

DECISION MAKING PROCESS IN SUCESSFUL CITY-WIDE BUS REFORMS – SAME STORY REPEATS IN THREE CONTINENTS

Madhav Pai - Technical Director EMBARQ India – mpai@wri.org

Ashwin Prabhu – Graduate Student University College London – aprabhu@gmail.com

Dario Hidalgo – Senior Transport Engineer EMBARQ – dhidalgo@wri.org

ABSTRACT

The objective of this paper is to synthesize information from successful city-wide bus system reforms in three world cities, London (Europe), Sao Paulo (Latin America) and Seoul (Asia). All reviewed systems improved system wide ridership, significantly improved conditions for commuters and produced other positive externalities such as reducing air pollution and improving traffic safety. The reforms were undertaken amidst varying political, economic and social contexts. The main focus of the reviews was to identify the common elements in successful reform processes in an attempt to assist planners and decision makers implementing city-wide bus system reforms. Individual case studies were prepared for each city and are presented in separate documents. The reviews are based on material available on the internet. The following seven aspects or commonalities stood out as the key factors for implementing successful bus system reforms across the three cities.

1. Strong Political Leadership in the Decision Making process
2. Strong local technical institution developing demand based route planning
3. Implementing bus Priority and/or building segregated infrastructure for buses
4. Use of Technology
5. Innovations in contracting and tendering processes
6. Need for managed subsidies to improve quality of service
7. System Performance Monitoring and User Feedback

The paper is divided in three sections. The first section provides a short description and indicator information about the performance of bus systems in each city. The second section examines each of the seven commonalities for each system. The final section summarizes the learning from the three systems.

Keywords: City-wide bus system reform, decision making process

INTRODUCTION

The objective of this study was to synthesize information from successful city-wide bus system reforms from around the world. Three world cities, each on a different continent, stood out as success stories. The section below summarizes the city-wide bus systems in these cities - London (Europe), Sao Paulo (Latin America) and Seoul (Asia). Individual case studies have been prepared for each city and are presented in separate documents.

London

London has one of the most extensive networks of public bus transport in the world. On any given weekday, over 6 million passengers travel on more than 6,800 scheduled buses, over more than 700 routes (1). Bus services in London are provided by private companies which compete for route tenders and are under contract to London Bus Services Limited, a division of Transport for London (TfL). Gross cost contracts with quality and service based financial incentives are used (2). Since 2000, increased usage of the bus system and public transport in general has been a major goal of the municipal government in London. In order to achieve this, bus service levels have been increased dramatically, with the number of bus-kilometers operated having gone up by over a third between 2000-01 and 2007-08 (3). Additionally, a large number of initiatives have been employed to improve the quality of bus services. These measures include curbside bus-only lanes, signal priority for buses, and a contact-less smart card system for fare collection. As a result, bus patronage has significantly increased over the past decade, an outcome unique amongst cities in the developed world. In the period between 2000-01 and 2007-08, annual bus-passenger-kilometers increased by 59% (3). In the same period, the number of annual passenger boarding's increased by 46%. This increase in bus ridership contributed to a net 7% shift in journey-stages from private to public modes of transport during the same period (4).

Sao Paulo

The Sao Paulo bus system, run by SPTrans, recorded a daily average of over 7.4 million boarding's in 2007 (5). The implementation of the city-wide bus system reform, initiated in 2001 under the leadership of Mayor Marta Suplicy, consisted of a very large planning and implementation effort involving 39 private bus providers, 6,000 co-operated self-employed van operators; and 13,700 vehicles (6). A large portion of the planned reform work was completed by May 2004. The main aspects of the system reform were the introduction of an integrated fare system using electronic smart cards (Bilhete Unico) and the reorganization of bus routes into segmented local and structural services. Terminal facilities were improved and now include prepaid boarding areas and additional auxiliary services. Bus priority schemes in the Sao Paulo bus system include median busways and bus stops (Passa-Rápido), fully segregated lanes (Expresso

Tiradentes/Paulistão), and curbside priority lanes (Via Livre). Annual passenger boardings in the bus system more than doubled between 2003 and 2007 (5). Operational improvements in the Passa-Rápido were well received by users – the Perituba-Lapa-Centro bus corridor achieved 85% approval rates in the first year of operation (7). However, the overall rating of municipal buses declined - only 48% of transit users indicate that services were excellent or good in 2006. The main complaints were high levels of pollution, long waiting and travel times, and congestion.

Seoul

In 2008, the Seoul bus system carried over 5 million people on nearly 400 routes on an average weekday (8). The bus route network includes 294 kms of curbside lanes and 73.5 kms of median lanes (9, 10). Starting in 2002, Seoul underwent a comprehensive reform of its bus system under the leadership of Mayor Lee Myung Buk. The reform process was unique in its use of a ‘bottom-up’ approach, wherein extensive input was sought from civil society and bus user groups. The Seoul Development Institute (SDI) led the technical planning effort. Routes were rationalized into a trunk-and-feeder system, and were integrated with other transport modes, like the metro rail system. A unified fare structure was introduced, with free transfers within a specified time period and a switch from a flat fare to a distance based fare. A contact-less smart card system was also introduced, which made fare collection from users and revenue distribution amongst operators easier. A significant aspect of the reforms was the widespread use of technology. GPS units were installed on all buses, allowing for the dynamic control of the bus system through a centralized command center and the deployment of real time passenger information systems. The reforms have had a significant impact on bus usage. From 2004 to 2008, the average daily ridership on the bus system has increased by 15.2% (8). Bus speeds have increased within the median bus corridors. The revenue generated by the bus system has increased, with average daily revenues per bus growing from \$358 in 2004 to \$510 in 2008 (8). User satisfaction with the bus system has also improved compared to the pre-reform period.

Comparison of Indicators of Performance

The main indicators of bus system performance for each city are summarized in Table I and Figures 1-6 below.

Table 1 – Performance Indicators, 2007

Indicator	London	Sao Paulo	Seoul
Population (millions)	7.5	10.4	10.4
Area (sq.kms)	1,572	900	605
Boardings per Day (millions)	6.0	7.5	5.6
Fleet Size	8,000	14,911	7,190
Bus mode share (%)	25	36.8	27.6
Passengers per Bus per Day	745	502	779
Boardings per Bus-Kilometer	4.65	n/a	3.03

Bus mode share is percentage of motorized trips
 Seoul Bus mode share is 2006 figure
 Sources: 3, 5, 6, 8, 11, 12, 13, 14, 15

Figure 1: Boarding's per day (2007)

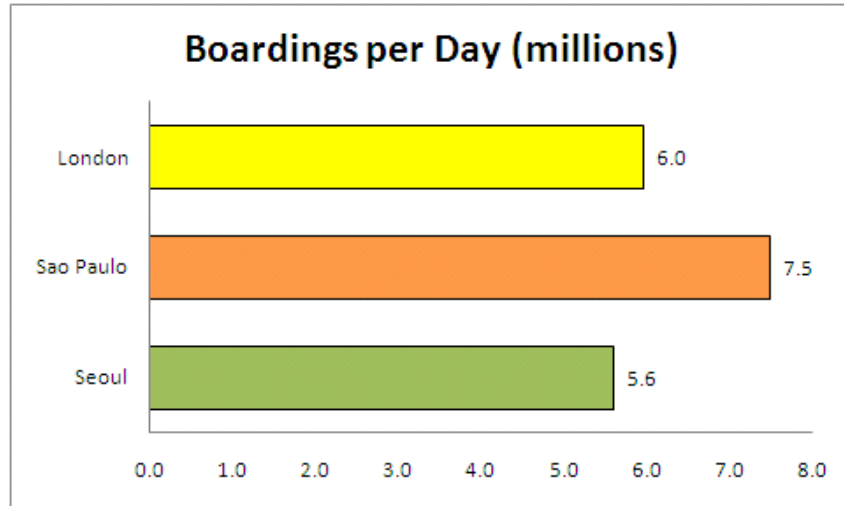
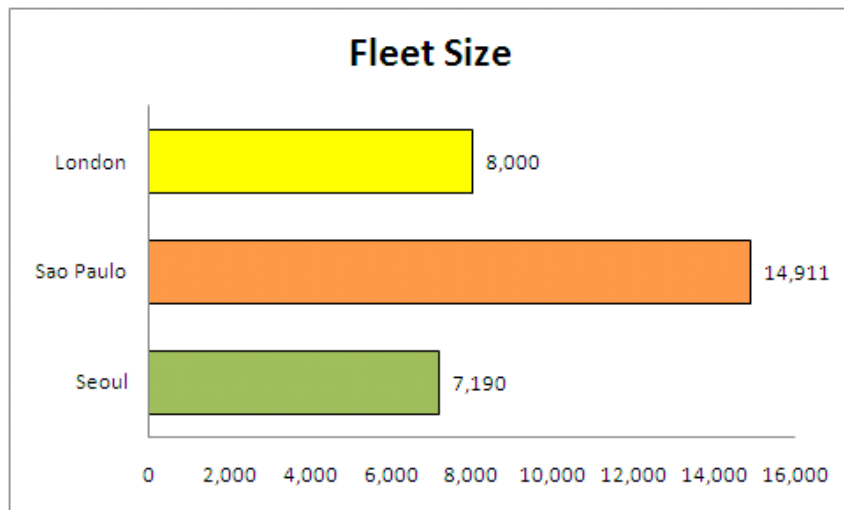


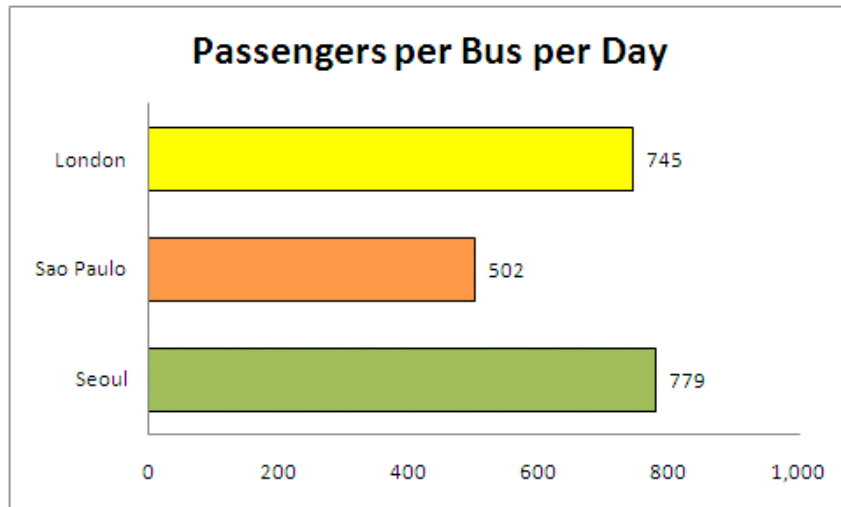
Figure 2: Fleet Size (2007)

Sources: 3, 5, 8



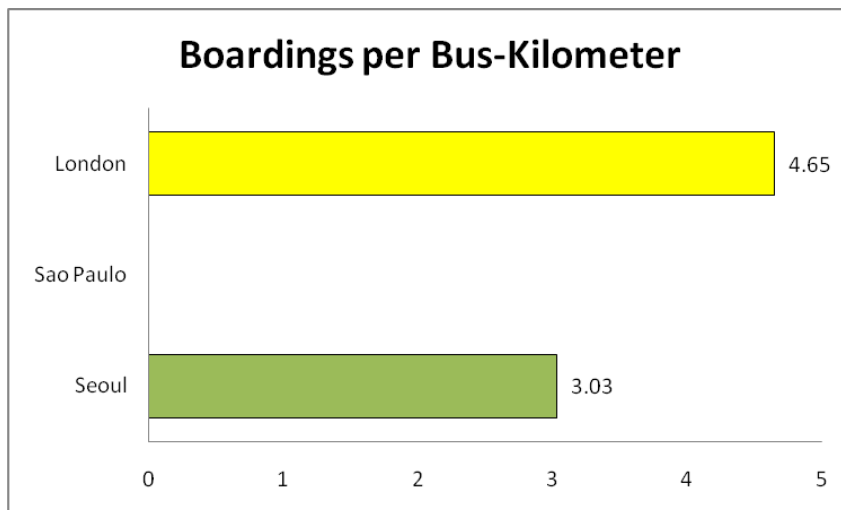
Sources: 8, 13, 15

Figure 3: Capital Productivity - Passengers per Bus per Day (2007)



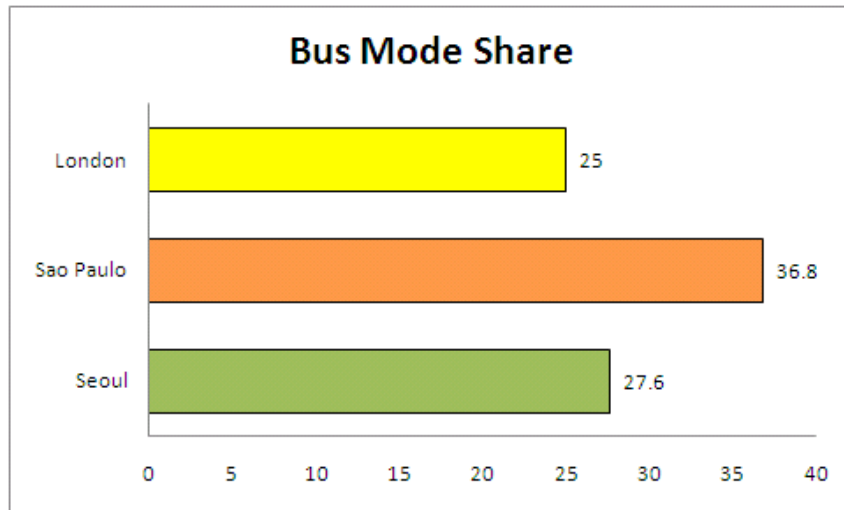
Sources: 4, 5, 13, 15, 16

Figure 4: Operational Productivity – Boardings per Bus-Kilometer (2007)



Sources: 3, 16

Figure 5: Bus Mode Shares (% of Motorized Trips, 2007)



Seoul figure is from 2006
Sources: 3, 8, 14

SYNTHESIS OF FINDINGS: KEY FACTORS FOR IMPLEMENTING SUCCESSFUL BUS SYSTEM REFORMS

Table II summarizes these 7 keys to success as they apply to the cities studied – London, Sao Paulo and Seoul. Following the table, each of these aspects is discussed in detail.

	Key Factors	London	Sao Paulo	Seoul
1	Strong Political Leadership in the Decision Making process	Reform Approach: Gradual Leadership: Initially National Government, Mayor Driven big push in 2000 Implementing Agency: TfL	Reform Approach: Gradual + Big Bang Leadership: Mayor driven Implementing Agency: SPTrans	Reform Approach: Big Bang Leadership: Mayor driven Implementing Agency: Seoul Metropolitan Government(SMG)
2	Local institution leads technical planning for route reorganization	Planning Agency: Transport for London (TfL) Service planning based on demand data	Planning Agency: SPTrans Service planning based on demand data	Planning agency: Seoul Development Institute (SDI) Service planning based on demand data
3	Implementing bus Priority and building segregated infrastructure for buses	280 kms of Curbside bus lanes Signal Priority for buses Whole Route planning approach to eliminate bottlenecks	204 kms of Curbside bus lanes 353 kms of Median bus lanes (no hard segregation, except for 31.8 km elevated corridor)	294 kms of Curbside bus lanes 73.5 kms of Median bus lanes (no hard segregation)
4	Use of Technology	GPS based signal priority Smart card automatic fare collection ('Oyster') Camera system for bus lane enforcement Central Control Center Real Time Passenger Information system	GPS based vehicle tracking Smart card automatic fare collection ('Bilhete Unico') Camera system for bus lane enforcement Central Control Center	GPS based vehicle tracking Smart card automatic fare collection ('T-money') Central Control Center Real Time Passenger Information system
5	Innovations in contracting and tendering processes	Gross cost contracts with quality incentives	Hybrid Approach	Gross cost contracts
6	Need for managed subsidies to improve quality of service	1.018 Billion USD (2006-2007)	17.5 Million USD (May, 2006)	163 Million USD (2007)
7	System performance monitoring and user feedback	Performance monitoring using roadside audits Mystery Traveller surveys Mechanical and Technical inspections User Satisfaction surveys	GPS based performance monitoring User Satisfaction Surveys	GPS based performance monitoring User Satisfaction Surveys

Subsidy figures converted at current exchange rates
Sources: 6, 8, 9, 10, 17, 18, 19,

1. Strong Leadership in the Decision Making Process

All three cities - London, Seoul, and Sao Paulo – undertook extensive reforms to improve the quality of their city-wide bus system. However, each city approached the reform process in a different way. In terms of the speed with which the reforms were pushed through, the three cities can be said to fall on a spectrum running from a 'Big Bang' method, where extensive and comprehensive reforms are undertaken in a very short period of time, to a 'Gradualist' method in which reforms are introduced in a piecemeal fashion over many years.

In Seoul, the reforms were of the Big Bang variety. By 2002, the quality and performance of bus transport in Seoul had reached its nadir. Lee Myung Bak was elected mayor in that year in part based on his campaign promise to fix the worsening public transport situation in the city (20). Once the political will and popular support for reforms was in

place, the overhauling of the bus system went from planning to implementation in a matter of 2 years. Within this short period, a large number of improvements were made to the Seoul Bus system – the introduction of median bus lanes, rationalizing routes into a trunk and feeder system, and a smart card ticketing system among others.

By contrast, reforms in London were of the Gradualist, piecemeal variety. This process began in 1985, with the introduction of competitive tendering for routes between the public bus company and private bus companies, which were now allowed to enter the market (21). Subsequently, over the course of a decade, other changes were gradually introduced such as splitting up the publicly owned bus company into independent subsidiaries which were eventually privatized. In the following years other reforms and innovations such as gross cost contracts, electronic ticketing using smart cards and an expanded bus lane system were introduced. The process by which bus services in London were transformed from the completely public system into the system as it stands today took approximately two decades.

The reform process in Sao Paulo falls somewhere in between the ‘Big Bang’ and ‘Gradual’ ends of the spectrum. In this case, the reforms, which included the introduction of unified ticketing, reorganization of bus routes and a change in the bus business model, were introduced over a period of 5-6 years beginning in 2001 (6).

One common thread running through the reform process in each of these cities is the existence of strong political leadership to push through planned reforms. In all three cities, the political leadership took on a major and active role in bus reform. In Seoul, Mayor Lee Myung Bak was especially active in promoting and securing support for the reform of the bus system. In London, though the reform process took place over many years, it was only with the creation of the Greater London Authority in 1999 and the election of Mayor Ken Livingstone in 2000 that improving the bus system advanced to the forefront of the public agenda. Similarly in Sao Paulo, Mayor Marta Suplicy was highly influential in actualizing the reform of the bus system.

The existence of political support is a prerequisite for successful bus system reforms. Strong political leadership is necessary for several reasons. Since public transport reform affects a large variety of potentially antagonistic stakeholders, strong leadership is useful in bringing these various stakeholders to the negotiating table and in enabling compromises and agreements to be reached. Further, strong political leadership enables the execution of reforms that may be unpopular but are essential to ensuring long term sustainability.

2. Local Institution leads Technical Planning for Route Reorganization

All three cities took a proactive approach to route planning and route rationalization. The changes in route networks were planned on the basis of demand assessment.

The most extensive changes were made in Sao Paulo and Seoul (6, 9). In both these cities the existing network of bus routes was completely overhauled. Prior to the reforms, the route network in each city lacked any overall organization. Routes often overlapped

due to the largely deregulated nature of the bus services market. In both cities routes were reorganized into a trunk-and-feeder system. The bus route network was also integrated with other travel modes, such as the metro and inter-city bus services. In Seoul, there is a continual process of analyzing travel data to evaluate demand and usage on bus routes and subsequently cancelling and adding routes as needed.

Although London did not undergo such a large-scale reorganization of its bus route network, it has used extensive monitoring systems to adjust bus frequencies and capacities as needed. These changes are introduced through the tendering process, wherein the fact that individual routes are re-tendered every 5 years allows the specifications of service supply to be altered to meet current levels of demand (2).

In sum, route rationalization was recognized as an important factor in bus reform in all three cities. It must be noted, however, that in each case the successful implementation of route rationalization was possible in large part due to the availability of considerable technical expertise from strong local planning agencies. In London, Transport for London (TfL) is the main agency tasked with providing public transport. TfL was able to draw upon its expertise in transport planning in order to recommend the needed changes in the route network and service supply levels. In Seoul, the Seoul Development Institute (SDI) led the way in producing the technical plans for the reform. SPTrans played a similar role in Sao Paulo. In all three cases, strong planning agencies were able to combine technical expertise in transport planning and a familiarity with the unique characteristics of transport patterns in each city to develop comprehensive programs for demand assessment and route planning.

3. Bus Priority and Segregation

The biggest hurdle in providing high quality bus based public transport is to deliver the required capacity and service when it is most needed (peak section, peak hour, peak direction). Transport authorities in each of the three cities recognized that this was only possible through the use of bus priority strategies such as signal priority for buses at intersections and building segregated bus lanes. These cities have used a variety of techniques to introduce bus priority and improve the performance of the bus system. The main tool in this regard has been the introduction of bus lanes. Bus lanes can come in two distinct varieties – curbside bus lanes and median bus lanes.

Seoul and Sao Paulo have large networks of both curbside and median bus lanes. Median bus lanes are especially effective in increasing speeds and throughputs. London also has an extensive network of curbside lanes, although it lacks any median bus-only corridors. Table III summarizes the extent of segregated infrastructure built in each city.

Segregated Bus Infrastructure	London	Seoul	Sao Paulo
Curbside lanes (kms)	280	294	204
Median lanes (kms)	-	74	353

Sources: 6, 9, 10, 19

In addition to the installation of bus lanes, London also has a system of signal priority for buses. Onboard GPS devices on buses or roadside beacons detect when a bus is nearing a traffic signal, and the system can then perform a variety of actions to provide the bus with a clear way through junctions (22). These actions include, for example, extending the green cycle in the direction of bus travel or reducing the green cycle for contra-flowing traffic.

None of the three cities, however, have adopted hard segregation for bus lanes. This has prevented them from achieving the high performance levels displayed by systems in cities like Bogota, Mexico City and a few others.

4. Use of Technology

Seoul, Sao Paulo and London have all made extensive use of technology in their bus systems. The most common use of technology has been the installation of GPS devices on buses for all three cities. The GPS devices have several uses. First and foremost it enables a central command center to monitor bus system performance in real time. The benefits of this vary from the ability to dynamically alter bus supply in response to traffic conditions, performance monitoring which enhances the ability to make appropriate changes to the system as needed, and also ensuring that private bus companies fulfill contractual obligations to provide specified levels and quality of service. In Seoul, for instance, bus companies are compensated based on Bus-Kilometers operated, which is automatically calculated based on data from the on-board GPS devices. Similarly the London GPS system iBUS, recently installed throughout the fleet in 2008, will allow the monitoring of various aspects of the bus service such the fraction of on time arrivals and average waiting times for bus users. All three cities have also made use of bus-based GPS system to develop real time passenger information systems, such as displays at bus stops and terminals showing the arrival time of the next bus.

Another technological innovation common to all three cities is the use of smart card technology for integrated ticketing systems and fare collection – ‘T-money’ in Seoul, ‘Bilhete Unico’ in Sao Paulo, and ‘Oyster’ in London (6, 9). In each of these cases, users can add money (or monthly passes) to their smart cards, and then use them to pay fares. Smart card technology allows for seamless fare collection, and also reduces bus dwell times at stops by eliminating the time consuming process of collecting cash fares from users. Initiatives such as free transfers, or transfers between different modes are also easier to operate with smart cards. Furthermore, smart cards enable easier distribution of revenues to private bus companies. Another big advantage of smart cards is the ability to perform in-depth analysis of travel patterns and other travel characteristics of system users.

London and Sao Paulo use camera technology to enforce bus lane segregation. Since bus lanes in these cities do not employ hard segregation, preventing the encroachment of bus lanes by other motor vehicles is a major concern. In London, cameras in bus lanes and on-board buses, in combination with automatic number plate recognition software, allows authorities to levy fines on private vehicles that enter bus-only lanes

(23). A similar system camera-based system for bus lane enforcement exists in Sao Paulo (6). The table below summarizes the technology features adopted in each city.

	London	Sao Paulo	Seoul
Control Systems	Centralized Command Center; GPS based Signal Priority for Buses	Centralized Command Center; GPS based bus Tracking	Centralized Command Center; GPS based bus Tracking
Fare Collection	Smart card system (Oyster)	Smart Card system and Unified Ticketing (Bilhete Unico)	Smart Card system and Unified Ticketing (T-Money)
Enforcement	Bus Lane enforcement using Camera and Number Plate Recognition software	Bus Lane enforcement using Camera and Number Plate Recognition software	-
User Information	Realtime Passenger Information; Next Bus Arrival Countdown	Realtime Passenger Information; Next Bus Arrival Countdown	Realtime Passenger Information; Next Bus Arrival Countdown

Table 4: Technology features adopted by each city.

5. Contracting & Tendering Innovations

In all three cities private bus companies are responsible for the delivery of bus services, under contract with the municipal government or the relevant transport authority. Competitive tendering is used to allocate routes, or service areas. London and Seoul employ route based tendering, whereas Sao Paulo uses an area based system in which a bus company is responsible for services in a particular area of the city.

The type of contracts used varies in each city. London and Seoul use variations of gross-cost contracting, wherein the companies are paid a set amount, which includes a profit margin, to provide a specified amount of service (i.e. bus-kilometers). The transport authority receives all the fare revenue. The transport authorities thus face all the revenue risk.

In London, the gross cost contracts are subject to quality incentives based on reliability, vehicle conditions, and driver quality and customer service (2). Consider, for example, the reliability incentive. Every contract specifies a 'Minimum Performance Standard' which sets targets for service levels and percentage of on-time arrivals and departures (in the case of low frequency routes with 4 or fewer buses per hour). Bus companies are then eligible for a bonus equivalent to 1.5% of the contract price for every 2% improvement in on-time percentage. Similarly, they may face a 1% deduction for every 2% reduction in on-time performance for failing to meet the Minimum Performance Standard. Similar incentives exist for percentage of scheduled bus-kilometers operated, vehicle condition, and driver quality and customer service.

In Sao Paulo, contracts are a hybrid between gross-contracts, where revenue risk lies with the authorities, and net-cost contracts, where all the revenue risk is borne by the bus companies. The compensation mechanism in Sao Paulo is governed by a formula which guarantees an 18% annual return (6). This formula is made up of several components and also has a readjustment provision that allows the mechanism to be change frequently depending on variations in cost and inflation.

6. Financial Analysis, Shortfall and the Need for Subsidy

Despite large increases in ridership numbers over the past decade, and the resultant increase in both fare-box and other revenues, all three bus systems require subsidies. The London bus system required a subsidy of 625 million GBP in 2007 and the Seoul bus system required an estimated subsidy of US\$ 190 million in 2008 (8, 24).

The reasons for these subsidies are wide ranging. In London, bus fares were frozen during the years 2000 to 2004 in order to encourage bus usage (25). This time period also coincided with large expansions in bus service, infrastructure improvements and the introduction of quality incentive contracts which lead to an increase in contract payouts.

In Seoul, bus ridership numbers and revenues per bus per day have been steadily increasing since the 2004 reforms. However, the reforms required large amounts of spending on capital improvements such as new infrastructure (median lane), new buses, the smart card system, and improved technology systems (9). The continued cost of developing and maintaining these systems has lead to an increase in subsidies from pre-2004 levels, although subsidies have been dropping after reaching an all time high of US\$ 265 million in 2006 (8).

Although subsidies for bus services in all three cities have increased post-reforms, this fact must be viewed in the context of the available alternatives to improving public transport usage and the positive externalities engendered by improved bus services. In all three cities, the need for subsidies has arisen expressly because of the recognized need to vastly improve the quality of existing bus systems. Achieving the resultant levels of increase in public transport usage through other means, such as expansions to rail-based systems, would be substantially more expensive. Furthermore, the positive externalities of improving public bus ridership, such as reduced traffic congestion (and reduced resultant costs to the economy) and improved air quality provide ample justification for subsidizing public bus services.

7. System Performance Monitoring and User Feedback

London has a wide range of system monitoring methodologies in place. These can be divided into three main categories: performance monitoring, service quality and user satisfaction. Performance monitoring involves ensuring that bus companies ply the specified number of bus-kilometers as per their contract, as well as ensuring that buses meet both average waiting time (for high frequency routes) and percentage on time (for low frequency routes) standards. Up until 2008, when the onboard GPS based iBus system was rolled out, these statistics were gathered using road side surveys of 3-5% of

the service on a given route (2). Static audits at bus stops and garages and mystery traveler surveys are used to gauge quality of service standards such as cleanliness of buses, driver quality and customer service. London also conducts a large number of direct user surveys to track satisfaction with the bus system. In addition to these three main types of service monitoring, London also conducts additional surveys and audits to judge contract compliance, the mechanical state of buses and the technical skills of drivers.

In Seoul, the bus-based GPS system is used to great advantage for system monitoring. In particular, the system is used to determine bus-kilometers operated by each bus company, which is the basis of revenue distribution and contract payments. This same system is also used to monitor the performance of buses with respect to factors such as reliability, headways, average speeds and so on (26). Multiple user surveys are carried out both by government transport authorities and a variety of civil society groups.

In Sao Paulo, a large user satisfaction survey is carried out by the ANTP, the national association of transport professionals in Brazil (6).

CONCLUSIONS

All reviewed systems improved system wide ridership, significantly improved conditions for commuters and had other positive externalities including reducing air pollution and improving traffic safety. The reforms were undertaken amidst varying political, economic and social contexts. However, in all three cities a common pattern of the progression of the reform process can be deduced.

The process started at the top with strong political backing and leadership. Hard decisions were required to change the status quo and this necessitated strong leadership. Once these decisions were made reform plans were formulated on the basis on demand assessment backed by extensive field data. These plans were developed by technically adept local planning institutions in each city. In urban environments where cars outnumber buses in absolute numbers and there is stiff competition for limited road space, it becomes difficult to provide high quality bus based public transport without intensive bus priority schemes. This fact was highlighted by the planning agency and accepted by the political leadership. All three cities therefore implemented priority schemes for buses through the building of segregated rights of way or creating bus priority at junctions. Each city made extensive use of technology to manage the reforms, monitor system performance and deliver quality of service improvements. Electronic fare collection systems made it possible to introduce integrated fares and seamless fare collection. Central control centers enabled dynamic monitoring and evaluation of system performance. Data from these technological systems allowed the cities to introduce appropriate changes in practice. Each city used innovations in contracting and tendering to provide high quality bus services. Private bus operating companies are hired through competitive tendering and contracted through gross cost contracts with some form of

performance incentives. Another aspect that stood out for all three cities was the size and nature of subsidies for the bus system. As quality of service was improved there was a substantial increase in subsidy. However, in each case subsidies were accepted as a necessary cost of improving bus service quality, and were justified based on the positive externalities of an expanded bus system and the costs of alternative solutions to improving public transport patronage. Once all the reforms were in place all cities employed wide-ranging performance monitoring systems to ensure continuous system performance improvement. User feedback through user surveys has been an important tool to ensure high quality of service.

All cities aspiring to reform their city-wide bus system operations need to create an environment that facilitates the seven keys to success as illustrated in this analysis.

REFERENCES

1. Transport for London website, London Buses, Accessed August 2009. Accessible at: <http://www.tfl.gov.uk/corporate/modesoftransport/1548.aspx>
2. Transport for London, London's Bus Contracting and Tendering Process, Retrieved August 2009, Accessible at: <http://www.tfl.gov.uk/tfl/businessandpartners/buses/tenderresults/lbsl-tendering-and-contracting-feb-09.pdf>
3. Author's calculations. Data Source: Transport for London, Travel in London Report number 1, 2009. Retrieved August 2009. Accessible at: <http://www.tfl.gov.uk/assets/downloads/corporate/travel-in-london-report-number-1.pdf>
4. Transport for London, Travel in London Report number 1, 2009. Retrieved August 2009. Accessible at: <http://www.tfl.gov.uk/assets/downloads/corporate/travel-in-london-report-number-1.pdf>
5. Author's calculations. Data Source: SPTrans website, Indicadores – Passageiros Transportados. Retrieved August 2009. Accessible at: <http://www.sptrans.com.br/sptrans08/indicadores/passageiros/>
6. Hidalgo, Dario. Case Study of the Interligado System, Sao Paulo, Brazil.
7. National Public Transportation Association of Brazil Bus user Survey 2006, referenced in Hidalgo, Dario. Case Study of the Interligado System, Sao Paulo, Brazil
8. Kim, K.S., 2008, Lessons Learnt from Seoul's Bus Reform, Presented at World Urban Transport Leaders Summit 2008 – Transforming Urban Transport for Liveability and Sustainability, Organized by LTA Academy, 4-6 November 2008
9. Pucher, J., Park, H., Kim, M.K., and Song, J. 2005. Public Transport in Seoul: Meeting the burgeoning travel demands of a megacity, Public Transport International 3: 54-60
10. Kim, S.B., 2009, Policy Directions of Seoul for a Clean and Green City, Presented at Connected Urban Development Global Conference 2009 Connecting Cities for Sustainable Living: An Urban Revolution, 21-22 May 2009, Seoul, South Korea
11. Office for National Statistics, Focus on London 2007, Retrieved August 2009, Accessible at: <http://www.statistics.gov.uk/focuson/london/>
12. Seoul Metropolitan Government Statistics, Retrieved August 2009, Accessible at: <http://english.seoul.go.kr/gtk/about/fact.php?pid=5>
13. Weston, M. 2007. London's Hybrid and Hydrogen Bus Programmes, Presented at C40 Transport and Congestion Workshop, 4 December 2007. Retrieved August 2009, Accessible at: <http://www.c40cities.org/docs/0712transport/day1-sess5-weston.pdf>

14. SPTrans Presentation. 2008. Public Transport in Sao Paulo and Metropolitan Region
15. SPTrans website, Indicadores – Frota Cadastrada. Retrieved August 2009. Accessible at: <http://www.sptrans.com.br/sptrans08/indicadores/frotaCont/>
16. Author's Calculations, Data Source: Kim, K.S., 2008, Lessons Learnt from Seoul's Bus Reform, Presented at World Urban Transport Leaders Summit 2008 – Transforming Urban Transport for Liveability and Sustainability, Organized by LTA Academy, 4-6 November 2008
17. Jennings, G., Davidson, B., 2009, Getting Back on the Bus, Mobility Magazine, Issue 3, Retrieved August 2009. Accessible at: http://www.mobilitymag.co.za/files/back_issues/mobility/issue3/London%20transport%202001.pdf
18. UK Department for Transport, Transport Statistics Great Britain 2008 Edition, Retrieved August 2009. Accessible at: <http://www.dft.gov.uk/pgr/statistics/datatablespublications/tsgb/2008edition/>
19. Souza, A Odilia P, 2007, "Novos paradigmas da integração temporal" in ANTP/BNDES, Integração nos transportes públicos, Caderno Técnico 5, pp 81-98, São Paulo, Brasil.
20. Lee, S., Lee, S., & Lee, Y. 2006. Innovative Public Transport Oriented Policies in Seoul, Transportation 33: 189-204
21. Finn, Brendan, 2005, Study of Systems of Private Participation in Public Transport – London, Prepared for Public-Private Infrastructure Advisory Facility (PPIAF). Accessible at: http://www.ppiaf.org/documents/toolkits/UrbanBusToolkit/assets/CaseStudies/summary/sum_london.html
22. Gardner, K., Hodges, J., 2007, Keeping London Moving – Bus priority in London, Presented at European Transport Conference, October 2007. Accessible at: <http://www.etcproceedings.org/paper/keeping-london-moving-bus-priority-in-london>
23. Transport for London, Traffic Enforcement in the Digital Age, Accessible at: <http://www.tfl.gov.uk/assets/downloads/TE-digital-age.pdf>
24. UK Department for Transport, Transport Statistics Great Britain 2008 Edition. Accessible at: <http://www.dft.gov.uk/pgr/statistics/datatablespublications/tsgb/2008edition/>
25. Hendy, P., 2005, New Development: Exemplary Provision of Bus Services – Is London a model for other conurbations?, Public Money & Management 25 (3): 195-200.
26. Seoul Metropolitan Government, Bus Operation Planning and Monitoring System, Presented at International Forum on the Public Transportation Reform in Seoul, Seoul Development Institute, 7-8 July 2005.