CASE STUDY METROVIA, GUAYAQUIL, ECUADOR
DARIO HIDALGO
PIERRE GRAFTIEAUX

SUMMARY

Metrovía is a bus based transit system featuring high end BRT features and integrated feeder and complementary services. The system components –bus operations, fare collection and support services-- are privately provided under contracts with an autonomous local organization –“Fundación Municipal de Transporte Masivo Urbano de Guayaquil”. This is a public organization operating under private sector rules, created to control, develop and supervise the mass transit system operations through outsourcing activities.

Metrovía system is expected to gradually transform all transit services in Guayaquil, with a network of seven integrated corridors, feeder and complementary lines. The initial phase (2000-2007) includes three corridors with a total length of 118 Km (unidirectional, about 59 Km, both directions), five terminals and 108 stations. Total fleet for phase 1 is 194 articulated buses, plus 156 feeder buses, to transport an estimated demand of 480,000 daily trips. Peak demand is expected to be 12,000 pax/h/direction. Operations started in July 2006 in the first corridor Guasmo-Rio Duale (31 Km both ways, 36 stations, two terminals, 40 articulated buses plus 10 conventional buses adapted for trunkway operations and 44 feeder buses).

Things done well

- Clear objectives and leadership of the Mayor Jaime Nebot, with an adequate arrangement of responsibilities according to the local conditions.
- Technical preparation of the system components, using adequate transport engineering methods and assistance of competent consultants.
- Regulation and control are instrumented through binding contracts. Priority to existing operators and bus owners was given in the selection process.
- Private operators are totally funded with fare revenues -no operational subsidies required. The fare of USD 0.25 is the same than traditional services and allows for full integration within the system. There are student discounts (50%).
- High performance: trunk commercial speed of 22-25 km/hour; more than 12,000 pax/per direction, and 2,600 pax/bus/day (expected).
- Creation of a solid institutional structure through a innovate arrangement involving key representatives of the private sector.
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Things that perhaps should have been done differently

- The system fare is set by a national body and does not have any connection with system costs. If system cost increase beyond the national fare of USD 0.25 the system can face financial stress.
- Rushed implementation. The political agenda resulted in very tight time tables, difficult to accomplish for system participants, specially the technological integrator (control, fare collection).
- Implementation was not preceded by an adequate user education campaign, resulting in problems and frustration during the first days of operation.
- Sequential approval of infrastructure design by different agencies (public works, urban planning and utility companies) caused unnecessary delays.
- Turnstiles were acquired directly by the municipality and there were problems in systems integration.

Critical positive enablers

- The recent administrative successes by previous Mayor León Febres-Cordero (1992-1996 and 1996-2000), created a positive image of the municipal administration and generated support from the general public.
- The continuous leadership and oversight of Mayor Jaime Nebot.
- The credibility generated in public transport operators by previous projects in Ecuador and Colombia (TransMilenio).
- Existence of a Urban Development Regulatory Plan, which provided an adequate framework for system design and implementation.
- International technical cooperation through the United Nations Development Program UNDP and UN-Habitat. Participation of knowledgeable international consultants and fast learning process of local universities and professionals.

Critical barriers

- Initial opposition from existing operators, later transformed in participation of all traditional transport providers.
- Placing transport agenda more important than just infrastructure. The tradition in Guayaquil was road construction, including tunnels, flyovers and interchanges. This was replaced by a vision of sustainable transport, connected with urban regeneration and orderly development.
- Contracting system in Ecuador, which is very inflexible. This was mitigated with the participation of international cooperation agencies and the creation of new type of agencies, with private contracting rules but under the supervision of control agencies.
- Technical capacity of local professionals, which was mitigated as well with international technical cooperation and the participation of the local universities. There was a fast and productive learning process.
CITY CONTEXT

Guayaquil is the largest city in Ecuador with 2'000,000 inhabitants (2001 Census, DMT, 2004), and a density of 1,803 inhabitants/km². It is located in the west margin of the estuary of the Guayas River, in the Ecuadorian Pacific Coast. Average temperature is warm and humid year round (25-30 °Celsius) It is also the main seaport and a mayor fishing and manufacturing center.

Total trips were estimated in 3'800,000, 53% of them using public transportation (OD Studies 2000, reported by DMT, 2004). Motorized trips were estimated in 2'500,000, 80% of them using public transportation. About 39% of the trips were to work, and 27% to study. Average public transport trip time was 43 minutes and about 30% of the O-D trips in public transportation require 1 or 2 transfers (On board survey 2002, reported by DMT, 2004).

Public transport supply before Metrovia implementation consisted of 164 routes, with 4,096 units (Arias, 2006). Average age of the bus fleet was 17.8 years, 31% of the fleet had a capacity below 50 passengers.. Around 25% of the traffic accidents in Guayaquil involved public transport vehicles.

There was a perceived excess in bus fleet and bus kilometers (Boarding/km below 2.7), due to an inadequate regulation scheme. Permits to operate public transport vehicles were assigned by the Traffic Commission of Guayas –CGT, to individual owners grouped in 72 associations. Individual owners pay the associations for the right to use the authorized routes. Dispersed operation was prevalent.

A process of modernization of urban development was initiated by the municipality with the election of ex-president León Febres-Cordero in 1992, which reorganized the municipal finances and the local institutions and expanded the road network capacity with new highways, interchanges, tunnels and flyovers. Renovation of the historic district was also launched with the emblematic construction of the Guayas River levee (Malecón 2000), a high quality public space landmark. Mayor León Febres-Cordero was reelected for a second term in 1996.

The following administration of Mayor Jaime Nebot (2000-2004, reelected for a second four year term in 2004), continued the city modernization programs and placed emphasis in the reorganization of public transportation and recuperation of the city center, among other programs. This effort received the institutional and financial support of the United Nations Development Program –UNDP- and UN-Habitat. The most important initiatives in transport during Jaime Nebot administration have been the implementation of Metrovia Mass Transit System and the renovation of the international airport terminal (inaugurated in July 2006).
DESCRIPTION OF THE PROJECT

Metrovía is a feeder-trunk system, with longitudinally segregated busways for trunk services, large integration stations for feeder services, enclosed stations with level boarding and prepayment, and advanced control and ticketing systems.

Busways have different treatments according to the roadway conditions. They are preferentially located on the median, but there are also one way busways either located on the left hand side or in the central lane (one way streets more than 15 meters wide). Segregation is provided through a concrete barrier along the road, plastic bumps. Some expressway sections are only marked through horizontal painted signs, including weaving sections to change from the median lane to the curbside lane.

The stations are located every 400 m, on average. The terminals are large structures, with the capability of growing with the system into the near future. Most stations operate platforms serving both directions, but the ones located on one-way streets, which are located in an island or on the left hand side curb. Validation is provided at the entrance of each station and interchange facility (off-board).

The feeder services are provided in the area of influence of the terminal stations. Service in feeder zones is provided with conventional buses (80 pax) and there are plans to have small buses also.

The fare collection system uses electronic contact less cards. Initial operation includes the use of direct payment at the ticket booths for single trips (USD 0.25) and contactless cards for multiple trips. Trip authorizations are sold at ticket booths at stations and terminals.

Overall contracting and supervision is provided by “Fundación Municipal de Transporte Masivo Urbano de Guayaquil”. This is a public organization operating under private sector rules, created to control, develop and supervise the mass transit system operations through outsourcing activities.

Metrovía started operations July 2006 in the first corridor Guasmo-Rio Duale. The corridor is 31 Km long (both ways), has 36 stations, two terminals, 40 articulated buses plus 10 conventional buses adapted for trunkway operations, and 44 feeder buses. Current system indicators (November 2006) are 96,000 pax/day; 5,000 pax/hour per direction in the heaviest loaded section; 1,920 pax/bus/day and about 8 boardings/bus-km (Inteviews, 2006). The public image of the system is good. The system is regarded as an important advancement in public transport in the city. Informal surveys indicate a 70% rate of approval of the system (Interviews, 2006).
The system will be expanded to complete Phase 1 before July 2007. Phase 1 (2000-2007) will include three corridors with a total length of 118 Km (unidirectional, about 59 Km, both directions), five terminals and 108 stations. Total fleet for Phase 1 is 194 articulated buses, plus 156 feeder buses, to transport an estimated demand of 480,000 daily trips. Peak demand is expected to be 12,000 pax/h/direction (Corridor 2: 25 Julio-Rio Duale). Plans for four additional corridors are underway, to be implemented before year 2020.

The cost of Phase 1 infrastructure (stations, terminals, segregation, geometric improvements, reconstruction of pavements, traffic signs and signals) was estimated in USD 54 Million including studies, infrastructure and signaling (DMT, 2004). Final costs are USD 63 Million (Arias, 2006). Cost increase is the result of the construction of large terminals with special architectural features and utilities relocation, mainly. Funds were provided through a loan with the Andean Development Corporation –CAF- (70%) and direct fund of the Municipality of Guayaquil (30%).

Private investment in Phase 1 is estimated in USD 52 Million for the acquisition of the buses and the fare collection system.

The main dates of project advancement are summarized as follows (Interviews, 2006 and DMT, 2004):

- Early planning. The city council approved Urban Development Scheme (Ordenanza del Esquema de Desarrollo Urbano de Guayaquil) in 1995, which includes zoning and road network hierarchy to shape the desired urban form, densities and uses. This urban plan is updated in 2000 through the Urban Development Regulation Plan (“Plan Regulador de Desarrollo Urbano”), a comprehensive regulatory instrument for the orderly growth and renovation of the city.

- Mayor León Febres-Cordero (a former President of Ecuador) is elected Mayor in 1992 (re-elected in 1996), with a development agenda including organization of waste recollection and disposal, construction of 40 interchanges and paving of local streets, transformation of the municipal administration, and construction of the Levee (Malecón 2000), generating very positive dynamics for urban development, private investment and tourism.

- Agreements with the United Nations Development Program –UNDP- and UN-Habitat are signed in 1994 to support the preparation of the Urban Development Plans. These agreements are the framework for later preparation of the Transport Reorganization Plans.

- Mayor Jaime Nebot (2000-2004) includes transport reorganization as one of the key elements of his administration and nominates Guillermo Argüello Sánchez, an architect specialized in urban planning, as Director.
of Transport, and Federico von Buchwald, an engineer and business person, as head of the mass transit project.

- Cesar Arias, a transport engineer with experience in Quito Trolebus and Ecovía planning and implementation, is retained by UNDP as technical coordinator for the transport reorganization program.
- Baseline data studies are developed in 2000 (Origin-Destination Survey through University of Guayaquil) through 2002 (Transit On-Board Survey), including the participation of international experts in transport regulation Guillermo Cramer and Alicia Rivera.
- The general public transport reorganization plan is finalized in April 2004 (DMT, 2004), which includes the long term vision and preliminary designs (infrastructure, operations and regulatory instruments) for Metrovía Phase I (three trunkways and feeder areas).
- The agency in charged of system development “Fundación Municipal de Transporte Masivo Urbano de Guayaquil” is created in July 2005 with participation of delegates of the Municipality, the Civic Board of Guayaquil, the Traffic Commission of Guayas, the Chambers of Commerce, Industry and Construction, the Universities, the Private Banks Association, the City Council and the Urban Transport Federation.
- Bidding process for service provision contracts started in the third trimester 2005. Contracts (buses, fare collection) are awarded in late 2005. Bus contractor is an association of all existing operators in the city (Metroquil). Technological integrator (Fare collection-Operational control) is contracted in late 2005 with the consortium Tacom-Teleholding.
- Operations of the first trunkway started in July 2006, with 40 articulated buses plus 10 conventional buses adapted for trunk operation (left hand side doors).
- Expansion to complete Phase 1 is expected during 2007-2008.

Details of the system are presented in the Metrovia fact sheet. Construction of four additional trunkways is planned before year 2020.

**ASSESSMENT**

**Planning**

The project is an local initiative of the Mayor of Guayaquil Jaime Nebot (2000-2004), and was part of his government plan. Mayor Nebot set three principles for system design and implementation: i) do not any technology that requires government subsidies; ii) do not significantly increase the fares currently paid in public transportation; and iii) that the historic providers of public transport of the city take part of the project as bus operators.
Planning for the project started in 2000 with several strategic studies including base line data collection (OD studies, traffic and passenger counts, supply characteristics, etc.), transport modeling, and public transport quality of service (DMT, 2004; Arias, 2006). Overall system conceptual design was completed in April 2004 with the Public Transport Rationalization Plan ("Informe Técnico, Plan de Racionalización del Transporte Público Masivo de la Ciudad de Guayaquil – PRTPM"). Funding for planning came from local resources and international technical cooperation through UNDP and UN-Habitat.

Planning was made by a team of professionals contacted on an individual basis, under the direction of Director of Transport, Guillermo Argüello Sánchez, in close coordination with Federico von Buchwald, then advisor to the Mayor. Technical coordinator of the transport planning and regulatory studies was César Arias.

Corridors selected for system implementation are the main arteries of the city as well as the most important public transport thoroughfares. Traffic counts show demand in excess of 5,000 pax/hour in the corridors, indicating the need for bus priority measures. Corridors include the most important transport generators and attractors. Corridor 1 crosses the historic district. Physical design included the reconstruction of pavements and construction of stations and large scale terminals.

Public participation was small. Most effort was dedicated to negotiations with existing operators which formed two groups to discuss conditions of inclusion. These groups presented a single proposal for the operation of the first trunkway and are now the single operators of the system. There was no major opposition to the project during the planning stages.

**Decision process**

The decision was a top-down process. The project was developed by a small team following the Mayor’s directives. The main decisions in the process were: institutional structure, 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.

**Institutional Structure**

The project is fully privately operated, under control and oversight by the special purpose agency “Fundación Municipal de Transporte Masivo Urbano de Guayaquil”. This foundation is a public entity, but operates under private sector rules. Members of the “Fundación” Board are the Municipality, the Civic Board of Guayaquil, the Traffic Commission of Guayas, the Chambers of Commerce, Industry and Construction, the Universities, the Private Banks Association, the City Council and the Urban Transport Federation.
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The purpose of such an agency, with strong participation of private sector representatives in the Board of Directors, is to assure independence, efficiency and sustainability of the transport system over the years. The political tradition of constant changes in the National Government and the fear of changes in political leadership in the city, were the main drivers to create the “Fundación”.

This type of agency has a good tradition in the city of Guayaquil in the last decade, where the most relevant projects have been managed through this type of arrangement: the Guayas Leevy (Malecón 2000), regeneration of the city center (Siglo XXI), the long distance bus terminal (Terminal Terrestre), the international airport terminal (Autoridad Aeroportuaria), the civil registrar (Registro Civil) and the citizens safety program (Corporación para la Seguridad Ciudadana).

Another institutional decision was the type of contract. At the beginning a concession was discussed, but the decision was to bid the project operation under service provision contracts to allow for maximum participation of existing operators. Existing service providers formed two blocks to interact with the municipality (delegated to Mayor’s Adviser Federico von Buchwald). Under the leadership of the Mayor himself, the two groups joined to present a single proposal to the city. At the end, there was no competition in the bidding process.

Technical Elements

The Metrovía system is modeled after Curitiba, Quito and Bogotá as a feeder-trunk system. High end BRT concepts were applied for the trunk-ways: longitudinal segregation for bus lanes, prepaid/level access stations, large buses, centralized control and programming, and a distinctive image.

Local demand levels only required one lane per direction for most of the trunkways. There is overtaking capacity in corridor 2, where demand is expected to be between 12,000 and 13,000 pax/hour/direction. Several adaptations were required to adjust the general concept to the local characteristics. For example, usage of roads in the downtown area was difficult, due to very limited right of way (under 15 meters). This required use of one way busways either in the left hand side or in the central lane (with stations forming islands). Inclusion of downtown narrow streets was very important to serve mayor work and business destinations, and to support the central area regeneration process.

The location of interchange facilities was selected according to the availability of space. It was important to generate a visual impact with large canopies using polycarbonate supported with large steel trusses; this resulted in fairly high cost interchange facilities.
Large buses provide a distinctive image to the system and are very important in differentiating the trunk operation from business-as-usual. Peak demand, below 7,000 passengers per hour per direction, could be handled with smaller buses on shorter intervals, but the decision was to go for large new buses, to provide reserve capacity and increase commercial speeds (less dwell time). Operations on the first corridor started with a combination of articulated and adapted conventional buses, a decision made by the operator Metroquil to reduce initial capital investment. This results in a minor inconvenience to the users, as the fourth door of the articulated buses is not available in conventional units.

Feeder services use conventional buses (12 meters) with on-board validation. The bidding process allowed the operator to use existing units under 10 years of age, but the operator offered new fleet.

Financial Aspects

The system was designed to be self sufficient (no operational subsidy). The final user fare was required to be the one set by the national authorities (National Traffic Commission). The national level body has set a flat fare of USD 0.25 for all transit operations in the country, with a 50% discount to students. As a result, very high efficiency of the buses is required to balance system costs and revenues.

Remuneration rules for project participants are included in the service provision contracts. Operators are also required to substitute existing buses to introduce new units.

Fare collection

Fare collection is off board on the trunk-way stations, and on-board in the feeder buses. The system uses contact-less fare cards. On board validation in feeder buses was decided to provide control for local trips. Fare cards are sold and recharged in selected locations in the feeder areas resulting in some inconvenience to the users (especially sporadic users).

Implementation approach

The project is a large scale intervention on public transport in the City with the participation of existing transport providers.

The private operators organized a new companies –Metroquil-- to own and operate the trunk and feeder buses. The service operation contracts were awarded after a bidding process in which only one proposal was received. The municipality valued more to have all the operators inside the system than to reduce fares through competition.
The interaction with the remaining transport services in the City and neighboring municipalities (Duran on the east bank of Duale River) is not clear. Expansion is planned for additional trunkways within Guayaquil in 2010-2020.

Implementation

Implementation problems are divided into infrastructure, operations, accessibility and user education issues.

Infrastructure

Infrastructure of the first corridor was not fully completed for system commissioning (July 2006). Two stations were not complete and several sections of the buslanes in the north part of the corridor. The main causes of the delays were result of problems in contracting (trunk way infrastructure contracts were declared deserted twice before final contracting), land acquisition problems, and utility networks relocation requirements (power company delayed approvals). Unrealistic time tables, low quality of the studies and low referential budgets also caused some problems.

Operations

Trunk buses were delivered very close to system commissioning. This caused problems with driver training, which resulted in very slow speeds during the first days of operations. There were also less buses than initially required, causing excessive crowding in the peak hours.

Fare collection and centralized control were also delayed due to a very tight time table for systems integration. The system started with manual fare collection, and the contact-less card was only introduced two months after system implementation. A decision of the Mayor not to charge the fare-cards modified the conditions of the contract. Cards were initially distributed free of charge; it is expected that personalized cards will be charged in case of loss or renewal.

As November 2006, there still was a shortage in fare-cards and single trips were paid manually at the ticket booths.

Accessibility

The trunk component of the system provides good accessibility conditions for people with reduced mobility. Adequate ramps are provided to access stations, and well marked and ramped crosswalks provide good conditions for wheelchairs and the visually impaired in the downtown sections. Crossings and sidewalks do not exhibit the same quality outside downtown. Terminals have a sound system useful for visually impaired. The interior of the buses has designated seats for
the elderly, pregnant women, mothers with babies and handicapped. Feeder buses do not exhibit the same accessibility features as the trunk buses.

User education

Probably the main implementation problem was the result of a scarce user education campaign. Change was difficult for many users due to lack of information. Commuting routines were changed, and the introduction of transfers from feeder to trunk services, caused discomfort. Problems were exacerbated by the insufficient bus fleet for trunk operations.

Issues during Operation

The system is in the first months of operation. Expected demand has been smaller than expected (96,000 pax/day, compared with 140,000 when phase 1 is completed). The system is operating well; with high performance. Preliminary data from DMT indicates 5,000 pax/hour per direction in the heaviest loaded section; 1,920 pax/bus/day and about 8 boardings/bus-km (Interviews, 2006).

No technical measurement of user satisfaction is still available, and mixed comments were reported. There are complaints on excessive heat (no air conditioning is provided) which has been mitigated with metallic flaps in the windows. Personal security has improved inside the system, but additional walking for feeder buses and to access certain stations is a concern for some users.

There is a learning process and it is still too early to report on other issues during operation.

Coordination with other initiatives

Metrovía supports the Urban Development Plan, by providing high quality public transportation to and from the mayor residential and work areas. The system supports the city center regeneration efforts, and also has direct accessibility to the north section of the Malecón 2000 and the new long distance bus terminal and international airport terminal.

RECOMMENDED IMPROVEMENTS

Recommended improvements can be summarized as follows:

- Use the flexibility of buses to improve quality of service in the heaviest loaded section. Currently all buses are dispatched from one terminal to the other. Operational conceptual planning (DMT, 2004) includes different services than can be implemented in the short term. This may result in
better frequency in the downtown section, without the need to increase bus fleet.

- Express services from the north and south terminal to downtown are possible, as some stations allow for overtaking. This can result in higher speeds and less travel time for a portion of the trips, as well as improved level of service without increasing the bus fleet.
- Evaluate system implementation, specially regarding the Millenium Goals for Guayquil and measure user’s perceptions.
- Finish the planned infrastructure (corridors 2 and 3
- Assign resources for timely maintenance.
- Integrate bicycles and park-and-ride facilities.
- Provide for further integrate regional transport services (e.g. Duran). Currently integration is physical only, but there can be agreements to provide for fare and operational integration, to enhance usage by regional commuters.

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INTERVIEWS IN THE CITY OF GUAYAQUIL

Guillermo Argüello Sánchez, Director, Dirección Municipal de Transporte, Municipio de Guayaquil (November 2006)
Federico von Buchwald, Presidente, Fundación Municipal de Transporte Masivo Urbano de Guayaquil (November 2006)
David Wong, Director Proyecto Naciones Unidas de Cooperación con Guayaquil
Cesar Arias, Transport Consultant, Technical Coordinator Transport Planning in Guayaquil UNDP.

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Exhibit 1 – Metrovía System Map

Source: Dirección Municipal de Transporte, Guayaquil, 2006
Note: Includes the corridors under construction to be completed in 2007-2008
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Exhibit 2 - Profile Corridor 1 Through Downtown

Exhibit 3 – Profile Corridor 1 in Front of The Boardwalk

Photo: D. Hidalgo, October 2006

Photo: D. Hidalgo, October 2006
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Exhibit 4 – Corridor 1 Downtown Profile

Exhibit 5 – Typical Station

Photo: D. Hidalgo, October 2006

Photo: D. Hidalgo, October 2006
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Exhibit 6 – Typical Station Interior

Exhibit 7 – Terminal Rio Duale

Photo: D. Hidalgo, October 2006

Photo: D. Hidalgo, October 2006
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Exhibit 8 – Terminal Rio Duale, Interior

Exhibit 9 – Terminal Rio Duale, Passengers

Photo: D. Hidalgo, October 2006

Photo: D. Hidalgo, October 2006
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Exhibit 10 – Feeder Bus

Exhibit 11 – Trunk Bus Interior

Photo: D. Hidalgo, October 2006

Photo: D. Hidalgo, October 2006