BETTER RAPID TRANSIT FOR GREATER BOSTON

The Potential for
Gold Standard Bus Rapid Transit
Across the Metropolitan Area

BOSTONBRT
The Greater Boston BRT Study Group
Spring 2015

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EXECUTIVE SUMMARY

At its highest level, Bus Rapid Transit (BRT) weaves together enclosed stations, exclusive lanes physically separated from traffic, pre-paid fare collection, smart use of real-time data, and beautiful design, to rival the speed, capacity, and comfort of the best rail lines. Since the 1970s, it's been gaining momentum, nearly quadrupling worldwide in just the past 10 years, as its benefits are tested and proven. But the United States has lagged, with only a handful of high-standard BRT corridors implemented to date.

Meanwhile, Boston finds itself at a crossroads. The metropolitan area is in dire need of bold, modern, resilient, but also cost-efficient transit solutions to improve and complement our existing system. The record-level snowfall in 2015 and other extreme weather events are harsh reminders of this longstanding reality. Metropolitan area planners have included BRT in a number of proposals, and portions of the Silver Line bus in Boston have elements of BRT. But its potential hasn't been truly realized, and there had previously never been a citywide technical analysis of what this mode of transit can offer.

To better understand whether and where BRT could work in the region, the Barr Foundation convened the Greater Boston BRT Study Group. Made up of diverse stakeholders and transit experts from across the city, the BRT Study Group partnered with the Institute for Transportation & Development Policy (ITDP), an internationally respected organization, to investigate the possibilities for implementing BRT throughout the metropolitan area. In particular, the Study Group focused on the highest performance level of BRT called Gold Standard. This report outlines the Study Group's conclusions, and the benefits Gold Standard BRT has to offer in Greater Boston.

There is significant potential for Gold Standard BRT across Greater Boston. ITDP, in coordination with the Study Group, conducted a technical analysis of transit corridors that could benefit from Gold Standard BRT. The methodology included a comparison of MBTA and MassDOT ridership data, average travel speeds, road layout, and future development plans. It also looked at one corridor where passengers might be drawn from other corridors, due to the inefficient options that currently exist. The analysis found 12 possible corridors that show technical potential for BRT.

- Washington Silver Line
- Silver Line Extension Dudley to Mattapan
- Silver Line Extension to Government Center
- Allston Union Square to Dudley Square
- Downtown Chelsea to Government Center
- Forest Hills to West Roxbury
- Harvard Square South to Newton Corner
- Forest Hills to Wolcott Square
- Sullivan to Longwood, Mass Avenue Bridge Scenario
- Sullivan to Longwood, BU Bridge Scenario
- Allston Union Square to Longwood Medical Center
- Harvard Square to Watertown

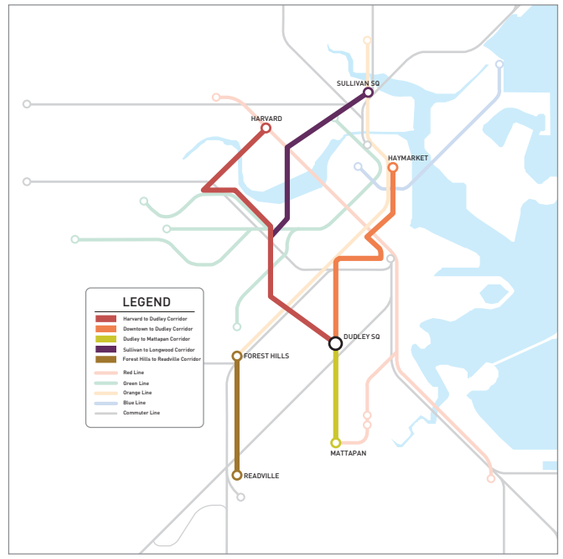
Five corridors show great promise, and should be prioritized. The Study Group examined which of these routes would best meet four criteria—reduce congestion on the T, serve underserved communities or groups, provide more direct connections, and serve planned future development. This narrowed the list of possible corridors to five. In most cases, corridors were either merged or adjusted slightly to come up with most beneficial options.

Among the findings, a travel time analysis found that implementing Gold Standard BRT could reduce trip times up to 45%, varying by corridor. A preliminary routing analysis plotted out multiple options to successfully implement BRT in Boston's unique streets. Analysis of recent transit development costs in the United States suggests that implementing BRT in these corridors would also be more cost-effective than other options for improving the existing transportation system. Based on this evidence, on average, BRT can be seven times more affordable per mile implemented than light rail. We expect this to be the case for these corridors as well, although how much more affordable, and the overall investment costs, would require more detailed assessment.

Greater Boston should make the Gold Standard its goal when pursuing BRT. Under a rating system developed in 2010 by a committee of international experts, the Gold Standard is the highest level this mode of transit can achieve. Gold Standard BRT will ensure a level of excellence that will draw ridership, deliver the best transit experience for Bostonians, and stimulate sustainable development. Pursuing the Gold Standard draws clear lines about the level of experience communities can demand and expect, and ensures BRT corridors will be competitive with other transit options and won't backslide in quality. In addition to these benefits, the first Gold Standard BRT in the United States will bring the city back to the forefront of transit by establishing a world-class, modern system that can serve as a model for the rest of the country.

BRT is producing real results in several major international and American cities. Under the BRT Standard rating system, there are now 98 recognized BRT corridors globally, in 62 cities, and in the past 10 years we've seen 383% growth in miles of BRT. The Study Group took a close look at other BRT systems, including a site visit to Mexico City in 2013 to experience its highly rated Metrobús firsthand. Existing BRT corridors have slashed CO2 emissions, air pollution, and congestion. Cities have demonstrated that investment in BRT can help channel real estate development into neighborhoods at relatively low cost to the city. Perhaps most impressive, city planners have used high-standard BRT to reimagine their streets with beautifully designed stations and vehicles, and strong connections to the unique identities of their communities.

BRT is a legitimate and effective mode of transportation and should be considered in transit planning for Boston and surrounding cities. The Study Group strongly urges local, regional, and state-level planning, transportation, and mobility efforts to include Gold Standard BRT as a peer among other transportation modes and as an option under consideration for improving the existing system, with high-quality, high-frequency transit service.



The Five Prime Corridors for Boston BRT. For more detailed information on the five corridors, travel time comparisons and costs comparisons, please see Chapter II, "BRT's Potential in Boston," on page 08.

BRT offers many advantages, including speed, a high-quality experience, and resiliency and flexibility in response to Boston's harsh weather and other unpredictable conditions. All of these traits are desperately needed to upgrade and bolster the area's existing transportation system. The ITDP and Study Group analysis in this report is a strong starting point for further assessment of specific corridors where BRT could first provide the greatest benefit. Transit officials should include BRT in planning processes and documents now, and upon request from communities, provide support for BRT analysis and development.

Planning for BRT in Greater Boston must be driven by the needs of the communities that stand to gain from it. Learning from conversations with stakeholders, as well as past BRT projects here and in other cities, it's very clear that future planning for BRT corridors must include extensive engagement with residents and community leaders in the areas that could benefit from BRT corridors. The neighborhoods of Greater Boston must play an instrumental role in driving any future plans.

To sum up, the BRT Study Group started with two simple questions: Is BRT right for Boston, and if so, where? Coming out of this process, the analysis here answers the first question with an emphatic yes, and presents an informed field of options for the second.

This report should serve as an analysis of BRT's potential, but also a tool and a call to action. With a bold vision and smart planning, Gold Standard BRT can help Greater Boston create a modern, more efficient transportation system.

The BRT Study Group is made up of members who hold deep ties to neighborhoods across Greater Boston and represented area universities, think tanks, design and engineering institutes, community groups, and economic development agencies. For more on the Study Group, please see page 9.

INTRODUCTION

Greater Boston at a Crossroads

The Greater Boston BRT Study Group

I. INTRODUCTION

A study group of diverse participants from across Greater Boston came together to conduct the first citywide assessment of whether Bus Rapid Transit could work here. The following report presents the results of the group's analysis, and further explores how BRT at its highest standard could improve mobility, equity, and sustainability for residents, commuters, and visitors.

As BRT spreads globally, cities in the United States are looking to it to revitalize urban centers and spur transit-oriented development.

It's a sunny morning in Dudley Square, and you walk out your door for a meeting with a colleague downtown. You tap your smart card to enter the station, passing two commuters parking bikeshare bikes at the Hubway rack outside. Keeping one eye on a display with the departure time—two minutes, just as your phone app indicated—you check an LCD panel near the entrance and note an author you like is doing a reading at the library next week.

A mother and her two kids sit comfortably inside the station, talking excitedly about plans for a day at the Children's Museum. You spot a few friends, sipping coffees from cups bearing the logo of the shop next door. You say hi. They have the day off and are headed to the North End for pastries and then shopping downtown.

A vehicle that looks like a cross between a bus and a train pulls in quietly, all the doors open, and a few dozen people board in seconds, having already paid at the turnstile before stepping onto the platform. Doors are level with the platform so the mother's stroller rolls in effortlessly. Passengers settle into their seats, checking phones and tablets, and the vehicle glides down wide-open, dedicated lanes free of traffic. In 10 minutes, you pull into your stop, a trip that took almost twice the time just a few years earlier.

This could be an everyday experience on Bus Rapid Transit (BRT) if its potential were realized in Greater Boston. And this route is just one example—the research behind the following report concluded that multiple stations and corridors like this stand to open up Boston's streets, better connecting legacy Boston neighborhoods, key economic centers, areas of rapid development, the downtown core, and parts of Cambridge. As BRT spreads globally, more cities in the United States are looking to it to modernize their transit systems, improve passenger experience, and spur sustainable, transit-oriented development.

GREATER BOSTON AT A CROSSROADS

Boston's transit needs are extensive. Throughout the country's history, Boston's public transit has led the way—with the first chartered ferries, first subway system, and strategic investments in public transit in the 1960s. But the city has fallen behind, both with upkeep of existing services, and with meeting the demands of a growing population and developing region.

The MBTA suffers from more than $5 billion in principal debt, and a backlog of more than $3 billion in unfunded basic repairs *(D'Alessandro 2009)*. As we were all reminded when winter storms crippled the T in 2015, the overall infrastructure is in desperate need of upgrades. Furthermore, our dependence on a "hub-and-spoke" rail system—with inbound and outbound lines coming together in the urban core—has serious weaknesses. Congestion and failures in the core strain the entire system, and rail lacks the ability to adapt to changes to the status quo in any part of the system, such as storm conditions, disabled vehicles, or maintenance issues.

Boston's future is bright, as multiple economic centers continue to develop simultaneously throughout the area, and the overall population and workforce grows. But this poses challenges for an already struggling transit system. The MBTA could see as many as 100,000 more riders daily within 10 years *(Pollack 2012)*. The economic costs of not improving and modernizing the system are serious and stretch well beyond a long wait or a crowded train. If our transit system can't keep up, all areas of the city will suffer, including our ability to grow sustainably, attractiveness to employers, and livability *(AECOM 2013)*. But it doesn't have to go this way.

The Commonwealth, the cities of Boston, Cambridge, and Somerville have all embarked on parallel planning processes to build a long-term vision of transportation in Greater Boston. Given the urgency of the problems facing our transit system today, and the city's predicted growth, it's crucial that we take this moment, not just to patch problems in an outdated system, but to reimagine and modernize transit to meet the city's needs. Now is the time for smart decisions and bold action.

The Greater Boston BRT Study Group

In response to the transit challenges the city faces, in September 2013 the Barr Foundation convened the Greater Boston Bus Rapid Transit Study Group. The group's members had deep ties to neighborhoods across the city and represented area universities, think tanks, design and engineering institutes, community groups, and economic development agencies. The group was not focused on any one segment of the city, but the entire metropolitan area, looking for the best opportunities, with an emphasis on serving as many Bostonians as possible.

The Study Group partnered with the Institute for Transportation & Development Policy (ITDP) to conduct a technical analysis of where BRT might make sense given the city's ridership, transit times, geography, and existing infrastructure. The institute combined transit data with best practices learned from several cities with BRT corridors, to perform a critical analysis of how it might serve the city.

Throughout this process, the Study Group thoroughly reviewed ITDP's analytic work, asked hard questions, and generally provided guidance at every step of the analysis. The group built on ITDP's work with thorough discussion that prioritized reducing congestion, promoting equity, providing more direct routes, and serving future development. Members of the Study Group visited Mexico City to tour the city's Metrobús BRT line and experience well-executed BRT in action. The Study Group also met with business, nonprofit, and community leaders, including elected officials from Boston, Cambridge, Somerville, and Brookline to share results and discuss ideas and concerns.

This report presents the conclusions from this process. The first section details the Study Group's and ITDP's findings from the technical analysis, including the five priority corridors throughout Boston. From there, the report presents a deeper look at how BRT works, and why the Gold Standard is important. This follows with case studies of successful BRT in action. The report closes with a survey of Boston planning processes that are considering, have considered, or have potential to incorporate BRT.

ITDP
Institute for Transportation & Development Policy

The Institute for Transportation & Development Policy is an international nonprofit organization founded in 1985. Today, the institute works with cities to bring about transport solutions that cut greenhouse gas emissions, reduce poverty, and improve the quality of urban life.

ITDP has offices in the United States, Argentina, Brazil, China, India, Indonesia, Mexico, employs more than 60 staff, and supplements the team with leading architects, urban planners, transportation experts, developers, and financiers. The team has worked in more than 25 countries and more than 100 cities, and had high involvement in the establishment of 29 BRT corridors.

The institute works on a variety of issues related to transit and growth, but in recent years it has become a leading authority on Bus Rapid Transit systems, providing technical support to cities worldwide with the aspiration of implementing Gold Standard BRT systems.

BRT'S POTENTIAL IN BOSTON

II. BRT'S POTENTIAL IN BOSTON

The Study Group partnered with the organization ITDP to conduct the first technical analysis of the entire metro area, looking for the corridors where BRT showed the most potential, and using the Gold Standard as the goal. The results are promising.

While Greater Boston has seen BRT proposals in the past, there had never been a technical analysis of whether and how it might serve the entire area. With technical analysis from ITDP, the Study Group posed for the first time whether BRT is right for Greater Boston, and if so, where it makes the most sense. They considered ridership, congestion, and projections of future growth. The technical analysis determined there is significant potential for BRT in Boston to reduce congestion in several key corridors, both in the heart of the city and in surrounding communities spanning the metropolitan area. Following is an analysis of the five most promising corridors.

METHODOLOGY

ITDP advises cities considering Bus Rapid Transit to primarily pursue the greatest time savings for the greatest number of people, based on existing demand. While cities are often tempted to pursue BRT in areas with limited or non-existent transit, this is typically not a recipe for success, and relies on predictive modeling to forecast the best corridors. This approach can be overly complicated and something of a "black box" determining why one area would get a BRT corridor instead of another.

Instead, ITDP's methodology is driven by existing ridership on conventional bus routes, which is not only tangible data, but also the most important factor to ensure a BRT corridor is well used and successful on day one. For the most part, aggregated bus ridership data provided by MassDOT and MBTA were at the core of the recommendations. Below are the criteria used by ITDP to determine which corridors in Greater Boston could benefit from BRT:

Ridership — The metric here is persons per hour per direction (pphpd), an internationally accepted measure to calculate demand. Generally ITDP recommends a dedicated lane carry at least 1,200 pphpd, but the absolute minimum was used in this analysis at 400 pphpd, due to Boston's smaller demand compared to other cities. Using this minimum assumes ridership will increase somewhat once established, and that a sophisticated service plan can pull in multiple nearby routes into a BRT corridor. Several corridors were above this minimum, ranging from 400 pphpd up to 1,615. Ranking by ridership, 10 corridors showed potential, although one long corridor (Mattapan to Government Center) was broken into three sections, leaving 12 initial options. One of the options was eliminated because of existing plans for a Green Line extension.

Speed — Using MBTA data, analysts mapped existing bus speeds over each of the corridors to determine where there is both high demand and slow speeds. Predictably, this was the case in most, but not all of these corridors. For example, the Mass Turnpike showed relatively good speeds and was eliminated as not showing much possible gain from BRT. Accounting for speed, nine options for corridors remained.

Development — The final variable was land use and development plans. BRT is used first as a way to move more people faster, but it's also a powerful tool for transit-oriented development. Based on evidence from elsewhere in the United States, BRT can generate as much if not more real estate investment around its stations as more capital-intensive rail-based alternatives. But BRT should also be built in areas that have potential for development. So ITDP focuses on areas where development is already beginning, or where a city is planning to develop. In the case of Greater Boston, development and plans for development are already largely focused on T lines, or in corridors already identified in the analysis based on other criteria. (This indicates that Boston is already following good transit-oriented development practices.)

Demand on the Urban Ring — While the most success can generally be found in responding to existing ridership, there are cases where there's sufficient evidence a new BRT corridor would serve a new pool of riders. That's because the demand estimates based on existing riders and speed don't always reflect the entire story of inconvenient transfers where routes don't match demand. That was the case with a portion of the Urban Ring, which the Study Group requested ITDP look at closer. To make the analysis transparent, the team created a new predictive model (available in its entirety online at www.bostonbrt.org/the-brt-report) to determine if there was enough latent demand in one additional corridor, from Sullivan Square to Ruggles. ITDP found this would in fact, benefit sufficiently from a BRT corridor, and it was added to the list of options.

Finally, the remaining corridors were ranked, and in some places listed as two different options due to alternative variations. The result was a list of 12 corridors in Greater Boston that, from a technical standpoint, would benefit from a BRT corridor. The results span the entire metro area:

Washington Silver Line

Silver Line Extension Dudley to Mattapan

Silver Line Extension to Government Center

Allston Union Square to Dudley Square

Downtown Chelsea to Government Center

Forest Hills to West Roxbury

Harvard Square South to Newton Corner

Forest Hills to Wolcott Square

Sullivan to Longwood, Mass Avenue Bridge Scenario

Sullivan to Longwood, BU Bridge Scenario

Allston Union Square to Longwood Medical Center

Harvard Square to Watertown

At this point in the process, the Study Group set out to narrow the list down to a more practical number of corridors to prioritize. The group determined four additional criteria they would use to make these decisions, prioritizing corridors that:

» Reduce existing congestion on the T

» Serve underserved communities or groups

» Meet additional demand by providing a more direct travel option

» Address the need for planned future development

After thorough discussion and careful comparison of data related to these criteria, the group was able to choose the corridors to prioritize. During this process, the group and ITDP ultimately chose to merge some of the original options together, and slightly adjust routing to maximize benefit. This resulted in the five priority corridors shown on the map on the next page.

TRAVEL TIME ANALYSIS AND ROUTING

Having prioritized these five corridors, the Study Group went back to ITDP and requested an analysis of what kind of time savings Bostonians would experience if BRT were implemented, as well as routing and corridor design options. This process intended to determine how fast BRT could move people here, and provide a reality check of how a BRT route would fit within the Hub's unique landscape. The travel time analysis began with a baseline, each corridor's current, end-to-end estimated running time at peak hours, then estimated the savings that BRT would provide by eliminating or reducing delays, including intersection wait times, transfers, boarding, and time spent sitting in traffic.

It's important to note that all of these travel time projections are based on implementing BRT at the highest standard (Gold) throughout the entire length of the corridor (see Section III for more detail). This study acknowledges that achieving every element of Gold Standard in a few portions of some of the corridors would require some bold steps. The exact corridor routing and any associated trade-offs will have to be explored in more detailed analyses in the future.

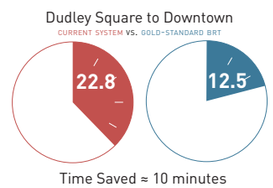
FIVE PRIME CORRIDORS FOR GOLD STANDARD BRT IN BOSTON

Dudley to Downtown

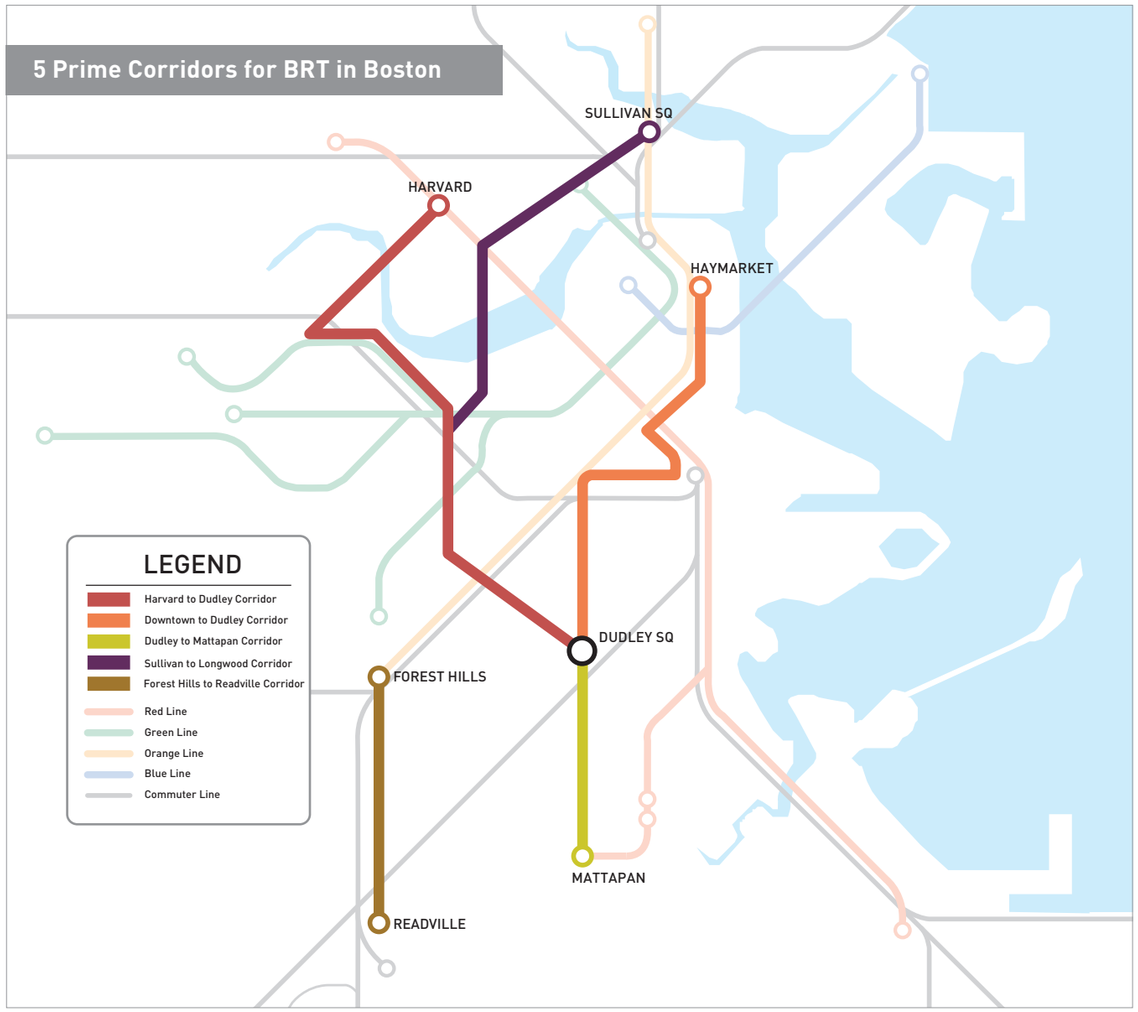
This corridor would essentially supercharge the Silver Line along Washington, one of the area's most used corridors, while providing a faster channel through the congested core of the city, all the way to Haymarket. This three-mile corridor would offer direct connection to the Orange and Red lines, and connection to the Green Line within walking distance.

Converting it to Gold Standard BRT would provide improved access for families, commuters, and young adults alike to jobs, shopping centers, restaurants, and events. Savings here would be significant in the downtown extension, cutting travel times nearly in half with an end-to-end running time of less than 15 minutes. Speeds with BRT would increase mostly as a result of eliminating the lengthy waits at crowded bus stops that people currently experience.

Time Savings:
45% improvement



Routing Notes/Issues: Narrow streets heading into downtown might seem like an impediment to BRT, but there's actually no minimum street width for a corridor, if a city is willing to take some bold steps. Mexico City has demonstrated that its tight,

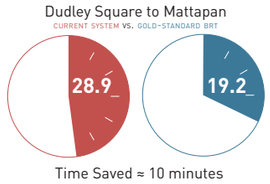


historic downtown streets could be comfortably repurposed for BRT. In the case of the Dudley to Downtown corridor, ITDP proposed two possible options for the downtown section—converting Devonshire to BRT only, or splitting the corridor into one-way pairs on Devonshire and Arch. This corridor can also either end at Haymarket, or in a one-way loop that runs past TD Garden and back to City Hall.

Dudley to Mattapan

This corridor would serve tremendous demand and potential along Blue Hill Avenue—one of the most heavily trafficked streets in the city—while improving connection between culturally and historically important Mattapan and other hubs in the area. Community groups and the city are focusing on developing more retail and local business along this corridor, meaning that easy access and connection to the surrounding city will be crucial to its future success. And as other cities have experienced, a high-standard BRT corridor is a powerful tool for stimulating successful economic development, with well-designed stations and access to rapid transit anchoring investment in the neighborhood. Again, reducing time spent at overwhelmed bus stops increases speeds along this four-and-a-half-mile corridor.

Time Savings:
33.7% improvement



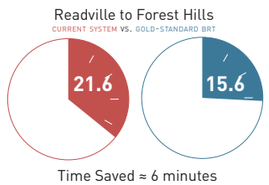
Routing Notes/Issues: The Study Group acknowledges challenges on this route. While Blue Hill Avenue has ample space for BRT, alternatives to the narrow section of Warren Street before it merges with Blue Hill are limited. Furthermore, a BRT route was previously proposed and withdrawn on Blue Hill Avenue, with concerns from the community (see Section V for more detail). With the very high existing demand that came up in ITDP's analysis, it would be a mistake to overlook the benefits BRT could hold for this important corridor of Boston. But any proposed BRT corridor must be driven by the communities' demand and vision for the neighborhoods involved.

Another compelling option with this proposal would be building it as one single corridor combined with the Dudley to Downtown corridor. This would create a single service traveling seven and a half miles from Mattapan to Downtown in about a half hour, without transfer, compared to the 52 minutes it takes now.

Readville to Forest Hills

This four-mile corridor would better connect Forest Hills Station to the Roslindale and Hyde Park neighborhoods, essentially extending the Orange Line to Readville. The overwhelming majority of the time saved is at bus stops, as peak times find Route 32 buses frequently packed and experiencing delays as large numbers of passengers wait to board. Downtown commuters using this busy corridor frequently must squeeze their way past fellow riders, and are no strangers to the disappointment of watching overloaded buses cruise past stops.

Time Savings:
27.8% improvement



Routing Notes/Issues: Similar to the Dudley to Downtown corridor, there is a narrow section of Hyde Park between River and Madison streets, where there are a couple of options to make either BRT or mixed traffic one way, split between two parallel streets.

Harvard to Dudley

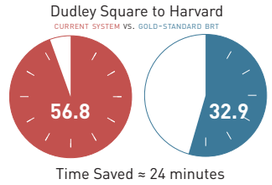
While the thought of traveling from Dudley Square to the heart of Cambridge in a half hour during highly congested peak hours is impressive, it's the improved connectivity for important academic and life science clusters that makes this corridor most exciting.

This option actually merges a few small potential corridors in the original 12 options to form one six-mile corridor with many benefits. The northernmost leg connects Harvard Square with Allston, it then comes down Commonwealth Avenue to the Fenway district, turning south through the Longwood Medical Area, one of the densest and fastest-developing areas of the city for job growth. The final segment ends up in Dudley Square, one of the busiest bus hubs in the city, which plays a central role in a number of these prime corridors due to overwhelming demand.

Residents of Greater Boston could gain many benefits from this corridor. For one, as Harvard expands into Lower Allston, the corridor could provide a better rapid transit option. The Longwood Medical Area has been looking to improve public transit to meet its rapid job growth. There are challenges to implementing the best route through Longwood, and this analysis found three options, each with pros and cons. But this corridor could create a fast transit option in the area, even adding an option for ambulance traffic, which could take advantage of a BRT lane, as happens in BRT corridors in other major cities. This route would also help to alleviate the gridlock that occurs before and after Red Sox games, affecting both attendees and regular traffic.

This is also the longest of the proposed corridors, and therefore shows the largest travel time savings with a 24-minute improvement. But it also offers the second-highest time savings by percentage. While current delays due to multiple bus stops and one-at-a-time boarding are significant, most of the benefit here would be relief from traffic congestion, thanks to dedicated lanes.

Time Savings:
42% improvement



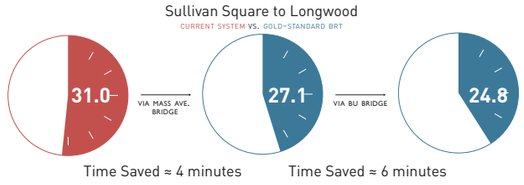
Routing Notes/Issues: This corridor would be beneficial to a number of areas in the city, but would require some decisions for integrating itself into existing infrastructure. On one end, community leaders and planners would face some decision points on its path into Harvard Square, but also some promising possibilities for taking advantage of the Harvard Bus Tunnel and quick, pre-paid transfer to the Red Line. Taking BRT across the JFK Bridge is workable, but would need support from the Harvard community and Cambridge. There are also a handful of possible paths for routing through Allston, Fenway, and Longwood, each with their own benefits.

Sullivan to Ruggles

This corridor would provide fast travel between flourishing life sciences hubs and nearby housing, and serve major development happening in Somerville and around Kendall. It's distinct from the others in that its potential ridership base draws largely from other rapid transit corridors that are far less direct. These are passengers who must now make several transfers for trips not well served by existing routes. The Sullivan to Ruggles corridor would be a more direct, efficient route that would draw riders from nearby bus routes and the T.

The resulting corridor begins at Sullivan Square, runs through East Cambridge to Kendall/MIT, and from there has two options to head into Boston—the Mass Ave Bridge or the BU Bridge. Both options end up at Ruggles.

Time Savings:
20.1% or 12.5% improvement, depending on routing



Routing Notes/Issues: While routing through Cambridge presents a few options, the biggest decision is whether to cross the Charles River at the BU Bridge or the Mass Ave Bridge. Either choice would then have multiple possible paths to get to Ruggles, each with tradeoffs. Another issue is that the stretch of the corridor from Sullivan to Lechmere would require an expensive piece of dedicated infrastructure. One option for avoiding this cost would be to begin the route at Lechmere, although connecting to Sullivan provides an important connection to the Orange Line.

This analysis is the beginning of a conversation, but it provides exciting answers to the two questions the Study Group initially posed—Is BRT right for Boston, and if so, where? The Study Group is confident that this expert research not only makes it evident that BRT is a legitimate mode of transit that Boston should be including in future planning, but it also provides a roadmap for how that planning can progress.

HOW BRT COMPARES TO RAIL

Bus Rapid Transit often finds itself cast as an inferior option to light rail. But when implemented at a high level, ITDP analysis has shown that it can rival light rail in speed and capacity at a much lower cost to build and maintain *(see figures A and B)*.

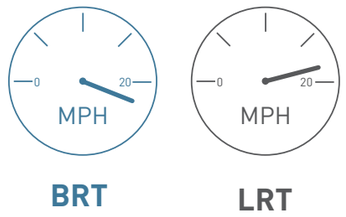


fig. A (left)

Speed Comparison:

BRT also has the added ability to offer more frequent service, to offer a mix of local, limited, and express services, and to save time by eliminating inconvenient transfers.

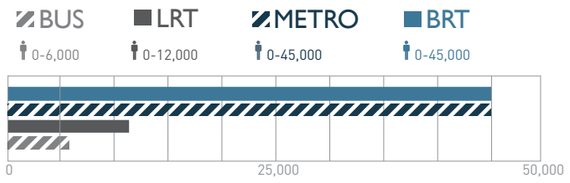


fig. B (above)

Capacity Comparison:

This chart represents the number of passengers, per hour, in one direction.

While far from the only reason to pursue BRT, cost-effectiveness is undeniable. Based on recent BRT and light rail corridor development costs in the United States, on average, BRT can be seven times more affordable than light rail, per mile. That could equate to 25 miles of BRT corridor for the same approximate cost of less than four miles of light rail.

It's important to note that, while we expect this to be the case for the corridors in this report, how much more affordable than light rail BRT would be here, and the overall investment costs, would require more detailed cost engineering assessments beyond the scope of this initial project.

Regarding operating costs, these are harder to measure than capital costs, because cities measure this in different ways. But generally, while labor costs are higher in BRT systems, when accounting for maintenance and depreciation of rail's more elaborate equipment, BRT's overall costs are lower.

For lower cost, BRT can provide comparable or superior service to riders than light rail. But more investment can then be spent on long-lasting infrastructure, technology, iconic stations that better serve neighborhoods, and green, complete streets with bike paths, walkways, and attractive landscaping. And evidence in the United States shows that communities have combined BRT corridors with billions in private real estate investments, more real estate development than has occurred over similar time periods per public dollar invested in light rail *(see Cleveland case study in Section IV)*.

Finally, one important advantage BRT has is speed of implementation. It's not unheard of for high-quality BRT projects to happen within 18 months, but three to four years is a common time frame, as in the case of Los Angeles and Pittsburgh BRT corridors. This is much faster than a typical light rail project, and makes it more likely that a champion can complete a project while in office, as was the case in Bogotá during the four-year term of Mayor Enrique Peñalosa.

For the full Greater Boston ITDP analysis, please visit: http://www.bostonbrt.org/the-brt-report

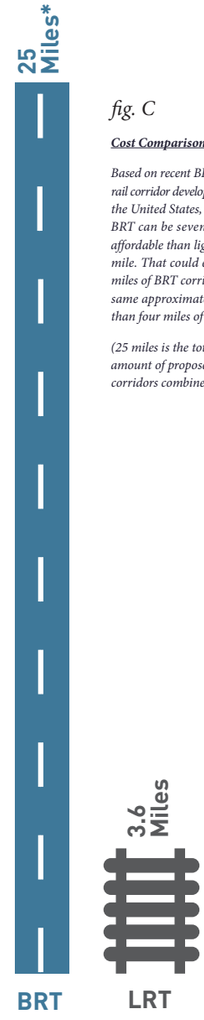


fig. C

Cost Comparison:

Based on recent BRT and light rail corridor development costs in the United States, on average, BRT can be seven times more affordable than light rail, per mile. That could equate to 25 miles of BRT corridor for the same approximate cost of less than four miles of light rail.

(25 miles is the total amount of proposed Boston corridors combined)

"You have to erase all notions of what a bus is today. BRT is so much more. Think of it more as an above ground subway, but with better flexibility since it doesn't rely on one rail line."

—Jackie Douglas, Study Group Member and Executive Director, LivableStreets Alliance

BRT AT ITS BEST

III. BRT AT ITS BEST

BRT at its highest level is unlike anything most public transit riders have experienced. Striving for the Gold Standard will realize its full potential in performance, rider experience, and design.

"Riding BRT is a surreal experience: You're traveling through congested city streets, but it feels like you're on a train. Traffic is a nonissue…"

—Ben Forman, MassINC, Greater Boston BRT Study Group, following a site visit to Mexico City's Metrobús BRT system

One of the challenges in discussing Bus Rapid Transit is that it's not always clear, even to some city planners, what exactly it is. American cities have lagged in implementing BRT, so most people haven't experienced it at its best, firsthand. The term BRT is also often used to describe regular bus service with modest enhancements, adding to the confusion. As a result, planners and the public tend to not know where to put BRT, relying on existing paradigms—bus on one side, rail on the other. But BRT is really neither.

Bus Rapid Transit weaves together elements of bus and rail to create a unique mode of transportation with high levels of speed, capacity, and comfort. City planners are also using BRT corridors in inspiring ways, building iconic stations that anchor development in neighborhoods, and designing "complete streets" that integrate transit, bike paths, and walkways to bring vibrancy and balance back to cityscapes.

Some of the benefits that Greater Boston could gain from BRT, based on real world examples, include:

A Better Connected, Modern Transit System — BRT can offer people getting around Greater Boston increased access to the best the city has to offer, and a more comfortable and modern transit experience while getting there, by improving connections between communities and other transit modes, including cycling and walking. BRT could upgrade and complement our transportation system, including improving resiliency and addressing key weaknesses.

Faster, More Open Conduits Throughout the City — BRT stands to reduce traffic congestion for drivers and provide faster travel times for transit riders. Dedicated corridors remove buses from mixed traffic and provide an attractive alternative to driving through some of the most congested parts of the metropolitan area.

Transit-Oriented, Sustainable Development — As Greater Boston prepares for continued growth in coming decades, BRT can help direct sustainable development and build vibrant, desirable neighborhoods. Communities are using BRT as a powerful tool for economic development.

Reduced Emissions — By increasing capacity in transit corridors and providing faster and more attractive transportation options, BRT can reduce the number of cars on the road and sitting in traffic. Combined with more efficient operations, BRT can improve air quality in cities and help reach emissions reduction goals.

Setting the Standard

All too often, the term Bus Rapid Transit is used to describe incremental improvements to conventional bus service, which can be beneficial, but don't offer the transformative impacts seen when BRT is implemented at a higher level. To alleviate this problem, a committee of international experts developed in 2010 the BRT Standard, a set of scored criteria to bring consistency and better understanding of the most important elements of good BRT, while certifying systems under a Basic-Bronze-Silver-Gold rating system to celebrate the best.

The standard —endorsed by institutions including the Barr Foundation, ClimateWorks Foundation, the Rockefeller Foundation, UN Habitat, the World Bank, and the International Council on Clean Transportation—defines five basic requirements of a BRT corridor, along with five other categories of elements that bring corridors to the next level of quality.

For more information on the criteria behind the BRT Standard, visit: www.itdp.org/library/standards-and-guides/the-bus-rapid-transit-standard/

BRT Basics: The 5 Essential Elements of BRT

Dedicated Right of Way: The core of Bus Rapid Transit is lanes fully dedicated to rapid transit vehicles, off-limits to other traffic to allow them to travel unimpeded much like rail lines. This can be accomplished through physical separation and/or enforcement. Some ability for vehicles to come and go is needed, but the highest standard includes dedicated lanes over 90% of the corridor's length.

Busway Alignment: The goal is to have busways that avoid conflict with other traffic, minimizing delays. Ideal configurations include median-aligned busways that sit in the center of a two-way road, allowing boarding to happen free from mixed traffic, bike traffic, and other curb activity.

Off-board Fare Collection: Paying fares in advance using turnstiles, for example, slashes boarding time, compared to each passenger paying a driver one by one. But it also eliminates the aggravation and anxiety of grappling with payment methods and an additional layer of waiting.

Intersection Treatments: Aside from boarding time and traffic congestion, wait times at intersections are the other main source of delay in conventional bus travel. There are several ways to reduce this, including prohibiting turns across the BRT lane, reducing the number of traffic signal phases, and in some cases, transit signal priority.

Platform-level Boarding: Another key to reducing boarding times, but also increasing comfort and ease, BRT vehicle thresholds glide open, flush with elevated platforms so all riders board quickly. Speed is key here, but this also makes for a better experience for passengers with strollers, wheelchairs, or limited mobility.

Global Bus Rapid Transit By The Numbers

98 Bus Rapid Transit corridors worldwide

62 cities have implemented BRT

383% growth of BRT in the past 10 years

Sources: BRT Standard 2014 Scorecard; ITDP

Better Performance and Design

In addition to the basic components, there are other features that define how well a corridor functions, how well it's designed, and the level of service it provides. Gold Standard BRT is about more than meeting the basics, and there are a few important ways it brings transit to a new level.

First, while BRT's cost-effectiveness is a major selling point, it would be a mistake to simply consider it a lower-cost version of rail. Rather than pocketing the comparative cost savings, investing even some of those resources can enhance service and boost ridership. Because it is so much more cost-efficient—on average, BRT can be seven times more affordable than light rail, per mile—opportunities for higher quality of service abound.

Second, while fixed, dedicated lanes are a hallmark of BRT, service can be smarter and more versatile than other forms of transit. One huge advantage of BRT over rail is the ability to take a disabled vehicle completely out of service with zero to minimal impact to the rest of the system. This also means the system is more resilient than rail in response to harsh weather conditions or emergency situations and it can change over time, allowing different vehicles and routes to take advantage of the permanent corridors. It creates a more nimble system.

And third, an often-overlooked trait of good BRT is good design. Branding and design that stand out while respecting the context of a corridor's setting make all the difference in creating a corridor with strong ridership and public satisfaction.

Here's a closer look at some of the criteria within the BRT Standard:

Service Planning

The key here, and probably one of the most underrated benefits of BRT compared to other mass transit, is the versatility of service it allows. Having multiple routes that operate on a single corridor offers faster travel times, as vehicles can leave the corridor and reach different destinations, eliminating time-consuming transfers, and allowing some ability to adapt. Smart service targets areas with the highest ridership, and brings in routes from nearby corridors. Smart planning can also orchestrate limited, express, and local services.

Another area where leading tech can make for seamless service is a central control center. In Bogota, Colombia, for example, something like an air traffic control allows dispatchers to monitor real time location of BRT vehicles on the corridor, interact with drivers using popup profiles with photos, and monitor overall performance of the system. Controllers can manage incidents and spread out the spacing of vehicles to avoid bunch-ups, an irritating occurrence in conventional bus service.

Stations

One of the most compelling strengths of BRT is how the stations have been put to use by planners. Gold Standard BRT stations show some of the most imaginative design and integration with surroundings happening in transit today (*Jaffe 2015*).

Infrastructure

Execution is key to establishing high-quality BRT. Cost-efficient is not equivalent to less substance. Done right, savings can be channeled into top-quality equipment that lasts longer and improves the experience, for example. This also applies to vehicles with reduced tailpipe emissions, such as particulate matter and nitrogen oxides that are the largest concern in urban buses. Investment in leading-edge vehicles can make BRT fuel-efficient and minimize emissions. Aside from quality components, strategic placement of infrastructure like setting stations apart from intersections, and building stations in center medians that serve both directions of traffic all improve performance.

Communications

Strong branding reassures that passengers will have the same positive experience, no matter what station they board or what destination they seek. Well-designed stations and vehicles challenge misperceptions about bus travel being an inferior experience, and demonstrate an investment and pride in the surrounding area.

Providing passengers with accurate information is important. But more creative uses of information panels can include advertising for local businesses and information on nearby attractions and neighborhood identity, to connect the corridor with the surrounding community.

Access and Integration

BRT integrates universal design approaches that ease the use of BRT for riders with needs of all kind, including people with disabilities, but also across age, demographic, and group or family size. People with disabilities and seniors are often strong BRT supporters because of its improved accessibility in the form of level boarding, automatic gap fillers and pre-paid fare collection as well as improved pedestrian street crossings along BRT corridors.

Integration with existing infrastructure and other forms of transit is another important factor, especially in a place like Greater Boston, where we have a well-established transit system. Integration improves how passengers pay fares, using the same magnetic cards as they use to board the train and conventional bus. There are also many opportunities for integration into other transit facilities for a better transfer experience. It's possible, for example to exit a BRT vehicle and within the same station, take a flight of stairs or elevator to a rail line, much like changing trains. All of this saves people time in transferring from one mode to another, and makes the BRT corridor easier and safer to access.

In Mexico City, for example, the city's bike-share program is integrated with the Metrobús, so users can easily park a bike and jump on BRT. Bicycle use in general is a major component of well-integrated BRT. Well-designed stations have indoor bike parking, such as Bogota's structures that hold 750 hanging bikes per station. Cities have taken the opportunity when implementing a BRT corridor to build parallel bike lanes, separate from traffic.

A Gold Standard BRT Station In Action

The smart use of stations in BRT systems is one of the elements that set it apart from conventional bus. BRT stations can serve as iconic anchors for neighborhoods, and at their best provide comfort and security, and features and amenities that make wait times pleasant. BRT systems worldwide have included beautifully designed additions to neighborhoods that elevate the corridors in the public's perception.

Design — Inspired BRT stations reinforce identity and investment in neighborhoods, provide branded recognition of the BRT corridor to draw passengers, and respect the

identity of the existing community by blending in with the local and historical contexts. Green landscaping helps revitalize streets. Good design combined with effective branding sends the message that people will find consistent, high-quality service, system-wide.

Better Passenger Flow — A well-crafted station will use layout to direct the flow of passengers, speeding up arrivals and departures and minimizing the feeling of being in a crowded space.

Passenger Information — Giving passengers good information is critical to satisfaction. Recent research has found that real-time transit data reduces waiting times, but it also increases trip satisfaction, and may increase ridership. BRT stations can offer real-time information on arrivals in electronic panels, announcements, and dedicated smartphone apps. Interactive panels can calculate arrival times, display service notices, and provide information on nearby tourist attractions, neighborhood history, and local businesses. Easy to understand maps and information about surrounding areas help people orient themselves and find their destinations.

Security and Protection from Elements — Enclosed stations, including multiple sliding doors allowing access to vehicles, allow protection from the weather. Well-lit spaces with security cameras or staff allow people to feel safe and welcome.

Community Participation — Local art is one great example of a way the surrounding neighborhood can connect with BRT stations. In Johannesburg, for example, the transit authority held competitions for artists who were local to each specific station to adorn its walls. Rotating public art projects can build community investment in the corridor.

Green Features — Plant-decorated space, stormwater features, solar-powered stations, garbage and recycling, and water bottle refill stations all reinforce respect for the urban and natural environments.

The Case for the Gold Standard

There are several systems globally that have been implemented and rated as Basic, Bronze, or Silver that have made major strides for the cities' mobility and use of streets. The difference between Gold, and Silver or Bronze is a matter of degree to which these criteria are met within the scoring system. This means that Silver and Bronze BRT systems are well done, but a notch below Gold in key traits. The Gold Standard has only been achieved in a relatively small list of cities, and does not yet exist in the United States.

But as Boston's communities pursue Bus Rapid Transit, the Study Group believes it should make Gold Standard the goal.

For one, the benefits are superior. All of the estimates in this analysis are based on hitting the Gold Standard. This translates to faster travel times, a higher quality of service, and higher ridership.

Second, Boston has historically been a world leader in public transit, and establishing the first Gold Standard BRT in the United States would modernize our transit system and make Boston world class in this realm once again.

But finally, Gold Standard BRT calls for courageous, imaginative decisions about how to create a better transit experience. The cost-effectiveness and performance of BRT present an opportunity to provide a level of experience that is undeniably competitive with other modes, complementing and improving the existing public transit system serving Greater Boston. Pursuing the Gold Standard provides clear goals and criteria for doing so, guarding against backsliding on expectations, and delivering on the promise of better rapid transit.

Understanding the Challenges

This report seeks to convey both the advantages of high standard BRT and the trade-offs required to make it successful. BRT is not a one-size-fits-all solution; on the contrary, BRT must "fit" in the community, both literally and figuratively. This requires bold leadership at the municipal level and often a careful examination of local priorities. It can mean overcoming both logistic and political challenges. Communities that benefit from BRT also bear the costs, so they need to take the lead in weighing those realities. Challenges or concerns sometimes associated with BRT include:

Parking — A dedicated BRT lane can sometimes replace space otherwise used for street parking. Any decision to do so must be made strategically, based on the needs of each neighborhood. Some areas could see a loss of street parking, and therefore, a close look at demand and availability at each site is necessary. There are other benefits to local businesses and residents, including more convenient access, mobility, and economic development. But different needs in the surrounding area must be balanced.

Traffic in Mixed-Use Lanes — Another option for a BRT lane is replacing a lane of mixed traffic. A site-specific analysis is an important step to determining the costs and benefits of repurposing a mixed traffic lane to dedicated BRT on a particular street. But in such a scenario, BRT can actually offer benefits for traffic in the remaining lanes. As opposed to conventional buses, which can block traffic during stops, a dedicated BRT lane allows car traffic to flow better, for example.

In addition to possible short-term benefits, by offering more convenient transit options, BRT can reduce traffic over time by providing a desirable alternative to driving. This becomes more important as Boston's population continues to grow. In many cities with BRT, like Los Angeles and Cleveland, initial BRT ridership was boosted by 18–25% due to some drivers on or near the corridors shifting to BRT *(Crowley 2012; Flynn et al. 2011)*.

Street Layout — Boston has a unique cityscape, and while the ITDP analysis shows that Gold Standard is possible, there are stretches where routing would pose a challenge. For example, tight passages can still accommodate BRT, but in some cases a street may need to be made BRT-only, or converted to one-way traffic.

CO_2 Emissions and Air Quality — When transit serves larger numbers of passengers, there are fewer cars on the road and less pollution. As Boston experiences the level of growth anticipated in the next 10–20 years, the city's environmental impact through air pollution will be heavily dependent on its public transit system. BRT can move large numbers of people more efficiently, which would mean lower greenhouse gas emissions.

Relative to rail, however, the biggest environmental concern about BRT is that most diesel buses are major producers of particulate emissions, which contribute to poor air quality. There are alternative fuel options for BRT vehicles that include compressed natural gas, low-emission liquefied petroleum gas, and hybrid vehicles, all of which can reduce emissions.

BRT IN ACTION

Mexico City, Mexico

Belo Horizonte, Brazil

Cleveland, Ohio, USA

IV. BRT IN ACTION

BRT projects around the world have been improving transit options and revitalizing cities for years, and more U.S. cities are implementing or seriously considering BRT.

BRT worldwide has nearly quadrupled in the past 10 years, with corridors most prevalent in Latin America, Europe, and Asia, while North America has lagged behind. But that's changing, and while the United States formerly had mostly conventional bus systems with only enhancements cherry-picked from BRT, a few cities in recent years have experienced the benefits of high standard corridors, and there is a significant number of new proposals for BRT systems in American cities. The following is a tour of three case studies of successful BRT.

Mexico City, Mexico

Population: 9 million (metro 21M)

BRT Ridership: 850,000 per day

Distance: 65 miles, five corridors

In the early 2000s, Mexico City had some of the worst smog and congestion problems in the world. Born out of a 2002 initiative to combat air pollution in the city, Mexico City's first BRT line opened in 2005, and in just its first year, replaced 350 microbuses with 97 new articulated buses, carrying 250,000 passengers per day. The system has rapidly expanded since, now up to five lines and carrying ambitious plans to expand to 10 corridors and 1.5 million passengers daily.

The investment has paid off, cutting travel times in half, and reducing pollution by 35% and traffic accidents by 54%, according to one recent estimate by Metrobús. The system is used by people across demographics, and one nonprofit's survey found that 15% of passengers were car owners. *(EMBARQ 2011)* According to Metrobús, the system has been responsible for 122,000 fewer tons of CO2 per year released into the atmosphere.

The Metrobús is part of an aggressive livable streets initiative in Mexico City, which includes a bike-share program that is integrated into the BRT system with payment accepted using the same smart cards. And the latest corridor of the system follows a complete streets model, mixing safe bike and pedestrian paths into a landscaped corridor, and offering bike parking at state-of-the-art, well-designed stations. *(ITDP 2013)*

Belo Horizonte, Brazil

Population: 2.5 million (metro 5M)

Ridership: 682,000 per day

Distance: 14 miles, 2 corridors

Belo Horizonte's new MOVE transit system is a Gold Standard BRT system that opened two corridors in 2014, on a short timeline. MOVE boasts some of the highest quality execution that was highlighted during the city's moment in the spotlight as a host city for the World Cup *(ITDP 2014)*.

MOVE combines center-aligned stations, off-vehicle fare collection, and separated lanes that allow it to travel five times the speed of a car in peak hours. The corridor's integration is also impressive, connecting up with the infrastructure of a crowded city (Belo Horizonte was designed in 1897 to accommodate only 100,000 people) to allow easy transfer from one mode to another, connected bike lanes, and even reserved seating for cyclists. *(EMBARQ 2014)*

But design is perhaps one of MOVE's strongest features, with modern, eye-catching stations and seating areas, and well-branded, unmistakable vehicles.

Cleveland, Ohio, USA

Population: 400,000 (metro 2M)

BRT Ridership: 15,800 per day

Distance: 7 miles, 1 corridor

Cleveland's HealthLine is the best BRT corridor in the United States, and it's serving as a model for other North American cities looking to leverage economic development and increase rapid transit ridership. Cleveland shares the story of other Rust Belt cities, struggling for years from the loss of the manufacturing industry. While it maintained two economic hubs, there were many deserted buildings and little activity in between.

BRT found a champion in George Voinovich, who over 40 years served Ohio as a state representative, Cleveland mayor, governor, and finally U.S. senator. In the late 1980s, Voinovich visited Curitiba, Brazil, home of the first BRT system, and recognized potential for Cleveland. The crawling pace of Cleveland's buses, just 9.3 mph between its two hubs, made it a perfect candidate. As part of a multi-pronged revitalization initiative for the city in the early 2000s, plans were made to turn the connecting street into a commercial backbone for the city.

A seven-mile corridor was established with just $50 million for stations, vehicles, and platforms, and another $150 million for road improvements and street enhancements.

HealthLine is the only Silver-rated BRT line in the United States, with platform-level boarding, central median alignment, off-board fare collection, and modern, sleek stations that serve as landmarks. It's well branded to reflect the medical hub it serves on one end of town. Articulated, silver vehicles could be mistaken for streetcars at a glance. From its launch in 2008 to 2013, ridership increased by 67%, CO2 emissions have been reduced, and particulate emissions in the corridor were reduced by 95% thanks to low emission vehicles.

But Cleveland's biggest bragging rights are the private investment in the surrounding community that it has experienced along with its BRT corridor. The area saw $5.8 billion in private real estate investments following the opening of its HealthLine BRT corridor. When compared to rapid transit corridors elsewhere in the United States, that's more real estate development than what has occurred, per dollar invested, than in light rail projects over similar time periods.

In other words, real estate development following BRT in Cleveland was competitive with that following light rail projects in the United States, but much higher than light rail, per dollar invested. Specifically, Cleveland experienced $114 worth of private real estate investment per dollar the city spent on BRT. *(Hook et al. 2013)*

"The HealthLine has not only dramatically improved transportation options from downtown to University Circle, it's also been a catalyst for nearly six billion dollars of real estate investment along Euclid Avenue and is contributing a great deal toward revitalizing the city."

—George Voinovich, former U.S. Senator, Cleveland mayor, and Ohio governor, and a champion of Cleveland's BRT corridor.

SPARKS OF BRT IN BOSTON PLANNING

The Silver Line

Blue Hill Avenue and 28X

The Urban Ring

2024 Olympics

South Boston Waterfront Plan

V. SPARKS OF BRT IN BOSTON PLANNING

Plans for BRT in Greater Boston have been scratching the surface long before the Study Group formed, and a number of opportunities exist in current city planning.

While this report includes the first technical analysis of BRT's potential citywide, the concept is not new to Greater Boston. In fact, regional transit experts have been including BRT in a number of plans, and the ongoing discussion of BRT in Boston partially inspired the convening of the Study Group. The following is a look at BRT in Boston's past, current and future transit planning, and how it fits in with the Study Group's findings.

The Silver Line

"I hope this report provides the impetus for political and social change to make BRT a viable option when considering new transit investments in the city, and that the existence of this new option leads to sustainable investments for the neighborhoods that are most likely to benefit."

—Bill Lyons, Fort Hill Infrastructure Services, Urban Land Institute of Boston, and Study Group Member

The Silver Line in Boston is an enhanced bus service currently operating in two sections—Washington Street and the Waterfront. The first section connects Dudley Square to Downtown, and the second section connects South Station to South Boston and Logan Airport.

The Silver Line has elements of BRT only in some portions, in particular when it operates underground, including dedicated busways, pre-board fare collection, and multiple door entrance and egress. The BRT elements it has have indeed improved the experience of riders in its corridors and increased ridership.

While the Silver Line is sometimes referred to as BRT it does not actually qualify as such under the BRT Standard, because it only possesses key BRT elements in limited sections, and primarily runs in mixed traffic, for example *(Cruz et al. 2011)*.

One of the five routes recommended in this report would convert the Silver Line on Washington Street to Gold Standard BRT. If this were executed, the resulting service would be markedly different. There are also plans to extend the Silver Line beyond its current routes. The Silver Line Gateway is a BRT line that will connect Chelsea and East Boston with the Waterfront and South Station, operating in part on a new dedicated busway on the former Grand Junction railroad right of way *(MassDOT 2015)*.

Blue Hill Avenue and 28X

State transportation officials in 2009 introduced a BRT proposal for Blue Hill Avenue running from Dudley to Mattapan, one of the busiest bus corridors in the region. The proposed BRT line (referred to simply as 28X because it would have followed more or less the same route as the existing 28 bus) intended to use federal stimulus grant funding to establish features including a dedicated lane through most of the corridor, fare prepayment, and new stations.

The proposal was controversial, especially at its outset, in part because it came as a surprise to many in the community, and because of concerns about street safety, changes to the streetscape, traffic and parking impacts. And while the subsequent public meetings were productive, some in the community could still not get behind the project and it was ultimately too contentious to move forward. A letter from local lawmakers to former Transportation Secretary Jim Aloisi ultimately asked the plan to be withdrawn. *(Dumcius 2009)*

This corridor is included in the recommendations from the Study Group because it meets the criteria established for the analysis that was applied across all of Greater Boston. The Study Group acknowledges the history associated with this corridor and maintains the view that BRT is worth a second look here, just as it is deserving of serious consideration in other corridors throughout Boston, Cambridge, and Somerville. As emphasized throughout this report, the Study Group adamantly encourages community engagement and leadership to ensure that all transit decisions fit with surrounding neighborhoods' own visions and priorities. As BRT is considered, decision-makers must learn from the history of infrastructure decisions in Roxbury, Dorchester, and Mattapan to guarantee equity in access and level of service, and above all, listen to the needs and visions of people in these communities.

The Urban Ring

The Urban Ring is a century-old idea first developed by city planners to connect the communities that circle the downtown core. Boston's transit system is currently organized mainly as a set of radiating spokes connecting the center to the outlying areas. The Urban Ring would create a roughly circular corridor to link up these outlying areas, providing a "wheel" to connect the spokes, reducing the need for inefficient transfers through downtown. Over the past decade, some civic and business groups collaborated on plans to complete a loop of BRT with dedicated busways and intersection treatments, connecting several T stations that circle the city. *(ABC 2015)*

MassDOT suspended plans in 2010 due to the entire project's high cost. But several pieces of the concept persist. The ITDP analysis identified two corridors that are closely matched with pieces of the Urban Ring: Harvard to Dudley and Sullivan to Ruggles.

2024 Olympics

The 2024 Olympics, at the time of this report, are a large question mark in planning for the future of the city. Should the city be selected by the International Olympic Committee for the 2024 Games, there will almost certainly be major changes to Boston's landscape, and transit will be an important component.

The organizers' presentation to the United States Olympic Committee included a conceptual transit map with three possible BRT corridors *(Boston 2024 2015)*. One would run from Harvard to MIT, across the Mass Ave Bridge and down to UMASS, where the Olympic Village would be set up. A second route starts around North Station, runs through downtown and to the South Boston Waterfront. And a third runs from the airport to Chelsea.

As suggested in a recent *Boston Globe* opinion piece by Harvard urban design professor Alex Krieger, the Olympics could provide an avenue for the city to chart out permanent improvements *(Krieger 2015)*. One of the principles identified by the organizers of the Olympic bid is: "We will only bid if we are sure that hosting the Olympic and Paralympic Games will align with and accelerate our long term planning as a city and state, through and beyond 2030." *(Boston 2024 2015)*

Should Boston be selected for the 2024 Olympic Games, Boston's transit system could see some permanent improvements, and BRT could be a part of the plan. Planners

should ensure that any BRT corridors selected to serve the Games would be justified as long-term additions, and follow high-standard BRT criteria. This report can help inform such decisions.

South Boston Waterfront Plan

The South Boston Waterfront is the fastest growing urban area in Massachusetts, adding thousands of residents and jobs since 2000, and on pace for significant development in the next 20 years. As this area continues to develop, more emphasis is being placed on sustainable transportation, including walking, bicycling, and transit.

In January 2015, a committee made up of City of Boston and state agencies including MassDOT released the South Boston Waterfront Sustainable Transportation Plan, creating a blueprint and action plan for the future of the area. Plans for Bus Rapid Transit are among the recommendations in the report, including for BRT service along Merrimac/Congress, connecting North Station and the Waterfront (this is similar to the route envisioned in the 2024 Olympics plan). The transit plan also discusses improvements to the Silver Line, which is often running at or over capacity where it serves the Waterfront. *(VHB 2015)*

Springfield, MA

The Pioneer Valley Transit Authority is currently pursuing an analysis to advance BRT service in Springfield, Mass. PVTA, MassDOT, the City of Springfield, and the Pioneer Valley Planning Commission are convening a committee to consider BRT along the State Street Corridor, the main east-west connector in the city that is home to businesses, parks, and other assets. The committee has preliminary plans to make a site visit to Cleveland or Eugene, OR to see their systems in action. (PVTA 2015)

CONCLUSION

VIII. CONCLUSION

The benefits of BRT at its highest standard are real, and they could be reality in Greater Boston. The Study Group not only found technical evidence for BRT's potential here, its members are enthusiastic about the possibilities in our future planning.

It's been a full day of appointments around downtown, but you were able to make it over to Harvard Square for dinner with a friend. You've boarded a BRT vehicle, and now relax in your seat, watching Cambridge pass by out the window.

Several students are on board, heading home from classes. Cutting through Fenway, it looks like a game got out not long ago. A group of Red Sox fans in matching jerseys hop on at the station near the park.

In a half hour, you're back at Dudley Square, thinking back to the days when this could take more like an hour, packing onto a train and transferring to a bus, or sitting in traffic crossing town. But not tonight. Glass doors slide open, you're back in the station, and then home.

This is an imaginary scenario. But something like it is very real, whether in Mexico City, Cleveland, Los Angeles, Rio de Janeiro, or Rouen in France. And it's evident that, technically, this could be a reality in the Boston metropolitan area. BRT weaves together enclosed stations, exclusive lanes physically separated from traffic, pre-paid fare collection, smart use of real-time data, and beautiful design, to deliver speed, capacity, and comfort. Certainly, there are misconceptions about BRT, skepticism, concerns to be ironed out, questions about route details. And it will require bold leadership. But the possibilities are great.

The Study Group has concluded that Gold Standard BRT is a sound option and should be seriously considered in at least five recommended corridors that span the city. The collaborative work with ITDP, site visits to Mexico City's Metrobús system, study of existing corridors, and initial meetings with community stakeholders strongly suggest that the area stands to realize significant gains.

Recommendations

The Study Group hopes that as more people learn about the strengths of Bus Rapid Transit, the rest of the city will share the enthusiasm built in the past year and a half. With a bold vision and smart planning, Gold Standard BRT can help Boston create a modern, more efficient transportation system.

Greater Boston should view BRT as a key piece of its transportation system. Boston, historically a world leader in transportation, is at a turning point when it comes to its transit system. Financial challenges and projections of continuing growth in ridership mean the city and surrounding area need to make major advances. For a number of high demand corridors, BRT could provide fast, comfortable, reliable service at lower cost than alternatives. Investment in BRT elsewhere in the United States has shown that on average, BRT can be seven times more affordable than light rail, per mile. Its flexibility and connectivity to other modes of transit also mean that BRT can improve and complement the area's existing transportation system, making it overall more dependable and resilient.

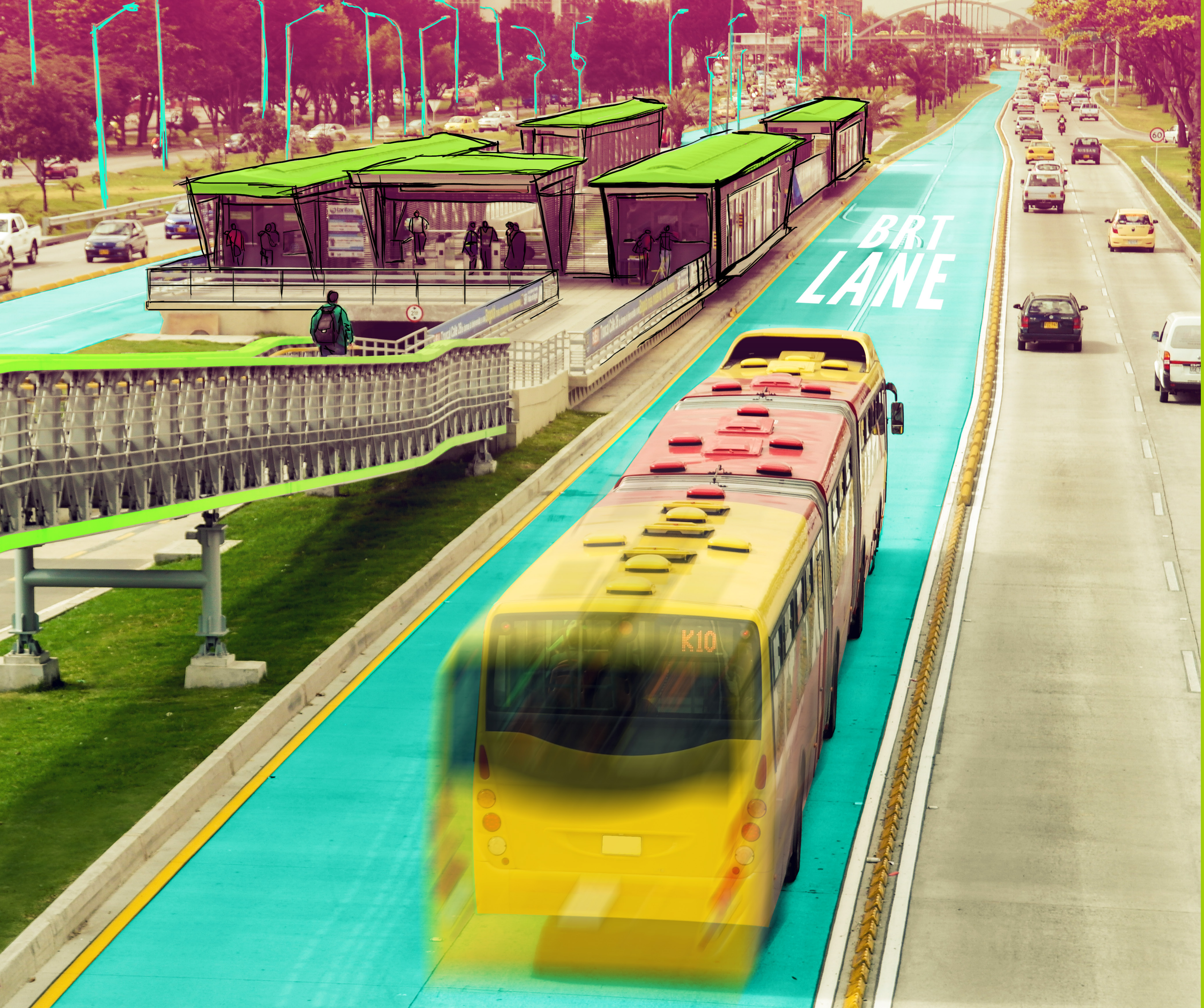
In planning efforts, elevate BRT to its rightful place as a high-quality, high-impact, cost-efficient mode of transportation co-equal among other modes. The Study Group strongly urges local, regional, and state-level planning, transportation and mobility efforts to regard BRT as a legitimate mode of public transit. BRT corridors in world-class cities have demonstrated speed and capacity competitive with light rail. Communities have combined BRT corridors with major public and private real estate and housing investments. Evidence in the United States shows that private real estate investment per public dollar invested in BRT corridors has outstripped such investment per public dollar invested in light rail. Planners and transport stakeholders should examine Gold Standard BRT along with alternatives as an option for high-quality, high-frequency transit service.

Make Gold Standard the goal. Decision-makers and community leaders serving the Greater Boston area should make Gold Standard the goal when pursuing BRT. On corridors where Gold Standard BRT is feasible, it has high potential to improve performance, stimulate development, and create more attractive, multi-mode streets. For example, reaching Gold Standard can achieve impressive time savings, up to 45% based on analysis of potential corridors. It also provides clear criteria to deliver on the promise of better rapid transit. It will bring the city back to the forefront of transit by establishing a world-class, modern system that will serve as a model for the rest of the country.

Transit officials should include BRT in planning processes and documents now, and upon request from communities, provide support for BRT analysis and development. MassDOT should include BRT in the Program for Mass Transportation, its long-term capital planning document. Officials must then listen to communities' voices on whether and how to proceed with BRT analysis along specific corridors. When a critical mass of stakeholders and leaders surrounding a potential corridor requests it, MassDOT should conduct a BRT alternatives analysis, which if favorable, will enable state support for design and development of Greater Boston's first Gold Standard BRT corridor.

Communities must lead the way. The Study Group identified five initial corridors in Greater Boston that show great promise for Gold Standard BRT to deliver reliable and resilient transit, greater access to the city's assets and economic opportunities, and a better transportation experience. A robust stakeholder and community engagement process is now necessary to determine which of these corridors is the most likely candidate for the first Gold Standard BRT line in Greater Boston and the United States. The logical next step is to use this report as a starting point to engage communities on a host of issues, such as station design and location, economic benefits, and routing details, that are associated with a BRT corridor. From here, it is crucial that communities and their representatives lead the charge for Gold Standard BRT, paving the way for an improved, modern transportation system.

For additional information on BRT, including the complete technical analyses that informed this report, and links to several external resources on Bus Rapid Transit, visit www.bostonbrt.org.



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NOTES

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