CROSS-COUNTY MetroLink Extension

Segment 1
Conceptual Design

Cross-County
MetroLink
Extension

Capital, Operating, and Maintenance Cost Estimation Methodology
Final Technical Report

Prepared for the
East-West Gateway Coordinating Council
in association with the
Bi-State Development Agency
Missouri Department of Transportation

By Parsons Transportation Group
and Associated Consultants

August 1999

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Contents

1 Purpose 1

2 Operating and Maintenance Costs 2

3 Capital Cost Estimation and Analysis 6

1
Purpose

This report addresses the methodology for estimating the capital, operating and maintenance costs of the planned Cross-County MetroLink Segment I Extension.

2
Operating and Maintenance Costs

Operating and maintenance costs (O&M) will be estimated for BSDA's (Bi-State Development Agency) bus and light rail system for the Cross-County Segment I Extension. These O&M costs will include both direct costs and all indirect, general and administrative expenses that vary with the types of changes to the bus and light rail system that will occur with this project. BSDA's other costs, including paratransit and indirect, general and administrative costs are not included in the detailed estimation process, and are instead assumed to increase with inflation. Note that these costs are calculated assuming that BSDA continues its current practices of directly operating both the bus system and the LRT system, while contracting for specific services.

The proposed methodology will represent a refinement of the labor buildup approach used on other recent major transportation planning projects and developed for a recent Bi-State System performance audit. This approach has been accepted as more realistic than other models based only on vehicle-miles, vehicle-hours, and fleet size. The methodology requires a detailed analysis of operating expense accounts by labor categories, materials, supply categories, etc. It is organized to reflect local experience regarding unit costs, wage rates, productivity levels and material costs, and data from other cities for specific rail and bus options.

The methodology will explicitly address the issue of uncertainty inherent in any approach to cost estimating. The cost items used, and service inputs to which they are allocated, are listed in Table 1 and Table 2 of this section. Note that the fixed and variable cost breakdown in the model is consistent with that used by many transit properties, as is the allocation of costs to service variables and the productivity factors.

TABLE ONE
BUS O&M MODEL: COST CATEGORIES AND ALLOCATION

COST CATEGORY	ALLOCATION
Administration & Scheduling	Fixed/Peak Vehicles
Operator Wages & Fringes	Peak/Off Peak Hours
Fuel & Lube	Miles
Tires & Tubes	Miles
Maintenance Administration-Vehicle	Fixed
Maintenance Administration-Non Vehicle	Fixed
Servicing Revenue Vehicles	Garage/Peak Vehicles
Repair of Revenue Vehicles	Miles
Repair of Service Vehicles	Miles
Maintenance Fare Collection Equipment	Peak Vehicles
Maintenance of Fixed Guideways	Fixed Guideway
Maintenance of Shelters	Shelters
Maintenance of Buildings and Grounds	Fixed/Garage
Maintenance of Communications System	Peak Vehicles
Ticketing and Fare Collection	Passenger Trips
General Administration	Fixed
System Security	Fixed/Peak Vehicles
Insurance	Fixed/Passenger Trips

TABLE TWO
LIGHT RAIL O&M MODEL: COST CATEGORIES AND ALLOCATION

COST CATEGORY	ALLOCATION
Administration & Scheduling	Fixed/Peak Trains
Operator Wages & Fringes	Total Train Hours
Fuel & Lube	Car Miles
Maintenance Administration-Vehicle	Fixed
Maintenance Administration-Non Vehicle	Fixed
Servicing Revenue Vehicles	Fixed/Cars
Repair of Revenue Vehicles	Car Miles
Revenue	Fixed/Stations
Maintenance Fare Collection Equipment	Stations
Maintenance of Fixed Guideways	Fixed/Track Miles
Maintenance of Stations	Stations
Maintenance of Buildings and Grounds	Fixed/Maint. Facility Size
Maint. of Signal/Communications System	Fixed/Track Miles
Ticketing and Fare Collection	Stations
General Administration	Fixed
System Security	Fixed/Stations
Insurance	Train Miles/Passenger Trips

An operating plan serves as the basis for all cost estimates. This plan is the source of service variables used in the model, and also allows the identification of additional adjustments that may need to be made to the cost estimate. With regard to the MetroLink Segment I cost estimate, this includes the need for supervisory and administrative positions resulting from the opening of a new maintenance facility in the Cross-County Corridor, over and above the number that would be required by an expansion of the existing Ewing Shop maintenance facility.

For MetroLink, the operating and maintenance costs are based on the operating plan set forth in Task 8 of this project. For the bus system, the operating plan is a continuation of the existing bus system, with those modifications as set forth in the operations plan. This plan is based on the Cross-County service beginning in year 2005 with eight (8) minute peak hour headways between Shrewsbury and Emerson Park, Illinois.

Costs and manpower requirements in the operating cost models will reflect the most current data available. The unit costs used in these models will be consistent with those for recent and current bus operations and LRT system operations. The major sources of these unit costs will be actual experience from current LRT and bus transit operations of BSDA, taking into account changes in efficiency associated with the new services being proposed, experience on similar systems elsewhere, and industry standards and averages adjusted for the St. Louis area operating environment. The final steps in the estimation procedure will include, if appropriate, the addition of other costs such as those from feeder systems or nonrevenue operations.

3
Capital Cost Estimation and Analysis

The Cross-County Corridor Extension - Segment I will be broken down into a number of smaller line segments for cost estimate itemization. Line segments will begin and end at a passenger station or other definitive landmark. For example, a segment will extend from the Forest Park Station to the Skinker Station. A list of segments is compiled in Table 3. For each segment there may be contrasting types of construction required for each respective MetroLink alternative. These construction cost differences can be readily compared when they are presented on a smaller segment type basis. Specific costs for items such as earthwork, retaining walls, utility relocation and traffic signal alterations will vary throughout the corridor. By breaking down the corridor into small segments each specific cost component may be adjusted according to its actual application. For example, the cost for earth excavation may be considerably higher in the Clayton CBD than along the CMT right-of-way. If typical unit cost rates were applied uniformly across the corridor, this particular construction cost item would be overstated or understated.

Capital cost will be calculated and assigned to the following five major cost categories: facilities, stations, systems, vehicles, and design and management.

Facilities Cost

This category includes components required to construct the guideway and related maintenance facilities.

TABLE THREE

Cross-County Corridor Segments
For At-Grade Alignment Options

1.	Forest Park Station (Sta. 10+00)	to	500' East of Skinker (Sta. 67+00)
2.	500' East of Skinker (Sta. 67+00)	to	500' East of Big Bend (Sta. 109+00)
3.	500' East of Big Bend (Sta. 109+00)	to	Pershing (Sta. 133+00)
4.	Pershing (Sta. 133+00)	to	E. Clayton (Bally's) (Sta. 150+00)
5.	E. Clayton (Bally's) (Sta. 150+00)	to	300' West of Hanley Road (Sta. 176+00)
6.	300' West of Hanley Road (Sta. 176+00)	to	Meramec Avenue (Sta. 188+00)
7.	Meramec Avenue (Sta. 188+00)	to	Shaw Park Drive (Sta. 202+00)
8.	Shaw Park Drive (Sta. 202+00)	to	CMT Right-of-Way (Sta. 225+00) (Behind the County Garage Complex)
9.	CMT Right-of-Way (Sta. 225+00) (Behind the County Garage Complex)	to	Linden Avenue (Sta. 267+00)
10.	Linden Avenue (Sta. 267+00)	to	Eager Road (Sta. 286+00)
11.	Eager Road (Sta. 286+00)	to	Manchester Boulevard (Sta. 248+00)
12.	Manchester Boulevard (Sta. 248+00)	to	Union Pacific Railroad (Sta. 285+00)
13.	Union Pacific Railroad (Sta. 285+00)	to	Lansdowne Avenue (Sta. 438+00)

<u>For Underground Alignment Option</u>

14.	Meramec Avenue (Sta. 188+00) Note: Replaces Segments 7, 8 & 9	to	Linden Avenue (Sta. 267+00)

<u>For Elevated Alignment Option</u>

15.	E. Clayton (Bally's) (Sta. 150+00) Note: Replaces Segments 5, 6 & 7	to	Shaw Park Drive (Sta. 202+00)

- **Guideway.** This item includes clearing, site preparation, earthwork, drainage, roadway paving, bridges, tunnels, underpasses, etc. This item is estimated on a per-linear-feet basis applying a variety of unit cost sections for each specific type of construction.

- **Trackwork.** This item includes all running rail, ties, ballast and special trackwork along the guideway as well as the trackwork in the maintenance yard. This item is estimated on a per-linear-feet basis for rail and a lump sum allocation for special trackwork.

- **Right-of-Way Acquisition.** This item covers all activities necessary to ensure the timely availability of the property or right-of-way for the construction of the project, including: the approval and certification of the required real estate, title work, appraisals, consulting fees, negotiations and acquisition, condemnation, and relocation. This item is based on a preliminary determination of required acquisitions for the guideway alignments and station areas. County tax assessor records will be reviewed to determine assessed values. The value representing the "cost of acquisition" will be calculated using the method prescribed by St. Louis and St. Louis County in determining the approximate fair market value and modified on a site specific basis.

- **Utility Relocation.** This item includes the relocation of existing service utilities (water, sewer, electric, gas, etc.) which would be in conflict with construction of the guideway or station areas. This item will be estimated for each specific utility.

- **Hazardous Waste Clean-Up.** In general, the cost of environmental cleanup of a property is the responsibility of the owner prior to sale of any property. Thus the cost for cleanup and remediation can be included in the final negotiated settlement in the acquisition of a particular property. However, this item will be included in the project cost as a contingency item for unknown and unexpected situations. This item will be estimated as an allocation on a per mile basis.

- **Maintenance Facilities.** This item includes all site preparation, utilities, building construction, roadway paving, landscaping, vehicles, and maintenance equipment for both bus and rail maintenance and vehicle storage facilities.

Stations

This category includes components required for the construction of passenger station facilities.

- **Bus Stops.** This item includes bus shelters, sidewalks, and roadway paving improvements for the typical curbside bus stop along local roadways.

- **LRT/Busway Stations.** This item includes site preparation and construction of the guideway stations (busway and LRT), including: station platforms, sidewalks, canopies, elevators, stairs, pedestrian walkways, seating, windscreens, signage, electrical and mechanical support systems, and earthwork, paving and drainage for park-and-ride lots.

Systems

This category includes components required to power, communicate, and control the light rail transit alternative.

- **Traction Power.** This item includes the purchase, construction, and installation of traction power distribution system equipment and facilities, including: overhead wires, poles, foundations, bracket arms, grounding rod, prefabricated and unitized substations, grounding mats, and dual AC power feed connections. This element will be estimated on a per mile basis.

- **Signals and Communications.** This item includes the purchase, associated construction, and installation of railway block signaling and highway grade crossing protection devices. Also included is the associated construction and installation of a communications system for central control communication functions, train operation, administrative telephone service, public address system, closed-circuit television, fire alarm, and emergency telephone systems, including remote intrusion detectors and alarms. This element will be estimated on an actual cost basis.

- **Fare Collection.** This item includes the procurement and installation of ticket vending machines (TVMs) and validation equipment at LRT stations. This element will be estimated on a per station basis.

Vehicles

- **Buses.** This item includes the purchases of transit bus vehicles for the Forest Park Circulator Service. The cost of buses will be estimated based on vehicle manufacturers data.

- **Light Rail Transit Vehicles.** This item includes the purchase of light rail transit vehicles similar to existing LRVs in the MetroLink fleet. The item covers the manufacturer's design, fabrication, component and subsystem testing, off-site and on-site LRV testing, delivery, and warranties. The number of required LRVs will be determined by the level of service and operations provided. A 15 percent spare ratio will be included in the determination of the fleet size. This element will be estimated based on recent vehicle purchases by BSDA.

Design and Management

The following components included in this cost category are individually calculated using typical percentage rates applied to construction, equipment, and right-of-way costs. The combined percentage applied to the base is approximately 29 percent.

- **Engineering.** This item includes the development of preliminary and final engineering designs, the preparation of construction and bidding documents, and technical support during the construction of the project. This item will be estimated at approximately 12 percent of the construction cost.

- **Project/Construction Management.** This item includes project and construction management service during the design and construction phases of the project. Principal elements of this category are: overall program management of design, construction, procurement, real estate acquisition scheduling and budgeting, permitting, testing and start-up. This item will be estimated at approximately 6 percent of the construction cost.

- **Project Administration.** This item includes support of the agency/owner's staff positions for the duration of the design and construction phases of the project. These cost items, include: salaries, fringes, supplies, materials, office furnishings, equipment, copies, computers, fax machines, telephones, and other miscellaneous items. This item will be estimated at approximately 6 percent of the construction cost.

- **Testing and Start-Up.** This item includes systems testing, operator training, planning and build-up of the agency/owner's operating staff and safety certification of the system. Also included is the development of public information and advertising programs addressing safety awareness, system information, tours, and ceremonies. This item will be estimated at approximately 1 percent of the construction cost.

- **Legal.** This item includes the cost to provide the owner/agency with legal services during the design and construction of the project. Legal services are generally required for the acquisition of property and right-of-way via agreements or condemnation; preparation and negotiation of easements, agreements with inter-governmental agencies, and permit applications; potential litigation resulting from construction claims and injuries, as well as other miscellaneous lawsuits. This item will be estimated at approximately 2 percent of the construction cost.

- **Insurance.** This item includes the cost of acquisiting various insurance policies to protect the agency/owner's interests, rights, property, and liabilities. Generally, the insurance requirements include builder's risk, railroad protection, general liability, automobile liability, workmen's compensation, and employer's liability. This item will be estimated at approximately 2 percent of the construction cost.

The conceptual alignment plan and profile drawings showing horizontal and vertical alignments for each Cross-County option will be the basis for determining all quantities and types of work. Trackwork, bridge structures, retaining walls, excavation, cut and cover, tunneling, utilities, electrification and power distribution, signals, stations, park and ride lots, street improvements,

right-of-way acquisition, communication and control systems, yards and shops are among the components that will be identified, measured, and estimated by the appropriate unit cost values.

The Bi-State Development Agency (BSDA) has an excellent source of capital cost data from their construction of the existing MetroLink system from East St. Louis to Lambert Airport and the current St. Clair County Extension work. The capital cost estimating procedures will strongly reflect and rely on these data from BSDA. Some major considerations of this methodology are:

- Capital cost estimates will be developed to an equivalent level of precision for all alternatives, and will draw on the BSDA cost data for unit cost factors where possible.

- All data requirements and anticipated data sources will be documented to assist the engineering tasks in producing results compatible with the cost-estimating procedures, and to identify early on all outside data requirements.

- Cost categories and physical unit categories will be defined on a preliminary basis, to guide execution of the various design tasks of the study.

- The Consumer Price Index will be included as the "baseline" rate of inflation.

- Two "market basket" indices will be considered in estimating the construction costs; the Engineering News Record (ENR) construction cost index (CCI) and the building cost index (BCI). The two indices differ in terms of the relative amounts of skilled labor, unskilled labor, and building materials. The cost estimates will assume that construction costs will inflate at a rate equivalent to the average of the CCI and BCI inflation rates.

- At the conceptual level of design, a typical contingency amount of 20% will be applied uniformly to all of the capital cost estimates.

The final product will provide a detailed estimate of capital costs for the construction of the alternatives designed for the Cross-County MetroLink Segment I Extension as identified in the conceptual design.