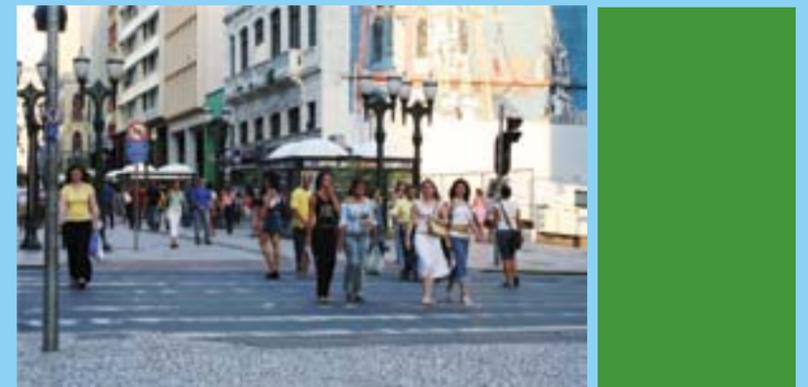




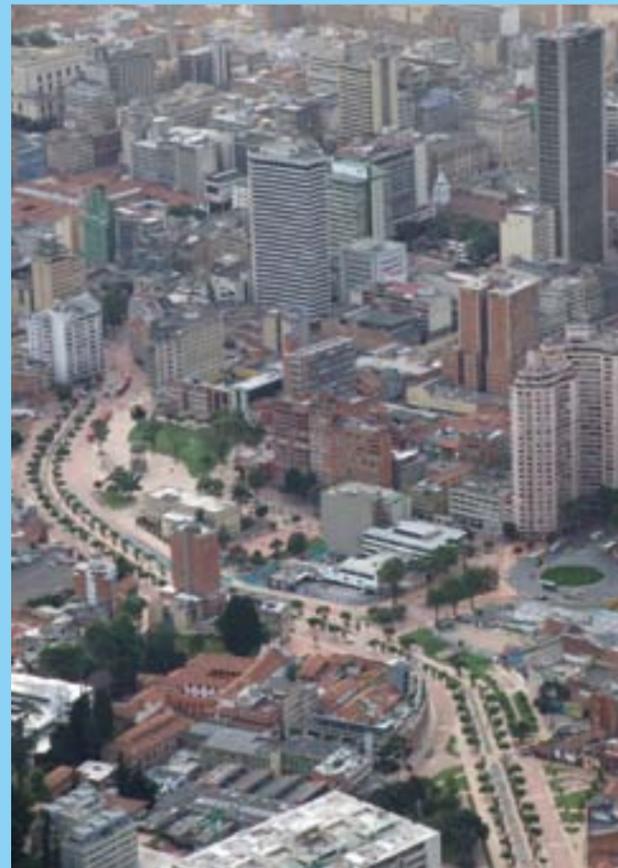
PLANNING FOR BRT-ORIENTED DEVELOPMENT: LESSONS AND PROSPECTS FROM BRAZIL AND COLOMBIA



For a sustainable transport to improve air quality, mitigate climate change and enhance quality of life in cities.

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Publication for policy makers

Findings, interpretations and conclusions expressed in this document are based on information gathered by Clean Air Institute (CAI) and its consultants, partners and contributors from indicated sources.

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ABOUT THE CLEAN AIR INSTITUTE

The Clean Air Institute (CAI) is a non-profit 501(c)(3) organization formed in 2006 to bridge knowledge and technical capacity gaps of national and local governments seeking solutions to reduce air pollution and greenhouse gas emissions. CAI continues and expands efforts of the Clean Air Initiative for Latin American Cities, a partnership originally launched in 1998 by the World Bank and a number of cities and other organizations.

Our vision is to facilitate cities to provide healthy and productive environments for their residents through cleaner air, reduced greenhouse gas emissions, and high quality, low impact transportation choices for all.

The **CAI** implements this vision by providing strategy and project development assistance coupled with access to state-of-the-art knowledge and expertise; fostering partnerships and coordination among projects; channeling training, technical assistance, and information exchange to support successful project implementation; and opening doors for financing and other opportunities.

Our founding directors include Dr. Mario Molina, a 1995 Nobel Laureate, Dr. Alan Lloyd, a former Secretary of the Environment for California, and Richard Ayres, a founder of the Natural Resources Defense Council. The CAI currently has offices and staff in Washington, DC, and Mexico City, Mexico, as well as a network of affiliated experts around the globe.

Our Priorities are:

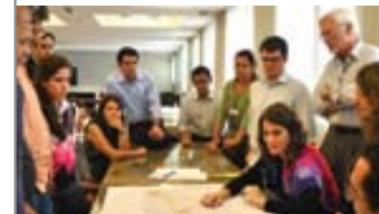
- Help governments and other stakeholders develop and implement environmentally, socially, and economically sound policies, plans, and actions to reduce greenhouse gases and air pollution in urban areas throughout Latin America (and the Caribbean).
- Help transform the urban transportation sector through improved public transport, cleaner fuels and vehicles, better non-motorized access, and land use patterns that enable access through multiple transportation options, not just through private vehicle use.
- Promote leveraging opportunities, partnership building, and coordination among efforts across the Latin American region.

This Paper and the Sustainable Transport and Air Quality Program

One of CAI's flagship efforts is the Sustainable Transport and Air Quality (STAQ) Program. Funded by the Global Environmental Facility (GEF) through the World Bank and executed by CAI in coordination with national and local institutions from Argentina, Brazil and Mexico, the STAQ Program is focused on: (i) reducing the growth of GHG emissions generated by urban transport in Latin America by promoting more energy efficient and cleaner transport modes; and (ii) inducing policy changes in favor of sustainable transport projects.

The STAQ Program is implemented through three country-level projects, one each in Argentina, Brazil, and Mexico, as well as through a Regional Project at the Latin American and Caribbean level.

This policy paper is part of a series of policy and technical documents being produced under the STAQ Program efforts. The Clean Air Institute thanks the authors as well as all institutions and organizations that have made it possible.



PLANNING FOR BRT-ORIENTED DEVELOPMENT: LESSONS AND PROSPECTS FROM BRAZIL AND COLOMBIA

ABSTRACT

Bus rapid transit with compatible land development is an important step toward urban systems that have effective accessibility, minimize absorption of peripheral agricultural lands, reduce average travel time and the consumption of fossil fuels, as well as facilitate democratic access to the benefits of metropolitan living. But combining the land use planning and development with a BRT project is essentially difficult. They involve widely different sectors of planning and implementation. In this article we first propose a process to facilitate the planning of BRT-oriented development. The process begins with selecting the planning group, moves through a cooperative plan preparation, and ends with defending the newly exposed urban periphery from uncontrolled development. Second, and in light of the proposed process, we review the special achievements of Curitiba's integrated land and BRT development and examine instructive new cases from several BRT project in Colombia. The cases conclude that access advantages provided by BRT investments have been considerable but the land development component, while attaining some success has also revealed problems. These problems include new BRT in corridors with limited new growth possibilities, a reliance on public rather than private leadership in land development except for large retail developments, a tendency of private developers to hold back with a wait-and-see strategy, a lack of visible "champions" to forcefully promote projects, and a preference to confine planning to the nodes (ie. stations) rather than including entire corridors.

1. INTRODUCTION

The emergence of bus rapid transit (BRT) has revolutionized the provision of mass transportation in cities. BRT consists of coordinated improvements in operations, technology, infrastructure, and equipment to provide preferential treatment to buses on urban roadways. While BRT emulates the level of service of rail systems, it is viewed as more cost-effective and flexible in terms of investments required. Low costs mean that rail-like mass transportation is now within reach of many cities across the globe. Currently there are more than 120 BRT projects worldwide, of which 94 have been built within the last decade (Hidalgo, 2011).

The scale of BRT implementation, and the ability to create a BRT network within cities, suggests that BRT can become a viable alternative to automobile transportation. In Bogotá 15 percent of BRT users had private automobiles available at home (Secretaría de Movilidad, 2005). In Pereira (Colombia), ten percent of BRT passengers used to travel by private automobile for the trip regarding which they were interviewed (Alcaldía de Pereira, 2011). Curitiba has the highest share of work commuters (75%) and the highest transit trip rates in Brazil (Cervero, 1998), despite being the Brazilian city with one of the highest rates of motorization at 614 vehicles per 1000 residents (Freitas-Miranda and Rodriguez da Silva, 2010). Depending on the context and the design, BRT projects have generated benefits in terms of travel time savings, reductions in greenhouse gas emissions, and improvements in air quality.

As with other mass transit options, the success of BRT can be enhanced further with the presence of supportive land development.

BRT-oriented development is the term used to describe development that is compact, with a mixture of land uses often including residential, commercial and office uses, and with high quality pedestrian environments that effectively connect with BRT. BRT-oriented development can concentrate demand along corridors, balance passenger flows, revitalize neighborhoods, and create of opportunities for multimodal travel. In fact, residents in development oriented towards mass transit, use transit two to five times more than other commuters, regardless of trip purpose (TCRP, 2008). As a result, BRT-oriented development is a strategy that complements and builds on the strengths of BRT, further encouraging alternative modes of transportation, strengthening urban efficiency, and contributing to decreasing emissions.

Despite the potential of BRT-oriented development, there is a paucity of evidence regarding the planning and institutional factors that contribute to its implementation. In this paper, we examine the experience of Curitiba (Brazil) and of three Colombian cities (Bogotá, Pereira, and Barranquilla) in implementing BRT-oriented development. Our emphasis on Curitiba and Bogotá is deliberate. They represent the earliest efforts of BRT worldwide—Curitiba in the 1970s, then Bogotá in the 2000s followed quickly by many others. Pereira and Barranquilla illustrate recent attempts to coordinate BRT and land development, likely to be more representative of what similarly-sized cities may encounter. Through the cases, we provide two complementary perspectives: at the corridor level, we identify conditions to facilitate the success of BRT-oriented development in providing significant reductions in auto use and emissions. At the station level, we determine characteristics helpful in instigating that development.

In the next section we review the literature on transit oriented development. Then, we summarize the programming functions for coordinating land development with BRT investments. We follow with the four city case studies. In the final section we provide study conclusions.

2. PRIOR RESEARCH ON TRANSIT ORIENTED DEVELOPMENT

Research on development oriented towards public transportation has grown in the past two decades. Direct benefits of transit-oriented development (TOD) include its ability to generate additional ridership and raise revenues. To date, studies from Hong Kong, New York City, Portland, San Francisco, Seoul, Shanghai, Taipei, and Washington DC have shown positive associations between TODs and transit ridership (Cervero, 2007; Cervero et al., 2004b; Dill, 2008; Lin & Shin, 2008; Loo et al., 2010; Sung & Oh, 2011). However, these studies focus exclusively on rail transit. The only exception is a study in Bogotá that found that BRT station areas that had higher density, land use mix, and pedestrian amenities, also had higher passenger ridership (Estupiñán & Rodríguez, 2008). Indirect benefits include the emissions

and pollution avoided by having additional transit ridership, the economic development around station areas, and increases in the value of properties and related property tax revenues (Bartholomew & Ewing, 2011; Duncan, 2011; Rodríguez and Targa, 2004; Rodríguez and Mojica, 2009).

The role of the public sector in promoting and supporting TOD has been covered in at least five comprehensive documents (Cervero et al., 2002; Cervero et al., 2004a; Curtis et al., 2009; Dittmar & Ohland, 2003; Dunphy et al., 2005). Most agree that TOD can be limited by a number of factors including existing land use pattern; difficulty in parcel assembly; limited market demand for the development envisioned; fiscal and financial constraints; and limited political support. Accordingly, to date the literature suggests that the public sector can promote TOD with financial and tax incentives, improved land management, and supportive development regulations.

A commonality across experiences in planning for TOD is that it requires regional resources for planning and infrastructure (Newman, 2009). Supportive financial and tax policies, such as grants, sliding scale impact fees, tax abatements, loans, direct investment (as in joint development), tax increment financing, special assessment districts, and value capture techniques (including additional development rights that can be traded, such as the CEPACs used in Sao Paulo) can be used to help finance TOD or the infrastructure around it. Another frequent barrier to TOD is the difficulty in assembling parcels (Boarnet & Crane, 1998; Thomas & Deakin, 2008). Land management tools available to the public sector include land assembly (such as land readjustments and land-for-land exchanges), land banking, and sale or lease of development rights. Further complicating things is the inherently different time scales in the implementation of transportation infrastructure and urban development, which underscores the difficulties (and importance) of institutional coordination in planning for tasks on different timelines.

Finally, public sector support for TODs is also necessary in the rules and permitting process with determines the type and intensity of development surrounding stops. One approach is to relax zoning and development regulations, such as increasing allowed densities or decreasing parking requirements. Other more sophisticated tools include incentive zoning, inclusionary zoning, overlay zoning, and form-based codes or design guidelines (Calthorpe, 1993). All of these tools aim at increasing the potential of development that will encourage transit use. Another approach, more commonly used for achieving the dual goal of higher development intensity combined with open space or historic property preservation, is to use transfer development rights (Nelson et al., 2011). Streamlining the permitting process and assisting with remediation of brownfield sites are ways in which the public sector can assist in the development process.

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A common challenge emerging from the TOD literature is how to manage what Cervero et al. (2004a) labeled the “congestion conundrum.” The congestion conundrum emerges from the multiple functions awarded to TOD. On the one hand, these nodes are viewed as funnels of passengers being fed by motorized and non-motorized means into an efficient, high-capacity transit network. Feeder vehicle access, egress, and in some cases storage (parking) often dictate street design and development priorities that accommodate vehicles to the detriment of local residents and users accessing transit with non-motorized modes. On the other hand, TODs are also attractive places or destinations in their own right, which means that multimodal transportation users may desire access to the TOD services, regardless of the regional accessibility functions that the node may have. In the end, the TODs become congestion hotspots, which frequently result in measures that sacrifice development intensity (such as downzoning) and are detrimental to the walkable character of the stop (such as devoting more space to parking and streets).

One limitation of prior research is that the vast majority of work has focused on rail transit. Cervero et al. (2004a) highlight some small-city TODs that are bus-based, organized around intermodal transfer facilities, while the Center for Transit Oriented Development has included some bus-based systems in its Transit Oriented Database. But these tend to be exceptions. The emphasis on rail transit may stem from perceived questions about its viability and usefulness as a mass transit option remain. A review of the US General Accounting Office (Hecker, 2003) suggested that decision makers perceive several disadvantages of BRT. First, relative to rail systems, BRT’s ability to foment economic development may be limited. It is argued that the locational rigidity and permanence of rail infrastructure is superior over bus-based services. Accordingly, developers and firms are assumed to be more likely to locate residential, commercial and office developments along a railway than along a BRT path. Second, BRT may be disfavored due to the noise, pollution, and negative image often associated with bus services. Whether these perceptions are correct or not are a matter of empirical debate. A recent study compared the land value increases attributable to BRT investments and compared them to increases from rail systems (Rodríguez and Mojica, 2009). It concluded that the increases were similar. Yet, regardless of the veracity of perceptions regarding BRT and rail, they may influence developer behavior and thus have to be tackled head on by planners and decision-makers.

3. PROGRAMMING FOR BRT AND LAND DEVELOPMENT

Experience in the planning of land use along with BRT has revealed that both activities should be carried concurrently and in coordination with each other. This is particularly true of experience in Brazil, where this matter has been taken the most seriously and pursued the most successfully. We feel it is worthwhile to compose a process that would provide check points, assuring that land use and BRT transport planning are complementary, mutually reinforcing yielding results during a limited length of time.

Participation in the Planning

Ultimately virtually every public agency has some aspect of concern about BRT and land development. Some, however, will have an important stake in the process—because it entails significant rise in capital expenditure (e.g. for water, sewerage, roads, etc.), because it entails special problems of development guidance (e.g. zoning, permit issuing, etc.), and service endowment (e.g. police, fire protection, refuse collection, etc.) As a result the process of programming needs to be led by a small group of the central public agencies involved.

At the same time there needs to be continual participation and information provided to the other public agencies with more limited, but still significant concern for the project. These actors may not be involved so deeply as to find it important to attend all the weekly meetings that give form to the project, nor to read the many documents produced by the project. This secondary level of interest may include 15 or 20 state and local agencies. They must be included in the process at some level but form a group that would be cumbersome if included in a management group because the number of them is so large and because their level of limited interest would in many cases leave them insufficiently informed about significant decisions compared with the more affected agencies.

There needs also to be participation of the private sector, particularly the land developers. The syndicates of these developers collect detailed data on housing starts and other real estate phenomena. They have seasoned judgment about the kinds of development likely to be attracted to particular sites. While relationships between the development sector and the public service invariably begin with a cautious sense of distrust, the experience is that they rapidly recognize on both sides the productive interdependence between them.

Sketching the Initial Corridor Plan and BRT Path

The first step is an initial crude sketch of the channel of high volume passenger transport. This requires a tentative assumption about the technologies to be used and the major facilities—boarding stations, transfer stations, plazas, parking for commuters’ cars, two-wheelers and bicycles, paths for entering and leaving passengers, and stops for feeder buses. There is a tendency to underestimate the land area requirements in a way that later confines the achievement of the project. Arrangements for surrounding commercial services should also be foreseen at this stage.

This activity is important to get a picture of the eventual project and the activity changes it attracts. Among the choices to be made, BRT hardware varies greatly from the broad boulevard pedestrian bridges that serve the large stations of Bogotá to the snug, tightly designed stations of Guayaquil.

Another need is to foresee demand for land development at some distance from the corridor, in a second tier corridor. In some cases, like in Curitiba or the Nuevo Usme case in Bogotá, there has been significant development at some distance from the BRT corridor. In Curitiba, during the last two decades the city has grown considerably slower than suburban municipalities. In Bogotá’s case, this was understandable since the BRT corridor was no doubt already more developed before installation of the system. In other cases, like the Suba stop in Bogotá, developers bought and redeveloped land next to the BRT stop.

Local Conditions that Facilitate or Obstruct Densification

It is useful to identify especially positive conditions that can be identified at the outset as a way of “seeding” further growth. These might include previously serviced land, parcels closest to the BRT stations, suitably large parcels for sizeable projects (but not so large as to make the development permitting process too cumbersome as in the case of Nuevo Usme), parcels available for development that are well located for uses in high current demand, and land in the ownership of agents anxious to undertake development themselves.

At the other extreme there are cases in which land is simply not available for development or not apt for it. That includes, for examples, land in speculation hoping for much higher prices later, land abutting incompatible uses, land in the hands of agents that cannot release it (government agencies, religious foundations, etc.), land in current use satisfactory to its owner but not to the development program. Available parcel size may confine possibilities for development, or actions to save land valued for agricultural or ecological functions. There are many possible explanations.

Some of these obstacles might be relieved by public action, so early discovery of them may enable additional parcels to become part of the development plan.

These issues are all affected by the unreliable phenomenon of demand. We note that Cervero and Landis’ (1997) evaluation of the San Francisco BART, metropolitan rail system, queried why more development had not taken place around the stations. They found no failure of attractiveness to development. It was just that there had been little demand for development of a type compatible with a station locality during the 25-year period in question. The relevant demand resumed later.

Alternative Sketch Development Scenarios

During the planning process it is practical to lay out possible scenarios of land development and possible changes of land use under impact from the project. This is to consider what forms of development are most compatible with the context of corridor and node positions, which current land uses are likely to survive new accessibility in their present form, which ones are likely to remain but densify, which ones are likely to be liquidated by investors intent on providing development more compatible with new access conditions.

This is necessarily a very sketchy process that should welcome many different assumptions about the future development of the corridor and its subregion. This study would also require making different assumptions about the local economy during the next years.

The main purpose of the scenario planning is to avoid mistaken assumptions about futures that turn out to be compatible with existing development or uncompetitive with stronger initiatives.

It enables developers to examine possibilities realistically. For example, suppose one wants to build middle class housing in a locality that does not currently contain it. There would be a need to introduce it at substantial scale in number of units to comprise a community. But at what scale? Is land assembly at that scale possible? Special attention should be given to the functional design of impact absorption in the major nodes. The major nodes are the most likely to sustain very significant change.

Note that the objective of this part of the program is not to produce attractive urban design pictures of new development, but to examine basic compatibility and functionality. It may be desirable to produce attractive pictures for other purposes, but it is important not to lose focus on the basic, different, functions of this exercise.

1. Impacts fees are fees charged to a new development to partially defray the costs of providing public services to that development. Roads, water, sewer, and schools are frequently considered public services that can be covered under an impact fee.

2. Tax incrementing financing is a way of raising debt capital to finance public investments. Capital is raised based on the expected increase in tax revenues that will result from the investment.

3. Land assembly is the joining of contiguous parcels of land to make a development feasible or more attractive. Assembling land can be done through a variety of private (such as outright purchase) or public mechanisms (such as expropriation). Land readjustment is an innovative land assembly tool in which land owners voluntarily trade ownership of unimproved land for improved land.

4. Land banking refers to the practice of purchasing land and holding it (“banking”) until the time for development or redevelopment is right. In the case of transit oriented development, a municipal government or non-profit may purchase land in the city periphery, next to transit stations, to ensure high density development decades later. Cervero (1998) details the Swedish case using land banking for transit-oriented development.

5. Downzoning is the practice of decreasing the allowable constructability of a parcel. By contrast, upzoning increases the intensity of development in a given parcel.

Refined Housing Demand and Urban Growth Studies

Market demand knowledge is an important part of the planning process. Nothing is going to happen in the corridor if there is weak market for the kinds of development facilitated.

Housing demand forecasting is a well-developed field but its expertise is mostly not in public agencies responsible for planning. Local developers watch housing starts in great detail to plan investment in the type, location, sizes etc. of housing units and other uses which will respond to effective demand.

A notable special case is Bogotá's Treasury Office, which has the Land and Housing Observatory to follow real estate market dynamics within the city. On the other hand, the Planning Department also has a list of potential investors interested in getting involved in affordable housing development projects in target locations.

Participation of the developers or their syndicates is often complicated at first by a sense of distrust between them and public authorities—a sense that public agencies regard developers as opportunists and a sense on the part of the developers that public officials are likely to take an unhelpful watchdog position against profitable options. Indeed, these groups speak different languages. In many recorded cases, however, once working together the two sides soon highly appreciate productive collaboration.

It is necessary to examine demand in various housing submarkets at different price levels, dwellings of different floor area, different patterns of grouping housing units, different tolerances for distances to public and commercial services, etc. Research must consider the different situations of potential residents with and without personal vehicles, different points in the family age cycle, etc.

Marketing the Corridor

A marketing campaign is the key to generating early response to the access provided by new BRT rather than leaving it to accumulate over time. There should be staff in charge of this aspect of the program from the beginning of the project. Some of the possible functions include:

- Sponsor urban design competitions for visions of the corridor future that attract public and professional attention to the promise of corridor futures. (No designs submitted would have any status as public commitment.)
- Exhibit pictures and functional records of successful similar cases in other cities, other countries.
- Sponsor programs in the schools that familiarize the students, and their parents, with the emerging possibilities of the corridor.

- Release information in the media—television, radio and the press, as well as maintaining a web site to keep the metropolitan population (and investors) informed.

- Provide graphic and media information about successful BRT systems elsewhere. Possibly organize inspection visits to other case cities.

- Advertise in trade journals the availability of superior access of substantial parcels for industrial and office development.

- Engage the conscience of the city with the important gains in prospective services to the low-income communities close to the BRT corridor and the environmental gains from transit that encourages less auto and motorcycle use.

- Hire specific staff to fulfill the above functions. They should seek out potential developers or locators and invite or visit them to discuss possibilities. Discussion with potentially interested locators can reveal what the project can do to relieve problems so that they are further encouraged to locate in the corridor.

- Have development regulations that are easy to communicate and understand. Based on the experience of Curitiba, clear land use regulations enhance public and private confidence in the planning system while increasing accountability and transparency.

Infrastructure Services

Since timely availability of infrastructure is important it is useful to convene a special subgroup of infrastructure providers—water, sewerage, electric power, streets. This group would be responsible for anticipating the infrastructure load required by BRT-oriented development. It would make an effort to coordinate extensions to avoid multiple excavations and rebuilding.

At the same time it is a means of considering financing substantial new capacity and assuring that could be provided in a timely manner for new development as an inducement to investment. The objectives include avoiding extra cost imposed on initiatives in the high access corridor, but to assure prompt attention to infrastructure needs for new development as an inducement to investment.

Forms of infrastructure provision of this sort may also put government in a position of greater project guidance, assuring compliance with the densification plan. Certainly, the infrastructure provision process is easier when it is well-bounded by planning instruments so that costs and benefits of the development process can be shared among parties involved. As part of the implementation of those planning instruments, management and finance tools for provision of services include those included in the literature review section of this paper.

Defending Against Sprawl

An important concern is to avoid the possibility that the suburban BRT stations and nodal developments at the urban fringe would serve as centers that radiate sprawl into surrounding areas. This might cause more of the congestion, increasing trip lengths and auto based travel that BRT was meant to reduce. It may be instructive to recall that the infamous sprawl of Los Angeles (California) was initiated at the beginning of the 20th century by the extension of rail transit lines, not by automobiles. By contrast, Curitiba built its BRT corridors in the 1970s and 1980s, and with coordinated land use policies was able to accommodate a tripling of the population largely along the BRT axis.

Sprawl may also be confounded by the effects of gentrification, as has been documented in the case in Portal Suba in Bogotá (Hurtado-Tarazona, 2009). As areas close to BRT stations improve their access, property values will increase. Renters, and to some extent owners, will be displaced over time by moving to more affordable, outlying areas. This process not only exacerbates the sprawl problem, but leaves the affordable housing problem untouched.

The issue of defending against sprawl falls under the broad rubric of growth management. The presence of a framework that facilitates the implementation of instruments to manage growth is important. At the level of a BRT stop or corridor, the instruments can be used to foster BRT-oriented development by changing development regulations, encouraging land readjustment, and sharing the costs and benefits of public actions among stakeholders.

Further away from the corridor, instruments such as transfer development rights, greenbelts, and tradable development permits can be used to avoid inducing additional growth. To be effective, these instruments should be viewed as complements to a policy of growth concentration along mass transportation corridors and that also supports affordable housing. On their own, and based on the experience of the USA and the UK, these policies may yield disappointing results and may have negative impacts on affordable housing.

There are land development tools in Brazil that enable the owners of environmentally or agriculturally valued lands to build on part of their land at high densities while agreeing to commitments to keep the rest of valued lands in agricultural use. In the USA also many of the states have agricultural protection zones for this purpose.

Preparing for Corridor Extensions at Later Stages

Planning for later extensions of BRT beyond the current range of intended service may create opportunities for consolidating development. In some cases, future extensions may reach into areas currently with lower density, permitting more control over increasing residential densities in anticipation of the BRT service. To the extent that extensions will service informal settlements, there are opportunities for market stabilization. Bogotá's experience in Nuevo Usme illustrates the potential of using BRT feeder routes to upgrade informal settlements through land readjustment, road improvements, and access to water and sanitation services.



4. CURITIBA: AN INTEGRATED BRT-LAND DEVELOPMENT STRATEGY

Any study of BRT and land development must be very attentive to the experience of Curitiba. It is the earliest of large-scale BRT undertakings and, as a result has come during 35 years to a more mature equilibrium between BRT transit capacity and land development than any other city. Secondly, Curitiba's outlook for BRT from the beginning was founded on expectations for BRT to have strong generating effects on land development. Thirdly, the BRT corridors have been extended beyond the earlier fully developed parts of the city to densifiable areas where impacts on land development are especially telling. BRT initiatives in other cities have mostly stayed within built up sectors. Finally, and importantly, the city has employed a number of creative measures to guide land development toward densification of trip origins in the vicinities of the BRT corridors.

For our analysis, perhaps the most important lesson from Curitiba is that they did not simply build BRT, then finding that it had significant effects on densification and auto trip reduction. On the contrary these consequences were a carefully planned and forcefully enacted part of a comprehensive transport and urban land development strategy.

Curitiba is at the center of a metropolitan area of 3.17 million inhabitants. Its population has grown by a factor of 9.3 during the last 50 years (4.6% annual growth) and 2.1 times over the last 20 years (3.8% annual growth) (IBGE, 2010, interpreted in Lindau et al 2010a). Curitiba is therefore a new city with relatively wide rights of way that give it certain advantage in planning multi-use corridors. The residential density is about 42 persons per hectare—almost the density of a European city, considerably denser than a North American city. At the same time it has a remarkably high vehicle ownership rate. The average number of unlinked trips per person per day is almost as high as New York City.

Curitiba had a comprehensive plan completed by the firm of Jorge Wilhelm in 1965, shortly before the beginning of the BRT initiatives. This plan identified the series of radials from the city center that became the corridors for BRT development. It may be of some interest to note that the BRT leadership of Curitiba and Bogotá in BRT has somewhat similar roots. Both metropolitan areas grew rapidly beginning in the 1950s. The leCorbusier plan for Bogotá and the Wilhelm plan for Curitiba endowed both cities with broad urban avenues adaptive to multi-use rights of way. Of course, since then other cities have adapted BRT to much narrower streets. In both cities BRT was received with great popularity. During recent years both cities' systems have experienced some decline in popularity (but not in patronage) due to increased crowding in the buses, complexity of orientation due to multiple services on the same lines, and loss of earlier sense of novelty. The two cities exhibit all this

similarity although the starts of service in the two cities are separated by some 25 years. Of course, Bogotá gave far less early attention to the land development aspect.

Management of implementation got a strong start with the empowerment of the IPPUC (Instituto de Pesquisa e Planejamento Urbano de Curitiba) to put the 1965 comprehensive plan and new BRT into place. Its director, Jaime Lerner, became Mayor. URBS (the urban development authority) was created to build and manage facilities for all the transportation modes of the metropolitan area. The URBS mandate is broad, including the parking and streets. Thus land use and new transport technology began on equal footing. This is very rare in any city. Significantly, the 1965 plan already emphasized nodal development on the outer parts of the radial axes. The creation of these two organizations has been very important to the coordination of land use and the entire transport system. As an organizational framework of close collaboration it has never been achieved in any other city.

Parking management may have influenced the use of the BRT system. Most of the paid parking in the city is concentrated at the center (Praça Rui Barbosa) where it is well used but rarely filled to capacity. Minimum parking requirements have been set along the BRT trunk routes. However most parking in the city is free. The density of development along the BRT routes of the city has limited the possibilities for residents to garage cars. The achievements of land development via BRT, however, have been largely accomplished without the support of assertive parking policy. Readers are by now familiar with the "trinary" system of Curitiba, the scheme of parallel streets serving different local and regional roles along a central corridor of BRT and service road. We are also accustomed to seeing the images showing files of tall buildings along BRT routes such as Curitiba's western structural axis.

Reporting by now more than ten years ago, Cervero (1998, pp. 282-286) examined the instruments used to create dramatic density differences in land development on the BRT corridors. They included:

- *Nearly all the parcels within two blocks of the structural axes were zoned for commercial-residential use. Considerably higher office and residential buildings were permitted.*
- *Buildings facing the exclusive right of way were required to have half the ground floors and second floors be available for commercial use.*
- *In the historic center of the city landowners could sell development rights to land owners in other parts of the city. These special property rights were often used along the BRT corridors because developers received special inducements on those corridors.*

- *Developers were encouraged to "buy up" their construction programs by paying a contribution to the municipal housing fund for low-income dwellings, permitting them to build higher buildings.*

- *Shopping centers were permitted only within the structural axes.*

IPPUC records that the localities closely along the lines of BRT grew by 12 percent during 1991-2009, but the areas just beyond these most proximate localities grew by 77 percent during the same period (Brindo IPPUC-Curitiba, ppt. image 22).

Note that, in contrast to most cities' planning programs Curitiba has focused its studies of land use and mobility more on the land use side, rather than the mobility side. The metropolitan area has never had an origin-destination survey. For purposes of learning further from Curitiba in BRT/land development the Linha Verde experience is important. The Linha Verde was planned in 2002 and opened in May 2009 along an initial 9.4 km initial stretch. It is the very wide right of way of a former national highway whose traffic has been diverted to a different route. It is the 6th BRT corridor of Curitiba.

The wide right of way (60 to 80 meters—ten lanes) and limited industrial development along the sides, has enabled the use of the Curitiba trinary profile, multimodal use and a 20,000 square meter park. The photograph of the corridor (Figure 1) clearly suggests great development possibilities, with industrial properties occupying the corridor at low densities in aging buildings. When the city law that enabled densification of the corridor was approved the real estate prices for the underutilized industrial land rose by a factor of three (URBS, 2010)..

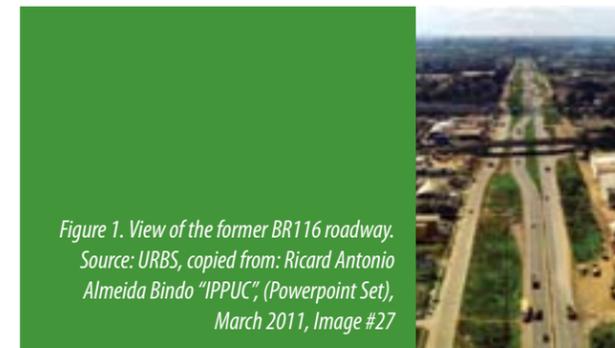


Figure 1. View of the former BR116 roadway. Source: URBS, copied from: Ricard Antonio Almeida Bindo "IPPUC"; (Powerpoint Set), March 2011, Image #27

When completed this corridor will be 18 km. long, connecting 23 neighborhoods and 287,000 inhabitants (City of Curitiba, 2010). Note that this radial corridor is affecting the travel of a very large portion of population. With the use of various land development instruments it is creating permanent nodal settlement around its trajectory, rather than simply serving an exurban hinterland of scattered development.

For example, fees collected from density bonuses elsewhere in the city have been used to pay for linear parks along the corridor. The large affected population is a key to the significant contribution of BRT to clean air and reduced congestion.

The Linha Verde is, of course, a special case—a quite low density, declined industrial corridor, further weakened by the diversion of its traffic to another route. It nonetheless serves as a model in the search for workable possibilities. If BRT is to make a significant contribution to clean air and mobility planners must seek high impact possibilities—though improved mobility in existing heavily populated areas has its own merit, we should seek qualitatively significant change. This will unfortunately entail low income from BRT lines in the short term. Only 10% of the income from the Curitiba transit system comes from metropolitan areas beyond the city itself. But in a rapidly growing metropolitan area this situation should not last long. Similar improvements along with increased mainline capacity have upgraded the Boqueirão Corridor.

Regarding this objective, it is also noted that the land development policies at Curitiba have enabled generating development on the outer parts of the lines, rather than permitting them to simply lead into unstructured outlying settlement where nodes of services and investment do not occur.

5. NASCENT OPPORTUNITIES FOR BRT AND LAND DEVELOPMENT INTEGRATION IN COLOMBIA

The number of BRT projects in Colombia has increased dramatically over the last decade. Led by Bogotá's BRT system inaugurated in 2000, seven of Colombia's largest cities have BRT projects under advanced planning, construction, or operation. Twelve other medium-sized cities in Colombia have BRT projects in varying stages of planning.

Despite the rapid diffusion of BRT in Colombia, there is limited experience coordinating land development with the BRT investments. Three cases in Bogotá, one in Pereira, and one in Barranquilla are used to illustrate the emerging Colombian experience with BRT-oriented land development. The Bogotá cases highlight different degrees of missed opportunities to redevelop land around BRT stops that have high passenger use. A case in Bogotá also underscores the feasibility of connecting compact, affordable housing to BRT investments. The Pereira case underscores the importance of preparatory work with land owners and prospective developers. The Barranquilla case embodies the execution of a downtown redevelopment and renewal project in close proximity to the BRT but with no coordination. It also highlights the importance of involving current tenants and informal workers (in this case, vendors), early on in the planning process.

The next section provides contextual information regarding policies for transportation planning and urban development, with four case study cities following.

National policies regarding urban development and transportation planning

The early success of Bogotá's TransMilenio compelled the national government to develop a policy for implementing BRTs as a mass transportation strategy in medium- and large-sized cities. It is important to understand the context within which this policy was adopted. Public transportation in Colombian cities is dominated by owner operators and small and medium-sized firms whose drivers compete with each other for passengers. This curbside competition has led to an oversupply of public transportation service, low vehicle utilization rates, and congestion and air quality problems.

In 2003, a national policy for urban mass transportation infrastructure was adopted (DNP, 2003). It aimed at reorganizing public transportation service in Colombian cities with more than 600,000 residents using BRT. A unique feature of the national policy was that it viewed BRT investments as catalysts for metropolitan redevelopment along the BRT axis, while encouraging the use of value capture techniques and betterment levies (DNP, 2003). In addition, the central government agreed to cover 70% of the capital cost of building a BRT system, with local governments covering the remainder.

While BRT was consolidating as a viable alternative for urban mass transportation, local land planning was undergoing a tectonic shift in Colombia. In 1997 legislation to manage urban development was approved. The aim was to strengthen localities in their ability to manage urban growth and development. The legislation gave cities authority to plan, manage, and apply financial instruments for building and modifying urban spatial structure (Giraldo, 1999), while enhancing community participation, and private sector involvement. The legislation also enabled, and in some cases mandated, the formulation of a hierarchy of plans and tools to manage urban development.

At the highest level, the legislation required the creation of a comprehensive spatial plan, the Plan de Ordenamiento Territorial (POT). For cities with more than 100,000 residents, the POT should contain housing, transportation, land use, and water and sanitation components, among others. These components contain specific tools and policies to bring about the vision regarding areas of the city considered for renewal, growth, preservation, and stability over a 12-year horizon.

The 1997 urban development legislation also enabled the creation of two instruments to manage land development in areas of change. First, "Urban Macroprojects," can be

used when a large scale urban intervention that has the ability to generate structural impacts on the city is envisioned. Second, partial plans are small area or neighborhood plans that can be used in planning for urban renewal or urban growth. These plans can be initiated by the city or by private parties seeking to develop or redevelop large tracts of land. Partial plans may be used within a macroproject, or they may be stand-alone, but always in concert with the POT.

At the next level of the hierarchy of development management instruments are urban action units (UAU). UAUs identify an area typically of three or four square blocks in which costs (for example for utilities and road infrastructure) and benefits (for example changes in zoning ordinance to allow certain land uses or additional intensities) are distributed fairly among landowners and central and local governments. To manage the distribution of these costs, UAUs rely on land management and financing tools like land assembly, land readjustments, transfer development rights, betterment levies, land banks, and land value capture. In 2010, among cities with more than 100,000 residents, there were 349 partial plans under formulation, approval, or implementation stages nationwide, of which 78 plans were for urban renewal and 271 plans for new development and urban growth (DNP, 2011).

The promise of BRT-oriented development in Bogotá

Although Bogotá adopted BRT just over a decade ago, BRT has become an integral response to its mobility challenges. The City has capitalized on its ample boulevards and streets planned in 1930s by Brunner and in 1949 by Le Corbusier and Sert to route BRT service along them while preserving automobile traffic flow along parallel lanes. Bogotá's BRT service has grown beyond the consolidated city areas. Areas with lower population density and areas with potential for redevelopment and renewal are now benefiting from BRT service.

In contrast to Curitiba, Bogotá offers important lessons regarding missed opportunities to integrate land development with BRT investments. A first lesson concerns the active role that city planning officials should play in coordinating transportation and land development activities. In Bogota, planners played a limited role in this coordination. In most cases, when development changes took place, they were led by private developers with city involvement limited to the ordinary development review process. The most noteworthy exceptions are cases in which affordable housing projects led by city agencies were loosely coordinated with the BRT service.

Second, in the absence of proactive city involvement, the private sector may capitalize on the accessibility benefits of the BRT investment particularly for stops with high passenger movements, such as termini and transfer stations. In the case of the Suba station, actual and expected land

value increases in and around these stops led developers to step in and reap the rewards of the accessibility and pedestrian flows afforded by the BRT system, without any city involvement.

Third, the Bogotá cases underscore the institutional complexity of the planning process for coordinating BRT and land development. The complexity of the planning and programming required a small group of central agencies involved. In Bogotá, ownership and responsibility for projects either changed or was shared among multiple parties. Current steps are being taken to improve institutional coordination.

Bogotá's 7 million residents make up more than 15 percent of Colombia's total population. The high population growth rate (about 6.5 percent) of the 1960s dropped to approximately 3 percent in the 1980s and averaged 2.5 percent annually during the 1990s. Future growth originates from displaced migrants responding to "push factors" such as rural violence, unfavorable climatic conditions, and poverty, rather than new births.

Over the past thirty years the city has experienced steady north-south growth between the floodplain of the Bogotá River in the west and mountains in the east (Figure 2). While local government policies have been somewhat successful in controlling low-density sprawl, and incorporating informal settlements to the city fabric and services through the POT, encroachment into neighboring communities continues to happen. City density remains high, at over 105 residents per hectare, positioning Bogotá midway among the world's densest cities..

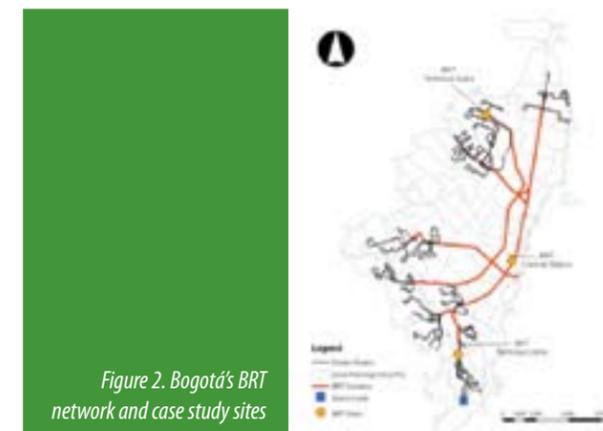


Figure 2. Bogotá's BRT network and case study sites

Bogotá's current BRT system covers 84km and carries more than 1.7 million trips per day. A system expansion of 36km is under implementation at a cost of USD\$689.5 million. Recent studies have detected increases in prices of residential properties of between 2% and 20%, depending on the real estate submarket, city section, and methodology

used (Muñoz-Raskin, 2010; Rodríguez & Targa 2003, Rodríguez y Mojica, 2009; Perdomo et al 2007). Other studies have focused on commercial properties, with substantial increases of between 96% and 127% detected in some BRT termini and transfer stations with high passenger movements (Borrero, 2007). These increases have benefited current land owners, and in some cases, have resulted in development patterns that take advantage of their proximity to BRT stops.

IN THE NEXT SECTION WE REVIEW THREE CASE STUDIES IN BOGOTÁ.

THE NUEVO USME MACROPROJECT

section of the city. The city planned the development under the banner of an urban macroproject. The aim was to expand the city by means of high density affordable housing, with water and sewer service, and with commercial and light industrial uses while attempting to stabilize the land market and prevent future informal settlements from locating in the vicinity of the project area.

The macroproject is being implemented with four partial plans using public-private partnerships, of which one has been implemented. For plan implemented, private land owners have contributed land which was reassembled in tracts, while the government invested in road infrastructure and utilities, zoning changes, and development permitting. To avoid speculation, land prices were frozen when the project was announced in 2003. This tool, also enabled by the 1997 legislation to manage urban development, aims to control price increases in areas where public interventions are announced but may take years to be completed. After improvements, tracts were given to private developers for development. Landowners who lost their land to parks, utilities, roads, or institutional uses (such as schools) got compensated with finished housing units. Planned development involves high density affordable housing with mixed land uses. At build-out, the project will include more than 55,000 housing units. Currently, one partial plan is the most advanced, with over 1,000 housing units built (Metrovivienda, 2011).





Figure 3. Developments around the Usme BRT Terminus, several kilometers away from the Nuevo Usme Project. Source: Vergel, E. (2011)

The case of Nuevo Usme shares many similarities with other affordable housing initiatives in Bogotá, such as El Recreo and El Porvenir documented by Cervero (2007). The government improves land at the urban fringe in coordination with land owners (or with land banked by the City as in the case of El Recreo and El Porvenir) and then negotiates development agreements with private parties. These affordable housing projects have benefitted from the proximity of BRT, but the coordination with the BRT investment appears to be largely fortuitous. In the case of Nuevo Usme, the BRT terminus inaugurated in 2001 is more than 5 km away from the Usme macroproject; the easiest way to access the BRT is by using BRT feeder services.

Several project characteristics merit highlighting:

- Inter-institutional coordination has been complex. The project was initially managed by the City Planning Department, but in 2004 was transferred to the affordable housing agency, Metrovivienda. In 2007, Metrovivienda was reorganized within a newly created cabinet in charge of housing issues and habitat.

- The scope of the macroproject meant that it would be implemented over a decade or two. This made it vulnerable to varying political priorities of elected officials.

- Environmental permitting was difficult because parts of the project disturbed areas of natural and heritage value. Because a single development permit for the entire macroproject was initially sought, the environmental permitting delayed the entire macroproject. Now each partial plan seeks its own development permits, thereby allowing some partial plans to move forward without further delay.

- Recently the discovery of burial site for pre-Columbian era natives delayed the implementation of the project. The development layout was adjusted accordingly.

- The project was made official two years after the BRT system opened its terminus in Usme. Land value increases due to the BRT were detected prior to the project announcement, even for areas served by feeder buses like the Nuevo Usme project area. Price elasticities of -0.16 with respect to distance to feeder lines have been estimated (Borrero et al, 2007).

Portal Suba

The terminus of the Suba BRT line is located in the north-western part of the City (Figure 2) and began operations in April, 2006. The case illustrates the missed opportunity for recapturing some of the benefits that accrued to private land owners due to the BRT investments, and the role that the private sector plays in identifying and acting on attractive development opportunities.

Before the BRT, land around the terminus was developed at modest densities, with single story brick and concrete housing and light industrial activities. Some significantly-sized vacant lots were also available. After the inauguration of the terminus, private developers acquired land and proposed projects consistent with existing land use regulations. Studies have identified significant increases in property values in areas close to the Suba terminus (in some cases greater than 100%) relative to a control area (Borrero et al, 2007). As a result, several large commercial developments were built in close proximity to the BRT stop, including some big box retail.

Although the presence of such retail is a welcome sign of the viability of development in close proximity to BRT, the density of the development that took place could have been much higher, with a mixing of residential and commercial land uses, and a variety of types of residential development.



Figure 4. Commercial Developments around the Suba BRT terminus. Source: Vergel, E. (2011)

High density housing developments have been built in close proximity to the BRT terminus. These developments took advantage of the presence of vacant land around the BRT, which is consistent with Boarnet and Crane's (1997) observation that land availability is an important determinant of the success of transit-based housing. Similarly, self-help housing around the terminus has undergone substantial improvements. First stories of houses abutting roads leading to the terminal have commercial activity.

"Central Station" Project

In response to the inability to take advantage of the land value increases generated by Bogotá's BRT, local planners have begun to identify projects in which BRT-oriented development can be successful. The Central Station is a project in the planning phase, aiming to take advantage of the need for a bus transfer station in downtown Bogotá (Figure 2). The transfer station connects two major BRT corridors: the north-south "Avenida Caracas" corridor with a new east-west corridor currently under construction. The Central Station project arose from the idea of placing the transfer station underground thereby freeing prime real estate for intense mixed use development. More than 200,000 square meters of development are planned, and more than 12,000 square meters of public space, including the construction of two public squares and two pedestrian boulevards.

Several characteristics of this case are worth highlighting:

- A partial plan developed by the city planning department includes a real estate development study, a market feasibility study, and examines the parcels within urban action units and the benefits and costs assigned to them. Visioning exercises and work with developers have been undertaken by the urban renewal agency.

- Given the scope, the project is to be implemented in three stages. In the first stage, land is acquired and the underground station built with resources associated with the BRT project. About 65% of the land development will take place in the first phase. The first phase includes the underground BRT station, underground parking for private automobiles, commercial and institutional (first floor and platform), and residential uses (third floors and above).

In the second phase of the project, additional mixed use developments containing commercial and institutional uses at densities lower than the first phase are created. In the third phase, residential development of no more than five stories has been planned.

All land development is to be done by private developers, under a public-private partnership with the City's urban renewal agency.



Figure 5. Central Station under construction. Source: Vergel, E. (2011)

6. The "Macroproject" planning tool was adjusted in the Bogotá's POT to be called a "Strategic Urban Operation". For parsimony we refer to it as a macroproject.

• The project has been institutionally complex due to the involvement of several city agencies. The BRT operator, the agency in charge of city public works, the urban renewal agency, and the city planning department have played important roles in the conception and implementation of the project. However, leadership and coordination roles have been assigned clearly and deliberately to the urban renewal agency.

BRT and land development in a mid-sized Colombian city:

Estación Cuba

Pereira is the core city of the West-Center Metropolitan Area of Colombia. The metropolitan area has more than 594,000 inhabitants in 4,553 hectares of urban land, with a resulting density of 130.6 residents per hectare. The BRT began operations in 2006 and serve the municipalities of Pereira and Dosquebradas. The BRT has over 17.9km of dedicated right of way and 40 stops, carrying 119,000 passengers per weekday. Total capital costs were USD\$154 million (DNP, 2007).

There are three characteristics to highlight in this case. First, Estación Cuba is relying on private sector-initiated partial plans for the redevelopment process. This is in contrast to Estación Central and the Nuevo Usme macroproject in Bogotá, where City planners have conducted market and feasibility studies and have relied on the private sector to implement a predefined development concept. Despite the importance of the private sector for the future success of Estación Cuba redevelopment efforts, we documented little effort in including land developers or their syndicates in the planning process of the project.

Second, Estación Cuba is surrounded by an economically active and a somewhat deteriorated urban fabric. The area is dominated by small one-story parcels with commercial land uses offering low-value goods. As a result, it has been difficult to encourage land redevelopment and renewal. Third, the city has had disappointing results attempting to recapture some of the land value increments caused by changes in regulations.

Estación Cuba was built as part of the BRT system in order to provide intermodal transfers with other bus services and taxi service that link the city with the metropolitan area. Local residents and light-industry owners initially opposed the project, fearing betterment levies due to the improvements. Concerns were allayed once the financing scheme, with 70% central government participation, was confirmed. Estación Cuba opened in 2009, and much like the planned Estación Central in Bogotá, it is an underground station with all intermodal exchanges also occurring underground. Commercial space in the underground station was sold off to private individuals.

Local planners quickly realized the potential value that the underground station would create on surface parcels. As a result, they sought to combine the BRT investments at Estación Cuba with improvements to a large public park and plaza above the station.

A partial plan covering 9.6 hectares was used to implement Estación Cuba and its improvements. Future redevelopments around the Estación will require only the expedition of a construction license within the land use regulation established by the UAU according to the partial plan guidelines. As part of the building of the underground station, street vendors who used to occupy park space were involved in a protracted resettlement process that resulted in litigation. The courts required the city to provide for adequate resettlement space within the boundaries of the partial plan. In addition to the physical changes, land use regulations were modified within the area of one partial plan, allowing for higher density and mixed use developments.

The city also has sought to recapture the value of the land use regulations changes. The recapture can only take place when the additional development rights are exercised with a development proposal. As of 2010, only one large commercial development had taken place and the value recapture instrument had not been used due to lack of development proposals in the area.

Landowners have shown lackluster interest in redevelopment in the area. Two potential explanations emerge. First, the current atomized land ownership appears to be a strong disincentive for redevelopment. To address this concern, an adjustment to the former partial plan was issued, defining a smaller UAU with tax incentives to encourage parcel assembly and integration among land owners. Although the effectiveness of these incentives remains to be seen, anecdotal evidence suggests the current parcel owners see little benefit in interrupting their current economic activities to get involved in land assembly. A second explanation for the limited interest shown by private land owners is that by effectively taxing away some of the land value increases due to the changes in legislation, the land value recapture may be moderating some of the redevelopment incentives that might exist. Future research will determine whether development changes in the area will materialize.

BRT and land development in a coastal city: Downtown Barranquilla

The case of Barranquilla illustrates two important lessons for coordinating BRT and land development. First, it is important to involve current residents and users of the space that will be affected by the project early on. As in the Pereira case, in Barranquilla a large group of informal vendors had been using public space to offer their wares.

These vendors had to be resettled through an extended negotiation process partly because there was little guidance on how to conduct such resettlements in the context of urban renewal projects of a partial plan.

A second lesson is that the timeline for BRT investments and the timeline for land development are very different. The Colombian national government wanted to implement the BRT system on a very short time frame. Yet, the planning for redevelopment, let alone the redevelopment itself, may take significantly longer. This may explain why, despite the physical proximity between the BRT and the redevelopment efforts in Barranquilla, the two projects were largely independent of each other. However, the speedy BRT implementation may be something positive to the future success of the redevelopment efforts. The plans involve redevelopment in areas that currently are well-served by a high quality BRT system.

Barranquilla is the core city of a metropolitan area located in the north coast of Colombia. The metropolitan area has almost 2.5 million residents with a density of 35 residents per hectare, while the city of Barranquilla has more than 1.2 million residents with an urban density of 137.17 residents per hectare. Barranquilla is where Colombia's longest river meets the ocean; it is also an active seaport. The BRT system, inaugurated in 2010, has 21.9 km of right of way

with 18 BRT stops along two transportation corridors and serving the municipalities of Barranquilla and neighboring Soledad (DNP, 2008). The total cost of the BRT infrastructure was USD\$370 million (DNP, 2008). Currently the system carries 349,000 passengers per weekday.

The POT for the Barranquilla metropolitan area calls for significant urban renewal led by the Barranquilla Urban Development Agency (EDUBAR). Renewal in the city center has been guided by two partial plans, with smaller UAUs to be defined in more detail with the involvement of private developers. The first partial plan encompasses the historic city center and is aimed at central city revitalization. The second partial plan attempts to connect the downtown with the riverfront and the seaport, thereby stimulating urban renewal and redevelopment in an area that is well-located and now well-served by the BRT system.

The downtown partial plan encompasses 145.4 hectares, including some historic buildings, and several institutional land uses. The partial plan attempts to encourage urban, social, cultural, economic, and environmental activities to reverse the urban decay process of the area by allowing higher intensity developments in lieu of sharing the costs of public space improvements in the area covered by the partial plan.



Figure 6. Cultural Park of the Caribbean and BRT Station. Source: EDUBAR (2011)

The downtown revitalization process of Barranquilla is unique also because it contains buildings and areas that are subject to stringent historic preservation rules dictated by the central government's Ministry of Culture. This has added to the complexity of the revitalization plan. Thus far, the Historic downtown plan has wrestled with legal issues related to land acquisition (application of eminent domain, inconsistencies in land records, informal occupation by private parties). The implementation also has struggled with street vendors that rely on public spaces for their informal commercial activity. According to EDUBAR, improvements worth US\$15.8 million to public spaces, road and utilities infrastructure, and the cost of managing the resettlement process of street vendors have been made while an additional of 743,000 square meters of development in the area have been allowed (EDUBAR, 2010).

The second partial plan covers an area served by a BRT stop and a BRT terminus. The plan is composed of seven UAUs from which three are currently being implemented, including major changes in the land use regulation for the area in exchange for funding to support investments in utilities and public spaces. EDUBAR estimates that \$28.8 million of improvements have been made while an additional 7 million square meters of development have been authorized. Much of the planned development for the areas of renewal and expansion remains to materialize. The implementation process of both the BRT and the renewal plans has lacked coordination. Furthermore, in neither partial plan were the changes in land use regulations used to pay for the BRT investments. Despite the limited coordination, local planners view the BRT investment as catalysts that could help instigate desired redevelopment and renewal.

A noteworthy exception to the renewal process in downtown Barranquilla is the development Parque Cultural del Caribe (PCC), a cultural complex containing a museum, public library, public plaza, and other amenities. The PCC was planned in the late 1990s, and was expected to be built in the early 2000s, but it took until 2007 and 2008 for its inauguration. The park is located just in front of one BRT stops with the same name (Figure 6). When the BRT project was in the planning stage, there was an agreement between public and private entities in order to establish one BRT stop just in front of the PCC, to leverage the two strategies. However, the extent to which the BRT has enhanced the renewal potential of the PCC remains to be examined.

CASE CONCLUSIONS:

BRT AND LAND DEVELOPMENT

We examined the planning and institutional factors that contribute or constrain the planning and implementation of BRT-oriented development by examining the experience of Curitiba, Bogotá, Pereira, and Barranquilla. Two complementary perspectives were offered by the cases studied. In the first perspective, we identified how enhancing the viability of BRT relative to the private automobile can be enhanced by focusing on planning and programming functions that consider corridors and regional spatial structure. The case of Curitiba underscores the results of a carefully planned and forcefully enacted transport and urban land development strategy. The case of Bogotá, by contrast, embodies a missed opportunity to use the BRT investment as a catalyst for spatial reorganization and growth management.

Related to the issue of corridors and regional structure, decision-makers are faced with a difficult choice. Route the transportation investment along corridors with high demand, or route the investment through areas that could attract new development. Most BRT services are routed through already densely built up areas, as highlighted by the Bogotá and Barranquilla cases. Under those circumstances, only a limited market response toward denser development can be expected unless urban redevelopment and renewal are considered. The Linha Verde example (in Curitiba), however, illustrated the opportunities available when new, managed development is to be encouraged through BRT investments.

In the second perspective, we determined station-level characteristics that facilitate or constrain BRT-oriented land development. The emphasis on nodes instead of corridors distinguishes the Colombian cases from the experience in Curitiba and other Brazilian cities. This attention to nodes may be the result of the need to show success stories and create interest in corridor-level development. It may also be largely opportunistic, and may be occurring at the expense of a deliberate corridor-level strategy to stimulate BRT-oriented development.

As Colombia's experience with BRT is limited to the past 10 years, the results of BRT-oriented land development pale in comparison to Curitiba's. Several factors help understand the country's experience thus far. First, the cities have been working within a complex institutional arrangement. In Bogotá, several agencies are involved in a given project, with conflicts and often overlapping roles. This evidence also supports the view that a project with a visible champion, but working through a planning process that is inclusive of public agencies, private parties, and non-profit groups with a stake in the project is likely to be successful. To further complicate the institutional milieu in Colombia,

cities have been working with a land planning and growth management framework that is just getting established in planning practice. Cities have been building local capacity in order to use current planning and land management instruments more effectively. Refinements in the planning process and a maturing framework for growth management are likely to yield improved outcomes in the future. This contrasts with the Colombian experience with "valorización" (a betterment levy) for road infrastructure, which have been institutionalized and used over time.

Second, the private sector in Colombia has shown mixed signals regarding its willingness to reap the benefits of BRT investments. On the one hand, in Bogotá developers built large scale commercial developments and property values in close proximity of certain high-use BRT stops have more than doubled. In areas close to the city center, several high density developments have taken place partly in response to the presence of TransMilenio. On the other hand, in other cases reviewed the private sector has been less enthusiastic about the development plans, frequently taking a wait-and-see approach. In contrast to Curitiba, the few changes in land development regulations around TransMilenio stops in Bogotá are likely to explain the reticence of developers in engaging more actively in BRT-oriented development. Furthermore, the Bogotá experience highlights the importance of market studies that identify the demand for the type of development envisioned and whether developers have an interest in supplying that development. It also contrasts with the more integrated and deliberate approach taken in Curitiba. The case of the PCC in Barranquilla is an effort to provide BRT access to an important public facility in the city. The redevelopment and renewal consequences of serving the area with BRT remain to be explored.

Third, although the new Colombian legislation allows for the private sector to develop partial plans, all cases reviewed that contained partial plans relied on government-led planning efforts. To date, these efforts have resulted in the creation of public spaces and plazas directly above underground BRT stations or in affordable housing projects served by BRT feeder routes. For plans that have results in expanded public spaces, land values appear to have increased, but their impact on land development remains to be seen.

The potential ubiquity of BRT networks raises one concerning possibility. While BRT may generate development at stations, it may propel additional uncontrolled growth in the periphery of cities, close to outlying BRT stops. It is this type of growth that the coordination of BRT and land development is supposed to remediate. However, in the absence of a thoughtful effort to control peripheral growth, BRT may end up inducing it. Consideration a framework that facilitates the implementation of instruments to manage growth on the corridor and further away from it is im-

portant. Policy tools such as transfer development rights, land reassembly, land banking, and conservation easements, transfer development rights, and greenbelts may be necessary to complement a policy of growth concentration along mass transportation corridors.

The prospect of BRT-oriented development is not as advanced as it could be. Curitiba is the best-known case, and for good reason. It is the embodiment of successful coordination between its transportation investments and its land development strategy. The Colombian cases are likely to be more representative than Curitiba of current BRT investments elsewhere in the world. Although some opportunities were missed, new and existing efforts are being strengthened so as to support future development that enhances BRT.

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LIST OF ACRONYMS

BART: Bay Area Rapid Transit System (in the San Francisco metropolitan area)

BRT: Bus Rapid Transit

DNP: National Planning Department of Colombia (Departamento Nacional de Planeación)

IPPUC: Institute of Research and Urban Planning of Curitiba (Instituto de Pesquisa e Planejamento Urbano de Curitiba)

PCC: Parque Cultural Caribe (in Barranquilla, Colombia)

POT: Spatial Ordering Plan (Plan de Ordenamiento Territorial, in Colombia)

TOD: Transit-oriented development

UAU: Urban action units (Unidades de actuación urbanísticas)

URBS: Urban Development Authority of Curitiba (Urbanizacao de Curitiba S/A)

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