INSTITUTIONAL AND REGULATORY OPTIONS

FOR DELHI'S

HIGH CAPACITY BUS SYSTEM:

LESSONS FROM INTERNATIONAL EXPERIENCE

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EXECUTIVE SUMMARY

The Delhi Government has initiated an ambitious program to improve public transit service throughout the metropolitan area. One important element of their sustainable transport program is the Delhi High Capacity Bus System (HCBS). Currently, Delhi's plans for HCBS focus primarily on the public procurement of modern, larger capacity, low floor buses, and the construction of center-lane bus lanes on 7 major corridors. These changes, when implemented, will bring lasting improvements for millions of Delhi bus passengers. Most importantly, Delhi's HCBS as currently designed will:

a. Improve bus speeds and reduce bus operating costs by getting buses out of traffic congestion and ending conflicts with bicycles, pedestrians and stopping taxis.
b. Improve the quality of service by providing some modern buses and bus stops
c. Reduce pedestrian and bicycle fatalities by ending the dangerous 'competition for the cent' between private bus operators and provide improved facilities for non-motorized travel.

However, important opportunities have still not been explored. In other cities around the world, the introduction of an HCBS has also been used to implement some important long-term transit sector reforms. Because HCBS makes bus operations more profitable, introducing an HCBS gives the municipality additional leverage to demand more from private operators. In other countries, HCBS projects have been used to:

a. Facilitate a smooth transition to a sometimes more efficient 'trunk and feeder' or 'hub and spoke' bus routing system.
b. Increase private sector investment into the transit system.
c. Change private bus operating contracts to include quality of service requirements.
d. Facilitate integrated ticketing systems that allow for smoother transfer between different transit modes.
e. Increase the capacity of the municipality to plan, manage, and regulate its transit system.

Section one identifies briefly the relationship between HCBS and bus sector regulatory reform in general. Section Two outlines current transit sector regulatory reform issues in Delhi. It identifies the key areas of concern for Delhi, and outlines how HCBS was used in many Latin American countries to leverage the implementation of similar regulatory reforms. It concludes by pointing out that without simultaneous institutional reforms, Delhi's HCBS is unlikely to reach the levels of public support that have made these systems popular in a growing number of cities.

Section Three reviews international experience with using HCBS to transition to a trunk and feeder transit bus routing system. Section Four reviews international experience with using HCBS to leverage increased private sector investment into the bus system. Section five reviews international experience with using HCBS to implement what has become known as quality of service contracting. Section six reviews international experience with HCBS and intermodal integrated ticketing systems. Section

seven reviews international experience with using HCBS to modernize bus fleets and induce greater investment in the domestic bus industry. Section seven reviews institutional structures for planning, building and managing HCBS.

Each section concludes with specific recommendations for how Delhi's HCBS project can be better used to leverage transit system reforms. The main recommendations are summarized below.

Recommendation I

While Delhi re-evaluates the bus routes to increase demand on the Metro corridor, the same analysis should also look at re-routing buses served by the HCBS corridor.

Delhi has already called for a re-appraisal of the integration of bus lines in the corridor served by the Delhi metro. By re-routing some passengers onto the under-utilized metro system, Delhi can increase the cost recovery of the metro system while partially de-congesting the parallel roads. If this is not done carefully, however, it will inconvenience many transit passengers and shift people onto private motor vehicles. Since this careful analysis is needed for the metro system, at the same time, the same analysis should be done for the HCBS corridors. The additional capacity that HCBS will provide to bus passengers will also create the potential to shift bus routes in the corridor to more trunk and feeder-based services, reducing congestion in the mixed traffic lanes, and increasing the profitability of the bus lines operating in the HCBS corridors. This cannot be achieved, however, unless the current review of bus routing for the metro project is expanded to also review the HCBS corridors.

Recommendation II

The Delhi Government should contract out HCBS operations, attracting private investment to cover the cost of bus procurement and ongoing maintenance.

HCBS increases the profitability of bus operations. By giving private operators partial or full exclusivity to operate in a particular corridor, and removing operating risk (congestion) and regulatory risk (uncertain fare policy, unclear legal status, unclear licensing procedures, etc), profitable operations can be more or less assured. As such, the Delhi Government should be able to attract sufficient private investment to cover the cost of bus procurement and ticketing systems.

For this to happen, several preliminary steps need to be taken. First, an accurate demand estimate for each of the HCBS corridors needs to be made using state of the art traffic modeling. While ITDP is supporting this process with funding from US AID, it will not be sufficient to complete this important work. After existing demand is estimated, an analysis can be performed of the likely profitability of the existing bus routes using the HCBS corridor. With this information, the Delhi Government can decide whether it needs to reroute some existing bus lines to increase or decrease demand on the HCBS corridor. At this point, a technical specification for the bus can be set in a

way that ensures private investors can pay for this bus and still earn a profit. Finally, the appropriate legal agreements need to be provided to protect the companies involved against regulatory risk.

Recommendation III

The Delhi government should restrict operations on HCBS corridors to private operators selected through competitive bidding. Operating contracts should stipulate rewards and fines based on clear service quality indicators to ensure high quality bus service.

Having created a low risk, high profit transit market through the HCBS, Delhi can then use the HCBS to leverage a higher quality of service from private operators. The two main mechanisms for ensuring these and other social goals is through the points system used in the competitive bidding process, and via rewards and fines specified in operating contracts. HCBS in Latin America has been used to require bus operators to maintain and clean buses, follow a fixed schedule, operate at safe speeds, provide good quality passenger information, and a host of other measures critical to good customer service or face fines. A sliding scale of rewards and punishments for good or bad quality service is critical to their effectiveness.

Recommendation Four

The plans for Delhi's HCBS and future lines of the Delhi metro should plan for free transfer between the two systems and physical integration of the stations.

As Delhi is moving ahead with a metro system that nevertheless will take many decades to complete, HCBS will play an important role for the foreseeable future in providing good quality transit services in all the corridors not served by the metro. The level of demand on a transit system is largely a function of the size of the system and how well integrated it is with other public transit modes. Currently, Delhi's Metro (DMRC), Delhi's Integrated Bus-cum-Rail Transit (IBRT), commuter rail, and HCBS corridors are all being planned in isolation. Rather than having these systems competing with one another for an ever-shrinking number of public transit passengers, the plans should be integrated to ensure that each piece of the mass transit system constitutes a critical element in an integrated transit network. While institutional integration of these very different systems with very different cost and operational structures is probably not advisable, integration could be facilitated by discount tickets for transferring passengers and physical integration of the systems, to ensure smooth transfers between systems.

Recommendation Five

Delhi should set up a special purpose company (SPC) to plan, supervise, and contract out HCBS operations in order to facilitate coordination and to ensure long term planning and contracting capacity is retained in the public sphere.

Coordination of HCBS projects is always difficult, as administrative authority is frequently divided between different administrative departments and different levels of government. In the absence of an existing transit authority, planning, contracting, and regulatory authority is normally consolidated into a single entity in order to improve coordination. It is also critical to ensuring that the capacity for longer term system planning and design be internalized in a branch of the government that has qualified long term staff somewhat insulated from the frequent transitions in the political system.

Recommendation Five: The Delhi Government Needs to Dramatically Strengthen In-House Capacity in Transit System Modeling and Planning for Any Transit System Regulation to be Successful in the Long Run. A new SPV for HCBS could become a focal point for such a capacity building effort.

Currently, the Delhi Government is not in control of the necessary information to perform the necessary demand analysis to make needed regulatory changes. Data is controlled by private contractors who treat it as proprietary despite assurances from the Transport Commissioner otherwise, and the data we have seen was generated in a non-scientific manner. Without retaining control over this data, Delhi Government will not be able to successfully regulate and modernize its transit system. In order to ensure that this process of capacity building is internalized and retained, a new SPV for organizing the HCBS project needs to be established and properly resourced.

Finally, the Delhi Government should be applauded for making a bold start on addressing the difficult task of transit system modernization by advancing the HCBS project. However, Delhi should also take full advantage of the opportunity that an HCBS project provides to leverage some critical, related, transit system reforms, which are critical to the full success of HCBS.

I. BACKGROUND: HCBS AND TRANSIT SYSTEM REGULATORY REFORM

This report builds on earlier work done by the IDFC entitled "High Capacity Bus System for Delhi: Examination of Institutional Systems and Financial Model." It is intended as a companion piece, reviewing the international experience with these issues in relation to the key institutional and regulatory issues currently faced by Delhi.

Internationally, the relationship between high capacity bus systems (HCBS) and bus system regulatory and institutional reform is perhaps the least understood and most important element of HCBS. An increasing number of decision makers understand that by giving buses special lanes in the center of the road, buses can often move faster, improving service for transit passengers and inducing some people to give up their private cars and go back to using buses. More and more decision makers understand that many of the benefits of a metro system can be achieved using HCBS technology at a fraction of the cost. But fewer understand that HCBS is also generally used to bring about institutional and regulatory reforms in the bus sector that were hitherto impossible.

HCBS has generally been implemented in parallel with, and in fact as a means toward transit system regulatory reform. The specific relationship depends on the structure of the bus industry and the pre-existing regulatory framework at the time of the transition to HCBS.

The amazing success of the Curitiba HCBS developed in the 1970s was not replicated anywhere in the world until the late 1990s, in large part due to resistance from private bus operators. A critical part of the more recent success stories of Bogota and Quito is how these city governments negotiated the transition to a fundamentally different institutional arrangement with private bus operators.

By the late 1990s, many major bus operators in Latin America realized that their resistance to Curitiba-style HCBS had not solved their long-term profitability problems. Virtually all operators of full-sized buses were facing crisis. Ridership was declining and profits were falling because of growing private car use and the loss of passengers to unregulated minivans, shared taxis and other forms of informal sector paratransit. Therefore, private bus operators in the 1990s were more open to being directly involved in negotiations for fundamental bus system institutional reforms than they had been in the 1970s, if in exchange for this a system could be developed where their profits were more secure.

This paper draws largely on experience from Latin American countries in linking HCBS to regulatory reform. In the developed world, transit systems tend to be owned and operated directly by public authorities, or are contracted out to private bus operators on a fee-for-service basis, largely because bus passenger ridership is too low to make private bus operation profitable. In developed countries, the maximum number of passengers that HCBS lines will get is in the range of 5000 per hour per direction, (with a few exceptions such as New York's Lincoln Tunnel), and they are considered 'viable' if

they move even 5000 passengers *per day*. In this context, HCBS has generally been introduced without any connection to bus system regulatory or institutional reform. ***These developed country conditions are so remote from developing country experience as to render an institutional review of first world HCBS experience of marginal relevance.***

In Latin America and other developing countries, where the most successful HCBS systems have been implemented, bus operations were dominated by the private sector. While publicly operated bus authorities continue to exist in Delhi, Dhaka, Dakar, Jakarta, Mexico City, and a number of other developing country megacities, in all cases the state-owned operator is rapidly losing passengers to private formal and informal transit operators. In most other developing country cities, bus operations are now entirely in private hands. In Quito, Bogota, and Curitiba, the most famous HCBS, the systems were 100% in private hands when planning for HCBS began.

While unregulated private control of transit operations has brought with it a large number of problems, such as dangerous 'competition for the cent' killing pedestrians, deteriorating service quality, poor emissions standards, weak scheduling, insufficient service levels to lower income lower density areas, lack of security and benefits for workers, the efforts in the 1960s – 1980s to introduce public authorities in the developing country context has largely failed to address these problems. Worsening congestion meant that the decline of public transit passengers translated directly into worsening public sector debt or deteriorating quality of service or both. Lack of accountability of public institutions often led to the misuse of public funds for political or other purposes, deteriorating maintenance, and lack of sensible investment into the system. ***HCBS is the only proven mechanism for addressing these problems and retaining public transit ridership levels over the long term in a developing country context.***

Because HCBS was introduced primarily in countries where bus systems were already almost exclusively in private hands, ***HCBS was not a mechanism for privatizing bus operations: rather, it was a mechanism for allowing municipal government to establish or re-establish effective regulatory control over largely privatized and deregulated transit systems***.

These institutional structures vary greatly, as do their impact on the quality of transit service and its ability to retain passengers in the long term. One initial lesson is that ***the more empowered the municipality is with information, the better it is able to turn the interests of the private operators to the public good.***

After the introduction of HCBS, in most cases, bus operations remained in private hands and the HCBS institutional structures that emerged were a compromise between the municipality and private bus operators. In most cases, HCBS projects were used to transform small independent private operators controlled informally by local strongmen

into modern bus companies operating on state-regulated routes following fixed schedules.[1]

Unlike Bogota, Quito, or Curitiba, Delhi continues to have a large public transit authority, DTC. It is only recently that large cities in developing countries that still have some form of public transit authority have begun to develop HCBS, and the relationship between the HCBS project and this existing transit authority remains in each case an issue of considerable debate. [2]

In Delhi, where demand on the HCBS system could run as high as 20,000 passengers per direction per hour during peak periods, there is no reason why the system, once constructed, should require operating subsidies of any kind even at current fare levels, **so long as diesel buses are used**. ***Thus, in these cities, including Delhi, HCBS could be used to further restrict the role of public bus services to less profitable routes, and as feeders to the HCBS lines, but in the context of a new regulatory regime that better protects the public interest.***

This report reviews in some depth how significant differences between institutional arrangements in different international HCBS projects affected transit service delivery. This information is then related to the Delhi context, and some preliminary recommendations are made.

[1] .The one exception to this was the Quito electric trolley bus HCBS system, where the vehicle costs proved too high to attract private investors, so the system was set up as a publicly owned company with the idea of eventual privatization, but the system remains in public hands. In this case, HCBS was used to create a public authority where previously there was none.

[2] . In Mexico City, it appears likely that the operating concession in the planned *Insurgentes* HCBS corridor will be turned over to a single large private operator that currently dominates the corridor, and the RDP lines in the corridor will be cut. In Jakarta, the public authority PPD is a junior partner owning 20% of the consortium operating the HCBS concession, PT JET. Of the 10 lines that the municipality agreed to cut in the HCBS corridor, only 7 of these lines actually existed (!), and many of the missing buses were supposed to be PPD lines. After the TransJakarta busway opened, only the PPD lines were actually cut. This indicates at least that cutting or re-routing the lines of public authorities will be less problematic than cutting the lines of private bus operators.

II. DELHI'S TRANSIT SYSTEM AND CURRENTLY PROPOSED REGULATORY REFORMS

II.1. Delhi's Transit System

Unlike in most of Latin America where the modal share of buses started dropping already in the late 1970s after many years of increase, in Delhi bus mode share was sharply increasing from the 1950s into the early 1990s, from only 22% in 1957 to 62% in 1994. From 1994 until the CNG conversion of 2001, it was roughly stable. Then, due to a poorly managed conversion to CNG, bus ridership turned sharply downwards. Total buses in operation dropped from over 10,000 prior to the conversion to under 5000. Though ridership is now rebounding, as more CNG buses are added, and modal share for buses is still thought to be roughly 60%, Delhi is now following the more typical global pattern of falling overall transit passenger mode share. Because this downward trend in ridership is a fairly recent phenomenon, and largely blamed on the CNG conversion, there has not been until recently a significant concern among private bus operators about losing bus passengers to private motor vehicles.

There are three types of ownership structure in Delhi's public transit system, though before the CNG conversion there were four. There are buses owned and operated by the Delhi Transportation Corporation (DTC), a public authority. There are about 2200 of these green and yellow buses in operation as of 2004. DTC was set up in 1971 and until 1996 was under the control of the Government of India, at which time it was transferred to the Government of the National Capital Territory. DTC buses follow routes and schedules established by the DTC and at fares set by the DTC. Prior to the regulatory chaos that ensued after the Supreme Court forced the Delhi Government to covert its bus fleet to CNG, DTC also used to lease lines to private operators on specific routes. These leased lines were scrapped during the CNG conversion. Some commentators believe that DTC operates at a loss of about $50 million annually, partially because of handling less profitable routes while providing services at low fares, and partly due to mismanagement.

The second type of buses in Delhi are private buses that operate on routes assigned to them by the State Transport Association (STA). There are roughly 2500 of these blue buses in operation since the CNG conversion. Most of the private operators own only one or two vehicles, but some individuals may own as many as 200 buses. Many of the bus owners just rent the bus out to the bus driver at a flat rate, and the driver then is responsible for collecting the revenue to offset his costs. STA is a separate agency under the Delhi Municipal Corporation. STA issues licenses that allow buses to operate on particular routes. When this system emerged in the 1980s, bus operators were also supposed to follow a schedule set by STA, but enforcement eventually broke down. Fares on STA – registered buses are also regulated by the STA with some oversight from DTC.

STA Bus Trapped In Congestion on Delhi's Inner Ring Road.

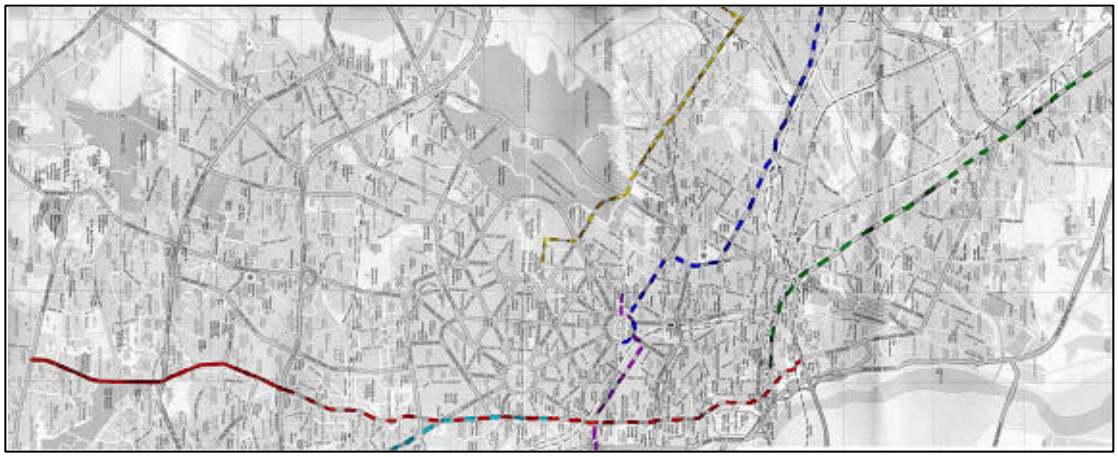
Both the DTC and STA-Regulated buses are manufactured by either Ashok Leland or Tata Telco, and are of similar design. The average age of both bus fleets is quite old by international standards, though good by Indian standards, and the quality of these buses in terms of emissions, passenger comfort, and ease and safety of boarding and alighting is poor by international standards.

Customer satisfaction with the private buses is somewhat worse than with the DTC buses because they do not follow a predictable schedule, they do not come to a full stop at bus stops, and they do not stop at all once the bus is full. Because the revenue of the bus operator depends on the number of passengers he carries, there is sometimes competition for passengers at bus stops, leading to unruly driver behavior and pedestrian fatalities.

Finally there are private charter buses and school buses. These are not regulated. There are large numbers of buses and minibuses chartered by businesses and government agencies for their employees. The number of these buses increased sharply after the CNG conversion, and could be as high as 5000 vehicles today. These buses tend to stop wherever the passenger wants to get on or off.

II.2. Status of the HCBS Project

From the beginning, Delhi's HCBS program was actually two separate and only partially related projects. One element focused primarily on inducing larger, more modern, low floor buses into Delhi. The second element focused on the construction of exclusive bus lanes on several major arterials. In January of 2003, the Delhi Government announced it would begin planning seven high capacity bus corridors, and would procure 30 more modern, low floor buses. The Delhi Government approved about $100,000 for the planning of the system, most of which went to RITES for the detailed engineering designs, and matching funds from US AID via ITDP to IIT TRIPP covered the basid design, planning, and costing work. To date, the detailed engineering for the first HCBS corridor has been completed for the first, 6.3 kilometer section of the first 18km long corridor, which connects Ambedkar Nagar and ISBT. While the Delhi Government approved some $1.2 million for the procurement of the buses, and another $6.6 million to reconstruct the corridor, to date only one bus has actually been procured, and the funding for reconstructing the corridor has yet to be approved by the expenditure finance committee of the Delhi Government (EFC).



Delhi's Preliminary HCBS Corridors

The selection of corridors was not based on a systematic analysis of bus passenger demand, since no detailed transit trip modeling had been done. Rather, the corridors were based partly on observed demand, partly on availability of road space, and partially based on corridors not slated to be served by the metro. The selected corridors were not planned as part of a single integrated system with the metro, though the first line selected does cross it.

Because the Delhi government had recently offered priority routes to bus operators willing to switch quickly to CNG buses, it was impossible for them to change the route concessions again prior to the elections.

Since no decision had been made about which of the roughly 200 buses per hour in the corridor would be allowed to use the busway, it was difficult for the technical team to know what level of demand they were designing the corridor to handle.

Lacking detailed data on bus routes, and knowing that the selected corridors did not have a lot of bus origins and destinations, the HCBS team decided early on that the system would be open to standard buses running existing routes, at least initially. This precluded the possibility of having the pre-paid boarding tubes that allow the very high operating speeds and capacity that make the Curitiba and Bogotá systems so successful.

Furthermore, the bus industry in India is heavily dominated by two firms, Tata and Ashok Leland. For years, IIT-TRIPP has been trying to get them to develop a better, lower floor bus that also complies with the CNG law. Having persuaded them to develop a superior prototype to the old industry standard bus after a multi-year advocacy effort, and knowing that for years the buses would have to operate both on and off the HCBS corridors, the project promoters were loathe to force the bus manufacturers to develop yet an additional bus with specifications suited only to the HCBS corridors. This, in turn, placed further constraints on bus station design.

The current plans are for a one-lane segregated center-lane busway with two lanes at the stations and two passenger platforms. This first section was selected based on ease of engineering, not based on maximum benefit or impact. Because that corridor is not badly congested, the benefits may be difficult for the public to observe.

II.3. Delhi's HCBS and Planned Regulatory Reforms

While regulatory reforms are currently being discussed in Delhi, thus far, there is no relationship between them and the HCBS project. The current plan for the Delhi HCBS is to have a trial of six new low floor buses procured and operated by the DTC. It is not yet clear if the trial, which has already begun, will occur only on the first HCBS corridor. Currently, only one is operating, and it is on the inner ring road, not on the first planned HCBS corridor.

The fares, the schedules and the route will all initially be determined by the DTC. The Chief Minister has indicated that she is open to gradually turning over the operations and perhaps even the planning functions of the HCBS to a new Special Purpose Company (SPC), along the lines of the SPC set up to operate the Delhi Metro, the Delhi Metro Rail Corporation (DMRC).

The DMRC was set up as a company with equity investment from the Government of India and the Government of the National Capital Territory of Delhi (GNCTD). It is a state company with enormous independent planning and investment powers. The DMRC plans, builds and operates the Delhi Metro Rail System directly, though some of the work is done through sub-contracts.

The main purpose of the SPC in the case of the DMRC, was to coordinate the planning, design, construction, and operational functions under a single authority as a mechanism for overcoming the bureaucratic confusion and gridlock that might ensue should these functions be left under the control of the numerous independent governmental agencies with responsibilities for transport in Delhi.

The IDFC report, of which this is a follow up, suggests four possible institutional structures for such an SPC, and generally recommends setting up an SPC with representation of the DTC, the MCD, and NDMC on its board. It also discusses the possibility of setting up a public-private partnership with private sector participation from the inception. (PPP).

This is the extent to which regulatory and institutional issues have been thought-through with regard to the Delhi HCBS. Meanwhile, ***there are three parallel though currently unrelated transit system reforms underway in Delhi.***

First, there is now active discussion of cutting bus lines that currently parallel the Metro. These lines may be turned into feeder buses for the Delhi Metro. This is usually done for two reasons. First, the Delhi Metro is operating well below its capacity, so getting ridership up is critical to reducing the long term operating cost burden of the

Delhi Metro. Secondly, re-routing bus lines on the surface streets would reduce congestion on the surface streets. **While similar re-routing of bus lines along the HCBS corridor is not currently being discussed, it should be discussed at the same time.**

Secondly, because the DTC buses are losing money and the government faces debts, whereas the STA buses do not lose money, the Delhi Government has discussed plans to restructure DTC, and put out many of the remaining 650 DTC bus routes for private tender. It is believed that after the tender, the DTC will retain control only over those bus routes that are inherently not profitable, while the profitable routes will be contracted out to private operators, much in the manner of those operated by STA. Whether they will be contracted out under the authority of DTC or STA is not known, as the measures are still at the discussion stage. Whether this tendering of DTC's routes will coincide with changes in DTC route structure to accommodate the metro system, is not yet known.

Increasing regulatory control over private STA – licensed routes has also been discussed, and included in Delhi's Sustainable Transport Plan announced in January of 2003. Industry consolidation and requiring the private bus operators to follow a timetable are the two principal reforms discussed.

The ability of the Delhi Government to use lucrative route licenses for further concessions from private bus operators is significantly compromised by the fact that this leverage was already used to hasten the process of private bus operator conversion to CNG. Those private operators that made the CNG conversion the fastest were given legal rights to operate some of the more important routes. The specific details of these contracts needs to be explored.

There is also some discussion of expanding the use of the current 'smart card' Metro tickets to other forms of public transport like the "Integrated Bus – cum – Rail Transit" system being discussed. However, to date, there is no discussion of integrating the ticketing of the Metro with normal buses or the HCBS.

Finally, there is considerable interest in modernizing the Delhi bus fleet and modernizing Indian bus manufacturing in general. The modern bus element of the Delhi HCBS project has been under discussion since before the possibility of exclusive bus lanes was discussed. The linkage between bus fleet and bus manufacturing modernization and Delhi's HCBS project has been at times mutually reinforcing and at times contradictory, but in general the relationship between bus modernization and HCBS has been much more tenuous than it was in most of the Latin American HCBS systems.

Currently, the Delhi government can affect the bus procurement process in two ways. First, it can change the baseline technical specifications for private STA-registered commercial bus operation. This so far has not been discussed. Secondly, it can change the type of buses that are procured by DTC.

Since the preliminary plans were for DTC buses to operate on the HCBS exclusive bus lanes, the original thinking was to modernize the bus fleet by having DTC procure better buses with a different technical specification. With this in mind, the Delhi Government set up a technical advisory committee to develop the specifications for a low floor 'high capacity bus.' These technical specifications were never intended to be specific to the HCBS corridor. As the additional cost of these modern buses it has been assumed would be picked up by the public sector, the need for linking the modern bus procurement with more profitable HCBS operating licenses has not been appreciated.

Because of the difficulties of getting new bus designs approved by a cumbersome regulatory process, and due to the difficulty of inducing new investment from quasi-monopolistic Indian bus manufacturers, HCBS has been used to leverage the introduction of a better standard bus, rather than for the development of a bus specifically designed to work in an HCBS corridor. As a result, the bus that has currently been developed is sub-optimal from the perspective of maximizing HCBS vehicle speed and carrying capacity.

II.4. Priorities for Delhi Bus System Regulatory Reform

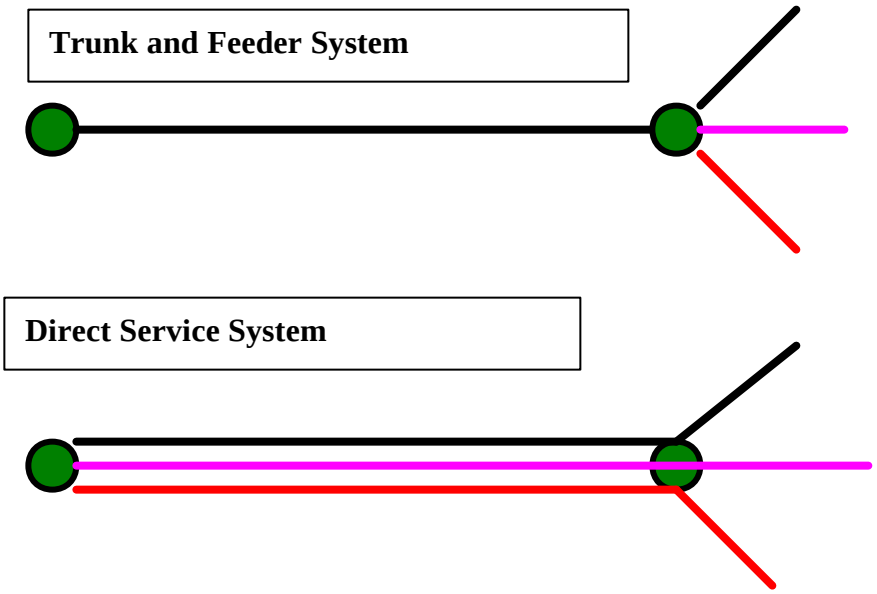
The regulatory reforms currently being discussed in Delhi have the following goals:

a. Making the overall transit system more efficient
b. Shifting the financial burden from the state to the private sector
c. Improving the quality of service by private bus operations
d. Facilitating smooth transfer between and within transit modes
e. Modernizing the Delhi bus fleet and Indian bus manufacturing
f. Improving the planning and management of the HCBS project

In the following sections, international experience in each of these areas will be discussed and then related to the context of Delhi's HCBS project.

III. REGULATION AND TRANSIT SYSTEM EFFICIENCY: HCBS AND 'TRUNK AND FEEDER' SERVICES

In all network-based systems, such as telecommunications systems, airlines, and public transport, there is a continuum between the convenience of direct door to door services, and the 'efficiency' of trunk and feeder systems where low volume local network trips feed high volume corridors. On one extreme, private car owners provide the ultimate door-to-door service, where no transfers are required, but this service is expensive because each person has to own and operate their own motor vehicle. Collective taxis and minibuses are the next step, close to providing the convenience of direct door-to-door services while still using collectively used and commercially owned and operated vehicles.



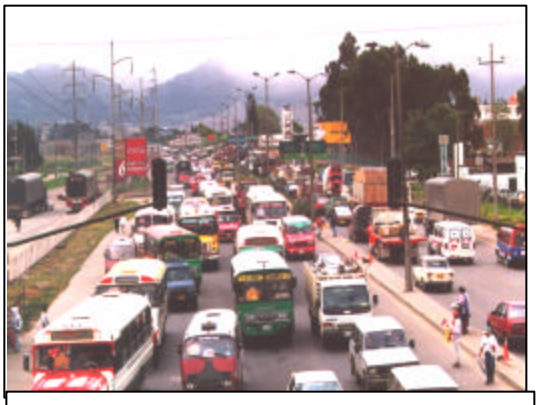
At the other extreme are metro and commuter rail systems which can move very high volumes of passengers but on a limited number of corridors, and which frequently require a significant conversion of direct bus services into feeder buses to be viable.

Between these two extremes are a host of interim measures. In a city where only private vehicles and minibuses exist, introducing large buses on major arterials is the first step towards the efficiencies of a trunk and feeder system. Once large bus services are introduced, connecting most major points in a city, they can be further consolidated into a trunk and feeder service with our without creating exclusive bus lanes. Sao Paulo is in the process of making this transition where there is no direct link to HCBS corridors, though some of the corridors do have bus lanes. On the other hand, bus speeds, profitability, and road capacity can all be increased through the use of exclusive bus lanes in an 'open' HCBS system without simultaneously changing bus routes into a trunk and feeder system. This was done in parts of Kunming, Porto Allegre, Taipei, Rouen, the

United States, and in Sao Paulo (before the recent regulatory changes), and is the closest to what is currently being proposed in Delhi. Then there are a few 'closed' bus systems and metro systems, like the TransJakarta busway and the Delhi metro, which are new high capacity trunk services without feeder services. These systems tend to suffer from weak demand. Next in the continuum are the highest speed, highest capacity HCBS systems like Bogota, Curitiba, and Quito, which were generally implemented simultaneously with a conversion to a trunk and feeder system. Finally, there are metro and commuter rail systems with feeder systems, like the Hong Kong metro, parts of the Sao Paulo metro, and the Bombay commuter rail system.

When deciding on whether direct services or trunk and feeder services are more appropriate in a given corridor, the first level analysis should be the level of transit trip demand. If the transit trip demand is above 4000-6000 passengers per hour per direction, a one lane busway without passing lanes is already going to begin to congest. Shifting to a trunk and feeder system is one option among many to deal with this capacity issue. A clear indicator of this situation will be if there is a very large number of existing buses in the corridor.

In some corridors in India, Bus Congestion Is A Significant Issue.



Bogota's Arterials, Before TransMilenio, Were Congested With Buses.

A second consideration is how many buslines may be overlapping on a particular corridor. The system will become more difficult to organize, particularly the bus stops, if there are a large number of different lines operating on a single corridor.

A third factor is the degree to which the transit trip demand changes within the bus routes on the corridor. If the demand is reasonably constant throughout the entire bus route, then using direct services with standard bus sizes makes economic sense. If the demand varies widely on the bus line, from very low volumes in peripheral areas to very high volumes on trunk corridors, then you are going to either be running very large buses half empty through peripheral areas, with considerable economic waste, or you will be running very many small buses on major arterials, with elevated operating costs per passenger due to higher than necessary labor costs, and additional vehicle congestion.

In summary, while there are numerous possible transitions, the following transitions are most relevant to the Delhi situation:

A. Leaving the existing bus routing system in place with a possible increase in bus capacity.
B. Constructing more metros and 'open' HCBS corridors without significant changes in exiting bus routes.
C. A transition to a trunk-and-feeder based bus system with the metro and 'open' HCBS lines serving as the trunk lines on some corridors, but with no direct relation between HCBS and the trunk and feeder routing changes.
D. New 'Trunk' Systems Without Feeders.
E. A transition to a fully integrated 'closed' trunk and feeder system with the metro and closed HCBS corridors serving as the trunk lines.

Deciding which sort of system is the most appropriate for Delhi is not inherently clear. The first order analysis should be to take existing transit demand in Delhi's major corridors, and comparing this to the capacity and commercial speed that can be attained using the different systems, and then selecting the system that meets this demand level plus projected latent demand and future growth at the least cost. As a second order of analysis, the impact of these two different systems on passengers travel time and travel cost, and of the travel time and travel cost of passengers in the mixed traffic lanes should be conducted. However, this level of analysis requires fairly sophisticated traffic modeling, which remains several years off in Delhi, so some interim decisions will have to be made.

Shifting between more door-to-door oriented services towards more trunk and feeder oriented services generally requires and creates the possibilities for regulatory and institutional changes. Because bus routes are regulated, changing them requires regulatory changes. Because trunk lines in trunk and feeder systems are likely to be more profitable than door to door collective transport services, the possibility of removing government subsidies at least on the trunk lines while retaining them on the feeder services through public service contracts becomes a new possible institutional option.

As such, the remainder of section three reviews similar transitions in other countries, then presents some tentative conclusions for Delhi

III.2. Leaving Existing Bus Routing in Place While Increasing Bus Capacity

If Delhi abandons the HCBS plans and only implements the scheme to introduce larger, more modern buses, this change may still increase bus capacity in the corridor. However, because the buses will remain trapped in ever-worsening traffic congestion, profitability of the bus system will continue to decline, forcing the public sector to pick up the cost of more modern and more expensive bus technologies. There are numerous examples of simply introducing larger buses into developing country cities without other reforms.

Large buses are introduced where previously only minibuses operated. Articulated buses are introduced where previously only normal buses operated. However, internationally, the trend is in the opposite direction, with informal sector minibus operators offering door-to-door services capturing a larger and larger share of the transit market, leading to a downward spiral in bus system profitability and deterioration in service quality.

III. 3. Constructing HCBS corridors with no Significant Changes in Bus Routes: The Case of Taipei, Kunming, and Sao Paulo and Bogota in the 1980s.

Taipei, Kunming, Bogota's Avenida Caracas (before TransMilenio), and Sao Paulo (before the recent reforms), all introduced HCBS corridors without substantially altering the bus routing system. These systems resulted in significant improvements in road capacity, some modest improvements in bus speeds, and significant reductions in bus operating costs. These systems cost very little to construct, and required minimal disruption of existing bus routes and contractual relationships. In each of the cities, high volume transit corridors were selected. The results in each city were largely positive but with some visible limitations.

Buses Cueing in Kunming's 'Open' HCBS System.

In Kunming, the system cost only about $1 million per kilometer, half of which was paid for by advertising revenues at the bus shelters. Before the busway was implemented the mixed traffic lane was moving only about 2000 passengers per direction per hour. The bus lane is now moving 7500 passengers per hour per direction. As a result, public transit mode share rose from 6% to 13%. Most of the modal shift was from bicycle to bus, however. Because of getting the buses out of traffic congestion, the busway reduced total fuel consumed by the buses by 7.7 litres per passenger. Bus speeds increased from 10km/hr to between 15km and 18km per hour in the corridor. The signal timing in Kunming is simple but long: a four-phase system lasts roughly 3 full minutes. This significantly reduces intersection capacity and can probably be adjusted and simplified. During rush hours the busway becomes very congested, and bus speeds drop significantly. A large numbers of buses are less than fully occupied. The bus platforms are very long but still too short to accommodate the bus cues at rush hour. The busway has received little attention in China because it has no independent marketing identity. Currently, the problem of private motorists occupying the non-physically separated bus lane is worsening, and political support for the system remains weak.

Bus Cues, Taipei's HCBS System, Morning Peak.

In Taipei, the bus rapid transit system also significantly improved bus performance in the corridor. During peak hours, the system is moving a maximum of 6000 passengers per direction per hour, roughly triple the capacity of a mixed traffic lane. The system could move far more than this, as the buses were on average less than half-occupied. Bus speeds appeared to be quite high, in the 20 kph range. These speeds were reached largely through a very simple two-phase, 3 minute signaling system gives the busway 110 seconds of green time. This two-phase system is possible by restricting turning movements at all but a small number of intersections. It works well for the buses but at the expense of crossing traffic and turning traffic.

In Bogota, one busway existed already since the 1980s, more than a decade before the construction of TransMilenio. On this major arterial, Avenida Caracas, the municipality built an 'open' busway in many ways similar to the one being planned in Delhi today, except that it had two full bus lanes in each direction along the entire corridor. This busway, like Delhi's current plans, used normal buses and was designed in the absence of any bus route rationalization. Unlike the Delhi plans, it had two full lanes in each direction, and the design allowed buses to pass each other at station stops. The Avenida Caracas bus lane was effective in that it moved over 30,000 public transit passengers per hour per direction, but because so many of the buses were operating less than full, the bus corridor had a capacity to move over 45,000. However, with so many buses congesting the corridor, this capacity was achieved at very low operating speeds, under 10kph. This corridor was basically considered 'blighted' by the public because of severe air pollution and noise, and transit passengers faced very slow trips.

Bogota's Avenida Caracas, Prior to the Construction of TransMilenio.

Sao Paulo has many HCBS corridors that were constructed prior to recent efforts to rationalize bus routes in these corridors. One good example is the Santa Amaru corridor. This one lane busway with a passing lane moved around 30,000 passengers per direction per hour at peak hour. It requires however, a very long station. At rush hour, this corridor is frequently experiencing operating speeds significantly below 10kph, and

frequent breakdowns of the aging and uncontrolled vehicle fleet often brings the system to a standstill. The concentration of old, polluting, and poorly maintained buses on a single corridor has led to the public perception that the corridor is 'blighted', leading to some disinvestment.

Sao Paulo's Sta. Amaru Corridor, Has High Capacity, But is Considered Blighted By Some.

The conclusions of this experience are quite clear. A busway of the general sort being designed in Delhi, without route rationalization, can significantly improve the capacity of roads. Bus speeds may increase somewhat but not significantly. Because buses are less than fully occupied, the busway becomes much more congested than it needs to be based on the level of passenger demand.

Secondly, because more buses are chasing fewer passengers than in systems were the routing structure was changed, the profitability of each bus line is far less than in the trunk and feeder systems. As a result, the level of investment into new buses has been lower. Because old, unregulated buses are still using the busway corridor, emissions problems are not resolved and in fact are concentrated in the corridor. In some of these systems, the buses using the HCBS system are much older, much more polluting, less well maintained, and subject to frequent breakdowns.

Currently, our assessment is that this is the sort of corridor most likely to result in Delhi if the regulatory issues are not taken up a the same time.

III. 4. Converting to Trunk and Feeder Bus Systems With No Direct Relation to HCBS: The Case of Sao Paulo

Sao Paulo, with over 15,000,000 people, is even larger than Delhi. It also sprawls out in all directions, with widely dispersed origins and destinations. Like Delhi, most trips are concentrated on a very limited number of large arterials, but until recently more trips were centered on a traditional central business district. Since the 1980s, Sao Paulo's SP Trans, its public authority, has contracted out to private bus operators point-to-point bus services along numerous routes. Recently, however, Sao Paulo has embarked on an ambitious transformation to a trunk and feeder system. Though some of the reconfigured lines are on existing or planned HCBS corridors, the reforms are being carried out independently of the construction of new busways.

The reason for the transition was to decongest the main arterials in response to a change over time of a large number of transit trip destinations. As congestion in downtown got worse, more and more businesses relocated to sub-centers just outside the central business district. Before, when all the trips were going downtown, buses would

start out empty in poor neighborhoods and by the time they reached the most congested part of the roadway they would be full. However, as businesses moved farther out, many of the buses were operating half empty by the time they reached the CBD, which nonetheless remained the most congested part of the roadway. In this context, SP Trans developed a route rationalization plan. All of the bus routes in the entire city were redrawn, creating a hierarchical system built on feeder buses and line-haul corridors. 28 local systems will offer dense service using minibuses at lower fares in smaller multi-neighborhood zones. These lines in turn connect to inter-zone trunk lines, offering faster connections over longer distances and connections with key metro stops and other popular locations.

One benefit of the old system was that 85% of passengers were able to make their entire trip without transferring. In the new system, people will have to make two and even three transfers to make the same trip. To avoid forcing passengers to pay two and three times, over 40 new bus terminals are planned throughout the city where passengers will be able to transfer free of charge. Long-term plans also exist to implement "smart card" technology to help compensate for what will be a greatly increased need for transfers where no bus terminal exists, but this has not been implemented yet either.

An Enclosed Bus Terminal at the Metro Entrance in Sao Paulo Allows for Free Transfer Between Metro and HCBS.

As a result of the changes, a similar level of transport service can be achieved with 10,000 fewer bus drivers and 5000 fewer buses. With 5000 fewer buses on the roads, traffic congestion for the remaining traffic is lessened. This efficiency was gained because buses that were operating at far less than full capacity for part of their trip are now operating more or less at full capacity for most of their trip.

To implement these changes, the Municipality had to re-negotiate the concession contracts with all of the private bus operators. The process has been plagued with conflict, and has yet to be implemented in full. As the new system should be much more efficient, the lines should be more profitable than before. Hence, the Municipality is also demanding that the new concessionaires invest in new buses, new ticketing systems, and new bus facilities without increasing the fare price. This led to considerable contention between the municipality and the private bus operators. The bus operators also objected because greater system efficiency is costing a lot of jobs, though the precise number is in dispute, as some will be rehired on the feeder lines

While Sao Paulo has numerous HCBS corridors, is constructing several more, and these lines roughly correspond to the 'trunk lines' in the new system rationalization plan, there is no direct connection between the transition to a trunk and feeder system and the construction of HCBS corridors. However, some of these HCBS corridors are

congesting, and addressing this bus congestion is one of the justifications for the transition to a trunk and feeder routing system.

III. 5. Constructing 'Closed' Trunk Services Without Feeders: TransJakarta and the Delhi Metro

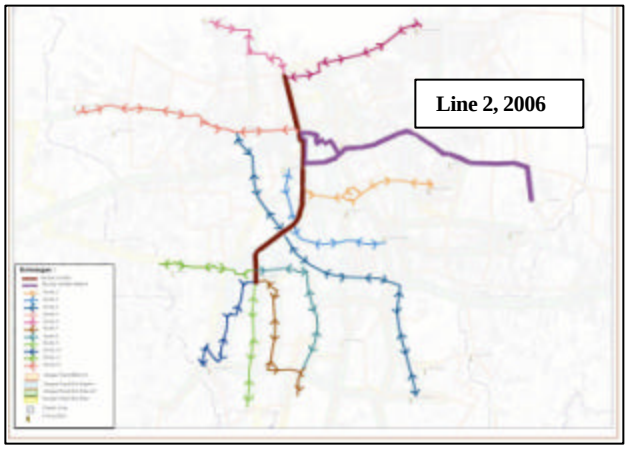
Jakarta is spread out like Delhi, with a similar size of population. Like Sao Paulo, it has a somewhat more concentrated CBD than does Delhi. Jakarta's new TransJakarta HCBS system is a 'closed' trunk system without a functioning feeder system. Jakarta also converted an existing mixed traffic lane to a buslane and created a single 'closed' HCBS line without any regulatory reforms in the corridor. As a result, almost all of the buses originally operating in the corridor continue to operate, congesting the mixed traffic lanes.

TransJakarta's Trunk Without a Feeder System. Congestion In The Mixed Traffic Lanes is a Concern.

An effort was made to contract out some existing private bus operators as official 'feeder lines', but so far these trunk lines have failed. These private lines are pre-corporate entities. Because the bus owners did not clarify the mechanism by which bus operators would be compensated by bus owners for TransJakarta feeder bus tickets collected, the bus operators thus far have refused to honor the discount tickets.

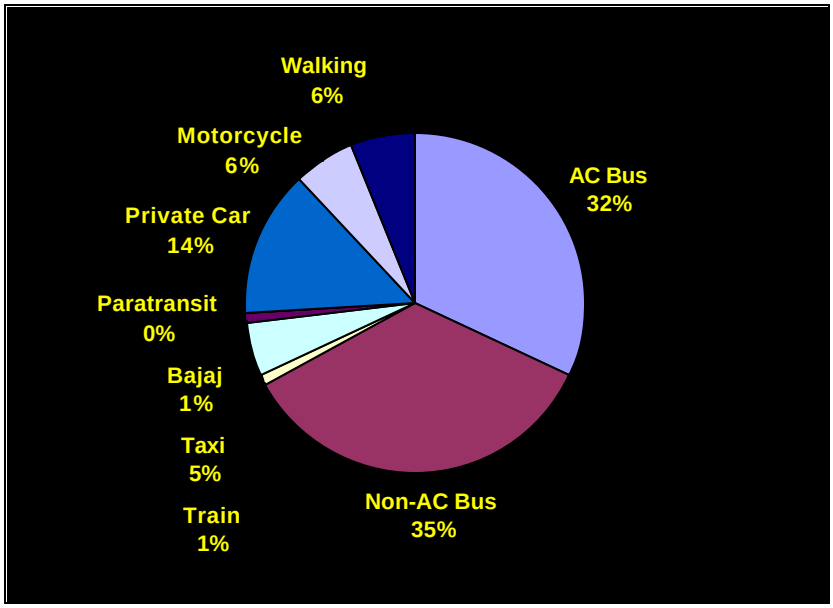
The result of this trunk system without a feeder system has been very serious congestion and deteriorating speeds in the mixed traffic lanes. This is largely because most of the old buses continue to operate and congest these mixed traffic lanes.

Demand on Trans-Jakarta has been higher than projected, however. Because of the significant adverse impact on the mixed traffic lanes, Trans-Jakarta is attracting a lot of passengers from competing bus routes and from other modes. It is carrying at the peak



TransJakarta's Planned HCBS Corridors.

roughly 6000 passengers per direction per hour, or about 60,000 passengers per day, and an average of around 4000 per direction per hour, roughly double what we projected. At this level it is roughly able to cover its operating costs. This is still only about half of the total transit passengers in the corridor, the rest of which continue to occupy the mixed traffic lanes. Operating speeds on the system are good, over 20kph.



Percentage of TransJakarta Passengers Drawn From Other Modes, March 2004

Because TransJakarta has only a single lane with no passing lane, because small buses are being used, because there is only one door in the bus, and because there remain some problems at roundabout intersections, the total capacity of TransJakarta is little more than about 8000 per direction per hour before significant decline in bus operating speeds results. Already the buses are cueing at the station stops. The cueing problem is exacerbated by the fact that the bus operators are not yet sufficiently controlled to follow a specific schedule. Pressure to resolve the feeder service problem has been lessened by the fact that the system as currently designed doesn't have the capacity to absorb a significant increase in passengers, though fixing this problem is not difficult.

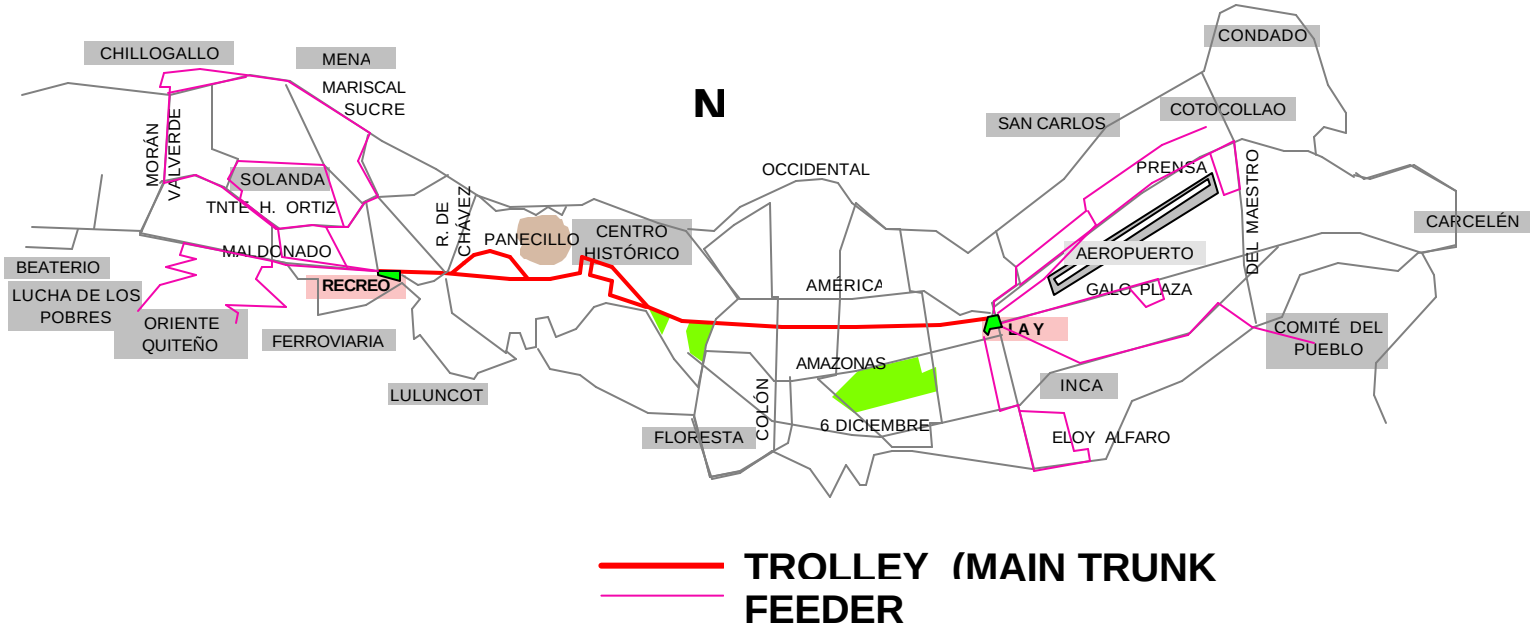
Delhi Metro, Rush Hour, July 2003

The Delhi metro, which is now moving roughly 8000 passengers per hour at the peak hour, also has reasonably low demand due to the lack of a feeder system. However, the gap between current ridership and the system's capacity is much greater in the case of the Delhi Metro and the TransJakarta busway.

III. 6. HCBS And Shifting to Trunk and Feeder Services: The Experience in Quito and Curitiba

Public transit trips in Quito, unlike in Delhi, are heavily concentrated along a single high-density corridor in a narrow mountain valley. Quito's HCBS corridors crisscross in the CBD, a dense historical center protected by UNESCO. Prior to the HCBS system, the narrow two-lane roads that wind through Quito's CBD were perpetually jammed. The majority of the vehicles on the road were private buses, some of them 35 years old, and they were the most visible source of air pollution.

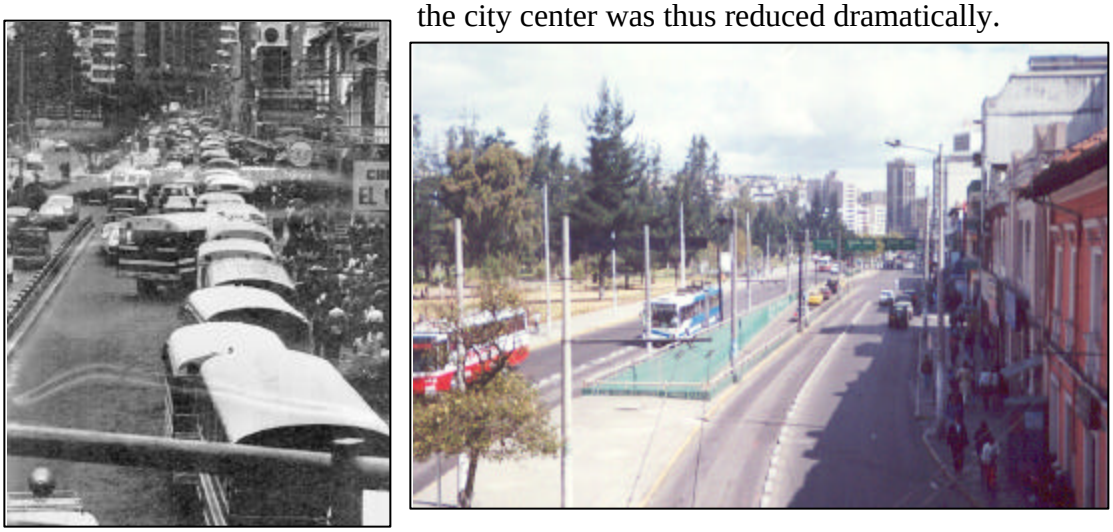
Quito developed two HCBS lines, and a third line being developed. Both of the existing lines are 'closed' trunk and feeder systems. The first line used electric trolleybus



Quito's Trolebus HCBS Trunk and Feeder Routing System

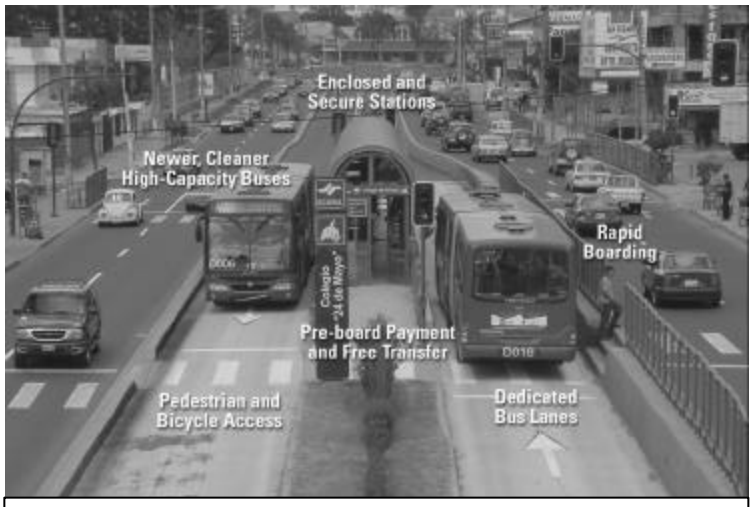
technology, and has feeder buses on both ends. Passengers from feeder buses transfer without charge at enclosed stations. On the new Ecovia line, which used diesel buses, there are only feeder buses on one end of the line.

The old bus lines operating in the corridor were re-routed, removed entirely from the Trolebus and Ecovia corridors. The total number of buses operating on the roads in the city center was thus reduced dramatically.



Quito's Avenida 10 de Agosto, Before and After the HCBS System was Implemented.

The Quito busway is single lane without a passing lane at station stops, but uses articulated buses. It managed to move some 9000 passengers per hour on the first trolleybus line, and has managed to increase this to about 12,000 passengers per hour per direction at the peak hours on the second, Ecovia line, through modest design changes, like moving the station platforms to the center of the Operating speeds are at a reasonable 20kph.



Quito's New Eco-Via Line.

Curitiba, like Quito, is a much smaller city than Delhi, at around 1.5 million. While it is also spread out like Delhi, when the HCBS was introduced, zoning changes were introduced at the same time which encouraged high density development along the HCBS corridors, while high density development was restricted along parallel one way mixed traffic arterials. The city then grew for many years at very high density along the HCBS corridor and at lower density off the corridor. As the city has continued to sprawl, however, the impact of this zoning system has gradually broken down.

Curitiba, the world's first HCBS, evolved over time into the current system. Bus system reform in Curitiba began already in 1962. At that time, there were 321 separate private, largely unregulated informal sector private bus companies. In that year, the Mayor forced these companies to consolidate into 10 separate collectives or companies.

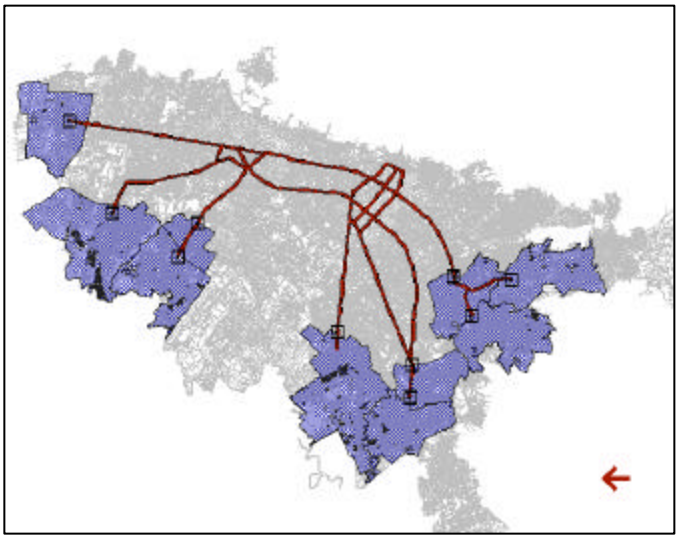
At the same time, the city gave licenses to these new cooperatives to operate a particular section of the city, or 'slice of the pizza'. However, during the 1962 to 1974 period, there remained lots of collectivos and independent private operators.

In 1974, the general concept of HCBS was first developed under the leadership of Jaime Lerner. This system was a combination of exclusive bus lanes, enclosed pre-paid boarding stations, and a shift from point to point bus routing to a trunk and feeder system. In 1974, two HCBS corridors were built. Thus, route rationalization occurred at the same time, and some bus lines were converted into feeder buses. However, there was initially no system of free transfers, so people had to pay twice. Because both the trunk lines and feeder buses were owned by the same bus consortium, rationalization of routes occurred within the same economic group without much controversy.

Curitiba's system has only a single bus lane without a passing lane. Using di-articulated buses, it has managed to get its capacity up to 15,100 passengers per hour per direction. At maximum capacity, there is a problem of buses cueing at the bus stations.

III. 7. HCBS And Shifting to Trunk and Feeder Services Part II: The Bogota Experience

Bogota, a city of about 8 million, is slightly smaller than Delhi. Half of the city abuts a row of mountains, at the foot of which sits the Central Business District. The rest of the city is spread out like Delhi, with a few wide arterials moving in a radial pattern into the valley. The first TransMilenio corridor followed the very high-density corridor along the mountains, passing through the CBD. It was from its inception designed as a 'closed' system, or as a 'surface metro', with enclosed stations, special vehicles, etc.



Preliminary TransMilenio Trunk Lines and Feeder Areas Identified by Steer Davies Gleave

Prior to TransMilenio, Bogota's bus system was entirely in the hands of small private bus operators offering point-to-point services. While in the 1970s there was a public transit operator, in the 1980s this system collapsed. All of the public sector buses were sold off. A few powerful families bought up a lot of the buses. These powerful families then became informal regulators of route access, and around them formed bus operators associations. The City Department of Transportation recognized the regulatory role played by these associations and began issuing the route licenses to the Associations rather than directly to bus owners. These associations then distributed the licenses among their members.

Fares were regulated based on negotiations held every year or two between the Municipality and the Associations based on such factors as fuel price increases.

The Associations were then supposed to make sure both that their members followed agreed upon bus routes and that no other buses operated on those routes. They did not expect the Associations to regulate the schedules, however. Over time, the Associations proved to be ineffective regulators, as buses did not always follow agreed upon routes, and illegal bus operators also began to proliferate on the same corridor.

In 2000, just before TransMilenio opened, there were some 22,000 registered buses and minibuses operating in Bogota, though the actual figure was probably closer to 30,000 – 35,000. Because of the breakdown of regulation, many bus corridors were overcrowded with buses, many of them only partially occupied. The roads in Bogota were congested with buses, which consumed more than two full mixed traffic lanes.

When TransMilenio was introduced, then, a main objective of the system's planners was to rationalize bus routes in the corridor so that the number of buses in the corridor could be reduced. Therefore, when this corridor was reconstructed, it was reconstructed as a 'closed' trunk and feeder system.

The trunk and feeder system in the first phase of TransMilenio, consisting of three corridors, allowed the number of buses operating in the corridor to be reduced dramatically, from 650 buses/hour /direction

TransMilenio's Green Feeder Buses and Red Trunk Lines

on heaviest link, down to about 270. Because the buses were much larger, however, the system's total capacity was only reduced by about 5,000 passengers per direction per hour. Thus, the operating speeds increased from under 10kph to around 26kph.

It is important to understand that ***ALL of the bus routes on the TransMilenio corridors were relocated onto other, parallel corridors***. They were relocated during the construction phase (when they had to be re-routed anyway), and they were simply not allowed to return.

Because the transition to a trunk and feeder system was done at the same time as the construction of HCBS, the provision of two special lanes for buses did not in fact

decrease operating speeds for mixed traffic in the remaining lanes, but actually significantly increased them even on Ave. Caracas where no new road capacity was added. This significantly contributed to the positive reception of TransMilenio as a win-win solution even for motorists. It did, however, push the remaining private bus operators onto parallel corridors, which became much more congested than they had been before. Nevertheless, the overall impact on traffic congestion was positive for both bus passengers AND private motorists.

When TransMilenio initially opened, the feeder buses were not in place, and ridership suffered. The feeder buses had to be brought directly under the control of TransMilenio because the private bus operators were unwilling to voluntary give up ridership to the new HCBS system. Private operators actually refused to stop at the TransMilenio stations. Today, 48.3% of TransMilenio trips begin or end with a trip on a feeder bus. The contractual relationships will be explained later. Feeder bus passengers pay nothing to enter a feeder bus, and only pay once they reach the TransMilenio station, so ***there is no charge for the transfer***.

Now, the system is operating with ridership levels over 45,000 per direction per hour, at operating speeds around 25kph. As such, Bogota is currently the state of the art in HCBS technology.

III. 8. Transit Route Rationalization Recommendations for Delhi's HCBS

In Delhi, while detailed origin and destination data has not been disclosed to us, passenger origins and destinations appear to be widely dispersed. Nevertheless, Delhi's road network is fairly limited, so most of these trips are concentrated onto a limited number of high volume corridors. The first 6.3 km section of Delhi's planned HCBS corridor has bus volumes around 135 buses per hour per direction (268 total), most of them medium and small in size. This is roughly 7000 passengers per direction per peak hour.

The first part of the first HCBS corridor does not connect many important origins or destinations. Very few existing bus routes are operating only along this corridor, and most of them are just passing through this corridor for a short part of their total trip. As such, ***for the first 6.3 kilometer corridor, Delhi's HCBS it would not be viable as a 'closed' independent trunk line in a trunk and feeder system***. This is not surprising, as the first part of the first corridor was selected primarily for ease of construction for demonstration purposes rather than based on a network analysis. For these reasons, the system is properly being designed as an 'open' system.

Because the bus volumes and passenger demand on that corridor is not that high, and the congestion in the mixed traffic lanes is not so high, possible adverse impacts on bus speeds and mixed traffic will be fairly minimal so long as the signal cycle is simplified and some turns are restricted. As such, ***route rationalization in the corridor is not that critical to the functioning of the first half corridor***.

However, the second part of the first identified HCBS corridor links to the Delhi metro and passes through a very congested area near old Delhi. Bus volumes in the second section of the HCBS line are much higher, and the risk of the existing HCBS design congesting without significant route rationalization and moving to more of a trunk and feeder approach is sufficiently high to warrant a thorough demand and capacity analysis of the planned HCBS corridor for the second section prior to proceeding with construction of the next phase. If the existing transit demand in the corridors is much above 12,000, then the current busway design is likely to congest, and forcing existing buses to use the exclusive lanes may lead to a significant deterioration rather than an improvement of bus speeds. If this turns out to be the case, either route rationalization, or larger buses, or pre-paid boarding stations, or a combination of these elements, will be need to be implemented. Moving some of the buses back into mixed traffic lanes would be one way to address this problem, but it would increase congestion in the mixed traffic lanes, further deteriorating travel speeds in the mixed traffic lanes.

Since changing bus routes into feeders for the Metro is going to be considered anyway, consideration of whether or not bus routes should also be adjusted to more of a trunk and feeder system in all of the HCBS corridors should be given at the same time, since the marginal cost of doing this analysis for all the corridors at once is minimal.

IV. HCBS AND SHIFTING TRANSIT'S FINANCIAL BURDEN FROM THE STATE TO THE PRIVATE SECTOR

Many cities around the world are trying to reduce the fiscal burden of transit systems while attracting new private investment into the system and maintaining good quality customer service. Achieving all three of these objectives is not easy. The public's financial burden can be reduced by full deregulation and privatization, but this could just as easily lead to disinvestments as investment, and in the absence of safeguards is almost certain to result in a deterioration of customer service. Ultimately, in any system there will be a tension between public interests and private interests. ***The ability of the public sector to negotiate a good deal for the public requires it to have access to very complete system information, a skilled staff, and sound advice***. The more information the public sector has before the contracting begins, the better chance that the contracting will support the public interest.

In the developing world, success stories when it comes to direct public operation of bus systems are limited. Sometimes perfectly legitimate social objectives, such as maintaining low bus fares, simultaneously lead to a dependence on government support which overtime breeds corruption and mismanagement. While these problems can often be controlled in cases where government authorities are highly transparent, and 'good government' watchdog groups are strong, such watchdog groups in India are largely absent in the transport sector.

From the international perspective, public bus operations in Indian cities have been reasonably successful. They provide a reasonably extensive, low cost service for large numbers of passengers, and total passengers were for many decades increasing both in absolute numbers and in terms of modal share. In Mumbai, cross subsidies from the electric power sector have maintained a reasonably functional bus fleet offering a low cost transit service.

However, the bus fleet itself has failed to modernize, private investment into the system has been unimpressive, and the taxpayers in some cities are shouldering an ever-increasing burden of the operating deficits, estimated to be some $50 million annually in Delhi. The modal share of the bus system is now dropping in most Indian cities, as motorcycles, auto rickshaws, and private cars are displacing transit trips. In many Indian cities, public sector bus operations are entering a crisis of escalating or at least continuing subsidies, deteriorated and deteriorating outdated buses, and mismanagement. By contrast with Ahmedabad, for example, where only 350 – 400 functional but very dilapidated public buses remain, down from over 900 in the early 1990s, DTC works quite well.

Evidence from both developed and developing countries of the impact of full privatization and deregulation of public bus authorities is not that encouraging. First, service at non-peak hours and on lower demand corridors tends to deteriorate. Secondly, the final collapse of a public transit system often also leads to the phasing out of larger buses all together, which leads to a retreat from the efficiencies possible from using

larger vehicles, and hence more road congestion. Third, pedestrian fatalities tend to escalate, as unregulated competition for passengers tends to lead to dangerous roadside conditions for waiting passengers. Fourth, with no regulation at all, unfettered competition tends to undermine the profit margin for operators, who then lack the funds to invest in modern buses. For this reason, and for lack of effective road-worthiness and emissions standards, the vehicles themselves tend to deteriorate in terms of safety and emissions. Finally, the cost savings from privatization are sometimes primarily at the expense of basic benefits for the employees, or from forcing the operators to work split-shifts (the morning and evening peak).

HCBS in Latin America has demonstrated a successful new paradigm of public sector regulation and private sector operation, combining the efficiency benefits of private sector management with social goals. Bus as the following discussion shows, the conditions under which these goals can be achieved are highly specific.

Current plans for Delhi's HCBS, like the existing structure for the Delhi Metro, are to have the Delhi Government finance the entirety of the cost of the infrastructure construction, the entirety of the rolling stock procurement, the ongoing maintenance of the rolling stock and the stations, and a large part of the operation of the system. In other words, all of the risks of project failure are falling on India's taxpayers, and these taxpayers face significant risk.

It is important to realize that this is not the case in many Latin American HCBS systems. In most Latin American HCBS, while the infrastructure and stations are paid for and maintained by the municipality with public funds, the investment into the buses and their ongoing maintenance, the investment in and maintenance of the ticketing systems, and other elements of HCBS, are paid for entirely by the private bus operators. In this way, the public sector is insulated from inheriting a permanent financial burden.

However, there are better and worse ways of leveraging this private investment. In some Latin American systems, the public interest was clearly compromised in the effort to secure private sector investment. In others, the public interest was well protected through innovative contracting methods.

The contracting system developed in Bogota's TransMilenio HCBS is a best practice example of how contracting out of bus operations can be used to minimize the public sector financial burden of transit services, while maximizing the responsiveness of bus operators to consumer needs. The contracting system designed in Bogota was based on a careful evaluation of the problems observed in the contractual relationships in the Curitiba, Quito, and other Latin American systems. The remaining chapters cover this experience.

IV. 1. Private Contracting of HCBS Within City Zones: Curitiba

Curitiba's HCBS system is still one of the best regulated bus systems in the world. Its contracting structure is very similar to that of TransMilenio, though TransMilenio made a few important improvements.

In Curitiba, the bus reform process began in 1962. Then, there were 321 separate private, informal sector bus companies. That year, the Mayor forced them to consolidate into 10 separate collectives or companies that would operate as formal sector companies. During this controversial restructuring, the city gave licenses to these new consortiums of private operators to operate a particular section of the city, or a 'slice of the pizza'. For lines that passed between two regions, operations were split between the two operating companies. These buses enjoyed a partial monopoly of full size bus operations in a particular part of the city, but until 1974 there remained many *collectivos* and independent private operators.

Then, in 1974, Mayor Jaime Lerner constructed the famous busway system, the world's first HCBS, or what is known in Brazil as 'canales'. At the same time that these 'canales' were built, the routes in that corridor were reconfigured into a trunk and feeder system, and competing collectivos and other private operators were removed from the streets. However, when new HCBS corridor was constructed, there was no new competitive bid, and the same company that operated the old lines in that part of the city was given automatic control over both the new trunk and the new feeder lines. This had the advantage of smoothing the transition process politically, and ensuring coordination between trunk and feeder lines, but it also compromised the ability of the municipality to control the private operators in the case of poor performance.

When first constructed, the Municipality of Curitiba paid for the entirety of the infrastructure for the HCBS system out of municipal resources, and it continues to maintain the roads with municipal funds. In 1977, the IBRD (World Bank) gave a loan for expanding the system, and in 1990 they got another loan from the Inter-American Development Bank. However, all of the funds for bus procurement in Curitiba came from the private bus operators, not from the city. Mayor Jaime Lerner was involved in the negotiations with Daimler and Volvo in Brazil and in the US when the technical specifications were being developed, but the procurement did not come from the city. Station maintenance was also the responsibility of the bus operator, and was covered by farebox revenue.

Nor did the municipality provide loan guarantees to the private operators in the early years. Only in 1989 did the city arranged for a special line of credit for the bus companies from the state development bank, (BNDES) to buy the buses. This was in part to help finance buses with higher emission standards. Buses are amortized over 10 years, and BNDES loans are paid back in 8 years. Before, normal bank loans required the loan be repaid in 48 months.

Because these local bus companies had a monopoly over a certain section of the city, and controlled the concession for an unlimited period of time, their routes were very profitable, so it was possible for them to invest in modern buses.

Until 1979, in Curitiba, the fares were collected directly by the private operating companies controlling a particular part of the city. Because the operating companies controlled the fare collection directly, passengers had to pay twice whenever they needed to transfer from one zone to another. From 1974 to 1979, many people complained that they now had to pay twice for the same trip, when before the shift to a trunk and feeder system they only had to pay once.

To overcome this problem, in 1979 they integrated the stations so there was a single unified fare with free transfers. From 1979 to 1987, the private operators still collected the money from their passengers directly, but the passengers were allowed to transfer to other lines anyway. Because there were inevitably some lines that benefited more than others as a result of the free transfers, the bus companies and the Municipality agreed in 1979 to set up a compensation fund to compensate the losers. URBIS, which gradually turned into the transit regulatory authority, was initially created to manage this compensation fund.

Then, in 1987, URBIS took over direct collection of the fares. It was only at this point that contracts with the operating companies were renegotiated with the private operating companies and URBIS established the payment per bus kilometer system, monitored by URBIS by simply looking at the odometers.

Shifting to direct collection of the bus fare by URBIS was a way of allowing the public sector to know the exact level of revenues and ridership. Because the private operators in Curitiba function as de facto monopolies over large parts of the system, with long-term lease rights to operate these lines, negotiations over the fare have been controversial. ***Unlike in Bogota, Curitiba never had any detailed traffic modeling information to give them a way to predict passenger demand on different routes.*** This work is only now being done. As a result, they had to take the word of the private bus operators about their operating costs and operating revenues. Many experts feel this compromised the ability of Urbis to negotiate a fair deal for the public. ***Transit fares in Curitiba are now at $0.55 per trip, compared to TransMilenio's $0.40 and Quito's $0.25***. Operators claim with some justification that the high fare is because Curitiba requires the operating companies to operate bi-articulated Euro-III compliant buses, which cost about $250,000.

Having the public sector collect the fare revenues, however, also created some risk that the trust fund would be raided by politicians for purposes other than maintaining and improving the HCBS system, which has happened on occasion. Curitiba is now considering contracting out the fare collection system to an independent operator, to better insulate farebox revenues from being raided for political purposes. Furthermore, because the unlimited concession periods are being legally challenged as a violation of federal competitive bidding law, this is also being reviewed.

Because of motorization, decentralization of the city, and fare increases, Curitiba's long-heralded HCBS system started to significantly lose mode share starting in the 1990s. Bus mode share in Curitiba was stable at about 72% of total trips from 1974 into the 1980s, but has since fallen to 54% of total trips in 2002, while car trips have increased from 21% to 30%. Transit's mode share is still extraordinarily high, given that Curitiba is one of the wealthiest and most motorized cities in Brazil, at 502 vehicles per 1000 population, higher than many European cities. No doubt the loss of ridership due to fare increases would have been even higher had it not been for the fact that Brazil has a system of transit passenger subsidies called *ValeTransport*, where formal sector employers must pay 6% of the transport costs of their employees.

IV. 2. Failed Privatization of HCBS Lines: Quito's Electric Trolleybus

In Quito, during the construction of their first HCBS line, the Municipality of Quito decided that they wanted to go with low noise and zero local-emission electric trolley buses (ETBs), mainly because the busway passes through the narrow streets of the historical center, and air pollution and noise filters directly into surrounding residential buildings. Air pollution was also exacerbated by Quito's high altitude. All of these were considerations in the ultimate selection of ETB technology.

When the ETB HCBS system was first installed, the capital costs of putting in the electric conduits was much higher than for diesel, and the cost of ETBs was also much higher than for standard diesel buses. As such, the municipality was unable to attract sufficient private investment to cover the cost of the bus procurement, and had to procure the ETBs directly. The ETB company was thus initially established as a publicly owned company, with the idea that the public investment would be recouped when, once the system was up and running and demonstrating clear operating profits, it could be privatized. There were the usual rumors, typical with any public procurement, that money changed hands under the table.

Quito set up a competitive bid for the procurement of ETBs. In this case, there were bids from Spain, Russia, and one other. The criteria in this case were cost, (which was heavily influenced by the availability of low interest financing), and the willingness of the manufacturer to provide ongoing maintenance services. Ultimately, while the Spanish bid was higher than the Russian bid, the municipality was uncomfortable with the Russian bidder's ability to provide reliable ongoing service for the vehicles. Furthermore, the Spanish government's export-import bank provided low interest loans, which made the vehicle cost plus financing competitive with the Russian offer.

After the system opened, however, hopes that the system could be privatized were dashed when electricity prices were deregulated, and the system's operating costs skyrocketed.

As such, the Quito ETB HCBS system continues to operate as a public sector company owned by the municipality. Thus, the Municipality ended up picking up the entire cost of the EBT rolling stock. Station maintenance and that of the infrastructure has not been as good as in Bogota or Curitiba. When they began to develop the second line, therefore, they opted for diesel bus technology.

IV. 3. Private Contracting to a Monopolistic Consortium of Bus Operators: Quito's Ecovia Line, Leon, and Jakarta

When Quito began to construct a second line, the financial problems with the first line convinced them to go with clean diesel technology for the second, Ecovia line. In the second corridor, all the small companies that operated on that corridor were formed into a consortium called TRANASOC. This consortium was "given" the concession.

There was only recently an agreement for the consortium to begin making payments for the buses, but these payments are dependent on certain profit guarantees. If demand is lower than expected, which is currently the case, the operators make lower payments. This creates partially undermines their incentive to attract passengers.

Ultimately, the municipality again had to assume the responsibility for bus procurement, but the consortium has been able to operate without subsidies. The operators are collecting the fares, which has created huge problems of underreporting ticket sales, especially since ridership is tied to vehicle payments. The current Mayor is talking about GPS control and better fare supervision.

In the third line in Quito, the Central North line, the management structure has yet to be decided, but perhaps some of the problems emerging in the Ecovia line will lead to a revision of preliminary plans to repeat the structure of the Ecovia line.

The new HCBS that opened last year in Leon, Mexico, is also a trunk and feeder system. Leon succeeded in getting the private operators to invest in the buses and their ongoing maintenance; however, with significant sacrifice of customer service. Early on in the HCBS negotiating process, Leon's private bus operators formed themselves into a monopoly consortium, called the Coordinadora de Transporte, which undermined the bargaining power of the city. This single consortium at first resisted the whole HCBS program. Ultimately, this consortium holds a monopoly over operations in the entire system, and there is no time limit on this concession.

Based on initial demand studies done by the municipality, the consortium was able to secure bank financing to procure modern buses. They created a trust fund, into which they invested 20% of the bus procurement costs, and private bank loans provided the remaining 80% of the bus procurement cost. The buses, articulated buses like on TransMilenio, cost some $225,000 each. On the trunk lines, the Coordinadora de Transporte consortium also owns and operates the feeder buses as well as other buses in the system, but the operators of feeder buses and the operators of trunk lines are paid

differently. Even though the system has an integrated ticketing system and a single fare, fares collected by the feeder buses is kept by the feeder bus operators. Feeders income is hence based on the number of passengers. Fares collected on the trunk line go into the Coordinadora de Transporte Fund. The Coordinadora de Transporte collects the money directly, and pays themselves for the bus operations, supposedly based on bus kilometers operated, but in fact the payment method to bus operators is not transparent.

The system has several problems. On the positive side, the buses were procured by the private sector without government investment. On the negative side, customers are complaining about the quality of service. The buses are very congested during the peak hours, as the bus operators are trying to maximize their profits per passenger by jamming more people onto the buses. Secondly, home-bound afternoon feeder bus services are very poor. Because the feeder bus operators are only paid for the in-bound trip, and not for the outbound trip, the feeder bus operators are cutting back on service in the afternoon. The City is trying to fix the problem by creating a compensating fund. The only influence that the City and the State have over the regulation of the system is through a Technical Committee of the Coordinadora de Transporte. The Coordinadora de Transporte also paid very high prices for European manufactured Volvo chassis bought from Brazilian assemblers.

Jakarta's new HCBS system is an example of where the entire cost and financial risk of the system has been assumed by the Municipality. Currently, demand is just barely sufficient to cover TransJakarta's operating costs. TransJakarta just opened on January 15, 2004, so many of the problems may still be resolved. Currently, it is being operated by a consortium of the four bus companies that were already operating in that bus corridor, plus a radio taxi company, Ratax. TransJakarta was created as a public authority, and days before the first line opened it awarded the operating contract to a company, PT JET (Jakarta Express Transit). The President of PT JET is from Ratax, but shares are divided equally 20% for each participating company.

None of these companies operated like modern bus companies in the past, so they are having difficulties with scheduling, estimating the labor they need, and otherwise estimating their costs and managing this business. As the buses were turned over to them at no cost by TransJakarta, which is under the control of the Department of Transportation, they were given only a two year operating contract. Because the buses are not owned by PT JET, they do not have a strong incentive to maintain the buses, and ***the buses are already suffering from routine maintenance problems***. After the first year, the fare price can be renegotiated. The fare price negotiated was reasonable, at only about $0.30, slightly lower than air-conditioned buses in the corridor, but the normal A/C buses travel much farther. PT JET is paid by the kilometer, so it absorbs no demand risk. The fares are actually collected by a third company, which is a consortium between a local Indonesian company and one of the turnstile suppliers in Bogota, Colombia. This company is supposed to ensure that the fares are collected and the revenues deposited into a trust fund. Currently the ticketing system is not working most of the time and tickets are being collected manually. It is unclear whether their contract will be cancelled or not.

IV.4. Private Concessionaires and Private Infrastructure Maintenance: Sao Paulo's State ETB HCBS Lines

The State of Sao Paulo's open busway regulated by EMTU, a state agency, is the only HCBS system in Sao Paulo that consistently receives public approval ratings of over 80%. This HCBS was originally designed to be only open to Electric Trolleybus (ETB), but it has always had a mix of both ETB and diesel vehicles. There are 10 lines operated in the corridor but they are all operated by one concession company which has a concession for 45 years. Sao Paulo's concession system is similar to that of Curitiba, where large bus companies control different parts of the city.

The use of diesel buses in the corridor was originally intended to be a temporary measure. Under the contract with EMTU the private bus operators were gradually supposed to modernize their fleet to ETB. However, the state power company did a poor job of maintaining the power conduits, and power failures were a regular occurrence. As a result of this, and increasing power prices due to deregulation, the bus companies refused to procure new ETBs and decided to stick with diesel.

Unique in BRT systems, in exchange for the exclusive right to operate in the busway, and the very long terms of the concession contract, the private operators also have to finance the maintenance of not only the stations but also the roadbed. The company always maintained the stations, but they used to pay 15% of their revenues to EMTU to cover the roadway infrastructure maintenance costs. However, EMTU was doing a poor job maintaining the roadway, which was damaging their vehicles. When the contract was re-negotiated, the private operators and EMTU agreed to end the 15% payment in exchange for the private operators maintaining the roadway. The trolleybus operators also wanted to take control of the maintenance of the electric conduit wires in exchange for concessions, but this has yet to be agreed upon.

Because the bus companies own the buses, they have a strong incentive to maintain the infrastructure, and infrastructure maintenance in this corridor has been good. Thus, ***there is an argument for giving bus operators more direct control of maintenance in the corridor*** under certain circumstances. In other words, infrastructure maintenance by the private operator is probably possible if the concession terms are long enough, the corridor profitable enough, and may be particularly desirable in the case of ETB. However, the municipality loses leverage over the private company with such long term, monopolistic concession contracts.

IV.5. Private Contracting While Maintaining Customer Service: Bogota's TransMilenio

The contracting in Bogota's HCBS is currently a best practice example of balancing the desire for private investment and good management with a desire to maintain good quality customer service.

	(US$ Million)	(US$ Million)
Studies and designs	4,01	0,09
Exclusive Ways	36,69	0,87
General traffic lanes	36,13	0,85
Public space[1]	28,29	0,67
Stations[2]	25,51	0,6
Pedestrian overpasses	16,57	0,39
Terminals	15,72	0,37
Parking and maintenance areas	17,16	0,40
Properties	29,18	0,69
Network services	18,57	0,44
Maintenance	18,57	0,54
Roads for feeder buses	15,28	0,36
Control Center	3,33	0,08
Others[3]	22,85	0,54
TOTAL TRUNK LINES	**292.2**	**6,89**

Unlike in some Indian cities, reducing the public sector's debt burden to public transit was not really the issue. The system was already fully privatized and there was no public subsidy. Bogota had a public bus authority starting in 1954, which superceded the collapse of a tram system that was operated by a US concessionaire. This bus authority took over the old tram routes, and it controlled about 1/3 of the transit passengers. It was mismanaged and lost passengers continually until 1991 when it finally collapsed. Thus, Bogota's bus system was already fully privatized.

Bogota had also not gone through the process of organizing the numerous small private bus operators into a small number of modern bus companies through a more formalized concessioning process that occurred in Curitiba in the early 1960s. When TransMilenio began, therefore, the several steps towards a modern, efficient, regulated transit system that evolved over many years in Curitiba were all done at once in Bogota. ***These efforts were mainly focused on regaining public influence over a dysfunctional, weakly regulated private system.***

Like in Delhi, the private buses were in poor condition, very polluting, unsafe, and unpopular, owned by numerous small individuals rather than by modern bus companies. The incentive for the HCBS reforms was not only to induce private investment into modernizing the bus system but also to regulate the bus system.

Public funds for TransMilenio were only used for planning and infrastructure. All of the funds for constructing the exclusive bus lanes, the enclosed bus stations, the terminals, the control center and part of its GPS, and the sidewalks and bicycle paths in the same corridor, were paid for by public funds, at a cost of about US$5.3 million per kilometer, not including the cost of land acquisition. This infrastructure cost about $196

million in Phase I. In Phase II, the cost was $13.5 million per kilometer, though this figure includes the cost of several expensive bridges and interchanges that are also used by mixed traffic. The breakdown for Phase I costs can be seen in the table above.

Far from being a simple parking area, the bus terminals are also maintenance, repair, and cleaning yards. The bus operators are responsible for operating the maintenance and cleaning yards.

A significant amount of money came from the privatization of the city's electric power company, some came from a new earmarked municipal gasoline tax, some came from new municipal revenues, and some came from diverting funds previously earmarked for a major ring road.

Like in Curitiba and Leon, but unlike in Quito and Jakarta, Bogota did not spend any money on bus procurement. Nor did it provide any municipal bank guarantees. Today, all of TransMilenio's operating costs are covered by the system.

This long-term economic and financial sustainability beyond the initial capital investment resulted because it was the primary goal of the planning process from inception to implementation. At every stage in the planning and design process, decisions were made with the aim of ensuring long term financial self- sufficiency, so that the majority of TransMillenio's operations could be contracted out to private investors, and to minimize the amount of money the government needed to invest in rolling stock. At the same time, however, ***enormous care was given to ensuring that this did not simultaneously undermine the ability of the municipality to demand good quality service and reasonable fares***.

Knowing that the system had to be financially self-sufficient, it was accepted from the outset that the introduction of ***TransMilenio would require a fundamental transformation in the existing route licensing system for private operators***. Unlike in Curitiba, where private bus consortiums were given concessions over areas historically under their control, Bogota wanted more control over the contracting process.

Unlike in Curitiba, where the private bus companies held control over most of the bus system information, in ***Bogota TransMilenio invested about $1 million in traffic demand modeling and planning***. Steer Davies Gleave and their team of Brazilian sub-contractors, developed public transit trip demand estimates for the three initial corridors. This was a critical element in maintaining public sector control over the contracting process with the private operators.

The decision to convert to a full 'trunk and feeder' system at the same time as implementing Bogota's HCBS system was largely motivated by a desire to maximize the profitability of the corridor. This also meant that bus size and bus occupancy could be maximized, achieving the maximum reduction in transit service cost per passenger kilometer. Finally, because more passengers were concentrated onto fewer buses, the number of buses in the corridor could be dropped substantially.

Once this decision was made, traffic modelers were able to predict with reasonable accuracy the number of passengers that the system was likely to carry. They essentially took the existing public transit trips in the corridor and added 25% for future growth. These ***demand estimates were critical in two ways***. First, they ***made it possible for the engineers to design a system that would have sufficient capacity to handle the projected demand***. In this way, the engineers could avoid under-building the system and having it congest, or overbuilding the system and wasting resources on underutilized capacity. Secondly, the ***demand estimates were critical to negotiating with the private bus operators and securing private financing for the buses***.

The technical specification for the bus was developed in dialog with international bus manufacturers as well as with the system's engineers. The final technical specification was based on meeting the systems's needs, ensuring Euro II compliant vehicles, and finally ***ensuring that there would be more than one bus supplier so that at least some competition would be available among suppliers***. Armed with this projected revenue information, and having already set the technical specification for the bus, TransMilenio, aided by McKinsey, then got quotes on the buses price.

One of McKinsey's main roles in TransMilenio was to take the demand data, the estimated bus price, and the projected revenue, and from this determine at what price the fare needed to be set in order for the system to break even financially while providing a reasonable rate of return to the private operators. Furthermore, McKinsey developed a formula by which they were able to determine how the fare revenue needed to be divided between the trunk line operating companies, the feeder line operating companies, the ticketing company, and TransMilenio itself. The contracts with the various operating companies were structured on this basis.

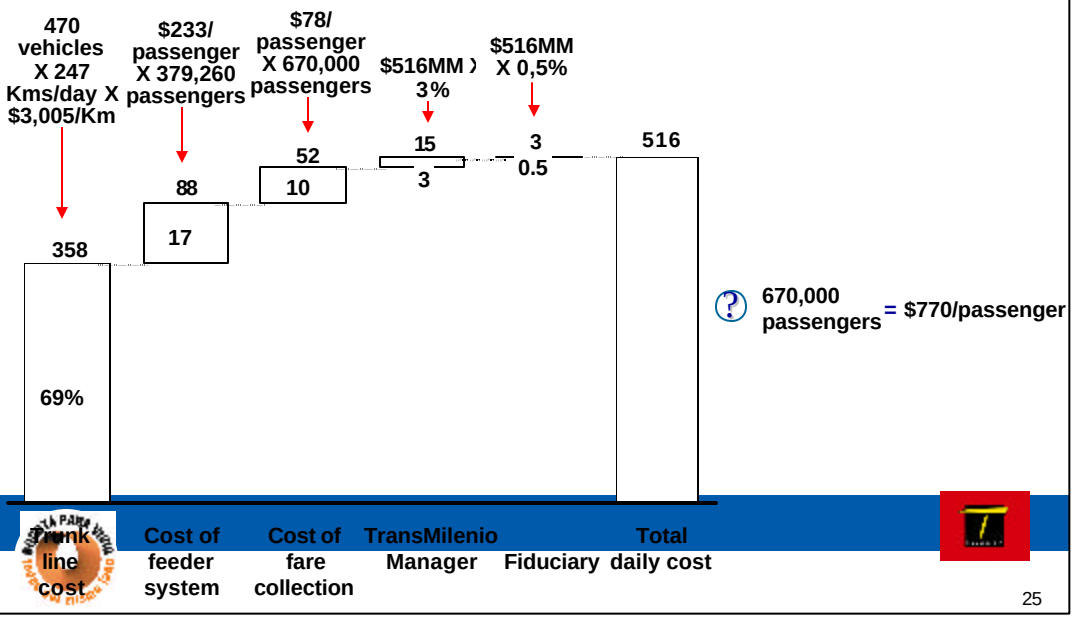
The estimation of the **technical fare,** which reflects the costs of operating the system plus a reasonable rate of return for the private operators, was done before the bid was open for the operators. In the tender documents, the operating companies were asked to offer the bus service at a price per bus kilometer. The four winning bids came within a certain range, and the final technical fare was established within this range through negotiation.

FOR TRANSMILENIO SHOULD BE 40 CENTS PER PASSENGER

Millions of pesos, July 2000 ($2,000 pesos ? 1 US dollar)

ILLUSTRATIVE

Daily operational costs (Phase I)



25

THIS IS THE FORMULA FOR THE CALCULATION OF THE INITIAL TECHNICAL FARE

$$T_{Technical} = \frac{\frac{120Veh \times 247Km/día}{590.000\ passengers} C_{OPER1} \times 0,0498 + \frac{100Veh \times 247Km/día}{590.000\ passengers} C_{OPER2} \times 0,0417 + \frac{90Veh \times 247Km/día}{590.000\ passengers} C_{OPER3} \times 0,0376 + \frac{160Veh \times 247Km/día}{590.000\ passengers} C_{OPER4} \times 0,0671 + 0,371\ C_{Feeder} + C_{Fare\ Collection}}{(1 - C_{FIDUCIA} - C_{GESTORA})}$$

37,1% de feeder passengers

Where:

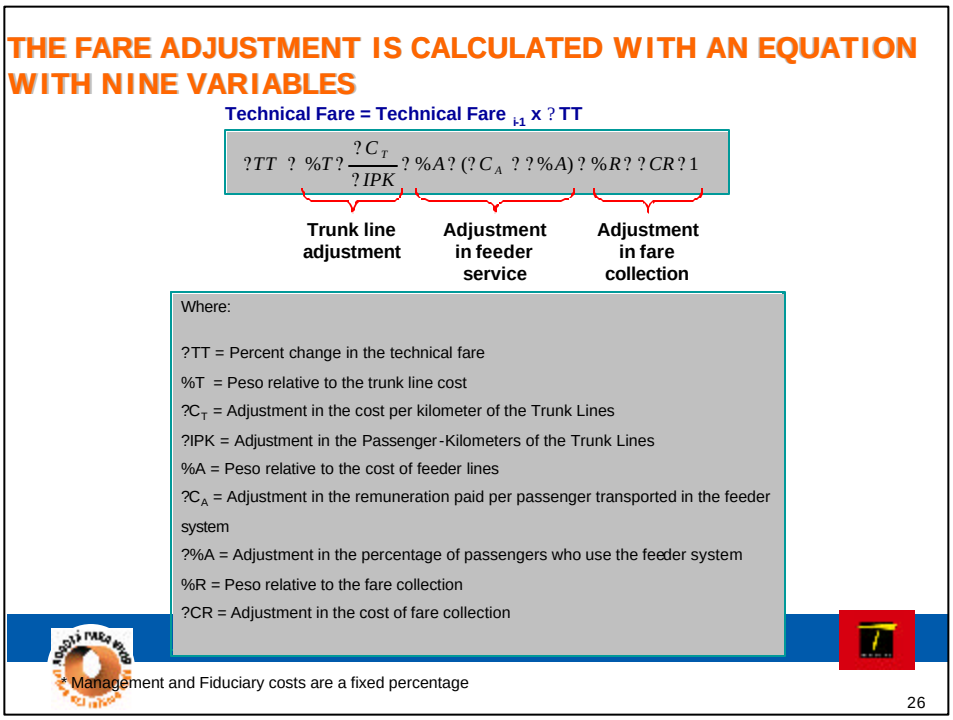
- C_{OPERn} = Adjusted cost per kilometer to operator n
- $C_{ALIMENTACIÓN}$ = Adjusted cost per passenger in the feeder system
- $C_{RECAUDO}$ = Adjusted cost of fare collection per paid passenger
- $C_{FIDUCIA}$ = Percent of the income corresponding to the Fiduciary (0.0387%)
- $C_{GESTORA}$ = Percent of the income corresponding to the Manager (3%)

25

Because this final technical fare was established in part based on independent cost and revenue projections by experts, and then adjusted based on negotiations with the contracting parties, the transaction costs of further adjusting this fare are extremely high, as the whole negotiation process has to be gone through again. The formula for the calculation of the technical fare itself has only been changed once since the system opened in 2000.

The formula for the division of the technical fare revenue between the operating companies was based on system characteristics specific to Bogota, and hence should not be simply adopted by other systems. In Bogota in Phase I a maximum of 65.5% of the revenues went to trunk line operators, 20% went to contracts to feeder service operators, 11% went to contracts to the fare collection and station management company, 3% went to TransMilenio's operating budget, and 0.5% went to the trust fund administrator.

While the formula for determining the technical fare has only changed once (to increase TransMilenio's share from 3% to 4% due to higher than expected profitability), the technical fare itself is adjusted periodically based on contractually agreed upon factors such as the price of gasoline and inflation. This has led to the increase in the bus fare from Pesos 900 to P1100 since TransMilenio opened.



Finally, the final fare faced by TransMilenio customers is .5% higher than the technical fare. Thus, the first 0.5% of the farebox revenue goes into a Contingency Fund. The Contingency Fund is intended to compensate the private companies if there is a substantial change in their operating costs due to changes in oil prices, currency fluctuations, or a sudden drop in demand due to an act of terrorism. After the deductions for the contingency fund are made, the rest of the farebox revenue collected by the ticketing company goes into the TransMilenio's Trust Fund and is divided following the formula above.

Because the payment per kilometer for the trunk line operators and per passenger for the feeder line companies (now modified as below), operating companies are more or less fixed, the main way that operating companies can increase their profits is to reduce their operating costs, which they have been doing through various means. One method has been through further outsourcing, with sub-contracts for fueling, cleaning, maintenance. Hence, the operating companies have a strong incentive to provide efficient service. Trunk and feeder lines contract out the hiring of bus drivers to outside companies. The drivers hired have to follow standard driver's contract for that company, though salaries can be different between the operating companies. The operators also successfully negotiated very tight service contracts with the bus manufacturers to provide on-site ongoing maintenance.

When TransMilenio calculated the technical fare, some one year before the system opened, it was $0.40. At that time, bus fares in Bogota were only $0.30. One year before TransMilenio opened, Bogota approved of an increase in the normal bus fare from $0.30 to $0.40 for private buses operating in Bogota. Naturally private operators supported this. There was considerable public outcry against this, but the outcry was against the private bus operators, and not so much against the city.

By the time TransMilenio opened a year later, at a fare price of $0.40, people had become accustomed to the new price and few people directly attributed the earlier fare price increase to the TransMilenio planning process.

While independent private bus operators continued to operate in large numbers on parallel routes, hence competing for some of TransMilenio's passengers, because the price of TransMilenio was at par with the private fare but the TransMilenio trip was much faster and of higher quality, these private independent operators quickly lost passengers on the parallel routes as well and cut back services.

TransMilenio's contracts with the operating companies were written in such a way that the demand risk (the risk that ridership would be lower than anticipated) was reasonably evenly divided between the city and the operating companies. In this way, the operating companies had a vested interest in maintaining a good quality of service and promoting the system, in order to retain ridership.

This initially made it difficult for the private operating companies to obtain loans from banks for the procurement of the buses. The professional demand analysis done by SDG and its subcontractors was a help, as was the contract giving them exclusive operating rights in the corridor for 10 years, but it was insufficient to convince the banks to provide loans. Nevertheless, these were newly formed corporate entities with no formal credit history, and despite the personal appeals of the Mayor, the Colombian banks refused to finance their bus procurement. Ultimately, the ***loans were procured from the Brazilian export credit agency, as the buses being procured were initially assembled in Brazil***. As it turned out, all of the bus companies that were able to supply buses that were in compliance with the technical specification set by TransMilenio were assembled or manufactured in Brazil, in the end, the Brazilian export credit agency provided the loans, largely at the behest of Daimler Chrysler's Brazilian subsidiary. This Bank also required that the bus operating companies secure insurance on the rolling stock from local sources, which imposed an additional cost to the operator, but after many headaches, this was arranged.

In the subsequent phases, private operators have had no difficulties securing private bank loans for bus procurement, now that TransMilenio's profitability has been clearly demonstrated.

Unlike in most other systems, in TransMilenio neither the trunk line operators nor the feeder bus operators directly collect any fares. While in Curitiba they are now collected directly by the transit authority URBIS, in Bogota they are collected by a separate company. The fare collection company has a ten year concession. They paid for the smart cards and the investment in the ticketing system. The smart cards and turnstiles are amortized over the time of their concession and will later revert to TransMilenio. The revenues go into a trust fund controlled in the name of TransMilenio by another contractor, a financial service provider, who in turn invests the money and distributes it among the partners. The stations, meanwhile, are maintained by TransMilenio under contract to private companies.

The funds are collected by a private company not allied with any of the bus operating companies in order to ensure fareness between the various private operating companies. This private control also insulates the system somewhat from the political process. In the TransMilenio system, the profits cannot be diverted directly from the system to other public uses. The government is allowed to reduce the passenger fare below the technical fare, but in this case the government has to pay the operating companies compensation. In this way, TransMilenio is insulated from the threat of disinvestment from the system by politicians. The only part of the farebox revenue directly under the Mayor's control is that share that goes to TransMilenio, or now 4% of the total.

How TransMilenio's buses operate in the HCBS system differs substantially from other systems, and requires some explanation. The first phase constructed exclusive lanes and enclosed bus stations along two intersecting corridors, forming a large "T". One line ran from Avenida Caracas to Autopista Norte. The other corridor ran from the

mid-point of this line, Los Heroes, to Calle Ochenta. Bus lines along these corridors were not restricted to one line or the other, but lines connected each of the terminals to each other. There were also express lines that skipped less-used stations, and local lines that make all the stops.

Unlike in Curitiba and Quito, where separate corridors are concessioned out to different operators, in TransMilenio three contracts were awarded to different private operating companies, Si 99, Ciudad Movil, Express Del Futuro, and Metrobus SA. These contracts obligate the companies to operate a certain fixed number of buses in the corridors, but ***the routes on which these buses operate are not all concentrated on a single corridor. Rather, they are divided roughly equally between the different bus lines.***

Each week, TransMilenio decides how many kilometers need to be operated to meet expected demand, and the private operators decide among themselves who is going to operate them each week. They then inform TransMilenio who is going to operate each route, and TransMilenio gives final approval. At first, TransMilenio directly assigned the buses to meet the daily scheduled service needs. Then according to the number of kilometers needed they divided the kilometers up according to each company's fleet size. The fleets are not all the same size. The bus operators, among themselves, try to organize it in a fair way among themselves so that each bus gets roughly the same number of kilometers. Victor Raul Martinez, Director of Si 99, the largest operator, plays a key role in coordinating.

Even though the bus operators are paid by the passenger kilometer, they ultimately bear some of the demand risk, because if the demand is lower than projected, TransMilenio has the right to reduce the total number of bus kilometers servicing the system. However, this risk is mitigated by two factors. First, because routes are diversified within the system, no one company suffers the demand risk for any particular part of the system but they all experience the risk collectively. Secondly, while the operating companies might lose money each year if demand is lower than anticipated by having their kilometers cut, the contract allows for them to extend the period of the concession. The concession contract lasts for 10 years or until the average kilometers per bus reaches 850,000, whichever comes first. However, if after ten years the average is not achieved, the concession is extended until it reaches that average, but no individual bus can have more than 1 million km, nor can bus operators extend the contract by simply buying new buses to bring down the fleet kilometer average. However, the concession cannot be extended more than 15 years. So, the possibility of extending the concession allows the investor to eventually recoup their bus investment in the case of lower than estimated demand, although they would recoup it over a longer period of time. In practice this has not been a problem, as demand has actually been in excess of what was anticipated.

There are several advantages of contracting out operations in this manner rather than by giving private operators concessions for specific routes or regions or corridors. First, it allows TransMilenio to penalize some operators and reward others by increasing

or decreasing their scheduled trips, based on contractually agreed upon principles of quality contracting, as is discussed in the next section. Secondly, it diversifies the demand risk throughout the system. On all transit systems, some lines are more lucrative than others. Allocation of the most lucrative routes is always a contentious issue, and a source of instability and possibly corruption in a flat-rate fare system. One method of allocation is to give lower subsidies or charge higher fees for operators with rights to operate the more lucrative routes. However, once the government has decided to remove the use of any subsidies, only an adjustment of fees would be possible.

TransMilenio's feeder bus contracts are structured differently. Passengers do not pay anything to ride the feeder buses in Bogota, they only pay once they reach the TransMilenio station. While this created a free rider problem of people riding the feeder buses for free for destinations along the feeder routes, this is partially enforceable by the drivers.

The feeder bus contracts in phase one were only for four years. For the first phase, they are paid per passenger that arrives at the TransMilenio station. As such, they are more directly exposed to demand risk than the trunk line operators. TransMilenio once again estimated the demand for each feeder zone using their traffic model, then estimated the type and number of buses that they needed to service this level of demand. Finally, they estimated the fixed cost and variable operating costs. These were divided by the estimated demand to derive a cost per passenger. They then drafted the tender documents which indicated a range of estimated per passenger costs. The feeder operators in turn then had to offer the service at a price per passenger within that range, and whoever provided the lowest bids won the contract. Unlike with the trunk lines where the bid price per kilometer was further negotiated, in the case of the feeder lines, the bid price per passenger was actually paid by TransMilenio. In the new contracts under phase ii, TransMilenio is shifting to a system that combines a payment per kilometer and per passenger, slightly reducing their exposure to demand risk, and extending the concession period to ten years, but the bidding process works more or less the same by offering a range in the tender documents.

Feeder bus operators were also required to meet minimum technical standards for their feeder buses, and they were also required to modernize their bus fleet and procure new or refurbished buses, but the technical specifications were far less stringent than for the trunk lines, as the lines were less profitable and the concession agreements of shorter duration.

In the end, therefore, Bogota was able to secure private investment into TransMilenio's buses and ticketing systems without giving a monopoly operating concession to a single operator. This allowed them to retain much more public regulatory control over the system than has been achieved in other systems. It also ensured competition between the bus manufacturers. Not only did the Bogota bus operators have long experience in negotiating bus procurement contracts, and knew how much such buses should cost, they also had a very strong financial incentive to minimize the cost as it would directly affect their profits and their ability to win the competitive bid. The

private bus consortiums negotiated fiercely, playing Volvo against Daimler Chrysler. Most analysts believe the price for bus procurement was at least 20% less than it would have been if the city had negotiated the contract.

Despite positive demand projections, it is ultimately unlikely that the private bus operators would have been willing to risk their investment capital in the new buses were it not for the fact that the Municipality made it clear to them that the choice they faced was either to invest in the new system or lose their old, very lucrative routes. This decision on the part of the municipality took considerable political courage and support from the highest levels of government.

IV.6. Recommendations for Contracting of Delhi HCBS Operations

Currently, the tentative plans for Delhi's HCBS system are to have the Delhi Government procure 10 modern low floor buses, with the fleet gradually expanding to 200 or more. Currently, only one of these 'modern' buses is operational. These buses will operate on the HCBS corridor, but they will not be operating only on the HCBS corridor, nor will they be the only buses on the HCBS corridor. Many of the existing buses with both DTC and private operators will continue to operate in the new HCBS corridors. As such, the identification of the public between the modern buses and the modern busway remains tenuous.

A key element of HCBS systems in other countries is that they have their own clear marketing identity that, by offering a higher quality of service, receives the same sort of popular approval that metro systems enjoy, despite much lower costs. In the case of Delhi, because there is no clear link in the public's mind between the modern buses and the modern busway infrastructure, some of this public relations benefit will be lost.

By having the Delhi government directly procure the buses from the bus manufacturer, and having DTC operate the buses, the entire cost of the bus procurement will fall on the Delhi taxpayers. Furthermore, as DTC operates at a loss, the operating loses of these buses will also be picked up by the general taxpayers. While the bus operator's costs should fall in all the HCBS corridors where the lanes bypass congested areas, this will not manifest itself at the beginning, because there is not much congestion in the first 6.2 km section being constructed. Currently, only one bus manufacturer has been identified able to manufacture the bus matching the technical specification developed. As a result of public procurement and lack of competition, bus prices procured are likely to be higher than would otherwise have been the case, and the burden will be born entirely by the Delhi taxpayers. Furthermore, bus maintenance is likely to suffer.

By allowing old buses to operate in the HCBS corridor, there is also an elevated risk of vehicle breakdown. If a vehicle breaks down in an exclusive bus lane, the difficulties are much more pronounced than if a bus breaks down in a mixed vehicle lane, as the single lane busway will congest until the bus can be removed. The separators should therefore probably not be designed so that they are impossible for buses to escape

from without damage, and the separators should also have periodic breaks in them so that buses can be diverted into the mixed traffic lanes in an emergency. While having the bus behind push a broken down bus out of the way has been suggested, operators may be reluctant to do this for fear of damaging the buses. As such, it normally requires having tow trucks on call, particularly near congested areas. To minimize this problem, it is normally best to concentrate the procurement of the new buses onto the HCBS corridor until all of the buses serving that corridor are modern buses, and the buses should be a mature, robust technology rather than one as yet untested.

Because the city is offering a modern bus, and an exclusive busway, it should be able to negotiate better terms in contracts with private operators than it normally gets with private contractors. Private operations should be more profitable than on normal routes once the system is expanded and passes through congested areas, so no public operating subsidy should be necessary. On more lucrative routes, a competitive bid should be held for the operating license that demands that the bus operators pay for the bus or part of the bus, and/or as a minimum to meet many quality of service requirements. These indicators will be discussed at length in the following section.

Should the Delhi government decide to also explore changing the routing system, ***it should be possible even in an open bus system to create HCBS routes so profitable that the entire cost of bus procurement would be placed on the shoulders of the private operator.*** The technical specifications of the bus could be at a similar level to the vehicle that has currently been specified or higher.

We recommend that, ***once the demand estimates for the future corridors have been completed, that a financial analysis be performed which assesses the degree to which HCBS lines can be contracted out to the private sector, and bus procurement and maintenance can be placed on the contractor***.

V. HCBS AND QUALITY OF SERVICE CONTRACTING: LESSONS FROM BOGOTA

In many countries, HCBS was a useful mechanism for introducing quality controls into licensing agreements. In completely deregulated transit markets, regulators have no control over many aspects of bus service that are critical to customer satisfaction. These include:

a. predictable scheduling
b. predictable routes
c. accessible bus route information
d. comfortable and safe vehicles
e. vehicle maintenance
f. safe driver behavior

By introducing competition between private operators, TransMilenio was able not only to demand that the private operators invest in the system, but also insisted on meeting other social goals as part of the points system for winning the operating contract. Furthermore, because firms compete for service within the same corridor, TransMilenio retained the power to penalize companies for poor quality service without disrupting service in a particular corridor by simply awarding more of the scheduled bus trips to rival companies.

V.1. Leveraging Social Objectives Through a Competitive Bidding Process

The competitive bidding process used by TransMilenio to select bus operators was a significant innovation that to date has not used in other HCBS systems. Bogota's TransMilenio system used the competitive bidding process not only to minimize the amount of money TransMilenio had to pay the bus operators per kilometer, but also to force the bus sector to modernize, to encourage wider bus company ownership among drivers, and to promote other reforms. At the same time, the points system used also ensured that at least some of the existing operators in the corridor would profit substantially from TransMilenio contracts. The full points system used by TransMilenio when evaluating the bids in the most recent round of competitive bidding is listed on the next page.

The private bus operators, at the beginning of TransMilenio, were not yet formal bus companies. They were consortiums of small, informal sector private operators controlled by a few powerful families. By writing the eligibility criteria for bidding on TransMilenio operating contracts in such a way that required bidders to have a certain minimum working capital, and to be incorporated as formal sector businesses, forced consolidation of many small informal companies into a few formal sector companies.

The bidding also awarded additional points to firms that included an international bus operator as a partner, but also gave points to firms that have experience operating

TRANSMILENIO POINTS SYSTEM FOR EVALUATION OF COMPETITIVE BIDS FOR TRUNK LINE OPERATORS.

FACTOR	DESCRIPTION	ELEGIBILITY	POINTS	
			MIN*	MAX
Legal Capacity***	Hold the appropriate credentials to submit a proposal	x	-	-
Economic Capacity (1)***	Minimum amount of Net Owner's Equity to submit a proposal	x	-	-
Experience in operation (2) **Maximum Points 450**	Passenger Public Transport Fleet in operation.		30	150
	Specific experience on the corridors (Américas – Calle 13 – NQS – Suba)		50	250
	International experience on mass transport services		-	50
Economic Proposal **Maximum Points 350**	Offered price per kilometer to operate the system		-	350**
Proposal to the City **Maximum Points 100**	Right of exploitation of the concession	x	-	-
	Valuation of the share of TRANSMILENIO S.A. in the revenue of the concessionaire		21	50
	Valuation for the number of buses to be scraped by the concessionaire.		14	50
Composition of the bidder company's structure **Maximum Points 200**	Share of bus company's stock held by former small bus owners.		32	200
Environmental Performance **Maximum Points 200**	Level of emissions, noise and disposal plan for the remainders of the operation		-	200
Fleet offered	Size of the fleet	X	-	-
Maximum Points 50	Manufacture origin of the fleet		-	50
TOTAL		1350 points		

* If the proposal is below the minimum, it will be qualified as NO ELIGIBLE
** If the proposal does not meet the range established in the proposal, it will be qualified as NO ELIGIBLE
*** If the proposal meets all the requirements, it will be qualified as ELIGIBLE

(1) ECONOMIC CAPACITY

The company should prove that, as function of the company's owner's equity, is capable to engage the initial investment based on the maximum number of buses that is offering to the system. (There is a pro forma that needs to be filled out)

The minimum owner's equity is defined by the formula:

$$Pnm = Nmv \times US\$200{,}000 \times 15\%$$

Pnm = Minimum Owner's Equity to be accepted
Nmv = Maximum number of buses offered to the system

(2) EXPERIENCE IN OPERATION

The bidder should prove to have experience in the operation of public transport of passengers. The experience can be in Bogota, the metropolitan area or in other Colombian cities using vehicle of more than 10 passengers. (There is a pro forma that needs to be filled out)

To account the number of vehicles of each owner and certify that the amount is equal or less than two, the following formula will be used:

$$Ownership(j) = \sum_i \frac{Vehicle(ij)}{N(ij)}$$

buses in the specific corridors. In this way, the bidding process encouraged the creation of joint ventures between the existing bus operators in the corridor and modern international bus companies with more management experience.

By giving a large number of points based on the price at which the private operator offers to provide the service in the corridor, and based on the share of total revenue collected that the bidder offered to turn over to TransMilenio, Bogota was able to bid down the cost of the operating contracts.

By giving points to the bus operators for each old bus that the bus operator agreed to destroy, the bidding process removed a large number of very old, polluting buses from the streets of Bogota.

In the most recent round of bidding, another factor considered was the number of shares in the bus company that are owned by former small bus owners (those owning only one or two buses). The higher the number of shares owned by small bus owners, the more points they received in the evaluation of the bid.

The bidding process also rewarded those bus operators who offered to provide buses with emissions levels below the minimum emission standard set in the bus

technical specification. Finally, additional points were awarded to those bus operators who procured buses locally assembled.

Mayor Penalosa was also very clear from the beginning that any private operators who opposed the TransMilenio project would be considered ineligible to bid for the lucrative operating contracts. This also helped to undermine political opposition to the project from existing private bus operators.

V.2. HCBS and Quality of Service Contracting

TransMilenio was able to use competition between private bus operators not only during the initial contracting period but also on an ongoing operational basis to ensure high quality service delivery. TRANSMILENIO S.A.'s contracts with the private bus operators gives TransMilenio the power to verify the accomplishment of all obligations, responsibilities and requirements listed in the contract, and gives them the power to fine the operators who don't comply with their contract obligations. The fines can be as high as 10% of the operator's total income in any given month.

Because TransMilenio pays by the kilometer and each week sets the schedule, the way the fines are imposed on the operators is by cutting back on the number of kilometers that a particular bus company is assigned in the weekly schedule. It is this quality contracting that assures the excellent maintenance of the TransMilenio vehicle fleet, which in turn has dramatically reduced the number of vehicle breakdowns in the system.

Types of Fines:

- Vehicle deficiencies, the fine is a function of the revenue per kilometer
    - ?? 50 kilometers for altering the vehicle in its interior or exterior, non-authorized advertisements, stereos, driver's cellular or walkman use, lights that don't work, unclean bus or seats in a bad shape.
    - ?? 100 kilometers for doors that don't work properly and worn tires.
    - ?? 250 kilometers for altering or damaging the GPS and radio communication system.

For customer service deficiencies, the fine is equivalent to a 20-day minimum wage.
For operations deficiencies, the fine is a function of the revenue per kilometer

- ?? 25 kilometers for stopping the bus at different stations than the assigned ones or for stopping for a longer period or not stopping at an assigned station. For blocking an intersection
- ?? 60 kilometers for parking the bus in an unauthorized place or change the route without authorization. For delaying the operation for no reason or for over passing another bus with the same route
- ?? 175 kilometers for operating in non-authorized hours
- ?? 250 kilometers for picking up or leaving passengers in places different from the stations. For riding the buses on streets different from the trunk

lines without TransMilenio's authorization, for drivers abandoning the bus for no reason

To assess compliance, performance indicators were developed that are a function of the best operator:

- Difference of < 20% with the best operator, fine = to 0
- Difference of > 20% < 25%, fine = to 30 kilometers for bus
- Difference of > 25% < 30%, fine = to 75 kilometers for bus
- Difference of > 30%, fine = to 120 kilometers for bus

TransMilenio, through its designated inspector, is in charge of the control and revision of the system operation with periodic or random visits.

TransMilenio can also directly fine the drivers for poor driver performance, such as speeding on the roadway or disobeying traffic signals. Speeds are monitored by the global positioning system (GPS) and are constantly monitored from a control center both to capture violators and to detect broken down vehicles for the dispatch of tow trucks.

For administrative and institutional deficiencies, the fine is a function of the revenue per kilometer, as follows:

- 50 kilometers for failing to send the reports required by TransMilenio and for opposing to receive inspectors from TransMilenio, hiding information or providing wrong information
- 100 kilometers for wrong practices in administrative and accounting procedures and abusing of the dominant position

There are also fines for environmental violations. For this type of violation, the fine is a function of the revenue per kilometer:

- 25 kilometers for running leaking fuel or oil
- 50 kilometers for noise and air pollutants above the levels stipulated in the public bid. For mishandling hazardous material and for not following the maintenance, reparation and revision schedules

Below is a list of fines the companies incur if their drivers break the following rules. Drivers face temporary suspension, and operating companies face fines of cutbacks on scheduled kilometers, as the table below indicates.

DRIVER'S ACTION	SUSPENSION	FINE (NO. OF KMS)
No driver's license and bus registration paper	Suspension on the next day	100
No first aid	One day suspension	100
Deny giving information	One day suspension	100
Crash between TransMilenio buses		100
Red light	Immediate suspension	
Putting the bus in reverse in the trunk lines	One day suspension	50
Carry any guns	Immediate suspension	100
Disobey the Police	One day suspension	200
Come to work drunk	Immediate suspension	200
Causing an accident for an irresponsible action	One day suspension	200
Wrong approaching to the platforms	Three in one day gives one day of suspension	50
Speeding	One day suspension	100
Invasion of the pedestrian crossing space		100
Have company in the bus	One day suspension	50
Run out of fuel		100
Mechanical problems that cannot be solved in less than 1 hour		50
Verbal or physical aggression to passengers	Immediate suspension	100
Charge the fare inside the bus	Immediate suspension	200
Disobey the Central Control instructions or traffic authorities	Immediate suspension	100

For security deficiencies, the fine is a function of the revenue per kilometer, 100 kilometers for each day of not complying with contract.

Other Fines for not following the terms of the contract have a fine equivalent to a 50-day minimum wage per month.

Fines can also be deducted from the operator's revenue. The revenues from fines becomes TransMilenio's income, and 90% is deposited in a Fines and Benefits Fund.

There is some recourse for private operators if they feel that fines are being imposed arbitrarily or unfairly. At weekly meetings, Transmilenio and the private operators meet to discuss technical issues such as operation and fines. If the operators and TransMilenio, during these discussions, judge that the fines were unfair, Transmilenio sends a message to the Coordinadora's Fund to discount the value of the fines from their payments.

In summary, by giving the bus operators only the right to operate a part of total scheduled bus service, and allowing them to lose money for violating quality service guarantees by adjusting the schedule, TransMilenio's contractual arrangements allow for much more continual monitoring and enforcement of customer service than is possible in the case where bus operators have monopolistic control over an entire territory or line for an extended period of time. TransMilenio, by creating the conditions for very profitable bus operations, at the same time is able to demand a very high standard of public service. If a private operator fails to meet this standard, their share of this lucrative market is immediately adjusted downwards. It is in this contracting arrangement that TransMilenio differs substantially from the other HCBS systems in Latin America.

V.3. Quality Service Contracting Recommendations for Delhi's HCBS

In Delhi, while most routes are predictable, bus stops are not always predictable, and private bus operators no longer follow a fixed schedule. Unless the passenger is already familiar with the bus they need to take, there is rarely any passenger information available at the bus stop, there is rarely a timetable, and often no route information. By international standards, Delhi's private bus fleet is uncomfortable, polluting, and of poor cleanliness. Passenger security is reasonable by international standards, but some customers have complained of problems. Bus inspection and maintenance is limited. Drivers frequently do not come to a full stop at bus stops, and compete with other operators for passengers, creating unsafe pedestrian conditions along the roadside.

Currently, the Delhi government is working on developing a more rigidly enforced schedule for the private buses, and the DTC has constructed some model new bus stations that have good information about the buses that stop there, and incorporate vendors into the design.

To some extent the physical designs of the HCBS being developed by the Delhi Government will of themselves address some of the key problems. For example, the location of the busway in the middle of the road with boarding platforms will force the buses to stop in a specific bus stop. This physical design will end to some extent the dangerous 'competition for the cent' that endangers pedestrians waiting for the vehicles.

Though the details have not yet been worked out, the stations should contain good maps with up to date bus route information and bus schedules.

The procurement of new buses by the Delhi government should also improve the quality of service, though ensuring their proper maintenance is very much open to question if the buses are operated by DTC.

Delhi's HCBS system, by hopefully giving bus operators congestion-free conditions in which to operate, will eventually increase the profitability of bus operations in those corridors. Unless the bus routes are rationalized the level of profitability will not

be as high as in Latin American systems, but where the routes pass through congested parts of Delhi, the reduction in operating costs should still be substantial. As such, the ***Delhi Government should take advantage of these more profitable operating conditions to require a higher level of customer service from private bus operators.***

We therefore recommend that bus lines in the HCBS corridors be contracted out to private operators through a process of competitive bidding. The criteria for awarding the contracts should include not only experience with bus operations in Delhi, but also should be used to push private operators to consolidate, formalize and professionalize their businesses.

Secondly, long term monopoly concession contracts should be avoided, and shorter term, competitive operating contracts which allow for a system of rewards and fines for good or poor service should be instituted. The Delhi government should consider contracting private operators in such a way that if schedules, maintenance, cleanliness, safety or other problems arise, the contract allows a system of rewards and punishments to be implemented immediately in a transparent manner. Simple fines are one possibility. Allowing the fare to be slightly adjusted upward is a possible reward. Turning over bus routes to companies doing a better job is yet another. An appropriate system of rewards and punishments for bus companies in the HCBS corridor will need to be negotiated that is appropriate to the conditions in Delhi.

VI. FACILITATING INTEGRATED TICKETING SYSTEMS BETWEEN TRANSIT MODES

The critical problem that needs to be overcome when shifting any public transit service from a normal point to point system to a hub and spoke or trunk and feeder system is the issue of passenger transfer between the feeders and the trunk lines. In systems that have multiple public transit modes, such as existing commuter rail, metro and other systems, integration between modes also becomes very important. This problem is both one of physical transfer as well as the increased costs that passengers face by transferring in the absence of an integrated ticketing system.

Because Delhi's HCBS is not currently being designed as a 'trunk and feeder' system, there will not be any major difficulties of ensuring passenger demand and facilitating transfers within the HCBS system itself. However, there is a serious issue about how to get the demand up on the existing Delhi metro system, and whether, once the HCBS is introduced, it will form part of an integrated public transit system or of separate and even parallel systems. When the new IBRT is also introduced, the same issues of integration with this system will need to be addressed as well.

The level of demand on any trunk and feeder system is partially a function of the size of the network that is served by a single integrated system using a single, integrated ticket. Passengers avoid transfers between modes not only because they have to pay twice but also because it is often time consuming, difficult, and unpleasant.

There are only three ways of dealing with this problem:

a. physically integrated systems under separate corporate managements at enclosed free transfer stations.
b. integration of the two systems under a single corporate management, which allows the use of simple transfer ticketing systems.
c. Smart-cards

Sao Paulo provides an example of a physically integrated Metro and HCBS system. At the terminus of the Sao Paulo metro and the state HCBS corridor, there is a physically closed station that allows for free transfer. [see photo on page 22]

The metro, as in most countries, is operated by a public authority, in this case under the State government. The HCBS is operated by private buses with concession contracts from another state agency, EMTU. The private operators agree to this free transfer because EMTU forced them to, and their ability to operate in the route is regulated by EMTU. They do not complain too much because while the bus operators make more money in the morning and the metro makes more money in the evening, in the end both make more money as a result of the free transfers. In cities where buses are weakly regulated and operated by private individuals rather than modern bus companies, however, problems arise that no drivers are willing to take the less lucrative afternoon shifts. This is precisely the problem in Leon, Mexico right now.

Most of the 'closed' HCBS systems are an example of free transfer facilitated by integration of the services under a single corporate management. In Curitiba, Quito, and Bogota, free transfer from feeder buses to trunk lines is made possible by physical integration (the bus terminal is built to allow smooth transfer for passengers) and by route regulation controlled by a single corporate entity: TransMilenio, in the case of Bogota, Urbis in the case of Curitiba, and the electric trolleybus company in the case of Quito.

Even in these cities, the HCBS is poorly integrated with private bus and collectivo operators, and competition between these two systems is fierce. Private bus operators and often minibus operators in Bogota refuse to stop at the TransMilenio stations precisely because they do not want to lose the more profitable long-haul routes. For this reason, the ***feeder bus system often do not emerge naturally as a private sector venture, and demand on the trunk lines can only be assured by direct contracting of feeder buses*** and by regulatory controls against private bus operators on the HCBS corridors.

In many developed country mass transit systems, free or discount transfer between buses and subways has long been standard procedure. This is facilitated generally by the fact that in developed countries most bus and metro systems are operated by a single public authority. While many of these systems are moving to smart cards, simple paper transfer tickets are usually also sufficient to provide discount or free transfer between subway and bus when both systems are under the same corporate management.

The biggest problems of system and ticketing integration tend to emerge in cities where buses, metro, and commuter rail system are operated by different corporate entities, whether public or private. Inability to coordinate between public authorities at the state or provincial level with those controlled by the municipality are also typical. Sao Paulo's metro, for example, is controlled by the State Government which is under a different political party than the municipality which runs the municipal bus system. Even coordination of Sao Paulo's metro and light rail system, both public authorities under the state government, has proven difficult.

The third mechanism for resolving the integration issue is smart cards. Smart cards are now being used in many cities in much the same way in which a credit card is used, allowing for passengers to use a single card to pay different institutions. However, this does not in and of itself resolve the issue of how revenues are divided between and among competing public authorities and private entities, or how discounts for transfer will be offered.

In the case of Delhi, demand on the metro has suffered considerably because the bus routes have not yet been changed to re-orient passengers onto the metro. Delhi metro stations were not designed for free transfer with bus operators, although there are usually bus stops in reasonable proximity to the stations.

Rerouting public bus lines under DTC should be possible, but rerouting the private bus lines that serve the same corridor is going to be more problematic, as their

licenses were recently re-issued during the complications surrounding the CNG conversion.

Because the Delhi metro corporation is operated by a special purpose company (SPC) under both the national and the municipal governments, it is unclear how willing the municipality will be to compromise the profits of DTC in order to ensure reasonable demand levels on the Delhi Metro.

Currently, there is no discussion of physical integration of Delhi's HCBS and its metro system and its IBRT system, though integration per se is finally being discussed. The systems are being planned independently. Thus, the possibility of having a free transfer to HCBS, and having the metro, IBRT, and HCBS forming parts of a single integrated mass transit network, has already been foreclosed on those parts of the metro where detailed engineering has already been completed.

What is currently being discussed in Delhi is a smart card system. While thus far smart cards are only being considered for use between the metro and the IBRT, there is no reason why smart cards could not be used at least to integrate with HCBS and for that matter standard DTC buses. Integration with private bus operators is likely to be much more difficult as these buses are not modern corporate entities. Furthermore, smartcards require substantial up-front investment, both for the card readers, the cards themselves, and the machinery that makes the cards. As such, introduction of smart cards onto private buses in Delhi is going to require debate about who pays for the introduction of this technology.

Finally, the smart-card itself does not resolve the issue of how revenues are divided. Obviously, the simple solution is to make passengers pay twice. However, if passengers are allowed to pay only once on a normal bus for the same trip, ridership on both the metro and the HCBS will be depressed. If they are not allowed to bypass this system, the daily travel costs of many poor people will double, with extremely negative social consequences. The issue of how revenues might be divided between the HCBS and the metro cannot really be addressed until the legal structure for HCBS bus operators is resolved.

VII. HCBS AND MODERNIZING BUS FLEETS AND BUS MANUFACTURING

VII.1. How HCBS Encourated But Didn't Force Investment into Domestic Bus Manufacturing

In many Latin American countries, HCBS has been used to leverage international investment into local bus assembly. Curitiba's HCBS system played a key role in turning Brazil into a globally competitive bus manufacturer. Around the world, many public bus companies have long term relationships with specific bus suppliers. In Francophone Africa, for example, many of the public bus companies that arose in the 1970s were from their inception joint ventures with Renault, and naturally the vehicles used were made by Renault. Renault did not invest in these systems because bus operations were inherently profitable. Rather, they invested in them because control over the bus technology procurement decision ensured long term lucrative parts supply contracts for the parent company. As a result, bus operators in Francophone Africa found their operating costs significantly elevated by monopolitistic bus and spare part procurement.

In many other parts of the world, public bus authorities were strongly encouraged to buy their buses from domestic bus assemblers or manufacturers in order to drive domestic bus assembly businesses. In Hungary, for example, many municipalities were put under great pressure to procure their buses from Ikarus even when used buses from Europe were of better quality.

Ultimately, therefore, it would be unwise to tie the hands of HCBS operators too closely to a specific bus manufacturer. A bus technology, once selected, locks the operator into a long term relationship with that supplier that can often have very negateive impacts on ongoing operating costs. Undermining the manufacturer's monopolistic control over bus procurement is critical to keeping bus system operating costs low.

On the other hand, developing countries in particular have a legitimate public interest in promoting domestic industries where the benefits of the bus procurement can be recycled back into the community.

The HCBS systems in Latin America represent a fairly successful compromise between the need to insulate private bus operators from bus manufacturers, while nonetheless providing incentives to procure buses with a maximum of locally added value.

HCBS, by increasing the profitability of bus operations significantly, creates a very lucrative market for more expensive buses. Deteriorating transit services and the gradual loss of bus passengers that typifies cities without HCBS also leads to disinvestment in bus manufacturing. Bus manufacturers are not going to invest in more modern buses if the profit margin for buses is falling.

When Curitiba, Brazil, set up the world's first HCBS system in 1974, they needed special, high capacity buses that were not manufactured in Brazil. The first buses were thus imported from Europe. By 1977, however, Daimler began to make buses in Sao Paulo. Then, in 1979 Volvo also set up in Curitiba, Brazil, specifically to take advantage of the large captive market for high quality buses created in Curitiba by the HCBS system. Thus, by the late 1970s, Curitiba's HCBS had two Brazilian suppliers for the higher-end buses that the system used.

In this way, the Curitiba HCBS played a key role in bringing investment into Brazil's fledgeling bus manufacturing industry, an industry now largely dominated by Brazil.

The process was similar in Bogota. When TransMilenio set its technical specifications for the buses it needed, the only bus manufacturers that could make the appropriate buses were Brazilian. The buses manufactured in Colombia at that time were of poor quality and could not meet the necessary technical specifications. Thus, the HCBS project in Curitiba years before had given Brazilian bus manufacturers a critical competitive advantage in exporting its buses.

However, the competitive bidding process awarded additional points to companies that procured buses assembled in Colombia. Therefore, while the bus operators were not forced to procure buses domestically, they were encouraged to do so by the competitive bidding conditions. Eventually, because the bus market created by TransMilenio was so large, both Volvo and Daimler Chrysler, in cooperation with Marco Polo, set up bus manufacturing operations in Colombia. Once again, the HCBS project in Bogota induced investment into modern bus manufacturing inside the country.

In Indonesia, there was considerable controversy surrounding the bus procurement. The technical specifications were made by the Department of Transportation, which was also responsible for designing the stations, so the buses are designed in a way that works, though capacity is compromised by the decision to have only one platform level door. The Department of Transportation also oversaw the procurement process. No formal competitive bid took place, a point which was raised by many civic groups. An informal bidding process did occur, with two bus companies agreeing to provide prototype buses. One of the bus companies was the local affiliate of Isuzu, and the other a local affiliate of Daimler Chrysler. Some buses were procured from each of the two companies. The buses are now criticized for being over-powered and too heavy relative to the needs of the busway, and for being somewhat too expensive. Nevertheless, it did generate business for some Indonesian bus assemblers and help these companies develop and expand their business.

This experience yielded four valuable lessons. First, **it is a mistake for bus operators to be owned by bus manufacturers.** Secondly, ***the government should do what it can to avoid forcing bus operators from buying buses from monopoly suppliers or the price of bus procurement will increase dramatically and quality will suffer***.

Third, ***the more profitable operating conditions created by HCBS can be used to create a domestic market for better, more expensive buses.*** Finally, ***once this market is created, contract provisions can be used to encourage the stimulation of domestic manufacturing or at least assembly of higher quality buses, that eventually may be able to capture lucrative export markets.***

VII.2. HCBS and Bus Sector Modernization in India

For decades, two domestic bus manufacturers dominated the Indian bus industry: Ashok Leland and Tata Telco. The buses that they manufacture are extremely low cost by international standards, under US$30,000. However, the floor of the bus is extremely high, as the bus is built on top of a chassis originally designed for trucks rather than for mass passenger transport. The emissions of the diesel model were also very high by international standards, and the emissions of the CNG model are still not fully understood. As with many other technologies in India, modernization of bus technology was stalled for many years by monopolistic conditions in the manufacturing sector, in the operations sector, and various regulatory controls on the vehicle specifications for different cities.

Volvo has recently entered the Indian market, but so far they have been primarily selling luxury buses to small private intercity bus operators. There are several other smaller bus assemblers, such as Satlij Motors, who use a combination of imported Daimler products and local components.

One of the main aims of the HCBS project was to create a new category of bus for which a new technical specification could be created for commercial operation in Delhi. Dr. Mohan of IIT played a central role on this committee, among others. The bus manufacturers, after main years of being reluctant to modernize their bus types, have become more interested developing modern buses in the hopes of winning a share of the export market.

The technical committee preparing the procurement specifications for the HCBS had to provide a specification for the bus to run on CNG due to the Supreme Court decision. The other attributes that the committee focused on were ease and speed of access and price. For this reason, it was decided that at least 60% of the bus had to have a 'low floor.' There was a lot of resistance from some to the idea of low floor buses on the grounds that Delhi's roads have a lot of potholes and bumps, and the bus operators were worried that the buses would be damaged. The specifications were changed so that the floor height would be identical to the current CNG buses. The newly converted CNG buses have CNG canisters hanging down under the bus, and the clearance is 380 mm. So on the bus specs, the technical committee required 380mm of clearance, not as low as a typical low floor bus, but much lower than current buses.

As Delhi's HCBS system is an 'open' system, the buses had to be designed to operate both on and off the corridor. As the objectives of the project sponsors were to

modernize the bus fleets in Delhi both on and off the HCBS corridors, and as it is a big headache to get a new technical specification approved for operation in Delhi, it was decided that the bus would have doors on the left hand side only, like any normal city bus.

This decision about the buses design foreclosed certain options in the design of the bus stations. Internationally, where road space is constrained, center lane busways generally place the bus platform in the middle of the right of way. In this way, a single bus platform can be used for bus passengers in both directions. It also facilitates the transfer of passengers between lines. Because usually bus trips are peaked, this does not cause major capacity problems at the bus station stops. In 'closed' busways, where separate enclosed stations must be built, this also saves money as a single bus shelter can be constructed instead of two separate bus shelters.

While buses can be designed with doors on both sides for operation both on and off bus platforms, it adds to bus cost and compromises to some extent the strength of the bus.

As a result, Delhi's HCBS will have one or two left side bus platforms on each side of all the major intersections, rather than only on one side of the intersection. The result of this decision is to reduce somewhat the throughput of the intersections. Because the corridor selected has a very wide right of way and is not heavily congested, we do not foresee this being a major problem in the first part of this corridor. However, in the second part of this corridor, and in the other corridors where space may be more constrained, this may cause considerable unnecessary additional traffic congestion as a result of the project.

This decision about the bus specification also foreclosed the possibility of using high bus platforms, which are used in most of the 'closed' HCBS corridors. It is compatible, however, with the use of a low bus platform, as is being used on some of Sao Paulo's new HCBS corridors.

Because different bus configurations sometimes make more or less sense depending on the characteristics of the busway corridor and the type of lines using it, more flexibility in the technical specification process in Delhi would allow for greater experimentation. Buses that have large doors on both sides of the bus are used in Sao Paulo, to allow them to operate both on and off the bus corridor while still having a median bus platform. This would allow more flexibility in bus platform design at trouble spots where the right of way is more constrained.

When the Delhi Government issued the tender for the first 6 pilot HCBS buses, three manufacturers prepared prototypes, two of which were displayed at the Delhi trade fair. Tata's vehicle was a single low floor bus with the back of the bus elevated, as it sits over the engine. It is one of the first buses constructed with an integral frame structure and not built on a truck chassis. The low floor component of the bus is exactly 60% of the total bus floor area. Ashok Leland made a larger, articulated bus. This bus was

normal height in the front, and low floor in the trailer. As there is no engine in the trailer, this was easy to do. It was only 40% of the bus floor area, and was rejected on those grounds. The technical committee wanted to use the HCBS procurement to force the introduction of a more modern bus design, and the Ashok Leland bus was just a normal bus with a low trailer, though its capacity was actually higher than that of the Tata bus. Volvo was one of the manufacturers of the articulated buses used in Bogota's TransMilenio (Daimler/Marco Polo was the other). They offered a good quality HCBS bus for Rp.6 million. but they did not want to make a CNG bus. The Tata Telco bus was only Rp. 2.5 to 3 million. Thus, Tata Telco won the bid.

In Delhi, then, the HCBS project is being used to induce the domestic production and use of more modern buses in general, and the HCBS element is primarily a mechanism for creating a political justification for changing the approved vehicle specifications.

Ultimately, however, it would be better for the Delhi Government to get out of the bus procurement process. The planning body responsible for the HCBS system (discussed in the next section) should set the technical specification for the bus type, and the specification should fit the specific needs of the Delhi HCBS system, not the more general needs of modernizing the standard bus fleet. The reasons for this technical specification need to be made very clear to the public so that likely accusations that a technical specification is being used to favor one specific manufacturer over another can be deflected. Private operators inside the HCBS system should then be required to invest in any buses meeting this technical specification, not the government itself. The government should help to ensure that at least two or three bus manufacturers are willing to supply the bus required so that private bidders do not face monopoly conditions in the bus supply. Finally, the government can provide incentives in the HCBS operating contracts for the operating companies to procure buses manufactured in India.

VIII. INSTITUTIONAL STRUCTURES FOR THE PLANNING, MANAGEMENT AND OPERATION OF HCBS

Ultimately, the success or failure of a HCBS depends on the ability of the municipality to assemble a successful project team for planning, implementation, and ongoing management of the project. Currently, the Delhi HCBS project is being developed primarily by IIT Delhi's TRIPP, with the detailed engineering work being done by RITES, with ITDP, IDFC, and other groups providing technical and institutional support to IIT Delhi. IIT Delhi serves at the behest of the Transport Commissioner, but all the work is being done at IIT and RITES. The bus procurement and operation at this time will be operated by the DTC, though the contracting out of bus operations to private operators is being considered. Once the construction begins, it will be done by a private contractor, probably DSIDC.

Because the Delhi HCBS at this stage has focused primarily on the construction of central bus lanes and bus stations, without considering the possibilities of route rationalization, quality service contracting, contracting out of the operations to private operators, or leveraging private investment into the system, the system currently being planned, and the institutional structure currently managing the project, faces several significant risks:

a. The operation of existing, poorly maintained and poor quality buses on the new infrastructure will undermine any clear 'identity' for the HCBS, and hence the level of political support for the project.
b. The lack of a thorough demand analysis means that the system is being designed in the absense of critical information about how much capacity it needs.
c. The operation of these buses on a narrow, dedicated corridor increases the risk that bus failures will congest the corridor, thus leading to a frequent deterioration in average bus speeds rather than an improvement in bus service, while providing little or no benefit to motorists.
d. The lack of route rationalization will undermine the profitability of the system, making it impossible to attract private investment to the system, and increasing the fiscal burden on the state.
e. The management issues at DTC will also affect the HCBS.
f. The lack of good quality customer service by STA-contracted private buses will not be addressed.

Because the Delhi government has not centralized the necessary planning information in one location under its own authority, and much of the information being used to plan the system is treated as proprietary by the individual partners, different parts of the system are being planned based on different sets of information. As a result, the planning team faces a high degree of uncertainty regarding the system it is designing.

All HCBS projects around the world have faced similar challenges, and to varying degrees have overcome them. Before discussing the best options for Delhi in resolving these issues, we will briefly review the institutional structures for HCBS projects in other countries.

VIII. 1. TransMilenio's Institutional Structure

In Bogota, there are now two separate municipal government bodies responsible for the regulation and management of public transport. On the corridors not served by TransMilenio, the municipal Department of Transportation is still responsible for issuing route licenses to private bus associations, which in turn allocate the route licenses to their member organizations.

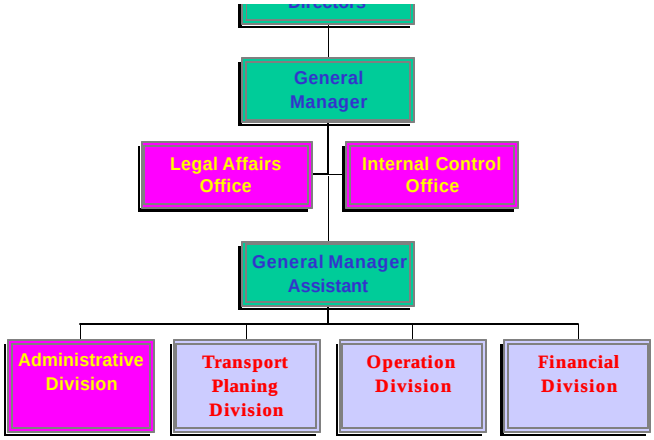
During the early planning phase of TransMilenio, TransMilenio did not exist as a legal entity. Rather, the project was managed out of a project management unit in the Mayor's office. The head of the project management unit reported directly to the Mayor. It had only four or five staff members at first. These four or five staff members included the former head of a planned metro project that was cancelled. Meanwhile, the Mayor contracted a management consulting firm (McKinsey) to actually manage the entire project in cooperation with the project management unit.

Some months after the project began, the municipality passed a law creating TransMilenio S.A. TRANSMILENIO S.A. was founded in October 13 of 1999, with 100 percent public funds, as a commercial society at the District level. TransMilenio S.A. is structured like a private company but it is 100% owned by the municipality, and hence de facto controlled by the Mayor. The Mayor serves as the Chairman of a five person Board of Directors. Also on the Board is the Director of the Urban Development Institute (which contracts construction like a Department of Public Works), the Director of the low income housing parastatal, Metrovivienda, the Director of the District Culture and Tourist Institute, and the Director of Fondatt, the transit and transport fund, which allocates the gasoline tax revenues. Later, an NGO (Fundacion Ciudad Humana) was also added to represent the concerns of bus passengers on the Board.

TransMilenio was structured like a private company in order to facilitate the possibility of eventually selling it to the private sector, but this is not currently being discussed. All of the staff of the project management unit were moved over to become the staff of TransMilenio.

Interestingly, the Department of Transportation is not on the board. This exclusion was not accidental. The reason for this was that the Department of Transportation was seen to be fairly corrupt, and its staff had a fairly low level of technical competence. The Mayor's office therefore had little confidence in their ability or interest in developing the project

According to its corporate charter, TRANSMILENIO S.A. cannot be a bus operator, either alone or in partnership with other transportation companies, unless no



private company bids to operate the system or if one of the operating companies abandons the contract prior to its termination date. TransMilenio is entitled to define the types of services, and the length of routes for bus rapid transit services, supervise the observance of established regulations regarding the quality of service, such as operating maintenance and neatness of buses, set bus schedules on the different services of routes, and evaluate the performance of operators. TransMilenio also determines the technical specifications of buses to operate on the routes. It also controls the speed limit in the HCBS corridor. It manages the financial resources from the Federal and local government offices for construction of TransMilenio routes, pedestrian bridges, garages and terminals. Finally, it directly manages and maintains the HCBS infrastructure.

McKinsey and TransMilenio's core staff essentially worked as one team. The Project Management Unit only had 3-4 staff members at first when the general guidelines for the busway project were developed, and the contract for McKinsey was drafted. These people were all given full time leave of absence from other line agencies. In the first year, from Nov. 98 to October 99, the full project team was as follows:

TransMilenio's staff rose to 12 people over the course of the year. Their main role at the beginning was to authorize or not authorize suggestions made by McKinsey.

McKinsey had 10 people working on the project. They were in fact managing the entire project the first year. They then drafted and supervised contracts to a transportation engineering firm and a law firm.

The transportation engineering firm, Steer Davies Gleave (SDG), had a team of 7 people by the end of the first year, including a sub-contract to Logitrans of Sao Paulo. Their role was to verify the current network, repair the origin destination matrix, estimate the demand on the corridors identified, identify future potential corridors, and designed the infrastructure. Virtually all the senior members of the SDG team have visited Delhi. (Enrique Lillo, German Lleras, Paulo Custodio, and Pedro Szasz).

Finally, 3 members of the Colombian law firm Taboada Hoyos were contracted to draft contracts on the needed regulatory changes.

In the second year of the project, Oct. 1999 to October 2000, McKinsey, with support from Taboada Hoyos, designed and developed the contracts for the private bus operators, the feeder operators, the ticketing system manager, the trust fund manager. The contracts for the actual construction were handled through the Urban Design Institute. During this time, SDG designed the operational plan for the corridor, which

included changes in the bus routes, etc. It was during this time that the multiple routing and multiple bus stop system was developed, primarily by Pedro Szasz, that made it possible to achieve capacity levels well above those achieved in other bus rapid transit systems. TransMilenio's role at this time was to manage these contracts, but also to provide local staff for the modeling and planning. Over the course of this year, these functions were gradually transferred to TransMilenio's planning staff.

From October to December of 2000, there was a pilot operational phase. During this time, TransMilenio's staff was increased to essentially take over all of the tasks previously performed by the international and national consultants. Their staff rose to 60 people. McKinsey by this time was phasing out staff, providing only support on the contracting process. SDG was also down to 2 – 3 staff, supporting the operational implementation. The law firm was also down to 1 – 2 staff, supervising the contracting process.

Of the total costs of TransMilenio, consulting fees alone cost $6 million. Staffing for TransMilenio and other line agencies cost about $4 million. Promotion and advertising cost another $4 million, though this came from private donations.

VIII.2. Project Management in Quito and other Cities

Project management in Quito for the electric trolleybus line was done at a much lower cost. The head of the City Planning Agency, Cesar Arias, primarily relied on the ongoing budget of the city planning office to do the planning in-house. As such, for only about $100,000 they managed to plan the entire system. Project management was also done out of the City Planning Office. Because the electric trolleybuses were more expensive, they were not quite financially self-sufficient, so a municipally owned company was set up to run it. It was set up so that it could be privatized, but thus far has not been able to find an investor. This company is just an operator and does not have any planning functions.

When Quito planned its second HCBS corridor, the Ecovia line, again the planning was done under the City Planning Agency. The operation of this line was contracted out to a private operating company, that is a consortium of former private bus operators. When Quito began planning its third line, the Mayor had changed. The new planning agency requested technical support from UNDP, and an international expert, was hired to run the planning on the third line. The tenure of this expert was controversial particularly with regards to the contracting.

In most of the developed world, collective transport is generally operated by public transit authorities similar to DTC. The specific nature of this transit agency differs from city to city, some operating under the state or provincial government, some under the national government, and some under the municipality. These transit agencies generally plan, manage, and directly operate bus and any metro operations. In most of

the developed world, all of the capital costs of the system and some of the operating costs of the system are subsidized by government revenues.

England, and some cities like Krakow in Central Europe, have moved the farthest towards the privatization of bus operations. Bus operations in England outside of London were contracted out to a few large bus operators, and the results have been very controversial. Most evidence suggests that service frequency declined during off peak periods and on less popular routes, while increasing slightly at peak periods on popular routes. Investment into the system increased temporarily then fell off. In London, the system is more popular, with specific routes and specific timetables set by London Transport, the transit agency, and these routes are then contracted out to private operators. This reform attracted new investment to the system without a major deterioration in service frequency, and is generally seen as a better privatization than the form of privatization that took place in the rest of England. In the US, because demand for buses is so low, there are only a few cases of contracting out to private operators. Bus operations in Queens, New York, are contracted out by the city, but all the scheduling, fares, routes, etc. are controlled by the New York Metropolitan Transit Authority (MTA) that directly operates bus operations in the rest of New York City. Service in Queens has been for decades virtually indistinguishable from bus service in the rest of the city, though the private operators are again facing a financial crisis and may be taken over by the MTA. In a few other cities, like Denver, it was only possible to contract out operations on those few routes that had high levels of demand, and the rest of the service remained in public hands. The benefits of privatization in this context have been quite limited.

As such, the ten pilot HCBS projects in the US are all being designed and operated by the transit authorities. They are receiving funds and technical support from the US Federal Transit Administration.

In Jakarta, the TransJakarta system until the time of its opening, was being managed by a Busway Project coordinator who answered directly to the City Secretary, the chief bureaucrat of the city, who in turn answers directly to the Governor. Under the busway project coordinator, there were several teams or task forces: infrastructure, bus operations and financing, socialization, and a few others. However, because the busway project coordinator did not have authority over contracting, and all of the budgetary authority was vested in the Director of the Municipal Department of Transportation, there was constant tension between the busway project director and the director of the Municipal Department of Transportation. Under the Department of Transportation, the Planning Department and the Infrastructure Department both had some budgetary authority, but the vast majority of the key decisions were made by the infrastructure department. The University of Indonesia Center for Transportation Studies (UI CTS) had a contract for the Transportation Master Plan, and with these funds became involved in planning of the additional corridors and other elements of system planning on an informal basis. ITDP had an official role as international advisor, and sent roughly seven international experts multiple times through the life of the project, which is ongoing.

ITDP advisors basically work out of UI CTS and presented conclusions of our analysis at the weekly busway coordination meetings under the auspices of the Busway coordinator, though regular meetings were held with the Department of Transportation.

When TransJakarta opened, TransJakarta was created as a public company with responsibility for managing the busway. TransJakarta in turn contracted out the operations to a consortium of bus operators called PT JET. It contracted a separate company to operate the ticketing system. The busway coordinator became the Director of TransJakarta. A senior technical expert at UI CTS was hired as a full time consultant to TransJakarta and now functions as TransJakarta staff, though he retains status as a consultant because he is paid more than most civil servants. Also on the staff of TransJakarta are two minor functionaries from the Department of Transportation and a former employee of one of the bus operating companies. The planning function for the rest of the system still lies with the Department of Transportation, though to a certain degree TransJakarta will also be directly involved in the planning process.

VIII.3. Public Private Partnerships and HCBS

Public Private Partnerships (PPP) in HCBS have to date not been successfully implemented. Some failed efforts were made in Sao Paulo and San Salvadore, and there is a recent effort in Addis Ababa about which limited information is available. There are two main reasons that PPP has been attempted in HCBS projects:

A. To attract private investment not only into the bus procurement but also for the infrastructure.
B. To attract private investment into the planning and ensure coordinated planning.

Ultimately, since in a PPP the public sector is giving up some of its prerogative, these possible benefits must be realized to make a PPP worthwhile.

Normally, the discussion has been that a private company or consortium would invest in the infrastructure in given corridor in exchange for exclusive operating rights in that corridor for an extended period of time. The most likely investor in such a PPP would be private but fully corporate bus operators.

There have been several attempts by municipalities to get bus companies to invest in the infrastructure as well as the buses, though not necessarily in the context of HCBS. Sao Paulo tried to give one private bus operator monopoly control over a lucrative corridor in exchange for the company's maintaining the bus stations and roads in the corridor. The project fell apart because when the Mayor changed, the new Mayor allowed competing bus companies to operate lines in parallel. Because the enforcement of government contracts in Brazil is legally difficult, the company was unable to use the

courts to enforce the contract. The result was several days of rioting, and the abandonment of the idea of PPP in bus operations in Brazil.

A PPP was also being developed for San Salvador's HCBS by a group of private bus operators. It was put on hold after an earthquake. The idea was to get investment from a major bus operator into the actual infrastructure in a municipality where the city had very limited resources, and the operator approached the World Bank's private sector lending arm, the International Finance Corporation (IFC), for a loan. Subsequent to this being put on hold, the Inter-American Development Bank (IDB) financed the planning under the municipality.

There is some possibility that a bus manufacturer, such as Volvo or Daimler or Tata, would invest in the bus corridor in exchange for ensuring that their buses would exclusively operate in the corridor. There is a history of bus manufacturers investing in bus operations, though not specifically in the case of HCBS, and the results have been discouraging, with the interests of vehicle and parts sales to preferred suppliers taking precedence over good quality customer service.

Similar PPP arrangements in the highway infrastructure sector also give rise to caution. Normally, in the highway sector, a government is willing to exchange future toll revenues on a major road for investments today in new road construction. The collapse of private road contracting in Mexico, Hungary, and other countries, showed that the private sector participation was generally by construction firms that were willing to bankrupt the highway operating company in exchange for very lucrative construction contracts. Studies by the European Investment Bank indicate that PPP in the highway sector are mainly just another form of financing highways, usually to get around public sector lending limits, and that the cost of financing highways through PPP on average has been much higher than for standard competitive bidding. Studies of PPP highways in India have come to the same conclusion. High profile bankruptcies in Mexico City and Hungary requiring huge state bailouts have soured most European countries and most of the development banks on the idea.

While in theory all these problems could be overcome by sophisticated contracting procedures, in practice the lack of experience with contracting in HCBS is likely to lead to significant mistakes by municipal authority that will lead to compromise of the public interest. Since there is such limited international experience with PPP in HCBS, we would recommend allowing developed countries to work out the complex contractual issues before attempting it in a developed country.

Another reason PPP has been discussed is because it would in theory resolve the coordination problems, as the investor would ensure that the busway being designed was appropriate for the buses being procured. Given coordination problems in Delhi and other cities, this is a serious consideration. However, allowing a private entity to coordinate all the planning of HCBS will ultimately ensure that the Delhi municipality never develops the internal capacity to design and manage the system in the public's

interest. While it may be a tempting shortcut around the lack of capacity in government agencies, ultimately it will not solve the capacity problem.

In both Quito and in Bogota, ultimately the capacity to plan and regulate the HCBS was built within the municipal government. In the case of Bogota, it was built in TransMilenio, and in the case of Quito it was built in the City Planning Office. While Bogota relied heavily on international consultants, Quito relied on talented in-house experts. To date, there are no successful PPP HCBS projects to our knowledge.

VIII.4. Institutional Recommendations for Delhi's HCBS System

Currently, design responsibility for Delhi's HCBS has been designated by the Delhi Municipal Government to reside with IIT-TRIPP, though the contract for the work was passed through RITES, and most of the funds from the Delhi Government went to RITES for the detailed design work. To date the Delhi government has only spent about $100,000 on the planning. ITDP with support from US AID, has provided roughly $200,000 to IIT TRIPP to also support their effort, and the Volvo Foundation has also supported TRIPP's work. Also involved is IDFC, under sub-contract to IIT TRIPP, and IPAN, a public relations firm, under contract to ITDP but under IIT TRIPP supervision.

Despite IIT TRIPP's designation as lead party on this effort, they are not fully empowered to speak or make decisions on behalf of the municipality, so problems of coordination and data sharing remain severe. For example, an origin and destination survey conducted by RITES using municipal funds, needed for the demand modeling, has still not been turned over to IIT despite many requests. The Municipality, not having retained control over the basic information needed to plan transportation in Delhi, has been less than successful in playing a coordinating and mediating role. From the point of view of the Municipality, this is probably not sustainable in the long run, as it will lead to coordination problems and lock the city into a dependence on a very limited number of contractors at the expense of the public interest.

Were an independent investor, such as Tata Telco, or Volvo, actually become an investor in the HCBS infrastructure, this would tie the hands of the municipality in the selection of bus technology, and if evidence from other cities is any indication, would compromise the public interest. The private operator would be likely to demand control over procurement, scheduling, routing, and other issues based on profit maximization rather than customer service.

In Delhi, it is highly unlikely that the private bus operators would be willing or able to invest in HCBS infrastructure on their own. Currently, the private bus operators in Delhi are not modern corporate entities. They have limited capital to invest and limited chances of receiving bank financing for an investment of this magnitude. Getting them to invest even in modern buses will be a big challenge.

As such, a PPP does not at this time seem like a feasible option for Delhi.

We therefore suggest that the Delhi Government establish immediately a special purpose company (SPC) reporting directly to the Transport Commissioner or even better to the Chief Minister, following a similar institutional framework established for the Delhi metro. It would be ill-advised to put the SPC under the DTC or STA, as the ability to control and reform the role of these two separate would be compromised.

The SPC should be given responsibility for planning of the whole HCBS system. Initially this should continue to be sub-contracted, but the sub-contracts should stipulate that the contractors gradually train and turn over control of all critical data to the SPV. The SPV should be able to contract staff and experts from both within and outside the bureaucracy, talented and skilled transportation planners, lawyers, engineers, and administrators, and build over time the institutional capacity to plan the HCBS system and to regulate the operations of the HCBS. It is critical that the SPV be able to pay more than standard civil service salaries, in order to ensure it can recruit and retain top quality technical staff.

Prior to the legal incorporation of the SPV, the Transport Commissioner or the Chief Minister should designate some talented staff and a qualified person within the bureaucracy to take over an interim project task force, the personnel of which would as soon as possible become the staff of the SPV. In preparation for this, all contracts under the HCBS project, whether they be IIT, RITES, ITDP or others, include a training component for the planned SPV staff, and insist that the raw data collected under this project be turned over to the SPV and made publicly available.

The SPV, once legally constituted, should be responsible for holding competitive bidding for operating contracts awarded on all bus routes allowed to use the special HCBS lanes. A condition of this contract should be that bidders be modern bus companies with proper labor protections, and the use of appropriate buses the technical standards for which should be set by the SPV.

Currently, the funds that are being used for bus procurement could be better used to hasten the construction of the entire first corridor, and to finance the enormous planning needs that Delhi's HCBS system needs to meet in order to ensure a satisfactory result.

IX. CONCLUSION

Currently, what Delhi is planning is not really a full, international standard High Capacity Bus System. While Delhi plans to procure some modern buses, and to construct center lane bus lanes and nicer stations, many of the critical elements of the world's best HCBS systems are missing. HCBS is not just about slightly more efficient use of road space: it is a fundamentally different system closer to a surface metro that provides a much higher standard of customer service than ordinary bus services. Unless Delhi addresses these institutional issues, its project will never achieve the sort of political support that the most successful HCBS systems are today enjoying.

At worst, it might prove unpopular. Old buses, poorly maintained, tend to break down. If they break down in an exclusive bus lane, it will congest the whole system. Without regulatory changes, modern private bus operation is not likely to succeed. The costs of constructing the HCBS will be higher than they need to be, maintenance will be poor, and the system will deteriorate rapidly. For these reasons, we urge the Delhi Government to use its current popular support for improving mass transit to take a more systematic look at how HCBS could better serve the needs of Delhi residents and modernize the city.