BRT Corridor III Identification Study

TECHNICAL REPORT

marta

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BUS RAPID TRANSIT
CORRIDOR IDENTIFICATION STUDY
TECHNICAL REPORT

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1 STUDY INTRODUCTION

The Metropolitan Atlanta Rapid Transit Authority (MARTA) initiated this Bus Rapid Transit Corridor Identification Study as the first step in an open planning-level discussion on the applicability of Bus Rapid Transit (BRT) systems throughout the MARTA service delivery area. The evaluation was designed to explore enhancing bus transit services within major travel sheds and corridors. The study includes a literature review of transit agencies that have implemented BRT with an eye toward identifying opportunities, lessons-learned, and other issues or constraints with the application of BRT in the Atlanta region. BRT has emerged as a highly flexible and cost-effective transit strategy involving the improved use of buses operating within a variety of design concepts. The Federal Transit Administration (FTA) has taken a keen interest in promoting BRT implementation in many metropolitan areas. In fact, FTA has sponsored a demonstration program that will evaluate the effectiveness of BRT projects from around the country. This program is funded at approximately $2 million per year throughout the extent of the TEA-21 federal transportation legislation.

Like many transit properties, MARTA recognizes the advantages and innovations that BRT can offer to improve the effectiveness of current and future bus service and operations. For 2002, MARTA set a strategic goal of identifying potential BRT corridors within the MARTA service area by the forth quarter. This study will accomplish this goal, as well as set in motion a series of additional project development and programming steps, requiring ongoing coordination with regional planning partners including the Atlanta Regional Commission (ARC) serving as the Metropolitan Planning Organization (MPO) for the Atlanta region, the Georgia Regional Transportation Authority (GRTA), and the Georgia Department of Transportation (GDOT).

1.1 What is Bus Rapid Transit?

FTA has defined BRT as follows; "Bus Rapid Transit refers to coordinated improvements in a transit system's infrastructure, equipment, operations, and technology that give preferential treatment to buses on urban roadways. The intention of Bus Rapid Transit is to reduce bus travel time, improve service reliability, increase the convenience of users, and ultimately increase bus ridership."

As such, BRT involves a myriad of concepts designed to transform ordinary bus service into BRT service. The fundamental goal of BRT is to improve the convenience and the bus transit experience by reducing travel time for passengers. This time reduction includes the time to and from the transit stop, the time waiting for the transit vehicle, the time boarding the vehicle, and the in-vehicle travel time. Travel time can also be significantly improved by reducing the number of system transfers required to complete a given trip.

The emphasis on travel time-savings can be attributed to a range of system efficiencies that give buses priority over automobile traffic. Several BRT concepts are presented in this report ranging from higher cost alternatives that provide priority for bus service on exclusive rights-of-way, such as busways and/or exclusive lanes on arterials and freeways. This can greatly reduce in-vehicle travel time providing rail-like transit service. Lower cost alternatives, referred to in this report as "Enhanced Bus" will be explored as well. These concepts can include traffic signal priority for buses where signal timing is adjusted to allow buses the priority movement through intersections. This is often accomplished through extended green times or shorten red times, and have been successfully implemented in a number of U.S. cities. Enhanced bus concepts can also include queue jumper lanes for transit vehicles to speed up operations allowing buses to bypass the queue of traffic at intersections. Queue jumpers lanes are successfully used in Seattle, Washington and Tucson, Arizona, among other cities.

There are many other features commonly associated with BRT. These include Automatic Vehicle Location (AVL) systems that track bus locations along the route. These systems can provide passengers real-time information that can be displayed at bus stops and bus stations on kiosks or variable message signs. Better passenger information can make transit service easier to use and more convenient. Prepaid boarding for bus service can reduce loading times and increase route efficiency. A well-defined image and marketing program for Enhanced Bus services can also play a major role in improving passenger convenience. Image programs may include a coordinated pattern and painting scheme for buses and stop locations where Enhanced Bus or BRT services are being offered. All of these BRT concepts encourage reducing travel time for users of transit, combined with rail-like amenities and convenience. Ultimately, the application of BRT strategies can offer increased flexibility, faster bus service, combined with better passenger information and amenities leading to higher bus ridership.

1.2 Purpose of MARTA's BRT Corridor Identification Study

The purpose of the study is to identify major travel corridors linking key destinations most applicable for BRT strategies. Identification of these corridors will establish a baseline for examining the appropriateness of BRT within the MARTA service area. For each travel corridor, a comparative analysis providing an order of magnitude evaluation of attributes conducive to BRT systems was completed. The analysis ranked corridors based on their likelihood of advancement of a BRT project. The ranking was accomplished through determining the extent to which a number of measures related to BRT applicability are met in a given corridor.

Corridors were ranked across measures relative to each other providing a sound basis for decisions concerning which of them warrant additional study of BRT deployment. A listing of top ranked corridors coupled with potential BRT strategies were then identified for consideration by MARTA as priorities. The final listing of BRT priority corridors afford the necessary information to recommend the undertaking of additional project development including Alternative Analysis, where a comprehensive evaluation of technology, alignment, design concept and scope, cost estimates, and ridership forecasts would be conducted. Additional details concerning the study's methodology are presented in Chapter 3 of the report.

2 BRT APPLICATION REVIEW

MARTA is exploring opportunities to implement BRT service in travel corridors throughout Fulton and DeKalb Counties. The study process includes first, reviewing domestic and international BRT systems, then identifying potential BRT corridors and ranking these corridors based on the potential for instituting effective BRT service. This chapter satisfies the initial efforts of the study providing a review of domestic and international BRT applications. A brief introduction highlights the status of BRT program development within the U.S., and then a total of 22 domestic and international BRT projects and systems are summarized. Each summary lists the agency that manages the program, service characteristics, and other elements particular to the system or project. Section 2.3 draws out conclusions about prototypes for successful BRT projects including the appropriate match of BRT elements with the various operating environments such as HOV lanes, dedicated roadway lanes, and mixed traffic lanes. Additionally, pros and cons related to implementation are highlighted. This information assisted in the ranking of short and long-term corridors presented in Chapter 4, and the BRT applications proposed for the highest ranked corridors presented in Chapter 5.

In the U.S., BRT is a relatively new transit concept compared to rail technologies. However, transit agencies across the country are developing and implementing limited demonstration projects to test the feasibility of larger scale BRT systems. Many cities have already begun operations of limited BRT facilities including busways in Pittsburgh and Miami, arterial bus service improvements in Los Angeles and Oakland, and exclusive bus lanes in Boston. At the national level, FTA is promoting BRT implementation by funding demonstration projects, and research and information sharing activities through the Bus Rapid Transit Demonstration Program. Ten demonstration projects have been funded at this time. The program maintains a website, which includes fact sheets on demonstration projects, contact information for BRT personnel at transit agencies, as well as, research and literature papers. Several agencies have successfully advanced BRT demonstration projects through the Federal New Starts funding program. Figure 2-1 on the next page highlights cities currently involved in FTA's demonstration program, as well as other cities included in this review.

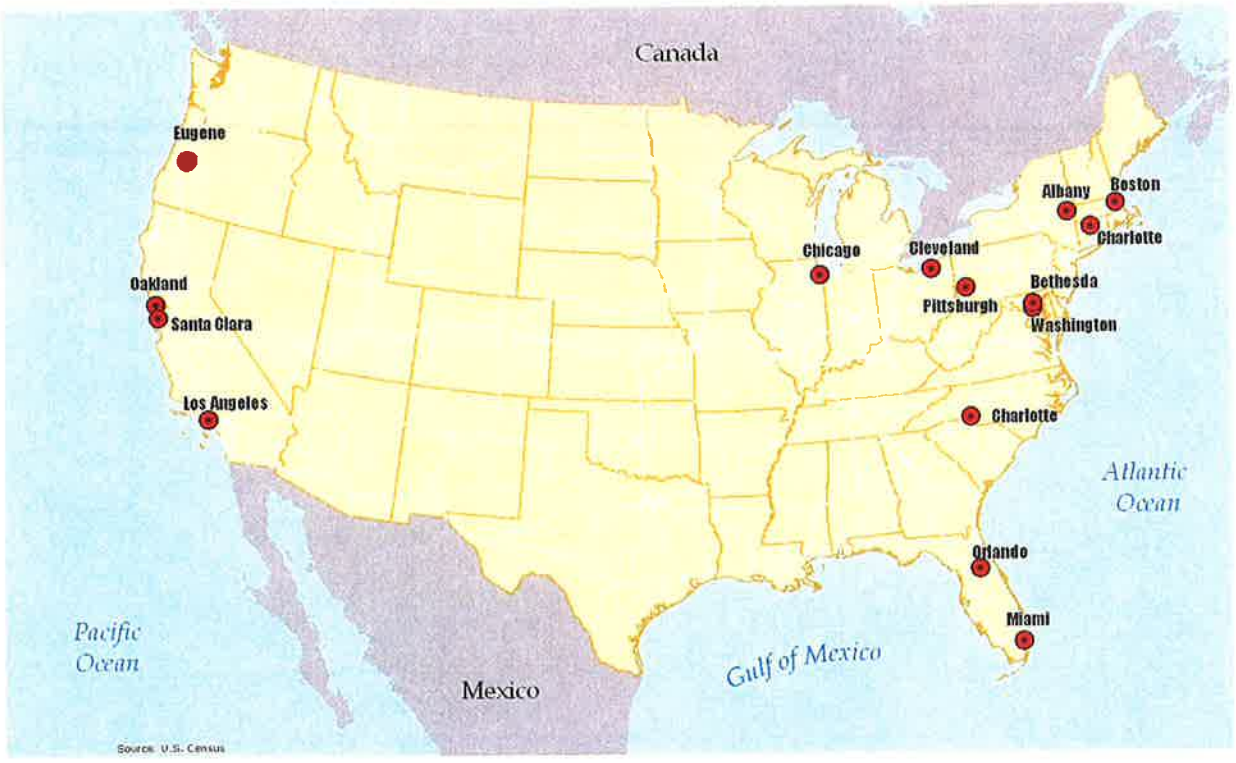
The international review focused on four cities that have implemented BRT systems significantly more comprehensive and mature than those in the United States; reflecting the fact that BRT is a proven transit technology. In cities such as Ottawa, Canada and Curitiba, Brazil complex transit systems built around premium BRT facilities have been operating successfully for many years, in some instances moving more than 1 million riders per day. The role of BRT in these cities is similar to heavy rail transit in many U.S. cities. The presentation of the potential of a mature premium BRT system is the main contribution of this portion of the review.

2.1 Review of Domestic BRT Applications

Orlando, Florida: Lymmo

The Central Florida Regional Transportation Authority or LYNX operates an enhanced bus service in the downtown Orlando, Florida area. The service is commonly referred to as Lymmo, operates as a downtown circulator utilizing an exclusive bus only lane along a 2.3-mile route. The system includes signal pre-emption, stations with large shelters and route information, AVL, next bus arrival kiosks, marketing and image development through vehicle graphics and logos, and it's a free fare service. There are 10 Compressed Natural Gas (CNG) low floor buses scheduled along the route connecting 11 stations and 8 stops. The peak headway is 5 minutes, and the off-peak headway 10 minutes. Weekday hours of operation are 6:00 a.m. to 10:00 p.m., and weekends from 10:00 a.m. to midnight. The route provides continues loop service from the TD Waterhouse Center to the Orange County Courthouse.

Figure 2.1: Domestic BRT Location



* Note: Honolulu, Hawaii and San Juan, Puerto Rico are not shown on the map.

Alameda and Contra Costa Counties, California

Alameda Contra Costa Transit in the San Francisco Bay Area is developing a BRT program focused on two major projects. Rapid bus service operating in mixed traffic will be implemented in phases in the San Pablo Corridor beginning in Summer 2002. This service will operate on arterial roadways and be characterized by:

- Limited stops;
- Proof-of-payment fare system;
- Signal priority;
- Far side of intersection bus stops;
- Boarding at front and rear doors; and
- Passenger information systems

Hours of operation will be from 6:00 a.m. to 9:00 p.m. Several bus routes will be converted to rapid service with headways of 10 minutes during peak-hours and 15 minutes during off-peak periods. Low floor buses will be used on the rapid bus routes. To provide funding for the service, local bus service will be cut. A higher capacity BRT application is under development for the Berkeley/Oakland/San Leandro Corridor. This 18-mile corridor connects major activity centers and has an existing daily bus ridership that exceeds 40,000 riders. By the year 2020, there is expected to 140,000 jobs located within the corridor.

The proposed BRT would operate on arterial roadways in exclusive lanes and would include:

- BRT stations;
- Dedicated bus-lanes;
- Signal priority;
- Passenger information systems; and
- Boarding at front and rear-doors.

This project is early in the development process. Funding and implementation details are not available at this time.

Miami, Florida: The South Miami-Dade Busway

South Miami-Dade Busway, operated by the Miami-Dade Transit Agency, began operations in 1997. The busway is an exclusive 8.5-mile, two-lane, two-directional system, utilized by transit buses and emergency and security vehicles. There are 16 intersections with 15 stations in each direction. The busway is served by ten local bus routes. Service is provided seven days a week from 5:30 am until 1:00 am. Traffic along this corridor ranges from 30,000 annual daily trips within the Cutler Ridge Mall area to 90,000 annual daily trips within the Dadeland Mall area. During peak periods, approximately 20 buses run in each direction. The Peak Vehicle Requirement (PVR) is 25 full size buses and 16 minibuses.

The busway utilizes equipment with Intelligent Transportation Systems (ITS). An Automatic Vehicle Location System (AVL) has been installed to track the vehicles in real time in order to ensure timely service and make quick adjustments when problems arise. A Computer Aided Dispatching (CAD) system is being utilized to allow dispatchers to directly communicate with drivers. Timed saved utilizing BRT service in comparison to traditional bus service is considered minimal because the buses operate at-grade and stop along intersections located at one-half mile intervals. Furthermore, fares are collected during boarding which increases dwell times.

Currently, the busway is being expanded to Homestead and Florida City. The busway extension will be divided into three sections (1) northern segment (5 miles) (2) central segment (3.75 miles) and (3) southern segment (2.7 miles). Construction is scheduled for completion in 2002.

Honolulu, Hawaii: Intown and Regional BRTs

The City and County of Honolulu Department of Transportation Services, is developing a regional BRT system of which two facilities are currently in the preliminary design/environmental planning phase. The Intown BRT will provide service in the urban core of Honolulu. System elements will include:

- A combination of exclusive, semi-exclusive and shared bus lanes;
- Bus pull-outs and lane widenings;
- Signal prioritization and automatic vehicle location; and
- BRT stations.

The BRT facility will comprise three branches covering a total of 12.8 miles in length. Stops will be spaced every quarter to half-mile and headways will range from 2-4 minutes during peak hours. The Regional BRT will extend the Intown BRT to the coastal suburbs to the west of downtown utilizing the H-1 freeway.

BRT vehicles will operate in existing and newly constructed facilities that will include:

- HOV lanes;
- Peak-hour Zipper and contra-flow lanes; and
- Dedicated ramps at key locations.

Regional BRT will service several transit centers and park-and-ride lots providing access to local bus services and personal automobiles. Stop spacing will average one per mile and the entire facility will cover a distance of 17.8 miles. The final environmental impact statement (EIS) for the project will be completed in the first half of 2002. The entire BRT system including the Regional and Intown facilities and other smaller scale bus improvements is estimated to have a capital cost of $1 billion. At completion the system is estimated to carry 330,000 riders per day.

As a precursor to implementation of the BRT system, the City and County of Honolulu Department of Transportation Services has implemented several express routes in the planned BRT corridors to demonstrate the effectiveness of improved bus services. City Express Route A connects major activity centers including the University of Hawaii and downtown Honolulu along a 19-mile long corridor. The service operates on 15-minute headways from 5:30 a.m. to 8:30 p.m. Monday to Friday. On weekends headways vary 15 – 30 minutes. Nine standard forty-foot transit buses are utilized for the route. This service has improved travel time over the existing local service, reducing total route running time from sixty-eight minutes to thirty-five minutes.

City Express Route B provides limited stop service along another heavily traveled arterial corridor in the downtown area. The route is seven miles in length and operates on 15-minute headways from 5:30 a.m. to 8:30 p.m. Monday to Friday. On weekends headways vary between 15 and 30 minutes. The service is operated with sixty-foot articulated transit buses, due to heavy demand, boardings in this corridor average 50,000 per day. The County Express (Route C) is an express service connecting the coastal development to the west with Downtown Honolulu. Hours of operation are from 5:00 a.m. to 8:30 p.m. seven days a week. Headway times are in thirty-minute intervals during the week and every hour on weekends. Ten sixty-foot articulated transit buses are used for this service.

Chicago, Illinois: Western Avenue Express

In 1998, the Chicago Transit Authority (CTA) began operations of the X49 Western Avenue Express limited stop bus service. Stops are spaced in one-half mile intervals. This service operates in mixed traffic along arterial streets on an 18-mile route. Currently, no additional BRT elements are included in the service, however, CTA plans to improve the performance of the rapid bus route through future intersection improvements, signal priority and automatic vehicle location systems.

Hours of operation include Monday through Friday from 6:00 a.m. to 7:00 p.m., excluding holidays. Service is scheduled every 15 minutes during peak periods and 20 minutes for off-peak. The limited stop service has allowed the route to achieve a 25-perecnt time-savings over local service on the same route. Ridership in the corridor has increased by 4,400 since the X49 began operation.

Pittsburgh, Pennsylvania: Busways

The Port Authority of Allegheny County operates three exclusive BRT facilities that feature busways. Begun in 1977, the BRT system now includes over 16 miles of exclusive busways and carries over 47,000 riders per day. The busway facilities are designed to accommodate express and all-stop services. The express services bypass busway stations providing faster connections between endpoints while the all-stop services stop at busway stations providing access to destinations along the busways.

In 1977, the 4.3-mile South Busway inaugurated BRT service in the Pittsburgh area. This was followed by the 6.8-mile East Busway in 1983. Construction is underway on a 2.3-mile extension of the East Busway. Four additional stations and six park-and-ride lots will be included in this project, which is expected be complete in 2005.

The West Busway, which opened in 2000, connects the City of Pittsburgh to Pittsburgh International Airport utilizing an abandoned railroad right-of-way. The facility combines an exclusive busway with general-purpose lanes along an arterial roadway leading into downtown. Signal priority is provided for buses at intersections along the arterial roadway. The busway is 5 miles long and varies from two to four lanes and includes six stations with park-and-ride lots. Exclusive bus ramps provide access to the busway at several points. In all, fourteen bus routes utilize the busway. The busways have decreased bus travel times in the corridors. For example ,the West Busway has reduced travel time by 26 minutes for an end-to-end trip in the peak-hour.

Santa Clara, California: Line 22 Rapid Bus Corridor

The Santa Clara Valley Transportation Authority has begun implementation of a rapid bus service along the existing Line 22 local bus route. Line 22 runs 27-miles through the Santa Clara Valley connecting major activity centers and transit facilities. It is considered the "backbone of [the] bus system," transporting more than 23,000 daily riders and operating twenty-four hours a day. During peak-hours the route is at capacity and operates on 10-minute headways. Plans to transform this traditional corridor into BRT service by 2005 are underway. The proposed BRT facility will reduce travel time along this corridor by instituting:

- Selective use of queue jumps;
- BRT stations;
- Bulb-outs at stations;
- Signal prioritization and AVL.

After implementing BRT service, Line 22 is projected to experience a 25 to 40 percent increase in travel time-savings over current travel times. Forty low-floor articulated buses scheduled to be introduced into the existing fleet will contribute to the rapid bus route performance, because boarding and alighting time will be reduced compared the existing conventional transit coaches.

San Juan, Puerto Rico: Rio Hondo Connector BRT

The Puerto Rico Highway and Transportation Authority is constructing a semi-exclusive BRT facility as part of the Rio Hondo Connector highway project. The 2.5-mile highway, which is expected to open later this year, has been designed to allow express shuttles to operate in HOV lanes and bypass traffic signals through signal priority technology. Two general-purpose travel lanes and one HOV lane is provided in each direction. As part of the project, a 500-space park-and-ride lot and bus station including ramps to the highway is being constructed at the western end of the facility. The BRT facility will link the park-and-ride lot to the Tren Urbano light rail system. Tren Urbano is a major transit investment featuring a light rail corridor linking the major activity centers in the San Juan area.

The BRT facility will be fully integrated into the Tren Urbano system. The BRT station and vehicles will use the Tren Urbano color scheme and logo. BRT vehicles will accept Tren Urbano fare media and Tren Urbano ticket machines will be installed at the BRT Station. Service is planned for 10-minute intervals during peak periods and 20-minute intervals during off-peak times from 5:00 a.m. to 1:00 a.m. on weekdays. Initially, 21-passenger minivans will be used to operate the BRT service. If greater demand is exhibited, higher capacity vehicles will be provided.

Cleveland, Ohio: Euclid Corridor Bus Rapid Transit Project

The Greater Cleveland Regional Transit Authority is completing final design of a BRT facility along Euclid Avenue to increase transit accessibility to and within the central business district. The project is expected to be complete in 2006. Currently, this travel corridor experiences 120,000 transit riders per day. Major activity centers along the corridor include the University Circle area, the second largest employment center in the city and major cultural,

educational, and medical district, downtown and the airport. The Euclid Corridor BRT Project comprises a comprehensive set of transit-oriented improvements including:

- Implementation of a new transit-only zone within the downtown area;
- Construction of a new intermodal station;
- Improved streetscapes and pedestrian facilities.

The BRT facility will run 6.6 miles from Public Square in Downtown Cleveland to Stokes Rapid Transit Station in the City of East Cleveland. The facility will include the following elements:

- BRT stations;
- Signal prioritization and AVL;
- A combination of dedicated median bus lanes and mixed traffic lanes;

Electric trolley buses purchased specially for the BRT and existing motorcoaches will operate along the entire length of the facility with the exception of short section of the busway that passes through a residential area near downtown. In this area motorcoaches will be prohibited to mitigate noise impacts. The electric trolley buses will be low floor, 60-foot articulated vehicles with rubber tires and doors on the left and right sides to allow for boarding from the busway median, as well as curb side stops. Several existing routes will utilize the busway resulting in peak-hour weekday headways of approximately two minutes. Based on the BRT design it is estimated that the time to travel the entire length of the corridor will be improved as much as 10 minutes or 30% over existing bus services.

Charlotte, North Carolina: Independence Corridor

The Charlotte Area Transit System operates bus service in a 3.6-mile section of dedicated lanes within the Independence Corridor. The dedicated lanes are located in the median of Independence Boulevard. A queue jump lane is located at the eastern terminus of the facility, allowing buses traveling eastbound to bypass a congested intersection. No stations are provided on the facility. Express and local bus service operates throughout the day with combined headways to two minutes.

Currently, the dedicated lanes are being extended an additional mile to the east. When the extension is complete, HOV traffic will be permitted to operate within the entire length of the facility. Additionally, a Major Investment Study to determine a transit strategy for the entire corridor is nearing completion. BRT and LRT technologies and a series of alignments including the existing facility are being considered for further investments.

Eugene-Springfield, Oregon: Lane Transit District

Lane Transit District is constructing a pilot BRT facility that will extend ten miles when complete. Phase I of the corridor, estimated to begin operations this year, will run approximately four miles from downtown Eugene to downtown Springfield. Features of the facility will include:

- A combination of exclusive facilities including dedicated lanes, busways and general purpose lanes;
- Traffic signal priority and AVL;
- Queue Jumpers;
- BRT Stations; and
- Barrier-free fare payment systems with random fare checks;

The facility will include 7 new stations and modifications of two existing stations for a total of 9 BRT stations. Station spacing will be every half-mile. The BRT facility concept includes feeder bus services to provide access to shopping

and employment centers and neighborhoods with smaller buses. Initially, the system will operate at 10-minute headways during daytime hours on weekdays and 20-minute headways in the evenings and weekends.

Hartford, Connecticut: New Britain – Hartford Busway

The Connecticut Department of Transportation (ConnDOT) has completed the final environmental impact statement for a proposed 10-mile busway linking downtown New Britain with Union Station in downtown Hartford. The project is expected to be open to traffic in 2004. The busway will be constructed along active Amtrak and abandoned rail rights-of-way and will include the following elements:

- At grade and grade separated intersection crossings;
- Signal prioritization and AVL;
- BRT stations.

The facility will include up to 12 stations featuring amenities and in some cases climate controlled environments. As part of the project pedestrian and bicycle improvements will be constructed near the BRT Stations and a multi-use path will be constructed adjacent to the facility. The following bus services will utilize the facility:

- Long Distance Commuter Express: Long distance travelers would take this rapid bus from New Britain to Hartsford with few stops. Projected time savings from utilizing this service is 10 minutes.
- Shuttles: This service would stop at all busway stations and then circulate throughout Hartford, New Britain, and downtown areas.
- Neighborhood Collectors: This service would circulate through neighborhoods gathering passengers and then access the busway for a portion of the trip.
- Feeders: This service would feed passengers to busway stations where they would transfer to routes operating in the busway.

The bus routes will be operated with a mix of standard 40-foot transit coaches and 60-foot articulated low buses. Overall, hours of operation are proposed to run from 4:30 am until 2 am. Peak period service will operate three hours in the mornings and evenings. Operating hours during weekends and holidays have not been decided.

ConnDot plans to use ITS strategies for this system that include station signage and announcements, signal priority, AVL and real time public information, and "Smart ITS" signal system for grading crossing. This project will allow bus riders to bypass congestion on arterial streets and on I-84 reducing travel time from 35 to 25 minutes for an end-to-end trip. Bus boardings are projected to reach 28,500 daily during the opening year of the project.

Boston, Massachusetts: Silver Line Bus Rapid Transit Project

The Silver Line Bus Rapid Transit Project, operated by the Massachusetts Bay Transportation Authority, will combine dedicated bus lanes, exclusive bus tunnels and improvements on arterial streets to connect downtown Boston, the South Boston Piers area and Logan Airport. The first phase of the project, estimated to be in operation by April 2002, is currently under construction. Phase I includes adding dedicated bus-lanes and seven stations to Washington Street from Dudley Station to downtown Boston, constructing a one-mile tunnel including three more stations and a maintenance facility, and making arterial street improvements.

During Phase II, estimated to be complete by 2010, the Silver Line will be fully integrated into MBTA's existing transit system by extending the tunnel section several miles to provide a one-seat ride to Logan Airport and connections to the central subway lines and commuter rail. The service will be capable of maintaining two-minute headways. Ridership is projected to be 60,000 riders per day when the system is fully implemented.

Silver Line vehicles will be 60-foot low floor articulated buses with dual power source fuel systems and capacity of 120 passengers. Buses will be powered by electricity when operating in the tunnel sections of the line and by diesel and CNG generators while at-grade. All buses will include ITS capabilities such as onboard communication systems that monitor vehicle locations, announcement of bus stops, and priority signaling.

The project is being constructed with a mix of funds. Phase I includes local funding for the dedicated bus lanes and stations on Washington Street and New Starts funding for the first tunnel section.

Albany, New York: The Best Bus Program

The Best Bus Program BRT facility, proposed by the Capital District Transportation Authority, will run a total of 16 miles from downtown Albany to downtown Schenectady. The BRT facility will utilize an arterial corridor that includes 72 intersections. Exclusive lanes are not included in this system but queue jumpers are being considered. Primary system elements will also include signal coordination with side street actuation and leading and lagging green bus signal priority and AVL equipment linked with door status and signal information Fares will be collected with smart cards and service will be provided with 22 NOVA 40-foot low-floor buses. Travel time-savings are estimated at 10-minutes over the current one-way running time of 68 minutes.

Los Angeles, California: Los Angeles Metro Rapid Bus Demonstration Project

The Los Angeles County Metropolitan Transportation Authority and City of Los Angeles Department of Transportation have implemented BRT service in two corridors as part of the Metro Rapid Bus Program. Rapid Bus which replaced limited-stop bus service in the corridor consist of the following elements:

- Far side of intersection stops;
- Signal priority and AVL;
- Dedicated operations control center;
- BRT stations; and
- Headway based schedules.

This service has been implemented in the Ventura Boulevard and Wilshire/Whittier corridors. Rapid bus stops are located every 0.8 to 1.0 miles and the graphical elements are coordinated with the transit vehicles. The service is distinguished from local bus service by a unique red paint scheme and logo. Also, local bus stops are located at the near side of the intersection.

The Rapid service operates on a headway-based schedule, meaning that buses arrive on specific headway rather than at a fixed time. On weekdays, the headways are fixed at every 5 minutes in the morning hours, 2 to 6 minutes in the afternoon and evening, and 5 to 8 minutes at night. Hours of operation are 5 am to 1 am. The routes are operated with 116 low-floor buses that are dedicated to the Rapid service.

Based on an evaluation of the performance of the two Rapid routes since service was initiated in June of 2000, it appears that operating speeds and ridership have improved with the service. Ridership has increased by an average of 30 percent, while operating speed has increased by an average of 26 percent over local routes.

Montgomery County, Maryland: Veirs Mill Bus Priority Project

Montgomery County, Maryland and the Washington Area Metropolitan Transit Authority are developing a semi-exclusive BRT facility along six miles of Veirs Mill Road connecting Rockville and Wheaton, Maryland. Functioning

as a major arterial, this roadway carries more than 55,000 vehicles and 11,000 transit riders per day. Eight traditional bus routes currently operate along Veirs Mill Road. Approximately 600 daily and 600 weekend trips with peak travel times ranging from 10 to 12 minutes are being provided within this area. The proposed BRT facility will include the following elements:

- Queue jumpers;
- Exclusive shoulder lanes; and
- BRT shelters.

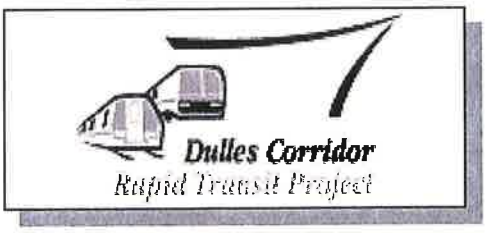
Route modifications that reduce the number of traffic signals encountered by the transit vehicle are also part of the concept. Sidewalk improvements and shoulder upgrades will also be implemented as needed to bring this concept into fruition.

Washington, DC: Dulles Corridor Rapid Transit Project

The Virginia Department of Transportation and the Washington Area Metropolitan Transit Authority (WMATA) are completing an Environmental Impact Statement for The Dulles Corridor Rapid Transit Project. Initially, this project will connect the existing WMATA Orange Line heavy rail facility through Tysons Corner to the Dulles Airport through the construction of an exclusive BRT facility. In later phases the BRT will be replaced with an extension of the existing heavy rail line. The proposed BRT facility would tie into the Orange Line at the West Falls Church Station. The facility will be aligned in the median of the Dulles Airport Access Road and include the following elements:

- Exclusive busway and ramps;
- AVL;
- BRT stations.

Nine bus routes would operate within the busway providing a variety of service types including express and all-stop. Peak hour headways would generally be 5 minutes on each of the routes. In total, 88 buses would operate to the West Falls Church Station in the peak hour.



The bus routes will be operated with 60-foot low floor articulated buses with doors on both sides of the vehicles to facilitate boardings from stations located in the median. The BRT bus vehicles will have a unique paint scheme to identify the service.

2.2 Review of International BRT Applications

Adelaide, Australia: O-Bahn

Adelaide Metro operates the O-Bahn, the longest and fastest guided busway in the world. The busway is 7.5 mile in length and features a track guideway that steers bus vehicles along the busway similar to rail technologies. Bus vehicles are equipped with a special set of front steering wheels in addition to regular roadway wheels allowing for seamless transition between guideway and roadway operation. A major advantage of this type of busway is that a relatively narrow right-of-way is required for the facility compared to traditional busways. Buses travel at speeds up to 60 mph and can operate at 20-second headways. The busway includes park-and-ride lots located near major interchanges to allow passengers to park their cars and ride the bus into the city. Multiple bus services operate along the facility including express and local routes The O-Bahn is integrated into a multimodal transit system that includes trams and trains. Multiple bus services operate along the facility including express and local routes.

Curitiba, Brazil

Curitiba has been heralded as possessing the most seamless and integrated BRT system in the world. The BRT system is designed around a series of arterial roadway groups radiating outward from the central city. Each roadway group is composed of three parallel facilities. The central street features an exclusive median busway dedicated to express service flanked by one slower moving general purpose lane on each side. The outer streets are one-way facilities located about one city block on either side of the central street. These facilities feature general purpose travel lanes located adjacent to dedicated bus lanes reserved for limited stop service. Signal priority is used on both facility types.

Central to the performance of the system are the 233 BRT stations within the system. These stations have a tubular shape and are raised a few feet above grade to match the floor height of the doors on the bus vehicles. Fares are collected before passengers board the buses.

Two thousand low-floor and bi-articulated buses are included in this fleet. These buses have a capacity of up to 270 passengers and are equipped with five doors to allow rapid boarding and exiting. All of these factors allow the Curitiba system to reduce "dwell time" to less than 30 seconds per stop. Buses operate on a multi-layered color-coded identification system. Yellow signifies conventional buses, orange identifies feeder buses, green highlights interdistrict buses, red indicates express and bi-articulated buses, and gray denotes speedy buses. All services utilize the same tube stations and passengers can transfer without paying additional fares.

Ottawa, Canada: The Transitway

OC Transpo operates a busway system, known as the Transitway, serving the metropolitan Ottawa area. The system features two exclusive busways that share a trunk section passing through central business district. Overall the system includes 34 BRT stations and five park-and-ride lots with a combined total of 2,380 parking spaces. Twenty of the stations are also equipped with bike racks and other amenities targeted at bicycle riders. Stations are designed with multiple bus bays, passing lanes and drop off/pickup areas.

All bus routes in the transit system utilize a portion of the Transitway or connect to one of the stations. Along the Transitway express and all stop services serve the differing trip needs of the patrons. Bus service operates approximately 22 hours a day beginning at 4:00 a.m. and ending after 2:00 a.m. Average weekday passenger volume is 200,000 riders. Duing the peak hour one-way passenger volume in the trunk section averages 10,000 riders and 190 buses pass through the CBD.

Vancouver, Canada: B-Line Rapid Bus Routes

The Greater Vancouver Transportation Authority operates two rapid bus routes connecting major destinations in the urban area. In 1996, BRT service was initiated in Vancouver with the introduction of the 99 B-Line rapid bus route connecting the central business district with the University of British Colombia. This 11-mile route operates in mixed traffic along a major arterial corridor. Route features include stop spacing of 0.8 miles and signal priority. Headways are every four minutes during peak hours, seven to eight minutes at midday, and 15 minutes in the evenings. Route 98 B-Line provides similar service connecting the Richmond business district with the CBD. The routes are operated with articulated low-floor transit buses that have a distinct paint scheme and logo to distinguish them from local buses.

Rapid bus has been a success in Vancouver. On the 99 B-Line travel times were improved 5 to15 minutes over local bus service. An onboard survey determined that 20 percent of riders had previously used single occupancy vehicles to commute to work. Currently, daily ridership on the route is 20,000 passengers per day.

2.3 Conclusions

Through the review five general BRT applications were identified operating or under development at transit agencies around the country. These are described briefly below:

- Exclusive Busway Only – This application features exclusive busways including stations. The busways may include exclusive ramps connecting to other roadways and where applicable signal priority for at-grade intersections and queue jumpers. The applications may also include other BRT elements such as AVL, prepayment of fares, and passenger information systems.
- Exclusive Bus Lane Only – This application features exclusive bus lanes on arterial streets, stations, signal priority, and where applicable queue jumpers. The bus lanes may be contra-flow and may be physically separated from general use lanes. Lanes may be located next to the curb or in the median. The applications may also include other BRT elements to such as AVL, prepayment of fares, and passenger information systems.
- HOV Lane Only – This application is characterized by bus vehicles operating in HOV lanes. Typically, the HOV lanes are accessed via exclusive ramps. The lanes may operate as Zipper Lanes, switching direction of travel to meet peak travel demands and the lanes may be barrier separated from other lanes. Some HOV systems also include stations along the facility. The applications may also include other BRT elements such as AVL, prepayment of fares and passenger information systems.
- Enhanced Bus Only – This application is characterized by buses traveling in general purpose lanes with stations or improved shelters. At intersections the bus vehicle movement is prioritized through signal priority systems and where applicable queue jumpers. The applications may also include other BRT elements such as AVL, prepayment of fares, far side of intersection stops and passenger information systems.
- Combination BRT– This application is defined by a seamless integration of some combination of the four applications described above. Bus vehicles transition from one operating environment to another as they traverse the length of the facility. Typically, the combined applications include exclusive guideway such as a busway connected to enhanced bus along arterial streets. The applications may also include HOV lanes.

Table 2.1 on the following page summarizes the findings of the domestic portion of BRT systems reviewed in Chapter 2 of the report. Generally, it appears that busway applications target regional trips into downtown areas. Also, there is a relatively large number of miles (24.6) of busway facility already in operation when compared to the other BRT concepts. It is also interesting to note from MARTA's perspective that in Washington, D.C., busways are being used as a precursor to a potential extension of heavy rail facilities. As MARTA considers extension of its heavy rail system, this staging approach may be an appropriate strategy.

HOV lane applications appear to be focused on regional trips bringing patrons from the suburbs to downtown, such as in Charlotte, North Carolina. However, of the system reviewed there involves a relatively small number (7.1) of miles currently open to operation. Several cities have already opened Enhanced Bus facilities. These facilities tend to serve multiple trip types, and are relatively long averaging 20 miles in length. These facilities are also located in urbanized settings such as downtown areas. Finally, the combined BRT approach is not in operation at this time, but is being pursued by many cities including Eugene-Springfield, Oregon and Boston, Massachusetts. This reflects the

fact that transit agencies are trying to take advantage of the flexibility and efficiencies of the combined BRT concept that allow seamlessly operations across multiple urban environments.

Table 2.1: BRT Application Review Summary				
BRT Application	**Miles of Facility**	**Primary Functions**	**Open to Passengers?**	**Comments**
Exclusive Busway Only				
Pittsburgh, Pennsylvania	16.1	Regional Trips	Yes	
Miami, Florida	8.5	Regional Trips	Yes	10 mile extension planned
Hartford, Conneticut	10	Regional Trips	No	2004
Washington, DC	No information	Regional Trips	No	BRT may be replaced by extension of heavy rail line in the future
Exclusive Bus Lanes Only				
Orlando	2.3	Downtown Circulator	Yes	
HOV Lane Only				
San Juan, Puerto Rico	2.5	Feeder to Rail Line	Summer 2002	
Honolulu, Hawaii	17.8	Regional Trips	No	EIS complete 2002
Charlotte, North Carolina	4.6	Regional Trips	Yes	
Enhanced Bus Only				
Alameda and Contra Costa Counties, California	No information	Local and Semi-Regional Trips	Summer 2002	
Chicago, Illinois	18	Local and Semi-Regional Trips	Yes	
Santa Clara, California	27	Local and Semi-Regional Trips	2005	
Albany, New York	16	Local, Semi-Regional and Regional Trips	Yes	Facility is being developed incrementally
Los Angeles, California	No information	Local, Semi-Regional and Regional Trips	Yes	
Combination BRT				
Honolulu, Hawaii	12.8	Downtown Circulator and Regional Trips	No	EIS complete 2002
Eugene-Springfield, Oregon	4	Local and Semi-Regional Trips	No	
Boston, Massachusettes	No information	Local, Semi-Regional and Regional Trips	Phase I Open	Phase II - 2010
Montgomery County, Maryland	6	Local and Semi-Regional Trips	No	
Alameda and Contra Costa Counties, California	18	Regional Trips	No	
Cleveland, Ohio	6.6	Local and Semi-Regional Trips	2006	

3 METHODOLOGY FOR BRT CORRIDOR IDENTIFICATION

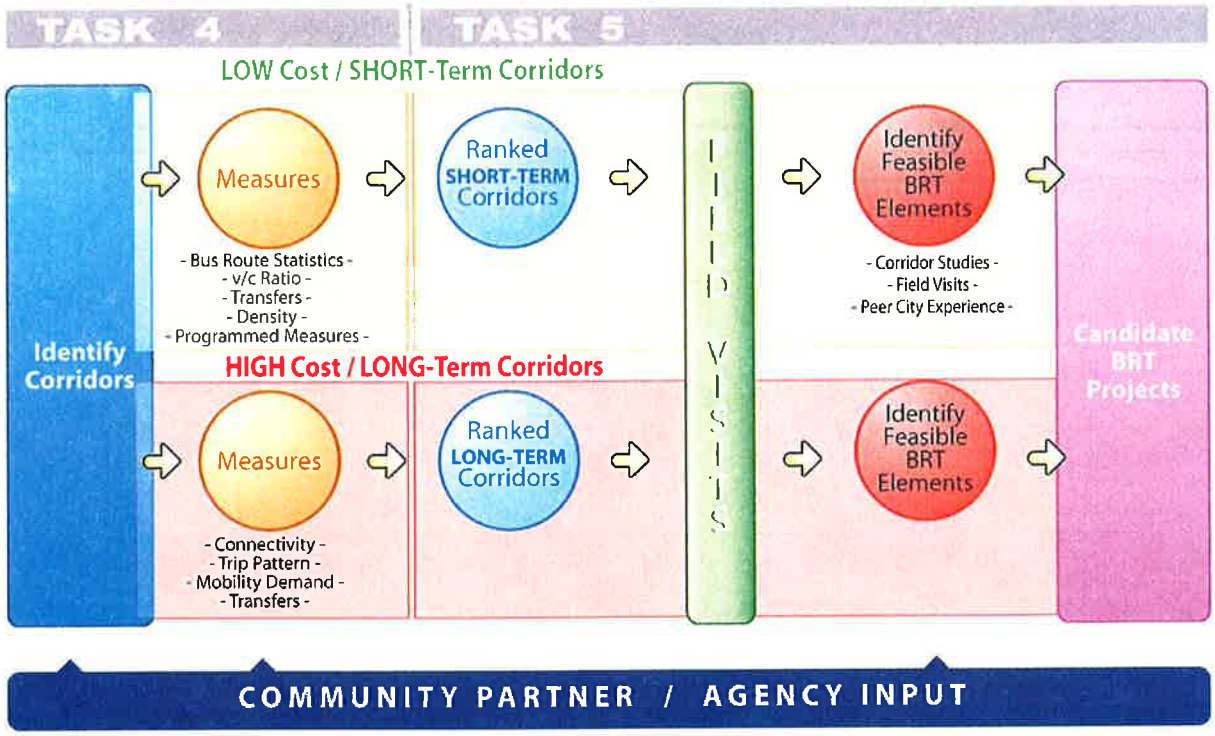
This section describes the evaluation methodology utilized in the BRT corridor identification process. With a relatively fast-paced schedule, the evaluation method applied in this study was designed to qualitatively assess the degree to which corridors satisfy a specific set of measures related to the application and potential deployment of BRT concepts. The analysis process began with the identification of major travel sheds and corridors utilizing regional travel demand data. The results from the corridor identification fed into a two-tracked multi-lateral evaluation framework. Each analysis track utilized a set of distinct measures incorporated into a decision matrix format. The matrix format allows for a scoring and ranking of corridors based on agreed upon evaluation measures. Measures for each of the evaluation tracks are described in detail in Section 3.3. The first track was designed to rank and advance corridors most applicable for short-term/low cost BRT strategies, while the second track is designed to rank and advance long-term/higher cost BRT strategies, such as exclusive BRT fixed guideway transit applications.

The evaluation process is graphically illustrated in the flow chart shown as Figure 3.1 on the following page. Additionally, it should be noted that the evaluation steps in this study were executed in collaboration with MARTA planning staff, as well as, under the guidance of a BRT Taskforce. The BRT Taskforce is made up of representatives from key transit planning agencies and community partners from around the region. Agencies represented on the Taskforce include the following:

- MARTA
- Atlanta Regional Commission;
- Georgia Regional Transportation Authority;
- Georgia Department of Transportation
- DeKalb County;
- Fulton County;
- City of Atlanta;
- Gwinnett County Transit;
- Cobb Community Transit;
- Clayton County Transit;
- Federal Transit Administration;
- Federal Highway Administration; and
- Metro Atlanta Chamber of Commerce.

The BRT Taskforce met twice over the course of the study. An initial kick-off meeting was held early on in an effort to present and review the scope of the project, solicit data materials, and review the preliminary list of the corridors identified for analysis. The second meeting of the Taskforce was intended to review major findings and recommendations of the study, and to determine coordination steps necessary to move BRT strategies forward through implementation.

Figure 3.1: Evaluation Process Flow Chart



3.1 Identification of Corridors

The first analysis step in the study process was to identify the universe of major travel corridors within the MARTA service delivery area. This step was accomplished through reviewing existing and future travel characteristics, and through gathering input from MARTA staff over the course of one-on-one interviews. In terms of reviewing travel patterns, a series of desire lines maps based on the adopted ARC regional travel demand modal were evaluated. Desire line maps were developed based on TRANPLAN modal networks for year 2000 and 2025. An example of a desire line map for the MARTA service area is shown as Figure 3.2. The baseline of corridors identified in this step served as the starting point for examining BRT applicability within the context of this study. Table 3.1 presents the resulting travel corridors analyzed for the MARTA service area.

Figure 3.2: MARTA Service Area Desire line Map

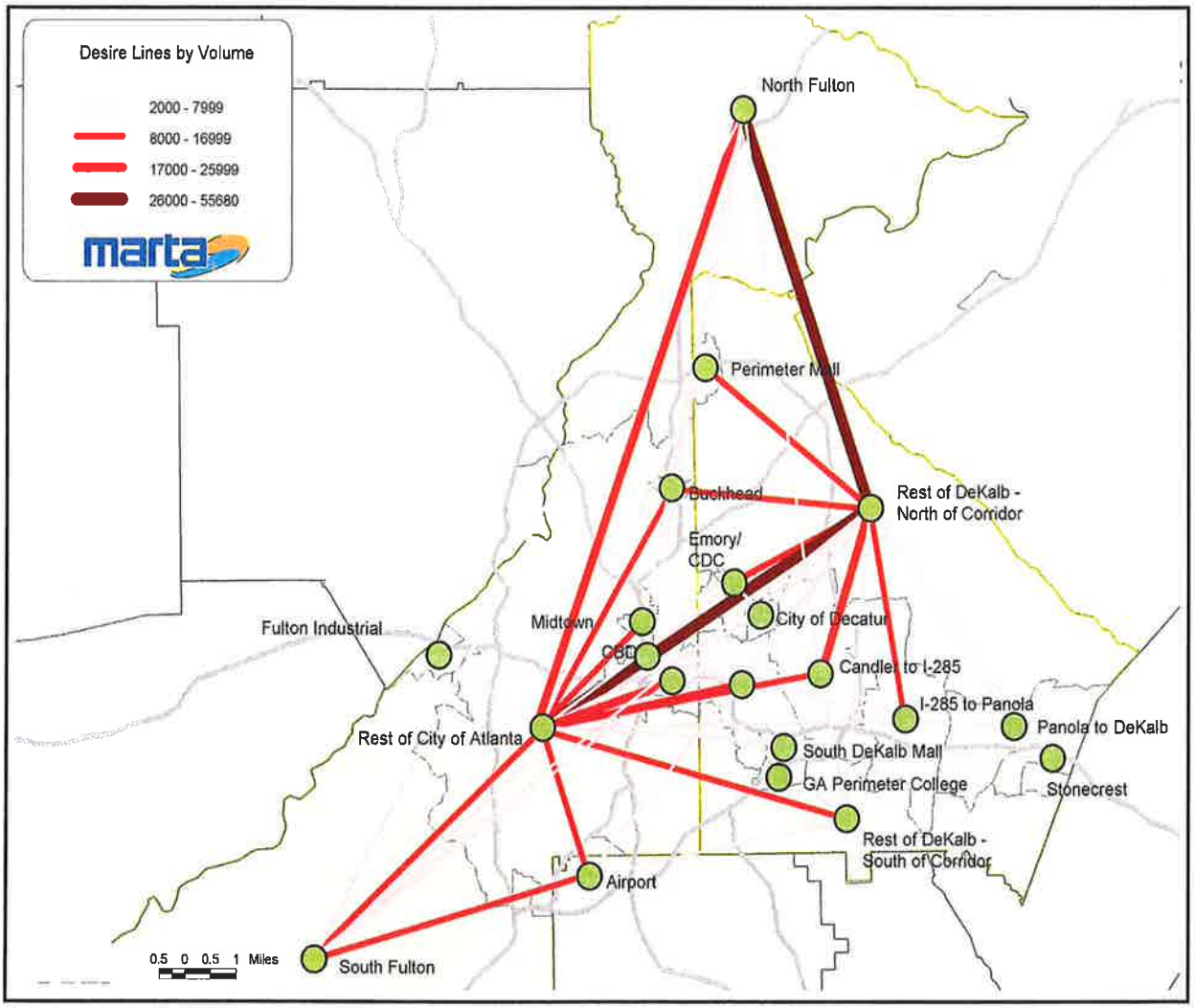


Table 3.1: Preliminary Corridor Identification

Corridor	MARTA Service Area(s) Served				Beginning Point	Ending Point
	N. Fulton	S. Fulton	City of Atlanta	DeKalb County		
Roswell Road	X		X		Buckhead Village	City of Alpharetta
Alpharetta Highway	X				City of Alpharetta	Fulton/Forsyth
Marietta Hwy	X				City of Alpharetta	Fulton/Cobb
State Bridge Rd	X				City of Alpharetta	Fulton/Gwinnett
Holcomb Bridge Rd	X				Roswell Road	Fulton/Gwinett
Johnson Ferry Road	X				Cobb County Line	Perimeter Center
GA 400	X				North Springs Station	Fulton/Forsyth
I-285 – Top End	X			X	Cumberland Area	Doraville Area
Metropolitan Pkwy/Northside Dr/W.		X	X		Hartsfield Airport	Buckhead
Bolton Road/West Paces			X		Fulton Industrial	Buckhead
Peachtree Road/Street			X		Five Points	Brookhaven
I-20 West			X		Hamilton Holmes	Fulton/Cobb
Campbellton Road		X	X		Oakland City MARTA	Greenbriar Mall
Lakewood Freeway		X	X	X	Greenbriar Mall	South Dekalb Mall
I-75 North			X		Downtown Atlanta	Cobb County Line
Camp Creek Parkway		X			Fulton Industrial	Hartsfield Airport
Roosevelt Highway		X			Hartsfield Airport	City of Palmetto
Metropolitan Pkwy		X	X		Hartsfield Airport	Downtown Atlanta
I-75 South		X	X		Clayton County Line	Downtown Atlanta
Moreland Ave/SR 42				X	Clayton County Line	Downtown Atlanta
I-20 East			X	X	Downtown Atlanta	Stonecrest Mall
Memorial Drive			X	X	Downtown Atlanta	Mountain Industrial
US 29 and 78			X	X	Midtown Atlanta	Stone Mountain
Candler Road				X	Emory University	Snapfinger Road
Covington Highway				X	Emory University	Stonecrest Mall
Panola Road				X	Browns Mill Road	Mountain Industrial
Buford Highway			X	X	Lindbergh Center MARTA Station	DeKalb/Gwinnett Countyline
I-285 – East Wall				X	I-20	Perimeter Area
I-85 North			X	X	Downtown	DeKalb/Gwinnett Countyline
La Vista Road/Clifton			X	X	Lindbergh MARTA	Emory University
I-285 - South		X		X	I-20	South Fulton Pkwy.
South Fulton Parkway		X			I-85	End
La Vista Road				X	Emory University	DeKalb/Gwinnett Countyline

3.2 Data Collection

The BRT corridor identification analysis utilized the most current available data including existing and future land use, socio-economic traits, area-wide travel trends, and congested corridor conditions. The ARC travel demand model provided a number of these data sets. Detailed MARTA bus ridership statistics, and MARTA market research data was reviewed as well. Bus route statistics collected included the number of daily passengers per hour, a.m. passengers per hour, and on-time performance data. Finally, during the later stages of the project, a series of field reviews of top ranked short-term corridors were undertaken. These reviews allowed for the collection of general corridor characteristics including lane widths, intersection geometry, driveway access, and other physical attributes that are conducive or attributes that could potentially prohibit the implementation of BRT concepts. The results of the field review are presented later in Section 4.2.

3.3 Definition of Evaluation Measures

The key component of the decision matrix approach is the use of well-defined evaluation measures. For each of the evaluation tracks (i.e., short-term/low cost and long-term/high cost), measures were defined as a way of comparing corridors as it relates to their potential for BRT applicability. A number of the measures applied in the analysis are quantitative, based on data collection items discussed in Section 3.2. However, other measures are highly qualitative relying on professional judgment and knowledge of the region's transportation network. An ordinal scoring scheme was developed to rank corridors for each measure applied in the decision matrix. The scoring scheme was defined as follows:

SCORING SCHEME

3 = HIGH

2 = MEDIUM HIGH

1 = MEDIUM

0 = MEDIUM LOW

-1= LOW

For both short-term and long-term evaluation tracks, total scores for each corridor were calculated by simply adding up the individual scores per evaluation measure. The higher the total score correlated higher corridor ranking, while lower total scores correlated lower corridor ranking. The evaluation measures employed in the decision matrix are described in the section below.

Short-term/Low Cost Evaluation Measures

- *Bus Route Statistics*- This measure was used to identify opportunities to increase ridership or performance of existing MARTA routes. The amount of bus ridership along corridors was compared based on daily and a.m. peak passengers per hour. Higher ridership correlated higher scores, while corridor with low ridership received lower scores.
- *Congestion* – Congestion in the short-term/low cost evaluation was viewed as a constraint. The notion behind this measure was that areas with high congestion levels do not lend themselves well to short-term BRT treatments. For example, in most cases taking a lane for bus only operations or modifying intersection for bus priority along a highly congested corridor would be a difficult sell. For this measure,

corridors with low levels of congestion received higher scores, while corridors with high congestion received lower scores.

- *Corridor Density*- This measure was used to identify transit supportive corridor areas. The concept for this measure was that high employment and population densities are supportive of transit, and therefore, high-density corridors received higher scores, while low-density corridors received lower scores.
- *Programmed Improvements (TIP)* – This measures identified opportunities to "piggyback" BRT projects as part of already programmed roadway projects. The higher the number of scheduled roadway projects along a corridor correlated higher scoring.
- *Transfer Reduction* – This measure was used to identify opportunities for travel time-savings due reductions in system transfers. Both bus-to-bus and bus-to-rail transfers were considered in this measure. The higher the number of transfers translated higher scoring.

Long-term/High Cost Evaluation Measures

- *Connectivity to Transit Stations + Activity Centers* - A measure of connectivity was used to identify the number of regional activity centers and transit stations linked by a given corridor. The greater the number of activities centers or stations tied together translated higher scores.
- *Trip Patterns and Purpose*- This measure was used to identify corridors that serve longer regional trip patterns. Corridors serving longer regional trips received higher scores, while corridors serving localized trips received lower scores.
- *Mobility Demand* – Both volume-to-capacity ratios (congestion measurement) and total traffic volumes were considered for this measure. High congestion and high traffic volumes correlated high scores, while low congestion and low traffic volumes allowed lower scores.
- *Transfer Reduction* – Similar to the short-term/low cost evaluation, time-savings due reduction in system transfers was assessed. The higher the number of transfers translated higher scoring.

4 BRT CORRIDOR RANKING ANALYSIS

The purpose of the corridor ranking analysis was to generate two distinct evaluations of corridors within the MARTA service area for potential BRT and projects. A low cost/short-term evaluation focused on identifying corridors in which relatively low cost Enhanced Bus improvements including signal priority and skip stop service could be implemented with few constraints to project development. Alternatively, the high cost/long-term evaluation aimed to determine which corridors could support a premium BRT service such as a busway or dedicated median bus lanes and was not as focused on existing constraints. The rankings were developed using subsets of the evaluation measures described in Chapter 3 designed to screen corridors relative to the constraints and opportunities associated with the evaluation timeframe. To simplify the analysis a decision matrix table was used to summarize the evaluations.

4.1 Enhanced Bus Corridor Rankings: Short-Term/Low-Cost

To perform the short-term evaluation a unique subset of the evaluation measures described in Chapter 3 was applied to the corridors. This set contained the following measures:

- Daily Ridership Statistics;
- A.M. Peak Ridership Statistics;
- Congestion Measures;
- Corridor Density;
- Programmed Improvements; and
- Transfer Reduction.

A geographic information system (GIS) developed for the project was used to develop the value for each measure at the corridor level. For some measures, such as Corridor Density, the GIS was used to calculate an exact value, while for other measures a visual assessment of the mapping was performed to estimate the value. To begin the ranking process, for all of the measures except Congestion, the corridors were arranged in descending order based on the value of the measure. Breaks were then established to group the corridors into 5 equal sized sets and the first set was assigned a score of *High*, the second set a score of *Medium High* and so on to a score of *Low*. For the Congestion measure the corridors were compared to set ranges of values rather than to each other. The lower the level of congestion the higher the score. For example a corridor that had less than 20 percent of its length in congested condition during the peak hour scored *High* for this measure.

To complete the evaluation, a number corresponding to each score was entered into the short- term decision matrix shown on the next page. The numbers ranged from +3 for a *High* score to -1 for a *Low* score. These numbers were then added across the row into the Overall Ranking Score. The higher the final value the more appropriate the corridor for a short-term Enhanced Bus improvement. The Overall Ranking Scores ranged from 15 (Memorial Drive) to –2 (Marietta Highway). Generally, top ranked corridors were characterized by high existing transit ridership, high density of development and low levels of congestion. High congestion levels and low density of development characterized lower ranked corridors.

Table 4.1: Short-Term/Low-Cost Decision Matrix

Short-term / Low-Cost "Enhanced Bus" Corridor Ranking	Daily Ridership Statistics	AM Peak Ridership Statistics	Congestion Measures (Corridor V/C Ratio)	Corridor Development Density (Employment x Population)	Programmed Improvements (TIP)	Transfer Reduction	Overall Ranking Score
Memorial Drive	3	3	3	3	1	2	**15**
Roswell Road	3	3	0	2	2	3	**13**
Covington Highway	3	3	3	1	0	1	**11**
Peachtree Road/Street	2	2	1	3	-1	3	**10**
Buford Highway	1	3	3	3	-1	1	**10**
Metropolitan Pkwy/Northside Dr./W. Paces Ferry	3	1	2	0	0	2	**8**
Camp Creek Parkway	1	2	3	3	-1	0	**8**
Moreland Ave/SR 42	2	1	2	1	0	1	**7**
I-85 North	2	2	-1	3	1	0	**7**
Lakewood Freeway	2	2	2	-1	1	0	**6**
Metropolitan Pkwy	1	0	3	2	-1	1	**6**
US 29 and 78	2	3	0	2	-1	0	**6**
Panola Road	2	3	2	1	-1	-1	**6**
GA 400	2	2	-1	0	3	-1	**5**
Campbellton Road	1	1	3	-1	0	0	**4**
I-20 East	3	-1	-1	0	1	2	**4**
Candler Road	0	2	2	1	-1	0	**4**
LaVista/Clifton	0	0	1	3	-1	1	**4**
La Vista Road	0	1	2	1	-1	1	**4**
Alpharetta Hwy	-1	0	3	-1	3	-1	**3**
Bolton Road/West Paces Ferry	1	1	1	0	0	0	**3**
I-75 South	0	0	-1	2	1	1	**3**
South Fulton Parkway	1	1	3	-1	-1	0	**3**
Roosevelt Highway	0	0	3	-1	-1	1	**2**
State Bridge Road	-1	0	0	0	3	-1	**1**
I-285 - Top End	-1	-1	-1	2	1	1	**1**
I-20 West	0	0	-1	2	1	-1	**1**
I-75 North	0	0	-1	1	1	0	**1**
I-285 – East Wall	-1	-1	-1	2	1	1	**1**
Johnson Ferry Road	-1	-1	0	1	1	0	**0**
Holcomb Bridge Road	-1	-1	-1	0	0	2	**-1**
I-285 South	1	1	-1	-1	-1	0	**-1**
Marietta Hwy	-1	-1	3	-1	-1	-1	**-2**

SCORING SCHEME

3 = HIGH, 2 = MEDIUM HIGH, 1 = MEDIUM, 0 = MEDIUM LOW, -1 = LOW

4.2 Field Review of Top Ranked Short-Term Corridors

Five of the corridors that scored well in the short-term decision matrix were selected for further evaluation through field review. These were:

- Memorial Drive;
- Covington Highway;
- Buford Highway;
- Roswell Road; and
- Peachtree Street/Road.

The purposes of field review were to refine the short-term evaluation through additional data gathering and to identify opportunities and constraints to the implementation of Enhanced Bus projects within the corridors. Field reviews of the corridors were conducted on May 1 and 8, 2002 through a windshield survey that included:

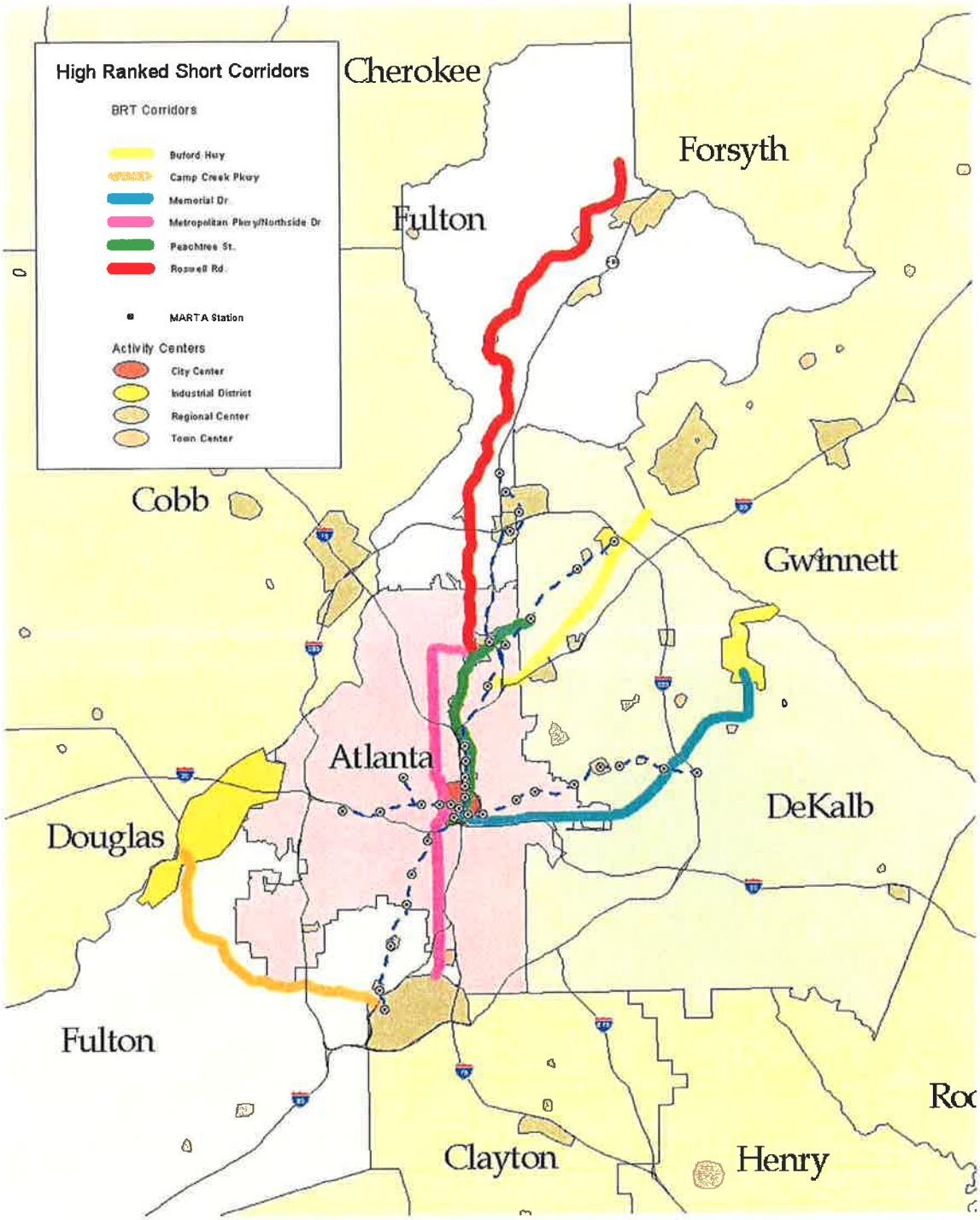
- Gathering physical data such as roadway geometry, lane widths, right-of-way boundaries and curb cut frequency; and
- Assessing the transit supportiveness of existing design, especially sidewalks, bus stop location and design and orientation of buildings to the street.

Generally, the information gathered supported the results of the matrix evaluation, however, based on the field review Covington Highway was removed from the list of top ranked short-term corridors because of the extremely low densities, lack of sidewalks and potential negative impacts to the downtown area of Avondale Estates. Taking into account this change the following set of corridors was moved forward in the short-term evaluation track:

- Memorial Drive;
- Buford Highway
- Roswell Road;
- Metropolitan Parkway / Northside Drive / Bolton Road;
- Camp Creek Parkway; and
- Peachtree Street/Road.

This set of corridors represents urban and suburban settings and is dispersed throughout the MARTA service area. Camp Creek Parkway and Metropolitan Parkway serve South Fulton County. Roswell Road serves North Fulton County. Memorial Drive serves DeKalb County. Buford Highway and Peachtree Street/Road serve both Fulton and Dekalb Counties. Figure 4.1 presents the top scoring corridors. In Chapter 5, the corridors will be matched with potential Enhanced Bus project elements and general cost estimates.

Figure 4.1: Top Ranked Short-term Corridors



4.3 BRT Corridor Rankings: Long-Term/High-Cost

To perform the long-term/high cost rankings a second subset of the evaluations measures defined in Chapter 3 was applied to the corridors. This set contained the following measures:

- Connectivity to Transit Stations and Activity Centers;
- Trip Patterns and Purpose;
- Congestion;
- Total Volume; and
- Transfer Reduction.

The project (GIS) was used to develop a corridor level value for each measure. These values were then compared to set ranges to determine the appropriate score. The application of each measure is shown in the tables below.

Connectivity to Transit Stations and Activity Centers:

Number of Connections in the Corridor	Score
0	Low
1	Medium Low
2	Medium
3	Medium High
4-5	High

Trip Patterns and Purpose:

Trip Patterns in the Corridor	Score
Local	Low or Medium Low
Subregional	Medium or Medium High
Regional	High

Congestion:

Percentage of Corridor Length with V/C Ratio Over 0.8 During Peak Hour	Score
0-20%	Low
20-40%	Medium Low
40-60%	Medium
60-80%	Medium High
80-100%	High

Total Volume:

Total Daily Traffic Volume in the Corridor	Score
0 - 20,000 vpd	Low
20,000 – 45,000 vpd	Medium Low or Medium
45,000 – 80,000 vpd	Medium High
80,000 – 130,000 vpd	High

Transfer Reduction:

Number of Potential Transfers Eliminated by a BRT in the Corridor	Score
0	Low or Medium Low
1	Medium
2	Medium High
3	High

To complete the evaluation, a number corresponding to each score was entered into the long-term decision matrix shown on the next page. The numbers ranged from +3 for a *High* score to -1 for a *Low* score. These numbers were then added across the row into the Overall Ranking Score. The higher the final number the more appropriate the corridor for a long-term BRT improvement. The overall ranking scores ranged from 13 (I-285 Top End) to –1 (South Fulton Parkway). Corridors that ranked well served regional travel patterns and high levels of travel demand, while also connecting existing activity nodes.

Lower ranked corridors were characterized by more local trip patterns and lower levels of travel demand and did not connect to numerous activity centers. Based on the evaluation results the following corridors were moved forward through the screening process:

- I-285 – Top End
- I-20 East
- I-75 South
- GA 400
- I-285 – East Wall
- I-85 North

This group of corridors considers improvement within all of the jurisdictions within the MARTA service area. GA 400 serves North Fulton County. I-75 South serves South Fulton County. I-20 East, I-85 North and I-285 – East Wall serve DeKalb County. Several of the corridors serve the City of Atlanta including I-20 East and I-85 North. Figure 4.2 presents the long-term top ranked corridors. In Chapter 5, the corridors will be matched with potential BRT project elements and general cost estimates.

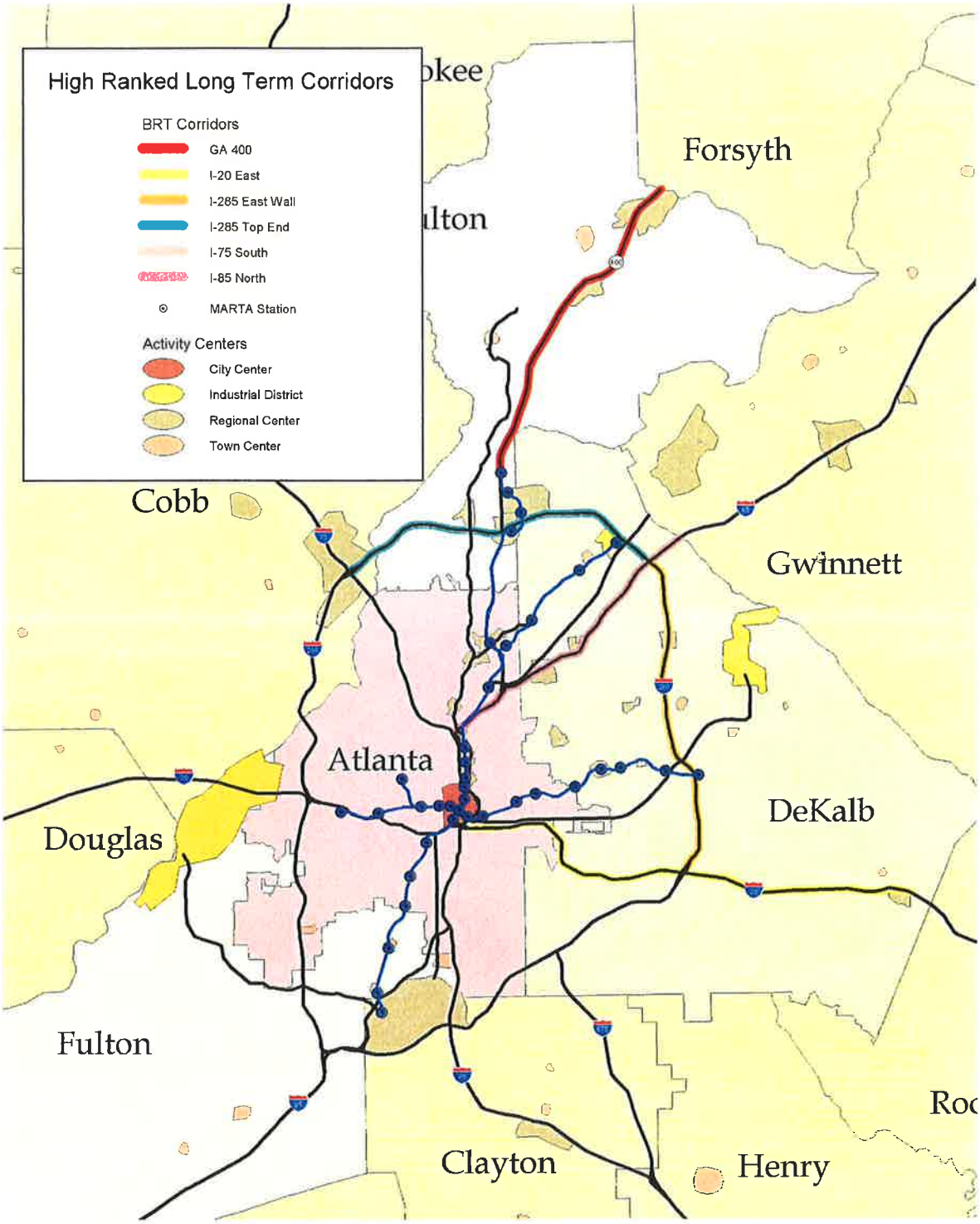
Table 4.2: Long-Term/High-Cost Decision Matrix

Long-Term / High-Cost BRT Corridor Ranking	Connectivity to Transit Stations + Activity Centers	Trip Patterns and Purpose	Congestion Measures (Corridor V/C Ratio)	Total Volume	Transfer Reduction	Overall Ranking Score
I-285 – Top End	3	3	3	3	1	**13**
I-20 East	2	3	3	2	2	**12**
I-75 South	2	3	3	3	1	**12**
GA 400	3	3	3	2	0	**11**
I-285 – East Wall	2	3	3	2	1	**11**
I-85 North	1	3	3	3	1	**11**
US 29 and 78	2	3	2	2	0	**9**
I-75 North	1	3	3	2	0	**9**
Peachtree Road/Street	3	2	1	1	1	**8**
I-285 South	0	3	3	2	0	**8**
I-20 West	1	3	3	2	-1	**8**
Buford Highway	2	2	1	1	1	**7**
Johnson Ferry Road	1	2	2	1	1	**7**
Holcomb Bridge Road	-1	2	3	1	2	**7**
Metropolitan Pkwy/Northside Dr./W. Paces Ferry	3	1	0	0	2	**6**
Roswell Rd	2	1	2	1	0	**6**
Memorial Drive	2	1	-1	1	2	**5**
Lakewood Freeway	1	3	0	0	1	**5**
State Bridge Road	0	2	2	0	1	**5**
LaVista/Clifton	1	1	1	0	1	**4**
Covington Highway	3	1	-1	-1	1	**3**
Camp Creek Parkway	1	2	-1	1	0	**3**
Metropolitan Pkwy	2	1	-1	0	1	**3**
Bolton Road/West Paces Ferry	1	1	1	-1	1	**3**
Roosevelt Highway	2	2	-1	-1	1	**3**
Candler Road	2	1	0	0	0	**3**
La Vista Road	1	1	0	0	1	**3**
Moreland Ave/SR 42	0	1	-1	1	1	**2**
Campbellton Road	1	2	-1	-1	1	**2**
Marietta Hwy	0	2	-1	1	0	**2**
Panola Road	1	1	0	-1	0	**1**
Alpharetta Hwy	1	2	-1	0	-1	**1**
South Fulton Parkway	-1	2	-1	-1	0	**-1**

SCORING SCHEME

3 = HIGH, 2 = MEDIUM HIGH, 1 = MEDIUM, 0 = MEDIUM LOW, -1 = LOW

Figure 4.2: Top Ranked Long-term Corridors



5 MAJOR FINDINGS AND RECOMMENDATIONS

The corridors that ranked well in the short and long-term evaluations are matched with BRT project strategies and general cost estimates in this chapter. Short-term corridors are paired with Enhanced Bus treatments that would improve performance and ridership. In many other cities these types of bus improvements have reduced the cost per passenger trip significantly. For the long-term corridors, further study of the alternatives in the corridor will be necessary. A few Alternative Analyses studies are underway or have been already completed in a number of the long-term corridors. For example, in the I-285 -Top End corridor, the ARC recently completed the Marietta-Lawrenceville Transportation Study, and the subsequent I-285 Transit Corridor Feasibility Study. This effort identified concept alignment and suggested Light Rail Transit and BRT as potential applications within the corridor from Cumberland to Doraville. However, several of the remaining corridors have not been addressed in detailed fashion. Therefore, these corridors are potential candidates to continue evaluating BRT as a transportation option.

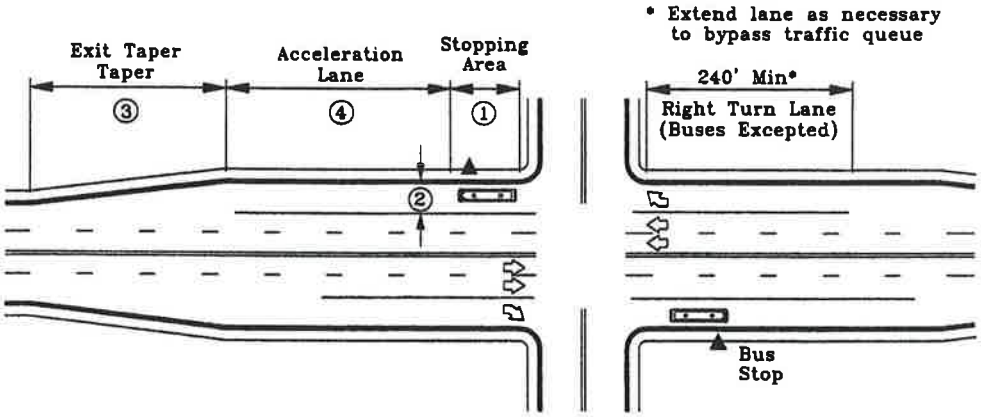
5.1 Recommendations for Short-Term/Low-Cost BRT Applications

In this section the BRT strategies for the short-term corridors are discussed in detail. For these corridors, Enhanced Bus improvements are the most appropriate approach because of the relatively low cost and ease of implementation. Through this process, opportunities have been identified to couple short-term/low cost improvements with roadway project upgrades. To take advantage of "piggybacking" Enhanced Bus concepts with road improvements, MARTA must maintain a continued collaboration with GDOT and ARC as road projects are programmed into the Transportation Improvement Program (TIP) and Regional Transportation Plan (RTP). A good example of such an opportunity was uncovered through this study process. GDOT is currently in the concept design phase of an interchange improvement at I-285 and Memorial Drive. This project was cited as an opportunity to include queue jumper lanes as a part of the design concept.

It should be noted that the discussions presented in this chapter should not be considered a complete project concept but rather a starting point for the development of specific improvement project. Enhanced Bus treatments vary in terms of their complexity, but include some combination of the following elements:

- Bus Signal Priority – A traffic signal system that gives priority treatment to bus vehicles at intersections. A variety of techniques are used to provide the priority to buses including extending the green phase, inserting a green phase and reducing the red phase on the approach that the bus travels. The bus priority system could take advantage of the automatic vehicle location equipment already installed on some MARTA buses. Often the priority systems include special bus traffic signal heads shown as an example from Orlando, Florida on the right.
- Queue Jumper – A special travel lane located at an intersection that allows the bus vehicle to bypass queued vehicles. This treatment is often combined with Bus Signal Priority to reduce intersection delay for buses. Queue jumpers can operate as mixed-use lanes – general traffic must turn while buses can continue through the intersection, or as exclusive bus lanes. Figure 5.1 on the following page shows plan view of a queue jumper lane.

Figure 5.1: Diagram of Queue Jumper Lane



- Far Side of Intersection Bus Stops – Location of bus stops on the far side of the intersection relative to the direction of travel so that buses cross the intersection before stopping. This reduces the chance that a bus will be delayed an extra signal cycle due to dwell time at a near side bus stop.
- Skip Stop and or Express Service – Modification and or addition of bus routes in the corridor that serve a limited number of stops. Skip Stop service typically stops every 0.75 to 1 miles as compared to local service which may have stops every 0.25 miles. Express service stops even less frequently than Skip Stop service, perhaps at the endpoints of the corridor only. These services may take the place of existing local service or may be additive in nature.
- Improved Bus Stations/Shelters – At their best Enhanced Bus stations are designed to improve both bus operations and the customer experience. Bus operational enhancements are achieved through prepayment of fares and designs aimed at reducing boarding and alighting times such as raising the station a few feet above grade to match the bus boarding door level. Customer amenities could include:
    - A larger sheltered area;
    - More seating;
    - Climate control;
    - Real-time next bus arrival information displayed on kiosks or variable message signs; and
    - Detailed schedule and route information.
- Service Branding – Development of a distinctive identity for the Enhanced Bus service including a unique paint scheme and logo for use on vehicles and bus stations/shelters, and a unique brand name for the service. In Los Angeles and Contra Costa County, California, Enhanced Bus service is known as Rapid Bus. Marketing to establish the identity of the service within the community of potential users is also recommended.

The table below summarizes the recommended Enhanced Bus treatments in the short-term corridors. As the table shows the treatments vary in complexity from Memorial Drive and Metropolitan Parkway/Northside Drive which would have several Enhanced Bus elements to Buford Highway which would have a more limited set of elements.

Corridor	Recommended Enhanced Bus Elements					
	Signal Priority	Queue Jumpers	Far Side Stops	Skip Stop Service	Improved Bus Stations	Service Branding
Memorial Drive	√	√	√	√	√	√
Buford Highway			√	√	√	√
Roswell Road	√		√	√	√	√
Metropolitan Pkwy./ Northside Dr.	√	√	√	√	√	√
Camp Creek Parkway			√	√	√	√
Peachtree Road/Street	√		√	√	√	√

In addition to the Enhanced Bus elements recommended for implementation in each corridor, general improvements aimed at the overall quality of the transit environment in the corridors are also recommended for inclusion in any project concept. Areas of concern in all corridors noted in the field review include the presence and quality of the sidewalk network along the roadway and connecting to adjacent developments, accessibility of bus stop locations, infrequency of bus shelters and lack of route and schedule information available at stops.

Cost estimates for the construction and operations of Enhanced Bus are presented in this section. These estimates are based partly on project implementation experience for similar treatments in other cities and partly on roadway projects implemented in the Atlanta Region providing only a planning level of detail. These costs do not include right-of-way acquisition. Based on information gathered the costs for major capital elements are estimated as shown in the table below.

Capital Element (Unit)	Cost Per Unit	Cost Per Mile
Station	$100,000	$100,000
Bus Signal Priority (Intersection)	$25,000	$125,000*
Queue Jumper (500' Lane)	$75,000**	$375,000*
Total		$600,000

*Assumes five intersections per mile. ** Cost does not include cost for right-of-way.

Source: FTA Case Study Los Angeles Rapid Bus Program.

In addition to the major capital costs are minor capital costs for items such as moving bus stop locations, repainting of bus vehicles for branding purposes and other marketing activities. Operating costs will vary depending of the type service improvements implemented. However, other agencies have found that Enhanced Bus improvements usually reduce maintenance costs as well as the operating cost per rider.

5.2 Recommendations for Long-Term/High-Cost BRT Applications

The top ranked long-term/high-cost corridors is discussed in this section. Many of these corridors are the focus of other major regional transportation planning efforts. A brief status summary for these major planning studies is provided in the bullets below. However, it should be noted that not all top ranked corridors have been addressed by these larger planning studies. These corridors may be candidates for additional project development by MARTA including Alternative Analysis, where a comprehensive evaluation of technology, alignment, design concept and scope, cost estimates, and ridership forecasts would be developed.

- I-285 – Top End: This corridor was the focus of the ARC's Marietta-Lawrenceville Transportation Study, and the subsequent I-285 Transit Corridor Feasibility Study. The effort identified a concept alignment and suggested Light Rail Transit and BRT as potential applications within the corridor from Cumberland to Doraville. The forecasted ridership for the corridor was 35,000 to 40,000 passengers per day, and the generalized cost estimated for an exclusive BRT alternative was approximately $35 million per mile.

  The next step for this corridor is the adoption of a locally-preferred alternative by ARC, and initiation of environmental and preliminary engineering studies. Roughly, 95 percent of this corridor is within the MARTA service area. Therefore, the corridor warrants close coordination efforts by MARTA through the Regional Transit Action Plan (RTAP), and MARTA should establish its role in the next phases of project development.

- I-20 East - This corridor is currently being studied by MARTA in an effort entitled the I-20 East Corridor Study. The scope for this project is to analysis the feasibility of heavy rail in the corridor, and develop strategies that will ensure that the corridor can compete favorably for FTA New Start funds. The study will also determine the most feasible connection to the existing MARTA rail system. The study schedule is 12-18 months, with final recommendations available March 2003.

- GA 400 - The GA 400 corridor is currently being studied as part of GRTA's Northern Sub-area Study (NSAS). NSAS is a 22-month study to evaluate transportation, land-use, economic growth, and air quality considerations for the northern Atlanta sub-region. Recently, the study released a set of short-term strategies for the corridor including MARTA express bus operations along the roadway shoulder. MARTA has also set a priority to extent the North rail line to Alpharetta in this corridor, and in the near future will be initiating further project development to include an Alternative Analysis.

- I-285 – East Wall - This corridor is <u>not</u> the focus of any recent or ongoing studies at this time. However, the corridor is heavily congested, and is of extreme interest by DeKalb County. As such, this corridor is a prime candidate for further BRT studies by MARTA including formal Alternative Analysis.

- I-75 and I-85 - GRTA is implementing new express bus services along these corridors as part of a regional express bus program. Eleven metro area counties, including Fulton and DeKalb counties have agreed to participate in the express bus program in exchange for arterial roadway improvement funding. As the implementation of the express bus program moves forward, it will be extremely important that MARTA continues coordination efforts with GRTA as these services come online. Additionally, GRTA's Northwest

Connectivity Study will explore fixed guideway transit strategies within the I-75 corridor from the Midtown/downtown Atlanta area north into Cobb County connecting Cumberland, Marietta, and Town Center.

5.3 Implementation Steps

This section presents the necessary steps to move both short-term/low-cost and long-term/high cost BRT strategies to implementation. The short-term/low-cost strategies discussed earlier in the report are extremely conceptual in nature. Therefore, these strategies will require additional study to define specific BRT elements and project design. For example, implementation of skip stop service along a corridor will require detailed analysis of boardings and alightings at specific stop locations along the corridor in order to determine which stop locations to skip or bypass. Queue jumpers lanes will require detailed study of available rights-of-way and traffic engineering studies to quantified impacts to traffic operation. Bus signal priority will require an inventory of existing signal equipment, as well as, coordination with jurisdictions responsible for signal installation and maintaining signal systems. However, many of the short-term/low-cost strategies can be implemented through MARTA's internal decision structure. For example, MARTA currently has funding in place to initiate color-coding and painting of buses, and marketing activities necessary to brand an Enhance Bus service along one of the corridors identified for short-term improvements. It may be appropriate that MARTA seek additional funding for BRT projects through ARC's TIP and RTP process.

For long-term/high-cost strategies, additional studies and project development leading to implementation of these corridors must be coordinated through the Regional Transit Action Plan (RTAP), and the 2030 Regional Transportation Plan. The RTAP will establish regional priorities for transit and feed directly into the 2030 RTP update. Therefore, any major investment decisions considered for BRT should be reflected in this plan. Additionally, a number of the corridors cited for long-term/high cost strategies will require formal Alternatives Analysis to determine if BRT is a viable option. MARTA may also consider seeking funding for Alternative Analysis studies through ARC's RTP process. Figure 5.2 identifies the 2030 RTP schedule. Based on this schedule, it will be advantageous for MARTA to target the "Call for Solution" to submit BRT projects for ARC consideration during the early forth quarter 2002.

Figure 5.2: 2030 Generalized RTP Schedule