BUS RAPID TRANSIT AND ECONOMIC DEVELOPMENT
CASE STUDY OF THE EUGENE-SPRINGFIELD, OREGON BRT SYSTEM

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Abstract

Bus rapid transit (BRT) in the United States is relatively recent. BRT has many promises, one of which is enhancing the economic development prospects of firms located along the route. Another is to improve overall metropolitan economic performance. In this article, we evaluate this issue with respect to one of the nation's newest BRT systems that operates in a metropolitan area without rail transit: Eugene-Springfield, Oregon. Using a share analysis, we find that between 2004 and 2010, about 42 percent of all new jobs in the Eugene-Springfield urban area located within one-quarter mile of a BRT station. Using shift-share analysis, we find that BRT locations attracted about a quarter of all new jobs. The analysis identifies those firms that are especially attracted to BRT locations, such as administrative and support, educational services, health care and social assistance, arts, entertainment and recreation, and accommodation. Planning and policy implications are offered along with an outline for future research.

Introduction

In this article, we assess the relationship between bus rapid transit (BRT) and the change in share of jobs in an urban area during the 2000s. Eugene-Springfield, Oregon is our case study. Our analysis covers the period between 2004, roughly the peak of the local economy in the 2000s, and 2010, or just after the trough that occurred in the middle of 2009. We use Eugene-Springfield because: it has one of the nation's newest BRT systems so we can assess economic influences in the short-term; its system is reasonably representative of emerging BRT design; and we were able to acquire firm-based data allowing us conduct spatially-related analysis. Our article includes the following sections: review of BRT systems in the United States; overview of the Eugene-Springfield BRT system; presentation of our theory, method, and data; assessment of results; and planning and policy implications.

BRT in the United States

Bus rapid transit (BRT) can be defined and characterized as:

> … a flexible, rubber-tired rapid-transit mode that combines stations, vehicles, services, running ways, and Intelligent Transportation System (ITS) elements into an integrated system with a strong positive identity that evokes a unique image. BRT applications are designed to be appropriate to the market they serve and their physical surroundings, and they can be incrementally implemented in a variety of environments. In brief, BRT is an integrated system of facilities, services, and amenities that collectively improves the speed, reliability, and identity of bus transit (1:1).

Bus rapid transit (BRT) applies to a range of public transit systems that use buses to reduce headways and thereby provide more efficient service than traditional bus systems. This is usually accomplished by redesigning the existing street system where BRT will be provided, specially-designed buses, and scheduling separate from regular bus routes. In effect, BRT aims to achieve the service quality of rail systems while enjoying the lower costs and flexibility of bus transit (2). Littman identifies these characteristics of BRT systems (3):

> Grade-separated right-of-way, including *busways* (for bus use only, also called *O-bahn* or *Quickways*) *HOV lanes* (for buses, vanpools and carpools), and other transit priorty measures. Some systems use guideways which automatically steer the bus on portions of the route.
>
> Frequent, high-capacity service that results in passenger waits of less than 10-minutes during peak periods.
>
> High-quality vehicles that are easy to board, quiet, clean and comfortable to ride.
>
> Pre-paid fare collection to minimize boarding delays.
>
> Integrated fare systems, allowing free or discounted transfers between routes and modes.
>
> Convenient user information and marketing programs.

High quality bus stations with transit oriented development in nearby areas.

Modal integration, with BRT service coordinated with walking and cycling facilities, taxi services, intercity bus, rail transit, and other transportation services.

BRT in the United States tends to be a polyglot of design and vehicle approaches. For the Federal Transit Administration, Tann and Hinebaugh summarize differences in key elements of running way (in-street) design, station features, and vehicles as follows (4):

<u>Running Way</u>

Mixed flow arterial in Los Angeles, Oakland, Kansas City
Mixed flow freeway in Phoenix
Dedicated arterial lanes in Boston, Cleveland, Orlando,
At-grade transit-ways in Eugene, Los Angeles (Orange Line), Miami Fully grade-separated surface transit-ways in Pittsburgh
Bus subways in Seattle, Boston
Mechanical guidance in Cleveland

<u>Stations</u>

Level boarding in Las Vegas
New applications of raised curbs in Eugene
Near-level boarding in Cleveland

<u>Vehicles</u>

Standard vehicles often identical to the rest of the fleet in Los Angeles and Boston (though being phased out)
Stylized and specialized BRT vehicles in Las Vegas, Cleveland, Eugene, Los Angeles (Orange Line) and Oakland including both articulated and standard sizes

In effect, the nation seems to be experimenting with finding BRT approaches that mimic rail but without the cost and long-term commitment to routes. Let us focus on one BRT experiment: Lane Transit District's Emerald Express (EmX).

Eugene-Springfield BRT System

Planning for the EmX BRT began in 1996, when local officials and citizens assessed transit alternatives. Unlike many smaller to medium sized metropolitan areas, Eugene-Springfield is constrained from outward urban expansion by an urban growth boundary (5). Transit is considered one way to provide more efficient connections within the metropolitan area than automobiles. The planning process identified BRT as the clearly preferred transit option since it significantly enhances transit service and achieves many of the benefits of light rail but without the cost. The BRT option was initially approved in 2001 by Eugene, Springfield, Lane County, and the Lane Transit District. EmX service began in 2007 and in 2008 it carried 1.5 million riders (6). The system is expanding away from the route connecting downtown Eugene and Springfield westward along commercial corridors. For instance, the Gateway extension opened in January 2011. It added 7.8 miles to the EmX and runs north-south on Pioneer Parkway from the Springfield Station to the Gateway Mall and the Sacred Heart Medical Center. On the other hand, efforts by the Lane Transit District to expand the EmX to the west on 11th Avenue has met with opposition from business owners who fear it would disrupt customer traffic.

The Emerald Express (EmX) connects downtown Eugene with Springfield, Oregon, illustrated in Figure 1(7). It is managed by the Lane Transit District which chose BRT over light rail deciding that it was the best option for service and price, especially given the area's modest population size (about 300,000 residents and 175,000 jobs in the urban area) (8). The vehicles are specially designed for this purpose, as shown in Figure 2. The EmX includes dedicated bus lanes for about 60% of the route with other travel in shared travel lanes. Vehicles are provided signal priority including special signaling at intersections. The vehicles have doors on both sides which provide for loading from platforms on either side.

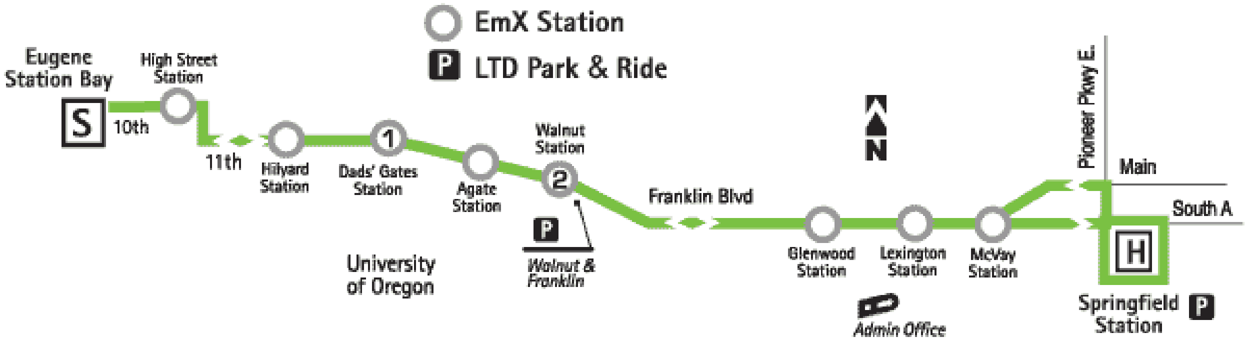

Figure 1. EmX BRT route map.
Source: Thole, Cain and Flynn (2009) accessed August 1, 2011 from
http://www.nbrti.org/docs/pdf/EmX_%20Evaluation_09_508.pdf.

Figure 2. EmX BRT vehicle.
Source: Thole, Cain and Flynn (2009) (2009) accessed August 1, 2011 from
http://www.nbrti.org/docs/pdf/EmX_%20Evaluation_09_508.pdf.

Theory, Method, and Data

There is a growing body of research showing that rail-based public transit enhances economic development (9). Generally, the chief purpose of transportation systems, regardless of model is to provide accessibility between people and their destinations (10). Improving accessibility usually means reducing time devoted to travel, and reducing the risk of failing to arrive at a destination; when this happens, economic activity increases (11). Sometimes, certain transportation investments can reduce economic development. This was found to be the case when beltways or other circumferential highways are constructed around metropolitan areas; they have the effect of dispersing development to densities lower than the economic thresholds needed to support certain firms (12). On the other hand, adding new transportation modes in built-up urban areas, such as rail, tend to increase aggregate economic activity (13).

Economic development can be measured in many ways. One is by evaluating how the market responds to the presence of transportation investments, such as rail stations. Higher values closer to stations implies market capitalization of economic developments, which can occur only when economic activity increases. Only a few studies have shown this with respect to commercial property values (14). and none for BRT although one study showed positive residential property value effects (15).

There is no research linking BRT to economic development, however. Our case study of the EmX system will lay the groundwork for determining whether there is a link. Literature shows a relationship between public transit and economic development. For instance, a particularly important study by Bhatta and Drennan shows that, compared to non-transit options, public transit improves output and productivity; reduces production costs; increases income, property values, employment, and real wages; and raises the overall rate of return to real estate investments (16). Whether these economic development benefits apply to BRT is not known. In this article, we will help close this gap in literature though much more research needs to be done as we will discuss later.

We will evaluate the EmX BRT systems for its economic development outcomes in terms of employment change within one quarter mile of BRT stations. To do this, our method is two-fold. First, we will conduct a descriptive analysis of the extent to which the EmX BRT may affect the concentration of new employment within one-quarter mile of BRT stations. Second, we will use shift-share analysis to assess particular patterns of firm location near BRT stations to identify those economic sectors that particularly benefit from BRT location, and those that do not.

Our study area is the Eugene-Springfield urban area. Our experimental interest is whether job changes in the study area are associated with the BRT route and stations. Our overall research design uses the case study method based on post-hoc outcomes. That is: because we know where the jobs are located throughout the study area, we can test for shifts in share of jobs before the introduction of the BRT in 2007, with outcomes later.

Our employment data come from Infogroup, which has provided us with the location of all firms, nonprofits, government agencies, and other entities for the Eugene-Springfield metropolitan area. The firm keeps current records on about 12 million firms nationally, including non-profit organizations and government entities. It acquired details on firm locations (including branches) from 5,200 Yellow Page and Business White Page Directories, 20 million phone calls to verify information one to four times a year, county courthouse and secretary of state data, annual reports, 10Ks and other SEC filings, new business registration and incorporations, and the U.S. Postal Service including its National Change of Address, ZIP+4 carrier route and Delivery Sequence Files (17). Infogroup provided us with two years of data: 2004 which is three years before the BRT became operational and 2010 which is three years afterward. In a sense, we also have a natural experiment. This is because the BRT was launched at the apex of the U.S. economy in 2007. Our data points are thus three years before the economic apex and three year after.

One perspective is that if the BRT has no effect on job location, we would see no difference in the share of jobs near BRT stations before (2004) or after (2010) the economic apex, which corresponds with the introduction of the BRT in 2007. There may be other factors that occurred during that time that are more difficult to measure, however In the case of Eugene, BRT was accompanied by changes in land use policies that encouraged new development near BRT stations, though those changes did not necessarily make new development more difficult elsewhere. Future research will need to explore the relationship between land use policy changes and development near BRT stations.

Our focus is on non-resource and non-industrial employment as shown in the tables.

Results

Table 1 provides an overall assessment of change in employment between 2004 and 2010, with the BRT system becoming operational in 2007. We find that of the 26,500 new jobs created in the Eugene-Springfield urban area about 11,000 of them were within one-quarter mile of a BRT station – about 42 percent of the growth. We cannot say conclusively that there is a cause-and-effect relationship between BRT locations and increasing concentration of certain kinds of jobs within one-quarter mile of BRT stations. Cause-and-effect relationships will be the subject of future research.

Especially impressive are shares of change in job growth in the administrative and management, educational, health and social assistance, arts, entertainment and recreation, accommodation, and public administration sectors. This does not necessarily mean that BRT proximity confers a comparative advantage for economic development, however. For this, we turn to shift-share analysis. In particular, because we know where the jobs were located throughout the study area in 2004 and 2010, we can compare shifts in share of jobs before and after the introduction of the EmX.

Shift/share analysis is used to decompose employment changes in small areas. The analysis identifies industries that have a comparative advantage in the small area. In our case, we use the Eugene-Springfield urban area, which is home to about 70 percent of the metropolitan area's 190,000 non-farming, forestry, fishing or mining jobs. Our study area is composed of one-quarter mile radii from the BRT stations. We apply shift-share analysis to determine the nature of employment change with respect to BRT stations using Carnegie Mellon Center for Economic Development notation (18):

$$SS = UA + IM + BRT$$

Where

SS = Shift-Share
UA = Urban Area share
IM = Industry Mix
BRT = BRT Location Advantage

The equations for each component of the shift-share analysis are

$UA\ {}_{i}local^{t-1} \cdot UA^{t}/UA^{t-1}$

$IM\ ({}_{i}local^{t-1} \cdot {}_{i}UA^{t}/{}_{i}UA^{t-1}) - UA$

$BRT\ {}_{i}local^{t-1} \cdot ({}_{i}local^{t}/{}_{i}local^{t-1} - {}_{i}UA^{t}/{}_{i}UA^{t-1})$

Where

${}_{i}local^{t-1}$ number of local jobs in sector (i) at the beginning of the analysis period (t-1)
${}_{i}local^{t}$ number of local jobs in sector (i) at the end of the analysis period (t)
UA^{t-1} total number of jobs in the nation at the beginning of the analysis period (t-1)
UA^{t} total number of jobs in the nation at the end of the analysis period (t)
${}_{i}UA^{t-1}$ number of jobs, nationwide, in sector (i) at the beginning of the analysis period (t-1)
${}_{i}UA^{t}$ number of jobs, nationwide, in sector (i) at the end of the analysis period (t)

Results of this analysis are reported in Table 2 and illustrated in Figure 3.

Figure 3 shows the main components of the shift-share analysis for employment growth or decline within quarter-mile distances of BRT stations between 2004 and 2010. The stacked bars allow us to see (1) how much of an industry’s growth or decline relates to how the industry itself grew or declined relative to overall urban area growth (red portion), and (2) the “local advantage" of being within a quarter mile of a BRT station (blue portion). The green portion of the bar represents the “share” component, or “mix” effect, which reflects the proportion of the industry’s performance within a quarter mile of BRT stations transit that is likely to be influenced by how the industry performed in relation to the economic growth of the urban area. If a particular industry increased jobs more rapidly than others in the Eugene-Springfield urban area economy, the “share” indicator would stand to show a greater positive influence on job growth within a quarter mile of a BRT station. Another way of looking at the share is what might we expect to be the effect on employment growth within a quarter mile of BRT stations if we were to assume that the industry’s urban area performance were to play out at the local level, which helps in isolating the “local advantages” of being within a quarter mile of a BRT Station.

The blue portion of the bar shows the second component of shift-share analysis, the “shift” or “local growth” effect or “BRT Advantage”. This “shift” measure isolates how industry employment changed within a quarter mile of BRT stations as compared to the urban area.

We can use Figure 3 in combination with Table 2 to identify economic sectors that are especially attracted to, or even repelled by, BRT stations. For instance, retail trade lost share at BRT stations. This could be a temporary outcome since local land-use planning aims to make BRT stations more attractive for retail trade (see discussion below). Health care and social services, and administrative services appear especially attracted to BRT stations. Accommodation, and arts, entertainment and recreation seem to be weakly attracted to BRT stations. The remaining sectors mostly follow urban area trends.

Table 1

Share of Change in Jobs With Respect to Distance from BRT Stations, 2004 and 2010

Economic Sector	Within 1/4 Mile of BRT, 2004	Within 1/4 Mile of BRT , 2010	Change	Eugene-Springfield Urban Area, 2004	Eugene-Springfield Urban Area, 2010	Change	BRT Location Share of Change
RetailTrade	1,483	1,376	(107)	12,692	19,090	6,398	-2%
Information	298	429	131	2,802	4,369	1,567	8%
Finance, Insurance, Real Estate	1,004	1,146	142	6,526	8,196	1,670	9%
Professional, Scientific, Technical	1,936	1,988	52	6,368	7,901	1,533	3%
Administrative & Management	350	3,892	3,542	2,616	7,203	4,587	77%
Educational Services	275	557	282	7,068	7,200	132	214%
Health Care, Social Assistance	586	5,639	5,053	11,583	17,139	5,556	91%
Arts, Entertainment, Recreation	37	574	537	2,019	3,517	1,498	36%
Accommodation	197	650	453	1,308	1,538	230	197%
Food Services	1,504	1,430	(74)	8,498	8,765	267	-28%
Other Services	939	1,047	108	6,516	7,680	1,164	9%
Public Administration	2,096	3,042	946	4,759	6,736	1,977	48%
Total	10,705	21,770	11,065	72,755	99,334	26,579	42%

Source: Analysis based on data provided by Infogroup.

Table 2

Shift-Share of Analysis of Job Change With Respect to Distance from BRT Stations, 2004 and 2010

Economic Sector	Within 1/4 Mile of BRT, 2004	Within 1/4 Mile of BRT, 2010	Eugene-Springfield Urban Area, 2004	Eugene-Springfield Urban Area, 2010	Urban Area Share	Industry Mix	BRT Advantage
RetailTrade	1,483	1,376	12,692	19,090	1,086	1,144	(855)
Information	298	429	2,802	4,369	218	246	(36)
Finance, Insurance, Real Estate	1,004	1,146	6,526	8,196	735	526	(115)
Professional, Scientific, Technical	1,936	1,988	6,368	7,901	1,418	984	(414)
Administrative & Management	350	3,892	2,616	7,203	256	707	***2,928***
Educational Services	275	557	7,068	7,200	201	79	***277***
Health Care, Social Assistance	586	5,639	11,583	17,139	429	438	***4,772***
Arts, Entertainment, Recreation	37	574	2,019	3,517	27	37	***510***
Accommodation	197	650	1,308	1,538	144	87	***418***
Food Services	1,504	1,430	8,498	8,765	1,102	450	(121)
Other Services	939	1,047	6,516	7,680	688	419	(60)
Public Administration	2,096	3,042	4,759	6,736	1,535	1,432	***75***
Total	10,705	21,770	72,755	99,334	7,841	6,549	7,380

Source: Analysis based on data provided by Infogroup.

Note: Those industries with a BRT advantage indicated in bold italics.

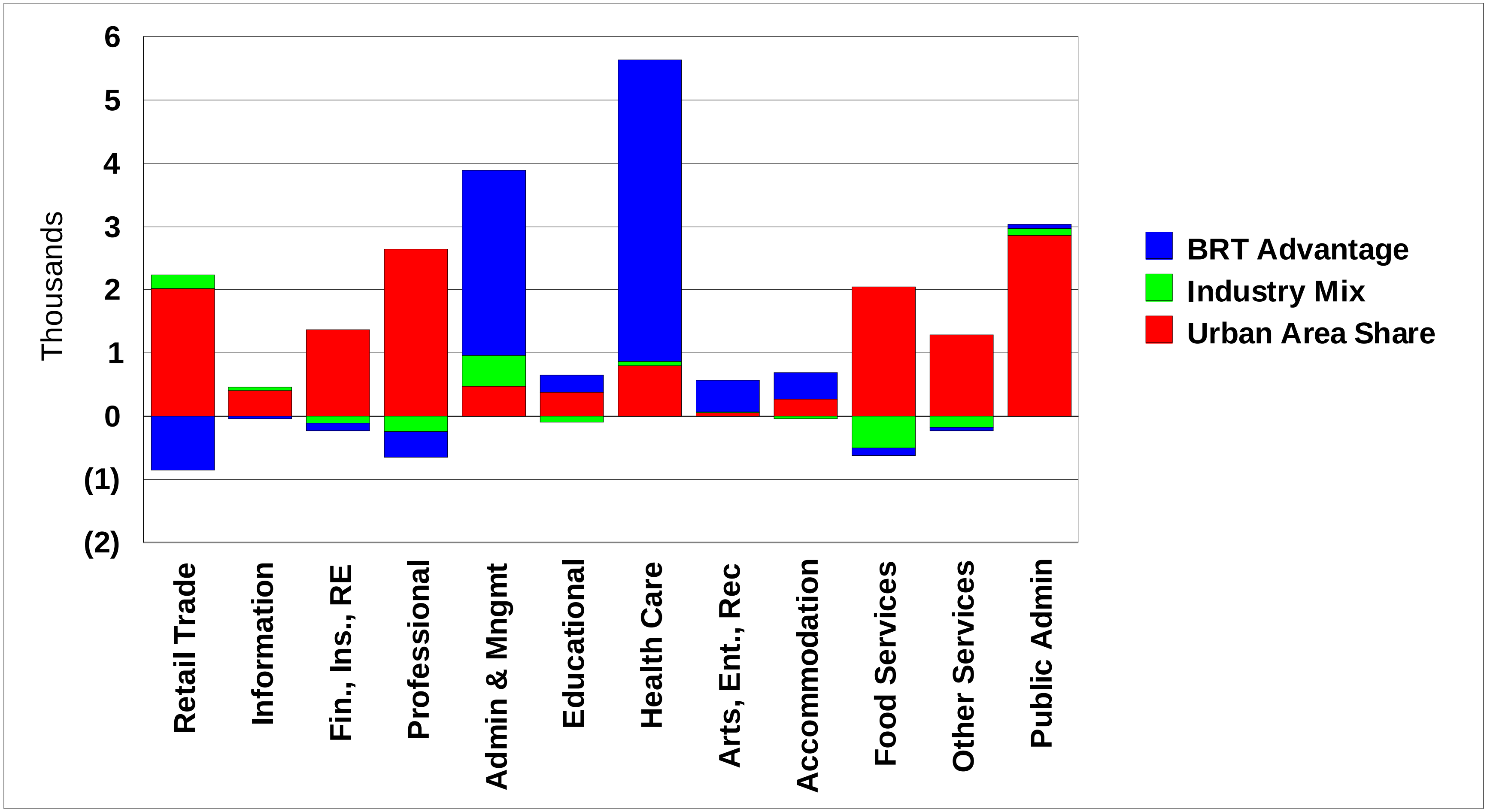

Figure 3. Shift-share distribution of employment change with respect to BRT Advantage, Eugene-Springfield urban area, 2004-2010.

Planning and Policy Implications

We are impressed to see how the Eugene-Springfield market responded so quickly to the EmX BRT system. Future research in other metropolitan areas, and over longer periods of time in Eugene-Springfield, can confirm whether our results are robust. Success, however, is likely due to several factors that need to be considered in planning, designing, and implementing BRT systems. These include the following (19):

The success of projects is due in part to high level of cooperation among public agencies, non-profit development communities and private developers.

In cities where the real estate market is not already strong, an active transit agency with a TOD program and/or active community development organization is critical.

Real estate developers and owners view permanence as an important factor for building around a BRT system. A key advantage of rail is that once the investment has been made, the real estate industry can usually rely on its permanence over the many decades it takes to maximize profits from high-density investments at or near those stations. However, even in the cities with a relatively low level of infrastructure, BRT is viewed as permanent when there is a clear long-term commitment by the transit agency.

BRT stations and their running ways need be prominent visually and be aesthetically appealing.

Frequency, speed and convenience of the service are important to developers, property owners, and riders. These are features that BRT service can provide better than local conventional bus service.

For cities that are using BRT to revitalize a corridor, streetscape improvements may be at least as important as the transit service itself.

The transit corridor must be amenable to high-density development, so the route needs to assure this opportunity. Corridors placed in areas without major employment or housing destinations are not likely to attract development, regardless of mode.

Providing financial incentives for TODs at BRT stations does not appear to be as important for attracting developer interest. Developers are much more interested in an expedited permitting or rezoning process, as time is a critical factor in making development projects financially viable.

One implication which seems to come to mind is that BRT may provide for many more opportunities for smaller metropolitan areas to serve numerous job sectors. We note that an urbanized population of about one million appears to be the smallest capable of supporting light rail with Salt Lake City being the key example. Light rail-like benefits may only be achieved in smaller metropolitan areas through BRT. Moreover, within metropolitan areas that have light or heavy rail, costs may prohibit their expansion. BRT could be the next-generation solution to increase multi-modal options. In either case, the BRT results for Eugene-Springfield's EmX, if it has this effect in other places, provides metropolitan planning organizations a rationale for investing in BRT to help create jobs magnets along key corridors of metropolitan areas that do not otherwise “pencil” for rail investments.

BRT may be the missing link to provide high-quality transit service along more commercial corridors and between more nodes than rail transit can afford. While more research is needed, that research should be aided by better data collection. For instance, neither the census nor the National Household Travel Survey include bus rapid transit as a transportation option respondents can choose – for now BRT is lumped together with conventional bus service. We recommend that the census and the NHTS include the BRT mode as a discrete response option in their future data collection activities.

We hope our work stimulates more research in this area. In the case of Eugene-Springfield, considering that 42 percent of the growth in jobs in the urban area appeared to cluster around BRT stations in just a short period of time, we think there is something going on that needs to be understood better. Among research issues to explore is determining cause-and-effect relationships between BRT stations and employment change, whether there is variation among economic sectors, whether employment shifts occur in the short-term as well as the long term, the extent to which local fiscal benefits improve with respect to BRT, among others. There is also the question of whether and the extent to which BRT affects residential location patterns.

In addition, it would be important to know whether different technologies have different economic development, and residential location, outcomes. Most light rail systems, for instance, use the same system design and mechanical technologies. In contrast, there could be up to a dozen or more different BRT designs and technologies.

We hope this article serves as a starting point for advancing discussion on BRT as an alternative to rail transit, conventional bus service, and the automobile.

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