

# U.S. BUS RAPID TRANSIT

10 high-quality features and the value chain of firms that provide them



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July 10, 2012

**Duke**

CENTER on GLOBALIZATION,  
GOVERNANCE & COMPETITIVENESS  
*at the Social Science Research Institute*

This research was prepared with generous support from [The Rockefeller Foundation](#).

**Acknowledgments** – The authors are grateful for valuable information and feedback from all participants in the working meeting held at Duke University on March 8, 2012. Many thanks also to Frances Hooper, Michael Replogle, Jason Hellendrung and Martin Zogran. For valuable comments on later drafts, we would like to thank Cliff Henke, Brendon Hemily, Alan Wulkan, Annie Weinstock, and Benjamin de la Pena.

None of the opinions or comments expressed in this report are endorsed by the companies mentioned or individuals interviewed. Errors of fact or interpretation remain exclusively with the authors. We welcome comments and suggestions. The lead author can be contacted at [marcy.lowe@duke.edu](mailto:marcy.lowe@duke.edu)

Free copies of this report and the accompanying [interactive visualization tool](#) are available at the CGGC website, <http://www.cggc.duke.edu/>

Cover image by Sasaki Associates, Inc.

# List of Abbreviations

A&E	Architectural and Engineering	KCATA	Kansas City Area Transportation Authority
AC Transit	Alameda-Contra Costa Transit District	LRT	Light Rail Transit
AGC	Associated General Contractors of America	LTD	Lane Transit District
APC	Automated Passenger Counters	MBIA	Municipal Bond Investors Assurance Corporation
APTA	American Public Transportation Association	MBTA	Massachusetts Bay Transportation Authority
AVL	Automatic Vehicle Location	MPO	Metropolitan Planning Organization
AWEA	American Wind Energy Association	NBRTI	National BRT Institute
BRT	Bus Rapid Transit	NEPA	National Environmental Policy Act
CAD	Computer Aided Dispatch	NOx	Nitrogen Oxides
CCTV	Closed-circuit television camera	OEM	Original Equipment Manufacturer
CGGC	Center on Globalization, Governance & Competitiveness	PM	Particulate Matter
CM	Construction Manager	PMC	Project Management Consultant
CMAQ	Congestion Mitigation and Air Quality Improvement	PMOC	Project Management Oversight Contractors
CMGC	Construction Manager General Contractor	PPP	Public-Private Partnership
CNG	Compressed Natural Gas	REIT	Real Estate Investment Trust
CTAA	Community Transportation Association of America	RFP	Request for Proposal
CTS	Center for Transportation Studies	RPO	Rural Planning Organization
DB	Design-Build	RTC	Regional Transportation Commission
DBB	Design Bid Build	SME	Small and Medium Enterprise
DBE	Disadvantaged Enterprise	STP	Surface Transportation Program
DIF	Development Impact Fee	SWF	Sovereign Wealth Fund
DOT	Department of Transportation	TIF	Tax Increment Financing
DSR	Debt Service Reserve	TIFIA	Transportation Infrastructure and Finance Innovation
FGIC	Financial Guaranty Insurance Company	TOD	Transit-Oriented Development
FHWA	Federal Highway Administration	TSP	Transit Signal Priority
FMOC	Financial Management Oversight Contractors	TUF	Transport Utility Fee
FSA	Financial Security Assurance Inc.	TVM	Ticket Vending Machine
FSP	Full Service Professional	VAA	Vehicle Assist and Automation
FTA	Federal Transit Administration	VMT	Vehicle Miles Traveled
GCRTA	Greater Cleveland Regional Transit Authority		
GEC	General Engineering Consultant		
ITDP	Institute for Transportation and Development Policy		
ITS	Intelligent Transportation Systems		
ITSA	Intelligent Transportation Society of America (ITSA)		

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# Section I.

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## I. Executive Summary

### Key Findings

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# Key Findings

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Bus rapid transit (BRT) is increasingly being considered in cities across the United States as a reliable and cost-effective public transit mode. A large part of the appeal of BRT is its flexibility, offering a choice of system features that can be adapted to each community's needs and constraints. As more U.S. cities look to BRT, they will need to understand the value chain that provides the vehicles, technology, services and financing needed to create a high-quality BRT system.

## Key Findings:

- ▶ At least 390 firms across the value chain serve markets directly relevant to BRT. The BRT value chain is essentially a public transit value chain. The Center on Globalization, Governance, and Competitiveness (CGGC) database of firms excludes those not directly relevant to BRT. In addition, of the total 390 firms identified, half have already supplied an existing BRT project and/or explicitly address BRT on their websites.
- ▶ Experienced full-service professional firms (FSPs) will likely play a crucial role in the development of U.S. BRT. FSPs stretch across all segments of the chain, performing services from architect/engineering to legal matters to finance, communications, branding, and environmental impact. The large FSPs have vital experience in coordinating public and private players and can draw on expertise gained in other infrastructure projects to explore new financing and project delivery approaches for BRT.
- ▶ BRT development promises an increasing role for Intelligent Transportation Systems (ITS). Lead firms face growing competition from new players. Parallel to rapidly expanding technology options, a new value chain sub-segment is emerging: ITS consulting.
- ▶ The finance segment is less developed for BRT compared with rail or highway projects. As more cities begin to embrace BRT—while facing strained state budgets and growing competition for federal dollars—it will be increasingly important to identify key private sector players that can drive innovative finance mechanisms.

# Section II.

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## I. Executive Summary

## II. Creating High-Quality BRT in the United States

### What is BRT?

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### The Need for Clear Definitions

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# What is BRT?

Bus rapid transit (BRT) seeks to achieve faster, more reliable bus service via features commonly associated with urban rail systems—for example, running the vehicles on their own right of way, or collecting fares before passengers get on board.

At its most developed, BRT can offer speeds and capacities similar to subways—as in Bogotá, Colombia’s TransMilenio—at a much lower capital cost. Yet all BRT systems are far from the same. Each system requires a mix of characteristics uniquely suited to its community. Systems also vary widely in their level of performance.<sup>1</sup>



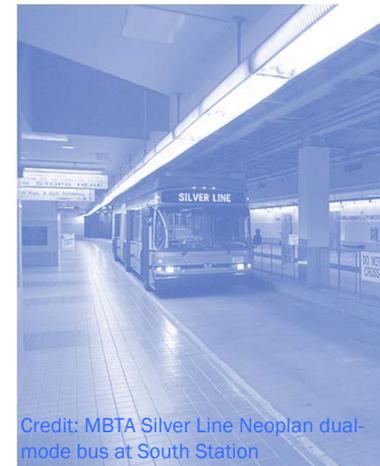
- ▶ Bogotá, Colombia
- ▶ Opened in 2000
- ▶ Over 54 miles of BRT lines
- ▶ 1.3 million passengers per weekday<sup>2</sup>
- ▶ Peak frequency (buses per hour)

# BRT in the United States

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Compared to other countries where BRT has been most successful, the United States has lower density land use, higher automobile ownership and less orientation toward public transit—all factors that mean BRT will often look different in U.S. cities. Yet a number of trends suggest that the time is ripe for U.S. BRT:

- ▶ Transit demand is growing
- ▶ Young Americans are driving less and using transit more
- ▶ Capital costs for BRT are usually much lower than for rail transit
- ▶ Competition for federal transit dollars is increasing, making cost-effectiveness more important than ever
- ▶ BRT projects can be developed in less time than rail projects
- ▶ **Important:** BRT is not a blanket replacement for light rail or other rail options; each transit option has its advantages or disadvantages in any given context



# Defining BRT

- ▶ Considering the importance of securing federal funding, the project requirements under FTA’s Very Small Starts grant program effectively set a federal minimum definition for BRT in the United States.
- ▶ The Institute for Transportation and Development Policy (ITDP) is currently leading an effort to establish a minimum standard for BRT based on the technical knowledge of the international BRT community.

Federal Funding Requirements <sup>3</sup>		BRT Definitions by Different Authorities <sup>4</sup>			
FTA Very Small Starts	FTA Small Starts	FTA	TCRP	NBRTI	ITDP
<p>A project must be a bus, rail or ferry project and contain the following features:</p> <ul style="list-style-type: none"> <li>• Transit Stations</li> <li>• Signal Priority/Pre-emption (for Bus/LRT)</li> <li>• Low Floor / Level Boarding Vehicles</li> <li>• Special Branding of Service</li> <li>• Frequent Service - 10 min peak/15 min off peak</li> <li>• Service offered at least 14 hours per day</li> <li>• Existing corridor ridership exceeding 3,000/day</li> <li>• Less than \$50 million total cost</li> <li>• Less than \$3 million per mile (excluding vehicles)</li> </ul>	<p>The total project cost must be less than \$250 million, with no greater than \$75 million in requested Section 5309 Capital Investment Grant funding. In addition, a project must meet one of the following guideway criteria:</p> <ul style="list-style-type: none"> <li>• Be a fixed guideway for at least 50% of the project length in the peak period –AND/OR–</li> <li>• Be a corridor-based bus project with the following minimum elements:               <ul style="list-style-type: none"> <li>○ Substantial Transit Stations</li> <li>○ Signal Priority/Pre-emption (for Bus/LRT)</li> <li>○ Low Floor / Level Boarding Vehicles</li> <li>○ Special Branding of Service</li> <li>○ Frequent Service - 10 min peak/15 min off peak</li> <li>○ Service offered at least 14 hours per day</li> </ul> </li> </ul>	<p>An enhanced bus system that operates on bus lanes or other transitways in order to combine the flexibility of buses with the efficiency of rail. By doing so, BRT operates at faster speeds, provides greater service reliability and increased customer convenience. It also utilizes a combination of advanced technologies, infrastructure and operational investments that provide significantly better service than traditional bus service.</p>	<p>An integrated system of features, services, and amenities that improves the speed, reliability, and identity of bus transit.</p>	<p>An innovative, high capacity, lower cost public transit solution that can significantly improve urban mobility. This permanent, integrated system uses buses or specialized vehicles on roadways or dedicated lanes to quickly and efficiently transport passengers to their destinations, while offering the flexibility to meet transit demand. BRT systems can easily be customized to community needs and incorporate state-of-the-art, low-cost technologies that result in more passengers and less congestion.</p>	<p>A high-quality bus-based transit system that delivers fast, comfortable, and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations, and excellence in marketing and customer service.</p>

# The Emerging BRT Standard

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- ▶ ITDP is developing [The BRT Standard](#), an effort to recognize international best practices by defining three levels of BRT: Gold, Silver, and Bronze.
- ▶ The evolving BRT Standard provides a useful framework for understanding the principal BRT features that together can create a high-quality BRT system.
- ▶ This study uses the BRT Standard to identify 10 high-quality BRT features, as part of the method for establishing the ecosystem of firms to be included in the BRT value chain.

## Supporters of the BRT Standard<sup>5</sup>

ITDP is the main convener and secretariat of the BRT Standard. The BRT Standard Committee is composed of the following experts who also represent their institutions unless otherwise indicated by an (\*):

Walter Hook, *ITDP*  
Manfred Breithaupt, *GIZ*  
Lloyd Wright, *Asian Development Bank*\*  
Dario Hidalgo, *EMBARQ*\*  
Gerhard Menckhoff, *World Bank (retired)*, *ITDP Vice President*  
Wagner Colombini Martins, *Logit Consultoria*  
Carlos Felipe Pardo, *Slow Research*  
Pedro Szasz, *Consultant*  
Ulises Navarro, *Modelistica*  
Scott Rutherford, *University of Washington*

The emissions scoring detail for buses was recommended by the International Council on Clean Transportation, a member of the Best Practice Network of the ClimateWorks Foundation.  
Lew Fulton and Tali Trigg of the International Energy Agency have also endorsed the BRT Standard.



# The BRT Standard, Version 1.0

Full text available at:  
<http://www.itdp.org/index.php?/microsites/brt-standard/>

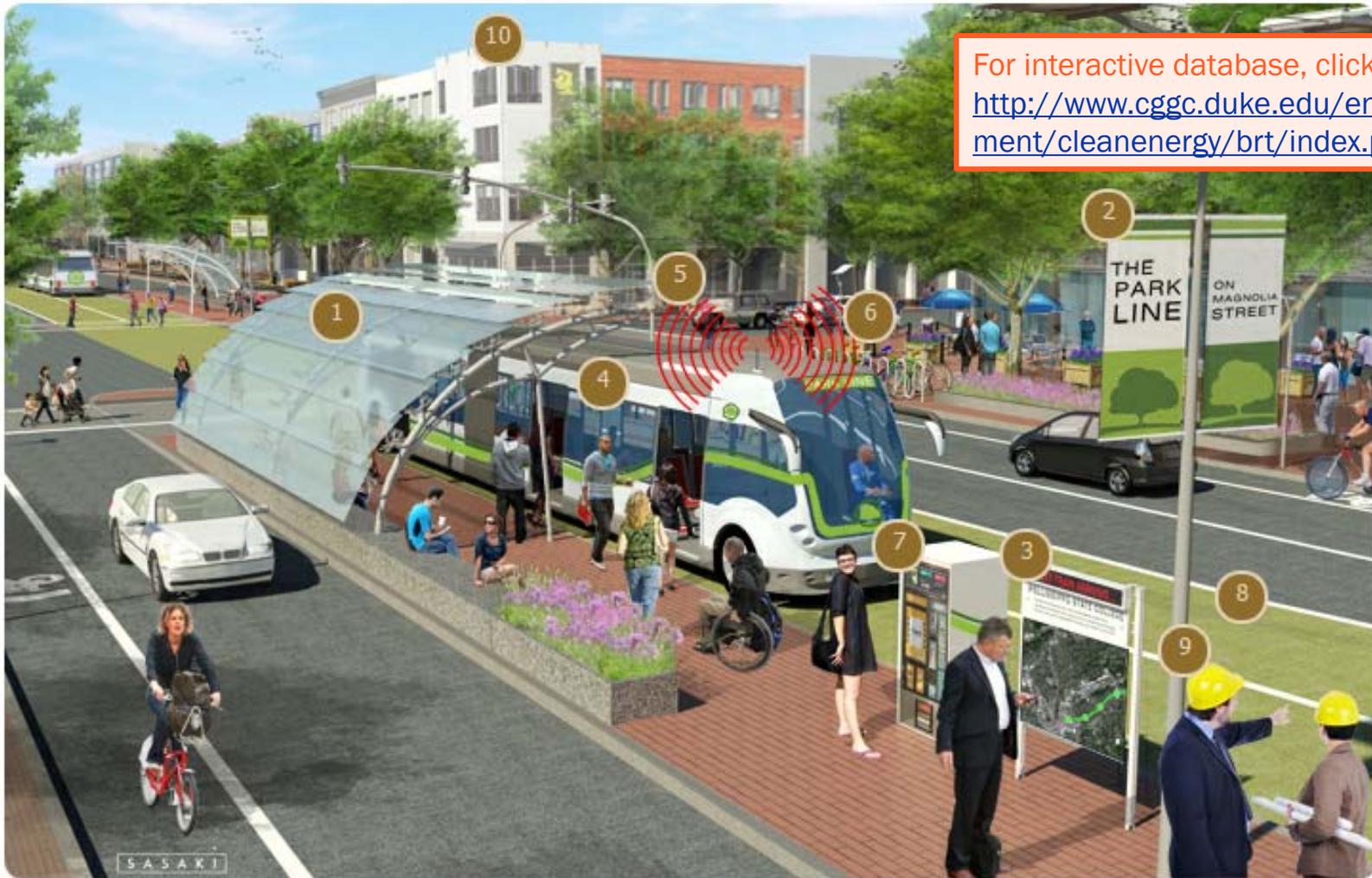
CRITERIA	DESCRIPTION
<b>SERVICE PLANNING</b>	
• Off-board fare collection	One of the most important factors in reducing travel time and improving the customer experience.
• Multiple routes	Having multiple routes operate on a single corridor is a good proxy for reduced door-to-door travel times by reducing transfer penalties.
• Peak frequency	How often the bus comes during peak travel times such as rush hour is a good proxy for quality of service and corridor selection.
• Off-peak frequency	How often the bus comes during off-peak travel times is a good proxy for quality of service and corridor selection.
• Express, limited, and local services	One of the most important ways to increase operating speeds and reduce passenger travel times.
• Control center	Increasingly becoming a requirement for a host of service improvements, such as avoiding bus bunching, monitoring bus operations, identifying problems, and rapidly responding to them.
• Located in top ten corridors	Will help ensure a significant proportion of passengers benefit from the improvements.
• Hours of operations	A viable transit service must be available to passengers for as many hours throughout the day and week as possible. Otherwise, passengers could end up stranded or may simply seek another mode.
• Multi-corridor network	Ideally, BRT should include multiple corridors that intersect and form a network as this expands travel options for passengers and makes the system as a whole, more viable.
<b>INFRASTRUCTURE</b>	
• Busway alignment	The busway is best located where conflicts with other traffic can be minimized, especially from turning movements from mixed-traffic lanes.
• Segregated right-of-way	A segregated right-of-way is vital to ensuring that buses can move quickly and unimpeded by congestion.
• Intersection treatments	There are several ways to increase bus speeds at intersections, all of which are aimed at increasing the green signal time for the bus lane. Forbidding turns across the bus lane and minimizing the number of traffic-signal phases where possible are the most important. Traffic-signal priority when activated by an approaching BRT vehicle is useful in lower-frequency systems.
• Passing lanes at stations	Passing lanes at station stops are critical to allow both express and local services. They also allow stations to accommodate a high volume of buses without getting congested from backed-up buses waiting to enter.
• Minimizing bus emissions	Minimizing bus tailpipe emissions (especially particulate matter (PM) and nitrogen oxides (NOx)) is critical to the health of both passengers and the general urban population.
• Stations set back from intersections	Stations should be located at least forty meters from intersections to avoid delays, or else delays can be caused when passengers take a long time to board or alight and the docked bus blocks others from pulling through the intersection. If stations are located just before an intersection, the traffic signal can delay buses from moving from the station and thus not allow other buses to pull in.
• Center stations	Having a single station serving both directions of the BRT system makes transfers easier and more convenient—something that becomes more important as the BRT network expands.
• Pavement quality	Good-quality pavement ensures better service and operations for a longer period by minimizing the need for maintenance on the busway.

# The BRT Standard, Version 1.0

Full text available at:  
<http://www.itdp.org/index.php?/microsites/brt-standard/>

CRITERIA	DESCRIPTION
<b>STATION DESIGN AND STATION-BUS INTERFACE</b>	
• Platform-level boarding	One of the most important ways of reducing boarding and alighting times per passenger.
• Safe and comfortable stations	One of the main distinguishing features of a BRT system as opposed to standard bus service is a safe and comfortable station environment.
• Number of doors on bus	The speed of boarding and alighting is partially a function of the number of bus doors. Much like a subway in which a car has multiple wide doors, buses need the same in order to let higher volumes of people on and off the buses.
• Docking bays and sub-stops	Multiple docking bays and sub-stops not only increase the capacity of a station, they help provide multiple services at the station as well.
• Sliding doors in BRT stations	Sliding doors where passengers get on and off the buses inside the stations improve the quality of the station environment, reduce the risk of accidents, and prevent pedestrians from entering the station in unauthorized locations.
<b>QUALITY OF SERVICE AND PASSENGER INFORMATION SYSTEMS</b>	
• Branding	BRT promises a high quality of service, which is reinforced by having a unique brand and identity.
• Passenger information	Numerous studies have shown that passenger satisfaction is linked to knowing when the next bus will arrive. Giving passengers information is critical to a positive overall experience.
<b>INTEGRATION AND ACCESS</b>	
• Universal access	A BRT system should be accessible to all special needs customers, including those who are physically-, visually-, and/or hearing-impaired, as well as those with temporary disabilities, the elderly, children, parents with strollers, and other load-carrying passengers.
• Integration with other public transport	Often, when a BRT system is built in a city, a functioning public transport network already exists, be it rail, bus, or minibus. The BRT system should integrate into the rest of the public transport network.
• Pedestrian access	A BRT system could be extremely well-designed and functioning but if passengers cannot access it safely, it cannot achieve its goals. Good pedestrian access is imperative in BRT system design. Additionally, as a new BRT system is a good opportunity for street and public-space redesign, existing pedestrian environments along the corridor should be improved.
• Secure bicycle parking	The provision of bicycle parking at stations is necessary for passengers who wish to use bicycles as feeders to the BRT system. Formal bicycle-parking facilities that are secure (either by an attendant or observed by security camera) and weather protected are more likely to be used by passengers.
• Bicycle lanes	Bicycle-lane networks integrated with the BRT corridor improve customer access, provide a full set of sustainable travel options, and enhance road safety.
• Bicycle sharing integration	Having the option to make short trips from the BRT corridor by a shared bike is important to providing connectivity to some destinations.

# 10 High-Quality BRT Features



For interactive database, click <http://www.cggc.duke.edu/environment/cleanenergy/brt/index.php>

Based on ITDP, [The BRT Standard](#)

## 1 Stations

- Passengers board the vehicle at platform level
- Station is safe and comfortable
- Space allows several buses to stop at once

## 2 Branding

- All vehicles, routes, and stations follow a single unifying brand that promises high-quality service

## 3 Passenger Communication

- Route maps are easy to find
- Passengers can get real-time information

## 4 Vehicles

- Doors allow many passengers to board or exit at once
- Vehicles are recognizable and clearly marked
- Vehicles meet strict emissions standards

## 5 Intelligent Transportation Systems (ITS)

- Vehicle tracking and intelligent transportation systems
- Operation control system to reduce vehicle bunching

## 6 Integration and Access

- BRT is integrated with other modes
- Secure bicycle parking at stations
- System is accessible to pedestrians and special-needs passengers

## 7 Fare Collection

- Passengers pay fare before boarding
- Fare is integrated with other public transport options

## 8 Infrastructure

- Multiple bus routes can share the same BRT infrastructure
- BRT vehicles have their own separate right-of-way

## 9 Service Planning

- Service operates frequently in peak and off-peak
- Express, limited, and local services
- Operates late nights and weekends

## 10 Value Capture & Innovative Finance

- Finance is not considered a BRT “feature,” nor is it included in the BRT Standard. It is mentioned here because innovative finance mechanisms are increasingly important for BRT projects facing strained state budgets and competition for federal transit dollars.
- Innovative finance mechanisms—such as special assessment districts or public/private joint development projects—attempt to capture the increased value of property surrounding a BRT line or corridor, using it to leverage public funding resources and help pay for capital costs.
- Key private sector stakeholders include real estate developers and investors, law firms and project management consultants.



For full description of high-quality features, see [The BRT Standard](#).

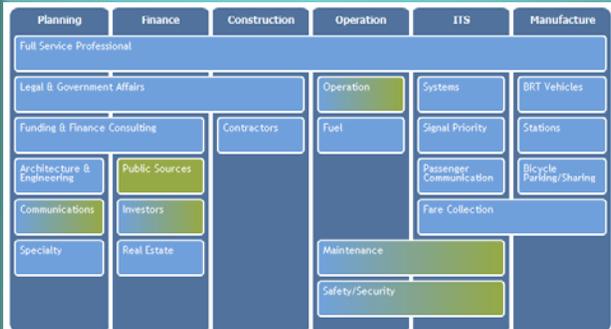
# This Report

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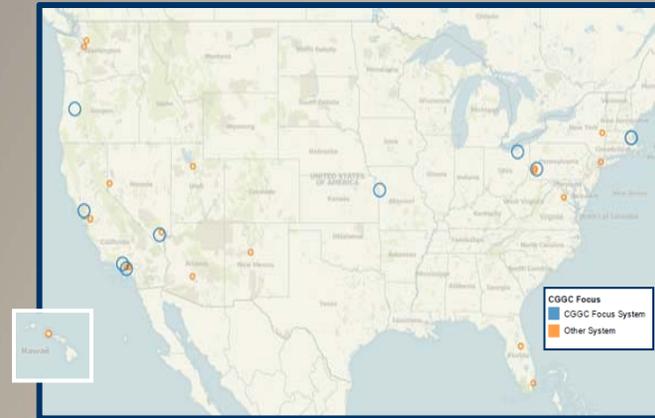
- ▶ This report examines the ecosystem of firms that provide services, vehicles and equipment relevant to BRT projects in the United States. The value chain includes six main segments and 21 sub-segments, each of which is analyzed for industry characteristics.
- ▶ The analysis also highlights 10 “CGGC focus” BRT systems to show selected system characteristics, capital costs per mile, federal versus state and local funding, and the relevant supplier firms from each segment of the value chain. Systems were selected based on data availability. See the Appendix for more information on methods.
- ▶ Also considered is the potential to develop a business constituency. How can firms across the value chain work together as an assertive industry to promote BRT in the United States?
- ▶ Finally, this report includes three interactive databases:
  - 1) 10 high-quality BRT features and the firms that provide them
  - 2) 10 CGGC focus BRT systems, cost and funding data
  - 3) 390 companies in the value chain, firm-level data

# Online Data Tools

1) 10 high-quality BRT features and the firms that provide them:  
<http://www.cggc.duke.edu/environment/cleanenergy/brt/index.php>

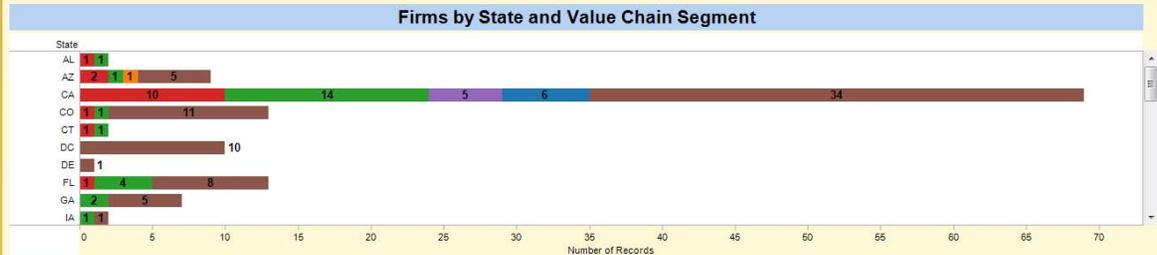


2) 10 CGGC focus BRT systems, cost and funding data:  
<http://tinyurl.com/7czcgm>



3) 390 companies in the value chain, firm-level data:  
<http://tinyurl.com/7pmzwjj>

Firm-level Data					
Company Name	US Headquarters	State	Value Chain Segment	Employees	Annual Sales
DesignLine Corporation	Charlotte	NC	Manufacturing	000	\$\$\$
DHK Architects	Boston	MA	Planning	00	\$
Di Domenico + Partners LLP	Long Island City	NY	Planning	0	\$
Digi International	Minnetonka	MN	ITS	0000	\$\$\$\$
Digital Recorders, Inc.	Durham	NC	ITS	00	\$
Dikita Engineering	Dallas	TX	Planning	00	\$
Dikita Management Services	Dallas	TX	Planning	00	\$
DILAX Systems Inc.	N/A	N/A	ITS	0	\$



# Section III.

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I. Executive Summary

II. Creating High-Quality BRT in the United States

**III. BRT Value Chain**

The BRT Value Chain

Analysis of Each Value Chain Segment

Interactive Database of Firms

Condensed List of Firms, by Segment

U.S. Map of Firms

Interactive Firm-level Data

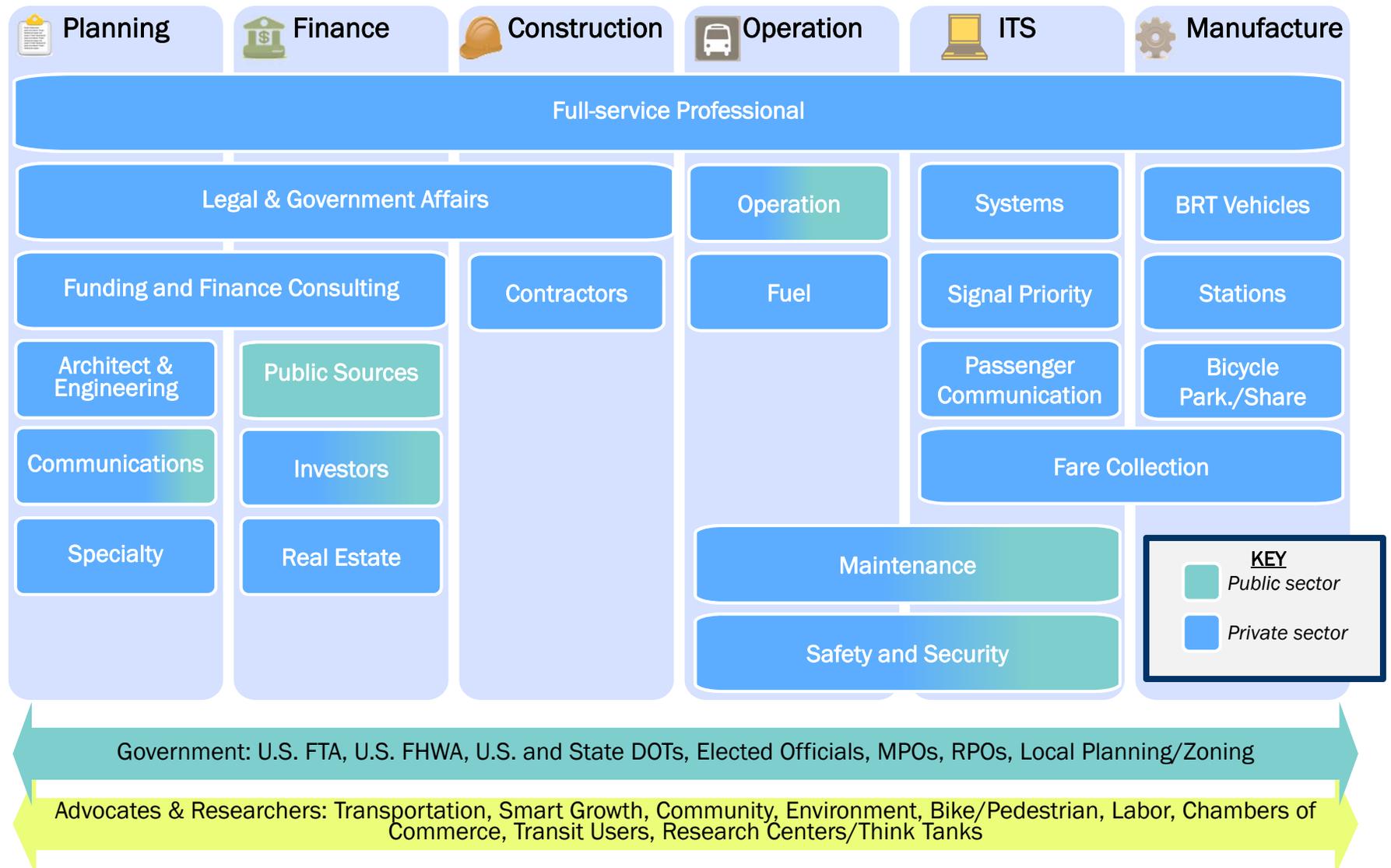
Vendors Used in 10 CGGC Focus Systems

IV. Potential for a BRT Business Constituency

V. Conclusion

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# The BRT Value Chain





## Planning

- Largest segment of the value chain in number of firms
- Represents a significant portion of a BRT system's total capital cost
- Involved in all planning and design phases of a BRT project
- Includes firms from architects & engineers to financial & legal professionals
- Firms perform coordination of public and private players
- Involvement is structured according to project delivery method



## Finance

- Segment includes public financial players (federal, state and local governments) and increasingly potential private players
- Potential private sector players include investors, who participate in the project itself, and real estate interests, who can participate in potential development opportunities associated with the BRT project, such as transit-oriented development



## Construction

- Segment includes prime construction contractors with experience in mass transit
- Usually represents greatest project cost
- Contractors build system according to final design developed by A&E design team
- Much activity is performed by local contractors and subcontractors
- As the number of major highway infrastructure projects declines, segment shows growing interest in BRT projects, especially those that include road building components



## Operation

- Segment includes firms that provide transit management services, fuel, and maintenance, as well as safety and security—two categories that overlap with the ITS segment
- Many opportunities exist for public-private partnerships with transit management companies, arrangements frequently found in Latin America, but not yet common in the United States



## ITS

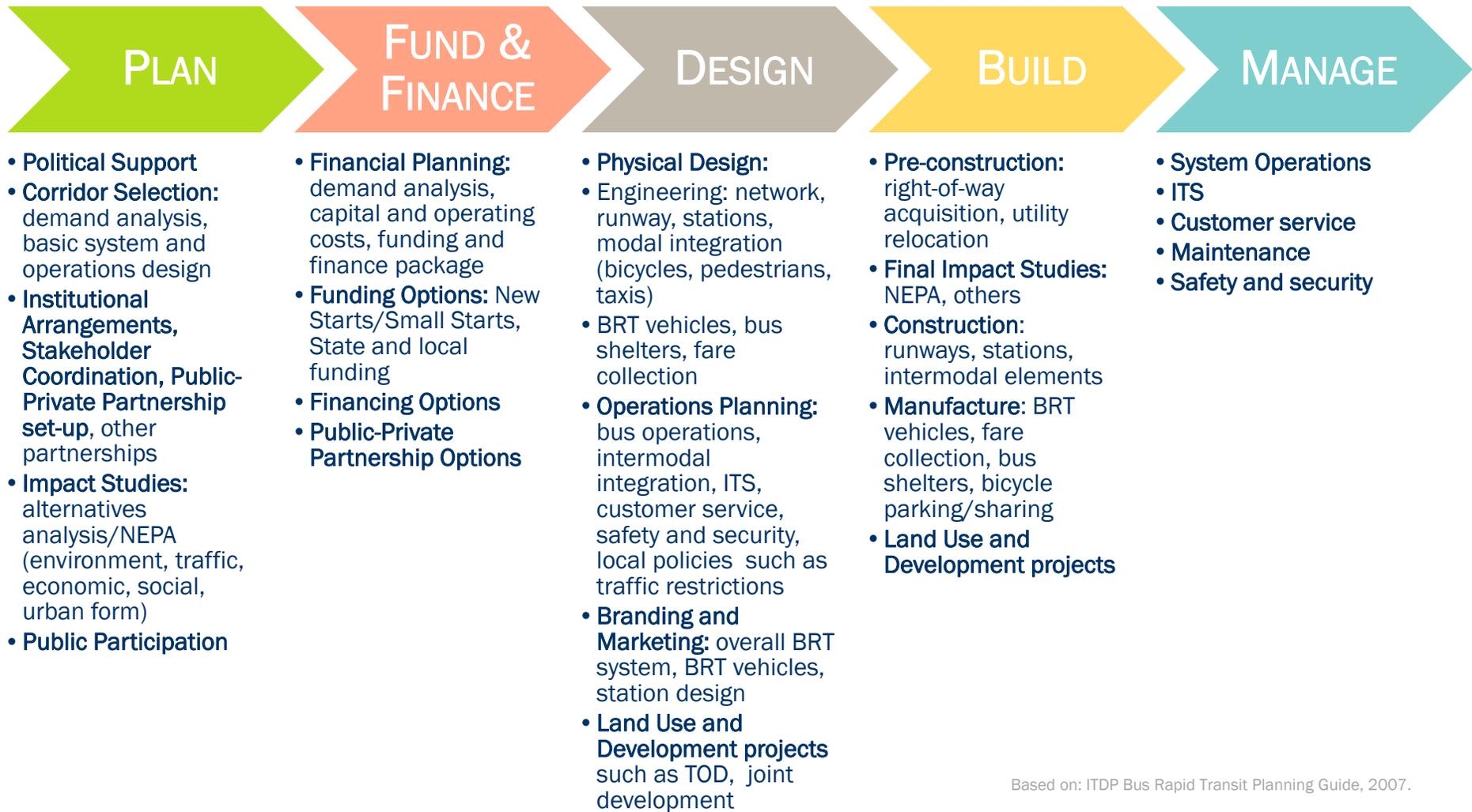
- Firms that provide Intelligent Transportation Systems (ITS)
- System Operations, Transit Signal Priority, and Passenger Communication are used in many U.S. BRT systems.
- Off-board fare collection, less common in U.S., is considered a high-quality feature
- Advanced vehicle assist/automation technologies in Safety/Security are a newer, growing U.S. field



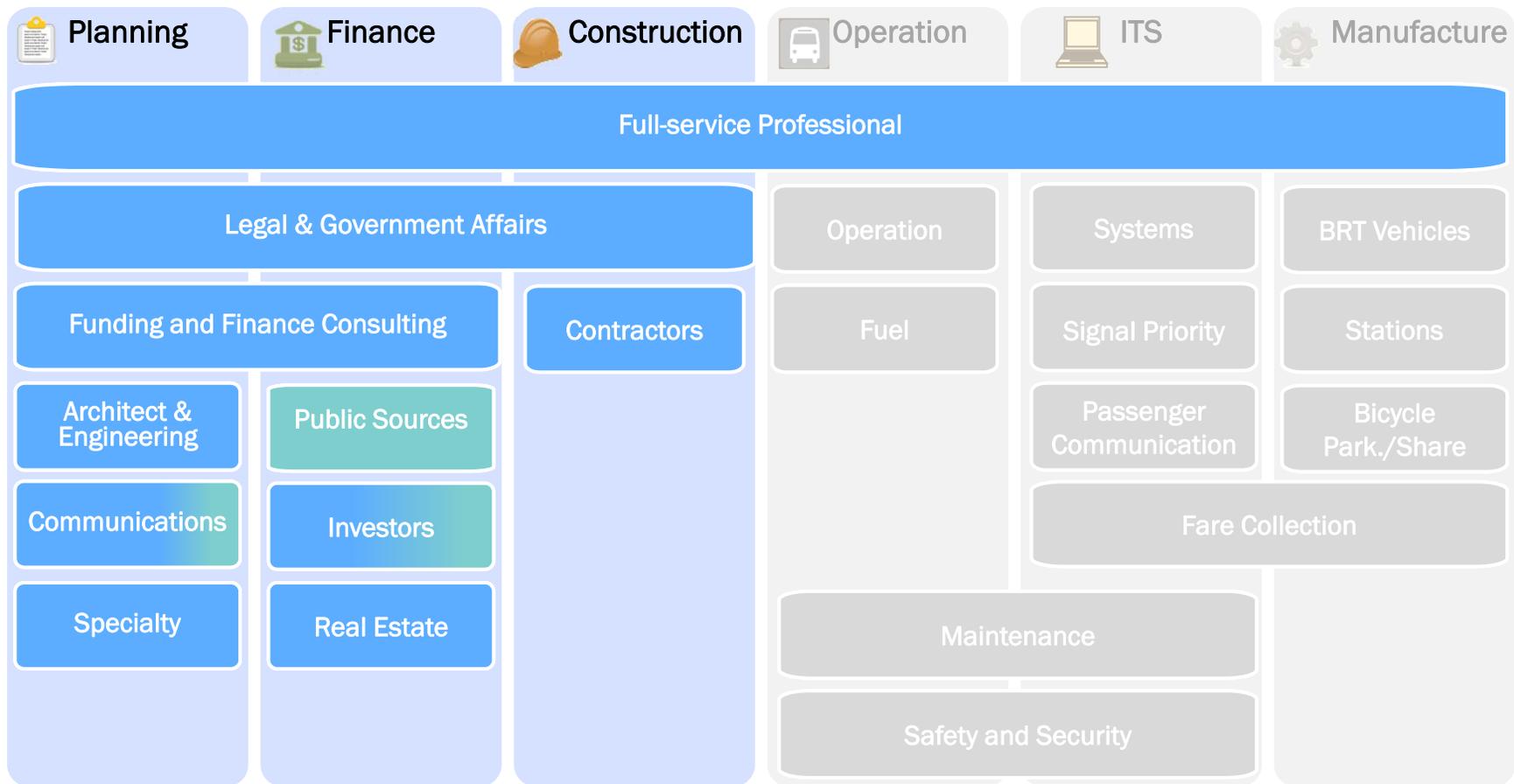
## Manufacture

- Firms that provide BRT vehicles, shelters/street furniture, and bicycle parking
- CGGC database emphasizes U.S.-based firms, since manufactured products procured with federal grant money must comply with Federal Buy America requirements
- In exchange for naming rights or advertising space, agencies can get shelters or bicycle sharing programs at low or no cost

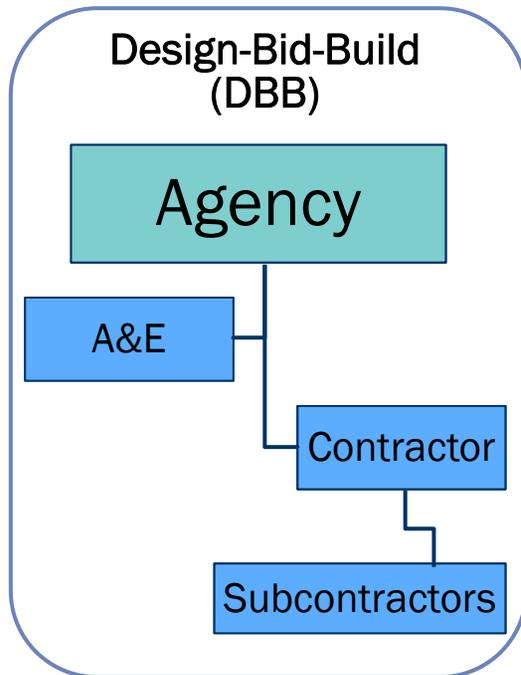
## ► Six main segments



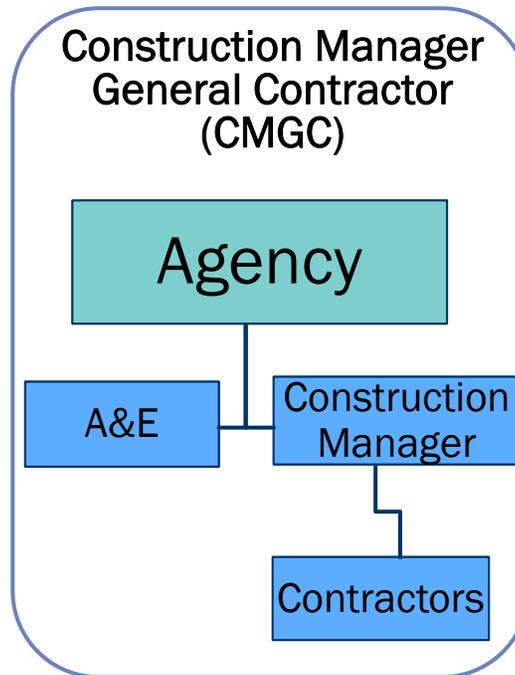
▶ *Firms operate within the transit project timeline*



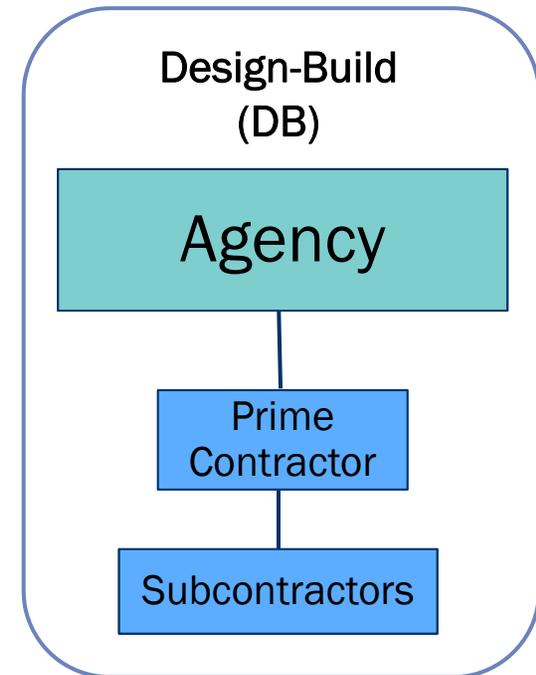
- ▶ *The first three segments of the value chain—Planning, Finance, and Construction—relate differently to the transit agency depending on the method of project delivery*



- Most widely used
- Highest control and risk for transit agency
- Lowest bid wins
- Can include:
  - General Engineering Consultant (**GEC**)
  - Construction Manager (**CM**)
  - Project Management Consultant (**PMC**)

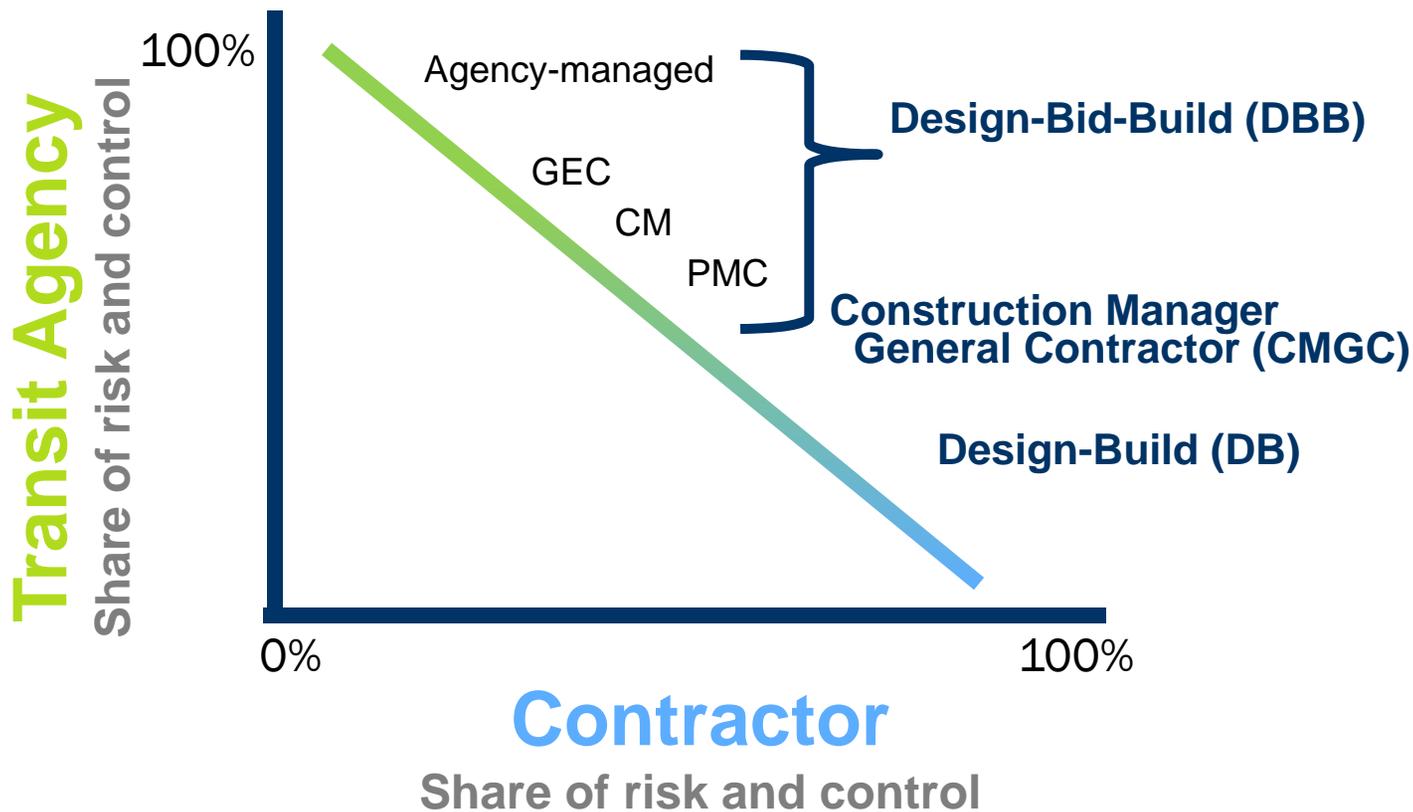


- Expected to increase in prevalence
- Middle ground between **DBB** and **DB** in terms of control and risk
- Offers greater integration between design and build phases
- Non-low bid method, so state laws may or may not allow



- Second most common
- Lowest control and risk for transit agency
- Often used for large infrastructure projects
- Streamlined process
- Reduced risk of cost overruns from construction change orders

► *Most transit projects use one of three types of delivery*



▶ *Sharing of control and risk varies by delivery type*

# Analysis of Each Value Chain Segment

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Planning



Finance



Construction



Operation



ITS



Manufacture

## Architect & Engineering (A&E)

Firms in this industry plan and design BRT buildings and structures, including road and transit infrastructure, shelters, and sometimes bus maintenance facilities and transit centers.

### Industry Findings:

- Firms are interested in working on BRT projects. 75% of the A&E firms in the CGGC list have documented BRT experience or mention BRT services on their company website.
- Having a local/regional headquarters presence is an advantage. About half of the A&E firms with documented BRT experience are local/regional firms.
- Alternative project delivery services are a priority. More than half of A&E firms explicitly list construction management and/or project management services on their website.

### Typical core services:

- Design – engineering design for corridors, stations, and sometimes maintenance facilities or transit centers, usually to fulfill preliminary engineering/final engineering requirements for FTA funding
- Planning – studies/surveys to inform engineering and project design and operations planning, including feasibility studies
- Project/Program Management – FTA grant process, especially financial requirements; procurement; public outreach
- Construction Management – represent project owner in construction activities; participates in the design process to ensure constructability and manages estimated construction costs; may be responsible for hiring and managing subcontractors

### Other typical services:

- other construction services
- environmental services
- urban planning, including transit-oriented development, bicycle and pedestrian integration

### Characteristics of A&E firms in CGGC database:

- Some firms provide mostly engineering services or architectural design or planning services (e.g., ZGF Architects LLP)

No. of Firms	Annual Sales (in millions)		No. of Employees		No. of Locations (North America)	
	Average	Median	Average	Median	Average	Median
51	\$148.1	\$40.5	875	264	17	7



Planning



Finance



Construction



Operation



ITS



Manufacture

**Full-Service Professional Firms (FSP)**

Firms in this industry are very large national—and sometimes global—A&E firms that provide a broad suite of services across the value chain, in addition to their core architectural and engineering services.

**Industry Findings:**

- FSPs or large, national construction firms are usually the prime contractors in a DB project delivery method.
- FSPs have expertise in alternative project delivery methods.
- In addition to core A&E services, FSPs can provide extensive ITS services, which is important for BRT projects.
- Some FSPs have business segments that perform construction.

**Typical services:**

- Core A&E services (see A&E)
- Environmental
- Construction
- Funding and finance consulting
- ITS consulting
- Operations and maintenance consulting
- Security and safety consulting

**Characteristics of FSP firms in CGGC database:**

No. of Firms	Annual Sales (in millions)		No. of Employees		No. of Locations (North America)	
	Average	Median	Average	Median	Average	Median
17	\$2,629.2	\$949.6	14,672	6000	83	50



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Operation



ITS



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**Funding & Finance Consulting**

Firms in this industry specialize in public transportation funding/finance consulting or project management. They are combined into one industry because funding and finance consulting is a key service offered by project management firms.

**Industry Findings:**

- CGGC-identified firms in this space are mostly small to medium-sized firms
- The industry can be divided into the following three sub-categories:
  - firms that provide only transportation funding and finance services (e.g., Public Financial Management, Inc.)
  - firms that provide only project/program management and/or construction management services (e.g., Gannett Fleming Project Development Corp.)
  - firms that provide consulting services, such as planning, funding/finance, and project management or construction management (e.g., InfraConsult LLC).

**Typical services:**

- Federal funding consulting, especially FTA New Starts/Small Starts guidance and application preparation and management
- Finance consulting – bonds and other public finance mechanisms; alternative financing methods – public-private partnerships, value capture mechanisms
- Project/program management (see A&E)
- Construction management (see A&E)
- Planning consulting – operations planning, feasibility studies and data collection, market research, procurement
- Management consulting – workforce, operations, budget

**Characteristics of Funding & Finance firms in CGGC database:**

No. of Firms	Annual Sales (in millions)		No. of Employees		No. of Locations (North America)	
	Average	Median	Average	Median	Average	Median
52	\$678.8	\$2.8	2,144	32	11.7	3



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### Legal & Government Affairs

Firms in this industry provide public transportation legal and/or government affairs services for public transportation agencies and contractors.

#### Industry Findings:

- Firms do not explicitly promote BRT services on their websites, perhaps because the legal services needed for BRT are mostly the same as for LRT and other major mass transit projects.
- Many law firms have traditional practices in transportation, construction, and/or real estate law.
- Law firms tout experience and services in public-private partnerships.

#### Typical services:

- Transportation law
- Construction law
- Real estate law
- Public-private partnerships counsel
- Financing counsel – bonds, innovative finance mechanisms
- Legal compliance with FTA requirements and other federal laws (e.g., Buy America, NEPA)
- Contracts, including government, private, contract negotiation and oversight
- Property, including right-of-way acquisition
- Dispute resolution
- Lobbying
- Government affairs, including monitoring of transportation policy and updating and providing counsel for clients
- Campaigns for state or local transportation funding initiatives such as new dedicated taxes or assessment districts

#### Characteristics of legal & government affairs firms in CGGC database:

No. of Firms	Annual Sales (in millions)		No. of Employees		No. of Locations (North America)	
	Average	Median	Average	Median	Average	Median
31	\$65.7	\$33	594	300	7.9	7



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## Communications

The firms in this industry provide exclusively communications services, including branding and marketing, signage and maps, and/or public outreach.

### Industry Findings:

- This industry faces competition from other industries that include communications in their suite of services. Many A&E, project management, and law/government affairs firms also provide public outreach or branding and marketing services.
- Except for advertising firms, most firms are small and specialize in the public transportation market.
- A potentially growing service, especially for BRT, is a marketing niche in finding sponsors to purchase naming rights as part of a public-private partnership arrangement.

### Typical services:

- Branding and marketing
- Advertising
- Signage and maps, including way-finding, bus stop signs, maps, timetables, sign/display fabrication
- Public outreach

### Characteristics of communications firms in CGGC database:

No. of Firms	Annual Sales (in millions)		No. of Employees		No. of Locations (North America)	
	Average	Median	Average	Median	Average	Median
22	\$2.3	\$1	47	10	2	1



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## Specialty

Firms in this miscellaneous category provide ITS consulting, safety/security consulting or services, environmental services, research services, or executive search services.

### Industry Findings:

- Some A&E firms also provide ITS consulting, safety/security consulting, environmental services, and/or research services.
- Executive search and security services (e.g., security guards) are specialized services not usually offered by A&E firms.
- For research firms in the CGGC database, federal research projects represent a large portion of their work. Local agency projects may include consumer surveys/studies.

### Typical services:

- Environmental, including noise/vibration consulting
- ITS consulting
- Safety/security consulting or services – IT security consulting, guards
- Executive search
- Consumer surveys



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### Additional Planning Segment Dynamics:

**FTA Oversight Contractors.**<sup>1,2</sup> Grantees receiving FTA funding, including New Starts funding, may be assigned FTA oversight contractors—project management oversight contractors (PMOC) and financial management oversight contractors (FMOC)—to oversee the project on behalf of the FTA. These contractors make sure the projects are on track, within budget, conform to Federal requirements, and are constructed according to approved plans in an efficient and effective manner. FTA oversight contractors may offer technical advice but do not have the authority to sign off on project documents or inspect, approve, or accept construction, vehicles or equipment. FTA contractors are typically A&E firms, have been FTA-approved as a PMOC/FMOC, and are competitively selected for projects.

**Procurement Requirements.**<sup>3</sup> FTA requirements and/or state or local laws may also require agencies to contract with a certain percentage of small and medium enterprises (SMEs) and/or disadvantaged business enterprises (DBEs). Federal DBE requirements for projects receiving federal funding is at least 10% of authorized funds.



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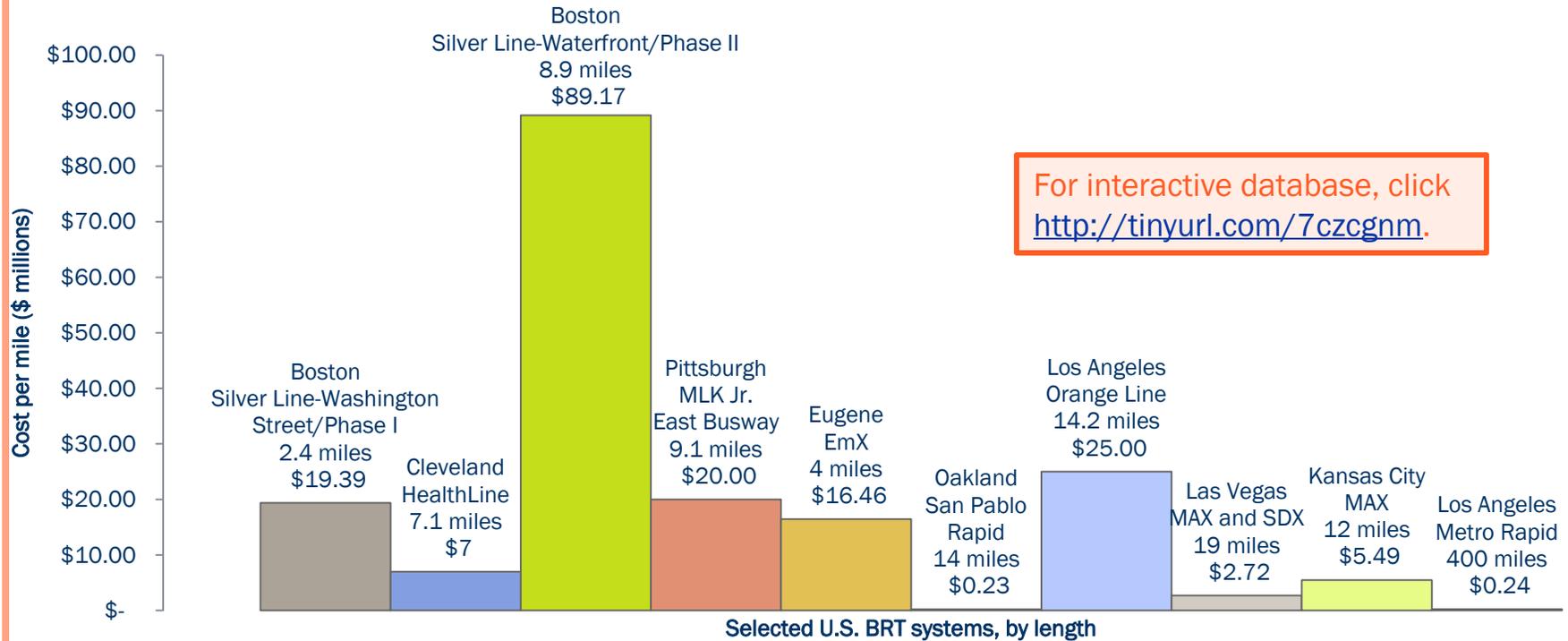
### Public Sources

To date, the bulk of funding for BRT projects has come from federal programs, with state and local sources providing a designated or negotiated match. In a few cases, cities have built BRT projects with little or no federal funding.

Federal Funding Sources <sup>4</sup>	Regional, State and Local Funding Sources <sup>5</sup>
FTA Grant & Formula Programs <ul style="list-style-type: none"> <li>• “Transit Capital Investment Program” (49 U.S.C. 5309)               <ul style="list-style-type: none"> <li>○ Fixed Guideway Modernization</li> <li>○ Bus Capital program</li> <li>○ New Starts program                   <ul style="list-style-type: none"> <li>▪ Small Starts</li> <li>▪ Very Small Starts</li> </ul> </li> </ul> </li> <li>• Urbanized Area Formula Grants program</li> </ul> The Interagency Partnership for Sustainable Communities <ul style="list-style-type: none"> <li>• Bus Livability grants</li> </ul> ARRA (Recovery Grants)           Flexible Funding <ul style="list-style-type: none"> <li>• Surface Transportation Program (STP)</li> <li>• Congestion Mitigation and Air Quality Improvement Program (CMAQ)</li> </ul>	State <ul style="list-style-type: none"> <li>• General funds</li> <li>• Taxes: sales, gas, motor vehicle/rental car</li> <li>• Vehicle registration/license/title fees</li> <li>• Other               <ul style="list-style-type: none"> <li>○ State highway funds</li> <li>○ Trust funds</li> <li>○ Lottery funds</li> <li>○ Documentary stamps</li> <li>○ Miscellaneous taxes, fees, revenues, assessments</li> </ul> </li> </ul> Local <ul style="list-style-type: none"> <li>• Local sales tax, local property tax</li> <li>• General revenues</li> <li>• Highway/road departments (maintenance funds)</li> </ul>

Federal and State Credit Programs <sup>6</sup>	Debt Instruments <sup>6</sup>
<ul style="list-style-type: none"> <li>• Transportation Infrastructure and Finance Innovation Act (TIFIA)</li> <li>• State Infrastructure Banks (SIBs)</li> </ul>	<ul style="list-style-type: none"> <li>• Capital Leasing</li> <li>• Revenue Bonds               <ul style="list-style-type: none"> <li>○ Fare Box Revenue Bonds</li> <li>○ Grant Anticipation Notes</li> </ul> </li> <li>• Debt Service Reserve (DSR)</li> <li>• Advance construction</li> </ul>

# 10 CGGC Focus Systems: Capital Costs and Funding



BRT system	Miles	Capital costs	Cost per mile	Federal funding	State and local funding
Boston Silver Line-Washington Street/Phase I	2.4	\$ 46,530,000.00	\$19,387,500.00	0%	100%
Cleveland HealthLine	7.1	\$ 197,182,000.00	\$7,000,000.00	50%	50%
Boston Silver Line-Waterfront/Phase II	8.9	\$ 624,200,000.00	\$89,171,428.57	77%	23%
Pittsburgh MLK Jr. East Busway	9.1	\$ 68,000,000.00	\$20,000,000.00	50%	50%
Eugene EmX	4.0	\$ 65,854,120.00	\$ 16,463,530.00	80%	20%
Oakland San Pablo Rapid	14.0	\$ 3,200,000.00	\$228,571.00	N/A	N/A
Los Angeles Orange Line	14.2	\$ 377,600,000.00	\$25,000,000.00	7%	93%
Las Vegas MAX and SDX	19.0	\$ 51,600,000.00	\$ 2,715,789.47	82%	18%
Kansas City MAX - Main and Troost	12.0	\$ 65,854,120.00	\$ 5,487,843.33	63%	37%
Los Angeles Metro Rapid	400.0	\$ 94,000,000.00	\$ 235,000.00	77%	23%



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## Investors

This sub-segment includes 1) municipal bond players, 2) private equity investors, and 3) sovereign wealth funds (SWFs). The analysis focuses on finance mechanisms associated with transportation infrastructure projects in general, with potential relevance for BRT.

### Investors Sub-segment Findings:

- Infrastructure funding in the United States is in crisis. The burden falls largely on state and local governments, which traditionally access municipal bond markets for funding. However, state budget problems are making bond investments less attractive and proposed policies to eliminate municipal bond tax benefits further threaten the market.<sup>7</sup>
- There is growing interest in innovative finance strategies and new funding sources, especially from investors and SWFs.<sup>8</sup>
- Public-private partnerships are important vehicles for channeling investment from investors and SWFs, but obstacles remain in the United States, especially regulatory issues.<sup>8</sup>
- Attracting U.S. investment from SWFs will require major foreign policy initiatives at the national level.<sup>7</sup>
- Investment in infrastructure currently represents a very small portion of investor investment.<sup>8</sup> BRT projects will face additional hurdles in attracting investors.

### 1) Municipal Bond Market

Bonds are a traditional financing tool for governments securing financing for public projects. Key players:<sup>9</sup>

- Bond Buyers – commercial banks, mutual funds, insurance companies, and others
- Rating Agencies – Standard & Poor's, Moody's, and Fitch are the three main bond rating agencies in the municipal market
- Insurers – buy bonds and re-sell insured bonds, which are secured against default and have lower interest rates. Major bond insurers are Municipal Bond Investors Assurance Corporation (MBIA Corporation), the Ambac Financial Group (AMBAC), the Financial Guaranty Insurance Company (FGIC), and the Financial Security Assurance Inc. (FSA) Company



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Investors

### 2) Private Equity

Interest is growing in the potential for private equity to help finance public infrastructure projects, though it is not common for transit projects at present. Investors are interested in diversifying portfolios with the long-term, stable assets associated with infrastructure.<sup>10</sup>

Page et al. characterize two types of investors: Strategic and Financial. Strategic investors are typically value chain firms (e.g., A&E, construction) who invest equity in a project for the greater purpose of supporting their industry. Financial investors are focused on direct financial returns.

### Strategic vs. Financial Investors

	Strategic	Financial
Goal	Benefits from project beyond direct financial returns	Financial returns
Players	<ul style="list-style-type: none"> <li>Construction</li> <li>A&amp;E</li> <li>Equipment suppliers (e.g., transit vehicles)</li> </ul>	<ul style="list-style-type: none"> <li>Investment banks</li> <li>Pension funds</li> <li>Private Equity Infrastructure Funds (PEIF)</li> </ul>
Financial Capability	Wide range: large firms are capable (ample funds), smaller firms are less capable (few funds)	Enormous new capacity, primarily through PEIFs; new pension fund focus

Adapted from: Page et al., 2008, p.103

### Macquarie and Goldman Sachs are largest infrastructure investors

top investors in the infrastructure asset class, 2011

Rank	Investor Name	5-Yr Capital Creation total (\$bn)
1	Macquarie Group	\$31.83
2	Goldman Sachs	\$10.72
3	Canada Pension Plan Investment Board	\$9.97
4	Ferrovial	\$9.42
5	APG Asset Management	\$7.43
6	Alinda Capital Partners	\$7.10
7	Energy Capital Partners	\$7.04
8	Brookfield Asset Management	\$6.26
9	QIC	\$6.24
10	La Caisse de dépôt et placement du Québec	\$5.92

Adapted from: ULI, 2012, p. 58



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Investors

### Sovereign Wealth Funds

- SWFs are state-owned investment funds composed of a country's reserves to be used for investment purposes.
- 56% of all SWFs currently invest in infrastructure, a 16% increase since 2011.<sup>11</sup>
- China has been particularly aggressive in investing in infrastructure investment in Africa and other parts of the world.<sup>8</sup>
- Abu Dhabi Investment Authority is one of the largest SWF infrastructure investors.<sup>11</sup>
- Because of its cash availability, SWFs can usually invest directly with concession teams, eliminating fees from financial institution intermediaries and reducing equity payouts to investors.<sup>8</sup>



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## Real Estate

This sub-segment encompasses major players in potential real estate development projects associated with BRT projects, including 1) REITs, 2) other large developers, and 3) major employers and institutions.

### Real Estate Sub-sector Findings:

- Fixed-guideway (rail) projects are often associated with an increase in economic development and real estate value, a benefit long assumed to result from a rail line's "permanent" nature. However, recent experience with BRT suggests that a fixed guideway is not necessary to create a positive effect on real estate and economic activity.<sup>12,13</sup>
- Real estate development projects such as transit-oriented development or joint development require an intensive stakeholder management process that will involve local authorities, business owners, community organizations, and citizens, in addition to the real estate players.<sup>14</sup>
- To facilitate coordination, partnerships may form among stakeholders, such as commercial property owners (White Flint Partnership in Montgomery County, MD)<sup>15</sup> or diverse community stakeholders (University Circle Inc. in Cleveland).<sup>16</sup>

### 1) Real Estate Investment Trusts (REITs)

REITs are publically traded companies that own and usually manage a portfolio of real estate property. Some REITs also finance real estate projects.<sup>17</sup> To qualify for tax benefits, a REIT must distribute at least 90% of its taxable income to its shareholders.<sup>18</sup> Major companies include: Simon Property Group, Vornado Realty Trust, ProLogis, and Equity Residential.<sup>17</sup>

### 2) Other Large Developers

Companies that own, develop, and manage properties. Large developers are involved in all phases of real estate development – from planning and construction to leasing and property management. An example is Lerner Enterprises, based in the DC metro area.<sup>19</sup> Lerner is involved in the proposed Montgomery County, MD BRT via a coalition of other developers.<sup>15</sup>

### 3) Major Employers and Institutions

Local employers and institutions, such as hospitals, universities, or museums located in or near a proposed or existing BRT corridor. The Cleveland Clinic hospital and Cleveland State University were very influential institutional players in the success of the Cleveland HealthLine BRT.<sup>14</sup>



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# Innovative Finance Mechanisms

**1) Value Capture** – “Refers to circumstances in which the provision of a public service or facilities such as public transportation increases the market value of surrounding real estate, and measures are enacted to capture some or all of that increase to defray public expense. Various mechanisms are used to capture either the current or future value created by public investment” (CTS, 2009).

- **Assessment Districts** – Dedicated taxes from newly established district expected to rise in property value are used toward transportation project costs
  - Tax Increment Financing District (TIF) – a TIF district is established for a set number of years; property taxes collected in excess of the baseline property value (due to rising property values in the district) are used to pay for the public transportation project
  - Special Assessment District – properties in the district are taxed or pay a fee in an amount that depends on the benefit the property receives from the transportation project; the taxes/fees are used to pay for the public transportation projects
- **Development** – development investment by real estate interests around the public transportation infrastructure can help fund some transportation facilities (e.g., stations) or surrounding community development
  - Joint Development – the coordinated development of a transportation facility (e.g., a transit station) and adjacent private real estate development; usually a mechanism used to help fund the transportation facility
  - Transit-Oriented Development (TOD) – “compact, mixed-use development near transit facilities and high-quality walking environments” (USDOT, 2012)
  - Air rights – development rights above or below an existing transportation facility
- **Fees**
  - Development Impact Fees (DIFs) – charges collected from the developer to help pay for new infrastructure and services associated with the new development; fees may be used for off-site services such as schools or parks
  - Exactions – similar to DIFs except they are usually contributions that can take the form of an in-kind local road or other public good on-site in the new development, rather than a formulaic determined fee that can be applied to an off-site infrastructure provision
  - Transportation Utility Fees (TUFs) – based on the notion that transportation networks can be treated like utilities, such as water and wastewater treatment, where fees are based on usage/demand (rather than property taxes); commercial and industrial properties would pay more because they usually use transportation infrastructure more than their relative tax contributions

**2) Public-Private Partnership** – arrangement between public and private sectors to acquire, build or maintain a public project (for variety of arrangements, see: <http://www.ncppp.org/howpart/ppptypes.shtml>)

**3) Naming Rights** – fees paid for the rights to name a component of the transportation project, usually the transit line or station name

**4) User/Market-Based** – mechanisms for collecting fees from drivers in a market-based approach that seeks to discourage driving and support transit; some or all the revenue would be dedicated to transit

- Tolling – fees paid to access a roadway
- Congestion pricing – charges for use of a roadway based on the level of congestion
- Emissions fees – charges based on air pollution emissions
- Vehicle miles traveled (VMT) – charges based on mileage driven



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## Examples of Innovative Finance in U.S. BRT

Innovative Finance Mechanisms	BRT Examples
<p><b>Value Capture Mechanisms</b></p> <p>Assessment Districts</p> <ul style="list-style-type: none"> <li>• Tax Increment Financing District (TIF)</li> <li>• Special Assessment District</li> </ul> <p>Development</p> <ul style="list-style-type: none"> <li>• Joint Development</li> <li>• Transit-Oriented Development (TOD)</li> <li>• Air rights</li> </ul> <p>Fees</p> <ul style="list-style-type: none"> <li>• Development Impact Fees (DIFs)</li> <li>• Exactions</li> <li>• Transportation Utility Fees (TUFs)</li> </ul>	<p><b>Chicago BRT</b> (planned) – \$7 million from new TIF district to match New Starts FTA grant<sup>14</sup></p> <p><b>Cleveland HealthLine</b> – attracted \$4.2 billion in new real estate investment along the corridor<sup>14,20</sup></p> <p><b>San Francisco Van Ness Avenue BRT</b> (planned) – Proposed financial plan includes Development Impact Fees as a local funding source, and would contribute less than 4.4% of total project funding<sup>21</sup></p>
<p><b>Public-Private Partnership (P3)</b> (Alternative Project Delivery Methods)</p>	<p><b>Las Vegas RTC</b> – RTC outsources all of the operations and maintenance for its fixed bus route services to private transit management firms.<sup>22</sup></p> <p><b>York Region, Ontario, Canada Viva BRT</b> – In North America’s first transit P3 arrangement of its kind, the transit agency partnered with the York Consortium (made up of 7 firms) to execute the design, building, operation, and maintenance of the Viva BRT<sup>23</sup></p>
<p><b>Naming Rights</b></p>	<p><b>Cleveland HealthLine</b> – sold naming rights of BRT system to the Cleveland Clinic and University Hospitals for \$250,000 annually over 25 years (\$3.25 million total); revenue will be used to help cover maintenance costs<sup>24</sup></p>
<p><b>User/Market-Based</b></p> <ul style="list-style-type: none"> <li>• Tolling</li> <li>• Congestion pricing</li> <li>• Emissions fees</li> <li>• Vehicle miles traveled (VMT)</li> </ul>	<p><b>Los Angeles Orange Line</b> funding consisted almost entirely of non-federal funding sources (93.4%), some of which came from congestion pricing revenue (by charging for use of a roadway based on the level of congestion)<sup>14,25</sup></p>

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 ITS

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## Contractors

Firms in this industry do construction of BRT infrastructure, a function also sometimes performed by large FSPs. Segment also includes involvement by legal and government affairs firms.

### Industry Findings:

- Prime contractors are typically large national or international firms.
- Prime contractors also offer construction management and/or project management services.
- Prime contractors are also usually responsible for hiring and managing subcontractors.
- Since many subcontractors are local, the CGGC database lists only *types* of subcontractors, with some sample firms. Subcontractor types include heavy construction, electrical, environmental, wrecking and excavating, landscaping, and materials suppliers.
- Contractors working on FTA projects are required to furnish three types of bonds—bid bonds, payment bonds, and performance bonds.

### Characteristics of contractors in CGGC database:

No. of Firms	Annual Sales (in millions)		No. of Employees		No. of Locations (North America)	
	Average	Median	Average	Median	Average	Median
16	\$4,595.6	\$361.5	8,040	450	7.7	1



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### Operation

Firms in this sub-segment provide transit management services for large fixed-route systems, ranging from a few services (such as fleet maintenance) to comprehensive management of bus operations. Opportunities exist for public-private partnerships with transit management companies, arrangements frequently found in Latin America. Although outsourcing of operations is not common, it is growing in the United States. Denver and San Diego partly outsource their operations, while Las Vegas has long hired contractors such as Veolia Transportation to manage its entire fixed-route services. Veolia also manages the operations of some of the biggest BRT systems in the world, such as TransMilenio in Bogotá, Colombia.<sup>26</sup>

### Fuel

Greener bus fleets that use less fuel and emit fewer emissions are a goal of many existing and planned BRT system operators because of the cost savings, environmental benefits, and green marketing opportunities.

About one-third of U.S. transit buses use an alternative source of power, with compressed natural gas (CNG) buses representing the most common type of green bus.<sup>27</sup> The United States already supports an extensive network of natural gas pipelines and refueling stations.<sup>27</sup> The CGGC database includes two major natural gas fuel suppliers for transit agencies, Clean Energy Fuels Corp. and Trillium USA.

### Maintenance

Firms in this sub-segment include those that provide ITS technology for bus fleet maintenance and monitoring, as well as firms that provide parts, refurbishment, and major repair. The greatest maintenance cost for agencies may be in the capital costs of bus maintenance facilities, which can cost millions of dollars to build and are usually treated as major construction projects on their own, separate from the BRT project. For example, construction of the Las Vegas RTC Sunset Maintenance facility alone cost \$90 million.<sup>28</sup> Typical maintenance facility features include repair bays, fueling stations, bus wash, bus parking, offices, and others.<sup>28</sup> Facilities also offer opportunities to incorporate green building features. Many firms in the Planning and Construction segments in the CGGC database also offer maintenance design/building services.

### Safety and Security

In addition to firms that provide surveillance technology (addressed in this report under ITS), the database includes one firm that provides security staff services, G4S Secure Solutions USA (formerly Wackenhut Corporation), used by the Las Vegas transit system. Some firms in the Planning segment also provide safety and security consulting services.



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### Industry Findings:

- Bus maintenance facilities represent a major capital cost in the Operation segment.
- Several opportunities exist for firms to provide services in maintenance and operations, ranging from a low to high degree of involvement. On the low end, public transit agencies may contract out some discrete services, such as operations or maintenance. On the high end, as exemplified by the Las Vegas RTC, all fixed-route operations and maintenance are managed by private contractors.

### Operation Segment Characteristics in CGGC database:

Operation Sub-segment	No. of Firms	Annual Sales (in millions)		No. of Employees		No. of Locations (North America)
		Average	Median	Average	Median	Average
Operation	7	\$257.9	\$159.0	7,037	2,500	1.1
Fuels	3	\$99.0	\$2.1	357	28	4.0
Maintenance (parts, refurbishment, and repair only)	6	\$9.9	\$5.8	91	69	2.7
Safety and Security (security staff services only)	1	\$1.4	n/a	50,000	n/a	1.0



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### Systems

**Automatic Vehicle Location (AVL)**, used in combination with **Computer Aided Dispatch (CAD)**, is the system used to manage communications with drivers. AVL/CAD supports incident management, improves operational control and on-time performance, and enhances safety. AVL used with predictive systems also enables real-time passenger information. **Communications technologies** such as radio networks, wireless, cellular, and other emerging technologies provide the infrastructure to support all ITS for BRT. **Automated Passenger Counters (APC)** are used for performance monitoring and service planning.<sup>29,30</sup>

### Signal Priority

**Transit Signal Priority (TSP)** technology enables automatic changes to the traffic signal control system at an intersection so that it provides priority to transit vehicles. As a BRT vehicle approaches the intersection, the TSP system triggers the traffic controller to modify the signal timing, by extending the green phase or shortening the red phase.<sup>29,30</sup>

### Passenger Communication

This group of ITS technologies provides real-time bus and transit information for passengers. Key BRT technologies include: real-time arrival signs, next-stop signs on buses, and mobile apps and website tools.<sup>29,30</sup> Mobile technologies in transit are advancing and are expected to become more important in the future.<sup>31</sup>

### Fare Collection

These firms supply ticket vending machines (TVMs) or fare collection/card reader machines and devices, as well as fare media for BRT-caliber systems. The key considerations are that equipment must be sufficiently rugged to be placed in stations that are often exposed to weather, and devices exist to support Proof of Payment enforcement (where required).

Smart card technology is advancing rapidly and could dramatically enhance transit fare collection in the future by improving integration of fare collection systems and offering flexible and fast payment methods.<sup>32</sup>

### Maintenance

Many agencies use technology and software for fleet maintenance and monitoring as part of their operations management.

### Safety and Security

1) **Surveillance**, especially mobile closed-circuit television (CCTV) cameras on BRT vehicles.<sup>29</sup>

2) **Vehicle Assist and Automation (VAA)** technologies, currently in an experimental phase, for lane guidance and precision docking, to help vehicles line up doors at stations, prevent accidents in narrow spaces, and automate some tasks.<sup>33</sup>

3) **Collision avoidance**, with vehicle cameras and other devices that improve visibility behind the vehicle and detect close objects to help the driver avoid collisions, or to monitor driver performance.<sup>29</sup> Pedestrian versions, mostly audio warnings of turning buses, are growing in number.

Technology Subcategories	Lead Firms
<b>System Operations</b> <ul style="list-style-type: none"> <li>• Automatic Vehicle Location (AVL)</li> <li>• Computer Aided Dispatch (CAD)</li> <li>• Communications technologies</li> <li>• Automated Passenger Counters (APC)</li> </ul>	ACS (A Xerox company), Clever Devices, INIT, Trapeze ITS
<b>Transit Signal Priority</b>	Opticom, by Global Traffic Technologies; EMTRAC Systems  Los Angeles County Metro uses its own proprietary TSP technology, which is deployed on the extensive Metro Rapid network and the Metro Orange Line
<b>Passenger Communication</b> <ul style="list-style-type: none"> <li>• Real-time arrival signs</li> <li>• Next-stop signs on buses</li> <li>• Mobile applications and website tools</li> </ul>	NextBus is a popular supplier of real-time arrival signs. The company is also making headway in other passenger communication tools, such as apps
<b>Fare Collection</b> <ul style="list-style-type: none"> <li>• Ticket Vending Machines (TVMs), readers, and validators</li> <li>• Fare media</li> </ul>	ACS (Xerox), Cubic Transportation Systems, Inc., GFI Genfare, Scheidt & Bachmann
<b>Maintenance</b> <ul style="list-style-type: none"> <li>• Fleet maintenance/monitoring technology and software</li> </ul>	Fleetwatch, fleet maintenance software by S&A Systems, Inc.; Clever Devices
<b>Safety &amp; Security</b> <ul style="list-style-type: none"> <li>• Surveillance - CCTV</li> <li>• Vehicle Assist and Automation (VAA) - lane guidance, precision docking technologies</li> <li>• Collision avoidance</li> </ul>	AngelTrax, Axis Communications, and Seon for surveillance firms

### ITS Industry Findings:

- The leaders in ITS for BRT in the U.S. market are ACS (Xerox), Clever Devices, INIT, Siemens (now part of Trapeze ITS), and Trapeze ITS. These lead firms provide comprehensive ITS products and services, from AVL to TSP to fare collection. Competition from other firms is growing.<sup>34</sup>
- As the array of ITS technologies expands and supplier information becomes more complex, the need for ITS consulting increases. Eleven firms in the CGGC database now specialize in ITS consulting. A number of architect/engineer, full-service professional, and project management firms also provide ITS consulting services.
- AVL is already a widely utilized ITS technology. In 2006, nearly 70% of fixed-route transit vehicles (including non-BRT) in the largest agencies in the United States use AVL systems.<sup>29</sup>
- All 10 CGGC-focus BRT systems use at least some TSP technology.
- The ITS industry is growing. In the United States, much activity is focused on mobile passenger communication, fare payment, and vehicle assist and automation technologies, which may greatly enhance BRT systems in the future. According to a recent report by Pike Research, a clean technology market research firm, investment in ITS is growing despite government funding cutbacks. This can be attributed to the much-improved communications technologies needed to support ITS, and also because governments are recognizing the benefits of implementing ITS technologies, such as improved traffic mobility, fuel and emissions reductions, and passenger customer service.<sup>35</sup>

### ITS Segment Characteristics in CGGC database:

ITS Sub-segment	No. of Firms	Annual Sales (in millions)		No. of Employees		No. of Locations (North America)
		Average	Median	Average	Median	Average
System Operations	38	\$1,470.7	\$12.6	6,689	97	11.6
Signal Priority	4	\$11.3	\$5.9	84	42	8.0
Passenger Communication	11	\$59.2	\$13.5	357	164	1.5
Fare Collection	11	\$220.0	\$65.0	871	422	2.0
Maintenance	12	\$468.9	\$78.0	1,701	444	2.0
Safety/Security*	24	\$86.5	\$17.2	981	115	3.6

\* Excludes outliers



Planning



Finance



Construction



Operation



ITS



Manufacture

### BRT Vehicles

Firms in this industry include U.S. and international original equipment manufacturers (OEMs) that manufacture buses for U.S. BRT systems.

#### Industry findings:

- The leading U.S. transit bus OEMs are the leading manufacturers of BRT buses in the United States.
- In the United States, transit agencies using Federal funding for purchasing buses must adhere to stringent "Buy America" regulations.
- Bus OEMs may need to coordinate closely with agencies and design and branding consultants on particular BRT specifications.
- While there is no particular "BRT" bus, widely used industry bus procurement guidelines include optional BRT features.<sup>36</sup> Features that provide for rapid, high-capacity boarding—articulated buses, larger/multiple doors, and level boarding—are typical BRT vehicle characteristics promoted by bus OEMs. Other BRT bus characteristics include styling, low-noise, and environmental features (alternative fuels, electric drive technologies).<sup>37</sup>

#### Characteristics of BRT Vehicle firms in CGGC database:

No. of Firms	Annual Sales (in millions)		No. of Employees		No. of Locations (North America)
	Average	Median	Average	Median	Average
14	\$137.2	\$48.5	1,190	666	1.4

**Procurement:** Bus OEMs usually bid for contracts in a traditional RFP process

 Planning

 Finance

 Construction

 Operation

 ITS

 **Manufacture**

## Stations

Firms in this industry manufacture and/or fabricate shelters and street furniture, such as benches and station lighting.

### Industry findings:

- Three types of firms provide shelters and/or furniture:
  - Manufacture and/or supply only (e.g., Columbia Equipment Company, Inc.)
  - Also design specialty shelters (e.g., Tolar Manufacturing Company Inc.)
  - Operate in marketing business model (e.g., Clear Channel Outdoor Holdings)
- Some firms supply “BRT” shelters.
- Many firms offer solar lighting.
- Some firms offer comprehensive services for an entire station– including fare collection machines, signs, and other (e.g., Trueform LLC).
- Firms may need to coordinate with design and branding consultants.

### Characteristics of Shelters/Station firms in CGGC database\*:

No. of Firms	Annual Sales (in millions)		No. of Employees		No. of Locations (North America)
	Average	Median	Average	Median	Average
21	\$22.0	\$8.1	152	45	3.5

\*Excludes outliers

**Procurement:** Firms that supply stations and furniture usually bid for contracts in a traditional RFP process



Planning



Finance



Construction



Operation



ITS



Manufacture

### Bicycle Parking/Sharing

The firms in this industry manufacture and/or fabricate bicycle parking or shelters, or provide bicycle sharing services.

#### Industry findings:

- Bicycle parking products include bus racks, station racks, and lockers.
- Byk-Rak LLC and Sportworks Northwest Inc. dominate the market for bike racks on transit buses.
- Bicycle sharing services are becoming more popular in cities, but they are not necessarily developed as part of a BRT project.
- Alta Bicycle Share recently secured contracts in major U.S. cities including Chicago and San Francisco because of its marketing business model, in which the bike share program is largely paid for by corporate sponsorships.
- One firm, BikeStation, builds and operates membership-based bike transit facilities where bike commuters can park and use showers.
- Large and sophisticated bicycle parking facilities such as those found at terminal TransMilenio stations in Bogotá, Columbia are not yet seen in the United States.

#### Characteristics: of Bicycle Parking/Sharing firms in CGGC database:

No. of Firms	Annual Sales (in millions)		No. of Employees		No. of Locations (North America)
	Average	Median	Average	Median	Average
11	\$3.2	\$0.96	27	11	1.1

**Procurement:** Firms that supply bike parking usually bid for contracts in a traditional RFP process. Bicycle sharing programs thus far are managed as city projects, not as a part of a BRT project.

# List of Firms, by Segment (Not Exhaustive)

PLANNING					
Abt SRBI, Inc.	Clear View Strategies, LLC	HDR, Inc.	LKG-CMC, Inc.	Parsons Brinckerhoff	SYSTRA USA (SYSTRA)
Acacia Financial Group, Inc.	Clough Harbour & Associates LLP (CHA)	High Street Consulting Group	Lockwood, Andrews & Newman, Inc.	Parsons Transportation Group	T.Y. Lin International
Acumen Building Enterprise, Inc.	Connetics Transportation Group, Inc.	Hill International, Inc.	Louis Berger Group, Inc.	Periscope	Taliaferro & Browne, Inc.
Adams Consulting	Cooper Carry	HNTB Corporation	LS Gallegos & Associates Inc.	PGH Wong Engineering, Inc.	Thomas Group, Inc.
AECOM	Creighton Manning Engineer, LLP	Hogan Lovells US LLP	LSA Design, Inc.	PIVOT Architecture	Thompson Coburn LLP
Akerman Senterfitt Wickwire Gavin	CRL Associates, Inc.	HOK Group, Inc.	LSC Transportation Consultants, Inc.	Professional Service Industries, Inc. (PSI)	TKDA
AllTransit Consultants, LLC	David Evans and Associates, Inc.	Holland & Knight LLP	LTK Engineering Services	Public Financial Management, Inc. (PFM)	Traffic Group, Inc.
Alta Planning + Design	Deeplocal, Inc.	Huitt-Zollars Inc.	Macro Corporation	Public Resources Advisory Group, Inc.	Transit Capital Support Services, LLC
Andrews Kurth LLP	Delcan Corporation	IBI Group	Maguire Group	Pulsar Advertising	Transit Marketing, LLC
Anil Verma Associates, Inc.	Delon Hampton & Associates	ICF International, Inc.	Maintenance Design Group, LLC	R&R Partners Inc.	Transit Police & Security Consulting
ARCADIS U.S. Inc.	Delta Services Group, Inc.	Ilium Associates, Inc.	MAJIC Consulting Group	Raul V. Bravo + Associates, Inc.	Transmetrics, Inc.
Arthur N. Gaudet & Associates, Inc.	DHK Architects	InfraConsult LLC	Manatt, Phelps & Phillips, LLP	RCC Consultants, Inc.	Transportation Management & Design
Arup	Di Domenico + Partners LLP	Infrastructure Management Group	Mass. Electric Construction Company	Redmond Consulting, Inc.	Transportation Resource Associates, Inc.
Atkins	Dikita Engineering	Interactive Elements Incorporated	McCloud Transportation & Associates	Reed Smith LLP	TranSystems Corporation
Auriga Corporation	Dikita Management Services	Jacobs Engineering Group Inc.	McCormick Rankin Corporation	Reichman Frankle Inc.	TRC Companies, Inc.
AZTEC Engineering Inc.	DuPont Sustainable Solutions (DSS)	Jakes Associates, Inc. (JAI)	McCormick Taylor	Reno & Cavanaugh PLLC	Urban Engineers, Inc.
Ballard Spahr LLP	Eckert Seamans Cherin & Mellott, LLC	Jeffrey A. Parker & Associates, Inc.	McDonough Associates, Inc.	Resource International, Inc.	URS Corporation
BBP & Associates, LLC	Edwards Wildman Palmer LLP	Jones Lang LaSalle	Mercator Advisors LLC	RNL Design	Van Scoyoc Associates, Inc.
Bechtel Enterprises Holdings, Inc.	Fleming Environmental, Inc.	Jones Worley Communications	Michael Baker Corporation	RNR Consulting (Rahim Inc.)	Vanasse Hangen Brustlin, Inc.
Benesch, Friedlander, Coplan & Aronoff	Frances Kernodle Associates	Jordan & Associates, Inc.	MIG, Inc.	RS&H	VIA Architecture
Best Best & Krieger, LLP	G4S Secure Solutions (acquired Wackenhut Corp.)	K&J Safety and Security Consulting Services, Inc.	Mission Group	Sasaki Associates, Inc.	Visual Marking Systems, Inc.
Blank Rome Government Relations LLC	Gaddam & Associates, Engineers	K&L Gates LLP	MMM Group Limited	Scully Capital	W.S. Sign Design Corp.
Bookhardt & O'Toole	Gannett Fleming Project Dev't Corp.	Kaplan Kirsch & Rockwell LLP	Moore & Associates, Inc.	Seifert Graphics, Inc.	Watt, Tieder, Hoffar & Fitzgerald, LLP
Booz Allen Hamilton Inc.	Gannett Fleming, Inc.	Keville Enterprises, Inc.	Nelson/Nygaard Consulting Associates	Sharon Greene + Associates	WENDEL Companies
Burns & McDonnell, Inc.	Generator Group, LLC	KFH Group, Inc.	Newlands & Company, Inc. (NC3D)	Smartmaps Inc.	Westat, Inc.
Burns Group	Genetec Inc.	Kimley-Horn and Associates, Inc.	Nixon Peabody LLP	Solis Group	Whitman, Reardon and Associates, LLP
C2 Group, LLC	Gensler	KKO and Associates, LLC	nMomentum Corporation	SRF Consulting Group, Inc.	Willdan Group, Inc.
Cambridge Systematics, Inc.	Gilbert Tweed International	KLD Associates, Inc.	Noble Erickson, Inc.	Stanley Consultants, Inc.	Williams & Jensen, PLLC
CAPtech, Inc.	GJB Consulting LLC	KPMG LLP	Nossaman LLP	Stantec Inc.	Willoughby Design, Inc.
Carmen Group Inc.	Goodman Corporation	Krauthamer & Associates, Inc.	Olsson Associates, Inc.	Steer Davies Gleave North America Inc.	ZGF Architects LLP
CDM Smith Inc. (acq. Wilbur Smith)	H.W. Lochner, Inc.	Kutak Rock LLP	Otak, Inc.	Steve Greene & Associates, PLLC	
CH2M Hill	Hanson Bridgett LLP	Lathrop & Gage LLP	PACO Group, Inc.	Stone & Youngberg	
Charlier Associates, Inc.	Hatch Mott MacDonald	Lea+Elliott, Inc.	Paragon Project Resources, Inc.	STV Inc.	
CHK America	Hawkins Delafield & Wood LLP	Let's Bus It Publications Inc.	Parametrix, Inc.	Superlative Group Inc.	

Finance	Operation	ITS				Manufacturing	
C.P. Braman & Co., Inc.	ABC Companies	247 Security Inc.	EMTRAC Systems	Luminator Technology Group, LLC	Strategic Mapping, Inc.	Acme Sign, Inc.	Gillig LLC
Goldman Sachs	Alternate Concepts, Inc. (ACI)	ACS (A Xerox Company)	Enghouse Transportation	Mackenzie Laboratories, Inc.	Sunrise Systems, Inc.	Alta Bicycle Share	Handi-Hut, Inc.
Hunt Companies	BRC Group (Big Rig Collision)	ADT Security Services, Inc.	Esri	Magnetic Ticket & Label Corp.	Syncromatics Corporation	American Bicycle Security, Co.	Icon Shelter Systems Inc.
JPMorgan Chase	Clean Energy Fuels Corp.	Aimola Communications Solutions, LLC	Eurotech, Inc.	March Networks	Tait Radio Communications	Austin Mohawk Inc.	Irisbus Iveco
Lerner Enterprises	Complete Coach Works	AngelTrax Bus Video	FAAC Inc.	MEI, Inc.	Teldat Group	B-cycle, LLC	Lacor/Streetscape
Meridiam Infrastructure	First Transit, Inc.	Apollo Video Technology	Fare Logistics	Mentor Engineering, Inc.	Telvent USA, Inc.	BikeLid, LLC	Landscape Forms
Northland Research Corporation	Keolis Transit America, Inc.	ASA Electronics Corporation	Fortress Systems International, Inc.	Mix Telematics	TransTrack Systems, Inc.	BikeStation	LNI Custom Manufacturing, Inc.
O.R. Colan Associates	McDonald Transit Associates, Inc.	AssetWorks (FleetFocus)	Gatekeeper Systems, Inc.	Motorola Solutions, Inc.	Trapeze ITS USA, LLC	Brasco International, Inc.	Millennium Transit Services LLC
Simon Property Group, Inc.	Midwest Bus Corp.	Avail Technologies, Inc.	Gemalto	NextBus	TwinVision na, Inc.	Byk-Rak LLC	New Flyer Industries Inc.
Surety Title Agency, Inc.	Mobility Transit Services, LLC	Avego	GFI Genfare	Nextiva Transit	Urban Transportation Associates, Inc.	Cemusa	North American Bus Industries, Inc. (NABI)
<b>Construction</b>	Mohawk Mfg. & Supply Co.	Axion Technologies Ltd.	GIRO Inc.	Novax Industries Corporation	VECOM USA, LLC	Central Denver Ironworks, Inc.	Nova Bus, Inc.
Ames Construction, Inc.	MV Transportation, Inc.	Axis Communications, Inc.	Global Traffic Technologies, LLC (Opticom)	Panasonic Security Systems	VeriFone Systems, Inc.	Clear Channel Outdoor Holdings	Orion International*
Anthony Allega Cement Contractor, Inc.	POMA Automated Fueling, Inc.	Cassidian Communications, Inc.	Hanover Displays Limited	Penta Corporation	Vigil Systems	Columbia Equipment Company, Inc.	PBSC Urban Solutions (BIXI bike system)
Bechtel Infrastructure Corporation	Signature Transportation Parts & Service Inc.	Chevin Fleet Solutions (FleetWave)	Harris Corporation	Radio Engineering Industries, Inc. (BUS-WATCH)	Vix Technology	Creative Pipe, Inc.	Proterra, Inc.
Comet Electric Inc.	Trillium USA	CIBER, Inc.	HBE Viscom Products	Radio Frequency Systems	Webtech Wireless Inc. (Quadrant)	CycleSafe, Inc.	Saris Cycle Group
Fluor Corporation	Veolia Transportation, Inc.	Clever Devices Ltd.	Honeywell Video Systems	RouteMatch Software, Inc.	Zepco Sales & Services, Inc.	Daytech Limited	Sol, Inc.
Granite Construction		Computer Sciences Corporation	IBM	RSM Services Corporation	Zonar Systems	Dero Bike Rack Company	Sportworks Northwest Inc.
Griffith Company		Cubic Transportation Systems	In Motion Technology, Inc.	S & A Systems, Inc. (FLEETWATCH)		DesignLine Corporation	Tolar Manufacturing Company Inc.
J.F. White Contracting Co.		Daktronics, Inc.	INFODEV EDI Inc.	Safety Vision, L.P.		Dimensional Innovations	Trueform LLC
Jance & Company LLC		Data Display USA, Inc.	INIT Innovations in Transportation, Inc.	Schedule Masters, Inc.		Duo-Gard Industries, Inc.	ValleyCrest
Jay Cashman, Inc.		Dedicated Micros, Inc.	Innovative Electronic Designs, Inc.	Scheidt & Bachmann		Dura Bike Locker	Van Hool
Kiewit Corporation		Digi International	Intec Video Systems, Inc.	SDI Enterprises		Ebus, Inc.	Wrightbus
Perk Company, Inc.		Digital Recorders, Inc.	Intelect Corporation	Seon Design, Inc.		EIDorado National - California	YESCO, LLC
Stacy and Witbeck, Inc.		DILAX Systems Inc.	Interfleet, Inc.	Siemens Mobility		Enseicom Inc.	
Stone & Webster, Inc.		DriveCam, Inc.	InterMotive Vehicle Controls	Smart Systems Innovations, LLC		Fisher Coachworks, LLC	
Terrace Construction Company, Inc.		Echovision Division of Armatron	Iteris, Inc.	SmartDrive Systems, Inc.		Forms+Surfaces	
Tutor Perini Corporation		Electronic Data Magnetics, Inc.	LECIIP Holdings Corporation	StarTran Software LLC		Foton America Bus Co., Inc.	

\*In 2012, Orion announced it will no longer make transit buses

# Vendors Used in 10 CGGC Focus Systems

(Not Exhaustive)

Value Chain Segment	Firm Name	Boston MBTA	Cleveland GCRTA	Eugene LTD	Kansas City KCATA	Las Vegas RTC	Los Angeles Metro	Oakland AC Transit	Pittsburgh Port Authority
PLANNING	AECOM		•						
	Anil Verma Associates, Inc.						•		
	Benesch, Friedlander, Coplan & Aronoff LLP		•						
	Booz Allen Hamilton Inc.				•		•		
	Cambridge Systematics, Inc.						•	•	
	CDM Smith Inc. (acquired Wilbur Smith Associates)		•						•
	Connetics Transportation Group, Inc.						•		
	CRL Associates, Inc.						•		
	G4S Secure Solutions (acquired Wackenhut Corp.)						•		
	Gaddam & Associates, Engineers			•					
	Gannett Fleming Project Development Corp. (GFPDC)						•	•	
	Gannett Fleming, Inc.						•	•	
	Hanson Bridgett LLP							•	
	HNTB Corporation				•				
	IBI Group	•					•		
	ICF International, Inc.						•		
	Jacobs Engineering Group Inc.						•		
	K&J Safety and Security Consulting Services, Inc.			•					
	Keville Enterprises, Inc.	•							
	Kimley-Horn and Associates, Inc.						•	•	
	Lathrop & Gage LLP					•			
	Louis Berger Group, Inc.						•		
	LS Gallegos & Associates Inc.			•					
	LTK Engineering Services						•		
	Maguire Group								•
	Maintenance Design Group, LLC						•		
Manatt, Phelps & Phillips, LLP						•			
McCormick Rankin Corporation					•			•	

Value Chain Segment	Firm Name	Boston MBTA	Cleveland GCRTA	Eugene LTD	Kansas City KCATA	Las Vegas RTC	Los Angeles Metro	Oakland AC Transit	Pittsburgh Port Authority
PLANNING	Michael Baker Corporation								•
	Nelson/Nygaard Consulting Associates								•
	Newlands & Company, Inc. (NC3D)			•				•	
	Olsson Associates, Inc.				•				
	Parametrix, Inc.			•					
	Parsons Brinckerhoff	•		•	•	•	•		•
	Parsons Transportation Group							•	
	PIVOT Architecture			•					
	Professional Service Industries, Inc. (PSI)		•						
	Pulsar Advertising							•	
	Resource International, Inc.		•						
	Sasaki Associates, Inc.		•						
	Stanley Consultants, Inc.					•			
	STV Inc.						•		
	Superlative Group Inc.		•						
	SYSTRA USA (SYSTRA)	•							
	T.Y. Lin International							•	
	Taliaferro & Browne, Inc.					•			
	Thompson Coburn LLP						•		
	Transportation Management & Design, Inc. (TMD)							•	
TranSystems Corporation	•				•				
URS Corporation	•	•							
Vanasse Hangen Brustlin, Inc.	•								
Visual Marking Systems, Inc.			•						
Willdan Group, Inc.							•		
Willoughby Design, Inc.					•				

Value Chain Segment	Firm Name	Boston MBTA	Cleveland GCRTA	Eugene LTD	Kansas City KCATA	Las Vegas RTC	Los Angeles Metro	Oakland AC Transit	Pittsburgh Port Authority
FINANCE	C.P. Braman & Co., Inc.		•						
	Northland Research Corporation		•						
	O.R. Colan Associates		•						
	Surety Title Agency, Inc.		•						
CONSTRUCTION	Anthony Allega Cement Contractor, Inc.		•						
	J.F. White Contracting Co.	•							
	Jance & Company LLC		•						
	Jay Cashman, Inc.	•							
	Kiewit Corporation	•							
	Perk Company, Inc.		•						
	Stone & Webster, Inc.	•							
	Terrace Construction Company, Inc.		•						
Tutor Perini Corporation	•								
OPERATIONS	MV Transportation, Inc.						•		
	Trillium USA						•		
	Veolia Transportation, Inc.					•	•		
ITS	ACS (A Xerox Company)						•		
	Cubic Transportation Systems						•		
	DriveCam, Inc.						•		
	Gemalto	•							
	GFI Genfare				•	•	•		
	GIRO Inc.				•				
	Global Traffic Technologies, LLC (Opticom)				•	•			
	Iteris, Inc.						•		
	Luminator Technology Group, LLC				•		•		
	March Networks					•			
	NextBus						•	•	
	S & A Systems, Inc. (FLEETWATCH)				•		•		
	Scheidt & Bachmann	•							
	Siemens Mobility		•			•	•		
	SmartDrive Systems, Inc.						•		
	Trapeze ITS USA, LLC				•				
Urban Transportation Associates, Inc.				•					
Vigil Systems						•			

Value Chain Segment	Firm Name	Boston MBTA	Cleveland GCRTA	Eugene LTD	Kansas City KCATA	Las Vegas RTC	Los Angeles Metro	Oakland AC Transit	Pittsburgh Port Authority
<b>MANUFACTURING</b>	Acme Sign, Inc.				•				
	Brasco International, Inc.	•							
	Byk-Rak LLC						•		
	Central Denver Ironworks, Inc.		•						
	Clear Channel Outdoor Holdings						•	•	
	Dero Bike Rack Company	•	•						
	Dimensional Innovations				•				
	Dura Bike Locker						•		
	Forms+Surfaces					•			
	Gillig LLC				•				•
	Icon Shelter Systems Inc.				•				
	Irisbus Iveco					•			
	Landscape Forms				•				
	LNI Custom Manufacturing, Inc.				•				
	New Flyer Industries Inc.		•	•				•	
	North American Bus Industries, Inc. (NABI)							•	•
	Sportworks Northwest Inc.							•	•
	Tolar Manufacturing Company Inc.							•	
	Trueform LLC						•		
	ValleyCrest							•	
Van Hool								•	
Wrightbus						•			
YESCO, LLC						•			

# Section IV.

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I. Executive Summary

II. Creating High-Quality BRT in the United States

III. BRT Value Chain

**IV. Potential for a BRT Business Constituency**

**Working Meeting at Duke University**

**10 Key Takeaways on Building a BRT Business Constituency**

V. Conclusion

VI. Appendix

# Working meeting at Duke University

## Bus Rapid Transit in the United States



March 8, 2012

### Building a Business Constituency

Proceedings of a working meeting convened by the  
Center on Globalization, Governance & Competitiveness  
with support from The Rockefeller Foundation

Duke | CENTER on GLOBALIZATION,  
GOVERNANCE & COMPETITIVENESS  
at the Social Science Research Institute

35 business and thought leaders met to discuss the potential of building a BRT business constituency



Proceedings available at {provide link}

# 10 Key Takeaways on Building a BRT Business Constituency

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1. BRT is a growing market in the United States and across the globe, with a total network length likely to double by 2020 (Trigg, 2012).
  2. Disagreement remains about what is, and what is not, BRT. Views differ regarding whether the BRT definition established by the FTA needs to be modified, and whether a BRT standard could help or hurt the advancement of BRT.
  3. It is important to avoid pitting public transit modes against each other when promoting BRT, without making damaging or unfair comparisons with light rail or other alternatives.
  4. Although the BRT value chain includes a full range of BRT-relevant firms, it is essentially a public transit value chain, with emphasis on firms directly relevant to BRT.
  5. BRT business leaders can benefit from the experience of fast-growing clean-tech industries. For instance, the U.S. wind power industry started with a marginalized technology but quickly transformed into a fast-growing industry with one voice.
  6. Ongoing cuts in federal funding highlight the need to identify innovative finance mechanisms and to recognize the associated private sector players that drive them.
  7. If a business constituency were to organize in the interest of advancing BRT, it could start by establishing a clear definition of BRT that recognizes the diverse transit needs of communities.
  8. A BRT business constituency could support important public policies at all levels—federal, state and local. Priorities include the need to eliminate mode bias in legislation; create tax incentives; create infrastructure banks; and pass enabling legislation for PPPs.
  9. Business leaders expressed interest in forming an assertive BRT constituency of some kind, although the future home for such an endeavor was not identified.
  10. Participants named many steps they are willing to take—in networking, research, and advocacy—to advance BRT.
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# Section VI.

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I. Executive Summary

II. Creating High-Quality BRT in the United States

III. BRT Value Chain

IV. Potential for a BRT Business Constituency

**V. Conclusion**

The BRT Value Chain

Main Challenges

Recommendations

VI. Appendix

# The BRT Value Chain

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This value chain study maps out the ecosystem of firms that provide services, vehicles, and technology for bus rapid transit systems in the United States. The firm-by-firm analysis is layered upon a 10-feature framework to emphasize the most important aspects of high-quality BRT, as identified by ITDP from experience with the world's most high-performing BRT systems.

- The U.S. BRT value chain is well developed, with a large number of experienced firms, many of which are global leaders. Given these strong capabilities, along with cities' rapidly growing interest in BRT, the future of the BRT "industry" should be bright.
- The BRT value chain is essentially a transit value chain—especially in the Planning, Construction, Manufacture and Operation segments. These firms provide many of the same services and products for BRT as for other public transit projects.
- The ITS segment is what makes this value chain more uniquely BRT. ITS technologies can dramatically enhance and distinguish the BRT experience for a public not yet familiar with this transit mode. The fast-growing ITS segment is competitive and continues to attract investment even in the economic downturn. It is also robust enough to support its own industry association, ITS America.
- The more fully featured a BRT system, the more resources are invested in the Planning and Construction segments in order to develop a thoughtful design, build the infrastructure, and secure the financial, legal, and other supporting services necessary to realize the project.

# Main Challenges

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## 1) Available funding may decrease in future years as the role of federal funding remains uncertain.

As public funding sources threaten to diminish, it will become increasingly important to find new funding sources and alternative financing mechanisms. This study identifies private investors and real estate interests as two potentially important finance players.

- Private investor involvement in transportation infrastructure in the United States has thus far largely been limited to highway projects that can generate a profitable revenue stream (such as toll roads). Similarly, design-build project delivery, while increasingly common in other infrastructure projects, are still rarely used in transit. There is still much to be learned about how private investors and alternative project delivery methods can be used for transit. One barrier is investors' hesitation to confront the complexities of state and local transportation planning and widely varying regulations governing public-private partnerships.
- Real estate interests, including REITs and other large developers, have long assumed that public transit projects require the “permanence” of a rail system to encourage economic development. Experts consider resolving the “permanence” issue especially important to attract these players to BRT.

## 2) Many public policy makers and the general public are surprisingly unaware of BRT and its benefits.

- BRT faces a considerable public awareness gap, especially in distinguishing it from regular bus service.
- Inadequate and inconsistent data collection for existing BRT makes it difficult for communities to make fully informed decisions when designing new BRT systems.

# Recommendations

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Financing	Awareness & Information
<ul style="list-style-type: none"><li>• Conduct further research on innovative finance mechanisms for transit in general, and BRT in particular</li><li>• Identify potential finance players and their potential role in the BRT value chain</li><li>• Conduct further research on the effects of existing BRT projects on property values and economic development</li><li>• Educate institutional investors and sovereign wealth funds about public transit projects for potential investment</li><li>• Study public-private partnership experience outside the United States for potential models</li><li>• Support federal policies to facilitate and provide incentives for private investment in public transit</li></ul>	<ul style="list-style-type: none"><li>• Showcase successful BRT systems to help elected officials, the public, and investors understand the potential of BRT and Transit-Oriented Development</li><li>• Organize industry lobbying for funding and financing and BRT. Although industry players lack consensus on whether a single industry voice for BRT is needed, there is general agreement on the need to better coordinate BRT players within already established industry organizations such as APTA</li><li>• Develop a standardized reporting system for documenting BRT system characteristics, performance, and costs</li><li>• Avoid promoting BRT by disparaging light rail or other transit modes; experience in other emerging value chains—for instance, renewable energy—suggests that negative comparisons with a second, related industry can backfire, damaging both industries</li></ul>

# Section VI.

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I. Executive Summary

II. Creating High-Quality BRT in the United States

III. BRT Value Chain

IV. Potential for a BRT Business Constituency

V. Conclusion

**VI. Appendix**

**Method**

**Interviews**

**References**

# Method

The CGGC BRT database includes 1) firm-level data on 390 firms across the value chain and 2) vendor data and system characteristics on a focus sample of 10 BRT systems in the United States.

We reviewed more than 1,000 firms collected from the buyer guides prepared by APTA, the leading industry association; Metro Magazine, a leading industry publication; and the Community Transportation Association of America (CTAA), representing organizations and individuals that support community transportation. To fill in gaps in construction and financial firms, which are typically not included in these sources, we relied on internet research and expert interviews. To ensure that the database captured the lead firms with documented experience in BRT, we surveyed a select group of transit agencies for their BRT vendors.

## Firms in the CGGC database

- BRT-relevant firms in six value chain segments and 21 sub-segments. In the *Manufacturing* and *ITS* segments, only firms at the product or OEM level are included.
- Firms that 1) have documented BRT experience, 2) mention BRT explicitly on their website, or 3) have public transit bus or light rail experience, and/or provide products or services appropriate for a BRT-scale system (as opposed to rural and small transit systems)
- Additional firms identified by industry contacts, transit agencies, and other experts

## Industry Interviews, Discussions and Survey

- Interviews with lead firms in each value chain segment
- Participant discussions in a working meeting that convened 35 business and thought leaders, held at Duke University on March 8, 2012 (proceedings available at: [http://cggc.duke.edu/pdfs/CGGC\\_BRT\\_Meeting\\_Summary\\_March2012.pdf](http://cggc.duke.edu/pdfs/CGGC_BRT_Meeting_Summary_March2012.pdf))
- Survey of selected U.S. transit agencies with BRT systems currently operating or planned

## Industry Publications

- APTA Buyers Guide
- Metro Magazine Fact Book 2012
- 2011 CTAA Buyer's Guide

## Additional Sources

- Institute for Transportation and Development Policy (ITDP), BRT Standard 2012 - to identify features of high-quality BRT; ITDP BRT Planning Guide (June 2007)
- FTA BRT reports, including evaluation reports of BRT systems (see: [http://fta.dot.gov/12351\\_4238.html](http://fta.dot.gov/12351_4238.html))
- National BRT Institute resources on NBRTI website (see: <http://nbrti.org/>)
- Hoovers, LinkedIn – for sales and employee information not found on company websites
- For full list of references with complete citations, see References

# 10 CGGC Focus Systems:

Selecting Systems for Study with the Most Recent and Available Data

BRT System CGGC Focus Systems (bold)	St.	Sources			
		FTA <sup>a</sup>	ITDP <sup>b</sup>	NBRTI <sup>c</sup>	Recently studied <sup>d</sup>
Phoenix Valley Metro LINK - Main Street	AZ	•		•	
El Monte Busway (Greater Los Angeles, CA)	CA			•	
<b>1. Los Angeles Orange Line</b>	CA	•	•	•	•
<b>2. Los Angeles Metro Rapid (multiple routes)</b>	CA	•		•	•
Los Angeles Silver Line	CA			•	
<b>3. Oakland San Pablo Rapid</b>	CA	•		•	•
Livermore Tri-Valley Rapid (Greater San Jose, CA)	CA			•	
Orlando Lynx Lymmo	FL	•		•	
South Miami-Dade Busway	FL	•		•	
Honolulu - City Express! and County Express!	HI	•		•	
<b>4. Boston Silver Line - Washington Street/Phase I</b>	MA	•	x	•	•
<b>5. Boston Silver Line - Waterfront/Phase II</b>	MA	•	x	•	•
<b>6. Kansas City MAX - Main and Troost</b>	MO			•	•
Albuquerque Rapid Ride	NM			•	
<b>7. Las Vegas MAX and SDX</b>	NV	•	•	•	•
Las Vegas Sahara Express	NV			•	
Reno RAPID	NV			•	
Albany BusPlus	NY			•	
New York City Select Bus Services (multiple routes)	NY		x	•	
<b>8. Cleveland HealthLine</b>	OH	•	•	•	•
<b>9. Eugene EmX</b>	OR	•	•	•	•
<b>10. Pittsburgh MLK Jr. East Busway</b>	PA	•	•	•	
Pittsburgh South Busway	PA	•		•	
Pittsburgh West Busway	PA	•		•	
Salt Lake City MAX	UT			•	
Dale City - Washington, DC BRT	VA			•	
Seattle RapidRide	WA			•	
Snohomish Swift (Greater Seattle, WA)	WA			•	

• System evaluated or identified as BRT by Source

x System evaluated but does not meet ITDP's requirements to be considered true BRT

## Sources

<sup>a</sup>FTA BRT system evaluations and other BRT reports:  
[http://fta.dot.gov/12351\\_4238.html](http://fta.dot.gov/12351_4238.html)

<sup>b</sup>ITDP 2011 report, *Recapturing Global Leadership in Bus Rapid Transit: A Survey of Select U.S. Cities*:  
[http://www.itdp.org/documents/20110526ITDP\\_USBRT\\_Report-LR.pdf](http://www.itdp.org/documents/20110526ITDP_USBRT_Report-LR.pdf)

<sup>c</sup>NBRTI list of BRT Systems with Project Status (updated May 2012)

<sup>d</sup>NBRTI and Parsons Brinckerhoff 2011 report for FL DOT, *Bus Rapid Transit Applications Phase 2*:  
[http://www.nbri.org/docs/pdf/BRT\\_Applications\\_PhaseII\\_Report\\_Final12-08-2011.pdf](http://www.nbri.org/docs/pdf/BRT_Applications_PhaseII_Report_Final12-08-2011.pdf)

# Interviews

Firm	Individual	Title	Date
AECOM	Jim Lightbody	Senior Consultant	January 30, 2012
Associated General Contractors of America (AGC)	Brian Deery	Senior Director, Highway and Transportation Division	January 30, 2012
American Wind Energy Association (AWEA)	Randy Swisher	Former Executive Director	February 6, 2012
AWEA	Tom Gray	Former Executive Director	February 2, 2012
GFI Genfare, SPX	Kim Green	President, GFI Genfare	January 20, 2012
Gilbert Tweed International	Stephanie Pinson	President	February 7, 2012
Holland & Knight	Jeff Boothe	Partner	February 3, 2012
InfraConsult	Alan Wulkan	Managing Partner	February 3, 2012
InfraConsult	Michael Schneider	Managing Partner	January 27, 2012
ITDP	Michael Replogle	Global Policy Director and Founder	January 23, 2012
Intelligent Transportation Society of America (ITSA)	Radha Neelakantan	Transportation Program Specialist	January 23, 2012
NABI	Bill Coryell	Vice President, Western Region Transit Sales	January 23, 2012
New Flyer	Paul Smith	Executive Vice President, Sales and Marketing	January 19, 2012
Parsons Brinckerhoff	Cliff Henke	Senior Analyst	January 20, 2012
Sasaki Associates, Inc.	Jason Hellendrung	Principal, Landscape Architecture Discipline	February 1, 2012
Trapeze	David Brandauer	General Manager of Trapeze ITS USA, LLC	January 23, 2012
ZGF Architects, LLP	Otto Condon, Ron Stewart, Brian McCarter	Principal, Principal, Principal	January 23, 2012

# References

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## Section II. Creating High-Quality BRT in the United States

<sup>1</sup>For a comprehensive source of global BRT data, visit <http://www.brtdata.org/>, a joint project of EMBARQ, Across Latitudes and Cultures - Bus Rapid Transit Centre of Excellence (ALC-BRT CoE), and the International Energy Agency.

<sup>2</sup>Bus Rapid Transit Policy Center. (2007). Bogota Transmilenio. Retrieved June 4, 2012, from <http://www.gobrt.org/Transmilenio.html>.

### *BRT in the United States*

Baxandall, Phineas, Benjamin Davis and Tony Dutzik. (2012). Transportation and the New Generation: Frontier Group and U.S. PIRG Education Fund. pp. 36. April 5, 2012. <http://www.uspirg.org/reports/usp/transportation-and-new-generation>.

Melaniphy, Michael P. (2012). Testimony of Michael P. Melaniphy, APTA President & CEO, on Federal Transportation Investments for Fiscal Year 2013 before the Senate Committee on Appropriations, Subcommittee on Transportation, Housing and Urban Development, and Related Agencies, March 21, 2012 Washington, D.C.: APTA. [http://www.apta.com/gap/testimony/2012/Pages/120319\\_SenateTestimony.aspx](http://www.apta.com/gap/testimony/2012/Pages/120319_SenateTestimony.aspx).

### *Defining BRT*

<sup>3</sup>FTA. (2012b). *Small Starts Fact Sheet*. Retrieved June 13, 2012, from [http://fta.dot.gov/12347\\_5221.html](http://fta.dot.gov/12347_5221.html).

<sup>3</sup>---. (2012c). *Very Small Starts Fact Sheet*. Retrieved June 13, 2012, from [http://fta.dot.gov/12347\\_5221.html](http://fta.dot.gov/12347_5221.html).

<sup>4</sup>---. (2012a). Bus Rapid Transit. Retrieved June 13, 2012, from [http://fta.dot.gov/about/12351\\_4240.html](http://fta.dot.gov/about/12351_4240.html).

<sup>4</sup>NBRTI. (2012). Homepage. Retrieved June 13, 2012, from <http://www.nbrti.org/>.

<sup>4</sup>TCRP. (2007). Bus Rapid Transit Practitioner's Guide: TCRP Report 118. Washington, DC: Transit Cooperative Research Program. (See p.1-1). <http://www.community-wealth.org/pdfs/tools/tod/tool-tcrp-bus-rapid-transit.pdf>.

<sup>4</sup>Weinstock, Annie, Walter Hook, Michael Repogle, and Ramon Cruz. (2011). Recapturing Global Leadership in Bus Rapid Transit: A Survey of Select U.S. Cities. New York City, NY: Institute for Transportation and Development Policy. pp. 80. (See p.18). [http://www.itdp.org/documents/20110526ITDP\\_USBRT\\_Report-LR.pdf](http://www.itdp.org/documents/20110526ITDP_USBRT_Report-LR.pdf).

### ***BRT Standard***

<sup>5</sup>ITDP. (2012). The BRT Standard: Version 1.0. New York City, NY: Institute for Transportation & Development Policy. pp. 47.  
[http://www.itdp.org/documents/BRT\\_English\\_REVISED2\\_FINAL\\_LR.pdf](http://www.itdp.org/documents/BRT_English_REVISED2_FINAL_LR.pdf).

## **Section III. BRT Value Chain**

### ***Transit Project Timeline***

Based on: ITDP. (2007). Bus Rapid Transit Planning Guide. New York City, NY: Institute for Transportation & Development Policy.  
<http://www.itdp.org/microsites/bus-rapid-transit-planning-guide/>.

### ***Project Delivery Methods***

Deery, Brian. (2012). Senior Director, Highway and Transportation Division, Associated General Contractors of America. Personal communication with CGGC Research Staff. January 30, 2012.

FTA. (2009). Construction Management Handbook. Washington, DC: Federal Transit Administration Office of Research, Demonstration and Innovation: U.S. Department of Transportation. <http://www.fta.dot.gov/documents/FTA-CONSTRUCTION-PRJT-MGMT-HDBK2009.pdf>.

NDCIC. (2010). Project Delivery Methods. Nebraska Design & Construction Industry Council: Project Delivery Systems Retrieved February 9, 2012, from <http://www.ne.dccouncil.com/delivery2010.html>.

USDOT. (2011). Construction. U.S. Department of Transportation Construction Program Guide Retrieved February 7, 2012, from <http://www.fhwa.dot.gov/construction/cqit/cm.cfm>.

---. (2012b). Cost Benefits to Construction Manager/General Contractor Approach. U.S. Department of Transportation Retrieved February 7, 2012, from [http://www.fta.dot.gov/grants/12840\\_9603.html](http://www.fta.dot.gov/grants/12840_9603.html).

### ***Control vs. Risk by Project Delivery Type***

Adapted from: FTA. (2009). Construction Management Handbook. Washington, DC: Federal Transit Administration Office of Research, Demonstration and Innovation: U.S. Department of Transportation, p. 3-7. <http://www.fta.dot.gov/documents/FTA-CONSTRUCTION-PRJT-MGMT-HDBK2009.pdf>.

### *Additional Planning Segment Dynamics*

<sup>1</sup>GAO. (2010). Use of Contractors is Generally Enhancing Transit Project Oversight, and FTA is Taking Actions to Address Some Stakeholder Concerns. Washington, DC: Government Accountability Office. pp. 42. <http://www.gao.gov/products/GAO-10-909>.

<sup>2</sup>NBRTI. (2008). The PMOC Program and the Euclid Corridor Transportation Project: National Bus Rapid Transit Institute. <http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CFsQFjAA&url=http%3A%2F%2Fwww.nbrti.org%2Fdocs%2Fppt%2FTRB%25207-22-08%2520G.%2520PMOC.ppt&ei=1H3PT4fcG4Wm6gGA1ZGQDA&usg=AFQjCNFWma-YftiT3BrQtp0JQH7TKPGWmw>

<sup>3</sup>Code of Federal Regulations. (2012). *Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs, Title 49, Pt. 26*. Retrieved June 5, 2012, from <http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=01b9b8c4fac66c31da4445d7523c0af3&rgn=div5&view=text&node=49:1.0.1.1.20&idno=49#49:1.0.1.1.20.2.16.1>.

### *Public Sources Table*

<sup>4</sup>FTA. (2012c). Funding & Finance. Retrieved January 9 2012, from <http://www.fta.dot.gov/grants/12309.html>.

<sup>5</sup>TTCRP. (2009). Local and Regional Funding Mechanisms for Public Transportation: Report 129. Washington, DC: Transit Cooperative Research Program. [http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp\\_rpt\\_129.pdf](http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_129.pdf).

<sup>6</sup>Martin, Elizabeth. (2008). Innovative Financing: Meeting the Needs for Capital: FTA. pp. 17. [http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0CFIQFjAC&url=http%3A%2F%2Fwww.fta.dot.gov%2Fdocuments%2FDay\\_1\\_-\\_Ild\\_-\\_Innovative\\_Finance\\_-\\_Martin.pdf&ei=WZbQT\\_T6HZSs8QSLyli\\_AQ&usg=AFQjCNEkPuUbCbNMO62gFQaGfyBfrwZhYw](http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0CFIQFjAC&url=http%3A%2F%2Fwww.fta.dot.gov%2Fdocuments%2FDay_1_-_Ild_-_Innovative_Finance_-_Martin.pdf&ei=WZbQT_T6HZSs8QSLyli_AQ&usg=AFQjCNEkPuUbCbNMO62gFQaGfyBfrwZhYw).

### *10 CGGC Focus Systems: Capital Costs and Funding*

Bartenstein, Sandra. (2000). Connecticut Department of Transportation Bus Rapid Transit Demonstration Project: New Britain-Hartford Busway. Newington, CT: Connecticut Department of Transportation. pp. 6. June 8, 2000. <http://www.crcog.org/publications/TransportationDocs/Viaduct/NBB-HartfordWestMIS.pdf>.

BTI. (2007). Funding BRT in the U.S. Retrieved May 7, 2012, from <http://www.gobrt.org/funding1.html>.

Callaghan, Lisa. (2009). Funding Bus Rapid Transit in the U.S. Washington, DC: Breakthrough Technologies Institute. pp. 18. <http://www.reconnectingamerica.org/assets/Uploads/bestpractice246.pdf>.

- FLDOT. (2011). Bus Rapid Transit Applications Phase 2. Tallahassee, FL: Florida Department of Transportation, District IV. pp. 86. [http://www.nbrti.org/docs/pdf/BRT\\_Applications\\_PhaseII\\_Report\\_Final12-08-2011.pdf](http://www.nbrti.org/docs/pdf/BRT_Applications_PhaseII_Report_Final12-08-2011.pdf).
- Flynn, Jennifer, Cheryl Thole, Victoria Perk, Joseph Samus, and Caleb van Nostrand. (2011). Metro Orange Line BRT Project Evaluation (No. FTA Report No. 0004). Washington, D.C.: FTA. pp. 163. [http://www.fta.dot.gov/documents/FTA\\_Research\\_Report\\_0004\\_FINAL\\_2.pdf](http://www.fta.dot.gov/documents/FTA_Research_Report_0004_FINAL_2.pdf).
- Kim, Eugene J., Georges Darido and Donald Schneck. (2005). Las Vegas Metropolitan Area Express (MAX) BRT Demonstration Project Evaluation (No. FTA-VA-26-7222-2005.2). Washington, D.C.: FTA. pp. 52. [http://www.nbrti.org/media/evaluations/Las\\_vegas\\_final\\_report.pdf](http://www.nbrti.org/media/evaluations/Las_vegas_final_report.pdf).
- McKeown, Stewart. (2003). Evaluation of Port Authority of Allegheny County's West Busway Bus Rapid Transit Project (No. FTA-PA-26-7010-03.1). Washington, D.C.: FTA. pp. 49. [http://fta.dot.gov/documents/Pittsburgh\\_West\\_Busway\\_BRT\\_Evaluation-April\\_2003.pdf](http://fta.dot.gov/documents/Pittsburgh_West_Busway_BRT_Evaluation-April_2003.pdf).
- Niles, John and Lisa Callaghan Jerram. (2010). From Buses to BRT: Case Studies of Incremental BRT Projects in North America (No. MTI Report 09-13). San Jose: Mineta Transportation Institute. pp. 110. [http://transweb.sjsu.edu/mtiportal/research/publications/documents/2704\\_book%20%286.15.10%20with%20Covers%29.pdf](http://transweb.sjsu.edu/mtiportal/research/publications/documents/2704_book%20%286.15.10%20with%20Covers%29.pdf).
- Sanders, Keith. (2012). Senior Project Manager, Kansas City Area Transportation Authority. Personal communication with CGGC Research Staff. May 25, 2012.
- Schimek, Paul, Georges Darido and Donald Schneck. (2005). Boston Silver Line Washington Street BRT Demonstration Project Evaluation (No. FTA-VA-26-7222-2005.2). Washington, D.C.: FTA. pp. 60. [http://www.nbrti.org/media/evaluations/Boston\\_Silver\\_Line\\_final\\_report.pdf](http://www.nbrti.org/media/evaluations/Boston_Silver_Line_final_report.pdf).
- Schimek, Paul, Kari Watkins, David Chase, Karl Smith, and Stephen Gazillo. (2007). Silver Line Waterfront Bus Rapid Transit (BRT) Project 2007 Evaluation (No. FTA-DC-26-7248-2007.02). Washington, D.C.: FTA. pp. 70. <http://fta.dot.gov/documents/FINALBOSTONBRTREPORT062507.pdf>.
- Thole, Cheryl and Alasdair Cain. (2006). The San Pablo Rapid - BRT Project Evaluation (No. FTA-DC-26-7248-2007.02). Washington, D.C.: FTA. pp. 78. [http://fta.dot.gov/documents/San\\_Pablo\\_Rapid\\_Evaluation\\_Final\\_Report\\_June\\_2006\\_2.pdf](http://fta.dot.gov/documents/San_Pablo_Rapid_Evaluation_Final_Report_June_2006_2.pdf).
- Thole, Cheryl, Alasdair Cain and Jennifer Flynn. (2009). The EmX Franklin Corridor BRT Project Evaluation (No. FTA-FL-26-7109.2009.2). Washington, D.C.: FTA. pp. 95. [http://www.fta.dot.gov/documents/EmX\\_FranklinCorridor\\_BRTProjectEvaluation.pdf](http://www.fta.dot.gov/documents/EmX_FranklinCorridor_BRTProjectEvaluation.pdf).
- Vincent, William and Lisa Callaghan. (2007). A Preliminary Evaluation of the Metro Orange Line: Breakthrough Technologies Institute. pp. 16. [http://www.gobrt.org/Orange\\_Line\\_Preliminary\\_Evaluation\\_by\\_BTI.pdf](http://www.gobrt.org/Orange_Line_Preliminary_Evaluation_by_BTI.pdf).

## *Investors*

- <sup>7</sup>West, Darrell M., Rick Kimball, Raffiq Nathoo, Daniel Zwirn, Vijaya Ramachandran, Gordon M. Goldstein, and Joel H. Moser. (2011). *Rebuilding America: The Role of Foreign Capital and Global Public Investors*. Washington, DC: The Brookings Institution. pp. 26.  
[http://www.brookings.edu/~media/research/files/papers/2011/3/11%20sovereign%20wealth%20funds/0311\\_sovereign\\_wealth\\_funds.pdf](http://www.brookings.edu/~media/research/files/papers/2011/3/11%20sovereign%20wealth%20funds/0311_sovereign_wealth_funds.pdf).
- <sup>8</sup>Miller, Jonathan D., Myerson Deborah and Rachel MacCleery. (2012). *Infrastructure 2012: Spotlight on Leadership*. Washington, DC: Urban Land Institute and Ernst & Young.  
<http://www.uli.org/ResearchAndPublications/PolicyPracticePriorityAreas/Infrastructure/~media/ResearchAndPublications/Priorities/Infrastructure/Infrastructure2012.ashx>.
- <sup>9</sup>Bond Market Association. (2001). *Overview of the Municipal Bond Market*. New York City, NY: The Bond Market Association.  
[http://media.wiley.com/product\\_data/excerpt/57/04713936/0471393657.pdf](http://media.wiley.com/product_data/excerpt/57/04713936/0471393657.pdf).
- <sup>10</sup>Page, Sasha N., William Ankner, Cheryl Jones, and Robert Fetterman. (2008). "The Risks and Rewards of Private Equity In Infrastructure." *Public Works Management Policy*, 13: 100-113.
- <sup>11</sup>Davis, Emma. (2012). *Sovereign Wealth Funds Investing in the Infrastructure Asset Class*. Retrieved May 30, 2012, from  
<http://www.pregin.com/blog/101/5125/swf-infrastructure>.
- <sup>12</sup>Henke, Cliff. (2010). *Economic Development and BRT*. Addison, IL: Parsons Brinckerhoff and The John Noel Public Transit Discovery Conference.  
[www.dupageco.org/EDP/Public\\_Transit/Docs/17407/](http://www.dupageco.org/EDP/Public_Transit/Docs/17407/).
- <sup>13</sup>Ho, Helen. (2012). *Estimating Impacts of Bus and Bus Rapid Transit on Property Values: Effects of Bus and BRT Station Proximity on Single-Family Home Prices along the North Las Vegas 113 and MAX Lines*. Independent Research Study. Duke University, Center on Globalization, Governance & Competitiveness (CGGC).
- <sup>14</sup>ISC. (2012a). *Accelerating Bus Rapid Transit*. Cleveland, OH: Institute for Sustainable Communities. pp. 63.  
[http://www.iscvt.org/who\\_we\\_are/publications/Resource-Guide-Bus-Rapid-Transit-v1.pdf](http://www.iscvt.org/who_we_are/publications/Resource-Guide-Bus-Rapid-Transit-v1.pdf).
- <sup>15</sup>Waters, Francine E. (2011). *A Case Study - Retooling Places and Leveraging Transit: Overcoming Funding and Coordination Challenges to Build a Better Region: White Flint Partnership*.  
<http://www.uli.org/sitecore/content/ULI2Home/ResearchAndPublications/PolicyPracticePriorityAreas/Events/~media/Events/TransitAtlanta/1%20%20WatersWhite%20Flint.ashx>.

<sup>16</sup>UCI. (2012). University Circle Overview. Retrieved May 29, 2012, from <http://www.universitycircle.org/about/overview>.

<sup>17</sup>Hoovers. (2012). Real Estate Investment Trusts (REITs). Retrieved June 4, 2012, from <http://www.hoovers.com/> (subscription required).

<sup>18</sup>REIT. (2012). What is a REIT? *REIT 101* Retrieved May 31, 2012, from <http://www.reit.com/REIT101/WhatisaREIT.aspx>.

<sup>19</sup>Lerner Enterprises. (2012). Real Estate Solutions. Retrieved May 23, 2012, from <http://www.lerner.com/>.

### *Innovative Finance Mechanisms*

CTS. (2009). Value Capture for Transportation Finance. Minneapolis, MN: Center for Transportation Studies.  
<http://www.cts.umn.edu/Research/featured/valuecapture/>.

IMG. (2009). Evaluating Innovative Financing Opportunities for Miami-Dade Transit. Bethesda, MD: Infrastructure Management Group, Inc.  
[http://www.miamidade.gov/citt/pdf\\_library/innovative\\_financing\\_report.pdf](http://www.miamidade.gov/citt/pdf_library/innovative_financing_report.pdf).

NCPPP. (2012). Types of Public-Private Partnerships. Retrieved April 26, 2012, from <http://www.ncppp.org/howpart/ppptypes.shtml>.

TCRP. (2003b). Bus Rapid Transit - Volume 2: Implementation Guidelines: Report 90. Washington, DC: Transit Cooperative Research Program.  
[http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp\\_rpt\\_90v2.pdf](http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_90v2.pdf).

TCRP. (2009). Local and Regional Funding Mechanisms for Public Transportation: Report 129. Washington, DC: Transit Cooperative Research Program.  
USDOT. (2012c). Transit-Oriented Development - Overview. Retrieved April 30, 2012, from  
[http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp\\_rpt\\_129.pdf](http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_129.pdf).

### *Innovative Finance Table*

<sup>20</sup>BTI. (2008). Bus Rapid Transit and Transit-Oriented Development: Case Studies on Transit-Oriented Development Around Bus Rapid Transit Systems in North America and Australia. Washington, DC: Breakthrough Technologies Institute.  
[http://www.valleyregionaltransit.org/Portals/0/Studies/StateStreet/TOD\\_USandAus.pdf](http://www.valleyregionaltransit.org/Portals/0/Studies/StateStreet/TOD_USandAus.pdf).

<sup>21</sup>FTA. (2011). Van Ness Avenue BRT - Project Development. Washington, DC: Federal Transit Administration.  
[http://www.fta.dot.gov/documents/CA\\_San\\_Francisco\\_Van\\_Ness\\_Avenue\\_BRT\\_profile\\_final\\_pdf.pdf](http://www.fta.dot.gov/documents/CA_San_Francisco_Van_Ness_Avenue_BRT_profile_final_pdf.pdf).

<sup>22</sup>Packer, Adrienne. (2012). RTC agrees to negotiate small transit contract with Veolia. *Las Vegas Review-Journal*. February 9, 2012 Retrieved June 14, 2012, from <http://www.lvrj.com/news/rtc-to-negotiate-1-year-contract-with-veolia-on-bus-contract-139062994.html>.

<sup>23</sup>ISC. (2012b). The York Consortium's VivaNext Project. Montpelier, VT: Institute for Sustainable Communities.  
[http://sustainablecommunitiesleadershipacademy.org/resource\\_files/documents/the-york-consortium-vivanext-project.pdf](http://sustainablecommunitiesleadershipacademy.org/resource_files/documents/the-york-consortium-vivanext-project.pdf).

<sup>24</sup>IMG. (2009). Evaluating Innovative Financing Opportunities for Miami-Dade Transit. Bethesda, MD: Infrastructure Management Group, Inc.  
[http://www.miamidade.gov/citt/pdf\\_library/innovative\\_financing\\_report.pdf](http://www.miamidade.gov/citt/pdf_library/innovative_financing_report.pdf).

<sup>25</sup>LACMTA. (2008). Fact Sheet on Congestion Pricing. Los Angeles, CA: Los Angeles County Metropolitan Transportation Authority.  
[http://www.sgvkog.org/site\\_images/FactSheetOnCongestionPricing.pdf](http://www.sgvkog.org/site_images/FactSheetOnCongestionPricing.pdf).

### *Contractors*

Deery, Brian. (2012). Senior Director, Highway and Transportation Division, Associated General Contractors of America. Personal communication with CGGC Research Staff. January 30, 2012.

FTA. (2009). Construction Management Handbook. Washington, DC: Federal Transit Administration Office of Research, Demonstration and Innovation: U.S. Department of Transportation. <http://www.fta.dot.gov/documents/FTA-CONSTRUCTION-PRJT-MGMT-HDBK2009.pdf>.

## *Operation*

<sup>26</sup>VEOLIA Transportation. (2012). Public Transit for the World's Entertainment Capital. Retrieved February 5, 2012, from <http://www.veoliatr transportation.com/transit/bus/key-contracts/las-vegas>.

<sup>27</sup>Lowe, Marcy, Bengu Aytekin and Gary Gereffi. (2009). Manufacturing Climate Solutions: Carbon-Reducing Technologies and U.S. Jobs - Public Transit Buses: A Green Choice Gets Greener. Durham, NC: Duke University Center on Globalization, Governance & Competitiveness (CGGC). [http://cggc.duke.edu/environment/climatesolutions/greeneconomy\\_Ch12\\_TransitBus.pdf](http://cggc.duke.edu/environment/climatesolutions/greeneconomy_Ch12_TransitBus.pdf).

<sup>28</sup>MDG. (2012). Maintenance Design Group - RTC Sunset Maintenance Facility. Retrieved March 12, 2012, from <http://maintenancedesigngroup.com/projects/las-vegas-nv-rtc-sunset-mf/>.

## *ITS*

<sup>29</sup>APTA. (2010). Implementing BRT Intelligent Transportation Systems. Washington, DC: American Public Transportation Association. pp. 32. [http://www.apta standards.com/Portals/0/Bus\\_Published/005\\_RP\\_BRT\\_ITS.pdf](http://www.apta standards.com/Portals/0/Bus_Published/005_RP_BRT_ITS.pdf).

<sup>30</sup>Kulyk, Walter and Matthew Hardy. (2003). ITS Enhanced Bus Rapid Transit Systems. Washington, DC: Federal Transit Administration [http://onlinepubs.trb.org/onlinepubs/archive/conferences/VHA-BRT/ITS\\_Enhanced\\_Bus\\_Rapid\\_Transit\\_Systems.pdf](http://onlinepubs.trb.org/onlinepubs/archive/conferences/VHA-BRT/ITS_Enhanced_Bus_Rapid_Transit_Systems.pdf).

<sup>31</sup>CGGC. (2012). Building a Business Constituency: Duke University. pp. 16. March 8, 2012.

<sup>32</sup>Smart Card Alliance. (2012). New Initiatives Deliver More Value. Retrieved May 14, 2012, from <http://www.smartcardalliance.org/>.

<sup>33</sup>Kulyk, Walter. (2012). FTA Perspectives on Development of BRT Concept in the United States. Washington, DC: Federal Transit Administration pp. 41. [http://sustainablecommunitiesleadershipacademy.org/resource\\_files/documents/Kulyk-FTA-Perspectives-on-Development-of-BRT-Concept-in-the-United%20States.pdf](http://sustainablecommunitiesleadershipacademy.org/resource_files/documents/Kulyk-FTA-Perspectives-on-Development-of-BRT-Concept-in-the-United%20States.pdf).

<sup>34</sup>Brandauer, David. (2012). General Manager, Trapeze ITS USA, LLC. Personal communication with CGGC Research Staff. January 23, 2012.

<sup>35</sup>Pike Research. (2012). Smart Transportation Systems: Intelligent Transportation Technologies in the Age of Smart Cities: Traffic Management, Smart Charging, Public Transit, and Vehicle-to-Vehicle Systems. <http://www.pikeresearch.com/research/smart-transportation-systems#>.

## ***Manufacture***

<sup>36</sup>APTA. (2010). Standard Bus Procurement Guidelines RFP, pp. 281. <http://www.apta.com/resources/reportsandpublications/Pages/BusParatransit.aspx>.

<sup>37</sup>FTA. (2001). Bus Rapid Transit Vehicle Characteristics. Washington, DC: Federal Transit Administration Office of Research, Demonstration and Innovation - U.S. Department of Transportation. [http://www.fta.dot.gov/documents/BRT\\_Vehicle\\_Characteristics\\_FINAL\\_June\\_2001.pdf](http://www.fta.dot.gov/documents/BRT_Vehicle_Characteristics_FINAL_June_2001.pdf).

Coryell, Bill. (2012). Vice President, Western Region Transit Sales, North American Bus Industries. Personal communication with CGGC Research Staff. January 23, 2012.

Smith, Paul. (2012). Executive Vice President, Sales and Marketing, New Flyer. Personal communication with CGGC Research Staff. January 19, 2012.

## ***List of Firms, by Segment***

Daimler Buses Reconfigures Operations in North America. (2012). *PRNewswire*. April 25, 2012 from <http://www.prnewswire.com/news-releases/daimler-buses-reconfigures-operations-in-north-america-148863415.html>.

## **Section IV. Potential for a BRT Business Constituency**

CGGC. (2012). Building a Business Constituency: Duke University. pp. 16. March 8, 2012.

Trigg, Tali. (2012). Bus Rapid Transit: Global Context and US Market Opportunity: Energy Technology Policy Division, IEA. March 8, 2012.

## **Appendix**

### ***10 CGGC Focus BRT Systems***

FTA. (2012a). Bus Rapid Transit Evaluation. Retrieved March 10, 2012, from [http://fta.dot.gov/12351\\_4238.html](http://fta.dot.gov/12351_4238.html).

Weinstock, Annie, Walter Hook, Michael Replogle, and Ramon Cruz. (2011). Recapturing Global Leadership in Bus Rapid Transit: A Survey of Select U.S. Cities. New York City, NY: Institute for Transportation and Development Policy. pp. 80. [http://www.itdp.org/documents/20110526ITDP\\_USBRT\\_Report-LR.pdf](http://www.itdp.org/documents/20110526ITDP_USBRT_Report-LR.pdf).

NBRTI. (2012). List of BRT Systems - Project Status (updated May 2012)

FLDOT (2011). Bus Rapid Transit Applications Phase 2. Tallahassee, FL, Florida Department of Transportation, District IV: 86. [http://www.nbrti.org/docs/pdf/BRT\\_Applications\\_PhaseII\\_Report\\_Final12-08-2011.pdf](http://www.nbrti.org/docs/pdf/BRT_Applications_PhaseII_Report_Final12-08-2011.pdf)

## **Additional Sources**

FTA BRT reports, including evaluation reports of BRT systems, visit: [http://fta.dot.gov/12351\\_4238.html](http://fta.dot.gov/12351_4238.html)

Hoovers database and LinkedIn – for sales and employee information not found on company websites, visit: <http://www.hoovers.com/> (subscription required); <http://www.linkedin.com/>

National BRT Institute resources on NBRTI website, visit: <http://nbrti.org/>