



**Sustainable Transport and Air Quality Program**

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**Bus Rapid Transit with Corridor  
Densification in Belo Horizonte:  
Case Analysis**

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# BUS RAPID TRANSIT WITH CORRIDOR DENSIFICATION IN BELO HORIZONTE: CASE ANALYSIS

Ralph Gakenheimer,<sup>1</sup> Daniel Rodriguez<sup>2</sup>

## Overview

The purpose of this paper is to examine the plan in Belo Horizonte to create two bus rapid transit corridors to the north of the city along Antonio Carlos/Pedro I Highways and Cristiano Machado Highway to improve accessibility to those corridors through the provision of buses on reserved rights of way. They will shorten local trips by inducing denser corridor subregions. The result will be to create a formative effect on this subregion that will reduce sprawl, provide more accessible and more economical housing as well as new institutional locations in the northern part of the metropolitan area, and induce the provision of more commercial and institutional services to communities in that region because of its improved accessibility. These services are currently insufficient in the modest but stable neighborhoods of the subregion.

Bus rapid transit (BRT) is a widely used technology in the cities of Brazil. The challenge here is to ensure that densification of land use is effectively encouraged to significantly achieve the environmental and social objectives of this project. The evidence from the substantial planning studies of Belo Horizonte is that considerable attention has been given to the projection of future travel demand with the use of a good demand forecast model (Emme3). But while the task of estimating future travel demand based on further land development is competent, the more difficult task of estimating future land development caused by improved transport access has not been undertaken. There have been experimental models for this purpose but there are no standard models. Nevertheless, densification of the selected corridors is an abiding concern to the Plano de Mobilidade and subsequent commentary by SMURBE.

The achievement of densified land development resulting from new BRT access will surely be based on efforts made by government and private enterprise to take advantage of this new access. Assistance to this process is the principal matter in which this case study hopes to make a contribution. The existing transport plans appear to assume significant land development will occur by simply building the BRT, itself alone constituting a transit oriented development (TOD) strategy. It is our belief that much more can be done to promote this densification (a) through public promotion of TOD to encourage housing industry response through design exercises and other means, (b) through adjustment of building density limits along the corridor (as currently planned by the Secretariat of Urban Policies), (c) by using government interventions to facilitate the provision of infrastructure in the corridors. A number of different fiscal and other tools are available in Brazil that have been used in Curitiba and elsewhere through management, regulation, and financing of corridor development (as portrayed in presentations by SMURBE)

It is also important to cope with the reality that nodes along new BRT lines will most likely serve to radiate sprawl. There are means of confronting this tendency among Brazilian land management actions. This aspect may be the most important part of assuring that new BRT access consolidates the outward growth of metropolitan regions, rather than spreading it.

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<sup>1</sup> Department of Urban Studies and Planning, Massachusetts Institute of Technology.

<sup>2</sup> Department of City and Regional Planning, University of North Carolina, Chapel Hill. Clean Air Institute Consultant.

## 1. The Problem Context

Corridor and nodal densification serves to help various problems in the current evolution of the Belo Horizonte metropolitan region. The increase rate of motor vehicles is over four times the growth of population. Traffic congestion on the radial arterials is becoming increasingly serious. The modal share of public transit is now just over 50 percent but will decline to under 50 percent within a few years. The growth of demand for radial access will grow proportionally relative to whatever highway capacity may be added during the coming years. This results from (a) increased motorization of the population, (b) traffic induced by increased highway capacity, (c) increased general affluence of the population, generally increasing their personal daily trip rates regardless of level of motorization, and (d) increased portion of the population residing in localities where employment, public services and shopping are distant.

Further challenges to dealing with these problems are the very rapid growth of two-wheeled motor vehicles. This growth is taking place in all parts of the developing and developed world. Since two-wheelers are now available at low prices, and entail low operating costs, they are often cheaper than the fares of the public transit systems while, of course, also offering door-to-door service. They are also faster in traffic than four wheeled vehicles. At the same time, however, they impose very high accident rates and air contamination. They increase total vehicle ownership by a very high percentage because of low cost. They facilitate multiple vehicle ownership even of auto-owning families. They are a threshold purchase for a family of increasing income that afterward purchases a car but keeps also the two wheeler(s).

BRT has the capability of overcoming these problems in significant ways. Under congested circumstances it is considerable

faster than private vehicles because of the independent right of way—the only mode that can offer this advantage at a reasonable price. It offers a good personal safety record, a relatively affordable fare (though often subject to political considerations) and, potentially, widespread spatial coverage because of low construction cost.

At the same time, however, this description of the problems to be solved for outlying areas around the two northern proposed routes is daunting. The magnitude of the problem we face of low and deteriorating accessibility and local services across this subregion is large and rapidly worsening. This is not a situation in which isolated islands of transit-oriented development are significant. Initiatives must relieve the limited accessibility eventually of hundreds of thousands of residents in widespread communities of modest income and also communities of substantial income. If BRT is to be sustainability significant it will have to show more than dense settlement in its corridor.

## 2. The Solution Context

The region's access problems are fortunately faced by active positive efforts in Belo Horizonte.

The Belo Horizonte transit system has been redesigned within the last ten years. It has completed construction of 4 bus-to-bus terminals and 2 bus-to-metro terminals. BHTrans has received the biennial award of the ANTP as best transit agency in Brazil four times during the last ten years.

Although national government support is very modest, the government having determined that public transport is outside its scope of action and although observers have reported that powerful operator lobbies in Brazil make it very difficult to rationalized transit systems, Belo Horizonte has attained a very high level of achievement.

The recently completed Plano de Mobilidade (August 2010) provides quite complete guidance for transport improvements of all kinds, including actions toward environmental sustainability. The plan focuses access improvement on five radial axes extending in different directions from the city center. Antonio Carlos and Cristiano Machado are within the North Axis. These axes are based on existing highway corridors (and in the case of the North Axis, also the Metro). Especially relevant related elements of the plan include:

- BRT plans for the near and further future
- Bicycle ways, especially in the vicinity of the transit centers in the south and north, and in the city center
- Pedestrian continuity from axis termini in the city center and in some of the axis subcenters
- Reduction of parking in the city center and also on main arteries.
- Taxi posting at the corridor transit stations.
- More effective transit priority in traffic management.
- Additional favela bus lines to connect with main transit lines
- Discussion of traffic ban (rodizio) and even congestion pricing toward future possibilities, and other forms of personal vehicle reduction in the city center.

All these features of the Plan have potential effect on the viability of BRT corridor TOD. Many of these features could take place within the TOD itself. Some of the potentially most important actions are those that respond to increased in-town congestion and plan to increasingly reduce private vehicle use there, further encouraging urban decentralization.

### 3. The Planning and Programming Process

Moving ahead on a planning process toward the creation of corridors and nodes of development along newly facilitated access, there are a number of compartments of technical and policy study required. These are proposed at a general level in the Termo de Referencia (November 2010, as amended).

A number of specific questions are quoted from the planners of the Politicas Urbanas office:

- What is the appropriate maximum distance for densification from city center?
- What actions should be taken to accomplish it?
- What is the relationship between access and density it impels?
- What are the related requirements for outlying nodes – e.g. business centers?
- What infra capacity needs to be installed for eventual use
- How large a study team needed
- How much attention to study, how long

The GEF proposal for Brazil mentions in the section on Belo Horizonte list a budget for “land use policies” but there is no elaboration. The municipal law that guides the comprehensive planning process (Lei no. 7.165, 27 Aug. 1996) gives extensive attention to the whole process and deals with land use planning with specific points requiring that it generate development that is socially just and environmental responsible.

The purpose of the pages below is to bring the different component activities to a somewhat more operational level.

These are put in sequence below, although they are in fact bound to be undertaken simultaneously and interactively.

### 3.1 Participation in the Planning

The relevant institutions are listed in element 2 (p 2) of the Termo de Referencia. The lead agencies are clearly the Secretariat Municipal de Políticas Urbanas (SMURBE) and BHTRANS. There is a number more listed in the TOR, some with a rather specialized interest in this project.

It is important to emphasize participation of agencies and companies responsible for provision of infrastructure. This is because provisions for the supply of infrastructure may be offered to developers so as to encourage dense development of the nodes and corridors. There are many different approaches to financing infrastructure in current use in Brazil or applicable to this case that would require the collaboration of responsible agencies.

It is also of great importance to involve representation of the private development sector, perhaps SINDUSCON-MG, the land developers' syndicate. The reason for this is that the beliefs about viability of development among private investors are centrally important to the success of this effort at densification. Current competition for their investment by other opportunities, and their changing conditions of access to capital may also be important.

Further, SINDUSCON collects data on housing starts and other real estate phenomena that will be important to the research on demand, which needs to be carried out in great detail. The greatest risk of failure at this BRT/TOD enterprise is that after the provision of new infrastructure for some reason private capital is not attracted to investment along the corridors. Due to increasing travel demand, as suggested earlier in this report, the corridors would surely prove well used in the long run but the short run could be an embarrassment. In addition, the composition of unguided development in the corridors could fail to achieve the good social objectives of the plan.

During interviews SINDUSCON representatives said of the northern corridor “nothing much goes on there. The land is too expensive for housing development.”

### 3.2 Detailing the Initial Corridor Plan and BRT Path

The first step toward structuring a specific proposal draft is to clarify, though tentatively, the principal components of the project:

- Make an initial assumption about the type of technologies to be used in BRT system. This means tentatively assuming a choice of bus technology (size of unit, power source, passenger capacity, station-serving capabilities {high/low platform, one-sided or both sided passenger entry}, electronics to control traffic. Specify assumed lane width and whether provision for passing express buses. The principal purpose of this is to ensure that the bus operations fit in the anticipated corridor and its station traffic.
- Consider demands for space at station locations including room for waiting crowds, paths for entering and exiting passengers, stops for feeder transit vehicles, parking for transfer passengers including cars, two-wheelers and bicycles, commercial services for passengers, and landscape amenities such as plazas.

This activity is important to get a picture of the eventual project, considering options to be taken on the basic hardware. BRT hardware varies greatly from the broad boulevard pedestrian bridges that serve the stations of Bogotá to the snug, tightly designed stations of Guayaquil.

- Propose an initial geometry for the dense development corridors. This

may require considerable thought and discussion. It is a task without precedent. The issue for resolution is how far from the station should high density continue. There should be means of eventually leaving that judgment up to developers, but requiring contiguity of high-density development. SMURBE has already provided a trial set of corridors. The carrying capacity of the corridor should be a consideration, declining residential densities with distance from the corridor.

### *3.3 Local Conditions that Facilitate or Obstruct Densification*

The annotated TOR gives attention to this matter. While there will be powerful forces in play toward making corridor land available for development, the future of different local areas may vary.

Especially positive conditions need to 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, parcel close to land development that is compatible with uses in high current demand, land in ownership of agents anxious to undertake development themselves, etc.

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, land in a current use satisfactory to its owner but not to the development program. Available parcel size may confine possibilities of the development; the land may be valued for agriculture or natural ecology value. There are many possible explanations. The appendix to this report includes a list of 21 different reasons why a

parcel might not be available for development.

Some of these obstacles might be relieved, so early discovery of them may enable additional parcels to become part of the development plan. Others may simply need to be accommodated in the development process.

This exercise is basic to the detailed rezoning of the corridors and nodes in accordance with the intent of the plan. The corridors are already identified for systematic reduction of permitted development densities (to hold them for subsequent higher density) and then substantial rises in permitted development densities when actors are aware possible response to the new BRT. It is fundamental to plan the specific levels of the densities permitted and the timing for changing them.

Setting these density levels on the corridors and nodes will require careful study. On the one hand we may suppose that considering the widespread successful use of express buses and BRT in Brazilian cities developers will need no prompting to anticipate good returns on dense development. We might expect that even though there has been no prior experience with it in Belo Horizonte. On the other hand, we might fear that there are many potential uses of capital and developers may think "It's just another bus, not wholly isolated from congestion to reach the city center." During early phases of development there will probably be no separate lane for the BRT since demand will not have yet been created to require it. Research has revealed increases in land value due to BRT and TOD has taken place in a number of touted locations, but it is not clear how much these developers will be persuaded.

And beneath all of this is the unreliable phenomenon of demand. We note that Robert Cervero's 25-year evaluation of the San Francisco BART system queried why

more development had not taken place around the station nodes. He found no failure of attraction involved. It was just that here had been little demand for development compatible with a station locality during the period in question. The demand resumed later.

### *3.4 Alternative Sketch Development Scenarios*

At an early stage of development it is practical to lay out possible scenarios of land occupancy. This is a process of considering what forms of development are compatible with the context of corridor and node positions, what 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 would be a necessarily very sketchy process, welcoming many different assumptions about the future of land development in the subregion. It would also take the form of different assumptions about the local and national economy during the next few years.

The main purpose of this scenario development is avoiding mistaken assumptions about futures that turn out to be incompatible with existing development or uncompetitive with stronger initiative.

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 a substantial scale in number of units. But at what scale? Is land assembly at that scale possible?

Special attention should be given to the functional design of the major nodes. It is very difficult to picture the future shape of Vilarinho with further concentration of

access and commercial functions. It is very clear, however, that growth will change the landscape around the station in very important ways.

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 function of this exercise.

### *3.5 Refined Housing Demand and Urban Growth Studies*

As proposed in the opening paragraphs of the revised TOR, market demand is a very important part of this planning process. Nothing is going to happen in the corridor if there is weak market for the kinds of development proposed.

Housing demand forecasting is a well-developed field, but most of it is not in public agencies responsible for planning.

As mentioned, the fit of specific housing types and prices to given environments is a crucial issue in understanding possible futures for development. Developers know this well, so they collect very detailed data on housing starts in quarterly periods. I saw it in the SINDUSCOM-MG office. They also collect data on loan availability while diligently searching for new borrowing opportunities.

Their participation in a planning process may be a bit complicated because of a possible initial sense on the part of the public sector that they are excessively opportunistic opportunists. That view may be confronted by the developers' belief that they need to resist the imposition of public control that confines their possibilities of making a proper profit. Indeed, these are groups that speak quite different languages. In many recorded cases, however, once working



together—however tenuously at first—the two sides soon appreciate productive collaboration. During brief conversation in Belo Horizonte I was amazed at the lack of awareness between the two groups.

It is necessary to examine housing demand 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, etc. This is a topic requiring the joint participation of public sector analysts and private sector experience.

### *3.6 Promotion of the Corridor*

One function that is fundamental to gathering momentum for the corridor is to begin promotional efforts early during the planning process. Some of the possible means of doing so:

- Sponsor urban design competitions for visions of the corridor future that attract public, and professional, attention to the promise of the corridor futures.
- Exhibit pictures and functional records of successful similar cases in other cities, other countries.
- Sponsor programs in the schools that familiarize the students, and then their parents, with the emerging possibilities of the corridor.
- Release information to the media—television, radio and the press, as well as maintaining a web site to keep the metropolitan population (and investors everywhere) informed.
- Provide graphic and media information about successful BRT systems elsewhere in Brazil. Possibly organize inspection visits to other Brazilian systems.

- Advertise in trade journals the availability of superior access substantial parcels for industrial and office development.
- Engage the conscience of the city with the important gains in social and commercial services to the modest income surrounding population and the environmental gains from daily trips that are shorter and show increased transit usage.
- Engage staff to fulfill the above functions and also to invite or visit potential developers and locators in the corridor. Positions on the corridor may well be some of the very best nationally for building large premises accessible to a maximum number of potential employees. The staff should identify and seek out possible locators.

Interaction with potentially interested locators will also produce information about relevant markets for corridor development that can be fed back into the process. “A major firm would like to move to a corridor site if we could also provide....”

### *3.7 Infrastructure Services*

Convene a special subgroup of infrastructure providers—water, sewerage, electric power, streets. Infrastructure services are available at a remarkably high level in Belo Horizonte: 92% of the metropolitan area is served by sewage. In the vilas and favelas it is about 70%, much higher than the average in Brazil.

This group would be responsible for anticipating the infrastructure load resulting from TOD. It would be an effort to coordinate extensions to avoid multiple excavations and reconstructions.

At the same time it is a means of considering financing substantial new capacity and assuring that it be provided promptly for new development. We want to avoid any

extra cost imposed upon initiatives in the high access corridor, but want 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.

Instruments relevant to this concern may include:

- CEPAC, bond purchases to finance infrastructure
- Density bonuses, as used in Curitiba
- Tradeable development rights that can convey additional density to the corridor from e.g. the city center
- Land readjustment, already used in Brazil to renew deteriorated localities
- Other forms of assisting land assembly
- Facilitating loans to approved developers
- Providing prior infrastructure to attract development
- Betterment levies (valorization)
- Selection of a government agency as executor
- Surplus value

### *3.8 Defending Against Sprawl*

There is a pernicious effect involved in the creation of high access corridors that is not treated in the transport/land documents in Belo Horizonte. It is the simple fact that new corridor and nodal settlement in the outer parts of the metropolitan area may generate much denser development in their immediate vicinity, but at the same time they will inevitably serve as centers to generate more sprawl. That is they will propel more distant surrounding areas likely to create and suffer many of the same problems that the BRT/TOD was meant to solve.

It may be instructive to recall that the infamous sprawl of Los Angeles (California) was initiated at the beginning of the twentieth century, not by automobiles, but by the extension of rail transit lines.

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 keeping the valued lands in agricultural or natural use. Transfer of development rights for this purpose is available in Brazil.

### *3.9 Preparing for the Corridor Extensions at Later Stages*

The staging over time of BRT/TOD in this corridor is not made specific. Planners should make initial decisions about phasing at the outset. The full scale of development, of course, is ultimately the measure of the infrastructure effort that will have to be made.

Further, the nature of the corridor will change. The final stage of the northern corridor will reach Venda Nova and Pampulha, which are distinctively higher income localities than the others traversed by the system. The demand characteristics of these localities need to be examined. The World Cup and Airport access issues are an important consideration, difficult to consider as a part of the overall plan.

## **4. The Broader Scope of Densifying and Containing Land Use**

The use of BRT to densify land use is a powerful tool to rationalize land development – shorten trips, convert trips to transit, relieve congestion. There are grounds for saying it should be undertaken even if the inadvertent sprawl it generates cannot be effectively controlled. This would be particularly arguable if the auto owning part of the metropolitan population was to remain small—but it will not. As a result

barriers to sprawl are in order. A search is appropriate through means such as:

- Transfer of development rights to preserve natural and agricultural lands.
- Restrictions on the extension of water and sewerage.
- Zoning that limits upper income residential development.
- Government acquisition of key natural sites, perhaps for the development of parks.
- Forms for the guidance of future informal settlement
- Management of land taxes to limit uncontrolled suburbanization.

The case of Curitiba is always before us as the confirmed success in densifying land use in the corridors of BRT. Much of this is surely because of the close collaboration among the Mayor, the planning and research agency (IPPUC) and the implementation authority (URBS). It is clear that this close collaboration enabled forceful leadership including requirement that the large commercial centers locate on the trinary axes. Residential buildings on the axes were zoned to include commercial uses as well. Developers were encouraged to “buy up” their buildings, providing stories higher than normal zoning by making contributions to a social housing fund. There has also been significant transfer of development rights, e.g. from the city center to the structural axes.

Dr. Schlomo Angel (with the participation of Ralph Gakenheimer) has experimented with directors of planning and public works of cities with significant low-income peripheral settlement to prepare for inevitable further invasions of settlement. The objectives are to preempt land in any case available for public use upon settlement for utilities and streets. This facilitates efficient use of invaded land and, in particular, reserves adequate street widths and street grades for use by public

transit. With the assistance of several international agencies, the design of such street systems was undertaken with seven cities in Ecuador.

In Canada cities have undertaken development limits with considerable success. There are functional rings around many of the cities that have successfully compacted urban development—in Toronto, Ottawa, Vancouver and other cities. It would be of special interest to observe the methods and achievements of peripheral development control in these cities to manage the development attracted to the outer rings around BRT nodes.

This is not easy. It has been, frankly, mostly unsuccessful in the United States in spite of vigorous concern by now for several decades. Critics have cited the reasons as (1) zoning is excessively influenced by business and commercial interests, (2) excessive focus on the planning process rather than the outcome, (3) misapplication of zoning districting to even require excessive lot sizes (4) allegations that confinement of housing within a growth boundary increases the cost of housing.

Cases in the USA have attempted to plan metropolitan peripheral uses from perspectives of (1) pro-growth strategy, (2) balanced growth strategy and (3) strategy of no growth. The balanced growth alternative might be of interest to Belo Horizonte. Interesting efforts in US cities have been undertaken by the creation of village-like settlements in forms called the New Urbanism, and also in controlling the pace over time of development. The principal instrument has been land use zoning.

## 5. Literature Review 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 (Estupinan & Rodriguez, 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).

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.

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, zoning, inclusionary, 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.

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 is that the majority of TOD research has focused on rail transit. Cervero et al. (2004a) highlight some small-city TODs that are bus-based and 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 are exceptions. Thus, our examination of efforts in Latin America to implement BRT-oriented development is timely.

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