QUITO, ECUADOR

BRIEF: TROLEBUS BUSWAY SYSTEM

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CITY CONTEXT

Quito, the capital of Ecuador, is a city of about 1.5 million inhabitants. The city is located at an altitude of 2,800 meters [9,200 feet] in a narrow valley. 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. Privately operated buses supply all motorized public transport, with a fleet estimated informally at about 6,000 vehicles. In 1992 (last date for available data), the existing bus fleet average age was 15+ years.

In the past, one bus impact on the environment was high noise pollution. Also, because older, conventional diesel buses do not operate efficiently at altitude, emissions were well in excess of international norms. Environmental pollution is an important political issue because of its adverse impacts on people, on the fabric of historical landmarks, and on the important tourism industry. In this context, it is noted that in 1978 the United Nations Educational, Scientific, and Cultural Organization (UNESCO) declared the historical center of Quito to be a World Cultural Heritage Site.

In the early to mid-1990s, standards of public transport were low, characterized by slow journey times, chaotic service levels, overcrowding, and as a result of controlled fares policies, lack of investment for bus fleet renewal. Improvement of public transport became a political imperative, and a "clean" system was sought in view of the city's cultural heritage. Project planning for an integrated public transport system, of which the *Quito Trolebus* scheme along the major north-south corridor forms the key component, was commenced in 1990 and became operational in 1996.

BASIC INFORMATION AND DESCRIPTION OF THE BUSWAY SCHEME

The *Quito Trolebus* is part of a trunk-and-feeder bus system. Trunk line services are provided by trolleybuses operating on a busway that is mainly segregated from other traffic. The trunk line can be accessed directly by passengers at on-line stops or by feeder buses with interchange at purpose-built terminals or at a number of trunk line stops. The *Quito Trolebus* operates in the center of Avenida 10 de Agosto – the north-south spine of the city. The route has terminals at both ends where feeder bus lines converge to serve the *Trolebus*. Buses are connected at several sections of the corridor; the route includes three overlapping service patterns.

The basic details of the busway system are the following:

- The busway comprises two sections: (1) a bus-only track (one 3.5-meter [11-foot] lane each direction) extending 11.2 km [7 miles] from La Y in the north to El Recero in the south (see Figure 1) and (2) 4.9 kilometers [3 miles] from El Recero to Moran Valverde. The busway track is discontinued through the historical center of the city where conventional bus lanes are used.

- The trolleybus busway first opened in 1995 and was extended in 1996 and 2000. The 6-km [3.7-mile] extension from Estacion Sur to Avenuda Valverde was placed in service during April 2000. Buses operate contra-flow in this section and are served by central high platform stations.
- Generally, the busway is located in the center of the roadway. Segregation of buses from other traffic depends on roadway width and is composed of a combination of island bus stop platforms or physical medians or, in restricted width sections, by roadway pavement markings. Other roads are crossed at-grade, and traffic signal bus priority is reported. Figure 2 shows the typical busway configuration on the roadway.
- Stop spacing is about 500 meters [1,600 feet], with a total (for both directions) of 39 on-line island platform stops. Stop configuration is similar to Curitiba (see Curitiba case study), and passengers pay at turnstiles on entry to stops, not on buses. Buses are not low-floor urban buses, and thus, stop platforms are raised to bus floor height with bus doors coordinated with stop doors. Bus doors have fold-down steps that deploy when a bus stops; therefore level and gap-free passenger boarding/alighting is provided. Access to stops is ramped to ensure disabled passengers access to the high-level stop platforms.
- Figure 3 shows a typical island platform. Figure 4 shows the interior of a bus stop including signage and fare collection. Figure 5 shows the southern terminal and buses with high doors for use in platform stops.
- The busway provides the trunk line of a trunk-and-feeder system. Fares are integrated. Passengers pay a fare on entry to feeder buses, at main terminals, or at intermediate stops along the trunk line busway. After initial payment, the system is "closed," and passengers can transfer from bus to bus without further payment. The lack of fare collection on trunk line buses, together with the use of three bus-stop coordinated doors, minimizes passenger-handling delays and increases service efficiency.
- A fleet of 54 to 58 articulated electric trolleybuses operates on the trunk line during peak periods. The buses are 17.75 meters [58 feet] in length with a maximum capacity of about 174 passengers. The buses are configured with three doors, each with an extendable "bridge" that allows level bus-to-station boarding/alighting. (See Figure 5.) Conventional buses provide feeder services at terminals and intermediate points. The trolleybuses have auxiliary diesel engines.
- The 17-km line has a fleet of 113 articulated trolleybuses. The buses are trimmed in various shades of red, yellow, blue, and green and were built in Spain. The electrical equipment came from Germany.
- Busway ridership averages 150,000 to 170,000 passengers per weekday on trunk line buses, with a maximum loading of 8,000 passengers per hour per direction on the busway. Anecdotal evidence suggests that some transfer of automobile users to trolleybus for city center journeys has taken place.
- On the busway, commercial bus speeds are 18 to 20 kph [11 to 12 mph] during peak times and 20 to 25 kph [12 to 16 mph] during off-peak hours. Headways of 90 seconds during peak times and 180 seconds off peak are reported.
- The costs of the initial 11.2-km [7-mile] busway section (data available), including articulated trolleybuses, was $57.6 million in U.S. dollars (US) in 1996 or about $US5 million per kilometer, and costs included (1) vehicles and infrastructure ($US46.3

million), (2) terminals and stops ($US7.0 million), (3) traffic signals ($US2.3 million), and (4) a ticket system –($US2.0 million).

IMPORTANT LESSONS RELEVANT TO U.S. CONDITIONS

In a case study of the present type—without direct data collection in the city—there will inevitably be unanswered questions. For example, some data sets are not available, such as treatment of other traffic in the residual general-purpose lanes or environmental and commercial impacts of the busway on property frontage and land use (a serious issue in some segregated busways – see the Sao Paulo case study). However, there are several important conclusions for busway planning that arise from the Quito data.

POLITICAL COMMITMENT AND INSTITUTIONAL ARRANGEMENTS

In many cities in the past, busway implementation has not been achieved because institutional responsibilities were fragmented. For example, in a conventional city, a busway can involve the traffic-planning department, the transport-planning department, the highway department, the bus-licensing authority, various bus operators, traffic police, and others. To realize the Quito scheme, the dynamic mayor made fundamental changes to the city's transport-planning structure and created a *single* agency, the Unidad de Planificación y Gestión del Transporte (UPGT), with a clear mandate and adequate powers to take control of public transport. This can only be achieved with strong political backing, but it was key to the scheme's realization and success. As stated by Arias and Wright, "Quito has created a world-class sustainable transport system, proving that financing is not an obstacle if the political will and vision exist to create a system that puts people first."

INTRODUCTION OF A BUSWAY INTO AN EXISTING ROAD NETWORK AND WITHIN AN EXISTING PUBLIC TRANSPORT SYSTEM

The Quito busway demonstrates that a high-quality busway can be introduced into an existing, important, heavily traveled road without major new construction and in a short time period. The existing road is wide, with three or four lanes in each direction, but in the context of many U.S. cities, this is not an atypical road width. Clearly, the reallocation of road space (one lane in each direction) to buses will have an impact on traffic (but not necessarily on "person") capacity. In Quito, the impact on general traffic capacity is probably less severe than in cities in the United States because (1) general traffic flows are likely to be lower and (2) the introduction of the Quito busway permitted the elimination of a significant volume of low-capacity buses that created general congestion – a condition not likely in U.S. cities. Nevertheless, the scheme has shown that with good engineering, an imaginative approach, and a commitment to public transport, a busway can be introduced into an existing roadway within a short time period. In some cases in the past, opposition from existing bus operators has frustrated busway implementation. Strong political commitment and acceptance of radical measures can resolve the issue, although the forceful measures applied in Quito may not be acceptable in all city contexts.

QUALITY SERVICE

The Quito busway has been able to realize a high passenger capacity and provide high-quality service at a fraction of the cost of a light rail or tram system. To achieve a high level of service, buses on a busway must provide frequent, reliable, and rapid service; it appears that the key components of the Quito scheme are in place to achieve this. These key components include the following:

- Nearly full traffic-bus segregation to allow rapid and, most importantly, reliable bus operation;
- Measures to allow efficient and rapid passenger boarding-alighting including off-bus fare payments, level boarding and alighting, buses with multiple doors, and gap-free level passenger boarding and alighting;
- High-capacity buses that allow an optimum balance to be achieved among frequency, attractive passenger service, and efficient operations (i.e., the buses allow a 90-second headway to be operated without resulting in bus-on-bus congestion at stops); and
- A quantum step in physical facilities and buses compared with those previously operated and an image of a modern and user friendly system

System Operation

The Quito system operates on a trunk-and-feeder basis. The system is common to bus operations in Latin American countries and not in other regions of the world. The trunk-and-feeder system requires good institutional arrangements. A high degree of service planning is involved, and the necessary integrated fares system must be managed (i.e., revenue sharing between trunk and feeder buses must be organized unless a single company operates both feeder and trunk bus services). Nevertheless, the system has much to offer in the right circumstances. It can offer a very high trunk line capacity at a low cost, can be implemented rapidly, and promotes the bus transit system with a new image. It is analogous to a light rail transit (LRT) or tram system that is fed by buses. There is no reason why, in appropriate cases, the Quito experience of a trunk-and-feeder system should not be replicated in other cities.

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http://members.aol.com/almo1435/etla.html

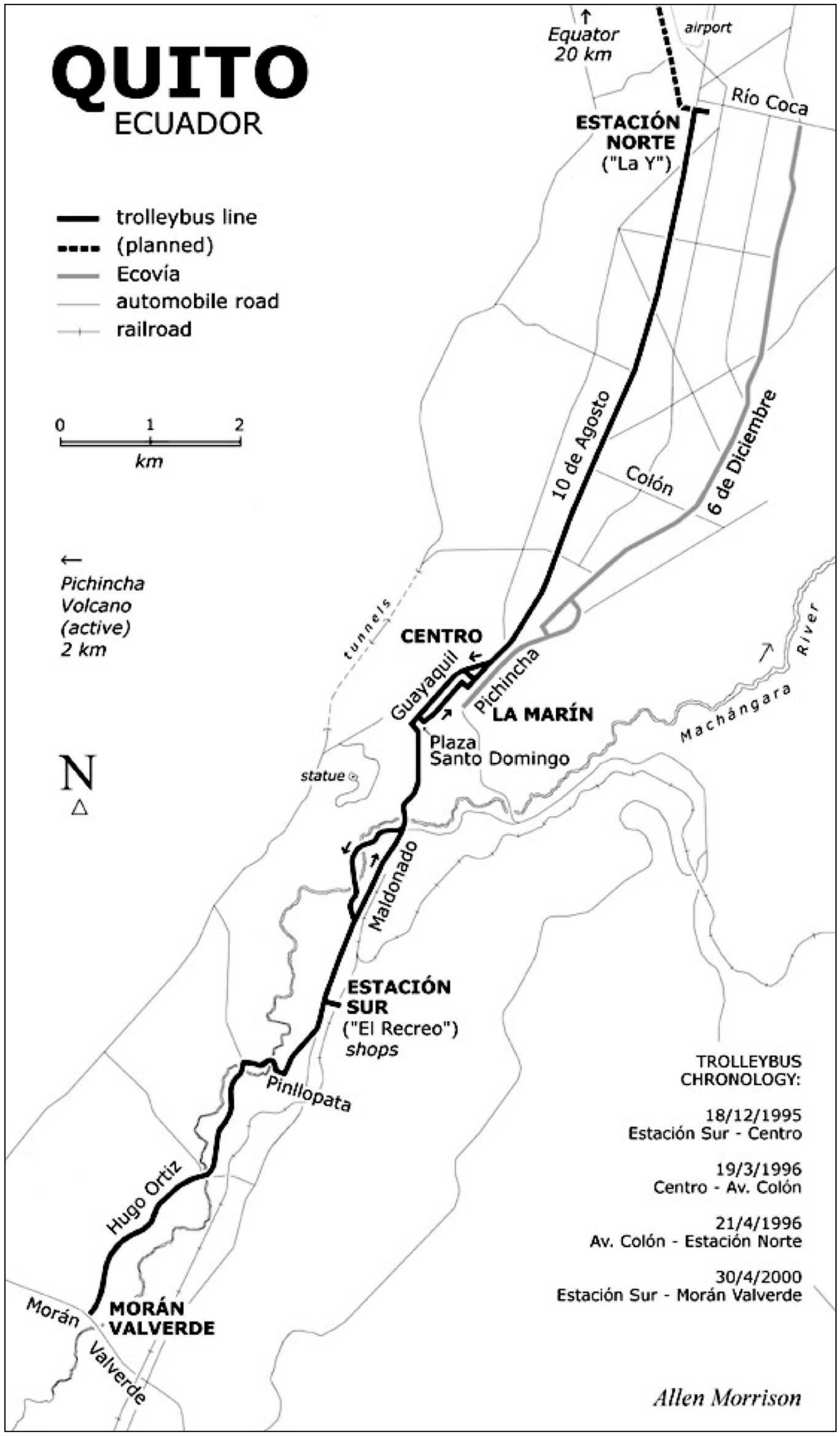

Figure 1: Location of Busway

Figure 2: General Configuration of Central Busway

Figure 3: Island Stop Platform Showing Ramped Access

Figure 4: “Trole” Station Interior with Off-vehicle Fare Collection

Figure 5: Articulated Bus with High Doors