



Bus Rapid Transit: Chicago's New Route to Opportunity

LETTER FROM THE PRESIDENT

In metropolitan regions, public transportation is the backbone of vital, thriving communities. Even if your commute rarely or never involves transit, a healthy, efficient transit network reduces congestion and speeds everyone's commute. On that premise of interdependency, the Metropolitan Planning Council (MPC) has crafted a vision for Chicago's transportation and community development future that puts people – not steel, rubber or pavement – first. It envisions transit as the foundation for new business clusters and walkable neighborhoods, and the connection to the schools and stores that people need, and the parks and theaters that people want.

This report, the culmination of more than a year of research, analysis and modeling, is **groundbreaking in two ways**. It presents a **new way of screening and prioritizing transit investments** – whatever the mode – to accomplish much more than simply moving people from point A to point B. It is also an initial assessment of the **top 10 routes in Chicago** where Bus Rapid Transit (BRT) is feasible, best supports existing community assets, and fills accessibility gaps in the current transit network.

True BRT has four core attributes: dedicated lanes, pre-paid boarding, level boarding, and signal prioritization technology. It also offers tremendous benefits, from cost-effectively utilizing existing road infrastructure, to triggering investment and development around its stations, to improving quality-of-life, creating jobs, and generating needed tax revenues. A BRT network in Chicago could complement and connect to existing rapid transit, making the entire system more attractive as a travel option, while at the same time spurring new construction, redevelopment and economic development throughout the region.

The methodology we used to screen potential BRT routes in Chicago evaluated not only standard transportation metrics such as current ridership and travel time, but also quantifies livability objectives such as improved access in underserved areas, and connections to employment centers, shopping and schools. We are immensely grateful to the Chicago Transit Authority and Chicago Metropolitan Agency for Planning for their assistance, data and expertise throughout the research process.

This report is not the end of our work on BRT, but rather the beginning. We have outlined a feasible, beneficial network, and now must rally support – from City Hall to Capitol Hill, and from the intersection of Western Avenue and Irving Park Road to the corner at 95th Street and Stony Island Avenue. Our call is for both BRT investment in Chicago and institutionalizing livability screening methodology. This is a new way of thinking about transit for many people, so we know it is a long road, but one we cannot afford to let pass us by.



MarySue Barrett
President
Metropolitan Planning Council

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PURPOSE OF STUDY

MPC undertook this study for three reasons.

To challenge and inspire city leaders, business owners, and residents to rethink what transit can mean for Chicago.

1 Investment in BRT lines and stations can trigger new private-sector development and provide rapid transit access in areas that need it most. At relatively low cost, a BRT network would complement and connect to existing rapid transit – making the entire transit system more attractive as a travel option – while spurring new construction, redevelopment and economic development throughout the city. BRT, simply put, is something to get excited about. However, true BRT will not work everywhere due to its unique construction demands. This report presents a vision of future transit and community development in the reality of what such a system would require. It provides the City of Chicago, Chicago Transit Authority (CTA), and Regional Transportation Authority (RTA) with an initial assessment of where BRT is feasible, best supports existing community assets, and fills accessibility gaps in the current transit network.

To test a theory about transit and livability.

People do not ride buses and trains for the sake of riding buses and trains. They ride them to go somewhere – jobs, hospitals, libraries, stores, homes. Connectivity must be a goal of new investment. Our methodology for screening potential BRT routes looks beyond such standard operating parameters as current ridership and travel time. As a result, it identifies routes for subsequent demand modeling that might not otherwise be considered. Our hypothesis is corridors rich with amenities and people, even if somewhat short on current ridership, would demonstrate demand for rapid transit. The results support our suspicion. By complementing standard transportation evaluation metrics with livability and connectivity, our screening process identifies opportunities for both moving people quickly and improving quality of life.

2

To pioneer a method for using livability as a guide for public investment.

3 MPC is not alone in urging the use of livability metrics in prioritizing investment. In 2009, the U.S. Dept. of Housing and Urban Development (HUD), U.S. Dept. of Transportation (USDOT), and U.S. Environmental Protection Agency (USEPA) jointly established six Livability Principles that would guide future federal policy and investment decisions. Subsequently, the Federal Transit Administration (FTA) solicited input as to how those Livability Principles could be measurably and substantively used to assess alternatives for transit investments, including BRT. As federal funding opportunities for livability solutions and BRT increase, Chicago must have a plan to maximize the likelihood and benefits of receiving competitive funding. This study is the first step in that direction. While certain aspects of this study are specific to BRT, the livability criteria and screening process are not. They are intended to have life beyond this report, and could be readily adapted to assessments of other investments, from workforce housing to new park space.

STUDY FACTS & SUMMARY OF FINDINGS

A true Bus Rapid Transit network for Chicago is both feasible and beneficial.

FACT: The BRT network MPC envisions in this report intentionally complements the existing rapid transit offered by the Chicago Transit Authority and Metra, and increases accessibility throughout the city, rather than duplicating existing service to and from downtown.

FACT: True BRT requires four critical elements – dedicated lanes, pay-before-you-board stations, level boarding, and signal priority at intersections. The first two dictate where BRT is feasible physically, based on the necessary right-of-way of 86 feet for travel and 97 feet to accommodate stations.

FACT: The study was conducted in four phases. Phase 1 examined basic suitability for BRT; Phase II assessed constructability and livability at the street segment level; Phase III defined BRT routes; and Phase IV modeled demand.

FACT: The analysis of potential BRT routes used 14 tangible livability measurements, based upon the six federal Livability Principles, and integrated them with transit performance metrics. They were divided into four weighted scoring groups: destination access (nine criteria at 3.59% each), transit performance (two at 16.17% each), transit equity (two at 16.17% each), and infill development potential (3%).

FINDING: Western Avenue and Ashland Avenue have the highest potential ridership of the 10 BRT routes identified in this report. To improve transit connectivity, four potential corridors, including Cicero Avenue and Pulaski Road, were extended outside of the city. One non-linear route, connecting Stony Island and Cottage Grove avenues to the CTA Green Line, scored highly on livability criteria, has ample right-of-way, and fills a gap in the network.

FINDING: BRT in Chicago would generate substantial new demand for transit. Transit trips beginning and ending in BRT corridors could increase by nearly 14 percent, with many drivers switching to BRT. Transit trips to destinations within the BRT corridors that begin in surrounding suburbs could increase substantially, as well.

FINDING: This network could be built at a fraction of the cost of light or heavy rail by utilizing existing roadways, and would create well-defined corridors for subsequent, transit-oriented development by public and private investors.

94.6

Total route miles in the network of 10 recommended BRT routes (see page 15)

86/97

Feet of right-of-way width required for BRT travel and stations, respectively (see page 8)

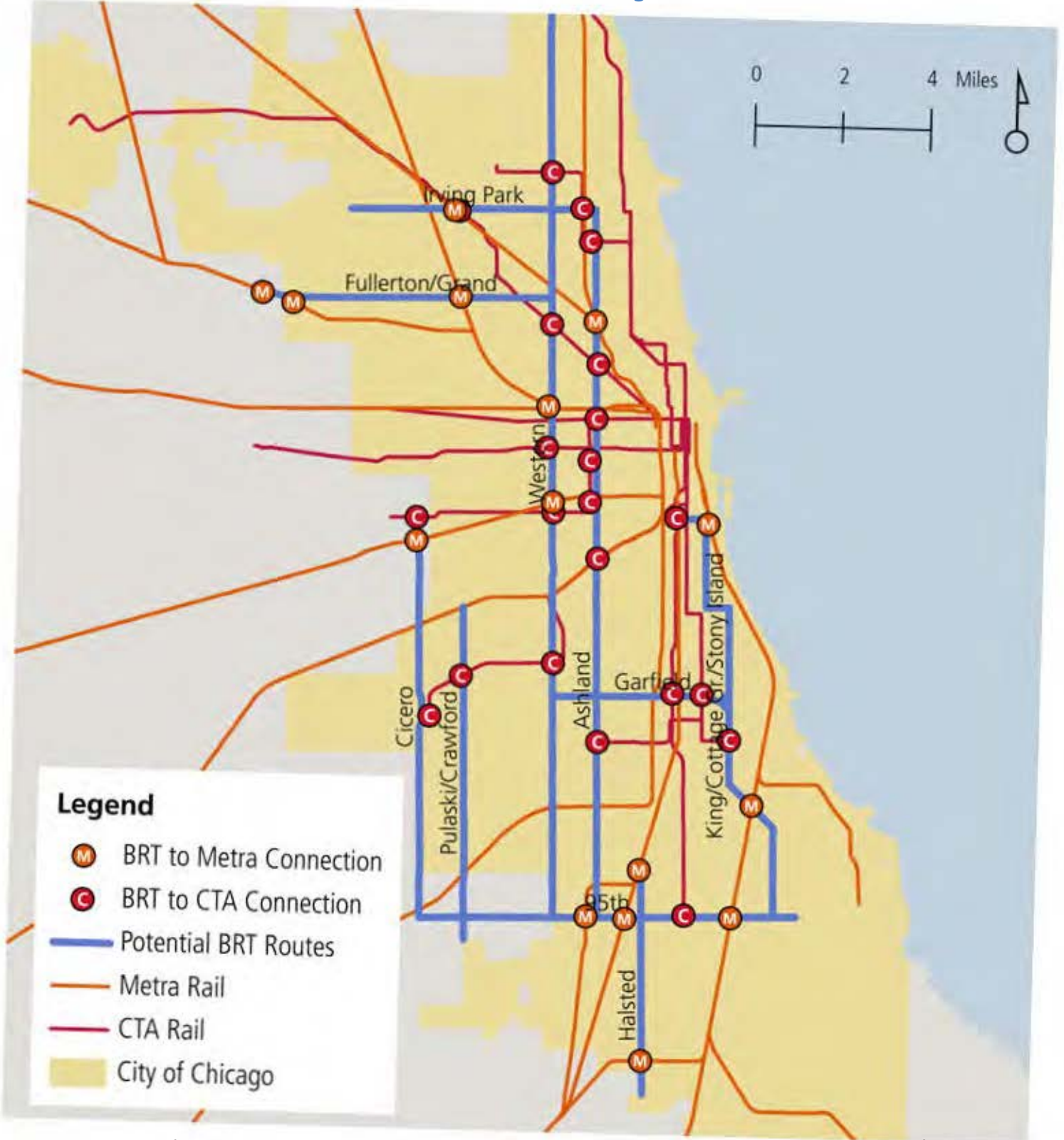
14

Livability measures considered in identifying worthy BRT routes (see page 10)

38%

Average cost of building one mile of BRT relative to one mile of light rail (see page 4)

FINDING: There are 10 recommended BRT routes for Chicago.



The BRT routes identified by the study connect with existing CTA and Metra rail to increase accessibility throughout the city, filling in the gaps of the downtown-centric, "hub and spoke" rail network.

WHAT IS BRT?

BRT has the advantages of rail at a fraction of the cost.

For a host of operational, cost and community development reasons, BRT is worth serious consideration by the Chicago region. It takes the best of rail – speed, limited stops, dedicated right-of-way, landmark stations – and puts it on the existing street grid, radically lowering construction cost. While heavy rail costs often exceed \$100 million per mile, and light rail costs approximately \$35 million per mile, BRT can often be built for a small fraction of that. The Cleveland HealthLine, for example, cost \$7 million per mile, while the Las Vegas MAX was only \$2.7 million per mile. BRT expands transportation choice, spurs community development, and improves travel time and peace of mind for transit riders. It has been gaining popularity in the United States and abroad (see case studies throughout) as a cost-effective solution for meeting the public’s growing demand for transit and livable communities.

The internationally accepted standard for a true BRT system has four main components.

1. **Dedicated lanes.** Instead of stopping and starting with the rest of traffic, BRT sails down the street in its own lane. This may divert some auto traffic into the remaining travel lanes, but drivers also have a better transit option at their disposal, and no longer have to contend with stop-and-go buses.
2. **Pay-before-boarding stations.** Rather than wait in a line of people standing at the bus door, passengers pay to enter the station, then simply get on the bus when it arrives, much like a train. This allows for much faster boarding.
3. **Level boarding.** The station platform is at the same level as the bus door. No stairs, just step (or roll) on and find a seat. Like a train car, many BRT buses have multiple doors.
4. **Signal prioritized intersections.** BRT systems are equipped with transponders that keep or turn traffic signals green for approaching buses, allowing them to continue through the intersection safely and without stopping.

The first component – dedicated lanes – plays the most significant role in determining where BRT is feasible (e.g., a wide right-of-way), but all four are essential to efficient system performance. Many BRT permutations exist, and no two systems are identical.

Transit Types by Average Capital Cost Per Mile

\$13.32

million

Bus Rapid Transit

\$35

million

Light Rail

\$96.25

million or more

Heavy Rail

Sources: Average of U.S. case studies presented throughout; survey of light rail projects in North America; and Colo. Dept. of Transportation white paper on heavy rail

BRT IN ACTION

Bogotá, Colombia

Dedicated lanes: **Yes** Pay-before-you-board stations: **Yes**
Level boarding: **Yes** Signal prioritization: **Yes**

TransMilenio, the BRT system in Bogotá, opened in 2000. With nine routes covering 54 miles, the system carries 1.4 million passengers per day, or more than 20 percent of the city’s total transit demand. The articulated, diesel buses carry 160 passengers each and travel in dedicated lanes. TransMilenio has reduced travel times in Bogotá by 32 percent and emissions by 40 percent. With the 2011 opening of the third phase, TransMilenio will expand to 80 miles of dedicated lanes and be capable of carrying nearly 2 million passengers per day.



Luis Molina

What is livability?

The Chicago Metropolitan Agency for Planning (CMAP) *GO TO 2040* plan defines “livability” in a community context:

“Livable communities provide safe, reliable and economical transportation choices, and promote equitable and affordable housing to increase mobility and lower the combined costs of housing and transportation. Through better access to jobs, schools, markets, and recreation, livable communities make the region more economically competitive.”

Both *GO TO 2040* and the federal Livability Principles stress that quality of life factors should be a central component in determining public investment at the community, regional, state, and federal levels.

BRT is synonymous with livability.

BRT is intertwined with livability, and the latter is used to prioritize investment in the former. People are not units of freight that are simply to be delivered to the right place at the right time. Transit planning must account for unique individuals’ needs to access work, schools, parks and stores. Transit systems move us to and from these places today, but often slowly or awkwardly. Fixed-guideway transit systems endure, and shape our communities’ growth, and should be planned with foresight. Transit can and should be the frame upon which we build future investments in housing, open space, and economic development. Done well, it will create more places to live, work and play, while stimulating greater ridership.

Both public and private investors are demanding more coordinated and sophisticated rationales before committing any funds. In the past, government spending was often driven by stand-alone purposes: build a road because someone said we need a road, build some affordable homes because we need those, too. The results did not always increase in value over time, nor did they benefit adjacent projects. Today’s investors are primarily interested in projects that will lay the groundwork for future economic growth, environmental sustainability, and social prosperity. These investments should increase in value over time by triggering additional, complementary development. Just building a road is no longer enough.

The FTA has challenged planners to develop measurable and substantive methods of using the six Livability Principles (detailed on page 9) to assess transit investment alternatives, including BRT. Doing so increases the Chicago region’s competitiveness for scarce federal funding.

A well-planned and well-executed BRT system can provide a framework for future investment in housing, open space, and economic development. Most importantly, development of BRT can spur job growth and redevelopment, enhance our existing transit system and roadways, and improve the lives of Chicago and suburban residents.



Streetcar Press

BRT IN ACTION

Eugene, Oregon

Dedicated lanes: **Some** Pay-before-you-board stations: **Yes**
Level boarding: **No** Signal prioritization: **Yes**

Eugene’s **Emerald Express (EmX)** line, which opened in 2007, was influenced by the success of Curitiba, Brazil’s BRT system. The four-mile line connects Eugene to Springfield, Ore., including 1.6 miles of dedicated lanes. Compared to the previous, local bus service, ridership has increased by 74 percent and speed has increased by 30.4 percent. Although EmX experienced some implementation challenges at first, the effects of BRT on travel time have been beneficial.

STUDY METHODOLOGY

Livability measures can and should be used to guide transit investment.

This study presents 10 potential BRT routes – selected to complement Chicago’s existing rail network – for further analysis and refinement. It also demonstrates, for the first time, that the six federal Livability Principles can be quantitatively and substantively measured to make transit investment and community development decisions.

This is not a route-specific engineering study, nor does it prescribe which BRT routes should be targeted first. Instead, it screens out impractical corridors from consideration, and offers prioritization scenarios – for instance, weighting access to parks more heavily than proximity to infill development opportunities, or vice versa. The study methodology greatly improves our ability to make wise transit investment decisions within the context of other public policy priorities such as Chicago Metropolitan Agency for Planning’s *GO TO 2040* plan, the Chicago Climate Action Plan, Reconnecting Neighborhoods, or the Chicago Housing Authority’s Plan for Transformation.

The study was done in four phases. Each phase of analysis eliminated a percentage of vetted routes, segments, or potential BRT routes from consideration due first to incompatibility with the physical demands of a true BRT system, and then to inconsistent livability scores. Each phase represents a finer level of analysis, moving from existing bus routes to street segments, then back to the feasibility of whole corridors, and ultimately to a practical, beneficial BRT network. The final phase modeled the potential ridership, mode shifts, and other effects of implementing the proposed BRT network. Building BRT alone could generate substantial new ridership, but BRT should not be built alone. It should be the framework for complementary public and private investment, which will only be realized through concerted planning efforts across sectors.

BRT IN ACTION

Pittsburgh, Pennsylvania

Dedicated lanes: **Yes** Pay-before-you-board stations: **No**
 Level boarding: **Yes** Signal prioritization: **Yes** (in Busway)

Pittsburgh’s **East Busway** BRT system began operating in 1983, and was expanded to cover 9.1 miles in 2003. This two-lane, dedicated, bus-only highway connects downtown Pittsburgh to adjacent neighborhoods and boroughs. The East Busway’s 34 routes save time by avoiding traffic and reduce congestion on other streets. Average weekday ridership is nearly 25,000, with annual ridership of approximately 7 million. Travel time decreased by 55 percent compared to previous bus service.



Port Authority of Allegheny County

All 154 CTA Bus Routes (2009)



120 Routes Passing to Phase II



Starting with all 154 CTA bus routes as of 2009 (top, in blue), Phase I eliminated any routes that would be inherently incompatible with BRT. The remaining 120 routes are depicted in red (bottom).

Phase I: Basic Suitability for BRT

BRT systems have unique characteristics and demands, necessitating a tailored approach to assessing their feasibility. BRT works best when it:

- travels within its own, dedicated lane;
- is long and straight; and
- connects to other transit modes, increasing access to and from the broader network.

Routes that turn a great deal, travel through narrow street sections, or eschew population and job centers will fail to deliver on the full promise of BRT. Pent-up ridership demand, which is traditionally used in making decisions to expand or upgrade transit, is an important determinant of whether a BRT route will be successful. However, it is not an indicator of construction feasibility. For instance, a narrow corridor with high ridership may well require some sort of transit enhancement, but BRT is probably not the best option because the corridor will not allow for a dedicated traffic lane or legitimate station.

Therefore, the analysis began by looking at constructability and other physical considerations. Starting with all CTA bus routes (as of 2009), Phase I removed routes that would be inherently incompatible with BRT, excluding certain existing bus routes from consideration. These include Lake Shore Drive segments of some routes, circulators, and special routes. Routes with significant service overlap were consolidated. Lake Shore Drive, for example, probably merits enhanced transit; however, the purpose of this study was to prioritize a small number of routes providing maximum community benefit. Given Lake Shore Drive's isolation, a BRT route along it would not deliver community redevelopment or other livability benefits. For similar reasons, this study did not consider BRT operating on expressways.

Special routes are identified as seasonal or temporary routes, short-run feeders, or routes that provide service for a limited customer base (e.g. circulator service for a university). Most circulator routes provide service within and directly adjacent to downtown Chicago. The unique challenges of providing a downtown circulator system are outside the scope of this study. Moreover, downtown Chicago is already well served by rapid transit. BRT should increase people's access to the region's rapid transit network, by complementing rather than duplicating it.

Phase II: Constructability and Livability

Taking the routes not eliminated in Phase I, we broke each route into relatively uniform segments, more or less corresponding to a city block. Each segment was first analyzed for width, then for livability benefits. The intent of Phase II was to eliminate street sections too narrow for BRT, with insufficient ridership, or scoring poorly in livability metrics. The result of Phase II was a preliminary set of feasible BRT corridors (see map, facing page).

Because true BRT requires a dedicated lane, right-of-way must be considerable. To be consistent with the Complete Streets philosophy – to accommodate BRT, traffic, parking, bike lanes, streetscaping, and comfortable sidewalks – a right-of-way must be at least 86 feet wide. This step greatly reduced the number of streets for further consideration. To include stations within the street’s median – the preferable location for reducing impacts on parking and provide safe options for left turns – the street must be at least 97 feet wide. The vast majority of Chicago street segments are narrower than this.

Thus, corridors with an overwhelming number of incompatible segments were eliminated. However, even the best corridors have pockets of insufficient width under bridges or at rail crossings. In that case, insufficiently wide segments were not eliminated if they were surrounded by otherwise appropriate segments. We selected three miles as a minimum length for a viable corridor in Chicago. In other words, the first part of Phase II indicates corridors where BRT *could* be built, rather than where it *should* be built.

After analyzing right-of-way, the remaining segments were analyzed through a livability lens. To do so, we created 14 quantitative proxies for the six Livability Principles (left) and analyzed

Sufficient Right-of-Way



The constructability part of Phase II identified streets with consistently sufficient right-of-way width over a minimum of three miles.

86-foot BRT Travel Right-of-Way



To incorporate all the features of a complete street, a minimum right-of-way width of 86 feet is required for BRT. This includes an ample sidewalk with greenery, a lane of parking, a comfortable bike lane, a lane for automobile traffic, and the separated BRT lane.

What are the Livability Principles?

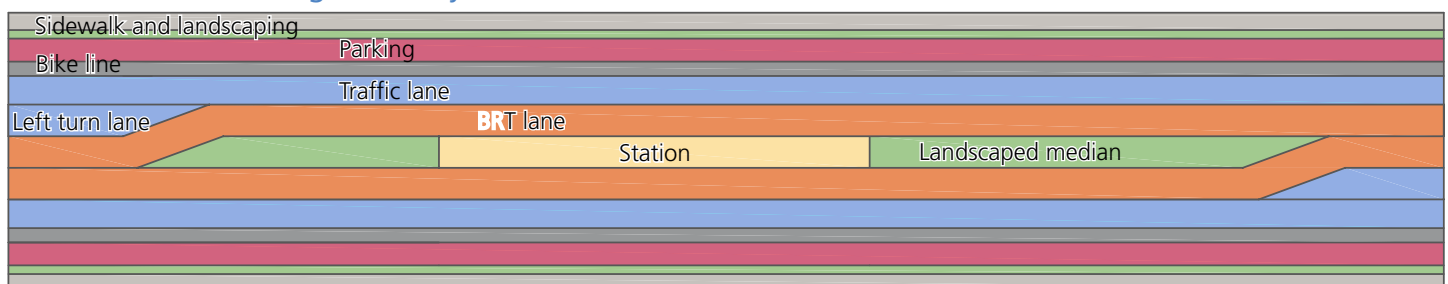
HUD, USDOT and USEPA use six Livability Principles to guide their joint decision making.

- 1. Provide more transportation choices.** Develop safe, reliable and economical transportation choices to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health.
- 2. Promote equitable, affordable housing.** Expand location and energy-efficient housing choices for people of all ages, incomes, races, and ethnicities to increase mobility and lower the combined cost of housing and transportation.
- 3. Enhance economic competitiveness.** Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services, and other basic needs of workers, as well as expanded business access to markets.
- 4. Support existing communities.** Target federal funding toward existing communities – through such strategies as transit-oriented, and mixed-use development, and land recycling – to increase community revitalization, improve the efficiency of public works investments, and safeguard rural landscapes.
- 5. Coordinate policies and leverage investment.** Align federal policies and funding to remove barriers to collaboration, leverage funding, and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.
- 6. Value communities and neighborhoods.** Enhance the unique characteristics of all communities by investing in healthy, safe and walkable neighborhoods – rural, urban, or suburban.

half-mile areas around each of thousands of street segments (or specific points, in the case of the two measures of existing transit performance), generating scores we used to compare the relative merits of each segment. It is important to note this stage of the process was not BRT-specific; a comparable process could be used for other types of transportation investments. The 14 criteria in this livability analysis, as well as the rationale and corresponding Livability Principle for each criterion, are listed in the table on the next page.

Each street segment was scored for each criterion using a percent-rank equation. Using this method, each street segment receives a rank based on its performance for each of the 14 criteria. Each of the 14 ranks is then divided by the total number of street segments to give a percentage score. The development of an overall score for each segment required that criterion of different units (e.g. annual retail sales, population, etc.) be converted to a comparable value (a percentage in this case). The percent-rank equation was a simple way to accomplish that requirement.

97-foot BRT Station Right-of-Way



Where stations are located, the minimum right-of-way width expands to 97 feet. This design leaves space for left turn lanes and landscaped medians, but the station could also be located closer to the intersection to facilitate pedestrian access.

Criteria for Livability Analysis

Criterion	Rationale for Selection	Study Measure	Main Corresponding Livability Principles* (see box, page 9)
1. Connectivity to Community Services	People need transit access to vital community services such as day care, vocational rehabilitation centers, and services for the elderly. These sites are also employment hubs.	Number of community destinations within a half-mile of street segments.	3 and 6
2. Connectivity to Educational Institutions	People of all ages need transit access to educational opportunities such as high schools, community colleges, and libraries. These sites are also employment hubs.	Number of educational institutions within a half-mile of street segments.	3 and 6
3. Connectivity to Entertainment	Transit access to cultural, entertainment and social destinations such as movie theaters and museums is a major quality-of-life benefit for many people. These sites are also employment hubs.	Number of entertainment destinations within a half-mile of street segments.	3 and 6
4. Connectivity to Food Stores	People need transit access to fresh food at grocery stores, produce markets, and other types of food stores. These sites are also employment hubs.	Total annual sales of food stores within a half-mile of street segments.	3 and 6
5. Connectivity to Major Medical Care	Patients and visitors need transit access to critical medical care at major hospitals. These sites are also employment hubs.	Number of hospitals within a half-mile of street segments.	3 and 6
6. Connectivity to Major Open Space	Transit access to outdoor recreational destinations can improve usage rates and health.	Number of community-level parks (more than 25 acres) and forest preserves within a half-mile of street segments.	3 and 6
7. Connectivity to Retail	People need transit access to retail opportunities to meet their shopping and socializing needs. These sites are also employment hubs.	Total annual retail sales at pedestrian-oriented businesses within a half-mile of street segments. Automobile-related businesses such as gas stations and auto dealers were omitted.	3 and 6

*The one Livability Principle not captured here is “5. Coordinate policies and leverage investment.” However, BRT could enhance the value or performance of past federal investments, from spurring market reactivation of EPA-funded brownfield sites, to improving a ready workforce’s connections to both training and employment opportunities. Additionally, BRT could provide a connective framework on which to “hang” investments. For example, future HUD-funded housing activities should align with a newly planned BRT route, to maximize livability benefits and minimize resident displacement due to increasing property values.

Criterion	Rationale for Selection	Study Measure	Main Corresponding Livability Principles (see box, page 9)
8. Employment/Job Access	Employees working in close proximity to BRT lines are a major group of potential riders, and BRT would increase their ability to live near work or live and work near transit.	Total employment at all businesses within a half-mile of street segments.	1 and 3
9. Existing Transit Ridership	Current bus ridership demonstrates existing demand for transit along the study routes.	Average passenger flow by street segment (controlling for direction) during the a.m. peak period.	1
10. Existing Transit Travel Time	Travel time reduction for passengers is a main function of BRT. It is important to identify routes where this benefit will be maximized.	Average passenger speed by street segment (controlling for direction) during the a.m. peak period.	1
11. Infill Development Potential	BRT could help infill development by increasing underlying property values, building station-area identity, and growing pedestrian activity.	Area of both properties with potential for redevelopment (defined by the Chicago Metropolitan Agency for Planning) and vacant properties within a half-mile of street segments.	3 and 4
12. Population	Residents living in close proximity to BRT lines are a major group of potential riders. BRT would increase their ability to live near work or live and work near transit.	Total residential population within a half-mile of street segments.	1 and 4
13. Population 1/2 Mile or More from Rail	Residents not currently well served by rail transit have a particular and pressing need for rapid transit service within walking distance of their homes.	Residential population within a half-mile of street segments that also live beyond a half-mile radius of existing fixed guideway transit (CTA and/or Metra).	1 and 2
14. Transportation Costs	BRT can help make overall housing costs more affordable by reducing the transportation costs associated with housing location.	Average household transportation costs as a percentage of household income within a half-mile of street segments.	2

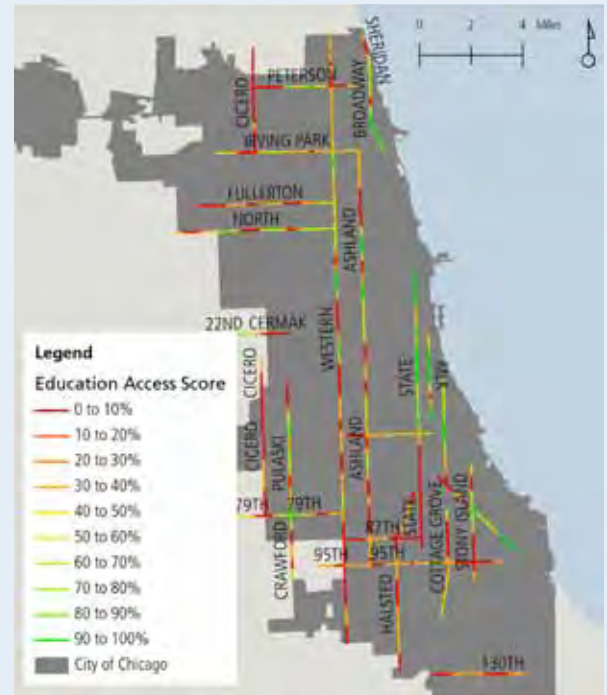
Analyzing the segments with these criteria provides 14 different ways of understanding the potential benefits of BRT. The maps at right show scores in terms of access to education (top) and population not within walking distance (one-half mile) of rail (bottom). There are overlaps, but also disparities. Segments that did not score above the median in any category were eliminated from further analysis, except where they connected with segments that scored well. The criteria used here are certainly not the only criteria we could have established, but we chose them because they:

- Can be easily replicated in Chicago and other cities, using data that are readily available.
- Are easily understood and clearly related to the potential benefits of transit enhancements.
- Cover issues of accessibility, equity of transit distribution, economic development, and system performance.
- Can be weighted in any number of different ways to reflect current policy goals.

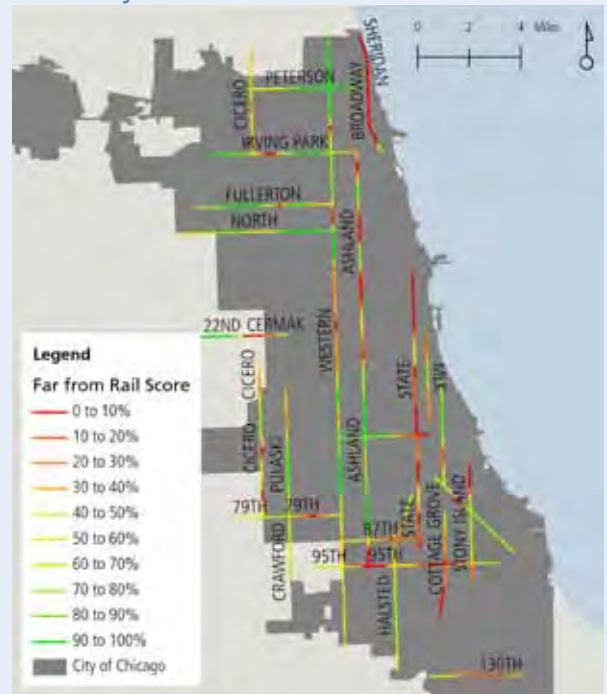
The next step was developing an overall score for each remaining street segment, expressed as a percentage, by taking a composite of the weighted individual scores of each criterion. Many scenarios are possible, depending on the weighting of the livability criteria. Subsequent use of this method may well entail different weighting to match the relevant policy goals of the project. In some cases meeting the needs of current ridership may be most critical, while in others the priority is meeting the needs of households and employers beyond easy walking distance of rapid transit options. We selected a balanced scenario with four general scoring groups:

1. **Access to important trip generators**
2. **Transit performance**
3. **Transit equity**
4. **Infill development potential**

Livability: Connectivity to Education



Livability: 1/2 Mile or More from Rail



Scoring results for two of the 14 livability criteria are shown, with green indicating a higher score. This segment-by-segment approach shows, for example, that a BRT route along Irving Park Road would provide minimal access to education, but serve a substantial ridership population without close access to CTA or Metra rail.

Livability: Weighting for Overall Score

Criterion	%
1. Connectivity to Community Serv.	3.59
2. Connectivity to Education	3.59
3. Connectivity to Entertainment	3.59
4. Connectivity to Food Stores	3.59
5. Conn. to Major Medical Care	3.59
6. Conn. to Major Open Space	3.59
7. Connectivity to Retail	3.59
8. Employment/Job Access	3.59
9. Population	3.59
10. Existing Transit Travel Time	16.17
11. Existing Transit Ridership	16.17
12. Transportation Costs	16.17
13. Population ≥ 1/2 mi from Rail	16.17
14. Infill Development Potential	3.00

Livability: Overall Score



The 14 livability criteria scores were weighted and combined to produce an overall “weak” or “strong” rating for each segment. Routes with an abundance of “weak” segments, such as State Street or Western Avenue south of 95th Street, did not advance to Phase III.

The first three scoring groups each contributed 32.5 percent of the score (for a total of 97 percent), while infill development contributed 3 percent (see table, left).

Infill development potential was given the lowest weight because of its uncertain relationship to the success of a BRT route. A corridor with a high number of infill development opportunities has long-term redevelopment potential, but lower prospects for immediate ridership. Having this data, however, allows planners and economic development professionals to easily identify clusters of undervalued land near BRT station areas to be target public and private investment. It may actually be more useful as an evaluation criterion after the fact, once transit corridors have been established, to plan future private and public investments in those corridors.

As shown at left, segments were identified as “weak” and “strong” based on whether they were below or above the median overall score. “Weak” segments were removed from the analysis unless flanked by several “strong” segments. Potential corridors or sections of potential corridors with an overwhelming number of “weak” segments were eliminated from further analysis. For example, the stretch of Cicero Avenue from Irving Park Road north to Chicago’s border was eliminated for consistently low scores, whereas the Pulaski Road corridor contained a handful of “weak” segments that were interspersed with a wealth of “strong” segments.

Phase III: Connectivity to Existing Transit

Phase III further narrowed the field of potential BRT routes. At the same time, a handful of segments previously eliminated were returned to consideration in order to create a more cohesive network. This included adding sections outside Chicago city limits.

This phase of the analysis used two criteria to further assess routes that passed Phase II. The first screen, which supports the “Provide More Transportation Choices” Livability Principle, analyzed the corridor’s integration with the existing rail network. This criterion counted CTA and Metra stations within 330 feet (approximately half a standard Chicago city block) from the proposed BRT route. This study only considered the physical connection to rail stations, not the different frequencies of service provided by CTA and Metra. Routes such as North Avenue that did not establish connections to existing rail transit stations were removed (the portion of North Avenue that connects to the CTA Red Line had already been excluded due to insufficient width). This study does not account for planned but not yet constructed rail service, such as the extension of the Red Line to 130th Street (a project MPC has supported with technical assistance to local stakeholders), or in-fill stations on the CTA Yellow Line. CTA or Metra might one day build new stations to connect with the BRT network shown here, but we did not include speculative locations in our analysis.

The second step in this phase reintroduced previously eliminated corridor options to facilitate better east-west travel and connectivity within the network. These corridors met the right-of-way demands, and thus could serve to connect the BRT network but, like Garfield Boulevard and portions of 95th Street, had been eliminated in the Phase II livability assessment. Likewise, potential BRT corridors along 95th Street, Cicero and Fullerton Avenues, and Pulaski Road were extended beyond the borders of Chicago to improve network connectivity. Additionally, a non-linear route was established to connect Stony Island and Cottage Grove avenues, Martin Luther King, Jr. Drive, and the CTA Red Line station at Cermak–Chinatown. While not straight, this BRT corridor scores high in livability, has ample right-of-way, and fills in the network.

BRT IN ACTION

Las Vegas, Nevada

Dedicated lanes: **Some** Pay-before-you-board stations: **Yes**
 Level boarding: **Yes** Signal prioritization: **No**

Las Vegas’s **Metropolitan Area Express (MAX)** line opened in 2004, operating alongside an existing bus line. Ridership increased 25 percent after the addition of BRT service. Based on MAX’s success, the **Strip & Downtown Express (SDX)** line opened in 2010, despite opposition from casino owners. Its vehicles are diesel-hybrid and are designed to mimic the interiors of low-floor, European trams. Both MAX and SDX continue to operate in tandem with local service, with combined headways as low as six minutes during rush hour.



Eric Weber

Recommended BRT Routes

Route	Length (mi)	Termini	Destinations
95th	8.6	S. Cicero Ave., Oak Lawn, Ill. S. Jeffery Blvd.	Advocate Christ Medical Center, Chicago State University, Oak Lawn Shopping Center
Ashland	16.1	W. Irving Park Rd. W. 95th St.	Riverside Square, Rush University Medical Center, Malcolm X College
Cicero	9.1	W. 21st Pl. W. 95th St.	AMC Showplace Cicero 14, Midway International Airport, Ford City Mall
Fullerton/Grand	6.6	N. 75th Ct., Elmwood Park, Ill. N. Western Ave.	Hanson Park, Riis Park, Brickyard Mall
Garfield	4.7	S. Western Ave. S. Cottage Grove Ave.	University of Chicago, Washington Park, Hope College Prep High School
Halsted	5.1	S. Vincennes Ave. W. 127th St.	Fernwood Park, Fenger Achievement Academy, West Pullman Library
Irving Park	5.6	N. Austin Ave. N. Ashland Ave.	Lake View High School, Horner Park, Market Place at Six Corners
King/Cottage Grove/Stony Island	10.6	W. Cermak Rd. E. 95th St.	McCormick Place, University of Chicago, Washington Park, Bronzeville Children's Museum
Pulaski/Crawford	7.6	I-55 W. 99th St., Evergreen Park, Ill.	Hancock College Preparatory High School, Richard J. Daley College
Western	20.6	Howard St. W. 95th St.	DeVry Institute of Technology, Saints Mary and Elizabeth Medical Center, Dan Ryan Woods

The 10 BRT routes mapped on page 3 are detailed here, including route length, termini, and some of the major destinations along the route.

The first three phases of the study identified the 10 most feasible routes for BRT in Chicago (as shown on the map on page 3). This network of corridors not only is possible from a construction perspective, but BRT investment in it would increase connections to the existing rail network, and result in greater accessibility to community amenities, improved transit equity, and enhanced livability. Gaps in east-west and north-south travel are filled, satisfying the long-standing goal of making it easier to move throughout the city without going through the Loop.

Some of the routes identified here likely would not be identified or prioritized for rapid transit enhancements by standard transit planning metrics (existing ridership and travel time). Our hypothesis, however, is areas rich in community amenities and development potential, but poor in access to rapid transit, would demonstrate significant demand in a transit demand model. Significant positive results would bolster the argument that livability criteria could and should be used in screening potential corridors for transit improvement. They would simultaneously serve to excite and inspire local officials, businesses and residents about the possible community development and quality of life benefits of transit investment. In the final phase of the study, the 10-route network was analyzed for potential demand, travel time savings, and traffic impacts in the final phase of the study.

CONCEPTUAL RENDERINGS

Garfield Boulevard at CTA Green Line



before



The Garfield CTA Green Line station is currently surrounded by undeveloped lots and shuttered storefronts. The proposed Garfield BRT line would create rapid connections from this area to the University of Chicago Medical Center, CTA Red Line, and proposed BRT routes on Western, Ashland, and King/Cottage Grove/Stony Island.

The addition of BRT service could catalyze in fill development, bringing more shops, restaurants, and services to the neighborhood. (These conceptual renderings are intended to show how BRT could improve the streetscape and character of a neighborhood, and are not meant to accurately represent engineering or design details.)

Western Avenue at Chicago Avenue



after



Running for 20 miles on Western Avenue, between Howard Street on the north and 95th Street on the south, the Western BRT line would dramatically improve north-south transit service on the west side of the city. It would connect to existing stations on both branches of the CTA Blue Line, and Orange, Green and Brown lines, as well as Metra's BNSF

Railway, North Central Service, and Milwaukee District North and West lines.

MPC thanks **Booth Hansen** for its assistance in creating these renderings.

Phase IV: Modeling Demand for BRT

To assess possible demand for BRT, MPC enlisted the Chicago Metropolitan Agency for Planning (CMAP), which made use of its standard package of Emme/2 travel demand modeling, ArcInfo GIS, and SAS statistical software. This step was not included to justify BRT with high ridership numbers, but to demonstrate that including livability measures in a prioritization process can result in substantial ridership gains.

It is important to note the model does not account for land use changes, residential or employment density shifts, or changes in adjacent property values. A significant, citywide investment in the BRT network proposed here would undoubtedly affect all of those. Ideally, private investors would concentrate new growth at station areas, and the public sector would locate new services or investments there as well. The community and economic development potential of BRT is one of the primary motivators behind this report. However, these factors cannot be accounted for in the modeling results. BRT routes passing through lower density or underdeveloped neighborhoods, as a result, tend to produce underwhelming demand numbers. Often, though, they are the same neighborhoods that score very high on livability criteria, particularly those dealing with a lack access to transit or community amenities. MPC believes that rather than wait for people to come, then provide transit, we should instead invest in a comfortable, efficient and safe transit network that will encourage the people to come.

The model is based on travel behavior of people collected through surveys over the past 40 years, and is used to estimate what people will do when faced with transportation choices – in this case, removing a driving lane in each direction to create a dedicated BRT lane, and simultaneously altering local bus service. The model looks beyond the specific BRT corridors, giving some idea of ramifications of enhanced transit service within Chicago for people traveling to or from other parts of the region. In all cases, the model reflects morning rush hour operations, often the busiest time of day for transit networks.

BRT IN ACTION

Cleveland, Ohio

Dedicated lanes: **Yes** Pay-before-you-board stations: **Yes**
 Level boarding: **Yes** Signal prioritization: **Yes**

Cleveland's **HealthLine**, in operation since 2008, covers 6.8 miles and connects the city's cultural and educational institutions, medical centers, and a rapid transit line. There is more than \$4 billion in new development and redevelopment along this corridor. Travel time has improved by an estimated 25 percent, while ridership has increased by 47 percent since the line opened. The hybrid-electric vehicles used on the line are powered by clean diesel engines and electric transmissions that reduce particulate emissions while dramatically improving fuel efficiency. The corridor also includes dedicated bicycle lanes.



Cleveland Regional Transit Authority

Garfield BRT Route and Stations



The Garfield Boulevard BRT route was modeled with nine stations, including connections to the CTA Red and Green lines, and three other potential BRT routes: Western, Ashland, and King/Cottage Grove/Stony Island.

The behavioral inputs from the surveys and the outputs of the modeling process provide estimates on:

- Total trip generation (including driving and transit)
- Trip destination distribution
- Preferred mode of travel
- Network assignment (route preference)
- Congestion effects on roadways

Demand Model Assumptions

Service Factor	Assumptions
Headway (Between buses)	5 to 10 minutes (peak)
	12 to 15 minutes (off-peak)
Station Spacing	2 stations per mile
Average Speed	20 mph (for 20 second dwell)
	15 mph (for 30 second dwell)
Dwell Time (In station)	20 seconds
	30 seconds

To perform the demand modeling, certain assumptions were made about performance and station location.

The modeling process considered the entire 10-route network, not each route individually or in any particular sequence. The performance of any given transit line, whatever the mode, will improve if it connects to another transit line, as the increase in speed and accessibility makes each of those lines more attractive to riders. This is a clear case of the whole being greater than the sum of its parts. However, because the entire network was modeled simultaneously, it complicates performance assessment of each route in the network.

To run the model, we had to make some assumptions on station locations and system performance (see table, left). Stations require at least 97 feet of right-of-way, and the more stations, the slower the system will run (see the Appendix for detailed maps of station locations for all routes). Stations were placed approximately every half mile, or four city blocks, with some variation to account for right-of-way. The map above shows hypothetical stations along the Garfield Boulevard BRT corridor, including two CTA rail lines, three other BRT corridors, and the University of Chicago’s employment complex and cultural amenities.

For system performance, we assumed BRT, running in its own dedicated lane, would move at a conservative average speed of 15 mph, including the dwell time at each station for boarding and alighting. In some cases, this is approximately twice the speed of existing local bus service. It is entirely possible BRT would actually go much faster than this, perhaps as high as 20 mph on some routes, but 15 mph was a reasonable starting point. Faster service would increase BRT’s attractiveness, and likely increase demand figures. Given that the model was performed for the morning peak period, we assumed a five-minute headway spacing between BRT buses. Finally, we modeled two scenarios: one in which local bus service on the BRT routes was cut in half, and one in which it was cut entirely. Due to constraints with the demand model, the transit demand results for these two scenarios were nearly identical. As a result, we will only discuss the results of the second scenario (BRT and no local bus service).

The modeling results validate our hypothesis that livability measures can and should be used in screening corridors for enhanced transit service. Total trips (car and transit) with both ends in the BRT corridors increase by approximately 1.4 percent daily. The faster speeds, shorter gaps between buses, and better connections with transit make travel within the corridors more attractive, regardless of mode. People seeking goods or services along these corridors now have better access to them, which means they do not need to go elsewhere. In some cases, total trips beginning in one of the BRT corridors and ending somewhere else in Cook County (or vice versa) decrease, largely because of an increase in local trips. Conversely, better transit speed and accessibility along the BRT corridors also make some suburban-to-city travel easier and more efficient, so both Lake and McHenry counties show trip increases to the BRT corridors.

The total number of transit trips also increases. Transit trips with both ends in the BRT corridors increase by approximately 40,000 daily, or 13.8 percent. By increasing transit options within these BRT corridors, transit options within

40,000

Additional transit trips every day that begin and end within the BRT corridors

13.8%

Additional transit trips every day that begin and end within the BRT corridors

71,000

Additional transit trips daily throughout the entire region, thanks to BRT

1 mph

Decrease in average automobile traffic speed when a lane is dedicated to BRT

BRT IN ACTION

Los Angeles, California

Dedicated lanes: **Yes** Pay-before-you-board stations: **Yes**
 Level boarding: **Yes** Signal prioritization: **Yes**

A part of the Metro Liner system in Los Angeles County, the **Orange Line** opened in 2005, and services 14 stations on its 14.2-mile route. The line has average weekday boardings of about 23,000 and nearly 600,000 boardings per month. The 60-foot, articulated vehicles are powered by compressed natural gas and travel in a dedicated right-of-way. Orange Line stations include sidewalk-level platforms, canopies, public art, and park-and-ride lots. They are long enough for two buses and equipped with passenger information displays.



Los Angeles County Metropolitan Transportation Authority

Modeled Trip Lengths

Trip length (minutes)	Change in daily trips with BRT (and no local bus service)
0 to 10	+11,073
10 to 20	+17,386
20 to 30	+35,769
30 to 40	+7,318
40 to 50	-6,882
50 to 60	-3,314
60 to 70	+5,683
70 to 80	-5,945
80 to 90	-4,513
90 to 100	+330

Adding BRT service (and removing local bus service) generally shortens transit trips. Some of these represent pre-existing transit users who will benefit from shorter trips, while others represent new transit users.

the whole region become more attractive, and regional transit trips actually increase by a larger total number, 71,000, or 3 percent. As noted above, for many suburban residents working in Chicago, or Chicago residents working in the suburbs, the BRT network modeled here has substantial benefit. In the morning rush hour, there are sharp increases in transit trips with destinations in the BRT corridors and origins in suburban Cook (1.6%), Kane (5.4%), Kendall (6.9%), Lake (30.0%), and McHenry counties (147.3%). There also are gains in transit trips from the BRT corridors to suburban Cook (4.0%), Kane (16.2%), McHenry (18.3%), and Will (2.0%) counties. Faster and more reliable connections with CTA and Metra rail play a large part in these ancillary benefits.

The model indicates that as many as 7,000 daily drivers within the BRT corridors could convert to using transit. Transit mode share for trips beginning and ending in the BRT corridors increases from 12 to 13.5 percent; for trips with one end in the BRT corridors, it increases from 14.7 to 15.8 percent. Total regional transit mode share increases as well.

While total transit trips increase, their distribution in terms of length of time shifts significantly. For travel time savings, the shift to BRT results in more short transit trips and fewer long trips. The biggest percentage gain is in transit trips of between 10 and 20 minutes, which increase almost 28 percent. Some of these are totally new trips, some are pre-existing trips with shorter trip lengths.

Given that a lane of traffic was removed in each direction on all 10 of the modeled corridors, it is not surprising there is an effect on roadways in the BRT corridors. The mode shift from driving to transit use results in 2 percent fewer vehicle miles traveled in the BRT corridors, which is a positive benefit. However, the model also suggests a 1 mph decrease in average traffic speed, from 17 mph to 16 mph and, as a result, a 4 percent increase in vehicle hours traveled. Vehicle hours traveled during periods of congestion – largely the morning and evening rush hours – increase more, by approximately 16 percent. For the



African Goals

BRT IN ACTION

Johannesburg, South Africa

- Dedicated lanes: **Yes**
- Level boarding: **Yes**
- Pay-before-you-board stations: **Yes**
- Signal prioritization: **Yes**

South Africa's first BRT system, **Rea Vaya**, was launched in 2009 and expanded in 2010 for the FIFA World Cup. The BRT trunk route is fed by local buses that share a ticket and fare structure. The service operates from 5 a.m. to 11 p.m., with three minute headways during rush hour. The system faced fierce opposition during planning and construction from local taxi drivers, many of whom were eventually offered jobs as bus drivers. BRT has tripled bus ridership in the city, and more than a million people now commute by bus every day.

region as a whole, however, the lane reductions on the 10 BRT corridors have almost no impact.

This is not, however, an argument against BRT with dedicated lanes. As noted above, the model did not account for anything other than the removal of a travel lane and increase in transit service and speed. There are many traffic enhancements, including signal optimization or congestion pricing, that could be used in conjunction with BRT to mitigate these impacts on congestion.

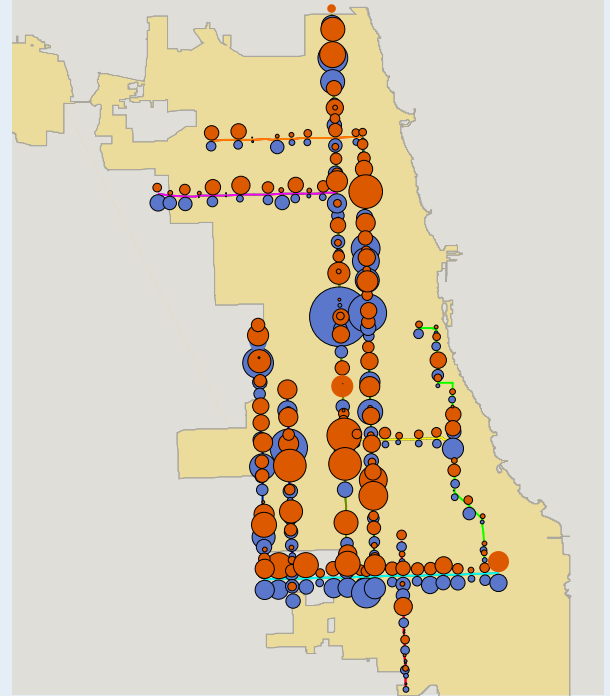
The maps here illustrate the relative transit demand for the 10-route network (during the morning rush hour period). Over a day, the boardings and alightings would be approximately equal because most people will make the return trip using the same route. Given no changes in land use, population, employment density, or private or public investment, the routes in decreasing order of modeled ridership demand would be:

1. Western
2. Ashland
3. 95th
4. Cicero
5. Pulaski/Crawford
6. Fullerton/Grand
7. King Drive/Cottage Grove Avenue/Stony Island Avenue
8. Garfield
9. Irving Park
10. Halsted

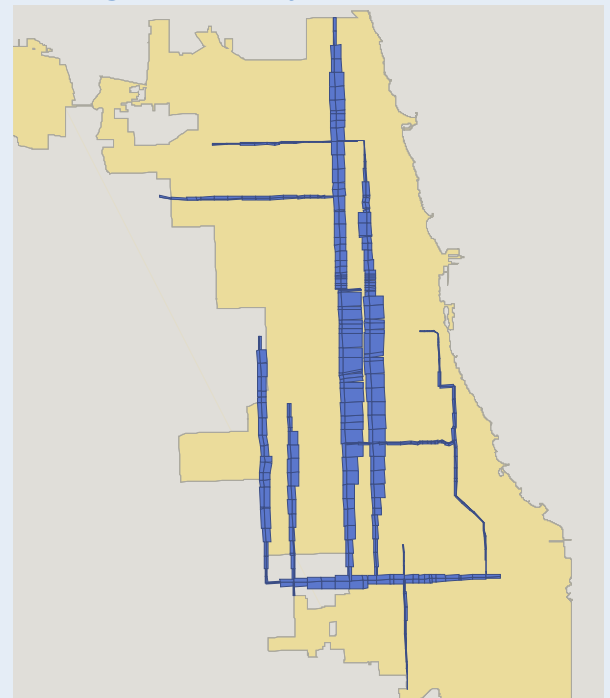
It is our belief that investment in BRT would trigger changes in land use, population and employment density, as well as private and public investment. The total number of riders, as well as demand along each corridor, would likely rise in proportion to that community investment. For this reason, it is important to consider routes with lower modeled demand. The addition of BRT service could help these corridors – which scored strongly on the livability criteria – grow into their full potential.

Again, the modeled ridership numbers are significant because they demonstrate that livability measures can be considered without substantially undermining ridership. It cannot be overstated that these figures assume the addition of BRT only, with no complementary investment in businesses, homes, schools, parks, or anything else. In this model, vacant lots stayed vacant. That is not our BRT vision. Instead, BRT must be planned in concert with other public and private investment to be successful and meet its full potential.

Boarding and Alighting (a.m. rush)



Passenger Volume by Direction (a.m. rush)



Demand models illustrate relative volumes of boarding (orange) and alighting (blue) by stop (top map), as well as total passenger volume by direction of travel (bottom map). A thicker line indicates higher passenger volume.

NEXT STEPS



A conceptual rendering of a station on the Garfield Boulevard BRT line.

Where We Go from Here

BRT is exciting city officials, business leaders, and residents – particularly those who know they waste valuable time, money, and good humor sitting in traffic. Yet to build a BRT network that revitalizes neighborhoods, we have to start looking at transit opportunities differently. The federal government has shifted from a “spending” to an “investment” mindset, prioritizing projects that spur additional investment by private firms, philanthropies, and local government. Moreover, public investments must increase in value over time – more transit opportunities, enhanced economies, stronger communities. To produce those results, we must plan for them as we screen opportunities for public spending. With transit, it means assessing where people are and where they want to go, whether they have equal ability to get there, and where new lines and stations have the best chance to breathe fresh life into struggling neighborhoods. The screening method we have developed is an earnest and innovative attempt to make that assessment.

Investment in BRT, and in transit more generally, should be done in concert with other improvements in traffic signal timing (one of the four critical elements of BRT performance), congestion pricing for roadways and parking facilities, employer and employee incentives for transit usage, and land use shifts and new development along

the BRT corridors. These measures will lead to behavioral changes not accounted for in the transit demand model results described here. That said, BRT is no silver bullet for the region’s congestion woes. It must be implemented as part of a comprehensive regional traffic gridlock mitigation plan. The primary benefits of BRT are improved accessibility and community development, which greatly offset any negative outcomes in traffic congestion. Finally, drivers would always have the option of converting to transit usage and, over time, many would.

Chicago can move and grow faster if we can make investment decisions better. Accomplishing both goals will require cooperation between the public and private sectors on such issues as construction financing, system operation, and station area development. Success also depends on inclusive, purposeful community engagement and neighborhood planning throughout the city and region. Ultimately, whether Chicago can achieve its economic, environmental and equity goals will come down to whether we can agree that livability is both the means by which investment opportunities should be scrutinized, and the ends for which investments are made.

APPENDIX & RESOURCES

Web Appendix

To view the appendix, including maps of scoring results for all 14 livability criteria and maps detailing proposed station locations for each of the 10 BRT routes, visit:

metroplanning.org/brt

Additional Resources

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Since 1934, the Metropolitan Planning Council (MPC) has been dedicated to shaping a more sustainable and prosperous greater Chicago region. As an independent, nonprofit, nonpartisan organization, MPC serves communities and residents by developing, promoting and implementing solutions for sound regional growth.



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