Cross County MetroLink
Strategic Alignment Analysis

DRAFT FOR PUBLIC DISCUSSION

Prepared for and in cooperation with

East-West Gateway Coordinating Council

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I. INTRODUCTION

Since 1993, MetroLink, St. Louis' regional light rail transit system, has been performing at levels that surpass the most optimistic planning estimates. The success of MetroLink has prompted the first expansion of the system in St. Clair County and has raised expectations for an ongoing program of growth. The corridor now designated for MetroLink expansion was first defined in a 1991 regional transportation study by the East-West Gateway Coordinating Council. Termed the Cross-County Corridor, it combines both east-west and north-south transportation corridors that link major employment centers (Clayton and Downtown St. Louis) and connects these to suburban residential neighborhoods (see Figure 1). Growing levels of highway congestion, constraints on the parking supply and the absence of a competitive alternative to automobile travel in this corridor made this the next priority for MetroLink expansion.

The region launched a Major Transportation Investment Analysis (MTIA) study[1] in 1995 to identify and investigate a range of transportation options to address transportation problems in the Cross-County Corridor. Led jointly by East-West Gateway, the Missouri Department of Transportation, and the Bi-State Development Agency, the MTIA process included an extensive public outreach effort to involve local communities and the public in the planning process. The public involvement program confirmed the desire to expand MetroLink in this corridor.

It has since been recognized that the traditional approach to rail transit expansion programs (i.e. a process of staged planning, design and construction activities funded in part by the Federal Transit Administration (FTA)) would be a major constraint in moving the Cross-County program ahead on an aggressive timetable. Earlier commitments not to compete with federal funding requests for the St. Clair expansion will limit the region's ability to access federal "New Start" funds for a Missouri project until after the St. Clair project is substantially funded, probably around 2003. However, local funds from the dedicated one-quarter cent sales tax in St. Louis City and County would be available and could provide funding to build a sizeable portion of a MetroLink extension in the Cross-County Corridor. The sense of urgency to make effective use of local funding sources to deal with corridor transportation problems and to maximize the impact a transit investment could have were confirmed in the MTIA study.

Following federal guidelines for Major Investment Studies, a range of improvement options were considered in the Cross-County MTIA. Highway, transit, and transportation system management (TSM) programs and projects were discussed and evaluated. In March 1997, the East-West Gateway Coordinating Council Board of Directors adopted the recommendations of the Study Management Group and approved a series of improvement strategies for the Cross-County Corridor. These improvements constitute a "Locally Preferred Alternative" in FTA terms and include the following:

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[1]The MTIA is a federally prescribed analysis of transportation alternatives, known generically as a Major Investment Study. Such studies are required to qualify for federal capital funding.

- I-170 (North) highway interchange improvements
  - Forest Park, Ladue, Delmar, Olive, Page and I-270
  - Lane addition: Scudder to I-270

- I-64 (East) highway interchange improvements
  - Brentwood/I-170/Hanley, Big Bend, McCausland/Clayton/ Oakland, Hampton, Kingshighway, Tower Grove
  - Auxiliary lanes

- I-64 (West) highway interchange improvements and lane additions
  - McKnight, Clayton, Lindbergh, Spoede
  - Lane addition: I-170 to Spoede

- MetroLink expansion
  - Stage 1: Existing MetroLink to Clayton and south to Butler Hill Road
  - Stage 2: Clayton north to I-270/Florissant

The specific strategies (above) that involve MetroLink expansion did not fully answer important questions with respect to:

- What specific alignment should MetroLink use?

- What would be the actual cost and staging of MetroLink expansion?

- To what length can MetroLink be extended with local funds?

- What financing options would provide the best opportunities to continue MetroLink expansion beyond the Cross-County Corridor?

- What would be the first operating segment and when would it be open for revenue service?

In addition, a number of concerns were raised regarding the impact of MetroLink in areas where the MTIA study proposed route alignments. Issues such as traffic and parking around stations, noise, safety, and property values all required attention. An understanding of these impacts along with funding strategies and cost-effectiveness is needed to provide a basis for the East-West Gateway Coordinating Council Board to come to closure on the implementation plan for MetroLink expansion. It is the purpose of this Strategic Alignment Analysis to develop the information needed for the Board of Directors to authorize the construction of the first operating segment for MetroLink in the Cross-County Corridor.

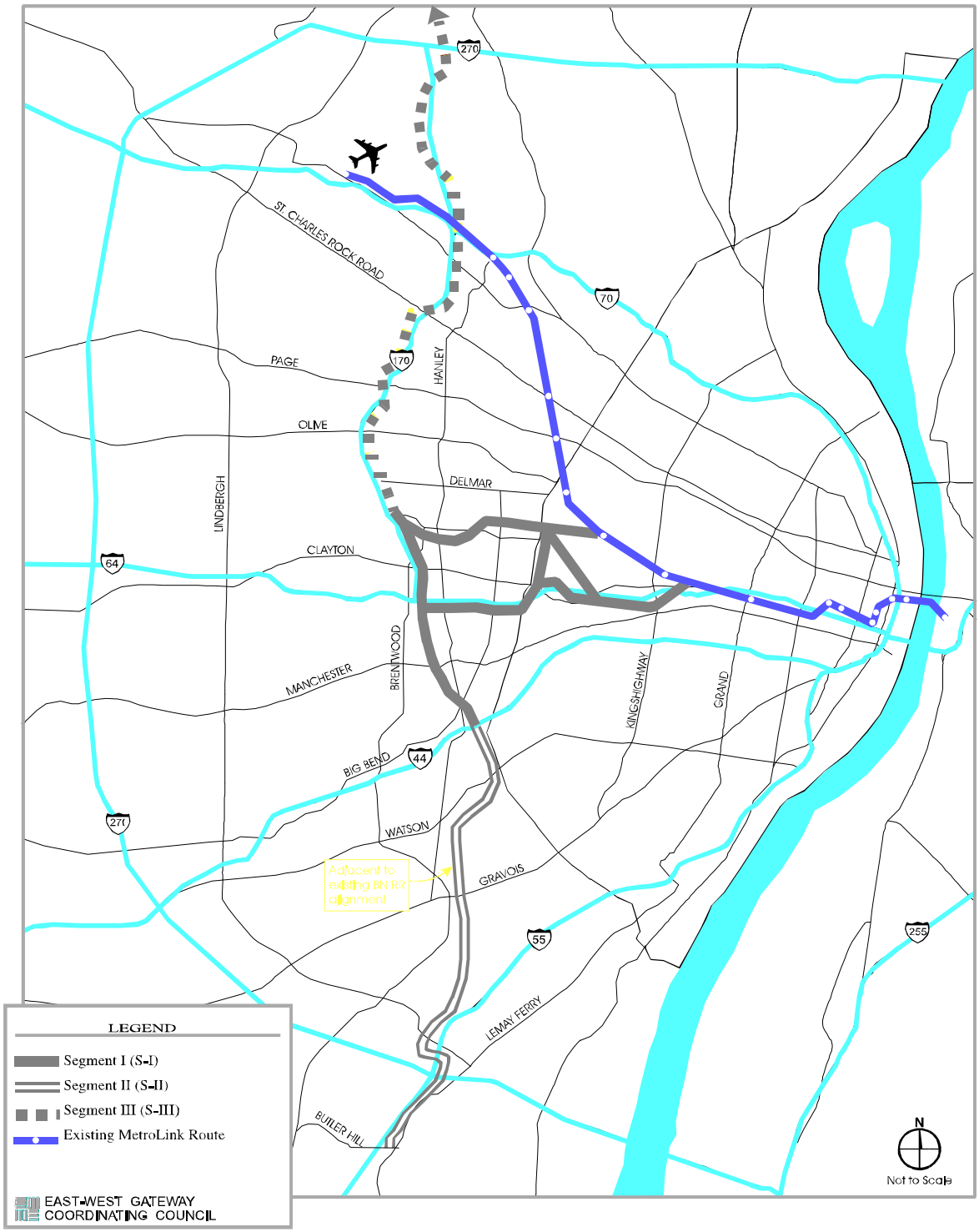

Figure 1
Cross-County Corridor
MetroLink Route Segments

The process by which the information is being developed to guide this decision is illustrated in Figure 2. This process builds on the policy objectives and the decisions already made as part of the MTIA. Ultimately, the purpose of the evaluation process is to define the choices available to the region's local elected officials and to clarify the consequences of those choices. In doing so, a careful review of the technical products of the MTIA was done. New revenue and cost estimates were prepared. The technical review and cost information was used to reduce the number of alternatives to two. The remaining two alternatives were more closely analyzed. Based on this analysis, a financial plan was developed. Since the financial plan revealed a need to contain costs to maximize potential to further expand MetroLink beyond the first operating segment, additional analysis was done to determine the most effective ways to reduce costs. Finally, implementation issues were reviewed.

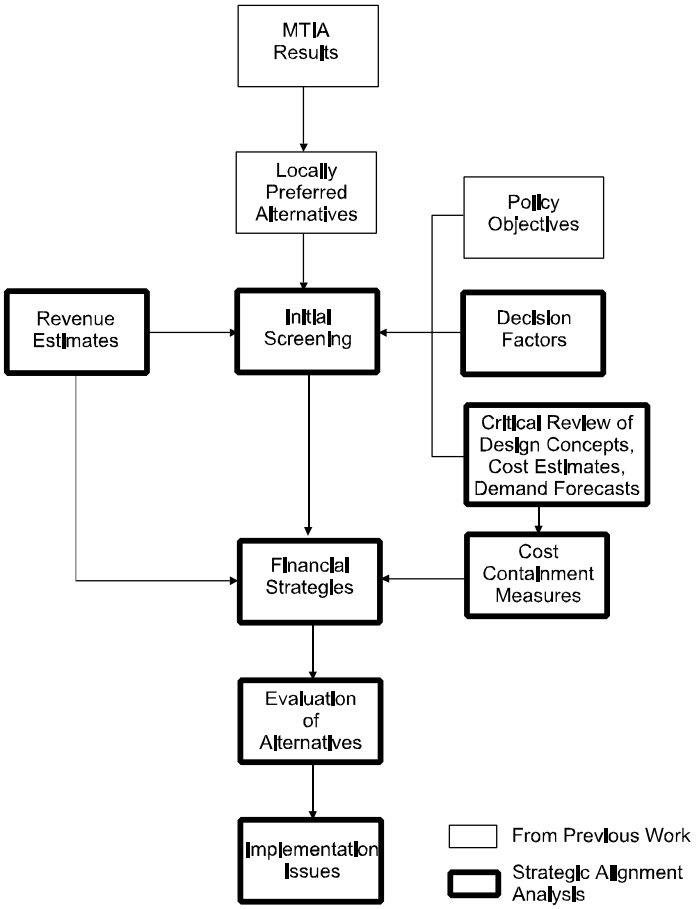

Figure 2
Strategic Alignment Analysis

This report makes no recommendation. In fact, there is no *wrong* decision. Each of the alternatives will be a positive addition to the already successful MetroLink system and will reinforce the strategic core of the region. There are however, significant physical and financial differences among the alternatives which will affect the future expansion of MetroLink. The purpose of this report is to make those differences apparent and to explore the long term consequences of the choices which are made now.

Definition of Terms

Throughout this report a number of terms are used to describe various routes, parts of routes and alternatives. In order to minimize confusion these are defined as follows:

1. Phase I MetroLink expansion refers to the expansion of the system currently underway in St. Clair County with termini in East St. Louis and Mid-America Airport.

2. Phase II MetroLink expansion is the full extent of the Cross-County Corridor to Clayton, Florissant and Butler Hill Road in St. Louis County shown in Figure 1.

3. Operating segments are discrete portions of the Cross-County Corridor, sequenced in their likely order of development, e.g. Segment I (S-I) runs westward from MetroLink in to Clayton and south to I-44, Segment II (S-II) extends from I-44 south to Butler Hill Road, and Segment III (S-III) extends from Clayton to Florissant. See Figure 3 for an illustration of these segments.

4. Alignments or routes are specific, reasonably defined locations for MetroLink operation. Within segment S-I four alternative alignments were proposed in the MTIA. These are shown schematically in Figure 4 and are labeled S-IA, S-IB, S-IC and S-ID.

II. OVERVIEW OF THE DECISION PROCESS

A. The Goal of this Decision Process

The goal of the current decision process is to choose the first operating segment (S-I) of MetroLink in the Cross-County Corridor, with an understanding of how this decision affects choices for future phases of MetroLink expansion.

Four alternate routes were identified in the MTIA to meet the region's strategic mobility, economic development and regional development goals. Each of these alternatives will:

- Yield substantial mobility benefits to residents of both the City and County.
- Reinforce downtown St. Louis as the region's center.
- Reinforce the central corridor by making the strategic linkage between the region's two largest employment centers — downtown St. Louis and downtown Clayton.
- Bring MetroLink to south and later north St. Louis County, although on a different time schedule. The ability to further expand the system varies among the S-I alternatives, depending on their location, design and cost.

However, there are important differences between the alternatives, and those differences may play an important role in the decision. It is also important to recognize that there are a number of project features or characteristics that are *not* a part of this route decision. Important *design features* of the project, including precise alignments, construction methods, and plans for station design, circulation and access, will be developed and decided upon during the preliminary engineering phase after this initial S-I decision is made.

B. Policy Objectives to Guide the Decision

The East-West Gateway Coordinating Council stands on the threshold of a decision that will be of critical importance in shaping the St. Louis region and in determining the future of the MetroLink system. Inevitably, such a decision is guided by a variety of objectives. Based on discussions with elected officials, agency staffs, and business and community groups, the following appear to be the most important policy objectives to weigh when making this decision:

- Build the First Operating Segment (S-I) as Quickly as Possible

The alternatives being considered are in the $300 to $700 million range, and even though rates of inflation are low, the cost of delay is substantial. At a 3.5% annual inflation rate, every month that goes by without a decision being made increases project costs by as much as $2 million.

But the importance of progressing quickly with MetroLink expansion goes beyond cost inflation. When voters approved the first Proposition M one-quarter cent sales tax, it was an echo of the tremendous success enjoyed by MetroLink to-date. Voters were expressing their wish that the system be expanded, and they placed their trust in the region's leaders to achieve that goal as quickly as possible. To maintain that trust, it is crucial that real and visible progress be made. This project route decision will be the first signpost that the taxpaying public can refer to on the road to the future of MetroLink.

- Build the First Operating Segment (S-I) Without Federal Funds.

Federal policy and current MetroLink commitments preclude the possibility of building this MetroLink extension in the near term with federal funds. Given the completion schedule of the St. Clair extension in Illinois, and the need to move quickly in the Cross-County Corridor, the only option to advance the project is to build segment S-I without federal funds.

	Years			
Funding Source	**1998-2004**	**2005-2010**	**2011-2015**	**Total**
Existing Prop. M Tax Receipts Available for MetroLink Expansion[2]	$262	$209	$185	$657
Additional ¼¢ Prop. M Tax Collections Beginning Mid-1998	$303	$322	$285	$911
Total Prop. M Revenues	$566	$531	$471	$1,568
Potential Federal Funds Available for MetroLink Expansion[3]	$4-$24	$245-$270	$0-$45	$294
Total Projected Funding	**$569-$589**	**$776-$801**	**$471-$516**	**$1,861**

Table 1
Projected Sources of Funding for MetroLink Expansion: 1998-2015 ($millions)[4]

The inability to use federal funds in the near term, coupled with the lack of a state funding program for transit capital improvements, means that segment S-I will have to be built with local funds. The only available local source of revenue for the construction program is the one-quarter

[2]Reflects 65 percent of existing Prop. M receipts being dedicated to MetroLink expansion and includes a $51 million reserve from existing Prop. M available on January 1, 1998.

[3]Federal funds are not anticipated to be available until 2004, after the completion of the St. Clair MetroLink extension. Timing of projected federal funds vary slightly based on route selection.

[4]Funds available to cover the construction costs and operating subsidies for MetroLink expansions.

cent sales tax collected in the City of St. Louis and St. Louis County. The tax currently raises between $42 and $43 million a year, two-thirds of which is now dedicated to MetroLink expansion. While a significant sum, it is far short of what is needed to construct and operate any of the S-I alignments as specified in the MTIA, even by borrowing. In the absence of cost-containment measures, additional sources of local funds will be necessary to build any of the S-I options and to construct the other MetroLink segments in the Cross-County Corridor.

- Select an Alignment That Is Consistent with Existing and Planned Land Uses.

Fixed transportation infrastructure investments, be they highway or rail, have the *potential* to both shape and reinforce a region's land uses, its patterns of settlement, economic development and recreation[5,6]. The St. Louis region is already experiencing first hand how MetroLink can serve economic development and community goals. The relationship of transportation and land use is undeniable, and thus it is important that it be considered when planning this and future MetroLink extensions.

- Extend MetroLink, at a Minimum, to I-44 Through Clayton.

Based on the MTIA analysis, and on additional considerations such as the desire to reinforce the downtown St. Louis-to-Clayton corridor as the region's economic and cultural core, the East-West Gateway Coordinating Council's Board of Directors has decided that the first operating segment of the Cross-County MetroLink extension should reach at least to I-44 via Clayton. This is referred to in this report as segment S-I or the first operating segment.

- Plan Ahead for Future MetroLink Extensions.

In planning any transportation system, it is important that future options and flexibilities be maintained to the degree possible. One implication is that S-I should be developed with *cost-effectiveness* in mind. In many other American cities, the costs of rail systems have soared as nonessential features and "betterments" have been added. All too often, this has limited a region's fiscal capacity to undertake future expansions without materially improving the level or quality of service on the line being built. MetroLink is one of the most cost-effective examples of high quality transit service. The principles which led to the development and success of MetroLink should be extended to future expansion.

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[5] Transportation Research Board, The Role of Transit in Creating Livable Metropolitan Communities (Transportation Cooperative Research Program Report 22), 1997.

[6] Transportation Research Board, Transit and Urban Form (Vols. 1,2: Transportation Cooperative Research Program Report 16), 1996.

- Develop Financial Plans That Are Fiscally Responsible and Maximize the Opportunity for Participation by Others.

For reasons cited above, it is not envisioned that federal funds will be used for the development of the first operating segment. The need to stretch available funding as far as possible dictates that every opportunity to tap other resources be explored. In general, these opportunities fall into two categories:

- Financial participation by local jurisdictions for system betterments, or by local agreement on less costly design features.

- Participation by the private sector, via right-of-way contribution, assumption of certain costs that would otherwise be borne by the project, or joint development agreements to generate up-front cash, an on-going revenue stream, and/or increased ridership and fare revenue once the system is open.

Preliminary discussions with public and private interests in the S-I subcorridor have identified a number of potential opportunities, particularly for in-kind contributions. The opportunity for cash participation appears limited.

C. Decision Considerations

In making the alignment decision, it is helpful to consider the following:

- MetroLink is not a stand-alone system. Rather, it is one part of a larger system of buses, paratransit and roads which work together to provide access to employment, recreational and cultural opportunities.

- A decision on the alignment in segment S-I of the Cross-County MetroLink expansion is also not stand-alone, but may involve other mobility- and access-related investments and decisions. For example:

  – MetroLink is not the only means of providing access to important activity centers;

  – The mobility of many residents of the City and County is dependent on the bus system as much or more than it is on MetroLink;

  – The MetroLink decision may also properly involve related investments which achieve these same fundamental goals of mobility and access.

III. REVIEW OF ALTERNATIVES

The timely implementation of the MetroLink extension in the Cross-County Corridor requires a better definition of the project. The East-West Gateway Board has already determined that the portion of the Cross-County Corridor to Clayton and Butler Hill Road will be developed first. Financial constraints dictate that the extension to south St. Louis County must be phased to coincide with available local funds. Therefore, the first part of the project definition is to divide the first stage of the corridor into two operating segments. The goal of the first operating segment (S-I) is to extend MetroLink from the existing line through Clayton as far south as I-44. The next operating segment (S-II) will extend the line to Butler Hill Road. Future segments will complete the Cross-County Corridor by extending MetroLink north from Clayton (see Figure 1).

The objective for the immediate future is to build the most cost-effective, buildable, and compatible alignment alternative in segment S-I that can be financed from available local funds. The alignment choices presented in the Locally Preferred Alternative approved by the East-West Gateway Board are the result of an extensive analysis and evaluation process. A review of the results of the MTIA reports indicates that the unit cost data and impact estimates of these alignments are, for the most part, reasonable (exceptions are noted in this report) and consistent with industry standards. MTIA documents, subsequent public comments, and meetings with elected and appointed officials and the public were used as part of this evaluation.

The MTIA study identified four potential alignment options for segment S-I. These alignments are illustrated conceptually in Figure 3. In the north-south section of the segment, the rail right-of-way (now owned by Citizens for Modern Transit (CMT)) was the single alignment identified between Clayton and I-44 and is common to all alternatives. The alignment alternatives differ substantially in cost and impact.

In the east-west section of S-I, the MTIA alternatives included the following:

A. "North of Forest Park" (alignment S-IA) - from the Forest Park Station, the alignment generally follows Forest Park Parkway and Millbrook Boulevard west to Clayton, then Carondelet Avenue, through Shaw Park to the CMT right-of-way.

B. "Through Forest Park" (alignment S-IB) - from the MetroLink Central West End station south across I-64 to Oakland Avenue, following Oakland Avenue to Hampton Boulevard, where it crosses I-64 to a tunnel under Forest Park, to the northwest corner at Skinker where it meets alignment S-IA. (Millbrook and Forest Park Parkway to Carondelet Avenue through Shaw Park to the CMT right-of-way).

C. "South via Skinker Boulevard" (alignment S-IC) - from the MetroLink Central West End station south across I-64 to Oakland Avenue, following Oakland Avenue to Skinker Boulevard, then north following Skinker Boulevard to the alignment in Millbrook and Forest Park Parkway as in S-IA and S-1B.

D. “South via I-64" (alignment S-ID) - from the MetroLink Central West End Station south across I-64, following Oakland Avenue and I-64 to the I-170 corridor, then north in the CMT right-of-way to Shaw Park, and into Clayton.

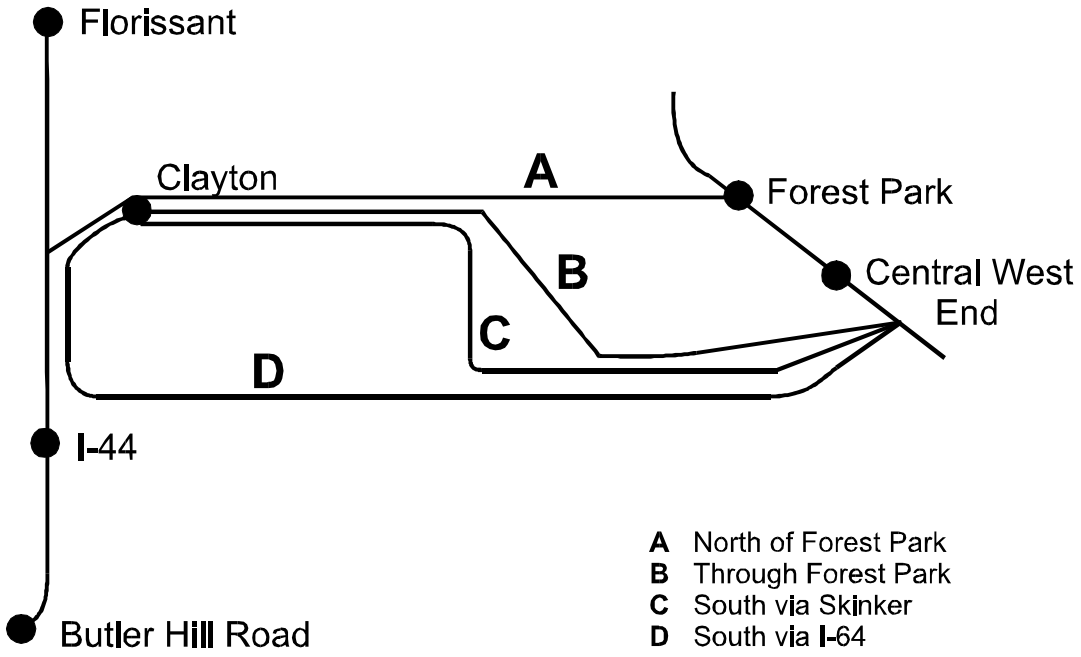

Figure 3
Alternative Alignments in Segment I of the Cross-County Corridor

Within each of these alignment alternatives there are various conceptual designs proposed in the MTIA documents. For the purposes of this initial screening, the following were used:

- Along Forest Park Parkway and Millbrook - cut and cover tunnel[7] from the Forest Park Station to Skinker and Big Bend to Clayton and open cut[8] between Skinker and Big Bend;
- Forsyth to Hanley (Clayton) - open cut;
- Carondelet (Clayton) - cut and cover and bored tunnel[9];

[7] Cut and cover is a construction technique for building a light-rail tunnel by excavating a trench, building a floor and walls, installing the trackwork, electrical and ventilation systems and then covering the top and restoring the ground surface.

[8] An open cut is a trench which is excavated in the ground and left open. It may include retaining walls.

[9] Boring is a construction technique for building a tunnel underground using machines which dig the tunnel horizontally without disturbing the ground surface.

- Shaw Park - bored tunnel;
- Oakland Avenue - at grade;
- Through Forest Park - bored tunnel;
- South of Central West End Station (Euclid Avenue) - cut and cover tunnel;
- Along Skinker - cut and cover tunnel;
- Along I-64 - at grade and elevated on structure;
- In the CMT right-of-way - at grade.

The information presented in Table 2**,** taken from the MTIA analysis, summarizes the essential statistics with respect to the four alignments.

Measure	**S-IA. N. of Forest Park**	**S-IB Thru Forest Park**	**S-IC Skinker**	**S-ID I-64**
Capital Cost ($Millions)	$348-$422	$542-$599	$506-$555	$453-$519
Annual Operating Cost ($Millions)	$13.5	$14.9	$15.3	$14.6
Daily Passengers	25,800	23,600	23,100	23,600
Route Miles	7.5	9.9	10.4	9.0
Capital Cost/Mile ($Million)	$46.4-$56.3	$54.7-$60.5	$48.6-$53.4	$50.3-$57.7
Annualized Cost/Passenger ($)	$4.48-$5.12	$7.17-$7.73	$6.96-$7.45	$6.17-$6.82

Table 2
Performance Measures for S-I -- Unadjusted MTIA Data
Existing Metrolink to I-44 via Clayton

Analysis of these alignments and MTIA Technical Reports resulted in modifications to the MTIA documentation. A number of revisions were made to improve the internal consistency of the MTIA analysis:

- Increased estimates of ridership generated by the direct rail service to the institutions south of Forest Park and in the park itself. The patronage model may have understated the potential ridership by 1700 passengers daily.

- Revised costs to be consistent with project scope described in the MTIA documents and to be consistent between alternatives.

- Corrected costs for building a maintenance yard/shop facility.

- Increased costs to accommodate the River Des Peres tunnel that crosses Forest Park Parkway. This will require reconstruction of the Parkway, Des Peres Avenue, and surrounding areas to raise the streets by approximately eight feet to keep the rail line in an open cut or more than eight feet for a cut and cover tunnel. An additional budget of $1.5 million has been included to pay for street reconstruction and private property improvements.

- Euclid Avenue, the proposed alignment south from the Central West End Station, is not a feasible route due to the utilities under the street and the impact on the hospital and surrounding land uses. The modified alignment leaves the existing line east of the Central West End Station, near Boyle Avenue.

These changes resulted in the adjusted MTIA capital cost estimates and performance statistics shown in Table 3.

In addition, the design concepts described in the MTIA were reviewed for reasonableness. This review resulted in further changes to capital cost estimates. These estimates were used to construct the financial strategies described in Section IV of this report. The following summarizes the principal suggested modifications to the project described in the MTIA:

- The Forest Park tunnel option (a bored tunnel below Forest Park) was investigated by others[10] to determine if specific alignments and less expensive construction methods could reduce the costs of the alternative (approximately $80 million savings).

- The open cut section between Skinker and Big Bend in the MTIA was changed to cut and cover tunnel to be consistent with the other sections along Forest Park Parkway, Millbrook Boulevard and through Clayton ($21 million added).

- The stations at Big Bend and at Hanley Road were changed from open cut to cut and cover to conform with the design of the line at those points and along the rest of the alignment ($11 million added).

- In order to protect the long term operational capacity of the MetroLink system, grade-separated wyes were added at the locations where the new alignments leave the existing line ($4 million added in S-IA; $9 million added in other alignments).

- A new station was added on the existing line at Boyle for all of the alternative alignments that branch off at this point (S-IB, S-IC, S-ID). This would serve as the transfer station for MetroLink passengers travelling from Clayton to the airport. The new alignment through the Central West End was also revised somewhat to be more direct but to require the purchase of more private right-of-way ($10 million added in all alignments but S-IA).

[10] Sverdurp Civil, MetroLink Alignment Options through Forest Park: Feasibility and Costing Data Study, August 14, 1997.

The above design changes are reflected in the high cost design alternatives for each of the alignments used as input to the financial analysis in Section IV of this report (see Tables 6-8).

Measure	S-IA N. of ForestPark	S-IB Thru Forest Park	S-IC Skinker	S-ID I-64
Capital Cost ($Millions)	$462.	$619.	$559.	$532.
Annual Operating Cost ($Millions)	$11.9	$13.3	$14.0	$14.8
Daily Passengers	25,800	25,300	24,800	25,300
Route Miles	7.5	9.9	10.4	9.0
Capital Cost/Mile ($Million)	$61.6	$62.5	$53.8	$59.1
Annualized Cost/Passenger ($)	$5.46	$7.16	$7.33	$6.54

Table 3
Performance Measures for S-I -- Adjusted MTIA Data
Existing Metrolink to I-44 via Clayton

A comparison of the four alternatives, based on the major community goals for the MetroLink extension, indicates that alignments "North of Forest Park" (S-IA) and "Through Forest Park" (S-IB) are the most promising. The comparative analysis presented in Figure 4 summarizes the evaluation of the four alignment alternatives.

The most significant factors that support the conclusion that Alignments S-IA and S-IB are the most promising include:

- The earlier construction schedule of alignment S-IA, due to the fact that the line does not involve Interstate highway crossings that could lengthen the design approval process.

- The lower capital cost of the S-IA alignment.

- The improved access to Forest Park and regional activity centers for residents of south St. Louis County resulting from S-IA and S-IB.

- The impact on neighborhoods both in construction and operation phases is minimized in S-IA and S-IB, while it is a negative factor in the S-IC and S-ID. Disruption to the neighborhoods on the west side of Skinker Boulevard (not protected by large setbacks and with mature vegetation), to the parkland on the east side, and to automobile traffic on the major north-

south arterial street makes the S-IC alignment less attractive, while the likely need to acquire properties on the south side of I-64 in S-ID results in strong public and political opposition.

- A very unfavorable location adjacent to a major freeway also contributes to the lower ranking of alignment S-ID. Such a location would severely limit access to MetroLink and impair development opportunities.

- Alignment S-ID provides an indirect and circuitous route between the two major regional centers, St. Louis and Clayton, and will pose future operating constraints by introducing another branch of MetroLink at the CMT right-of-way. The capacity and attractiveness of MetroLink in the Cross-County Corridor will be significantly reduced by the indirect routing.

Initial Measures	Alt. S-IA North of the Park	Alt. S-IB S. Park via Park Tunnel	Alt. S-IC S. Park via Skinker	Alt. S-ID S. Park via I-64
Transportation Improvement				
● Ridership	◒	◒	◒	◒
● Network Completion Schedule	●	◒	○	○
Economic Vitality				
● Cost (Capital)	●	○	○	○
● Impact on Future Funding	◒	○	○	○
● Support Local Planning Goals	○	●	○	○
Livability				
● Improve Air Quality	◒	◒	◒	◒
● Reduced Traffic Congestion	◒	◒	◒	◒
Access to Regional Centers				
● Alternate Modes to Major Destinations	◒	●	●	◒
Neighborhood Impacts				
● Reduce Encroachment	○	◒	○	○
● Perception of "Fit" With Neighborhood Goals	○	◒	○	○

● Positive ◒ Neutral ○ Negative

Figure 4
Comparative Analysis of Alignments for Initial Screening

Both of the two most promising alignments meet the major objectives of the MetroLink Cross-County extension. Available revenues (see Table 1) are, however, insufficient to build either alignment in the schedule contemplated. To meet the local funding objective and minimize any borrowing needed to construct an S-I alternative (debt financing could add as much as $100 million to the cost), additional cost containment options must be considered in both alignments.

A number of options to reduce the cost of each alignment alternative have been identified. The greatest impacts are found in the modification of tunneling techniques beneath Forest Park (approximately $80 million savings) and Shaw Park ($4 million savings) and running at-grade rather than in tunnel through Clayton ($70 million savings). The general appearance of an at-grade alignment on Forsyth Boulevard in Clayton is depicted in Figure 5 which illustrates a similar at-grade rail alternative in an urban commercial center. An additional major cost containment option would be to keep the MetroLink line along Forest Park Parkway and Millbrook at grade in the roadway and operate either in mixed traffic or in a separate right-of-way. These options are schematically illustrated in Figure 6. The advantages of the mixed traffic option, in addition to the cost savings of being at grade, are the preservation of the mature vegetation along the street and the reduced impact of construction of the line on adjacent neighborhoods. The disadvantages are the slightly reduced traffic capacity of the street, and slower operating speeds for the light rail vehicles.

Figures 7 and 8 and Tables 4 and 5 describe the two most promising alignments, S-IA and S-IB, summarizing the low cost and high cost options in the two alignments together with savings strategies. The Forest Park alignment portrayed in the second figure follows an alternative that best serves the Science Center and other Oakland Avenue institutions without unduly disrupting the Zoo or Forest Park forests (south of Highway 40 and east of the Zoo). It incorporates the most recent conceptual engineering and cost data[11]. Savings options also include the deferral of some vehicle acquisition for the ultimate fleet needs until ridership levels warrant.

Each of these alternatives will achieve East-West Gateway's mobility goals and objectives. Each has approximately the same ridership potential and can be in revenue service between 2004 (for alignment S-IA) and 2005 (for alignment S-IB). In the following section, the two alignments are evaluated in more detail.

[11] Sverdrup Civil, MetroLink Alignment Options Through Forest Park: Feasibility and Costing Data Study, August 14, 1997

Figures 5 and 6 go here

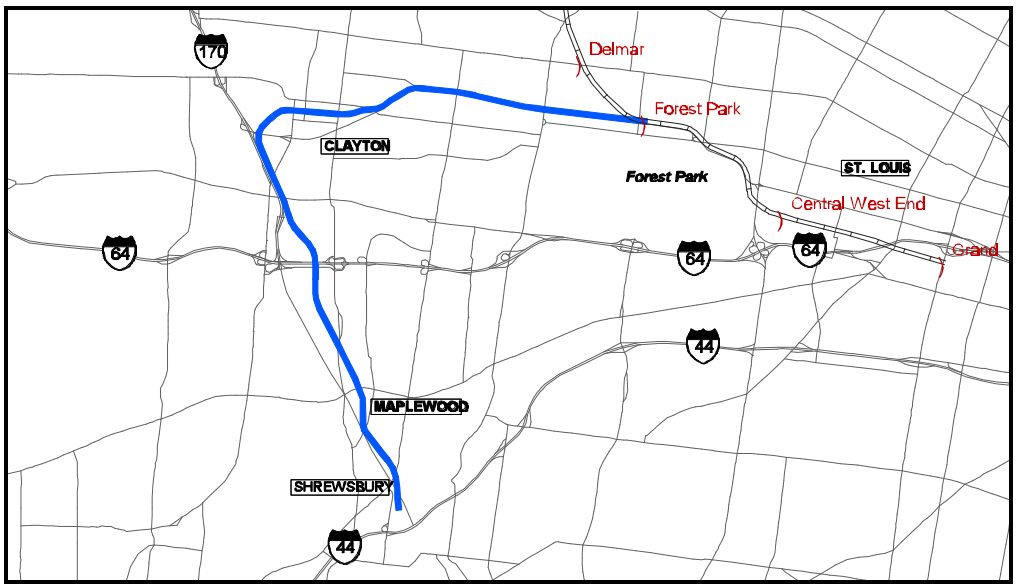

Figure 7
Alignment S-IA ("North of Forest Park")

	Cost Reduction ($millions)	*Total Cost ($millions)*
Modified MTIA Cost Estimate		**462**
At-grade along Forest Park/ Millbrook Blvd.		
▸ Forest Park Station - Skinker	30	
▸ Skinker - Big Bend	22	
▸ Big Bend - Pershing	16	
At-grade in Downtown Clayton	70	
Cut & Cover Tunnel in Shaw Park	5	
Estimate for Lowest Cost Alignment S-1A		**319**[12]

Table 4
Cost Containment Measures - Alignment S-IA

[12]Low cost estimate used in financial strategy calculations

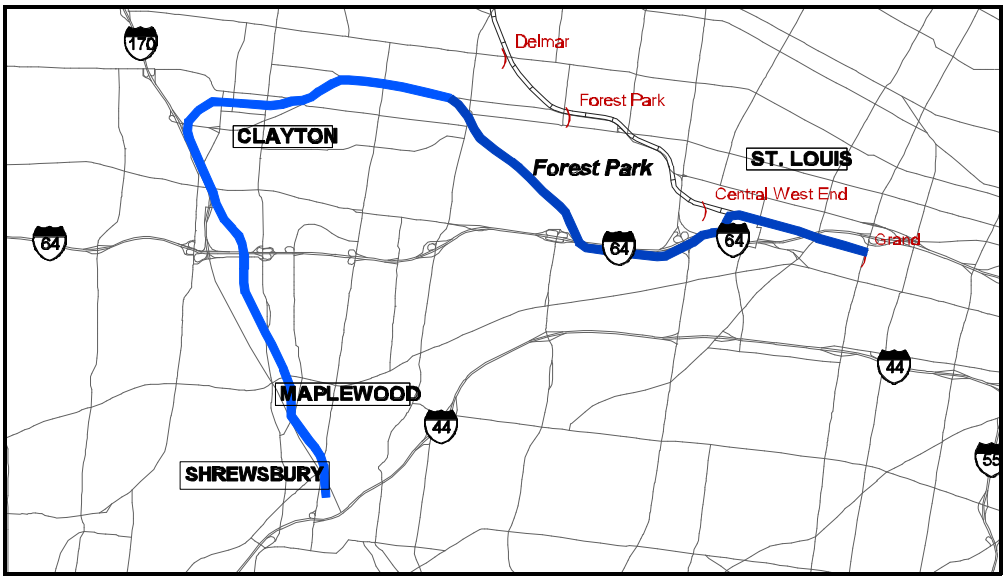

Figure 8
Alignment S-IB ("Through Forest Park")

	Cost Reduction ($millions)	*Total Cost ($millions)*
Modified MTIA Cost Estimate		**619**
Cut & Cover Tunnel in Forest Park	80	
At-grade along Forest Park/ Millbrook Blvd.		
▸ Skinker - Big Bend	22	
▸ Big Bend - Pershing	16	
At-grade in Downtown Clayton	70	
Cut & Cover Tunnel in Shaw Park	5	
Estimate for Lowest Cost Alignment S-1B		**426**[13]

Table 5
Cost Containment Measures - Alignment S-IB

[13] Low cost estimate used in financial strategy calculations

IV. FINANCIAL STRATEGIES AND DECISION FACTORS

The ability to fund the MetroLink Cross-County extension while minimizing debt is a major factor in the definition of the project. Incurring substantial debt will compromise opportunities for future expansions of MetroLink. This section examines the financial implications of the MetroLink alternatives and evaluates the two principal alternatives with regard to the policy objectives and community concerns identified in the MTIA process.

A. Long Range Financial Capabilities

As is often the case with major public infrastructure investments, there is an inherent tension between the present and the future: dollars spent on one project are dollars that are not available for other projects, now or in the future. If financial resources are limited, and they almost always are, decision-makers must carefully weigh the trade-offs between costly project features, which may be desirable but nonessential, and future expansions of the basic system. This is especially true when future dollars may be "leveraged" against federal or state dollars. In such cases, a dollar spent today may mean foregoing two or more dollars tomorrow.

This situation pertains to East-West Gateway as it considers the MetroLink extension in the Cross-County Corridor. Based on reasonably conservative assumptions about growth in sales tax revenues, inflation, and capital and operating costs for MetroLink, there will be approximately $260 million in capital funds available *from existing sources* through the year 2004 for a MetroLink extension in the City of St. Louis and St. Louis County. That level of funding, by itself, is insufficient to finance any of the S-I alternatives. It is sufficient, however, to support a debt program that would generate over $400 million for MetroLink construction, while preserving a future revenue stream adequate to cover the subsidy needed to operate the extension. Such a debt financing scenario, based solely on existing revenues, could fund some lower cost S-IA options, leaving all other design options and alignments financially unattainable without significant additional funding.

To finance the higher cost options in S-IA and all options in alignment S-IB, it is necessary to assume another revenue source. The most likely source is the passage of an additional one-quarter cent sales tax in the City of St. Louis and St. Louis County. This tax is expected to be on the ballot in November, 1997 as Proposition M.

Table 1 describes the income available for MetroLink expansion through 2015. A complete analysis of income and expenditure projections for segment S-I and future Cross-County operating segments was undertaken to evaluate the longer term capacity to finance MetroLink expansions. Tables 6-8 summarize the findings of that analysis and provide an overview of capital needs and outlays for the Cross-County alignments. These tables assume collection of an additional one-quarter cent sales tax beginning mid-1998.

The analysis shows that with the additional sales tax funds the region would have sufficient revenues to construct either of the low cost S-I alternatives (including an allowance for operations) without incurring debt. But even with the additional one-quarter cent sales tax, the region's financial capacity remains limited. Given East-West Gateway's intent to pursue extensions south to Butler Hill Road and north to Florissant without incurring substantial debt, and to keep open possibilities for further MetroLink expansions in other corridors, only the low cost design options in S-IA and S-IB are financially feasible. Building the entire Cross-County MetroLink expansion (S-I, S-II, S-III) using the higher cost design options would require debt financing of $277-$374 million, compared to a debt of $0-$59 for the low cost options. The higher debt level would severely restrict future expansion possibilities beyond the Cross-County Corridor.

While it appears that both the low cost S-IA and S-IB options can be financed, there are notable differences between them. Because of the greater construction risks associated with S-IB, it would begin operating one year later than S-IA. Further, assuming the full build-out of the entire Cross-County Corridor, the higher initial cost of S-IB leads to a total capital outlay, including debt service, $200 million higher than S-IA. This affects the availability of funds for MetroLink expansions beyond the Cross-County Corridor. There would be $706 million available through 2015 for additional MetroLink construction after building S-IA compared to $493 million for S-IB. That difference would be greater if A were not in operation earlier than B (one year for S-I and one year for S-II and S-III, combined) and therefore incurring additional operating expenses.

The implications of the financial analysis seem clear: East-West Gateway should seek a strategic approach that:

- Achieves an appropriate balance between near-term and long-term investment options and opportunities;

- Addresses the policy objectives and political constraints of the City and County of St. Louis and of the East-West Gateway Coordinating Council; and

- Maximizes financial participation by those interested in nonessential project features.

Segment I Alternatives	Construction Period	Capital Costs		Debt Required to Finance	Total Capital Outlay, Including Debt Service[14]
		1996 Dollars	Actual Dollars[15]		
S-IA ("North of the Park")					
Low Cost	1998-2004	$319	$372	$0	$372
High Cost	1998-2004	$498	$581	$37	$603
S-IB ("Through the Park")					
Low Cost	1998-2005	$425	$505	$0	$505
High Cost	1998-2005	$590	$701	$53	$732

Table 6
Capital Costs and Outlays for Cross-County Segment I Alternatives ($millions)
(assumes additional one-quarter cent sales tax and federal funds)

Segment I Alternatives	Construction Period	Capital Costs		Debt Required to Finance	Total Capital Outlay, Including Debt Service
		1996 Dollars	Actual Dollars		
S-IA ("North of the Park")					
Low Cost	1998-2010	$999	$1,344	$0	$1,344
High Cost	1998-2010	$1,178	$1,553	$277	$1,718
S-IB ("Through the Park")					
Low Cost	1998-2011	$1,105	$1,509	$59	$1,544
High Cost	1998-2011	$1,270	$1,705	$374	$1,928

Table 7
Capital Costs and Outlays for All Cross-County Segments ($millions)
(assumes additional one-quarter cent sales tax and federal funds)

[14]Includes debt service payments beyond the 2015 horizon year for the study.

[15]Actual dollars reflect construction costs inflated by 3.5% annually to year of expenditure.

Segment I Alternatives	MetroLink Capital Uses			Prop. M Account Balance in 2015[16]	Total Funds Available for Next Corridor in 2015[17]
	Direct Capital[18]	Debt Service[19]	Total Capital		
S-IA ("North of the Park")					
Low Cost	$1,051	$0	$1,051	$481	$706
High Cost	$982	$194	$1,176	$247	$472
S-IB ("Through the Park")					
Low Cost	$1,157	$25	$1,182	$313	$493
High Cost	$1,037	$239	$1,277	$139	$319

Table 8
Projected Prop. M Capital Uses for All Cross-County Segments: 1998-2015 ($millions)
(assumes additional one-quarter cent sales tax)

B. Decision Factors:

Seven evaluation factors are used to compare the two alternatives. These are:

- Cost
- Schedule
- Long Range Financial Capabilities
- Operations Feasibility
- Ridership
- Community Impacts
- Constructibility

In each alternative the high and low cost options are included in the comparative analysis, notwithstanding the fact that the financial capability indicates that the highest cost options are beyond current means using existing revenues.

1. Cost

Alignment S-IA from the Forest Park Station to Clayton can use a variety of design concepts, ranging from the lowest cost fully at-grade system, operating in mixed traffic within the

[16]Includes interest earnings on surplus Prop. M funds and adjusts for operating subsidies associated with Cross-County extensions being drawn out of Prop. M funds.

[17]Includes additional federal funds for next corridor. Other MetroLink expansion after Cross-County could include alignments in either the Northside, Southside, St. Charles, or West County corridors. The next corridor expansion could begin construction in 2011 or 2012, depending on the availability of funding.

[18]Does not include borrowed amounts or federal expenditures.

[19]Includes debt service payments only through 2015.

Millbrook/Forest Park Parkway and Forsyth Boulevard rights-of-way, to the most expensive, a cut and cover tunnel along Millbrook/Forest Park Parkway and a bored tunnel beneath Clayton (Carondelet right-of-way). The total cost difference between the two design options for this alignment is $179 million.

Alignment S-IB is more expensive primarily because of the cut and cover tunnel section beneath the park and the additional length of the route. While the revised alignment and construction method reduces the cost of this section significantly, S-IB remains the more costly alternative. The differences between the high and low cost options for alignment S-IB result from the aforementioned changes in construction method and the different alignment profiles along Forest Park Parkway, Millbrook Blvd. and through Clayton. The total cost difference between the two design and construction options is $165 million.

Although the at-grade alternatives discussed herein are a departure from existing MetroLink operations, the design is both technically feasible and a common and successful operating practice in cities throughout the world. Experience shows that compared to below the surface alternatives (open cut, cut and cover and bored tunnel) the construction of at-grade alternatives would have fewer effects on the surrounding environs and landscape and would enhance the experience of both riders and adjacent neighborhoods.

The cost of all the S-I alternatives are such that if the sole source of funding for this project is existing revenue sources, the only financially feasible alternative is option S-IA, with most of the cost containment provisions included. But even that low cost option would require incurring over $300 million in debt to have it operating by 2005.

2. Ridership

The travel demand model for the St. Louis region, which was used for the MTIA, estimates that transit ridership for alignments S-IA and S-IB will be essentially the same, i.e., within the statistical variation normally expected. Both alignments are projected to attract between 25,000 and 26,000 riders a day, increasing daily systemwide rail patronage to 88,000 riders. These systemwide numbers include the existing MetroLink line, the St. Clair extension, and the first operating segment of the Cross-County extension.

Alignment S-IA provides the most direct route between Clayton and downtown St. Louis, and it provides slightly shorter travel times between south St. Louis County and downtown St. Louis. At-grade operation in either alignment could add up to six minutes travel time due to operating conditions. Based on a review of the travel demand model, it is not likely that the latter would have a negative impact on ridership.

For the purposes of this analysis, the ridership estimate for alignment S-IB has been augmented from that produced by the travel demand model in the MTIA by 1700 daily passengers to account for the off-peak, non-work trips to the institutions in Forest Park and along Oakland Avenue. This ridership estimate was developed based on experience in other cities where light rail service is provided to institutions similar to those served by this alignment. If the Arena site is developed

for tenants *not currently located in St. Louis*, an additional 500-1000 daily riders could be attracted to MetroLink in this alignment.

Including the revised ridership forecast, the differences between the two alignments, in terms of daily systemwide ridership levels, is less than two percent.

3. Schedule

The schedule to design and construct the Cross-County extension, as shown in Figure 9**,** is based on conventional procurement methods. The use of other procurement options (such as "turnkey") is particularly complicated by the nature of this corridor and the fact that final design and potential mitigation actions are community issues that will likely be subject to extensive discussion until consensus is reached. The impact on cost and schedule of alternative procurement options may not, therefore, be substantial.

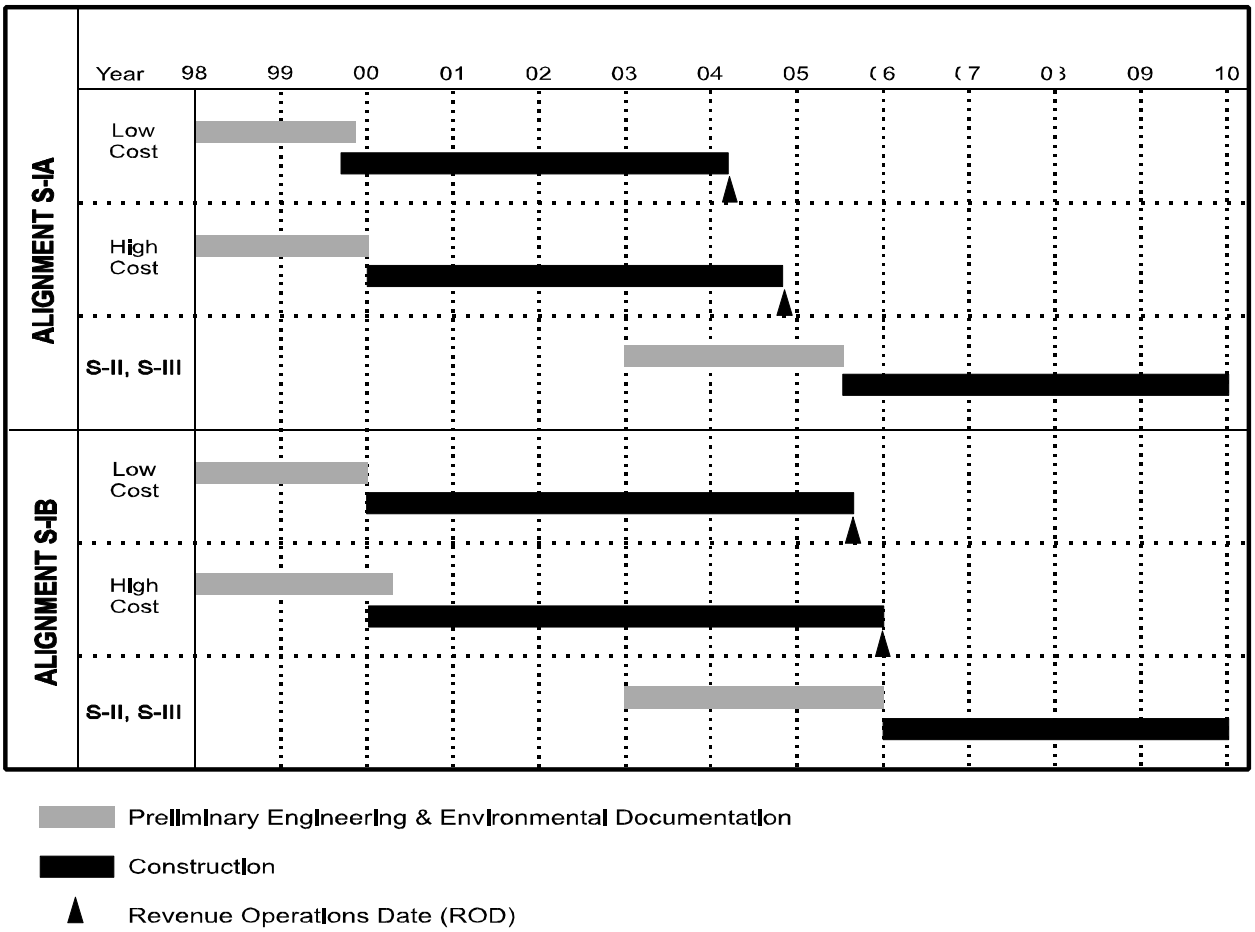

Figure 9
Estimated Schedule to Implement Cross-County MetroLink Expansion

Timing of revenue service in alignment S-IA will depend upon the choice of final design concepts. The construction time for at-grade options will be shorter than the time it will take to build in an open cut or cut and cover tunnel. The likely revenue operation date (ROD) is in the first quarter of 2004.

Alignment S-IB will require additional construction time for the tunnel beneath Forest Park, together with the time required for design coordination with Forest Park master plans and the Missouri Department of Transportation (for highway crossings). Coordination of construction schedules for the highway interchanges and the Park's golf course redevelopment could also cause delay. The likely ROD for the alternative S-IB alignment is the first quarter of 2005.

There are significant schedule risks associated with each of the alignments that lie outside the authority of the transit project. Coordination with other agencies, such as MoDOT and the City of St. Louis regarding Forest Park improvements, may be affected by the fiscal position of each to initiate their part of the joint projects. In addition, the approval of final designs and the consensus with the community may be factors in determining the beginning of service.

4. Community Impacts

Across the country, people are increasingly concerned about the livability of their communities. They want greater connectivity, more public places, increased safety, easier access to jobs and other destinations, improved environmental quality and reduced traffic congestion. They seek a sense of place that has often been lost in our fast-paced, sprawling world. Modern public transit, especially light rail transit, is increasingly being viewed as an essential ingredient in making communities more livable. By carefully responding to community needs, people-oriented transit can help build successful, safe, communities, bolster local character and enrich the lives of the citizens. In response to this growing community interest, there have been numerous national and international studies published examining the link between transit and communities. Some of the best and most recent examples are two comprehensive studies from the Transportation Research Board (TRB) of the National Research Council: Transit and Urban Form (TCRP Report 16, 2 volumes, 1996) and The Role of Transit in Creating Livable Metropolitan Communities (TCRP Report 22, 1997). [20]

MetroLink, and the planned extension in the Cross County Corridor, will continue to act as a catalyst for orderly, compact metropolitan development. Within the St. Louis region, it will attract and focus new development that supports local community plans, by providing new capacity in congested travel corridors and access to jobs for potential employees. The return on the public's investment is significant. Studies from throughout the country, such as those cited above, verify the positive impact of rail transit investments on local communities.

Throughout the public involvement process for the proposed Cross-County MetroLink expansion, a variety of measures were used to elicit input from interested parties. These included conducting

[20] These documents are available from TRB at 2101 Constitution Avenue, N.W., Washington, D.C., 20418 or can be ordered through the Internet at http://www.nas.edu/trb/index.html.

a public survey, holding meetings with groups of stakeholders, hosting public open houses, and various other strategies. The complete documentation of the outreach process is contained in the MTIA document, Public Involvement Summary Report (July, 1997). In addition, numerous meetings with public officials, interested citizens and interest groups were held during the course of the current Strategic Alignment Analysis.

Many of the issues raised can only be credibly addressed in the required detail during the preliminary engineering stage for the selected alignment. It will be important to engage interested and affected citizens, interest groups, and public officials throughout preliminary engineering to ensure that issues which have been raised on specific alignments are addressed with a sensitivity to community and neighborhood perceptions.

Issues common to both alignments are typical of those voiced in the development of rail projects in any community. They include economic development, neighborhood enhancement, safety and security, parking and historic preservation.

In the S-IA alignment, the lowest cost alternative that uses the existing streets (Millbrook/Forest Park Parkway) in an at-grade profile is the least intrusive. Tunnel or open cut construction will require the removal of mature vegetation along the street. Replacement of this type of landscaping may not be feasible. On the other hand, both at-grade options (in mixed traffic or separated right-of-way) retain most of the vegetation along the Forest Park Parkway right-of-way. Unlike the tunnel or open cut options, the at-grade alignment can be accommodated within the street right-of-way and does not require acquisition of private property. Figure 6 illustrates this alternative.

A disadvantage of at-grade options is the perceived noise impact of MetroLink trains, yet the ambient noise levels of city streets such as Forest Park Parkway, with cars and buses throughout the day and night, is greater than that which would be generated by the transit line. Typically, neighborhoods next to an urban street will have ambient noise levels in the range of 75-90 dba. Modern, well maintained light rail trains (operating on continuously welded rail using soft direct fixation fasteners and new ballast/trackbed) have proven in Portland and San Jose to reduce noise and vibration of the train to levels (approximately 77 dba) below those of adjacent arterial streets. Horns that sound for grade crossings would not be required in street operation where traffic regulations will apply.

Modern urban rail systems have had no adverse impact on real estate values. In fact, studies and anecdotal evidence in cities across the country (e.g. San Diego, Santa Clara and St. Louis) indicate that real estate sales are improved in proximity to urban rail systems. The same is true for commercial properties such as those on a Clayton at-grade alignment. Developers and investors are increasingly taking advantage of the access and exposure that are provided by such systems.

Traffic and parking, particularly in residential neighborhoods, could be a negative impact of MetroLink expansion. There are, however, a number of well-tested strategies that may be used to mitigate the potential impacts and reduce or eliminate the inconvenience to nearby residents. Stations should be sited to be readily accessible to refocused local feeder bus services. Not every

station needs a park and ride lot. Depending on its location, people will walk, take the bus, car pool or be dropped off at the closest station. In areas of developed or developing properties with parking incorporated, a joint use could be explored. Clayton lends itself to joint use of parking facilities. Where land is not available and joint use facilities are not an option, parking restrictions (often with residential permits) together with "kiss and ride" areas have proven successful. In all cases, the facilities (parking lots, bus transfer stations, kiss and ride and pedestrian/bicycle areas) must be carefully planned and landscaped to minimize adverse visual impacts on the community. The appropriate site development at each station must be coordinated in the preliminary engineering process. In the design of the St. Clair extension, local station-area committees are successfully dealing with all matters relating to the environs surrounding stations.

Finally, safety concerns - particularly where the rail system operates at-grade - have been expressed in public meetings and group discussions. There are many examples of cities where light rail systems operate at-grade or in an open cut. Modern design and good planning virtually eliminate any hazard beyond that already present from an arterial street. With appropriate designs that include decorative fencing, signals, and lighting, the impacts of the rail lines on pedestrian safety are minimized. This is especially the case when the rail alignment is in a street right-of-way with mixed traffic.

Since the alignment alternatives do not require any alteration of the historic neighborhoods along the alignments, the impacts of the MetroLink extension should not be inconsistent with the community's goal to preserve these districts. Alignment S-IB does not alter the park buildings or the patterns of Forest Park and, following construction, would have no visual or noise impact. In alignment S-IA and the common section through to Clayton, the alignment options are almost entirely within the street right-of-way and, therefore, should not substantially disturb private property. Appropriate site and neighborhood surveys should be completed during preliminary engineering to affirm these observations and to plan effective mitigation measures where needed.

5. Long Range Financial Capabilities

There are two principal considerations in the financial evaluation of each alignment. First, the operating needs of the rail system must be protected and provided for as a priority. Second, sufficient funds need to be reserved for future phases of MetroLink expansion. Where federal funds are used for subsequent phases of expansion, it is critical to reserve the local share of funding. These factors are reflected in the financial analysis shown in Tables 6-8.

Only the low cost S-IA alternative is financially feasible with existing revenues, and that requires borrowing to construct. After construction, debt service payments and operating subsidies for the S-IA extension would fully commit existing Proposition M funds, leaving no surplus to pursue extensions in other Cross-County segments. All of the S-I alternatives are financially feasible if the additional one-quarter cent sales tax is enacted, and with borrowing, all of the Cross-County segments could be constructed and operated. The key questions become how much debt is the region willing to incur to build subsequent segments and how important is it to reserve funds for MetroLink expansion in corridors beyond Cross-County? Completing the full build-out of the

Cross-County Corridor using the high cost S-I alternatives would require several hundred million dollars in borrowing, whereas building with the low cost alternatives would require minimal or no debt. However, S-IA is the only alternative that provides sufficient funds at the end of Cross-County construction to expedite construction of MetroLink in another corridor.

6. Constructability

Alignment S-IA along Millbrook/Forest Park Parkway, if in an open cut or a cut and cover tunnel, will remove the majority of mature trees that line the street and require traffic control measures during construction. Tunnels through the Clayton area have the potential for construction delays. Underground water and ground conditions may affect both the schedule and budgets for these sections. Finally, the location and depth of the River Des Peres tunnel will require the rebuilding of Forest Park Parkway and adjacent streets in order to provide sufficient clearance for MetroLink under the Des Peres Avenue crossing.

Constructability issues in alignment S-IB relate principally to the tunnel through Forest Park, the coordination of construction activities with MoDOT and Forest Park and the aforementioned tunnels in Clayton. The ground conditions through the park may make this route more difficult and costly. Since no geotechnical engineering has been done, it is not possible to accurately assess many of the more substantial construction risks.

Through a cooperative effort with other agencies on a final design and mitigation program and on construction, both alignments can be constructed within the projected time frames.

7. Operations Feasibility

The primary considerations in transit operations are the safe, reliable and convenient delivery of service for passengers. In at-grade design options in alignment S-IA and west of Skinker Boulevard in S-IB, at-grade operations would introduce a new operating condition for MetroLink. Coordination of traffic signals with transit operations would be desirable and would improve operations reliability and travel time. Funding for these signal improvements is included in the cost estimate.

The tunnel or open cut alternatives yield more reliable operations, although operating in tunnels increases operating costs. However, both environments – at-grade and in tunnel (or open cut) are common to light rail transit systems and are equally feasible.

V. PROJECT IMPLEMENTATION

A. Risk Assessment

There are four categories of risk typically associated with urban rail projects. These categories are technical, market, funding and legal risks. The most significant risks in each category include the following:

- Technical:
  - tunnels in Clayton and Forest Park, and along Forest Park Parkway present a number of unknowns related to the physical conditions in each right-of-way.
  - contingency budget levels for these tunnel segments must be higher to account for these risks.
  - the schedule implications of the tunnel risks have been factored into the draft construction timetables shown in Figure 9.
- Market:
  - there is very little market risk associated with the expansion of MetroLink.
  - both alignments are expected to attract similar numbers of passengers.
  - additional park and ride space in suburban locations (e.g. at the CMT right-of-way) should increase ridership.
  - travel time delays, if the at-grade alignments are chosen, should not have an impact on ridership.
- Funding:
  - the financial strategy to pay for alignment S-IA in its lowest cost configuration from existing sources, while requiring debt, is a low risk program.
  - strategies to pay for higher cost options in alignment S-IA and all options for alignment S-IB will require the passage of another one-quarter cent sales tax and possibly some debt.
  - the new one-quarter cent sales tax proposal will not affect the Phase 1 schedule, but will affect the choice of design and extent of the operating segment.
  - depending on the choice of alignment, the financial feasibility of future phases of MetroLink expansion may be affected.

- Legal:
  - although community impacts are not significant based on the experience in other cities, and there is ample evidence that benefits accrue to neighborhoods along the light rail alignments generally, there is a significant risk that citizens, neighborhood associations and local governments may challenge an alignment decision.

B. Schedule

Figure 9 illustrates the estimated schedule for construction of the MetroLink extension. This schedules are based on a conventional approach to design and construction, and may be improved by as much as six months by an aggressive construction contract approach. Such a contract strategy employs some of the techniques of a "turnkey" approach to rail projects.

C. Business Plan

Following a review by the East-West Gateway Coordinating Council Board and the general public, a detailed implementation plan for the chosen project will be prepared. In order to meet the schedules described in this report, the initial preliminary engineering and environmental documentation activities need to begin in January 1998.

The detailed financial plan for design and construction will be included in the Business Plan to be prepared following a selection of alignment by East-West Gateway. This management and fiscal plan will reflect the cash flow requirements of the project and the necessary revenues to keep the project on schedule.