

DOWNTOWN – AIRPORT TRANSIT CORRIDOR ALTERNATIVES ANALYSIS AND ENVIRONMENTAL SCREENING REPORT

CHAPTER 6.0 – COMPARATIVE BENEFITS & COSTS

DRAFT
NOVEMBER 2005

PREPARED FOR
MEMPHIS AREA TRANSIT AUTHORITY
MEMPHIS, TENNESSEE

PREPARED BY CONSULTANT TEAM:

PARSONS BRINCKERHOFF, INC.
PICKERING FIRM, INC.
JACKSON PERSON AND ASSOCIATES, INC.
BELSTAR INC.
TRUST MARKETING, INC.
STRAUGHAN ENVIRONMENTAL SERVICES, INC.
HESS ENVIRONMENTAL SERVICES, INC.
PANAMERICAN CONSULTANTS, INC.
JUDITH JOHNSON AND ASSOCIATES

This is a draft document that has not been reviewed by the Federal Transit Administration (FTA). If the FTA has comments, changes will be made to address those comments.

Additional analysis is underway on ridership forecasts. Changes to the document can be expected based on new ridership forecasts. Affected sections of this document would be Section 6.2 Effectiveness (Goal Attainment). Section 6.3 Efficiency (Cost Effectiveness) will also be affected by the change in the FTA measure of cost effectiveness; this section will be completely rewritten to address the new measure (Transportation System User Benefits). Other changes will be made, as appropriate, to incorporate more current information that becomes available

On May 22, 2006, the MATA Board of Commissioners voted to eliminate Alternative 1 and Alternative 1/Fairgrounds. References to these alternatives remain because the document was prepared prior to the Board action.

Table of Contents

6.0	COMPARATIVE BENEFITS AND COSTS	6-1
6.1	EVALUATION FRAMEWORK.....	6-1
6.2	EFFECTIVENESS (GOAL ATTAINMENT).....	6-2
6.2.1	Goal 1 – Enhance Mobility and Access to Jobs and Other Opportunities.	6-2
6.2.2	Goal 2 – Support Economic Development and Redevelopment	6-4
6.2.3	Goal 3 – Enhance Quality of Life	6-5
6.2.4	Goal 4 – Efficient, Economical and Safe Transit Service	6-6
6.3	EFFICIENCY (COST – EFFECTIVENESS)	6-8
6.4	FINANCIAL FEASIBILITY	6-10
6.5	EQUITY	6-11
6.5.1	Service Equity.....	6-12
6.5.2	Financial Equity	6-13
6.5.3	Environmental Equity.....	6-13
6.6	TRADE-OFFS	6-14
6.6.1	No-Build Versus TSM Versus Build Decision	6-14
6.6.2	Build Alternatives Trade Offs	6-15

List of Tables

Table 6-1	FTA Cost Effectiveness Index	6-9
Table 6-2	Comparison of No-Build Versus TSM Versus Build Decision Trade-Offs.....	6-15
Table 6-3	Comparison of Build Alternative Trade-Offs	6-16

List of Appendices

Appendix A	- List of Acronyms and Abbreviations	A-1
------------	--	-----

6.0 COMPARATIVE BENEFITS AND COSTS

This chapter presents the results of the evaluation and trade-offs analysis conducted for the alternatives developed for the Downtown-Airport Transit Corridor. The purpose of this chapter is to bring together the key findings for each alternative so that benefits, costs, and environmental consequences can be evaluated against the project goals and objectives presented in Chapter 1 - Purpose and Need. The intent of this comparative analysis is to facilitate the decision-making process by the Regional Rail Steering Committee, the MATA Board and other public officials, interested residents, businesses and institutions in the project area. Consideration of these findings will lead to the selection and implementation of the best alternative for providing high capacity transit service for the Downtown-Airport Transit Corridor study area.

6.1 Evaluation Framework

The transportation goals and objectives set forth in Chapter 1 provide the overall framework for analyzing and comparing the alternatives and selecting the best alternative for implementation. The alternatives are No-Build, TSM, and two Build Alternatives. The Build Alternatives have unique and common alignments through the study area. The unique portions of the alignments run from Madison Avenue to Airways Boulevard at Arlington Avenue. The common or combined portions of the alignment run from Airways Boulevard at Arlington Avenue to the Airport. Alternative 1 includes an optional alignment, Fairgrounds Option, which avoids the Cooper-Young community.

This evaluation draws upon the background information and analysis found in previous chapters and features the following criteria:

- **Effectiveness (Goals Attainment)** – This criterion examines how well each alternative helps achieve the purpose of, and satisfies the need for, transportation improvements in the project areas. It focuses on how well each alternative addresses the project’s goals and objectives.
- **Efficiency (Cost Effectiveness)** – This criterion examines the effectiveness of each alternative in attracting new riders relative to estimated capital costs and operating costs based on a methodology prescribed by the FTA. It relates the value received to the resources invested in each alternative.
- **Financial Feasibility** – The criterion focuses on MATA’s ability to pay for each of the alternative’s capital and operating costs.
- **Equity** – Each alternative may benefit certain communities or members of the public more effectively than others. This criterion examines the question of equity from the perspective of service, financial and environmental benefits, and impacts among affected groups.
- **Trade-Offs** – The objective of this analysis is to substantiate the rationale for the selection of the alternative, or combination of alternatives that will become the locally preferred alternative (LPA). The important differences among alternatives are highlighted, a process that permits decision makers to apply their individual

value judgments with respect to costs and benefits, looking at what is being given up relative to what is being gained for each alternative.

The criteria listed above, as well as comments on the findings of the approved DEIS (if one is prepared) from the public, affected agencies and other stakeholders, will be used to make two decisions. The first decision is whether the community desires no action (No-Build), implementation of modest transit service improvements (TSM) or the implementation of high capacity, fixed guideway transit service in the Downtown-Airport Transit Corridor. A Build decision would affirm the decision to implement improved transit in the priority corridors that was made by the MATA Board in January 2001. The decision-making process that led to the 2001 decision is described in Section 2.1.1.4 of Chapter 2. With a no action or modest transit improvement decision, MATA would select the No-Build or TSM Alternative with the expectation that a major transportation investment would not be implemented in this corridor in the foreseeable future. If the decision to build the Downtown-Airport Transit Corridor high-capacity, fixed guideway service is approved, the second decision would determine which of the Build Alternatives is the LPA that would be carried into further study in the PE/EIS stage.

The following sections of this Chapter describe each of the first four evaluation criteria, the evaluation findings associated with each criterion, and the relevance of those findings to the decisions by comparing trade-offs among the alternatives.

6.2 Effectiveness (Goal Attainment)

This evaluation criterion examines how well each alternative achieves the purpose of, and satisfies the need for, transportation improvements in the study area. It focuses on how well each alternative attains the goals and objectives defined for the project in Chapter 1. The primary focus is on what the Downtown-Airport Transit Corridor project could achieve over the No-Build or TSM Alternatives.

The project is intended to address the following needs and problems in the Downtown-Airport Transit Corridor and the Memphis region: general mobility, work force development, and economic redevelopment of underutilized areas.

6.2.1 Goal 1 – Enhance Mobility and Access to Jobs and Other Opportunities.

This goal is intended to meet the future transportation needs of all citizens through greater mobility by providing access from established residential areas to jobs as well as to educational, cultural, recreational, medical, shopping, and other opportunities.

The achievement of this goal is expressed in terms of three objectives:

1. Provide convenient, reliable high capacity transit service to major employment centers such as the Central Business District, the Medical District, the Airport, and the FedEx Hub. The Airport area has been recognized as the largest point of economic generation in the region and should be linked with service to downtown Memphis in the first phase of a high capacity transit system.
2. Provide all citizens with alternative means of transportation (non-single occupant vehicle) to all major activity centers in the Memphis region. The

Downtown, the Medical District, and the Airport are the predominant activity centers in the region.

3. Provide high capacity transit service to link transit dependent and low-income workers with major employment centers, with educational and vocational opportunities, and with a variety of other destinations.

Through the MPO's planning process, the larger Memphis community has expressed in the adopted LRTP the desire to see the implementation of high capacity transit service in priority corridors by 2023. The transit element of the LRTP recommended development of the three priority rail corridors identified in the 1997 RTP, and a corridor selection process in 1999 and 2000 resulted in the selection of the Downtown-Airport Transit Corridor as the initial corridor because of its ability to connect the CBD, the Medical District, and the Airport.

The No-Build Alternative would not achieve this goal because it would not provide high capacity service to the major employment and activity centers. The TSM would begin to achieve the goal with its increased bus frequency and its two new routes, including the express service between the downtown and the Airport. However, the proposed LRT line in either of the Build Alternatives would be more effective in achieving the goal by providing a higher frequency, higher capacity service that serves the Downtown, the Medical District, the Depot, and the Airport and FedEx areas.

In terms of the amount of service that would be provided, the TSM Alternative would provide 126,645 additional bus service hours for the study area. Each of the Build Alternatives would provide a total of about 127,000 service hours, including 94,000 additional bus service hours and about 33,000 LRT vehicle service hours.

Comparison of the Build Alternatives indicates that Alternative 1 (and the Fairgrounds Option) would allow riders to travel from the Main and Madison intersections to the Airport Terminal in approximately 30 minutes and 40 seconds, while the travel time from the eastern terminus of the Madison Avenue Line (Claybrook / Cleveland) would be approximately 20 minutes and 40 seconds. The ride between the Main and Madison intersection and the Airport for riders under Alternative 2 riders would be approximately 27 minutes and 10 seconds, while the travel time from Pauline Street Station (where the LRT leaves the Madison Avenue Line) would be approximately 19 minutes and 15 seconds.

Ridership forecasts for the study predict that in 2023, the transit service provided under the TSM Alternative would have 24 percent more daily boardings than would the No-Build Alternative ridership (94,319 versus 76,212 daily boardings). The daily boardings of the two primary Build Alternatives would be essentially the same, about 33 percent increase over the No-Build in 2023 (101,557 for Alternative 1 and 101,352 for Alternative 2).¹

¹ For the ridership analysis, Alternative 1 and the Alternative 1/Fairgrounds Option are considered essentially the same.

The racial and ethnic composition of the study area closely resembles the City as a whole; about two thirds of the study area's population is considered minority (all persons not identified as white non-Hispanic). The predominant racial group within the study area and in the City as a whole is Black or African-American. Looking at the populations within walking distance of the proposed stations, Alternative 1, and the Alternative 1/Fairgrounds Option would each serve a larger number of the study area population. However, Alternative 2 would provide the LRT services to a greater number of minority residents. Alternative 2 will provide service to 45 percent of the minority population in the study area compared to 32 percent and 26 percent for Alternative 1 and the Fairground Option respectively. Alternative 2 would also serve more of the study area's low-income population than Alternative 1 and the Alternative 1/Fairground Option.

6.2.2 Goal 2 – Support Economic Development and Redevelopment

This goal is intended to support commercial, institutional and employment growth in the CBD, Medical District, Airport, and other areas, to stimulate new economic development in the vicinity of station areas, and to reinvigorate neighborhoods, all by providing additional convenient transit service with enhanced capacity.

The achievement of this goal is expressed in terms of the following objective:

- Provide transit stations that will act as a focus for private and public neighborhood rehabilitation and redevelopment activities. Effective station planning and design can encourage more efficient land use, create activity centers that encourage community interaction and support economic development.

The No-Build and the TSM Alternatives would not achieve this goal, as they would not include the development of transit stations in the study area. Typically, bus service has little or no effect as a stimulus for land redevelopment along its service corridor. Light rail transit service, on the other hand, can provide a stimulus for investment of private funds in urban development/redevelopment projects because of improved accessibility of land near stations and the long-term commitment of the fixed guideway system.

For each Build Alternative, a series of new LRT transit stations are being proposed, and their locations have been identified taking into consideration the characteristics of the surrounding communities and the travel patterns in the area. Alternative 1 and Alternative 1/Fairgrounds Option would provide 10 new LRT stations, while Alternative 2 would incorporate eight new LRT stations. During preliminary and final design, more detailed station area planning would be conducted to determine whether the station locations should be shifted slightly to improve service to the surrounding communities or to provide better opportunities to support economic development activities.

6.2.3 Goal 3 – Enhance Quality of Life

Goal 3 is intended to ensure that the region remains a desirable place to live and work and that the built and natural environments are enhanced through sound planning and design principles applied to the development and refinement of the region's transportation system.

The achievement of this goal is expressed in terms of the following objectives:

- Provide transportation facilities that preserve the integrity of urban communities and neighborhoods and conserve cultural resources, such as historic districts.
- Provide transportation facilities that avoid or minimize alterations to environmentally sensitive areas and conserve natural resources.
- Provide transportation system improvements that maintain or improve the region's air quality.

In general, the Build Alternatives would achieve this goal and the first objective as well as or better than the No-Build or TSM Alternatives. The community has expressed its desire for high capacity transit through the Community Compact process, the RTP adopted in 1997, and the LRTP. The RTP and the LRTP envision a major transit improvement in the general corridor.

The refinement of alignments through the Downtown-Airport Transit Corridor, resulting in the Build Alternatives under study in this document, reflected consideration of this goal through the selection of alignments that would, for the most part, run in or along major roadways so to preserve the integrity of residential neighborhoods.

Comparison of the Build Alternatives reveals that Alternative 1 and Alternative 1/Fairgrounds Option would have a greater potential to affect adversely the integrity of neighborhoods and the conservation of cultural resources. Alternative 1 would have an adverse visual impact on the Cooper Young Historic District (a NRHP district), with the construction of the planned 90-foot long station platforms on both sides of Cooper Street at Young Avenue. The two sidewalk platforms would have an adverse visual impact by blocking the views to and from the low-profile historic residential and neighborhood commercial buildings in this area. In addition, the physical removal of parking spaces on Cooper Street in the block north of Young Avenue would constitute an adverse effect to the district as it has the potential to damage the viability of the neighborhood's businesses, a secondary effect.

Under Alternative 1/Fairgrounds Option, the construction of the rail line and LRT station on the western lawn of Fairview Junior High School would have an adverse visual impact on this NRHP listed property. The LRT would occupy part of the grounds in front of the school that are a contributing feature of the property's NRHP eligibility. The proposed Central/Fairgrounds Station would also partially obscure the view from the historic East Parkway toward the school.

Alternative 2 in its unique segment would not intrude into any historic district or property boundary and would have no adverse effect on any historic district.

In their common alignment south of the Lamar Avenue/Airways Boulevard intersection, the Build Alternatives would run on new location through the Alcy-Ball/Nob Hill super neighborhood, resulting in four residential and one institutional (a church) displacements. The LRT rail maintenance yard and shop would be located on Dunn Field north of the main installation property of the Depot, adjacent to the Mason Hays super neighborhood, resulting in visual impacts. The impacts of the Build Alternatives to these two neighborhoods would not be substantially adverse, but during PE and final design, MATA would work with these neighborhoods to provide ways to minimize the effects

In measuring the alternatives against the second and third objectives, none of the Build Alternatives would result in adverse impacts to environmentally sensitive areas, and any of them would help to maintain the region's air quality by contributing to the conversion of auto trips to transit trips. The proposed project is included in the region's conforming LRTP.

6.2.4 Goal 4 – Efficient, Economical and Safe Transit Service

The community has expressed its desire for an efficient, economical, and safe transportation system to meet the region's current and future transportation needs.

The achievement of this goal is expressed in terms of the following objectives:

- Construct and operate the high capacity transit service as a cost effective addition to the regional transportation network.
- Ensure that the first phase of the high capacity transit system is easily integrated with the existing system and expandable to the other high capacity corridors identified in the Regional Transit Plan (1997).
- Reduce traffic congestion on the region's roadway system by providing attractive alternatives to private vehicles.
- Design and operate the new transit services and facilities in a manner that enhances the safety of the public.

Considering the four objectives, the No-Build Alternative would not accomplish this goal for the study corridor. The TSM Alternative would partially meet this goal by increasing the hours of transit service in the study area, and it would be less costly than the Build Alternatives. However, it would not fully achieve the level of high capacity service anticipated in the RTP and the LRTP.

The Build Alternatives would achieve this goal by providing the level of high capacity service anticipated in the RTP and the LRTP. As directed by the RRSC and the MATA Board in early 2002, consideration has been given in the development of the Build Alternatives and the operations plan for integration of this line with the other high capacity corridors identified in the RTP. Both Build Alternatives would allow integration with the North Corridor (through the existing North Terminal) and the

South Corridor (through existing Central Station or as an extension from the Airport Corridor) via the Madison Avenue Line and the Main Street Trolley.

Connection to future high capacity transit service in the remainder of the Southeast Corridor could occur under one of several options in addition to using Central Station as the downtown terminus. Considering the north access route into the Airport, service could be extended to the east along Winchester Road or service could be provided to the east along the Norfolk Southern tracks from the Young/East Parkway Station (under Alternative 1 or Alternative 1/Fairgrounds) or from the Rozelle Station under Alternative 2. Extension of future service to the South Corridor could occur as a separate set of tracks diverging from the airport-access tracks south of the Democrat Road Station. The South Corridor tracks could continue south on Airways or turn west into Winchester and then south into Elvis Pressley Boulevard.

If the west access option were to be chosen for the Airport Station as part of the LPA, other service options to the South Corridor would be created. Service to the South Corridor could occur as the LRT trains reverse out of the terminal and turn to the south along Airways Boulevard or to the west/north along Winchester Road. Once on Winchester, trains would then merge with the South Corridor. Service to the Southeast Corridor could also occur as a guideway extended south from the Democrat Road Station to follow Airways Boulevard to the south and Winchester Road to the east to the East Winchester/ Collierville area. An alternative access route to the east could also occur from Alternatives 1, 1/Fairgrounds Option or 2 along the Norfolk Southern railroad to the Poplar Corridor.

In regard to the proposed project providing an attractive alternative to the private automobile (Objective 3), neither the TSM nor the Build Alternatives are expected to cause dramatic shifts away from private autos to transit. In the design year of 2023, there are projected to be almost 4.5 million daily resident person-trips in the region, an increase of 52 percent from the 1995 data. In 2023, over 50,500 of the region's daily residential trips are projected to be on transit under the TSM condition. Alternative 1 would increase this figure to more than 54,000 transit riders and Alternative 2 would be generating an estimated 53,000 daily residential transit trips. These figures represent about 1.2 percent of the total residential trips. The projected growth in transit trips over 1995 levels represents an increase of 64 percent in the TSM Alternative, 76 percent in Alternative 1 and 72 percent in Alternative 2.

The TSM Alternative would reduce travel times for many riders of the existing bus service through the corridor due to its reduction of headways and the new express route. The Build Alternatives would provide even more of a reduction in travel times for riders in the corridor. A comparison of several origin and destination pairs predicted that the Build Alternatives have the potential to reduce transit travel times by 0 to 53 minutes over the No-Build Alternative and by 0 to 32 minutes over the TSM Alternative. In terms of transfers, implementation of LRT could result in an increase in the number of transfers for certain trips, but many trips would see a decrease in the number of transfers or shorter wait times due to the direct connections provided to the southeast and the Airport. The performance of both Build Alternatives is similar, with certain travel times being lower on Alternative 2 due to the more direct routing to the Airport and the greater proportion of semi-exclusive operation.

6.3 Efficiency (Cost – Effectiveness)

This evaluation criterion provides local decision-makers with a means to compare the total expected costs of each alternative to its expected ridership benefit, which is the number of additional annual new transit riders attracted to the proposed project. The evaluation of cost effectiveness uses the FTA New Starts cost-effectiveness measure. Like effectiveness measure, the primary focus of the efficiency measure is on what the project could achieve over the No-Build Alternative (the No-Build/Build decision).

The incremental cost per incremental new rider, or cost-effectiveness index, is used by the FTA to compare proposed New Start projects from across the country and make recommendations for federal funding. The cost of all New Start projects seeking discretionary New Starts funding far exceeds available funds. Each year, the FTA rates the competing projects and submits funding recommendations to Congress. The cost-effectiveness index is one of several factors considered in the ratings. Others include mobility improvements, environmental benefits, operating efficiencies, local commitments to transit supportive land use, the degree of local financial commitment, and project management.

The index used to calculate cost effectiveness (CEI) is as follows:

$$\text{Cost Effectiveness Index} = (\Delta \$\text{CAP} + \Delta \$\text{O\&M}) / \Delta \text{Annual Linked Trips}$$

Where the Δ 's represent changes in costs and linked trips resulting from the New Starts investment compared to the New Starts baseline and the No-Build, and

\$\$CAP: means Total capital costs, annualized over the life of the project based on the useful life of each component and a 7% discount rate.
\$\$O&M: means Annualized operating and maintenance costs; and
Annual Trips: means Annual transit ridership, measured in "linked" trips.

This index produces ratios with units of "added cost per new rider," and reflects benefits to existing riders and savings in operating costs as well as the attraction of new riders. It can be interpreted as the ratio between the necessary capital investment and the return in transit ridership, with credits for O&M costs and travel timesavings. Alternatives that have low cost-effectiveness index values are more cost-effective than alternatives with high values.

A cost-effectiveness ratio greater than \$20.00 is generally considered higher than desirable to be competitive with other transit systems seeking federal funding. A cost-effectiveness ratio of \$10.00 to \$20.00 is generally competitive. A cost-effectiveness index of \$10.00 or less is considered highly competitive.

Table 6-1 presents cost effectiveness index (CEI) for the TSM and the Build Alternative options using the No-Build and the TSM Alternatives for comparison.

Table 6-1 FTA Cost Effectiveness Index

Alternative	Annual Cost (millions \$)		Annual Ridership (millions)	New Riders Over No-Build	New Riders Over TSM	CEI vs. No-Build	CEI vs TSM
	Capital Costs	O&M Costs					
No-Build	\$0	\$30.991	13.770				
TSM	\$1.201	\$38.550	16.487	2,363,616		\$3.22	
Alternative 1	\$31,703	\$43.924	17.825	4,055,040	1,338,048	\$11.01	\$26.81
1/Fairgrounds	\$31,546	\$43.924	17.825	4,055,040	1,338,048	\$10.97	\$26.69
Alternative 2	\$31.365	\$43.421	17.290	3,520,224	803,232	\$12.44	\$43.62

Source: Parsons Brinckerhoff, May 2003.

In comparing the TSM and the Build Alternatives to the No-Build Alternative, the incremental cost per new rider ranges from a low of \$3.22 for the TSM to a high of \$12.44 for Alternative 2, with the Alternative 1 and its Fairgrounds Option being about \$11.00 per new rider. When compared with the TSM Alternative, the CEI for the Build Alternatives range from a low of \$26.69 for Alternative 1/Fairgrounds Option to a high of \$43.62 for Alternative 2.

Table 6-1 indicates that the cost effectiveness indices for the Build Alternatives 1 and 1/Fairgrounds Option compared with the TSM are about 35 percent higher than the \$20.00 threshold of competitiveness for federal funding, while Alternative 2 is about 115 percent higher than the \$20.00 threshold when compared with the TSM. The reason for the undesirable index values is the low number of incremental new riders over the TSM and the No-Build Alternatives. Most of the riders attracted by the project under the Build Alternatives would be existing bus riders in the corridor. The majority of new riders are projected to be residents who do not currently ride buses in the corridor. Additional non-visitor riders will be required to produce a desirable cost effective index below the \$20.00 threshold of competitiveness for federal funding.

It should be noted that the ridership projections used to calculate the cost effectiveness indices might be underestimated for several reasons. The projections do not account for recent development proposals in the study area such as the Lamar Terrace/Veterans Hospital redevelopment area on Lamar Avenue or the Lamar/Airways intersection redevelopment concepts. Recently proposed development projects near rail stations, or projects that may be initiated solely because of the decision to implement a light rail line are not reflected in the land use data. Other refinements to the travel forecasting model transit networks would be expected to improve the attractiveness of transit (e.g., timed-transfers of buses and rail at stations). The underestimation occurs because current land use and 2000 Census data has not been incorporated into the MPO's existing regional travel forecasting model. The MPO is in the process of issuing a contract for a complete overhaul of the regional travel-forecasting model that should result in forecasting capabilities that are more sophisticated and sensitive to changes in the transit system.

6.4 Financial Feasibility

A further consideration in the selection of a preferred alternative is MATA's ability to finance the associated capital and operating costs. Section 2.5 of Chapter 2 summarizes MATA's Financial Plan including proposed funding sources for the Build Alternative. It also notes some of the uncertainties that are implicit in the financial plan.

A financial feasibility assessment identifies the financial implications of each alternative, enabling federal and local decision-makers to judge the practicality of building and operating each of them. As such, the financial feasibility criterion relates to all decisions that have substantive differences in capital and operating costs. Thus, this criterion is related to the No-Build/TSM/Build decision, as well as to the decision about the preferred alignment of the LRT Build Alternatives.

The Financial Plan shows that the Build Alternative would be financially feasible under a certain set of economic growth, funding, schedule, and other assumptions. Noteworthy assumptions are:

- For the construction of the Downtown - Midtown - Airport LRT project, federal discretionary Section 5309-New Starts funds (50 to 80 percent) can be secured and matching funds from the City (10 to 25 percent) and State (10 to 25 percent) will be made available from existing revenue sources;
- Operating subsidies for the Downtown-Airport Transit Corridor can be accommodated with increases from the same state and local sources that are currently funding MATA operations;
- Fares are assumed the same for all services. Revenues will increase by three percent annually consistent increases in operating costs. Fare revenues and system-generated revenues would cover 28 percent of operating costs; and
- The additional funding needed to operate the system would be shared between the City of Memphis at 75 percent and TDOT at 25 percent.

Regardless of the shares contributed by the local funding partners, the project would require a higher level of financial commitment of capital and operating monies from the City level and the State level than has been the case for previous projects. Although the funding levels would be higher, the share of the total available City and State funds would remain a relatively small percentage of available budgets in most years. With regard to the City of Memphis, the annual capital funding need for each year of project implementation (in constant dollars) was compared to City funds in the CIP budget (\$109 million) in Fiscal Year 2003. MATA's current capital needs share of the City budget is about 5 percent. Under the 25 percent City match scenario, MATA's capital need as a percentage of City funds would range from a low of about 8 percent in the early years of the project development to a high of 43 percent in the final year of project implementation (2009), with an average annual share over the seven years of 22 percent. Based on the 10 percent City match scenario, the range would be about 6 percent to 19 percent, averaging 11 percent annually over the seven-year implementation period. As a percentage of State monies, the current share for capital projects is 0.5 percent of all TDOT funds (excluding federal) and 12 percent of funds dedicated to transit statewide. Under the

25 percent State match scenario, MATA's capital need for the project as a percentage of State funds ranges annually from 0.7 and 6 percent and 18 to 144 percent of State transit funds, with averages of 3 percent and 66 percent respectively. Based on a 10 percent State match scenario, the range is about 0.4 to 2.3 percent for State funds and 9 to 57 percent for State transit funds, with averages of 1.2 percent and 29 percent, respectively.

A similar analysis was conducted for operating budgets. At the City level, MATA's share of the FY 2003 operating budget is about 3 percent. In the first year of operation of a Build Alternative (2010), MATA would require a share of about 5 percent of the City operating budget (based on constant dollars). At the State level, MATA's current share of 0.7 percent of State funds and 17.7 percent of State transit funds would rise to 1.1 percent and 26 percent, respectively, with the opening of one of the Build Alternatives.

The Downtown-Airport Transit Corridor project is estimated to result in a net increase in annual operating costs of \$15,287,000 (for Alternative 2) to \$15,906,000 (for Alternative 1 or the Fairgrounds Option) in 2010 dollars, which would represent 22 to 23 percent of MATA's overall operating budget. This total includes improvements to connecting bus service as well. Fare revenues are expected to cover about 28% of costs, making the net subsidy \$11.0-11.5 million. Under the assumptions stated in the Financial Plan, MATA's operating budget remains balanced over the 20-year period. The Financial Plan shows that MATA would maintain sufficient operating cash flow to operate both the Downtown-Airport Transit Corridor project and MATA's other bus and trolley service.

6.5 Equity

Equity is defined as the fairness of the distribution of costs, benefits, and impacts of the alternatives across various population subgroups. The equity of the alternatives considered was evaluated for the following three categories:

- **Service Equity** – The extent to which the alternatives provide service to various population segments, particularly those that tend to be transit-dependent;
- **Financial Equity** – The distribution of the project's cost across population segments through funding arrangements covering the local contribution to construction and operation; and
- **Environmental Equity** – The incidence of any substantial environmental impacts, particularly in low-income and minority communities immediately adjacent to proposed facilities.

This criterion helps to address the following questions:

- Would the service provided by the Downtown-Airport Transit Corridor project be equitably distributed among various population groups?
- Would funding the Downtown-Airport Transit Corridor project place an unequal burden on any particular population group or community served by MATA?
- Would implementation of the Downtown-Airport Transit Corridor in any of Build Alternative alignments place an inequitable burden on minority or various socio-economic populations, or are the impacts evenly distributed among communities of various socio-economic characteristics?

Following is a summary of the findings on the service, financial and environmental equity of the alternatives under consideration.

6.5.1 Service Equity

Improved or enhanced accessibility to employment opportunities under each of the Build Alternatives would result in direct and indirect benefits to all persons in the study area. The stations proposed under each Build Alternative are distributed in such a way that they provide fairly equitable service to the population groups found within the study area, particularly the transit dependent, elderly, minority, and low income populations. The distribution also provides accessibility to employment centers, such as the Medical District, the Airport and FedEx areas, and the Depot, as well as numerous smaller employment areas. Alternative 1 and Alternative 1/Fairgrounds Option each service the small-scale but continuous commercial area along Madison Avenue and Cooper Street. Alternative 1/Fairgrounds Option was introduced in response to concerns expressed by the Cooper Young community to perceived economic impacts to the Cooper Young commercial node. Alternative 2 provides service to the University of Tennessee's campus, Baptist College of Health Sciences, Southwest Tennessee Community College, and the small-scale commercial enterprises along Lamar Avenue.

Approximately 44 percent of all people residing within the study area live within one-half mile of one of the Alternative 1 stations. One-half mile is generally considered walking distance. The stations of Alternative 1/Fairgrounds are within a half-mile of about 40 percent of the study area population, while about 38 percent of Alternative 2's stations are within one-half mile of the population. While Alternative 1 serves the greatest proportion of residents in the study area, Alternative 2 serves the largest proportion (45 percent) of study area's minority residents, compared with 32 and 26 percent of the areas minority population for Alternative 1 and the Alternative 1/Fairgrounds Option, respectively.

Alternative 2's stations serve the highest proportion (40 percent) of the study area's low-income population, compared to 34 percent for Alternative 1 and 37 percent for Alternative 1/Fairgrounds Option. Alternative 2 also serves the largest proportion of children (residents under age 18); 44 percent of the study area's youth live within walking distance of the Alternative 2 station locations, while 37 percent living within walking distance to Alternative 1 and only 33 percent are within walking distance to Alternative 1/Fairgrounds Option.

Alternative 1 stations serve the largest proportion (41 percent) of the study area's elderly population, compared with 39 percent each by Alternative 1/Fairgrounds Option and Alternative 2 stations.

The No-Build and TSM Alternatives would provide accessibility to transit service similar to the Build Alternatives for all population groups and employment centers, but would lack the speed, capacity, and frequency provided by the LRT line.

6.5.2 Financial Equity

MATA's local funding for capital and operating expenses is provided by the City of Memphis. The largest source of funds for the City's budget is property taxes, and the second largest is the local option sales tax. The burden of a property tax increase to fund additional capital and operating funding for the implementation of the TSM or one of the Build Alternatives would fall equally on all property owners and consumers regardless of income or race/ethnicity. Thus, financial equity should not be an issue of concern.

6.5.3 Environmental Equity

No environmental impacts would be expected to occur under the No-Build Alternative or the TSM Alternative.

None of the Build Alternatives would result in inequitable environmental impacts on low income and minority communities and businesses in the study area. As with any major transportation project, it is likely that residents within the study area would endure some impacts because of the construction and operation of the light rail project. The primary potential impacts would be related to property acquisitions and residential and commercial displacements, noise level, changes in the visual character, and effects to businesses during construction. These impacts would not be disproportionately high or adverse for low income and minority residents of the area. Site-specific impacts on particular properties would vary depending upon the selected alternative.

Alternative 1 (with or without the Fairgrounds Option) would require the acquisition of 79 whole parcels of property, and the displacement of 73 residences, businesses and other uses. Alternative 2 would require acquisition of 73 parcels and the relocation of 58 residences, businesses and other uses. While many of these relocations may affect minority and/or low-income persons, these displacements would not adversely affect the stability of the associated low-income or minority neighborhood. They would require special attention to ensure that the housing needs of the households displaced are adequately met. MATA will develop and adopt a Relocation and Assistance Plan in accordance with the Federal Uniform Relocation Assistance and Real Property Acquisitions Act of 1970

Among the positive impacts of the project for these residents are enhanced mobility options, greater access to regional jobs and non-job opportunities such as educational, shopping and cultural/entertainment activities, and potential revitalization of the neighborhoods.

6.6 Trade-Offs

The purpose of the trade-off analysis is to provide decision makers with a comparison of the alternatives using the key differences among the alternatives across all four perspectives: effectiveness, efficiency, financial feasibility, and equity. When selecting the LPA, decision-makers will consider the evaluation results presented in this document and comments from government agencies and the public during the public hearings and circulation period for an approved DEIS, if one is prepared.

As described in Chapter 5.0, Environmental Consequences, the Build Alternatives were evaluated on the basis of environmental impacts. This trade-offs analysis highlights the environmental impacts that were found to be substantially different. These include visual quality and aesthetics, historic resources, Section 4(f) impacts on historic resources, noise, vibration and construction impacts.

In comparison of trade offs, attention is given first to the No-Build versus the TSM versus the Build decision. Secondly, the Build decision is addressed in a comparison of the alternative alignment options – Alternative 1, Alternative 1/Fairgrounds, and Alternative 2.

6.6.1 No-Build Versus TSM Versus Build Decision

Table 6-2 presents a comparison of trade-offs among the No-Build, TSM and Build decision.

In terms of cost effectiveness, implementation of the LRT under any of the Build Alternative alignments would achieve the purpose and need in an efficient manner. The TSM Alternative represents the most cost effective alternative. Although implementation of the Build Alternative concept represents a substantial investment of local financial resources, the decision to build LRT in one of the alignments is financially feasible. However, debt would be incurred during the construction period. The Build Alternative concept would be provided on an equitable basis in terms of population groups served, sources of funds and in general on environmental impacts.

The No-Build Alternative and the TSM Alternative encompass planned transit and highway improvements that will be built regardless of the construction of the Downtown-Airport Transit Corridor; therefore the No-Build and TSM are considered to have no environmental impacts to this study area. However, with the No-Build or TSM scenarios, the travel timesavings and service benefits of the LRT for riders in this corridor would not occur.

Table 6-2 Comparison of No-Build Versus TSM Versus Build
 Decision Trade-Offs

Evaluation Criteria	Decisions		
	No-Build	TSM	Build
Effectiveness			
• Mobility and Access	○	●	●
• Economic Development & Redevelopment	○	○	●
• Quality of Life	◐	◐	●
• Efficient, Safe and Cost Effective Transportation System	○	◐	●
<i>Efficiency (Cost Effectiveness)</i>	◐	●	○
<i>Financial Feasibility</i>	◐	◐	○
<i>Equity</i>	◐	◐	●
<i>Air Quality Impacts</i>	○	◐	●
Transportation Impacts			
• <i>Transit Travel Time</i>	○	◐	●
• <i>Transit Ridership</i>	○	◐	●

Source: Parsons Brinckerhoff, Inc. 2003

Rating: ● – Better; ◐ – Neutral, ○ – Worse

6.6.2 Build Alternatives Trade Offs

The comparison of trade-offs between the Build Alternatives is presented in Table 6-3.

Each of the Build Alternatives would meet the transportation needs of the project by providing high capacity transit service in the corridor. Under each alignment alternative, LRT stations would be constructed to provide convenient access to residents and employees. The stations would be designed to enhance opportunities for economic development and redevelopment.

Table 6-3 Comparison of Build Alternative Trade-Offs

Evaluation Criteria	Build Alternatives		
	1	1/Fairgrounds	2
Effectiveness			
• Mobility and Access	●	●	●
• Economic Development & Redevelopment	●	●	●
• Quality of Life	●	●	●
• Efficient, Safe and Cost Effective Transportation System	●	●	●
<i>Efficiency (Cost Effectiveness)</i>	●	●	○
<i>Financial Feasibility</i>	●	●	●
<i>Equity</i>	●	●	●
Environmental Impacts			
• Land Use/Neighborhoods	●	●	●
• Relocations	●	●	●
• Visual & Aesthetics	○	○	●
• Air Quality	●	●	●
• Noise & Vibration	○	●	●
• Natural Environment	●	●	●
• Historic & Archaeological Resources	○	○	●
• Parks	●	●	●
• Section 4(f) Resources	○	○	●
• Contamination	●	●	●
<i>Traffic Impacts</i>	●	●	○
<i>Construction Impacts</i>	○	○	●

Source: Parsons Brinckerhoff, Inc. 2003

Rating: ● – Better; ● – Neutral, ○ – Worse

The operational characteristics of the LRT service under any of the Build Alternatives would be the same. The capital and operating costs of Build Alternatives are very similar, as are the ridership estimates. The primary differences among the alternative alignments and their stations in their unique segments relate to their environmental impacts. The principal areas of differences are visual and aesthetics, noise and vibration, historic resources and Section 4(f) and construction impacts.

Aesthetics

Alternative 1 and Alternative 1/Fairgrounds Option would each have adverse visual impacts as a result of their alignments through a historic district or a historic property. Alternative 1 would travel through the NRHP Cooper Young Historic District, and would cause adverse visual impacts in the vicinity of the proposed Cooper/Young Station LRT station where the station, with its long canopies, has the potential to block views to and from the residences and businesses at the station areas. The Fairgrounds Option would travel across the western edge of the NRHP Fairview Junior High School east of East Parkway, and place a station on the property. The proposed Central/Fairgrounds LRT station would add a modern element into the historic setting and disrupt the symmetry of the school's historic circle driveway. Alternative 2 would not have adverse visual impacts along its alignment.

Noise

Alternative 1 and Alternative 1/Fairgrounds Option would each have potential noise impacts and vibration impacts. The operation of Alternative 1 would exceed the FTA criteria for a noise impact for properties along Young Avenue and the west side of East Parkway south of the Young/East Parkway LRT station. The operation of Alternative 1/Fairgrounds Option would exceed the FTA criteria for a noise impact for some of the same properties along East Parkway south of the Young/East Parkway LRT station, but the option would avoid the noise impacts to the Young Avenue properties that Alternative 1 would cause. Neither alternative meets the criteria for a severe noise impact. The operation of Alternative 2 would not exceed the FTA criteria for a noise impact at any properties along its alignment.

Vibration

Typical urban land uses adjacent to the LRT operation are not expected to experience vibration or ground-borne noise impact as a result of the project under any of the Build Alternatives. However, Alternative 1 and Alternative 1/Fairgrounds Option each are adjacent to several businesses that fall into a special category of land use that is sensitive to vibrations – recording and video studios. Five recording and video studios (four on Madison Avenue and one on Young Avenue) would be impacted by Alternative 1, and five (four on Madison Avenue and one on Central Avenue) would be impacted by Alternative 1/Fairgrounds Option. No recording or audio studios would be impacted by Alternative 2.

Historic Resources and Section 4(f)

Alternative 1 would adversely affect the Cooper-Young Historic District, which would result in a Section 4(f) impact to that resource. Alternative 1/Fairgrounds Option would adversely affect the Fairview Junior High School, which would result in a section 4(f) impact to that resource. Alternative 2 would have no effect on historic resources.

While Alternative 1 avoids a Section 4(f) use of the Fairview Junior High School and Alternative 1/Fairgrounds Option avoids a use of the Cooper-Young Historic District, the only build alternative that totally avoids a Section 4(f) use is Alternative 2. Alternative 1/Fairgrounds Option could be modified to avoid a Section 4(f) use by moving the Central/Fairgrounds Station off the NRHP-listed Fairview Junior High property, preserving its historic circle driveway, and placing poles in a manner to minimize any visual impacts.

Construction Impacts

Members of the public have raised the issue of construction impacts to businesses as a concern. The construction of any of the Build Alternatives could result in impacts to adjacent businesses and residences during the construction period. Alternative 1 has the highest potential to result in construction impacts to adjacent businesses because of the concentrations of businesses along Madison Avenue and Cooper Street. Alternative 1/Fairgrounds has the potential to affect the same businesses along Madison Avenue and the portion of Cooper Street between Madison Avenue and Central Avenue, and would possibly affect the business node along Central Avenue west of East Parkway. Alternative 1/Fairgrounds Option would avoid the heart of the Cooper Young business district. Alternative 2 has the potential to affect businesses during construction, but the nature of the commercial districts along the Alternative 2 alignment are more dispersed. Regardless of the Build Alternative selected, MATA would design and implement a construction mitigation plan to address many of the concerns raised during the construction of the Madison Avenue Line and the evaluation of this project.

APPENDIX A

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Name
ACHP	Advisory Council on Historic Preservation
ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
AGT	Automated Guideway Transit
Airport	Memphis International Airport
APE	Area of Potential Effect
ARAP	Aquatic Resource Alteration Permit
ASTM	American Society for Testing and Materials
BNSF	Burlington Northern Santa Fe
BRT	Bus Rapid Transit
CAAA	Clean Air Act Amendments
CBD	Central Business District
CEQ	U.S. Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CFR	Code of Federal Regulations
CIP	Capital Improvement Program
CMAQ	Congestion Mitigation and Air Quality
CN/IC	Canadian National/ Illinois Central
CO	Carbon Monoxide
COGIC	Church of God in Christ
CORRACTS	Corrective Action Reports
dB	Decibels
dBA	A-Weighted Decibels
DASH	Downtown – Airport Shuttle
DEIS	Draft Environmental Impact Statement
DOI	United States Department of Interior
EDR	Environmental Data Resources, Inc.

Acronym / Abbreviation	Name
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ERNS	Emergency Response Notification System
FedEx	Federal Express
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FFA	Federal Facilities Agreement
FHWA	Federal Highway Administration
FIRMS	Flood Insurance Rate Maps
FTA	Federal Transit Administration
GIS	Geographic Information System
GTC	Ground Transportation Center
HC	Hydrocarbons
HCM	Highway Capacity Manual
HMIRS	Hazardous Materials Incident Report System
HOV	High Occupancy Vehicle
HSWA	Hazardous and Solid Waste Amendments
Ldn	Day-Night Sound Level
Leq	Equivalent Continuous Noise Level
Leq(h)	Hourly Equivalent Sound Levels
LOS	Level of Service
LPA	Locally Preferred Alternative
LQG	Large Quantity Generator
LRT	Light Rail Transit
LRTP	Long-Range Transportation Plan
LT	Long-term (noise measurement)
LUST	Leaking Underground Storage Tank
MATA	Memphis Area Transit Authority
Memphis Depot	Memphis Defense Distribution Depot
MHA	Memphis Housing Authority
MIFA	Memphis Interfaith Association

Acronym / Abbreviation	Name
MLGW	Memphis Light Gas and Water
MOA	Memorandum of Agreement
MPO	Metropolitan Planning Organization
N/A	Not applicable (does not apply)
NAAQS	National Ambient Air Quality Standards
NBA	National Basketball Association
NEPA	National Environmental Policy Act
NFRAP	No Further Remedial Action Planned
NHPA	National Historic Preservation Act
NOI	Notice of Intent
NO _x	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System Permit
NPL	National Priority List
NRHP	National Register of Historic Places
NSA	Noise Sensitive Area
NWI	National Wetland Inventory
O&M	Operating and Maintenance
O ₃	Ozone
OCS	Overhead Contact System (catenary system)
PADS	PCB Activity Data Base System
Pb	Lead
PCB	Polychlorinated Biphenyl
pcphpl	passenger cars per hour per lane
PE	Preliminary Engineering
PIP	Public Involvement Plan
Phase I ESA	Phase I Environmental Site Assessment
Phase2 ESA	Phase 2 Environmental Site Assessment
PM ₁₀	Particulate Matter sized 10 microns or less
PM _{2.5}	Particulate Matter sized 10 microns or less
PPM	Parts Per Million
RCRA	Resource Conservation and Recovery Act

Acronym / Abbreviation	Name
RCRIS	Resource Conservation and Recovery Information System
REC	Recognized Environmental Conditions
RMS	Root-Mean-Squared
ROD	Record of Decision
R.O.W	Right-Of-Way
RRSC	Regional Rail Steering Committee
RTP	Regional Transit Plan
SARA	Superfund Amendment and Reauthorization Act
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO _x	Sulfur Oxides
SO ₂	Sulfur Dioxide
SQG	Small Quantity Generator
ST	Short-term (noise measurement)
TAZ	Transportation Analysis Zone
TCA	Tennessee Code Annotated
TDEC	Tennessee Department of Environmental and Conservation
TDEC-MEAC	Tennessee Department of Environmental and Conservation, Memphis Environmental Assistance Center
TDOT	Tennessee Department of Transportation
TIP	Transportation Improvement Program
TPSS	Traction Power Substation
TSD	Transportation, Storage, and Disposal
TSM	Transportation System Management
UPS	United Parcel Service
USDA	United States Dairy Association
USDOT	United States Department of Transportation
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UP/SP	Union Pacific / Southern Pacific
UST	Underground Storage Tank

Acronym / Abbreviation	Name
VdB	Vibration Velocity Levels
Vdc	Volts of Direct Current
VRH	Vehicle Revenue Hours