Bus Rapid Transit: A Viable Alternative?

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Abstract

Bus Rapid Transit (BRT) presents a significant opportunity for the public transit industry to enhance the set of transportation investment options that can be brought to bear on the mobility problems experienced by urban areas across the country. As new Census data are released, the picture of strong population growth in dispersed patterns, growing congestion levels, and stubbornly modest transit use levels emerges. This paints a compelling picture that merits serious consideration by transportation planners with regard to the full range of transportation investment options available for urban areas.

This article addresses several specific characteristics of BRT that differentiate it from other public transit modes and supports the explicit consideration of BRT as an alternative in Major Investment Studies (MIS). Clearly, the high cost of rail transit limits the possible role it can play in urban mobility even under radical changes in modal spending priorities. The pursuit of more moderate costing infrastructure transit options increases the chances of public transit being able to make more meaningful contributions to urban mobility. A key characteristic of BRT is the prospect that it can offer a lower-cost method of providing better performing public transit service (not yet fully verified) that is able to both retain current and attract new customers as well as garner political and taxpayer support. Evidence provided by the Government

Accounting Office (GAO) in its recent report on BRT indicated that the BRT projects reviewed cost less to build than the light rail transit (LRT) projects reviewed, on a per-mile basis. In addition, the GAO also points out that ridership was comparable between the BRT and LRT systems reviewed and that five of the six BRT projects had higher overall system operating speeds than the LRT projects.

This article also addresses the definition of BRT and the implications of the various definitions on branding of the mode. An interesting perspective on the BRT branding is offered by looking at it from the perspective of various user groups. In addition, the article explores the prospects of BRT becoming attractive to the public transit industry and with customers, decision-makers, and taxpayers. It continues by addressing certain aspects of BRT that differentiate it from LRT and the comparative impacts on land use by BRT and LRT. The article concludes by offering thoughts regarding the opportunities presented by BRT concept.

Introduction

BRT presents a significant opportunity for the public transit industry to enhance the set of transportation investment options that can be brought to bear on the mobility problems experienced by urban areas across the country. As new Census data are released, the picture of strong population growth in dispersed patterns, growing congestion levels, and stubbornly modest transit use levels emerges. This paints a compelling picture that merits serious consideration by transportation planners with regard to the full range of transportation investment options available for urban areas. Public transit has gained mode share during the past few years and is receiving serious funding commitments from numerous urban areas that program as much as 50 percent or more of transportation resources in support of public transportation as part of long-range transportation financial plans. Yet, the public transit industry continues to struggle to find adequate resources to offer the kinds of services that current and potential riders find attractive.

The ability to implement enough service to meet the expectations for public transportation of even the most pragmatic planners is constrained by the high cost of providing appealing services. Various calculations suggest that the backlog of urban areas proposing light rail systems and rail system expansion is

equal to several decades' worth of funding at current federal program spending levels. In the extreme, if one took the current federal trust fund highway capital spending levels of approximately $33 billion annually and assumed approximately half was available for capital spending (historically, half has gone for maintenance, administration, enforcement, and research) and assumed that half of that was redirected to guideway transit in urban areas (leaving a modest remainder for nonurban area roadway needs), one would have, roughly, an additional $8 billion available annually to build new rail transit projects. At average costs of approximately $50 million per mile, 160 miles of rail systems could be built annually. If that pace were sustained, in approximately 100 years, U.S. urban rail system mileage would equal today's urban interstate mileage.[1] (The cost of operations, maintenance, and replacement is ignored in this hypothetical scenario.)

Clearly, the high cost of rail transit limits the possible role it can play in urban mobility even under radical changes in modal spending priorities. Thus, the pursuit of more moderate infrastructure cost transit options increases the chances of transit being able to make more meaningful contributions to our urban mobility. A key characteristic of BRT is the prospect (not yet fully verified) that it can provide a lower-cost method of providing better performing public transit service that is both able to retain current and attract new customers as well as garner political and taxpayer support. Evidence provided by the GAO in its recent report on BRT indicated that the BRT projects reviewed cost less to build than the LRT projects reviewed, on a per-mile basis (U.S. GAO 2001). In addition, the GAO also points out that ridership was comparable between the BRT and LRT systems reviewed and compared and that five of the six BRT projects had higher overall system operating speeds than the LRT projects (U.S. GAO 2001).

This article addresses several specific characteristics of BRT that differentiate it from other public transit modes and supports the explicit consideration of BRT as an alternative in MIS. This article addresses the definition of BRT and the implications of the various definitions. It explores the prospects of BRT becoming attractive to the public transit industry and with customers, decisionmakers, and the taxpaying public. The article also addresses aspects of BRT that

differentiate it from LRT. In addition it addresses the comparative impacts on land use of BRT compared to LRT. The article offers some concluding remarks regarding the opportunities presented by BRT.

Defining BRT and Establishing the BRT Brand/Concept

Early attempts at defining BRT have offered several definitions of exactly what BRT is and Vuchic (2002) has even challenged the "rapid" nomenclature in the name BRT. It is inevitable that there will be discussions of the exact meaning of BRT, and it is likely to be an evolutionary concept just as transportation planners spent several years and hundreds of hours discussing with colleagues the definitions of such terms as intermodal, sustainable, and Intelligent Transportation Systems (ITS). One consideration that will ultimately influence the image and acceptance of BRT is the breadth of application of the BRT designation. One question that will need to be answered is how different and distinct from standard local bus service does BRT have to be to be designated "Bus Rapid Transit." As there are more applications of any public transit mode, there are greater opportunities to refine the mode to accommodate specific local conditions and the modal definition evolves with the integration of evolving technologies such as new propulsion systems, vehicle design changes (e.g., low floors), and other factors that impact fare collection and customer information and other amenities. As this occurs, the historic technology-based definitions of modes become less precise and the variations in traits become wider. Just as we increasingly see huge variations in fundamental traits ranging from capacity to costs to operating speeds for LRT projects, so too is the prospect for huge variation in what is branded as BRT, ultimately contributing to wide variations in capital and operating costs, ridership, performance, and other crucial considerations. The extent to which there is variation in these traits may influence the extent to which BRT can establish a niche identity within the modal arena with current and future customers as well as decision-makers.

Historically defined by technological characteristics, modal definitions have become increasingly complex as evidenced by the rather elaborate classification and trait enumeration developed by Vuchic (1981) and several others. The

argument could be made for a narrow and comprehensive set of traits as the basis for defining BRT. Or, perhaps, it could be argued that even modest initiatives are a step in the right direction in defining BRT (especially if specific BRT branding offers marketing benefits). Auto manufacturers change styles and vehicle names every few years for essentially the same product. So, perhaps public transit should similarly leverage any advantage the BRT branding can create. It could be argued that BRT is an attempt to inject new energy into traditional bus services and that incremental or piecemeal implementation of various features categorized as aspects of BRT to improve individual bus services is for the good of all concerned. It might even be argued that the use of the BRT designation can enhance the overall image of bus-based public transit and looser definitions will make it affordable to implement BRT features for many parts of a transit system. This, in turn, should spread the benefits over the larger community and diminish equity and political allocation issues that accompany more expensive programs that could only be implemented in a much narrower application.

Some have argued that the "B" in BRT has to go and that part of the branding should distance the mode from bus by referring instead to Commuter Rapid Transit or variants on that terminology to create a whole new image for consumers divorced from the image of "bus." A narrower definition and classification structure could be used to support the unique image of BRT in contrast to standard local bus transit. Arguably, the unique definition can build customer support and decision-maker endorsement thereby positioning BRT proposals to gain sufficient favor to aid in securing funding and use by prospective passengers. Furthermore, the higher standard of classification may be perceived as significant and positive to the transportation professionals in planning and land development. A higher standard of definition creates a greater opportunity to leave a unique, positive image for BRT and further differentiate it from standard local bus services.

To the extent that there may be differential eligibility for funding for BRT versus standard local bus service, the BRT definition used would influence the number and nature of the projects seeking the designated funding and make the issue of the definition of BRT far more significant.

Who Cares What Better Public Transit Service Is Called?

An interesting perspective on the BRT branding is offered if one looks at it from the perspective of various user groups. Existing customers of standard local bus services that might alter their mode of travel would no doubt be indifferent to the nomenclature used. These customers often have no alternatives to public transit, no matter how low or high the quality or how low or high the cost of providing the service. They are obviously not avoiding the service today due to any stigma, so any substantive service or image improvements are positive regardless of what the new service is called. Admittedly, the image of public transit can impact current users and nonusers may be more likely to use improved public transit service if it was branded in a way that had a more positive image. However, the substantive improvements in performance (speed, reliability, comfort, etc.) are likely to be as or more influential in the decision to use the service or not. Just as rail transit planning and forecasting professionals have spent a great deal of resources researching and debating the presence of a modal bias factor in rail ridership, so too, there may be ridership impacts based on how we define and position the image of BRT (Ben-Akiva 1991). The GAO's (2001) recent report on the promise of BRT as a viable alternative to rail indicates that one of its disadvantages is that buses have a poor public image. The unique features of BRT such as improved vehicles and higher operating speeds can be used as part of the BRT branding to leverage the amelioration of the negative perception of bus-based public transit. Further, according to Camph (1997), while local government officials have been eager to spend more money on transit, voters, when given a choice, are turning down transit initiatives a significant share of the time.

The definition of BRT may also be relevant to funding partners and the development community. The nomenclature may impact on the general public, whose image of public transit service may be affected, influencing the willingness of the public to support funding for public transit. Will a community be more willing to pass a referendum to support bus service expansion versus BRT implementation versus LRT investments? If BRT is perceived as a substantive and significant improvement in service, will it be more positively

received and supported than if it is perceived as a cosmetic makeover of an existing service? It can be speculated that the narrower definitions of BRT that refer to a higher quality of service might have the greatest influence in terms of financial support from the public and decision-makers.

The Role of BRT in the Great Bus versus Rail Debates

> *The real dead end is BRT, we've been trying BRT in one form or another in this country for eighty years and it's been a miserable failure. Transit ridership has fallen when all bus systems have been adopted and rose when rail systems implemented. I seriously doubt BRT will be used on a large scale in this country. Unless of course the bus manufacturers spread big bucks around to get it adopted.*
>
> *The big selling point of BRT is that anything compared to light rail looks like a bargain and effective transportation solution. As long as the question remains "how can we provide the cheapest most effective public transit" the answer will be BRT. The problem for agencies however is the dysfunctional accounting standards of the FTA. BRT operating expenses are calculated as being higher than LRT under the current weird rules. As long as "somebody else" is paying for the infrastructure the agency will still prefer LRT.*[2]

The two above quotes taken from a listserv that regularly debates the merits of various public transit proposals epitomize some of the passionate positions that have regularly surrounded discussions of bus and rail service. This debate has become a major issue as various urban areas contemplate rail investments and propose local referendums to provide the necessary capital and operating funds. Developing strategies for responding to criticisms of rail critics have resulted in numerous initiatives within the public transit industry such as Railvolution (an annual national conference espousing the virtues of rail development and associated land-use initiatives) and a series of American Public Transit Association (APTA) sponsored publications authored by noted conservatives such as Weyrich and Lind (1996, 1999, 2001). These publications

advocate the virtues of rail from a conservative perspective. These passionate debates embrace issues of smart growth, personal freedoms, environmental impacts, and technical performance. BRT appears to be embraced by historic critics of rail investments but, inevitably, will be embroiled in the debate about what transportation investments are best for our urban areas. As evidenced by the discussion, perhaps inaccurate perceptions, historic prejudices, and modal biases will inevitably influence the public's perception of BRT. Ultimately, the definition of BRT and its acceptance will be significantly influenced by BRT's ability to influence development patterns and land use. This issue is discussed in the BRT land-use section of this article.

Enriching the Choice Set for Urban Transportation Investments

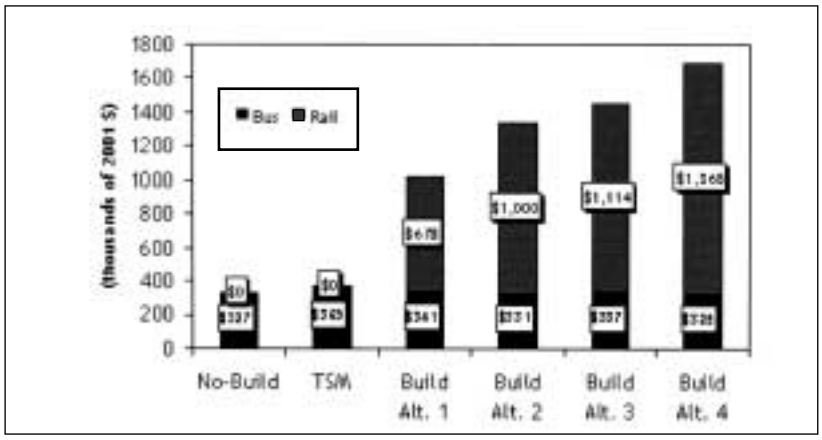
Often alternative mode investments are supported partially because they offer a "choice" or "option" for travelers. Indeed, many advocates of various modes argue that they should be provided to offer travelers several choices. The virtue of offering choices has at least two elements of value. First, consumers value choice in various products from housing to breakfast cereal to footwear. Manufacturers certainly offer choice in vehicle styles with dozens of variations, from economy compacts to luxurious sport utility vehicles. The value of this choice to consumers is acknowledged in economic theory and this logic has been extended to explain the value of offering modal choices as well by Chu and Polzin (1999). Choice also has contingency value or value in the context of unexpected events. Public transit has evidenced its value in this manner in a number of situations from providing travel options when much of the roadway is shut down due to inclement weather to being available when earthquakes, hurricanes, energy shortfalls, or acts of terror cripple other parts of the transportation system. Since September 11, 2001, there has been increased sensitivity to the value that alternative modes might provide in cases of acts of terror.

While BRT or other new transit options for an area may provide value in these situations, a perhaps equally relevant benefit is the value that it provides by offering decision-makers a far greater set of investment and service options from which to choose. A historic dilemma of the MIS process, and before it the

Alternatives Analysis process, is the fact that the range of choices explored in these studies is typically quite limited and has major discontinuities in the range of key evaluation traits. The BRT alternative may offer an option where its performance is significantly different than for other build alternatives. The cost, time frame for implementation, geographic coverage, and ridership can each be significantly different than for other alternatives under consideration. By virtue of providing an alternative with distinctly different traits than the base or Transportation Systems Management (TSM) alternative and the Build Rail alternatives, it offers value to decision-makers by enhancing the range of options they have in addressing an area's needs. Typically, BRT options will "fill the gap" in a significant range of cost differences between TSM and LRT options.

In corridor studies with no BRT options, decision-makers are faced with a situation where the cost variations between the no-build and build options are very large, with the capital cost of rail-build options often orders of magnitude larger than the capital cost of the TSM option. Perhaps an even more relevant consideration to local decision-makers, the choice set is one between a project that qualifies for federal new start funding or one that is dependent on local and formula funding. Thus, decision-makers are often faced with an all or nothing choice as it relates to federal new start funds. A BRT option offers not only a chance to provide a richer range of choices with options that have various costs and impacts, but it offers another choice or choices that are eligible for federal funding. This is a very significant consideration as local areas weigh various investment options. In general, a richer set of choices with variations in values along critical evaluation criteria values will provide decision-makers with an opportunity to more closely match a solution with their particular value sets as mapped against the various impact measures.

Figure 1 shows select data from an MIS conducted in 2001 that considered six alternatives including a no-build option. BRT was not considered as an alternative during the MIS process. As is apparent from the figure, the variation between the bus and rail-build options resulted in an area of cost and ridership ranges for which the decision-makers had no options. The prospect that BRT options might have been able to be prescribed such that they would



Source: www.tamparail.com.

Figure 1. Tampa rail project capital costs (in year 2001$)

have offered investment opportunities that provided a richer range of choices offers value to decision-makers. An analogy might be a consumer shopping for a new car having to select between a low-cost economy car and a high-priced luxury car with no other choices (would you like a Ford Pinto or a Mercedes sedan?). Decision-makers are more likely to find alternative options that are appealing within a set of investment options that gives them a richer range of choices.

BRT Versus Rail or BRT Versus Nothing?

A second issue impacting the consideration of BRT is the nature of the choices being made. As the introductory paragraphs of this article suggest, some of the motivation for considering BRT is the prospect that one cannot afford the "true preference" of a rail alternative. Indeed, in many cases, the BRT option may be a direct competitor with a rail alternative, and affordability as well as or regardless of cost effectiveness and other factors will be important in the decision.

In some contexts, BRT is perceived to be a default alternative to implementing a rail system, indeed, a second-class alternative compared to the light rail alternative. As is readily acknowledged by many transportation planners,

MISs are occasionally situations where the public will or at least the political will is well known and the process is more a case of refining expectations and design and then complying with requirements than a sincere search for alternatives that address a given transportation problem. In situations where that is the case, the BRT option is a threat to pursuit of "the preferred option." To the extent that BRT compares favorably with the other alternatives, some parties with predetermined preferences may be reluctant to see the consideration of BRT options as standard options in most MISs. To the extent that BRT risks making it more difficult to select another alternative because its performance based on evaluation criteria is relatively attractive, the advocates of other options would be motivated to not include or perhaps discredit the BRT option. These contexts are likely to perpetuate the "bus" versus "rail" tension and push the focus to the intangibles. Thus, factors such as public acceptance, impact on land use, status and image considerations, and the old reliable "but choice riders just aren't willing to ride the bus" arguments are likely to surface. The modest empirical data on BRT impacts in U.S. operation will, at least initially, enable these arguments to persist.

However, the choice is seldom between an LRT and a BRT option for a given corridor. In some cases the trade-offs will be between BRT and traditional baseline or what used to be known as the "do nothing alternative." BRT may be an attractive option in some situations where LRT is clearly not in the set of choices. Thus, in these situations, none of the comparative relationships between BRT and LRT comes into play in the choice. In other situations, the choice might more realistically be characterized as between LRT in part of one corridor and BRT in more of the corridor or even in multiple corridors. The comparative cost of BRT may be such that the urban area may actually be trading off the financial ability to provide LRT in one corridor while they might be able to provide BRT in two or more corridors at a lesser or similar total cost. Thus, while a given corridor-level MIS may imply that the choice is between two modes for a given geographic need, the more accurate reflection of the longer-term systems-level choice may be to characterize the BRT option as enabling the area to trade off unit cost versus overall system coverage.

Numerous communities are operating under the assumption that the federal government will pay half of the cost of a rail system and that their state may pay another share. This expectation, absent a realistic understanding of the probability of receiving federal funds or the probable time frame for receiving federal funds, makes it very difficult for decision-makers to show the same sensitivity to affordability as would be the case if their projects were funded with formula or local dollars. Thus, as the prospect that the federal share of rail projects declines as directed by the Fiscal Year (FY) 2000 Consolidated Appropriations Act (P.L. 106-113) there is a greater chance that the affordability issue will become more important in urban transit investment decisions.

BRT and Equity

Over the past several years there have been repeated challenges to rail investment programs based on concerns over equity. These challenges have been both concerns about equity between various parts of the urban area and equity between investment in rail versus sustaining or enhancing existing bus services. BRT, by virtue of it being lower-cost than rail and perhaps having a lower standard of justification than rail, will inevitably create additional challenges regarding equity of investment allocation. The more modest the cost and performance impact of a BRT investment the stronger the challenge to provide BRT enhancements for a broader range of locations within the community. Thus, it is inevitable that there will be pressure to define standards of performance for proposed BRT projects to have a basis for justifying locations where BRT is a prudent investment. As the profession moves closer to a standard definition of BRT, it may well be prudent to establish expectations of BRT performance improvements that provide a rational basis for justifying the geographic allocation of BRT services. Title IV has long required the equitable allocation of bus equipment and necessitated a conditions-based justification for differential allocation of equipment. So too the establishment of BRT services will require a rational basis for the allocation of these services across urban areas. As more areas consider BRT, there will be more need to refine the processes by which BRT planning and decision making are carried out if it is not part of a major investment study process.

Flexibility Over Time

One of the oft-cited virtues of rail investment is the physical presence and permanence of the infrastructure investment that accompanies its construction. Indeed, this physical presence does have an advantage of enhancing customer awareness, and the permanence does signal to the development community a commitment to public transit service in a given area. BRT options do need to acknowledge these issues and offer logical responses to these traits of rail investment. First, the issue of physical presence can be quite readily responded to by BRT proposals because most BRT initiatives have identifiable traits intended to make them unique. Thus, customers, adjacent residents and businesses, and the general public traveling past a BRT alignment should be able to identify its physical presence. A host of features from exclusive rights-of-way to signage, stations, electrification, or other features can establish the presence of a BRT project. Indeed the physical presence of some subway systems is extremely modest and can clearly be matched by modest BRT infrastructure investments.

The issue of permanence can also be addressed by BRT. First, permanence is not always a virtue. Indeed, dark, narrow rail platforms, 5-mile-per-hour elevated curves, restrictive platform widths and lengths, and the massive investment in fixed infrastructure for propulsion systems, station access, and structures often precludes rail systems from adapting the most attractive and efficient current technologies or designs. A rail car investment with a 40-year life, in effect, locks the system into a specific design for 40 years. New materials, propulsion systems, safety features, and other modernizations are often precluded by the constraints of the initial infrastructure's fundamental design and financial realities. BRT systems, on the other hand, are afforded the opportunity to have vehicle technology amortized over shorter time periods more typical of the 12-year average life of a standard coach. Thus, changes in amenities, safety, accessibility, propulsion system efficiency and cleanliness, and other features can be updated on a more meaningful and more frequent basis. The lack of permanence can indeed be a virtue, offering the opportunity for regular modernization.

The other aspect of permanence deals with the prospect that the service will remain in its current location. Presumably, a more major investment symbolizes a greater likelihood that the investor will be less likely to walk away from the investment. Perhaps the most relevant context would be the abandonment of the streetcar systems in U.S. cities in the decades following World War II. With the exception of that era, there have been few meaningful abandonments of guideway service. It might be presumed that BRT, being less capital intensive, would more likely be abandoned if the market were not supporting the service. While such a situation is possible, the level of planning and the market conditions that would support BRT investment are such that there should be very little prospect that the service would be abandoned. In fact, one of the criticisms of bus service in many U.S. cities is that the buses still operate on the same route they did a century ago and have not adapted to evolving travel patterns. The practical reality is that BRT investments in markets that are strong or forecast to be strong are highly unlikely to see dramatic declines in public transit service. BRT represents a significant investment with a probable amortization time frame for all assets of greater than 20 years. The existing infrastructure that justifies these investments, in all probability, has an economic life far greater than 20 years. This same infrastructure also supplies the travel demand that enables BRT investments to be justified and rationalized. The greater risk is that land-use changes cause transit ridership declines rendering the BRT investment less productive, rather than the BRT investment abandons a healthy or vigorous activity corridor.

Is BRT a Step Toward LRT?

Some planners and policy decision-makers envision BRT as an incremental investment that may be a precursor to the eventual implementation of rail. The logic of this argument is that the BRT investment will test and develop the market and when the market matures it will be appropriate to implement rail options. This logic, similar to that of many incremental investment advocates, has the virtue of minimizing risks if the market never develops. Higher capacity and higher-cost investments are not implemented and it potentially matches the investment level more closely with the benefit stream attributable to a project.

The major criticisms of this strategy fall into two types. First, there is the issue of whether incremental implementation is physically or financially possible. To the extent that the interim technology uses the same right-of-way, the prospect that the initial service can be shut down or worked around while a future higher-class facility is implemented is often very tenuous. Perhaps, more critical, the motivation for subsequent implementation of a rail investment is likely to be difficult to establish.

BRT should enable incremental upgrades and it is highly improbable that a corridor that had a BRT project is also likely to be in line for rail investment within the near term. It may be difficult to come back to the same corridor a second time with major investment dollars as other geographic areas argue that it is their turn to receive investments. Advocates of rail would have two possible fears of proposals for incremental implementation with an initial BRT project. First, if the BRT were not deemed successful, transit critics might argue that it was a good thing that rail was not implemented since the BRT project was not successful, the logic being that if the corridor would not support BRT it certainly would not be able to support rail investments. Rail advocates might counter that disappointing performance of BRT is not necessarily indicative of how a rail investment would have performed, as rail might have been better able to attract ridership and development. This fear of success is similar to that of those persons who do not feel that the lack of success of traditional intercity rail is necessarily a harbinger of the success of high-speed rail.

Alternatively, a successful BRT might suggest to some that rail was not necessary. The successes of BRT would be used as evidence that the benefits could be captured at a lower cost with BRT. Thus, those with a passionate advocacy of rail for a given corridor may be reluctant to see BRT proposed as an alternative even if it is envisioned as only an interim solution. Their fear would be that BRT would be successful and rail might never be implemented if there were a successful BRT. In the case of BRT, the specific nature of the proposed BRT and its capabilities and performance may be critical in determining how well its success is a harbinger of how rail might do in the corridor.

BRT and Land Use Versus LRT and Land Use

Perhaps the most critical consideration in evaluating BRT proposals in comparison to LRT proposals will be the perceptions as to the ability of the respective alternatives to meaningfully influence land use. This issue will be discussed in the context of a framework for understanding the impacts of public transit investments on land use detailed in Polzin's "The Transportation–Land Use Relationship: Public Transit's Impact on Land Use" (1999).

Figure 2 outlines a series of factors that are hypothesized to underlie the impact that transit investments can have on land use. This representation of transportation's impact suggests that there are three ways that transportation investment can influence land use:

1. by providing transportation accessibility,
2. by encouraging complementary investment policies, and
3. by creating momentum or expectations that influence land use.

Current theory and land-use modeling focus almost exclusively on trying to define this first relationship, how transportation accessibility improvements impact development. The second and third elements are hypothesized as perhaps more significant in the overall relationship, particularly as it relates to public transportation. Indeed, the impact of an LRT project on an urban area may arguably be far more significantly influenced by the impact it has on stirring land-use policy and planning activities than through the power of the increased transportation capacity it delivers to station areas. In the context of this more complex model of how transportation impacts land use, the differences between BRT and LRT are not just their differences in transportation performance and capacity, but also the differences in their ability to motivate other planning changes that significantly drive land-use development.

The top section in Figure 2 (labeled "Accessibility Improvements") is the one that receives the most attention by urban and transportation planners. If our urban planning goal set includes influencing land use, then the planner

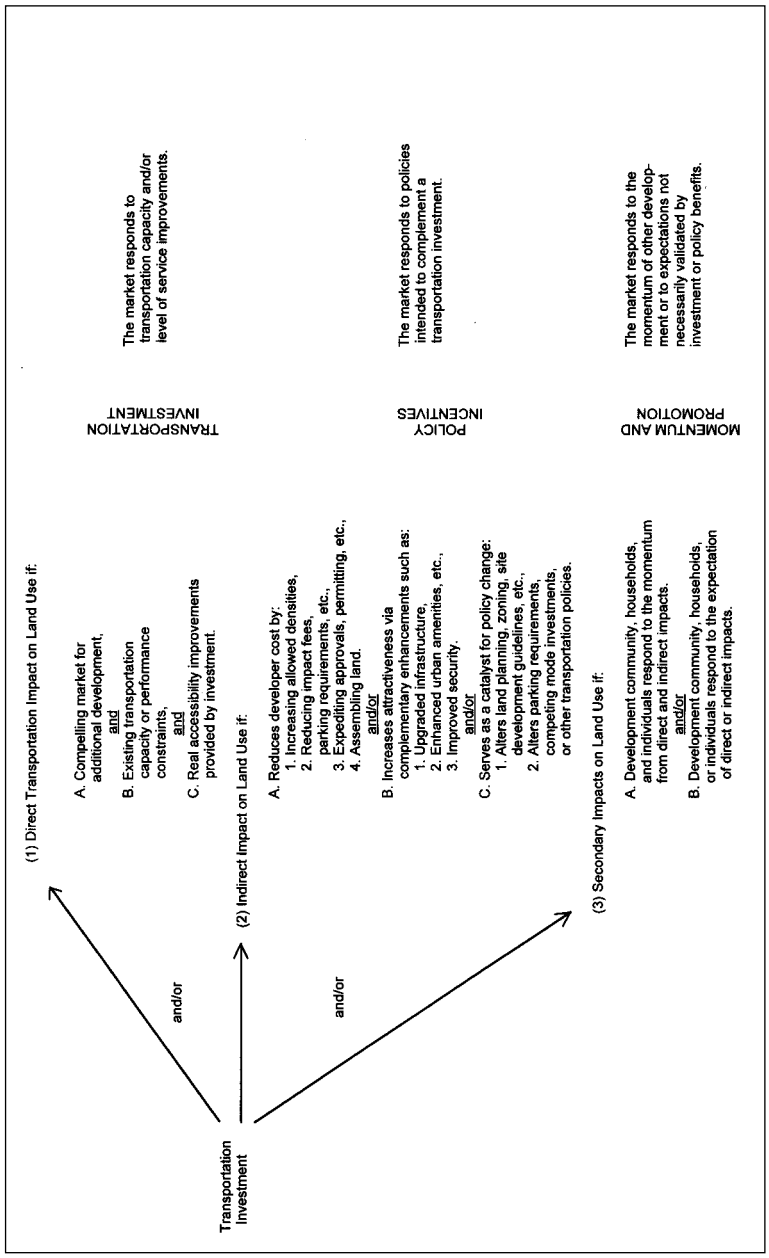


Figure 2. Land use responses to transportation investment

might typically measure the ability of an investment to accomplish this goal based on how the proposed investment changes accessibility. MIS, for example, includes assessments of the changes in accessibility attributable to the new investment. Changes in accessibility are then a major contributor to travel demand and development potential. One might speculate as to whether a given BRT proposal would result in a different change in accessibility than would an LRT investment for the same corridor. Analytically, planners could apply measures that could determine this.

While context-specific data would need to be evaluated, BRT could conceivably have greater frequency and faster door-to-door travel speeds. Alternatively, LRT may have more exclusive right-of-way and provide faster travel time.

Figure 2 reminds the reader that additional accessibility is only of value if there is a demand for additional travel (which is a catalyst for development) and if there is a constraint in existing capacity. Thus, neither transit investment will cause development if the underlying demand is not there. For example, building BRT lanes or LRT lines in rural farmland will not induce high-rise condos to sprout up at transit stops.

The second section in Figure 2 (labeled "Complementary Policies") indicates the role of transportation planning and investments in motivating complementary policies. Thus, the impact of transportation investment is not only in its direct accessibility impact but, perhaps, as or more importantly, in its ability to spur complementary policy initiatives that subsequently influence land use. A key benefit of rail system planning may be the fact that it can serve as a community focal point to discuss a community's transportation and land-use vision. The transportation investment provides the impetus, and perhaps the planning funds to support the development of community plans and policies that influence land use. Transit investments, in particular, can be a catalyst for a host of planning, investment, and policy commitments that subsequently influence development. Thus, the transit investment may be leveraged by a community to create a land-use response far greater than might be achieved based solely on the changes in regional accessibility that the transit investment

provides. The nature of the incentives from additional complementary investments or policies is categorized into three groups in Figure 2: cost reductions for development, additional amenities that enhance development, and complementary policies that support development.

The critical issue when contrasting the land-use influencing capabilities of LRT and BRT becomes one of determining the extent that these types of development-inducing actions are exclusive or more significant for LRT than for BRT proposals. Is the extent to which these conditions exist due to the financial magnitude of the project or the physical presence of the project? Or are they due to the perceptions and attitudes of the transportation and planning professionals and decision-makers who are variously motivated to make things happen based on their own values and perceptions?

It is too soon to draw conclusions from empirical evidence as to the resultant ability of BRT versus LRT initiatives to coalesce complementary land-use initiatives. The extent to which BRT is able to create land-use impacts will be significantly dependent on the actions of the profession, funding agencies, and decision-makers toward leveraging the investment in BRT.

The third section in Figure 2 (labeled "Promotion and Momentum") indicates that the transportation investment can serve as a vehicle for drawing attention to development opportunities near transportation facilities. Momentum and promotion can influence development regardless of the transportation consequences of transportation investments. This category may be less significant than the preceding two categories but, nonetheless, is very relevant in today's planning and development environment. This category is intended to acknowledge the influence of development momentum, agglomeration economies, and the impacts of promotion associated with development near major transportation investments. Economic theory of development often talks about the economies of agglomeration for development. In simple terms, this means that development is attracted to development. A copy shop or restaurant might logically choose to locate near a new office building. Thus, if enhanced transit accessibility or developer inducements can attract an office building, one may get a print shop, restaurant, day care center, or other complementary development as a result of

the natural market forces at work in the development community. The restaurant may not be motivated to make a location decision based on the transportation investment but rather based on the office development. The development community is very much momentum-driven. To the extent that a trend can be started in development, there is often continuing momentum after the initial motivation for development has been satiated.

Related to this is the "hype" that the planning community creates. Regardless of the empirical data or quantitative accessibility offered, if decision-makers or professional planners tell developers or the public that it is a great idea to locate near rail or BRT stations, some of them will. Perceptions are reality, and with enough attention, at least some expectations regarding the land-use impacts of transit investment can be self-fulfilling prophecies simply by virtue of the fact that this subject is getting a great deal of attention and advocacy by some elements of the planning community. If enough people are told how useful or advantageous it can be to locate near transit, then there is likely to be some land-use impact. Professionals and policy-makers influence perceptions and, in turn, perceptions influence behavior. Thus, the land-use impact of BRT may be meaningfully impacted by the messages that the profession espouses regarding the virtues of development adjacent to BRT. BRT's ability to influence land use relative to LRT is partially in the hands of the professionals in the transportation planning community. Will BRT be embraced as a tool to influence land use and advocated and leveraged as have LRT investments, or will BRT's land-use impacts be discounted or diminished irrespective of the accessibility impacts of BRT?

One feature of rail investments that has perhaps contributed to the perception that they influence land use is the fact that they are relatively modest systems in many cities. That is, the number of miles of rail investments is a small fraction of the number of miles of bus routes or the number of miles of roadways of any given type. Thus, rail stations are relatively unique. For many products, limited supply can drive up demand. Thus, if there are limited opportunities to develop near rail stations, then the value of those limited sites may be driven up suggesting a significant land-use influence/impact. On the other

hand, if an urban area were saturated with rail service such that there was very little exclusivity associated with being located near a station, then the land-use impact, as measured in land price changes, might be far more modest. In light of this price elasticity, the prospect that more expensive rail investments are likely to be more modest than BRT investments may mean that proximity to rail is rarer and, hence, of higher value. However, this does not speak to the total impact on land use of BRT versus LRT. One might, in the case of BRT, be able to influence land use in several corridors for the same total cost as influencing land use in one corridor with rail investment. Thus, one must be cautioned as to how land-use impacts are measured and interpreted across modes.

Conclusions

Over the next decade or two, there is an opportunity to have a greater change in the technology and image of bus service than has occurred since the introduction of internal combustion powered buses. Much of this change is cast regardless of the terminology that the industry applies or the classification and categorization strategies that are used to define various modes of public transit. With respect to virtually every parameter of performance relevant to transit customers and the community, these changes signal improvements in public transit services. Aesthetics and amenities that translate into image, pollutants and energy efficiency, service reliability and safety, customer information/communications capabilities, accessibility to passengers and, perhaps, even capital and operating costs can be improved with the careful integration of technology into the provision of bus services. These changes, implemented in varying degrees in all bus service or coordinated into comprehensive packages and positioned as BRT services, provide an opportunity for the transit industry to deliver an improved product to the public. In some cases this will be independent of consideration of rail investments, in some cases in addition to rail investments, and in some cases instead of rail investments. BRT adds an opportunity to showcase improvements in public transit service and, in many instances, enables improvements that would otherwise not be affordable or cost-effective in the context of lower-density transit markets.

The impact of BRT on public transit cannot be preordained but will definitely be impacted by how well the industry delivers on the promise of BRT and also on how well the BRT concept is leveraged to accomplish all that can be accomplished across the full range of goals that communities have for public transit systems. How BRT becomes defined is far less important than how it is effectively integrated into the overall range of transportation solutions planners use to address mobility and related problems.

Endnotes

1. This statement is partially based on data from Highway Statistics 2000, a report of the Federal Highway Administration. This document outlines revenues, spending, and system extent.
2. Extracted from listserv discussion of transit technologies, December 2001.

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