor, with 4 integration points and 24 stations. It will have 84 articulated diesel buses and 67 feeder buses (conventional). Corridor was under implementation as of April 2006 (63% of the planned total buses) and with some temporary facilities. The calculated ridership was 120,000 pax/weekday. Central Norte is privately operated by the historic transport companies in its area of influence.

Things done well

- The concept of organized feeder-trunk operations has evolved as the paradigm of public transport in Quito as opposed to traditional transport with loose affiliation and vehicles competing with each other for passengers.
- The infrastructure costs have been very low.
- Inclusion of electric trolleybuses for the first corridor has been respectful of colonial Quito and environmentally friendly.
- High performance: commercial speed of 14-23 km/hour; 1,900-2,200 pax/per bus per day; and 7.5-11.0 pax per km run. Service in Trolebús and Ecovía receives good ratings by the users.
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Things that perhaps should have been done differently

- Corridors do not have physical and fare integration yet.
- Fares are politically defined and do not cover operation and bus capital costs. The municipality has not used its authority to determine fares, leaving this responsibility to national authorities.
- A transition to private operation could be beneficial, but no adequate mechanisms have been used. As a matter of fact, a contract with private operators in Ecovía failed, and operations in Central Norte exhibit some problems. These two cases used direct negotiation rather than competitive bidding.
- Some infrastructure problems, such as pavement rutting and station floor deterioration in the Trolebús and the Ecovía corridors could have been avoided with timely maintenance.
- Corredor Norte started operations with temporary facilities that are yet to be completed, causing operational and quality of service problems.
- Implementation of advanced fare collection technologies has been delayed. It is still planned for near future implementation.
- Respect of the busways by general traffic is not adequate due to failures in drivers’ traffic education and lack of enforcement. There are also problems with pedestrians in downtown streets.

Critical positive enablers

- International cooperation through the United Nations Development Program and the Government of Spain (long term soft loans for trolleybus acquisition).
- Decentralization of transport authority from the National government to the municipality of Quito.
- Continuous mayoral support, even with changes in political parties.
- Initial leadership of project director César Arias, which crafted the institutional arrangement and managed the technical details.
- Continued leadership of Architect Hidalgo Nuñez, which envisioned development of the corridors into a single system, yet to be implemented.
- Initial success of the Trolebús corridor helped in development of the other two corridors, and an expansion of the Trolebús corridor itself.

Critical barriers

- Opposition from existing transit operators caused major disruptions during initial implementation of Trolebús corridor. The city suffered several days of protests that required the participation of the army to be solved.
- This opposition has generated a process in which all the historic operators are included through direct negotiations. These negotiations have brought unbalanced results for the city.
- Low technical capacity and hands on experience of the implementation team and consultants. Technical cooperation partially covered the gaps, but not
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enough capacity has been built in public authorities, also limited by remuneration scales.

- Very low fare (USD 0.25) does not cover capital investment in Trolebús and Ecovía (buses have been purchased by the municipality), and may cause financial problems to private operators in Central Norte, as gains in productivity may not be enough to balance cost and revenues.
CITY CONTEXT

Quito is the capital of Ecuador. It is located in a narrow valley 2,800 meters above sea level. The mountainous topography has constrained the city to grow in a linear form approximately 30 kilometers [19 miles] in length and 3 to 5 kilometers [2 to 3 miles] in width. The population is 1.6 million inhabitants (Quito, 2006). Its historic city center was declared a world cultural heritage site by UNESCO in 1978 due to its outstanding colonial architecture.

Transport conditions before the initiation of the first high capacity corridor were considered very poor. The city had low quality public transportation, provided in inadequate and obsolete vehicles under dispersed operation and ownership (Interviews, 2006). Transport authority was concentrated at the national level (Minister of the Interior, through the National Police) and focused on rules, regulation, permits and fare definition. Lack of planning, regulation and control resulted in long routes, an excessive fleet, inefficient and unsafe operations. Authority for transport was transferred to the Metropolitan District of Quito in 1995, after a constitutional change (DMT, 2006).

In 1990, the Municipality of the metropolitan District of Quito began transport-engineering studies focused on the reorganization and modernization of the city’s transport system. An integrated transport system was proposed, and implementation started along the main axis of the city - Trolebús in 1995. This project was followed by a new bus corridor on a roughly parallel route – Ecovía in 2002. A third corridor was implemented in the northern part of the City - Central Norte in 2005). These corridors are now grouped under the name Metrobus-Q reflecting a desire to integrate operations as a single system (DMT, 2006). As of April 2006, the projects operated separately and exhibited different characteristics.

DESCRIPTION OF THE PROJECTS

Trolebús

Trolebús started operations 17 December 1995 (First Phase, South El Recreo- Esmeraldas). The corridor was complemented with a Second Phase (March-April 1996, North Esmeraldas-Colón-La Ye). Recently (2000), a south extension was completed (Moran Valverde). The corridor exhibits high-end BRT characteristics using electric buses: 17 km median busway, 90% longitudinally segregated; 3 terminals and 28 intermediate stations with level access and prepayment located on islands on the right hand side; 113 large capacity articulated trolleybuses (electric, with dual diesel engine), 78 feeder buses (conventional diesel buses); high frequency service, centralized control and a distinctive image.
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The corridor currently handles 246,000 pax/weekday (March, 2006; DMT), with high performance standards: 1.0 minute peak hour interval; 10.6 passengers per kilometer run; 2,181 passengers per bus per day; and 8,000-9,000 pax/hour/direction (Interviews, 2006). Commercial speed is relatively low (14.5 km/h, DMT). Public acceptance of the operation is good with the main complaints being high occupation of the buses, poor service by feeder buses and pickpocketing (Interviews, 2006).

The system is publicly owned and operated through a municipal agency: Trolebús System Operating Unit (UOST). Cost of the infrastructure (terminals, stations, segregation, improvement of pavements at selected sites) was USD 20 million, buses, fare collection and signaling was USD 80 million (Menckhoff, 2005). Details of the corridor are presented in the Metrobus fact sheet.

Ecovía

Ecovía - started operations 11 August 2001 The corridor also exhibits high-end BRT characteristics: 9.7 km median busway, 95% longitudinally segregated; 2 terminals and 16 intermediate stations with level access and prepayment, located on the median –left hand side; 42 large capacity articulated Diesel buses (Euro II); high frequency service, centralized control and distinctive image (DMT, 2006).

The corridor handles 81,000 pax/weekday (March, 2006; DMT), with high performance standards: 2.5 minute peak hour interval; 11.1 passengers per kilometer run; 1,928 passengers per bus per day; and 5,000 pax/hour/direction (Interviews, 2006). Commercial speed is high (18 km/h, DMT). It also has good public acceptance, with similar complaints to the Trolebús: high occupation of the buses and deficient service by feeder buses (Interviews, 2006).

The buses for trunk operations are publicly owned and operated through OUST on a temporary basis (as March, 2006). There was an unsuccessful process to provide the trunk operations through the historic operators of the corridor (March 2003 to July 2005) under a leasing agreement. The municipality (owner of the buses) recalled the contract due to infringements by the private operator (Tranasoc). As of March 2006, negotiations were taking place to assign ownership and operation to the historic operators. The cost of the infrastructure (terminals, stations, segregation, improvement of pavements at selected sites) was USD 12 million; trunk bus acquisition was USD 7 million (Menckhoff, 2005). Details of the corridor are presented in the Ecovía fact sheet.

North-Central Corridor

The North-Central Corridor initiated operations in November 2004 (pre-contractual operation). It consists of an 11.5 km busway with longitudinal segregation and some non-grade intersections, which is located on the median lanes and features passing lanes at stations; 4 integration points and 24 stations
with level access and prepayment located on islands on the right hand side; 84 articulated buses (Diesel, Euro II), and 67 feeder buses (conventional).

As of April 2006 the system was not fully implemented with only 53 articulated buses (63% of the planned total) and temporary facilities for the north terminal (La Ofelia) and southern integration point (Mirafloros). The estimated demand was 120,000 pax/weekday; with 7.46 passengers per kilometer run and a commercial speed of 23 Km/h (DMT, 2006).

The buses are privately owned and operated by the 19 historic operators of the corridor, under a direct agreement with the municipality (signed in May 2005). The historic operators grouped themselves into 5 companies to buy and operate the articulated buses. Feeder buses continue under dispersed ownership. Income is handled through a trust fund that distributes revenues among the participants, and is in charge of coordinating operation (operational programming and supervision), implementing fare collection and control systems (not yet in place), maintaining the stations and terminals and providing security.

The cost of the infrastructure (reconstruction of bus lanes, construction of stations, and terminals) was USD Million 26. Trunk bus costs are estimated to be USD 17 Million. Feeder services use existing buses. Details of the North-Central corridor are presented in the attached fact sheet.

**ASSESSMENT**

**Planning**

Quito corridors have evolved over an 18 year period beginning in 1987. Despite the fact that local administration was not in charge of transportation, it produced several feasibility studies that indicated the need to implement an integrated transport system, similar to Curitiba. Funding the planning and implementation of transport projects was difficult and the municipality used technical cooperation funds, mainly from the United Nations Development Fund.

Planning for the Trolebús was developed by a local team, lead by César Arias, a transport engineer and professor, with external help, mainly from Brazilian consultants. The planning team had support from the mayor of Quito Rodrigo Paz (1987-1991). The effort was completed by the same planning team under the following Mayor, Jamil Mahuad (1992-1997).

Planning for the Trolebús during the early period was difficult due to scarce resources: financial, technical, and data. No origin-destination matrices were available however this was mitigated through extensive data collection on existing operations, participation of universities and obtaining technical cooperation funds (mainly UNDP). The commitment of the Mayors was very important to orientate the planning efforts towards concrete results.
While focusing on the technical issues of high capacity corridors with feeder services, the planning team recognized the importance of institutional and financial issues. The local administration received support from the national government and the congress, when the national government passed a constitutional reform that created the Metropolitan District of Quito in 1992, as well as laws and regulations that decentralized several planning and control activities, including transport. On the financial side, the planning team found that it was not possible to cover capital costs of new equipment with existing fare levels, and worked out a scheme to obtain a concessionary loan from the Spanish Government to purchase the trolleybuses and signaling equipment. The vision was to start operations under government control and gradually shift them to the private sector (Interviews, 2006).

With the experience of Trolebús, the planning team proceeded with the preparation of a second corridor—Ecovía (1998)—under the administration of Mayor Roque Sevilla (1998-2000). There were some technical enhancements, such as the use of median stations; but, in general the design concept follows a trunk-feeder scheme that was already being used successfully by Trolebús. The most important difference from the Trolebús was the idea of private operation by existing historic concessionaries of public transport on the corridor (Interviews, 2006). The planning team dedicated a great deal of effort to establish a scheme to transfer existing permits to the new operator Tranasoc, formed by the 7 companies with route permits on the corridor, and to negotiate with them the conditions. This was difficult and progressed very slowly. Most infrastructures were completed in 1999-2000 apart from the Terminal Rio Coca, finished in 2001.

Economic crisis in 1999 and a new local administration (Mayor Paco Moncayo) changed the conditions. Historic operators were not capable of assuming credit; and the new administration wanted to study and review the ongoing process to fund bus acquisition through a concessionary credit by the Spanish Government (Interviews, 2006).

A new planning and implementation team was formed. Early in 2001, the municipality decided to acquire the buses for Ecovia and operate them through UOST. Operations started in August 2001, and they were handed over to Tranasoc in March 2003. The contract signed between the Municipality and the private operator’s group required a fixed monthly payment as compensation for lending the buses. It also required the private operators to retire existing buses on the corridor. From the beginning of the private operations it was apparent that Tranasoc was not able to comply with the terms of the contract due to internal problems (lack of governance, internal divisions). After two years of discussions between the municipality and the private operators, the city terminated the contract (June 2005). Operation was taken over by UOST, the public operator of the Trolebus. As of April 2006, there were ongoing conversations regarding
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returning operations to the historic operators of the corridor under a new contract with stronger conditions than the first one.

The planning team, under architect Hidalgo Núñez, prepared a long term Transport Master Plan during 2000 and 2001. The plan was approved by the City Council in May 2002, and it includes the following proposals (DMT, 2006):

- Development of a trunk public transport network
- Enhancement of the entrepreneurial capabilities of private operators
- Central traffic management, with priority for public transportation
- Better use and capacity of the road network
- Implementation of advanced technologies for system integration
- Institutional reform of the local transport sector (planning, control, construction)

The first project of the Master Plan is North Central Corridor, which was prepared and implemented through the Directorate of Municipal Transport (DMT), an office of the Secretary of Territorial Development. The planning team was small and had scarce resources. Technical cooperation was received from the UNDP and two transport planning consultants were technical advisors for project preparation. Several improvements over the existing corridors (Trolebús-Ecovía) were proposed, such as the ability to pass at stations, and the opportunity to use combined services (Express-Local), to provide additional capacity. The integration of neighborhood services was also envisioned, not only at terminal stations but at intermediate points.

Demand and fleet calculations were done with the idea of replacing all existing routes. There was not a detailed transport engineering study, but rather estimation from observed data in the area of influence of the corridor. Demand was initially estimated at 600,000 passengers per day, and later cut back to 420,000 (including trunk and local services). System is not fully implemented and there still are several parallel routes being served by traditional operators. The demand of the North Central Corridor as April 2006 was 120,000 passengers per day.

Problems arising from lack of funding for project preparation were compounded by the strain of the negotiation process with the existing operators of the corridor. While trying to complete technical components of the project, the planning team was also required to inform and negotiate terms and conditions with the historic operators, and coordinate system infrastructure with the agency in charge of public works in the municipality.

The North-Central corridor was constructed in 2001-2002, and included full replacement of pavements for the busways and construction of stations. Some components were not completed, such as the North Terminal (La Ofelia) and the south integration station. Other corridors are planned for implementation in the near term.
Decision process

Leadership of 4 successive mayors has been very important for the development of the Quito Corridors. The first three mayors had a continuous process as they were members of the same political alliance. Change of administration in 2000 to a party opposed to the previous majors generated the need for a different vision. The initial champion of the project was Engineer César Arias and currently is Architect Hidalgo Nuñez.

The main decisions in the three projects were: which corridor, with which operators, how the system should be planned and controlled, technical elements (infrastructure, buses, operations), financial aspects (fare and remuneration to the operators), and fare collection system (technology, implementation). These decisions are commented on below:

Corridor selection

The Trolebús corridor is on the main axis linking the north and south of the city through the city historic center and was chosen for its importance for transport in the city. The Ecovía corridor is a parallel corridor, which was relatively easy to implement due to its physical characteristics (right of way) and few operators to be displaced. The North-Central corridor and its area of influence is the main thoroughfare in the northern section of the city, connecting several low income communities with commercial and industrial areas and the city center. It exhibited high public transport ridership levels and is very wide, allowing the introduction of passing lanes at stations.

Operators

The municipality decided to have full public ownership and operation of the first corridor (Trolebús) as it found it very difficult to assign operation to incumbent operators lacking management and financial capabilities. This decision caused very large opposition by the incumbent operators that included blockage of the city for a whole week in March 1996. Public management has proven successful for the corridor; after 10 years of operation at a relatively low fare of USD 0.25, operations are working smoothly and there is even an operational surplus of USD 600,000/year (although UOST does not service the debt for the trolleybuses). Even though the operator is a public entity (UOST), it has outsourced most activities: drivers, fare collectors and maintenance personal are under contract with human resource providers.

The decision taken for the second corridor was to assign it to the historic operators through direct negotiation. Buying the buses was not possible for the private operators at that time, and the municipality decided to purchase the vehicles and hand them over to a consortium formed by them -Tranasoc. Lack of
management and financial capabilities of the operators caused several problems that were compounded by politics within the group of 7 operators grouped under Transasoc. One of the leaders of these operators tried to capture the whole business for himself and the partnership was broken due to lack of trust among the members. As a result of these problems, Transasoc was not able to fulfill the contract conditions: monthly payments for the bus lease were outstanding, and incumbent buses in the corridor were not fully retired. On the other hand, the private operators claim that the agreed fare of USD 0.28 per passenger was not applied.

This experience can be regarded as a failure; the municipality took back the operations in June 2005, and is operating the buses through UOST on a temporary basis. Despite the problems already described, the Ecovía corridor is currently operating with a good performance level. Conversations were ongoing as of April 2006 to sell the buses to the historic operators and to agree on a new contract.

For the third corridor (North-Central), it was decided to ask the 13 historic private operators to buy and operate the buses, retire or reassign to feeder routes the existing buses and create a trust fund to manage system revenues. After many months of negotiations, incumbent operators agreed to on system implementation, and formed 5 groups to buy and operate trunk buses under coordinated management. The effort was aimed at enhancing the entrepreneurial capabilities of existing operators, but this is yet to be achieved, as previous concepts of individual operation of vehicles prevail, especially on the feeder component. Operators claim that expected results have not been achieved and that they are having financial problems, as expected demand has not been met. System implementation was incomplete as of April 2006, and several existing routes remain in the area of influence of the corridor, competing for the same passengers.

Planning, control and supervision

General transport planning is the responsibility of the Directorate of Transport, an office under the Secretary of Territorial Planning. This Directorate prepares and updates the long term Master Transport Plan. It also coordinates the implementation of system components and conducts negotiations with existing operators. It is a small team with non-competitive remuneration and so has a limited capacity.

Day to day operational planning is in the hands of UOST for Trole and Ecovía (temporary basis) and the trust fund for North-Central Corridor. UOST has a team that has been working in operational planning and control for a decade. The trust fund contracted an engineer previously working with the Municipality in Trole and Ecovía corridors planning, implementation and operation. Operational
programming in the three corridors is done with simple tools (spreadsheets). Control is provided at terminals and intermediate points using radio.

Overall supervision of public transport is in the hands of EMSAT (“Empresa Municipal de Servicio y Administración de Transporte”) created in 2001 after a reorganization of the municipal government. The supervision capabilities of this public company are scarce, with a very small team in charge of controlling contract compliance. Most of the effort of EMSAT is dedicated to issue and control traffic permits and licenses.

Financial Aspects

The fare level was low prior to the first corridor implementation and has remained low thereafter. The municipality has the legal capacity to set fares, but fare definition has remained at the national level (Ministry of the Interior). The normal Fare is USD 0.25, with a reduced fare of 0.12 for elderly, students and handicapped. The achievement of financial equilibrium is the main challenge for the operation of each corridor. They need to operate at very high occupancy, with passenger per kilometer indices above 10.

The Trolebús is not required to cover the debt for the trolleybuses and has been able to generate a surplus of USD 600,000 that is applied to the system infrastructure. The Ecovía is currently generating funds to cover debt for bus acquisition although the Municipality has already covered part of it from when the private operators defaulted on payments.

The North-Central corridor operators claim that the corridor is not covering its costs and the business model is not working as expected (Interviews, 2006). This seems to be partially caused by incomplete implementation of system components and lack of enforcement of traditional services, that still provide service parallel to the corridor. It is worth to say that the Municipality did not provide any type of guarantee on the financial outcome.

Implementation approach

Quito has had a long term vision with gradual implementation. The vision is clear: an integrated system (Metrobus-Q); nevertheless, special conditions of each corridor have resulted in three non-integrated corridors. Facilities are not provided for physical integration, and each corridor charges a separate fare – USD 0.25 per adult trip. There is integration between feeder and trunk services on a corridor by corridor basis. There is also, an ongoing process to contract electronic fare collection and centralized control for Trolebús, with the idea of eventually extending this system to the other corridors.

The implementation of the corridors has required legal changes, and the city has transformed its institutions 3 times over the last 11 years. The most important
regulatory change has been the assignment of the responsibilities on transportation to the municipality, as well as the creation of specialized agencies to plan, supervise, control operate transportation within the Metropolitan Area. Operations of the corridors are mixed: public and private, with public operation outperforming private operation. Quito replaced disorganized private operations on the main corridor, with the publicly owned and operated Trolebús. The system performs well (IPK 10.6) and is achieving operational surplus, by keeping cost as low as possible (outsourcing drivers, station personnel and mechanics). Quito also attempted unsuccessfully to operate the second corridor by private operators that were not able to comply with the agreed conditions. As a result the second corridor was turned back to public operation (through the same public agency that operates Trolebús, which also outsourced drivers and station personnel for this corridor). The third corridor initiated operations under private hands, but does not exhibit the same standards achieved in the publicly run corridors yet.

Implementation

The system components have received the support of the Mayor in each phase of implementation. Different agencies participated in the process under the oversight of the planning team at the time.

Construction of the infrastructure (stations, terminals, pavements, segregation, pedestrian overpasses, non-grade intersections) was contracted through the city public works agency EMOP, for the three corridors. The quality of infrastructure improved from Trolebús to Ecovía, but declined for the North-Central corridor.

Negotiation with existing concessionaries in the corridor was carried out by the implementation team headed by César Arias (Ecovía, up to 2000) and Hidalgo Nuñez (Ecovía, 2000 thereafter and North-Central).

Commissioning of each system phase has been difficult for different reasons. Trolebús implementation faced severe opposition of existing private operators, that blocked the city in a standoff that lasted several days (Interviews, 2006). Use of the armed forces was required to remove protesters and provide service to the citizens of Quito. Ecovía operations were delayed by the economic crisis and difficulties agreeing on several issues with existing operators. North-Central corridor operations began without a fully constructed terminal and without access barriers at the stations. These two elements were still absent after 6 months of operation.
Issues during Operation

Trolebús

Trolebús has now completed 10 years of operation in 2006. The corridor is operating well, with high occupation and performance (10.6 passengers per kilometer). Trolleybuses are well maintained, and seem to still have several years of useful life ahead. The turnkey contract for the original acquisition provided for 10 year maintenance guarantee. It is not clear how maintenance will be handled from now on. There are some complaints on the high occupation of vehicles and operational speed but probably the main concern is that operating costs, including bus amortization, are not fully covered by system fares. Trolleybuses were acquired with a loan to the National Government from the Government of Spain; bus amortization is not being repaid from fare revenue. There are other issues that deserve attention in both the infrastructure and operational sides.

The system infrastructure is very low cost. Aspects to improve include:

- Reinforcement of pavements, especially at stations and traffic lights. There is evident cracking and rutting in some points that need immediate maintenance. The municipality has already improved some sections (e.g. south of downtown), replacing asphalt with concrete pavements with good results.
- Maintenance of stations. Several stations, especially in the downtown area were relocated and improved; nevertheless, heavy duty operations require permanent attention. Stations floors and glasses are the most common elements that exhibit deterioration.

Bus operations are currently smooth, with high occupation in the peak hours, which is the major user and public image concern. The corridor has reached 8,000 passengers per hour per direction, a figure close to capacity for a single lane, single platform bus system (required headways 1.2 minutes). Bus bunching is common. There were plans to enlarge stations to operate trolleybuses in convoys but this is yet to occur.

Management of the exclusive busway is a continuous challenge. Invasion by general traffic is common, deteriorating corridor performance. There is not enough priority given within the traffic police to busway control. Recently a very strict traffic regulation was passed, but it is not fully enforced.

Ecovía

Ecovía has been operating for 5 years. The corridor also performs at a high standard, with high occupation and performance (11.1 passengers per kilometer). High occupation is the main complaint by users, but there is still
reserve capacity. The quality of infrastructure is better than in Trolebús. It shares with Trolebús the invasion problem, although at a somewhat lesser degree. Changes in administration (public-private-public) have been very smooth from the users’ point of view so far however it remains uncertain how the corridor will operate when it is turned back to private operation.

North-Central Corridor

Operations in this corridor started with incomplete infrastructure and some components are still missing. The most important infrastructure yet to be completed is the north terminal, currently under provisional operation without adequate infrastructure. The provisional arrangement is very unfriendly to the users. Another integration station that is not fully operational is the southern station (Miraflores) which currently has only a temporary structure.

There are quality problems with the intermediate stations, which were completed with low cost materials. Stations were initially low floor, but they were changed to high floor during construction. Hence the capability to integrate local buses was reduced. Passengers need to step down to and step up from feeder buses at intermediate integration stations. Additionally, some stations are separated by more than 1 km, generating long walks for users. Finally for the intermediate stations, the roofing does not provide adequate shelter.

Control of operations is weak. There are no permanent supervisors of the contractual conditions, and lack of infrastructure provides an excuse for low system performance. Users complain of long waits for feeder buses, especially at the afternoon peak.

Finally, there seems to be a difference between expected demand and actual demand. System components (feeder, trunk) are expected to carry 400,000 pax/weekday, and current demand is 120,000. This is at least partly explained by the fact that many routes have not been eliminated, and the operators are therefore competing with the traditional system. There are economic interests of incumbent operators not to reduce traditional operations, and the authority has been weak in enforcing compliance on this issue. Exerting authority is difficult, as the municipality has not been able to complete the required infrastructure (North Terminal) she promised.

Coordination with other transport initiatives

The corridors are part of the Transport Master Plan and thus are conceptually integrated into the transport and land use vision for the Municipality of Metropolitan Quito. Nevertheless, corridors are being implemented separately and need integration.
There is a perception that Trolebús has reached capacity and that the only way to improve operations is to turn it into a Light Rail System, with non-grade segments (Interviews, 2006). There is a request for proposals for the implementation of such a system in the Trolebús corridor, launched by the Municipality. It is certain that Trolebús is close to capacity with the existing arrangement, but there are opportunities to improve capacity at a relatively low cost (at least as compared with non-grade rail transit). One potential low cost capacity improvement is the expansion of stations to operate convoys. Operations can be also enhanced with better control of busway invasions.

RECOMMENDED IMPROVEMENTS

There are several opportunities to improve existing and future corridors in Quito. They can be summarized as follows:

- Complete the missing infrastructure of North-Central corridor, especially the La Ofelia Terminal. Replace some elements of the stations with higher quality materials.
- Introduce barriers for access to the stations at the North-Central corridor. The use of coin based turnstiles, such as the ones in Trolebús and Ecovía could improve control in this corridor.
- Devise a practical integration scheme. Quito has already started a process to contract via concession fare collection and centralized control systems for Trolebús; a clear strategy on how these elements will be applied to the other corridors is required.
- Introduce a mechanism to adjust the fare without political interference, for example with an up-front commitment to externally subsidize system components at predefined efficient costs.
- Support the change process of the private operators to become actual companies as they still work as cooperatives or syndicates, through capacity building and incentives. Capacity building may include training courses for managers, operational personnel, drivers, mechanics and support staff, as well as the introduction of quality assurance procedures (e.g. ISO certification). Incentives may include performance based penalties and bonuses built in the contracts.
- Bid the operation of new corridors with large incentives for the existing operators to participate. Granting their automatic participation provides an unbalanced relationship between the government and historic operators, sacrificing important elements in the process.
- Invest in infrastructure and assign resources for timely maintenance. Fixing pavements and some stations appear to be the priorities.
- Create a capable oversight scheme, within or outside the existing authority (EMSAT).
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- Alejandro Lasso – Gerente General; Alberto Viteri – Gerente de Transporte Público – Empresa Metropolitana de Servicio y Administración de Transporte Municipalidad del Distrito Metropolitano de Quito (March, 2006)
- Calos Poveda – Gerente Técnico Corredor Central Norte (Fideicomiso Operadores), March 2006
- Luis Vaca, Luis Barrejo – Miembros del Comité de Administración Corredor Central Norte (Operadores Privados), March 2006
- César Arias – Consultor (March 2006)

REFERENCES

- Menckhoff Gerhard (2005). LATIN AMERICAN EXPERIENCE WITH BUS RAPID TRANSIT. WORLD BANK. Annual meeting- Institute of Transportation Engineers.
A Critical Look at Major Bus Improvements in Latin America and Asia: Case Study Metrobús-Q, Quito, Ecuador
## Quito

### General Characteristics

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Population: 1,625,000 million</td>
</tr>
<tr>
<td>4</td>
<td>Location: 2,800 meters above sea level (<a href="https://en.wikipedia.org/wiki/Foot_(unit)#9200_feet">9,200 feet</a>) in a narrow valley. The mountainous topography has constrained the city to grow in a linear form approximately 30 kilometers (<a href="https://en.wikipedia.org/wiki/Mile#19_miles">19 miles</a>) in length and 3 to 5 kilometers (<a href="https://en.wikipedia.org/wiki/Mile#2_to_3_miles">2 to 3 miles</a>) in width.</td>
</tr>
</tbody>
</table>

### Government

Local government elected by popular vote with full responsibilities for public transportation within the metropolitan area. Mayor serves a 4 year term with one single opportunity for re-election. Traffic under national police.

### Economy

<table>
<thead>
<tr>
<th></th>
<th>2005 country GNI/capita ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,180</td>
</tr>
</tbody>
</table>

## Trolebús

### General Description

Very complete BRT system with exclusive median busways, large electric buses, stations with level access and prepayment, and integrated feeders, serving a major corridor including the historic center and central business district. Components, except feeders, are publicly owned and operated. Feeders are contracted on a short term basis.

### Design Features/Technical Characteristics

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
</table>
| 3 | Running ways:  
  - Busway 17 km long 90% of which is longitudinally segregated (depending on ROW width).  
  - Runs from north to south, through the center of the city (UNESCO world heritage site).  
  - Busway is located on the median.  
  - At-grade signalized intersections, with some non-grade intersections.  
  - Traffic signal programming provides priority to the buses. |
| 4 | Stations:  
  - 3 terminals and 28 intermediate stops with an average separation of 400 m and without passing lanes.  
  - Pre-payment.  
  - Level boarding and alighting.  
  - Access to stops is ramped to ensure disabled passengers access to the high-level stop platforms. |
A Critical Look at Major Bus Improvements in Latin America and Asia:
Case Study Metrobús-Q, Quito, Ecuador

### TROLEBÚS

| Operations/Service plan | • Vehicles per hour per direction: 40 (convoy operation)  
  • Current services: 5 circuits with different extension along the corridor (allows greater capacity in high load sections without increasing the fleet as compared with terminal-to-terminal services).  
  • Feeder services integrated at 3 terminals. |
|-------------------------|---------------------------------------------------------------------------------------------------------------|

| Trunk Line Vehicles     | • 113 articulated trolleybuses (overhead wiring) for 160 pax.  
  • Buses are equipped with diesel engines for maneuvers in depots and emergency operation.  
  • Right hand doors with fold-down steps that deploy when a bus stops providing gap free boarding/alighting.  
  • Bus are owned and operated by the local government agency UOST (Unidad Operativa del Sistema Trolebús). |
|-------------------------|---------------------------------------------------------------------------------------------------------------|

| Feeder services Vehicles| • 89 conventional buses, diesel engines for 80 pax.  
  • Integrated at terminals and designed intermediate stations.  
  • Buses are owned and operated by independent providers under contract with UOST. |
|-------------------------|---------------------------------------------------------------------------------------------------------------|

<table>
<thead>
<tr>
<th>ITS</th>
<th>Information not available.</th>
</tr>
</thead>
</table>

| Fare Collection         | • Fare collection off-board, coin based at station entrances (no tickets/cards)  
  • Free transfers from/to feeders |
|-------------------------|-------------------------------------------------------------------------------|

<table>
<thead>
<tr>
<th>FARES</th>
<th>• Adult flat fare of 0.25 USD, includes transfers to feeder buses in enclosed terminals. Not integrated with other corridors. Discounts for special groups (students, elderly)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SYSTEM PERFORMANCE</th>
<th></th>
</tr>
</thead>
</table>

| Speed              | • Commercial trunk line speed is 15 km/hr  
  • 10 km/hr in the historic central area, 20 Km/hr in other areas. |
|---------------------|------------------------------------------------------------------------------------------------|

<table>
<thead>
<tr>
<th>DEMAND</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Total Riders</th>
<th>• 240,000 pax/weekday</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Peak-Hour Riders</th>
<th>• 8000 pphpd</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>IMPLEMENTATION BENEFITS AND IMPACTS</th>
<th></th>
</tr>
</thead>
</table>

| • System implementation included phasing out more than a thousand buses older than 20 years (30% fleet reduction citywide). Workers in the transport sector who lost their jobs received compensation.  
  • Estimated decrease of 400 tons of contaminants per year; especially important in the historic city center, where operation of traditional buses has been drastically reduced.  
  • Reduced travel time along the corridor for users and non users (general traffic also benefited from segregation of flows and... |
### TROLEBÚS

- Implementation of a centralized signaling system.
- Anecdotal evidence suggests that some transfer of automobile users to trolleybus for city center journeys has taken place.

#### INSTITUTIONAL ARRANGEMENTS

- System planning and implementation by a local agency specifically created as the authority for transportation and roads in the Quito Metropolitan Area (Dirección Metropolitana de Transporte y Vialidad DMTV). Transfer from National to Local authorities was done in 1995.
- Trolebús is fully government owned and operated through an agency created for this purpose under the authority of DMTV: Unidad Operacional del Sistema Trolebús (UOST). According to Hermman (2004) UOST’s goal was to establish the system and transfer the operation to the private sector in two years. Transfer to private concessionaires has not happened.
- No operational integration with the other BRT lines, which are separated concessions.

#### COST AND FINANCE

- Total cost 5.1 million USD per km
- Capital cost of 110.3 million USD. Infrastructure 20 million USD and 80 million USD for 113 vehicles. Vehicles and signaling system purchased with a soft loan from the Spanish Government to the National Government of Ecuador.
- Infrastructure cost per km 1.0 million of USD. (busway, stations and civil works)

### ECOVÍA

**GENERAL DESCRIPTION**

Very complete BRT corridor with exclusive median busways, large diesel buses, and stations with level access and prepayment, serving a secondary corridor in Quito. Private operation of the corridor was attempted, but operators failed to comply with contract conditions and operations were taken back by the municipality. Negotiations are ongoing to contract operations with historic permit holders.

**DESIGN FEATURES/ TECHNICAL CHARACTERISTICS**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>TECHNICAL CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running ways</td>
<td>Median busway 9 km long, more than 95% segregated.</td>
</tr>
<tr>
<td>Stations</td>
<td>2 terminals and 16 intermediate stops and without passing lanes.</td>
</tr>
<tr>
<td></td>
<td>Payment to enter the stations</td>
</tr>
<tr>
<td></td>
<td>Level boarding and alighting</td>
</tr>
<tr>
<td>Operations/ Service plan</td>
<td></td>
</tr>
</tbody>
</table>


## A Critical Look at Major Bus Improvements in Latin America and Asia: Case Study Metrobús-Q, Quito, Ecuador

### ECOVÍA

| **Trunk Line Vehicles** | • 42 trunk line articulated diesel buses for 160 pax.  
• Doors on the left side  
• Engines are Euro II Diesel (nevertheless, only high sulfur diesel available) | 3 |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Feeder services Vehicles</strong></td>
<td>• 40 conventional diesel buses for 80 pax.</td>
<td>3</td>
</tr>
<tr>
<td><strong>ITS</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Fare Collection** | • Fare collection off-board  
• Coin based at station entrances  
• An attendant window exist to provide change to those who require it | 3 22 24 |
| **FARES** | Flat fare of 0.25 USD | 3 |
| **SYSTEM PERFORMANCE** | | |
| **Speed** | • Commercial trunk line speed of 17 km/hr | 3 |
| **DEMAND** | | |
| **Total Riders** | • 55,000 pax/weekday (total annual not available) | 3 |
| **Peak-Hour Riders** | • 3700 pphpd | 3 |
| **IMPLEMENTATION BENEFITS AND IMPACTS** | Information not available | |
| **INSTITUTIONAL ARRANGEMENTS** | • System planning and control by DMTV.  
• Currently operated by UOST (public agency); a contract with a consortia of existing operators is being negotiated (after default by the contractors in 2005).  
• No operational integration with the other two lines. | 5 22 |
| **COST AND FINANCE** | • Total cost 2.1 million USD per km  
• Infrastructure cost 1.2 million USD per km.  
• Buses were purchased by the municipality, leased to Transsoc | 3 |
### GENERAL DESCRIPTION

BRT Corridor with feeder and neighborhood services integration. It has an exclusive median busway with overtaking at stations, prepayment, and large capacity buses. Corridor is in operation since November 2004, but infrastructure has not been completed yet. Buses are privately owned and operated, by historic permit holders.

### DESIGN FEATURES/ TECHNICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>M. S</th>
<th>Running ways</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 22</td>
<td>Busway of 11 km length with more than 95% segregated. It is located on the median between Plaza Seminario Mayor and Ofelia, and curbside between Ofelia to Carcelén.</td>
</tr>
<tr>
<td>3 22</td>
<td>Priority to public collective transport in critical intersections</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3 22</th>
<th>Stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 22</td>
<td>4 terminals and 24 intermediate stops with passing lanes.</td>
</tr>
<tr>
<td>3 22</td>
<td>Payment upon entrance to stations</td>
</tr>
<tr>
<td>3 22</td>
<td>Lateral stops on the trunk services with high platforms (originally planned low floor stations to use existing buses for neighborhood integration)</td>
</tr>
<tr>
<td>3 22</td>
<td>Separation between stops: Around 750 m on the trunk services, 350 on the transversal service, and variable according to the necessities for feeder service.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>22</th>
<th>Operations/ Service plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Two types of trunk services: regular and semi-express</td>
</tr>
<tr>
<td>22</td>
<td>Neighborhood services integrated to the trunk line in some stops.</td>
</tr>
<tr>
<td>22</td>
<td>Feeder service integrated to the trunk line in transfer stations</td>
</tr>
<tr>
<td>22</td>
<td>Connectors or transversal (west-east) services</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3 22</th>
<th>Trunk Line Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 22</td>
<td>According to the type of service</td>
</tr>
<tr>
<td>3 22</td>
<td>34 trunk line buses, articulated with high floor and doors on the right side.</td>
</tr>
<tr>
<td>3 22</td>
<td>Euro II Diesel buses</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>Feeder services Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>67 integrated feeder buses</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ITS</th>
<th>Planned centralized control, not implemented yet</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Fare Collection</th>
<th>Fare collection off-board</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Electronic card (planned, not implemented yet)</td>
</tr>
</tbody>
</table>

### FARES

- Integrated fare: single payment of USD 0.25 for neighborhood, feeder and trunk services. Zone based fare system planned with integration at an additional charge not yet implemented.
### CENTRAL-NORTE

<table>
<thead>
<tr>
<th>SYSTEM PERFORMANCE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>• Commercial trunk line speed of 20 km/hr</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEMAND</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Riders</td>
<td>• 120,000 pax/weekday (total annual not available)</td>
</tr>
<tr>
<td>Peak-Hour Riders</td>
<td>• 4500 pphpd</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IMPLEMENTATION BENEFITS AND IMPACTS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Information not available</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INSTITUTIONAL ARRANGEMENTS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Operators contracted by DMTV, through direct negotiation.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COST AND FINANCE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Total cost 3.3 million USD per km</td>
<td></td>
</tr>
<tr>
<td>• Infrastructure cost 2.3 million USD per km.</td>
<td></td>
</tr>
</tbody>
</table>
Exhibit 1
Quito BRT Corridors

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Exhibit 2
Trolebús Integrated Services (Circuits and Feeders)

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Case Study Metrobús-Q, Quito, Ecuador

Exhibit 3  
Trolebús Typical Profile  
[Image]

Photo: D. Hidalgo, March 2006

Exhibit 4  
Trolebús Profile in Downtown Area (One way Streets)  
[Image]

Photo: D. Hidalgo, March 2006
A Critical Look at Major Bus Improvements in Latin America and Asia: Case Study Metrobús-Q, Quito, Ecuador

Exhibit 5
Downtown Trolebús Station

Photo: D. Hidalgo, March 2006

Exhibit 6
Trolebús Station Interior

Photo: D. Hidalgo, March 2006
Exhibit 7
Trolebús Station Villaflora
(Special Design Roundabout)

Photo: D. Hidalgo, March 2006

Exhibit 8
Trolebús Terminal El Recreo

Photo: D. Hidalgo, March 2006
Exhibit 9
Ecovía Typical Profile and Station

Photo: D. Hidalgo, March 2006

Exhibit 10
Ecovía Station Interior

Photo: D. Hidalgo, March 2006
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Exhibit 11
Ecovía Station Downtown
(future integration with other corridors)

Photo: D. Hidalgo, March 2006

Exhibit 12
Ecovía Terminal (Rio Coca)

Photo: D. Hidalgo, March 2006
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Exhibit 13
Profile and Station Corredor Central Norte (feeder bus and trunk bus)

Photo: D. Hidalgo, March 2006

Exhibit 14
Station Corredor Central Norte

Photo: D. Hidalgo, March 2006
Exhibit 15
Integration of Feeder Services in an Intermediate Station Corredor Central Norte

Exhibit 16
Temporary Terminal La Ofelia Corredor Central Norte

Photo: D. Hidalgo, March 2006
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Case Study Metrobús-Q, Quito, Ecuador

Exhibit 17
Temporary Terminal La Ofelia
Corredor Central Norte

Photo: D. Hidalgo, March 2006

Exhibit 18
Bunching of Vehicles and Invasion of Busways – Trolebús

Photo: D. Hidalgo, March 2006
A Critical Look at Major Bus Improvements in Latin America and Asia:
Case Study Metrobús-Q, Quito, Ecuador

Exhibit 19
Pavement Deterioration – Trolebús

Photo: D. Hidalgo, March 2006

Exhibit 20
Station Maintenance – Trolebús

Photo: D. Hidalgo, March 20
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Case Study Metrobús-Q, Quito, Ecuador