



## **PICKING UP THE PACE:**

*An analysis of best practices for improving bus speeds and their potential applicability to Milwaukee*

## **ABOUT THE PUBLIC POLICY FORUM**

Milwaukee-based Public Policy Forum – which was established in 1913 as a local government watchdog – is a nonpartisan, nonprofit organization dedicated to enhancing the effectiveness of government and the development of southeastern Wisconsin through objective research of regional public policy issues.

## **PREFACE AND ACKNOWLEDGMENTS**

This report was undertaken to provide citizens, policymakers, and business leaders in the Milwaukee area with information about potential strategies for improving the speed and efficiency of Milwaukee County Transit System bus services. We hope that policymakers and community leaders will use the report's findings to inform discussions during upcoming policy debates, budget deliberations, and civic gatherings regarding public transportation services and strategies in our region.

Report authors would like to thank the leadership and planning staff of the Milwaukee County Transit System, Milwaukee County Department of Transportation, and the many other organizations throughout the country that provided us with information and insight. Those organizations include the Central Ohio Transit Authority, Chicago Transit Authority, Chicago Department of Transportation, Greater Cleveland Regional Transit Authority, Institute for Transportation and Development Policy, King County Metro Transit, Metropolitan Transit Authority (Nashville), Regional Transportation Commission of Southern Nevada, Southwest Ohio Regional Transit Authority, Southeastern Wisconsin Regional Planning Commission, and Spokane Transit Authority.

Finally, we wish to thank the Helen Bader Foundation for its grant to the Forum for workforce development research, which helped make this report possible.



Cover photo: Cleveland's HealthLine BRT service features enhanced bus stops that allow for level boarding.

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# TABLE OF CONTENTS

Executive Summary .....	3
Introduction .....	11
Background .....	12
Transit Access to Job Centers .....	13
Strategies for Improving Bus Speeds .....	16
Strategies for MCTS to Consider .....	17
Summary .....	33
What is Bus Rapid Transit (BRT)? .....	34
Defining BRT .....	34
The BRT Standard .....	38
BRT Case Studies.....	40
Cleveland’s HealthLine .....	40
Las Vegas’ BRT Network.....	44
Nashville’s “BRT Lite” Services.....	46
Chicago’s Existing and Planned BRT Services .....	48
Summary .....	53
Past Proposals for BRT in Milwaukee .....	55
Policy Implications and Conclusion.....	58
The East-West Corridor as a Starting Point? .....	58
Bus System Improvements in the Context of MCTS’ Fiscal Challenges .....	65



## EXECUTIVE SUMMARY

The Public Policy Forum's December 2013 report, *Getting to Work*, described the lack of viable mass transit options available to Milwaukee County residents wishing to access jobs in the suburbs.<sup>1</sup> We found that many suburban job centers are not served by transit at all, while others only can be accessed via lengthy bus commutes of more than 60 minutes each way. The findings of that report led us to ask how other metro areas had addressed similar bus service challenges, as well as how they had responded to the general challenge of improving bus service effectiveness and attractiveness.

In this report, we focus on common strategies that transit systems around the country have utilized to enhance the speed and efficiency of their bus services, and consider the potential implementation of those strategies in the Milwaukee area. These strategies may hold promise to improve transit connections for the regional workforce and enhance its appeal to the general population, including those who currently do not use transit. Major sources for our analysis include research conducted by the Transportation Research Board (TRB) of the National Academies and conversations with transit system planners from around the country.

While many of the strategies we examine are relatively small changes that could be made to existing Milwaukee County Transit System (MCTS) bus routes, we also consider larger improvements, including some that could involve substantial capital investment. Among those are **bus rapid transit** (BRT), a faster and more comfortable type of bus service that can be comparable to light rail systems in speed and design, but that can be implemented at a much lower cost.

## STRATEGIES FOR IMPROVING BUS SPEEDS

After a decade of service cuts and fare increases, MCTS has managed to stabilize bus services and make several significant improvements over the past few years. A new network of six express bus routes has been developed, for example, and an electronic fare card system recently was introduced that makes boarding and transferring faster and easier.

Milwaukee has not yet implemented many other common strategies that have been adopted in other U.S. metro areas, however, including the following:

- **Increased bus stop spacing.** Some transit systems have established minimum standards for bus stop spacing and eliminated stops as appropriate as a means of improving bus speeds. The Spokane Transit Authority's Stop Consolidation Plan, for example, resulted in a 35% reduction of



MCTS introduced an electronic fare card system in the fall of 2014, which expedites boarding.

<sup>1</sup>Public Policy Forum. "Getting to Work: Opportunities and obstacles to improving transit service to suburban Milwaukee job hubs." December 2013. <http://publicpolicyforum.org/sites/default/files/GettingToWork.pdf>



total bus stops system-wide. This approach has been found to modestly speed up service and improve on-time performance, though it does require some transit users to travel further to reach the nearest stop.

While MCTS has a stop spacing guideline of  $\frac{1}{8}$  mile for regular bus routes, it is used more as a target than a minimum. Our initial analysis found that 37% of the stop segments on MCTS bus routes are shorter than  $\frac{1}{8}$  mile; and that overall, 30% of stops could be removed without leaving any stops spaced further than  $\frac{1}{4}$  mile apart, which is considered a walkable distance by industry standards. There are legitimate reasons why some bus stops are spaced close together, however, and additional analysis and public input would be required to determine where stops could be removed without unacceptably harming service quality.

- Limited-stop express service.** In many metro areas, stops on express bus routes are spaced  $\frac{1}{2}$  to  $\frac{3}{4}$  mile apart. For example, the Southwest Ohio Regional Transit Authority in Cincinnati recently introduced an express bus route called Metro Plus, which stops every  $\frac{2}{3}$  mile on average and reduces travel times by approximately 17% compared with regular bus service.

Actual stop spacing on MCTS' BlueLine, GreenLine, and RedLine express routes averages around  $\frac{1}{4}$  mile, which limits the distinction between those routes and regular bus service. Consequently, MCTS express bus routes typically offer passengers a time savings of only 5-10% compared with regular bus service. MCTS could consider modifying its policy to increase stop spacing further on express routes, but again must balance the desire for increased speed with accessibility concerns.

- Transit signal priority technology.** Several transit systems equip buses and traffic lights with devices that grant priority to buses as they approach, producing 5-10% reductions in travel times. In Seattle, for example, transit signal priority has been shown to reduce average travel times on six "RapidRide" express bus routes by an average of 5.5% and to improve on-time performance.



On average, Cincinnati's Metro Plus express bus route stops every  $\frac{2}{3}$  mile.

MCTS currently does not utilize transit signal priority technology, but is planning to do so for a short stretch of Wisconsin Avenue in the future. Implementing TSP on priority bus routes in Milwaukee may be a relatively easy and inexpensive system improvement, as the City already has some of the needed technology in place.

- Bus-only lanes and bus-only shoulders.** Allowing buses to have exclusive use of certain traffic lanes or highway shoulders is a proven strategy for improving travel speeds and reducing delays



on congested roads and highways. San Francisco, for example, has 15 miles of bus-only lanes and plans to add more in the future. Some are designated exclusively for buses at all times of day and night, while others are shared with taxis and/or are only “active” during peak periods. Regular vehicles also are allowed to use bus lanes to make turns.

The Minneapolis-St. Paul metro area, meanwhile, has developed a network of more than 300 miles of bus-only *shoulders* along arterial roads and highways. Buses are able to use the shoulders to bypass traffic, provided certain criteria are met. Many other metro areas are experimenting with bus-only shoulders as well, including Chicago.

In the Milwaukee area, the only bus-only lanes are on a roughly 5-mile stretch of Bluemound Road between 124<sup>th</sup> Street and the Goerke’s Corners park and ride lot. The right lanes on Prospect and Farwell Avenues also were once dedicated exclusively to buses and bicycles during weekday morning and afternoon rush hours, but those lanes were removed in 1995. Bus-only shoulders have never been introduced here, but could be considered for several express bus routes and Freeway Flyers.



The Minneapolis-St. Paul area has over 300 miles of bus-only shoulders on arterial roads and highways.

Each of these strategies has the potential to improve bus speeds and reduce travel times to some extent. As we stated in *Getting to Work*, however, “to truly address the prohibitive travel times faced by many reverse commuters, more advanced and expensive strategies may be required.”

## **BUS RAPID TRANSIT (BRT)**

BRT combines a variety of bus system improvements to produce an enhanced level of service that offers substantial benefits to users in terms of speed, reliability, and accessibility. Below are several major elements that distinguish BRT from other bus services.

- **Running Ways** – BRT services typically operate in exclusive bus lanes. Some use dedicated curbside lanes, but the preference is use of center/median lanes, which allow buses to avoid right-turning vehicles and pedestrians.
- **Stations** – BRT stops and stations often allow for level boarding and include many passenger amenities, such as real-time vehicle arrival displays and ticket vending machines.



A BRT service in Minneapolis features level boarding at bus stops.



- **Vehicles** – BRT vehicles often are articulated (extended) with three sets of doors, thus offering increased capacity and faster boarding. Vehicles typically include other features designed to improve speed and comfort as well, including wider doors and aisles and larger windows.
- **Fare Collection** – Most BRT services feature off-board fare collection, which requires passengers to purchase bus tickets or fare cards before boarding. Off-board fare collection reduces “dwell time” associated with buses waiting for passengers to pay fares.



The BRT system in Las Vegas uses articulated and stylized vehicles.

- **Intelligent Transportation Systems (ITS)** are advanced communications technologies used to improve speed and function. In addition to transit signal priority, one example of ITS is precision docking, which assists with docking at stations to facilitate level boarding.

To provide perspective regarding how BRT services are being implemented in U.S. metro areas, we examined four distinctive examples that show the range of BRT options. Those options range from “BRT lite” (i.e. modest upgrades to express bus routes) to those that entail major capital investments that allow BRT buses to operate similarly to light rail trains. Local officials could consider this range of examples if they wish to explore the implementation of BRT services in Greater Milwaukee.

1. **Nashville** has implemented two lengthy “BRT lite” routes (12 and 14 miles). While the routes lack many key BRT features like dedicated lanes and off-board fare collection, they still provide a faster service than typical express bus routes. Both routes use wide stop spacing that averages  $\frac{3}{4}$  mile, while one uses transit signal priority and it will soon be added to portions of the other.
2. **Las Vegas** has implemented four BRT routes that have slightly different designs, but that together form a network of faster, higher-quality bus services. Three of the four routes serve downtown Las Vegas, including one that connects downtown with “The Strip.” This “Strip and Downtown Express” is categorized as “Basic BRT” under standards developed by the Institute for Transportation and Development Policy (ITDP). The other three routes do not meet the Basic BRT standard, but contain features that are much more advanced than typical express bus routes.
3. **Cleveland’s** HealthLine is a 7.1-mile BRT service that serves Cleveland’s two largest employment centers – downtown Cleveland and University Circle, where major regional healthcare facilities are located. The HealthLine is the only BRT route in the U.S. that has achieved a rating of “Silver” from ITDP. It operates 24/7 with service offered every 6-8 minutes during peak travel times. The line also features exclusive center/median lanes for most of the route; articulated, hybrid electric vehicles; raised platforms and a precision docking system; transit signal priority; and off-board fare collection.
4. **Chicago** established a “BRT lite” service called the Jeffery Jump in 2012. It is now planning a Central Loop BRT project that will speed up service for multiple bus routes traveling east and





west through the Loop, as well as an Ashland Avenue BRT route that could become the most advanced BRT service in the country. The Ashland BRT service is expected to cut travel time by 45% compared with existing service and it will be comparable in speed to service on 'L' train routes.

It is very difficult to compare costs and benefits between services due to their varied features and the distinctive contexts in which they were developed. With that major caveat, the tables below summarize the specific features of the routes we examined, their total start-up costs, and their travel-time savings.

### Key features of BRT case studies

Location	BRT Service	Exclusive Lanes	Median or Curb Lanes	Avg. Stop Spacing	Transit Signal Priority	Off-Board Fare Collection	Level Boarding
Cleveland	HealthLine	Yes	Median	1/5 mile	Yes	Yes	Yes
Las Vegas	Strip & Downtown Express (SDX)	Partial	Median	1/2 mile	Partial	Yes	Yes
Las Vegas	Metropolitan Area Express (MAX)	Yes	Curb	1/2 mile	Partial	No	Yes
Las Vegas	Boulder Highway Express (BHX)	Yes	Curb	1/3 mile	Partial	No	Yes
Las Vegas	Sahara Express (SX)	Yes	Curb	1/3 mile	Partial	No	Yes
Nashville	Gallatin Pike	No	Curb	3/4 mile	Yes	No	No
Nashville	Murfreesboro Pike	No	Curb	3/4 mile	Planned	No	No
Chicago	Jeffery Jump	Partial	Curb	1/2 mile	Partial	No	No
Chicago	Central Loop (planned)	Yes	Curb	1/4 mile	Yes	Partial	Yes
Chicago	Ashland (proposed)	Yes	Median	1/2 mile	Yes	Yes	Yes

### Approximate start-up cost per mile and travel time savings offered by BRT case studies

Metro Area	BRT Service	Approx. Start-Up Cost per Mile	Approx. Travel Time Savings <sup>2</sup>
Cleveland	HealthLine	\$7 million <sup>3</sup>	25%
Las Vegas	Strip and Downtown Express (SDX)	\$5.9 million	30%
Las Vegas	Metropolitan Area Express (MAX)	\$2.7 million	20%
Las Vegas	Boulder Highway Express (BHX)	\$2.4 million	N/A
Las Vegas	Sahara Express (SX)	\$2 million	N/A
Nashville	Gallatin Pike	\$160,000	10-20%
Nashville	Murfreesboro Pike	\$70,000	10-20%
Chicago	Jeffery Jump	\$700,000	10-15%
Chicago	Central Loop (planned)	\$16 million	15-25%
Chicago	Ashland Avenue (proposed)	\$10 million	45%

<sup>2</sup> The layouts of Las Vegas's BHX and SX routes are significantly different from any current or past local bus service, which makes travel time savings difficult to calculate.

<sup>3</sup> Cleveland's HealthLine required major corridor improvements beyond those specifically related to introducing BRT. Overall project costs were \$28 million per mile, including \$7 million for transit-specific components.



Here in the Milwaukee area, “BRT lite” services have been proposed by both Milwaukee County and the City of Milwaukee in recent years, and the Southeastern Wisconsin Regional Planning Commission has included potential BRT routes in its long-range transportation plans. Yet, in part because of the lack of consensus over the optimal way to improve public transit in southeast Wisconsin, BRT services have never been implemented.

## **POLICY IMPLICATIONS FOR MILWAUKEE**

Strong arguments can be made for enhancing bus routes along several different corridors in Milwaukee County to provide faster and more reliable service. The corridors where MCTS’ five color-coded express bus routes and Route 30x currently operate, for example, appear to be prime candidates for further experimentation and investment, as they already provide faster service throughout the day and week.

Among those corridors, the east-west corridor may offer the most advantageous setting for exploring options for improvements. The segment of Wisconsin Avenue extending from Cass Street to 17<sup>th</sup> Street already is the busiest transit corridor in the region, so enhancements to infrastructure on that 1.7-mile stretch could speed up service for passengers on multiple bus routes, including three existing express routes (BlueLine, GoldLine, and Route 30x). The east-west corridor also functions as a transit spine for the region, providing connections to numerous north-south bus routes.

The east-west corridor also would be a logical place to introduce a BRT service, as all of the past BRT proposals for Milwaukee have included an east-west route. It also would be a strikingly similar route to Cleveland’s HealthLine, as it would connect the region’s two largest employment centers (downtown and the Regional Medical Center) and would directly serve the city’s two largest universities (UWM and Marquette). With several years of reconstruction planned for Interstate 94 in the near future, the timing also may be ideal for adding new BRT service in that area as a mitigation strategy.

Below, we lay out three scenarios for improving bus service in the east-west corridor, from small modifications to the introduction of a high-quality BRT system.

### **Small Modification: Add Transit Signal Priority on Wisconsin Avenue**

One example of a small improvement in the east-west corridor would be to equip all intersections with traffic signals and all buses operating on Wisconsin Avenue with transit signal priority technology, which could be programmed to give buses priority depending on a set of pre-determined factors. Research indicates that transit signal priority systems have the potential to reduce bus travel times by 5-10%. Based on case studies from around the country, the cost of adding such improvements on Wisconsin Avenue likely would be in the \$500,000 to \$1 million range, but may be much lower if the County is able to utilize the City’s existing signal preemption system. MCTS already plans to experiment with transit signal priority on Wisconsin Avenue between 27<sup>th</sup> and 35<sup>th</sup> Street within the next five years.



## Larger Modification: Introduce bus-only lanes or bus-only shoulders

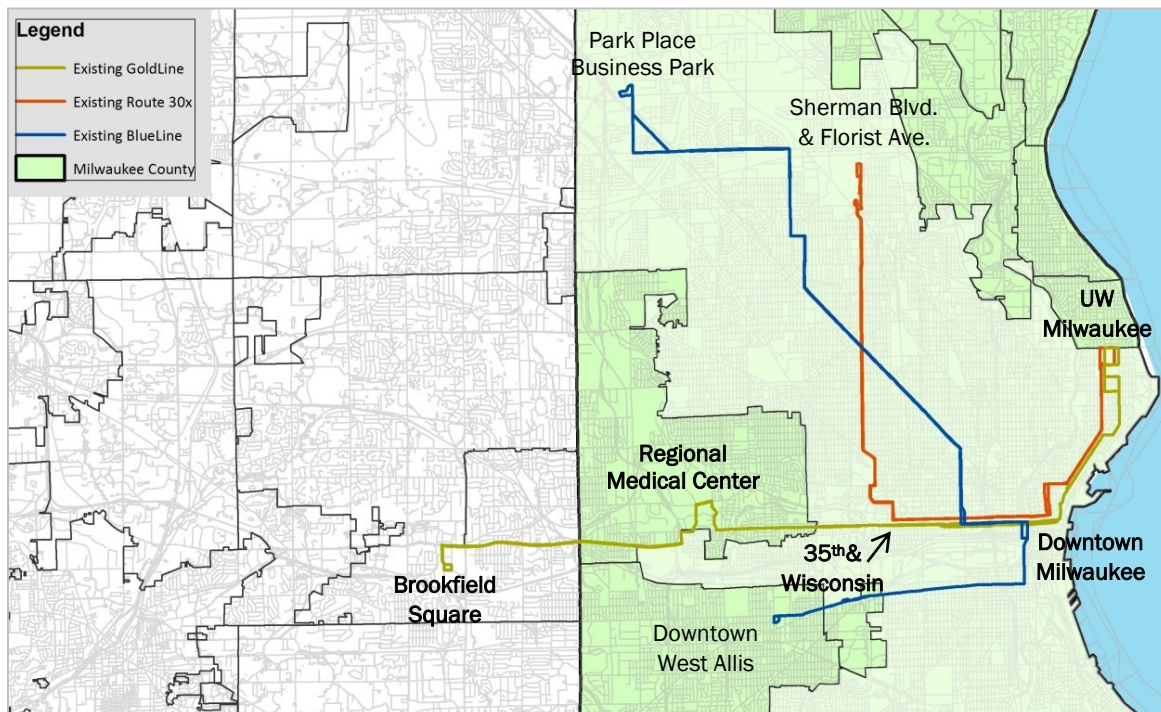
Given the substantial number of MCTS bus routes that currently operate on any given block of Wisconsin Avenue between Cass Street and 17<sup>th</sup> Street, introducing dedicated bus-only lanes on part or all of that 1.7-mile stretch would be one option for significantly increasing the efficiency of bus travel through the east-west corridor. Other options could focus on improving travel times for the GoldLine, which travels from UWM to Brookfield Square, such as by extending the bus lanes that already exist on Bluemound Road in Waukesha County into Milwaukee County.

## Major Improvement: BRT in the east-west corridor

If a BRT service were added to the east-west corridor, several important factors would need to be considered, including the number of routes that would use the BRT infrastructure, the length and precise layout of the route or shared infrastructure, and the specific set of features the system would include. All of these factors would influence the quality and cost of the system and its potential to reduce travel times and attract new riders.

For example, BRT infrastructure in the east-west corridor could be developed exclusively for an enhanced GoldLine, or could be shared by several bus routes. As shown in the map on the following page, express Route 30x and the BlueLine currently travel on Wisconsin Avenue for significant stretches and could share BRT infrastructure with the GoldLine where the routes overlap.

### Express bus routes currently using the east-west corridor



As shown in the table below, converting the GoldLine to a full BRT service could make travel times competitive with driving. A “BRT lite” alternative for that stretch of the east-west corridor would have a more modest impact on travel times, but still could offer an attractive option for many Milwaukee



County residents. Estimated travel times for both BRT options are based on the BRT case studies included in this report.

#### Approximate travel times from downtown Milwaukee to the Regional Medical Center<sup>4</sup>

Travel Mode	Travel Time
Driving (current)	13-22 minutes
MCTS GoldLine (current)	28-32 minutes
GoldLine converted to "BRT lite" (estimate)	22-29 minutes
GoldLine converted to full BRT (estimate)	14-25 minutes

While the exact costs of a potential BRT system would require much more extensive research, the case studies included in this report indicate that the total start-up costs could range from less than \$1 million per mile for a "BRT lite" service like those in Nashville or Chicago's Jeffery Jump, to as much as \$7 to \$10 million per mile for a Silver- or Gold-standard BRT route like Cleveland's HealthLine or Chicago's planned Ashland Avenue BRT service.

### **BUS SYSTEM IMPROVEMENTS IN THE CONTEXT OF MCTS' FISCAL CHALLENGES**

In light of MCTS' substantial long-term fiscal challenges, it will be challenging to maintain existing bus services, let alone implement major improvements such as BRT. Nevertheless, there are several potential federal capital funding sources, such as the Federal Transit Administration's Small Starts program and the U.S. Department of Transportation's TIGER discretionary grant program, which could be pursued.

Even if federal funding could be secured, substantial local funding also would be required to support large improvements like a new BRT service. Based on the case studies included in this report, Milwaukee could consider replicating Chicago's use of tax increment financing (TIF) for BRT service, Las Vegas' donation of city right-of-way, and Cleveland's use of contributions from health care entities. Area universities and their supporters also may be a source of local contributions, given the potential benefits they would enjoy from new rapid transit service, and sponsorships or naming rights from businesses that would benefit from BRT station locations also could be pursued.

Other metro areas facing similar financial challenges have mustered up the resources to implement such improvements, in part because they researched and recognized the benefits that faster and more convenient bus service could bring to their citizens and local economies. In Milwaukee, where the notion of rapid transit either has been dismissed by those who do not support public investment in transit, or has focused exclusively on commuter and light rail, we have never seriously considered those benefits and what it might take to realize them. With years of major highway reconstruction on the horizon and the demand for workers in both downtown Milwaukee and the suburbs likely to grow, we would suggest that the time to start doing so is now.

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<sup>4</sup> Calculations for current travel times are based on Google Maps estimates from Water Street and Wisconsin Avenue in downtown Milwaukee to Froedtert Hospital at the Regional Medical Center. Current driving travel times range from 13 minutes with no traffic via Interstate 94, to 22 minutes at peak times via Wisconsin Avenue.



## INTRODUCTION

In December 2013, the Public Policy Forum released a report (*"Getting to Work"*) that identified several major challenges limiting the ability of Milwaukee residents to access suburban jobs by public transit. Our analysis showed that many job centers are not served by transit at all, while others can only be accessed via lengthy bus commutes of more than 60 minutes each way. Overall, we found that the combined effects of sprawling job locations, funding constraints, and competing priorities have made it very difficult for the Milwaukee County Transit System (MCTS) to provide bus services that efficiently serve many job sites throughout the region.

The findings of that report led us to ask whether – despite those challenges – there are ways that MCTS could modify its bus services to improve connections for the regional workforce and the general population. Specifically, we were interested in learning how other metro areas had addressed similar bus service challenges, and what we might learn from their actions.

In this report, we provide insight into those questions by presenting common strategies that transit systems around the country have utilized to increase bus speeds. In addition to examining case studies from other U.S. metro areas that have employed such strategies, we analyze the potential for such strategies to be implemented in the Milwaukee area.

While many of the strategies we include in this report are relatively small changes that could be made to existing MCTS bus routes, we also consider more comprehensive and expensive approaches, including the potential introduction of *bus rapid transit* (BRT). BRT is a new and enhanced type of bus service that is growing in popularity in metro areas around the world. BRT systems provide a faster and more comfortable service that can be comparable to light rail systems in speed and design, but that can be implemented at a much lower cost.

Research conducted by the Transportation Research Board (TRB) of the National Academy of Sciences served as a major source of data for this study. One recent TRB report in particular included an extensive literature review and a survey of 59 transit systems around the country on their experiences in modifying services to improve bus speeds.<sup>5</sup> Conversations with transit system planners in other cities complemented our research.

Of course, service speed is just one of many factors MCTS considers in designing the local bus system. In many cases, transit planners must balance a desire for increased speed with issues of accessibility, cost, on-time performance, and other needs. Nevertheless, the strategies explored in this report should provide some realistic possibilities for MCTS leaders and policymakers to consider if they are interested in improving public transit services in Greater Milwaukee.

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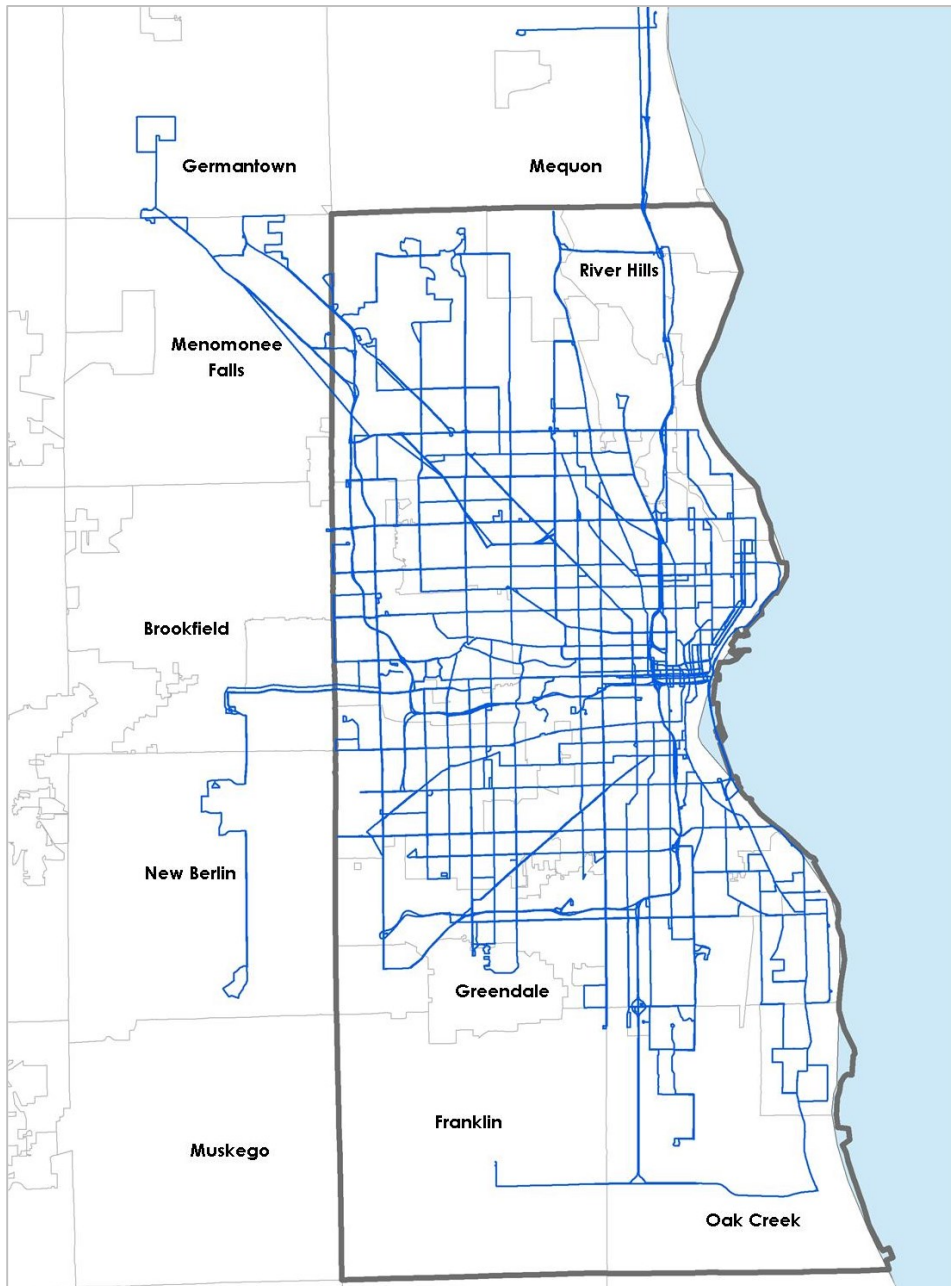
<sup>5</sup> Boyle, Daniel K. "TCRP Synthesis 110: Commonsense Approaches for Improving Transit Bus Speeds." 2013. Transportation Research Board. [http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp\\_syn\\_110.pdf](http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_syn_110.pdf)



## BACKGROUND

Broadly speaking, MCTS provides relatively extensive service to most areas of the city, limited service to Milwaukee County suburbs, and very little service beyond the county's borders, as shown in **Map 1**. It is important to note that most MCTS bus routes provide “local” service, meaning they operate exclusively on city streets and make frequent stops – typically every  $\frac{1}{8}$  mile (about 1-3 blocks). As explained in the text box on the following page, this type of service is distinct from “express” and “rapid” service, which are faster modes that stop less frequently.

**Map 1: MCTS transit system map, 2015**



**Table 1** breaks down the 59 bus routes currently operated by MCTS, excluding those only serving special events like Brewers games and Summerfest. Of those, 39 provide local service and 20 are considered express or rapid. Freeway Flyers and UBUS routes (university-focused routes) are designed to connect suburban park-and-ride lots and area universities with downtown Milwaukee, with no or few stops in between. Those routes provide faster service than any other MCTS bus routes and could be considered “rapid” because they operate largely on highways, and not due to any other service modifications. In contrast, rapid transit in many other metro areas is provided by rail or bus service operating independently from automobile traffic on reserved rights-of-way, and featuring other service enhancements that improve speed and convenience.

**Table 1: MCTS bus routes, January 2015**

Route Category	Service Type	No. of Routes
Regular local routes	Local	28
Freeway Flyer routes	Express/Rapid	8
MetroExpress & other express routes	Express	8
School day routes	Local	7
Shuttle routes	Local	4
UBUS routes	Express/Rapid	4
<b>Total</b>		<b>59</b>

### Public Transit Service Types

Public transportation systems in large U.S. cities typically offer a range of service types, including local, express, and rapid transit services. Each of these transit service types can be implemented in a variety of ways, but the purpose of offering a spectrum of services is to meet the needs of individuals who use public transit to complete trips of differing lengths and for varied purposes.

Local transit service operates on local roads in mixed traffic and makes frequent stops – typically every  $\frac{1}{8}$  to  $\frac{1}{4}$  mile. (Research has found that people are generally willing to walk up to  $\frac{1}{4}$  mile to access public transit, which takes roughly five minutes.) Although typically provided by buses, local service also can include fixed rail lines, such as trams, trolleys, or streetcars.

Express transit service involves less frequent stops than local service, often every  $\frac{1}{4}$  to  $\frac{3}{4}$  mile. Reducing the number of stops increases the average speed along the route and reduces travel times, but at a cost to accessibility to riders who often have to travel a greater distance to reach the nearest stop.

Rapid transit service offers riders increased capacity and frequency and typically operates in a reserved right-of-way. The goal of rapid transit is to cover long distances faster than local and express routes by traveling at higher speeds and serving fewer stations that are spaced further apart. Stops typically are placed every  $\frac{1}{2}$  to 2 miles, depending on the density of the area served. Fares for rapid transit services sometimes are higher than for local or express service.

Until the world’s first bus rapid transit (BRT) system began operating in Brazil in 1974, rapid transit services were provided exclusively by trains, but that has since changed. BRT has become a popular option among budget-constrained cities and regions around the world.



## TRANSIT ACCESS TO JOB CENTERS

The Public Policy Forum's recent report, *Getting to Work*, showed how current MCTS bus services are inadequate for Milwaukee County residents wishing to access many suburban job sites.<sup>6</sup> From a transit user's perspective, two of the major limitations are prohibitively long travel times to reach many job centers, and challenges related to traveling the "last mile" from the terminus of a bus route to the doorstep of the workplace. In this report, we focus on the "travel time" challenge, while fully acknowledging that additional solutions are needed to address the last mile problem.

Addressing the urban-suburban transit gap has become increasingly important given that, over the past 20 years, Milwaukee County has vastly underperformed its surrounding counties with regard to job growth. In fact, UW-Milwaukee's Center for Economic Development found that between 1994 and 2009, Milwaukee County *lost* approximately 12,000 net jobs, while the suburban counties of Waukesha, Washington, and Ozaukee gained a combined 56,000 net jobs.<sup>7</sup> The *Milwaukee Journal Sentinel* also recently found that post-recession job growth has been stronger in the suburban counties relative to Milwaukee County.<sup>8</sup> At the same time, Milwaukee County residents are less likely to own vehicles and more likely to be unemployed than their suburban counterparts.

**Maps 2** on the following page provides further context for analyzing this issue. Job concentrations are displayed for each *quarter section* in the four-county region, which is a much more refined level of analysis than we were able to include in our *Getting to Work* report. (A quarter section is a 1/2 mile by 1/2 mile square.) As the map shows, MCTS provides bus services to many areas of the region where jobs are most concentrated, but many others are left out. In addition, some bus routes that *do* serve suburban job centers operate during very limited hours or are designed primarily for suburban residents commuting to jobs in downtown Milwaukee, rather than for reverse commuters. Those factors are not visible in the map but represent additional limitations.

MCTS' suburban bus service expanded in 2014 and will continue to do so in 2015. New routes to the Menomonee Falls Industrial Park, the New Berlin Industrial Park, and the Westridge Business Park in New Berlin were initiated in August 2014, and service was added to the Germantown Industrial Park in January 2015. In addition, the Northbranch Industrial Park in Oak Creek and the Brown Deer Business Park will be better connected by transit in March 2015 when bus routes will be created or extended to serve those areas.

Yet, despite these recent improvements, lengthy travel times to suburban job centers via public transit remain an imposing obstacle for many Milwaukee County residents. In the following section of this report, we examine several strategies being utilized by public transit systems around the country to improve the speed of bus services, and consider their potential applicability in the Milwaukee area.

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<sup>6</sup>Public Policy Forum. "Getting to Work: Opportunities and obstacles to improving transit service to suburban Milwaukee job hubs." December 2013. <http://publicpolicyforum.org/sites/default/files/GettingToWork.pdf>

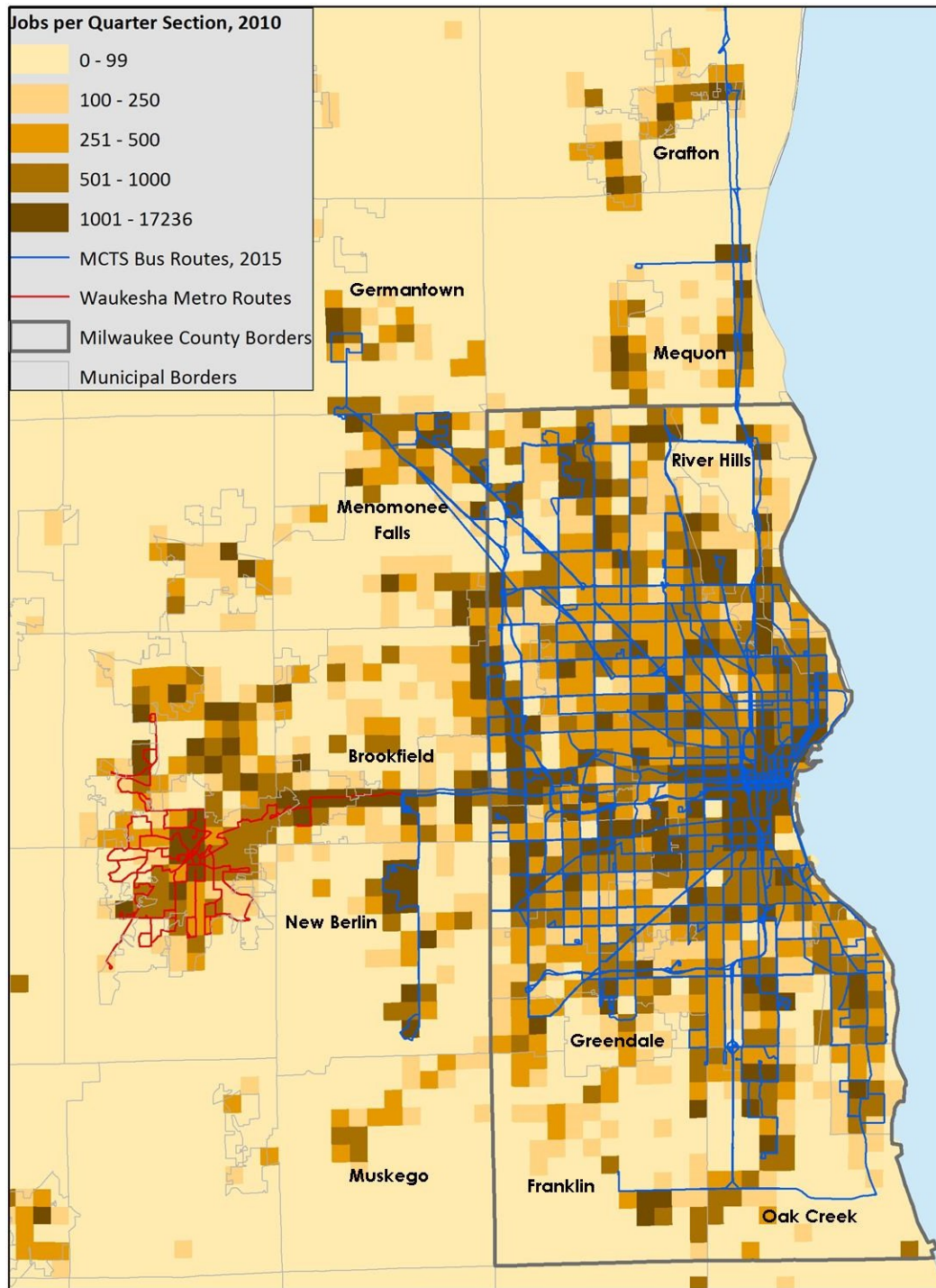
<sup>7</sup> Levine, Mark. "Perspectives on the Current State of the Milwaukee Economy." UW-Milwaukee Center for Economic Development. July 2013. <http://www4.uwm.edu/ced/publications/perspectives.pdf>

<sup>8</sup> Romell, Rick. "Urban-suburban divide seen in Milwaukee area's employment gains." *Milwaukee Journal Sentinel*. December 7, 2014. <http://www.jsonline.com/business/metro-suburban-divide-seen-in-milwaukee-areas-employment-gains-b99402556z1-285038351.html>





**Map 2: Jobs by quarter section (2010) and existing transit services (2015)**



Sources: Southeastern Wisconsin Regional Planning Commission and Milwaukee County Transit System



## STRATEGIES FOR IMPROVING BUS SPEEDS

Numerous strategies aimed at improving the speed of bus service have been implemented by MCTS and by transit systems in other U.S. metro areas. While the goal of those efforts often has been simply to improve operational efficiency and on-time performance, in some cases the purpose also has been to introduce a new level of service that is faster and more convenient than regular bus service. Another key objective in many growing cities and regions has been to mitigate against slowly decreasing bus speeds resulting from increased traffic congestion and/or increased transit ridership.

A recent study by the Transportation Research Board (TRB) synthesizes the body of national research on strategies used to improve transit bus speeds.<sup>9</sup> National research indicates that all of these strategies can have a positive impact on bus speeds, but precise travel time savings are not always clear and vary significantly depending on numerous factors. More research is needed to be able to predict the benefits to transit users that would be derived from each strategy in a given context.

Several “commonsense approaches” cited by the TRB have become standards for MCTS. For example, MCTS has frequently **streamlined routes** to reduce turning, minimize duplicative service, and maintain service primarily on arterial streets, particularly as tight budgets have forced planners to develop a leaner and more efficient network of bus routes. This approach has been utilized by most transit systems across the country. In fact, a strong majority of transit systems that responded to the TRB’s survey stated that they had streamlined routes to improve speed and efficiency.

MCTS also has followed a national trend by converting exclusively to **low-floor buses**, which feature **ramps rather than lifts** for passengers using wheelchairs.<sup>10</sup> Low-floor buses do not require passengers to climb multiple stairs when boarding and alighting and are capable of “kneeling” at stops to make boarding easier. Since there are no stairs to climb, ramps can be used instead of lifts to assist passengers using wheelchairs. In addition to improving accessibility, these features make boarding and alighting faster, reducing dwell time at each stop. (Dwell time refers to the time a vehicle spends at each stop allowing passengers to board and alight.)

One approach MCTS has utilized to provide a new and faster level of service is the reintroduction of **limited-stop (express) service**. (“Express” and “limited-stop” service are used interchangeably in this report.) National research indicates that limited-stop service is one of the most effective strategies for improving bus speeds. MCTS now has six express bus routes in operation (BlueLine, GoldLine, GreenLine, PurpleLine, RedLine and Route 30x) and two express shuttle routes (Routes 6 and 279). MCTS’ Freeway Flyers and UBUS routes also provide limited-stop



MCTS’ low-floor buses with ramps for wheelchair access.

<sup>9</sup> Boyle, Daniel K. Transportation Research Board. 2013.

<sup>10</sup> Milwaukee County Transit System. <http://www.ridemcts.com/how-to-ride/accessibility>



service, but rather than skipping stops along a busy transit corridor, they travel on highways for large segments, offering a different type of service.

MCTS recently introduced **electronic fare cards** called M-CARDS, which can reduce dwell time at bus stops by making boarding faster.<sup>11</sup> Paper passes, tickets, and transfers will be phased out in 2015. Users can purchase bus passes or add stored value in any quantity desired to their M-CARD, and can pay their fares and make transfers by simply tapping their card on fare boxes located inside all MCTS buses. MCTS also offers **discounted fare for pre-payment**, which encourages users to pre-pay rather than paying with cash upon boarding a bus. Whereas regular-priced fare for a single ride is \$2.25, the M-CARD's stored value option charges users only \$1.75 per ride. Eventually, users will be able to manage their M-CARD accounts online.

## **STRATEGIES FOR MCTS TO CONSIDER**

While many changes have been made to improve the speed and efficiency of MCTS bus services, many approaches being utilized around the country have not been tried in Milwaukee or have been implemented in a less robust manner than has been done elsewhere. We examine four such strategies here. The first is a system-wide approach, while the others can be utilized for an individual route or transit corridor. In many cities, several of these service enhancements are combined to create even greater increases in bus speed.

### **Increased Stop Spacing**

Several transit systems around the country have identified the close proximity of bus stops as a significant problem. That is because when buses have to accelerate and decelerate constantly, both travel times and fuel efficiency suffer. In response, those systems have established new minimum stop spacing policies, conducted comprehensive analyses of current stop spacing throughout their systems, and eliminated stops as appropriate. Stop spacing guidelines often are established based on several factors, including the time of service and the density of the area being served (e.g. urban vs. suburban vs. rural).

Perhaps unsurprisingly, national research has found that the average distance between bus stops is one of the most influential factors on bus speeds. Increasing stop spacing also was the approach most frequently cited by respondents to TRB's survey of U.S. transit systems as having been successful in improving bus speeds.<sup>12</sup> While increasing stop spacing appears to be an effective strategy for improving speed, consolidating stops often is controversial, as it requires some riders to walk longer distances to access the service. Finding the right balance between speed and access is one of the fundamental challenges transit system leaders face.

Several studies have attempted to measure the potential benefits of increasing average stop spacing. One TRB study analyzed numerous U.S. transit systems and found that reducing bus stops from every  $\frac{1}{8}$  mile (MCTS' standard for local routes) to every  $\frac{1}{6}$  mile, combined with reducing average dwell time at each bus stop from 20 seconds to 15 seconds, can create a 40% increase in

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<sup>11</sup> MCTS. <http://www.ridemcts.com/fares-passes/new-fare-system>

<sup>12</sup> Boyle, Daniel K. Transportation Research Board. 2013.



average speed.<sup>13</sup> That increase in average speed translates into a 28.3% reduction in travel time. Of course, additional system changes are required to reduce average dwell time.

Another study by the Center for Urban Studies at Portland State University measured the impacts of a bus consolidation program in Portland, OR. The study found that travel times on route segments that were modified decreased by 5.7% more than control route segments that were not changed.<sup>14</sup> The study also found that boardings and alightings did not change significantly on routes that were part of the stop consolidation program, indicating that the changes did not lead to lost ridership.

*Example: Columbus, OH*

The Central Ohio Transit Authority (COTA) in Columbus is one transit system that has restructured bus stop spacing. COTA’s “Bus Stop Service Improvement Project” was launched in 2010 to reflect new stop spacing standards that had been established for four distinct density categories, as shown in **Table 2**. Previous to the establishment of these standards, bus stops often had been added based on requests, which made the system inefficient overall as many stops were spaced closely together.

**Table 2: COTA’s new bus stop spacing standards<sup>15</sup>**

Population Density	New Bus Stop Spacing Standard	Approx. Equivalent in Miles
High-density, Central Business District, Shopping ( <i>&gt;20 persons/acre</i> )	500-700 feet	$\frac{1}{10}$ mile
Fully developed residential area ( <i>10-20 persons/acre</i> )	700 – 850 feet	$\frac{1}{7}$ mile
Low-density residential ( <i>3-10 persons/acre</i> )	850 – 1,200 feet	$\frac{1}{5}$ mile
Rural or Express Service ( <i>0-3 persons/acre</i> )	1,200+ feet	$\frac{1}{4}$ mile+

COTA’s new stop spacing minimums are fairly modest compared with many other systems around the country. As shown in **Chart 1** on the following page, some transit systems have established minimums as high as 880 feet ( $\frac{1}{6}$  mile), including Seattle and Richmond. For COTA, however, the new standards represent a significant change, as no guidelines existed previously.

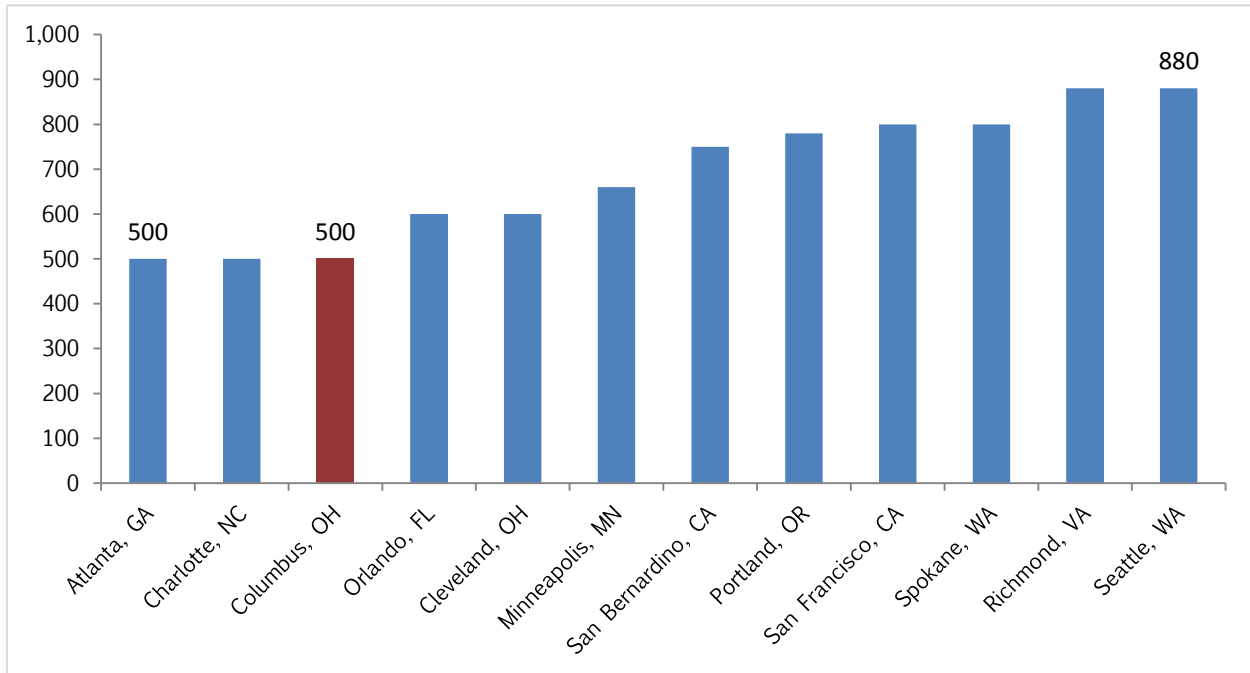
<sup>13</sup> Levinson, H.S. “Analyzing Transit Travel Time Performance.” Transportation Research Record 915. Transportation Research Board. National Research Council. 1983. pp. 1–6.

<sup>14</sup> Center for Urban Studies. May 2005. <https://www.pdx.edu/sites/www.pdx.edu.cus/files/PR132.pdf>

<sup>15</sup> Central Ohio Transit Authority. <http://www.cota.com/busstopserviceimprovement.aspx>



**Chart 1: Minimum bus stop spacing guidelines in Columbus and 11 other selected cities<sup>16</sup>**



Following the establishment of these standards, COTA reviewed stop spacing throughout their entire system and removed stops where appropriate (see **Map 3** on the following page). According to the project manager, COTA has reduced the number of bus stops in its system by 17% to date. That reduction included the removal of 723 stops and the relocation of 62 more. During the same period, COTA experienced growth in both service and ridership.

The changes were expected to save riders on local routes approximately 3-12 minutes per trip.<sup>17</sup> According to COTA, it has been difficult to isolate the time savings attributed only to stop spacing consolidation, as other changes have been made to routes during the same period. The agency believes that the project has had a positive impact on bus speeds and on-time performance, and feedback from transit operators has been positive.

The cost of implementing the bus stop removal project has not been calculated, but COTA's project manager characterized the costs as "minimal" and noted that the project fit within the agency's normal budget. In addition, the project has been implemented over a five-year period, which has spread costs over time.

<sup>16</sup> Central Ohio Transit Authority, Spokane Transit Authority, and Public Policy Forum data collection. [http://www.cota.com/assets/riding-cota/cota\\_bssip\\_public\\_presentation\\_summary.pdf](http://www.cota.com/assets/riding-cota/cota_bssip_public_presentation_summary.pdf)

<sup>17</sup> Ibid.



Map 3: Example of COTA's bus stop spacing analysis<sup>18</sup>



Public opposition to stop removals has been an issue on a case-by-case basis, but has not been an overwhelming challenge. According to the agency, a great deal of stakeholder involvement was needed to make the project a success.

#### Example: Spokane, WA

The Spokane Transit Authority (STA) has completed a stop consolidation program that was more aggressive than the one in Columbus. For local bus routes, the program called for minimum stop spacing of 800 feet, maximum of 1,500 feet, and average of  $\frac{1}{4}$  mile (1,320 feet).<sup>19</sup> The standards also vary based on service type. For example, commuter/express routes have minimum stop spacing of 1,000 feet. According to the STA, their new guidelines were created based on other model cities, including Seattle.

Following the plan's adoption, STA removed bus stops in four phases over four years, completing the project in 2014. In total, 35% of the bus stops in the system were removed. While the new spacing standards guided the stop removals, existing ridership data also played a major role, as the stops

<sup>18</sup> This example is for a local bus route operating in an area with moderate population density.

<sup>19</sup> Spokane Transit Authority: <http://www.spokanetransit.com/about-sta/view/stop-consolidation-plan>



that were removed had relatively low ridership. Stops were preserved at all transfer points and significant destinations, and all enhanced bus stops – such as those with shelters – also were maintained.

STA has not calculated the exact impact the new stop spacing has had on travel times, but newly installed technology on their fleet will allow them to do so in the future. As in Columbus, feedback from bus operators has been positive.

The lack of solid data from both transit systems regarding travel time impacts is an admitted weakness of these case studies. The aforementioned analysis of Portland's program, however, indicates that bus stop consolidation programs can have a modest impact.

### *What about Milwaukee?*

MCTS' stop spacing standard for local bus routes is  $\frac{1}{8}$  mile (660 feet), which is treated as a target rather than a minimum. The aim is to place stops as close to  $\frac{1}{8}$  mile apart as possible, with the size of blocks often dictating whether stops are slightly closer or further apart. MCTS' maximum stop spacing standard for local routes is  $\frac{1}{4}$  mile (1,320 feet, or roughly 3-4 blocks). Express routes stop only at transfer corners and major destinations where local bus service operates along the same path, and every  $\frac{1}{4}$  mile in areas where no local bus service is provided.

If MCTS were to change its policy and begin to use the  $\frac{1}{8}$  mile stop spacing standard as a minimum rather than a target for local bus routes, it appears that a significant number of bus stops could be removed. An initial analysis of MCTS stop spacing data for all bus routes revealed that 1,950 stops are located less than  $\frac{1}{8}$  mile apart, which represents 37% of all bus stop segments.<sup>20</sup> Among those, there are 1,589 cases (30% of the total) in which one stop could be removed without creating a distance of more than  $\frac{1}{4}$  mile between the stops that would remain. Research has shown that  $\frac{1}{4}$  mile is a distance most people are willing to walk to access public transit.

This is not to suggest that all 1,589 stops could or should be removed. MCTS planners estimate that 25% to 33% of riders would be required to travel one or two blocks further to access bus services under this scenario, and there are several justifications for some stops being less than  $\frac{1}{8}$  mile apart. In downtown Milwaukee, for example, stops often are closer together because of the high concentration of major destinations and transfer points. Also, stops often are closer together in places where routes branch. To determine whether the speed and efficiency that could be gained by removing bus stops would outweigh potential reductions to accessibility, MCTS would need to consider other factors, such as existing ridership at each stop and potential impacts on transfers. Community input would be needed as well.

Nevertheless, it appears that the possibility of removing a portion of MCTS' existing bus stops is one that is worth exploring, as it holds potential for modestly improving the speed and efficiency of the system overall.

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<sup>20</sup> PPF analysis of data provided by MCTS.



## Limited-Stop (Express) Service

Another common strategy for increasing bus speeds is to offer express bus routes, which stop less frequently to provide a faster service. As with bus stop consolidation, the need to balance speed and access is a major consideration when introducing express bus routes. While they can reduce travel times, they require many users to travel longer distances to access the service. In many cases, express service is introduced on busy routes to complement underlying local service that continues to stop more frequently. Offering both services along the same corridor can increase costs, however, depending on how the service is designed.

Despite the fact that MCTS already offers several express bus routes, we looked at examples from other places for their similarities and differences.

### *Example: Cincinnati, OH*

One transit system similar to MCTS that has introduced express service is the Southwest Ohio Regional Transit Authority (SORTA) in Cincinnati. SORTA launched a new bus route in 2013 called “Metro Plus,” which connects downtown Cincinnati with the city’s northeast suburbs (**Map 4**). The roughly 12-mile route serves several area colleges and universities, hospitals, shopping centers, and other key destinations.<sup>21</sup> On average, the new route stops every  $\frac{2}{3}$  mile, compared with stops spaced every  $\frac{1}{8}$  mile on the local bus route that serves the same corridor, which was preserved.

The Metro Plus service emerged from a comprehensive plan developed by SORTA for its Metro bus system in 2012.<sup>22</sup> The plan included a market study that featured extensive surveying of transit system users and the general public. The market study revealed that one of the public’s highest



<sup>21</sup> Southwest Ohio Regional Transit Authority: <http://www.go-metro.com/riding-metro/metro-plus>

<sup>22</sup> SORTA's Metro Transit Plan "Go Forward": <http://www.go-metro.com/about-metro/goforward>





priorities for improving the transit system was to shorten travel times. Introducing BRT was rated highest among all of the options given for improving the transit system.

In response, SORTA created the new Metro Plus route, which is considered a “pre-BRT” service. The Montgomery Road corridor, where the Metro Plus route operates, is the transit system’s third busiest corridor and is one of six corridors targeted for BRT service in the future. The route was chosen because it provides direct connections from downtown Cincinnati to many major destinations and transfer points. Downtown Cincinnati remains the strongest job center in the region.

Travel times on Metro Plus from downtown Cincinnati to the route’s northern terminus at Kenwood Town Center is roughly 50 minutes, compared with about 60 minutes via local bus service, a 17% reduction in travel time. According to a SORTA official, the cost of adding the Metro Plus service included \$4.5 million to purchase 10 new buses. Operating costs for the route are approximately \$2.5 million per year, 20% of which is supported by farebox revenue.

### *What about Milwaukee?*

MCTS operated an express bus service in the 1990s known as MetroLink, which connected downtown Milwaukee with the city’s northwest side via Fond du Lac Avenue. By the early 2000s, however, fiscal constraints forced Milwaukee County to discontinue the service.

In 2012, MCTS reintroduced express bus service through the creation of the BlueLine, GreenLine, and RedLine, and since has expanded its services to include a total of six express routes and two express shuttle routes (see **Map 5** on the following page).

Most of MCTS’ express bus routes were designed to serve corridors that already had particularly strong ridership. As shown in **Table 3** on the following page, the BlueLine and GreenLine were among the 10 MCTS bus routes with the highest average weekday ridership in 2013, and the BlueLine operates on roughly the same path as Route 23, which also is among the busiest routes. Three additional routes with very high ridership (Routes 30, 27, and 10) were recently supplemented or replaced with new express routes (30x, PurpleLine, and GoldLine) in January 2015.<sup>23</sup> Routes 30 and 27 also were among the routes with the highest ridership per hour of operation (“passengers per bus hour”), a metric commonly used in transit planning to measure route productivity.

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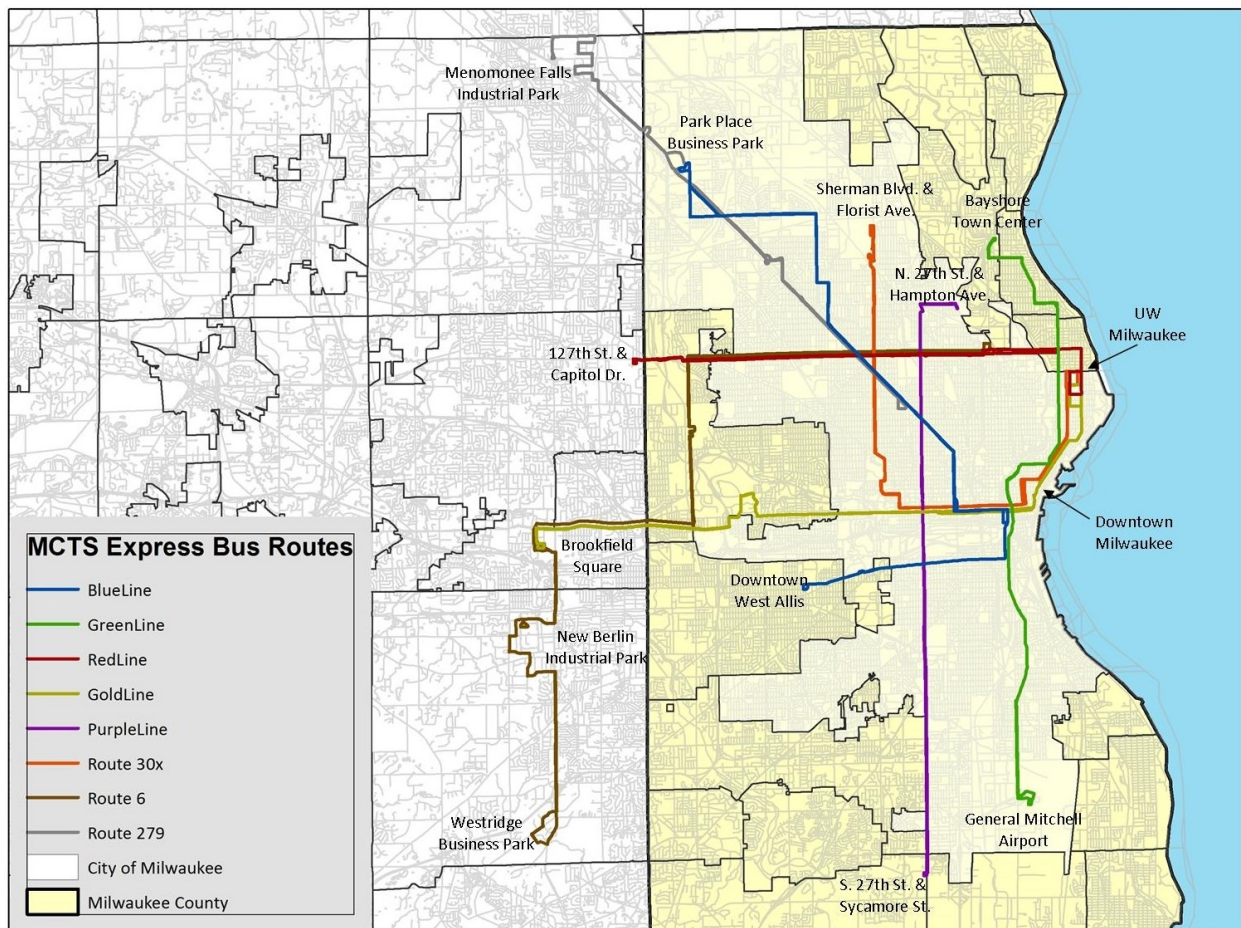
<sup>23</sup> Route 30x and the new PurpleLine supplement existing routes 30 and 27. The GoldLine replaced Route 10 but was modified to serve UWM rather than Bayshore Town Center. Route 14 also was modified to take the place of Route 10 between downtown Milwaukee and Bayshore, operating largely on Humboldt Boulevard.



**Table 3: Average weekday ridership on MCTS' 10 busiest bus routes, 2013<sup>24</sup>**

Route	Total Rides	Total Bus Hours	Passengers per Bus Hour
30	14,698	283.9	51.8
27	13,110	227.3	57.7
12	9,699	187.4	51.8
19	7,971	209.4	38.1
21	7,925	136.6	58.0
BlueLine	7,822	159.9	48.9
80	7,477	191.9	39.0
GreenLine	7,416	207.7	35.7
23	6,690	172.7	38.7
10	6,156	176.6	34.9

**Map 5: MCTS' express bus routes**



<sup>24</sup> Bus hours are a sum of the total hours buses are in operation on each route every weekday. For example, if ten buses operate for 12 hours per day on a given route, the bus hours for that route would be 120.



Routes 6 and 279, which provide express service to New Berlin and Menomonee Falls, are distinct in that they were not developed to serve corridors with extremely high ridership, but rather to connect Milwaukee residents with suburban job centers. They were developed as a result of a settlement agreement reached by the Milwaukee Inner-City Congregation Allied for Hope (MICAH) and Black Health Coalition of Wisconsin with the State of Wisconsin following a lawsuit involving the Zoo Interchange reconstruction project, and its lack of accommodation for transit riders.<sup>25</sup>

The general policy for MCTS' express bus routes is to stop every 1/4 mile where no local bus route is in operation. For areas where an express bus route and a local bus route operate alongside one another, express routes only stop at transfer corridors and major destinations. Actual stop spacing on those routes averages around 1/4 mile, however, which limits the distinction between those routes and regular/local bus routes.<sup>26</sup>

Most of the express bus routes offer relatively frequent service for much of the day and night, seven days per week, with headways typically in the 10-to-20-minute range. Routes 6 and 279, which are considered express shuttle services, only operate on weekdays at typical shift change times.

MCTS' express bus routes provide time savings for passengers to varying degrees. Among the newest express routes, for example, the PurpleLine offers the greatest time travel savings and the GoldLine the least. The PurpleLine essentially mirrors local Route 27, which has been preserved. The overlapping service allows the express service to stop less frequently. The PurpleLine has an added advantage in that it does not traverse downtown Milwaukee, where several other express routes (including the GoldLine) make frequent stops. Conversely, the GoldLine replaced Route 10 entirely. Because it is the only route in operation along a roughly five-mile stretch of Wisconsin Avenue and Bluemound Road, from 35<sup>th</sup> Street west to Highway 100, it stops more frequently. Overall, the PurpleLine offers passengers a time savings of 10-15%, while the GoldLine offers a time savings of 5-10%.

The development and design of MCTS' new express routes has been impacted significantly by funding considerations. Most of the express routes have been initiated with the support of federal Congestion Mitigation and Air Quality Improvement (CMAQ) funding, which supports new transit routes for their first three years of operation. After that, MCTS must find other means of sustaining those routes.

With MCTS' financial challenges posing the possibility of substantial service reductions in recent years, its leaders instead have devised a means of using CMAQ funding to temporarily supplant local funding for service in certain popular transit corridors. While there is a prohibition on using CMAQ funds to replace local funds for existing service, the initiation of new express service makes those routes eligible for CMAQ. MCTS then has been able to produce savings by eliminating underlying local routes or route segments. From a service-level perspective, the consequence is that portions of most MCTS express bus routes operate with no underlying local bus service, resulting in more frequent stops.

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<sup>25</sup> Biz Times Milwaukee. "Zoo Interchange lawsuit settlement will increase Milwaukee County bus service." 5/19/2014. [http://biztimes.com/article/20140519/ENEWSLETTERS02/140519806/0/money\\_eneus](http://biztimes.com/article/20140519/ENEWSLETTERS02/140519806/0/money_eneus)

<sup>26</sup> Public Policy Forum analysis of MCTS data for the BlueLine, GreenLine, and RedLine.



Average stop spacing is one striking difference between MCTS' express routes and similar services in many other metro areas, including Cincinnati. While MCTS' express routes typically stop every 1/4 mile, express bus routes in many other metro areas stop every 1/2 - 3/4 mile. In some cases, MCTS' express routes do not provide much of a time savings over local bus service, as noted by a user group when the GreenLine was launched.<sup>27</sup> MCTS could consider lengthening the stop spacing on one or more express bus routes to speed up service, even in places where no local bus service is provided, but the time savings such changes would offer would have to be weighed against potential losses in access and transfer connections.

## Transit Signal Priority

Transit signal priority (TSP) is a strategy that uses technology to allow buses to travel faster by being able to extend green lights and shorten red lights at intersections with traffic signals. Buses and treated intersections are equipped with devices that can communicate with one another and grant priority to buses as they approach. TSP systems sense when a bus that has been given priority crosses through the intersection, at which point signal timing gradually readjusts to normal settings.

When TSP is implemented, bus stops typically are moved to the far side of each intersection, which speeds up service as buses are able to pass through traffic lights before making stops. Far-side bus stops also have been found to be safer than near-side stops for pedestrians crossing at intersections.

Transit systems often utilize TSP systems in a targeted and conditional fashion, such as by installing them along a priority corridor or at a select set of intersections that create significant time delays for transit vehicles. In some cases, buses only are granted priority if they meet certain conditions that have been defined by the transit system, such as if they are express or BRT routes or if the bus is behind schedule.

Common benefits of TSP include reduced travel times for transit passengers, improved on-time performance for buses, and greater system efficiency. While some studies suggest that TSP also provides time savings benefits for automobiles traveling in the same direction as transit vehicles – and modest delays for cross traffic – many analyses seem to show the effects on traffic delay to be negligible.<sup>28</sup>

Numerous studies have modeled the time savings benefit of TSP or measured the exact benefits provided in specific locations.<sup>29</sup> Time savings vary significantly depending on the system and the setting, but appear to be consistently at least 5-10%. A University of Washington study, for example, found that implementing TSP in two corridors in Tacoma, WA created a 5% time savings compared

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<sup>27</sup> Sandler, Larry. "New express bus routes not always faster, passenger group says." Milwaukee Journal Sentinel. January 30, 2012. <http://www.jsonline.com/news/milwaukee/new-express-bus-routes-not-always-faster-passenger-group-says-g73vgar-138372034.html>

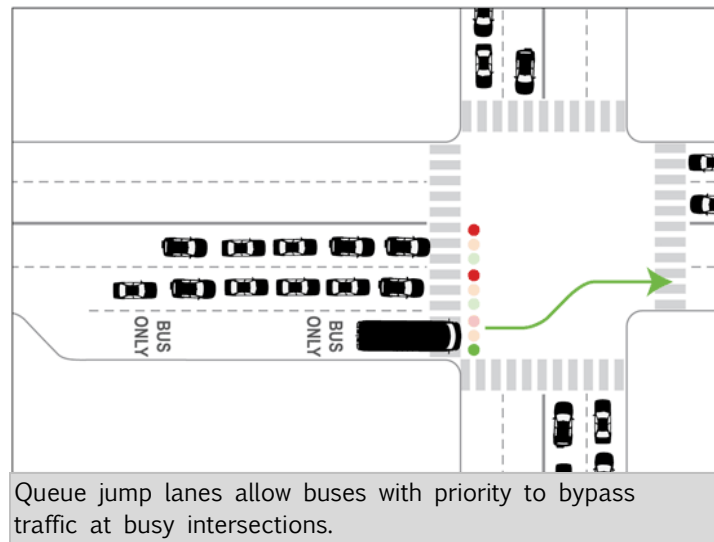
<sup>28</sup> ITS America. "Transit Signal Priority (TSP): A Planning and Implementation Handbook." May 2005. <http://www.fta.dot.gov/documents/TSPHandbook10-20-05.pdf>

<sup>29</sup> Boyle, Daniel K. Transportation Research Board. 2013.



with service without TSP.<sup>30</sup> Impacts on traffic delay were found not to be statistically significant. A 2005 report commissioned by the Federal Transit Administration (FTA) includes eight case studies where time savings ranged from 5.5% in King County, WA to 25% in Los Angeles.<sup>31</sup> In addition, retiming traffic signals to better match transit schedules often can provide as much benefit as adding a TSP system. It appears that when combined, these two strategies typically can create an overall time savings for transit passengers of at least 10%.

In some cases, TSP systems have been found to be less effective during peak periods, as heavy congestion minimizes the benefits they are able to provide. One approach sometimes used to complement TSP systems is the introduction of *queue jump lanes*, which are short lanes near busy intersections that are dedicated to buses and sometimes shared with right-turning vehicles (see image at right). Queue jump lanes give buses an early green signal, allowing them to bypass traffic at those intersections.<sup>32</sup>



The cost of implementing a TSP system can vary significantly depending on the number of buses and intersections that are equipped with new technology and the type of technology used. The TRB estimates the cost at \$30,000 per intersection.<sup>33</sup> As shown in **Table 4** on the following page, a review of several case studies showed the cost per corridor where TSP was added ranged from \$325,000 for a corridor in Oakland to more than \$1.1 million per corridor for a nine-corridor system in Los Angeles.

One challenge of implementing TSP systems is that transit system operators do not typically own the traffic signals where the systems are installed. Implementing TSP projects, therefore, requires establishing buy-in from the municipalities that would be affected.

<sup>30</sup> Wang, Y. and M. Hallenbeck. "Comprehensive Evaluation of Transit Signal Priority System Impacts Using Field Observed Traffic Data." University of Washington. June 2008. <http://www.wsdot.wa.gov/research/reports/fullreports/699.1.pdf>

<sup>31</sup> ITS America. 2005.

<sup>32</sup> Zhou, Guangwei and Albert Gan. "Design of Transit Signal Priority at Signalized Intersections with Queue Jumper Lanes." Journal of Public Transportation, Vol. 12, No. 4, 2009. <http://nctr.usf.edu/jpt/pdf/JPT12-4Zhou.pdf>

<sup>33</sup> Transportation Research Board. 2007.



**Table 4: TSP systems in six U.S. metro areas<sup>34</sup>**

Location	No. of Corridors	No. of Intersections	No. of Buses	Travel Time Savings	Cost	Cost per Corridor
Oakland, CA	1	62	21	9%	\$325,000	\$325,000
Los Angeles, CA	9	654	283	19% - 25%	\$10 million+	\$1.1 million+
Chicago suburbs	1	15	125	15%	\$732,000	\$732,000
Seattle, WA	3	28	1,400	5.50%	\$2.5 million	\$833,333
Tacoma, WA	6	110	245	5%	\$2.8 million	\$466,667
Portland, OR	8	250	650	10%	\$5.8 million	\$725,000

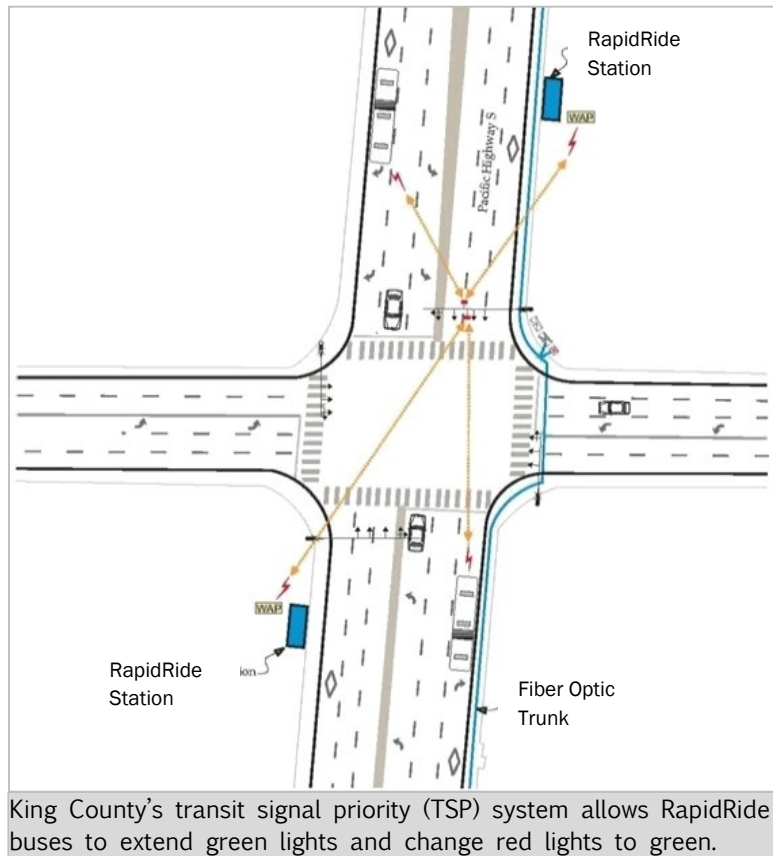
*Example: Seattle, WA*

King County Metro Transit in Seattle initially began using TSP in the 1990s and recently installed a more sophisticated system for six limited-stop bus routes known as RapidRide, which began operating in 2010. As a part of the new system, RapidRide buses and the traffic signals where those routes operate are equipped with new technology, and data is processed through a fiber optic cable network (see image below). King County’s system grants priority to RapidRide buses and is even able to detect whether the bus will be turning or going straight through an intersection.

The TSP system has brought about a 25% average reduction in travel delay at intersections and a 5.5% average reduction in overall travel times during peak periods. Reliability (on-time performance) has improved as well. According to the lead developer of King County’s TSP system, improved on-time performance can be an even greater benefit of TSP than increased speed.

The cost of implementing TSP on King County Metro Transit’s first three RapidRide routes was \$2.5 million.<sup>35</sup> A total of 1,400 buses and 28 intersections were equipped with the technology needed for the system. .

Total ridership on the six RapidRide bus routes was up to approximately 53,500 rides per day as of July



King County’s transit signal priority (TSP) system allows RapidRide buses to extend green lights and change red lights to green.

<sup>34</sup> PPF analysis of ITS America data. Pierce County’s travel time savings taken from Wang, Y & M. Hallenback. 2008.

<sup>35</sup> ITS America. May 2005.



2014, often outperforming the routes they replaced by significant margins.<sup>36</sup> A RapidRide route serving West Seattle, for example, has 72% higher ridership than the route it replaced, and ridership on the newest RapidRide route in South King County is already 23% higher than on the routes it replaced.<sup>37</sup>

### *What about Milwaukee?*

In the 1990s, MCTS collaborated with the City of Milwaukee to include TSP at limited intersections for the MetroLink express bus route between downtown Milwaukee and the city's northwest side. That technology still is in place but has not been utilized since the MetroLink route was discontinued. TSP has not been utilized anywhere else in Milwaukee to date, but County officials are in the planning process for a project that could include TSP along an eight-block stretch of Wisconsin Avenue, from 27<sup>th</sup> Street to 35<sup>th</sup> Street.

Efforts to implement TSP on priority bus routes in Milwaukee would be aided by the fact that the City already has some of the needed technology in place. According to the City's director of public works, nearly 50% of the intersections with signals in the city are equipped with "signal preemption" technology that allows Milwaukee Fire Department vehicles to trigger green lights. That technology includes a "high priority" setting for fire vehicles and a "low priority" setting that could be used by transit vehicles.

Allowing MCTS buses on priority routes to utilize the "low priority" setting of the City's signal preemption system may be a relatively inexpensive system improvement. It would require equipping MCTS buses on chosen routes with transponders, which cost approximately \$1,000 per vehicle to purchase plus any costs related to installation.<sup>38</sup> Additional costs would result from the need to relocate bus shelters from the near side to the far side of intersections to maximize the system's effectiveness. The City and County also would need to coordinate in designing specific signal plans for routes that would use the system.

### **Bus-Only Lanes**

Dedicating travel lanes for the exclusive use of buses reduces delays caused by other traffic and parked cars. In some cases, lanes are designated as bus-only at all times of the day and night, while in other cases buses only have exclusive right-of-way during specified hours, such as on weekdays only during the morning and afternoon rush hours. Often, certain other vehicles are allowed to use bus-only lanes, such as high-occupancy vehicles or taxis. Other vehicles can be allowed to use bus-only lanes to make turns, as well.

In places where bus-only lanes exist, they are most often curbside lanes on the right side of the street. Using the curbside lane typically requires removal of on-street parking, which is often met with strong resistance from area business owners. In some cases, the center/median lane is used, which

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<sup>36</sup> King County. "Ridership for Metro's RapidRide surges again, up nearly 40 percent." July 30, 2014. [http://kingcounty.gov/elected/executive/constantine/News/release/2014/July/30\\_rapidride-results.aspx](http://kingcounty.gov/elected/executive/constantine/News/release/2014/July/30_rapidride-results.aspx)

<sup>37</sup> Ibid.

<sup>38</sup> U.S. Department of Transportation. <http://www.itscosts.its.dot.gov>



can be advantageous as it can reduce the need for buses to slow down for right-turning vehicles and pedestrians crossing the street.

Enforcement can be a challenge with bus-only lanes, as unauthorized vehicles frequently use them. Photo enforcement is sometimes used, and fines are often given for those who drive or park in bus-only lanes. In Austin, TX, for example, larger fines are given to those who park in bus-only lanes (\$500) and smaller fines are given to those who drive in the lanes (\$200).<sup>39</sup>

To help bus-only lanes stand out, they are often painted red near intersections or for their entire length. In many places where bus-only lanes have been painted, transit systems have reported less illegal use of the lanes by unauthorized vehicles.

The cost of developing bus-only lanes varies, but for curbside lanes that only need paint and signage, the TRB estimates the cost to be roughly \$100,000 per mile.<sup>40</sup> Costs are much higher, of course, if new lanes and/or new bus stations need to be constructed.

#### *Example: San Francisco, CA*

San Francisco has approximately 15 miles of bus-only lanes and plans to add more in the future.<sup>41</sup> The bus-only lanes were developed as a response to increasing congestion over the past 20 years, which was slowing down transit services. Most of the bus-only lanes in San Francisco are curbside lanes, though some are center/median lanes. Some are designated exclusively for buses at all times of day and night, while others are shared with taxis and/or are only bus-only during peak periods. Regular vehicles also are allowed to use bus lanes to make turns.



Bus-only lanes in San Francisco are painted red and are shared with taxis.

Researchers have found that the effectiveness of San Francisco's bus-only lanes varies widely, as enforcement has been poor and the times during which lanes are dedicated to buses are inconsistent from one street to another, making following the traffic rules difficult.<sup>42</sup> The San Francisco Metropolitan Transit Authority (SFMTA) has recently installed cameras on buses for enforcement purposes, however, and has painted the bus-only lanes red, which appears to be helping to keep more drivers out of the lanes, according to transit system leaders. According to a May 2013 press

<sup>39</sup> Fox 7 News Austin. "Greater penalties approved for blocking bus-only lanes." January 23, 2014.

<http://www.myfoxaustin.com/story/24533345/greater-penalties-approved-for-blocking-bus-only-lanes>

<sup>40</sup> Kittleson & Associates, Inc. "TCRP Report 118: Bus Rapid Transit Practitioner's Guide." Transportation Research Board. 2007. [http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp\\_rpt\\_118.pdf](http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf)

<sup>41</sup> Boyle, Daniel K. Transportation Research Board. 2013.

<sup>42</sup> Kiesling, Michael and Matthew Ridgway. "Effective Bus-Only Lanes." National Association of City Transit Officials. 2006. [http://nacto.org/docs/usdg/effective\\_bus\\_only\\_lanes\\_kiesling.pdf](http://nacto.org/docs/usdg/effective_bus_only_lanes_kiesling.pdf)



release, a recently-developed bus-only lane on Church Street has generated travel time savings of approximately 5% and increased on-time performance by 20%.<sup>43</sup>

*Example: Minneapolis-St. Paul, MN*

Another example of bus-only lanes is the extensive network of **bus-only shoulders** that has been developed over the last 25 years in Minneapolis-St. Paul. The Minnesota Department of Transportation (MNDOT) and Metro Transit (the regional transit agency for the Twin Cities metropolitan area) established the region's Bus-Only Shoulders program in 1991. The program has now grown to comprise a network of more than 300 miles of bus-only shoulders along arterial roads and highways. Roughly half of all bus routes operated by Metro Transit and the Minnesota Valley Transit Authority (a suburban transit provider) are now able to use bus-only shoulders for some portion of their route. Many other metro areas are experimenting with bus-only shoulders, including Chicago, but according to Metro Transit, the Twin Cities area has more than three times as many miles of bus-only shoulders as the rest of the U.S. combined.<sup>44</sup>



Minneapolis has developed a network of over 300 miles of bus-only shoulders.

The Bus-Only Shoulders program in Minneapolis was envisioned as a low-cost way to provide faster transit service in areas where congestion is a consistent problem. It started as an experiment on Trunk Highway 252, and over the next two years, additional bus-only shoulders were designated on several other arterial roads.<sup>45</sup> In 1993, congestion on Minnesota Highway 77 had become severe due to a major flood, which led MNDOT to pilot the use of bus-only shoulders on a state highway for the first time. That practice has since expanded to include U.S. interstate highways in the region.

Several policies guided the development and use of bus-only shoulders in the Twin Cities metro area. First, they are only developed in places where congestion is a consistent problem, and where at least six buses pass each day. Bus drivers can only use the lanes when traffic is moving slower than 35 mph, can only exceed the speed of traffic by 15 mph, and cannot drive faster than 35 mph in the shoulder lane. In addition, buses driving in a shoulder lane “must yield to any vehicle entering the shoulder, including at freeway ramps or intersections.”<sup>46</sup>

The Bus-Only Shoulders program is widely considered successful in attracting new riders and providing a faster service in a safe manner. One early study found that ridership on routes with bus-

<sup>43</sup> Boyle, Daniel K. Transportation Research Board. 2013.

<sup>44</sup> Metro Transit. <http://www.metrotransit.org/transit-advantages.aspx>

<sup>45</sup> Douma, Frank. “Bus-Only Shoulders in the Twin Cities.” University of Minnesota. June 2007. <http://www.hhh.umn.edu/img/assets/11475/Bus%20Only%20Shoulders%20Report%20FINAL.pdf>

<sup>46</sup> Metro Transit. <http://www.metrotransit.org/transit-advantages.aspx>



only shoulders increased 9.2% during a period in which overall transit ridership declined system-wide by 6.5%.<sup>47</sup>

The cost of developing bus-only shoulders has varied widely depending on the existing conditions of the shoulders, but often costs around \$100,000 per mile. According to a Metro Transit representative, in the early years of the program, bus-only shoulders only were approved in places where no strengthening of the pavement was required. Therefore, program costs were very low, as they only included costs associated with line painting, signage, and bus driver training. As the program grew, MNDOT began to invest in strengthening and widening shoulders to be able to handle the weight of transit vehicles. Stormwater catch basins had to be redesigned to allow for a smooth bus ride, and in some cases, rumble strips had to be repositioned so buses driving on shoulders could avoid them.

Capital costs for the program have been split between MNDOT and Metro Transit, with MNDOT paying for most of the costs of developing and maintaining the shoulders and Metro Transit paying for the construction and enhancement of park-and-ride facilities that complement the Bus-Only Shoulders program. Funding has come from a variety of sources, including the federal CMAQ program and bonding by MNDOT.<sup>48</sup> MNDOT contributes \$1 million per year to maintain the bus-only shoulders, and Metro Transit supplements those investments by contributing federal “capital guideway maintenance” funds it receives.<sup>49</sup>

### *What about Milwaukee?*

Until the mid-1990s, Milwaukee had designated bus and bicycle-only lanes during peak travel periods on a roughly 1.2-mile stretch of Prospect Avenue and Farwell Avenue. Parking was restricted from the right lane of Farwell Avenue from Maryland Avenue to Franklin Place between 7 am and 9 am on weekdays. Likewise, the right lane of Prospect Avenue from Knapp Street to North Avenue was dedicated to buses and bicycles only from 3:30pm to 5:30pm on weekdays. In 1995, the City of Milwaukee adopted legislation that eliminated the parking restrictions, and thus, the bus-only lanes. According to the City Engineer, demand by business owners for on-street parking, coupled with a desire for dedicated bike lanes rather than shared bus/bike lanes, led to the elimination of the bus lanes.

Currently, the only bus-only lanes in Milwaukee County are a limited number of freeway ramps, which are shared with high-occupancy vehicles. In Waukesha County, there are lanes dedicated exclusively to buses and bicycles on W. Bluemound Road from 124<sup>th</sup> Street to Goerke’s Corners.

Milwaukee has not experimented with bus-only shoulders to date. MCTS has relatively few routes that use highways and the Milwaukee area doesn’t have the same level of congestion as the Twin Cities, but bus-only shoulders could be an effective option to consider for highways where Freeway Flyer and UBUS routes operate during the morning and afternoon rush hours. Bus-only shoulders may only be feasible in certain areas, however. According to County officials, significant work may be

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<sup>47</sup> Douma, Frank. June 2007.

<sup>48</sup> Douma, Frank. June 2007.

<sup>49</sup> Martin, Peter C. “TCRP Synthesis 64: Bus Use of Shoulders.” Transportation Research Board. 2006. [http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp\\_syn\\_64.pdf](http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_syn_64.pdf)



needed in some areas to create shoulders that are consistently wide enough and strong enough to handle bus traffic.

## **SUMMARY**

After several years of transit service cuts and fare increases, MCTS has managed to stabilize Milwaukee County's bus services over the past few years and has made some significant system improvements. Express bus services have been re-established along a handful of the region's busiest transit corridors, and several job centers that previously were inaccessible via public transit are now served by new or newly-extended bus routes. Electronic fare cards also were introduced recently, which allow passengers to board and transfer buses more quickly. These improvements have helped to increase the speed and reliability of MCTS bus services.

While progress has been made, our analysis also reveals that there are several strategies being utilized by other U.S. transit systems to improve bus speeds that have not been applied locally. While some of these strategies could be considered system-wide – such as a bus stop consolidation program – most could be used in a more limited fashion for select routes.

Each of the strategies examined in this section has the potential to improve bus speeds and reduce travel times to some extent. As we stated in *Getting to Work*, however, “to truly address the prohibitive travel times faced by many reverse commuters, more advanced and expensive strategies (in terms of up-front capital)” may be required,” such as true bus rapid transit with dedicated lanes or light rail services.” In the remaining sections of this report, we analyze the use of bus rapid transit in other U.S. metro areas and consider its potential for Milwaukee.



## WHAT IS BUS RAPID TRANSIT (BRT)?

Over the past 15 years, numerous U.S. metro areas have introduced BRT or BRT-like services, from major cities with already-robust transit systems, to smaller metros where BRT represents the first available rapid transit option. BRT has become widely established as a viable alternative to light rail for regions that wish to consider new or expanded rapid transit services.

BRT combines a variety of bus system enhancements to produce an optimal level of service that offers substantial benefits to users in terms of speed, reliability, and accessibility. Transit systems also typically benefit through increased ridership. In addition, a small but growing body of research indicates that BRT can have a positive impact on economic development, as businesses may be drawn to areas near BRT stations and corridors.<sup>50</sup>

### DEFINING BRT

According to the FTA, bus rapid transit includes several major elements that make it distinct from local or express bus services. Those elements are its running ways; stations; vehicles; fare collection systems; intelligent transportation systems (ITS); service and operations plans; and branding elements.<sup>51</sup> Each of these elements is briefly described below.

#### Running Ways

In a BRT system, the running way is the lane or transitway used for travel. The type of running way used for BRT “can significantly impact travel speeds, reliability, and identity,” according to the FTA.<sup>52</sup> The use of an exclusive right-of-way is one characteristic that makes BRT easily distinguishable from other bus services, but is only one key component among many.

There are several common ways of providing an exclusive bus lane for BRT systems, including some described in the previous section of this report. Some BRT systems operate in curb lanes on the right side of the street. Others use the lane next to the curb lane, which preserves on-street parking but requires “bus bulbs” at intersections where there are BRT stops. (Bus bulbs are extensions of the sidewalk that allow passengers to board buses, which remain in their travel lane.) BRT advocates prefer the third option, however: center/median lanes, which allow buses to avoid right-



The running ways for Mexico City’s BRT system are dedicated median lanes. Physical barriers prevent other traffic from entering bus lanes.

<sup>50</sup> Levinson, David. “Does BRT have Economic Development Effects?” Streets.mn. September 11, 2013. <http://streets.mn/2013/09/11/does-brt-have-economic-development-effects/>

<sup>51</sup> Federal Transit Administration. “Characteristics of Bus Rapid Transit for Decision-Making.” U.S. Department of Transportation. February, 2009. [http://www.fta.dot.gov/documents/CBRT\\_2009.pdf](http://www.fta.dot.gov/documents/CBRT_2009.pdf)

<sup>52</sup> Ibid.



turning vehicles and pedestrians entirely. Of course, the use of center/median lanes requires that existing medians already be wide enough to accommodate bus stops or that they can be widened for that purpose.

In some places, such as Mexico City, the running ways for BRT systems are grade-separated or involve some type of physical barrier between the transitway and mixed-flow travel lanes. Not surprisingly, BRT systems that use separate rights-of-way offer the most benefits in terms of travel speed, service reliability, brand identity, and passenger attraction, but also are the most expensive to develop.

## Stations

BRT stops or stations can range from smaller passenger waiting areas with simple shelters to enhanced stations or terminals with many passenger amenities, such as maps, real-time vehicle arrival displays, emergency telephones, vending machines, seating, temperature control, and public art. The image that BRT stations convey can be critical not only to reinforcing the BRT's identity as a unique and premium service, but also in encouraging economic development in the surrounding area.

Level boarding, which is considered one of the greatest advantages of light rail systems, also can be achieved with BRT systems through the use of low-floor buses and raised curbs at stations. With level boarding, passengers are able to board and alight quickly and easily, including those using wheelchairs.



A BRT service in Minneapolis features level boarding at bus stops.

## Vehicles

The quality and style of BRT vehicles play a critical role in influencing perceptions of the service, both for users and non-users.<sup>53</sup> As such, BRT systems typically utilize buses that are as similar to light rail vehicles as possible in terms of look and feel, with the aim of providing a more comfortable experience for users than regular buses and a modern design. Enhancements can include wider doors and aisles, unique windshield and window treatments, use of high-quality interior materials and lighting, and larger windows to increase light and airflow. Vehicles often have doors on both sides, which allow buses to make stops at both median stations and curbside stations. In addition, BRT vehicles often are articulated (extended) with three sets of doors, thus offering increased capacity and faster boarding and alighting. Depending on their specific design, BRT vehicles are slightly-to-moderately more expensive than conventional buses, but can have a positive impact on ridership.

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<sup>53</sup> Kittelson & Associates, Inc. "Bus Rapid Transit Practitioner's Guide." Transportation Research Board. 2007. [http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp\\_rpt\\_118.pdf](http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf)



Choosing a fuel system for BRT vehicles also is an important consideration. Options include hybrid electric, natural gas, and ultra-low sulfur diesel. The fuel system influences how smoothly the vehicle operates, how much energy it consumes, and how much air pollution it produces. In addition, the type of fuel can affect vehicle acceleration. According to the TRB, vehicles with hybrid electric propulsion systems tend to offer smoother, quieter, and faster acceleration than vehicles with internal combustion engines, and produce 90% less pollution.<sup>54</sup> Hybrid electric buses can cost \$150,000-\$250,000 more per vehicle; however, reduced costs resulting from their superior fuel efficiency can mitigate their higher purchase price over time.<sup>55</sup>



The BRT system in Las Vegas uses articulated and stylized vehicles that provide an enhanced customer experience.

## Fare Collection

The fare collection method utilized by a BRT system affects both passenger and conductor convenience and the efficiency of loading and unloading at stations. Most BRT services feature off-board fare collection, which requires passengers to purchase bus tickets or electronic fare cards at vending machines located at bus stations, rather than on the bus. Off-board fare collection reduces dwell time associated with buses waiting for passengers to pay fares. When off-board fare collection systems are employed, passengers typically are allowed to use both (or in many cases, all three) sets of doors to board, which also reduces dwell time at busy intersections.

Off-board fare collection systems typically operate in one of two ways. In some cases, passengers must swipe their tickets or fare cards at machines and pass through turnstiles prior to boarding, ensuring that they have paid their fare. In other cases, transit systems opt to employ personnel who inspect passengers' tickets or fare cards on buses, issuing citations to those who lack proof of payment.<sup>56</sup>



The Select Bus Service in New York City features off-board fare collection. Inspectors patrol buses to ensure that passengers have paid their fare.

Another fare-related consideration is whether fares will be flat for all rides or whether a differentiated fare structure will be employed. Under a differentiated fare structure, fares can vary based on trip

<sup>54</sup> Kittelson & Associates. 2007.

<sup>55</sup> Ibid.

<sup>56</sup> Larwin, Thomas F. "TCRP Synthesis 96: Off-Board Fare Payment Using Proof-of-Payment Verification." Transportation Research Board. 2012. [http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp\\_syn\\_96.pdf](http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_syn_96.pdf)



distance, time of day, day of week, or other factors. BRT services can involve higher fares than regular local bus services, but typically that is not the case.

### Intelligent Transportation Systems (ITS)

Intelligent Transportation Systems are advanced communications technologies that are used to improve the speed and function of a BRT service. Transit signal priority, which was discussed in the previous section, is an example of ITS. There are numerous other examples, however, including signal timing/phasing optimization, which involves modifying traffic signal sequencing to improve the flow of BRT vehicles; and precision docking, in which vehicles are equipped with automated controls that assist with docking at stations to facilitate level boarding.

### Service and Operations Plan

A service and operations plan refers to a BRT system’s route design, stop spacing, frequency of service, and hours of operation. Ideally, BRT routes are direct, service is frequent, and stops are spaced far enough apart to provide a faster service than local or express bus services, typically every  $1/2 - 3/4$  mile. Providing frequent service improves speed and convenience for passengers. The TRB recommends that BRT service maintains headways of “8 to 10 minutes or shorter during peak periods and not more than 12 to 15 minutes during off-peak periods.”<sup>57</sup> Most BRT services operate seven days per week for most of the day and night, but some only operate on weekdays during peak periods.

### Branding Elements

Branding allows BRT systems to establish a unique identity from the rest of the public transit system. Branding typically includes a distinctive system name and logo, which is applied to all BRT vehicles, stations, fare media, and schedules.



Eugene, Oregon’s BRT service has a unique name – “Emerald Express” – and a distinctive logo.

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<sup>57</sup> Kittelson & Associates. 2007.



## THE BRT STANDARD

Services that are called “bus rapid transit” vary dramatically in the specific features they include and benefits they provide over local and express bus services, making it difficult to know which systems truly qualify as BRT and which do not. In fact, the term “BRT creep” has been used to reflect the lack of consistency and clarity regarding what constitutes true BRT.<sup>58</sup>

In response, the Institute for Transportation and Development Policy (ITDP) – an international organization that works to improve urban transportation systems – developed the “BRT Standard,” which provides a definition for BRT and establishes a tiered quality rating system. ITDP evaluates BRT routes across the globe using its standard scorecard and issues ratings based on the number of points each route earns in six categories: The BRT Basics; Service Planning; Infrastructure; Stations; Communications; and Access and Integration.<sup>59</sup>

According to ITDP, a BRT corridor must include dedicated lanes for a stretch of at least 3 km (1.9 miles). The ITDP’s requirements related to running ways are particularly strict. In order to be considered even “Basic BRT,” the dedicated lanes must be center/median lanes rather than curbside lanes in light of the benefits provided by avoiding right-turning traffic and pedestrians. The only exception to that rule is a BRT service that operates in curbside lanes on one-way streets or that otherwise operates in an exclusive right-of-way, such as a former rail line that has been converted into a busway.

To qualify as BRT, additional points must be earned for the BRT corridor’s dedicated right-of-way elements and busway alignment, and a minimum total of 20 points must be earned overall in the rating system’s BRT Basics category. The BRT Basics category also offers points for off-board fare collection, platform-level boarding, and intersection treatments.

Bus routes must meet the BRT Standard’s minimum qualifications to be considered Basic BRT. ITDP further categorizes those meeting such qualifications depending on the total number of points earned, as shown in **Table 5**.

**Table 5: ITDP quality ratings<sup>60</sup>**

Rating tier	Points Earned
Gold-standard BRT	85 points or more
Silver-standard BRT	70-84 points
Bronze-standard BRT	55-69 points
Basic BRT	Less than 54 points

<sup>58</sup> Malouff, Dan. “BRT creep” makes bus rapid transit inferior to rail.” Greater Greater Washington. March 9, 2011. <http://greatergreaterwashington.org/post/9600/brt-creep-makes-bus-rapid-transit-inferior-to-rail/>

<sup>59</sup> Institute for Transportation and Development Policy. <https://www.itdp.org/library/standards-and-guides/the-bus-rapid-transit-standard/the-scorecard/>

<sup>60</sup> Institute for Transportation and Development Policy. <https://www.itdp.org/library/standards-and-guides/the-bus-rapid-transit-standard/>





No BRT service in the U.S. has earned a Gold-standard rating, and only nine BRT routes (in seven cities) are considered Basic BRT or better. Most of the world’s Gold-standard BRT routes are located in large and densely-populated Latin American cities, including Bogota, Guatemala City, Lima, and Rio de Janeiro.<sup>61</sup> **Table 6** identifies the nine routes in the U.S. that meet ITDP’s minimum qualifications to be considered BRT. There are several other services in the U.S. that are referred to as BRT, but those have not met ITDP’s minimum standards.

**Table 6: ITDP’s quality ratings for BRT routes in the U.S.**

Metro Area	Route	Points Earned	Quality Rating
Cleveland	HealthLine	76	Silver
Los Angeles	Orange Line	65	Bronze
San Bernardino	sbX	63	Bronze
Seattle	Transit Tunnel/SODO Busway	56	Bronze
Pittsburgh	Martin Luther King Jr. East	56	Bronze
Eugene, OR	Emerald Express: Green Line	55	Bronze
Las Vegas	The Strip and Downtown Express	54	Basic
Pittsburgh	West Busway	51	Basic
Pittsburgh	South Busway	50	Basic

In the following section, we take a closer look at some of these nine services. We also examine several bus services throughout the U.S. that are not included on this list, as many transit systems offer services that fall somewhere between simple express bus routes and routes ITDP recognizes as Basic BRT. For example, Seattle’s RapidRide and New York City’s Select Bus Service, which were described previously in this report, are not considered true BRT even though they include several BRT features that distinguish them from ordinary limited-stop bus service.

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<sup>61</sup> Ibid.



## BRT CASE STUDIES

To provide perspective regarding how BRT services are being implemented in U.S. metro areas, we examined four distinctive case studies, including their design and features, the cost of developing and operating the services, and the range of benefits they provide. These four case studies include the highest-rated BRT service in the U.S. (Cleveland's HealthLine), a metro area with one of the most extensive networks of BRT routes in the country (Las Vegas), and two bus services that are more advanced than typical express bus routes but do not qualify as BRT (Nashville's "BRT lite" services and Chicago's Jeffery Jump). We also look at Chicago's plans for the future, which include what could be the nation's first "Gold-standard" BRT route.

### CLEVELAND'S HEALTHLINE

Completed in 2008, Cleveland's 7.1-mile HealthLine connects downtown Cleveland with East Cleveland (a first-ring suburb) along Euclid Avenue (see **Map 6** on the following page). The HealthLine stands out as the only BRT service in the U.S. to have achieved a Silver rating from ITDP, making it the leader with which all other systems are compared.

#### Service Design

The idea for the HealthLine was to connect Cleveland's two largest employment hubs – Public Square (downtown) and University Circle, where Cleveland Clinic, University Hospitals, and Case Western University are located. The Euclid Avenue corridor already was one of the busiest transit corridors in the region.



Cleveland's HealthLine operates in a dedicated median lane and offers level boarding at stations.

The HealthLine operates 24 hours a day, seven days a week, with service offered every 6-8 minutes on weekday mornings and afternoons and less frequently late at night and on weekends. In addition to its high service frequency, the HealthLine includes numerous features that contribute to improving speed and convenience, including the following.

- Exclusive use of center/median lanes for most of the route (4.5 of the 7.1 miles)<sup>62</sup>
- Articulated, hybrid electric vehicles that include a total of five sets of wide doors, which makes boarding and alighting quicker and allows buses to make stops at both median-side and curbside stations
- Raised platforms and a precision docking system, which allow for level boarding at stations
- Transit signal priority technology to speed up service through busy intersections
- Off-board fare collection

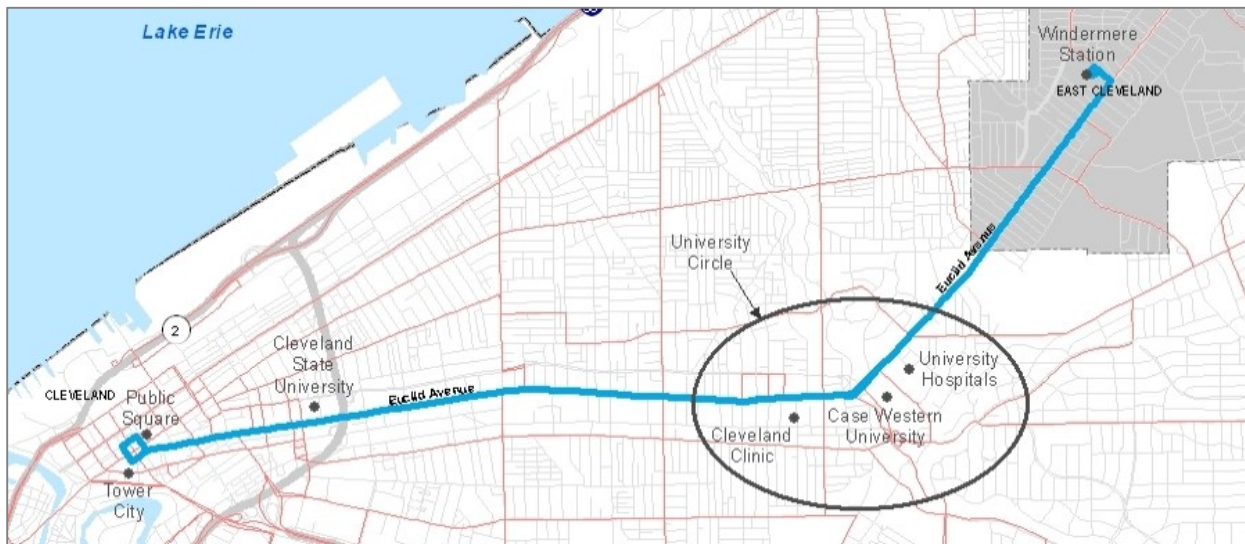
<sup>62</sup> National Association of City Transportation Officials. <http://nacto.org/usdg/dedicated-median-bus-lanes/>



To enforce the HealthLine’s off-board fare collection system, the Greater Cleveland Regional Transit Authority’s (GCRTA) transit police randomly board HealthLine buses to examine tickets and passes and ensure that all passengers have paid their fares. The fine for fare evasion is the equivalent of the cost of a monthly bus pass.

One aspect of the HealthLine’s design that appears to limit the speed of the service is its stop spacing. While high-quality BRT services in other metro areas typically stop every 1/2 mile or more, Cleveland’s HealthLine stops every 1/5 mile (roughly every 1,000 feet) on average.<sup>63</sup> As previously discussed, stop spacing is one of the design considerations that have the greatest influence on the speed of a BRT service.

The HealthLine includes many features that make the service stand out from the rest of the bus system. HealthLine buses are branded with a unique and modern design. Stations along the route are enhanced with real-time information displays, ticket vending machines, and public art. As a part of the project, the Euclid Avenue corridor also was improved with new bicycle lanes, 1,500 newly planted trees, and landscaping installed near stations and throughout the corridor.



**Map 6:** The HealthLine serves Cleveland’s two largest employment centers – Public Square (downtown Cleveland) and University Circle, where major regional healthcare facilities are located.

<sup>63</sup> Metropolitan Council. “Regional Transitway Guidelines Technical Report.” May 2011. <http://www.metrocouncil.org/METC/files/f3/f36ba467-feb7-4193-b1eb-006d01e194d0.pdf>



## Impact on Travel Times & Ridership

Despite the HealthLine's relatively short average stop spacing, the route has improved travel times for users traveling the entire length of the corridor from 48 minutes to 36 minutes, a savings of 25%.<sup>64</sup> Most of the time savings occurs on the 4.5-mile stretch where the HealthLine operates in exclusive center/median lanes.

The HealthLine also has performed well from a transit ridership perspective, increasing ridership along the Euclid Avenue corridor by 60% in its first three years of operation.<sup>65</sup> Ridership was up to 4.8 million rides per year as of November 2013, making it the second busiest transit route in a system that includes two light rail lines and one heavy rail line.<sup>66</sup> The HealthLine's ridership is roughly on par with MCTS' busiest bus line – Route 30 – which provides 4.2 million rides per year.

## Cost & Funding Sources

The overall cost of developing the HealthLine and improving the Euclid Avenue corridor was \$197.5 million, but only \$50 million of that paid for transit components (vehicles, stations, platforms, and traffic signal upgrades). The remaining \$147.5 million covered other needed improvements along the corridor, including improvements to streets, curbs, sidewalks, utilities, and landscaping.<sup>67</sup> According to the GCRTA, the corridor was in poor condition before the HealthLine project took place, so the improvements that went beyond those directly related to transit were important for the project's success. A more detailed breakdown of project costs is as follows:

- \$115 million for road, median, sidewalk, station, and utility construction
- \$47.5 million of “soft costs,” including engineering, construction management, various specialty consultants, financing, and public art
- \$20.5 million for new BRT buses
- \$13.5 million for right-of-way acquisition

The project's overall cost per mile, therefore, was just under \$28 million, including \$7 million per mile for the transit components. Construction costs per mile ranged from roughly \$23 million per mile for the 4.5-mile stretch where the HealthLine runs in median lanes, to \$2.5 million per mile for the 2.6 miles where the service runs in curbside lanes.

Funding for the project came primarily from federal and state grants, including an \$82.2 million federal grant from the FTA's New Starts program, which supports major transit capital investments, and \$75 million from the Ohio Department of Transportation.<sup>68</sup> Additional funding sources included the following:

- \$21.4 million from Greater Cleveland Regional Transit Authority (GCRTA)
- \$10 million from Northeast Ohio Area-wide Coordinating Agency (NOACA)
- \$8 million from the City of Cleveland

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<sup>64</sup> Data provided by the Greater Cleveland Regional Transit Authority.

<sup>65</sup> Ibid.

<sup>66</sup> Greater Cleveland Regional Transit Authority: <http://www.riderta.com/HealthLine/about>

<sup>67</sup> Funding data provided by the Greater Cleveland Regional Transit Authority.

<sup>68</sup> National Association of City Transportation Officials. <http://nacto.org/usdg/dedicated-median-bus-lanes/>



- \$3 million from Cleveland Clinic
- \$600,000 from FTA's Fixed Guideway Modification grant program<sup>69</sup>

In addition, the name "HealthLine" came about through a naming rights partnership with Cleveland Clinic and University Hospitals, which will support the system with \$6.75 million in funding for ongoing maintenance over 25 years.<sup>70</sup>

### Additional Information

- Prior to the introduction of the HealthLine, street parking was prohibited along much of the Euclid Avenue corridor during peak hours in the morning and evening. According to GCRTA's director of engineering, when the corridor was reconfigured for the HealthLine, parking spaces were removed entirely from some areas where abundant off-street or side-street parking existed and was not being fully utilized. In many other adjacent areas, parking restrictions were removed, making street parking available 24 hours per day.
- One major challenge the HealthLine encountered was opposition from business owners along Euclid Avenue, as some businesses were negatively affected by the restrictions to access during construction. In fact, the City of Cleveland stepped in and offered low-interest loans to businesses during the construction phase of the project to help them remain open.<sup>71</sup> A few businesses that already were struggling did not survive, but those that did generally seem pleased with their proximity to the service.
- Since the HealthLine was introduced in 2008, at least \$5.8 billion in development has occurred within 1/4 mile of the route, which is far more than what was expected.<sup>72</sup> The extent to which that development has occurred as a direct result of the new transit service is unclear, however. Supporters of the BRT system contend that the new development represents a return on investment of at least \$29 for every \$1 invested in the project, and point out that much of the development occurred during the recession.

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<sup>69</sup> Ibid.

<sup>70</sup> Institute for Transportation and Development Policy. 2011.

<sup>71</sup> Zicari, Peter. "Euclid Corridor project becomes a route to lost business for many on the avenue." [http://blog.cleveland.com/pdextra/2007/06/euclid\\_corridor\\_project\\_become.html](http://blog.cleveland.com/pdextra/2007/06/euclid_corridor_project_become.html)

<sup>72</sup> Urban Land Institute. "HealthLine Drives Growth in Cleveland." July 13, 2012. <http://urbanland.uli.org/economy-markets-trends/HealthLine-drives-growth-in-cleveland/>



## LAS VEGAS' BRT NETWORK

The Regional Transportation Commission of Southern Nevada (RTC SNV) currently operates four BRT routes, though its Strip and Downtown Express (SDX) service is the only one ITDP recognizes as true BRT (it is rated Basic BRT). While the other routes may not meet ITDP's BRT standards, they are much more advanced than a typical express bus route.

### Service Design

Las Vegas's four BRT routes are the Strip and Downtown Express (SDX), Metropolitan Area Express (MAX), Boulder Highway Express (BHX), and Sahara Express (SX). As shown in **Map 7** on the following page, three of the routes serve downtown Las Vegas and extend out in different directions. The SDX, for example, connects downtown Las Vegas with The Strip, where most of Las Vegas' casinos are located, while also serving the Las Vegas Convention Center and other major destinations. The most recent route to be added, the SX, does not serve downtown Las Vegas but crosses the BHX and SDX routes along its path.



The Strip and Downtown Express (SDX) service in Las Vegas includes features level boarding at stations.

The MAX and SDX, which were the first two BRT routes to be developed in the area, complement local bus routes that operate along roughly the same paths with more frequent stops. In contrast, the newer routes (BHX and SX) *replaced* local bus service and now are the only routes operating on those corridors. Stop spacing differs slightly on the routes that operate alongside local bus routes versus those that do not. Typically, stop spacing is every  $\frac{1}{2}$  mile for the MAX and SDX versus every  $\frac{1}{3}$  mile for the BHX and SX and every  $\frac{1}{4}$  mile for local bus routes.

With the exception of the SDX, Las Vegas's BRT routes operate primarily in dedicated curbside lanes that are only shared with right-turning vehicles. They operate in mixed traffic for limited portions of the routes. One of the factors that helped the SDX achieve its Basic BRT designation is its use of a dedicated center/median lane for a 2.25-mile downtown segment of the 9-mile route, with left turning restrictions at many intersections. Use of the center/median lanes, which are painted red, was authorized by the City of Las Vegas. The SDX operates in mixed traffic for the remaining 6.75 miles of the route.

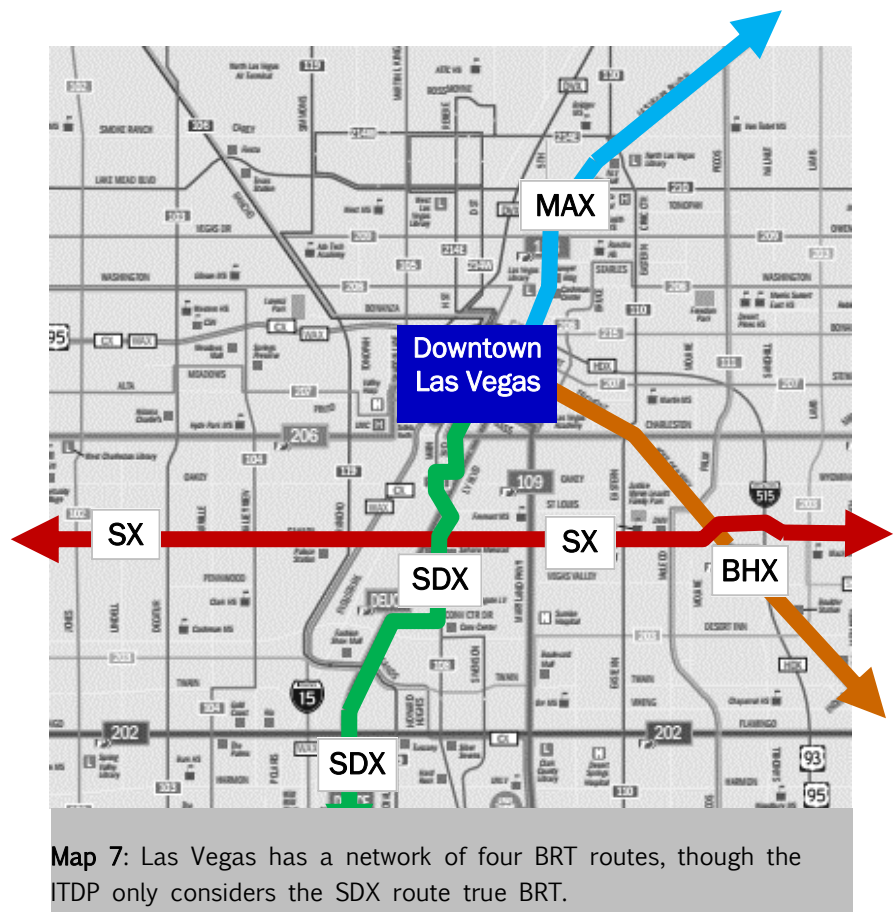
Other features that distinguish Las Vegas's BRT routes from its local and express bus routes include enhanced stations (with ticket vending machines, information displays, and public art), level boarding, specially designed articulated buses, and unique branding. Transit signal priority is utilized for some intersections on all four routes. The SDX features an off-board fare collection system, and self-serve ticket machines also are available inside buses. Notably, off-board fare collection also was offered on the MAX and BHX routes, but was removed recently due to problems with fare evasion.



## Impact on Speed & Ridership

Las Vegas's BRT routes provide significant time savings compared with local bus service. The SDX, for example, saves passengers about 20 minutes when traveling the entire length of the 9-mile corridor, a time savings of nearly 30%. Running times for the MAX are approximately 7-10 minutes shorter than for local bus Route 113, shortening trips by up to 20%.

The introduction of BRT services has increased ridership on all four corridors where it now operates. The introduction of the SDX, for example, has boosted total ridership along the busy corridor from downtown Las Vegas to The Strip from approximately 35,000 rides per day to over 47,000 rides per day, an increase of 36%.<sup>73</sup> Notably, ridership has increased on the corridors where the BHX and SX replaced local bus routes despite an increase in stop spacing from every 1/4 mile to every 1/3 mile, indicating that increased stop spacing did not cause an access problem for many transit riders.



## Cost & Funding Sources

The cost of developing the Strip and Downtown Express service included \$52.8 million for infrastructure improvements, which amounts to \$5.9 million per mile.<sup>74</sup> The RTC SNV was unable to provide cost information related to purchasing new buses for the route. A \$25 million federal grant from the FTA's Small Starts program, which provides funding support for new transit capital projects costing up to \$250 million, was one of the major funding sources for the project.

Total costs for each of the other routes ranged from \$20 million to \$40 million, with federal funds covering 80% of the cost of all three routes. The Sahara Express, for example, was supported by a \$34.4 million federal TIGER grant, with local funds covering the remaining \$6 million. The MAX and

<sup>73</sup> Ridership data provided by the Regional Transportation Commission of Southern Nevada.

<sup>74</sup> All funding data provided by the Regional Transportation Commission of Southern Nevada.



Boulder Highway Express routes received federal grants from the Small Starts program and Urbanized Area Formula Program.

### Additional Information

- A unique challenge in developing The Strip and Downtown Express service was opposition from casino owners, who did not want to make it easier for people to leave The Strip. Based on the compromise that was reached, the SDX does not include dedicated bus lanes along The Strip, which limits the speed of the service.
- Street parking was removed in some areas where BRT services operate. According to one RTCSNV official, that was not a significant challenge because Las Vegas is a relatively young city that was designed around the automobile, and most businesses in Las Vegas offer on-site parking.
- The RTCSNV currently is planning a fifth BRT route along Maryland Parkway, which would operate in center/median lanes.<sup>75</sup> The proposed route would replace local bus Route 109, with stop spacing every  $\frac{1}{3}$  mile rather than the current  $\frac{1}{4}$  mile.
- A RTCSNV representative stressed the need to be flexible in designing a BRT system, as each of their BRT routes has a slightly different design based on existing land uses, available infrastructure, cost and schedule constraints, and other factors.

### NASHVILLE’S “BRT LITE” SERVICES

After experiencing a slow decline in average bus speeds for several years, Nashville’s Metropolitan Transit Authority (MTA) created new “BRT lite” routes on two of its busiest transit corridors in 2009 and 2013. The 12-mile Gallatin Pike route provides service from downtown Nashville to RiverGate Mall near the Davidson County border. A second 14-mile “BRT lite” route extends from downtown Nashville along the Murfreesboro Pike corridor to another major commercial center.<sup>76</sup>



### Service Design

One of the primary features that distinguish Nashville’s two “BRT lite” routes from its local bus routes is wide stop spacing, which averages  $\frac{3}{4}$  mile. The Gallatin Pike route includes transit signal priority at all signalized intersections outside of downtown, and Nashville MTA recently obtained a \$10 million TIGER grant from the FTA to make improvements to bus services along the Murfreesboro Pike

<sup>75</sup> Regional Transportation Commission of Southern Nevada: <http://www.rtcnv.com/planning-engineering/transportation-planning/maryland-parkway-alternatives-analysis/#.VKHja14BA>

<sup>76</sup> Nashville Metropolitan Transit Authority: <http://www.nashvillemta.org/news/pub152.pdf>





corridor, which will include adding a transit signal priority system.<sup>77</sup> Nashville's BRT lite routes do not operate in exclusive lanes and the system does not include off-board fare collection.

Other features of Nashville's service are articulated, hybrid electric buses and enhanced bus stations with real-time information displays. Service is relatively frequent, with 15-minute headways from 6am to 6:15pm on weekdays and throughout much of the morning and afternoon, and 30-minute headways late at night and on weekends.

### **Impact on Speed & Ridership**

According to Nashville MTA, the two "BRT lite" routes save passengers approximately 5-10 minutes on average when traveling the entire length of the corridors during peak periods, a time savings of roughly 10-20%.

Ridership is up on the Gallatin Pike route from 80,000 rides per month before the "BRT lite" service was added to 115,000 rides per month today, an increase of 44%.<sup>78</sup> According to a Nashville MTA transit planner, ridership already has increased by 15% on the newer Murfreesboro Pike route as well, from 76,000 to 87,000 rides per month.

### **Cost & Funding Sources**

The cost of implementing the "BRT lite" services was a significant challenge, as the local bus routes that already existed on the two corridors were not removed. Like Milwaukee, Nashville is among the minority of large U.S. cities lacking a dedicated funding source for public transit. A majority (51%) of MTA's funding comes from the unified Metropolitan Government of Nashville and Davidson County (Metro Nashville).

According to Nashville MTA, total start-up costs were \$1.9 million for the Gallatin Pike route and \$983,000 for the Murfreesboro Pike route, with funding appropriated from Metro Nashville's General Fund through the annual budgeting process. As previously mentioned, an additional \$10 million in federal funding has been secured to improve transportation on the Murfreesboro Pike corridor.

### **Additional Information**

- Nashville currently is debating a proposed "full service" BRT route called the Amp, which would operate primarily in dedicated center/median lanes and would include many other service enhancements. According to Nashville MTA, the Amp proposal has been met with strong opposition due to proposed parking removals and restrictions to left turning and concerns that the service would increase traffic congestion. Opposition also has stemmed from disappointment with Nashville's existing "BRT lite" service, as it was marketed as BRT but is not seen as providing as significant an improvement over regular bus service as was suggested. This may be a lesson Milwaukee should consider when planning future bus services.

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<sup>77</sup> USDOT. "U.S. Department of Transportation Announces \$10 Million TIGER 2013 Grant to Improve Bus Service Into Downtown Nashville." September 2013. <http://www.nashvillemta.org/News/news644.pdf>

<sup>78</sup> Garrison, Joey. "Bus rapid transit 'lite' planned for Murfreesboro Pike". The City Paper. April 24, 2012. <http://nashvillecitypaper.com/content/city-news/bus-rapid-transit-lite-planned-murfreesboro-pike>



- Nashville also has one 32-mile commuter rail line that connects it with its eastern suburb of Lebanon, TN.

## CHICAGO'S EXISTING AND PLANNED BRT SERVICES

The City of Chicago, with its already robust and multi-modal transit system, recently has focused on adding BRT. In late 2012, the Chicago Transit Authority (CTA) introduced a “BRT-lite” service called the Jeffery Jump, which connects the city’s far south side (103<sup>rd</sup> Street and Stony Island Avenue) with the Loop.<sup>79</sup> By March 31, 2015, the Chicago Department of Transportation (CDOT) is expected to break ground on a more advanced BRT route serving the Central Loop. Chicago’s most ambitious plan is to add a north-south BRT route along Ashland Avenue that would be the first BRT service in the U.S. to meet ITDP’s Gold standard.

### Service Design

The Jeffery Jump includes fewer service enhancements than what is planned for the Central Loop and Ashland routes, but still represents a significant improvement over the CTA’s other express bus routes. One of the service’s most distinctive features is dedicated curbside bus lanes on a roughly 2-mile stretch of a one-way street, though those lanes are only active on weekdays during the morning and afternoon rush hours. At other times of the day and week, vehicles are allowed to park in those lanes. Other features of the Jeffery Jump include:

- Stops spaced every 1/2 mile, compared with every 1/4 mile on other express bus routes
- Headways of only 4-6 minutes for much of the morning and afternoon
- Transit signal priority on a 11-block stretch
- Enhanced bus stations with street furniture
- Real-time arrival information on buses
- Articulated buses with a unique design

Since the Jeffery Jump’s dedicated bus lanes only are active during limited hours, and since the service lacks many BRT elements such as off-board fare collection and level boarding, ITDP does not consider it BRT. Nevertheless, it represents Chicago’s most advanced express bus route to date.

The planned 2.5-mile Central Loop BRT service, which will connect Chicago’s Union Station with Michigan Avenue, appears to be on track to become Chicago’s first BRT service to achieve ITDP’s



The Jeffery Jump is Chicago’s first attempt to integrate BRT into its transit system.

<sup>79</sup> Hilkevitch, Jon. “CTA to roll out Jeffery Jump express buses.” November 12, 2012. Chicago Tribune. [http://articles.chicagotribune.com/2012-11-12/news/ct-met-jeffery-jump-20121112\\_1\\_bus-rapid-transit-73rd-and-84th-streets-jeffery-jump](http://articles.chicagotribune.com/2012-11-12/news/ct-met-jeffery-jump-20121112_1_bus-rapid-transit-73rd-and-84th-streets-jeffery-jump)



stamp of approval. A unique feature of the Central Loop BRT service is that not one, but six bus routes will be able to utilize the new infrastructure, speeding up travel for numerous passengers.

East-west travel through the Loop via public transportation is notoriously difficult and slow. In the 1960s, there was a proposal to add a subway line through the Loop, and in the 1990s a light rail line was considered. Both ultimately were rejected, largely due to cost. Thus, the planned Central Loop BRT service will address a need that was identified at least 50 years ago.

The Central Loop BRT will operate largely in dedicated curbside lanes on one-way streets, which will be painted red. Right-turning vehicles will be allowed to use the bus lanes to turn, except at four intersections where right turning will be prohibited. Additional service features will include:



Chicago's planned Central Loop BRT service will operate in dedicated bus lanes and include protected green bicycle lanes on three streets.

- Stops spaced every 1/4 mile in an area where buses often stop every block
- Enhanced stations with level boarding and real-time arrival information displays
- Off-board fare collection at one station, with plans to add that option to additional stations in the future
- Transit signal priority at seven busy intersections
- Articulated buses with a unique design
- A new CTA bus terminal at Union Station for smooth connections to Metra and Amtrak services

According to CDOT officials, bus passengers account for approximately 47% of the people traveling through the Central Loop corridor in vehicles.<sup>80</sup> The City of Chicago feels particularly justified, therefore, in dedicating one of the three travel lanes on those streets to buses.

As with the Central Loop BRT, Chicago's proposed Ashland BRT route would address a long-standing transportation problem in Chicago. While Chicago's elevated rail system (the 'L') provides rapid transit services in and out of the Loop, no north-south rapid transit service exists to connect the 'L' lines in the central or western parts of the city. As shown in **Map 8** on the following page, the 16-mile Ashland BRT service would provide connections to seven CTA 'L' stations, two Metra commuter rail stations, 37 CTA bus routes, and the Divvy public bicycle network. It would serve many major destinations as well, including the Illinois Medical District (IMD), University of Illinois-Chicago (UIC), and the United Center arena.

<sup>80</sup> This figure excludes pedestrians, who make up an estimated 56% of the individuals traveling through the corridor. [http://www.cityofchicago.org/city/en/depts/cdot/supp\\_info/central\\_loop\\_busrapidtransit.html](http://www.cityofchicago.org/city/en/depts/cdot/supp_info/central_loop_busrapidtransit.html)



Ashland Avenue was chosen because it provides so many connections and because ridership on the existing local bus route on Ashland (Route 9) already is the second-highest in the city. Currently, 30,000 passengers use Route 9 on an average weekday and more than 10 million passengers use the route each year.<sup>81</sup> (Route 9 will be preserved when BRT service is added.) Providing bus-only lanes on Ashland is feasible as well, as the street is 70-feet wide and currently includes five travel lanes and two parking lanes.<sup>82</sup>

The Ashland proposal has garnered national attention because it aspires to be the nation's first Gold-rated BRT service.<sup>83</sup> It would operate in dedicated, center/median lanes with left turning restrictions at many intersections. Additional features include:

- Stops spaced every 1/2 mile and at 'L' stations
- Enhanced stations with real-time arrival information and level boarding
- Landscaped medians between stations
- Transit signal priority at many intersections
- Off-board fare collection
- Articulated buses with wide doors
- Preservation of approximately 90% of street parking and loading zones

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<sup>81</sup> Chicago Transit Authority:

[http://www.transitchicago.com/assets/1/brt/CTA\\_Ashland\\_BRT\\_Fact\\_sheet\\_English\\_FINAL.pdf](http://www.transitchicago.com/assets/1/brt/CTA_Ashland_BRT_Fact_sheet_English_FINAL.pdf)

<sup>82</sup> Ibid.

<sup>83</sup> Greenfield, John. "CTA Officials Share Details of the Plan for Gold-Standard BRT on Ashland." Streetsblog Chicago. April 19, 2013. <http://chi.streetsblog.org/2013/04/19/cta-officials-share-details-of-the-plan-for-gold-standard-brt-on-ashland/>



Map 8: Chicago's proposed Ashland BRT route, with existing 'L' and Jeffery Jump BRT lines



### Impact on Speed & Ridership

The Jeffery Jump saves commuters approximately seven minutes when traveling from one end of the 16-mile route to the other, a time savings of roughly 13%. Local bus service also is provided on the corridor. Overall bus ridership has fluctuated on the corridor since the introduction of the Jeffery Jump, but according to a CTA representative, survey results to date indicate the service is being well received by transit users.



The planned Central Loop BRT is projected to make eastbound trips through the Loop roughly 25% shorter and westbound trips 15% shorter, according to the CTA.<sup>84</sup> The Ashland BRT service is expected to cut travel time by 45% compared with the local bus route on Ashland, which will make it comparable in speed to service on 'L' train routes. In addition, the CTA projects that the Ashland BRT project will lead to a 30% increase in bus ridership on the corridor, from roughly 30,000 to 40,000 passengers per weekday.<sup>85</sup>

## Cost & Funding Sources

The Jeffery Jump project cost \$11 million and was supported by a federal grant from the FTA's Bus and Bus Facilities program.<sup>86</sup> Since no changes were made to curbs and medians, the project was relatively inexpensive. The Central Loop BRT is estimated to cost \$39.9 million and is funded primarily by a \$24.6 million FTA Urban Circulator grant.<sup>87</sup> The remainder will be financed with tax increment financing (TIF).

Preliminary cost estimates for the Ashland BRT are \$10 million per mile, which would amount to \$160 million total for the 16-mile route. According to CTA, the final costs, funding sources, and timetable for completing the project will not be determined until officials complete the public feedback process and determine the final service plan.

## Additional Information

- The Chicago metropolitan area is home to the second largest public transportation system in the country. The CTA operates eight 'L' routes and 127 bus routes, and Metra operates 11 commuter train lines in the Chicago area. In addition, PACE provides bus services in the suburban parts of the region.

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<sup>84</sup> Greenfield, John. "CDOT Is Finally Moving Forward with the Loop BRT Project." Streetsblog Chicago. September 29, 2014. <http://chi.streetsblog.org/2014/09/29/cdot-is-finally-moving-forward-with-the-loop-brt-project/>

<sup>85</sup> Chicago Transit Authority: [http://www.transitchicago.com/assets/1/brt/CTA\\_Ashland\\_BRT\\_Fact\\_sheet\\_English\\_FINAL.pdf](http://www.transitchicago.com/assets/1/brt/CTA_Ashland_BRT_Fact_sheet_English_FINAL.pdf)

<sup>86</sup> Greenfield, John. "Might as well Jump! The CTA debuts a stepping-stone to bus rapid transit." Grid Chicago. November 13, 2012. <http://gridchicago.com/2012/might-as-well-jump-the-cta-debuts-a-stepping-stone-to-brt/>

<sup>87</sup> Greenfield, John. Streetsblog Chicago. September 29, 2014.



## SUMMARY

These case studies show the range of BRT and “BRT lite” services being developed around the country, from those that involve modest improvements to express bus routes, to those that are much more advanced and expensive and represent a new and truly rapid type of bus service. **Table 7** on the following page summarizes the specific features of each of the routes included in this section. While all 10 of the routes we examined include features that make them faster than existing express bus services in Milwaukee, only Cleveland’s HealthLine and Las Vegas’s Strip and Downtown Express service quality as true BRT per the ITDP standards. At least one of Chicago’s planned routes also is likely to qualify in the future.

**Table 7: Key features of BRT case studies**

Location	BRT Service	Exclusive Lanes	Median or Curb Lanes	Avg. Stop Spacing	Transit Signal Priority	Off-Board Fare Collection	Level Boarding
Cleveland	HealthLine	Yes	Median	1/5 mile	Yes	Yes	Yes
Las Vegas	Strip & Downtown Express (SDX)	Partial	Median	1/2 mile	Partial	Yes	Yes
Las Vegas	Metropolitan Area Express (MAX)	Yes	Curb	1/2 mile	Partial	No	Yes
Las Vegas	Boulder Highway Express (BHX)	Yes	Curb	1/3 mile	Partial	No	Yes
Las Vegas	Sahara Express (SX)	Yes	Curb	1/3 mile	Partial	No	Yes
Nashville	Gallatin Pike	No	Curb	3/4 mile	Yes	No	No
Nashville	Murfreesboro Pike	No	Curb	3/4 mile	Planned	No	No
Chicago	Jeffery Jump	Partial	Curb	1/2 mile	Partial	No	No
Chicago	Central Loop (planned)	Yes	Curb	1/4 mile	Yes	Partial	Yes
Chicago	Ashland (proposed)	Yes	Median	1/2 mile	Yes	Yes	Yes

It is very difficult to compare the costs and benefits of these services, as each route was developed in a distinct setting. For example, it likely is more difficult and costly to speed up bus service through Chicago’s Central Loop – one of the densest downtowns in the U.S. – than it is to speed up service in outlying areas of Las Vegas, where development density is much lower. The existing conditions of the corridor where BRT service is introduced also makes a major difference to overall project cost, because some projects require major improvements beyond those specifically associated with transit, as was the case for Cleveland’s HealthLine.

With those major caveats, **Table 8** shows that the overall project costs of the routes we analyzed range from less than \$1 million per mile for Nashville’s two “BRT lite” routes and Chicago’s Jeffery Jump, to \$10 million per mile or more for Chicago’s planned Central Loop and Ashland Avenue BRT projects and Cleveland’s HealthLine. As previously mentioned, however, the transit-related components of Cleveland’s HealthLine only cost \$7 million per mile. The reductions in travel time offered by these routes, as compared with local bus service on the same corridors, range from 10-20% for Nashville’s two “BRT lite” routes and Chicago’s Jeffery Jump to an estimated 45% for Chicago’s proposed Ashland Avenue BRT service.



**Table 8: Approximate cost per mile and travel time savings offered by BRT case studies**

Metro Area	BRT Service	Approx. Cost per Mile	Approx. Travel Time Savings
Cleveland	HealthLine	\$7 million +	25%
Las Vegas	Strip and Downtown Express (SDX)	\$5.9 million	30%
Las Vegas	Metropolitan Area Express (MAX)	\$2.7 million	20%
Las Vegas	Boulder Highway Express (BHX)	\$2.4 million	N/A
Las Vegas	Sahara Express (SX)	\$2 million	N/A
Nashville	Gallatin Pike	\$160,000	10-20%
Nashville	Murfreesboro Pike	\$70,000	10-20%
Chicago	Jeffery Jump	\$700,000	10-15%
Chicago	Central Loop (planned)	\$16 million	15-25%
Chicago	Ashland Avenue (proposed)	\$10 million	45%

These case studies provide examples MCTS could consult in considering future BRT services in the Milwaukee area. While BRT services have not been introduced here, there have been several proposals to do so, which we explore in the next section.

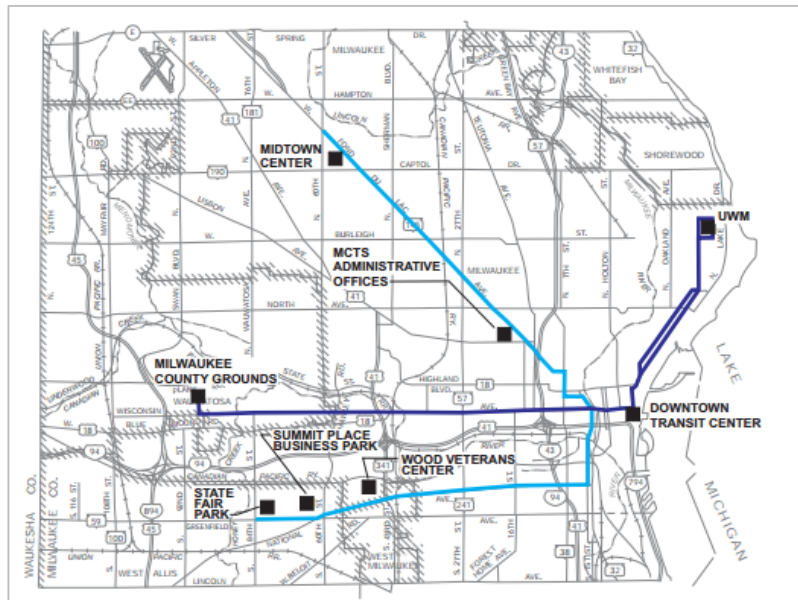




## PAST PROPOSALS FOR BRT IN MILWAUKEE

In recent years, both Milwaukee County and the City of Milwaukee have proposed BRT systems, and the Southeastern Wisconsin Regional Planning Commission (SEWRPC) has included potential BRT routes in its regional transportation plans. Each of those proposals and plans have envisioned a BRT system with at least two high-speed routes connecting major destinations in the region, though their specific route layouts and service designs have varied.

In 2008, Milwaukee County proposed a new system called “Suburban & Milwaukee Advanced Rapid Transit,” or SMART, which would have provided a “BRT lite” level of service.<sup>88</sup> The proposal originally called for a four-route system, but later was scaled back to two routes: one north-south and one east-west. Several route variations were considered, but under the most recent proposal (shown in **Map 9**), the east-west route would have connected UWM with downtown Milwaukee, the Milwaukee County Grounds, and the Regional Medical Center in Wauwatosa, while the north-south route would have operated primarily on Fond du Lac Avenue and National Avenue.<sup>89</sup>



Map 9: Milwaukee County's proposed BRT routes, 2010

The proposed routes were expected to reduce travel times by as much as 25% and provide more convenient service by making several improvements, including:

- Frequent service provision
- Dedicated curbside bus lanes for limited stretches
- Wider stop spacing of  $\frac{1}{4}$  to  $\frac{1}{2}$  mile
- Transit signal priority at some intersections
- Articulated, hybrid electric buses with a modern design
- Enhanced stations with real-time arrival information

Around the same time, the City of Milwaukee proposed developing both a county-wide BRT system and a downtown streetcar line to circulate transit riders around downtown (**Map 10**). Like the

<sup>88</sup> Milwaukee County. “SMART Bus Transit System: Transit in Milwaukee County and the Region.” [http://www.milwaukee.gov/ImageLibrary/Groups/cntyExecutive/SMART\\_plusWeb.pdf](http://www.milwaukee.gov/ImageLibrary/Groups/cntyExecutive/SMART_plusWeb.pdf)

<sup>89</sup> Southeastern Wisconsin Regional Planning Commission. “Milwaukee County Transit System Development Plan. October, 2010. <http://www.sewrpc.org/SEWRPCFiles/Publications/CAPR/capr-279-milwaukee-county-transit-system-development-plan.pdf>



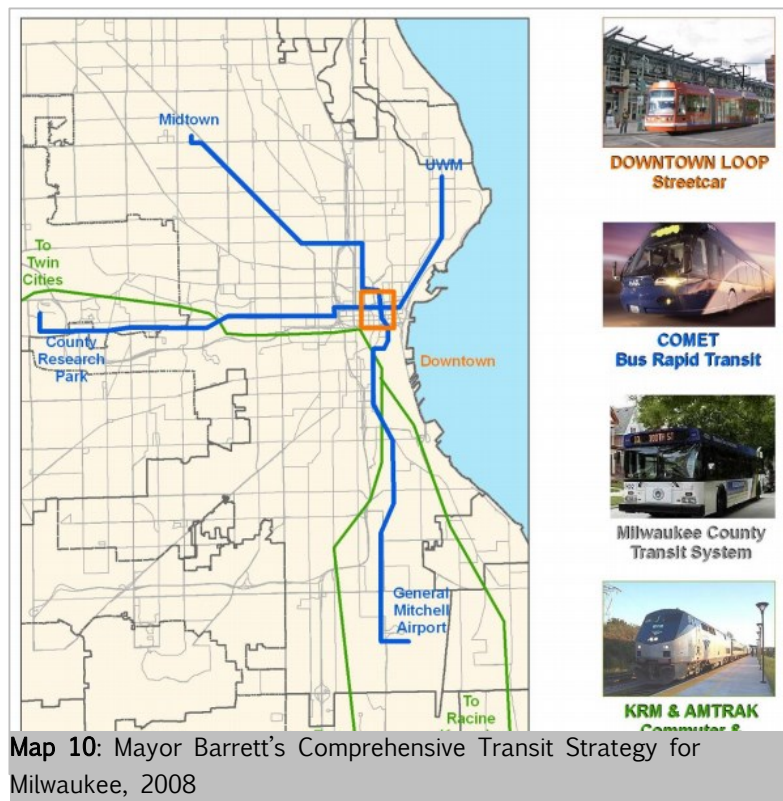
County’s proposal, the City’s “Comprehensive Transit Strategy for Milwaukee” included one east-west BRT route that would have connected UWM, downtown Milwaukee, and the Regional Medical Center.<sup>90</sup> A second route would have connected the Midtown Center on the city’s north side with downtown Milwaukee and General Mitchell Airport.

The City’s and County’s proposals were similar and had many common goals. Both sought to serve areas with already-high transit ridership, improve transit connections throughout Milwaukee County, serve major job centers, increase transit ridership, and spur new development.

Both proposals called for using \$91.5 million in federal funding that remained from a \$289 million allocation that originally was granted to the Milwaukee area to modernize its transit system in the 1990s, but that was largely diverted for other transportation purposes. The County also sought additional federal funding from the FTA’s Small Starts program, but was unable to secure a grant. A 20% local match would have been required.

Ultimately, the City and County were unable to reach consensus on a unified plan. At the request of the Milwaukee mayor, Congress passed legislation in 2009 dividing the \$91.5 million between the City and County on a 60-40 basis. Neither BRT proposal has been advanced by either party since that time.

For several decades, SEWRPC’s long-range regional plans have recommended implementing BRT in the Milwaukee area. Most recently, SEWRPC’s Milwaukee County Transit System Development Plan, which was published in 2010, recommended a system of express bus routes and proposed improving those routes over time to BRT service.<sup>91</sup> As shown in **Map 11**, the four recommended routes are very similar to MCTS’s recently developed BlueLine, GoldLine, GreenLine, and PurpleLine. Notably, the east-west route in SEWRPC’s plan is the same as routes included in



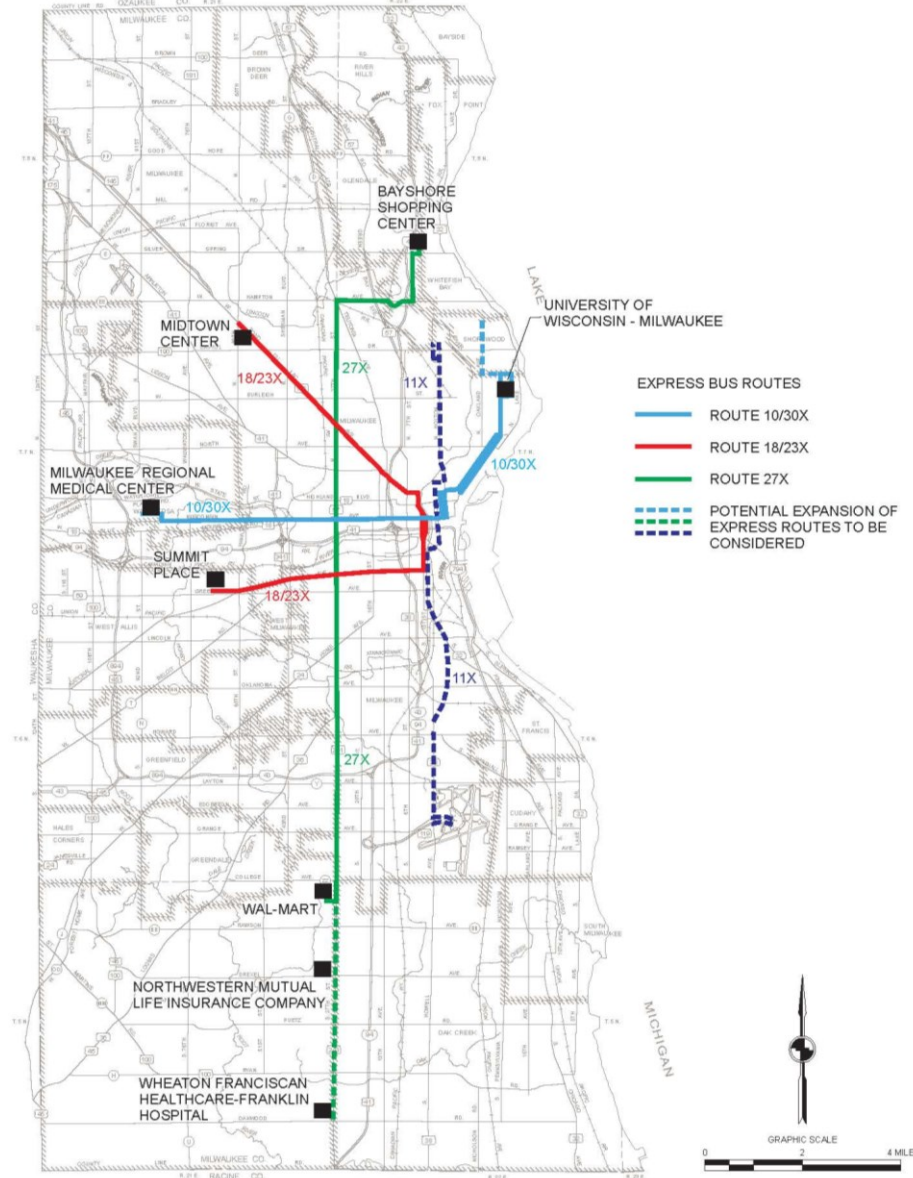
<sup>90</sup> City of Milwaukee. “Mayor Tom Barrett’s Comprehensive Transit Strategy for Milwaukee.” 2008. [http://www.city.milwaukee.gov/ImageLibrary/Groups/MayorAuthors/issues/FINAL\\_Barrett\\_Comprehensive\\_Transit\\_Strategy.pdf](http://www.city.milwaukee.gov/ImageLibrary/Groups/MayorAuthors/issues/FINAL_Barrett_Comprehensive_Transit_Strategy.pdf)

<sup>91</sup> Southeastern Wisconsin Regional Planning Commission. “Milwaukee County Transit System Development Plan. October, 2010. <http://www.sewrpc.org/SEWRPCFiles/Publications/CAPR/capr-279-milwaukee-county-transit-system-development-plan.pdf>



both the County's and City's proposals, connecting UWM with downtown Milwaukee and the Regional Medical Center. SEWRPC proposed adding transit signal priority, reserved lanes, real-time bus arrival information, and other service amenities to these routes over time.

**Map 11: SEWRPC's recommended express/BRT routes<sup>92</sup>**



<sup>92</sup> Ibid.



## **POLICY IMPLICATIONS AND CONCLUSION**

Our analysis shows that transit systems around the country are using a wide range of strategies to improve the speed and reliability of their bus services, from the use of bus-only shoulders in Minneapolis to the introduction of an advanced BRT route in Cleveland. In Milwaukee, MCTS has made a variety of service improvements and developed a network of express bus routes in recent years, but many of the strategies being used around the country have not been seriously considered here.

For example, a bus stop consolidation program has the potential to improve on-time performance and reduce travel times modestly throughout the entire transit system. Based on the case studies included in this report, MCTS could increase stop spacing on local bus routes to range from a minimum of  $\frac{1}{8}$  mile to a maximum of  $\frac{1}{4}$  mile, depending on surrounding land uses and development densities. Potential reductions to accessibility would have to be weighed against likely improvements to speed and reliability. The financial cost of such a program would be low.

Many other strategies – such as the use of transit signal priority or the introduction of bus-only lanes or bus-only shoulders – would be comparatively more expensive and complex than a bus stop consolidation program. Those strategies could be implemented in a limited fashion to further enhance one or more of MCTS’ existing express bus routes or Freeway Flyer routes, or to improve service for multiple bus routes along a busy transit corridor, such as Wisconsin Avenue. It appears that each of those solutions has the potential to reduce travel times – in some cases by a substantial amount.

Introducing a true BRT service in Milwaukee would create the greatest improvement to service speed and perhaps the greatest boost in transit ridership, and could be tailored to the corridor in which it operates based on operational needs, transfer opportunities, cost constraints, and other factors. The case studies included in this report, from Nashville’s “BRT lite” services to Chicago’s planned “Gold-standard” BRT route on Ashland Avenue, show the range of rapid and “express plus” services being developed around the country, which vary widely with regard to costs and benefits provided.

### **THE EAST-WEST CORRIDOR AS A STARTING POINT?**

Strong arguments can be made for enhancing bus routes along several different corridors in Milwaukee County to provide faster and more reliable service. The corridors where MCTS’ express bus routes currently operate, for example, appear to be prime candidates for further experimentation and investment, particularly where the five color-coded routes and Route 30x operate, as they already provide faster service throughout the day and week. A network of BRT routes like the one in Las Vegas, for example, may be an attractive long-term option.

Among the Milwaukee County corridors where express bus services already operate, the east-west corridor may offer the most advantageous setting for exploring options for improvements. The segment of Wisconsin Avenue extending from Cass Street to 35<sup>th</sup> Street already is the busiest transit corridor in the region in terms of ridership and routes in operation. Enhancements to infrastructure on that 2.8-mile stretch, therefore, would have the potential to speed up service for thousands of passengers on multiple bus routes, including three existing express routes (BlueLine, GoldLine, and



Route 30x). The east-west corridor also functions as a transit spine for the region, providing connections to numerous north-south bus routes.

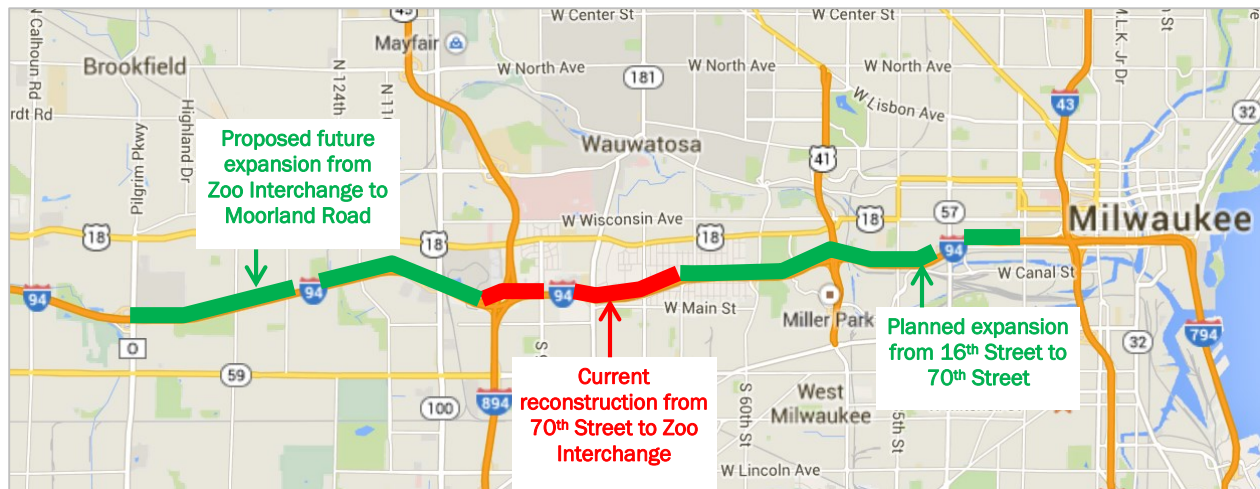
The east-west corridor also would be a logical place to introduce a BRT service for the following reasons:

- All of the past BRT proposals for Milwaukee have included an east-west route serving UWM's main campus, Columbia St. Mary's hospital, downtown Milwaukee, Marquette University, and the Milwaukee Regional Medical Center. SEWRPC has long recommended the consideration of BRT or express bus service in this corridor, extending from downtown Milwaukee to downtown Waukesha.
- An east-west BRT route would follow Transportation Research Board recommendations that BRT serve transit corridors that already are among the busiest in the region, and that they connect two or more major activity centers. It also would be a strikingly similar route to Cleveland's HealthLine, as it would connect the region's two largest employment centers (downtown and the Regional Medical Center) and would directly serve the city's two largest universities (UWM and Marquette). MATC's downtown campus also would be easily accessible.
- From a workforce connectivity perspective, not only would an east-west BRT route connect the region's two largest employment hubs, but it also would serve a corridor with dense employment throughout. As discussed earlier in this report, strong employment concentrations exist along most of the east-west corridor between downtown Milwaukee and downtown Waukesha.
- With several years of reconstruction planned for Interstate 94 in the near future (see **Map 11** on the following page), the timing may be ideal for adding new BRT service in that area as a mitigation strategy. With reduced highway capacity on the region's busiest corridor, travel will be slowed down significantly, which could make a rapid bus service an attractive option for workers and residents traveling back and forth between the city and its western suburbs, including many who do not use transit currently.

Below, we lay out three scenarios for improving bus service in the east-west corridor, from small modifications to the introduction of a high-quality BRT system.



**Map 11: Segments of I-94 where reconstruction soon will take place**



**Small Modification:** Add Transit Signal Priority on Wisconsin Avenue

One example of a small improvement in the east-west corridor would be to introduce a transit signal priority system on Wisconsin Avenue. Nearly every intersection on Wisconsin Avenue has traffic signals between the Lakefront and 19<sup>th</sup> Street; from there, signals occur approximately every 1/4 mile. All intersections with signals and all buses operating on Wisconsin Avenue could be equipped with transit signal priority technology, which could be programmed to give buses priority depending on a set of pre-determined factors. For example, express bus routes could be given priority at all times and local bus routes could be given priority only when they are behind schedule.

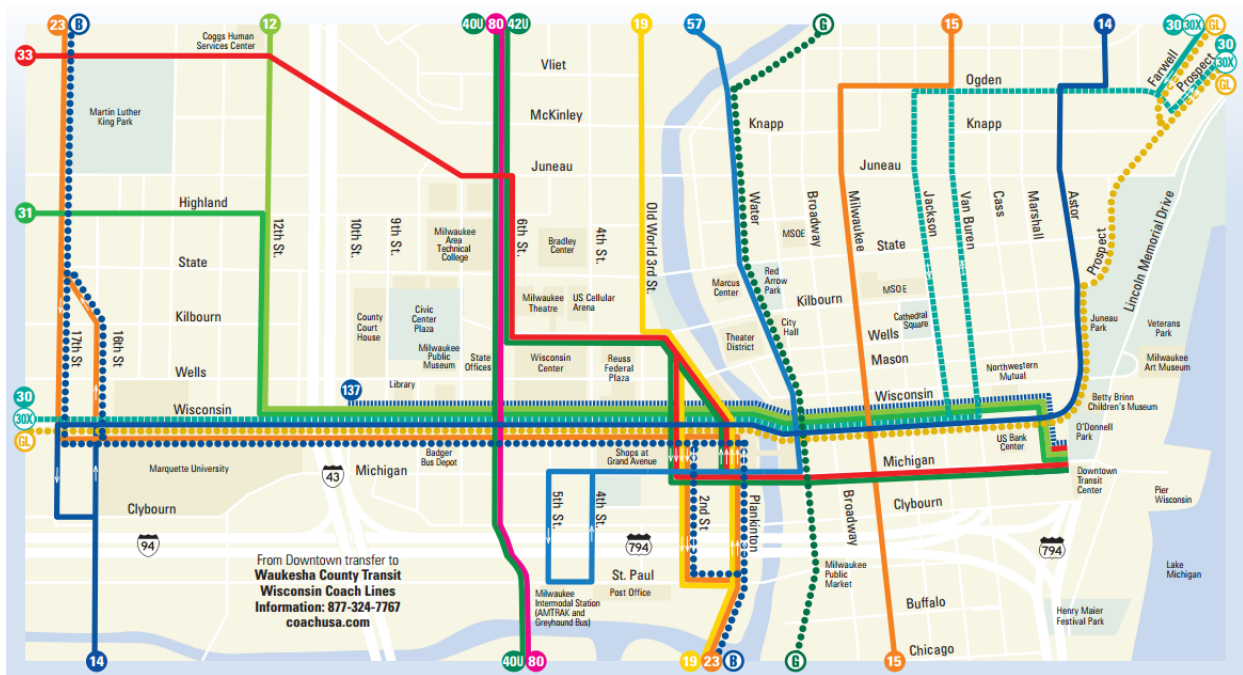
Research indicates that transit signal priority systems have the potential to reduce bus travel times by 5-10%. Based on case studies from around the country, the cost of adding such improvements on Wisconsin Avenue may be in the \$500,000 to \$1 million range. Those costs may actually be much lower if the County is able to coordinate with the City to utilize the City's existing signal preemption system. As previously mentioned, MCTS plans to experiment with transit signal priority on a short segment of Wisconsin Avenue (27<sup>th</sup> Street to 35<sup>th</sup> Street) within the next five years.

**Larger Modification:** Introduce bus-only lanes or bus-only shoulders

Given the substantial number of MCTS bus routes that currently operate on any given block of Wisconsin Avenue between Cass Street and 17<sup>th</sup> Street (**Map 12**), introducing dedicated bus-only lanes on part or all of that 1.7-mile stretch would be one option for significantly increasing the efficiency of bus travel through the east-west corridor. Of course, that would require removing street parking entirely or at least prohibiting street parking during peak travel periods. Along that stretch of downtown Milwaukee, however, there is abundant off-street parking available in nearby parking structures.



Map 12: Current local and express bus services in downtown Milwaukee<sup>93</sup>



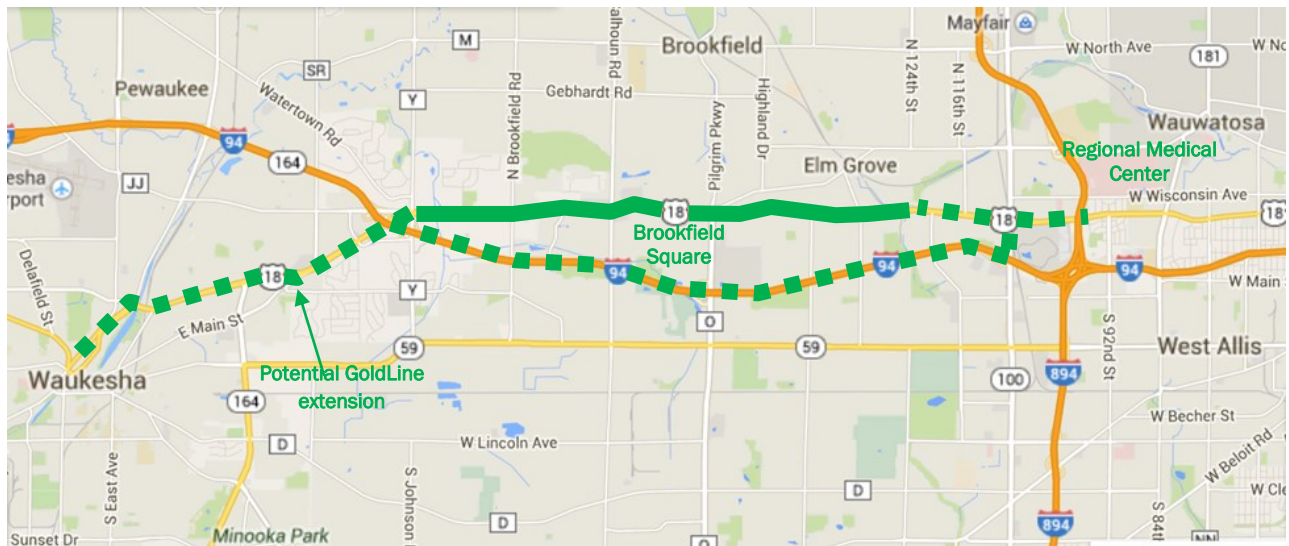
Other options for experimenting with bus-only lanes could revolve around improving travel times for the GoldLine, which travels from UWM to Brookfield Square. Travel times to Brookfield Square via public transit are extremely long from many parts of Milwaukee County, particularly during non-peak hours. The shortest possible travel times from four Milwaukee County zip codes with high unemployment rates to Brookfield Square range from 50 minutes (53206-Milwaukee) to 72 minutes (53209-Brown Deer) and involve transferring between MCTS and Waukesha County Route 901, which is operated by Wisconsin Coach Lines and requires an additional fare. During much of the day, Route 901 does not operate, however, and the same trips take roughly 80 and 110 minutes, respectively.

Additional improvements to the GoldLine could shorten those trips. For example, it may be possible to extend the bus-only lanes on Bluemound Road in Waukesha County east to 95<sup>th</sup> Street (**Map 13**). Another option would be to reroute the GoldLine onto Interstate 94 for the 2.7-mile stretch from Highway 100 west to Brookfield Square, with new bus-only shoulders added to Interstate 94 for that portion of the route. Several Waukesha Metro express routes could share the bus-only shoulders on I-94. The potential future expansion of that stretch of I-94 may make that option impossible in the short term, however. Also, access would be reduced for GoldLine passengers traveling to destinations and job sites along Bluemound Road.

<sup>93</sup> This map does not include the eight Freeway Flyer routes that also operate in downtown Milwaukee. Also note that express Route 30x and local Route 30 are displayed as one line in this map.



**Map 13: Existing bus-only lanes (solid lines) and potential extensions (dashed lines)**



Extending the GoldLine out to downtown Waukesha also may be worth considering (this option also is shown in **Map 13**), as that 6.6-mile extension would connect Milwaukee with its most populous suburb and serve additional areas with strong job concentrations along the way. West of Brookfield Square, the GoldLine potentially could continue to operate in bus-only lanes/shoulders on Bluemound Road or I-94, completing the trip to downtown Waukesha via E. Moreland Boulevard (U.S. Highway 18).

### **Major Improvement: BRT in the east-west corridor**

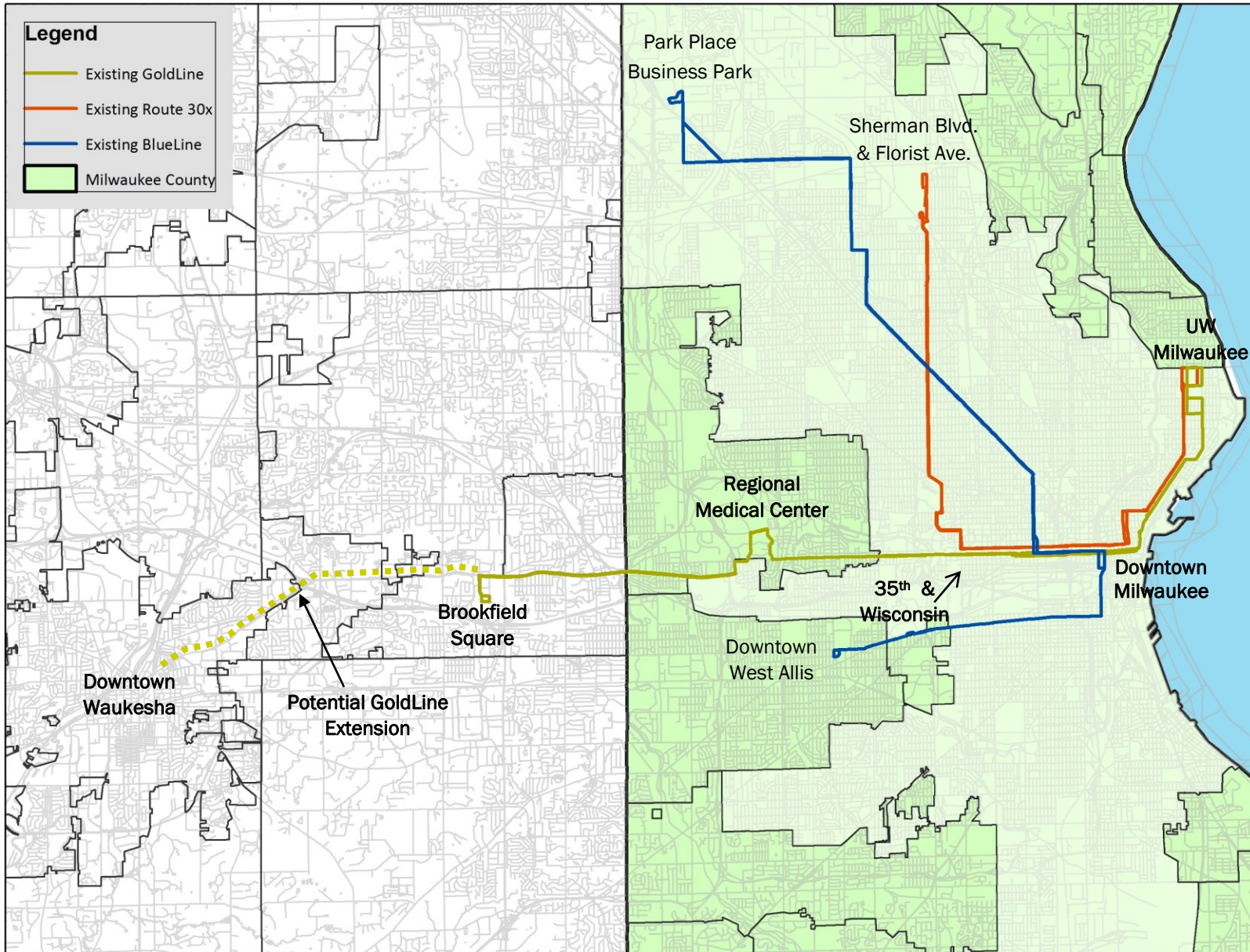
If a BRT service were added to the east-west corridor, several important factors would need to be considered, including the number of routes that would use the BRT infrastructure, the length and precise layout of the route or shared infrastructure, and the specific set of features the system would include. All of these factors would influence the quality and cost of the system and its potential to reduce travel times and attract new riders.

BRT infrastructure in the east-west corridor could be developed exclusively for an enhanced GoldLine, which would be similar to what has been proposed in the past, or could be shared by several bus routes. For example, express Route 30x and the BlueLine currently travel on Wisconsin Avenue for significant stretches and could share BRT infrastructure with the GoldLine where the routes overlap. As shown in **Map 14**, the GoldLine and Route 30x overlap for a 2.8-mile stretch from Van Buren Street west to 35<sup>th</sup> Street; the BlueLine also overlaps with those routes for a 1.2-mile downtown segment.





Map 14: Express bus routes currently using the east-west corridor & potential GoldLine extension



Certain BRT features, such as bus-only lanes and transit signal priority, could even be used by all bus routes in the east-west corridor, including local routes and Freeway Flyers. If multiple bus routes were to share BRT infrastructure in the corridor, it would mirror what is being done in Chicago's Central Loop to improve the speed of service for multiple routes traveling through that city's busy downtown.

The length of a BRT route or shared BRT infrastructure also would need to be determined. Logical options include the following, which are ordered from shortest to longest (see **Map 14** on the previous page for visual reference):

***Downtown Milwaukee west to 35<sup>th</sup> Street***

- Could be shared by three express bus routes and possibly other local and Freeway Flyer routes
- The “shared infrastructure” approach would be similar to Chicago's Central Loop BRT project

***Downtown Milwaukee to the Regional Medical Center***

- Would connect southeast Wisconsin's two largest employment centers

***UWM to the Regional Medical Center***

- Reflects past proposals for BRT in Milwaukee
- Would closely mirror the layout of Cleveland's HealthLine by connecting the region's two largest employment centers and serving major universities, colleges, and medical facilities
- Would provide a rapid transit connection between UWM's main campus and its new Innovation Park campus

***UWM to Brookfield Square or downtown Waukesha***

- Would cover the entire length of the existing GoldLine
- Potentially could be extended out to Milwaukee's largest suburb

The exact routing of an east-west BRT system would be another critical decision point. Likely options include portions of Wisconsin Avenue (where most east-west bus routes currently operate), Michigan Street, Clybourn Street, Wells Street, and Bluemound Road. Notably, Wisconsin Avenue is the only street in the east-west corridor that runs continuously from downtown to the Regional Medical Center. Additional analysis would be needed to determine which streets would best accommodate BRT infrastructure from both an engineering and cost perspective.

If MCTS aspires to develop a BRT route capable of meeting the Gold, Silver, or Bronze ratings criteria developed by ITDP, dedicated median-running lanes would be needed for the vast majority of the route. Even to earn recognition as Basic BRT, dedicated median-running lanes would be required for at least a roughly 2-mile stretch. Wide stop spacing, enhanced stations with level boarding, a transit signal priority system, and an off-board fare collection system also would be required. Such a system would improve travel times substantially, likely by at least 25%.

A “BRT lite” system that does not meet ITDP's BRT Standard but improves upon MCTS' existing express bus routes also could be considered. Like Nashville, for example, MCTS could widen stop



spacing on the GoldLine, add a transit signal priority system, and develop enhanced bus stations with real-time information displays and other amenities. Or, like Chicago’s Jeffery Jump, MCTS could add dedicated curbside lanes to the GoldLine (or a portion of the route) and utilize unique buses to set the service apart from the rest of the bus system. “BRT lite” also could be developed as a precursor to true BRT service in the future.

**Table 9** shows that converting the GoldLine to a full BRT service from downtown Milwaukee to the Regional Medical Center could make travel times on the GoldLine competitive with driving. A “BRT lite” alternative for that stretch of the east-west corridor would have a more modest impact on travel times, but still could offer an attractive option for many Milwaukee County residents. Estimated travel times for both BRT options are based on the BRT case studies included in this report, ranging from a 10-20% time savings for a “BRT lite” alternative to a 25-45% savings for full BRT.

**Table 9: Approximate travel times from downtown Milwaukee to the Regional Medical Center<sup>94</sup>**

Travel Mode	Travel Time
Driving (current)	13-22 minutes
MCTS GoldLine (current)	28-32 minutes
GoldLine converted to "BRT lite" (estimate)	22-29 minutes
GoldLine converted to full BRT (estimate)	14-25 minutes

The specific features of the potential BRT system obviously would greatly influence the system’s costs and benefits. While the exact costs of a potential BRT system would require much more extensive research, the case studies included in this report indicate that the total start-up costs could range from less than \$1 million per mile for a “BRT lite” service like those in Nashville or Chicago’s Jeffery Jump, to as much as \$7 to \$10 million per mile for a Silver- or Gold-standard BRT route like Cleveland’s HealthLine or Chicago’s planned Ashland Avenue BRT service.<sup>95</sup>

## **BUS SYSTEM IMPROVEMENTS IN THE CONTEXT OF MCTS' FISCAL CHALLENGES**

In light of MCTS’ substantial long-term fiscal challenges (described in the text box on the following page), it will be challenging to maintain existing bus services, let alone make major improvements such as BRT. Nevertheless, there are several possible funding options that have been used in other cities that could be pursued for Milwaukee bus service enhancements, particularly with regard to one-time capital expenditures.

Among potential federal capital funding sources, the FTA’s Small Starts program would be one likely source. The U.S. DOT’s highly competitive TIGER discretionary grant program is another possibility, as

<sup>94</sup> Calculations for current travel times are based on Google Maps estimates from Water Street and Wisconsin Avenue in downtown Milwaukee to Froedtert Hospital at the Regional Medical Center. Current driving travel times range from 13 minutes with no traffic via Interstate 94, to 22 minutes at peak times via Wisconsin Avenue.

<sup>95</sup> Lawicki, Jane and William S. Bike. “City considers more left turns in Ashland Avenue BRT plans.” Gazette Chicago. August 1, 2014. <http://www.gazettechicago.com/index/2014/08/city-considers-more-left-turns-in-ashland-avenue-brt-plans/>



is its CMAQ program, which MCTS used to start all of its new express bus routes. (MCTS will be eligible for another round of CMAQ funding beginning in 2018.) With the upcoming reconstruction of Interstate 94 in the east-west corridor, mitigation funding from that project is another potential source of support, as alternative transportation options will be needed for several years.

Even if federal or state funding could be secured to support potential improvements discussed in this section, substantial local funding also would be required. While on its face, MCTS' financial predicament would appear to preclude the provision of such funding, possibilities may exist to help address that dilemma, as well. For example, replication of Chicago's use of TIF financing for BRT service, Las Vegas' donation of city right-of-way, and Cleveland's use of contributions from health care entities could be pursued in Milwaukee. Area universities and their supporters also may be a source of potential local contributions given the potential benefits they would enjoy from new rapid transit service, and sponsorships or naming rights from businesses that would benefit from BRT station locations also could be pursued.

It is difficult to predict the precise impact that converting a bus route to BRT service would have on overall operating costs, as faster service would allow MCTS to turn buses around faster, thus increasing service frequency without necessarily increasing costs. To the extent that additional annual operational costs would pose another substantial hurdle, however, options also may exist to address that need. For example, some of the potential capital funding sources noted above also could be temporary or permanent sources of operational support – including CMAQ, I-94 mitigation funding, and university/corporate support. There also may be an opportunity to offset added BRT operating costs by modifying existing underlying or parallel bus service, and there even may be

### Overview of MCTS' fiscal challenges

In 2008, the Public Policy Forum published a report examining the financial problems facing MCTS.\* The report found that the funding sources supporting MCTS had been unable to keep pace with growth in fixed operating costs, necessitating a series of short-term solutions – including service cuts and fare increases – that were not addressing the structural problem, and in some respects were making it worse. Since that time, MCTS has continued to find short-term solutions to prevent a fiscal crisis and has managed to stabilize services, but a long-term solution has not materialized.

The structural problems identified in our 2008 report still pose a significant challenge today. MCTS continues to use its annual share of federal capital appropriations to accommodate inflationary growth in its operating budget, meaning there is little wherewithal to replace buses when they exceed their useful lives. According to MCTS' latest 5-year forecast, there will be a \$15 million gap in MCTS' operating budget by 2020, assuming regular bus replacements resume and existing service levels are maintained.

With federal and state funding for transit still tenuous – and local appropriations from Milwaukee County still subject to fierce competition with other competing needs – MCTS' overall fiscal challenges remain extremely difficult, thus calling into question the prospects for any major service enhancements.

\*Public Policy Forum. "Milwaukee County's Transit Crisis: How did we get here and what do we do now?" May 2008. <http://publicpolicyforum.org/sites/default/files/MilwaukeeTransitCrisis.pdf>



potential to attract enough new riders to both new BRT routes and connecting routes that any needed increases in operating funds would be manageable.

MCTS already ranks as one of the most cost-efficient transit systems among its peers, but Milwaukee County recently contracted with a national consultant to find ways to generate additional efficiency improvements. It is possible that implementing some or all of the recommendations that emerge from that analysis could free up additional funding that could be redirected to service enhancements.

There is no question that MCTS' financial predicament, including its lack of a dedicated funding source, will be a significant deterrent to any imaginative thinking and planning for bus service improvements. Yet, in light of the City of Milwaukee's development of a plan to generate nearly \$60 million in local funds for a two-mile streetcar line, we would question whether the time has come to challenge the assumption that substantial bus service improvements are a financial impossibility.

Other metro areas facing similar financial challenges have mustered up the resources to implement such improvements, in part because they researched and recognized the benefits that faster and more convenient bus service could bring to their citizens and local economies. In Milwaukee, where the notion of rapid transit either has been dismissed by those who do not support public investment in transit, or has focused exclusively on commuter and light rail, we have never seriously considered those benefits and what it might take to realize them. With years of major highway reconstruction on the horizon and the demand for workers in both downtown Milwaukee and the suburbs likely to grow, we would suggest that the time to start doing so is now.





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