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### Authors

Miller, Mark A.  
Buckley, Stephen M.

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# **Institutional Aspects of Bus Rapid Transit Operation**

**Mark A. Miller**  
**Stephen M. Buckley**

**California PATH Research Report**  
**UCB-ITS-PRR-2001-9**

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**Mark A. Miller**  
**Stephen M. Buckley**

**April 2, 2001**

## **ACKNOWLEDGEMENTS**

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## **ABSTRACT**

This report presents the findings of its investigation of institutional aspects of bus rapid transit (BRT) through both a macroscopic examination, a survey of members of the U.S. Bus Rapid Transit Consortium and several Canadian transit properties, and a more focused site-specific examination of three California BRT systems. The macroscopic examination resulted from a literature review, project team brainstorming meetings, and input from the Federal Transit Administration. Several dozen issues were identified and were grouped into nine categories that formed the basis of the survey: intergovernmental and inter-organizational; intra-transit property; political; public relations and marketing; funding and finance; labor; safety and liability; planning and land use; and the physical environment. The survey was administered to members of the U.S. Bus Rapid Transit Consortium and several Canadian BRT systems. Survey responses were analyzed to discern those issues that were deemed to be the most important and most difficult to resolve overall and with respect to distinct BRT system operational settings, respondents' organizational affiliation, and professional experience. In addition, those issues for whom the respondents were most unfamiliar as well as new issues identified by respondents were also examined. Recommendations for resolving the issues based on respondents' views are also presented. Finally, a closer examination of the findings from the perspective of the three California BRT systems was conducted to assess the state's BRT systems.

Overall, the following issues were deemed the most important and most difficult to resolve: Local and business community opposition to the removal of/restrictions on parking spaces for BRT use; Availability and acquisition of right-of-way or physical space; Integration of multiple priorities, objectives, and agendas; Concerns over long term funding commitments to BRT; Impacts of BRT on roadway operations; Finding political champions to support BRT; Gaining community support for transit-oriented development; Educating the public on BRT, and managing perceptions and expectations. Valuable insight has been gained into the institutional issues of bus rapid transit that are actually experienced.

Key Words: bus rapid transit, institutional issues, survey

## **EXECUTIVE SUMMARY**

This report constitutes the final deliverable for PATH Project MOU 394 — “Institutional Aspects of Bus Rapid Transit Operation”. The project has examined institutional issues on a generic or macroscopic level, through a survey of site-specific bus rapid transit (BRT) systems in the U.S. and Canada, and an examination of three site-specific California BRT systems based on the survey findings.

The primary objective of this work was to identify and investigate the institutional aspects of bus rapid transit operation with respect to their relative level of importance, likelihood of occurring, and difficulty of resolution and, where appropriate and possible, recommend strategies for the resolution of these issues. In this way, the results of this research study should be able to offer guidance to practitioners involved with bus rapid transit systems.

The macroscopic examination resulted from a literature review, project team brainstorming meetings, and input from the Federal Transit Administration’s bus rapid transit staff. Several dozen issues were identified and were grouped into the following categories: intergovernmental and inter-organizational; intra-transit property; political; public relations and marketing; funding and finance; labor; safety and liability; planning and land use; and the physical environment. These issues formed the basis of the survey administered to members of the U.S. Bus Rapid Transit Consortium and several Canadian BRT systems. Survey responses were analyzed to discern those issues that were deemed to be the most important and most difficult to resolve overall and with respect to two distinct BRT system operational settings (mixed traffic and exclusive facilities), respondents’ organizational affiliation (transit properties, highway and streets departments, and planning agencies), and professional experience (planners, engineers, and administrators). In addition, those issues for whom the respondents were most unfamiliar as well as new issues identified by respondents were also examined. Recommendations for resolving the issues were also considered. Finally, a closer examination of the findings from the perspective of the three California BRT systems was conducted to help assess California’s BRT systems.

This preliminary assessment will provide vital information as follow-up in-depth case studies are conducted.

Performing the survey as part of this project prior to case study work enabled the project team to perform a reality check of the institutional issues we originally identified by means of our macroscopic assessment. In this way, our work was well grounded in real world experience to gain a broad understanding of the institutional issues affecting those organizations involved with such systems, to learn numerous lessons about designing and administering the institutional issues survey that we will also apply to the case study work, to develop survey instruments for the case study work based on actual experiences from participants at the specific case study site(s), and to obtain Federal Transit Administration support for our survey directed at each U.S. BRT Consortium member that likely boosted the response rate of the survey to nearly 60%.

Overall, the following issues were deemed to be in a crosscutting fashion the most important and most difficult to resolve: local and business community opposition to the removal of/restrictions on parking spaces for BRT use, availability and acquisition of right-of-way or physical space, integration of multiple priorities, objectives, and agendas, concerns over long term funding commitments to BRT, impacts of BRT on roadway operations, finding political champions to support BRT, gaining community support for transit-oriented development, educating the public on BRT while managing perceptions and expectations.

With respect to operational setting, survey respondents representing *mixed traffic* type of BRT systems expressed primary concerns over the following issues: streets and highway departments having to relinquish control of their infrastructure, being able to reach agreement or consensus on bus stop/station area enhancements, and the capital costs associated with BRT. With respect to the *exclusive facility* type of operational setting, major concerns include: bus rapid transit being viewed as a top down solution to a problem, local and community opposition to BRT, lack of empirical evidence on the

effects of BRT on land use, and how potential developers will perceive BRT's lack of permanence as compared to rail.

With respect to organizational type, the following issues were deemed the most important and most difficult to resolve for *transit properties*: responsibility for enforcement on bus lanes/busways, and educating the public on BRT and managing perceptions and expectations. With respect to the *highway/streets departments* type of organization, the following issues were of major concern: maintenance responsibilities for shared infrastructure and hardware/software, capital costs of BRT, reaching agreement or consensus on bus stop/station area enhancements, how potential developers will view BRT's lack of permanence as compared to rail, local and community opposition to BRT, responsibility for enforcement on bus lanes/busways, concerns about BRT redirecting funds away from existing service or other routes, cost of additional staff and/or training to support BRT, lack of empirical evidence on the effects of BRT on land use, and gaining community support for transit oriented development. With respect to the *planning agencies* type of organization, the following issues were of major concern: reaching agreement or consensus on bus stop/station area enhancements, educating the public on BRT, and managing perceptions and expectations, gaining community support for transit oriented development, perceived or actual competition of BRT with rail transit, safety concerns of residents along BRT corridors, capital costs of BRT, and safety issues arising from interaction of pedestrians/motorists with new technologies/strategies.

The most frequently sighted issues about which the survey respondents were unsure included issues of insurance, liability, differing responsibilities between BRT and non-BRT routes, the changing role of drivers, new vehicle procurement, and the use of AVL in monitoring.

Survey respondents, all from mixed traffic types of BRT systems, identified only four additional issues that the survey had not originally listed. These include the following: obtaining funding from multiple sources and project sponsors, dealing with special interest groups such as environmental groups, responsibility for building the BRT:



highway/streets department or transit property, and long-term operational commitments between transit property and local municipality.

Approximately half of the respondents made recommendations on how to resolve the issues they found to be the most important. Emphasis was placed on marketing and public relations, public outreach and education, stakeholder participation, creation of new institutional entities, and study of land use and planning policies. Reference was also made for the need to quantitatively document the impacts, both benefits and costs, of BRT by means of cost-benefit analyses, needs assessment/engineering studies, and overall evaluations. Calls were also made to develop solutions to various potential negative impacts or dis-benefits of BRT such as excessive noise, vehicle emissions, and safety-related problems. Respondents also thought it would be very important that all study findings be fully communicated to both local jurisdictional decision-makers and the public who live in the communities or along a specific corridor most impacted by a BRT system implementation. Also of particular import, from the respondents' perspective, is the need to welcome and solicit input from a multitude of stakeholders to build as large as possible constituency of political supporters within the affected community for the proposed BRT system.

There are three California members of the U.S. BRT Consortium: Santa Clara Valley Transit Authority (SCVTA), Alameda-Contra Costa Transit (AC Transit), and Los Angeles County Metropolitan Transportation Authority (LACMTA). Of primary concern to SCVTA are the following issues: Insufficient understanding of the "state of the art" of BRT technologies; Finding political champions to support BRT; Educating the public on BRT, and managing perceptions and expectations; Safety issues arising from interaction of pedestrians/motorists with new technologies; Lack of empirical evidence on the effects of BRT on land use; Concerns of potential developers over BRT's lack of permanence as compared to rail; Reaching agreement or consensus on bus stop/station area enhancement.

Of primary concern to AC Transit are the following: Maintenance responsibilities for shared infrastructure and hardware/software; Responsibility for enforcement on bus lanes/busways; Coordinating other transit agencies' services and BRT operations; Determining an appropriate fare structure and medium; Coordinating schedules of other transit routes with BRT operations; Concerns over the distribution of the costs and benefits of BRT; Legal issues associated with service changes; New vehicle procurement; Educating users on changes in and uses of multiple fare structures; Concerns about BRT redirecting funds away from existing service on other routes; Agency reluctance to expand services due to current fiscal constraints; Cost of operating and maintaining new technologies and infrastructure; Use of AVL systems to monitor schedule adherence; Integrating BRT projects into the metropolitan planning process; Coordinating BRT project with local planning agencies' land use plans.

Primary concerns to LACMTA include: Integration of multiple priorities, objectives, and agendas; Streets/highway departments "relinquishing" control of their infrastructure; Coordination on selection and implementation of technologies; Defining and agreeing on new roles, responsibilities, and organizational structures to support BRT; Concerns over long term funding commitments to BRT.

Though a small set of opinions, this investigation was based on and value was gained from the insight and expertise of individuals who have experienced these BRT issues. This study should offer guidance to anticipate future problems and develop strategies to solve them. Follow-on work in this area will include in-depth site-specific case studies of BRT systems to more thoroughly probe into the institutional environment of bus rapid transit.

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## **1.0 INTRODUCTION**

This report constitutes the final deliverable for PATH Project MOU 394 — “Institutional Aspects of Bus Rapid Transit Operation”. The project has examined institutional issues 1. on a generic or macroscopic level, 2. through a survey of site-specific bus rapid transit (BRT) systems in the U.S. and Canada, and 3. through case studies of three California BRT system sites based on findings from the survey. The remainder of this section discusses the motivation for, objectives of, and the methodological approach used in the project.

The opportunity arose early in the project to solicit the insight and expertise from members of the entire U.S. BRT Consortium as well as operational BRT systems in Canada. This was outside the scope of the project’s work and would entail additional tasks, however, performing the survey itself as well as performing it when we did, i.e., after the macroscopic analysis though before the case study work proved to be quite valuable for the project in many ways. Site-specific case studies were conducted in this project, though based on information obtained from the survey. More in-depth case study analyses will be conducted in follow-on work to this project.

Performing the survey as part of this project prior to case study work enabled the project team:

1. To perform a reality check of the institutional issues we originally identified by means of our literature reviews and project brainstorming sessions for the macroscopic assessment. In this way, our work was well grounded in real world experience and not just an academic exercise. This is vitally important because our ultimate goal is to suggest, to the extent possible, recommendations on how to resolve the most significant issues.
2. To greatly enhance the breadth of this project’s work that has provided us with a much broader understanding of the institutional issues affecting those organizations involved with such systems, e.g., transit properties, streets/highway departments, and planning agencies.
3. To learn numerous lessons about designing and administering an institutional issues survey that will also be applied to the next stage of case study work since survey instruments will also

be used as a methodological tool in that endeavor. Lessons learned will allow us to perform the additional case study work more efficiently than we otherwise would have been able to.

4. To develop subsequent survey instruments based on actual experiences from participants at the specific case study site(s). For example, survey responses included those from representatives of the Santa Clara Valley Transit Authority (VTA) and these responses will assist us in focusing on the particular issues of most interest and importance to VTA.

5. To receive official FTA support by means of a letter of support for the survey distributed to all U.S. BRT Consortium members. We had a response rate of nearly 60% to our survey and are confident that FTA's support contributed to this.

## **1.1 Motivation**

Various areas of intelligent transportation systems (ITS) are currently being applied to the transit field including advanced transportation management and information systems, advanced vehicle control and safety systems, and advanced public transportation systems. Several ITS transit applications have already been deployed or are being considered including advanced vehicle identification and location systems (AVL), electronic fare/ticket payment systems, and automatic passenger counting systems.

Several of these applications are being explored as a means of enhancing transit bus operations and services, under the moniker of bus rapid transit. Improvements to bus operations and quality of services delivered may result from changes in the operational setting/right-of-way, bus stop/station design, vehicle design, and land use applications.

While BRT will raise technical, operational, and institutional issues, it is the institutional ones that may be the most challenging to resolve. This report documents our investigation of bus rapid transit's institutional issues based on a macroscopic examination from a review of the relevant literature, the findings from a survey administered to members of the U.S. BRT Consortium (a group of 17 transit properties developing their own BRT systems) and to several Canadian transit



properties that are currently operating BRT systems, and preliminary case study analyses of California BRT systems. While the literature review provided insight into the history of bus rapid transit, the review's primary objective was to help identify potential institutional issues for investigation. The survey provided us with information culled from the insights and experiences of individuals working for transit properties, regional planning organizations, or highway and street departments who are intimately familiar with bus rapid transit systems in their communities.

## **1.2 Objectives**

The primary objective of this work was to identify and investigate the institutional aspects of bus rapid transit operation with respect to their relative level of importance, likelihood of occurring, and difficulty of resolution and, where appropriate and possible, recommend strategies for the resolution of these issues. In this way, the results of this research study should be able to offer guidance to practitioners involved with bus rapid transit systems.

## **1.3 Methodological Approach**

To fulfill the project's objective, we initially identified as exhaustive a list of potential issues as possible from a theoretical or "what is likely?" perspective as an academic exercise. Next, we honed in on these candidate issues from the experiential point of view of individuals working on bus rapid transit projects in the "real world". The approach taken for the academic exercise consisted of 1. performing a literature review of bus rapid transit and related topics and 2. holding project-team brainstorming sessions that produced a list of institutional issues. We gained insight from people with direct and first-hand bus rapid transit experience by designing and administering a survey instrument to members of the U.S. BRT Consortium and individuals associated with several Canadian BRT systems and subsequently analyzing survey responses. By design, the survey sample size was relatively small and thus even with a large response rate, survey response analysis was accomplished more qualitatively than quantitatively with an assessment of current opinions on this topic rather than a scientific study.

This is the first of six sections. Section 2 provides general background material. Discussion of the survey design and administration is presented in Section 3, followed by the analysis of survey

findings in Section 4. Case study examinations of three California BRT systems are presented in Section 5. Conclusions and a brief description of future work are provided in Section 6.

## **2.0 BACKGROUND**

This section provides a brief discussion of bus rapid transit systems' implementation currently on-going in the U.S. and Canada and an abridged version of the macroscopic analysis we performed early in the project. A complete write-up and discussion of these topics may be found in (1). This brief discussion provides a foundation from which the survey work—its design, administration, and analysis, is presented.

### **2.1 U.S. BRT Program**

Though there is a current interest in it, BRT is not a new concept. As early as the 1950's, transportation agencies were looking for ways to implement high-quality, low cost transit service. Many of the features that are currently being investigated or utilized in current BRT projects were envisioned back during this time. Exclusive lanes, signal priority, rapid boarding and alighting, rapid fare collection, and prepayment boarding stations were all strategies described in Crain's 1963 paper "The Rapid Bus Transit Concept" (2). Whether these strategies were not technologically feasible or not yet cost-effective, they were used sparingly in the U.S.

With the high costs of capital intensive modes such as light or heavy rail, placing such systems out of the reach of all but a few select cities, transportation officials have shown a renewed interest in the "rapid bus transit" concept as a means of cost-effectively increasing the quality of their transit services. Additionally, successes with BRT in cities such as Curitiba, Brazil, Ottawa, Canada, and Pittsburgh, Pennsylvania, further fueled interest in utilizing low—or at least lower—cost strategies to make bus transit more attractive and competitive.

In 1998, the FTA released a Request for Proposal for projects to participate in a Bus Rapid Transit Demonstration Program. The program, which was planned to extend over the six-year life of the Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21), received seventeen proposals. While only ten of the seventeen were selected to officially be demonstration projects, the remaining seven were included in the program as members of the Bus Rapid Transit Consortium.

The goal of the Consortium, as described by FTA Administrator, Gordon Linton, is to, “share successes, learn from each other, avoid replicating mistakes, and explore new technology as they make bus transportation more efficient, reliable and attractive as we move into the next century.” (3).

## **2.2 Canadian BRT Systems**

While the U.S. exploration of BRT has been somewhat tepid over the last several decades, several Canadian cities have used BRT not only for routes, but also as the backbone for regional transit systems. In 1973, Ottawa chose to use the bus rapid transit concept in lieu of a significantly more expensive rail alternative. Inaugurated with 6.8 miles of bus lanes, the system was later upgraded to provide buses with exclusive, grade-separated right-of-way (1,4). Today, the system utilizes 16 miles of exclusive right-of-way, 7.8 miles of priority lanes, and operates for two miles in mixed traffic. The Ottawa system has been extremely successful, making nearly 200,000 trips per day, and is capable of carrying peak directional flows of 10,000 passengers per hour.

Though not on such an extensive, system-wide scale as Ottawa, several other Canadian cities have embraced BRT, with BRT routes in operation in Montreal, Quebec City, and Vancouver. Though none of these cities have exclusive right-of-way facilities, they have chosen instead to utilize technology in place of exclusive facilities to achieve higher bus operation performance.

## **2.3 In-Use BRT Implementation Strategies**

The most popular strategies for improving bus service appear to be station area improvements, automated vehicle location systems, advanced passenger travel information system (APTS), signal priority or preemption, and modifications to bus stop spacing. BRT projects also are using articulated fleets and low floor vehicles to expand capacity and reduce boarding times. Table 1 shows the bus rapid transit strategies that are currently used or planned for use in the four Canadian projects and 17 BRT Consortium projects. With such implementation strategies and others, improvements have been observed and documented in terms of increases in ridership,

reduction in travel times and other performance measures, examples of which are described in (5) and (6).

## **2.4 Macroscopic Examination of BRT's Institutional Issues**

The goal of this portion of the project was to identify as many institutional issues<sup>1</sup> as possible into mutually exclusive categories. Because of the inter-relatedness of many of these issues, the team erred on the side of inclusiveness and the reader may observe that some issues appear somewhat redundant and could fit into more than one of the following nine categories: intergovernmental and inter-organizational; intra-transit property; political; public relations and marketing; funding and finance; labor; safety and liability; planning and land use; and the physical environment. While each individual bus rapid transit project will not experience all issues, this macroscopic assessment provides a general overview of potential issues.

The following subsections summarize the institutional issues that were identified and separated into nine categories. A more thorough treatment of the macroscopic assessment is documented in a previous deliverable for this project (1).

### **2.4.1 Intergovernmental/Inter-organizational**

Many bus rapid transit projects, like their transit properties, operate across multiple jurisdictional boundaries and involve numerous stakeholders. This complicates the decision-making process as stakeholders typically bring their own philosophies, priorities, and agendas. Achieving consensus, or even agreement, among these stakeholders, whether political jurisdictions or other transportation organizations, often proves to be a significant challenge. Many BRT systems, to work effectively, require the transit property to achieve agreement with localities and other agencies on infrastructure, technologies, operations, and responsibilities. Additionally, issues

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<sup>1</sup> While a universally accepted definition of *institutional issues* may be hard to come by, they are usually easy to identify and recognize. Basically, institutional issues describe differences in philosophies, priorities, agendas, business cultures, etc. between or among groups, organizations, and institutions as a result of certain actions either proposed or taken as strategies or solutions to problems and the impacts these actions could or do have.



such as the operational effects on facilities shared with other vehicles (primarily automobiles), agreements on maintenance, and enforcement responsibilities, may slow the implementation process.

Summary of intergovernmental/inter-organizational issues:

- Integration of multiple priorities, objectives, and agendas
- Impacts of BRT on roadway operations
- Streets/highway departments “relinquishing” control of their infrastructure
- Agreement on performance measures
- Maintenance responsibilities for shared infrastructure and hardware/software
- Responsibility for enforcement on bus lanes/ busways
- Institutional fears of new technologies
- Coordination on selection and implementation of technologies
- Coordinating other transit properties’ services and BRT operations

#### **2.4.2 Intra-agency**

Institutional issues may arise not only among transit properties, political jurisdictions and highway agencies, but also internally within an individual transit property. Unless additional funding sources are available, increased spending on one route may simply mean decreased funding for others. Concerns over funding priorities and scarce resources, the delegation of responsibilities, and increased responsibilities of the staff may each result in internal resistance and morale issues for a transit property.

Summary of intra-agency issues:

- Concerns (or perceptions) that BRT is given special preference over other transit services
- Defining and agreeing on new roles, responsibilities, and organizational structures to support BRT
- Creation of design and operational guidelines for BRT
- Determining an appropriate fare structure and medium
- Internal coordination on selection of technology
- Coordinating schedules of other transit routes with BRT operations
- Insufficient understanding of the “state of the art” of technologies and how they can be used in BRT operations

#### **2.4.3 Political**

Transportation projects are often very political in nature. Gaining public support for them often requires the support of public leaders. Gaining the support of key decision-makers is often critical to the success of “new” concepts such as BRT. Elected officials are often cautious about backing “unproven” policies and desire tangible results before backing an initiative. Questions may also arise regarding whether BRT is a market driven initiative or merely a technological push. BRT may also be viewed as competing with other more familiar modes, particularly light rail transit. Similarly, while there have been several international success stories, domestically there have been very few examples of BRT and very little study to determine the effectiveness of such systems, which could further hinder a transit property’s ability to generate political support. Finally, strong political champions could also allay fears of affected constituents and aid in the coalition building efforts required to help bring BRT projects to fruition.

Summary of political issues:

- Concerns of BRT being a top down solution
- Perceived or actual competition of BRT with rail transit
- Lack of domestic BRT success stories
- Lack of empirical evidence of BRT’s operational effectiveness
- Finding political champions to support BRT
- Concerns over long-term level of interest waning
- Local and business community opposition to the removal of, or restrictions on, on-street parking spaces for BRT lanes/use
- Local and community opposition to BRT
- Concerns over the distribution of the costs and benefits of BRT
- Legal issues associated with service changes
- New vehicle procurement

#### **2.4.4 Public Relations and Marketing**

The success of BRT, as with nearly any new product, depends largely on how well it is “sold” to the public. This often requires setting expectations. Setting high, yet realistic, expectations will be crucial to gain support for BRT. Failure to produce what was promised could lead to disappointment and a loss of public confidence and support. BRT may also require a significant public education campaign on interacting with new transit strategies and technologies such as bus lanes, signal priority systems, queue jump lanes, and new fare collection systems. Moreover, the transit property needs to consider public opinion of its current performance including quality of service. Before taking on the additional responsibilities, such as a bus rapid transit system, a

property must ensure it is currently performing satisfactorily, or it could face political and public opposition.

Summary of public relations and marketing issues:

- Educating the public on BRT, and managing perceptions and expectations
- Concerns over a transit property's existing performance and reputation
- Concerns over effects of BRT on existing roadway operations
- Educating pedestrians and motorists on interacting with BRT
- Educating users on changes in and uses of multiple fare structures

### **2.4.5 Funding and Finance**

Though funding and financial issues themselves warrant their own investigation, we included them in our study because they may create institutional issues for BRT as well. During the 1960's and 1970's interest in BRT previously waxed and waned. The fear of history repeating itself may lead to the reluctance of transit properties to embrace BRT. Though the capital costs of many BRT projects are relatively small compared with other, more capital-intensive modal alternatives, transit properties will still be responsible for the operations and maintenance of new infrastructure. With continued fiscal pressures, transit properties may be concerned over the long-term financial commitment to BRT. Similarly, BRT will also require additional financial commitments for staff, training, and enforcement.

Summary of funding and finance issues:

- Concerns over long term funding commitments to BRT at the state and federal levels
- Concerns about BRT redirecting funds away from existing service or other routes
- Lack of understanding of funding mechanisms available for BRT
- Property's reluctance to expand services due to current fiscal constraints
- Ability to use existing buses or need for a new fleet
- Capital costs of BRT
- Cost of operating and maintaining (O&M) new technologies and infrastructure
- Cost of additional staff and/or training to support BRT
- Cost of additional facilities to support BRT
- Cost of and responsibility for enforcement, e.g., proof-of-payment, bus-only lanes

### **2.4.6 Labor**

Transit properties must consider the effects of BRT on its staff. BRT may raise concerns over additional work and responsibilities, especially without assurances of additional staff, resources,



and/or pay. Transit properties must also address how BRT operations may change the responsibilities and duties of employees who will work on a BRT system. Finally, for systems employing AVL, labor issues pertaining to schedule monitoring must also be resolved.

Summary of labor-related issues:

- Lack of support from transit property staff
- Changing role of drivers
- Use of AVL systems for monitoring schedule adherence
- Different responsibilities between BRT and non-BRT routes

#### **2.4.7 Safety and Liability**

Many bus rapid transit strategies involve new procedures, new technologies, or new personnel tasks. With them, the potential exists for system components to not function as anticipated, raising both safety and liability issues. Stakeholders need to consider how BRT changes the assignment of risk and responsibility should the technologies or strategies not function as intended. Safety issues regarding pedestrians and motorists and their interaction with BRT components such as signal prioritization and queue jumps will also need to be addressed.

Summary of safety and liability issues:

- Insurance industry initiated changes in assignment of risk and responsibility for bus transport
- Potential changes in liability associated with technological and/or operational malfunctions of BRT systems
- Safety issues arising from changing interaction of pedestrians and motorists with new technologies and/or strategies
- Safety concerns of residents along BRT corridors

#### **2.4.8 Planning and Land Use**

Large-scale public transportation projects have the potential for influencing travel patterns and surrounding land uses. Bus rapid transit, intended to replicate high-level transit service, may raise concerns over how it fits into a region's overall transportation plans and how it will affect local land uses. Many BRT projects intend to strengthen and to encourage higher land uses. Project sponsors will need to educate and address public concerns regarding the potential impacts of BRT on the physical environment. The public's fear of change and the "unknown" may lead to opposition against many BRT projects. Finally, a BRT system's inherent flexibility, often a much-touted attribute, may, in fact, be disadvantageous if influencing land use is a primary goal.

Potential developers may be reluctant to invest heavily along BRT corridors due to its perceived lack of permanence.

Summary of planning and land use issues:

- Integrating BRT projects into the metropolitan planning process
- Lack of empirical evidence on the effects of BRT on land use
- Coordinating BRT project with local planning agencies' land use
- Gaining community support for transit-oriented development
- Concerns of potential developers over BRT's lack of permanence as compared to rail

#### **2.4.9 Physical Environment**

The physical presence of a BRT system may also raise institutional challenges. Many project areas, especially in older city centers, may simply lack the physical space to easily accommodate certain BRT implementation strategies. Bus rapid transit projects may also find themselves competing with other interests for high-value real estate, which may not only inflate costs, but also complicate institutional dealings.

Image is also a strong marketing tool for BRT. While station area improvements are a popular BRT strategy, these improvements are typically being inserted into the existing urban design. Organizations may find it a challenge to develop station-area improvements that promote a strong BRT system image, while being acceptable to numerous local interests.

Summary of physical environment issues:

- Availability and acquisition of right-of-way or physical space
- Reaching agreement or consensus on bus stop/station area enhancements

### **3.0 SURVEY DESIGN AND ADMINISTRATION**

After developing the list of issues, the team then designed and administered a survey to solicit the “real world” opinions of individuals actively involved with BRT systems. In the U.S., the Federal Transit Administration’s (FTA) BRT Consortium provided a pool of survey participants familiar with these issues. Since Canada has a similar political, institutional, cultural, and economic climate to the U.S., and several operational BRT systems, Canadian transit properties were also selected to participate. Though globally additional cities have successfully deployed BRT systems, e.g., Curitiba, Brazil, potential survey participants were limited to the U.S. and Canada.

While institutional issues might vary among North American cities, including participants from regions with significantly different political and institutional cultures might not provide significant insight for the U.S. experience—the focus of this study.

The opinions of Consortium members and Canadian participants would provide this study with insight and expertise grounded in experience intended to provide guidance to ongoing and new BRT projects. Our goal was to identify issues by both their importance and difficulty of resolution. We also sought to identify differences among the types of BRT operational settings, among the various participating stakeholder organizations, and the participants' professional background and experience.

### **3.1 Participant Identification**

Project leaders from each of the 17 U.S. BRT Consortium sites were asked to help identify potential survey participants from and familiarity and experience with their BRT projects: two persons from the sponsoring transit property (typically, the project leader and one other), one person from a street or highway department, and one person from the private sector. From the private sector, we sought a developer, Chamber of Commerce member, or a Merchants Association representative with a special interest in the BRT project. Ideally, candidates would be knowledgeable in the BRT project's institutional dealings and issues. For many sites, the project leaders were unable to identify a private sector individual and, instead suggested a planning agency representative to participate. Planning-agency representatives were not meant to substitute for the private sector, but were included to enlarge the participant pool and to provide a broader base of opinion and expertise.

### **3.2 Survey Instrument**

The survey consisted of a listing of the 57 issues grouped into the previously referred to nine categories. The grouping into categories provided the survey with a more organized and readable layout. Prior to administering the surveys, several FTA bus rapid transit staff and Consortium

members reviewed and commented on a draft version of the survey for clarity, comprehensiveness, and readability. The final survey may be found in Appendix A of this report.

Survey participants were asked to rate each issue on a scale of 1 (lowest) to 5 (highest) in terms of the issue's importance and difficulty in resolving it. Rather than have participants guess on how they may rate the issue "in general", we requested they answer with respect to their specific BRT project. Participants also had the option to respond "Not Applicable" if appropriate, or "Don't Know" if they were unsure of whether an issue was applicable or unsure of how to rate it.

Participants were asked to provide demographic information: city/region, organizational type affiliation, and professional expertise. Also, participants could list additional issues they felt were overlooked. Finally, participants were asked how their "top three" issues could be resolved.

### **3.3 Survey Limitations**

The survey was distributed to 58 people in 18 sites. Thirty-four surveys were returned providing a 58.6% response rate. Due to the small number of survey participants and the diversity of BRT project types, we did not intend this survey to be a quantitative evaluation but rather a qualitative one with study findings interpreted as an assessment of current opinions on this topic rather than a scientific study. We believed a small yet knowledgeable and experienced group of participants would provide greater insight than a larger population of speculative or uninformed participants. Though the response rate was high, the sample size was small from a statistical standpoint. Our intent, however, was not to perform rigorous statistical hypothesis testing, but rather to provide guidance into which issues tend to be crosscutting and which tend to be site- or project-specific.

Another limitation involved the lack of a clear definition of what constitutes a BRT system. BRT encompasses a variety of implementation strategies that can be combined in numerous ways. BRT's modular nature and the variation in employable strategies make it challenging to determine if specific types of implementation strategies give rise to specific institutional issues.

There is also the concern that our findings may be skewed toward certain types of projects or toward certain strategies employed in those projects. The potential exists for some institutional issues to be over represented as some BRT strategies are utilized more often than others and some BRT projects had a greater number of respondents than others. Response rates varied between one and four returned surveys by site even though surveys were mailed out to approximately equal numbers of participants per U.S. site. We considered ways to factor out such over-representation, through various weighting techniques to aggregate the results until we had one “vote” per site and per implementation strategy, but felt that this would have resulted in a loss of valuable information pertaining to individual responses especially when considered in light of the small sample size as well as resulting in overly complicating the analysis. As a result, we instead weighted each survey respondent equally.

#### **4.0 GENERAL SURVEY FINDINGS**

The survey permitted us to investigate several features of this topic. First, we sought to identify which issues were crosscutting, i.e., which issues were important and difficult to resolve for all projects. These institutional issues would then be important for any BRT project. Second, we sought to identify which issues were specific to certain types of projects. Because of the numerous combinations of technologies and strategies that could be employed, requiring the responses to be broken out for analysis in a multitude of ways, we focused primarily on the operational environment of the projects. The operational environment, we believed, might give rise to specific issues that may be “drowned out” in an “overall” analysis. Third, we sought to identify if different parties/organizations hold different views on the importance or difficulty of resolution of specific issues. Different organizations may have different perspectives on what issues are important and how difficult they may be to resolve. Attempting to identify the issues in which organizations have different opinions may aid in permitting a greater understanding of perspectives by project stakeholders. Fourth, we sought to determine if different professions hold different views on issues. Once again, we sought to identify whether the different professions involved hold different priorities, or see differently in regard to certain issues. This might highlight any sort of “professional” biases on certain issues, and again aid in better understanding stakeholder positions. Fifth, the survey would identify issues that were not particularly relevant to

most projects. A large number of responses of “Not Applicable” would indicate that an “issue” identified in the brainstorming session may not be an issue at all. Alternatively, the survey may identify informational gaps that exist for specific issues. Not knowing about an issue, or whether the issue exists, might highlight institutional issues that need to be further investigated or shared among stakeholders. Sixth, we sought to identify new issues previously not listed on the survey. Finally, we sought to identify means to help resolve the issues from the survey respondents.

In summary, then, this section discusses the survey findings by first presenting results from an overall perspective considering common themes and differences, followed by an examination of responses partitioned by operational setting, by organizational type, and finally, by profession. We then looked for issues in which there were high numbers of “Not Applicable” or “Don’t Know” responses, to identify issues that were not pervasive or those on which survey respondents were not well informed. Lastly, we briefly discuss the issues that survey respondents felt were omitted from the survey and suggested strategies to resolve the issues they deemed to be the most important.

In analyzing survey responses, we focused on issues that were high on both “Importance of Issue” and “Difficulty of Resolution” scales. We examined scatter plots of average scores for both “Importance of Issues” (on x-axis) and “Difficulty of Resolution” (on y-axis), identified those points that appeared to be in the upper-right-hand-most corner of the scatter plot, i.e., the most important and the most difficult-to-resolve issues, and examined this issues cluster further. The definition of “high” was not uniquely or quantitatively defined across all types of scatter plots to accommodate the differences inherent in the issue ratings. Moreover, while we strove to select the boundary between each issues cluster and the remaining issues within a clearly delineated no-issues gap of the scatter plot, this was not always possible and somewhat left the definition of the “primary” issues at the discretion of the authors<sup>2</sup>.

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<sup>2</sup> There is, of course, a tradeoff between this more qualitative approach and a more rigorously quantitative approach in which the most important and most difficult-to-resolve issues would be identified by more objective means. For example, issues could have been selected if both their x- and y-axis ratings were greater than or equal to some specific score, say 3.5 or 4.0. It should be noted that for this method a unique pair of scores for “Importance of Issue” and “Difficulty of Resolution” may not always be appropriate across all sub-groupings in which case the authors’ judgment comes into play as in the more qualitative approach. Moreover, using this quantitative method may also omit issues that do not meet the minimum threshold rating criteria yet under the more qualitative approach could be included because they are tightly clustered with other issues that do meet the threshold

For the “Overall” section the identification of the most prominent issues was rather simple. However, for the sections in which comparisons between sub-groupings were made, the authors used several criteria to help determine whether differences did exist. To aid us in noting differences, we developed the following four criteria to consider:

1. Whether the issue in the primary cluster was in at least one of the compared groups
2. Degree of difference in the averages between the groups
3. Number of respondents in each group
4. Whether differences could be explained logically or by common sense.

No definitive values were placed on defining “significant difference” or “significant sample size”, so the identification of issues in which differences did exist were left to the authors.

#### **4.1 Overall Issues**

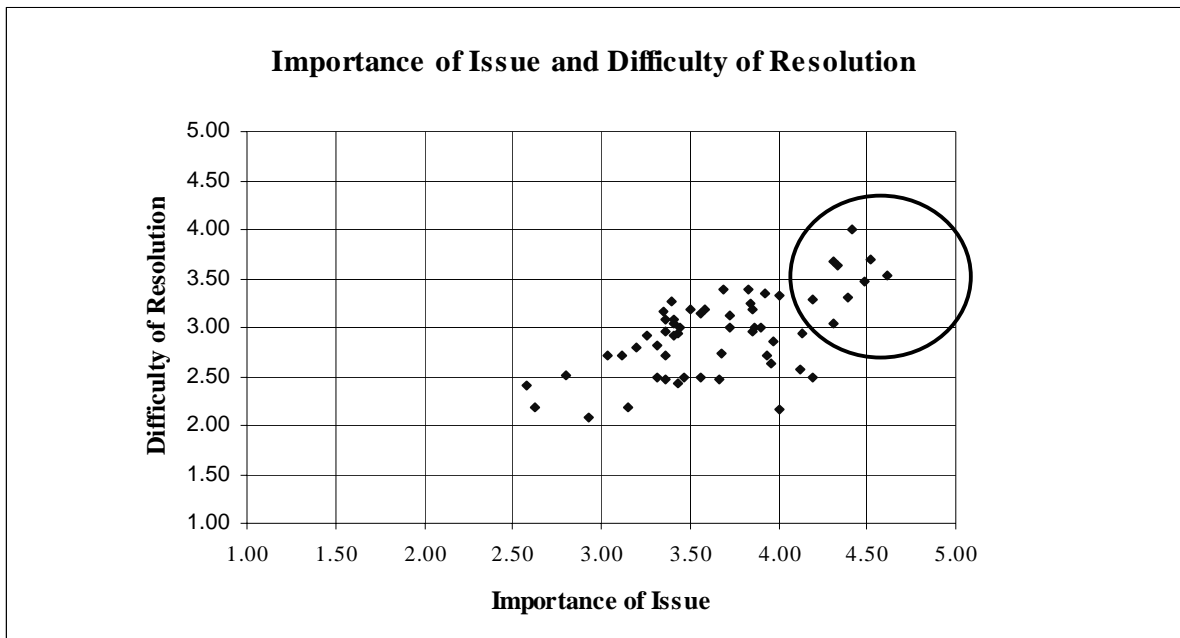
Figure 1 shows a plot of the average score for each issue over all survey respondents. This plot shows several issues that lie in an upper range of values for both “Importance of Issue” (higher values indicate greater importance) and “Difficulty of Resolution” (higher values indicate greater difficulty to resolve). There appear to be eight primary issues that clearly stand out from the rest of the cluster, scoring high on both scales. These issues appear to be crosscutting in the sense that they averaged the highest among all respondents. (Appendix B shows tabulated results.)

These eight primary issues are listed below (in no particular order) with average ratings for each Importance of Issue and Difficulty of Resolution pair shown in parentheses:

1. Local and business community opposition to the removal of/restrictions on parking spaces for BRT use (4.42, 4.00)
2. Availability and acquisition of right-of-way or physical space (4.52, 3.70)
3. Integration of multiple priorities, objectives, and agendas (4.61, 3.53)
4. Concerns over long term funding commitments to BRT (4.31, 3.68)
5. Impacts of BRT on roadway operations (4.33, 3.63)
6. Finding political champions to support BRT (4.48, 3.47)
7. Gaining community support for transit-oriented development (4.39, 3.30)
8. Educating the public on BRT, and managing perceptions and expectations (4.19, 3.29)

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criteria. The authors erred on the side of flexibility and to moderate the downside effects of this approach, we also examined non-selected issues adjacent to the boundary of the scatter plot area identified as containing the most important and most difficult-to-resolve issues.



**FIGURE 1 Scatter Plot for Overall Issues.**

#### **4.1.1 Integration of Multiple Priorities, Objectives, and Agendas**

Respondents identified one of the first issues the team identified as one of the greatest institutional issues of BRT. The integration of multiple priorities, objectives and agendas often lies at the heart of institutional issues. Of 31 respondents who rated this issue, 20 rated it a “5” and ten rated it a “4” in the “Importance” category. When several institutions come together to discuss issues of common interest, each brings their own organizational experiences, cultures, and goals. A “win-win” strategy might not always be achievable, but BRT project members need to acknowledge and be thoughtful of other agencies’ issues and concerns. Modal biases and agendas have historically infiltrated transportation planning. However, in recent years, with the recognition that multi-modal transportation systems tend to be the healthiest, we have witnessed greater levels of cooperation. Many transportation organizations, however, still have responsibilities to their respective agencies or jurisdictions, and are still expected to protect their own interests. Though we are witnessing greater cooperation, we must encourage continuous



dialogue to discuss and better understand stakeholders' concerns and attempt to address them throughout the BRT development and deployment process.

#### **4.1.2 Finding Political Champions to Support BRT**

Though public support is critical in implementing a BRT system, it is usually not attainable through transportation agencies alone. Finding a political champion to support a BRT initiative may be critical in gaining public support. Politicians are typically the final decision makers and often have the clout to produce results. Gaining the ear and voice of influential politicians is one of the most often-cited means of achieving results. This issue received the greatest number of “5” votes in “Importance” with 24 out of 33. Though it scored lower on its “Difficulty of Resolution” rating (3.47), this is due to several “1” and “2” votes, perhaps in regions where political champions for transportation projects are plentiful and easy to enlist. Finding a political champion was still ranked the sixth most difficult issue to resolve.

#### **4.1.3 Roadway-related Issues**

The following three issues may be covered under the umbrella of *roadway-related issues*:

- Local/business community opposition to removal of/restrictions on parking spaces for BRT use
- Availability and acquisition of right-of-way or physical space
- Impacts of BRT on roadway operations

BRT is intended to provide the high-quality service associated with rail transit at a much lower price. In many BRT projects this is accomplished by providing buses with exclusive or nearly exclusive right-of-way, so operations are not affected by urban-street congestion. However, obtaining the required right-of-way may be difficult. Most BRT projects operate, for at least a portion of their route, in developed urban areas where physical space for transportation improvements is typically not in abundance. In several projects this space comes from currently utilized roadway lanes or from existing parking lanes. This consideration appears in three of the eight primary issues identified. Operators of the roadway facilities (typically municipal streets departments or state Departments of Transportation) used for BRT projects will be interested in how BRT operations would affect their facilities. In cases where projects look to utilize roadway space that is currently on-street parking, businesses and residents may be opposed to the “loss” of

parking, even if it is only for peak-period directions and times. Therefore one of the major institutional considerations in assessing where BRT is a realistic alternative for specific corridors or roadway facilities is the availability of physical space to accommodate BRT operations. Though this issue doesn't appear to be insurmountable, proper consideration must be given to identify if there are competing interests for space and how BRT operations may impact these facilities.

#### **4.1.4 Concerns Over Long-Term Funding Commitments to BRT**

Another issue that ranked high was concern over BRT's long term funding prospects. Concerns include BRT merely being the "flavor of the month" and the implications for transit properties should the BRT concept fall out of favor. Some BRT projects will require a great deal of capital investment, often requiring transit properties to shoulder the risk of having greater capital to maintain without recovering sufficient additional revenue to cover those costs. Whether these are items that a transit property can afford to operate and maintain, may cause reluctance on the part of transit properties to embrace BRT. Until there are several domestic success stories, and the federal government shows a firm commitment to the program, many transit properties may proceed with caution.

#### **4.1.5 Gaining Community Support for Transit-Oriented Development**

Allaying the fear of the unknown is often a responsibility that must be borne when presenting an untested concept to the public. Many BRT projects have incorporated land use strategies to encourage and reinforce transit usage. However, for most outside of the transportation and planning communities, the concept of transit-oriented development (TOD) is new. For many, higher density and mixed use equals more crowding and greater congestion. Attempting to garner public support for this concept appears to be a difficult undertaking, especially if there are not many local examples to aid the public's understanding. Proactively educating the public on the underlying purposes and goals of TOD may assist a transit property in avoiding public opposition to this unknown.

#### **4.1.6 Educating the Public on BRT, and Managing Perceptions and Expectations**

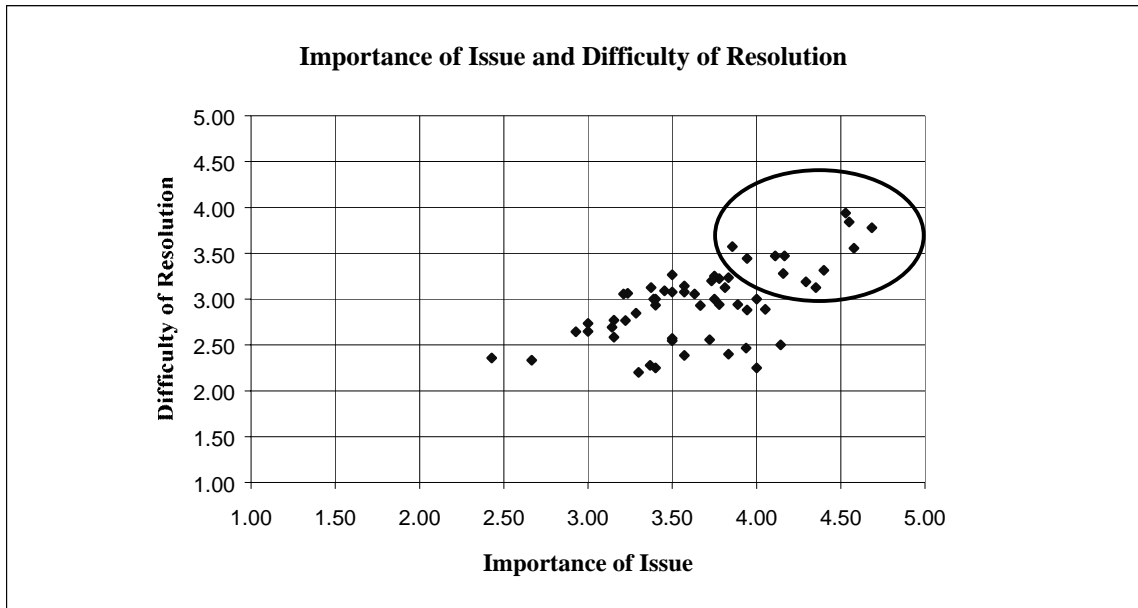
The survey indicates a concern over creating and managing perceptions and expectations. Though rated as one of the easier to resolve of the eight primary issues, this issue may be critical in maintaining continued support and interest for the BRT program. Agencies must perform a balancing act on this issue. For BRT to be embraced by both the public and decision makers, the concept must be “sold” to them but it must be sold in the correct manner and amount. Setting unrealistically high expectations can lead to disappointment and a loss of support both from the public and from decision-makers. It is important that balance be maintained between the “hype” and actual results.

On average, issues scored higher on the “Importance of Issue” rating than on the “Difficulty of Resolution”. It appears that even for the issues presented, which scored high in both categories, none appear to be insurmountable. The two highest scoring issues in the “Difficulty of Resolution” were the opposition to the removal of/or restrictions on parking (with a 4.00 average) and the availability of right-of-way (with a 3.70 average). While the remainder of the issues identified in the survey need to be considered, as each project has specific institutional issues that are locally unique, this survey has identified several of the most common and site-independent institutional issues of bus rapid transit systems.

## **4.2 Operational Setting**

An important attribute of a BRT system is its operational setting, examples of which include: a busway, an expressway or High Occupancy Vehicle facility, bus lanes on arterials, abandoned railroad right-of-way, or mixed traffic operation. We decided to investigate whether a project’s operational setting raised specific institutional issues, however, this was made more difficult because a BRT system can employ multiple operational settings along its deployment route(s) (e.g., Ottawa’s Transitway employs exclusive bus lanes on arterials, a bus-only lane on expressways, and mixed traffic operation through Ottawa’s central business district (1)). We then aggregated operational types into two distinct operational-setting families: mixed traffic (MT) and exclusive facilities (EF). Each completed survey was then identified with one of these two families based on the predominant operational setting of the corresponding local BRT project.

Of the 34 returned surveys, 20 and 14 corresponded to MT and EF, respectively. Two scatter plots were prepared (Figures 2 and 3) for MT- and EF-specific data, respectively, for the average ratings of survey respondents for each issue. They reveal specific issues that lie in clusters of upper range values for both “Importance of Issue” and “Difficulty of Resolution”. The eight issues that were previously identified and discussed as the most important and most difficult issues to resolve overall (See Overall Issues discussion) also appear in the MT and EF clusters and thus reflect issues that crosscut a BRT system’s operational setting. A ninth issue, “Responsibility for enforcement on bus lanes/ busways”, appears in both operational-setting clusters. So while this issue does not appear in the “overall” list of eight primary issues, it does appear to be crosscutting relative to a BRT’s operational setting. (Appendix C and D show tabulated results for MT- and EF-specific data, respectively.)



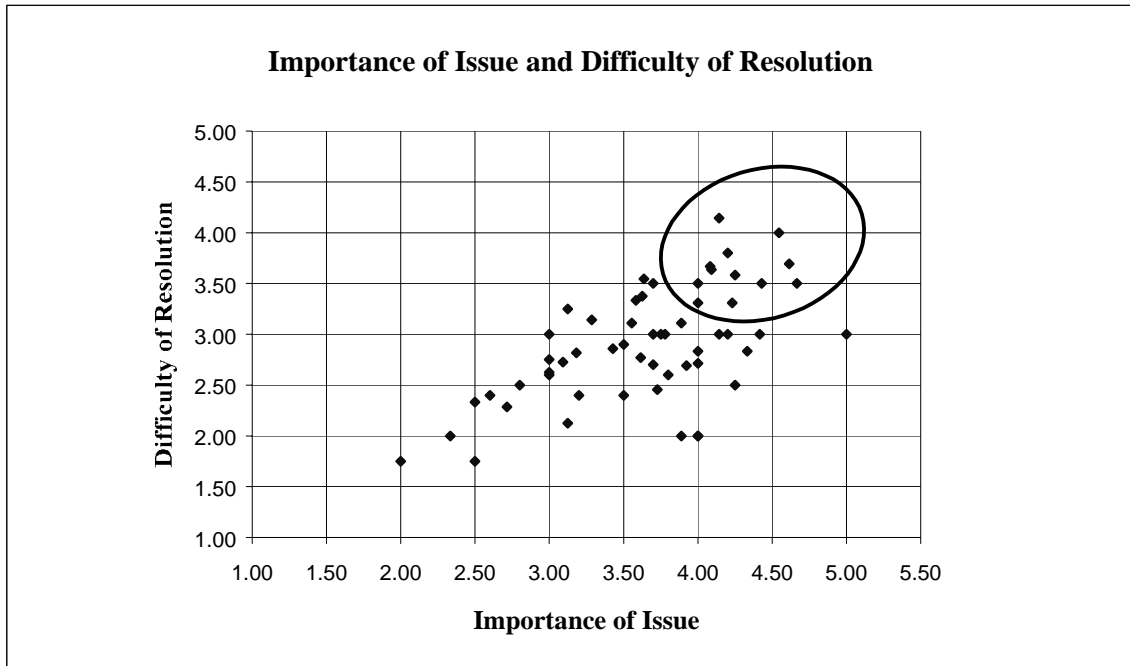
**FIGURE 2 Scatter Plot for Operational Setting: Mixed Traffic.**

#### 4.2.1 Mixed Traffic

The three remaining issues (listed below in no particular order) within the MT cluster are less crosscutting and appear more closely associated with mixed traffic type of BRT systems.

Average ratings for each “Importance of Issue” and “Difficulty of Resolution” pair are shown in parentheses:

1. Streets/highway departments “relinquishing” control of their infrastructure (3.94, 3.44)
2. Reaching agreement or consensus on bus stop/station area enhancements (4.29, 3.19)
3. Capital costs of BRT (4.11, 3.47)



**FIGURE 3 Scatter Plot for Operational Setting: Exclusive Facilities.**

The first two issues are clearly associated with mixed traffic type of operational settings and so it makes intuitive sense that MT respondents would consider them among their most important and difficult-to-resolve issues. Mixed traffic systems are geared more to upgrades of existing systems while exclusive facility systems are likely viewed more relative to other systems such as light rail transit. For this reason, capital costs may be of greater importance for mixed traffic systems than for exclusive facilities.

#### **4.2.2 Exclusive Facilities**

The four remaining issues (listed below in no particular order) within the EF cluster are less crosscutting and generally, more closely associated with an exclusive facilities setting. Average ratings for each “Importance of Issue” and “Difficulty of Resolution” pair are shown in parentheses:

1. Concerns of BRT being a top down solution (4.00, 3.50)
2. Local and community opposition to BRT (4.08, 3.67)
3. Lack of empirical evidence on the effects of BRT on land use (4.09, 3.64)
4. Concerns of potential developers over BRT's lack of permanence as compared to rail (4.20, 3.80)

If these issues are viewed through the prism of regional planning, development, and land use, then their importance to EF system respondents can be more readily understood. EF systems are generally larger in scale and scope than MT systems, especially relative to required infrastructure and capital. Thus, EF system respondents are concerned about BRT's same potential impact, as expressed through issues 1 through 4, as seen through the lens of regional deployment of large scale systems.

### **4.3 Organizational Type**

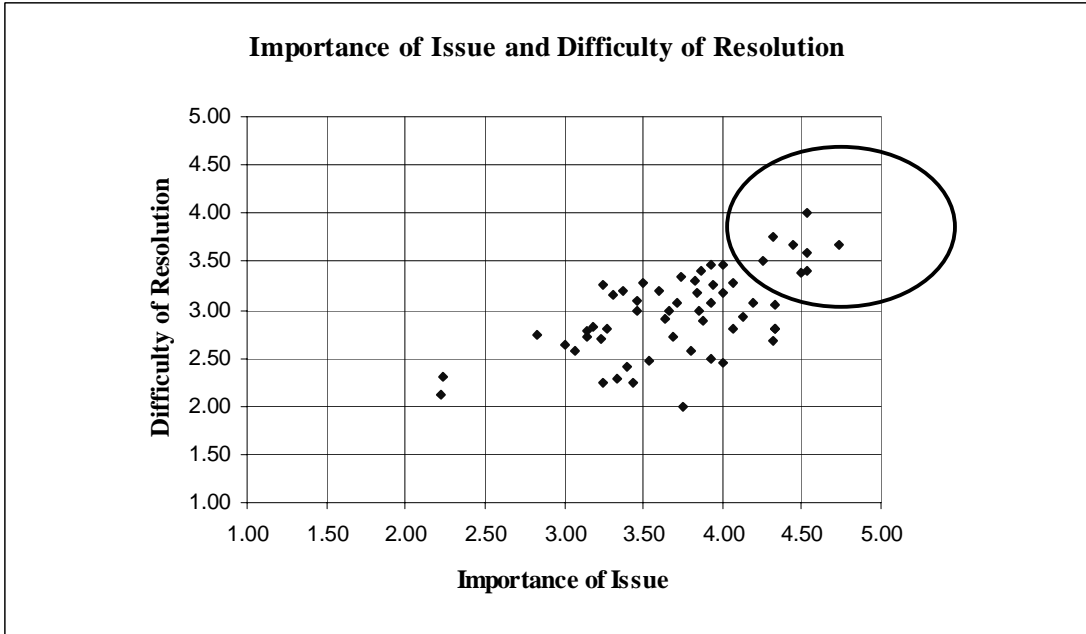
Survey participants' responses reflect the organization they work for, its objectives, agendas, and business cultures. By examining responses by organizational type we hoped to identify any differing values, priorities, and perceptions. The three organizational types are transit properties (TP), highway/street departments (HSD), and planning agencies (PA).

Of the 34 completed surveys, 18, 7, and 7 corresponded to TP, HSD, and PA, respectively (Two surveys indicated "Other" for their employment affiliation and were from the private sector and are not reported on further in this report). Three scatter plots were prepared (Figures 4 through 6) for TP-, HSD-, and PA-specific data, respectively, for the average ratings of survey respondents for each issue. They reveal specific issues that lie in clusters of upper range values for both "Importance of Issue" and "Difficulty of Resolution". (Appendix E, F, and G show tabulated results for TP-, HSD-, and PA-specific data, respectively.)

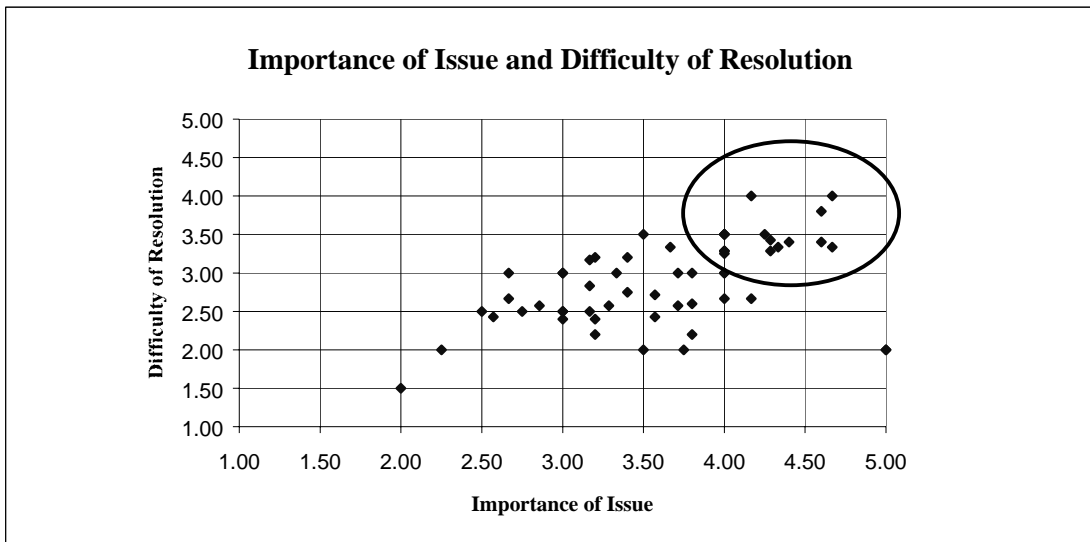
There are six issues appearing in each of these three scatter plots that were previously identified among the most important and most difficult-to-resolve issues overall. These issues reflect concerns that crosscut a BRT system's organizational type:

1. Integration of multiple priorities, objectives, and agendas
2. Impacts of BRT on roadway operations
3. Finding political champions to support BRT

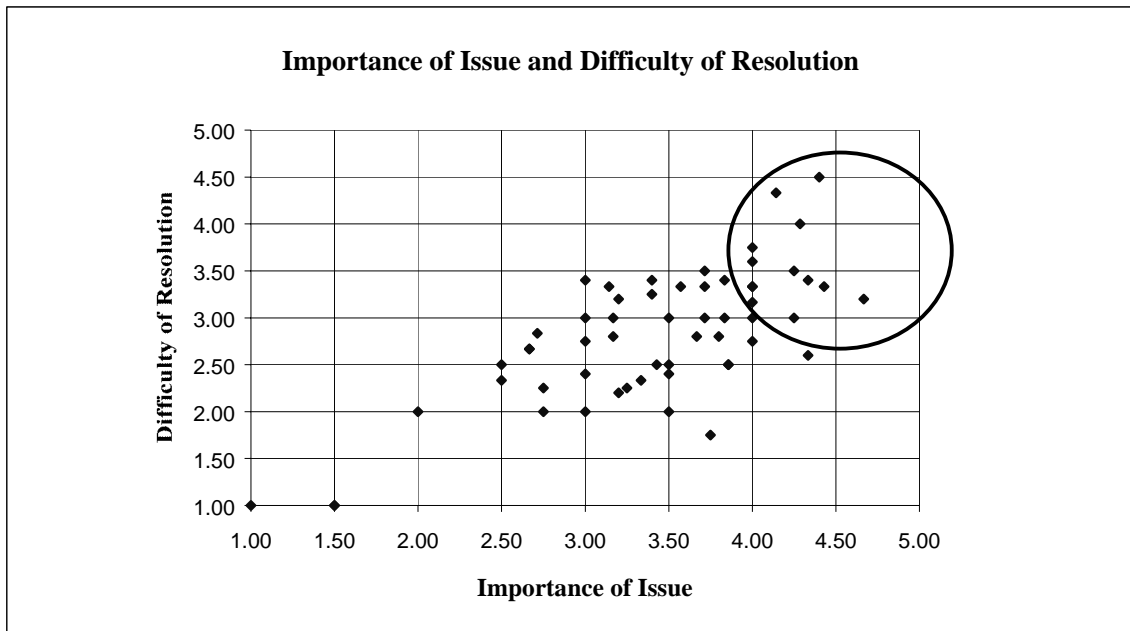
4. Local and business community opposition to the removal of, or restrictions on, parking spaces for BRT use
5. Concerns over long term funding commitments to BRT
6. Availability and acquisition of right-of-way or physical space



**FIGURE 4 Scatter Plot for Organizational Type: Transit Properties.**



**FIGURE 5 Scatter Plot for Organizational Type: Highway/Streets Departments.**



**FIGURE 6 Scatter Plot for Organizational Type: Planning Agencies.**

### 4.3.1 Transit Properties

There are two remaining issues (listed below in no particular order) within the TP cluster that are less crosscutting and generally, more closely associated with a transit property’s priorities.

Average ratings for each “Importance of Issue” and “Difficulty of Resolution” pair are shown in parentheses:

1. Responsibility for enforcement on bus lanes/busways (4.25, 3.50)
2. Educating the public on BRT and managing perceptions and expectations (4.50, 3.38)

The enforcement of bus-only usage on a BRT facility will be critical for achieving operational gains, especially in the mixed traffic setting, and will be a priority to a transit property. A goal of bus rapid transit is to provide high-quality public transportation service associated more with rail transit than traditionally associated with bus transit with the benefit of attracting more members of the public to bus transit. Thus it makes sense that educating the public, both current and potentially future customers, about bus rapid transit would be important to a transit property.



### **4.3.2 Highway/Streets Departments**

There are 10 additional issues (listed below in no particular order) within the HSD cluster, however, only one (Issue 1) may be easily viewed as more closely associated with a highway and streets departments' interests. The selection of the boundary for the cluster of upper range values for both "Importance of Issue" and "Difficulty of Resolution" from the HSD scatter plot was less easily identifiable for HSD-specific data resulting in clustering considerably less clear than in the "Overall Issues" assessment. Average ratings for each "Importance of Issue" and "Difficulty of Resolution" pair are shown in parentheses:

1. Maintenance responsibilities for shared infrastructure and hardware/software (4.00, 3.29)
2. Capital costs of BRT (4.67, 3.33)
3. Reaching agreement or consensus on bus stop/station area enhancements (4.60, 3.40)
4. Concerns of potential developers over BRT's lack of permanence as compared to rail (4.33,3.33)
5. Local and community opposition to BRT (4.17, 4.00)
6. Responsibility for enforcement on bus lanes/busways (4.00, 3.50)
7. Concerns about BRT redirecting funds away from existing service or other routes (4.00, 3.50)
8. Cost of additional staff and/or training to support BRT (4.00, 3.50)
9. Lack of empirical evidence on the effects of BRT on land use (4.00, 3.25)
10. Gaining community support for transit oriented development (4.40, 3.40)

"Maintenance responsibilities for shared infrastructure and hardware/software" is the issue from this group that is one of the most intuitive concerns of HSD interest. Moreover, this issue is the only one from this group rated by all seven respondents. Local (or branch offices of state) DOTs could find these issues interesting and important especially in arterial street settings or at interfaces between arterial and limited access facilities, i.e., on- and off-ramps. While the other issues would seem to be of more interest to the transit or planning communities, overlapping interests exist.

### **4.3.3 Planning Agencies**

There are seven additional issues (listed below in no particular order) within the PA cluster, however, some (Issues 1 through 4) are more easily explained than others (Issues 5 through 7) as more closely associated with a planning agency's interests. Again, the selection of the boundary

for the cluster of upper range values for both “Importance of Issue” and “Difficulty of Resolution” from the PA scatter plot was less easily identifiable for PA-specific data resulting in clustering considerably less clear than in the “Overall Issues” assessment. Average ratings for each “Importance of Issue” and “Difficulty of Resolution” pair are shown in parentheses:

1. Reaching agreement or consensus on bus stop/station area enhancements (4.00, 3.33)
2. Educating the public on BRT, and managing perceptions and expectations (4.00, 3.33)
3. Gaining community support for transit oriented development (4.33, 3.40)
4. Perceived or actual competition of BRT with rail transit (4.25, 3.00)
5. Safety concerns of residents along BRT corridors (4.25, 3.50)
6. Capital costs of BRT (4.00, 3.60)
7. Safety issues arising from interaction of pedestrians/motorists with new technologies/strategies (4.00, 3.75)

Planning agencies generally have a broader scope of interest and responsibility than individual transit properties or street departments since the former are, by definition, metropolitan or regional in nature. This broader scope is reflected in issues 1 through 4 that focus on regional issues such as intergovernmental relationships, funding and finance, political, and public relations types of concerns. Issues 5 through 7, however, represent more of an issues potpourri.

#### **4.4 Professional Background and Experience**

Survey responses also reflect the professional expertise of individual respondents in their field, their educational background, and on-the-job training. By examining responses by professional experience we hoped to identify any differing values, priorities, and perceptions. The three organizational types are Planners (P), Engineers (E), and Administrators (A) and correspond to how respondents self-identified themselves on the survey. Because some respondents identified themselves in multiple categories (e.g., engineer/administrator and engineer/planner), three alternative ways to manage this data were identified: 1. Include such responses in all “Professional Experience” categories each respondent associated him/herself with, 2. Remove such data and corresponding surveys from the data sample pool, thus precluding them from being used in an analysis relative to the “Professional Experience” attribute, and 3. Place such responses in only one of the categories each respondent chose for him/herself.

The number of respondents who self-identified themselves with professional groupings is as follows:

- Planners – 21
- Engineers – 2
- Administrators – 5
- Engineers/Administrators – 2
- Engineers/Planners – 1
- Other/None – 2

For this section, the Other/None responses were not included. Therefore, for Planners there were a total of 22 responses (21 Planners, 1 Engineers/Planners), 5 responses from Engineers (2 Engineers, 2 Engineers/Administrators, 1 Engineers/Planners), and 7 responses from Administrators (5 Administrators, 2 Engineers/Administrators).

The shortcoming for the first alternative is that response differences among the three groupings, especially between Engineers and Administrators, would tend to be reduced or get “washed out” because of the overlap between categories and this result is contrary to our objective in analyzing these three sub-groupings. The second alternative, i.e., removing these overlap data points from further consideration, would result in a smaller data sample of 21 Planners, 5 Administrators, and 2 Engineers, which results in no problem for the Planners group, and only slightly more of a problem for the Administrators group. However, relying on only 2 data points with which to analyze responses and draw conclusions for the Engineers group would be a concern. Nevertheless, this alternative at least provides for the most differentiated sample of the three alternatives for the different sub-groupings. Using the third alternative would require the research team to make its own selection of which category to place such responses into. This would be totally arbitrary and introduce the team’s own bias to a considerable degree and so we decided not to consider it further.

We analyzed the data for both the first and second alternatives to gauge the extent to which the results might get “washed out” under the first alternative<sup>3</sup>. The results under the first alternative

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<sup>3</sup> The first alternative compared results for the following three groupings: Administrators (consisting of 5 self-identified administrators plus 2 self-identified administrators/engineers), Planners (consisting of 21 self-identified

confirmed our expectations of a washing out effect in the differences among the three professions, especially comparing Administrators with Engineers and Planners with Engineers.

Except for the lack of sufficient data for the Engineer sub-group in the second alternative, we would have unequivocally favored using this approach because it offered the best opportunity to unambiguously identify professional differences. We used the second alternative, but because of insufficient data in the Engineers group, we examined differences among the professions only at a more macroscopic level to assess the broad gist of the issues rather than their individual specifics as discussed previously when analyzing the differences among organizational types and operational settings.

#### **4.4.1 General Professional Differences**

For each of the three professional groups, there were issues that were included in the primary issues list described in the “Overall” Section. Apart from these “Overall” issues that were common to either two or all of the three sub-groups, we have observed the following:

- Administrators generally focus on issues from the Intra-agency and Funding and Finance categories
- Planners identify only one other issue that is from the Physical Environment category
- Engineers focus on Intergovernmental/inter-organizational, Public Relations and Marketing, Safety and Liability, Planning and Land Use, and Physical Environment categories

The focus of Administrators makes intuitive sense given their general professional responsibilities. The issue that Planners identify within the Physical Environment category, “Reaching agreement or consensus on bus stop/station area enhancements”, makes at least partial intuitive sense since it deals more with resolving disagreements and less with strictly engineering or technical issues. The issues that Engineers identify, though spread out over several categories, tend to center on the engineering aspects of those respective issues. For example, the issues within the Safety and Liability and Physical Environment categories, respectively, were “Safety concerns of residents along BRT corridors” and “Availability and acquisition of right-of-way or physical space”.

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planners plus 1 self-identified planner/engineer), and Engineers (consisting of 2 self-identified engineers plus 2 self-

Overall, there appears to be moderate differences among professions. This portion of the report simply indicates that some differing perceptions about what issues are important and how difficult they are to resolve, does exist, and team members need to consider how a BRT system will affect each of the professions who are stakeholders.

#### 4.5 Relationships Among Factors

With the three types of primary factors examined, i.e., operational setting, organizational type, and professional experience, we were also interested in identifying the most important and difficult issues corresponding to each of the individual sub-groupings based on these three primary factors<sup>4</sup>. Only 32 out of the 34 returned surveys were used for analysis because two surveys indicated “Other” for their employment affiliation and were from the private sector. However, dividing these 32 returned surveys into 18 cells, corresponding to the 18 different combinations of the three primary factors left numerous cells empty and several more with only a single data point (See Table 2a). It was thus felt that pursuing this line of analysis would be only partially fruitful at best and so was not investigated further. However, a more aggregated sample, i.e., a two-way split (operational setting x organizational type) of the data, was investigated further (Table 2b).

**TABLE 2a Three-Way Sub-Group Partition of Returned Surveys  
Number of Returned Surveys Assigned to Each Cell**

	<b>Mixed Traffic (20)</b>					<b>Exclusive Facilities (12)</b>					
	<b>P</b>	<b>E</b>	<b>A</b>	<b>No Profession Listed</b>	<b>Total</b>	<b>P</b>	<b>E</b>	<b>A</b>	<b>P/E</b>	<b>E/A</b>	<b>Total</b>
<b>Transit Properties (18)</b>	8	1	3	0	12	3	0	2	1	0	6

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identified administrators/engineers plus 1 self-identified engineer/planner).

<sup>4</sup> There are 2, 3, and 3 sub-groupings within operational settings, organizational types, and professions, respectively, thus generating 18 (2x3x3) different sub-groupings.

<b>Highway/Streets Departments (7)</b>	1	1	0	1	3	2	0	0	0	2	4
<b>Planning Agencies (7)</b>	5	0	0	0	5	2	0	0	0	0	2

**P = Planners**  
**E = Engineers**  
**A = Administrators**  
**P/E = Planners/Engineers**  
**E/A = Engineers/Administrators**

**TABLE 2b Two-Way Sub-Group Partition of Returned Surveys**

	<b>Mixed Traffic (20)</b>	<b>Exclusive Facilities (12)</b>
<b>Transit Properties (18)</b>	12	6
<b>Highway/Streets Departments (7)</b>	3	4
<b>Planning Agencies (7)</b>	5	2

From Table 2b, we see that the two-way partition of the data yields six different combinations of these two primary factors. Our objective was to identify the most important and most difficult-to-resolve issues that are unique to each operational setting and organizational type combination rather than the more cross cutting issues. First, from each of the six scatter plots of ‘importance of issue’ and ‘difficulty to resolve’ average ratings for each issue, we identified the most important and most difficult-to-resolve issues, on average, i.e., those lying within an area in the “upper right hand most” part of each plot. The next step in the analysis involves removing those issues that are common to multiple sub-groupings and this next step depends on which of the two factors is considered first. Selecting operational setting first means that for each of the two operational settings (MT, EF), we examine the differences among the three organizational types (TP, HSD, PA). Alternatively, initially selecting organizational type means that for each of these three, we examine the differences between the two operational settings. Essentially, this means that we either look at these six different sub-groupings column by column or alternatively, row

by row from the perspective of Table 2b's structure, respectively. The choice of which of these two approaches will affect the outcome of the issue removal process.

We chose the column-by-column approach because it is more applicable to subsequent site-specific case study investigations and is consistent with the project's overall analytical approach beginning at the macroscopic level, working through aggregate survey findings, and culminating with site-specific examinations in California. In addition, this approach initially, and we think correctly, focuses on the type of BRT system then considers perspectives of the survey respondent rather than the other way around. Moreover, follow-up work will delve more deeply into site-specific case studies and each such case study site will initially be categorized as a mixed traffic or exclusive facility type of operational setting.

Using the column-by-column approach, we first removed those issues that are common to at least two of the three sub-groupings, i.e., TP, HSD, and PA for each operational setting, i.e., MT then EF. We next removed issues, using the same procedure, which were previously identified as the most important and most difficult to resolve, overall, i.e., the cross cutting issues. Lastly, to address any previous under-accounting of the most important and difficult-to-resolve issues for each operational setting/organizational type combination (highlighted region on each such combination's scatter plot) because of the somewhat subjective nature of identifying such regions, we re-examined the proximity for each operational setting/organizational type combination of its issues to the boundary of such regions for the other organizational types for that combination. There could have been issues that, while very close to a region's boundary, nevertheless, fell outside it in our judgment. To try to correct for this, we undertook this re-examination. For example, we examined the remaining issues for MT/TP to see how close they were to the boundary in the highlighted regions of the MT/HSD and MT/PA scatter plots. Those issues that appeared close to either of these boundaries and, except for a judgment call, could have been inside a slightly larger region for either MT/HSD and MT/PA, would now be considered as appearing on at least two of the three issue lists (MT/TP and one of the others) and be removed from further consideration since we are searching for issues unique to each operational-setting and organizational-type combination.

After this thinning-out process of the issues was performed for each operational setting, what remained were the most important and most difficult-to-resolve issues unique to each operational-setting and organizational-type combination. These are highlighted in Table 3. For each operational setting, i.e., each column, the listed issues generally make sense intuitively as to why a particular organizational type would consider such issues as the most important and most difficult to resolve especially for transit properties and planning agencies. The value in describing these issues lies more in providing a general sense of the type of issues raised and investigative direction they point to with respect to follow-up case studies and less with any inherent and lasting permanence of specific issues raised.

**TABLE 3 Most Important and Most Difficult Issues Unique to each Operational Setting/Organizational Type Combination**

	<b>Mixed Traffic</b>	<b>Exclusive Facilities</b>
<b>Transit Properties</b>	<ul style="list-style-type: none"> <li>—Creation of design and operational guidelines for BRT</li> <li>—Cost of and responsibility for enforcement</li> </ul>	<ul style="list-style-type: none"> <li>—Lack of domestic BRT success stories</li> <li>—New vehicle procurement</li> <li>—Lack of understanding of funding mechanisms available for BRT</li> <li>—Ability to use existing buses or need for new fleet</li> <li>—Liability</li> </ul>
<b>Highway/ Streets Departments</b>	<ul style="list-style-type: none"> <li>—Concerns over transit agency’s existing performance and reputation</li> <li>—Concerns of potential developers over BRT’s lack of permanence as compared to rail</li> </ul>	<ul style="list-style-type: none"> <li>—Capital costs of BRT</li> <li>—Cost of operating and maintaining new technologies and infrastructure</li> <li>—Cost of additional staff and/or training to support BRT</li> <li>—Cost of and responsibility for enforcement</li> <li>—Safety concerns of residents along BRT corridors</li> </ul>



<b>Planning Agencies</b>	<ul style="list-style-type: none"> <li>—Concerns over long term level of interest, potential for waning political support</li> <li>—Educating users on changes in and uses of multiple fare structures</li> <li>—Safety concerns of residents along BRT corridors</li> </ul>	<ul style="list-style-type: none"> <li>—Lack of empirical evidence of BRT’s operational effectiveness</li> <li>—Coordinating BRT project with local planning agencies’ land use plans</li> </ul>
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#### 4.6 “Don’t Know” and “Not Applicable” Responses

One of the survey goals is to determine which BRT-related institutional issues survey participants were unsure of. Survey respondents were asked to reply “Don’t Know” if they knew the issue pertained to their project but did not feel knowledgeable enough to respond, or if they did not know if the issue was applicable to their project. Either response would highlight a lack of understanding of the issue.

There were only nine issues with ten or more “Don’t Know” responses. The greatest, by far, were the issues of Insurance (20 responses) and Liability (19 responses ). The other major “Don’t Know” issues included differing responsibilities between BRT and non-BRT routes (15 responses), the changing role of drivers (13 responses), new vehicle procurement (11 responses), and the use of AVL in monitoring (11 responses). However, all of these issues are responsibilities that should fall upon the transit property, and not other project participants such as streets and highway departments or planning agencies.

Of the nineteen respondents from transit properties, only the Insurance and Liability issues had a substantial number of “Don’t Know” responses with nine and eight, respectively. Of the next highest “Don’t Know” scores among transit property participants, legal issues of service changes, new vehicle procurement, and the changing role of the driver, each received only three “Don’t Know” responses.

While the issue of Liability and Insurance might not appear to be issues of considerable concern (ranking 44<sup>th</sup> and 56<sup>th</sup>, respectively, out of the 57 issues in “Difficulty of Resolution”) recent experience on Miami-Dade Transit Authority’s South Dade Busway may indicate otherwise. During the first several months of operation, 14 collisions occurred between buses and cross

street traffic due to new signalization configurations along the Busway route. During the entire following year, after several signalization modifications were made, only five collisions occurred (7). We recommend these two issues be further explored and “lessons learned” shared among BRT project participants.

Though this survey indicates a gap may exist on certain issues for stakeholders, in general, it appears that there does not exist a significant one for the organizations that should be responsible for overseeing these specific issues.

#### **4.7 New Issues Identified by Survey Respondents**

Survey respondents, all from mixed traffic types of BRT systems, identified only four additional issues. The following lists these issues with the average Importance of Issue and Difficulty of Resolution average ratings in parentheses.

1. Obtaining funding from multiple sources and project sponsors (4, ---).
2. Dealing with special interest groups, e.g. environmental groups (4, 4).
3. Responsibility for building the BRT: highway/streets department or transit property (3, 2).
4. Long-term operational commitments between transit property & local municipality (4, 4).

The first issue, a Funding and Finance category issue, highlights the “How” and “Who” of BRT funding—a very crucial issue. While the survey focused more on “What”, i.e., the costs of BRT, “When”, i.e., long-term funding commitments, as well as “How”, the added issue fills a gap for further investigation. The second issue, an Inter-organizational category issue, points out that inter-organizational relationships involving other than the major BRT system participants must also be considered. The third issue deals ultimately more with leadership than funding sources and would appropriately fit into the Inter-organizational and Political categories. The fourth issue fits into the Inter-organizational category and complements another issue that also appears in this category: “Streets/highway departments ‘relinquishing’ control of their infrastructure”. The former deals more with working relationships between highway/street departments and transit properties and the latter with the same relationships but relative to control of their physical assets.

Having respondents identify only four additional issues does not mean we now have the exhaustive list of all such issues, even if there were such a list. Several factors played a role in determining what issues survey respondents identified, not the least of which was the timing of the survey relative to those issues currently occurring or having occurred within the setting of a particular BRT system. Certainly other, as yet unidentified, institutional issues abound and will likely be recognized during follow-on site-specific case studies.

#### **4.8 Respondents' Recommendations for Resolution of Issues**

Of the 34 survey respondents, 16 made recommendations on how to resolve the issues they found to be the most important. Emphasis was placed on the following topics:

- Marketing and public relations
- Public outreach and education
- Stakeholder participation
- Creation of new institutional entities
- Study of land use and planning policies

Reference was also made for the need to quantitatively document the impacts, both benefits and costs, of BRT by means of cost-benefit analyses, needs assessment/engineering studies, and overall evaluations. Calls were also made to develop solutions to various potential negative impacts or dis-benefits of BRT such as excessive noise, vehicle emissions, and safety-related problems through, respectively:

- Sound walls or berm barriers,
- Clean fuel or low-emission buses, and
- Grade separation or fences

It is crucial, some respondents mentioned, that all study findings be fully communicated to both local jurisdictional decision-makers as well as the public who live in the communities or along a specific corridor most impacted by a BRT system implementation.

Suggested topic areas warranting specific investigation, especially relative to the U.S., included:

- Impacts of specific BRT elements such as signal priority and exclusive bus lanes
- Right-of-way needs assessment
- Impacts of BRT in settings with limited roadway capacity
- Forecasting of potential new riders in relation to cost

- Relationships among land use, transportation, and taxation policies as they relate to the development of public transportation
- Travel-time changes associated with BRT system implementation

Also of particular import, from the respondents' perspective, is the need to welcome and solicit input from a multitude of stakeholders in order to build as large as possible a constituency of political supporters within the affected community for the proposed BRT system. For example, community input is crucially needed for determining station location and architecture, especially from bus riders.

## **5.0 CASE STUDIES: THREE CALIFORNIA BRT SYSTEMS**

The survey was distributed to 16 of the 17 members of the U.S. BRT Consortium<sup>5</sup>. Of these 16 sites, three are in California:

- Santa Clara (Santa Clara Valley Transit Authority (SCVTA))
- Alameda-Contra Costa (AC Transit)
- Los Angeles (Los Angeles County Metropolitan Transportation Authority (LACMTA))

The agencies listed in parentheses are the individual transit properties responsible for the operation and management of each region's BRT system. Where appropriate, additional organizations were included in the administration of the survey (See Section 3.1). The report thus far has examined the data contained in returned surveys from several different perspectives: overall, operational setting, organizational type, and professional affiliation and experience. Another component of this project is to perform site-specific case studies and we do this in a preliminary fashion now by examining the survey findings more closely for three specific California sites. We obtained two to three responses for each of these California sites<sup>6</sup> from the survey and subsequent findings from an analysis of these responses provide the basis of specifically identified issues for each of these sites from which more in-depth case studies will be performed in a follow-up PATH/Caltrans BRT project including at least some of these California sites as well as perhaps sites from outside the state.

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<sup>5</sup> The 17<sup>th</sup> site, in Louisville Kentucky, opted for a light rail alternative instead of a bus rapid transit alternative.

<sup>6</sup> Santa Clara and Los Angeles each returned two surveys. Alameda/Contra Costa County returned three surveys.

As may be seen from Table 4, which describes the characteristics and strategies employed by each of the California BRT systems surveyed, these three systems have much in common as well as have differences. How well these system characteristic differences explain the survey findings for these three sites is an important question, yet we are constrained by the limitations described above in fully addressing this question here. There are numerous characteristics that none of the three systems has covering the operational setting, arterial-specific strategies, use of technologies, and bus station and vehicle design (Table 1). A complete description of each of these three sites may be found in (6, 8, and 9) for LACMTA, SCVTA, and AC Transit, respectively.

To identify and analyze the most important and difficult-to-resolve issues for each of these three California sites, we used the same methodology described in Section 4.0. Our objective was to identify the most important and most difficult-to-resolve issues that are unique to each site and not the more cross cutting issues. First, from each of the three scatter plots of ‘importance of issue’ and ‘difficulty of resolution’ average ratings for each issue, we identified the most important and most difficult-to-resolve issues, on average, i.e., those lying within an area in the “upper right hand most” part of each plot. From these issues we first removed those that are common to at least two of the three sites. We next removed issues, again common to at least two of the three sites, which were previously identified as the most important and most difficult to resolve, overall, i.e., the cross cutting issues. Obviously these issues are important, however, the focus here was on issues unique to each site. Lastly, to address any previous under-accounting of the most important and difficult-to-resolve issues for each site (highlighted region on each site’s

**TABLE 4 BRT System Characteristics for California Sites**

	<b>Present in Each System</b>	<b>Unique to SCVTA</b>	<b>Unique to AC Transit</b>	<b>Unique to LACMTA</b>	<b>Present in SCVTA and AC Transit</b>
<b>System Characteristics</b>	-Mixed traffic operational setting on arterials -Signal priority or preemption strategies on	-Bus lanes -Queue jump lanes -Articulated buses -Integrated land use	-Alternative payment options -Proof of payment	-On-board diagnostics	-Bus bulbs -Electronic fare collection

	arterials -AVL systems -Information systems and advanced public transportation systems -Changes to bus station spacing -Bus station improvements -Low floor buses	policies			
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scatter plot) because of the somewhat subjective nature of identifying such regions, we re-examined the proximity for each site of its issues to the boundary of such regions for the other two sites. There could have been issues that, while very close to a region’s boundary, nevertheless, fell outside it in our judgment. To try to correct for this, we undertook this re-examination. For example, we examined the remaining issues for LACMTA to see how close they were to the boundary in the highlighted regions of the AC Transit and SCVTA scatter plots. Those issues that appeared close to either of these boundaries and, except for a judgment call, could have been inside a slightly larger region for either AC Transit or SCVTA, would now be considered as appearing on at least two of the three issue lists (LACMTA and one of the others) and be removed from further consideration since we are searching for issues unique to each site. The results of this thinning-out-process are shown in Table 5. Note that for LACMTA, there are no issues unique to this site, i.e., all issues identified as the most important and most difficult to resolve for LACMTA’s system were also issues identified for at least one of the other two sites. However, we do list those issues to indicate which ones are of concern to LACMTA.

**TABLE 5 Most Important and Most Difficult Issues Unique to each California Site**

<b>California BRT System Site</b>	<b>“Most Important and Most Difficult-to-resolve” Issues Unique to each Site</b>
SCVTA	<ul style="list-style-type: none"> <li>—Insufficient understanding of the “state of the art” of BRT technologies</li> <li>—Finding political champions to support BRT</li> <li>—Educating the public on BRT, and managing perceptions and expectations</li> <li>—Safety issues arising from interaction of pedestrians/motorists with new technologies</li> <li>—Lack of empirical evidence on the effects of BRT on land use</li> </ul>

	<ul style="list-style-type: none"> <li>—Concerns of potential developers over BRT’s lack of permanence as compared to rail</li> <li>—Reaching agreement or consensus on bus stop/station area enhancements</li> </ul>
LACMTA	None
AC Transit	<ul style="list-style-type: none"> <li>—Maintenance responsibilities for shared infrastructure and hardware/software</li> <li>—Responsibility for enforcement on bus lanes/busways</li> <li>—Coordinating other transit agencies’ services and BRT operations</li> <li>—Determining an appropriate fare structure and medium</li> <li>—Coordinating schedules of other transit routes with BRT operations</li> <li>—Concerns over the distribution of the costs and benefits of BRT</li> <li>—Legal issues associated with service changes</li> <li>—New vehicle procurement</li> <li>—Educating users on changes in and uses of multiple fare structures</li> <li>—Concerns about BRT redirecting funds away from existing service on other routes</li> <li>—Agency reluctance to expand services due to current fiscal constraints</li> <li>—Cost of operating and maintaining new technologies and infrastructure</li> <li>—Use of AVL systems to monitor schedule adherence</li> <li>—Integrating BRT projects into the metropolitan planning process</li> <li>—Coordinating BRT project with local planning agencies’ land use plans</li> </ul>

LACMTA issues (which of the other two agencies also noted this issue):

- Integration of multiple priorities, objectives, and agendas (AC Transit)
- Streets/highway departments “relinquishing” control of their infrastructure (AC Transit and SCVTA)
- Coordination on selection and implementation of technologies (AC Transit)
- Defining and agreeing on new roles, responsibilities, and organizational structures to support BRT (SCVTA)
- Concerns over long term funding commitments to BRT (AC Transit)

There are numerous issues unique to both SCVTA and AC Transit each covering several issue categories. For example, the SCVTA-unique issues are contained in the following categories: Intra-agency, political, public relations and marketing, safety and liability, and planning and land use. Whereas, the AC Transit-unique issues cover issues in the following categories: Intergovernmental/inter-organizational, intra-agency, political, public relations and marketing, funding and finance, labor, and planning and land use.

Some of the differences between these two sets of issues may be attributed to the system characteristics unique to each site. For example, concern over land use and development of policies to foster an integrated approach between transportation and land use is a system

characteristic unique to SCVTA and also shows up as one of its primary issues. Alternative payment options and proof-of-payment strategies are characteristics unique to the AC Transit system and two of AC Transit’s issues in Table 5 concern fare structures.

Other factors, such as the organizational type and professional experience of survey respondents, progress on the implementation of a BRT system, the influence of the timing of the survey vis-à-vis issues concurrently receiving considerable attention, and availability of alternative transit modes, may also help to explain the presence of particular issues unique to a particular site. For example, the Santa Clara Valley Transit Authority operates an extensive light rail system, parts of which are in the vicinity of its BRT route. The issue, “Concerns of potential developers over BRT’s lack of permanence as compared to rail” thus may be particularly relevant to SCVTA since it operates both rail and bus routes and may be quite familiar with developers’ concerns.

In addition to these site-specific institutional issues, the eight issues that all survey respondents deemed to be the most important and difficult to resolve overall (Section 4.1) are also generally viewed as the most important and challenging issues from the perspectives of the three California sites and thus must also be accounted for when developing strategies for resolving issues. We list below which of these eight issues were also viewed as most important and difficult to resolve for each of the three California case study sites.

1. Local and business community opposition to the removal of/restrictions on parking spaces for BRT use
2. Availability and acquisition of right-of-way or physical space
3. Integration of multiple priorities, objectives, and agendas
4. Concerns over long term funding commitments to BRT
5. Impacts of BRT on roadway operations
6. Finding political champions to support BRT
7. Gaining community support for transit-oriented development
8. Educating the public on BRT, and managing perceptions and expectations

<u>SCVTA</u>	<u>ACTransit</u>	<u>LACMTA</u>
1,2,5,6,8	1,2,3,4,5	3,4

In recommending strategies to resolve issues (Section 4.8), emphasis was placed on the following topics for the three California case study sites:



- Public outreach and education
- Stakeholder participation
- Open two-way communication between all interested parties

Of particular importance is for there to be open communication throughout all phases of a BRT project, i.e., planning through implementation, between project decision-makers and all other stakeholders such as local jurisdictions and the general public who live in the communities or along a corridor most impacted by BRT system deployment. Maintaining open lines of communication will help insure that early consensus is reached among major players on the primary elements of the proposed BRT system. Another important area is to work toward sustaining sufficient funding to implement BRT as expeditiously as possible. Additional in-depth investigations for these California BRT systems will be made in follow-on work to this project.

## **6.0 CONCLUSIONS AND NEXT STEPS**

This study investigated institutional issues of bus rapid transit from a research perspective coupled with actual experiences from the U.S. BRT Consortium and several Canadian transit properties and case study investigations of three California BRT system sites. We identified specific issues that, overall, are both the most important and most difficult to resolve: local and business community opposition to the removal of/restrictions on parking spaces for BRT use; availability and acquisition of right-of-way or physical space; integration of multiple priorities, objectives, and agendas; concerns over long term funding commitments to BRT; impacts of BRT on roadway operations; finding political champions to support BRT; gaining community support for transit oriented development; and educating the public on BRT, and managing perceptions and expectations. Additionally, we identified issues specific to particular operational settings and organizational types for BRT systems. Though a small set of opinions, this investigation was based on the insight and expertise of individuals who have experienced these BRT issues and should offer guidance to anticipate future problems and develop strategies to solve them. Follow-on work in this area will include site-specific in-depth case studies of BRT systems in California and possibly in other states to investigate much more deeply into the institutional environment of bus rapid transit.

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## **APPENDICES**

**Appendix A: Survey on Institutional Aspects of Bus Rapid Transit**

**Appendix B: Tabulated Results for All Respondents**

**Appendix C: Tabulated Results for Mixed Traffic**

**Appendix D: Tabulated Results for Exclusive Facilities**

**Appendix E: Tabulated Results for Transit Properties**

**Appendix F: Tabulated Results for Highway/Streets Departments**

**Appendix G: Tabulated Results for Planning Agencies**

# APPENDIX A: Survey on Institutional Aspects of Bus Rapid Transit

City/Region: \_\_\_\_\_

Representing (please circle one): Transit Agency    Transportation (Streets/Highway) Department    Regional Transportation Planning Agency    Other

Professional expertise (e.g., planning, engineering, administration, public relations, businessperson, etc.): \_\_\_\_\_

**Instructions:**

- 1) From the perspective of *your regional BRT project*, please rate the following issues on a scale of 1 to 5 with respect to their, (a) importance as an issue, and (b) ease of resolution.
- 2) If you know the issue is not applicable to the BRT project in your region, please circle "NA". If you do not know whether the issue is applicable, or if you know it is, but are not familiar with it, please circle "DK". Otherwise, please rate the issue as previously described. Statements in parentheses are provided to clarify and give examples of the issue above it in bold typeface.
- 3) If you have any questions about the survey, please contact us by phone or e-mail as follows:  
 Phone: 510-231-9465 (Mark Miller)                      E-mail: mamiller@uclink4.berkeley.edu

	Not Applicable To Our Project	Don't Know	Importance of Issue					Ease of Resolution				
			Very Important	Not At All Important	Very Difficult	Very Easy						
<b>I. Intergovernmental/Inter-organizational</b>												
<b>a. Integration of multiple priorities, objectives, and agendas</b> (Fragmented decision-making, can consensus or agreement be reached?)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>b. Impacts of BRT on roadway operations</b> (Effects of bus lanes, signal preemption, queue jumps, bus bulbs, etc., on roadway operations )	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>c. Streets/highway departments "relinquishing" control of their infrastructure</b> (“Turning over” their roadways, signals, parking, etc., to transit)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>d. Agreement on performance measures</b> (Defining performance measures that accurately quantify effectiveness of BRT, e.g., vehicle-moving capacity vs. people-moving capacity)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>e. Maintenance responsibilities for shared infrastructure and hardware/software</b> (Responsibility for maintaining BRT infrastructure, queue jumps, signals, etc.)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>f. Responsibility for enforcement on bus lanes/ busways</b> (Defining responsibilities for enforcement, commitment of local law enforcement to ensure "bus only" compliance)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>g. Institutional fears of new technologies</b> (Concerns over complexity and reliability of new technologies)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>h. Coordination on selection and implementation of technologies</b> (Can/should BRT technologies be selected to meet the needs of multiple stakeholders? e.g., transit, streets department, emergency services, etc., Does this complicate BRT deployment?)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>i. Coordinating other transit agencies' services and BRT operations</b> (Scheduling or rescheduling services to coordinate passenger transfers among transit agencies)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>II. Intra-Agency (i.e., the Transit Agency)</b>												
<b>a. Concerns (or perceptions) that BRT is given special preference over other transit services</b> (Internal agency issues regarding priorities and policy)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>b. Defining and agreeing on new roles, responsibilities, and organizational structures to support BRT</b> (Determining responsibilities for management, maintenance, operations, etc.)	NA	DK	5	4	3	2	1	5	4	3	2	1

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	Not Applicable To Our Project	Don't Know	Importance of Issue					Ease of Resolution				
			Very Important	Not At All Important	Very Difficult	Very Easy						
<b>c. Creation of design and operational guidelines for BRT</b> (Developing standards for BRT facilities and operations)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>d. Determining an appropriate fare structure and medium</b> (Impacts of BRT's fare structure on transit agency departments - administration, accounting, maintenance, etc.)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>e. Internal coordination on selection of technology</b>	NA	DK	5	4	3	2	1	5	4	3	2	1

(Can/should BRT technologies be selected to meet the needs of multiple departments within the transit agency? e.g., planning, operations, maintenance, etc.)

<b>f. Coordinating schedules of other transit routes with BRT operations</b> (Need to schedule feeder services to coordinate transfers with BRT)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>g. Insufficient understanding of the "state of the art" of technologies and how they can be used in BRT operations</b>	NA	DK	5	4	3	2	1	5	4	3	2	1

### III. Political

<b>a. Concerns of BRT being a top down solution</b> (Is this a solution in search of a problem? Is this the appropriate technology? Is there a market?)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>b. Perceived or actual competition of BRT with rail transit</b> (Concerns of "modal allegiance" to rail over non-rail alternatives)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>c. Lack of domestic BRT success stories</b> (Concerns over how applicable international success stories are to the U.S.)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>d. Lack of empirical evidence of BRT's operational effectiveness</b> (Decision makers wanting proof of operational and quality-of-service benefits prior to supporting BRT)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>e. Finding political champions to support BRT</b> (Need to build coalitions to help promote BRT)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>f. Concerns over long term level of interest, potential for waning political support</b> (BRT merely being the "flavor of the month", or a potential white elephant)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>g. Local and business community opposition to the removal of, or restrictions on, parking spaces for BRT use</b>	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>h. Local and community opposition to BRT</b> (Concerns that BRT will produce "negative" impacts: e.g., higher density, greater sprawl, mixed-use development, the "wrong" element)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>i. Concerns over the distribution of the costs and benefits of BRT</b> (Equity issues, concerns over benefits accruing to a particular corridor, income group or long-haul travelers)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>j. Legal issues of service changes</b> (Does eliminating stops or lengthening station spacing present any legal issues?)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>k. New vehicle procurement</b> (Are there any restrictions, legislative or otherwise (e.g., "Buy American"), that could delay deployment? )	NA	DK	5	4	3	2	1	5	4	3	2	1

### IV. Public Relations and Marketing

<b>a. Educating the public on BRT, and managing perceptions and expectations</b> (Need to "sell" BRT to gain support, but could lead to disappointment)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>b. Concerns over transit agency's existing performance and reputation</b> (If the agency isn't performing well now, should it assume additional responsibilities?)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>c. Concerns over effects of BRT on existing roadway operations</b> (Motorist backlash over preferences given to BRT through bus lanes, signal preemptions, queue jumps, etc.)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>d. Educating pedestrians and motorists on interacting with BRT operations</b> (Educating on interactions with bus lanes, signal priority systems, queue jump lanes, etc.)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>e. Educating users on changes in and uses of multiple fare structures</b> (Comprehension and acceptance by the public of fare structure changes)	NA	DK	5	4	3	2	1	5	4	3	2	1

A-2

Not Applicable To Our Project	Don't Know	Importance of Issue				Ease of Resolution		
		Very Important		Not At All Important	Very Difficult		Very Easy	

### V. Funding and Finance

<b>a. Concerns over long term funding commitments to BRT</b> (Consistency of policies and preferences with changes in political and transit agency administrations over time)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>b. Concerns about BRT redirecting funds away from existing service or other routes</b>	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>c. Lack of understanding of funding mechanisms available for BRT</b> (Lack of knowledge on federal funding sources and how they may be applied to BRT projects)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>d. Agency reluctance to expand services due to current fiscal constraints</b> (Financial concerns over "merely keeping existing fleet rolling" )	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>e. Ability to use existing buses or need for new fleet</b> (Need for higher performance vehicles)	NA	DK	5	4	3	2	1	5	4	3	2	1

<b>f. Capital costs of BRT</b> (New vehicles, new technologies, new infrastructure, etc.)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>g. Cost of operating and maintaining (O&amp;M) new technologies and infrastructure</b> (Maintaining new shelters, ticket machines, "Next Bus" signs, etc.)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>h. Cost of additional staff and/or training to support BRT</b> (New technical maintenance/repair staff, e.g., how to work on low floor or alternative fueled vehicles)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>i. Cost of additional facilities to support BRT</b> (New maintenance garages for alternative fueled vehicles, repair shops for electronics, etc.)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>j. Cost of and responsibility for enforcement</b> (Enforcement for busways and/or bus lanes, passenger proof-of payment, etc.)	NA	DK	5	4	3	2	1	5	4	3	2	1

**VI. Labor**

<b>a. Lack of support from transit agency staff</b> (Concerns of agency employees over additional work and responsibilities without additional staff, resources, and/or pay)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>b. Changing role of drivers</b> (Driver's embrace of technology, job description change, fear of replacement, etc.)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>c. Use of Automated Vehicle Locators (AVL) for monitoring schedule adherence</b> (Concerns over performance monitoring, work rules changes, privacy and "Big Brother" issues )	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>d. Different responsibilities between BRT and non-BRT routes</b> (Training for new driving conditions and situations, fare collection enforcement, ability to switch between BRT and non-BRT routes)	NA	DK	5	4	3	2	1	5	4	3	2	1

**VII. Safety & Liability**

<b>a. Insurance</b> (Does BRT increase or decrease risk and/or responsibility?)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>b. Liability</b> (Assignment of liability in the event of technological failures)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>c. Safety issues arising from changing interaction of pedestrians and motorists with new technologies and/or strategies.</b> (Pedestrians using high platforms, motorists interacting with BRT technologies - signal preemption, queue jump lanes, etc.)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>d. Safety concerns of residents along BRT corridors</b> (Higher speed buses traveling through their communities)	NA	DK	5	4	3	2	1	5	4	3	2	1

**A-3**

Not Applicable To Our Project	Don't Know	Importance of Issue				Ease of Resolution	
		Very Important	Not At All Important	Very Difficult	Very Easy		

**VIII. Planning and Land Use**

<b>a. Integrating BRT projects into the metropolitan planning process</b> (Concerns that planning requirements, e.g., Transportation Improvement Programs, could delay implementation)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>b. Lack of empirical evidence on the effects of BRT on land use</b> (Concerns of stakeholders over the unknown impacts on land use)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>c. Coordinating BRT project with local planning agencies' land use plans</b> (Ensuring that transit agency's goal of more transit-supportive development around BRT coincides with localities' land use plans)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>d. Gaining community support for transit oriented development</b> (Garnering community support for high density, mixed-use development around BRT stops and stations)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>e. Concerns of potential developers over BRT's lack of permanence as compared to rail</b> (Inherent "flexibility" of BRT could lead to a reluctance in development along BRT corridors)	NA	DK	5	4	3	2	1	5	4	3	2	1

**IX. Physical Environment**

<b>a. Availability and acquisition of right-of-way or physical space</b> (Right-of-Way for bus lanes/busways, adequate space for queue jumps, shelters, fare machines, etc.)	NA	DK	5	4	3	2	1	5	4	3	2	1
<b>b. Reaching agreement or consensus on bus stop/station area enhancements</b>	NA	DK	5	4	3	2	1	5	4	3	2	1

(Designing and coordinating aesthetics that are acceptable to stakeholders)

Are there any additional institutional issues that you feel are important that were overlooked in the above list?

1		NA	DK	5	4	3	2	1	5	4	3	2	1
2		NA	DK	5	4	3	2	1	5	4	3	2	1
3		NA	DK	5	4	3	2	1	5	4	3	2	1

What means could you suggest for resolving the top three issues you have identified from the above list or from your additions?

(Use back if necessary.)

- 1
- 2
- 3

After receiving your completed survey, we may have follow-up questions. If we may contact you with our additional questions, please provide your name and telephone number. Your participation and the information you provide in any follow-up call will remain strictly confidential. *Inclusion of your name will not jeopardize the anonymity of your responses on this survey.*

Name: \_\_\_\_\_ Telephone Number: \_\_\_\_\_

Thank you for taking the time to participate in our survey. Please take a moment now to seal your completed questionnaire in the self-addressed stamped envelope provided and drop it in the mail or alternatively, just fax it back to us at 510.231.9565 or 510.231.5600.

## APPENDIX B: Tabulated Results for All Respondents

	NA DK		Importance of Issue							Ease of Resolution								
	AVG	SD	5	4	3	2	1	NR	AVG	SD	5	4	3	2	1	NR		
<b>Intergovernmental/Inter-organizational</b>																		
Integration of multiple priorities, objectives, and agendas	1	1	4.61	0.56	20	10	1	0	0	1	3.53	0.90	4	12	10	4	0	4
Impacts of BRT on roadway operations	0	1	4.33	1.02	20	7	4	1	1	0	3.63	0.98	6	13	8	5	0	2
Streets/highway departments "relinquishing" control of their infrastructure	7	1	3.69	1.29	10	5	5	5	1	0	3.38	1.30	6	8	4	6	2	8
Agreement on performance measures	0	1	3.47	1.05	6	10	9	7	0	1	2.48	1.06	1	5	7	13	5	3
Maintenance responsibilities for shared infrastructure and hard/software	4	2	3.68	1.06	8	7	9	4	0	0	2.74	0.86	1	3	12	10	1	7
Responsibility for enforcement on bus lanes/ busways	7	3	4.00	0.93	9	7	7	1	0	0	3.33	1.05	4	6	8	6	0	10
Institutional fears of new technologies	3	1	2.80	1.21	3	6	7	10	4	0	2.52	1.06	1	4	9	10	5	5
Coordination on selection and implementation of technologies	5	2	3.85	0.95	9	6	11	1	0	0	3.19	0.94	1	9	12	2	2	8
Coordinating other transit agencies' services and BRT operations	10	1	3.43	1.41	7	5	5	3	3	0	2.43	1.16	2	1	5	9	4	13
<b>Intra-Agency (i.e., the Transit Property)</b>																		
Concerns (or perceptions) that BRT is given special preference over other transit services	6	4	2.58	1.14	1	5	5	9	4	0	2.42	0.93	0	4	5	12	3	10
Defining and agreeing on new roles, responsibilities, and organizational structures to support BRT	5	7	3.73	1.08	5	10	4	2	1	0	3.00	1.11	1	7	8	3	3	12
Creation of design and operational guidelines for BRT	1	3	3.97	0.89	10	10	9	1	0	0	2.87	0.82	0	7	13	9	1	4
Determining an appropriate fare structure and medium	9	5	3.44	1.42	6	3	4	3	2	2	3.00	1.19	2	4	6	4	2	16
Internal coordination on selection of technology	4	6	3.67	1.01	6	7	8	3	0	0	2.48	0.59	0	1	9	13	0	11
Coordinating schedules of other transit routes with BRT operations	3	5	4.19	0.94	12	9	3	2	0	0	2.50	1.14	1	4	8	7	6	8
Insufficient understanding of the "state of the art" of BRT technologies	3	6	3.04	1.10	2	7	8	6	2	0	2.72	1.10	1	5	9	6	4	9
<b>Political</b>																		
Concerns of BRT being a top down solution	4	0	3.41	1.43	8	8	6	2	5	1	3.07	1.41	5	7	5	5	5	7
Perceived or actual competition of BRT with rail transit	11	0	3.41	1.44	7	4	5	3	3	1	3.05	1.36	4	4	5	5	3	13
Lack of domestic BRT success stories	5	1	3.50	1.07	5	10	8	4	1	0	3.19	1.21	4	7	9	4	3	7
Lack of empirical evidence of BRT's operational effectiveness	2	1	3.35	1.08	7	3	16	4	1	0	3.17	1.09	4	7	10	8	1	4
Finding political champions to support BRT	1	0	4.48	0.97	24	4	2	3	0	0	3.47	1.19	7	10	8	5	2	2
Concerns over long term level of interest, potential for waning	4	2	3.39	1.17	6	7	8	6	1	0	3.26	1.20	4	9	6	6	2	7
Local and business community opposition to the removal of/restrictions on, parking spaces for BRT use	9	1	4.42	0.78	14	6	4	0	0	0	4.00	1.09	10	6	4	3	0	11
Local and community opposition to BRT	2	2	3.57	1.38	12	4	4	9	1	0	3.14	1.13	4	7	8	9	1	5
Concerns over the distribution of the costs and benefits of BRT	8	3	3.26	1.14	4	6	5	8	0	0	2.91	1.00	2	3	10	7	1	11
Legal issues of service changes	8	10	2.63	1.54	3	2	2	4	5	0	2.19	0.98	0	1	6	4	5	18
New vehicle procurement	9	11	3.36	1.39	5	0	5	3	1	0	3.07	1.44	4	1	2	6	1	20
<b>Public Relations and Marketing</b>																		
Educating the public on BRT, and managing perceptions and expectations	2	0	4.19	0.90	15	9	7	1	0	0	3.29	0.90	2	11	13	4	1	3
Concerns over transit agency's existing performance and reputation	11	1	3.36	1.33	5	8	0	8	1	0	2.71	1.49	4	3	2	7	5	13
Concerns over effects of BRT on existing roadway operations	3	1	3.43	1.22	7	9	5	8	1	0	2.93	1.16	3	5	12	5	4	5
Educating pedestrians and motorists on interacting with BRT	4	0	3.93	1.08	10	13	3	3	1	0	2.72	1.03	1	5	12	7	4	5
Educating users on changes in and uses of multiple fare structures	15	3	3.31	1.54	5	3	3	2	3	0	2.81	1.17	1	3	7	2	3	18
<b>Funding and Finance</b>																		
Concerns over long term funding commitments to BRT	1	4	4.31	0.81	15	8	6	0	0	0	3.68	1.06	8	7	9	4	0	6
Concerns about BRT redirecting funds away from existing	5	5	3.58	1.21	8	4	6	6	0	0	3.17	0.89	1	7	11	3	1	11
Lack of understanding of funding mechanisms available for BRT	8	4	3.36	1.18	3	9	5	3	2	0	2.48	0.98	0	3	8	6	4	13
Agency reluctance to expand services due to current fiscal constraints	10	4	3.20	1.36	6	0	8	4	2	0	2.79	1.27	3	1	7	5	3	15
Ability to use existing buses or need for new fleet	7	8	3.89	0.94	6	6	6	1	0	0	3.00	1.00	3	0	10	6	0	15
Capital costs of BRT	1	6	3.93	1.00	10	7	8	2	0	0	3.35	0.80	2	8	13	3	0	8
Cost of operating and maintaining (O&M) new technologies & infrastructure	2	5	3.85	0.91	8	8	10	1	0	0	2.96	1.08	3	4	9	9	1	8
Cost of additional staff and/or training to support BRT	3	9	3.41	1.14	6	1	12	2	1	0	2.91	0.97	1	4	11	4	2	12
Cost of additional facilities to support BRT	6	10	3.11	1.41	4	3	5	3	3	0	2.72	1.18	2	1	8	4	3	16
Cost of and responsibility for enforcement	2	7	3.72	1.10	7	8	7	2	1	0	3.12	1.09	3	5	11	4	2	9
<b>Labor</b>																		
Lack of support from transit agency staff	10	10	2.93	1.33	2	3	3	4	2	0	2.07	1.07	0	2	2	5	5	20
Changing role of drivers	7	13	3.32	1.14	3	1	7	1	1	0	2.50	1.16	0	3	5	2	4	20
Use of Automated Vehicle Locators (AVL) for monitoring schedule adherence	7	11	3.56	1.09	4	4	5	3	0	0	2.50	1.03	0	3	5	5	3	18
Different responsibilities between BRT and non-BRT routes	6	15	3.15	1.41	3	2	4	2	2	0	2.19	0.90	0	1	3	5	3	21
<b>Safety and Liability</b>																		
Insurance	8	20	4.00	1.26	3	1	1	1	0	0	2.17	1.17	0	1	1	2	2	28
Liability	7	19	4.13	1.25	5	0	2	1	0	0	2.57	1.13	0	2	1	3	1	27
Safety issues arising from interaction of pedestrians/motorists with new technologies/strategies	2	9	3.87	1.01	7	9	4	3	0	0	3.00	1.13	3	4	7	8	1	11
Safety concerns of residents along BRT corridors	6	6	3.36	1.29	5	6	5	4	2	0	2.95	1.09	2	4	9	5	2	12
<b>Planning and Land Use</b>																		
Integrating BRT projects into the metropolitan planning process	6	0	3.96	1.10	12	7	5	4	0	0	2.63	1.24	2	5	7	7	6	7
Lack of empirical evidence on the effects of BRT on land use	6	2	3.85	1.19	11	5	5	5	0	0	3.24	1.30	4	9	4	5	3	9
Coordinating BRT project with local planning agencies' land use plans	2	1	4.13	1.04	15	7	5	3	0	1	2.93	1.19	3	6	10	6	4	5
Gaining community support for transit oriented development	2	1	4.39	0.80	17	10	3	1	0	0	3.30	1.02	3	10	12	3	2	4
Concerns of potential developers over BRT's lack of permanence as compared to rail	5	5	3.83	1.34	11	4	5	2	2	0	3.39	1.16	4	7	8	2	2	11
<b>Physical Environment</b>																		
Availability and acquisition of right-of-way or physical space	2	0	4.52	0.89	22	5	2	2	0	1	3.70	1.26	11	7	5	6	1	4
Reaching agreement or consensus on bus stop/station area enhancements	2	2	4.31	0.85	15	9	4	1	0	1	3.04	0.96	1	9	9	8	1	6



## APPENDIX C: Tabulated Results for Mixed Traffic

	NA	DK	Importance of Issue							Ease of Resolution								
			AVG	SD	5	4	3	2	1	NR	AVG	SD	5	4	3	2	1	NR
<b>Intergovernmental/Inter-organizational</b>																		
Integration of multiple priorities, objectives, and agendas	0	0	4.58	0.61	12	6	1	0	0	1	3.56	0.98	3	7	5	3	0	2
Impacts of BRT on roadway operations	0	0	4.55	0.69	13	5	2	0	0	0	3.84	0.90	4	10	3	2	0	1
Streets/highway departments "relinquishing" control of their infrastructure	2	0	3.94	1.16	8	4	3	3	0	0	3.44	1.25	4	6	3	4	1	2
Agreement on performance measures	0	0	3.37	1.12	4	4	6	5	0	1	2.28	0.89	0	2	4	9	3	2
Maintenance responsibilities for shared infrastructure and hard/software	2	0	3.78	0.94	5	5	7	1	0	0	2.94	0.83	1	2	9	5	0	3
Responsibility for enforcement on bus lanes/ busways	5	1	3.86	0.86	4	4	6	0	0	0	3.57	1.02	3	4	5	2	0	6
Institutional fears of new technologies	1	1	3.00	1.24	3	3	4	7	1	0	2.65	1.11	1	3	4	7	2	3
Coordination on selection and implementation of technologies	1	1	3.83	0.99	6	4	7	1	0	0	3.24	0.97	1	6	7	2	1	3
Coordinating other transit agencies' services and BRT operations	5	1	3.14	1.56	4	2	3	2	3	0	2.69	1.32	2	1	3	5	2	7
<b>Intra-Agency (i.e., the Transit Property)</b>																		
Concerns (or perceptions) that BRT is given special preference over other transit services	3	3	2.43	1.16	1	1	4	5	3	0	2.36	0.84	0	1	5	6	2	6
Defining and agreeing on new roles, responsibilities, and organizational structures to support BRT	2	6	3.75	0.87	2	6	3	1	0	0	3.25	0.87	0	5	6	0	1	8
Creation of design and operational guidelines for BRT	0	3	4.00	0.94	6	6	4	1	0	0	3.00	0.94	0	6	6	4	1	3
Determining an appropriate fare structure and medium	7	4	3.38	1.85	4	0	1	1	2	1	3.13	1.55	2	1	3	0	2	12
Internal coordination on selection of technology	2	4	3.57	1.09	4	2	6	2	0	0	2.38	0.51	0	0	5	8	0	7
Coordinating schedules of other transit routes with BRT operations	2	4	4.14	0.95	6	5	2	1	0	0	2.50	1.22	1	2	3	5	3	6
Insufficient understanding of the "state of the art" of BRT technologies	2	4	2.93	1.00	0	5	4	4	1	0	2.64	1.08	0	4	3	5	2	6
<b>Political</b>																		
Concerns of BRT being a top down solution	2	0	3.00	1.50	4	2	5	2	4	1	2.73	1.44	2	3	3	3	4	5
Perceived or actual competition of BRT with rail transit	6	0	3.29	1.38	3	4	3	2	2	0	2.85	1.34	2	2	3	4	2	7
Lack of domestic BRT success stories	2	0	3.39	1.14	3	6	5	3	1	0	3.00	1.27	2	4	6	2	3	3
Lack of empirical evidence of BRT's operational effectiveness	0	1	3.21	1.13	4	1	10	3	1	0	3.06	1.11	2	4	6	5	1	2
Finding political champions to support BRT	0	0	4.40	1.10	14	3	0	3	0	0	3.32	1.34	4	6	3	4	2	1
Concerns over long term level of interest, potential for waning	1	2	3.24	1.20	3	4	5	4	1	0	3.06	1.29	2	5	3	4	2	4
Local and business community opposition to the removal of/restrictions on, parking spaces for BRT use	3	0	4.53	0.72	11	4	2	0	0	0	3.94	1.18	7	4	2	3	0	4
Local and community opposition to BRT	1	1	3.22	1.40	5	3	2	7	1	0	2.76	1.03	1	3	5	7	1	3
Concerns over the distribution of the costs and benefits of BRT	4	1	3.40	1.12	3	4	4	4	0	0	3.00	1.13	2	2	6	4	1	5
Legal issues of service changes	5	3	2.67	1.56	2	2	2	2	4	0	2.33	1.07	0	1	6	1	4	8
New vehicle procurement	5	4	3.45	1.29	4	0	4	3	0	0	3.09	1.38	3	1	1	6	0	9
<b>Public Relations and Marketing</b>																		
Educating the public on BRT, and managing perceptions and expectations	1	0	4.16	0.83	8	6	5	0	0	0	3.28	0.89	2	4	9	3	0	2
Concerns over transit agency's existing performance and reputation	6	0	3.50	1.22	3	6	0	5	0	0	3.08	1.50	3	3	1	4	2	7
Concerns over effects of BRT on existing roadway operations	1	0	3.63	1.21	5	7	3	3	1	0	3.06	1.16	2	3	10	0	3	2
Educating pedestrians and motorists on interacting with BRT	1	0	4.05	1.08	8	7	1	3	0	0	2.89	1.08	1	3	10	1	3	2
Educating users on changes in and uses of multiple fare structures	9	2	3.78	1.30	4	1	2	2	0	0	3.22	0.97	1	2	4	2	0	11
<b>Funding and Finance</b>																		
Concerns over long term funding commitments to BRT	0	2	4.17	0.79	7	7	4	0	0	0	3.47	1.07	4	3	7	3	0	3
Concerns about BRT redirecting funds away from existing	3	1	3.50	1.26	5	3	3	5	0	0	3.27	0.96	1	5	7	1	1	5
Lack of understanding of funding mechanisms available for BRT	5	3	3.50	1.24	2	6	1	2	1	0	2.55	0.93	0	2	3	5	1	9
Agency reluctance to expand services due to current fiscal constraints	5	2	3.15	1.46	4	0	5	2	2	0	2.58	1.38	2	0	4	3	3	8
Ability to use existing buses or need for new fleet	4	4	3.75	0.97	3	4	4	1	0	0	3.00	1.04	2	0	6	4	0	8
Capital costs of BRT	1	1	4.11	0.96	8	5	4	1	0	0	3.47	0.72	1	7	8	1	0	3
Cost of operating and maintaining (O&M) new technologies & infrastructure	1	1	3.89	0.96	6	5	6	1	0	0	2.94	1.09	2	3	4	8	0	3
Cost of additional staff and/or training to support BRT	2	3	3.40	1.18	4	1	8	1	1	0	2.93	0.96	1	2	8	3	1	5
Cost of additional facilities to support BRT	3	4	3.15	1.63	4	2	2	2	3	0	2.77	1.30	2	1	4	4	2	7
Cost of and responsibility for enforcement	1	4	3.73	1.28	5	5	2	2	1	0	3.20	1.08	2	3	7	2	1	5
<b>Labor</b>																		
Lack of support from transit agency staff	4	6	3.30	1.25	2	3	1	4	0	0	2.20	1.14	0	2	1	4	3	10



## APPENDIX E: Tabulated Results for Transit Properties

	NA	DK	Importance of Issue							Ease of Resolution								
			AVG	SD	5	4	3	2	1	NR	AVG	SD	5	4	3	2	1	NR
<b>Intergovernmental/Inter-organizational</b>																		
Integration of multiple priorities, objectives, and agendas	1	0	4.53	0.62	10	6	1	0	0	0	3.41	0.87	1	8	5	3	0	1
Impacts of BRT on roadway operations	0	0	4.44	0.92	12	3	2	1	0	0	3.67	0.97	3	9	3	3	0	0
Streets/highway departments "relinquishing" control of their infrastructure	3	0	3.87	1.25	7	2	3	3	0	0	3.40	1.24	3	5	3	3	1	3
Agreement on performance measures	0	1	3.44	1.03	3	4	6	3	0	1	2.25	0.86	0	1	5	7	3	2
Maintenance responsibilities for shared infrastructure and hard/software	4	1	3.54	0.97	3	2	7	1	0	0	2.46	0.52	0	0	6	7	0	5
Responsibility for enforcement on bus lanes/ busways	5	1	4.25	0.87	6	3	3	0	0	0	3.50	1.09	2	5	2	3	0	6
Institutional fears of new technologies	3	1	3.07	1.27	2	4	2	5	1	0	2.57	1.02	0	3	4	5	2	4
Coordination on selection and implementation of technologies	3	2	4.00	0.91	5	3	5	0	0	0	3.46	1.05	1	7	3	1	1	5
Coordinating other transit agencies' services and BRT operations	5	1	3.25	1.54	4	1	3	2	2	0	2.25	1.22	1	1	1	6	3	6
<b>Intra-Agency (i.e., the Transit Property)</b>																		
Concerns (or perceptions) that BRT is given special preference over other transit services	4	1	2.23	1.24	1	1	2	5	4	0	2.31	1.03	0	2	3	5	3	5
Defining and agreeing on new roles, responsibilities, and organizational structures to support BRT	4	2	3.83	1.19	3	7	0	1	1	0	3.17	1.27	1	5	3	1	2	6
Creation of design and operational guidelines for BRT	1	1	4.19	0.83	7	5	4	0	0	0	3.06	0.93	0	6	6	3	1	2
Determining an appropriate fare structure and medium	5	1	3.45	1.69	5	1	1	2	2	1	3.09	1.45	2	3	2	2	2	7
Internal coordination on selection of technology	3	0	3.80	1.01	5	3	6	1	0	0	2.57	0.65	0	1	6	7	0	4
Coordinating schedules of other transit routes with BRT operations	2	0	4.31	0.95	9	4	2	1	0	0	2.69	1.20	1	3	5	4	3	2
Insufficient understanding of the "state of the art" of BRT technologies	2	2	3.14	0.95	1	4	5	4	0	0	2.79	0.89	0	3	6	4	1	4
<b>Political</b>																		
Concerns of BRT being a top down solution	2	0	3.38	1.36	4	4	4	2	2	0	3.19	1.33	3	4	4	3	2	2
Perceived or actual competition of BRT with rail transit	4	0	3.50	1.51	5	3	2	2	2	0	3.29	1.49	4	3	2	3	2	4
Lack of domestic BRT success stories	3	0	3.73	1.10	4	5	5	0	1	0	3.33	1.29	3	4	5	1	2	3
Lack of empirical evidence of BRT's operational effectiveness	1	1	3.25	1.00	3	1	9	3	0	0	3.25	1.06	2	5	4	5	0	2
Finding political champions to support BRT	1	0	4.53	1.07	14	0	1	2	0	0	3.59	1.12	3	8	3	2	1	1
Concerns over long term level of interest, potential for waning	3	2	3.31	1.11	2	4	3	4	0	0	3.15	1.28	2	4	2	4	1	5
Local and business community opposition to the removal of/restrictions on, parking spaces for BRT use	5	0	4.54	0.78	9	2	2	0	0	0	4.00	1.00	5	4	3	1	0	5
Local and community opposition to BRT	1	2	3.27	1.49	5	2	1	6	1	0	2.80	1.08	1	3	4	6	1	3
Concerns over the distribution of the costs and benefits of BRT	4	0	3.14	1.17	2	4	2	6	0	0	2.71	0.99	1	1	6	5	1	4
Legal issues of service changes	6	3	2.22	1.48	1	1	1	2	4	0	2.11	1.17	0	1	3	1	4	9
New vehicle procurement	5	3	3.60	1.26	4	0	4	2	0	0	3.20	1.40	3	1	1	5	0	8
<b>Public Relations and Marketing</b>																		
Educating the public on BRT, and managing perceptions and expectations	2	0	4.50	0.73	10	4	2	0	0	0	3.38	0.81	1	6	7	2	0	2
Concerns over transit agency's existing performance and reputation	7	0	3.00	1.18	1	4	0	6	0	0	2.64	1.43	2	1	1	5	2	7
Concerns over effects of BRT on existing roadway operations	3	1	3.71	0.91	2	8	2	2	0	0	3.07	0.83	0	4	8	1	1	4
Educating pedestrians and motorists on interacting with BRT	3	0	4.07	1.03	6	6	1	2	0	0	2.80	0.94	1	1	8	4	1	3
Educating users on changes in and uses of multiple fare structures	11	0	3.86	1.35	3	2	0	2	0	0	3.00	0.82	0	2	3	2	0	11
<b>Funding and Finance</b>																		
Concerns over long term funding commitments to BRT	1	1	4.31	0.79	8	5	3	0	0	0	3.75	1.06	5	4	5	2	0	2
Concerns about BRT redirecting funds away from existing	2	1	3.67	1.18	5	3	4	3	0	0	3.00	0.85	0	4	8	2	1	3
Lack of understanding of funding mechanisms available for BRT	5	2	3.64	1.29	3	4	2	1	1	0	2.91	0.94	0	3	5	2	1	7
Agency reluctance to expand services due to current fiscal constraints	5	0	3.23	1.36	4	0	5	3	1	0	2.69	1.25	2	0	5	4	2	5
Ability to use existing buses or need for new fleet	5	1	4.00	1.04	5	3	3	1	0	0	3.17	1.19	3	0	5	4	0	6
Capital costs of BRT	0	1	3.82	1.07	6	4	5	2	0	0	3.29	0.92	2	4	8	3	0	1
Cost of operating and maintaining (O&M) new technologies & infrastructure	1	0	3.88	0.93	6	3	8	0	0	0	2.88	1.05	1	4	5	6	1	1
Cost of additional staff and/or training to support BRT	1	2	3.47	1.25	5	0	8	1	1	0	3.00	1.00	1	3	7	3	1	3
Cost of additional facilities to support BRT	5	2	3.18	1.60	4	0	3	2	2	0	2.82	1.40	2	1	3	3	2	7
Cost of and responsibility for enforcement	1	1	3.94	1.00	6	4	5	1	0	0	3.25	1.18	2	5	6	1	2	2
<b>Labor</b>																		
Lack of support from transit agency staff	6	2	3.40	1.17	2	3	2	3	0	0	2.40	1.07	0	2	2	4	2	8

## APPENDIX F: Tabulated Results for Highways/Streets Departments

	NA	DK	Importance of Issue							Ease of Resolution								
			AVG	SD	5	4	3	2	1	NR	AVG	SD	5	4	3	2	1	NR
<b>Intergovernmental/Inter-organizational</b>																		
Integration of multiple priorities, objectives, and agendas	0	1	4.67	0.52	4	2	0	0	0	0	4.00	0.63	1	4	1	0	0	1
Impacts of BRT on roadway operations	0	0	4.00	1.53	4	1	1	0	1	0	3.29	1.11	1	2	2	2	0	0
Streets/highway departments "relinquishing" control of their infrastructure	2	0	3.40	1.82	2	1	0	1	1	0	3.20	1.64	1	2	0	1	1	2
Agreement on performance measures	0	0	3.29	0.95	0	4	1	2	0	0	2.57	1.51	1	1	1	2	2	0
Maintenance responsibilities for shared infrastructure and hard/software	0	0	4.00	1.15	3	2	1	1	0	0	3.29	0.76	0	3	3	1	0	0
Responsibility for enforcement on bus lanes/ busways	1	0	4.00	0.89	2	2	2	0	0	0	3.50	1.22	2	0	3	1	0	1
Institutional fears of new technologies	0	0	2.57	0.53	0	0	4	3	0	0	2.43	0.53	0	0	3	4	0	0
Coordination on selection and implementation of technologies	0	0	3.71	0.95	2	1	4	0	0	0	2.57	0.79	0	0	5	1	1	0
Coordinating other transit agencies' services and BRT operations	2	0	3.00	1.22	0	2	2	0	1	0	2.50	0.58	0	0	2	2	0	3
<b>Intra-Agency (i.e., the Transit Property)</b>																		
Concerns (or perceptions) that BRT is given special preference over other transit services	1	0	3.17	0.98	0	3	1	2	0	0	2.83	0.98	0	2	1	3	0	1
Defining and agreeing on new roles, responsibilities, and organizational structures to support BRT	0	2	3.80	0.84	1	2	2	0	0	0	2.60	1.14	0	1	2	1	1	2
Creation of design and operational guidelines for BRT	0	0	3.57	0.98	1	3	2	1	0	0	2.43	0.53	0	0	3	4	0	0
Determining an appropriate fare structure and medium	2	1	4.00	0.82	1	2	1	0	0	0	3.00	0.82	0	1	2	1	0	3
Internal coordination on selection of technology	0	2	3.00	1.00	0	2	1	2	0	0	2.40	0.55	0	0	2	3	0	2
Coordinating schedules of other transit routes with BRT operations	1	2	3.75	0.50	0	3	1	0	0	0	2.00	1.15	0	0	2	0	2	3
Insufficient understanding of the "state of the art" of BRT technologies	0	1	2.67	1.03	0	1	3	1	1	0	2.67	1.03	0	1	3	1	1	1
<b>Political</b>																		
Concerns of BRT being a top down solution	2	0	3.40	1.52	1	2	1	0	1	0	2.75	1.71	1	0	1	1	1	3
Perceived or actual competition of BRT with rail transit	3	0	2.25	0.96	0	0	2	1	1	0	2.00	1.00	0	0	1	1	1	4
Lack of domestic BRT success stories	2	0	3.20	0.84	0	2	2	1	0	0	2.40	0.89	0	0	3	1	1	2
Lack of empirical evidence of BRT's operational effectiveness	1	0	3.17	1.33	1	1	3	0	1	0	2.50	1.05	0	1	2	2	1	1
Finding political champions to support BRT	0	0	4.29	1.11	4	2	0	1	0	0	3.29	1.25	1	2	3	0	1	0
Concerns over long term level of interest, potential for waning	1	0	3.17	1.60	2	0	2	1	1	0	3.17	1.47	1	2	1	1	1	1
Local and business community opposition to the removal of/restrictions on, parking spaces for BRT use	2	1	4.25	0.96	2	1	1	0	0	0	3.50	1.73	2	0	0	2	0	3
Local and community opposition to BRT	1	0	4.17	1.33	4	0	1	1	0	0	4.00	1.26	3	1	1	1	0	1
Concerns over the distribution of the costs and benefits of BRT	2	2	3.33	0.58	0	1	2	0	0	0	3.00	1.00	0	1	1	1	0	4
Legal issues of service changes	1	4	3.00	1.41	0	1	0	1	0	0	2.50	0.71	0	0	1	1	0	5
New vehicle procurement	2	4	3.00	-----	0	0	1	0	0	0	3.00	-----	0	0	1	0	0	6
<b>Public Relations and Marketing</b>																		
Educating the public on BRT, and managing perceptions and expectations	0	0	3.71	1.11	2	2	2	1	0	0	3.00	1.15	0	3	2	1	1	0
Concerns over transit agency's existing performance and reputation	3	1	4.00	1.73	2	0	0	1	0	0	2.67	2.08	1	0	0	1	1	4
Concerns over effects of BRT on existing roadway operations	0	0	2.86	1.57	2	0	1	3	1	0	2.57	1.72	2	0	0	3	2	0
Educating pedestrians and motorists on interacting with BRT	0	0	3.57	0.98	1	3	2	1	0	0	2.71	1.11	0	2	2	2	1	0
Educating users on changes in and uses of multiple fare structures	1	2	2.75	1.26	0	1	2	0	1	0	2.50	1.00	0	0	3	0	1	3
<b>Funding and Finance</b>																		
Concerns over long term funding commitments to BRT	0	2	4.60	0.89	4	0	1	0	0	0	3.80	0.84	1	2	2	0	0	2
Concerns about BRT redirecting funds away from existing	2	3	4.00	1.41	1	0	1	0	0	0	3.50	0.71	0	1	1	0	0	5
Lack of understanding of funding mechanisms available for BRT	1	1	3.20	0.84	0	2	2	1	0	0	2.20	0.84	0	0	2	2	1	2
Agency reluctance to expand services due to current fiscal constraints	3	2	3.50	2.12	1	0	0	1	0	0	3.50	2.12	1	0	0	1	0	5
Ability to use existing buses or need for new fleet	1	3	4.00	1.00	1	1	1	0	0	0	3.00	0.00	0	0	3	0	0	4
Capital costs of BRT	1	3	4.67	0.58	2	1	0	0	0	0	3.33	0.58	0	1	2	0	0	4
Cost of operating and maintaining (O&M) new technologies & infrastructure	1	3	3.67	1.53	1	1	0	1	0	0	3.33	1.53	1	0	1	1	0	4
Cost of additional staff and/or training to support BRT	2	3	4.00	1.41	1	0	1	0	0	0	3.50	0.71	0	1	1	0	0	5
Cost of additional facilities to support BRT	1	3	2.67	1.53	0	1	1	0	1	0	3.00	0.00	0	0	3	0	0	4
Cost of and responsibility for enforcement	0	2	3.20	1.64	1	2	0	1	1	0	3.20	1.10	1	0	3	1	0	2
<b>Labor</b>																		
Lack of support from transit agency staff	3	2	2.00	1.41	0	0	1	0	1	0	1.50	0.71	0	0	0	1	1	5

## APPENDIX G: Tabulated Results for Planning Agencies

	NA DK		Importance of Issue							Ease of Resolution								
	AVG	SD	5	4	3	2	1	NR	AVG	SD	5	4	3	2	1	NR		
<b>Intergovernmental/Inter-organizational</b>																		
Integration of multiple priorities, objectives, and agendas	0	0	4.67	0.52	4	2	0	0	0	1	3.20	1.10	1	0	3	1	0	2
Impacts of BRT on roadway operations	0	0	4.29	0.76	3	3	1	0	0	0	4.00	0.89	2	2	2	0	0	1
Streets/highway departments "relinquishing" control of their infrastructure	1	1	3.20	0.84	0	2	2	1	0	0	3.20	1.30	1	1	1	2	0	2
Agreement on performance measures	0	0	3.43	1.27	2	1	2	2	0	0	2.50	0.84	0	1	1	4	0	1
Maintenance responsibilities for shared infrastructure and hard/software	0	1	3.67	1.03	1	3	1	1	0	0	2.80	1.48	1	0	2	1	1	2
Responsibility for enforcement on bus lanes/ busways	1	2	3.50	0.58	0	2	2	0	0	0	3.00	0.82	0	1	2	1	0	3
Institutional fears of new technologies	0	0	2.71	1.60	1	2	0	2	2	0	2.83	1.60	1	1	2	0	2	1
Coordination on selection and implementation of technologies	1	0	3.83	1.17	2	2	1	1	0	0	3.40	0.55	0	2	3	0	0	2
Coordinating other transit agencies' services and BRT operations	2	0	4.00	1.22	2	2	0	1	0	0	2.75	1.71	1	0	1	1	1	3
<b>Intra-Agency (i.e., the Transit Property)</b>																		
Concerns (or perceptions) that BRT is given special preference over other transit services	0	3	2.75	0.96	0	1	1	2	0	0	2.25	0.50	0	0	1	3	0	3
Defining and agreeing on new roles, responsibilities, and organizational structures to support BRT	0	3	3.00	0.82	0	1	2	1	0	0	2.75	0.50	0	0	3	1	0	3
Creation of design and operational guidelines for BRT	0	2	3.80	0.84	1	2	2	0	0	0	2.80	0.84	0	1	2	2	0	2
Determining an appropriate fare structure and medium	2	3	2.50	0.71	0	0	1	1	0	0	2.50	0.71	0	0	1	1	0	5
Internal coordination on selection of technology	1	4	3.50	0.71	0	1	1	0	0	0	2.00	0.00	0	0	0	2	0	5
Coordinating schedules of other transit routes with BRT operations	0	3	3.75	1.26	1	2	0	1	0	0	1.75	0.50	0	0	0	3	1	3
Insufficient understanding of the "state of the art" of BRT technologies	1	2	2.75	1.50	0	2	0	1	1	0	2.00	1.41	0	1	0	1	2	3
<b>Political</b>																		
Concerns of BRT being a top down solution	0	0	3.17	1.83	2	1	1	0	2	1	3.00	1.87	1	2	0	0	2	2
Perceived or actual competition of BRT with rail transit	3	0	4.25	0.96	2	1	1	0	0	0	3.00	0.82	0	1	2	1	0	3
Lack of domestic BRT success stories	0	0	3.14	1.21	1	2	1	3	0	0	3.33	1.21	1	2	1	2	0	1
Lack of empirical evidence of BRT's operational effectiveness	0	0	3.57	1.13	2	1	3	1	0	0	3.33	1.03	1	1	3	1	0	1
Finding political champions to support BRT	0	0	4.43	0.79	4	2	1	0	0	0	3.33	1.37	2	0	2	2	0	1
Concerns over long term level of interest, potential for waning	0	0	3.71	1.11	2	2	2	1	0	0	3.50	1.05	1	2	2	1	0	1
Local and business community opposition to the removal of/restrictions on, parking spaces for BRT use	2	0	4.40	0.55	2	3	0	0	0	0	4.50	0.58	2	2	0	0	0	3
Local and community opposition to BRT	0	0	3.71	1.38	3	1	1	2	0	0	3.00	0.89	0	2	2	2	0	1
Concerns over the distribution of the costs and benefits of BRT	2	0	3.40	1.52	2	0	1	2	0	0	3.40	1.14	1	1	2	1	0	2
Legal issues of service changes	1	1	3.20	1.79	2	0	1	1	1	0	2.20	0.84	0	0	2	2	1	2
New vehicle procurement	2	2	2.67	2.08	1	0	0	1	1	0	2.67	2.08	1	0	0	1	1	4
<b>Public Relations and Marketing</b>																		
Educating the public on BRT, and managing perceptions and expectations	0	0	4.00	0.82	2	3	2	0	0	0	3.33	1.03	1	1	3	1	0	1
Concerns over transit agency's existing performance and reputation	1	0	3.50	1.64	2	2	0	1	1	0	2.40	1.52	0	2	0	1	2	2
Concerns over effects of BRT on existing roadway operations	0	0	3.71	1.38	3	1	1	2	0	0	3.33	1.03	1	1	3	1	0	1
Educating pedestrians and motorists on interacting with BRT	1	0	4.33	0.52	2	4	0	0	0	0	2.60	1.14	0	1	2	1	1	2
Educating users on changes in and uses of multiple fare structures	3	1	3.00	2.00	1	0	1	0	1	0	3.00	2.00	1	0	1	0	1	4
<b>Funding and Finance</b>																		
Concerns over long term funding commitments to BRT	0	0	4.00	0.82	2	3	2	0	0	0	3.17	1.17	1	1	2	2	0	1
Concerns about BRT redirecting funds away from existing	1	0	3.00	1.26	1	1	1	3	0	0	3.40	1.14	1	1	2	1	0	2
Lack of understanding of funding mechanisms available for BRT	2	0	3.00	1.41	0	3	0	1	1	0	2.00	0.82	0	0	1	2	1	3
Agency reluctance to expand services due to current fiscal constraints	2	1	2.50	1.00	0	0	3	0	1	0	2.33	1.15	0	0	2	0	1	4
Ability to use existing buses or need for new fleet	1	3	3.33	0.58	0	1	2	0	0	0	2.33	0.58	0	0	1	2	0	4
Capital costs of BRT	0	1	4.00	0.89	2	2	2	0	0	0	3.60	0.55	0	3	2	0	0	2
Cost of operating and maintaining (O&M) new technologies & infrastructure	0	1	3.83	0.75	1	3	2	0	0	0	3.00	1.22	1	0	2	2	0	2
Cost of additional staff and/or training to support BRT	0	2	3.00	0.71	0	1	3	1	0	0	2.40	0.89	0	0	3	1	1	2
Cost of additional facilities to support BRT	0	3	3.25	0.96	0	2	1	1	0	0	2.25	0.96	0	0	2	1	1	3
Cost of and responsibility for enforcement	1	2	3.50	0.58	0	2	2	0	0	0	2.50	0.58	0	0	2	2	0	3
<b>Labor</b>																		
Lack of support from transit agency staff	1	4	1.50	0.71	0	0	0	1	1	0	1.00	0.00	0	0	0	0	2	5