



Appendix F: Signature Transit Analysis

Bus Rapid Transit and Streetcar Evaluation

Previous and current evaluations (including this Transportation Plan Update) have revealed Ann Arbor's desire and ultimate potential to introduce high-quality transit to the city. As a result, an evaluation of other cities' experiences with streetcar and bus rapid transit was completed in order to gather ideas on what needs to be done in order to successfully implement such a project.

Much of the current interest in high-quality transit projects for small and medium-size cities begins with Portland, Oregon. The Portland Streetcar was completed in 2001 and proved to be a successful demonstration of a small-cost high-capacity transit project. Since that time many cities around the US both big and small have explored streetcars and bus rapid transit (BRT) as transit and development tools in their own communities. This memo examines both streetcar and BRT projects in various stages of development in several cities. The memo points out the ways in which each of these cities projects resembles and differs from Ann Arbor. Many of the cities discussed have a major university, and in a few of these the university is as culturally dominant as the University of Michigan is in Ann Arbor. Included here is a discussion of information on the capital and operating cost of the systems (where data was available) and other characteristics of the systems. Also included is a preliminary discussion of the growing body of information on the development effects of transit investment and the relative development benefits of streetcars versus BRT systems.

Streetcar Systems & Plans

Eight systems with streetcar plans at various stages were evaluated for this document.

The cities evaluated include:

- Ames, Iowa
- Atlanta, Georgia
- Austin, Texas
- Columbus, Ohio
- Grand Rapids, Michigan
- Little Rock, Arkansas
- Madison, Wisconsin
- Portland, Oregon

Ames, Iowa

Population: 51,557

Ames is home to Iowa State University (ISU). Enrollment at ISU is 25,462 undergraduate and graduate students, while the campus covers 1,984 acres. Unlike Ann Arbor, where campus and downtown blend together, in Ames there are physical barriers between downtown and campus even though the campus is only 1.2 miles from downtown.

The transit provider in Ames is CyRide, which is funded jointly by the City of Ames and ISU. Unlike Ann Arbor, which has a separate city and university bus system, CyRide provides all of the bus service both on-campus and throughout Ames. CyRide bus routes typically run on 20 to 30 minute headways, although the frequency for routes through ISU increases both in frequency of individual routes and frequency due to routes combining through campus.

CyRide commissioned the Ames Transit Feasibility Study, which was delivered to the agency in June 2007. The study looked at five corridors and two study areas. While fixed guideway transit was not the sole purpose of the study, two of the corridors in the study did consider both BRT and/or streetcar.

Corridor 1 runs between Iowa State Center and Iowa State's central campus, at a length of 1.67 miles. Any transit improvement would replace CyRide's current Orange Route, which has a daily ridership of 8,100. The feasibility study considered both bus rapid transit and streetcar alternatives. According to the feasibility study, Corridor 1 is the highest priority corridor based on ridership. The study recommends that BRT version of Corridor 1 could qualify for a Very Small Starts project, based on existing and projected ridership and relatively low cost of BRT project. It makes no recommendations on where local funding would come from.

Corridor 1 BRT Cost

- Estimated BRT construction cost – \$5.83 million (including vehicles and 1.02 miles of exclusive busway)
- Estimated BRT cost of \$2.53 million per mile without vehicles, \$3.49 million per mile with vehicles

Corridor 1 Streetcar Cost

- Estimated Streetcar construction cost - \$51 million (including vehicles and double tracked)
- Estimated Streetcar cost of \$19.67 million per mile without vehicles, \$30.85 million per mile with vehicles

Corridor 2 runs between downtown Ames and Iowa State's central campus. The proposed streetcar option in this corridor would run between 1.9 and 2.1 miles, based on alignment. However, the study also notes low demand between downtown Ames and ISU central campus. As a result, this corridor is the second lowest priority corridor in the Ames Transit Feasibility Study. The study concludes that based on low ridership demand and high capital cost, Corridor 2 would not qualify for an FTA New Starts grant.

Corridor 2 Streetcar Cost

- Estimated between \$43 and \$81 million based on alignment (variance based on structure needed to cross railroad tracks).
- Estimated Streetcar cost of \$17.87 – \$34.45 million per mile without vehicles, \$22.82 to \$38.95 million with vehicles

CyRide is the implied operator for all fixed guideway services suggested in the report.

As of January 2008 there is no information on whether CyRide will move forward with either Corridor 1 or Corridor 2.

Atlanta, Georgia

Population: 486,411

The City of Atlanta is unlike Ann Arbor because it sits at the center of a large and sprawling metropolitan area of 5.1 million people. And unlike Ann Arbor, where University of Michigan dominates higher education, Atlanta is home to numerous universities spread across the city, including Georgia Tech, Georgia State, and historically black Spelman College and Morehouse University.

City leaders in Atlanta are proposing a streetcar line to run along the city's main north-south thoroughfare, Peachtree Street. The stated goal is to make Peachtree Street a "glittering urban thoroughfare similar to those found in New York and Chicago."

The proposed line would run approximately five miles one way in mixed traffic along Peachtree. Costs are estimated at \$190 million, with funding proposed to come from a special tax district along Peachtree Street. The City of Atlanta has also pledged \$47.5 million for capital costs. The special district is a divisive issue amongst property owners on Peachtree, mostly because it includes businesses and multifamily homes like condos, but excludes single family homes in neighborhoods only a few blocks off the line.

Because the idea is in the early stages, specifics such as stations, number of vehicles, and headways have not been studied, and no recommendations have been made.

Austin, Texas

Population: 715,893

Austin, Texas is a much larger city than Ann Arbor, with a population of 715,893. But what Austin does have in common with Ann Arbor is the flagship university of the University of Texas at the heart of the city. UT-Austin has an enrollment of 49,696 undergraduate and graduate students. Similar to the University of Michigan's Central Campus, the UT Austin has a campus size of 350 acres located adjacent to downtown Austin.

The combination of university campus and vibrant downtown has led to important congestion and accessibility issues for the City of Austin. Capital Metro, the transit provider for the Austin region, embarked in the early 2000s on a study entitled *All Systems Go Long Range Transit Plan*. This study recommended a host of improvements, including commuter rail, bus rapid transit, and a streetcar circulator. The study assessed ways to improve the transit system in order to give citizens of Austin more options when commuting to downtown or to the UT Austin campus.

The commuter rail project, Capital Metrorail, was approved by voters in a referendum in November 2004, with construction of the initial corridor commencing in 2005 and finishing in 2008. The project took a lightly used freight rail corridor and upgraded it for commuter rail service running from the north suburbs to both the UT campus and downtown Austin.

The bus rapid transit project, Capital Metrorapid, improved the efficiency on heavily traveled bus corridors by adding articulated buses, implementing traffic signal priority, and constructing user-friendly stations. As of January 2008, the first phase of the Capital Metrorapid project was approximately 80% complete, with completion expected by 2009.

In order to tie these transit corridors together, Capital Metro also studied the feasibility of a downtown and campus circulator. This study looked at the feasibility of a circulator system running in mixed traffic to get patrons to where they want to go around central Austin, including downtown, the state capitol complex, and UT Austin campus.

The length of the circulator was estimated at four miles in length. The circulator study assessed both a streetcar and bus option, and concluded the following:

Streetcar Circulator

Ridership – 11,500

Capital cost – \$229,407,000*

Operating and Maintenance costs (per year) – \$5,807,700*

Development Investment – \$1,000,000,000* by 2017

Bus Circulator

Ridership – 7,600

Capital costs – \$29,337,300*

Operating costs - \$4,411,900*

Development Investment – none discernable

* All money is in 2006 dollars

As of January 2008 the streetcar circulator was selected as the locally preferred alternative, although the project has not applied to the FTA for funding. Currently Capital Metro is studying funding options and looking for public/private partnership opportunities to develop the streetcar circulator.

Columbus, Ohio

Population: 733,203

While the City of Columbus has a much larger population than Ann Arbor, Columbus is similar to Ann Arbor in that Ohio State University – the flagship university for the State of Ohio – is located within the city limits. Ohio State has an enrollment on its Columbus campus of 52,568 undergraduate and graduate students. The OSU Columbus campus covers 1,755 acres.

The idea for a streetcar route (or routes) in Columbus comes from local community members and downtown business owners. The Downtown Columbus Streetcar Working Group (DCSWG) – a working group with backing from Mayor Colman and Columbus City Council – has explored the idea of bringing a streetcar to Columbus, including routing options and funding sources. The working group has identified routings (including capital costs) and looked at preliminary ridership estimates along the preferred corridor.

Two issues not clear are what agency would operate the streetcar and the potential participation of COTA, the local transit provider in Columbus. COTA recently conducted their own fixed guideway transit study, which looked at light rail, bus rapid transit, and streetcar options. The COTA study concluded that a light rail project in Columbus would not meet FTA guidelines, and ultimately recommended a no build option. While COTA is supportive of the streetcar, they have not actively participated in the planning of streetcar lines in Columbus. It should be noted that the streetcar as proposed by DCSWG would run between downtown and OSU in the same corridor as studied in the COTA project.

Preliminary funding sources identified for a streetcar project include the City of Columbus, the State of Ohio, Mid-Ohio Regional Planning Council, and the FTA. A feasibility study or alternatives analysis with regard to qualifying for federal funds has not been completed.

Three routes have been proposed by the DCSWG, with all three prominently serving downtown Columbus. All costs are in 2006 dollars. In addition, the cost analysis assumed streetcar stops would be in the median and would require median modifications during construction.

High Street Line

- Line would connect downtown Columbus to close-in German Village neighborhood (south of downtown) and Short North neighborhood (north of downtown).
- 2.1 miles served (4.86 miles of proposed track).
- Estimated capital costs between \$66 and \$81 million (including vehicle cost).
- It is estimated 10 streetcar vehicles would be needed, at a cost between \$11 and \$13 million.

OSU Line

- Same routing as High Street Line, but with extension north of Short North neighborhood to serve OSU campus.
- 3.4 miles served (7.13 miles of proposed track).
- Estimated capital costs range between \$102 and \$132 million (including vehicle cost).
- It is estimated 15 streetcar vehicles needed, at a cost between \$17 and \$19 million.

"Z" Line

- Idea for a circulator route through downtown Columbus.
- Miles served (3.7 miles of track).
- Estimated capital costs range between \$42 and \$51 million (including vehicle cost).
- It is estimated four streetcar vehicles needed, at a cost between \$4.5 and \$5.5 million.

A further idea is to combine part (or all) of the Z line routing with the High Street routing. It is unknown at this time whether the routing ideas suggested by the DCSWG will be moved forward to a feasibility study.

Grand Rapids, Michigan

Population: 197,800

While Grand Rapids has a number of college campuses within its city limits, including Calvin College and a branch of Grand Valley State University, it does not have a large flagship institution that relates to the city like the University of Michigan relates to Ann Arbor. However, Grand Rapids was analyzed because it is located in Michigan and thus would encounter similar governance, institutional, and funding environments as Ann Arbor.

The local transit provider in Grand Rapids is The Rapid. The Rapid has taken the lead in forming the Public Transportation Tomorrow (PTT) Task Force. The PTT Task Force has hired a consultant and commenced in November 2007 to study the feasibility of a streetcar line running through downtown Grand Rapids.

In January 2008 the PTT Task Force selected a preliminary routing through downtown Grand Rapids on Market and Monroe streets, connecting the Belknap-Monroe North neighborhood, Grand Rapids Medical Mile, downtown, and The Rapid's Central Station. This routing is 1.55 miles in length.

Information on potential ridership, service frequency and track routing, or the overall costs of the project for the selected corridor are expected by the end of the study.

While the specifics of this initial routing are unknown, the PTT Task Force has stated their intention to build a streetcar spine through downtown that would be able to be extended to the north, south, east, and west parts of Grand Rapids in the future as ridership and development make such an expansion feasible.

Little Rock, Arkansas

Population: 184,422

Little Rock, Arkansas is similar to Ann Arbor in size, although the dominant economy in Little Rock is the state government and not a major research university. The city is home to the University of Arkansas at Little Rock, which has an enrollment of 12,000 undergraduate and graduate students.

The local transit provider is the Central Arkansas Transit Authority (CAT). CAT constructed the River Rail streetcar and opened the system 2004. Unlike a commuter based streetcar built to provide daily transit service, the River Rail system is considered a heritage streetcar. The streetcar connects visitor points of interest in both downtown Little Rock and North Little Rock.

The River Rail was initially a 2.5 mile loop, although this was extended to 3.4 miles in 2006. Headways on the service are roughly every 30 minutes. The capital cost of constructing the initial system was \$19.5 million, and this included the cost of vehicles. The 0.9 mile extension had a construction cost of approximately \$7.6 million. The vehicles used on the system cost approximately \$750,000, and according to the National Transit Database, CAT owns four streetcar vehicles.

Some residents and politicians in Little Rock would like to extend the streetcar to larger destinations such as the Arkansas State Capitol and the Little Rock airport. However, as of January 2008 no study has been initiated for an extension of the system.

Madison, Wisconsin

Population: 223,389

Madison is similar to Ann Arbor in many ways, including the location of a large flagship university in the University of Wisconsin-Madison, and a well-developed bicycle, transit, and pedestrian network throughout the city. Madison, however, has a larger political and legal economy, being the state capital of Wisconsin, and it is also almost double the size Ann Arbor in population. The University of Wisconsin-Madison has an enrollment of 41,466 undergraduate and graduate students, and its campus is 933 acres in area.

Ideas for high capacity transit have been studied in Madison since the early 1990s, at first focusing on light rail and then on commuter rail. The latest study is entitled Transport 2020, and is being sponsored by the City of Madison, Dane County, and the Wisconsin DOT

(WisDOT). The Transport 2020 study focused utilizing lightly used rail corridor for commuter rail within the Greater Madison Metropolitan Area. However, early alternatives of commuter rail included portions running on the street through downtown Madison.

Streetcars in Madison were an offshoot of the Transport 2020 program, and a City committee was formed by Mayor David J. Cieslewicz in late 2005 to study the idea of a streetcar in downtown Madison. The study proceeded throughout 2006, and the committee selected three corridors for further study emanating from the State Capitol for approximately three miles in the east, west, and south directions.

Each corridor alignment was selected partly because of redevelopment opportunities along the route:

- The south corridor runs on Park Street, including Meriter and St. Mary's hospitals and the UW-Madison campus and ends at the Villager Mall
- The east corridor includes the east Isthmus and ends at Union Corners
- The west corridor extends to Hilldale Mall, including the UW-Madison campus, UW-Medical Center, and the University Avenue corridor

Eventually the streetcar idea gained momentum, and the Mayor proposed to put the streetcar issue onto the ballot in spring 2007 so that voters could approve money to formally study the streetcar idea through a feasibility study. A backlash against the streetcar by citizens led the mayor to withdraw the idea before it could be put to a vote. The backlash was not just driven through concerns on costs of the study, but also by people in Madison who wanted to see regional commuting issues addressed before considering another form of transit. The vote never occurred and as of January 2008 the information has been removed from the City of Madison website.

Portland, Oregon

Population: 568,380

Portland, Oregon and Ann Arbor do not have a lot in common when comparing cities. Portland is the central city of a major metropolitan area (metro population: 2.1 million), and does not have a major flagship university like the University of Michigan at its center. What Portland does have is the most successful new streetcar system in the United States.

Portland's streetcar is not a new idea, having first been suggested in the 1970s as a downtown circulator when city leaders were looking for ways to mitigate automobile congestion with transit improvements. The idea for regional light rail system to enable commuters to access downtown without their cars was also considered. The light rail planning and construction was carried forward by the regional transit provider TriMet. The result was the highly popular and successful MAX light rail system, which began operations in the mid 1980s.

Despite light rail's popularity in Portland, TriMet and city leaders did not forget the streetcar idea. By the late 1990s, with the MAX system mostly completed, city leaders began to suggest a streetcar line to connect close in neighborhood residents, tourists, and light rail commuters with destinations in the immediate vicinity of downtown. The result was the Portland Streetcar, which began operations in 2001.

The Portland Streetcar as it was originally constructed consisted of a 4.8 mile loop from Portland State University through downtown Portland and back. Construction of this portion

was from 1999 to 2001, and cost approximately \$57 million. The construction cost came almost entirely from local sources, with only \$5 million coming from the federal government. What also made construction unique was the minimal amount of disruption to the city. A special type of rail which can be laid in the street without substantial digging or disruption of utilities allowed for a quick and relatively painless construction process.

Capitalizing on the success of the original loop, three extensions were planned and constructed between 2001 and 2007: Riverplace extension, Lowell extension, Gibbs extension. The Riverplace extension cost approximately \$16 million for a 0.6 mile extension, and opened in 2005. The Gibbs extension cost approximately \$15.8 million for a 0.6 mile extension, and opened in 2006. Finally, the Lowell extension was completed in 2007, and featured a 0.6 miles extension of the line for approximately 13.8 million dollars.

TriMet and the City of Portland are also planning a much larger extension that would cross the Willamette River to the east side of Portland. The extension is in the planning stages, but consists of a 3.3 mile extension at the cost of \$146 million dollars. As of 2008 TriMet has applied for an FTA grant, but it has not been approved by the Federal government. If approved, construction could begin in 2008, with operations commencing in 2011.

The biggest success story with the Portland Streetcar may not be the actual transit, but the redevelopment that has occurred due to the transit investment. According to the Portland Streetcar website, as of January 2006 over \$2.28 billion has been invested within two blocks of the streetcar line. Thus, for the \$102 million invested in the initial streetcar line, vehicles, and extensions, development and redevelopment in Portland has paid back 22 times the original investment.

Table F-1 below summarizes each of these projects in tabular format.

Table F-1: Streetcar Projects

Streetcar Projects	City Population	Est. Size & cost	Est. Opening Date	Alternative Financing Needed?	TOD Important?	Comments
Ames, IA	51,557	1.67 miles \$51M				No decision by local transit operator on whether to move forward. Corridor includes both streetcar and BRT options.
Atlanta, GA	486,411	5 miles \$190 M		New special taxing district	Yes	Would run in mixed traffic along Peachtree Street. Tax district excludes single family homes.
Austin, TX	715,893	6 miles (estimate) \$250M	2012	Yes	Yes	Actually more like LRT. Agency looking for bond issue in 2008.
Columbus, OH	733,203	3 miles \$64-84M, w/possible 2 nd phase 5-miles \$179 M	2012	Yes	Yes	
Grand Rapids, MI	197,800	3 track-miles (estimate)			Yes	Currently being studied. Identified routing is from downtown transit center through downtown and hospital area.
Little Rock, AR	184,422				Probably	RFP out for extension of north end of system to airport
Madison, WI	223,389	3 lines totaling 15 miles				Project stopped in spring 2007 by Mayor. Desire by citizens to focus on commuter rail project.
Portland, OR east side line	568,380	3.3 miles \$146 M	2011	Yes	Yes	Currently applied for FTA grant, but no approval yet. Would run across Willamette River to Portland's east side.

Bus Rapid Transit (BRT) Systems & Plans

Eight systems with bus rapid transit (BRT) plans at various stages were evaluated for this document.

The cities evaluated include:

- Boston, Massachusetts
- Cleveland, Ohio
- Eugene, Oregon
- Grand Rapids, Michigan
- Kansas City, Missouri
- Las Vegas, Nevada
- Los Angeles, California
- Oakland, California
- Vancouver, British Columbia

This overview of BRT in various cities illustrates the variety of projects – many partly funded by the FTA – that have been developed under the name bus rapid transit. The term is flexible enough to include systems ranging from fully grade-separated lines virtually indistinguishable from light rail, to buses operating in mixed-traffic with minimal operational and cosmetic improvements to right of way and/or station stops.

Boston, Massachusetts

Population: 590,763

The idea for BRT in Boston came out of demolition of the Washington Street Elevated line in the late 1980s. The Massachusetts Bay Transportation Authority (MBTA) tore down the line because a replacement subway line was constructed two miles west of Washington Street, and because maintenance costs on the old line were very high.

A result of the loss of the Washington line was that residents of the area saw their transportation times dramatically increase. The MBTA looked at several solutions to increase accessibility within the corridor, including a new subway line beneath Washington Street and a surface-running trolley. Eventually MBTA decided to construct a BRT line along Washington Street from Roxbury to downtown Boston.

At the same time as the Washington Street issue was being considered, the MBTA was also considering ways to give better access to Logan International Airport. MBTA coordinated with Federal, State, and Local officials on the Central Artery/Third Harbor Tunnel Project (the “Big Dig”) to include an exclusive bus lane in the Ted Williams Tunnel, which would allow buses to run from downtown to the airport terminal.

From these two separate projects emerged the idea for MBTA’s Silver Line BRT line. The concept of the Silver Line was to run BRT along Washington Street to downtown, then from downtown out to Logan Airport. Currently, however, the Silver Line is in two unlinked sections.

The Washington Street portion finished construction in 2002 and runs 2.2 miles in a dedicated lane on Washington Street between the Dudley Square station in Roxbury to the Downtown Crossing station in downtown Boston. The capital cost of this project was \$27.2

million, or \$12.4 million per mile (2002 dollars). There are 13 stations on this route, and the entire trip takes approximately 16-21 minutes. Buses on the Silver Line run at a very high frequency. Buses run every four minutes during the AM and PM peaks, with a mid-day frequency of eight minutes and an off-peak frequency of 12 minutes. The buses are rubber-tired single-articulated coaches that run on compressed natural gas (CNG).

The Waterfront section, between downtown's South Station and Logan Airport, finished construction in 2004 at a cost of \$601 million, or \$148.4 million per mile. This section of the Silver Line uses dual mode electric trolley buses. From South Station they run in an electrified tunnel and exclusive right of way to the Silver Line Way station. At that point the buses switch to diesel mode for the trip in the Ted Williams Tunnel to Logan Airport. There are eighteen stations/stops on this route, including one at each of the terminals at Logan Airport. Buses run every ten minutes during the daytime, with nighttime frequencies of 15 minutes.

Redevelopment has occurred on both completed portions of the Silver Line. According to a FTA report published in 2005, a total of \$1.2 billion in development (both new construction and renovation) has occurred in the seven years between the beginning of planning in 1997 and the opening of the line in 2004.

The future plans for the Silver Line are currently open for debate. Originally the MBTA planned to link the two sections with a 1-mile underground tunnel underneath downtown Boston. However, after receiving an unfavorable recommendation from the FTA, MBTA has not moved forward with the project. The estimated cost for the tunnel was \$780 million (2005 dollars). As of February 2008 it is unknown whether MBTA plans to link the two Silver Line sections. Instead of a tunnel, it has been suggested to run buses on surface streets between the two points. There is some opposition to this for a variety of reasons. Some critics point out surface buses may not have the cache to be considered bus rapid transit, while others argue that traffic congestion could mitigate any time savings on other parts of the trip.

Cleveland, Ohio

Population: 478,403

For many years the Greater Cleveland Regional Transit Authority (GCRTA) and the City of Cleveland planned a link between downtown Cleveland and University Circle, two high-use activity hubs located some five miles apart. University Circle, sometimes described as Cleveland's second downtown, is a dense neighborhood with education, medical, and cultural destinations. Plans dating from the 1930s through the 1960s envisioned a subway line beneath Euclid Avenue connecting the two sites.

When the idea to develop a major transit improvement along Euclid revived again in the 1990s, the GCRTA and Cleveland refined their proposal through the FTA Alternatives Analysis process into a BRT line due to the high cost of the proposed subway. This line, known locally as the Euclid Corridor Project, was proposed to run in special bus lanes along Euclid Avenue with BRT stations located in the median of the avenue. While Cleveland is much larger than Ann Arbor, the Euclid corridor project is similar to Ann Arbor in that it will serve the downtown area and will also link the two largest academic institutions in the city (Cleveland State and Case Western Reserve Universities) and the most prestigious hospital complexes (Cleveland Clinic and University Hospital).

The final BRT line, as designed, will run for 6.7 miles along Euclid Avenue between Public Square (downtown) and University Circle, and then on to the Windermere Rapid Transit Station in East Cleveland. Thirty-six stations are proposed between downtown and the Windermere. Stations between downtown and University Circle will be in the median, while those in other areas will be on the sides of Euclid Avenue. The line will use special articulated coach buses (the same type of coach as used in Eugene, Oregon) with diesel-electric engines. Fare payment will be through the honor system, with patrons purchasing tickets at vending machines located at each station and fares enforced by on-board officers.

Just as important to the project as the infrastructure improvements is the streetscape improvements and design. A goal of the Euclid Avenue Corridor Project was to provide new sidewalks, a new tree-lined median, and pedestrian lighting in order to make Euclid a pedestrian-friendly corridor.

The timeline for the Euclid Corridor project was more than ten years from the initial alternatives analysis to completion. Planning for the project occurred between 1997 and 2000. Preliminary engineering and final design occurred between 2000 and 2005. Construction started in 2005, and is expected to be completed in 2008. While some stretches of Euclid have already opened to buses, full service on the line is expected to commence by mid-2008.

The overall cost of the project is projected at \$168.4 million, or approximately \$25.1 million per mile. Approximately \$82.2 million of the capital funding came from the Federal Transit Administration, with the rest being made up of local, regional, and state sources. It is estimated that operating costs will be approximately \$1.03 million annually.

Development and redevelopment along the corridor has been emphasized by GCRTA and the City of Cleveland. The City has a program of small loans and grants to stimulate business development on Euclid Avenue. The GCRTA estimates a total of \$1.3 billion in development has occurred since the beginning of construction in 2005, with more planned after the line opens in the summer of 2008.

Eugene, Oregon

Population: 153,690

The city of Eugene, Oregon is a city of similar size to Ann Arbor and is home to the University of Oregon (UO). UO has 20,000 undergraduates and graduates, and their campus is 280 acres in size. Also similar to Ann Arbor, the UO campus is located adjacent to Eugene's downtown.

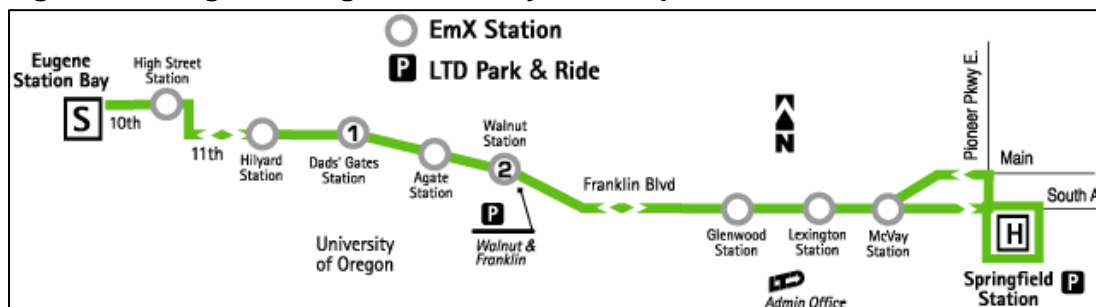
The transit provider for the Eugene area is the Lane Transit District (LTD). In 1996 LTD and the City of Eugene began discussions about future transit service, including a potential light rail line. In the late 1990s, BRT became the favored alternative for high capacity transit because (in the words of the LTD website) "it is appropriate in scale and cost for a community our size." In 2001 voters approved new funding for LTD, including capital funds to construct a BRT line on Franklin Boulevard.

The first BRT line for LTD opened in 2007 as the EmX Green Line. The line includes dedicated bus lanes for approximately 60% of the route, special stations and distinctive vehicles. Six vehicles were purchased for the initial construction of the Green Line. The

vehicles are hybrid-electric powered and cost \$960,000 apiece. Total cost of the project was \$24 million, with \$19.2 million provided by the FTA, a cost of \$6.7 million per mile.

The EmX Green Line corridor connects the downtown Eugene transit center with the UO campus and the Springfield transit center along Franklin Boulevard. Springfield and Eugene Oregon are similar to the relationship between Ann Arbor and Ypsilanti, and Franklin Boulevard is similar in some respects to Washtenaw Avenue between Ann Arbor and Ypsilanti. The Green Line runs approximately 3.6 miles on Franklin Boulevard between Eugene and Springfield. Buses run every ten minutes during the daytime, with 20 minute frequencies at night. LTD currently does not charge a fare for riders on the EmX, since most riders are either transferring from another route, or working at UO or Sacred Heart Hospital, which offer free transit passes to workers. Ridership was 50% higher than expected during the first month of operation, and as of February 2008 surpassed the 20 year forecast for ridership.

Figure F-1: Eugene, Oregon Transit System Map



Future expansion plans for the EmX include the Pioneer Parkway corridor, which is currently being constructed by LTD and is scheduled to be completed in 2010. The estimated construction cost of this extension is \$37 million (\$29.6 million provided by the FTA) for the 3.9 mile length of the corridor, a cost of \$9.5 million per mile.

LTD also began a study in 2007 to examine the feasibility of an EmX extension into West Eugene along the West 11th Avenue corridor. As of February 2008 the Alternatives Analysis for this corridor has not been completed.

Grand Rapids, Michigan

Population: 197,800

In 2002 the local transit provider in Grand Rapids, The Rapid, launched the Great Transit Grand Tomorrows (GT2) Study. This study was an alternatives analysis for transit in the US 131 freeway corridor south of downtown Grand Rapids.

In 2007 the outcome of the study was the selection of bus rapid transit on Division Avenue as the locally preferred alternative (LPA). The proposed corridor will run for 9.87 miles between 60th Street and Central Station in downtown Grand Rapids. Division Avenue runs parallel to US 131 and will offer commuters an alternative to using the freeway to access downtown Grand Rapids. There are 19 proposed stops along the route, with buses proposed to run every ten minutes during peak periods and every fifteen minutes during off-peak periods. Portions of the corridor will include dedicated lanes with an off-board fare collection system. However, final engineering has not been completed for the project.

Similar to Ann Arbor, Grand Rapids is a regional destination with medical and institutional facilities. The proposed BRT corridor will connect to high employment areas, including Grand Rapids Community College, the Health Hill Medical Corridor, downtown, and The Rapid's Central Station. Because Division Avenue parallels US 131, there should be easy access between the freeway and park and ride lots at the southern end in order to intercept commuters.

The project is estimated to cost \$40.1 million, or \$4.06 million per mile in construction costs. The estimated operating cost is \$2.4 million per year. The FTA has approved the project as part of the Very Small Starts funding program. Of the total cost, the FTA has given \$16.8 million to the project. The other \$31.3 million is the responsibility of state and local sources. As of June 2008 this money has not been secured.

Kansas City, Missouri

Population: 447,306

In 2005 the City of Kansas City, Missouri and the Kansas City Area Transportation Authority (ATA) launched their first BRT line. The BRT line is branded as the MAX in order to distinguish it from ATA's other bus routes. The MAX buses have a distinct color scheme and are outfitted with GPS units for real-time updates of bus position, but are otherwise similar to other ATA buses.

The route for the MAX Main Street is 6 miles long, running from downtown Kansas City along Main Street to the upscale residential and commercial County Club Plaza area. There are 26 stations served by the line. All of the stations feature a permanent structure and are named in order to make the stops on the line more recognizable. The stations are barrier free, and fares are collected on the bus. The stations are also unique in that they feature ITS message boards with updates on when the next bus will arrive.

Buses run at 9-minute frequencies during the AM and PM peaks, with 15 minute frequency during mid-day and 30 minute frequency at night.

In terms of infrastructure improvements, 3.75 miles of the route are in exclusive bus lanes. The system also utilizes traffic signal priority at 31 intersections along the route. The final cost to construct the MAX Main Street line was \$21 million, with \$16.8 million coming from the Federal Transit Administration. The capital cost for the corridor was approximately \$3.5 million per mile for the MAX Main Street line.

ATA also has future plans to expand the MAX system. The original Main Street BRT line is envisioned as a spine line, with feeder BRT lines connecting to the main line. Currently a BRT expansion project is being studied along Troost Avenue on Kansas City's south side. The study projects design in 2008, with operations beginning in 2009. The project is estimated to cost \$30.7 million in capital cost, with an FTA share of \$24.6 million for the project, including \$125,000 for 2009.

Las Vegas, Nevada

Population: 552,539

In Las Vegas transit service is provided by Citizens Area Transit (CAT). In 2004 CAT put in place BRT service, called MAX, on Las Vegas Boulevard North. Although Las Vegas Boulevard North had the fourth highest ridership of all CAT routes, it was selected because

the boulevard had an extra vehicular lane that could easily be converted into a dedicated bus lane without generating discomfort for auto drivers. Service in the corridor is also augmented by local bus service.

The MAX runs for approximately seven miles from the Downtown Transportation Center to Nellis Air Force Base northwest of downtown Las Vegas. Bus frequencies are every 12 minutes during the day and every 20 minutes at night.

There are 22 stations on the route, although these include both northbound and southbound stations which are not necessarily directionally across from each other. Fares are paid by vending machines at each station and riders are on the honor system when boarding the bus. Fare officers randomly check passengers for their ticket throughout the day. Because of this, boarding is faster and more efficient than on other CAT routes.

Typical of BRT, the MAX features five (out of seven total) miles of dedicated bus lane and also includes traffic signal priority. The MAX also employs hybrid diesel-electric vehicles in a distinctive paint scheme. The vehicles are articulated coaches and have a capacity of approximately 131 passengers (sitting and standing) per vehicle.

The cost of the Las Vegas Boulevard North line was \$20.3 million, or \$2.8 million per mile (all in 2004 dollars). Operating costs for all of 2007 was \$3.2 million. Ridership in July 2007 was estimated at 197,411 for the month, or approximately 6,300 passengers per day.

Los Angeles, California

Population: 3,849,378

The Los Angeles County Metropolitan Transportation Authority (LACMTA) runs a large system of bus and rail routes throughout Los Angeles County. The Orange Line, opened in 2005, is viewed by LACMTA as an east-west extension of their rapid transit system into the southern San Fernando Valley.

The Orange Line runs along exclusive right of way in an abandoned rail corridor. In this way the Orange Line can be compared to the vision of running buses or trains along the Ann Arbor Railroad alignment through the southern portion of Ann Arbor. The abandoned rail corridor was originally acquired by LACMTA in 1991 to be used to build a rail transit line. A 1991 state law prohibited LACMTA from any construction other than a deep bore subway for the corridor, but a county proposition also passed in 1991 restricted LACMTA from using their local funding for subways. As a result, LACMTA was unable to build any sort of rail in the corridor and revised their plans to BRT for the corridor.

Construction on the line began in 2002, with the official opening in August 2005. The line runs for 14 miles and has 13 stations. Construction costs were \$318 million (2005 dollars), or \$22.7 million per mile. The Orange Line uses 60-foot long articulated buses that use compressed natural gas for fuel. Each bus has three doors for faster boarding at each of the stations. Tickets for the Orange Line are purchased at vending machines located at each station, and passengers are on the honor system.

The Orange Line corridor crosses many surface streets through its route. Signalization equipment along the line is coordinated with roadway signals that balance green times for cars with efficient through movements for buses. The number of buses that LACMTA can run is limited because of the interaction between the Orange Line and surface streets and

the fact that the system tries to balance traffic green times with bus movements. Operating more buses would mean reducing green time for intersecting roadway traffic.

As of February 2008 LACMTA is facing an overcrowding issue with Orange Line buses. The Orange Line has an estimated daily ridership of 23,000. Many of the riders on the Orange Line ride for the entire corridor and connect to the LACMTA Red Line at the North Hollywood station.

Several solutions have been suggested to relieve overcrowding on the line. One suggestion is to run longer, high-capacity buses along the route, but this is currently prohibited under California law. Another solution proposed would be to upgrade the corridor to light rail, which could handle higher volumes than buses. However, the interaction with surface streets would remain unless a grade separated system is constructed.

Oakland, California

Population: 415,492

Transit in Alameda and Contra Costa Counties, including the City of Oakland, is provided by AC Transit. AC Transit's vision is to run "rapid bus" on their highest ridership corridors. The rapid bus has limited stops (spaced approximately every 2/3 of a mile). Eventually, AC Transit would like to convert their rapid bus lines into full BRT lines.

In 2003 AC Transit launched their first rapid bus line on San Pablo Avenue, labeled the 72R. On the San Pablo line there are 26 stations, which also accommodate slower local service. The routing for the 72R is approximately 13 miles, from downtown Oakland to Contra Costa College in San Pablo. In terms of frequency, the 72R BRT service runs in dedicated bus lanes at 12 minute intervals throughout the day, with no schedule. Instead buses run with traffic and arrive at stops as quickly as they can.

A second rapid bus line entered into service in 2007. This line, labeled Route 1R, runs on Telegraph Avenue, International Avenue, and 14th Street between downtown Oakland and Berkeley. There are 37 stations on the line, which runs for approximately 16 miles between Berkeley BART and the Bay Fair BART station, via downtown Oakland. The 1R route also runs at 12 minute frequencies all day, with service between 6 AM and 7 PM. According to the preliminary documentation for the Major Investment Study for the corridor, the 1R rapid bus line had a projected construction cost of between \$85 and \$95 million.

AC Transit is currently preparing final environmental documentation for the FTA to convert the Route 1R into a full bus rapid transit line. The estimated capital cost for this is \$245 million dollars, or about \$15 million per mile. It is unknown when funding would be approved or when construction would start on this improvement.

Vancouver, British Columbia

Population: 611,869

Prior to 2001 congestion on the main arterials linking Vancouver and the large suburb of Richmond had slowed bus trips between the cities. A bus rapid transit solution for the corridor had been discussed, first by BC Transit and their successor agency TransLink, but never acted upon. Finally, political support in the mid-1990s allowed a new bus rapid transit line to open in 2001 along the Granville Street/No.3 Road corridor between Richmond and Vancouver.

The route, known locally as the 98-B, employs the use of a dedicated bus lane in order to run more efficiently through congested streets. Other BRT features on this line include new stations, the purchase of new vehicles, and the use of GPS for real-time bus locations and traffic signal priority. The vehicles used for the route are 60-foot articulated buses with low-floor boarding. The cost of the new 10-mile BRT line was \$69 million including vehicles (2001 US dollars), or \$6.9 million per mile.

Very quickly after the 2001 launch the 98-B became the most used bus route in the TransLink system. There are approximately 18,000 boardings per day on the route. The line has a total of 19 stops in each direction. Frequencies are every 6 minutes during the AM and PM peak and 7-8 minutes during off peak conditions. It has been estimated that the savings in trip time is 8 minutes in each direction.

What is captivating about the 98-B route is how quickly the BRT line became obsolete. After opening in 2001, in just five short years TransLink began construction on the Canada Line rapid transit line, connecting the Vancouver Airport, Richmond, and downtown Vancouver. The overwhelming ridership success of the 98-B and the impending 2010 Winter Olympics gave TransLink the opportunity and funding needed to construct the extension of Vancouver's SkyTrain system. In essence, the 98-B was a placeholder for the more expensive and higher capacity system. Had the 98-B not been constructed, with its high ridership, it is unclear if the political will to build the estimated CDN \$1.72 billion line would have existed. However, the 98-B demonstrated to politicians that the ridership existed within the corridor and that a rapid transit line could be successful.

Table F-2: Bus Rapid Transit (BRT) Projects

BRT Projects	City Population	Est. Size (length & cost)	Est. Opening Date	Alternative Financing Needed?	TOD Important?	Comments
Boston, MA Silver Line, Washington Street	590,763	2.2 miles \$27.2 M	Now			
Boston, MA Silver Line, Waterfront	590,763	4.0 miles \$601 M	Now			
Boston, MA Downtown tunnel	590,763	1.0 miles \$780 M	unknown			Construction on tunnel to connect the two existing portions of Silver Line is on hold (est. cost of \$780M in 2005 dollars).
Cleveland, OH	478,403	6.7 miles \$168.4 M	2008		Yes	Estimated operating cost of \$1.03 M annually
Eugene, OR	153,690	3.6 miles \$24 M	Now			Looking to expand in 2009 – new 3.9 mi corridor
Grand Rapids, MI	197,800	9.87 miles 40.1 M	unknown			Corridor has FTA Very Small Starts funding, but needs local match
Kansas City, MO Main Street MAX	447,306	6 miles \$21 M	Now			
Kansas City, MO Troost MAX	447,306	\$30.7 M	2010			Final design of Troost Corridor in 2008-09
Las Vegas, NV	552,539	7 miles \$20.3 M	Now			2007 operating costs of \$3.2M annually Ridership of 6,300 passengers per day
Los Angeles, CA	3,849,378	14 miles \$318 M	Now		Yes	Capacity issues on line – either need bigger buses or perhaps grade separation. Redevelopment occurring at North Hollywood Station (east end of line)
Oakland, CA	415,492	Route 1R: 16 miles \$100 M	2012?			Rapid bus lines on two corridors. AC Transit is looking for funding to upgrade to full BRT.
Vancouver, BC	611,869	10 miles \$69M (US)	Now			With high ridership on line, transit provider Tri-Link decided to upgrade corridor to SkyTrain automated rapid transit. Construction should be complete by 2010 Winter Olympics.

Streetcar and Bus Rapid Transit Development Opportunities

The link between transit and development opportunity has been proven many times over in various research documents and studies. However, most of these studies deal with higher-capacity modes of transit such as heavy rail rapid transit, light rail, and commuter rail.

Since the year 2000, the idea of flexible, cost effective transit systems in the form of bus rapid transit and streetcars has spread across the country. Many systems have been proposed and several have been implemented. Because these systems are relatively new and new development and land use intensification take years to occur, it is difficult to gauge the full impact of streetcar and bus rapid transit service on surrounding development. It is much easier to find information on proposed circulators and corridors than it is on systems that have been built. Further complicating the streetcar/BRT development issue is the question of how much development would have occurred even without the transit being built.

That being said, it is clear that transit does have some impact on when and where development occurs. The construction of transit (along with favorable land-use regulation along a corridor) can catalyze development and direct it towards those areas serviced by transit.

This text assesses the claimed impact of transit on development dollars for four different projects built recently in the US, two streetcar projects (Portland, OR and Little Rock, AR) and two BRT projects (Cleveland, OH and Boston, MA).

Streetcar Development

The first modern streetcar in the United States was constructed in Portland, Oregon and opened in 2001. Between 1997 (when the alignment was identified) through the end of 2005 it is estimated by the City of Portland's Department of Transportation that \$2.2 billion has been invested in new construction and redevelopment within two blocks of the streetcar alignment.

When compared with the construction cost of \$73 million for the original streetcar line and one extension opened in 2005, the development multiplier for the Portland Streetcar system is 30.1. Meaning, for every dollar spent on capital construction, 30.1 dollars were spent in new development.

Since 2005 other legs have been opened, but the value of development along these alignments has not been estimated. Because of the benefits of agglomeration, the development dollars invested along these new portions will benefit not only from the newly constructed portions of the system, but also from the fact that a comprehensive streetcar system goes to many parts of the city.

Little Rock, Arkansas opened their heritage streetcar line in 2004. The Little Rock system operates differently from the one in Portland, providing less service oriented to commuters and more frequent service during times of the day and months of the year oriented to recreational uses and visitors to the city—service is more frequent in the evening, weekends and during the summer. These differences make the streetcar less of a contributor to regular travel patterns supported by the city's transit system. Nonetheless, the impact of development by transit is clear. A 2005 study estimated that \$140 million worth of development and redevelopment had occurred near the line between planning of the alignment in 2002 and early 2005. When

considering the capital costs of the original alignment of \$19.5 million, the benefit multiplier is 7.2 dollars for every dollar in capital cost for the streetcar.

The large discrepancy between Portland and Little Rock can be explained by not accounted for variables. Portland offers all-day frequent service and had a dormant industrial neighborhood adjacent to downtown ripe for redevelopment right when the streetcar was being constructed. In Little Rock, the streetcar runs more frequently during busier tourist times – nights, weekends, and in the summer months. In addition, the pricing and value of property in Portland is higher than in Little Rock, meaning that a comparable physical amount of development in Little Rock would cost only a fraction of what it would in Portland. Finally, development dollars in Portland were estimated over a seven year period, while in Little Rock the period was only three years.

Despite these differences, the two case studies prove the ability of streetcar to channelize and catalyze development when they are implemented.

Bus Rapid Transit Development

The Massachusetts Bay Transportation Authority (MBTA) completed the Silver Line in two separate sections in 2002 and 2004. The project was part of the FTA's Bus Rapid Transit Demonstration Project Program, and as a result had a lengthy assessment completed in 2005. The project assessment estimated that between planning for the Silver Line in 1997 and completion of construction in 2004, a total of \$1.2 billion was invested along the corridor.

With a total capital cost for the two sections of \$628.2 million, the economic benefit of the project was 1.9 dollars of investment for every dollar spent in capital cost. However, it should be noted that the capital cost included the tunnel access between South Boston and Logan International Airport – an area with high capital costs and no available land for development. For the Washington Street portion, with a capital cost of \$27.2 million and an estimated \$420 million in investment, the economic benefit was 15.4 dollars of investment for every dollar of capital costs.

The Greater Cleveland Regional Transit Authority (GCRTA) has been planning the Euclid Corridor BRT since 1997, with construction starting in 2005 and set to end in summer 2008. Since the beginning of construction the GCRTA estimates over \$400 million worth of development has occurred along the corridor, with a total of \$1.3 billion estimated to occur in the life of the project.

The capital cost of the Euclid Corridor project is \$168.4 million, which is a benefit multiplier of 2.4 development dollars already invested for every dollar spent on the project. However, if the entire \$1.3 billion worth of investment occurs along the line, the multiplier jumps to 7.7 development dollars for every dollar of capital construction cost.

Because the Euclid Project is not completed, it is unknown what the final impact of the project will be for the city. Of the four projects assessed in this memo, it is the only one that is not yet completed and has not had time to mature as part of the city. Therefore, the economic impact for the Euclid Corridor could be very different ten years from now than it is today.

Conclusions

The estimates in this memo attempt to address the developmental impacts that a streetcar or BRT system can have on an area. There are simply too many variables unaccounted for to make a sweeping generalization about BRT or streetcar economic impacts.

It is clear from the four projects detailed in the memo that development, or the location of development, is affected by major transit investments. Whether that development would have occurred or located in the same location or the same configuration regardless of the transit investment is more difficult to determine. The fact that none of the projects were operational before 2001 is another key factor. The long periods of time that it takes for development and land use intensification to occur argue that the full extent of impacts in an area have not been observed. In all of the cities considered, development will continue for many years to be shaped by the transit investments that have been there. Even Portland, with its impressive amount of development already accounted for, has not seen the end of transit-driven development. The evidence from these four case studies suggests that streetcars produce greater development returns than BRT. However, so many variables differ between the various projects and the cities in which they were built that it throws that conclusion into doubt. These differences include the relative health of the development market in the cities examined, the point that each project was built relative to the development business cycle, the relative level of development and the ripeness for redevelopment along the various alignments, and many other factors. The relative value of land in the cities is a key differentiator; land prices in Portland or Boston might be 2-3 times as much as for a comparable area in Cleveland or Little Rock.

What is clear based on this limited survey of places where BRT or streetcars have been developed is that, regardless of mode, transit can and does help to generate and direct development within an area. What is known for the four cities in this memo is that the development dollars in the economy is paying back for the money invested in transit.