Metro Transit
Arterial Transitway Corridors Study

Technical Memorandum #2
Arterial Transit Modes

10/25/2011

Prepared by the
SRF Consulting Group Team

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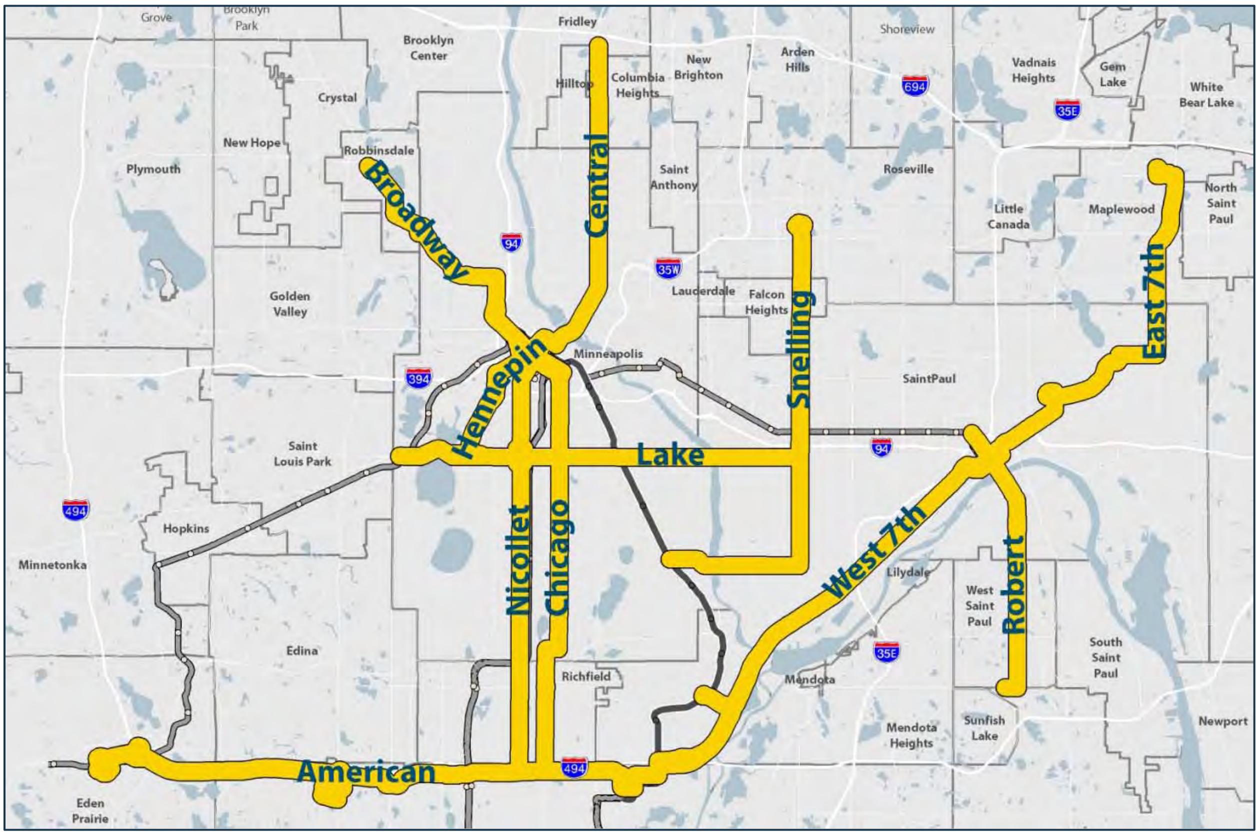
Introduction

The purpose of the Arterial Transitway Corridors Study (ATCS) is to develop a facility and service plan to enhance efficiency, speed, reliability, customer information and facilities, and transit market competitiveness on 11 high-demand local bus corridors, nine of which are identified for arterial bus rapid transit (Rapid Bus) in the Metropolitan Council's *2030 Transportation Policy Plan*, shown in Figure 1. This technical memorandum documents the activities conducted in Phase II of the ATCS to develop an understanding of transit modes with potential applications in the 11 studied arterial corridors.

Figure 1. ATCS Corridors



Local bus service currently operates in all of the corridors, and streetcar feasibility has been studied for potential implementation in three of the corridors. An understanding of the Rapid Bus, streetcar, and local bus modes will help to inform the concept development work to be completed in Phase III of this study. The first section of this technical memorandum describes and compares the core characteristics of these modes.

One objective of Phase II of the ATCS was to develop a more detailed description of the Rapid Bus mode. While the Twin Cities region is familiar with the local bus mode, and several studies of streetcar feasibility have been conducted in recent years, Rapid Bus is a new transit mode for the region. The second section of this memorandum includes the results of a peer review of other Rapid Bus projects across the country. The case studies chosen supplement previous research done by Metro Transit staff on New York Select Bus, Kansas City MAX, and Cleveland Healthline arterial bus rapid transit services. A toolbox of potential and recommended Rapid Bus elements is also included to inform concept development in Phase III.

The final section of this memorandum documents local sources of information to be considered during modal comparison in future phases of transit development in these corridors.

Applicable Modes

All of the corridors being examined in the ATCS have existing local bus service. The ATCS will recommend improvements to these corridors to create an integrated high-frequency, premium Rapid Bus service. The Central Avenue, Nicollet Avenue, and Robert Street corridors are also being studied for potential streetcar implementation. The following sections define and describe the characteristics of local bus, Rapid Bus, and streetcar.

Local Bus

A bus is a transit mode comprised of rubber-tired passenger vehicles operating on fixed routes and schedules over various types of roadways. Vehicles are powered by diesel, gasoline, battery, or alternative fuel engines contained within the vehicle. Buses can operate in local, limited-stop, or express service configurations. Local bus service is currently operated in all of the corridors under consideration. Local services stop frequently (8-10 times per mile) on fixed routes to provide access to a wide variety of markets. The level of customer information and facilities provided vary from minimal (e.g., pole in the ground) to substantial (e.g., Transit Center). A typical Metro Transit bus is shown in Figure 2.

Figure 2. Standard Bus (Metro Transit Low-Floor 40-Foot Hybrid)

Rapid Bus

Rapid Bus (Figure 3) is a transit mode that uses bus vehicles while incorporating many of the premium characteristics of LRT. BRT service on arterial streets incorporates limited-stop service, technology improvements, and branding to provide a fast trip and differentiate the service from regular bus routes. The primary objectives of Rapid Bus are to provide faster and more frequent service as well as an improved customer experience. Faster service is accomplished by reducing signal and passenger boarding delay, and stopping at fewer locations. An improved passenger experience is achieved through more comfortable vehicles, stations, information technology, and improved service reliability. Rapid Bus generally operates in mixed-flow traffic conditions; however, semi-exclusive lane treatments in targeted locations and transit signal priority are desirable to help improve transit travel time.

Figure 3. Rapid Bus Vehicle (Seattle, WA)

Modern Streetcar

A streetcar is a rail transit mode that operates on tracks running on city streets (Figure 4). Most often, streetcars are powered by electricity supplied through an overhead wire. Generally, streetcars operate in mixed traffic conditions and make frequent stops, similar to local bus. Streetcars function more as a part of a local circulation system as opposed to a regional transportation system. Some "rapid streetcar" corridors are planned with limited stop spacing. Still, most existing modern streetcar lines are designed for shorter-distance trips.

Figure 4. Streetcar (Portland, OR)

A streetcar has higher passenger capacity than a typical bus; however, a streetcar is operationally less flexible than a bus due to fixed rail and power infrastructure. Streetcars require a unique maintenance facility. Capital costs for a streetcar system are higher than capital costs for both Rapid Bus and local bus service, but are lower than those for LRT. Streetcar systems have more restrictive grade, turning, and clearance requirements than local bus or Rapid Bus modes. These design requirements are described in more detail in Table 1.

Comparison of Modes

Table 1 defines and describes the characteristics of each mode in more detail. The characteristics below represent a range of observed characteristics in several systems. The recommended characteristics for Rapid Bus are further described in the Rapid Bus Toolbox.

Table 1. Mode Characteristics Matrix

Characteristic	Local Bus	Rapid Bus	Modern Streetcar
Station Spacing	0.1 to 0.25 miles between stops	0.25 to 1 mile between stations	0.1 to 0.25 miles between stations
Service Frequencies (minutes between trips)	7 to 60 minutes	5 to 15 minutes	Portland = 12 to 15 minutes Other systems variable, 5 to 15 minutes
Average Operating Speed	6 to 8 MPH	Arterial = 10 to 20 MPH Guideway/Highway = 15 to 25+ MPH	6 to 12 MPH
Vehicle Types	40' Standard Bus 60' Articulated Bus 2 to 3 Doors Single-Side Boarding/Alighting	60' BRT Vehicle 2 to 5 Doors Single- or Double-Side Boarding/Alighting	Modern 2 to 6 doors Single-Unit or Articulated; Single-Ended or Bi-Directional
Station/Stop Attributes	<u>Curb Height:</u> Standard Curb (6") No platform, sidewalk only	<u>Curb Height:</u> 6"-14" (level or near-level boarding depending on the vehicle) <u>Platform Length:</u> Minimum = 25' boarding area between doors Typical planning length = 66' to 120', plus tapers as required to curb bus <u>Platform Edge Location:</u>[1] • Bulbout • Sidewalk Platform • Guideway Platform	<u>Curb Height:</u> 11"-14" (level or near-level boarding depending on the vehicle) <u>Platform Length:</u> Minimum = 25' Typical planning length = 66' <u>Platform Edge Location:</u>[2] • Bulbout • Center Platforms • Mid-Block Platform • Near-Side Platform • Far-Side Platform

[1] <u>Rapid Bus Bulbout:</u> Allows for street parking except at platform locations; requires at least 50' of parking removal, up to around 70'.
<u>Sidewalk Platform:</u> Far-side stations preferable for travel time and transit priority. Near-side stations would require "countdown" clock to allow Rapid Bus vehicle to not miss the next signal cycle. Requires up to 120' (equivalent to 6 parking stalls) of parking removal at near side locations, 80' (equivalent to 4 parking stalls) or more at far side locations.

Characteristic	Local Bus	Rapid Bus	Modern Streetcar
Station/Stop Attributes (continued)	Station Amenities: Minimal shelter, route pole, minimal amenities. Occasional lighting or heater installation.	Station Amenities: Range from simple stops to LRT-like shelters, wayfinding, real-time information, fare collection and security features	Station Amenities: Shelters, wayfinding, real-time information, fare collection and security features
Vehicle Power	• Clean Diesel • Compressed Natural Gas • Liquid Natural Gas • Diesel Electric Hybrid • Battery electric vehicle concepts under in-service testing, requiring charging at layover locations	• Clean Diesel • Compressed Natural Gas • Liquid Natural Gas • Diesel Electric Hybrid • Diesel/Electric Dual Propulsion (electric power from overhead wires) • Battery electric vehicle concepts under in-service testing, requiring charging at layover locations	Overhead Wires: The aesthetics of overhead wires depends on suspension type and streetscaping. Decorative poles or cantilevers from shared-use poles minimize wire lengths. Spanwire may be tied directly to buildings for support. Some modern streetcars are under testing to run using on-board batteries for short distances Ground Level Switch Contact: In-ground power is an expensive alternative to overhead power. Substations: Substation housing design depends on power requirements.

Guideway Platform: Side-running station for right-side only boarding or central platform for left- or dual-sided boarding.

[2] Streetcar Bulbout: Allows for street parking except at platform locations; requires at least 50’ of parking removal (3 stalls), up to around 90’ (5 stalls). Shifting track to curb requires at least 150’ of parking removal (8 stalls). Side stations desirable for narrow street operation and may enhance pedestrian activity.

Center Platforms: Typically not compatible with buses in the same corridor due to left-sided boarding; Requires wide streets with ~15’ median; Minimizes disruptions to parking bike lanes.

Mid-Block Platform: Creates the least amount of disruption to traffic, but generates transit passenger inconvenience and encourages jaywalking.

Near-Side Platform: Medium traffic impacts (most common type in Portland), allows for boarding during red time but may generate cycle failures, minimizes parking removal.

Far-Side Platform: High traffic impacts, most cycles disrupted, may generate queue buildup in intersection, minimizes parking removal.

Characteristic	Local Bus	Rapid Bus	Modern Streetcar
Vehicle Dimensions	Length = 40-42' Bumper to Bumper Width = 8.5' body, 10' (w/ mirrors) Height = 9.5' to 11'	Length = 60' to 65' Bumper to Bumper Width = 8.5' body, 10' (w/ mirrors) Height = 9.5' to 11'	Length = 66' to 95' Widths= 7.5' to 8.7' Height – 11.9' without pantograph Height (min) – 13.5' with pantograph)
Vehicle Capacity	Standard 40' Vehicle = 25 to 39 seated 50 to 60 seated and standing	Standard 60' Vehicle = 40 to 58 seated 60 to 105 seated and standing Door configuration (number/size) and interior configuration affect seated and standing capacities.	30 to 70 seated 115 to 160 seated and standing.
Vehicle Capital Cost	Standard 40' Vehicle = $300k to 450k	60' BRT Vehicle = $900k to $1.3M	$2M - $4M
Grade Limitations	8 % Incline; 10% Decline maximum grades	8 % Incline; 10% Decline maximum grades	6% maximum grade; 5% or less is desirable
Turn Limitations	Minimum Inner Turn Radii = 25' Minimum Outer Turn Radii = 45'	Minimum Inner Turn Radii = 25' Minimum Outer Turn Radii = 50'	Typical Radius Range = minimum 60'; but up to 82' The Skoda Astra (Portland & Tacoma) has a turning radius of 59', with some LRT vehicles able to achieve 36' (Philadelphia & Toronto) Vehicle type controls track curvature design Vehicles with a large turning radius may require lane shifts prior to curves, reducing street parking in sections Depending on the turning radius of the vehicle, some intersections may require a lane shift before the turning maneuver
Clearance Requirements	10.5' to 11' Width	10.5' to 11' Width	Horizontal[3] and vertical [4]clearance is dependent on the specific vehicle used.

[3] Horizontal Clearance – State law indicates that a horizontal clearance of 8'-6" (min) to fixed objects that are not part of the system is required; however, based on the vehicle dimensions, that could be more than what is actually required for narrow vehicles within curved track. Providing a 7' clearance between the track centerline and a face of curb is acceptable, as long as vertical elements (poles, posts, etc.) are placed 2' from the face of curb.

Characteristic	Local Bus	Rapid Bus	Modern Streetcar
Floor Level	40’ vehicle = Low Floor up to the back door, High Floor in the back	60’ vehicle = Low floor up to the 3rd door, High Floor in the back Fully level boarding requirements: • 12-15 inch curbs depending on the vehicle • Bridge plates/ramps at doors may be used for nearly level boarding operation	Partial low floor requires specific accessible boarding doors; 100-percent low floor vehicles are fully accessible throughout Fully level boarding requirements: • Maximum vertical gap of 5/8-inch at all doors, requiring 14-inch curbs, creating compatibility issues with buses • Bridge plates at accessible doors may be used for nearly level boarding operation, reducing curb height requirements to around 11 inches
Other Operating Characteristics	Right-side boarding only requiring side-running stop on sidewalk	Some vehicles allow for both right-side and left-side boarding. Allows for central platforms on guideways.	Single-ended vehicles require turnaround track or continuous loop operation Bidirectional vehicles prevent the need for a turnaround track
Fare Collection	Fare collection can be off-board, on-board, or a hybrid combination depending on needs of agency/customers		
Railroad Crossing Issues	Requires stop at non-exempt railroad crossings	Requires stop at non-exempt railroad crossings	Special trackwork is required when there is a streetcar/ freight rail at-grade crossing. Sometimes difficult to get approval from freight rail companies to make these required improvements. Overhead contact system wires need to be raised to accommodate freight rail vertical clearance requirements.

[4] Vertical Clearance Requirements – Providing a 16’ vertical clearance is a practical minimum on anything that is planned to be shared with cars; providing an 18’ vertical clearance is the desirable minimum. Maximum vertical clearances for the placement of overhead contact system wires and pantographs are dependent on the vehicle type; however, most pantographs are able to reach greater vertical clearances that are greater than 21’.

Rapid Bus Peer Review

As part of Phase II of the ATCS, a peer review of Rapid Bus projects from other regions of the United States was completed. The peer review used a questionnaire to research and interview agencies that have developed Rapid Bus projects and to learn from their experiences with applications of BRT in arterial corridors. The discussion with each agency focused on pre-implementation lessons learned, implementation route performance, operating environments, and project costs and benefits. Additional peer review preceded the ATCS and was conducted by Metro Transit staff on New York Select Bus, Kansas City MAX, and Cleveland HealthLine.

The ATCS peer review included three agencies and projects for participation in the review:

- San Diego Association of Governments (SANDAG), San Diego, CA – Mid City Rapid
- Alameda-Contra Costa Transit District (AC Transit), Berkeley/ Oakland /San Leandro, CA – East Bay BRT
- King County Metro Transit, Seattle, WA – Rapid Ride

Each project review focused on the following questions:

1. How was the corridor selected?
2. What was the station selection process?
3. What sort of demand has been observed at stations? Does the demand vary by location?
4. Have you found any benefit to providing connecting routes?
5. What size/type of shelter was used?
6. What was the range of costs for the improvements?
7. How has the line performed, relative to expectations? (If applicable)
8. What are three examples of “lessons learned”?
9. How do the corridor and mode brands relate to the system as a whole?
10. How and where were the branding elements applied in Rapid Bus? How did you differentiate between different modes?
11. How effective has the branding been in your system?
12. What are the tangible benefits that you’ve seen?
13. Did you complete any customer/market surveys about the brand? What were the results?

The following sections contain the results of the review for each examined project.

Mid City Rapid, San Diego, CA

The Mid-City Rapid project is part of SANDAG's regional transportation program and the first Rapid Bus application for San Diego. It is along one of the oldest and most densely populated corridors in the region and serves major employment and activity hubs in the city (Downtown San Diego and San Diego State University). The project's stated vision is to "demonstrate how increased efficiency, speed, and service can attract new transit ridership, improve customer satisfaction, and benefit the broader community by providing light rail transit (LRT) level-of-service through the use of bus technology."

The 10-mile long project consists of mostly arterial mixed flow conditions with 34 stations; 22 stations will be implemented in the first phase. The project will have 3,500 feet of dedicated guideway with BRT stations along Park Boulevard between El Cajon Boulevard and University Avenue—the two most active bus transit corridors in the region. Stations along El Cajon and Park Boulevard will receive full station improvements (except in Balboa Park) while downtown stations are improved via a separate downtown BRT station project.

The Mid-City Rapid will travel along a very densely populated corridor with numerous residential and employment centers, anchored by downtown San Diego and San Diego State University. Based on these characteristics, the project is forecasted to become the highest ridership bus route in the San Diego region. The corridor already has strong transit ridership on existing bus lines, with over 8,700 weekday boardings, excluding the downtown portion of the proposed route, which approximately doubles ridership. Over 24,000 existing customers travel over at least a portion of the proposed alignment, excluding downtown. The questionnaire results are in Table 2.

Table 2. Peer Review: Mid City Rapid Project

Question	Response
What was the range of costs for the improvements?	$38M Total (Approximate) • $14M for Vehicles • $24M for Capital Improvements, including 2/3 mile of exclusive guideway • $600k to $1M per pair of stations
What sort of demand has been observed at stations? Does demand vary by location?	• Current demand on corridor is approximately 11,000 • Anticipated ridership will increase to 16,000 (opening day)
What was the station selection process that was used?	• Selection and spacing was intuitive- ½ mile spacing in the end. • First placed at "connecting route" cross-streets to provide regional along with corridor mobility. • Stations then placed at quarter-half mile intervals along the street grid. • Stations were selected based on ridership and travel time improvements. Allowing for the higher performing stops to be kept and decreasing travel time.
What size / type of shelters were provided?	• 30' x 10' • Equivalent to an LRT station shelter • Custom shelter to meet the character of El Cajon Blvd – 1950s Retro • Integrated seating and amenities • Very open and highly visible
Have you found any benefit to providing connecting routes?	Yes, significant ridership and mobility is driven through opportunities to transfer to/from the rapid transit corridor. At one station, it connects with regional BRT providing express service north and south into Downtown.

Question	Response
How has the line performed, relative to expectations?	• Project construction begins summer 2011. Ridership is expected to increase dramatically on this corridor with corridor improvements including transit signal priority.
What are your examples of "lessons learned"?	1. Parking was the single biggest deterrent for the project. Created a delay of more than a year—even after six years of community involvement and participation on all aspects of the project (including parking). The updated parking plan associated with Park Blvd was developed in 2008; final design and configuration of the parking was not completed until July 2011. ***Have a parking plan in place; and a contingency plan.*** 2. Organize public support—***have them take ownership of the project.*** There was some thought of having communities compete for the projects in order to establish that ownership from the community. 3. Project was part of voter initiative—but many in community felt the project was a "pilot project" for the region. ***Develop a program of projects vs. only one project.*** A program allows for communities to know that they are part of something larger in the region and not just "guinea pigs."
How do the corridor and mode brands relate to the system as a whole?	MTS remains the system brand and the critical brand overall. Mid City Rapid will be integrated into the regional BRT branding scheme for features. However, stations will be unique to the Mid City Corridors.
How and where were the branding elements applied in Rapid Bus? How did you differentiate between different modes?	Branding was integrated into as much of the project features as possible.
How effective has the branding been in your system?	Unknown. Expect branding to help with gaining greater awareness of services in the community.
What are the tangible benefits that you've seen?	Shelter design and brand has garnered community support for the project—the 1950's retro design fits well with "The Boulevard" brand of the corridor.
Did you complete any customer/market surveys about the brand? What were the results?	For the corridor, the public was engaged on how the project can be a better fit for the community. SANDAG is currently undertaking surveys and focus group for "before and after" studies about the influence of branding in stated and revealed preferences.

East Bay BRT, Berkeley/Oakland/San Leandro, CA

AC Transit is completing the environmental review phase (Final EIS/EIR) for the implementation of the East Bay BRT Project, a 14.4-mile BRT line connecting Berkeley, Oakland, and San Leandro. The project was developed on the success of core "arterial rapid service" on the International Boulevard and Telegraph Avenue corridors (Route 1R, which was designed to be the predecessor of the BRT project as a ridership builder). East Bay BRT will be anchored by several major centers in the eastern bay communities:

1. Downtown Berkeley and University of California, Berkeley
2. Downtown Oakland
3. San Leandro central business district and Bay Area Rapid Transit (BART) Station.

The East Bay BRT project will have five-minute headway service during peak periods. Proposed stations are spaced on average 0.31 miles apart and will feature: shelters, boarding platforms, benches, security features, fare machines, real-time bus arrival information, and other amenities. To improve upon travel time, low-floor BRT vehicles will be used with level or near-level boarding platforms, along with pre-paid ticketing and proof-of-payment fare verification and enforcement. Over 75 percent of the corridor is proposed to have dedicated bus lanes along arterial streets and will be combined with transit signal priority treatments and signal coordination throughout the BRT project alignment. Questionnaire results are included in full in Table 3.

Table 3. Peer Review: East Bay BRT

Question	Response
What was the range of costs for the improvements?	$150 M – Improvements Only (Opening Year Cost – 2015) • $10 M in guideway • $69 M in stations and non-guideway improvements • $63 M in systems • $8 M right-of-way • no vehicle costs (cost estimates assumed a "re-wrap" of existing vehicles)
What sort of demand has been observed at stations? Does demand vary by location?	• Current demand on corridor is approximately 23,000 • Anticipated ridership will increase to 45,000-50,000
What was the station selection process that was used?	• Stations were based on success and lessons learned from Route 1R • Right-of-way constraints created adjustments to station locations but not overall spacing • Emphasis was placed on connectivity to many routes and transit services
What size / type of shelters were provided?	• Canopies of shelters were approximately 45' x 12'
Have you found any benefit to providing connecting routes?	• Connectivity to other transit services are fundamental to overall success of project • Project connects to existing bus routes, AC Transit Transbay (service to San Francisco), and BART stations

Question	Response
How has the line performed, relative to expectations?	• Route 1R, the predecessor project, has performed well and has exceeded expectations. • All services on proposed corridor currently serve 12 percent of AC Transit's total ridership. • Project entering the design phase with service implementation in 2014.
What are your examples of "lessons learned"?	• Coordination with multiple cities and jurisdictions requires consistent communication and understanding of expectations**. *Create a communication plan with the cities to ensure that the public, technical advisor groups, and political stakeholders are appropriately informed throughout the process.*** Delays due to specific issues should not stop communication with others, especially the public. • Right-of-way coordination and parking impacts were a significant undertaking along the arterial corridors. ***Understand your right-of-way needs and have a parking plan/program in place.*** Out of 7,000 parking spaces along the project alignment, 950 to 1,300 would be displaced. As part of the project mitigation, approximately 20-25 percent of the parking spaces displaced were relocated.
How do the corridor and mode brands relate to the system as a whole?	AC Transit has taken a "system" approach where the vehicles and stations will be the same brand or color scheme as existing AC Transit services. The branding concept for the service has not been completed. Majority of focus is on quality of amenities and frequency of service.
How and where were the branding elements applied in Rapid Bus? How did you differentiate between different modes?	Branding of the service is through the quality of the infrastructure, amenities, and service. Differentiation is through separated transit lanes, center platforms, and high-quality amenities.
How effective has the branding been in your system?	Unknown. However, the predecessor, Route 1R, was a rapid service that increased ridership significantly without unique service branding.
What are the tangible benefits that you've seen?	N/A
Did you complete any customer/market surveys about the brand? What were the results?	N/A

RapidRide, Seattle, WA

RapidRide is King County Metro Transit's voter transit initiative program for the Seattle region. Passed by voter referendum in 2006, the program provided a sales tax for corridor, station, and service improvements for transit. Six corridors were selected as part of a six-year planning process geared at improving transit in high-performing, transit-conducive corridors. One line is operational, another is in construction, and four are in the planning phase. The main focus of the program was to provide fast, frequent service. Branding and amenities were part of the BRT program to associate with the service. Customers responded well to the dramatic increases to frequency.

These corridors had existing local bus services with high frequency and strong ridership performance; RapidRide Line A, for example, replaced Metro's Route 174 which stopped its single seat ride service into downtown a year before Line A implementation. The corridors also have land uses that vary from heavy commercial to light commercial/residential—the latter have had some difficulties in getting transit priority measures such as transit lanes. The questionnaire results are included in full in Table 4.

Table 4. Peer Review: RapidRide

Question	Response
What was the range of costs for the improvements?	• Program costs at $215M for six corridors • $50M in roadway costs • $28M in passenger facilities and amenities (not including "Next Bus" signage) • $7M for "Next Bus" signage • $128M for 113 new RapidRide hybrid vehicles (fleet size expected to be reduced as more detailed planning is performed)
What sort of demand has been observed at stations? Does demand vary by location?	• Program's goal was to increase ridership 50 percent • Stations demand varied from 50 to 200 people per day • Transit centers had the highest ridership
What was the station selection process that was used?	• The station selection process was a tiered approach: High ridership stations which tended to be 0.5 to 1 mile apart and other stations for intermediate points no less than 0.25 miles from the nearest station/stop. No underlying service—all local or existing service was replaced by RapidRide service. • Stations/stop location selection and sizing were based on ridership performance of the existing routes. • Transit centers and transfer points were critical to regional connectivity. Line A is effectively an extension of the light rail line at SeaTac Airport • Right-of-way constraints created adjustments to station/stop amenities. Some improvements were on private property requiring ownership/maintenance agreements.
What size / type of shelters were provided?	• Canopies of shelters varied from 10 ' to 20' in length and were 8' wide • Simple, sleek structure cantilevered from rear support columns
Have you found any benefit to providing connecting routes?	• Existing connections needed to be maintained • Increased frequency benefited transferring passengers by dramatically reducing wait time • Connectivity to other transit services are fundamental to overall success of project

<table>
<tr><th>Question</th><th>Response</th></tr>
<tr><td>How has the line performed, relative to expectations?</td><td>

Program has an objective of increasing ridership in the corridors by 50 percent in 5 years
Line A has experienced a 25 percent increase in ridership in 9 months

<table>
<tr><th colspan="2">Local Rt. 174</th><th colspan="2">RapidRide A Line</th><th>Year over Year % Change</th></tr>
<tr><td>Fall 2009</td><td>5,040</td><td>Fall 2010</td><td>6,790</td><td>34.7%</td></tr>
<tr><td>Spring 2010</td><td>6,030</td><td>Spring 2011</td><td>7,440</td><td>23.4%</td></tr>
<tr><td>Summer 2010</td><td>5,140</td><td>Summer 2011</td><td>7,840</td><td>52.5%</td></tr>
</table>

Customer satisfaction for the service corridor increased from 52 percent in 2009 to 84 percent in 2011

</td></tr>
<tr><td>What are your examples of “lessons learned”?</td><td>

Frequency is key. Metro was clear that the frequency is the biggest winner with their customers. The branding and amenities are nice, but people perceived their trips faster and more efficient with the more frequent service.
Anticipate longer implementation time. Schedule is always ideal—it doesn’t happen that way. Be conservative and beat expectations. Having a program of projects has been stressful as there are expectations for all six lines in a short period of time. Because Metro doesn’t control the right-of-way, coordination is critical—especially with parking.

</td></tr>
<tr><td>How do the corridor and mode brands relate to the system as a whole?</td><td>Metro Transit is the service provider. However, RapidRide is a brand of its own that is easily visible in the stations, the vehicles, station markers, and marketing materials.</td></tr>
<tr><td>How and where were the branding elements applied in Rapid Bus? How did you differentiate between different modes?</td><td>Brand is definitely unique and clear differentiator from local bus.

All components were branded with either “RapidRide” or matched the RapidRide color scheme.</td></tr>
<tr><td>How effective has the branding been in your system?</td><td>Not clear. Would have implemented the branding regardless. However, customer satisfaction is through the service. Branding has brought the awareness for new riders—however, it’s up to the service to “wow” them.</td></tr>
<tr><td>What are the tangible benefits that you’ve seen?</td><td>Easily recognizable and provides a perception of “easy to use”</td></tr>
<tr><td>Did you complete any customer/market surveys about the brand? What were the results?</td><td>N/A</td></tr>
</table>

Rapid Bus Toolbox

Based on the results of the peer review and other documented Rapid Bus experiences, the study team compiled a toolbox of potential elements for this study to consider during concept development in Phase III, along with recommendations for phased inclusion of some elements during different stages of project development. The toolbox, shown in Table 5, is intended to inform the concept-level decision-making process for this study's continued development of the Rapid Bus mode. The toolbox has three general time frames for implementation "periods": short, intermediate, and long terms.

Table 5. Rapid Bus Elements

Runningways/Intersections	Examples	Timeframe Recommendation
Grade Separated Transit Lanes	Ottawa, Pittsburg	Not recommended- cost prohibitive
Median Transit Lanes	Eugene, Las Vegas, Cleveland, San Diego	Not recommended in current project scope/planning horizon
Center Transit Lanes	Cleveland, AC Transit	Not recommended in current project scope/planning horizon
Side Running Transit Lane & Time of Day		
a) Outside/Parking Lane (All day or Peak Period)	Boston, Los Angeles	Intermediate Term
b) Middle/Travel Lane (All day or Peak Period)	San Diego, Boston, Seattle	Intermediate Term-Recommended build-out
Mixed Flow		
a) Queue Jump Lanes (at intersections)	San Diego, Boston, Los Angeles, AC Transit, Seattle	Short Term

Stations	Examples	Timeframe Recommendation
Station Placement (Relative to Intersection)		
a) Far Side	AC Transit, San Diego	Recommended
b) Near Side	Los Angeles, Boston, Las Vegas	
c) Mid Block	Boston, San Diego, AC Transit	
Station Placement (Relative to Street)		
a) Sidewalk Bulb-Out or Bump-Out	San Diego, Los Angeles, AC Transit	Short and Intermediate Term-Recommended
b) Center/Median Platform	Las Vegas, San Diego	Long Term
c) Bus Pullout		Not Recommended- should be avoided except in corridors with 45+mph speed limits

Stations	Examples	Timeframe Recommendation
Station Height		
a) 6" standard curb		Recommended in short term as necessary based on engineering constraints
b) 9" curb (Near-level boarding)	San Diego, Los Angeles	Recommended in short term where feasible
c) 12-14" (Level boarding)	Cleveland, Eugene, Las Vegas, Seattle	Not recommended; difficult to integrate in non-dedicated guideway environment. Steps, single point entry may be required.
Station Components		
a) Signage/Branding		Recommended
b) Wayfinding/System Maps/Community Maps		Recommended
c) Shelter		Recommended; major branding element, but needs to integrate well with surrounding community.
d) Seating		Minimal; better to provide high volume circulation
e) Lean Bars		Recommended in lieu of seating
f) Real Time Arrival Information		Recommended at higher volume station locations
g) Urban Design Features		Recommended
h) Bicycle Racks/Lockers		Recommended based on station constraints
i) Lighting- Street, Shelter, Pedestrian, Accent		High Priority for comfort, safety, and aesthetics
j) **Security (i.e. CCTV, DVR, communications to central control)**		Recommended; communications and recording of activity will need to be discussed with Metro security and local jurisdictions.

Vehicles	Examples	Timeframe Recommendation
Types		
a) 60' Articulated BRT	Eugene, Seattle, Las Vegas	Recommended for all scenarios.
b) 45' BRT	Los Angeles	
c) 40' BRT	Los Angeles	
Floor Layout Checklist		
a) Seats		High priority for long trips
b) Standing Room		High priority for high volume/short-trip commutes
c) ADA Seating/Space, Rear-facing Restraint System		High priority to minimize dwell times
d) Circulation		High priority to minimize dwell times
e) Door Clear Zones, Access/Egress, Fare Collection		High priority to minimize dwell times

Fare Collection	Examples	Timeframe Recommendation
Point of Fare Payment		
a) Station Ticket Vending Machine		Recommended at high volume stations
b) Bus Farebox		Recommended at low volume stations
c) Website		
d) Transit Store		
e) Community Business/Vendors		Recommended for corridors with low Smart Card market penetration
f) Employers/Schools/Senior Centers/Activity Centers		Recommended for corridors with low Smart Card market penetration
Point of Fare Validation		
a) Station Smart Card Validator		Recommended for all door boarding
b) Vehicle PCIDs		
i. Driver Door		Recommended if operator to validate all fares
ii. All Doors		Recommended. Ideal for all boarding and dwell times
iii. Bus Farebox		
Fare Collection Media		
a) Cash		
b) Smart Card (Reusable/Plastic)		Recommended- create corridor target rates for smart card use on BRT
c) Smart Ticket (Single Use/Paper, Plastic)		
Fare Enforcement a) Roving inspections b) Point inspections c) Driver enforcement		There are many options on how enforcement can take place. The light rail proof-of-payment enforcement program is good starting point. The system will need to be tailored to bus operations with either station or bus enforcement. Regardless, enforcement can be labor intensive and expensive.

Technology	Examples	Timeframe Recommendation
System Technologies		
a) Automatic Vehicle Location		
b) Automatic Fare Collection		
c) Automatic Passenger counters		
d) Transit Signal Priority		

Technology	**Examples**	**Timeframe Recommendation**
Station Technologies		
a) LED Matrix Displays (Variable Message Sign)		
b) LCD Video Screen Displays- Next Bus and Service Alerts		Recommended
c) Security Cameras		Recommended
d) Fiber Optic/Wireless Communications		Recommended
e) ADA Station ID/Audio Message		Recommended
Vehicle Information		
a) LED Displays (Next Stop Display)		Recommended
b) Next Stop Audio/Annunciator		Recommended
c) Corridor Destinations/ Major Stops Display		Recommended
Decentralized Information		
a) System website		
b) Smart Phone Apps		Recommended
c) Text Message- Next Bus, Service Alerts		

Mobility and Access	**Examples**	**Timeframe Recommendation**
Walkshed and Mobility Paths	San Diego	Wayfinding for the path of travel to the 5-10 minute walkshed is important for mobility/access.
Bicycle Access and Facilities	AC Transit, Seattle	
ADA Access and Services a) Braille display b) Audio jack for next bus arrival c) Curb contrast color for low visibility condition d) Ramps e) Sidewalks with 2% crossfall		Critical to create an ADA checklist.
Park-and-Ride Stations	San Diego	Drive access increases potential ridership catchment area to 3+ miles.
Wayfinding		Development information displays and signage for “decision point” locations (e.g. outside train doors directing to BRT stations)

Branding Elements	Examples	Timeframe Recommendation
System/Service Brand a) Materials b) Color Palette		 High quality-valued by customers; easy to obtain and maintain-continues value
Vehicle		Coordinated with service brand color pallet
Station Shelter/Station Urban Design		Coordinated with service brand color pallet
Station Marker (Pylon)		Recommended, can be used as station/community identifiers along corridor
Website		BRT service should be a separate mode for people to select and learn about on the site

Relevant Local Studies

In addition to the studies completed by Metropolitan Council, other studies of potential transit improvements have been completed by partner agencies on some of the identified corridors. These additional studies are:

- Minneapolis Streetcar Feasibility Study (City of Minneapolis, 2007)
- Minneapolis Streetcar Funding Study (City of Minneapolis, 2010)
- Robert Street Transit Feasibility Study (Dakota County Regional Rail Authority, 2008)

Although the ATCS focuses on the potential for Rapid Bus, the local studies completed will help inform the project regarding desired investments in the corridors. These studies will serves as sources of information for modal comparison. A brief summary of these studies is in the following sections. Potential recommendations resulting from the ATCS study for improvements specific to Rapid Bus will not preclude future streetcar investments in the identified corridors. The ATCS will not evaluate the feasibility of streetcars in the identified corridors, but will instead rely on the results of the previously completed studies as well as upcoming Alternatives Analysis (AA) studies to aid decision makers in selecting the appropriate level of transit investment for these corridors.

Minneapolis Streetcar Feasibility Study

The City of Minneapolis completed a Streetcar Feasibility Study in December 2007, as a component of the city's Access Minneapolis Ten Year Transportation Plan. The study initially evaluated 14 "Primary Transit Network" (PTN) routes. Of the 14 PTN routes evaluated, 7 were recommended for the long-term streetcar network. The seven corridors are:

- West Broadway Avenue (Robbinsdale Transit Center to downtown via Washington Avenue)
- Hennepin Avenue South (downtown to Lake Street)
- Midtown Corridor (Southwest LRT to Hiawatha LRT)

- Nicollet Avenue South (downtown to 46th Street)
- University Avenue Southeast/4th Street Southeast (downtown to Stadium Village via East Hennepin Avenue)
- Chicago Avenue South (downtown to 38th Street- downtown via 9th/10th Street or Chicago/Washington Avenue)
- Central Avenue Northeast (downtown to 49th Avenue Northeast via Hennepin Avenue bridge)

In December 2010, the city was awarded a grant from the Federal Transit Administration (FTA) to evaluate transit improvements (either streetcar or enhanced bus) on Nicollet and Central avenues. The city is expected to initiate an AA for these corridors in late 2011.

Minneapolis Streetcar Funding Study

The City of Minneapolis completed a Streetcar Funding Study in March 2010. Initially, the study examined local funding alternatives for streetcars based on the assumption that the likelihood of obtaining federal funds for projects was remote. In 2009, a shift in federal policies placed a greater emphasis on livable communities and sustainable development. Based on this new direction, the FTA New Starts and Small Starts program rating criteria were revised to place a higher value on criteria related to livability, economic development, and environmental, social, and congestion relief benefits. The change in rating criteria allows streetcar projects a better opportunity to be more competitive for federal funding. The City of Minneapolis amended the original Funding Study to assume that 50 percent of the initial capital costs could be covered through federal programs.

Robert Street Transit Feasibility Study

Dakota County Regional Rail Authority (DCRRA) completed the Robert Street Transit Feasibility Study in November 2008. The study evaluated seven transit alternatives, including bus, streetcar, and LRT options. The long-term vision for the Robert Street corridor includes a transitway from downtown St. Paul to Rosemount; however, developing a robust, multi-faceted transit system for the corridor will take time and will require support by the communities in the corridor. DCRRA's recommended approach to moving towards the long-term vision is as follows:

- Build a foundation of transit ridership with expanded bus options
- Institute transit-oriented development (TOD) policies to transform corridor land use
- Develop dedicated sources of funding for transit operations and capital investments
- Amend federal transit funding criteria to recognize a wider range of public transit benefits[5]
- Develop a regional rail integration plan to define interfaces to other rail transit corridors and access to the downtown cores
- Develop public/private partnerships to promote corridor needs and opportunities

[5] In January 2010, the FTA proposed that new funding guidelines for major transit projects be based on livability issues such as economic development opportunities and environmental benefits, in addition to cost and time saved, which were previously the primary criteria. The FTA rescinded budget restrictions issued that focused primarily on how much a project shortened commute times in comparison to its cost.

In December 2010, DCRRA was awarded a grant from the FTA to evaluate transit improvements (either streetcar or enhanced bus) on Robert Street. The county is expected to initiate an AA for the Robert Street corridor in late 2011.