City of Minneapolis

Minneapolis Streetcar Feasibility Study

Final Report

December 2007

Funding for this project was provided by the City of Minneapolis.

Technical guidance for this project was provided by a Project Management Team and a Project Steering Committee, members of which are as follows:

Project Management Team members
Michael Abegg, Beth Elliott, John Griffith, Jim Grube, Rick Kjonaas, Connie Kozlak, Craig Lamothe, Steve Hay, Steve Mahowald, Michael McLaughlin, Susan Moe, Don Elwood, Katie Walker, Jon Wertjes, Charleen Zimmer.

Project Steering Committee members
Michael Abegg, John Akre, Richard Anderson, Tim Brown, Douglas Davis, Caren Dewar, John DeWitt, Darrell Gerber, Bob Greenberg, Jim Grube, Adam Harrington, Margot Imdieke Cross, William Johnson, Janet Keysser, Rick Kjonaas, Steve Kotke, Connie Kozlak, Steve Hay, Michael McLaughlin, Susan Moe, Jan Morlock, Tom O'Keefe, Kerri Pearce Ruch, Maureen Scallen, Lea Schuster, Pat Scott, Tom Thorstenson, John VanHeel, Katie Walker, Doug Walter, Kent Warden, Jon Wertjes, Charleen Zimmer.

Consultant Team
Iteris, Inc. | Meyer, Mohaddes Associates
Nelson\Nygaard Consulting Associates
Short Elliot Hendrickson Inc.
Richardson, Richter and Associates, Inc.

The Geographic Information System (GIS) Maps used in this report are provided "as is" and without any warranty as to their performance, merchantability, or fitness for any particular purpose. Data for these GIS Maps were provided by the City of Minneapolis, Hennepin County and the Metropolitan Council.

This publication is available in alternative formats upon request.

Table of Contents

Table of Contents *(continued)*

PAGE

Table of Figures

Table of Figures *(continued)*

Executive Summary

This Streetcar Feasibility Study is being conducted in conjunction with the Access Minneapolis Ten-Year Transportation Action Plan, which lays the groundwork for transportation improvements that are designed to meet the long-term objectives of the Minneapolis Plan, the City's comprehensive plan.

Streetcars have been successfully implemented or are being implemented in over a dozen cities in North America and are being planned in many more. Streetcar service offers the benefits of a legible, high amenity transit service without the high costs and large scale of a light rail system. The goals for developing a streetcar line include:

- Increase transit ridership by regular and occasional riders; especially by providing enhanced and attractive local circulation service connecting city neighborhoods with the downtown core.
- Increase the attractiveness of transit to new markets by providing a unique vehicle and customer experience.
- Provide connections and distribution between high capacity regional transit and local neighborhoods.
- Enhance the environment by replacing diesel bus service with clean and quiet electric vehicles.
- Catalyze and organize development and redevelopment potential around a transit investment by providing a quality transit line with a sense of permanence.

This study evaluated fourteen Primary Transit Network (PTN) routes identified in the Ten-Year Transportation Action Plan as highly productive transit routes. The study focused on both physical feasibility and the ability of each potential route to meet the objectives articulated above. While all of the seven corridors included in the long-range streetcar network for Minneapolis may not meet each objective to the same degree, they all contribute an important link to a long-term streetcar system.

Long-term Streetcar Network

The long-term streetcar network is a 20-50 year vision for streetcar service in Minneapolis. The long-term network was developed from corridors that are both physically feasible for streetcar service, and that offer the greatest potential for long-term streetcar operation that meet the goals described above.

The fourteen candidate corridors were analyzed in a series of phases using six different categories of evaluation criteria. These were:

- Physical and Geometric Constraints

- Transit Supportive Land Use
- Economic Development Potential
- Transit Operations
- Transit Demand
- Cost-Effectiveness

Figure ES-1 presents a map of the long-term streetcar network and Figure ES-2 highlights the markets served, strengths and constraints for each long-term corridor. As the figures show, all of the corridors in the long-term network are anchored in the greater downtown area, with the exception of the Midtown Corridor. The Midtown Corridor is very different from the other corridors in a number of key ways. These include:

- The Midtown Corridor is a cross-town corridor that is designed to provide local circulation and connectivity between high employment nodes and two light rail lines.
- The exclusive right-of-way offered by the Midtown Corridor provides an opportunity for a completely separated transitway that avoids conflicts between cars and transit vehicles. This separated right-of-way also offers some advantages in the ability to utilize different construction techniques and some sections of single track which reduce construction cost. The right-of-way, which is owned by the Hennepin County Regional Railroad Authority, also brings some unique challenges related to vertical circulation, stop placement and impacts on historic bridges.
- The line would be built alongside a very popular bicycle and pedestrian trail, with unique design and safety constraints presented by the high volume of non-motorized traffic alongside the streetcar.
- The operating plan for the Midtown Corridor streetcar would be essentially dictated by the operation of the light rail lines it touches. Unlike the other streetcar lines, service in the Midtown Corridor would primarily supplement rather than replace existing bus service.
- Unlike the other streetcar lines, the Midtown Corridor service would not be easily visible from the street, particularly Lake Street which is the primary business corridor in the area.
- The Midtown Corridor is not designed for direct physical connections to the other streetcar lines, although connections will be possible at Chicago, Nicollet and Hennepin via vertical circulation.
- The Midtown Corridor would likely be implemented in a single segment, rather than beginning with a starter line (minimal operable segment) and expanding out from there.

Additional information about the Midtown Corridor can be found in Chapter 3. Chapter 4 in this report presents more detailed information about the other long-term corridors and

compares operating costs, capital costs and ridership estimates among each of the long-term streetcar corridors.

Phasing and Implementation

The implementation of most new streetcar systems begins with a relatively low-cost short segment that can serve as a building block to an ultimate line or system. In addition, almost all new streetcar systems in this country have begun with one end "anchored" in the central business district, primarily because all residents have a stake in a healthy downtown. Because of this, "minimal operable segments" were identified for each of the long-term corridors. Initial operating plans, operating costs, capital costs and ridership estimates were then developed for each minimal operable segment. The minimal operable segments are about 2-3 track miles (1- 1.5 route miles) and can serve an important short-term circulation function.

There are several possible phasing scenarios for implementing the long-term streetcar network. One scenario would be to develop a single corridor in logical segments until an entire corridor is built before starting another corridor. The primary advantage of this option would be that a significant share of bus service in the corridor could be replaced with streetcar service. Another option is to construct several minimal operable segments out from the downtown core, before completing any one long-term corridor. While the amount of bus service that could be replaced in this scenario is limited, this scenario may have some benefits in terms of economic development and internal downtown circulation. This report does not make a final recommendation as to which segment(s) should be implemented first, or which phasing approach is more appropriate. Additional work is needed before this decision is made to determine the level of community support in each corridor, the level of private sector interest and the ability to generate sufficient capital and operating funding.

As discussed in Chapter 5, the following minimal operable segments were identified.

- **Hennepin Avenue** from Groveland to 5th Street in downtown (connects to Hennepin Avenue corridor and could be implemented with MOS for Central and University Avenue corridors)
- **5th Street Downtown to East Hennepin area** (connects to Central and University Avenue long-term corridors and could be implemented with MOS for Hennepin Avenue corridor)
- **W. Broadway/Washington Avenue** from 10th Street to either 5th Street/Nicollet or 5th Street/Park Avenue (connects to W. Broadway long-term corridor)
- **Nicollet Avenue** from 13th Street/Grant Street to Washington Avenue (connects to Nicollet Avenue long-term corridor)

- **Chicago Avenue S** from 14th Street/Chicago or Franklin/Chicago to Nicollet Avenue/5th Street via 9th/10th Streets (connects to Chicago Avenue long-term corridor)

As described above, the Midtown Corridor is recommended to be implemented in its entirety due to the close relationship between ridership on the Midtown Corridor and the SW LRT corridor.

The estimated operating costs, capital costs and ridership figures for the minimal operable segments are summarized in Figure ES-3.

Maintenance and Storage Facilities and Potential Sites

One of the most important factors influencing the decision on where to begin building a streetcar network is the ability to find a location to house and maintain the vehicles. These facilities must be located as near as possible to the "revenue" line to minimize the cost. Assuming a fleet size of 8-10 vehicles, a one- to two-acre site would be needed, preferably flat and generally rectangular in shape. Prefabricated steel buildings are a low cost alternative for a maintenance facility if area zoning and design requirements allow for their use.

It is estimated that the development of a fully functional storage and maintenance facility would cost in the range of $2-4 million plus any cost for property acquisition.

Although specific sites were not identified in this study, a general review of current zoning identified the following areas as having potential for location of a streetcar maintenance and storage facility:

- Dunwoody Boulevard and I-394
- North of the Basilica of St. Mary
- Industrial Park northwest of Washington Avenue and 10th Avenue North
- Area east of Metrodome
- Nicollet Avenue and 31st Street (Bus Garage)
- On the east end of the Midtown Corridor (near 28th St E and 21st Ave S).

Owner/Operator Arrangements

Nationally, streetcar implementation has been approached somewhat differently than implementation of other transit investments, due to the unusual financial arrangements that have often provided a high level of city and private funding to streetcar projects.

Chapter 6 presents several owner/operator arrangements that summarize the experience of other cities (Portland, Memphis and Seattle). Based on the three case studies, and the options that seem most likely in Minneapolis, it is recommended that the City take responsibility for implementation of the first streetcar line (with the possible exception of the Midtown corridor). This recommendation is made primarily because the City is the only governmental unit strongly advocating for streetcar at this time, the funding will likely come from private and city funds, and the initial primary circulation benefits will be to city residents, employees and visitors. Given their experience in successfully operating rail transit in Minneapolis, it is likely that Metro Transit would be the operator of streetcar service, either directly or through contract with the city. Additional dialogue with Metro Transit will be needed to finalize any operating plans for streetcars.

Figure ES-1 Long-Term Streetcar Network (Corridors Outside of Downtown)

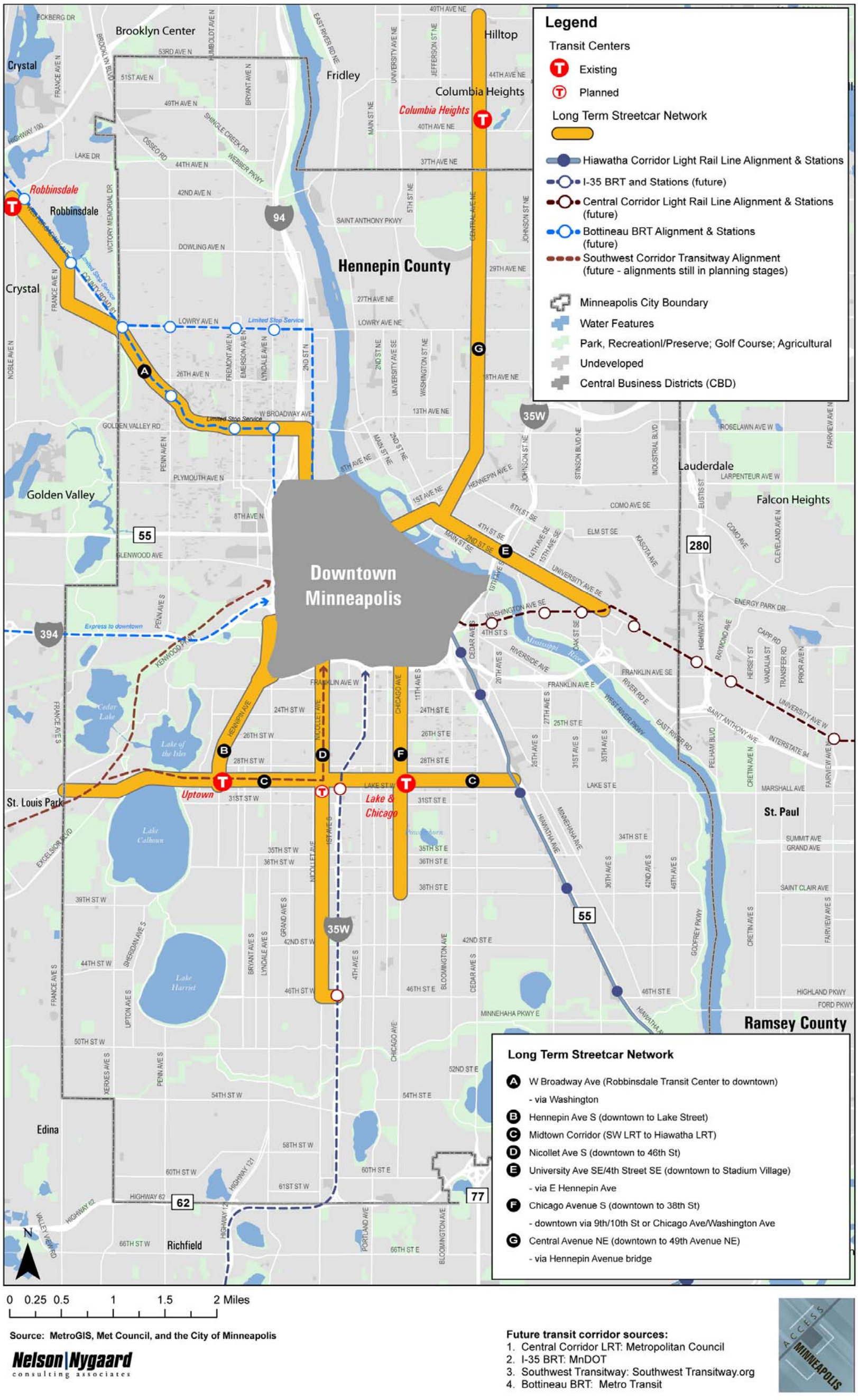


Figure ES-2 Summary of Long-Term Streetcar Corridors

Corridor	Markets Served	Strengths	Constraints
W Broadway Ave	• Short term: Developing close-in high density residential neighborhoods in North Loop to downtown • Long term: Improved local service to residential / commercial neighborhoods in North Minneapolis; long-term potential for moderate density redevelopment in corridor; connecting to regional routes at Robbinsdale transit center	• Economic development potential in North Loop, W Broadway and Robbinsdale. • If aligned with Park Avenue; strong economic development potential in East Downtown. • Good opportunity for maintenance/storage facility near 10th Ave N. • Provides additional service in a developing underserved corridor. • Adequate right of way width; limited conflict with bus volumes.	• Not the strongest mix of uses – mostly residential with limited commercial. • No major special generators along the corridor limits visitor/tourist appeal. • If via Park Avenue, would not penetrate the core of downtown. • Depends on new development to achieve high ridership. • Minimal bus replacement until the route gets to Robbinsdale transit center. • Dependent on alignment and transit technology decisions in Bottineau Blvd Alternatives Analysis (currently underway)
Hennepin Ave S	• Short term: tourists, downtown workers, MCC students and visitors to entertainment district, Walker Art Center / Minneapolis Sculpture Garden and residents in Loring Park. • Long term: Uptown to Dinkytown route connecting downtown with two of the most active neighborhoods in the city. Possible game day connection to Twins new stadium.	• Economic development potential along Hennepin in greater downtown (near 10th Street) and in the East Hennepin area. • Has the highest potential for ridership if Uptown is linked with University • Once route reaches Uptown – significant bus replacement – could potentially replace all buses if alignment serves Uptown-Dinkytown. • Serves multiple anchors, special generators and mix of uses	• Short term conflicts with high bus volumes on Hennepin. • Need solution to I-94 Bottleneck to provide connection to Uptown • Traffic and on-street parking issues on Hennepin between Groveland and Uptown.
Central Ave NE	• Short term: tourists, downtown workers, visitors to entertainment district, East Hennepin residents and businesses connected to core • Long term: Residents and businesses along corridor; connecting regional routes at Columbia Heights transit center	• Moderate economic development potential especially East Hennepin area and near Lowry and Shoreham Yards. • Opportunity to replace significant numbers of buses once the alignment reaches Columbia Heights transit center (if connected to Nicollet). • Maintenance and storage potential at Shoreham Yards.	• Relatively modest ridership until bus replacement begins. • Bridge crossing required to reach downtown (likely Hennepin Avenue). • Needs to be connected to another corridor to serve significant ridership. • No special generators and limited mix of uses.
University Ave SE /4th St SE	• Short term: tourists, downtown workers, visitors to entertainment district, East Hennepin residents and businesses connected to core • Long term: University students, staff and local residents.	• Moderate economic development potential in East Hennepin area and along river. • Long term has the highest potential for ridership if linked with Hennepin and Uptown. • Potential to replace most buses in the Hennepin and University/4th corridor • Serves multiple anchors (downtown, Uptown, U of M), special generators and mix of uses.	• Requires a bridge crossing – likely on Hennepin Avenue.
Nicollet Ave S	• Short term: tourists, downtown workers and visitors to inner core, Convention Center and very dense downtown neighborhoods. • Long term: serves high density residential neighborhoods south of I-94 and all of Nicollet Avenue S., connecting to regional routes at I-35W BRT 46th Street station	• Prominent downtown circulator service on Nicollet Mall • Potential to reduce bus service once the line reaches Lake Street; could essentially eliminate buses on Nicollet Avenue once the line reaches 46th. • Potential for higher density development between downtown and Franklin Avenue. • Opportunity to "knit together" Nicollet Ave at Lake Street with redevelopment potential. • Very high ridership potential, especially as buses are replaced.	• Limited breadth and intensity of economic development potential downtown and south of Franklin (except at Lake Street). • Limited opportunity for maintenance and storage facility if line does not connect to Lake Street. • Dependent on SW LRT Corridor decision. • Requires significant capital costs to connect Nicollet to Lake Street (reconnection of Nicollet Avenue) • Conflicts with high bus volumes on the Nicollet Mall in the short term.
Chicago Ave S	• Short term: Local circulation near-downtown neighborhoods including Elliot Park. • Long term: Potential redevelopment in East Downtown; employment centers at HCMC, Children's Hospital and Abbot-Northwestern Hospital and related facilities.	• Economic development potential especially in Elliot Park and East Downtown. • High ridership potential if the alignment goes to Lake St or 38th St. • Opportunity to replace significant numbers of buses in downtown long term. • Can leverage City street reconstruction.	• Limited opportunity for maintenance and storage facility on line. • Limited economic potential between downtown and Midtown Corridor.
Midtown Corridor	• Local connections to regional service connecting two LRT lines with Uptown and high employment district between I-35 and Chicago; intensification opportunities along corridor; local neighborhood circulation.	• Connectivity to employment and residential from LRT lines • Development potential on corridor but less intensity and breadth than other downtown serving corridors • Existing grade separated ROW – no conflict with other modes; higher speed potential. • Potential for single track construction which reduces cost.	• Trench location requires vertical circulation and limits stop spacing and visibility • Limited opportunity for maintenance and storage facility on line. • Dependent on SW LRT Corridor decision. • Very limited opportunity to reduce bus service (with the exception of Route 53).

Figure ES-3 Summary of Minimal Operating Segments Characteristics

	Hennepin Avenue	*Central and University Avenues*	*W Broadway/Washington Avenue to Nicollet Avenue (Option A)*	*W Broadway/Washington Avenue to Park Avenue (Option B)*	*Nicollet Avenue (Option A)*	*Nicollet Avenue (Option B)*	*Midtown Corridor*	*Chicago / 9th/10th Streets to Nicollet Avenue (Option A)*	*Chicago / 9th/10th Streets to Nicollet Avenue (Option B)*
From	Groveland	5th Street / Hennepin Ave	10th Avenue N/ Washington Ave	10th Avenue N/ Washington Ave	Nicollet Avenue / 5th Street	Nicollet Avenue / 5th Street	West Lake Station (SW LRT)	Nicollet Avenue / 5th Street	Nicollet Avenue / 5th Street
To	5th St / Hennepin Ave	Central Avenue NE	5th Street / Nicollet Avenue	5th Street / Park Avenue	13th Street S	Franklin Avenue	Lake St/Midtown Station	14 Street / Chicago Ave S	Franklin Ave / Chicago Ave S
Operating Characteristics									
Peak Vehicle Requirement	*2*	*2*	*2*	*2*	*2*	*2*	*5*	*2*	*2*
Annual Service Hours	*11,448*	*11,448*	*11,448*	*11,448*	*11,448*	*11,448*	*28,175*	*11,448*	*11,448*
Estimated Annual Operating Costs (assuming $149.75/hour)	*$1,714,338*	*$1,714,338*	*$1,714,338*	*$1,714,338*	*$1,714,338*	*$1,714,338*	*$4,219,206*	*$1,714,338*	*$1,714,338*
Ridership Estimates									
Estimated Annual Ridership	*463,000 – 566,000*	*364,000 – 445,000*	*338,300 – 413,500*	*307,300 – 375,600*	*402,000 – 491,400*	*446,900 – 546,200*	*1,000,000[1]*	*310,600 – 379,600*	*329,800 – 403,100*
Economic Development									
Special Use Generators	*High*	*Moderate*	*Moderate*	*Moderate*	*High*	*High*	*Moderate*	*Moderate*	*Moderate*
Development Opportunity	*Moderate to High*	*Moderate to High*	*Moderate*	*High*	*Moderate*	*Moderate*	*Moderate to High*	*High*	*High*
Capital Cost Estimates ($2007)									
Track Miles	*2.6*	*2.2*	*2.2*	*3.4*	*1.8*	*2.7*	*4.4*	*2.2*	*3.1*
Capital Cost (excluding vehicles and maintenance facility)[2]	*$26,000,000*	*$22,000,000*	*$22,300,000*	*$33,900,000*	*$17,900,000*	*$26,900,000*	*$24,850,000*	*$21,900,000*	*$30,800,000*
Additional Capital Costs	*1) Center Stations (5th – 10th) - $300,000* *2) LRT Crossing - $50,000*	*1) Hennepin Bridge (Miss. River) - $2.08 M* *2) Center Stations (5th – Washington) - $150,000*	*1) 4th Avenue N Bridge - $70,000* *2) LRT Crossing - $50,000* *3) Mall Modifications - $300,000*	*1) 4th Avenue N Bridge - $70,000* *2) LRT Crossing - $50,000*	*1) LRT Crossing - $50,000* *2) Mall Modifications - $2,100,000* *3) I-94 Bridge - $400,000*	*1) LRT Crossing - $50,000* *2) Mall Modifications - $2,100,000* *3) I-94 Bridge - $400,000*	*1) Side Track - $6,200,000* *2) Vertical Circulation - $2,000,000* *3) At-Grade Embedded Track - $382,000*	*1) I-94 Bridge - $660,000* *2) LRT Crossing - $50,000*	*1) I-94 Bridge - $660,000* *2) LRT Crossing - $50,000*
Subtotal	$26,350,000	$24,100,000	$22,700,000	$34,000,000	$20,450,000	$29,450,000	$33,500,000	$22,600,000	$31,500,000
Vehicle Costs[3]	$12,000,000	$12,000,000	$12,000,000	$12,000,000	$12,000,000	$12,000,000	$18,000,000	$12,000,000	*$12,000,000*
Non-revenue track[4]	$4,500,000	$4,500,000	$4,500,000	$4,500,000	$4,500,000	$4,500,000	$2,800,000	$4,500,000	*$4,500,000*
Maintenance Facility[5]	$4,000,000	$4,000,000	$4,000,000	$4,000,000	$4,000,000	$4,000,000	$4,000,000	$4,000,000	*$4,000,000*
Total Capital Costs ($2007)	$46,900,000	$44,600,000	$43,200,000	$54,500,000	$40,950,000	$49,950,000	$58,300,000	$43,100,000	$52,000,000

[1] Annual ridership on the Midtown Corridor estimated based on 3,300 weekday boardings developed in the Southwest Transitway Alternatives Analysis Study. Saturday boardings are estimated to be 80% of weekday and Sunday boardings are estimated to be 60% of weekday.
[2] Assumes approximately $9,950,000 per track mile for embedded track and approximately $5,650,000 for ballasted track (Midtown Corridor).
[3] Assumes $3,000,000 per vehicle. Costs include one spare vehicle per minimal operable segment. If all segments were implemented together, the number of spare vehicles would likely be lower.
[4] For planning purposes, it is assumed that ½ mile of single track would be required to access a maintenance facility.
[5] Maintenance facility costs would only apply to the first shortest operable segment.

Hennepin County has jurisdiction over the streets/right-of-way where several of the streetcar corridors are proposed including Midtown, West Broadway, Hennepin and University/4th. Mn/DOT has jurisdiction over the Central Avenue corridor. These agencies will need to be closely involved in any future work in these corridors.

All of the corridors have some potential for the development of a public-private partnership or even a private not-for-profit owner/operator arrangement. The extent to which this is feasible will vary depending on the corridor and its development potential.

Potential Funding Options

A preliminary review of options for funding the development, capital and operating costs associated with streetcar implementation in Minneapolis is identified in Chapter 7. Several potential sources are explored, including federal, state and local sources, as well as private financing options. The primary funding options that were explored include:

Federal Funding

- Project Earmarks/Federal Demonstration Projects
- Federal Transit Act Formula Funds
- Housing and Urban Development Funds

State and Local Funding Options

- Taxes (e.g, local sales tax, hotel guest tax, convention center tax, etc.)
- Fees (e.g., transit impact development fee, in-lieu of parking fee, etc.)
- Benefit Districts (e.g., Local Improvement District, Tax Increment Financing, Special Assessment District, etc.)
- Parking (e.g., meter and/or ramp revenues)
- Streetcar funding (e.g., farebox revenue, advertising revenue, naming rights)
- Other (e.g., air rights, non-profit status, etc.)

A review of six streetcar systems around the U.S. was conducted to better understand the variety of funding mechanisms that have been used to pay for capital and operating costs. While there is no single funding option that appears to be a perfect fit for funding streetcar services in Minneapolis, there are a number of options that could be pursued. New legislation may be required to develop a full funding package, which is likely to include a variety of sources.

Next Steps

This study identified a long-term streetcar network which will require at least twenty or more years to achieve. The study also identified a number of possible starting places, each of which offers different advantages to riders, to the City and to other stakeholders.

The next major steps in developing a streetcar network are to determine a financing strategy and to select a minimal operable streetcar segment to begin building the long-term network. The following "next steps" have been identified to help move this process forward. These steps are discussed in more detail in Chapter 8.

1. Develop detailed funding plan
2. Identify site for maintenance and storage facility
3. Gauge developer support and economic development potential
4. Develop design guidelines for streetcar construction (will ensure that streetcar requirements are considered when streets are reconstructed)
5. Determine who will own and operate the service
6. Further evaluate the impact on the local bus network
7. Continue to gauge political and community support

Once a preferred initial segment is identified, there are a number of steps required to move toward implementation. The responsibility for each step will depend on the organizational structure selected for implementation and operations phases.

- Preliminary engineering
- Environmental Assessment (EA) or Environmental Impact Statement (EIS)
- Finalize funding plan
- Final Design
- Develop public information campaign during construction
- Solicit construction bid
- Procure and prepare vehicles
- Solicit bid for operations (if not being administered by Metro Transit)
- Develop marketing materials and initiate advertising campaign
- Testing and training
- Final implementation details

Chapter 1. Introduction

In March 2006, the City of Minneapolis authorized Meyer, Mohaddes Associates and its subconsultants Nelson\Nygaard Consulting Associates, Short Elliot Hendrickson (SEH), and Richardson, Richter & Associates to study the feasibility of implementing a streetcar network in Minneapolis. The study was conducted in conjunction with the Access Minneapolis Ten-Year Transportation Action Plan, which lays the groundwork for transportation improvements that are designed to meet the long-term objectives of the *Minneapolis Plan,* the City's comprehensive plan.

The Access Minneapolis project recommends a system of Primary Transit Network (PTN) corridors, which can be defined as a network of high-frequency, all-day transit services that are intended to carry the majority of transit ridership in the city. The PTN corridors are designed to be "mode neutral" – that is, PTN routes can be operated by any appropriate transit technology (bus, streetcar, light rail, etc.) so long as certain performance quality standards are met. It is important to note that the PTN corridors have significance in terms of regional transit operations. The PTN network has been included in the regional Transportation Policy Plan document due to be updated in early 2008. This streetcar feasibility study builds on the work of the Access Minneapolis project by evaluating 14 PTN corridors for potential streetcar operations.

The primary goal of the Streetcar Feasibility study was to develop a prioritized set of potential streetcar investments that are both physically feasible and offer the greatest potential to Minneapolis in one or more of the following areas:

- Increase transit ridership by regular and occasional riders; especially by providing enhanced and attractive local transit service connecting City neighborhoods with the downtown core.
- Increase the attractiveness of transit to new markets by providing a unique vehicle and customer experience.
- Provide connections and distribution between high capacity regional transit and local neighborhoods.
- Enhance the environment by replacing diesel bus service with clean electric vehicles.
- Catalyze and organize development and redevelopment potential around a transit investment by providing a quality transit line with a sense of permanence.

In order to accomplish the goals of this study, the evaluation was conducted in a series of phases. Phase I first developed a set of evaluation criteria and, based on those criteria, "screened" each of the 14 candidate corridors to eliminate those corridors (or segments of corridors) with serious physical constraints. The Phase I analysis also screened out corridors where land use and zoning are not expected to be supportive of streetcar

investments (during the life of the plan). The Phase II analysis added additional information, including known utility impacts, additional land use information and impacts on the bus network. Phase II identified a long-term streetcar system for the city. Phase III provided detailed operating and capital plans and preliminary costs for each of the corridors in the long-term system, and identified and evaluated potential implementation phasing for each corridor.

This final report also includes a detailed review of potential funding sources, owner/operator arrangements and how the network might be implemented over time. The final report does not recommend a specific place to start building the streetcar network. Several next steps are identified that need to be completed before a final decision can be made regarding whether the city should implement a streetcar system and, if so, which corridor or corridor starter segment is the best place to start construction.

It should be noted that this feasibility study focuses exclusively on modern streetcar operations. Although similar in many ways to historic or replica streetcar vehicles, modern streetcar vehicles have unique operating characteristics that were considered when evaluating each corridor, such as wider turning radii, overhead clearance and stations that are accessible to people with disabilities.

Why Streetcars?

More than a dozen North American cities have streetcar systems that have either been expanded or initiated operation in the past 15 years. At least twice as many additional cities have new systems or new lines under active planning. Streetcars have become popular because they provide cities with the ability to add visible rail service with a capital cost that is much less than the higher capacity light rail. Streetcars are also popular because they are a good fit for densely developed, pedestrian-oriented, urban neighborhoods and activity centers. Many cities, including Minneapolis, were shaped by early streetcar systems, whose remnants can be seen today in the way streets and neighborhoods are laid out.

Some of the defining characteristics of modern streetcar systems include:

- **Streetcars generally attract at least 15-50 percent more riders than bus routes in the same area.** In many cases, the difference in ridership is much higher. Based on recent North American examples of streetcar implementation, there is a clear ridership boost that can be attributed directly to the implementation of streetcar service replacing bus service in a given corridor. In Toronto, on routes where streetcar service replaced a nearly identical bus service, ridership increased 15-25 percent. A particularly dramatic example can be found in Tacoma, where streetcar service is running on a future light rail transit (LRT) alignment. Transit ridership in the streetcar corridor increased by over 500 percent compared to the bus route that ran previously. The route charges no fares and offers free parking, conditions that

were present on the previous bus route as well. San Francisco experienced a three-fold increase over bus ridership on its historic F-line corridor since beginning streetcar service in 1995.

- **Streetcars often attract private funding.** Property owners are often willing to financially contribute to a streetcar system because they realize the value that a streetcar brings to their property and to the neighborhood. In Portland and other cities, private owners were willing to "tax themselves" either through fees, benefit districts, or other forms of exactions to receive the benefits of a fixed streetcar system. Nearly half of the operating costs of Tampa's TECO streetcar line are paid through an endowment created by local business contributors.
- **Streetcars can provide needed capacity on inner route segments.** Minneapolis has a number of newly developing neighborhoods that are located close in to downtown, on or adjacent to very successful PTN corridors. While there may be adequate bus capacity in those corridors, riders who are near the end of the line in the morning experience heavy loading and may have the perception of crowding or inadequate service to their neighborhoods. Adding streetcar service to the inner neighborhoods provides an attractive alternative that will not be overloaded with commuters from outside the City. Also, by providing additional capacity to inner neighborhoods, streetcar services can allow more flexible commute operations including skip stop and express service, speeding transit for all riders.
- **Streetcars are an excellent way to provide local circulation, promoting "park once" and pedestrian and transit travel throughout a high density activity center or multi-use corridor.** Similar to other street-running modes, streetcars are generally focused on serving a neighborhood, not just moving through it rapidly. While streetcars can benefit from many of the same treatments that would be given to improve speed on buses or LRT such as signal preemption, queue jumps, longer stop spacing and exclusive right-of-way, modern streetcars typically have minimal priorities over other vehicles and are often designed to operate in mixed flow with vehicular traffic. Streetcar stops are generally spaced closer together than light rail or bus rapid transit; because streetcar service is designed for local circulation and connections to higher capacity services rather than providing high speed or high capacity service themselves. In Minneapolis, because candidate streetcar corridors are intended to provide primary transit network service, it will be critical to provide as much transit priority as is necessary to keep the streetcar moving at least as well as the PTN bus route requires. Streetcars are not inherently faster than buses, and in fact, can be less reliable on streets with heavy congestion or other impediments, since streetcars cannot change lanes or maneuver around a problem.
- **Streetcars provide a visible and easy-to-understand routing which attracts new users.** Rail systems in general provide a physical presence on the street that is easy to comprehend. Riders can stand at a stop and literally see where the line comes from and where it is going. Streetcar routes generally make few deviations from a straight path, giving the user more confidence. Visitors and occasional users are

more inclined to use them, since there is less confusion about the streetcar than about taking one of many possible bus routes.

- **Streetcars attract both a visitor market and a local user market to transit.** The fact that streetcars are easy to "understand" and often operate in areas with high visitor populations, helps attract visitors as well as local riders. Some streetcar operations use replica "vintage" vehicles, and some actually use rehabilitated vehicles from earlier eras (such as the existing Como-Harriet Streetcar line). Other systems use very modern, but distinctive vehicles. All of these vehicle types help attract visitors, as well as local riders, to transit.
- **Streetcars catalyze and organize development.** Throughout their history, streetcar lines have been an organizing principle behind new development. Streetcars can help create dense pedestrian environments where access to local streetcar stops is possible by foot. Most of the modern streetcar applications in the United States have been catalyzed by the promise of new development, and in fact, have been championed by local developers who also partially funded the projects. Since the decision to build the streetcar was made, over $3 billion in new development has occurred around Portland's streetcar line including retail, office and housing. In Memphis, 4,000 residential units have been built within a block of the streetcar in a formerly underused industrial area. And in Tampa, over $800 million in new private development has been built along the 2.4 mile TECO line. Although it is difficult to know whether development would have happened at the same pace without the streetcar investment, it appears that the streetcar line provided a "focus" which organized development and assured the transit focus of new development along and spreading out from the streetcar corridor.
- **Streetcar costs are higher than bus infrastructure, but lower than light rail.** The cost for streetcar construction is approximately $20-$40 million per mile and $2.5-3 million is typical for each car. This price compares to $50 to $75 million per mile for LRT implementation and $3-4 million for a light rail vehicle. Standard 40-foot diesel buses typically cost around $400,000, while articulated (65-foot) buses cost approximately $650,000 each. Hybrid electric buses typically cost about 50 percent more than diesel buses. While lower in cost, bus lines do not typically attract private funding for capital costs and typically attract lower ridership. Streetcar vehicles, while substantially more costly than buses, have significantly longer lives and may have equivalent life cycle costs.
- **Streetcars in the U.S. generally operate in "single car operation" and cannot be considered "high capacity transit" except at very high frequency**. Although there is a range of streetcar types operating today, the most common streetcars generally have capacities in the range of an articulated bus – around 60 to 70 seated passengers and a maximum of 110 passengers (seated and standing). Unlike LRT service, streetcars are generally not strung together in "trains" with a single operator, but rather, operate as single cars on the track. Therefore, streetcars cannot be considered high capacity transit based on the number of people who can be

served at one time with one operator. There are typically minimal or no per hour operating cost savings of operating streetcars in place of buses. Because streetcars can attract new riders, the cost per rider for streetcar service may be less than the cost per rider on equivalent bus service.

Figure 1-1 on the following page compares streetcar operations to both light rail and bus technologies.

Figure 1-1 LRT, Streetcar and Bus Technology Comparison

Characteristic	Light Rail	Streetcar	Bus
Capacity	Highest capacity mode. Cars hold 66 seated passengers plus standing room for 120. Can be strung together in multi-car trains to increase capacity.	Medium capacity, generally comparable to an articulated bus. Seated capacity ranges from about 40 to 66 passengers. Standing capacity for a total of between 70 and 100.	Low to medium capacity, depending on size of bus, which can range from a shuttle to an articulated coach. Seated capacities are typically about 60 passengers for an articulated bus. Standing capacity for a total of about 85 passengers.
Flexibility	Not Flexible – high investment cost requires much longer life span to recover fixed costs.	Medium flexibility – track and wire can be relocated for lower cost than a light rail investment.	Highest flexibility – buses are relatively easy to move with minimal infrastructure requirements unless BRT in dedicated ROW.
Right-of-Way	Generally requires dedicated ROW for optimal operations.	Can operate in street or on dedicated ROW.	Can operate in street or on dedicated ROW.
Ability to Attract Choice Riders	High – rail services (including LRT and streetcar) attract at least 15-50% more riders than equivalent bus routes and 25-75% more choice riders in route-by-route comparisons.	High – rail services (including LRT and streetcar) attract 15-50% more riders than equivalent bus routes, and 25-75% more choice riders in route-by-route comparisons.	Low – Standard bus services tend to attract fewer choice riders than rail services.
Optimal Markets	Regional commutes and longer distance routes where speed and capacity are at a premium.	Most effective for short, local trips, circulator service in activity centers, and to provide connections to regional services. Closer stop spacing, reliability and visibility are more important than high speed or high capacity.	Can be effective for local and long distance commuter trips or other trips that are repeated frequently. Also well suited to areas where travel demand patterns are not yet established or are low density.
Capital Costs (infrastructure)	$50 to $75 M per mile. Approximately $60 M per mile for Hiawatha LRT.	$20 - $40 M per mile.	Typically less than $200 K per mile); Bus Rapid Transit - $250K – $4.5 M per mile
Vehicle Costs	$3-4 M per vehicle	$2.5-3 M per vehicle	~$400 K (40-foot coach) ~$650 K (60-foot articulated coach) ~$580 K (40-foot diesel/electric hybrid coach)[1]
Operating Cost[2,3]	Highest operating cost. Ranging from $200 to $250 per hour.	Medium operating cost – ranging from $100 to $150 per hour	Lowest operating cost per hour. Large operators average about $100 per hour.

Data sources: Transportation Research Board; American Public Transportation Association (APTA); Federal Transit Administration; various transit agency websites.

[1] Based on Metro Transit's experience with hybrid diesel/electric vehicles, it is estimated that the cost differential between hybrid vehicles and regular diesel vehicles is approximately $180,000.
[2] Operating cost per passenger is typically lower for LRT, and somewhat lower for streetcar, compared to bus due to increased capacity and ridership.
[3] Metro Transit's fully allocated cost per platform hour is $93.70

Brief History of Streetcars in Minneapolis

As with most cities in North America, the Twin Cities region has a rich streetcar history. Beginning with horse-drawn and eventually steam-powered vehicles, streetcars first arrived in Minneapolis in the 1870's. Electric streetcars were first introduced in the 1880's and by 1890, all streetcar lines in Minneapolis were electric. Although some lighter ridership crosstown lines and long suburban lines were converted to buses, streetcars thrived through the 1920's and carried the majority of transit users in Minneapolis. The 1930's saw a major slump in transit ridership overall as the country slipped into the Great Depression. Although this affected streetcar ridership, the Depression slowed the growth of suburban expansion, which spared many streetcar lines. During and just after World War II, streetcars still played a major role in Minneapolis as ridership rebounded after the Depression. By the late 1940's, however, streetcar ridership was declining again and many streetcar lines were being replaced by buses. By the 1950's many streetcar lines and vehicles were in disrepair and in 1954 streetcar service in the Twin Cities ceased all together.

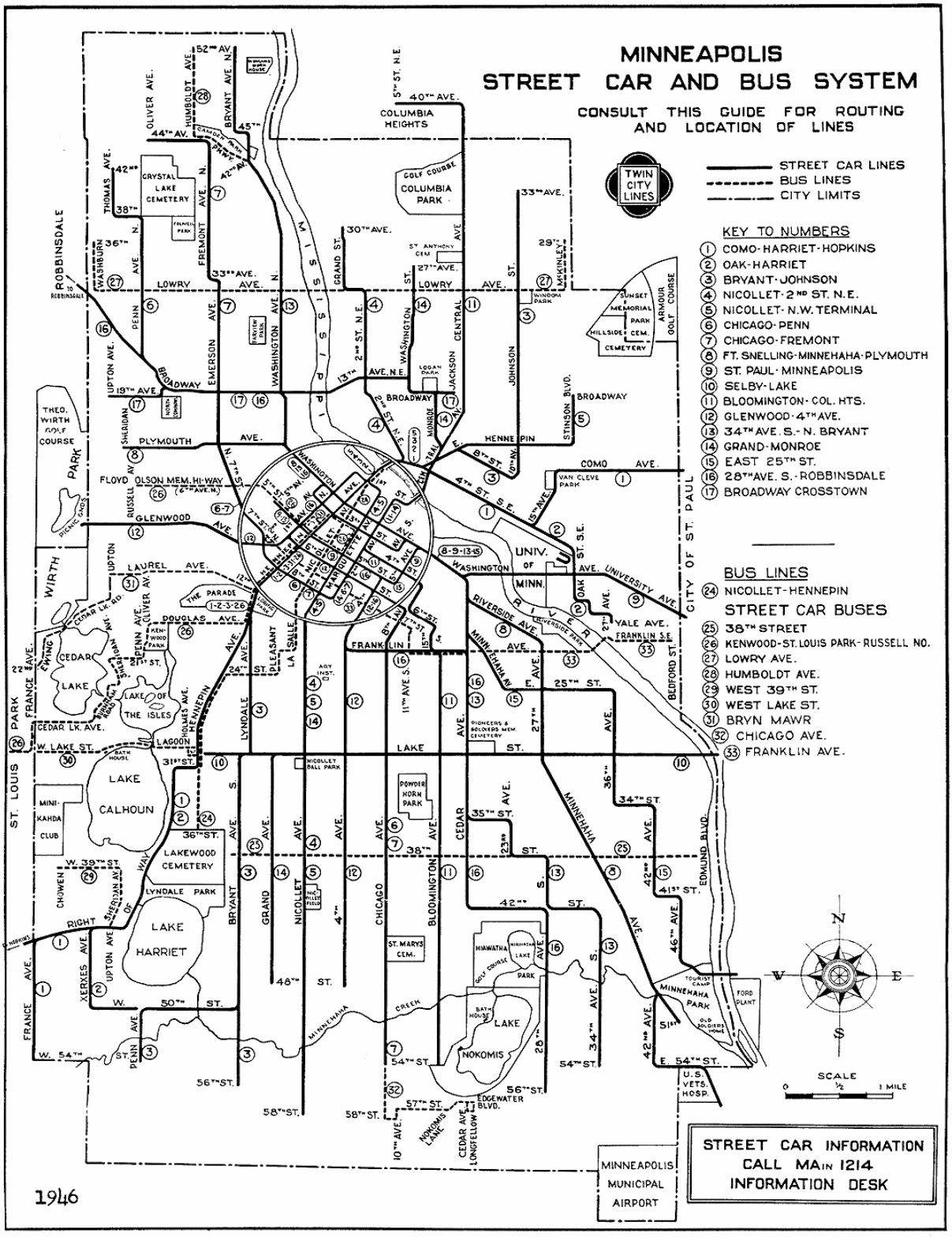
At its peak, the Twin City Rapid Transit Company (Twin City Lines) had 524 miles of streetcar track in the Twin Cities and owned 704 streetcar vehicles. There were six major streetcar barns in the Twin Cities and many streetcar lines operated 24 hours a day. Service levels on major streetcar routes were very frequent, operating every minute or two during peak hours. Due to the high frequency operation, transfers between streetcar lines were convenient.

By 1946, Minneapolis' streetcar network was fairly extensive, with service continuing well beyond the city limits, especially to St. Paul. Most major streets in the city had at least one streetcar line and some streets (such as South Nicollet) had three streetcar lines. Very few neighborhoods in the city were more than ½ mile from a streetcar line, and many neighborhoods were much closer. Many of the streetcar lines were "through-routed" in downtown Minneapolis, which means they continued on to another part of the city instead of terminating downtown. In fact, many of the current bus lines are based on the old streetcar routing network, such as Route 6 (from Uptown to the University via Hennepin Avenue and 4th Street SE) and Route 5 (from South Chicago Avenue through downtown to Emerson/Fremont Avenues North).

Figure 1-2 on the following page shows Minneapolis' streetcar network as it existed in 1946[4].

[4] Source: The 1940's, Minnesota Transportation Museum

Figure 1-2 Minneapolis Streetcar and Bus System Map (1946)



Source: Minnesota Transportation Museum

Transportation Planning Context in Minneapolis

Streetcars are only one mode being developed as part of a major, multi-modal approach to improving transportation service in Minneapolis and throughout the Twin Cities. Other transit and transportation projects that will impact future streetcar investments are summarized below:

- **Central Corridor.** Light Rail Transit (LRT) is envisioned for the 11-mile Central Corridor between downtown St. Paul and downtown Minneapolis. Traveling mostly along University Avenue, once in Minneapolis the corridor also uses Washington Ave SE, through the University of Minnesota, and connects with the Hiawatha LRT corridor between the Cedar/Riverside and Metrodome LRT stations. The Metropolitan Council selected LRT as the preferred alternative in June 2006. The FTA allowed the project to move into Preliminary Engineering in December 2006, which is expected to take approximately 2 years. By late 2008, the FTA will determine if the project should move into the final design phase and in 2009 will determine whether or not to approve a full funding grant agreement. Assuming the project continues to progress, construction could start in 2010 with service opening in 2014.
- **Southwest Corridor.** This corridor stretches from Eden Prairie to downtown Minneapolis, also serving the communities of Minnetonka, Hopkins and St. Louis Park. An Alternatives Analysis[5] was completed in 2007 that compared the benefits, costs and impacts of a range of transit alternatives, including Light Rail Transit or Bus Rapid Transit. LRT was selected as the locally preferred alternative. Two possible routing alternatives on the south end and at least two alternative routings into downtown Minneapolis will be evaluated in a Draft Environmental Impact Statement. One alignment, called the Kenilworth alignment, would travel along an abandoned rail right-of-way along the west edge of the city before connecting with the planned Intermodal Transit Station on the west edge of downtown via Royalston. Another alignment would travel in the Midtown Corridor to Nicollet and in a tunnel under Nicollet to Franklin, then traveling at-grade into downtown Minneapolis via Nicollet Mall.
- **Bottineau Boulevard Transitway.** Bottineau Boulevard (Co Rd 81) has been studied in the past as a Bus Rapid Transit (BRT) project that would offer high-quality bus transit between Rogers and downtown Minneapolis. FTA has recently approved an Alternatives Analysis for this corridor, looking at both LRT and BRT and evaluating several alternative alignments. Likely alternative alignments for BRT into Minneapolis are T.H. 100/I-394, W. Broadway, and Lowry Avenue. Likely

[5] The Southwest Corridor Alternatives Analysis is being funded entirely by the Hennepin County Regional Railroad Authority.

alternative LRT alignments are less clearly defined but would include the BNSF railroad and possibly T.H. 55 and Lowry Avenue.

- **Northstar Commuter Rail.** The 40-mile Northstar Commuter Rail corridor will include 6 stations and carry an estimated 5,600 passengers per day. Only one station is planned in Minneapolis, the Intermodal Transit Center, on the west edge of downtown. The FTA recently approved the full funding agreement for Federal New Starts funding. Service is expected to begin in late 2009.
- **I-35W and Cedar Avenue Bus Rapid Transit.** The I-35W Bus Rapid Transit project includes the I-35W corridor from Lakeville to downtown Minneapolis. The project envisions a shared BRT/HOV lane in the I-35W corridor with on-line stations at Lake Street and 46th Street in Minneapolis. Rather than utilize unique vehicles that have the look and feel of rail vehicles, the I-35W BRT concept would utilize the existing fleet and consist of both local station-to-station service and non-stop express routes. BRT is also planned for Cedar Avenue south of Hwy 62 (Crosstown Highway). Buses from Cedar Avenue would use Hwy 62 and the I-35W BRT lanes to access downtown Minneapolis. The State of Minnesota was awarded a federal Urban Partnership Agreement (UPA) grant in August 2007 to construct dynamically priced bus shoulder lanes on I-35W and implement a number of other transit, congestion pricing and technology strategies in the I-35W and Cedar Avenue corridors. If the necessary State legislation is passed in early 2008, construction will begin in 2008 and must be completed by late 2009. The UPA funding also includes the reconstruction of 2nd and Marquette Avenues in downtown Minneapolis to provide double-width bus lanes.
- **Intermodal Transit Center.** A new intermodal transit center is planned on the west side of the Third Street Garage along the Burlington Northern – Santa Fe railroad line. The transit center will be the terminus for the planned Northstar Commuter Rail line as well as the Hiawatha LRT line via a short spur from the current terminus at Hennepin and 5th Street N, which is currently under construction.
- **Primary Transit Network.** One of the guiding principles of this study has been to ensure that any future streetcar investment will provide service that will eventually meet the Primary Transit Network (PTN) requirements. The PTN is a permanent network of all transit lines — regardless of mode or operator— that operates at frequencies of every 15 minutes or better all day for at least 18 hours every day, 7 days a week. Service on these routes should be highly reliable and should operate at no less than 30 percent of posted speed. Boardings should be as fast as possible. Standing loads are acceptable but crush loads are not. For more information on the PTN performance criteria, see the Citywide Ten-Year Transportation Action Plan.

An important consideration for this study has been how any proposed streetcar line would interact with bus service on the PTN corridor. Bus service in these corridors tend to travel long distances from suburban areas into the City; while the streetcar lines would either be entirely within the City or between downtown Minneapolis and an adjacent community.

Chapter 2. Corridor Screening

This chapter presents the results of the first two phases of corridor screening and evaluation, which culminated in the identification of a long-term streetcar network for Minneapolis. The following factors were considered in the two screening phases of this study:

- Physical and Geometric Constraints
- Transit Supportive Land Use
- Economic Development Potential
- Transit Operations
- Transit Demand
- Cost-Effectiveness

Additional information about the screening phases of this study can be found in the Phase I and Phase II reports completed for this study.

Candidate Streetcar Corridors

Figure 2-1 below shows the Primary Transit Network (PTN) that was developed in the Access Minneapolis Ten Year Transportation Action Plan. The highlighted corridors represent the 14 "candidate" streetcar corridors that were evaluated as part of this study. Corridors labeled as "definite" PTN corridors already have service that meets most PTN criteria, while the recommended corridors are expected to have service that meets most PTN criteria in the near future.

Downtown Streetcar Corridors

Because the evaluation of candidate corridors within and through downtown Minneapolis is more complicated, Figure 2-2 highlights all streets that might accommodate streetcars in the downtown area. *The following corridors were selected because they logically connect with a candidate corridor outside of downtown and do not have an obvious major physical flaw that would eliminate them from further consideration*. For further information on why other downtown streets were eliminated, see the Phase II report.

Figure 2-1 Candidate Streetcar Corridors

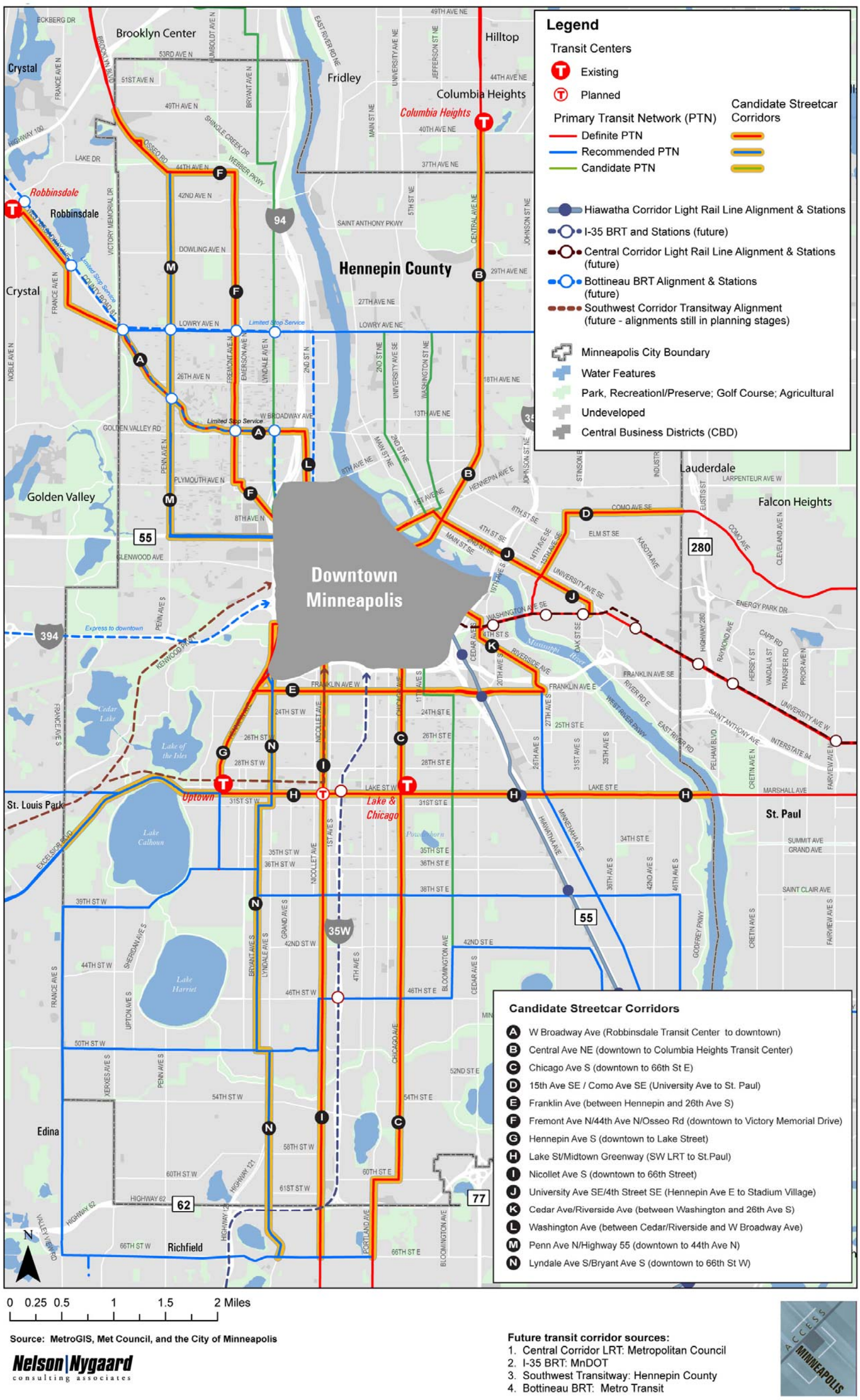
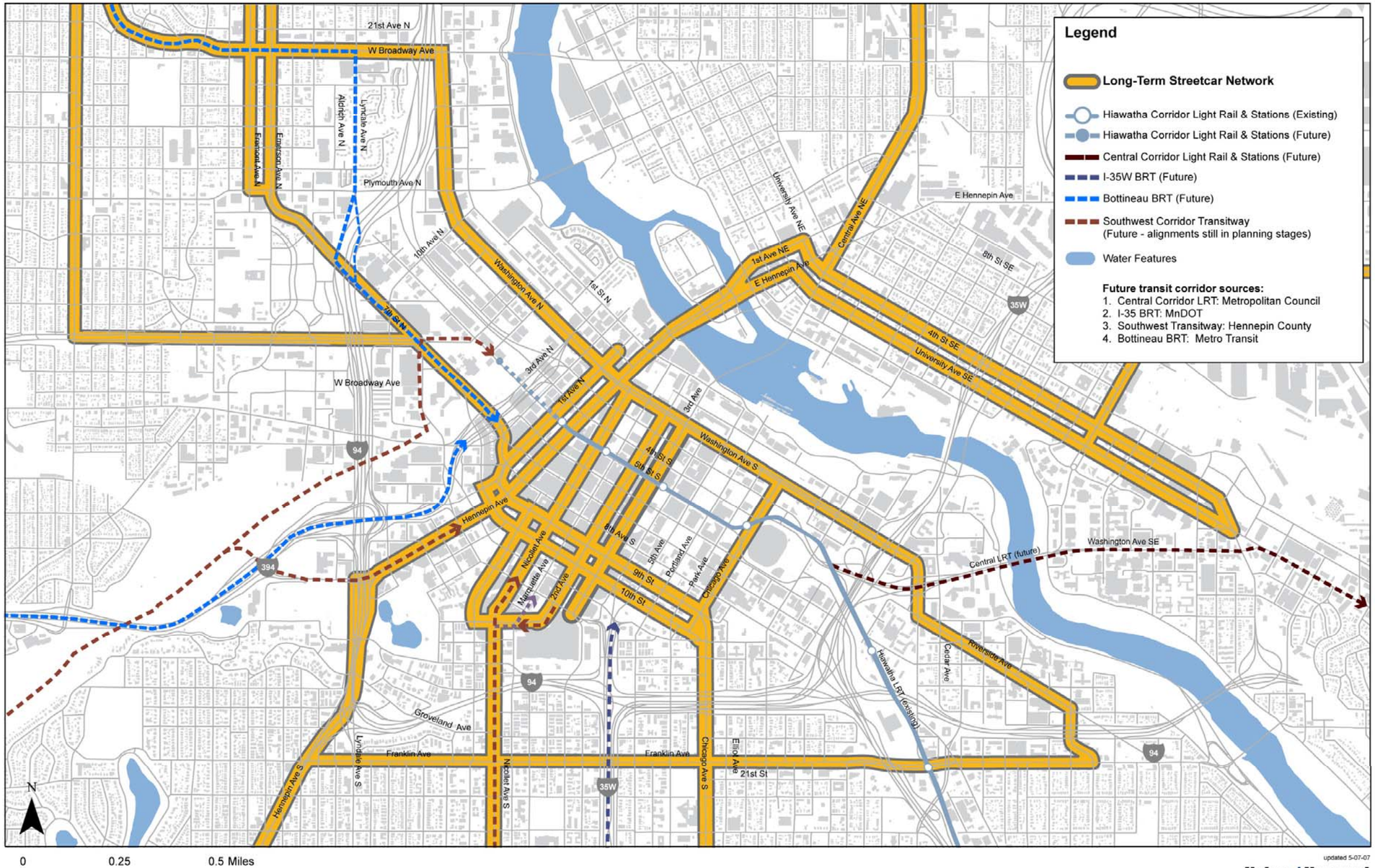


Figure 2-2 Candidate Streetcar Corridors (Downtown Minneapolis)



Evaluation Criteria

Figure 2-3 shows the various analyses that each corridor was subjected to as part of this evaluation. The evaluation criteria can be organized into eight general categories as follows:

- Physical and Geometric Constraints
- Transit Supportive Land Use
- Economic Development Potential and Community Support
- Transit Operations
- Transit Demand
- Cost-Effectiveness
- Funding

The goal of this study was not to eliminate options down to a single corridor, but rather, to define an ultimate network of streetcar routes that will develop at their own pace based on a variety of factors including public acceptance, public and private financing options, timing of development and/or street reconstruction, and the ability to provide increased transit ridership or increased service quality.

Other cities have made decisions to implement streetcar service for a variety of reasons, including their ability to catalyze development and their ability to increase transit ridership. The routes chosen in Minneapolis are as different as their alignments and each route has the potential to excel in one or more area. This analysis did not focus on a single "purpose" for implementing streetcar service, but rather, identified feasible options for services that would generally enhance ridership, improve transit service levels, and either provide a higher quality of service to existing land uses or support current and future development.

Figure 2-3 Evaluation Criteria

Evaluation Criteria and Description	Phase and Chapter: Phase I (Chapter 2)	Phase II (Chapter 2	Phase III (Chapter 4
Physical and Geometric Constraints			
Grade. Corridors with grades that inhibit streetcar operations, or make streetcar operation too expensive, such as those with grades over 6%, are eliminated from further study. A corridor with grades between 4-6% is carried forward to Phase II only if it passes all other screening criteria.	X		
Street Geometry. Identifies whether street geometry would inhibit streetcar operation, or require significant capital investments that make operation infeasible. This includes major modifications to interchanges, skyway conflicts, exclusive right-of-way needs or other types of transit priority that would be required (such as bridges, underpasses, etc.). Potential for wheel noise.	X		
Other Physical Barriers. Evaluates whether other physical barriers besides grade and street geometry inhibit potential streetcar operations without significant capital expenses. Bridges or skyways with less than 14'2" of clearance for combined streetcar and auto operation are eliminated from further study; clearances between 14'2" and 14'8" would be a tentative pass.[1] Lane widths that cannot be striped to more than 10 feet; At grade freight railroad crossings (at grade crossing of two tracks requires difficult FTA approval and would likely not be allowed without expensive additional signalization or grade separation)	X		
Terminal Location. Evaluates whether there is a reasonable location for a streetcar line to terminate where connections to other transit service can be made, such as a transit center, LRT station or major activity center.	X		
Transit Supportive Land Use			
Special Use Generators and Corridor Anchors. Evaluates how well the corridor serves major transit generators, categorized by two different types of generators: "special use generators" and corridor anchors, such as major activity centers. This analysis is based on an evaluation of access to special use generators within ½ mile of the streetcar line.		X	
Transit Supportive Land Use. Measures transit supportive 2020 *planned* land use types (by land area) within ½ mile (as the crow flies) from the streetcar corridor.	X	X	
Economic Development Potential and Community Support			
Economic Development Potential. Evaluates in more detail the potential of the corridor to generate significant economic development.		X	
Area Targeted for Redevelopment. Measures whether or not a corridor is targeted for redevelopment, either in the Minneapolis Plan, small area plans or other neighborhood planning initiatives. Evaluates redevelopment and community planning initiatives in the corridor and assesses the intensity of development potential in each corridor.		X	
Community Support. Evaluates level of community support for streetcar technology in the corridor.		X	X
Coordination with Other Jurisdictions. Evaluates the need to coordinate with other jurisdictions and assessment of barriers. Includes high level assessment of coordination with other jurisdictions and overall assessment of implementation barriers.			X
Transit Operations			
Ability to Maintain Adequate Speed and Reliability. Evaluates existing traffic conditions in the corridor to determine whether or not streetcar operations would be able to maintain adequate speed and reliability. (For purposes of evaluating LOS, assumes that streetcars would operate in mixed-flow traffic as buses do currently and therefore be exposed to the same level of delay). Analysis does not assume preemptive signals. Evaluates existing transit speed as percent of speed limit (Peak and Midday). High level assessment of need for transit priority treatments to maintain speed and reliability (e.g., exclusive ROW or signalization).	X	X	
Integration with other potential streetcar corridors. Evaluates the relationship between the corridor and a future expanded streetcar network.		X	
Integration with current/future high capacity transit investments. Measures the relationship (connectivity, distribution of high-capacity transit investments, etc.) between streetcar and current or future LRT or BRT corridors. Includes an assessment of how potential streetcar lines may enhance or duplicate proposed high capacity service.		X	

[1] The minimum clearance was determined based on City of Minneapolis ordinance 503.2.1 which states that the Fire Department must have a minimum of 13 feet six inches of unobstructed vertical clearance. A streetcar line passing under a bridge or skyway would require at least eight inches of clearance for the wire and hanger and at least another six inches of clearance from the high voltage wire. Therefore, the absolute minimum distance determined to be safe for streetcar operation was 13 feet six inches + eight inches, or 14 feet two inches. A clearance less than six inches below the high-voltage wire is considered a significant issue. Thus, the desirable minimum clearance is 14 feet eight inches. This issue was discussed in detail with the Minneapolis Fire Department.

Evaluation Criteria and Description	Phase and Chapter: Phase I (Chapter 2)	Phase II (Chapter 2	Phase III (Chapter 4
Competition with LRT or BRT lines. Evaluates whether or not the streetcar corridor is in competition with a future LRT or BRT corridor.		X	
Integration with/ability to replace existing bus service. Evaluates how well streetcar would fit in the corridor and what impact streetcars would have on existing bus volumes. Evaluation based on initial operating plans and potential impact on underlying bus network. Measures estimated change in operating hours and daily vehicle volumes if streetcar were introduced along the corridor. Estimated operating cost per rider based on high level ridership estimates adjusted from PTN.		X	X
Transit Demand			
Projected Population Within Corridor. Measures total population and population density served within ½ mile of the corridor – 2020 forecasted data.		X	
Projected Employment Within Corridor. Measures the total number and density of jobs within ½ mile of the corridor – 2020 forecasted data.		X	
Low Income Households. Measures total and density of low income households (under $25,000 annual household income) – 2000 Census data.		X	
Zero Car Households. Measures total and density of zero-car households – 2000 Census data.		X	
Current and Future Transit Ridership. Estimates ridership based on current travel demand and how streetcar service might change ridership in a given corridor. This analysis is not a traditional travel demand model but is based on bus productivity (passengers per revenue hour) in the corridor and adjusted to account for streetcar operation.			X
Cost-Effectiveness			
Utilities. Corridors that would require relocation of major utilities (such as water, storm and sanitary) would make streetcar service too costly to be provided cost effectively. Presence and diameter of water, storm and sanitary utilities along the corridor within 3 feet below proposed streetcar trackway is considered a major issue. Corridors with utilities between 3 – 6 feet of proposed streetcar trackway is considered a moderate issue.	X	X	X
On-Street Parking Impact. Evaluates the width of the street and whether or not a streetcar line would significantly impact on-street parking – especially through local business districts. Parking could be eliminated to create a transit lane and/or to provide for turning movements when streetcars are operating in mixed flow traffic.		X	
Maintenance Site. Evaluates the presence of vacant land within ½ mile of the corridor that is zoned industrial and could be used for a maintenance facility. Sites that are within public ownership will receive a higher rating. No industrial zoning for potential maintenance facility within ½ mile of corridor (or corridor segments) is treated as a fatal flaw.	X		X
Capital Costs. Develops planning level capital cost estimates per track mile and identifies major cost items that deviate from a standard cost/mile. Examples of items that will create additional capital costs over a standard streetcar section include bridges, tunnels, exclusive ROW, property acquisition, etc. Detailed costing will be conducted in the implementation phase of the evaluation.		X	X
Time to Implement. Evaluates corridors (or segments) that are slated for major reconstruction and/or other factors that may delay implementation.			X
Funding			
Private Financing Support. High level assessment of private development interest and support and identifies potential private funding sources. Based on stakeholder interviews with development community in each priority corridor.			X
Funding Potential. Assessment of obtaining local, State or Federal funds, including the FTA Small Starts program. Identification of other potential funding options.			X

Phase I: Physical and Geometric Constraints

Phase I of the evaluation of potential streetcar corridors assessed physical and geometric constraints. Each corridor was reviewed based on existing data and field observations to determine "fatal flaws" related to grade (over 6%), street geometry, bridge and skyway overhead clearance (ideally 14.2' or more), traffic conflicts, lane widths, at-grade railroad crossings and other physical barriers to streetcar construction and/or operation. A reasonable location for a streetcar line to terminate was also identified for each corridor (generally, a transit center, LRT station or major activity center). Figure 2-4 provides a summary of the screening results for physical and geometric constraints. Key findings were:

- **Central Avenue NE**. An at-grade railroad crossing at 36th Avenue NE is a significant barrier to streetcar service. While it was initially recommended that streetcar operation on Central Avenue NE terminate at Lowry based on this constraint, it was subsequently determined that there were potential operations advantages and development opportunities if the corridor could terminate at the transit center in Columbia Heights. This constraint will, however, add considerable cost to the construction of a streetcar line in this corridor.
- **15th Avenue SE / Como Avenue**. A low railroad underpass at 8th Street SE is a major barrier to streetcar operation. It was recommended that this entire corridor be eliminated from further study based on this constraint.
- **Franklin Avenue**. Steep grade (over 6%) on either side of Lyndale Avenue S is a significant issue. It was recommended that Franklin Avenue be eliminated from further study based on this constraint and several other factors.
- **Fremont Avenue N / 44th Avenue N / Osseo Road**. Difficult turns at Fremont Avenue and Plymouth Avenue are a significant issue. It was recommended that this corridor be eliminated from further study based on this constraint.
- **Cedar Avenue / Riverside Avenue**. Turning movements at Seven Corners were identified as a significant issue. It was recommended that this corridor be eliminated from further study based on this constraint.

Phase II: Evaluation of Corridor Performance

All of the corridors that passed through initial screening are at least technically feasible for operation as a streetcar corridor. However, not all corridors are equally well suited for streetcar operations in the short term. Figure 2-5 summarizes the results of the initial evaluation and identifies those corridors that best meet each of the criteria used in this phase of the evaluation.

The table identifies the opportunities and constraints presented by each corridor based on the broad criteria of Transit Supportive Land Use, Economic Development Potential,

Transit Operations, and Cost Effectiveness. Other considerations are identified, where they are evident. The detailed results of the evaluation of each of these criteria are provided in Appendix B.

Figure 2-4 Candidate Corridors and Major Technical Issues

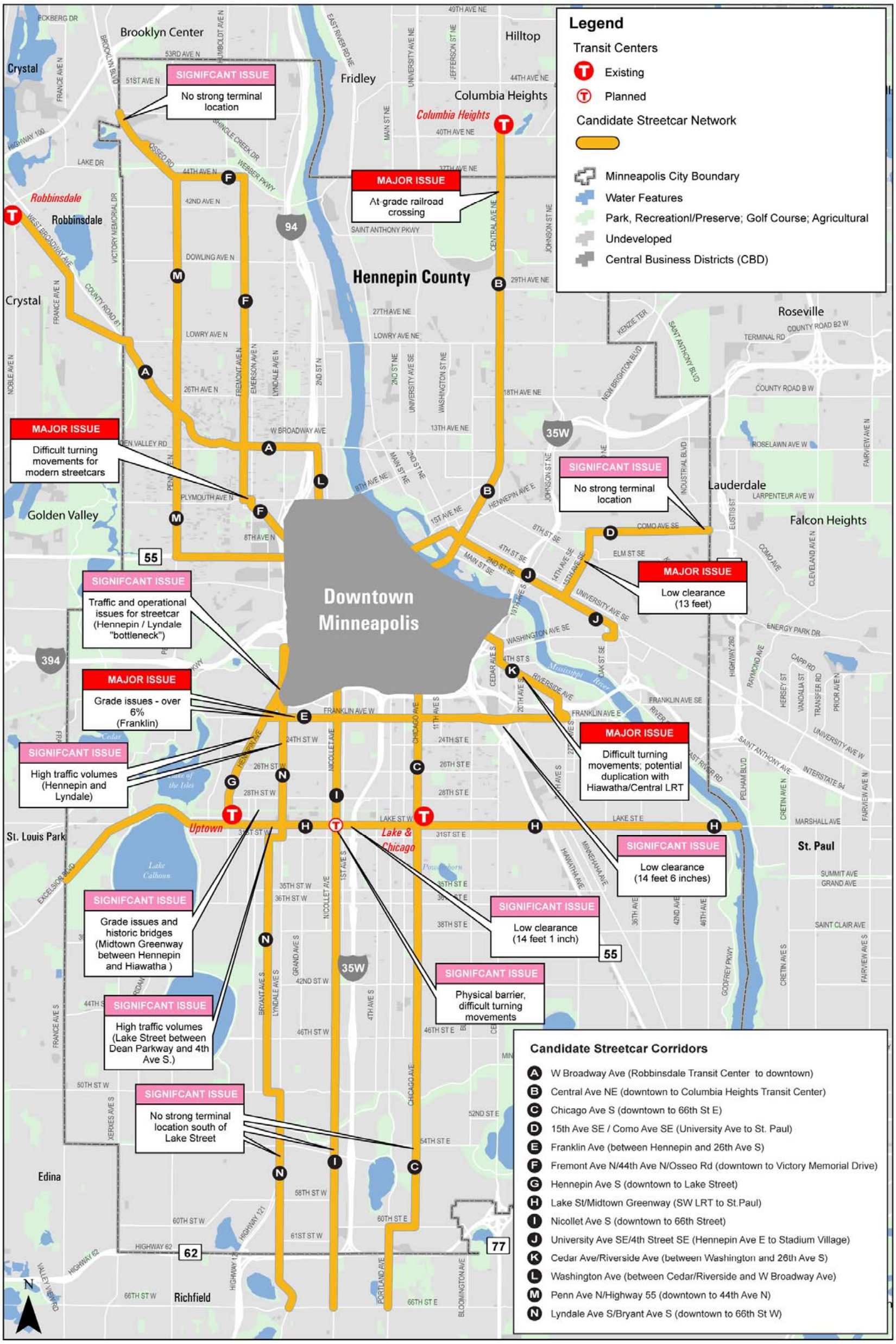


Figure 2-5 Summary of Phase II Analysis

Principal Streets	Broadway	Central	Chicago	Hennepin	Midtown Corridor	Lake	Nicollet	University / 4th	Lyndale
From...	Robbinsdale Transit Center	29th Ave NE	Lake St	Lake St	SW LRT	SW LRT	66th St	Downtown via Hennepin	Lake St
To...	Downtown	Downtown	Downtown	Downtown	Hiawatha LRT	Hiawatha LRT	Downtown	Stadium Village	Downtown
Transit-Supportive Land Use	Serves only one special generator but has relatively strong anchors. Moderate to low transit supportive land use.	Does not serve any special generators and weak anchor on north end. Moderate to low transit supportive land use.	Serves a moderate number of special generators and has high transit-supportive land use.	Serves many special generators, has strong anchors and has moderately high transit-supportive land use.	Serves several special use generators and has strong anchors. Moderate transit supportive land use.	Serves several special use generators and has strong anchors. Moderate transit supportive land use.	Serves moderate number of special generators, has moderately strong anchors and moderate transit supportive land use (higher north of Lake).	Serves several important special generators, has strong anchors and high transit supportive land use.	Serves moderate number of special generators, but weak anchor on south end. Moderately high transit supportive land use.
Economic Development Potential	Strong potential for high intensity development in North Loop area. Good long-term potential for moderate to low intensity development along the rest of the corridor.	Good long-term potential for high intensity development in East Hennepin area and moderate intensity development along corridor near Lowry. Good potential for high intensity development in downtown.	Strong potential for high-intensity development downtown and moderate intensity development at Midtown Corridor/Lake Street.	Strong potential for high-intensity infill development in Uptown, and in several locations in downtown (near Washington Avenue and near 10th Street).	Good potential for moderate intensity development along Corridor – especially at major nodes.	Good potential for moderate intensity development at major nodes – Hennepin, Lyndale, Nicollet, Chicago and to a lesser degree, Bloomington.	Good potential for high intensity development in downtown and moderate intensity development at Midtown Corridor and Lake Street and between Lake and downtown.	Good potential for high intensity development along river (south of University) and in East Hennepin area.	Some potential for moderate intensity development at Midtown Greenway/Lake Street, and in several locations downtown.
Transit Operations	Good potential to impact bus volumes; relatively good connections with other modes; may duplicate BRT or LRT service on Bottineau Blvd, depending on alignment	Good ability to impact bus volumes; relatively good connection with other modes; potential duplication with Univeristy/4th corridor.	If extended to 38th Street, good potential to impact bus volumes; good connections to other modes.	Limited ability to impact bus volumes unless connected to University Ave corridor; relatively good connections to other modes.	Limited potential to impact bus volumes; strong ability to connect Southwest Corridor LRT to Hiawatha LRT. No connection to other modes downtown.	Strong potential to impact bus volumes; moderate ability to connect Southwest Corridor LRT to Hiawatha LRT; no connection to other modes downtown.	Strong potential to impact bus volumes; good connections to other modes.	Strong potential to impact bus volumes if connected to Hennepin Ave; good connections to other modes.	Limited ability to impact bus volumes; relatively good connections to other modes; potential competition with streetcar service on Hennepin and Nicollet corridors
Cost Effectiveness	Limited utility conflicts; no major increase over standard capital costs/mile.	Strong potential for utility conflicts; potential for higher capital costs due to long bridge crossing.	Limited utility conflicts; no major increase over standard capital costs/mile.	Limited utility conflicts; moderate potential for higher capital costs due to Lowry Hill tunnel.	Limited utility conflicts; no major increase over standard capital costs/mile – potentially could be less costly if single-track.	Minor potential for utility conflicts; moderate potential for higher capital costs due to several bridges and reconstruction project	Potential for utility conflicts on Nicollet Mall; capital costs higher in some segments, but relatively low overall.	Strong potential for utility conflicts in University area; potential for moderately high capital costs due to bridge crossings.	Moderate potential for utility conflicts; potential for higher capital costs due to Lowry Hill tunnel.
Other Issues (not included in evaluation criteria)	No other major issues.	No other major issues.	No other major issues.	No other major issues.	Service in this corridor is highly dependent on the outcome of Southwest Corridor LRT.	Service in this corridor is highly dependent on the outcome of Southwest Corridor LRT; Major reconstruction and streetscaping project on Lake Street.	Service in this corridor is highly dependent on the outcome of Southwest Corridor LRT.	No other major issues.	No other major issues.

Transit Supportive Land Use

All of the proposed streetcar corridors are located in areas that already have significant bus transit ridership. Key determinants of transit ridership, regardless of mode, are both residential and employment density and the presence of "special generators and anchors" that may increase ridership over what would be expected from a given level of density. Thus, the streetcar corridors were evaluated based on: (1) Land use type and intensity, and (2) the presence of special generators and anchors.

Land Use Type and Intensity

This criterion measures the level of "transit supportive" planned land use (by area) within approximately ¼ mile of each candidate corridor. The analysis was based on the most recent planned land use dataset for the Twin Cities. While this information was obtained from the Metropolitan Council, it was based on work completed by Minneapolis Community Planning and Economic Development (CPED) for projected land use in the year 2020. Land use types within ¼ mile of each streetcar corridor were categorized into low, medium and high "transit-supportive" land uses, as shown in Figure 2-6 below. Because the majority of downtown has high transit supportive land use, this area was excluded from this analysis in order to better see the difference between corridors outside of downtown. The results of this analysis are presented in Figure 2-7.

Figure 2-6 Ratings for Transit-Supportive Land Uses

Low	Medium	High
Airport General Area	Commercial Small Scale	Commercial General
Golf Course	Downtown Secondary Office	Downtown Edge
Industrial General	Office- Residential Medium Density	Downtown Entertainment
Industrial Light	Mixed Use - Residential Medium	Downtown Primary Office
Institutional Uses	Office / Convertible Space	Downtown Retail
Minneapolis Parks	Residential Medium Density	Live Work Units
Protected Open Space		Residential High Density
Residential Low Density		Mixed Use - Residential High
Retail Single Story		Mixed Use with Retail on Ground Floor
		Office- Residential High Density
		Residential Highest Density
		Transit Oriented Use

The following adjustments were made to reflect more recent planning and development activities:

- **Central Avenue NE:** The Shoreham Yards area between 27th Avenue NE and 31st Avenue NE, which was shown in the land use data as industrial, was adjusted to "moderate" transit supportive land use.
- **University Avenue SE/4th Street SE:** Between 2nd Avenue SE and I-35W, the area between University Avenue SE and the river is planned for medium- to high-density residential. This area was shown in the land use data as industrial. It was adjusted to "high" transit supportive land use.
- **Midtown Corridor:** Between Uptown and Hiawatha Avenue, much of the industrial land use on either side of the corridor is planned for mixed use, medium- to high-density residential and commercial uses. A significant amount of this area was shown in the land use data as industrial. Based on the overall planned density, this area was adjusted to "moderate" transit supportive land use.
- **Nicollet Avenue S:** The intersection of Nicollet Avenue S and the Midtown Corridor is planned for either mixed use, medium- to high-density residential, or commercial uses. This area was shown as industrial in the land use data. Based on the overall planned density, it was adjusted to "high" transit supportive land use.
- **W Broadway Avenue:** The North Loop area is quickly converting from a mostly industrial area to moderate- to high-density housing with small neighborhood commercial uses. This trend is expected to continue in the future. The entire North Loop area was shown as industrial in the land use data. Based on the overall planned density in the North Loop, such as the new Twins Ballpark, the entire corridor was adjusted to "moderate" transit supportive land use.

Figure 2-7 "Transit-Supportive" Average Land Use Score

Corridor and/or Corridor Segment	Average Transit Supportive Land Use Score	Qualitative Rating (HIGH, MODERATE, LOW)
Nicollet (north of Lake Street)	2.53	HIGH
Chicago (via 9th/10th Street to Nicollet)	2.26	HIGH
Chicago (via Chicago Avenue and Washington Avenue to Nicollet)	2.23	HIGH
University/4th (entire corridor)	2.20	HIGH
Lyndale (entire corridor)	2.09	MODERATE
Hennepin (entire corridor)	2.06	MODERATE
Midtown (entire corridor)	1.80	MODERATE
Lake (entire corridor)	1.75	MODERATE
Nicollet (entire corridor)	1.75	MODERATE
Central (entire corridor)	1.69	MODERATE
Broadway (east of Memorial Drive)	1.58	MODERATE
Broadway (entire corridor)	1.55	MODERATE
Nicollet (south of Lake Street)	1.22	LOW

Special Generators and Corridor Anchors

Special generators are facilities such as sport stadiums, major entertainment facilities, major hospitals, and the convention center that tend to attract large numbers of occasional riders. These riders are typically not captured in daily ridership estimates that are based on recurring or routine activities. Streetcars are particularly appealing to occasional riders who may not be familiar with the overall transit system if the streetcar line is very close to the special generator. Therefore, all special generators within ¼ mile (approximately 3-4 city blocks) were identified for each of the potential streetcar corridors.

Corridor anchors may be single destinations or may be activity centers with regional or citywide importance and especially high trip generation. These anchors are important to the ridership calculation, but are also important because they help to define viable corridor segments and create corridor identity. For the purposes of this analysis, regional transit connections, such as Light Rail or Transit Center connections are also described as anchors. While a transit station may not generate trips per se, providing new connectivity will increase the ridership of a proposed segment and will help a segment to be sustainable before an entire corridor can be completed.

Streetcar service to corridors with high residential and employment density will generate significant ridership even if they do not serve specific nodes. However, corridors that do serve special generators and have strong anchors will have a "leg up" on generating ridership.

Figure 2-8 shows a map of the major special use generators, as well as areas that serve as strong anchors for each corridor.

Evaluation of Economic Development Potential

Many of the modern streetcars implemented or planned in the US were designed to be integral to an overall strategy for redevelopment (see Appendix A for further information on streetcar lines in other cities). In Minneapolis, there is significant variation in the potential or desirability for redevelopment along the proposed streetcar corridors.

In coordination with the sector planners from Minneapolis CPED, a qualitative assessment of development potential was completed for each streetcar corridor. This process included a review of existing neighborhood and small area plans, a review of the city's comprehensive plan, and a discussion of each corridor with the sector planners. Discussions were also held with some private developers. It should be reiterated that this evaluation is not intended to provide an *exhaustive* list of *all* redevelopment initiatives occurring within the corridor. Rather, the goal was to conduct a qualitative, high-level assessment of the corridors *compared to each other* with regard to redevelopment and the relative intensity of that redevelopment.

Many of the corridors being considered for streetcar have good short and/or long-term development potential. However, it is also important to understand the intensity of the development that is likely to occur. Thus, two corridors may have equivalent potential for redevelopment but one may experience a much higher intensity of development than another. Areas within downtown, for example, can be expected to achieve a relatively high intensity of development. Many of the most recent buildings constructed in downtown have been high rises that have significant development intensity. In comparison, most of the new development that is occurring outside downtown tends to be a maximum of 3-4 story buildings. The resulting development intensity is, therefore, less than that being experienced in some parts of downtown. Based on this initial assessment of economic development potential, several corridors (or areas) stand out in terms of their redevelopment potential:

- **W Broadway Avenue.** While the market has yet to fully respond to redevelopment opportunities along W Broadway, the North Loop area along Washington is quickly adding new residential and commercial uses. Development intensity will be relatively high in the North Loop area but moderate to low intensity in outlying parts of the corridor.

- **Hennepin Avenue S.** The Uptown area of this corridor offers relatively high potential for redevelopment. A Small Area Plan is being conducted to evaluate the potential in this area. Moderate to high intensity development is likely to occur in the downtown and Uptown portions of the Hennepin Ave. corridor.
- **Midtown Corridor/Lake Street**. This corridor between Uptown and Chicago Avenue (especially along the Midtown Corridor) is currently experiencing major redevelopment. Although not as intense as some of the development occurring in the downtown area, moderate-density housing is planned at the major nodes (Hennepin, Lyndale, Nicollet, and Chicago) as well as near the Midtown/Lake Street station of the Hiawatha LRT line. Higher intensity of development can be expected at the nodes than between the nodes.
- **Chicago Avenue S.** Although there is less redevelopment potential between Lake Street and downtown, the Chicago/Lake area (especially along the Midtown Corridor), Elliot Park and the Downtown East area all show strong potential for redevelopment. The intensity of development is likely to be greater in Elliot Park and Downtown East than in the Midtown and Lake Street areas.
- **University Avenue SE / 4th Street SE.** Although this corridor has less potential redevelopment opportunity overall, the area between University Avenue and the river is slated for major residential redevelopment. In addition, a new University of Minnesota stadium along with the future Central LRT line will create strong redevelopment potential. Also, the downtown to East Hennepin portion of this corridor exhibits some potential for additional infill development. Intensity of development is expected to be greater near the UM campus and near the East Hennepin area than in other areas along the corridor.
- **Central Avenue NE.** The downtown portion of this corridor shows relatively strong potential for high intensity development, but will likely be built out in several years. The northern half of the East Hennepin area also shows some potential, as does the commercial corridor around Lowry Avenue, but these areas will likely experience a lower intensity of development than within the downtown.

Figure 2-8 Special Use Generators and Corridor Anchors

Evaluation of Transit Operations

Each corridor was initially evaluated based on: (1) the potential to reduce bus volumes, (2) the ability to maintain adequate speed and reliability of transit service, and (3) the relationship of the streetcar service to regional transit system (LRT, BRT and other streetcar lines).

Potential to Reduce Bus Volumes

From a transit operations and operating cost perspective, when converting a PTN line to streetcar operations, it would be ideal if the entire line could be converted at once, allowing buses to be replaced by streetcars essentially one for one. While this may be ideal, it is simply not practical – most of the PTN routes are very long, coming into central Minneapolis from outlying suburbs, while the streetcar corridors being studied are either entirely within the City of Minneapolis or continue only to the next adjacent jurisdiction. Corridors can certainly be extended over time, but it is likely that streetcars and buses will need to be able to coexist in the PTN corridors until these extensions are financially feasible.

While entire bus routes may not be replaced in most cases, demand for bus service may be reduced when streetcars operate over a significant portion of the route, and when reasonable connectivity between buses and streetcars is offered as an option to riders. In these cases, it may be possible to reduce bus frequencies serving the outer part of a line, reduce bus stops (allowing faster service for longer distance riders), or terminate regional bus routes at transit centers serviced by the streetcar line. In this analysis, forced transfers were not assumed in most cases unless a very significant share of bus service could be replaced by the streetcar.

Ability to Maintain Adequate Speed and Reliability

It was assumed that streetcars would typically have similar operating speeds as buses. While streetcar speeds can be impacted by their inability to travel around obstacles such as double-parked vehicles where the track is blocked, they also have some travel time benefits over buses through all door boarding and "pay on board" fare collection. Examples of techniques that can be used to improve overall transit operating speeds include minor signal pre-emption, exclusive transit lane, queue bypasses, proof of payment and/or on-board payment that does not require driver involvement, all-door boarding, free fare zones, wider stop spacing (when provide as an overlay to bus service).

Relationship to Other Streetcar, LRT or BRT Lines

Each corridor was evaluated to determine how well streetcar service would integrate with (or compete with) other high investment transit modes, such as BRT and LRT, as well as other streetcar lines. All of the corridors have relatively logical connections with other streetcar corridors. While the Midtown/Lake Street Corridor would not interline with other

streetcar corridors, it would provide a crosstown connection for the Hennepin, Nicollet and Chicago corridors.

Likewise, most of the proposed streetcar lines fit well into the system of high capacity transit either already in place or planned by Metro Transit. It is assumed that if streetcar service were implemented in the W Broadway Avenue and Central Avenue corridors, it would at least connect with a LRT station in downtown. Corridors with potential conflicts include:

- **Midtown Corridor and Nicollet Avenue.** If the Uptown to Nicollet alignment for the Southwest Corridor LRT line is chosen, streetcar service in the Midtown Corridor or on Nicollet Avenue S would be duplicative. Streetcar service between Nicollet Avenue and the Lake Street station of the Hiawatha LRT line would still be possible if the Uptown/Nicollet alignment is chosen for the Southwest Corridor LRT line.
- **Lyndale Avenue/Hennepin and Nicollet.** A Lyndale Avenue streetcar corridor would compete with streetcar investments in the Hennepin and Nicollet corridors. This is true today in the bus system, and as a result Lyndale is a lower transit ridership corridor then either of the other two corridors. It is unlikely that a future streetcar network could support development in all three corridors.
- **W. Broadway and Bottineau Blvd.** A West Broadway streetcar corridor may potentially compete with LRT or BRT investments in the Bottineau Blvd corridor, where an Alternatives Analysis will begin in early 2008. Any decisions relative to streetcar in this corridor will need to be coordinated with activities and decisions being made as part of the Bottineau Blvd Alternatives Analysis.

Transit Demand

The demographic factors most correlated with transit ridership include total population and total employment, population and employment *density,* households with no vehicle available, and low income households (less than $25,000). Although total figures are important, the focus of this analysis is on density, which is the single most important factor determining transit demand. 2000 census data and 2020 projections from the Metropolitan Council were used to analyze demographic characteristics within ½ mile of each candidate corridor.

Evaluation of Cost Effectiveness

Most modern streetcars developed in the United States in the last decade experienced costs per track mile that were relatively consistent, depending on the average construction costs in a given city, and other unique factors impacting a particular line. All streetcar corridors have many common elements including the cost for tracks, overhead wire, passenger amenities, etc. What will differentiate the cost for developing one corridor versus another in the same city, built at the same time, has more to do with the unique

features of the corridor – the need for expensive over or underpasses, unusual earth movement, or unusual circulation features that are not "standard" with streetcar development.

As a general rule of thumb, streetcar capital costs have averaged between $10 and $15 million per track mile, exclusive of maintenance facilities and cars. (see Chapter 4 for more detail on costs). For the purposes of screening, all potential streetcar corridors were evaluated based on factors that often drive costs up or down. Conditions that will create additional capital costs over a standard cost per mile include:

- **Utilities**. The presence of significant utilities will either constrain streetcar development or will require extensive relocation.
- **Bridges**. The estimated cost of adding streetcar rails to an existing bridge is approximately $1,000 per lineal foot, in each direction. This condition is estimated as having a greater cost differential compared to a standard street, depending on the condition of the bridge.
- **Underpasses**. Several locations along the candidate corridors require streetcars to pass under a bridge. In some of these situations, the vertical clearance is very close to the minimum required, which will likely result in some modification to construction methods. This condition is estimated as having a small impact on cost differential.
- **Unique Streets.** There are several "non-standard" features on some corridors that would likely increase costs over a standard street. These include special street paving (such as brick) and crossing of existing LRT tracks. Most of these conditions were identified in downtown. Special street paving is estimated as having a minimal additional cost, whereas LRT crossings are estimated as having a slightly higher cost differential but still relatively low.
- **Other unique factors** which may make one corridor more or less expensive than another (for example, the opportunity to begin service with a single track; the need for elevators or other vertical circulation; and/or the need to address particular bottle necks or physical changes in the street, extensive movement of curb lines, changing drainage, etc.).

It is important to note that more detailed cost estimates (that assigns an estimated dollar amount) were developed for the corridors in the long-term streetcar system (Chapter 4).

Recommendations of Phase II Evaluation

Figure 2-9 summarizes the recommendations for each streetcar corridor evaluated in the Phase II evaluation. These recommendations led to the formation of the "long-term streetcar network" that is evaluated further in Chapter 4. While the long-term streetcar network represents corridors that are similar to each other, several areas of this network require further explanation – the Midtown Corridor and downtown corridors.

Midtown Corridor

Through the screening process, the Midtown Corridor was selected as the preferred alignment bisecting Midtown Minneapolis. While this corridor is included as part of the long-term streetcar network, the streetcar route envisioned for the corridor would function differently than other proposed streetcar routes in Minneapolis. Some of the differences between the Midtown Corridor and the other corridors studied include:

- The Midtown Corridor is a cross-town corridor that is designed to provide local circulation and connectivity between high employment nodes and two light rail lines.
- The construction of the Midtown Corridor is dependant on the decision regarding the alignment of the Southwest Light Rail alignment (as is the Nicollet Avenue S corridor).
- The exclusive right-of-way offered by the Midtown Corridor provides an opportunity for a completely separated transit-way that avoids conflicts between cars and transit vehicles. This separated right-of-way also offers some advantages in the ability to utilize different construction techniques than the proposed embedded track in the regular street right of way. The right-of-way, which is owned by the Hennepin County Regional Railroad Authority, also brings some unique challenges related to vertical circulation, stop placement and interactions with historic bridges.
- The line would be built alongside a very popular bicycle and pedestrian trail, with unique design and safety constraints presented by the high volume of non-motorized traffic alongside the streetcar.
- The operating plan for the Midtown Corridor streetcar would be essentially dictated by the operation of the light rail lines it touches. Service in the Midtown Corridor would primarily supplement rather than replace existing bus service.
- Unlike the other streetcar lines, the Midtown Corridor service would not be easily visible from the street, particularly Lake Street which is the primary business corridor in the area.
- The Midtown Corridor is not designed for direct physical connections to the other streetcar lines, although connections will potentially be possible at Chicago and potentially Nicollet and Hennepin via vertical circulation.
- The Midtown Corridor would likely be implemented in a single segment, rather than beginning with a starter line and expanding out from there.
- The Midtown Corridor has already been studied previously. The Midtown Greenway Coalition sponsored a feasibility study in 2001 of a single-track streetcar service operating in the Greenway. The Hennepin County Regional Railroad Authority has also conducted previous transit studies for this corridor. The HCRRA provided ridership estimates for this corridor in conjunction with the Southwest Transitway Alternatives Analysis.

Because this corridor functions very differently than the other corridors, its development may occur independent of the other lines. Additional information about the Midtown Corridor is presented in Chapter 3 of this report. The remaining corridors are discussed in more detail in subsequent chapters.

Downtown Corridors

Downtown routes were evaluated separately from the primary streetcar corridors, both because different corridors could be connected to a variety of downtown routes and because travel through downtown has specific complexities that are distinct from the rest of the route[2]. From an operational standpoint, *only corridors that logically connect with a corridor outside of downtown were considered for streetcar operation in downtown*.

This assessment was also based on consideration of a number of issues in downtown Minneapolis when determining appropriate streetcar corridors including centrality to the core, skyway clearance, severe traffic congestion, current and future bus volumes, conversion of one-way to two-way streets, turning movements, and competition with existing Hiawatha LRT and future Central LRT. Based on this evaluation of all possible downtown corridors using the above criteria, the following downtown corridors are included in the long-term streetcar network:

- **Nicollet Avenue** – entire corridor.
- **Hennepin Avenue** – entire corridor.
- **Washington Avenue** – between Plymouth Avenue N and Park Avenue.
- **Chicago Avenue and Park Avenue** – south of Washington Avenue.
- **9th/10th Streets** – between Chicago Avenue and Nicollet Avenue.

[2] Downtown is generally defined as the area bound by I-94, Plymouth Avenue North, the Mississippi River and I-35W.

Figure 2-9 Summary of Screening Evaluation – Identification of the Long-Term Streetcar Network

Candidate Corridor	Included in Long-Term Streetcar Network?	Comments / Explanation
W Broadway Avenue	Yes, entire corridor	Lacks high intensity land uses but shows long-term potential for moderate development density, especially east of Penn Avenue N.
Central Avenue NE	Yes, extended to 49th Avenue NE	Lacks high intensity land uses but shows long-term potential for moderate development density, especially near Lowry Avenue NE and in Columbia Heights and high intensity development in the East Hennepin area. Corridor was extended from initial recommended terminus to 49th St NE based on interest expressed by the City of Columbia Heights in serving proposed new development in this area.
Chicago Avenue S	Yes, north of 38th Street E	High intensity land uses currently exist along entire corridor with both short- and long-term potential for high intensity development in the Elliot Park and Downtown East areas and moderate intensity development in the remaining portions of the corridor. At least two potential alignments through downtown are included.
15th Ave SE / Como Ave	No	Low underpass at 8th St SE.
Fremont Ave N / 44th Ave N / Osseo Rd	No	No strong anchor north of 44th Ave N / Penn; Difficult turns at Fremont/Plymouth; Low transit-supportive land use along entire corridor and very limited potential for future development.
Hennepin Avenue S	Yes, entire corridor	Existing high intensity land uses in Uptown and in downtown with short- and long-term potential for high intensity development in downtown and moderate to high intensity development in the Uptown area.
Lake Street	No	Good potential to impact local bus network and more traditional streetcar corridor. However, has less potential as a regional connection between LRT lines compared to Midtown Corridor and corridor in process of major reconstruction and streetscaping project.
Midtown Corridor	Yes, between Hiawatha and Southwest LRT	Good redevelopment potential (moderate intensity) and ease of transit operations. Better than Lake Street at providing regional connection between Hiawatha and Southwest Corridor LRT lines. This connection could be made at the West Lake station or the Nicollet/28th Street station, depending on the alignment selected for the SW LRT corridor.
Nicollet Avenue S	Yes, only as far as 46th Street	High intensity land uses (north of Lake Street) with strong potential to impact local transit services. *Note: would not be included if the Uptown/Nicollet alignment is chosen for the Southwest Corridor LRT line.*
University Avenue SE / 4th Street SE	Yes, entire corridor	High intensity land uses in downtown, East Hennepin area and around the University of Minnesota. Both short and long-term potential for increased development density along the corridor.
Cedar Ave / Riverside Ave	No	Turning movements at Seven Corners; possible duplication of service with Hiawatha and Central LRT
Washington Ave	Yes, entire corridor	Corridor consolidated with the W Broadway corridor.
Penn Ave N / Hwy 55	No	No strong anchor north of 44th Ave N / Penn; Low transit-supportive land use along entire corridor
Lyndale Avenue S	No	Less redevelopment potential and minimal impact on transit operations. Higher capital costs than other corridors. Potential duplication of service with Hennepin and Nicollet corridors.

Chapter 3. Midtown Corridor

The Midtown Corridor is a part of the long-term streetcar network but it has some characteristics that set it apart from the rest of the network and required additional analysis or a different method of analysis. These differences are related primarily to the fact that the Midtown Corridor is not an existing Primary Transit Network corridor (Lake Street is the PTN alignment) and the Greenway is in a below grade abandoned railroad corridor rather than along an existing at-grade street. These factors influence ridership, ability to replace bus service, capital and operating costs.

This chapter summarizes the information developed for the corridor, including projected ridership, capital and operating costs and provides additional information about the unique conditions on this corridor.

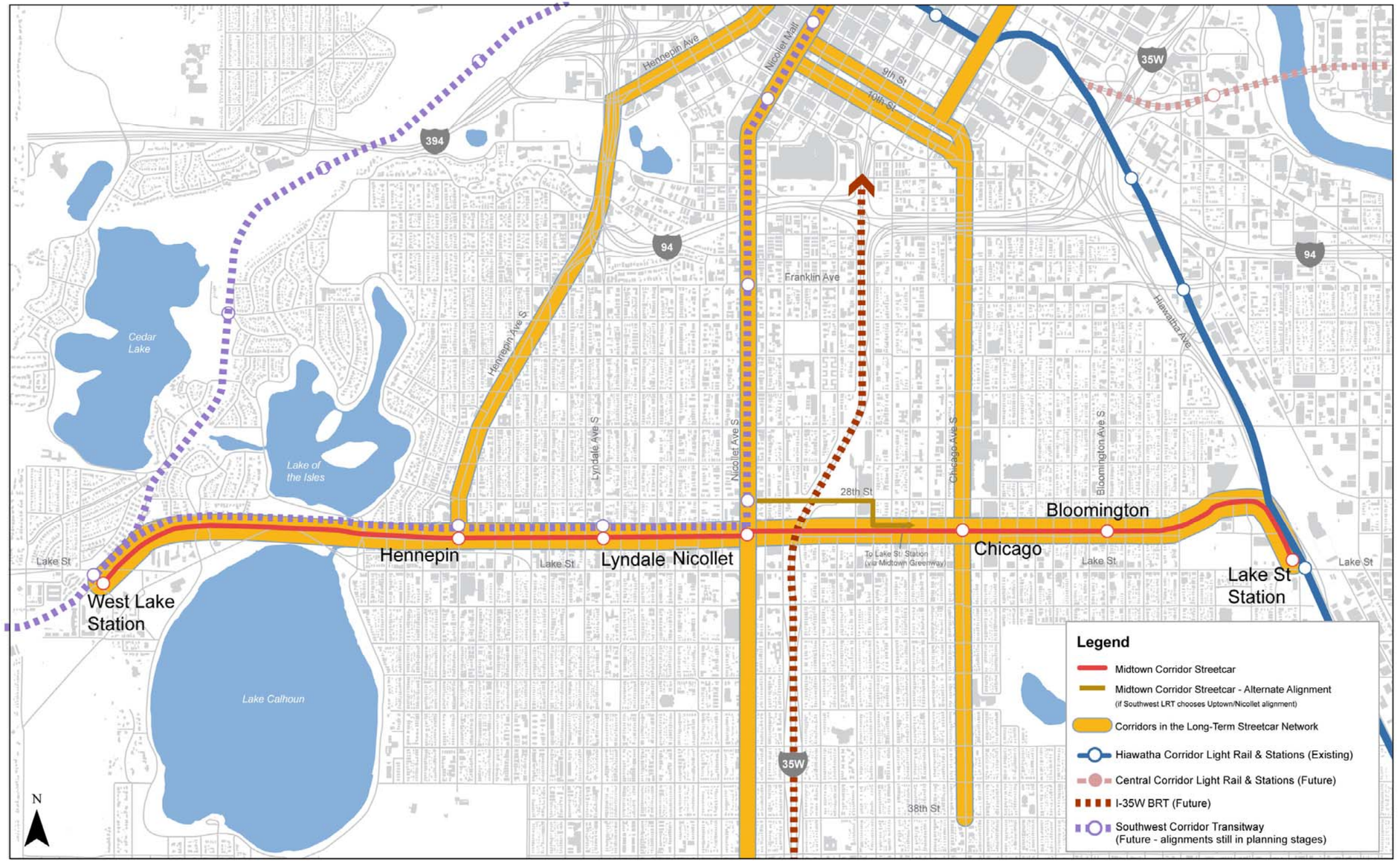
Midtown Corridor Routing

The Midtown Corridor streetcar alignment primarily serves as an extension of the SW LRT and Hiawatha LRT lines into south Minneapolis and a connection between the two lines. It would operate in the 29th Street abandoned railroad trench next to the existing Midtown Greenway multi-use trail. Streetcar service would operate from the West Lake Station (SW LRT line) to the Lake Street Station (Hiawatha LRT line). A total of seven stations are recommended along the Midtown Corridor, including the two LRT stations:

- West Lake Station (along future Southwest Corridor LRT line)
- Hennepin Avenue S (Uptown Transit Center)
- Lyndale Avenue S
- Nicollet Avenue S
- Chicago Avenue S
- Bloomington Avenue S
- Lake Street Station (along Hiawatha LRT line)

Figure 3-1 shows the alignment of streetcar lines in the Midtown Corridor, along with the proposed stations and alignments of planned and existing LRT lines. The limited number of stations (about every one-half mile) and the exclusive right-of-way will allow streetcar to operate with speeds and service characteristics very similar to LRT.

Figure 3-1 Conceptual Midtown Corridor Streetcar Alignment



Nelson|Nygaard consulting associates

The Midtown Corridor Streetcar is recommended to be implemented in a single segment, rather than in phases, because its ridership is very closely tied to the SW LRT service (see ridership section for further details). A decision on whether to proceed on the Midtown Corridor is dependent on the alignment decision in the SW LRT Draft Environmental Impact Statement, which is currently underway, because one of the SW LRT alignment alternatives uses a significant portion of the Midtown Corridor. While construction is not technically dependent on construction of the SW LRT line, ridership on the Midtown Corridor would be higher if the SW LRT line were operational prior to service in the Midtown Corridor. For purposes of comparative analysis, most of the information presented in this chapter assumes that the Southwest LRT line connects to downtown Minneapolis via the Kenilworth alignment and would require a transfer to the Midtown Corridor at the proposed West Lake Station. However, this should not be interpreted as a recommendation for or against the Kenilworth alignment.

Operating Plan

The operating plan for streetcar service in the Midtown Corridor is based on several key variables:

- **Length of the corridor.** This is the round trip distance of the line in miles. The round-trip distance of the corridor is approximately 8.8 miles (4.4 miles each direction).
- **Travel speed.** With exclusive ROW, service in the Midtown Corridor was estimated at a consistent 18 mph throughout the day. This includes a 20 second dwell time at each station. This is consistent with travel times on the Hiawatha and Southwest LRT lines, and is faster than streetcars operating in mixed traffic.
- **Layover requirements.** Assuming Metro Transit would be the streetcar operator, layover time for streetcars is the same as for buses, or a minimum of 15% of the total round-trip running time.
- **Frequency of service.** Streetcar headways in the Midtown Corridor should provide meaningful connections between the Hiawatha and Southwest LRT lines. Currently, the headway on the Hiawatha line is every 7-8 minutes during peak periods, 10 minutes during the midday and every 15 minutes in the evening. It is assumed that the Southwest Corridor LRT line will have similar headways. The frequency of streetcar service in the Midtown Corridor is assumed to be the same as LRT.
- **Hours and days of service.** Total hours of service for the long-term network mimic that of the LRT service, or approximately 23 hours per day on weekdays and 21 hours per day on weekends. Streetcar service is assumed to operate 255 weekdays, 52 Saturdays and 58 Sundays and holidays annually.

Based on these variables, Figure 3-2 estimates the total number of vehicles required to operate streetcar service in the Midtown Corridor for weekdays, Saturdays and Sundays, as

well as an estimate of daily revenue hours, annual revenue hours and annual operating cost[1].

Figure 3-2 Estimated Revenue Hours and Operating Costs

	Peak Vehicles	Daily Rev. Hours	Annual Rev. Hours	Annual Op. Cost
Weekday	5	79	20,145	$3,016,714
Saturday	4	73	3,796	$568,451
Sunday	4	73	4,234	$634,042
Total		225	28,175	$4,219,206

Single- Versus Double-Track Operation

It is assumed that streetcar service in the Midtown Corridor would have a single-track along the entire corridor with sections of double-track where necessary for passing. This alignment will provide adequate capacity to match peak period LRT headways as currently planned.

When considering single-track versus double-track construction, it is important to note that only full double-track construction provides total operational flexibility – e.g., the ability to change streetcar headways with maximum flexibility. While the current plan will allow for frequent operations, and will allow streetcars to run at the same frequencies proposed for light rail during peak periods, headways may not be able to be changed easily, as the location of double-track segments is entirely dependent on the frequency of service. For example, streetcar service operating every 7-1/2 minutes in each direction would require three separate sections of double-track to allow vehicles to pass each other along the line. Because it is exactly half the amount of service, 15 minute headways can utilize the same sections of double-track. However, service every 10 minutes would require three sections of double-track but in different locations then the other frequencies require. In order to operate a service that mimics light rail frequencies throughout the day, between 6 and 8 short sections of double-track would be required along the corridor. The sections of double-track would need to be located between bridges and strategically placed to ensure an efficient, reliable and safe operation. It is assumed that, regardless of the headway, double-track sections are required at the West Lake and Lake Street/Hiawatha stations.

The decision to utilize the proposed alignment rather than a full double-track operation is not based strictly on a desire to reduce capital costs, although clearly, building less track will reduce costs significantly. Currently, there are 37 bridges that span the Midtown Corridor, all of which vary in the year they were built, the location of bridge supports and

[1] Operating cost per revenue hour is estimated at $149.75. This estimate is less than Metro Transit's operating cost per revenue hour for light rail service (approx. $167/rev. hour), but more than Metro Transit's operating cost per revenue hour for bus (approx. $99.00/rev. hour). Based on experience in other streetcar cities, operating cost per revenue hour is typically higher than bus but less than light rail.

the distance between bridge supports. Several of these bridges would not accommodate a double-track right of way along side the bicycle and walking path. Although capital cost estimates for constructing double-track along the entire length of the Midtown Corridor have not been developed, it is assumed for high-level planning purposes that these costs would be prohibitive and the construction would be unnecessary unless streetcar headways were changed significantly.

It should be noted that the Hennepin County Regional Railroad Authority (HCRRA), as the owner of the right-of-way will ultimately determine whether single-track operation is sufficient in this corridor. Initially, the right-of-way was acquired as a potential light rail alignment, which would have required full double-track operation. Part of the alignment is still a potential LRT alignment, and no final decision has been made on the requirements for this facility. While the alignment identified for streetcar service is physically feasible, the HCRRA will need to determine the long-term plan for this corridor.

Because a transfer will be required between the Midtown Corridor streetcar and both LRT lines, it is important to ensure that the streetcar schedule is coordinated with the LRT schedules. Because the Hiawatha LRT line is already operational, the streetcar schedules should be developed around this service first. The Southwest LRT schedules should then be developed around the streetcar's arrival and departure times at the West Lake Station.

Alternative Alignment

If the Southwest LRT connects to downtown Minneapolis via the Midtown Corridor and Nicollet Avenue S, streetcar service in the Midtown Corridor would not operate between the West Lake Station and Nicollet Avenue S. However, the connection between the Southwest LRT and Hiawatha LRT lines could still be made.

To make this connection, an alternate routing in the Midtown Corridor was developed. From the Midtown/Lake Street station, the line would travel westbound via the Midtown Corridor. At 5th Avenue S (the only at-grade crossing in the Midtown Corridor between Cedar Avenue and Hennepin Avenue), the streetcar would travel north to 28th Street, and then westbound to Nicollet Avenue S. The streetcar would return via 28th Street and 5th Avenue S to the Midtown Corridor. Because 28th Street is a one-way eastbound street, an exclusive streetcar lane would be required in the westbound direction. It is assumed that double-track would be required on 28th Street and 5th Avenue S, but that single-track with sections of double-track would be sufficient in the Midtown Corridor.

At this point in the study, a detailed operating plan has not been developed for this alternative alignment. If the Uptown to Nicollet alignment is chosen for the Southwest LRT line, however, total operating costs are estimated to be approximately 50% less than service in the entire corridor. Capital cost estimates would also be significantly lower for this alternative alignment since it is about half the length of the full corridor. Capital cost estimates for the alternative alignment are provided later in this report.

Ridership Estimates

The Southwest Transitway Alternatives Analysis Study prepared a detailed model of ridership in the Midtown Corridor for the year 2030 using the same operating assumptions as those described in the previous section. The model was run assuming the LRT 1A alignment from Eden Prairie via the Kenilworth alignment to downtown Minneapolis. The estimates were made using the Twin Cities Travel Demand Model and assumed streetcar service would have the same attributes as light rail transit. It is important to note that the ridership estimates using the 1A LRT alignment are conservative and made to understand the system-wide impacts of operating an LRT line via the Kenilworth alignment with a rail service in the Midtown Corridor that connects to the Hiawatha LRT line. The ridership estimates developed for the Midtown Corridor are very different than ridership estimates presented in the next chapter for other corridors in the long-term streetcar network.

Based on the travel demand model, approximately 3,300 weekday boardings were generated along the Midtown Corridor. The model produced several primary trip types:

- Internal trips on the Midtown Corridor (50%)
- Trips from Midtown Corridor to the southbound Southwest LRT line (25%)
- Trips from the Southwest LRT line to the Midtown Corridor (12%)2
- Trips from the Midtown Corridor to the southbound Hiawatha LRT line (8%)
- Trips from the Hiawatha LRT line to the Midtown Corridor (3%)
- Trips from the Midtown Corridor to the northbound Southwest LRT line (2%)
- Trips from the Midtown Corridor to the northbound Hiawatha LRT line (<1%)
- Trips from the Central LRT line to the Midtown Corridor (<1%)

Overall, the model suggests that about half of all boardings on the Midtown Corridor streetcar are internal – that is, approximately 1,650 daily trips originate and terminate within the corridor. Approximately 39% of all boardings are directly linked to the SW LRT line and about 11% are directly linked to the Hiawatha LRT line. The model also predicted an increase in total light rail boardings of approximately 1,000 as a result of the streetcar in the Midtown Corridor.

Ridership estimates were not developed for the alternate streetcar alignment if the Uptown to Nicollet alignment is chosen for the Southwest LRT line.

It should be noted that the Hennepin County Regional Railroad Authority is studying several light rail variations on the south end of the alignment which could produce increased light rail ridership and likely would produce more streetcar ridership than the numbers presented in this report. The linkage between higher LRT ridership resulting from

[2] Trips are primarily destined for either Uptown (Hennepin) or Lynlake (Lyndale).

alternative alignments outside of the Midtown Corridor and ridership on any proposed streetcar line has not yet been established.

Unique Physical Issues in the Midtown Corridor

This section provides an initial assessment of the unique physical issues associated with operating a streetcar in the Midtown Corridor. This section is intended for planning purposes only – a more detailed evaluation of each element identified below would be required before moving forward with implementation.

Maintenance and Storage Facility

As with any rail transit, streetcar service requires a maintenance and storage facility for the streetcar vehicles. The Phase II evaluation included an initial assessment of areas appropriate for a maintenance/storage facility and identified the east end of the corridor as the most appropriate area to explore.

The area with the greatest potential to accommodate a maintenance/storage facility along the Midtown Corridor is in the vicinity of Hiawatha Avenue and 28th Street E. Most of the land in this area is currently zoned industrial (I-1, I-2 or I-3), and it appears that several parcels are either vacant or underutilized. Access to this area would likely be via 28th Street E and require less than 1,300 feet of non-revenue track.

Although there are several other areas along the Midtown Corridor that may be conducive to a maintenance/storage facility, accessing those areas will likely be too expensive due to grade issues. There is, however, an at-grade crossing of the Midtown Corridor at 5th Avenue S which could provide access to this area (currently zoned I-1). It should be noted, however, that while industrial zoning currently exists along the corridor, the long-term vision is for more residential and commercial uses, which is not entirely compatible with a maintenance/storage facility.

The existing LRT maintenance facility located near Hiawatha Avenue and Franklin Avenue is not expected to be available for routine streetcar maintenance and storage because the facility will be at capacity when vehicles are acquired for the Central LRT. However, major maintenance work on streetcar vehicles could be conducted at this facility by moving the streetcar vehicles to this location by truck. This is currently done in Portland where the main TriMet light rail maintenance facility is used for all major mechanical work on the streetcars.

Another possible location for a maintenance/storage facility is the proposed Southwest Corridor LRT line, where streetcar vehicles could share space with LRT vehicles. This option would need to be discussed further with the Hennepin County Regional Railroad Authority.

Historic Bridges

The Midtown Corridor Streetcar would pass under 35 bridges, many of which are designated historic structures. The Phase I report determined that a minimum height of 14′8″ was required for streetcar operation in mixed flow traffic. Although the minimum height may be somewhat flexible because streetcars would operate in an exclusive right-of-way, this standard is assumed to be a reasonable benchmark. Based on a review of all bridges in the Midtown Corridor, none of the bridges the streetcar would pass underneath is lower than 18 feet – and many of the newer bridges have over 20 feet of vertical clearance.

While the streetcar is likely to be able to "fit" under the historic bridges, it is important to note that the width of the bridges is a major factor in deciding to build a single-track system with passing tracks rather than a full double-track system. Many of the historic bridges have spans that clearly require the rebuilding of a number of bridges to accommodate a double-track right-of-way built to full LRT standards. Right-of-way for a double-track is approximately 30-35 feet.

Power

Because the Midtown Corridor is entirely in a grade-separated, exclusive right-of-way, streetcars can achieve a higher average speed compared to streetcars operating at-grade in mixed flow traffic. The estimated average speed for streetcars in the Midtown Corridor is 18 miles per hour, which includes stops. Between stops, speeds can be higher – between 25-30 mph. Because of higher average speeds, it is assumed that overhead lines required to power streetcars in the Midtown Corridor will need to use a catenary system similar to that used for LRT. A catenary system utilizes two wires – one that is strung between supporting poles and has a natural "catenary" curve. A second wire is then held parallel to the streetcar track by a series of connecting wires and clamps. Because the second wire providing power to the streetcar is parallel to the tracks, higher speeds are possible. Catenary wire generally requires 18-19 feet of height for standard operations. Catenary wire should be hung by special support poles rather than make use of the existing bridges or other structures in the corridor. Depending on the height of each bridge, it may be necessary to install protective coverings under the bridge for safety purposes.

Vertical Circulation

Unlike other streetcar corridors, the Midtown Corridor is grade separated from the surrounding areas. Because of this, access to the line will require vertical circulation at each station. Because the Americans with Disabilities Act (ADA) requires adequate access to public transit for all transit users, the five stations between Hennepin and Bloomington will require vertical circulation. A typical station will consist of at least an elevator and a stairwell.

Embedded versus Ballasted Track

Streetcars can operate on either embedded or ballasted track. Embedded track is embedded in the roadway and is appropriate where other modes must also be able to utilize the same right-of-way, as is the case with all other streetcar corridors. Ballasted track, on the other hand, can only be utilized by rail vehicles. Figure 3-3 shows embedded track on the left and ballasted track on the right. Ultimately, the Hennepin County Regional Railroad Authority will need to determine whether ballasted track is sufficient for the Midtown Corridor operation.

Figure 3-3 Embedded versus Ballasted Track

Embedded

Ballasted

While ballasted track is less expensive than embedded track, it does have trade-offs. The primary concerns with ballasted track are that it is more difficult to cross and access across the track may need to be limited or restricted. Also, the ballast consists of loose rocks which can be "kicked up" by the vehicle or purposely thrown. Given the number of cyclists and pedestrians who would need to cross the trackway to reach the multiuse path and who will be riding alongside the streetcar, ballasted track may also be considered hazardous. It should also be noted that both Hennepin County Regional Railroad Authority and the ultimate operator of this service could have standards for rail operation that would need to be considered. The negatives associated with this type of construction may be outweighed by the potential savings and reduction of paved surface that ballasting provides. Separate capital cost estimates are provided in the next section, comparing both types of track options.

The use of turf track has also been suggested for the Midtown Corridor. However, turn track is not recommended because this type of track is not compatible with the higher operating speeds expected in this corridor, because it is susceptible to fire and this is a safety hazard for the adjacent trail users, and because it creates additional maintenance costs and maintenance problems.

At-Grade Crossings

It should be noted that there are several at-grade crossings of the Midtown Corridor where embedded track would be required. These locations include 5th Avenue S, James Avenue, Irving Avenue and Humboldt Avenue as well as 21st Avenue S near the Hiawatha LRT station.

Station Design, Safety and Lighting

All stations in the Midtown Corridor must be designed to meet appropriate ADA standards and include at a minimum a platform, shelter, benches, passenger information and vertical circulation. In addition, it is assumed that each station will be designed to maximize visibility and provide adequate lighting. Because the Midtown Corridor does not have the advantage of "eyes on the street" as do other street-running transit modes, clearly identified emergency telephones and perhaps surveillance cameras should be considered for all station platforms.

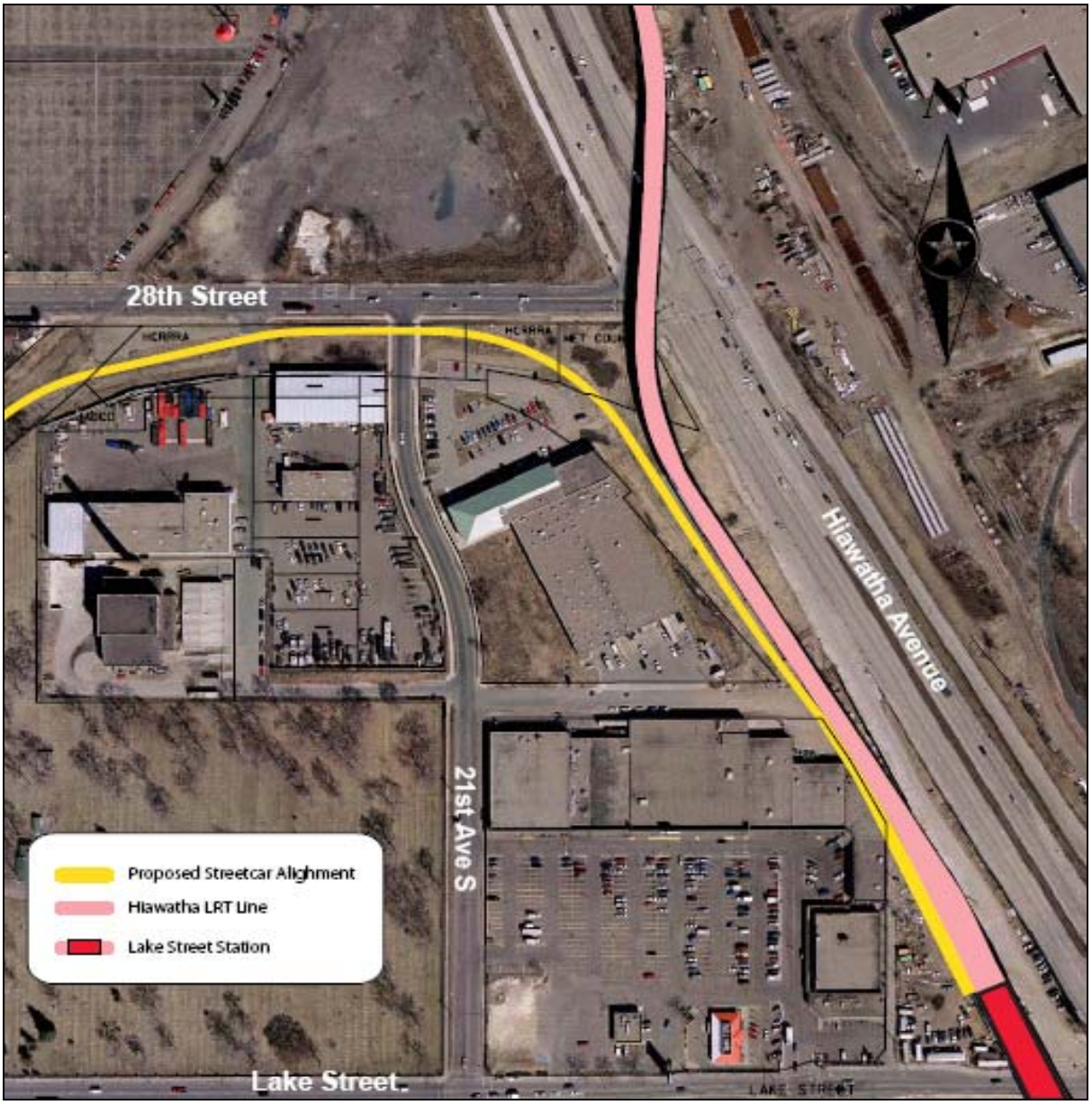
Connection to LRT Stations

Streetcar service in the Midtown Corridor is proposed to connect with the Southwest and Hiawatha LRT lines. While the streetcar stations are proposed to be as close to the LRT stations as possible, a transfer is required between the two modes.

On the west end of the line, at the West Lake Station, the Southwest LRT line and the streetcar station will both be at-grade. Although the streetcar would require a separate station, it should be located as close as possible to the LRT station to allow for seamless connections.

On the east end, the Lake Street Station is elevated and requires the use of a stairwell or elevator to access the platform. Pedestrian access between the streetcar terminal and the Lake Street Station should be reinforced to minimize the transfer time between modes. Figure 3-4 shows the proposed streetcar alignment to the Lake Street station.

Figure 3-4 Midtown Corridor Proposed Alignment at Lake & Hiawatha LRT Station



Capital Cost Estimates

This section provides order-of-magnitude capital cost estimates for streetcar service in the Midtown Corridor. The methodology used for developing these costs is consistent with the costing completed for the other long-term streetcar corridors.

Capital Costing Methodology

Initial order-of-magnitude cost estimates were developed based on component costs from other comparable projects in the same region of the country. The capital cost estimates developed for the Southwest Corridor LRT being conducted by Hennepin County Regional Railroad Authority provided local unit cost information for many of the materials required to build a streetcar. Because there are only a small number of examples of modern streetcar systems already built in North America, Portland, OR was selected as a good peer to help formulate costs appropriate to a modern streetcar system. Since cost estimates were completed in previous years, costs were inflated and adjusted to more closely match local construction costs in 2007.

All estimates presented in this report are order-of-magnitude for planning and feasibility assessment purposes only and do not represent any level of design. A preliminary design and engineering study would need to be completed to increase the accuracy of capital costs.

A number of key components drive the cost of rail streetcar in an urban environment. These include:

- **Trackwork** – as noted earlier, trackwork in the Midtown Corridor could either be embedded or ballasted, depending on local preference. Costs are provided for both embedded and ballasted track and are estimated on a per mile basis. These costs also include additional costs for switches, crossovers and other special devices/improvements.
- **Platforms** – a basic cost for platforms at each station include the base, ramps, shelter/bench, trash receptacle, static passenger information and possibly street lighting and drainage modification as needed. Other costs unique to the Midtown Corridor, such as vertical circulation to and from the platform, are included as an additional cost.
- **Catenary system, signals and substations** – this category is also referred to as the Power System. It includes costs for the catenary system itself (poles and wires), train control system for single-track sections of the alignment and the cost of required power stations. Power cost estimates were based on the Southwest Corridor study using a general figure of $2.0 million per route mile.
- **Utilities** – A utility cost estimate was derived from the Southwest Corridor study on a linear foot basis and adjusted for this report. Major public utilities (water, sewer, sanitation) are not expected to be a significant issue in the Midtown Corridor, but

"minor" costs associated with utility work is included at this level of analysis to account for potential fiber optic relocation and any additional unforeseen utility relocation issues.

- **Switch** – a standard amount per switch was used per the Southwest Corridor study. Two switches per mile were assumed where a transition from single-track to double-track was needed.
- **Construction soft-costs and taxes** – this cost estimate includes an allowance to cover unforeseen costs related to the road itself (utilities, traffic systems, street lighting, drainage, etc.) as well as any State of Minnesota taxes that may apply to construction materials.
- **Engineering and project management** – this category assumes a cost estimate of 20% for project design and engineering, and the administration of the project startup.
- **General Contingency** – a 25% general contingency was added for all other unforeseen costs to the project as a whole.

The cost estimation methodology uses these component costs to develop a generic cost per single-track mile estimate for the Midtown Corridor. Figure 3-5 shows an estimated cost per track mile for embedded track, while Figure 3-6 shows an estimated cost per track mile for ballasted track.

Figure 3-5 Streetcar per Track Mile Construction Costs (Order of Magnitude) $2007 – Embedded Track

Cost Category	Unit Cost	Quantity	Total Price
Trackwork - Embedded Track Installation	$420 / LF	5,280	$2,217,600
Catenary System, Signals and Substations	$228 / LF	5,280	$1,203,840
Switch	$18 / LF	5,280	$95,040
Utilities – Moderate Conflicts	$360 / LF	5,280	$1,900,800
Platforms	$60,000 each	avg. 5 per mile	$300,000
Construction Soft Costs and Taxes	20%	of cost	$1,143,456
Sub-Total Construction Cost	–	–	$6,860,736
Engineering and Project Management	20%	of sub-total	$1,372,147
General Contingency	25%	of sub-total	$1,715,184
Total Anticipated Construction Cost ($2007)	Per Mile		$9,948,067

Figure 3-6 Streetcar per Track Mile Construction Costs (Order of Magnitude) $2007 – Ballasted Track

Cost Category	Unit Cost	Quantity	Total Price
Trackwork – Ballasted Track Installation	$192 / LF	5,280	$1,013,760
Catenary System, Signals and Substations	$228 / LF	5,280	$1,203,840
Switch	$18 / LF	5,280	$95,040
Utilities – Minor Conflicts	$120 / LF	5,280	$633,600
Platforms	$60,000 each	avg. 5 per mile	$300,000
Construction Soft Costs and Taxes	20%	of cost	$649,248
Sub-Total Construction Cost	–	–	**$3,895,488**
Engineering and Project Management	20%	of sub-total	$779,098
General Contingency	25%	of sub-total	$973,872
Total Anticipated Construction Cost ($2007)	Per Mile		**$5,648,458**

Figure 3-4 and 3-5 Assumptions:

- All costs are for single-track miles; double-track cost is twice the amount per mile
- Cost estimates are based on Southwest Corridor LRT unit costs and adjusted where needed based on the Portland Streetcar project or Midtown Corridor estimates.
- Unit costs are based on 2003 data and inflated 5% per year to 2007 dollars. The inflation rate of 5% was used to account for recent increases in the cost of steel, concrete and other construction materials required for streetcars.

Other Costs

The following costs are not included in the standard cost per track mile calculation shown in Figure 3-5 and Figure 3-6, but do add to the total cost of the project.

- **Vehicles** – a wide range of vehicle types are available for streetcar service. This study does not presuppose a preferred vehicle type, but does assume a cost associated with modern vehicles similar to those used in Portland and Tacoma (between $2.5 and $3.0 million each). Based on the operating plan presented above, the peak vehicle requirement in the Corridor is 5 vehicles (assuming a maximum frequency of 7-1/2 minutes). At least one spare vehicle should be obtained to account for scheduled maintenance and unexpected breakdowns. A total estimated vehicle cost for the Midtown Corridor is approximately $18 million.
- **Maintenance and storage facility** – a maintenance or storage facility is a requirement of any streetcar service. Assuming streetcar service in the Midtown Corridor is operated independent of other future streetcar corridors in the city, a

maintenance and storage facility would be required as close as possible to the alignment. Maintenance and storage facility costs vary, but a small facility required to house streetcars in the Midtown Corridor is estimated at $4.0 million.

- **Right-of-way** – Because the Midtown Corridor is in an existing ROW and owned by the Hennepin County Regional Railroad Authority, property acquisition costs are not anticipated.
- **Vertical circulation** – This cost item includes vertical circulation to the platform in the Midtown Corridor, such as elevators and stairwells. These costs are assumed only for the stations in the corridor that are not at-grade (Hennepin, Lyndale, Nicollet, Chicago and Bloomington).
- **Double-track passing sections** – This cost item includes short sections of double-track required for passing. Eight sections of double-track at approximately 400' long would be required to provide varying service headways in the corridor.
- **Embedded track for at-grade crossings** – For the capital costs developed for ballasted track, several short sections of embedded track are required for the at-grade crossings along the corridor (5th Avenue S, James Avenue, Irving Avenue, Humboldt Avenue and 21st Avenue S). These costs are estimated by assuming the cost per mile for embedded track for the short sections that are required.

Rather than present costs for the corridor as a whole, the Midtown Corridor has been broken into three shorter segments. In addition, capital costs for the alternate routing via 5th Avenue S and 29th Street (to serve the 28th Street Station) have also been included. Figure 3-7 provides an estimate of costs per segment assuming the track is embedded in pavement. Figure 3-8 provides an estimate of capital costs if the track is ballasted along the entire segment.

Figure 3-7 Order of Magnitude Streetcar Capital Costs by Segment (Midtown Corridor) – Embedded Track

From	To	Track Miles	Standard Cost per Track Mile	Standard Cost	Additional Capital Items	Additional Capital Cost	Total Capital Cost (excluding vehicles and maintenance facility)[3]
Entire Corridor							
West Lake Station	Hennepin	1.4	$9,948,067	$13,927,294	1) Side Track – (3) 2) Vertical Circulation – (1)	$1,860,000 $400,000	$16,600,000
Hiawatha / Lake Station	Chicago	1.3	$9,948,067	$12,932,487	1) Side Track – (3) 2) Vertical Circulation – (2)	$1,860,000 $800,000	$15,200,000
Chicago	Hennepin	1.7	$9,948,067	$16,911,714	1) Side Track – (4) 2) Vertical Circulation – (2)	$2,480,000 $800,000	$20,200,000
Total	–	4.4	–	–	–	$10,460,000	$52,000,000
Alternate Alignment (if Southwest Corridor LRT via the Midtown Corridor / Nicollet is chosen)							
Hiawatha / Lake Station	28th St Station	4.4	$9,948,067	$43,771,495	1) Side Track – (3) 2) Vertical Circulation – (2)	$1,860,000 $800,000	$29,100,000

[3] Figures rounded to the nearest 100,000.

Figure 3-8 Order of Magnitude Streetcar Capital Costs by Segment (Midtown Corridor) – Ballasted Track

From	To	Track Miles	Standard Cost per Track Mile	Standard Cost	Additional Capital Items	Additional Capital Cost	Total Capital Cost (excluding vehicles and maintenance facility)[4]
Entire Corridor							
West Lake Station	Hennepin	1.4	$5,648,458	$7,907,841	1) Side Track – (3) 2) Vertical Circulation – (1) 3) At-Grade Embedded Track	$1,860,000 $400,000 $195,000	$10,400,000
Hiawatha / Lake Station	Chicago	1.3	$5,648,458	$7,342,995	1) Side Track – (3) 2) Vertical Circulation – (2) 3) At-Grade Embedded Track	$1,860,000 $800,000 $122,000	$10,100,000
Chicago	Hennepin	1.7	$5,648,458	$9,602,378	1) Side Track – (4) 2) Vertical Circulation – (2) 3) At-Grade Embedded Track	$2,480,000 $800,000 $65,000	$13,000,000
Total	–	4.4	–	–	–	$8,582,000	$33,500,000
Alternate Alignment (if Southwest Corridor LRT via the Midtown Corridor / Nicollet is chosen)							
Hiawatha / Lake Station	5th Ave S	1.5	$5,648,458	$8,472,686	1) Side Track – (3) 2) Vertical Circulation – (2) 3) At-Grade Embedded Track	$1,860,000 $800,000 $122,000	$10,900,000
5th Ave S[5]	28th Street Station	1.2	$9,948,067	$11,937,681	–	–	$11,900,000
Total	–	2.7	–	$25,040,716	–	$2,382,000	$22,800,000

[4] Figures rounded to the nearest 100,000.
[5] This section of track shares right-of-way with other uses and therefore must be embedded.

Other Issues

This section discusses other issues related to implementation of streetcar service in the Midtown Corridor.

Development Potential

As noted in the Phase II report, strong development potential exists along the Midtown Corridor although the intensity of development is less than is likely to occur in the downtown and near-downtown neighborhoods. While development potential is significant along the corridor itself and at major nodes, the breadth of this development potential is limited to approximately one or two blocks on either side of the corridor and the height of development to date has typically been 3-4 stories. A limited amount of higher intensity development may be acceptable in one or more of the nodes but this is an issue that is currently being debated by many of the adjacent neighborhoods. The majority of development potential in the Midtown Corridor exists in the Uptown/Lynlake area, at Nicollet Avenue S, Chicago Avenue S and at both LRT station locations.

Owner / Operator Arrangements

As the owner of the Midtown Corridor right-of-way, the Hennepin County Regional Railroad Authority (HCRRA) will play a critical role in determining policies and developing design guidelines for the corridor. No decisions have been made regarding the development, ownership and operation of streetcar lines in Minneapolis, including the Midtown Corridor. See Chapter 6 for further discussion of strategies for streetcar ownership and operation.

Staging of Construction

As mentioned earlier in this chapter, it is recommended that the Midtown Corridor be constructed as one project, rather than phased in smaller segments over time. This is recommended because the long-term projected ridership for the corridor, when fully completed, is relatively low (3,300 trips per weekday) and half of this ridership is directly linked to the SW LRT line (39%) and the Hiawatha LRT line (11%). While the construction of streetcar in the Midtown Corridor is not dependent on construction of the SW LRT, much of the ridership is. Therefore, this linkage should be considered when determining the timing of construction of the Midtown Corridor.

Finally, a *decision* on whether to construct streetcar in the Midtown Corridor should not be made until a decision is made on the alignment of the SW LRT line. If the Midtown/Nicollet alignment is the preferred alignment for LRT, then streetcar would likely not be a feasible alternative in the Midtown Corridor or in the Nicollet Corridor.

Chapter 4. Long Term Streetcar Network

Minneapolis is planning a streetcar system first, and then determining how the system can be phased over time. Minneapolis recognizes that the system will be implemented one corridor at a time and that the initial corridor may start with a very short starter line. It is important, however, that this starter line be one from which the long-term system can grow.

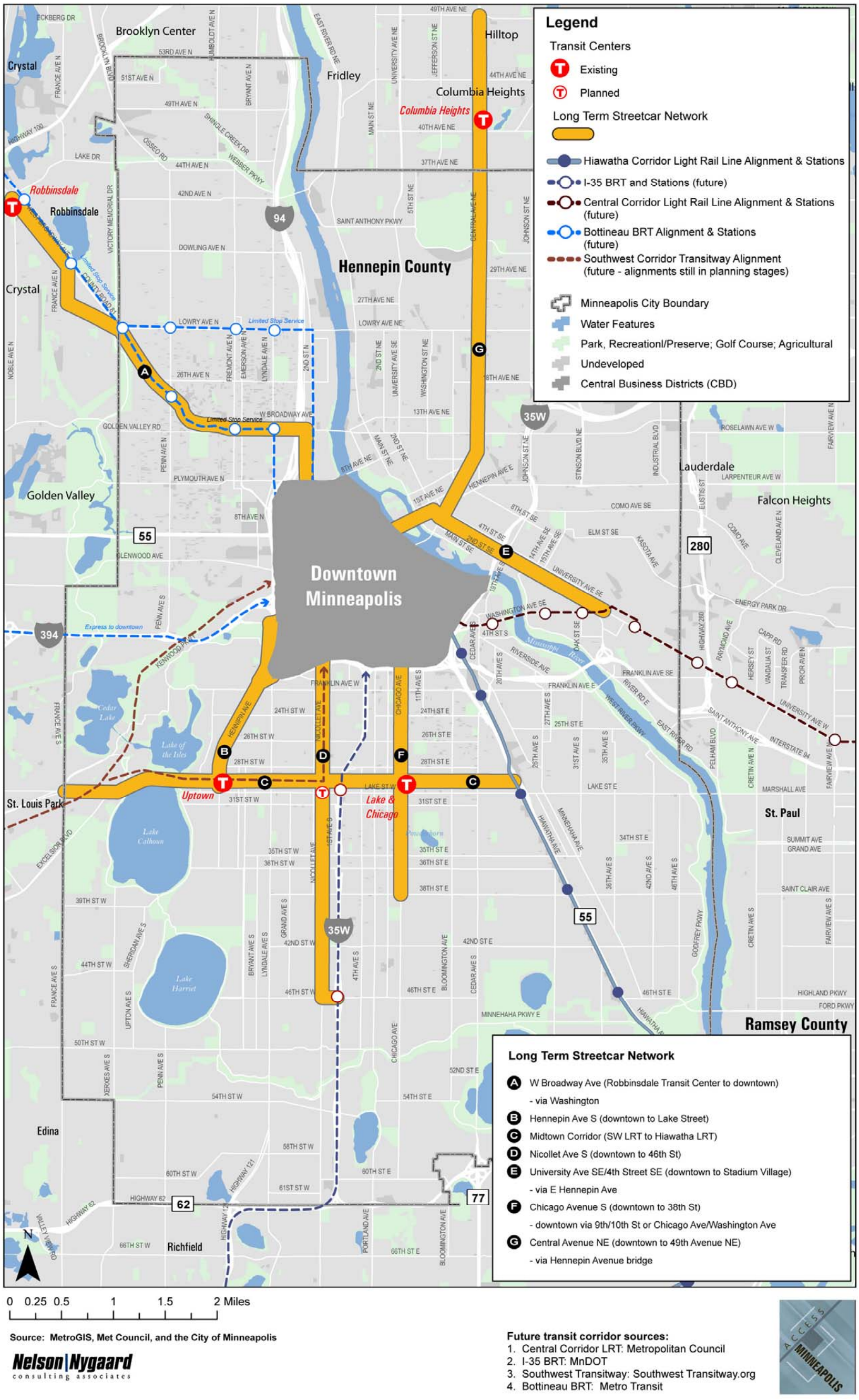
This chapter presents the results of more detailed and quantitative analysis on the corridors which remain in the long-term streetcar network for Minneapolis, providing operating costs, capital costs, ridership estimates, and development opportunities for each of the corridors in the network. Because these lines would likely not be implemented in a single phase, Chapter 5 analyzes how implementation might be phased for each corridor and presents capital and operating costs, ridership estimates, and development opportunities for the initial phases for each long-term corridor.

The Long-Term Network

The long-term streetcar network includes seven corridors as shown in Figure 4-1. Six of the seven corridors provide service to, from and through downtown. The seventh corridor, the Midtown Corridor, has different characteristics from the other corridors and was discussed in detail in the previous chapter. This system represents at least a 20-50 year plan for streetcars in Minneapolis. Based on the initial evaluation, all of these corridors have good potential for replacement of bus service, high ridership, and future development.

The downtown alignments for the proposed long-term streetcar network are shown in Figure 4-2.

Figure 4-1 Long-Term Streetcar Network

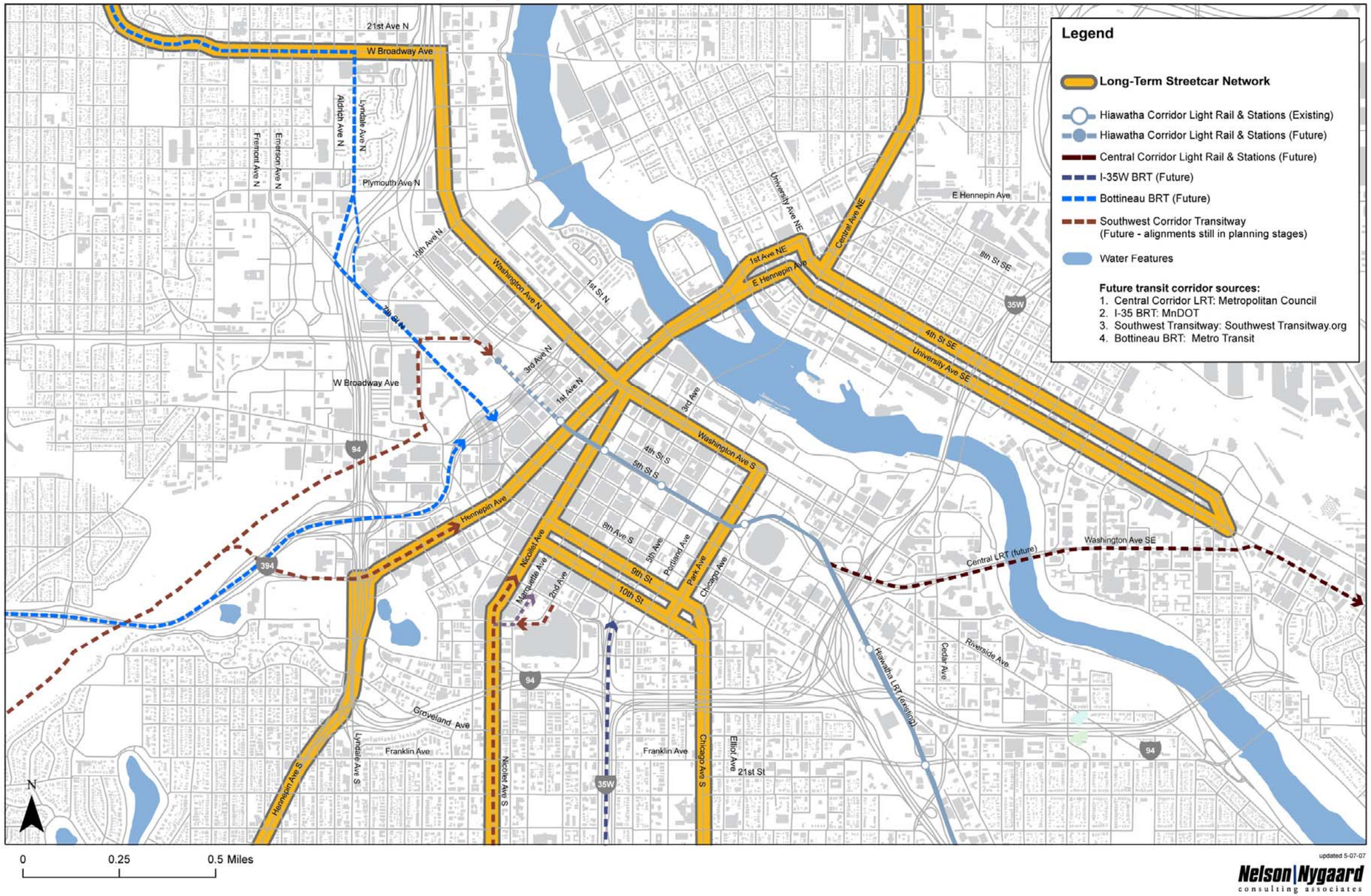


Source: MetroGIS, Met Council, and the City of Minneapolis

Nelson|Nygaard consulting associates

Future transit corridor sources:
1. Central Corridor LRT: Metropolitan Council
2. I-35 BRT: MnDOT
3. Southwest Transitway: Southwest Transitway.org
4. Bottineau BRT: Metro Transit

Figure 4-2 Long-Term Streetcar Network in Downtown



Streetcar Cross Sections

Streetcars are proposed to run in mixed traffic on all corridors except the Midtown Corridor. While design engineering will be required to determine exactly how streetcar would be constructed in each corridor, several locations along the long-term network were chosen to illustrate how streetcar tracks could be integrated into the street. Most of the streets proposed as streetcar corridors have right-of-way widths of 80 feet – in many cases this is a building front to building front dimension. Hennepin Avenue downtown has an existing right-of-way of 100 feet. Five cross sections are illustrated:

- **Hennepin Avenue (downtown) between Washington Avenue and 11th Street South (Figure 4-3).** The Hennepin Avenue alignment assumes two-way operation along the entire segment and shared operation in the curb lanes with buses.
- **Typical Community Corridor (Figure 4-4).** Nicollet Avenue S is an example of a typical community corridor, which has one travel lane in each direction, on-street parking, and a center turn lane in some locations.
- **Typical Community Corridor (Neighborhood Commercial Node) (Figure 4-5).** Both Nicollet Avenue S and Chicago Avenue S have neighborhood commercial nodes at various locations along the corridor.
- **Typical Commerce Corridor (Figure 4-6).** The Washington Avenue, W Broadway Avenue, Central Avenue NE and Hennepin Avenue S corridors typically have two travel lanes in each direction with an on-street parking lane.
- **Typical Downtown One-Way Street (Figure 4-7).** The one-way streets in downtown typically have three travel lanes and on-street parking on both sides.

Figure 4-3 Hennepin Avenue Typical Cross Section Downtown

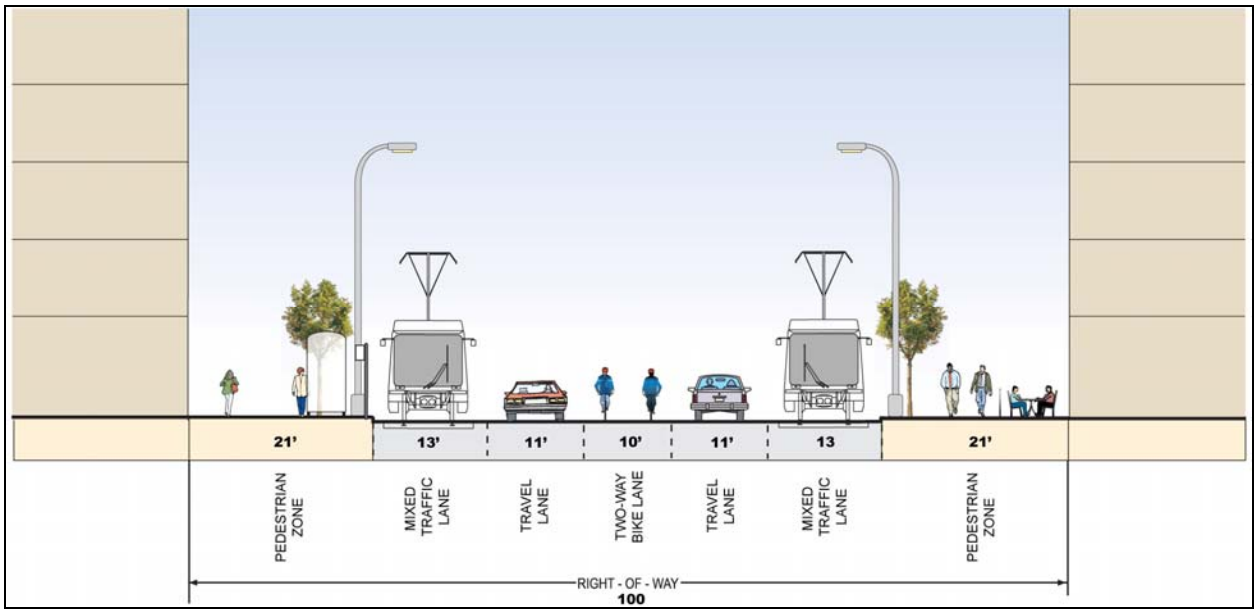


Figure 4-4 Typical Community Corridor Cross Section

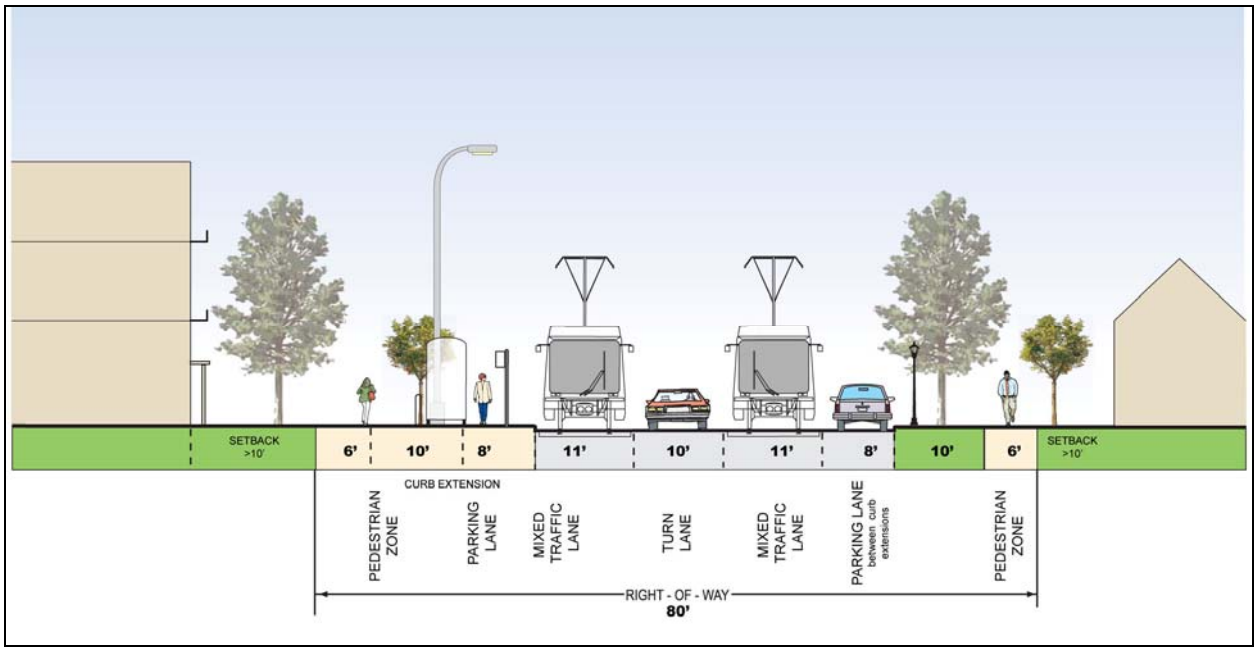


Figure 4-5 Typical Community Corridor Cross Section (Neighborhood Commercial Node)

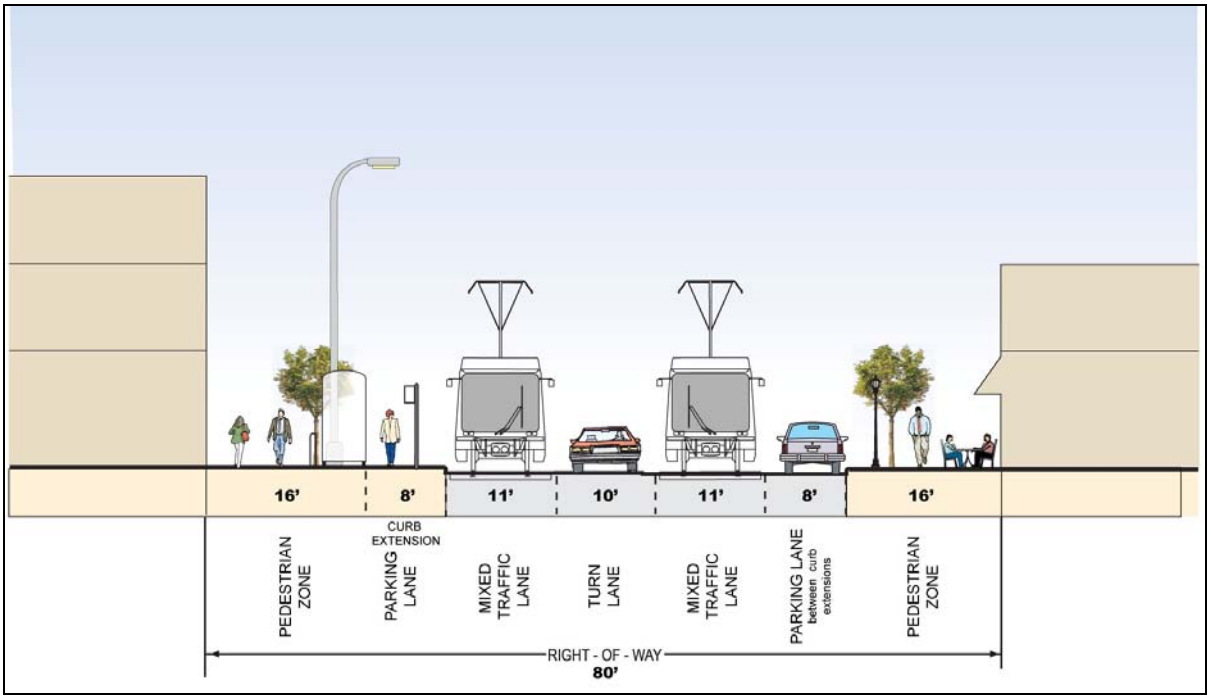


Figure 4-6 Typical Commercial Corridor Cross Section

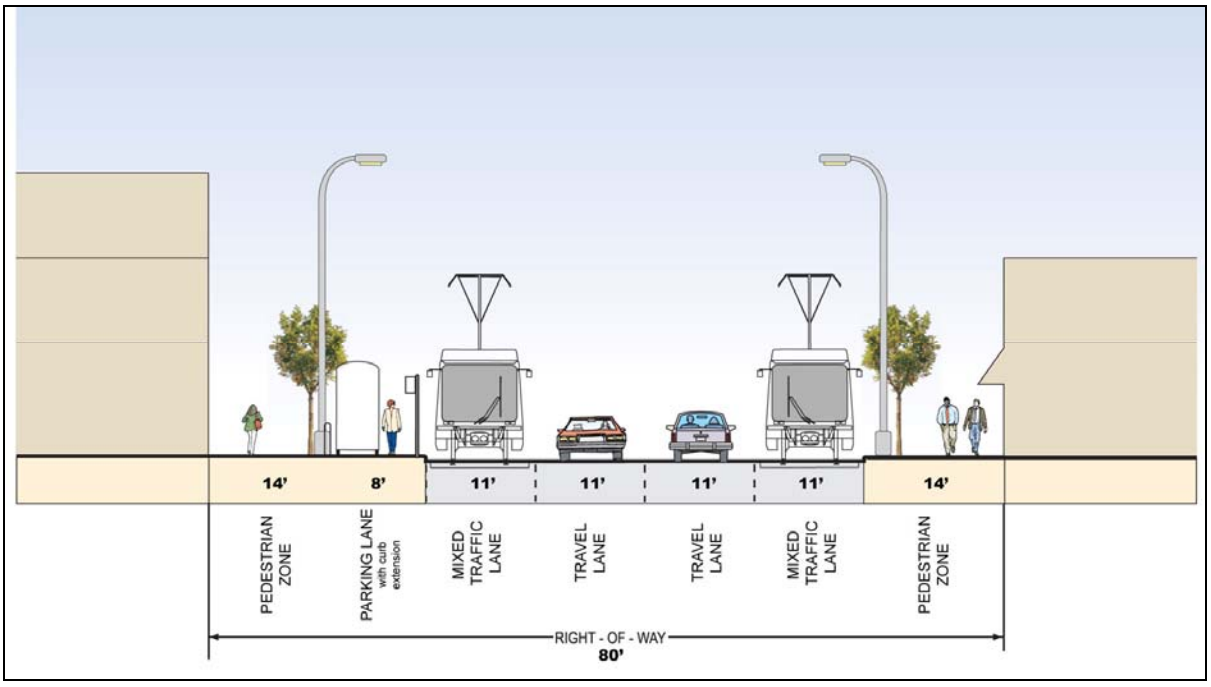
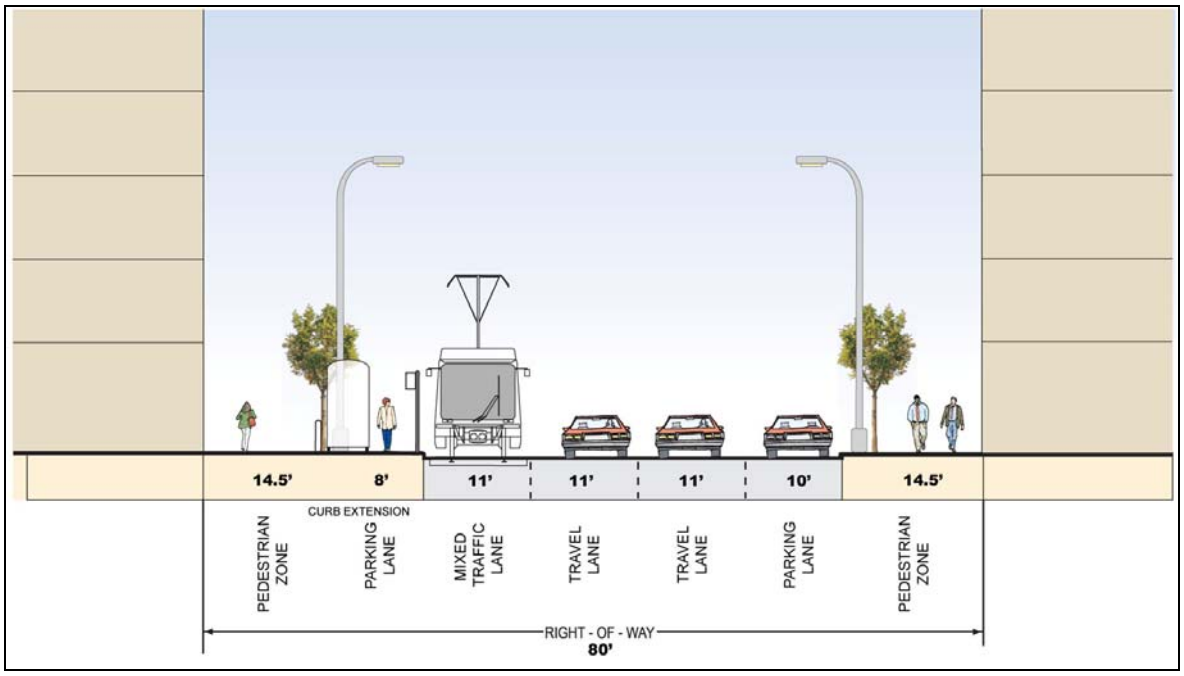


Figure 4-7 Typical Downtown One-Way Street Cross Section



"Long Line" Development Opportunities

Each of the corridors in the long-term streetcar network has existing and planned uses that are supportive of transit. Each also has development opportunities as described below.

W Broadway Avenue/Washington Avenue

The City is in the midst of intensive planning for this corridor – called the West Broadway Alive! Plan. The potential for new housing is strong, especially for medium-density housing that fits into the scale of the corridor. However, the housing market has not yet responded to this corridor as it has in other areas of the city, and the intensity of this development is likely to be low to moderate in scale. Most of the potential for redevelopment in this corridor is between Penn Avenue N and Lyndale Avenue N, or the core of the commercial development on W Broadway. Between W Broadway and downtown (via Washington), this corridor will remain mostly industrial, with the exception of some potential for new housing along the river and future conversion of industrial land uses in the North Loop area.

Between Penn Avenue N and downtown Robbinsdale is relatively low density with some small-scale commercial uses along the corridor. The Robbinsdale Comprehensive Plan presents a vision for downtown Robbinsdale that focuses on historic W Broadway and Hubbard Avenues, and making downtown Robbinsdale a destination for shopping,

services and cultural amenities. This line would also serve the Terrace Mall redevelopment area. In addition, the Robbinsdale Transit Center provides a strong connection point for the end of this corridor. The intensity of this redevelopment is expected to be relatively low. It should be noted that the extension of streetcar service outside the city boundaries would occur only with the cooperation and support of the City of Robbinsdale. In addition, any decisions on alignment and LRT/BRT that come out of Hennepin County's Alternatives Analysis process for this corridor will significantly influence whether streetcar service is appropriate in this corridor and where streetcar service might terminate and/or connect with future LRT service.

The North Loop area (south of Plymouth Avenue) is currently experiencing high intensity redevelopment – mostly residential with small-scale neighborhood commercial. Nearly a dozen new condominium projects (approximately 1,200 units) have recently been completed, are under construction or are in the planning phases. Although dependent on the housing market, redevelopment in this area is expected to continue in the future. The current construction of the new Twins Ballpark in close proximity to this area is expected to further spur development in the North Loop area.

Washington Avenue east of Nicollet has seen significant redevelopment over the past decade. This has occurred along the entire corridor, but mostly between Washington Avenue and the river. Numerous large housing projects are still under way or are in the planning stages along the entire corridor. The new Guthrie Theatre recently opened in this corridor, which adds significantly to the redevelopment wave that has occurred in the Downtown East area. Near the intersection of Washington Avenue and Nicollet Avenue, the new Minneapolis Public Library has recently opened, which has increased redevelopment potential in the middle section of Washington Avenue.

Central Avenue NE

Several areas along this corridor show redevelopment potential. On the north end of the corridor, the area between approximately 18th Avenue NE and 29th Avenue NE shows good potential. While this is one of NE Minneapolis' most active retail/commercial corridors, the market has yet to respond fully to the potential in this area. Still, housing and redevelopment in this area is occurring, though only ½ to 1 full block on either side of Central Avenue. Just north of this area, some potential for redevelopment exists at the Shoreham Yards property, west of Central Avenue NE between 27th Avenue NE and 32nd Avenue NE. While redevelopment planning for this area has just begun, the initial vision for this area includes retail/commercial adjacent to Central Avenue and light industrial uses further west. This area is identified in the Minneapolis Plan as an Activity Center.

Between Shoreham Yards and Columbia Heights, the land use density is primarily low density housing with small-scale commercial uses along the corridor. Downtown Columbia Heights, however, is experiencing some redevelopment and is actively encouraging more intensive development along Central Avenue. A moderate density

development is proposed in the vicinity of 49th Avenue NE and the City of Columbia Heights supports the extension of streetcar service to this area. In addition, the Columbia Heights Transit Center provides a strong connection point for the end of this corridor.

Redevelopment potential also exists along this corridor in the East Hennepin area, which is identified as an Activity Center in the Minneapolis Plan. Commercial and housing infill developments have been occurring in this area for many years. A new Lund's grocery store has just opened at the corner of University Avenue SE and Central Avenue SE. The intensity of development in this area is significantly higher than along the northern section of the corridor. Just east of the East Hennepin area, redevelopment is continuing to occur along the river, notably the East Bank Mills project which will include around 960 residential units.

In downtown, the 3rd Avenue S corridor, and the Mill District to the east of the corridor, is continuing to redevelop. The new Carlyle condominium project recently opened, and the Mill District continues to infill. With the exception of the new Guthrie Theatre, most of the development in this area is residential, with some small-scale neighborhood commercial development.

University Avenue SE / 4th Street SE

The greatest potential for redevelopment in this corridor is along the river, between University Avenue SE and Main Street SE in the Marcy Homes neighborhood. At least four major condominium projects are planned or underway in this area (accounting for over 1,000 new housing units).

The neighborhood north of 4th Street SE (between I-35W and East Hennepin Avenue) is likely to remain mostly unchanged. The University Avenue SE and 4th Street SE corridor connects to the East Hennepin neighborhood, which also has strong redevelopment potential (as noted under the Central Avenue section).

The University of Minnesota will continue to serve as a strong impetus for redevelopment in Dinkytown and the surrounding areas. A new stadium is planned for the north part of the campus and will serve as a major activity center. Finally, the future Central LRT line will serve the University Avenue/Washington Avenue SE area, which will likely aid in future redevelopment of the area.

Chicago Avenue S

Between downtown and Lake Street, the Chicago Avenue S corridor has relatively limited redevelopment potential compared to other corridors. In general, this segment of the corridor is dominated by institutional uses (Children's Hospital and Abbott Northwestern Hospital). While some growth of the hospital area is expected, other areas in the segment of the corridor have relatively little redevelopment activity. The area outside downtown

with the greatest redevelopment potential includes the Midtown Corridor and the area surrounding the Midtown Exchange at Lake Street, which is currently being developed.

In downtown, the Elliot Park area has experienced a tremendous amount of residential growth over the past decade, with some of the highest density developments being built in the city. This trend is expected to continue as several high-density residential developments (approximately 700 units), are currently under construction or in the planning stages. The Downtown East / North Loop Master Plan envisions the expansion of the core of downtown to the west (around the planned Twins Ballpark) and to the east in the area around the Metrodome.

Although the market has responded favorably to the area north of Washington Avenue and directly along Washington Avenue, the area south of Washington has yet to redevelop to any great degree. Recent planning initiatives to redevelop the area around the Metrodome are focused on moderate to high density housing coupled with smaller scale commercial development supportive of a new football stadium and the surrounding neighborhoods.

South of Lake Street, some moderate density redevelopment potential exists (mostly at 38th Street), and future planning efforts are currently underway, but the market has yet to respond to redevelopment in this area.

Nicollet Avenue S

The section of Nicollet Avenue between Lake Street and downtown is one of Minneapolis' most active commercial streets – also known as "Eat Street." In 2000, the Nicollet Avenue Task Force produced a plan entitled "Nicollet Avenue: The Revitalization of Minneapolis' Main Street." This plan identified recommendations that were intended for the corridor as a whole, as well as for specific areas. The plan identified four basic strategies, all with the goal of revitalizing the corridor and encouraging redevelopment and improved livability of the corridor. Several of these goals explicitly state redevelopment of some key areas along the corridor, especially reconnecting Nicollet Avenue at Lake Street. As discussed in the plan, the K-Mart store is a major barrier to the redevelopment of this corridor, and was identified as the single most important element to revitalizing Nicollet Avenue. Likewise, strategies were developed for numerous intersections between 15th Street and 58th Street. The 26th and 38th Street intersections are also identified as "investment areas" in the Minneapolis Plan.

Redevelopment plans are also underway for the downtown section of Nicollet between Grant Street and Franklin Avenue. This area has the potential for very high density residential and mixed use development. Significant work is currently being done by the Stevens Square neighborhood on a large redevelopment site between I-94 and Franklin Avenue.

Redevelopment potential along this corridor is relatively strong between Lake Street and downtown within one full block of the corridor. Several residential developments have recently been completed along this corridor (at Franklin and at 26th), further enhancing vitality of this corridor.

Hennepin Avenue S

Because the Hennepin Avenue S corridor outside downtown is mostly built out, and is already one of the most vibrant corridors outside of downtown in the city, relatively little redevelopment potential exists along this corridor. However, in the Uptown area, and near the Midtown Corridor, additional redevelopment potential exists. The City has recently completed a draft Uptown Small Area Plan, which provides a master plan for this area. The plan supports moderate to high density development in the core of the Uptown area.

There is greater potential for high intensity development in the downtown area, along both the northern end of the corridor near Washington Avenue and along the southern end of the corridor south of approximately 10th Street S. This middle section of the downtown corridor is an entertainment, hotel and retail district within walking distance of the Target Center and the new Twins Ballpark.

"Long Line" Ridership Estimates

This section provides planning-level estimates of ridership for each corridor in the long-term streetcar network. Separate ridership estimates for the first phase segments of each long-term corridor are presented in the next chapter.

There are a number of known factors that contribute to streetcar ridership. These include:

- Intensity of land use within walking distance of the line – including both residential and employment density
- Mix of land use – residential, employment, retail, recreational
- Travel time (speed of service)
- Frequency of service
- Fares
- Connectivity to a broader public transportation network
- Legibility and information
- Comfort and ride quality

It is important to note that while there is no direct mathematical relationship between all of these factors and ridership, they have collectively proven to be key factors in attracting ridership to all types of transit routes. Figure 4-8 summarizes these factors and compares

the ability of bus routes and streetcar lines to capitalize on each factor. The cumulative advantages of streetcar service explain the ridership increase transit operators have noted when replacing a bus route with an equivalent streetcar line. These factors are described in more detail in the Phase III report.

Ridership Estimates for Long-Term Network Corridors

To develop some sense of ridership potential on the long-term streetcar corridors, ridership estimates were "pivoted" off productivities (passengers per revenue hour) from existing bus lines. Productivities of bus lines in each corridor are based on three different sector studies completed from 1998 – 2004. It should be noted that the bus productivities used for this analysis are for the entire bus line. Because this analysis uses average productivities for the entire line and streetcars are proposed for the most heavily used sections of existing bus routes, it is likely that the ridership estimates are conservative.

Figure 4-8 Factors Influencing Ridership (Streetcar vs. Bus)

Factor	How it Influences Ridership	Ridership Advantage – Streetcar vs. Bus
Intensity of Land Use	Density is the most direct influence on transit ridership – the greater the intensity of land use, the greater the ridership.	Advantage to streetcar, which tends to have higher carrying capacity than bus on a one for one basis.
Mix of land uses	Different land uses have different demand patterns. Mixing land uses ensures steady ridership through the day, rather than directional peaking.	Streetcar has a proven track record of attracting some types of trips that generally do not use bus transit – especially non-work, visitor- and tourist-oriented travel and weekend trips.
Travel Time	Riders are attracted to transit services that more closely match auto travel times.	Both bus and streetcar can be designed for fast service. The flexibility of bus service may give it an advantage as buses can maneuver around obstacles. However, streetcar has some advantages over buses due to faster boarding times.
Frequency and Span of Service	Frequent service reduces wait times and allows riders to make trips without planning. Services with a longer service span are attractive to more types of trips. Longer evening service ensures riders who work late, or attend events in the evening will be able to get home.	No advantage – both bus and streetcar can be designed to run frequently and over long service spans.
Fares	High fares discourage ridership. Lower fares encourage ridership.	No advantage – fares can be the same for both.
Connectivity to a Broader Network	Connecting to regional services provides greatly enhanced mobility and enhances the ridership of the overall system.	Advantage to streetcar, which provides a highly visible connection to other routes.

Factor	How it Influences Ridership	Ridership Advantage – Streetcar vs. Bus
Legibility and Information	The easier it is to understand a transit system, the more likely it is that occasional riders will use it. Real time information has been proven to increase ridership by as much as 5%.	Both bus and streetcar can be designed for quality real time information. However, streetcar has an advantage in that the tracks provide instant legibility.
Comfort	Roomier seats, ample room for standees, and a less "rocky ride" contribute to rider comfort and to increased ridership.	Advantage to streetcar, which operates on rails and therefore has less lateral movement than a bus. Riders often report they can read on streetcars but not on buses. Streetcars are also quieter and less polluting than buses.

The existing bus productivities were adjusted based on the eight factors outlined above. Based on these adjustments, an adjusted "streetcar productivity" was calculated. A range of streetcar productivities was then calculated by using plus or minus 10% of the adjusted figure. The range is then multiplied by the total revenue hours[1] for each corridor to arrive at an estimated range of daily and annual ridership figures.

Figure 4-9 presents a summary of the ridership estimates for each long-term corridor. A more detailed table showing the productivity estimates is provided in the Phase II Evaluation Report.

Figure 4-9 Ridership Estimates – Long-Term Streetcar Network

Corridor	Streetcar Ridership Estimates				
	Revenue	Daily Ridership		Annual Ridership	
	Hours (1)	High	Low	High	Low
Chicago Ave S					
Weekday	137.0	13,322	10,900	3,397,079	2,779,429
Saturday	126.0	11,171	9,140	580,900	475,282
Sunday	70.0	6,707	5,487	388,989	318,263
Hennepin Ave S / University Ave Se / 4th St SE (2)					
Weekday	128	11,827	9,677	3,015,936	2,467,584
Saturday	126	8,649	7,076	449,729	367,960
Sunday	114	6,170	5,048	357,841	292,779
Nicollet Ave S					
Weekday	139	12,041	9,852	3,070,423	2,512,164
Saturday	121	9,317	7,623	484,484	396,396
Sunday	96	7,788	6,372	451,704	369,576

[1] Revenue service hours are from the operating plans presented in the Phase III report.

Corridor	Streetcar Ridership Estimates				
	Revenue	Daily Ridership		Annual Ridership	
	Hours (1)	High	Low	High	Low
W Broadway / Washington Ave					
Weekday	96	5,322	4,355	1,357,171	1,110,413
Saturday	90	4,158	3,402	216,216	176,904
Sunday	90	3,802	3,110	220,493	180,403
Central Ave SE					
Weekday	123	6,765	5,535	1,725,075	1,411,425
Saturday	84	3,696	3,024	192,192	157,248
Sunday	66	2,904	2,376	168,432	137,808
Midtown Corridor (3)					
Weekday	n/a	3,300	3,300	841,500	841,500
Saturday	n/a	n/a	n/a	n/a	n/a
Sunday	n/a	n/a	n/a	n/a	n/a

Notes

(1) Based on Operating Plans

(2) Hennepin and University corridor ridership were combined for purposes of ridership estimates because bus service on these two corridors is currently interlined and ridership estimates were pivoted based on existing bus ridership.

(3) See Chapter 5 for details on ridership estimate for the Midtown Corridor.

"Long Line" Operating Plans and Costs

The operating plans developed for the long-term streetcar network are based on an assessment of the potential impact streetcar operations could have on the underlying bus network. Initial operating plans developed in the screening phases were refined based on input from City staff, the Project Steering Committee and Metro Transit. The following guidelines were used to develop the proposed operating plans:

- Streetcars should replace bus volumes where significant overlap occurs.
- Forced transfers are undesirable, unless at major turnover locations (such as Uptown, Columbia Heights Transit Center, 38th Street/Chicago Avenue S, 46th Street/Nicollet Avenue S and downtown).
- No major route restructuring was proposed. However, on some routes some or all remaining buses could be operated on a limited stop basis. This not only speeds up the buses (making the service more attractive to riders beyond the streetcar corridor) but has a positive impact on bus operating costs.
- To justify the investment, minimum streetcar service frequency is assumed to be 15 minutes, 16-18 hours per day (PTN levels). More frequent streetcar service would be provided if ridership demanded higher service levels or if existing service levels are higher.

Based on these guidelines, bus service was re-evaluated for the corridors that make up the long-term network and an assessment was made as to which, if any, bus routes or trips would be affected if streetcars were present. Based on this process, revenue service hours and vehicle requirements were developed for streetcar service in each long-term corridor. Likewise, if bus trips were replaced, or buses operated limited stop, an initial estimate of reduced service hours associated with this change was developed.

It is important to note that there will likely be additional refinements to the operating plans as corridors are developed. These plans are designed to have the least impact on riders coming into Minneapolis from suburban locations, while enhancing service to City riders. Alternatives could be developed to shift more riders to streetcars, however these options would increase streetcar operating costs as well as ridership, and would force more suburban passengers to transfer before reaching downtown. Detailed operating plans will be developed by Metro Transit, the City of Minneapolis and other stakeholders as implementation occurs.

Possible Connections between Corridors

One of the most important features of any successful transit network is connectivity. Many of the local bus lines in Minneapolis flow into and out of downtown, ultimately forming a radial network where riders can make connections and get to most corners of the city. Route 6, for example, is one of Metro Transit's most productive lines. It serves Uptown via

Hennepin Avenue S, traverses the core of downtown and then serves Dinkytown and the University area via University Avenue SE. While this line serves some very dense urban neighborhoods, as well as downtown, one of its strengths is the connection between different parts of the city.

For the purposes of this study, it is assumed that a long-term streetcar network would function in a similar way, with connections between corridors that feed into and out of downtown. Based on the existing bus network, and travel patterns transit users are accustomed to, the following connections were identified between corridors in the long-term streetcar network:

- **W Broadway Avenue to Chicago Avenue S** – via Washington Avenue, Nicollet Mall and 9th/10th Streets OR via Washington Avenue, Park Avenue and 9th/10th Streets.
- **Central Avenue NE to Nicollet Avenue S** – via 3rd Avenue, Washington Avenue and the Nicollet Mall
- **Central Avenue NE to Hennepin Avenue S** – via East Hennepin and 1st Avenue NE
- **Hennepin Avenue S to University Avenue SE/4th Street SE** – via East Hennepin and 1st Avenue NE

In addition to connections between the various streetcar corridors, connections to other regional transit services, especially light rail, are also important. All of the corridors in the long-term streetcar network have at least one connection to an LRT station.

Standard Operating Cost per Revenue Hour

The operating cost for streetcar service, as with any type of transit service, is driven by the number of hours and miles operated, and by the cost for a unit (usually a revenue hour) of operation. The cost per revenue hour is unique to the transit operator providing the service and reflects prevailing wage rates, operator-specific overhead costs, costs specific to the vehicles purchased, etc.

Based on experience in other cities that operate bus and streetcar service, streetcar operating costs average 35-50% higher than the hourly cost for bus service.[2] The premium is due to the maintenance of track-way and a unique vehicle which requires separate shop facilities, etc. as well as the lack of economies of scale that accrue to larger fleets. Even at properties that operate modern streetcars, streetcar operation tends to be more costly than bus operation. In Portland, for example, an hour of streetcar service costs about $130 compared with about $85 for a fully allocated hour of bus service.

[2] This is based on a review of all currently operating streetcar systems in the United States conducted by Nelson\Nygaard, which compared hourly operating costs to hourly operating costs for local bus service.

Based on data from the 2005 National Transit Database, Metro Transit's fully allocated operating cost per revenue hour for buses is approximately $99.83. By comparison, the operating cost per revenue hour for light rail (LRT) is $165.22. Generally, operating costs for streetcar service is between bus and light rail operating costs. For planning purposes, and as a conservative estimate, this study assumes a 50% premium over bus operating costs for streetcar operation, or approximately $149.75 per revenue hour. While streetcars do not have fuel costs per se, operating costs include the cost for electricity and the cost of maintaining trackway, stations and overhead. These additional costs result in a higher operating cost per revenue hour than for buses. However, since streetcars typically attract higher ridership, the cost per rider is often lower than for buses.

Figure 4-10 below provides a summary of the estimated annual operating costs in each corridor, taking into account the reduction in bus service where appropriate.

Figure 4-10 Estimated Impact on Annual Operating Costs

Corridor	Streetcar Service Hours	Annualized Streetcar Operating Cost (1)	Estimated Reduction in Bus Revenue Hours	Annualized Reduction in Bus Operating Cost (2)	Estimated Adjusted Change in Operating Costs
W Broadway Ave/Washington	34,380	$5,148,405	19,600	$1,956,668	$3,191,737
Central Ave NE/ 3rd Ave	45,742	$6,849,865	34,100	$3,404,203	$3,445,662
Chicago Ave S/9th/10th	45,547	$6,820,663	16,100	$1,607,263	$5,213,400
Hennepin Ave S / Univ./ 4th (long and short line)	45,804	$6,859,149	24,000	$2,395,920	$4,463,229
Nicollet Ave S	47,305	$7,083,924	43,600	$4,352,588	$2,731,336

(1) Assuming $149.75 per revenue hour

(2) Assumes Metro Transit's fully loaded cost per revenue hour of $99.83 (2005)

"Long Line" Capital Costs

Modern streetcars have now been implemented in a number of cities; enough to produce a very rough estimate of the cost per track mile[3] for developing a streetcar line. These costs generally range from $10 million to $15 million per track mile, but can **vary greatly** depending on the type of construction, difficulty of utility work, and the overall costs for construction in each City. Figure 4-11 summarizes capital costs for several recently implemented systems in the United States. It should be noted that the capital costs presented in Figure 4-11 **do not include** the cost of vehicles or maintenance facilities. Vehicle and facility costs are included in the summary table Figure 4-12 at the end of this chapter. As a point of reference, modern streetcar vehicles used in Portland cost between $2-3 million each, and the maintenance facility cost approximately $4 million.

Figure 4-11 Capital Costs for Recently Completed Streetcar Lines

City	Agency/ Organization	Most Recently Opened Line	Track Miles	Construction Cost (2006$)	Cost per Track Mile (2006$)
San Francisco	San Francisco Municipal Railway (Muni)	2000: Embarcadero to Fisherman's Wharf	4.8	$88.6M (1)	$18.5M
Portland	Portland Streetcar Inc.	July 2001: Phase I and II	4.8	$45.6(2)	$9.5M
		May 2005: Riverplace extension	1.2	$16.1M(3)	$13.4M
		November 2006: Gibbs extension	0.6	$8.3M(4)	$13.8M
Little Rock	Central Arkansas Transit Authority	November 2004	2.5	$15.9M (5)	$6.36M

Notes:

(1) Total costs were $70.0M, 1998 dollars. This cost adjusted to $88.6M in 2006 dollars (3% inflation/year).

(2) Total costs were $54.6M, in 2001 dollars. This cost includes 5 vehicles (estimated at $2.25M each) and a maintenance facility (at $4.0M). Excluding vehicle and maintenance facility costs: $54.6M - $15.3M = $39.3M (2001$). This cost adjusted to $45.6M in 2006 dollars (3% inflation/year).

(3) Total costs were $15.6M, in 2005 dollars. This cost adjusted to $16.1M in 2006 dollars (3% inflation/year).

(4) Total capital costs were $15.8M, including three vehicles (estimated at $2.5M each). Excluding vehicle costs: $15.8M - $7.5M = $8.3M. All figures in 2006 dollars.

(5) Total cost of $20.0M includes 3 replica vehicles and a maintenance facility, in 2004 dollars. Replica vehicles are estimated at $1.0M each and the maintenance facility is estimated at $2.0M. Excluding vehicle and maintenance facility costs: $20.0M - $5.0M = $15.0M. This cost adjusted to $15.9M in 2006 dollars (3% inflation/year).

[3] One-way section of track.

Capital Costing Methodology

Initial order-of-magnitude cost estimates were developed based on component costs from other comparable projects in the same region of the country. The capital cost estimates developed for the Southwest Corridor LRT being conducted by Hennepin County Regional Railroad Authority provided local unit cost information for many of the materials required to build a streetcar. Because there are only a small number of examples of modern streetcar systems already built in North America, Portland, OR was selected as a good peer to help formulate costs appropriate to a modern streetcar system. Since cost estimates were completed in previous years, costs were inflated and adjusted to more closely match local construction costs in 2007. More detailed information on the capital costing methodology is provided in the Phase III report.

All estimates presented in this report are order-of-magnitude for planning and feasibility assessment purposes only and do not represent any level of design. A preliminary design and engineering study would need to be completed to increase the accuracy of capital costs.

Vehicles

Modern streetcar vehicles are assumed to cost approximately $3.0 million each, depending on the vehicle configuration and market conditions when the vehicles are acquired. This cost is based on similar acquisitions in Portland and Tacoma. In addition to the base cost of in-service vehicles, spare vehicles will be required for scheduled maintenance and unexpected breakdowns. For the long-term network, a conservative spare ratio of 20% was applied.

Maintenance and Storage Facility

A maintenance facility is a requirement of any streetcar service, and should be located as close as possible to the "revenue" track. Costs associated with a maintenance facility may be slightly higher in Minneapolis because streetcar vehicles are assumed to be stored inside; but, for planning purposes, it is assumed that a facility would be between $3 and $5 million exclusive of land costs. For the purposes of this analysis a $4 million estimate is used. This cost is derived from the maintenance/storage facility in Portland, OR, which currently accommodates 10 streetcar vehicles. An additional cost, which is included in the summary table, is an estimated ½ mile of track to access the facility.

While each corridor includes the basic cost of a maintenance/storage facility, the location and size of the first maintenance/storage facility is a complicated decision. On one hand, it is important to select a site that can accommodate additional vehicles as the network grows. On the other hand, it is difficult to justify a larger facility that can accommodate more vehicles and then burden the initial line with this higher cost. As the network grows, it may no longer be appropriate (or cost-effective) to have just one maintenance/storage facility. In Toronto, for example, there are several maintenance and storage facilities of various sizes located throughout the system. Multiple facilities may also reduce out-of-service time (deadhead) traveling from the facility to reach the in-service portion of a line.

Figure 4-12 Summary of Long-Term Streetcar Network Characteristics

	Hennepin Avenue / University/4th to Univ. of Minnesota[4]	W Broadway/Washington Avenue to Nicollet Ave or Park Ave	Central Avenue NE[5]	Nicollet Avenue	Chicago Avenue S
From	*Lake Street*	*Robbinsdale Transit Center*	*49th Avenue NE (Columbia Heights)*	*46th Street / Nicollet*	*38th Street / Chicago Avenue S*
To	*University Avenue SE / Washington Avenue SE*	*5th Street / Nicollet Avenue or 5th Street / Park Avenue*	*5th Street / Nicollet Avenue*	*Washington Avenue*	*Nicollet Avenue / 5th Street*
Operating Characteristics					
Peak Vehicle Requirement	9	7	10	9	8
Annual Service Hours	45,800	34,400	45,700	47,300	45,500
Estimated Annual Operating Costs (assuming $149.75/hour)	$6,859,100	$5,148,400	$6,849,900	$7,083,900	$6,820,700
Ridership Estimates					
Estimated Weekday Ridership	9,700 - 11,800	4,400 – 5,300	5,500 – 6,800	9,900 – 12,000	10,900 – 13,322
Estimated Annual Ridership – Low	3,128,300 – 3,823,500	1,467,700 – 1,793,900	1,706,500 – 2,085,700	3,278,100 – 4,006,600	3,573,000 – 4,367,000
Capital Cost Estimates ($2007)					
Track Miles	7.8	8.4	12.2	8.6	7.0
Estimated Cost per Track Mile	$9,948,067	$9,948,067	$9,948,067	$9,948,067	$9,948,067
Subtotal	*$77,594,900*	*$117,387,200*	*$119,346,800*	*$85,553,400*	*$69,636,500*
Additional Capital Costs	1) Lowry Tunnel - $244,000 2) Hennepin Bridge (Miss. River) - $2.08 M 3) LRT Crossing - $50,000 4) Midtown Corridor Bridge – $120,000	1) 4th Avenue N Bridge - $70,000 2) LRT Crossing - $50,000 3) Mall Modifications - $300,000 4) I-94 Bridge - $660,000	1) Hennepin Bridge (Miss. River) - $2.08 M 2) 9th Street NE RR Bridge - $300,000 3) Broadway Street NE Bridge - $440,000 4) 36th Ave NE RR Crossing - $50,000	1) LRT Crossing - $50,000 2) Mall Modifications - $2,100,000 3) I-94 Bridge - $400,000 4) Midtown Corridor Bridge - $200,000	1) I-94 Bridge - $660,000 2) Midtown Corridor Bridge - $180,000 3) LRT Crossing - $50,000
Subtotal	*$80,100,000*	*$118,500,000*	*$122,200,000*	*$88,300,000*	*$70,500,000*
Vehicle Costs[6]	$33,000,000	$27,000,000	$36,000,000	$33,000,000	$30,000,000
Non-revenue track[7]	$4,500,000	$4,500,000	$4,500,000	$4,500,000	$4,500,000
Maintenance Facility[8]	$4,000,000	$4,000,000	$4,000,000	$4,000,000	$4,000,000
Total Capital Costs ($2007)	$121,600,000	$154,000,000	$166,700,000	$129,800,000	$109,000,000
Cost Effectiveness Measures[9]					
Capital Cost per Passenger – Low	$31.80	$85.85	$79.93	$32.40	$24.96
Capital Cost per Passenger – High	$38.87	$104.92	$97.69	$39.60	$30.51
Operating Cost per Passenger – Low	$1.79	$2.87	$3.28	$1.77	$1.56
Operating Cost per Passenger – High	$2.19	$3.51	$4.01	$2.16	$1.91
Service Efficiency Measure					
Passengers per Service Hour – Low	68.3	42.7	37.3	69.3	78.4
Passengers per Service Hour – High	83.5	52.2	45.6	84.7	95.9

[4] Hennepin and University corridor ridership were combined for purposes of ridership estimates because bus service on these two corridors is currently interlined and ridership estimates were pivoted based on existing bus ridership.
[5] From an operating perspective, the terminus in the Central Avenue NE corridor makes the most sense at the Columbia Heights Transit Center but was extended to 49th St at the request of the City of Columbia Heights.
[6] Assumes $3,000,000 per vehicle. Costs include a 20% spare ratio.
[7] For planning purposes, it is assumed that ½ mile of single track would be required to access a maintenance facility.
[8] Maintenance facility costs would only apply to the first shortest operable segment.
[9] These cost effectiveness measures are not the same ones used by the FTA to evaluate light rail.

Chapter 5. Staging the Implementation of the Streetcar Network

The proposed long range streetcar plan for Minneapolis was described in the previous chapter. At an estimated cost of over $740 million (order of magnitude, $2007), this entire system is obviously not going to be built at once. In fact, most streetcar implementations begin with relatively short segments that serve as building blocks to an ultimate line or system. Most modern streetcar implementations in North America have consisted of initial operating segments that are quite short (2-3 route miles in length).

This chapter identifies proposed staging for each of the long-term streetcar corridors including a "minimal operable segment," which represents the shortest segment that could be built and still provide a reasonable amount of service. *It is not recommended to start with a streetcar line shorter than a minimal operable segment.*

Each of the long-term streetcar corridors is divided into two or three potential phases based on the location of major transit stations (transfer points) or activity centers. Operating costs, capital costs, ridership estimates, and development opportunities are identified for the minimal operable segment for each corridor.

There are several possible phasing scenarios for developing the long-term network. One scenario would be to develop a single corridor in staging segments until an entire corridor is built before starting another corridor. Another option would be to construct several minimal operable segments in/near the downtown before completing any one long-term corridor. It should be noted that the benefits of reducing bus service in the streetcar corridors cannot be fully realized until the entire long-term streetcar corridor has been constructed. This benefit would need to be weighed against any development or other economic benefits that might come from a system that was initially oriented to downtown and the near-downtown neighborhoods.

A final recommendation is not made in this report as to which segment(s) should be implemented first, or which phasing approach is more appropriate. Additional work is needed before this decision is made to determine the level of community support in each corridor, the level of private sector interest and the ability to generate sufficient capital and operating funding.

Criteria for Selecting Minimal Operable Segments

Guidelines for selecting the minimal operable segment on each corridor were developed in order to ensure that the first streetcar line would be viewed as a success. A well selected initial segment will not only generate further interest in streetcars, but will also build confidence that streetcars can successfully be integrated into the transportation

network. An unsuccessful initial segment almost guarantees minimal investment in future extensions and a general lack of support for completing the long-term streetcar network. The following guidelines were followed in selecting the minimal operable segments:

- Initial segment must be successful from the beginning and should provide the foundation on which to "grow" the long-term system.
- Initial segment must lead to a longer line and provide meaningful service to nearby neighborhoods.
- Initial segment must avoid extraordinary capital costs.
- Initial segment must end at a safe and logical terminal location (turnaround).
- Initial segment must have access to a maintenance/storage facility.

Based on the guidelines presented above, the following minimal operable segments were identified (also shown in Figure 5-1):

- **Hennepin Avenue** from Groveland to 5th Street LRT Station (long-term connection to Hennepin Avenue corridor)
- **E. Hennepin and University/4th** to 5th Street LRT Station (long-term connection to University Avenue and Central Avenue corridors)
- **W. Broadway/Washington Avenue** from 10th Street N. to Nicollet Avenue/5th Street LRT station or to Park Avenue/5th Street LRT station (long-term connection to W. Broadway corridor)
- **Nicollet Avenue** from 13th/Grant Street or Franklin Avenue to Washington Avenue (long-term connection to Nicollet corridor)
- **Chicago Avenue S** from 14th Street/Chicago or Franklin Avenue to Nicollet Avenue/5th Street via 9th/10th Streets (long-term connection to Chicago corridor)
- **Midtown from SW LRT Station to Hiawatha/Lake LRT Station.** It should be noted that it is not recommended that the Midtown Corridor be split into phases for implementation due to the close link between the ridership on the Midtown Corridor and the SW LRT line (see Chapter 3 for further discussion of the Midtown Corridor).

Both the Nicollet Avenue S and the Midtown Corridor are dependent on the preferred alignment of the Southwest Corridor LRT project. If the Midtown/Nicollet alignment is the preferred alignment for SW LRT, then Nicollet Avenue would not be a feasible alternative for streetcar. Likewise, there is an Alternatives Analysis (AA) underway for the Bottineau Blvd corridor which will result in a preferred technology (LRT or BRT) and a preferred alignment. The viability of the W. Broadway corridor as a streetcar corridor and the appropriate terminus of streetcar service will be dependent on the outcome of the Bottineau Blvd AA. *A decision on streetcar in these three corridors should not be made until the outcomes of the respective DEIS and AA processes are known.*

All minimal operable segments are proposed to operate on 15-minute headways, seven days a week except where improved frequencies can be justified based on a modification of the underlying bus service. All minimal operable segments are assumed to operate for 16 hours on weekdays and Saturday, and 14 hours on Sundays. In most cases, it is assumed that the initial streetcar service would not have an impact on the existing bus network – that is, for a period of time, existing levels of bus service will operate in the same corridor as the streetcar. Streetcar trips would be primarily local in nature and would generally be very short trips. Longer trips, and trips into the corridor from outlying areas would continue to be made by bus.

Unless the initial segment served a strong transfer location, bus service was not designed to force transfers between the "long line" bus service and the "short line" streetcars, as this would require more streetcar service than would otherwise be justified, and would require large numbers of passengers to make transfers very close to their ultimate destinations. To the extent that long-line bus service is truncated or otherwise modified, streetcar ridership would increase. And while the elimination of some buses may reduce bus operating costs, it is assumed that operating costs for streetcars are higher than for bus ($149.75 per revenue hour for streetcar compared to approximately $99.83 per revenue hour for bus).

Ridership estimates have been developed for each of the minimal operable segments based on peer systems. A description of the methodology is included in Appendix D. Significant additional work, completed in coordination with Metro Transit, to develop detailed bus and streetcar operating plans will be needed prior to the implementation of any streetcar line or MOS. Refined ridership and operating cost estimates will need to be prepared at that time.

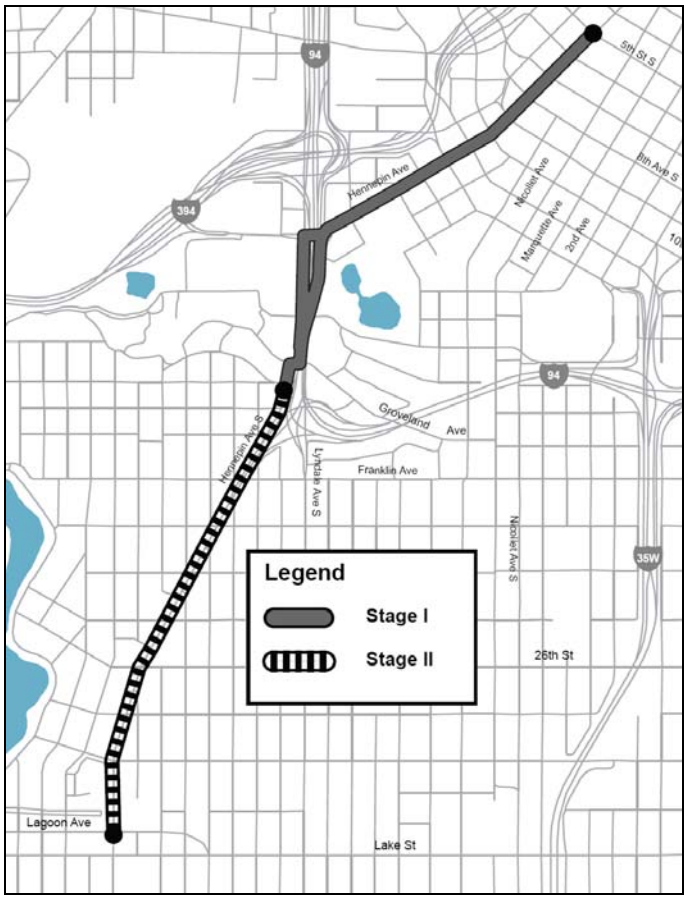
Hennepin Avenue

The logical staging of the Hennepin Avenue Corridor would be (see Figure 5-1):

- Stage 1: Loring Park (Groveland/Douglas) to Downtown (5th Street)
- Stage 2: Loring Park (Groveland/Douglas) to Uptown

There would be some service and development benefits in constructing an initial segment that combined the minimal operable segment for the Hennepin Avenue Corridor with the minimal operable segment for the Central and University Avenue Corridors. This combined segment would travel on Hennepin Avenue from Groveland/Douglas across the Hennepin Avenue Bridge to the East Hennepin area. The streetcar line would be double-track on Hennepin from I-94 to the Mississippi River. All portions of this combined segment would operate in mixed traffic. The combined initial line would be 2.6 route miles (5.1 track miles). A maximum of three in-service vehicles would be required to maintain 15-minute headways.

Figure 5-1 Hennepin Avenue Minimal Operable Segment and Proposed Staging Options



Minimal Operable Segment

An initial "minimal operable segment" could be built on the Hennepin Avenue corridor from 5th Street south to Groveland/Douglas. This segment would require two in-service vehicles, assuming service every 15 minutes.

Development Opportunities and Special Generators

This line would serve the downtown entertainment district along Hennepin Avenue and would provide service to Loring Park, the Walker Art Center, Minneapolis Sculpture Garden, the Target Center, the new Twins Ballpark and the warehouse district. Therefore, this line would likely serve a significant tourist market.

Opportunities for moderate to high density residential and mixed use development exist along Hennepin Avenue on the north edge and south edge of the downtown core. Although not directly on the streetcar line, the Hennepin Avenue line would be within easy access of the proposed development around the new Twins Ballpark.

Ridership

The Hennepin Avenue MOS would generate approximately 463,000-566,000 riders per year (see Figure 5-2). If the Hennepin MOS is combined with the MOS from Central and University Avenue between Groveland and Central Avenue NE, the line is expected to generate approximately 662,000-809,000 riders per year.

Turnaround Considerations

On the south end of the line, the terminal station could be integrated into the short segment of Douglas Avenue just south of Groveland Avenue (west of Hennepin). A turnaround at 5th Street and Hennepin would be slightly more challenging. The most promising option would be to use the existing LRT tracks exclusively for turning the vehicle around (no layover at this location would be possible). Another option would be to integrate a short section of track into the one westbound traffic lane on 5th Street (west of Hennepin). This would require a special signal phase at this intersection that restricts all turning movements until the streetcar vehicle has turned around.

Maintenance Facility

The most likely location for a maintenance facility for the Hennepin Avenue corridor would be in the area near I-394 and Dunwoody Boulevard or near the intersection of N 16th St/Linden (see Maintenance Facility section later in this chapter for more details).

Capital and Operating Costs

Capital costs for the Hennepin Avenue MOS is around $26 million, not including vehicles and maintenance facility costs. While capital costs are roughly twice as much to implement the combined segment between Loring Park and East Hennepin, this is preferable for several key reasons:

- The entire Hennepin Avenue corridor is intensely developed and that development does not end at 5th Street.
- The existing bus service is currently linked between Hennepin Avenue and University Avenue – retaining this link has long-term advantages for riders.
- Tourists and visitors are expected to account for a significant portion of ridership in this corridor and destinations are located both north and south of 5th Street.
- Avoids need for complicated turnaround at 5th Street LRT station in downtown.

Figure 5-2 Capital and Operating Costs – Hennepin Avenue Corridor

	From	To	Vehicles Required for 15-Minute Headways	Annual Revenue Hours	Estimated Annual Ridership	Operating Cost	Track Miles	Capital Cost Excluding Vehicles and Maintenance Facility[1]
Stage 1 Hennepin MOS	Hennepin / 5th St	Groveland Ave / Hennepin Ave S	2	11,448	463,000 – 566,000	$1,714,338	2.6	$26,100,000
Stage 1 Hennepin and Central/ University MOS combined	Groveland Ave / Hennepin Ave S	Central Ave NE / 4th St SE	3	17,172	662,000 – 809,000	$2,571,507	4.8	$50,100,000

[1]See Figure 5-11 for total capital costs including vehicles and maintenance facility.

Central Avenue and University Avenue Corridors

The logical staging for the Central Avenue Corridor would be:

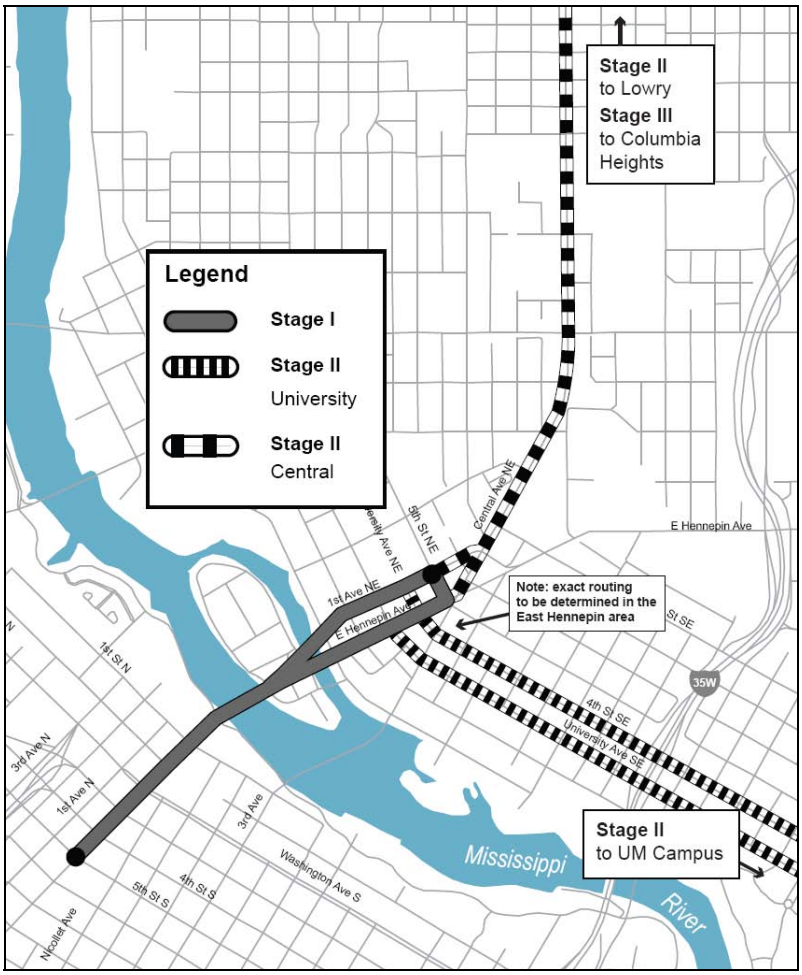
- Stage 1: Downtown (5th Street at Hennepin or Nicollet) to East Hennepin area
- Stage 2: East Hennepin area to Lowry Avenue
- Stage 3: Lowry Avenue to Columbia Heights Transit Center (or beyond)

The logical staging for the University Avenue Corridor would be:

- Stage 1: Downtown (5th Street at Hennepin or Nicollet) to East Hennepin area
- Stage 2: East Hennepin area to UM campus (Dinkytown)

The MOS for the Central and University Corridors, as well as proposed staging options, are shown below in Figure 5-3.

Figure 5-3 Central and University Avenue Minimal Operating Segment and Staging Options



Minimal Operable Segments

As noted above, there are some advantages to combining the MOA for the Hennepin Avenue Corridor with the MOA for the Central and University Avenue Corridors. The Central and University Avenue Corridors share the same MOA, which would extend from the 5th Street LRT station at either Hennepin Avenue or Nicollet Avenue across the Hennepin Avenue Bridge to the East Hennepin area. If operated independent of the Hennepin Avenue MOS, the MOS for Central and University Avenues would require two in-service vehicles, assuming service every 15 minutes. If the MOS segment were combined with the Hennepin Avenue MOS, three in-service vehicles would be required, assuming service every 15 minutes.

Development Opportunities and Special Generators

This line would connect to the downtown entertainment district along Hennepin Avenue and would provide service to the East Hennepin area. Opportunities for moderate to high density residential and mixed use development exist in the East Hennepin area, as well as along Hennepin Avenue on the north edge of the downtown core.

Ridership

The MOS for Central/University would generate approximately 364,000-445,000 riders per year (see Figure 5-4). The initial combined operating segment on Hennepin Avenue between Groveland and Central Avenue NE is expected to generate approximately 662,000-809,000 riders per year.

Turnaround Considerations

To turn around on the north end, the streetcar would use Hennepin Avenue northbound, turn westbound on 5th Street NE, and return southbound via 1st Avenue NE. The most logical routing options in this area are ultimately dependent on how the two lines are staged.

A turnaround in downtown at 5th Street and Hennepin would be slightly more challenging. The most promising option would be to use the existing LRT tracks exclusively for turning the vehicle around (no layover at this location would be possible). Another option would be to integrate a short section of track into the one westbound traffic lane on 5th Street (west of Hennepin). This would require a special signal phase at this intersection that restricts all turning movements until the streetcar vehicle has turned around.

Maintenance Facility

It may be possible to incorporate a maintenance/storage facility near the railroad tracks west of 1st Avenue NE. There are several industrial parcels in this area that may be appropriate for a maintenance/storage facility.

Capital and Operating Costs

The capital costs for the Central/University MOS is around $24 million, excluding vehicles and maintenance facility costs (see Figure 5-4). While capital costs are roughly twice as much to implement the combined Hennepin/Central/University segment, this is preferable for reasons stated earlier in the description of the Hennepin corridor MOS.

Figure 5-4 Capital and Operating Costs – Central and University Avenue Corridors

	From	To	Vehicles Required for 15-Minute Headways	Annual Revenue Hours	Estimated Annual Ridership	Operating Cost	Track Miles	Capital Cost Excluding Vehicles and Maintenance Facility[1]
Stage 1 Central / University MOS	Hennepin / 5th St	Central Ave NE / 4th St SE	2	11,448	364,000 – 445,000	$1,714,338	2.2	$22,000,000
Stage 1 Central / University MOS and Hennepin MOS combined	Groveland Ave / Hennepin Ave S	Central Ave NE / 4th St SE	3	17,172	662,000 – 809,000	$2,571,507	4.8	$50,100,000

1See Figure 5-11 for total capital costs including vehicles and maintenance facility.

W Broadway / Washington Avenue

The logical staging of this corridor would be (shown in Figure 5-5):

- Stage 1: North Loop (10th Ave N) to 5th Street/Nicollet or 5th Street/Park
- Stage 2: North Loop (10th Ave N) to Emerson/Fremont
- Stage 3: Emerson/Fremont to Robbinsdale Transit Center (or appropriate LRT connection)

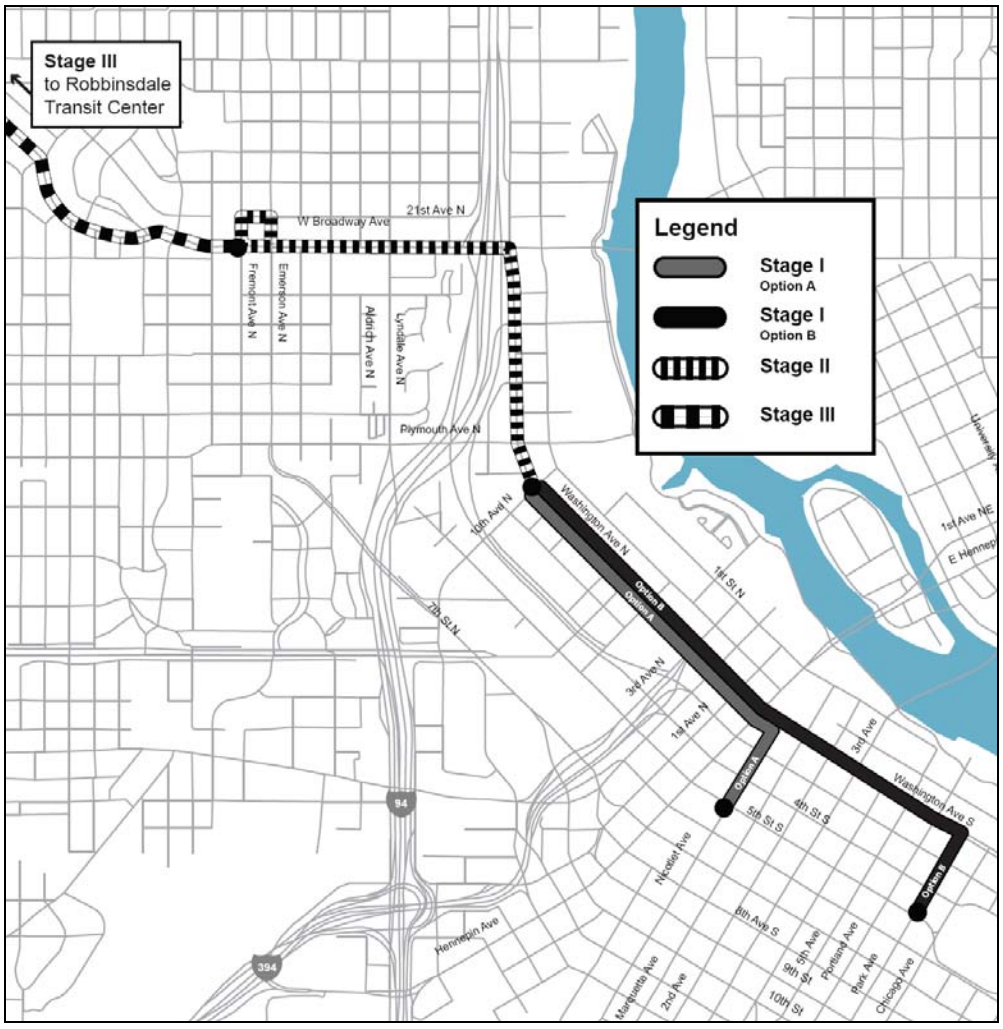
Minimal Operable Segments

There are two options for a MOS on the W. Broadway/Washington Corridor:

- Option A: 5th/Nicollet to Washington Avenue to 10th Avenue N. Two in-service vehicles would be required to maintain 15-minute headways.
- Option B: 5th/Park to Washington Avenue to 10th Avenue N. Two in-service vehicles would be required to maintain 15-minute headways.

The extension to Fremont Avenue N would require 3 vehicles to maintain 15-minute headways for both Options A and B.

Figure 5-5 W Broadway / Washington Avenue Minimal Operating Segment and Staging Options



Development Opportunities and Special Generators

Both options for a MOS for the W. Broadway/Washington corridor would serve the near-downtown neighborhood market in the emerging North Loop area. Option A would serve the new Central Library and the north end of the Nicollet Mall. Option B would serve the Riverfront Mills District, the Guthrie and the Metrodome.

Economic development is an important goal of this corridor. The North Loop area, in particular, shows great promise for continued residential growth. As one of the major landmarks in downtown Minneapolis, plans call for demolition of the Metrodome and construction of a new Vikings stadium on the existing site. The Metrodome sits just east of Chicago Avenue (Kirby Puckett Place) between 4th and 6th Streets, encompassing much of the East Downtown area. The most recent plans include a new retractable stadium surrounded by new development east of the stadium that would include as many as 4,500 new housing units, 1.7 million square ft. of office and a new hotel. And while the long-term W Broadway corridor may be lagging behind other corridors in terms of economic development, the long-term potential for redevelopment in this corridor is strong, as noted in the "West Broadway Alive!" revitalization plan.

Ridership

The MOS between Washington/10th Ave N and Nicollet/5th Street (Option A) would generate approximately 338,300-413,500 riders per year (see Figure 5-6). The minimum operating segment between Washington/10th Avenue N and Park Ave (Option B) would generate approximately 307,300-375,600 riders per year (see Figure 5-6).

Turnaround Considerations

For both options A and B, there would need to be a way to turn vehicles around in the vicinity of 10th Avenue N. Because 10th Avenue N has relatively low traffic volumes, and has two through lanes with a middle turn lane, the most likely option is to incorporate a short section of single-track into the left lane of 10th Avenue N. Because of the low traffic volumes at this intersection, a separate signal phase would not be required. The single traffic lane on 10th Avenue N would need to allow vehicles to go straight and make both left and right turns.

For Option A, the line would terminate at the Nicollet Mall LRT station – either by utilizing the existing light rail tracks to turnaround, or by utilizing a short section of the parking lot just north of the LRT station for a single track.

Because Park Avenue is currently a one-way, northbound street, streetcar service would require an exclusive, contraflow lane from Washington Avenue to 5th Street. The turnaround for this line would occur on Park Avenue in a single lane in the exclusive contraflow lane (where the vehicle can layover and switch directions).

Maintenance Facility

There is still a considerable amount of land in the North Loop area that is currently zoned industrial and there is an industrial park northwest of Washington Avenue/10th Avenue N. While care will need to be taken due to the changing character of the North Loop area, there appear to be appropriate sites for a maintenance facility (see later section in this chapter for details).

Capital and Operating Costs

Based on the two options for minimal operable segments, Figure 5-6 provides a summary of estimated impacts of developing this line in phases.

Figure 5-6 Capital and Operating Costs – Washington/W Broadway Corridor

	From	To	Vehicles Required for 15-Minute Headways	Annual Revenue Hours	Estimated Annual Ridership	Operating Cost	Track Miles	Capital Cost Excluding Vehicles and Maintenance Facility[1]
Stage 1 – Option A	Nicollet / 5th St	Washington Ave / 10th Ave N	2	11,448	338,300 – 413,500	$1,714,338	2.2	$22,300,000
Stage 1 – Option B	Park Ave / 5th St	Washington Ave / 10th Ave N	2	11,448	307,300 – 375,600	$1,714,338	3.4	$33,900,000

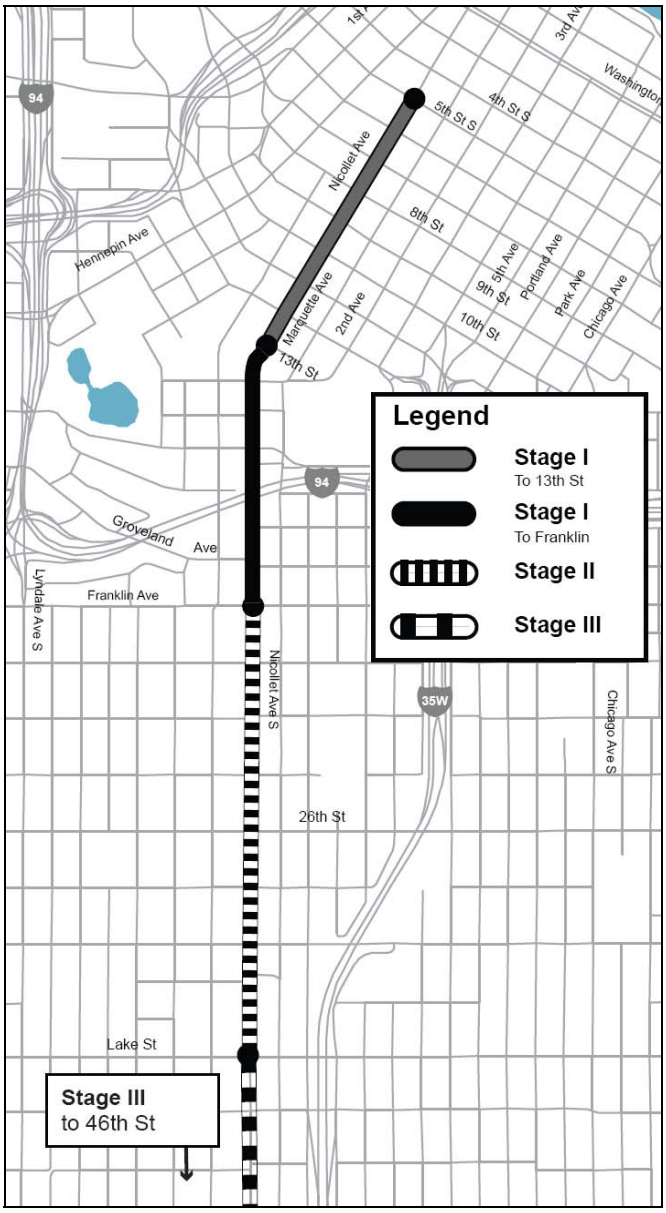
[1]See Figure 5-11 for total capital costs including vehicles and maintenance facility.

Nicollet Avenue

The logical staging for the Nicollet Avenue Corridor would be (shown in Figure 5-7):

- Stage 1: 5th Street/Nicollet Mall to 13th/Grant Street or Franklin Avenue
- Stage 2: 13th/Grant Street or Franklin Avenue to Lake Street
- Stage 3: Lake Street to 46th Street Transit Center (I-35W)

Figure 5-7 Nicollet Avenue Minimal Operating Segment and Staging Options



If initial implementation could be completed all the way to Lake Street, it would be possible to make some minor modifications to the underlying bus system and provide more frequent service on streetcars. Streetcar service could be improved to 7.5-minute headways (peak and midday periods) and could be reduced to 15-minute headways during early morning and evening hours. The long-line buses could then operate limited stop every 15 minutes between Lake Street and Grant Street via 1st Avenue S (northbound) and Blaisdell Avenue S (southbound) with a single stop at Franklin Avenue. A maximum of six in-service vehicles would be required to maintain 7.5-minute headways during peak and midday periods. Three in-service vehicles would be required when headways are reduced to 15 minutes.

One potential concern with incorporating streetcars on Nicollet is the width of the Nicollet Mall and the impact of operating streetcars and buses together. Nicollet Mall is only one lane in each direction, which can accommodate approximately 50 buses per hour[1] before operating speed starts to deteriorate significantly. The extent of the impact of streetcar on bus operation on the Mall will depend on the number of buses that can be replaced by streetcar in the corridor and the relative frequency of service between buses and streetcars. This is an issue that will need to be analyzed in detail, in coordination with Metro Transit, if streetcars are to be implemented in any of the corridors that would utilize Nicollet Mall in the downtown area.

Minimal Operable Segment

The Nicollet Corridor line would be double-tracked its entire length. An exclusive lane of track at the north end of the line (likely near the Nicollet Mall LRT station) would be needed to allow streetcar vehicles to layover and reverse direction.

Two options were identified for the MOS on the Nicollet Corridor. The north end of the corridor is at the 5th Street/Nicollet Mall LRT Station. Depending on resources available, the MOS might extend only to the 13th Street/Grant Street area (with service to the Convention Center) or it might extend to Franklin Avenue. Two in-service vehicles would be required to maintain a base 15-minute headway to either Grant Street or Franklin Avenue. No impact on the underlying bus network is assumed unless service is implemented at least to Lake Street.

Development Opportunities and Special Generators

The MOS of the Nicollet Avenue corridor would serve all of Nicollet Mall, the Minneapolis Convention Center and would be within walking distance of the Hennepin Avenue entertainment district. If extended to Franklin, it would provide service to the Loring Park and Stevens Square/Loring Heights neighborhoods, both high density

[1] This is the level at which bus-bus interference causes about a 20% loss in operating speed. See the Access Minneapolis Downtown Transit Circulation Report.

residential areas. There are existing plans for development of high density residential and mixed use along Nicollet Avenue between approximately 9th Street S and Franklin Avenue.

Ridership

The MOS between Nicollet/5th Street and 13th Street/Grant Street (Option A) would generate approximately 402,000-491,400 riders per year. Option B (to Franklin Avenue) would generate approximately 446,900-546,200 riders per year.

Turnaround Considerations

On the north end, a short section of exclusive streetcar track could be added near the Nicollet Mall LRT station at 5th Street. Although this option would require further study, the surface parking lot just north of the LRT platform would likely allow adequate right-of-way to incorporate a single lane of exclusive streetcar track. The MOS from 5th Street to 13th Street/Grant Street (Option A) could utilize the middle lane of 13th Street or Grant Street for a short single-track spur to turn vehicles around.

A turnaround location near Franklin Avenue (Option B) would be most appropriate one block north of Franklin at Groveland. Because this is a two-lane, two-way street, a short single-track could either be incorporated into the middle of the street, or take over one of the lanes and restrict travel to only one direction.

Maintenance Facility

The location of a maintenance facility is problematic for this corridor. There are some parking lots in the vicinity of I-94 that might be usable but these are currently proposed for redevelopment, are relatively small for a maintenance/storage facility and offer limited expansion opportunities. A maintenance facility might be incorporated near Lake Street but this area is currently proposed for redevelopment and expansion opportunities are likely to be limited. Another potential maintenance facility at the south end of this corridor is the existing Metro Transit bus garage at 31st Street and Nicollet. If a maintenance facility site cannot be found in close proximity to Nicollet near or north of Franklin, there may not be a viable MOS for the Nicollet Avenue corridor.

Capital and Operating Costs

Figure 5-8 below provides a summary of estimated costs involved with completing this line in phases.

Figure 5-8 Capital and Operating Costs – Nicollet Avenue Corridor

	From	To	Vehicles Required (15-Minute Headways)	Annual Revenue Hours	Estimated Annual Ridership	Operating Cost	Track Miles	Capital Cost Excluding Vehicles and Maintenance Facility[1]
Stage 1 – Option A	Nicollet / Washington Ave	Nicollet / 13th Street	2	11,448	402,000 – 491,400	$1,714,338	1.8	$17,900,000
Stage 1 – Option B	Nicollet / Washington Ave	Nicollet / Franklin Ave	2	11,448	446,900 – 546,200	$1,714,338	2.7	$27,800,000

[1]See Figure 5-11 for total capital costs including vehicles and maintenance facility.

Operating costs would be the same whether the service terminates at 13th Street/Grant Street or is extended as far as Franklin Avenue, since 15-minute headways can be maintained with two vehicles. Operating only to 13th/Grant Street would result in longer layover times and would be generally less efficient than an initial line built to Franklin. Building the initial segment to Franklin Avenue would add about $9.4 million in additional capital costs. The extension to Franklin provides a connection to the crosstown Route 2 and begins to serve the very dense neighborhoods south of I-94.

Implementing streetcar service all the way to Lake Street (with improved headways) would require an additional $626,000 in operating costs. Although four extra vehicles are required to maintain 7.5-minute headways, this is a relatively small increase in operating costs because of the impact on the underlying bus network. In addition, capital costs are about $19.1 million higher because it is a longer line. It should be noted that at least seven streetcar vehicles would also need to be purchased to implement service to Lake Street, adding another $21.0 million in costs. Despite the higher cost, the advantages of implementing service to Lake Street include:

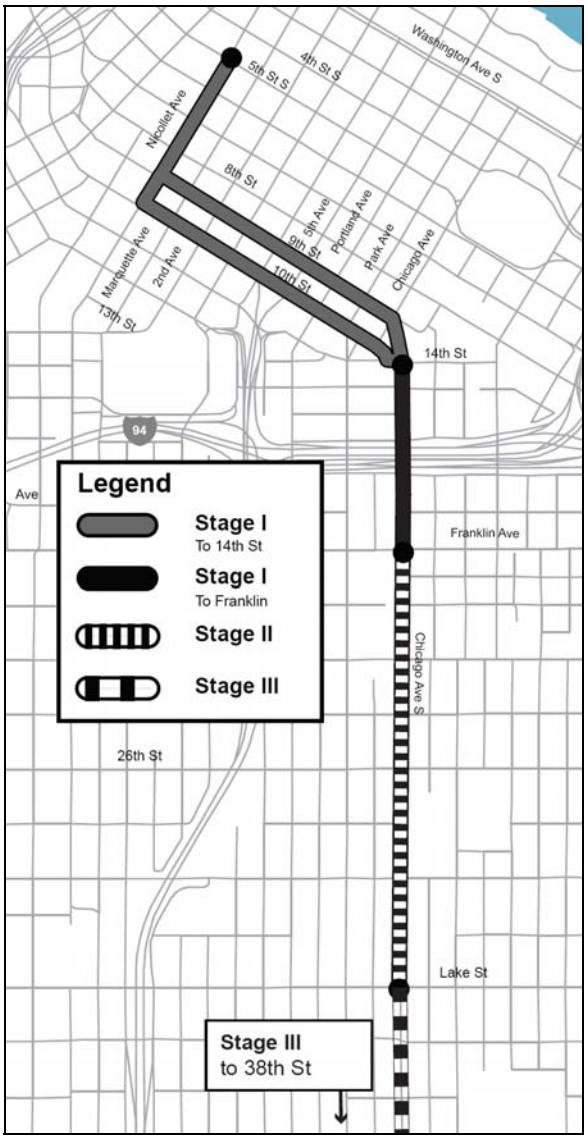
- A connection can be made to Routes 21 and 53 – one of Minneapolis' most popular transit corridors
- Development intensity is relatively high between Franklin and Lake Streets
- The potential to connect the south portion of Nicollet Avenue with the Nicollet Mall could attract significant tourists/visitors to the Nicollet (Eat Street) corridor

Chicago Avenue S and 9th/10th Streets to Nicollet

The logical staging of the Chicago Avenue Corridor is (shown in Figure 5-9):

- 5th Street/Nicollet Mall to 14th Street/Chicago Ave or Franklin/Chicago Ave via 9th/10th
- 14th Street/Chicago or Franklin Avenue to Lake Street
- Lake Street to 38th Street

Figure 5-9 Chicago Avenue Minimal Operating Segment and Staging Options



The Chicago Avenue corridor would run on double-track the entire length of Chicago Avenue S and then split to use the one-way couplet of 9th and 10th Streets before turning north on Nicollet Avenue (double-track) to the LRT station at 5th Street. Like the other lines using Nicollet, it is recommended that the terminal station on the north end be in an exclusive right-of-way so as not to interfere with the volume of buses required to use Nicollet. If the issue of skyway clearance could be resolved, it would be preferable to make the east-west connection along 8th Street (or 8th and 9th Street) to avoid the freeway ramps on 10th Street.

As with the Nicollet Avenue corridor, if streetcar service were implemented all the way to Lake Street, the underlying bus network could be modified to make better use of the streetcar investment on Chicago Avenue S. It is proposed that streetcar service be improved to 7.5- minute headways (peak and midday periods) and then be reduced to 15-minute headways during early morning and evening hours. The long-line buses (from the Mall of America to Brookdale) could then operate every 15 minutes with limited stop service between Lake Street and 8th/9th Streets via Portland Avenue S (southbound) and Park Avenue S (northbound) with a single stop at Franklin Avenue. A maximum of six in-service vehicles would be required to maintain 7.5-minute headways during peak and midday periods. Three vehicles would be required to operate 15-minute headways during evenings and weekends.

Minimal Operable Segments

Similar to the Nicollet Avenue South corridor, the MOS could be terminated in more than one location. Option A would be from 5th/Nicollet to 14th Street/Chicago Avenue. Option B would be from 5th/Nicollet to Franklin Avenue/Chicago Avenue via the 9th/10th one-way pair. Service to either 14th/Chicago or Franklin/Chicago would require two in-service vehicles to maintain a 15-minute headway. It is assumed that until streetcar service reaches Lake Street, the shorter MOS would not have an impact on the underlying bus service.

Development Opportunities and Special Generators

Both MOS options would connect the Elliot Park neighborhood to the inner core of downtown and the LRT station at 5th Street and would serve the Hennepin County Medical Center complex. The streetcar would also be within walking distance of the Metrodome. Economic development potential in this corridor is the strongest in the Elliot Park neighborhood, where very high intensity residential development is occurring, and in the areas surrounding the proposed new Vikings stadium.

Ridership

Option A between Nicollet Avenue and 14th Street/Chicago would generate approximately 310,600-379,600 riders per year. Option B between Nicollet Avenue and Franklin Avenue would generate approximately 329,800-403,100 riders per year.

Turnaround Considerations

The turnaround on the north end of this line would be the same as other segments that serve the Nicollet Mall LRT station. Because 9th and 10th Streets are a one-way couplet, the turnaround for the 14th Street/Chicago MOS would simply utilize the existing traffic lanes. A specific option for a turnaround has not been identified at Franklin/Chicago but one of the intersecting local streets could be used for this purpose.

Maintenance Facility

Most of the area east of the Metrodome is currently zoned industrial so there may be some opportunity for a maintenance storage facility in this area. However, there are redevelopment plans for this area which could make it challenging to provide a maintenance facility for the Chicago Avenue corridor. There are no known sites along Chicago Avenue outside downtown based on an initial review of zoning. Further study is needed to determine if a suitable site might be available. If an appropriate site cannot be found for a maintenance facility that is near or within downtown, the Chicago corridor may not have a viable MOS.

Capital and Operating Costs

Figure 5-6 provides a summary of estimated impacts of building the initial operable segment in phases.

Figure 5-10 Capital and Operating Costs – Chicago Avenue Corridor

	From	To	Vehicles Required (15-Minute Headways)	Annual Revenue Hours	Estimated Annual Ridership	Operating Cost	Track Miles	Capital Cost Excluding Vehicles and Maintenance Facility[1]
Stage 1 - Option A	Nicollet / 5th St	14th St / Chicago Ave S	2	11,448	310,600 – 379,600	$1,714,338	2.2	$21,900,000
Stage 1 – Option B	14th St / Chicago Ave S	Chicago Ave S / Franklin Ave	2	11,448	329,800 – 403,100	$1,714,338	3.1	$30,800,000

[1]See Figure 5-11 for total capital costs including vehicles and maintenance facility.

As with the Nicollet Avenue route, there is no difference in operating costs between a line terminating at 14th Street and Chicago Avenue S and one that is extended to Franklin Avenue, since it is still possible to provide 15-minute service frequency with two vehicles.

If streetcar service were provided all the way to Lake Street, four more vehicles would be required to maintain the proposed 7.5-minute peak headway. This would increase operating costs by approximately $1.7 million. Extension of the line to Lake Street would increase capital costs by about $19 million and would require purchasing an additional vehicle at $3 million. Despite the higher cost, there are some advantages to providing service to Lake Street:

- Service would be provided to the hospitals (Abbot Northwestern and Children's Hospital)
- The Midtown Exchange building and the business district at Lake Street are a strong anchor for this corridor.
- A connection can be made to the crosstown Routes 21 and 53 at the Chicago-Lake Transit Center

Midtown Corridor

It is recommended that the Midtown Corridor be constructed as one segment, rather than in stages, due to the close relationship between ridership on the Midtown Corridor and the proposed SW LRT line. Since one of the alignments for the SW LRT line would utilize a significant portion of the Midtown Corridor, a decision on implementation of streetcar in the Midtown Corridor should not be made until the alignment decision has been made for the SW LRT line. See Chapter 3 for a detailed discussion of the Midtown Corridor.

Maintenance and Storage Facilities and Potential Sites

One of the most important factors influencing the decision on where to begin building a streetcar network is the ability to find a location to house and maintain the vehicles. In order for a streetcar network to function, there must be facilities to maintain and store the streetcar vehicles, which are located as near to the "revenue" line as possible. Since Minneapolis does not currently operate streetcars, an initial streetcar line would require a new facility designed to house and maintain the streetcar vehicles. As new streetcar lines are added, existing facilities would need to be expanded, or new facilities would need to be added if the vehicles could not access the existing facility.

Initial Maintenance and Storage Facility

The maintenance and storage facility for an initial streetcar line would maintain and store the streetcar vehicles on a daily basis. A typical modern streetcar vehicle is 66 feet long and 8 feet wide, runs on standard gauge tracks, is 11.5 feet high, and is classified as a low-floor vehicle. These vehicles have support equipment (HVAC, air compressor, resistor banks) mounted at roof level. The SKODA vehicle, which is being used in Portland and Tacoma, has two trucks with either a single or double center articulation. Each truck has

two AC motors and drive units mounted on a wheel set that may or may not have resilient/bochum wheels. Although modern streetcar vehicles can be stored outside (as long as they are in a secure area), it is assumed that all vehicles in Minneapolis would need to be stored inside to minimize the impacts of extreme weather.

Key functions that will need to be provided for at a maintenance and storage facility include:

- Vehicle Storage
- Equipment and Parts Storage
- Administrative Functions
- Employee Parking
- Vehicle Cleaning (interior and exterior)
- Daily Inspections
- Preventative Maintenance
- Running Repairs

It is assumed that heavy repairs could be contracted out to other facilities, such as the existing LRT maintenance facilities owned by Metro Transit. Streetcar vehicles can be transported on a tractor-trailer to this facility when major repairs are required instead of requiring streetcar track. Portland Streetcar uses this method, using trailer trucks to transport streetcar vehicles to the TriMet light rail maintenance facility for major work, overhauls and component change-outs.

Site and Building Size Requirements

Site and building size requirements are dependent on the vehicle fleet size the facility will need to accommodate. A facility should be designed to accommodate peak vehicle requirements of an initial planned segment and any planned expansions.

Assuming a fleet size of 8 to 10 vehicles (which includes fleet expansion) a one- to two-acre site is needed. The site should be flat and generally rectangular in shape. The building footprint would be in the range of 8,000 square feet and would need to accommodate two tracks within the building of 100 feet in length each. One track could be used for inspections, running repair and exterior and roof-mounted work. The other should be over a pit to allow for work on the entire undercarriage of the vehicles.

Prefabricated steel buildings are a low cost alternative for a maintenance facility if area zoning and design standards allow for their use. The facility should be designed and situated on the lot to allow for easy expansion as the system grows and additional bay/storage capacity is required.

Cost

It is estimated that the development of a fully functional storage and maintenance facility for up to ten vehicles would cost in the range of $2-4 million. This cost does not account for property acquisition, so it is preferable if the site is owned by Metro Transit, the City of Minneapolis, Hennepin County or another public entity willing to contribute the land.

Potential Site Locations

Deciding which initial streetcar segment to begin with is dependent in part on the availability of a site for a maintenance and storage facility. Based on the minimal operable segments identified earlier in this chapter, the location will need to be somewhere in the general vicinity of downtown2. The maintenance and storage facility should be sited as close as possible to the initial streetcar alignment, as it will require additional track to get vehicles from the line to the facility (thus adding to the total cost of the project). In Portland, for example, the maintenance facility was located between the two directions of revenue track under a freeway overpass that would never have demands for higher and better uses. While this may be an ideal situation, the location of this facility made the initial streetcar line more cost effective than if non-revenue track was required to access a maintenance facility.

Although specific sites are not identified in this study, the following section identifies some general areas, based on existing industrial zoning, that may be appropriate for a maintenance and storage facility. A possible alignment for connecting these areas with an MOS is also identified.

Dunwoody Boulevard and I-394

The area north of this intersection is primarily zoned Industrial 1 (I-1) or Industrial 2 (I-2), which would be appropriate for a maintenance and storage facility. While this area may present some challenges, it may be possible to use the area under I-394 in the vicinity of Dunwoody Boulevard or another parcel along this right-of-way (likely owned by MnDOT). A short section of single-track, approximately 2,000 feet, could be used to access a facility in this location. Although additional study of the area is necessary, expansion opportunities appear good in this area.

This facility location would support an initial streetcar line on the Hennepin Avenue corridor.

[2] As noted in Chapter 3, the Midtown Corridor is the only corridor that has limited opportunities to physically connect to one of the initial segments, and would likely require a separate maintenance facility. There are only a few at-grade crossings along the Midtown Corridor. The only possible connection to an initial operable segment from the Midtown Corridor is 5th Avenue S.

North of the Basilica of St. Mary

The area north of I-394 near N 16th Street and Linden Avenue could be an appropriate location for a streetcar maintenance/storage facility. While some of this area is zoned OR3 (Institutional Office Residence District), adjacent parcels are zoned light industrial (I1) and the area in general is much more industrial in nature. A short section of single-track, less than ¼ mile, could be constructed to access a facility in this location. Although additional study of the area is necessary, expansion opportunities are likely in this area.

This facility location would support an initial streetcar line on the Hennepin Avenue corridor.

North Loop Area

Much of the North Loop area is currently zoned I-2. Due to the changing character of this area, however, a maintenance facility will only be appropriate in certain locations. The area between 10th Avenue N, 4th Street N, 6th Avenue N and 7th Street N, as well as the industrial park northwest of Washington Avenue/10th Avenue N, shows the most promise. Although the 3rd/4th access viaduct lanes to and from I-94 may not always define the character of this area, it is likely that the northern portion of this area will remain industrial – at least for the foreseeable future. One major advantage of this area is the proximity to the existing Heywood Bus Garage facility, owned by Metro Transit. It may be possible to integrate a streetcar maintenance facility into this facility, though this has not been confirmed with Metro Transit and other needs at that facility may prevent use for streetcar vehicles.

A section of single-track could be used to access a maintenance facility in this area. From Washington Avenue, a facility in this area could be accessed via 10th Avenue N with less than ½ mile of track. A maintenance facility in this area would be most appropriate for any of the initial streetcar segments on Washington Avenue. Based on existing land use, expansion opportunities appear to be strong in this area, especially closer to the 3rd/4th Street access lanes and I-94.

These facility locations would support an initial streetcar line on either W. Broadway/Washington Avenue alignment.

East Hennepin Area

While the East Hennepin area is a thriving neighborhood with strong economic development potential, it may be possible to incorporate a maintenance/storage facility near the railroad tracks west of 1st Avenue NE. There are several industrial parcels in this area that may be appropriate for a maintenance/storage facility.

This facility location would support an initial streetcar line on either the Central Avenue or the University Avenue corridors.

Downtown East / Metrodome

Most of the area east of the Metrodome (to I-35W) is currently zoned I-1. While there are currently several opportunities for a maintenance/storage facility in this area, the Downtown East / North Loop Master Plan envisions a dramatic change in character for this neighborhood, including medium-density housing. The Downtown East / North Loop Master Plan also suggests the addition of a new LRT station east of the Metrodome, and a transit-oriented community node.

If the Metrodome remains in its current location, or is rebuilt in this general vicinity, a maintenance/storage facility may be more appropriate in this area – possibly integrated into future parking facilities.

This facility location would support an initial streetcar line on the W. Broadway/Washington to Park alignment or on the Chicago Avenue corridor.

Nicollet Ave S / Franklin or 31st Street

There are some parking lots in the vicinity of I-94 and Nicollet Avenue that might be usable for a maintenance facility but these are currently proposed for redevelopment and they are relatively small.

Metro Transit has an existing bus garage facility located at 31st Street and Nicollet Avenue S. Although further study would be required, it may be possible to retrofit this facility to store and maintain a small fleet of streetcars.

These facility locations would support an initial streetcar line on the Nicollet Avenue corridor.

Total Costs for Minimal Operable Segments

Estimated operating costs, capital costs, ridership and development opportunities for the minimal operable segments are summarized in Figure 5-11. Two key cost elements that were excluded from trackway capital cost estimates are included in Figure 5-11.

- **Vehicles.** Modern streetcar vehicles, such as those used in Portland and Tacoma, typically cost $3.0 million each, depending on the vehicle configuration and market conditions when the vehicles are acquired. In addition, spare vehicles will be required for scheduled maintenance and unexpected breakdowns. For all of the minimal operable segments, a single spare vehicle is assumed. However, as the system grows, a standard spare ratio of 15-20% should apply.
- **Maintenance and storage facility.** A maintenance facility for a starter line can range from $2.0 to 4.0 million, assuming capacity for approximately 10 vehicles. This figure assumes that the land will be owned by the City (or other government

entity) and that land acquisition costs are minimal. Also, costs associated with a maintenance facility may be slightly higher in Minneapolis because streetcar vehicles are assumed to be stored inside. Another consideration is the location of the maintenance facility. The further the facility is located from the main line, the longer the track required to reach the facility will be and the higher the costs. For planning purposes, it is assumed that capital costs associated with a maintenance/storage facility would cost approximately $4.0 million and that ½ mile of single track would be required to access the facility.

It is important to note that a maintenance/storage facility will be a one-time cost that would apply only to the first line. As the system evolves, however, it may be necessary to construct an additional maintenance/storage facility in order to accommodate a larger streetcar fleet.

Figure 5-11 Summary of Minimal Operating Segments Characteristics

	Hennepin Avenue	*Central and University Avenues*	*W Broadway/Washington Avenue to Nicollet Avenue (Option A)*	*W Broadway/Washington Avenue to Park Avenue (Option B)*	*Nicollet Avenue (Option A)*	*Nicollet Avenue (Option B)*	*Midtown Corridor*	*Chicago / 9th/10th Streets to Nicollet Avenue (Option A)*	*Chicago / 9th/10th Streets to Nicollet Avenue (Option B)*
From	Groveland	5th Street / Hennepin Ave	10th Avenue N/ Washington Ave	10th Avenue N/ Washington Ave	Nicollet Avenue / 5th Street	Nicollet Avenue / 5th Street	West Lake Station (SW LRT)	Nicollet Avenue / 5th Street	Nicollet Avenue / 5th Street
To	5th St / Hennepin Ave	Central Avenue NE	5th Street / Nicollet Avenue	5th Street / Park Avenue	13th Street S	Franklin Avenue	Lake St/Midtown Station	14 Street / Chicago Ave S	Franklin Ave / Chicago Ave S
Operating Characteristics									
Peak Vehicle Requirement	*2*	*2*	*2*	*2*	*2*	*2*	*5*	*2*	*2*
Annual Service Hours	*11,448*	*11,448*	*11,448*	*11,448*	*11,448*	*11,448*	*28,175*	*11,448*	*11,448*
Estimated Annual Operating Costs (assuming $149.75/hour)	*$1,714,338*	*$1,714,338*	*$1,714,338*	*$1,714,338*	*$1,714,338*	*$1,714,338*	*$4,219,206*	*$1,714,338*	*$1,714,338*
Ridership Estimates									
Estimated Annual Ridership	*463,000 – 566,000*	*364,000 – 445,000*	*338,300 – 413,500*	*307,300 – 375,600*	*402,000 – 491,400*	*446,900 – 546,200*	*1,000,000[3]*	*310,600 – 379,600*	*329,800 – 403,100*
Economic Development									
Special Use Generators	*High*	*Moderate*	*Moderate*	*Moderate*	*High*	*High*	*Moderate*	*Moderate*	*Moderate*
Development Opportunity	*Moderate to High*	*Moderate to High*	*Moderate*	*High*	*Moderate*	*Moderate*	*Moderate to High*	*High*	*High*
Capital Cost Estimates ($2007)									
Track Miles	*2.6*	*2.2*	*2.2*	*3.4*	*1.8*	*2.7*	*4.4*	*2.2*	*3.1*
Capital Cost (excluding vehicles and maintenance facility)[4]	*$26,000,000*	*$22,000,000*	*$22,300,000*	*$33,900,000*	*$17,900,000*	*$26,900,000*	*$24,850,000*	*$21,900,000*	*$30,800,000*
Additional Capital Costs	*1) Center Stations (5th – 10th) - $300,000* *2) LRT Crossing - $50,000*	*1) Hennepin Bridge (Miss. River) - $2.08 M* *2) Center Stations (5th – Washington) - $150,000*	*1) 4th Avenue N Bridge - $70,000* *2) LRT Crossing - $50,000* *3) Mall Modifications - $300,000*	*1) 4th Avenue N Bridge - $70,000* *2) LRT Crossing - $50,000*	*1) LRT Crossing - $50,000* *2) Mall Modifications - $2,100,000* *3) I-94 Bridge - $400,000*	*1) LRT Crossing - $50,000* *2) Mall Modifications - $2,100,000* *3) I-94 Bridge - $400,000*	*1) Side Track - $6,200,000* *2) Vertical Circulation - $2,000,000* *3) At-Grade Embedded Track - $382,000*	*1) I-94 Bridge - $660,000* *2) LRT Crossing - $50,000*	*1) I-94 Bridge - $660,000* *2) LRT Crossing - $50,000*
Subtotal	$26,350,000	$24,100,000	$22,700,000	$34,000,000	$20,450,000	$29,450,000	$33,500,000	$22,600,000	$31,500,000
Vehicle Costs[5]	$12,000,000	$12,000,000	$12,000,000	$12,000,000	$12,000,000	$12,000,000	$18,000,000	$12,000,000	*$12,000,000*
Non-revenue track[6]	$4,500,000	$4,500,000	$4,500,000	$4,500,000	$4,500,000	$4,500,000	$2,800,000	$4,500,000	*$4,500,000*
Maintenance Facility[7]	$4,000,000	$4,000,000	$4,000,000	$4,000,000	$4,000,000	$4,000,000	$4,000,000	$4,000,000	*$4,000,000*
Total Capital Costs ($2007)	$46,900,000	$44,600,000	$43,200,000	$54,500,000	$40,950,000	$49,950,000	$58,300,000	$43,100,000	$52,000,000

[3] Annual ridership on the Midtown Corridor estimated based on 3,300 weekday boardings developed in the Southwest Transitway Alternatives Analysis Study. Saturday boardings are estimated to be 80% of weekday and Sunday boardings are estimated to be 60% of weekday.
[4] Assumes approximately $9,950,000 per track mile for embedded track and approximately $5,650,000 for ballasted track (Midtown Corridor).
[5] Assumes $3,000,000 per vehicle. Costs include one spare vehicle per minimal operable segment. If all segments were implemented together, the number of spare vehicles would likely be lower.
[6] For planning purposes, it is assumed that ½ mile of single track would be required to access a maintenance facility.
[7] Maintenance facility costs would only apply to the first shortest operable segment.

Chapter 6. Owner/Operator Options

Historically, the regional transit operating agency would be considered the obvious choice for operating any new transit service. Within the Minneapolis area, this has been the case as light rail transit has been implemented.

While there is a general preference for having the regional transit operator involved, the arrangements and level of involvement vary considerably among cities that have implemented streetcar service. The key reasons that streetcar service has been treated differently than other types of transit service is that the proposed streetcar lines typically serve short local trips and are usually funded with local and private funds. Often, initial streetcar lines overlay the regional transit network.

One of the potential challenges facing implementation of streetcar in Minneapolis is the jurisdiction over the streets that are proposed for streetcar corridors. Existing jurisdiction is summarized below:

Corridor	Jurisdiction
West Broadway and Washington Ave.	Hennepin County
Central Avenue	Mn/DOT and Minneapolis
University Ave and 4th Ave NE	Hennepin County
Chicago Avenue	Minneapolis
Nicollet Avenue	Minneapolis
Hennepin Avenue	Hennepin County and Minneapolis
Midtown Greenway	Hennepin County

Any roadway that falls under the jurisdiction of Hennepin County or Mn/DOT will require close coordination with the responsible agency before successful implementation can occur. This will include, among other things, addressing issues of concern such as traffic impacts as well as having an interagency agreement about responsibilities related to funding, construction, operation and maintenance.

This chapter provides a brief overview of owner and operator options that should be considered before initiating streetcar service in Minneapolis and describes the major advantages and disadvantages associated with each option.

Lead Agency Options

The lead agency would assume all administrative functions such as overseeing the streetcar's daily operation, as well as the planning, financing and overall performance monitoring of the network. In addition, a new streetcar system would require a significant amount of effort associated with initial implementation, including:

- Securing appropriate grants and other financing mechanisms
- Issuing a Request for Proposal (RFP) for design and construction of the streetcar line
- Procuring streetcar vehicles
- Establishing fare policy and marketing/advertising materials
- Establishing a policy/oversight board
- Preparing a plan for operation and maintenance of streetcar:
    - If operated in-house, developing an organizational structure and hire and train staff
    - If contracted out, developing and issuing a RFP, evaluate proposals and negotiate contract with selected bidder.

Once the system is up and running, major on-going administrative responsibilities of the lead agency are:

- Contract oversight (if not operated directly)
- Staffing and support for policy board
- Planning for future extensions
- Scheduling
- Analysis of system performance
- Capital improvement programming and grant applications
- Annual federal and state reporting requirements
- Monitoring federal and state legislation
- Marketing and advertising

There are three practical options for the administrative or lead agency:

- City of Minneapolis
- Metro Transit
- New non-profit agency (JPA)

The advantages and disadvantages of these options are discussed below.

City of Minneapolis

There are four possible departments that could serve in a lead role if the City were to manage the streetcar system. They are:

- Public Works
- Community Planning and Economic Development (CPED)

- Mayor's Office
- New Department

In all cases, additional staff would be needed for the initial implementation phase as well as potentially for on-going work. The type of individual needed for implementation would likely not be the same as the person needed for on-going administration. Key skills for implementation work include project management, facilitation and consensus building, lobbying and legislation and grant development.

Public Works

The Public Works Department has been managing this streetcar feasibility study and currently handles all transportation functions in the city. Public Works staff is also knowledgeable about streetcar operations and understands the role streetcars can have within the City's ongoing Transportation Action Plan. This suggests that the Public Works Department would be well positioned to take a lead role if the City is interested in assuming this responsibility.

Community Planning and Economic Development (CPED)

While it would be unusual for a planning department to assume the responsibilities of streetcar operation, CPED could play a larger role in using streetcars to further citywide development and growth goals – particularly downtown. However, if CPED does become the lead agency, it would likely require at least one experienced staff person if they were to assume such responsibilities.

Mayor's Office

Putting together the funding package and catalyzing the necessary public and private support for a new streetcar line is a significant task which requires a centralized "champion". In some cities, where the Mayor's office has advocated for streetcar development, implementation tasks are assigned to the Mayor's office, where the liaison staff can speak with the political authority of the Mayor. While the Mayor's office may not be a logical department for on-going administrative activities, having a dedicated project leader working out of the Mayor's office can make a very strong statement about the need to pull together across disciplines and agencies to make this happen.

New Department

The City could elect to create a new department devoted exclusively to streetcars. The rationale for doing so is to establish and devote a department to a single purpose. The major advantages of this type of approach are that a new public transportation department would have a single focus and would be able to devote 100% of its time for this purpose. The City may feel it is inappropriate and not necessary to establish a new department and

that the existing structure works fine. Should the City assume the lead role for a consolidated transit system, it may be worthwhile to further explore this option.

Metro Transit

The major advantage of having Metro Transit serve as the lead agency is that it is the regional agency that clearly has extensive experience designing, implementing and administering transit projects. As the largest regional transit provider in the Twin Cities, Metro Transit also understands how streetcars would best integrate into the underlying bus network. Metro Transit has been actively involved in the development of this feasibility study.

Metro Transit's unique experience in operating rail transit services in Minneapolis should be a key factor in determining a role for this agency. While Metro Transit's experience makes this agency an obvious candidate for being the lead operating agency, they may be less interested or able in other areas. A key issue is whether Metro Transit can balance the needs of new streetcar service with the demands of managing a regional agency. It should be noted that Metro Transit could manage and operate any new service under contract or under the direction of a different lead agency. Metro Transit may have a greater interest in operating streetcars, and less interest in championing the implementation, managing the construction (though it would necessarily provide input), and/or managing and financing the line. A key next step is to have City leadership and Metro Transit leadership meet to discuss the level of interest and commitment of each entity in each of these critical roles.

New Agency or Non-Profit Organization

Another option for a lead agency is to create a new agency to administer and manage the service, which would most likely be operated under contract by Metro Transit. The most common arrangement when two or more agencies administer a public service is a Joint Powers Authority (JPA). JPAs are formal decision making bodies created to provide a specific service (i.e., water service, waste management, fire suppression, regional transit services, etc.). JPAs are generally very formal organizations with a voting board, ruled by majority rather than consensus voting. JPAs generally have an assigned staff and an annual operating budget funded by the participating agencies. The assigned staff could be an existing agency (such as the City of Minneapolis) or a new staff could be hired by the JPA to administer service. A JPA can also apply for and administer grants and can receive tax revenues or other funding from participating jurisdictions, although it cannot introduce tax measures for financing its work.

Another option is to create a "purpose built" non-profit organization whose basic purpose is to manage the streetcar. This is similar to the way Portland operates its streetcar, as described below. In the Portland example, the non-profit Portland Streetcar, Inc. is responsible for managing the streetcar line and contracting for service with their regional transit operator. The non-profit includes representation from the local improvement

district that funds the streetcar, as well as members of the City and transit boards. This technique has proven to be very flexible and gives the public the feeling that the streetcar is somehow "different" from other transit. A downside of this option is that the non-profit can not apply directly for certain funding sources, and is dependant on other agencies to apply for and advocate for public funds.

Experience in Other Cities

This section presents several case studies from other cities that currently have streetcars in place or are nearing completion of their first line. A brief summary of the organizational structure is included, along with advantages or disadvantages associated with each.

Seattle, Washington

The City of Seattle and their regional transit provider, King County Metro, are working together to implement a new 2.3 mile streetcar line along South Lake Union, connecting downtown Seattle to the University of Washington Medical School, and serving a developing area that will house the City's growing biotechnology industry.

The City's Mayor has been a key proponent of the line and has maintained control of all aspects of implementation. The City will own the right of way and the rolling stock for the line, which will be operated and maintained by King County Metro.

A significant amount of the funding for this line, including on-going operating resources, will come from a Local Improvement District in the South Lake Union neighborhood. Representatives of the South Lake Union District and the City will serve as an advisory committee for the streetcar service, and will have a policy role in approval of any changes in service levels, hours etc.

The involvement of the Mayor's office was critical to implementation. The City hired a local consultant with experience in managing and expediting projects as well as lobbying and political experience. The consultant was assigned essentially full time to managing all aspects of implementation, including establishing the Local Improvement District, overseeing the design and environmental consultants and negotiating an MOU between the City, the Local Improvement District and the transit agency on all aspects of administration and operation of the service.

While the South Lake Union Streetcar line has not yet opened, the plan calls for the City continuing to own the right-of-way. This is particularly important and relevant to Minneapolis because the trackway is a multi-use lane in the street. The City procured the vehicles with assistance from King County Metro who will operate and maintain the line. Because the line has a unique funding source, it will not "count" against the proportion of service hours provided in the City of Seattle by regional agreement unless or until it becomes a regular transit route funded by regional transit dollars.

Given the unique funding arrangement for this line, and the ownership of the right-of-way, a Memorandum of Understanding has been negotiated explaining the roles and responsibilities of each agency. The City and Local Improvement District will continue to have a role in overseeing the line, as long as special funding is provided for operations.

Advantages of This Approach

- There is general agreement that the line could not have been built without the dedication of resources from the Mayor's Office. Although the project manager utilized by the Mayor was a consultant and not a City employee, he spoke with the authority of the Mayor and provided constant encouragement to all City departments to get the job done.
- Like Metro Transit in the Twin Cities, King County Metro had expressed interest from the beginning in operating the route, and would have been very concerned about bringing in a separate operator for this new service. Complex union issues may even have prevented that from happening if it were desirable. King County Metro has been a willing partner in all aspects of service design and implementation and has provided considerable expertise in the design of vehicles and amenities.
- The City is able to leverage facilities that King County Metro already owns for heavy maintenance. The City is also able to leverage King County Metro's expertise in rail vehicle and facility maintenance.
- The Local Improvement District was able to accomplish their goal of maintaining some greater level of involvement in this service than in traditional transit services in Seattle, and guarantees high levels of service for the early years of implementation. This allows for reasonably high levels of service to be provided as the new neighborhood develops, even when ridership may be slow in developing.

Disadvantages of This Approach

- Although the MOU describes the roles and responsibilities of each agency, it is not completely clear what would happen in the case of a dispute over service levels or spans. For example, if after 5 years, King County Metro decides that demand does not justify the minimum frequencies that the other partners require, and if the partners are not paying directly for those hours, it is unclear how that would be resolved.
- King County Metro's costs are considered quite high by some and there has been some concern that the costs associated with this line are being unfairly computed. It is difficult to adjudicate these issues which have generally been resolved by a "handshake" and political negotiation.
- It is not clear whether this arrangement sets a precedent for all other streetcar lines in Seattle, or whether this was unique and tied to the involvement of an active Local Improvement District.

Portland, Oregon

Development of the first 2.4 mile streetcar line in Portland was a highly collaborative project from the beginning. The initial line has been extended two times in the past few years and is preparing to open a third extension in the Fall of 2007.

The initial effort to develop streetcar service was spearheaded by leaders from the City of Portland, and a variety of public, non-profit and private organizations. The initial line was funded largely through a creative combination of local public and private sources, rather than the traditional federal and state grants. The approach to funding each extension has been slightly different, tailored to the local area being served.

The critical component that made streetcar implementation successful was that the project was embraced by developers, property owners and the neighborhoods from the very beginning. The City of Portland has always assumed the role of owner of the Portland Streetcar. In 1990, the City initiated a comprehensive feasibility study. In 1992, the City was awarded a $900,000 federal grant from the US Department of Housing and Urban Development, and provided the local match. This money allowed the City to continue outreach and preliminary design and engineering on the first line. By 1995, the City issued an RFP to design, build, operate and maintain the streetcar line. The independent non-profit Portland Streetcar, Inc. was selected to implement the streetcar line.

While the City owns the line, Portland Streetcar, Inc. (PSI), a 501c3, single purpose non-profit agency, is essentially an umbrella agency that was formed with the sole purpose of operating the streetcar system. Rather than employ their own staff, PSI contracts with TriMet and the City of Portland to operate, maintain and administer the service. TriMet staff, funded by contract, consists of 20 operators, 3 superintendents and 5 maintenance technicians. City of Portland staff consists of a Manager, Assistant Manager of Maintenance, Manager of Operations and Safety and two stop and car cleaners.

Future planning of the streetcar network is being conducted through the City of Portland's Office of Transportation in partnership with Metro (the regional planning agency), TriMet and Multnomah County. Portland Streetcar, Inc. also has a Citizen's Advisory Committee (CAC), which governs the streetcar line and reviews and offers its advice on all significant project planning, design and operation issues. The active and effective CAC has had a significant role in shaping the Streetcar Project and continues to serve as a driving force behind its success. In addition, a separate Eastside Project Advisory Committee is overseeing development of an extension planned for Portland's eastside (which will utilize federal funding sources).

Advantages of This Approach

- Portland Streetcar, Inc. was established to focus exclusively on the streetcar corridor. Although TriMet was certainly qualified to serve as the operator of the

service, their focus as a regional agency was moving people over longer distances – not necessarily on downtown circulation.

- The marketing and advertising role of Portland Streetcar, Inc. was critical to its success. Because streetcar service was a new concept, some people needed to be convinced that it would work as real downtown circulation.
- The Portland Streetcar, Inc. board consists of a broad base of local business owners and developers, which helped with implementing the Local Improvement District (LID) and continues to support growth of the network.
- As the system plans to add another line, federal funding is being pursued through the Section 5309 New Starts program. The use of various funding mechanisms to build the original line and each extension provides direct experience in piecing many different sources together to build a line.

Disadvantages of This Approach

- TriMet may have access to a broader array of transit funds than could be reached through Portland Streetcar Inc. The involvement of the private non-profit requires that funding be generated through that agency to support streetcar operations.
- Unit costs for drivers and maintenance workers are determined by TriMet and there is some concern that their costs are very high. It is unclear what would happen if there was an impasse on costs.
- As a non-profit agency, Portland Streetcar, Inc. can not directly compete for many public funding sources. Either TriMet or the City has to sponsor grant applications, and some granter may restrict who can direct grant funds. This has not been a significant issue previously because the City sponsored the HUD grants, but this can be more complicated if FTA funds are involved.
- There is less integration of the streetcar with other TriMet services than might be expected. While fares are mostly integrated between the systems, Portland Streetcar is branded differently from other TriMet services and they offer an annual pass that is only good for streetcar service.

Memphis, Tennessee

The Memphis Area Transit Authority (MATA) operates three Trolley lines in central Memphis: two parallel, 2.5-mile lines downtown that connect on either end to form a loop, the Main Street and Riverfront lines, as well as a perpendicular 2-mile route connecting downtown to Midtown and the Medical District, the Madison Avenue Line.

The Main Street Line was the first built, opening in 1993. Its capital cost, including reconstruction of the Main Street Mall, was $34.9 million. The line's middle segment is part of the mall, and indeed, redevelopment of the mall was the impetus for the line's construction. To the north and south, the alignment is on-street, in mixed traffic flow. The Riverfront Line, opened in 1997, cost $15.8 million to construct and primarily utilizes a

freight and passenger rail right-of-way, while the Madison Avenue Line, opened in 2004 at a cost of $55 million, operates almost entirely on-street.

While MATA is solely responsible for Trolley operations, maintenance and administration, the agency has no dedicated funding source and its budget relies on subsidies from the City of Memphis's general fund, the Tennessee Department of Transportation and federal grants. Nor does MATA own any part of the Trolley right-of-way; the City holds title not only to the underlying land, but tracks. Capital costs for the three projects were covered in large part by the federal government, with some matching funds provided by the City and State and a small amount by MATA.

Planning for the system grew out of a determination by City officials that a transitway for rubber-tired vehicles originally proposed as part of the redevelopment of Main Street Mall would be incompatible with the mall's pedestrian environment. A report issued in 1989 by the Hnedak Bobo Group recommended the use of vintage streetcars, and evaluated several possible extensions of a mall line. The report was adopted by MATA and the City in 1990, and the three existing corridors were built according to its recommendations. While MATA was the lead agency responsible for planning, the City's engineering department was involved.

MATA is now planning a regional rail network utilizing modern light rail vehicles that would interline with historic trolleys in the existing corridors. To advise MATA on the "development and implementation" of the system, a Regional Rail Steering Committee consisting of 30 key stakeholders including elected officials, staff and private citizens was established.

Advantages

- Responsibilities are well defined. As with all other aspects of transit planning, administration and operations in Memphis, the Trolley is primarily a MATA responsibility, with assistance from the City.
- Strong integration with existing operations. The Trolley system is fully integrated with MATA's bus operations, both in terms of management and service provision. The Trolley is thus able to take advantage of existing resources, expertise and economies of scale.
- Partnership between City and transit operator. The relationship between MATA and the city is longstanding and well understood.

Disadvantages

- Operating budget is not assured. Because MATA has no guaranteed funding source, MATA must rely on contributions from the City on an annual basis. However, MATA staff expressed little concern about the arrangement, as City contributions have historically increased year over year.

- Reliance on traditional funding sources. Unlike public-private partnerships in other cities, the traditional public sector model employed by MATA relies entirely on fare revenues and taxpayer subsidies for funding.

Summary

Based on the three case studies, and the options evaluated in Minneapolis, the most likely candidate to take responsibility for implementation of the first streetcar line is the City. No streetcar line will be built without a champion, and while Metro Transit has shown interest in potentially operating and maintaining any resulting streetcar line, the only champion for this service at this time is the City of Minneapolis. Further, it is likely that funding for future streetcar development will include a significant contribution of funding from city and private sources. While the City may be a likely candidate for leadership in implementation, the City does not have jurisdiction over several of the proposed streetcar corridors and this will create additional implementation challenges.

Metro Transit has experience as a successful operator of rail transit services. There are a number of ways to involve Metro Transit as the operator of a future streetcar service, and additional discussions are needed to determine the optimal arrangement.

Chapter 7. Potential Funding Options

This chapter presents a preliminary review of funding options for funding the development, capital and operating costs associated with streetcar implementation in Minneapolis. Several potential sources are explored, including federal, state and local sources, as well as private financing options. A review of funding mechanisms for six cities that have successfully implemented streetcar systems is included at the end of this chapter.

Federal Funding Options

Project Earmarks/Federal Demonstration Projects

While recent federal transportation policy focuses on the devolution of spending decisions to state, regional and local entities, congressional earmarking of funds for projects still occurs, especially during the transportation bill reauthorization process (which will occur again in 2009). To obtain an earmark, project sponsors must raise the profile of their project and local congressional representation must be effective in advocating for the project during legislative negotiations. A key to the federal earmarking process is local support for a project. Members of Congress have limited access to earmarked funds, and since each member is interested in returning funds to their home district for projects that are broadly popular, it is important that a proposed project have high visibility and a high degree of local support. Earmarking can often jump start a project, by providing initial funds for environmental analysis or another specific aspect of the project development process. Earmarks are not available for operating funds.

Federal Transit Act Formula Funds

This federal program is devoted to funding the region's capital improvement program. Public transit operators can claim these funds for the purchase of buses, trains, vans and support equipment. Formula Funds require a 20 percent local match. The formula funds that Metro Transit might be able to claim are generally fully allocated to replacement vehicles for the regional vehicle fleet and is currently being used to help fund the purchase of hybrid vehicles.

Federal Transit Act New Starts/Small Start/Very Small Starts Discretionary Program

The New Starts Discretionary Program is the primary federal funding source for new rail transit services. Projects are determined via a highly competitive process. While the funds are allocated at the federal level, a critical component of this process is regional support and coordinated land use planning. Another critical component for New Starts funds is the ability to leverage funding for both the capital investment and ongoing operating support for a project. The Administration proposed to increase the local share requirements for New Starts to 50 percent. Currently, transit programs have the same federal share

requirements as highways (80% federal, 20% state or local). However, FTA typically requires a 50 percent match on all New Starts projects.

Figure 7-1 shows criteria and measures that are being used to support funding decisions for FTA New Starts program. It is assumed that similar criteria will be applied for Small Starts, with the exception that fewer measures are required and their development is simplified.

SAFETEA-LU established a new category of New Starts projects that request less than $75 million in federal funding and have a total cost under $250 million as "Small Starts." Small Starts projects would also have a streamlined evaluation process that fit with the spirit of SAFETEA-LU. This new category was developed to foster the development of less capital-intensive transit systems, such as Bus Rapid Transit and urban streetcar. However, final rulemaking is not expected to be complete until Summer 2008 and FY2007 funds for Small Starts have been rolled into the general New Starts program for allocation (See sidebar). In addition to the Small Starts program, the FTA has defined a class of projects that are very simple and low cost as "Very Small Starts." The Very Small Starts program is contained within the Small Starts program and represents projects that are low risk, low cost and highly cost effective. Very Small Starts must have a total capital cost of less than $50 million (including all project elements) and be less than $3 million per mile, exclusive of rolling stock. Very Small Starts projects qualify for an even simpler and expedited evaluation and rating process than Small Starts projects.

It is important to note that while projects can be built in phases (or minimal operable segments), potential Small Starts and Very Small Starts projects in a corridor will be evaluated as a single project. If the total combined cost of the project in the corridor is over the Small or Very Small Starts limits ($250 million and $50 million, respectively), the project will be evaluated as a traditional New Starts project.

It should be noted that since Federal funds are allocated at the regional level, the region should be involved in funding decisions to ensure that a streetcar project in Minneapolis does not put other regional priorities at a competitive disadvantage. Because most of the long-term streetcar network is part of the Primary Transit Network, which has been included in the regional network as the "Arterial Corridor Network" in the Metropolitan Council's Transportation Policy Plan, streetcar service could qualify for federal funding in these corridors.

Housing and Urban Development Funds

While this is not a traditional source of support for transportation projects, Portland Streetcar, Inc. has been successful in lobbying the Federal Housing and Urban Development Department (HUD) for earmark funds, citing the important connection to new housing. On average, Portland Streetcar has received $500,000 per year from HUD. These monies have largely supported planning and design work and have not been used for construction to avoid federal requirements on construction projects. Strong support from the area's Congressional delegation has made this funding possible. HUD earmark

funds do require local match. In Portland, the City provided the local match requirements for these funds.

SMALL STARTS/VERY SMALL STARTS PROGRAM SUMMARY AND STATUS (November 2007)

The following summarizes the requirements of the Small Starts program:

- $75 million in New Starts Funds and total project costs must be under $250 million.
- Small Starts will have a separate funding category beginning in FY 2007, starting at $200 million per year.
- Streamlined criteria and approval process.
- Non-fixed guideway corridor improvements (e.g., Bus Rapid Transit) are allowed under Small Starts.
- Exemption for projects under $25 million eliminated once Small Starts regulation is final. All projects receiving funding will be analyzed and rated.

The Very Small Starts program is within the Small Starts program but is different in the following ways:

- Total project costs must be under $50 million and less than $3 million per mile, exclusive of vehicle costs.
- Projects are in corridors that exceed 3,000 existing riders per average weekday.
- Evaluation criteria and process simpler than Small Starts.

Initially $200 million per year was scheduled for FY2007 through FY2009. However, the House of Representatives approved the Fiscal Year (FY) 2007 Transportation, Treasury, and Housing and Urban Development, the Judiciary, District of Columbia, and Independent Agencies Appropriations bill (H.R. 5576) on June 14 by a vote of 406-22. The House bill redirected the $200 million in funds that SAFETEA-LU authorized for the Small Starts program in FY2007 to the New Starts program for future earmarking. The House Appropriations committee report noted that the Federal Transit Administration would not complete the program guidelines until June 2007, leaving only a few months remaining in the fiscal year for funds to be spent subsequent to the guidelines being finalized. In June 2007, the FTA issued the Updated Interim Guidance and Instructions for Small Starts, which is intended to provide interim guidance for projects already in project development, evaluating and rating projects as part of the Annual Report on Funding Recommendations, and making funding recommendations until final rulemaking is in effect (expected in Summer 2008).

Figure 7-1 FTA New Starts Project Justification Criteria and Measures

Criteria	Measure
Mobility Improvements	Travel Time Benefits per Project Passenger Mile Low-Income Households Served Employment Near Stations
Environmental Benefits	Change in Regional Pollutant Emissions Change in Regional Energy Consumption EPA Air Quality Designation
Operating Efficiencies	Operating Cost per Passenger Mile
Cost Effectiveness	Cost per Hour of Travel Time Saved
Transit Supportive Land Use and Future Patterns	Existing Land Use Transit Supportive Plans and Policies Performance and Impacts of Policies Other Land Use Considerations
Other Factors	Project benefits not reflected by other New Starts criteria, including Economic Development

Source: Federal Transit Administration

State and Local Funding Options

Locally, there are a variety of financing tools available for funding capital and operating and maintenance costs for streetcars. A good number of these options, however, are not unique to streetcar funding and will present competition for other transit and transportation funding needs.

The more traditional funding mechanisms such as tax increment financing, the Motor Vehicle Sales Tax (MVST), metro transit funding or fare box receipts, although legislatively available, will likely create the most competition with other priorities. Some of the funding options require support of local developers or land owners for implementation authority. For example, in lieu of parking fees, density bonuses or development fees for transit-oriented development have all been used to fund transit infrastructure, but are unlikely to be implemented without support for local zoning code amendments. Similarly,

local improvement districts, or special assessment districts, will provide a level of funding reliability, but also would require support from property owners in the area.

There are also a variety of tax options that would provide new funding. Most of these sources are somewhat controversial and for many, authorizing legislation is required. For example, for a local sales or county sales tax, authorizing legislation is needed and a transit utility tax would be a new taxing vehicle for the City but not available without new legislation.

Figure 7-2 provides a summary of available financing tools. It includes their potential reliability as a funding source, whether or not the legal authority exists, and discusses some of the potential barriers, as well as some examples of where the tool has been utilized elsewhere. This list is not intended as an endorsement of any funding source. In fact, a combination of a variety of sources will be needed to develop an urban streetcar system in Minneapolis. This list simply identifies possibilities.

Review of Funding Mechanisms in Peer Cities

A review of six streetcar systems around the US shows that cities and transit systems use a variety of funding mechanisms to pay for capital and operating costs. These range from Federal New Starts, HUD, and CMAQ grants to sales tax measures, bonds, sale of naming rights, improvement districts, tax increment financing, and parking meter revenue. This section provides an overview of the capital and operating funding mechanisms used by streetcar systems in Charlotte, North Carolina; Memphis, Tennessee; Portland, Oregon; Savannah, Georgia; Tacoma, Washington; and Tampa, Florida.

Charlotte, North Carolina

Charlotte's streetcar line began service as a weekend-only service in 1996, over a one-mile route south of downtown. It was operated by Charlotte Trolley, Inc., a non-profit organization staffed with volunteers, using a single diesel engine car.

From 2001 to 2004, new track and electric overhead wires were installed along an extended two-mile streetcar route, which opened for service in late June 2004. The new service is operated daily by the Charlotte Area Transit System (CATS), and was constructed to serve as a portion of a longer light rail route.

Funding for capital and operating costs came primarily from a 0.5% sales tax for mass-transit improvements, approved by voters in 1998. Additional capital funding contributions came from the Charlotte Convention Center and CATS. A portion of the operating costs is from the local Arts and Science Council.

Figure 7-2 Summary of Funding Options

	Brief Description	Estimated Annual Revenues (High, Medium or Low)	Estimated Annual Revenue	Capital or O&M	Reliability as a Funding Source	Legislative Change Required? (Yes, No or Possibly)	Notes	Best Practices / Examples
Federal								
Federal Earmarks/ Demonstration Projects	Funding from direct earmark of federal funds procured by congressional delegation.	Low	Up to $15 million	Capital only	Low	No	Reduced interest in earmarks by Congress	
Federal Transit Act - Formula Funds	Federal program to fund region's capital improvement program.	Low-Medium		Vehicle purchases	High	No	Limited funds cover extensive regional needs	
Federal Transit Act - New Starts Program	Grants are for capital costs associated with new fixed guideway systems, extensions, and bus corridor improvements	Low	Varies tremendously	Capital only	High	No	20% local match requirement; FTA encourages higher local match	
Federal Transit Act - Small Starts Program	Grants are for capital costs associated with new fixed guideway systems, extensions, and bus corridor improvements	Low	In 2007, up to $75 million from feds per project	Capital only	High	No	Total project costs must be under $200 million	
Congestion Mitigation and Air Quality (CMAQ)	Funding for surface transportation and other related projects that contribute to air quality improvements and reduce congestion	Low	Between $500 K - $7 M per project	Capital only	Moderate	No	One-time, three-year grants; requires 20% local match	
Housing and Urban Development Grants	Non-traditional Federal source, but have been know to earmark funds for streetcar projects	Low	Up to $500,000	Capital only	Moderate	No	20% local match requirement	Portland
State and Local								
Taxes								
Convention Center Taxes	Revenues generated from the Minneapolis Convention Center Tax. Rate is 1/2 of 1% and is restricted to convention center related use legislatively; sources include food, liquor, hotels and sales tax.	Medium	Dependant on rate set	Capital only	High	Yes	Currently used for debt service on convention center	Charlotte
Local Sales Tax	Revenues generated from general sales tax imposed by local unit of government.	Medium	Dependant on rate set	Capital only	High	Yes	Would require an increase as current taxes are already pledged.	Tacoma
County Sales Tax	Revenues generated from general sales tax imposed by local unit of government.	Medium	$25-28 million/annually (ball park estimate).	Capital and O&M	High	Yes		
Hotel Guest Tax	Revenues generated from tax on hotel guests (tourists).	Low		Capital	Moderate	Possibly	Recently increased to 3%; ties into convention center tax; city will not want to be non-competitive	New Orleans
Transit Utility Tax	A fee for public transit added to sewer/garbage bill (indirect tax).	Low-Medium		Capital and O&M	Moderate to High	Yes	Benefit study would probably be needed.	

	Brief Description	Estimated Annual Revenues (High, Medium or Low)	Estimated Annual Revenue	Capital or O&M	Reliability as a Funding Source	Legislative Change Required? (Yes, No or Possibly)	Notes	Best Practices / Examples
Land Gains Tax	Tax is paid when land is sold or exchanged and is calculated based upon the pre streetcar appraisal as compared to the sales price following completion of the streetcar. Data would indicate that increase in value can be attributed to the benefit of the streetcar if property is within 3 blocks distance of line.	Low	Amount may be initially somewhat speculative	O&M	Moderate	Yes	New; will require some speculation	Vermont (not due to transit benefit)
Motor Vehicle Sales Tax	Sales tax on motor vehicles, all of which is dedicated to transportation. Transit is guaranteed 40% of these funds.	Medium	$120 M annually (only 50% for Metro)	Capital and O&M	High	No	Viewed as insufficient for transit needs; lots of competition	
Tax Abatement	Revenues from a tax collected by the City and held for a designated purpose.	Medium	Maximum of $200,000/year or 10% of current levy, whichever is greater	Capital	High	No	Not available on property within TIF district; city, county, school approval required	
Wheelage Tax	Revenues generated from tax on motor vehicles using public streets or highways.	Medium	Annual for City residents $15 for trucks, $10 for other motor vehicles	Capital and O&M	High	Special Election Vote	Requires a general referendum	Dakota County has collected and used for Cedar Avenue Transitway; Tacoma
Parking Tax	A tax on parking similar to a use tax.	Medium		Capital and O&M	Moderate	Yes	Would not generate revenue where parking is free; State would receive and return a portion to the City.	SF and LA
Fees								
Parking Impact Fee	An annual fee charged based upon the number of spaces available to property owners.	Medium		Capital and O&M	Moderate	Yes	Annual amount, Impact fee; free parking does not avoid the need to pay	Sydney
Regional Rail Authority	Revenues from an authority organized and existing as a political subdivision.	Medium- High		Capital only	High	No	Authority rests with the HCRRA; 6 weeks public notice; may require public vote	
Transit Impact Development Fee	One time fee (typically) on new property based upon projected usage of transit and benefit created by proximity of tenant.	Low		Capital only	High	Yes	Requires developer support	
In Lieu of Parking Fee, Density Bonus, Development Fee (TOD)	One time payment from developers. [Example: City negotiates one time payment for increased density, or one time payment for relief from parking requirements within certain distance of streetcar, (found in transit oriented developments) payment by developer for density increase over what is allowable by zoning.]	Low-Medium	One time fee	Capital only	High	Zoning code amendment	Requires developer support	Lynn Lake model; buy credits; annual assessment or consider downtown where zoning code does not require parking and a fee in lieu to all buildings

	Brief Description	Estimated Annual Revenues (High, Medium or Low)	Estimated Annual Revenue	Capital or O&M	Reliability as a Funding Source	Legislative Change Required? (Yes, No or Possibly)	Notes	Best Practices / Examples
Benefit Districts								
Local Improvement District (Special Services District)	District where special services are rendered and the costs of such services are paid from service charges collected; typically used for advertising, lighting, parking; may NOT be for services typically paid for through general funds.	Low		Capital and O&M	Moderate	Yes if wish to include residential properties	If route largely serves residential this would present a challenge; would require local business/developer support	Minneapolis, Seattle, Portland
Special Assessment District	Revenues generated from a district established for improvements paid by special assessment.	Medium		Capital only	High	Yes	Must satisfy the law that benefit is received; change needed to apply to residential; developer/business support needed	Similar to special district on Nicollet Mall
Housing Service District	Similar to special assessment district but would apply to residential and not just commercial and industrial.	Low-Medium		Capital and O&M	Moderate	Yes		
Tax Increment Financing (TIF)	Tax increment financing for improvements: water, sewer, roads and parking facilities, etc.	Medium - High		Capital	High	Possibly	Very competitive; restricted uses; 15% of total market value currently in TIF	Austin; Portland
Recycled Matured TIF	Dedicated portion of previous TIF stream when TIF districts sunsets.	Medium - High	Some portion of current districts that are expiring in 2009	Capital and O&M	High	Possibly	Very competitive; restricted uses; 15% of total market value currently tied up in TIF in Minneapolis	
State Aid; MSAS	DOT funding for City of Minneapolis' highway maintenance and construction.	Low	M.S. 162 State funding varies	Capital for designated municipal state aid streets	Low	Yes	Very competitive; cannot be used for rail projects	
Parking								
Parking Meter Revenues	Revenues received from use of parking meters.	Medium	Downtown or throughout city?	Capital and O&M	Moderate	No	Already funding other priorities; ordinance may be required	Portland
Parking Ramp Revenue	Revenues received from use of parking ramps.	Medium		Capital and O&M	Moderate	No	Already funding other priorities; ordinance may be required	
Streetcar Funding								
Streetcar Farebox Revenues	Revenues generated directly from rider fares.	Low		O&M only	Moderate	No		
Streetcar Advertising Revenue (Vehicles and Shelters)	Monthly revenue from interior/exterior ads, ads on benches and stations/stops.	Low	Annual amount	O&M only	Moderate to High	No	Will need to be negotiated with entity owning or operating	Many examples. Galveston generates $100,000 month for interior and exterior ads.

	Brief Description	Estimated Annual Revenues (High, Medium or Low)	Estimated Annual Revenue	Capital or O&M	Reliability as a Funding Source	Legislative Change Required? (Yes, No or Possibly)	Notes	Best Practices / Examples
Streetcar Naming Rights	Naming the system, individual cars or stations for a fee; can be a one time or annual sponsorship	Low		Capital or O&M	Moderate			
Other								
Air Rights	Revenues generated by selling of air rights over part of a corridor or maintenance building, etc.	Low	Route dependent; involving sale of City owned air rights	Capital only	Moderate	No		Seattle
Non-Profit (Streetcar Established as Non-Profit)	Endowment similar to non-profits, hold events to fund streetcar service.	Low		Capital and O&M	Low	Possibly	Legal input needed	Tucson
Operating Endorsements (Program Related Invest Program)	Foundations with PRI can provide endowment; distinguish from corporate grants, grants for livability improvements to community.	Low		Capital and O&M	Moderate	Yes	Competition for non profit and foundation support for affordable housing, social welfare, etc	

Memphis, Tennessee

In 1990, Memphis began construction on a 2.5 mile streetcar line in an effort to redevelop its failing downtown pedestrian mall. The line extended beyond the pedestrian mall, operating on-street to other areas in need of economic development. Operation began in 1993, and was extended into a loop using an existing railroad right-of-way, in 1997. A third line, which was engineered for eventual light rail use, opened in Spring 2004, bringing the system to a 10 mile total.

The initial line cost $34.9 million to construct. Both the first and second lines were funded by Federal Interstate Substitution Funds (80%) and the City's General Fund (20%). The 2004 line was constructed using Federal New Starts (80%) and the City's General Fund (20%). The Memphis Area Transit Authority (MATA) owns and operates the lines using General Fund money (45%), State Department of Transportation funding (15%), and Federal Grants and Fares (40%). For the first three years of operations, CMAQ funds were also used.

Portland, Oregon

Construction on the Portland Streetcar began in 1999, with the original line opening in 2001. Since then, two extensions to the line have been constructed, with the newest one opening for service in Summer 2006. Another short extension is expected to open in mid-2007 and several additional lines are in the planning stages, including an entirely new line on the east side of the Willamette River. Portland's streetcars are owned by a non-profit public benefit corporation and operated and maintained by the City of Portland.

Funding for the original $57 million, 2.4-mile portion came from a number of sources: Federal Transportation Funds - reallocated with TriMet for local funds (9%), a Federal HUD Grant (1%), Local Improvement Districts (17%), Tax Increment Financing (13%), the City Parking Fund - Cash (4%), the City Parking Fund - Bonds (50%), the City Transportation Fund (2%), the City General Fund (3%), and a Tax-Advantage Lease Agreement (1%).

The second $16.0 million, 0.6-mile extension to RiverPlace was financed through the following sources: Tax Increment Financing - North Macadam URA (53%), transportation land sale (19%), a Local Improvement District (19%), a Federal HUD grant (5%), the City Transportation Fund (4%), and miscellaneous funds accounting for less than 1% of the project cost.

The third extension is a 0.6-mile single-track segment estimated to cost $15.8 million. Funding sources for this segment include: Regional Transportation Funds (63%), Tax Increment Financing – North Macadam URA (24%) and the Local Improvement District (13%).

Operating funds for the Portland Streetcar come from TriMet, parking meter revenue, advertising and sponsorships, and fares.

Savannah, Georgia

In 2000, the City of Savannah purchased several miles of existing railway along River Street, the main tourist district in Savannah. In mid-2007, 1.25 miles of track will open for service. The City is hoping that this project will garner interest in a more extensive streetcar network.

Funding to purchase the tracks came from a voter approved sales tax; additional capital costs came primarily from the City's General funds. The City did not seek Federal funding because it is a small system and is unlikely to have any commuter base. Operations will also be paid for primarily from the City's General Fund though there may be a small amount of on board advertising and a nominal fare.

Tacoma, Washington

The 1.6-mile Tacoma streetcar line began service in 2003, as part of a plan to reduce traffic downtown. Commuters park at remote parking garages or transfer from the Sounder Commuter Train and Amtrak, and take the streetcar into the downtown.

Funding for the initial $80.4 million in capital costs as well as about 91% of operating costs are from a transportation package that went before voters in 1996. That package included a new regional sales tax, motor vehicle excise tax, and rental car tax to fund specified transportation projects. Currently, this includes approximately 71% of operations funding from the Retail Sales and Use Tax, 20.4% from the Motor Vehicle Excise Tax and Rental Car Tax. Additional operating funds come from fares (5%), and other income sources including advertising on other Sound Transit services, rental income, and interest earnings (4%).

Tampa, Florida

The Teco Line Streetcar began operation in Fall 2002, and is a partnership between Tampa Historic Streetcar Inc., the City of Tampa, and Hartline - the regional transit authority contracted to operate the system. The initial 2.4-mile line operates between downtown, Channelside, and Ybor City, with a .3-mile extension planned to connect the downtown with major parking garages.

Initial capital funding for Tampa's streetcar came from Federal TEA-21 grants (50%), State Department of Transportation funds (10%), and local funds generated by the sale of gas tax bonds (38%). Operating costs for the line total $1.2 million per year and are funded by a voluntary special assessment district within downtown Tampa, Ybor City and Channelside (12%), income from a naming rights endowment (49%), fares (18%), advertising (0.6%),

the Port Authority (8%), and car leasing (0.3%). Summary tables of the capital and operating funding sources for each peer system are included in the Appendix.

Chapter 8. Next Steps

This feasibility study identified a long-term streetcar network which will require at least twenty years, and probably much longer, to achieve. The study also identified a number of possible starting places, each of which offers different advantages to riders, to the City and to other stakeholders.

There are some key things that the City needs to know before a final decision can be made on whether it is financially feasible to implement a streetcar system and, if so, where and when it would be best to start construction. The following "next steps" have been identified to help move this process forward.

1. **Develop detailed funding plan.** Utilizing the information provided in the Streetcar Feasibility Study, the most promising funding sources should be selected and evaluated further and a detailed capital and operating funding plan should be developed. It is likely that the funding plan will vary somewhat for each corridor and will be dependent on the ability to generate revenues within each corridor. This analysis is critical to determining if the City has the financial tools to move forward with streetcar implementation and, if so, where it would make the most financial sense to start construction. An early decision should be made whether or not to pursue federal funding. This is an important decision because: (1) the process is dictated by federal procurement rules and the timeline for implementation may be elongated by as much as two years, (2) federal restrictions may also increase costs, and (3) streetcar should not compete with other regional transit projects for federal funding.
2. **Identify site for maintenance and storage facility.** An important element in deciding where to start building the streetcar network is availability of a site for a maintenance and storage facility. While some potential areas have been identified in this study based strictly on existing zoning, a more detailed study that identifies specific sites and estimates costs should be conducted. If a streetcar corridor or initial phase of a corridor does not have convenient access to a maintenance and storage facility, it will not be a reasonable candidate for the first line to be constructed.
3. **Gauge developer/property owner support and economic development potential**. Since the capture of future value may be one of the tools needed to implement streetcar in Minneapolis, there are two things that will need to occur for a corridor to be well-positioned as a good candidate for early construction: (1) there must be developer/property owner support for the use of these revenue tools and the implementation of streetcar in the corridor, and (2) there must be support for higher intensity development in the corridor. Additional work is needed to asses the relative support for streetcar implementation, development density, and value capture revenue tools along the candidate streetcar corridors. Finally, developers

have had strong influence in making streetcar lines happen in Portland, Memphis, Little Rock and Tampa. While the long-term streetcar network proposed for Minneapolis will eventually be an integral component of the PTN, support from local developers and a line that supports economic development can tip the scales toward successful implementation of streetcar.

4. **Determine who will own and operate the service**. Based on the information provided in Chapter 6, there are several options for implementing and operating streetcar service. It is likely that this responsibility will initially fall to the City, with operations and maintenance being provided by Metro Transit. The City needs to identify its "champion" who will be focused on delivering this important project. The City also needs to work closely with Metro Transit, the Metropolitan Council, Hennepin County and other partner agencies to determine the best way to proceed on the implementation of streetcar service in the City of Minneapolis.
5. **Develop design guidelines for streetcar construction**. Some of the corridors included in the long-term streetcar network are slated for major streetscape and reconstruction over the next 5 years. To help make streetcars more cost-effective, street reconstruction projects should incorporate streetcar design guidelines prior to laying track (such as station bulbouts, utility relocation, etc.). Even if streetcar service is not implemented in these corridors right away, these changes may be beneficial to PTN bus service and may reduce the costs for future implementation of streetcar.
6. **Further refine operating plans, both in the short-term and long-term.** Although streetcars and buses generally do not have major conflicts when operating in the same corridor, the first phases of most of the streetcar corridors will initially add transit vehicles to already congested streets without removing a comparable number of buses. Over the long run, it is expected that a significant number of buses could be removed if streetcar service was provided along the entire proposed long-term streetcar line. Considerable additional work will be required with Metro Transit to determine the optimum balance of service between streetcar and bus in the initial stages of implementation. This may also influence decisions regarding the length of construction segments and the best place to start system construction. Throughout the decision process, Metro Transit should continue to be consulted regarding these operational issues.
7. **Continue to gauge political support.** It is important to ensure that elected officials and the general public are supportive of an initial investment in streetcars. While the first segment to be constructed will provided service to only a small portion of the city, possibly only the downtown, it must be understood that the streetcar system will eventually serve many corridors throughout the city. Political support is necessary at the local level, but also with state and federal representatives who may be required to pass legislation to support funding the streetcar and/or to provide earmarks for accelerating implementation.

Once a preferred initial segment is identified, there are a number of steps required to move toward implementation. The responsibility for each step will depend on the organizational structure selected for implementation and operations phases.

- **Preliminary engineering.** This phase of the project includes a more detailed operating plan and capital costs associated with the selected segment. Depending on the owner/operator arrangement, this typically requires the selection of an engineering consultant to develop more refined costs.
- **Environmental Assessment or Environmental Impact Statement (EIS).** All major public projects will require an environmental assessment of the impact associated with streetcar service. If federal funding is pursued, an Environmental Impact Statement (EIS) must be prepared that meets guidelines established by NEPA. These documents also include an assessment of alternatives to the proposed action, which is the major component of an EIS. An Environmental Assessments (EA) is similar to an EIS but can be briefer and can be used when only minor impacts are anticipated. An EA is also used to determine the need for an EIS and, if none is needed, culminates in an agency issuing a "Finding of No Significant Impact" (FONSI).
- **Finalize funding plan.** This may include the establishment of local assessment districts or other local funding mechanisms. A key decision is whether to seek federal funding, which has its own set of requirements. A decision about which lines or segments are most likely to attract federal funding may dictate the pace of implementation – lines or segments which do not require federal dollars may be implemented more quickly while those segments that do follow federal procurement policies will require less private and local funding, but will take more time to implement.
- **Final design.** Following the preliminary engineering and environmental phase, an RFP should be released soliciting a firm to develop a final design for the initial line.
- **Develop public information campaign during construction.** During construction of the streetcar infrastructure, the corridor along the line will be disturbed at certain times. It is important to keep the public (especially business owners and residents along the corridor) informed of current and future work throughout the construction phase. This process should be coordinated with the mitigation plan included in the construction plan.
- **Solicit construction bid.** This should also include a detailed mitigation plan for managing parking, pedestrian movement and traffic during the construction period.
- **Procure and prepare vehicles.** Depending on the type of vehicles selected for the initial line (determined in the preliminary engineering and final design phase of the project), adequate time should be allowed for vehicle procurement. This process should be initiated at about the same time as construction.

- **Solicit bid for operations (if not being administered by Metro Transit).** Similar to the bid for construction, this step will solicit an entity to operate and maintain the vehicles.
- **Develop marketing materials and initiate advertising campaign.** As with any major public investment, it is important to provide information about the new service. A targeted advertising campaign should be launched well in advance of the opening of the streetcar line and distributed through various media outlets.
- **Testing and training.** A designated period of time – typically 3 months should be reserved for testing of the streetcar infrastructure and vehicles prior to the first day of service. Operations and administrative staff training should also occur at this phase of the project.
- **Final implementation details.** This includes development of fare media, signage at all streetcar stations and final preparation for first day of service.

APPENDIX A

STREETCAR EXPERIENCE IN OTHER CITIES

Appendix A Streetcar Experience in Other Cities

Over a dozen North American cities have streetcar systems that have either been expanded or initiated operation in the past 15 years. In addition, at least twice as many other cities have new systems or new lines under active planning. Streetcars are an attractive transportation mode because of their ability to add a *visible* transit line with minimum capital investment. Streetcars are also being promoted as a way to create a circulator system that connects into a high capacity network (such as LRT or Commuter Rail) without requiring additional extension or expansion of the more expensive high capacity mode. Streetcars are also popular because they are a good fit for densely developed, pedestrian-oriented, urban neighborhoods.

The following section below describes experiences in Toronto, Portland and Memphis. It should be noted that no two cities are exactly alike. When using peer information to project results in a different city, it is important to understand all of the issues that make the cities different, as well as alike.

Toronto, Canada

Toronto has the most extensive network of streetcars in North America. Figure A-1 is a photo of its typical modern streetcar. The Toronto Transit Commission has 11 streetcar routes, 10 of which run through downtown in mixed traffic. During the 1960s there was considerable interest in abandoning the streetcars in favor of bus service. However, the streetcar system has not only been preserved but has been significantly expanded, with four lines opening in the last decade.

Toronto officials cite three key factors contributing to the success of the expanded streetcar network. These factors are present in Minneapolis as well:

- The continuing strength of downtown as a regional employment, retail, and cultural center;
- The increasing role of downtown as a residential center, and;
- Streetcars work very well with a walkable, mixed-use downtown, in which transit does not need to be fast, but it does need to serve a variety of shorter trip markets.

Toronto's existing network and new extensions helped support the transition of the industrial areas along the lakeshore to redevelop with residential, recreational and cultural uses. The lakeshore area is now active with local residents, making both work related and other types of trips, as well as with the many tourists and visitors from other neighborhoods who come to shop, or recreate in the lakeshore area.

A key finding from Toronto's experience is that streetcar service generates more ridership than equivalent bus service generated in the same corridor. For example, in 1997 the transit agency opened a new streetcar line on Spadina Avenue. This line directly replaced a local bus route that was one of the most heavily used and productive in the system. With no appreciable change in service levels or travel speed, ridership increased by approximately 15 percent with the implementation of streetcars.

One reason for this change is that streetcars clearly attract a wider rider market than bus service in Toronto, including a higher percentage of riders who are not transit dependant. The Toronto Transit Commission estimates that 60 percent of streetcar riders are "choice" riders - that is, those who have a car, but choose to take the streetcar instead. While it is difficult to know exactly why streetcars are so popular, the following feedback was provided from recent rider surveys:

- Residents value the streetcars and consider them an important part of the city's image and heritage.
- Streetcars are popular with Toronto visitors who might not otherwise ride transit.
- Riders like the fact that streetcars don't have to pull out of traffic and then remerge back into traffic at every stop. Riders perceive this as taking too much time and as "letting the traffic control the bus".
- Streetcars provide a smoother ride, with less jostling than buses. Riders report being able to read or work on the streetcar but not on buses.

Figure A-1 Modern Toronto Streetcar

Memphis, Tennessee

As part of a downtown revitalization effort, Memphis converted a failing downtown pedestrian mall into a streetcar line using vintage streetcars (see Figure A-2). Buses running down the mall were considered, but rejected as incompatible with high pedestrian volumes. The initial streetcar line began service in 1993. It was 2.5 miles long, mostly double-tracked. Streetcar served the mall, but also ran beyond it on both ends to serve areas that were expecting economic development. Outside the mall the streetcars ran on the street, sharing a lane with automobile traffic. In 1997, the initial line was converted into a loop by adding a parallel line, running mostly on an old railroad track. The addition brought the total system up to a length of five track miles. In 2004, the Madison Avenue extension was completed, adding another 2 miles to the system and connecting the hospitals on Madison Avenue with the Main Street line. All but one of the streetcars are renovated historic vehicles and there are 20 total vehicles.

In 1994, annual ridership on the Memphis streetcar system was around 500,000; by 1999, it was around 900,000, and in 2000 it rose to nearly 1,000,000 riders. By 2004, with the recent Madison Avenue addition, streetcars in Memphis carried nearly 1.5 million passengers/year.

A study of the Memphis streetcar line by Thomas Fox, the system's Director of Planning and Capital Projects, notes that:

- Monday through Thursday ridership is comprised mainly of downtown workers and residents who use the system on a regular basis.
- Friday through Sunday ridership is more dependent on the cultural, recreational and shopping activities that occur downtown.
- Saturday is the highest ridership day, contrary to common transit experience.
- Individual day ridership peaks generally coincide with major events in the downtown area such as the Beale Street Music Festival and Memphis Redbirds (Triple A) baseball games at AutoZone Park, and cultural exhibits at the Cook Convention Center.
- An on-board survey of streetcar riders in Memphis taken in 1994 found that:

  Almost half of the streetcar riders chose streetcar "for the experience" and would otherwise be making their trip by car.

  83 percent of streetcar riders did not ordinarily use public transit, suggesting that streetcars can attract riders that similar bus services cannot.

  36 percent of riders had incomes over $50,000, and a total of 14 percent had incomes below $20,000, which further suggests that streetcars attract a wide range of riders.

Ridership has grown for a variety of reasons, the most important of which is the gradual growth and diversification of development in the areas served by the streetcar. Since 1990, residential population along the line has expanded from fewer than 1,000 to more than 5,000 people. Developments such as AutoZone Park (baseball), Peabody Place (entertainment retail), Gibson Guitar Factory and Museum, and numerous restaurants, clubs, and hotels, have resulted in downtown becoming much more of a cultural and entertainment destination than it was previously.

Interestingly, Memphis is using the success of its streetcar system to plan a more regional light rail system. As planned, the streetcar system will constitute the downtown circulation for the larger system, replicating the system currently in place in cities like Toronto. By starting with streetcars, Memphis city officials believe they established the market for rail transit service at a lower initial investment cost, and created the understanding of how rail could serve regional as well as local needs. Once Light Rail is built, the existing streetcar will continue to provide a functional downtown circulator that complements the regional system.

Figure A-2 Memphis Streetcar

Portland, Oregon

The City of Portland, Oregon is noted for the dramatic revitalization of its downtown core. Today, Portland's central city is one of the most admired in North America. Many things contributed to this turnaround, but one key factor was an emphasis on transit and cooperative planning for transportation, parking and land uses. The initial success of the MAX regional light rail system and the downtown transit mall helped instigate the planning and development of a new streetcar system to operate as a downtown circulator. Figure A-3 is a photo of the streetcars used in Portland.

The Portland Streetcar currently operates on a 6-mile loop, connecting the Pearl and River districts with Downtown, Portland State University and the RiverPlace district. A short extension to the South Waterfront area is currently under construction and scheduled to open in late 2006.

The Streetcar stops every three to four blocks, and operates at 15-minute headways for much of the day and evening. Its primary purpose is to provide short trips to residents, workers, students and visitors.

Like Toronto, Portland uses modern streetcars. Modern streetcars are designed to fit the scale and traffic patterns of the neighborhoods through which it travels. Streetcars are 8 feet wide and 66 feet long, about 10 inches narrower and 1/3 the length of a standard light rail vehicle. They have a low floor center section for ease of boarding.

In addition to acting as a circulator for dense inner city development, one of the goals of the project is to encourage development in neighborhoods adjacent to downtown, particularly the Pearl District. Prior to the arrival of the streetcar in 2001, the Pearl District

was mostly a mix of industrial buildings, small-scale commercial and rail yards. Although redevelopment in the District was underway before the streetcar was built, the streetcar system has helped organize development and create significant incentives for new development. The northern part of the Pearl District, which was mostly abandoned rail yards, has experienced the most dramatic changes. Studies have shown that property values have increased most significantly for those properties closest to the streetcar. Not surprisingly, these properties are developing ahead of those more remote from streetcar service. In its first year, it exceeded ridership projections by more than 10 percent, and increased an additional 10 percent its second year. The success of the initial line has spurred expansion plans; the first extension is currently complete, another extension is expected to open in late 2006 and several more extensions are being contemplated.

Portland's system provides an excellent study in how urban development may be affected by the early implementation of streetcar infrastructure. It is claimed that over $1.5 billion in new development has been added to the streetcar corridor since the decision to build the line. While it can be argued that the Pearl District and adjacent neighborhoods would have developed to some extent with or without a streetcar investment, the streetcar has served as an "organizing principle" catalyzing development closest to the streetcar first, and encouraging development to be transit-friendly.

Figure A-3 Modern Portland Streetcar

APPENDIX B

RESULTS OF CORRIDOR SCREENING

Figure B-1 Summary of Physical and Geometric Evaluation Criteria

Principal Streets	Broadway	Central	Chicago	15th Ave SE / Como	Franklin	Fremont / 44th Ave N / Osseo	Hennepin	Lake / Midtown Corridor	Nicollet	University / 4th	Cedar / Riverside	Washington	Penn / Hwy 55	Lyndale / Bryant
From…	Robbinsdale Transit Center	Columbia Heights TC	66th St E	University/SE 4th St	Hennepin Ave S	Victory Memorial Drive	Lake St	SW LRT	66th St	Downtown via Hennepin	Washington	W Broadway	44th Ave N	66th St W
To…	Downtown	Downtown	Downtown	St. Paul	Hiawatha LRT	Downtown	Downtown	St. Paul	Downtown	Stadium Village	26th Ave S	Cedar / Riverside	Downtown	Downtown
Grade	No grade issues	Minor issues at 8th Street NE	MINOR ISSUE: turning movements at 9th/10th and Chicago.	No grade issues	MAJOR ISSUE: Significant grade issues east and west of Lyndale	No grade issues	No grade issues	SIGNIFICANT ISSUE: Grade issues between Hennepin and at least Chicago along the Midtown Corridor; SIGNIFICANT ISSUE: Passenger access to below-grade stations.	No grade issues	No grade issues	No grade issues	No grade issues	No grade issues	MINOR ISSUE: Grade issues on Bryant north of 50th
Street Geometry	No major issues	No major issues	No major issues	Difficult right turn at 15th Ave SE and Como	No major issues	MAJOR ISSUE: Difficult turns at Fremont/Plymouth	SIGNIFICANT ISSUE: Configuration of streetcar operations through Hennepin/Lyndale bottleneck.	No major issues	SIGNIFICANT ISSUE: Difficult turning movements around Lake Street	MINOR ISSUE: One-way configuration of both streets.	MAJOR ISSUE: turning movements at Seven Corners	No major issues	No major issues	SIGNIFICANT ISSUE: Configuration of streetcar operations through Hennepin /Lyndale bottleneck. Difficult turning movements at 50th/Bryant and 50th/Lyndale
Physical Barriers	No major issues	MAJOR ISSUE: Railroad crossing at 37th Ave NE MINOR ISSUE: Low overpass at 16th Ave NE - 14'11"	No major issues	MAJOR ISSUE: Low underpass at 8th Street 13'0"	SIGNIFICANT ISSUE: Low overpass at Franklin and Hiawatha - 14'6"	No major issues	No major issues	SIGNIFICANT ISSUE: Historic bridges in Midtown Corridor could limit use of double-track alignment. SIGNIFICANT ISSUE: Low underpass at I-35W - 14'1".	SIGNIFICANT ISSUE: K-Mart is a huge physical barrier at Lake and Nicollet.	No major issues	No major issues	No major issues	No major issues	No major issues
Possible Terminal Location	Downtown Robbinsdale	Retail core between 18th and 27th Ave NE	Lake and Chicago TC in Midtown. SIGNIFICANT ISSUE: No strong anchor for southern layover/terminal south of Lake.	No strong anchor for eastern layover/terminal location difficult - would need to continue well into St. Paul.	Hiawatha LRT Franklin Station	SIGNIFICANT ISSUE: No strong anchor for northern layover/terminal location	Lake/Lagoon in Uptown	Multiple layover/terminal possibilities on west end of corridor (Market Plaza or Excesior/Grand in SLP). Fewer layover/terminal possibilities on east side besides Hiawatha LRT - east of Hiawatha, would need to continue well into St. Paul	MINOR ISSUE: No strong anchor for southern layover/terminal south of Lake.	In and around Dinkytown or University Village (Central LRT)	Franklin or Cedar/Riverside LRT Station	North end (as far as N 10th Ave); South end (Cedar/Riverside or Chicago)	SIGNIFICANT ISSUE: No strong anchor for northern layover/terminal location	SIGNIFICANT ISSUE: No strong anchor for southern layover/terminal south of Lake.

Principal Streets	Broadway	Central	Chicago	15th Ave SE / Como	Franklin	Fremont / 44th Ave N / Osseo	Hennepin	Lake / Midtown Corridor	Nicollet	University / 4th	Cedar / Riverside	Washington	Penn / Hwy 55	Lyndale / Bryant
From…	Robbinsdale Transit Center	Columbia Heights TC	66th St E	University/SE 4th St	Hennepin Ave S	Victory Memorial Drive	Lake St	SW LRT	66th St	Downtown via Hennepin	Washington	W Broadway	44th Ave N	66th St W
To…	Downtown	Downtown	Downtown	St. Paul	Hiawatha LRT	Downtown	Downtown	St. Paul	Downtown	Stadium Village	26th Ave S	Cedar / Riverside	Downtown	Downtown
Volume/ Capacity Ratio	SIGNIFICANT ISSUE: High traffic volumes between Girard and Washington Ave N.	No major issues	No major issues	SIGNIFICANT ISSUE: High traffic volumes @ 15th Ave SE/5th St SE and Como/16th Ave SE	No major issues	No major issues	SIGNIFICANT ISSUE: High traffic volumes between Franklin and Lake	SIGNIFICANT ISSUE: High traffic volumes between Hennepin Avenue and Hiawatha Ave.	MINOR ISSUE: High traffic volumes at 26th St	No major issues	No major issues	SIGNIFICANT ISSUE: High traffic volumes @ 1st Ave N	No major issues	SIGNIFICANT ISSUE: High traffic volumes @ 24th and 28th St W

Figure B-2 Summary of Transit Supportive Land Use Criteria

Principal Streets	Broadway	Central	Chicago	Franklin	Hennepin	Midtown Corridor	Lake	Nicollet	University / 4th	Lyndale
From...	Robbinsdale Transit Center	29th Avenue NE	Lake St	Nicollet Avenue S	Lake St	SW LRT	SW LRT	66th St	Downtown via Hennepin	Lake St
To...	Downtown	Downtown	Downtown	Chicago Avenue S	Downtown	Hiawatha LRT	Hiawatha LRT	Downtown	Stadium Village	Downtown
Number of Special Generators	**Downtown:** Future Twin's stadium (just over ¼ mile) **Outside of Downtown:** North Memorial Hospital	None identified	**Downtown:** HCMC, Metrodome (Chicago/Washington) Convention Center, Nicollet Mall (9th/10th/Nicollet) **Outside of Downtown:** Children's Hospital, Abbott (Northwestern Hospital)	None identified	**Downtown:** Theatre district, Target Center, inner core of downtown, Minneapolis Community College. **Outside of Downtown:** Loring Park, Walker Art Center, Minneapolis Sculpture Garden	Lake Calhoun, Midtown Exchange, Hiawatha LRT station		**Downtown:** Minneapolis Convention Center, Nicollet Mall **Outside of Downtown:** Minneapolis Institute of Art (MIA), Minneapolis College of Art and Design (MCAD), Loring Park, Minneapolis Convention Center	**Downtown:** Inner core of downtown **Outside of Downtown:** Univeristy of Minnesota, U of M sports facilities, future U of M football stadium	**Downtown:** Theatre district, Target Center, inner core of downtown, Minneapolis Community College. **Outside of Downtown:** Loring Park, Walker Art Center, Minneapolis Sculpture Garden
Potential Anchors	**North**: downtown Robbinsdale **South**: downtown Minneapolis	**North**: East Hennepin area or commercial node at Lowry **South**: downtown Minneapolis	**North**: downtown Minneapolis **South**: Lake/Chicago (Midtown Exchange and Chicago-Lake Transit Center)	No strong anchors along corridor	**North**: downtown Minneapolis **South**: Uptown (Lake/Lagoon and Hennepin)	**West**: West Lake Station (Southwest LRT line) or Uptown **East**: Hiawatha LRT		**North:** downtown Minneapolis **South:** Nicollet/Lake or Nicollet/38th	**East**: University and Washington (Central LRT) **West**: downtown Minneapolis	**North**: downtown Minneapolis **South**: Lake/Lyndale
Transit Supportive Land Use	LOW (east of Memorial Dr) LOW (entire corridor) Corridor scored low due to Large sections of low-density residential or industrial uses.	MODERATE (entire corridor) Corridor scored low to moderate due to low-density residential and industrial uses.	HIGH (via 9th/10th) HIGH (via Chicago/Washington) Very strong corridor due to numerous major activity centers and very dense residential neighborhoods.	Not scored. Only considered a connecting corridor.	MODERATE (entire corridor) Moderately strong corridor due to downtown, Uptown and high-density housing in Loring Park and north part of the Wedge. Low- to moderate-density housing beyond 1-2 blocks of Hennepin between downtown and Uptown.	MODERATE (Midtown Corridor) MODERATE (Lake Street) Although this corridor serves several commercial nodes (Hennepin, Lyndale, Nicollet, Chicago), and has development potential along the corridor, it also includes major sections of industrial land uses (on the east side) and low-density housing and parks on the west end.		HIGH (north of Lake) MODERATE (entire corridor) LOW (south of Lake) Because of the length of the corridor, scores varied greatly depending on the section. Section north of Lake was very strong and had the highest score of any corridor or section. The segment south of Lake had the lowest score due to large sections of low-density residential and 1-35W.	**Score:** HIGH (entire corridor) Very strong corridor due to connection between downtown, East Hennepin, Dinkytown and the University of Minnesota.	**Score:** MODERATE (entire corridor) Moderately strong corridor due to downtown and high-density housing in Loring Park and north part of the Wedge. Low- to moderate-density housing beyond 1 block on either side of Lyndale between downtown and Lyn-Lake.

Figure B-3 Summary of Economic Development Potential and Community Support Criteria

Principal Streets	Broadway	Central	Chicago	Franklin	Hennepin	Midtown Corridor	Lake	Nicollet	University / 4th	Lyndale
From...	Robbinsdale Transit Center	29th Ave NE	Lake St	Nicollet Ave S	Lake St	SW LRT	SW LRT	66th St	Downtown via Hennepin	Lake St
To...	Downtown	Downtown	Downtown	Chicago Ave S	Downtown	Hiawatha LRT	Hiawatha LRT	Downtown	Stadium Village	Downtown
Area Targeted for Redevelopment	East of Penn and west of Lyndale has the greatest potential, but relatively small scale (1/2 to 1 block from Broadway). Market has yet to fully respond to significant redevelopment in this area. Good redevelopment potential in downtown Robbinsdale, but at a relatively small scale. Very high redevelopment potential in North Loop area on both sides of Washington (mostly residential and neighborhood commercial).	Good potential between Shorham Yards and Lowry – ½ to 1 block from Central Avenue (market just beginning to respond to redevelopment potential). Good infill development potential in the East Hennepin area, with somewhat higher intensity than northern part of corridor. 3rd Avenue South / Mill District continues to redevelop at very high intensity (mostly residential).	Strong redevelopment potential in Elliot Park area (especially residential), along 9th/10th closer to Nicollet, as well as in Downtown East area. Mill District north of Washington Avenue currently experiencing major residential development. Potential exists south of Washington Avenue. Some redevelopment potential at Chicago/Lake and along Midtown Corridor. Corridor between Chicago/Lake and downtown dominated by institutional uses - growth in hospital area expected to continue. Some potential south of Lake and at 38th/Chicago, but market has yet to respond to this area.	Some redevelopment interest between Nicollet and Hiawatha LRT, mostly at the major intersections (Nicollet, Chicago, Bloomington, Hiawatha).	Moderate potential along Hennepin, but corridor mostly built out. Greatest potential in and around Uptown with moderate density commercial and residential development. Continued redevelopment potential along Hennepin Avenue in downtown – especially around Washington and around 10th Street.	Strong redevelopment potential, especially between Lake and 28th Street between Uptown and Chicago Avenue S. Moderate-density, residential infill development, occurring mostly at the major nodes (Hennepin, Lyndale, Nicollet, Chicago).		Good redevelopment potential at Nicollet and Lake. Infill development potential between Lake and downtown – ½ to 1 block on either side of Nicollet. The 26th and 38th Street intersections are also identified as "investment areas." Nicollet Mall mostly built out with the exception of the north end of the Mall.	Good potential along river, south of University Ave SE (mostly residential). Neighborhood north of 4th between I-35W and Hennepin to remain mostly unchanged. New stadium planned for U of M campus on east end of corridor.	Mostly built-out corridor with some redevelopment potential within ½ - 1 block of corridor. Some redevelopment potential between Midtown Corridor and Lake Street.

Figure B-4 Summary of Transit Operations Criteria

Principal Streets	Broadway	Central	Chicago	Franklin	Hennepin	Midtown Corridor	Lake	Nicollet	University / 4th	Lyndale
From...	Robbinsdale Transit Center	29th Ave NE	Lake St	Nicollet Ave S	Lake St	SW LRT	SW LRT	66th St	Downtown via Hennepin	Lake St
To...	Downtown	Downtown	Downtown	Chicago Ave S	Downtown	Hiawatha LRT	Hiawatha LRT	Downtown	Stadium Village	Downtown
Ability to Maintain Adequate Speed and Reliability	No major issues north of downtown. Minor speed issues on Washington Ave close to Hennepin Ave.	No major issues north of downtown. 3rd Avenue bridge, 3rd Avenue and Washington Avenue between 5-10 mph during peak periods.	Entire corridor between 5-10 mph during peak and midday periods.	Approaching midday and peak speeds less than 10 mph between Blaisdell Ave and Park Ave S.	Downtown speeds between 7-8 mph; speeds between 24th St and Uptown between 5-10 mph during peak and midday periods.	Exclusive right-of-way, no speed or reliability issues anticipated.	Midday and peak speeds approaching 8 mph along entire corridor.	No major issues south of Lake St. Speed between Lake and downtown between 8 and 10 mph. Speeds along Nicollet Mall range from 4-8 mph throughout the day.	Midday and peak speeds above 12 mph except on Hennepin bridge, in East Hennepin area and near Dinkytown where speeds are around 8 mph.	No major issues midday, approaching 8 mph between Lake and Franklin during the peak.
Relationship to Future Streetcar Network	Good connections to downtown corridors, especially Chicago Avenue corridor.	Good connections with all downtown corridors. Some potential duplication with University/4th corridor in East Hennepin area.	Good connections to downtown corridors, especially the W Broadway corridor; also connects with Midtown Corridor and Lake Street corridor.	Limited utility as a connecting route between Nicollet and Chicago.	Good connections with other streetcar corridors downtown, especially to the University/4th corridor; also connects with Midtown Corridor and Lake Street corridor.	Connects with all south Minneapolis corridors – no interlining opportunities between corridors.	Connects with all south Minneapolis corridors – no interlining opportunities between corridors.	Good connections to all downtown corridors, especially the Central Avenue NE corridor; also connects with Midtown Corridor and Lake Street corridor.	Good connections with all downtown corridors, especially the Hennepin or Lyndale Avenue S corridors; potential duplication with Central Ave NE corridor.	Good connections with other streetcar corridors downtown, especially to the University/4th corridor; also connects with Midtown Corridor and Lake Street corridor.
Relationship to Current/Future LRT or BRT	No direct connection, but close to Hiawatha/Central LRT stops on 5th St.	No direct connection, but close to Hiawatha/Central LRT stops on 5th St.	Direct connections to either the Nicollet Mall or Downtown East/Metrodome LRT station.	Potential connection to SW Corridor LRT at Nicollet.	Connection to Hiawatha/Central LRT station at Hennepin Avenue station.	Potential connection with SW Corridor LRT and Hiawatha LRT (Kenilworth / Royalston alignment only).	Potential to connect SW Corridor LRT and Hiawatha LRT, but slower connection than Greenway (Kenilworth / Royalston alignment only).	Connection to Hiawatha/Central LRT station at Nicollet Mall. I-35W BRT connection could be made at 46th Street	Connection to Central LRT station on U of M campus; close to downtown LRT stations on 5th Street.	Connection to Hiawatha/Central LRT station at Hennepin Avenue station.
Competition with Current/Future LRT or BRT	Potential duplication with Bottineau BRT.	No duplication identified. Only part of the city without planned high-capacity transit.	No duplication identified.	No duplication identified.	Very minor competition with SW Corridor LRT.	Duplication with SW Corridor LRT between Nicollet and West Lake Station (Uptown/Nicollet alignment only)	Potential duplication with SW Corridor LRT between Nicollet and West Lake Station (Uptown/Nicollet alignment only)	Direct duplication with SW Corridor LRT (Uptown / Nicollet alignment only).	No duplication with Central LRT, even though both serve downtown and the U of M.	Some duplication with SW Corridor LRT (Uptown/Nicollet alignment is only).

Figure B-5 Summary of Transit Demand Criteria

Principal Streets	Broadway	Central	Chicago (1)	Chicago (2)	Hennepin	Midtown Corridor	Lake	Nicollet	University / 4th	Lyndale
From...	Robbinsdale Transit Center	29th Ave NE	Lake St	Nicollet Ave S	Lake St	SW LRT	SW LRT	66th St	Downtown via Hennepin	Lake St
To...	Downtown	Downtown	Downtown	Chicago Ave S	Downtown	Hiawatha LRT	Hiawatha LRT	Downtown	Stadium Village	Downtown
Population Within Corridor	40,677	32,650	38,584	40,478	42,833	51,307	52,434	83,208	33,484	47,075
Population Density (per sq. mile)	6,779	7,915	12,903	11,641	11,556	10,452	9,862	11,418	9,381	13,112
Employment Within Corridor	106,782	118,786	170,563	154,080	154,450	27,426	26,363	173,576	118,620	156,545
Employment Density (per sq. mile)	17,794	28,795	57,037	44,313	41,668	5,587	4,958	23,818	33,234	43,602
Low Income Households Within Corridor	4,571	4,855	7,994	7,557	7,089	7,402	7,324	12,914	4,727	8,530
Low Income Density (per sq. mile)	762	1,177	2,673	2,173	1,913	1,508	1,378	1,772	1,324	2,376
Zero Car Households Within Corridor	3,186	3,310	6,453	5,873	5,476	4,947	4,844	9,772	2,612	6,783
Zero Car Density (per sq. mile)	531	802	2,158	1,689	1,477	1,008	911	1,341	732	1,889
Square Miles	6.0	4.1	3.0	3.5	3.7	4.9	5.3	7.3	3.6	3.6

(1) via 9th/10th Street to Nicollet Avenue

(2) via Chicago Avenue and Washington Avenue to Nicollet Avenue

Figure B-6 Summary of Cost Effectiveness Criteria

Principal Streets	Broadway	Central	Chicago	Franklin	Hennepin	Midtown Corridor	Lake	Nicollet	University / 4th	Lyndale
From...	Robbinsdale Transit Center	29th Ave NE	Lake St	Nicollet Ave S	Lake St	SW LRT	SW LRT	66th St	Downtown via Hennepin	Lake St
To...	Downtown	Downtown	Downtown	Chicago Ave S	Downtown	Hiawatha LRT	Hiawatha LRT	Downtown	Stadium Village	Downtown
Utilities	No major utilities in Minneapolis; need to examine Robbinsdale utilities.	24" water main between 12th Ave NE and Lowry; 30" water main north of Lowry Ave NE; 40" water main north of 31st Ave NE	No major utility issues	No major utility issues	No major utility issues	No major utility issues	12" water main along entire length of Lake Street corridor	16" water main between 3rd St S and 12th St S (Nicollet Mall)	24" water main between 18th Ave NE and Oak St SE ; 48" water main between Oak St SE and Ontario St SE	24" water main between Franklin and 27th St W
On-Street Parking	Minor impact on parking due to 90 degree turns in downtown Robbinsdale and for stops on Broadway between Fremont and Lyndale Ave N. Minor impact downtown for stops.	Some potential impact on parking at 29th Ave NE for turn and vehicle layover, and for stops between 27th Ave NE and 18th Ave NE, as well as East Hennepin area. Minor impact downtown for stops.	Minor impact on parking at 38th, relatively minimal impact north of Lake. Minor impact downtown for stops.	Minor impact on parking for stops at commercial nodes (Nicollet and Chicago).	Moderate impact on parking for stops and turns in Uptown. Minor impact downtown for stops.	Negligible impact on parking.	Minor impact on parking for stops along the entire corridor.	Some potential loss of parking for stops north of Lake. Minor impact downtown – no impact on Nicollet Mall.	Some potential loss of parking due to 90 degree turns at University/Hennepin, and for stops in East Hennepin area, Dinkytown and near the University. No major impact downtown.	Moderate impact on parking between Franklin and Lake and for turn and layover (possibly at 31st). Minor impact downtown for stops.
Capital Costs	LOW - only one short bridge crossing at I-94; 4th Avenue N bridge.	MODERATE - long 3rd Ave river bridge, several shorter bridges.	LOW - short bridge at Midtown Corridor, I-94/I-35W bridge	LOW - only one short bridge at I-35W	MODERATE - Lowry Hill tunnel (NB only), bridge at Midtown Corridor	LOW - based on previous estimate of capital costs from Midtown Corridor trolley study	MODERATE - two short bridges on west end of corridor; corridor in process of major reconstruction and streetscape project.	LOW - several short bridge crossing, Nicollet Mall streetscaping, very long corridor	MODERATE - long Hennepin Ave bridge, several shorter bridges at I-35W and in Dinkytown.	MODERATE - Lowry Hill Tunnel (NB), overpass (SB), Midtown Corridor bridge

APPENDIX C

CAPITAL COSTS FOR CORRIDOR SEGMENTS

Appendix C Capital Costs For Corridor Segments

Capital Costing Methodology

Initial order-of-magnitude cost estimates were developed based on component costs from other comparable projects in the same region of the country. The capital cost estimates developed for the Southwest Corridor LRT being conducted by Hennepin County Regional Railroad Authority provided local unit cost information for many of the materials required to build a streetcar. Because there are only a small number of examples of modern streetcar systems already built in North America, Portland, OR was selected as a good peer to help formulate costs appropriate to a modern streetcar system. Since cost estimates were completed in previous years, costs were inflated and adjusted to more closely match local construction costs in 2007.

All estimates presented in this report are order-of-magnitude for planning and feasibility assessment purposes only and do not represent any level of design. A preliminary design and engineering study would need to be completed to increase the accuracy of capital costs.

A number of key components drive the cost of rail streetcar in an urban environment. These include:

- **Trackwork** – costs for trackwork assume that Minneapolis would use a slab type construction throughout the network (with the exception of the Midtown Corridor). Costs are estimated on a per mile basis and include additional costs for switches, crossovers and other special devices/improvements.
- **Platforms** – this plan assumes the use of simple platforms raised approximately 12 inches above the existing sidewalk. The 10' x 40' platform base is located in a "bumpout area" extending from the existing curb ten feet into the street containing the streetcar line. The basic costs contained in each platform include the base, ramps, shelter / bench, trash receptacle, static passenger information and possibly street lighting, drainage modification, or fire hydrant relocation as needed.
- **Catenary system, signals and substations** – this category is also referred to as the Power System. It includes costs for the catenary system itself (poles and wires), train control system for single track sections of the alignment and the cost of required power stations. Power cost estimates were based on the SW Corridor study using a general figure of $2.0 million per route mile.
- **Utilities** – A utility cost estimate was derived from the Southwest Corridor study on a linear foot basis and adjusted for this report. Major public utilities (water, sewer, sanitation) are not expected to be a significant issue due to the City of Minneapolis

practice of placing these at a depth that should not conflict with a streetcar line (around 8 feet deep). However, costs were conservatively estimated to be moderate for the purposes of this report to account for unforeseen utility relocation issues.

- **Switch** –a standard amount per switch was used per the Southwest Corridor study. Two switches per mile were assumed.
- **Construction soft-costs and taxes** – this cost estimate includes an allowance to cover unforeseen costs related to the road itself (utilities, traffic systems, street lighting, drainage, etc.) as well as any State of Minnesota taxes that may apply to construction materials.
- **Engineering and project management** – this category assumes a cost estimate of 20% for project design and engineering, and the administration of the project startup.
- **General Contingency** – a 25% general contingency was added for all other unforeseen costs to the project as a whole.

The cost estimation methodology uses these component costs to develop a generic cost per single-track mile estimate that can be applied to various corridor segments and alignments, as shown in Figure C-1.

It should be noted that costs for the Midtown Corridor are somewhat unique because the construction of a rail service on the Midtown Corridor would be different than in the other corridors. While all of the other corridors would use embedded track that is designed for ease of mixed flow operation, the Midtown Corridor service would not compete with other modes on the same right-of-way and can used more traditional ballasted track. Costs for this construction technique were developed from the Southwest Corridor LRT study, which evaluated ballasted track in some sections of the corridor.

Other Costs

The following costs are not included in the standard cost per track mile calculation shown in Figure C-1, but do add to the total cost of the project.

- **Vehicles** – a wide range of vehicle types are available for streetcar service. This study does not presuppose a preferred vehicle type, but does assume a cost associated with modern vehicles similar to those used in Portland and Tacoma (between $2.5 and $3.0 million each).
- **Maintenance and storage facility** – see Chapter 7 for a more detailed discussion of maintenance and storage facility requirements.
- **Right-of-way** – One advantage of urban streetcars over heavier gauge rail modes is that they can operate in mixed traffic, allowing them to share existing right-of-way with private vehicles. This reduces the need for expensive and often difficult right-of-way acquisition. Because all service is either in an existing row, or in the case of

the Midtown Corridor, owned by a public entity (HCRRA), property acquisition costs are not estimated.

- **Other major capital improvements – m**ajor capital improvements, such as incorporating streetcar operation into the Mississippi River bridges (Hennepin and 3rd Avenue), are estimated separately and added to the total segment cost.

Figure C-1 Streetcar per Track Mile Construction Costs (Order of Magnitude) $2007

COST CATEGORY	UNIT COST	QUANTITY	TOTAL PRICE
Trackwork - Track Slab Installation	$420 / LF	5,280	$2,217,600
Catenary System, Signals and Substations	$228 / LF	5,280	$1,203,840
Switch	$18 / LF	5,280	$95,040
Utilities – Moderate Conflicts	$360 / LF	5,280	$1,900,800
Platforms	$60,000 each	avg. 5 per mile	$300,000
Construction Soft Costs and Taxes	20%	of cost	$1,143,456
SUB-TOTAL CONSTRUCTION COST	-	-	$6,860,736
Engineering and Project Management	20%	of sub-total	$1,372,147
General Contingency	25%	of sub-total	$1,715,184
TOTAL ANTICIPATED CONSTRUCTION COST ($2007)	PER MILE		$9,948,067

Assumptions:

- All costs are for single track miles; double track cost is twice the amount per mile
- Cost estimates are based on Southwest Corridor LRT unit costs and adjusted where needed based on the Portland Streetcar project or Midtown Corridor estimates.
- Unit costs are based on 2003 data and inflated 5% per year to 2007 dollars. The inflation rate of 5% was used to account for recent increases in the cost of steel, concrete and other construction materials required for streetcars.

Summary of Capital Costs by Segment

Figure C-2 provides a summary of the order-of-magnitude capital costs for all corridors included in the long-term streetcar network. Each corridor has been broken into several shorter segments which could be logical segments for phased implementation. Breaking the longer corridors into segments makes it possible to calculate costs of alternative alignments, combining segments into lines in a variety of configurations without "double counting" when more than one line uses the same alignment. For example, portions of the Nicollet Mall would be utilized by several streetcar lines – Nicollet Avenue, Central Avenue NE, W Broadway Avenue/Washington Avenue. Therefore, in order to produce an accurate capital cost for the entire network, it is important to estimate costs by segment and to include each segment only once.

It is important to note that the capital costs presented in this section do not include two important components: **vehicles or a maintenance/storage facility**. While these costs are significant, they are not included in this section because they are related to the type of service provided in each corridor, as well as the extent of the network that is implemented. Because this plan is developing a ***network*** of streetcar lines, rather than a single line, there will be cost savings associated with multiple lines. An initial line, however, will be burdened with higher costs associated with a maintenance facility, higher vehicle spare ratio and other start-up costs. For comparison purposes only, vehicle costs are included in Figure C-2. A maintenance facility, costing between $3 and $5 Million exclusive of land costs, would also be required for the streetcar network.

Figure C-2 Order of Magnitude Streetcar Capital Costs by Segment – All Corridors, Embedded Track

Segment	Corridor	From…	To…	Track Miles	Cost per Track Mile (see Figure C-1)	Basic Cost	Major Capital Items	Major Capital Costs	Total Capital Cost (excluding vehicles and maintenance facility)3[1]
1-A	Hennepin	Groveland / Hennepin	Hennepin / 5th	2.6	$9,948,067	$25,864,975	1) Lowry Tunnel	$244,000	$26,100,000
1-B	Hennepin	Hennepin / 5th	University / 4th / Central	2.2	$9,948,067	$21,885,748	1) Hennepin Bridge (Miss. River) 2) LRT Crossing	$2,080,000 $50,000	$24,000,000
1-C	Hennepin	Groveland / Hennepin	Lake / Hennepin	3.0	$9,948,067	$29,844,201	1) Midtown Corridor Bridge	$120,000	$30,000,000
2-A	University/4th	University / 4th / Central	Washington / University	3.6	$9,948,067	$35,813,041	1) I-35W Bridge 2) Dinkytown Bridge	$400,000 $440,000	$36,700,000
3-A	Broadway/Washington	10th Ave N / Washington	Nicollet / Washington	1.8	$9,948,067	$17,906,521	1) 4th Avenue Railroad Bridge	$70,000	$18,000,000
3-B	Broadway/Washington	Nicollet / Washington	Nicollet / 5th St	0.4	$9,948,067	$3,979,227	1) LRT Crossing 2) Mall Modifications	$50,000 $300,000	$4,300,000
3-C	Broadway/Washington	Nicollet / Washington	Park Ave / 5th St	1.6	$9,948,067	$15,916,907	1) LRT Crossing	$50,000	$16,000,000
3-D	Broadway/Washington	10th Ave N / Washington	Broadway / Lyndale	1.8	$9,948,067	$17,906,521	1) I-94 Bridge	$660,000	$18,566,521
3-E	Broadway/Washington	Broadway / Lyndale	Broadway / Fremont	0.8	$9,948,067	$7,958,454	-	$0	$7,958,454
3-F	Broadway/Washington	Broadway / Fremont	North Memorial Hosp.	3.6	$9,948,067	$35,813,041	-	$0	$35,813,041
3-G	Broadway/Washington	North Memorial Hosp.	Robbinsdale TC	3.4	$9,948,067	$33,823,428	-	$0	$33,800,000
4-A	Chicago	Nicollet / 5th	14th St / Chicago	2.2	$9,948,067	$21,885,747	-	$0	$21,900,000
4-B	Chicago	Park / 5th	14th St / Chicago	1.0	$9,948,067	$9,948,067	-	$0	$9,900,000
4-C-1	Chicago	14th St / Chicago	Chicago / Franklin	0.9	$9,948,067	$8,953,260	1) I-94 Bridge	$660,000	$9,600,000
4-C-2	Chicago	Chicago / Franklin	Chicago / Lake	1.9	$9,948,067	$18,901,327	1) Midtown Corridor Bridge	$180,000	$19,100,00
4-D	Chicago	Chicago / Lake	Chicago / 38th	2.0	$9,948,067	$19,896,134	-	$0	$19,900,000
5-A	Nicollet	Nicollet / 5th St	Nicollet / 13th St	1.4	$9,948,067	$13,927,294	1) Mall Modifications	$1,800,000	$15,700,000
5-B	Nicollet	Nicollet / 13th St	Nicollet / Franklin	0.9	$9,948,067	$8,953,260	1) I-94 Bridge	$400,000	$9,400,000
5-C	Nicollet	Nicollet / Franklin	Nicollet / Lake	1.9	$9,948,067	$18,901,327	1) Midtown Corridor Bridge	$200,000	$19,100,000
5-D	Nicollet	Nicollet / Lake	Nicollet / 46th	4.0	$9,948,067	$39,792,268			$39,800,000
6-A	Central	Central / 4th St SE	Central / 29th Ave NE	4.8	$9,948,067	$47,750,722	1) 9th Street NE RR Bridge 2) Broadway Street NE Bridge	$300,000 $440,000	$48,500,000
6-B	Central	Central / 29th Ave NE	Columbia Heights TC	2.8	$9,948,067	$27,854,588	1) 36th Ave NE RR Crossing	$50,000	$27,900,000

[1] Figures rounded to the nearest $100,000.

Segment	Corridor	From…	To…	Track Miles	Cost per Track Mile (see Figure C-1)	Basic Cost	Major Capital Items	Major Capital Costs	Total Capital Cost (excluding vehicles and maintenance facility)3[1]
6-C	Central	Columbia Heights TC	Central / 49th Ave NE	2.2	$9,948,067	$21,885,748	-	$0	$21,900,000
7-A	Midtown Corridor	West Lake Station	Hennepin	1.4	$9,948,067	$13,927,294	1) Side Track – (3) 2) Vertical Circulation – (1)	$1,860,000 $400,000	$16,600,000
7-B	Midtown Corridor	Hiawatha / Lake Station	Chicago	1.3	$9,948,067	$12,932,487	1) Side Track – (3) 2) Vertical Circulation – (2)	$1,860,000 $800,000	$15,200,000
7-C	Midtown Corridor	Chicago	Hennepin	1.7	$9,948,067	$16,911,714	1) Side Track – (4) 2) Elevators – (2)	$2,480,000 $800,000	$20,200,000
7-D	Midtown Corridor	Hiawatha / Lake Station	28th St Station	2.7	$9,948,067	$26,859,781	1) Side Track – (3) 2) Elevators – (2)	$1,860,000 $800,000	$29,500,000

APPENDIX D

METHODOLOGY FOR ESTIMATING RIDERSHIP FOR INITIAL SEGMENTS

Appendix D Methodology for Estimating Ridership for Initial Segments

Ridership estimates for all of the long-term streetcar corridors were based on existing bus ridership because streetcar is intended to replace significant portions of those bus routes. For most of the initial operable segments and all of the minimal operable segments, however, the segments are too short to attract the same market as the bus service in the longer corridors and are not expected to replace any bus lines initially. For two corridors, Nicollet Avenue S and Chicago Avenue S, the same methodology used for the long-term streetcar corridors is used to estimate ridership on the initial operable segments (not the minimal operable segments). This methodology was used because significant modifications to the underlying bus service is proposed if service in these corridors extend to Lake Street. For all other corridors, a different methodology using experience in other cities was used to develop ridership estimates for these shorter segments.

Ridership Experience in Other Cities

To estimate ridership for the initial and minimal operable segments, examples from other cities were reviewed where relatively short streetcar lines are serving similar land uses in their downtown areas. Figure D-1 shows the range of ridership and productivity (as measured in passengers per hour) for each of the peer cities included in this analysis. Also included is a brief description of the unique factors that may contribute to each city's ridership compared to the shortest operable segments in Minneapolis.

Based on the productivities in the peer cities listed above, an average productivity figure of 39.3 passengers per revenue hour of service was calculated. While an average productivity could be used to estimate ridership on the initial operable segments (by multiplying this figure by annual revenue hours), productivities in each peer city were adjusted up or down for each of the initial operable segments based on seven factors that influence ridership (see description in Chapter 4).

The productivities for each initial and minimal operable segment were adjusted up or down by making comparisons between the peer city and that particular segment in Minneapolis. The adjustments were made using the following guidelines for each factor:

- **Intensity of Land Use.** What is the overall density and intensity of development in the peer city compared to the initial operable segment?
- **Connectivity to a Broader Network.** Does the peer city system provide better connections to regional transit services compared to the initial operable segment?
- **Tourist Market.** How large of a tourist market does the peer city attract compared to what could be expected for the initial operable segment?

- **Frequency.** What is the frequency of the peer city streetcar service compared to the initial operable segment?

Figure D-1 Peer Streetcar System Ridership

City	Annual Ridership	Ridership (Passengers/ Rev. Hour)	Factors Contributing to Ridership
Tampa	519,564	29.7	• Less intense land use compared to downtown Minneapolis • Does not directly serve downtown Tampa • Serves major tourist attractions along water • Connects with specialized rubber-tired service, called "In-Town Trolley"
Tacoma	794,582	79.9	• Free service and plentiful parking • Good connections to regional commuter rail system • Similar land use to Minneapolis • Integral to current and future transit network
Little Rock	204,000 (estimated)	25.8	• More intense land uses in downtown Minneapolis • Serves major tourist attractions in Little Rock and North Little Rock
San Francisco (F Line)	5,134,839	53.0	• More intense development than downtown Minneapolis • Provides connection to major regional transit services (BART and MUNI Metro) • Serves substantial tourist market.
Memphis	1,030,848	16.7	• Less intense land use compared to downtown Minneapolis • Three lines provide service to different parts of the city • Serves major tourist market
Portland	1.9 M (estimated)	91.0 (estimated)	• Similar land use to downtown Minneapolis • Free fares for the majority of the line • Utilizes real-time information at each stop
Average Passengers per Rev. Hour:		39.3	

•

- **Fare Structure.** Does the peer streetcar line have a similar fare structure to the initial operable segment? It is assumed that the existing Downtown Fare Zone would remain in place with streetcar.
- **Underlying Bus Service.** Does the streetcar line in the peer city also have underlying bus service, and if so, how does that compare to the initial operable segment?
- **Service Span.** Does the peer streetcar line operate the same hours as the initial operable segment? All initial operable segments were assumed to operate 16 hours on weekdays and Saturdays, and 14 hours on Sundays.

Because these are ridership *estimates*, a low and high range was calculated by taking plus or minus 10% of the adjusted average productivity. This range of productivities is then multiplied by the annual revenue hours, which is based on the operating plans developed above, to develop high-level annual ridership figures for the five initial operable segments.

A summary of the ridership estimates for the initial operable segments is shown below in Figure D-2. The detailed table used to develop the ridership estimates is provided at the end of this section. As with the analysis of the full streetcar network, ridership is very dependent on both land use changes and underlying transit service changes which have not yet been determined. These estimates are conservatively based on existing land use and maintenance of the underlying bus network.

Figure D-2 Ridership Estimates – Initial Operable Segments and Minimal Operable Segments

		Initial Operable Segment					Minimal Operable Segments							
		Hennepin Avenue	Broadway / Washington (via Nicollet)	Broadway / Washington (via Park)	Nicollet Avenue *	Chicago, 9th/10th to Nicollet *	Hennepin Avenue (south of 5th)	Hennepin Avenue (north of 5th)	Nicollet Ave (to 13th)	Nicollet Ave (to Franklin)	Chicago / 9th / 10th (to 14th St)	Chicago / 9th / 10th (to Franklin)	W Broadway / Washington / Nicollet (to 10th Ave N)	W Broadway / Washington / Park (to 10th Ave N)
Average Productivity		42.8	36.5	33.1	53.2 – 59.9	55.8 - 61.2	45.0	35.3	39.0	43.4	30.1	32.0	32.8	29.8
Annual Revenue Hours (based on operating plan)		17,172	17,172	17,172	27,630	27,630	11,448	11,448	11,448	11,448	11,448	11,448	11,448	11,448
Productivity	Low Estimate	38.6	32.8	29.8	47.9 – 53.9	50.2 – 55.1	40.5	31.8	35.1	39.0	27.1	28.8	29.5	26.8
	High Estimate	47.1	40.1	36.5	58.5 – 65.8	61.4 – 67.3	49.5	38.9	42.9	47.7	33.2	35.2	36.1	32.8
Annual Ridership (rounded to the nearest 100)	Low Estimate	662,000	563,800	512,200	1,480,000	1,520,000	463,400	364,100	402,000	446,900	310,600	329,800	338,300	307,300
	High Estimate	809,200	689,100	626,100	1,810,000	1,860,000	566,400	445,100	491,400	546,200	379,600	403,100	413,500	375,600

* Uses the same ridership methodology as the long-term streetcar corridors because significant modifications to the underlying bus service is proposed.

APPENDIX E

SUMMARY FUNDING TABLES FOR PEER CITIES

Peer City Funding Characteristics - Capital

Streetcar Location/System	Federal Funding Sources					State Funding Sources	Local Funding Sources							Notes
City	Interstate Substitution Funds	New Starts	Other Federal Sources	CMAQ	HUD	DOT	City General Fund	Transit System	Voter Approved Taxes	Local Improvement District	Tax Increment Financing	Parking Bonds	Other	
Charlotte								X	X				Convention Center	Original trolley service cost 16.7 million to construct, which was allocated out of the General Fund on the assumption increased property taxes would pay it off within 8 years. It took only half that time. The extension completed in 2004, was as part of a larger transit capital projects program funded by a 1/2-cent sales tax passed by the voters in 1998. The Charlotte Convention Center and the Charlotte Area Transit System are also contributors.
Memphis	80% (first two rail projects)	80% (third rail project)					20%							The first 2 of 3 rail projects (in 1993 and 1997) were 80% funded by Federal Interstate Substitution funds (no longer available) and 20% from City's general fund. Third project (2004) was 80% funded with New Starts, 20% from City's general fund.
Portland - Central City			9%		1%		3%			17%	13%	50%	4% - City Parking Fund ($2,000,000) 1.5% - City Transportation Fund ($863,539) 1.5% - Tax-Advantage Lease Agreement ($850,000)	For original 2.4 mile portion cost $57 million to construct, funded by : • Federal Transportation Funds (reallocated with TriMet for local funds) $5,000,000 (9%) • Federal HUD Funds $500,000 (1%) • Local Improvement Districts $9,608,000 (17%) • Tax Increment Financing $7,527,000 (13%) • City Parking Fund – Cash $2,000,000 (4%) • City Parking Bonds $28,551,238 (50%) • City Transportation Fund $863,539 (2%) • City General Fund $1,863,000 (3%) • Tax-Advantage Lease Agreement $850,000 (1%)
Portland - 1.2 mile extension					7%	11% (Land Exchange / Sale)	20%			16%			46% (Portland Development Commission)	The new 1.2 mile extension cost $18.2 million, funded by: • $3 million Local Improvement District (LID) • $5.25 million Portland Development Commission – Streetcar • $3.10 million Portland Development Commission - Harrison Street connector • $1.25 million HUD grants • $3.60 City funds for two new streetcars • $2.00 ODOT/PDOT land exchange/sale
Savannah							X (primary source)		X					Essentially 100% from City general fund; some of the funding was from a voter approved tax bill that included many other initiatives; voters did not specifically vote on this issue.
Tacoma									X					The full $80.4 million cost was funded as part of a transportation package that went before voters in 1996 paid for by a sales and use tax, motor vehicle excise tax, and rental car tax.
Tampa	51% - "Federal TEA 21 Grants"					11%	38%							Funding for first phase ($32M): 62% from Federal DOT and Florida DOT. 38% from local funds

Peer City Funding Characteristics - Operating

Streetcar Location/System	Federal Funding Sources		State Funding Sources	Local Funding Sources								Advertising	Fares	Notes
City	Other Federal	CMAQ	DOT	City General Fund	City DOT	Transit System	Voter Approved Taxes	Local Improvement District	Tax Increment Financing	Parking Revenues	Naming Rights & Sponsorships	Other			
Charlotte							X (primary Source)					Arts & Science Council			The primary operating fund is the 1/2 cent sales tax. For FY2005 Charlotte Trolley also received a Basic Operating Grant of $52,518 from the local Arts & Science Council (ASC).
Memphis		X (part of 40%)	15%	45%										X (part of 40%)	• 45% City General Fund • 15% Tennessee DOT • 40% Fares and Federal grants Utilized CMAQ funding for first 3 years of operating costs.
Portland - Central City						59%				30%	X (part of 11%)	X (part of 11%)		X (part of 11%)	For the original section ($2.7 million annually): • 59% TriMet - $1.6 million • 30% parking meter revenues - $800,000 • 11% farebox revenues, sponsorships and promotions - $300,000
Portland - Extension					25%	66%								9%	Source of additional operating funding (to cover extended service) includes: • 66% TriMet - $400,000 • 25% City of Portland Office of Transportation - $150,000 • 9% fares/sponsorships - $50,000
Savannah				100%											Possibility of advertising and fare revenue, but limited
Tacoma						X	70.7% Sales Tax 20.4% MVET & Rental Car Tax					4%		5%	Total 2006 Operating Budget is 3.5 million. Funded from Sound Transit's General Revenue, which is primarily from: • 70.2% Retail Sales and Use Tax • 20.4% Motor Vehicle Excise Tax (registration fees) & Rental Car Tax • 5.0% Farebox Revenue • 1.9% Interest Earnings • 2.1% Misc. Revenue (including advertising on bus and commuter rail, rental income from Sound Transit properties, etc)
Tampa	8% (Through Transit System)	0.5% (Through Transit System)				X		12%			49%	8% - Port Authority; Car Leasing (0.3%)	0.6%	18%	Total operating cost $1.2 million per year and come from the following sources: • 12% Voluntary special assessment within downtown Tampa, Ybor City and Channelside • 49% Income from a naming rights endowment fund • 18% Fare box revenue • 0.6% Advertising CMAQ Grant for $700,000 each of first three years