FINAL
COST ESTIMATES

TECHNICAL MEMORANDUM

CENTRAL BROWARD
EAST-WEST TRANSIT ANALYSIS
BROWARD COUNTY, FLORIDA

FINANCIAL PROJECT ID NUMBER 411189-2-22-01

FLORIDA DEPARTMENT OF TRANSPORTATION
DISTRICT 4

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EXECUTIVE SUMMARY

This document describes the methodology applied to the development of capital, and operating and maintenance cost estimates of the alternatives being considered as part of the Central Broward East-West Transit Analysis (CBEWTA) for the Florida Department of Transportation, District 4 (FDOT). The development of the capital cost estimates for this study will be conducted following the methodologies as described in guidance described in *Advancing Major Transportation Project Through The Planning Process*, FHWA/FTA, January 2003 and *FTA New Starts Criteria*, FTA, June 2003.

The approach to the development of the cost estimates of alternative transportation improvements is described in this report. The description includes a general estimating approach, data management, data sources, cost categories for the estimates, and format for presentation of the results. The cost estimates will be used to evaluate the cost-effectiveness and financial feasibility of the transportation alternatives.

1 . 0 COSTING PROCEDURES AND UNIT COSTS

1.1 PURPOSE

The purpose of the *Capital Cost Technical Memorandum* and its related appendices is to outline the basis for preparing capital cost, and operating and maintenance cost estimates of the build alternatives studied in the CBEWTA. These cost estimates will be used to evaluate the cost-effectiveness and financial feasibility of the proposed alternatives. These estimates will also be used in the development of the Financial Plan that is a required part of the request to the Federal Transit Administration (FTA) to entire into Preliminary Engineering.

1.2 COST ESTIMATING METHODOLOGY

1.2.1 General Approach

Capital costs were estimated for each alternative, with all costs expressed in current (2004) dollars. The cost estimate utilizes parametric unit costs and special condition costs for the majority of the cost effort. The parametric unit costs are based on a conceptual scope appropriately developed for each specific work item. (See Table 1.1 for the parametric unit costs proposed for the corridor.) A parametric unit cost is an estimate developed for all elements included in a "cross section" of a work item for a unit of measurement (route feet, linear feet, each, etc.). The parametric unit cost is then multiplied by the total length of the alternative or the number of units as appropriate in order to calculate the total cost.

The more complex parametric unit costs, such as passenger stations, have a detailed unit price development backup to substantiate the parametric unit cost. (See Section 1.4 for the unit price development detail). Special conditions items can include street reconstruction, major utility relocation, building demolition and environmental mitigation costs and other items that cannot be identified during the alternatives analysis phase of the project.

Once the unit costs or special condition costs have been determined, they are subject to several allowances and add-on factors. Most unit costs contain "internal" allowances to cover generic costs that have not been quantified. For example, a percentage is included in the unit costs for:

- Unspecified mitigation
- Minor Utilities
- Mobilization and Demobilization
- Traffic Control
- Testing, Training and Start-Up

These allowances are referred to as internal allowances because they are included in the parametric unit costs and found only in the unit price development backup.

Table 1.1 Parametric Unit Costs

Description		Unit	Unit Cost
Rail Bed Construction			
Grade Preparation		RF	$105
Trackwork			
Ballast Track Adjacent to Main RR		RF	$368
Ballasted Double Track		RF	$290
Paved Track (Double)		RF	$1,1103
Direct Fixation (Bridge/Tunnel)		RF	$546
At-Grade BRT Guideway		RF	$485
Mainline Special Trackwork			
	Double Crossover Ballasted	EA	$251,790
	Mainline Crossover Ballasted	EA	$228,900
	Permanent Terminal Ballasted	EA	$457,8000
	Railroad Crossing	EA	$185,535
Structures			
Elevated Track		LF	$3,150
Tunnel		LF	$10,500
New Bridge (Minor)		LF	$4,725
New Bridge (Major)		LF	$6,825
Reconstruct Existing Bridge		LF	$2,625
Stations			
At-grade		EA	$262,500
Aerial		EA	$2,625,000
Parking Space	(300 square feet)	EA	$4148
Fare Collection			
Ticket Vending Machines (4 per station)		EA	$26,250
Traction Electrification			
Route Foot Allowance		RF	$305
Signal System			
Route Foot Allowance		RF	$425
Communications			
Route Foot Allowance		RF	$147

Right-of-Way (ROW)		
ROW Allowance	SF	$26.25
Utilities		
Route Foot Allowance	RF	$79
Crossings / Roadway		
Minor Street At-grade	EA	$210,000
Major Street At-grade	EA	$472,000
Preferential Signal Treatment ($250,000/mi.)	RF	$47
Reconstruct Exist Roadway	SY	$42
Vehicles		
Standard LRT – articulated (including spare parts)	EA	$1,785,000
BRT - articulated (including spare parts)	EA	$750,000
Maintenance Facility		
per LRT vehicle	EA	$157,500
per BRT vehicle		$10,500

Legend:

RF = Route Foot
EA = Each
LF = Linear Foot
SF = Square Foot
SY = Square Yard

The add-on factors include a percentage for engineering, management, insurance, conceptual estimate contingency, and construction contingency. These factors are referred to as add-on factors because they are not added to the unit costs and appear in the cost tables as a separate cost category. The cost-estimating methodology uses both internal allowances and add-on factors.

After the cost data is developed, it is put into a cost stream format based upon the stationing of the alignments. For CBEWTA, the alignment alternatives were divided into sections called analysis units to facilitate the identification of areas of various guideway types and special trackwork, etc. This format directly relates the cost to the schematic drawings and facilitates in summarizing of costs, and the analysis of alternatives.

1.2.2 Data Management

Calculation of cost estimates requires using a sizeable database of alignment information (length of at-grade sections, length of structures, number of stations, etc.) as well as the various unit costs.

Thorough review and cross checking of the cost data is required to avoid clerical and mathematical errors. The data management procedures are summarized as follows:

1. Use of proven computer software, such as Excel, for data storage and processing.
2. Developing data in a cost-stream format and subsequently summarizing to a higher level.

The presentation of the cost data (via spreadsheets) in a cost stream format enables a thorough review and cross check of the cost data with respect to the plan and profile drawings.

1.2.3 Control of Potential Cost Variances

A variance between the actual construction costs and the costs estimated at the conceptual stage can occur for two basic reasons. First, ignoring inflation/price escalation, which is a part of the financial analysis, a cost variance will occur if the unit costs applied at the conceptual level differ from actual unit cost at bid time. Second, a cost variance will occur if the scope (project description) estimated at the conceptual level differs from the scope that is actually implemented.

The cost methodology uses two different approaches to control potential cost variances. To control unit cost variances, a conceptual estimating contingency (also called a "line-item contingency") has been included as one of the add-on factors. This particular add-on factor provides a safeguard against potential large variances in the unit costs.

The second approach involves the consideration of potential changes in the scope of the project. Given the conceptual nature of the alternatives, the scope items are very likely to change as the design progresses. In order to evaluate potential changes, a high/low cost (upper or lower bound) will be prepared, in addition to the "best" estimated cost. The cost range provided by high/low cost estimates will be developed by assuming reasonable scope variances from the scope presented for the best estimate.

1.2.4 Cost Estimating - Bottom Up Approach

The majority of the cost categories comprising the CBEWTA capital cost estimate will be developed based on the "bottom up" approach. In this approach, the cost of major work elements is determined by totaling the costs of their component parts. Again, given the conceptual nature of design, engineering and scope at this time, cost estimates will be used primarily for consistent evaluation of alternatives - not for preparation of grant request or bid documents. Sufficient engineering data is required to reasonably define the scope of work and the quantities. Unit prices are developed and combined with the estimated quantities to determine the costs for each major category of work, such as guideway construction, trackwork, stations, signaling, and communications.

The advantage in this approach is the ability to adjust costs for minor changes of scope, and the higher confidence level inherent in a bottom up estimate. The disadvantage is the level of engineering and estimating effort required to produce a bottom up estimate and the additional time required to adjust the estimate for revisions.

1.2.5 Cost Estimating - Top Down Approach

The approach used in conceptual estimating is referred to as the "top down" approach. In this method, an order-of-magnitude cost is determined, derived from similar projects, and this cost is used directly or divided by some measure such as track miles and applied as a unit cost. This method is faster than the bottom up approach; and, for some projects, it can be sufficient.

The cost for transit vehicles is generally derived from other projects and therefore is a top down unit cost. The system-wide elements, which are not specifically located, are top down unit costs even though a detailed scope serves to support the projected costs.

1.2.6 Selected Estimating Approach

The estimating methodology selected to estimate the options of the CBEWTA will use a combination of the two basic procedures described above. The "bottom up" approach is used for elements for which reasonable assumption about quantities can be made for the various transit technologies. These elements include the following:

- Fixed Guideway
- Passenger Stations
- Special Conditions
- Roadway Modifications (Major Roadwork)
- Right-of-Way Acquisitions
- Trackwork and Special Trackwork (Mainline)
- Automatic Train Control (ATC) System
- Communication Equipment in the Stations
- Fare Collection Equipment

The "top down" approach is used to estimate the following elements:

- Vehicles
- Maintenance Facility Needs

1.3 DATA SOURCES FOR ESTIMATES

During the past several years, a number of contracts for major transit projects have been let and constructed in the U.S. Each contract includes a total contract amount based on unit prices submitted by the Contractor. These unit prices for concrete, steel, bridge components, drainage structures, utility relocations, roadway improvements, etc. provide a reliable database of current estimates of costs to be used in the Central Broward East-West Transit Analysis project. The cost estimates are based on experience and results from other projects. This document provides approved typical cross sections and specifications for construction of a regional high performance system, either light rail transit (LRT) or bus rapid transit (BRT) technologies.

In addition, any other cost estimates that are needed and have not been bid/awarded recently will come from the planning, engineering, and cost-estimating tasks undertaken from various agencies over the past several years. This provides an extensive cost-estimating library for this project.

1.4 COST CATEGORIES FOR THE CAPITAL COST ESTIMATES

1.4.1 Guideway

The guideway cost estimate is based on parametric unit costs specifically developed for each construction type. Guideway cost with the exception of grade separations (bridges) or elevated guideway. The construction types include at-grade, retaining-wall at-grade structures and aerial guideway. Generally, all the parametric guideway cost estimates provide for the following:

- At-grade structure
  - All site work, including clearing, grubbing and excavation
  - Borrow fill and soil stabilization
  - Seeding slopes and ditches
  - Retaining walls where needed in cuts and fills

- Aerial Structures
  - Structural excavation and backfill
  - Concrete footings, columns, pier caps, and deck slab
  - Steel reinforcement
  - Pipe guardrail on both sides

The unit cost for trackwork is not included in the unit cost for guideway construction, but is calculated separately. Table 1.1 includes the parametric unit prices used for at-grade single guideway, aerial structure single guideway, etc.

1.4.2 Passenger Stations

The passenger station cost estimate is based on parametric unit prices developed for each station type. The station types include an at-grade station, a retaining wall at-grade station and an aerial station. Generally, the parametric station cost estimates consist of the following:

- At-grade Station
  - Station types will be either side or center platform and may have additional amenities. The cost for additional amenities will be included in the special conditions category.
  - Canopy covering one-third of the platform.
  - A low-level platform approximately 300' in length (expandable to 400').
  - Platform for people with disabilities with lift or ramp.
  - Allowance for benches, signs, artwork, etc.
  - All site work, including clearing, grubbing and excavation.
  - Grading, borrow fill and soil stabilization.
  - General landscaping.

- Aerial Station
  - Station types will be either side or center platform, and may have additional amenities. The cost for additional amenities will be included in the special conditions category.
  - Canopy covering one-third of the platform.
  - Platform for people with disabilities with lift or ramp.
  - Allowance for benches, signs, artwork, etc.
  - Escalators and elevators.
  - Structural excavation and backfill.
  - Concrete footings, columns, pier caps, deck slab, steel reinforcement and pipe handrail.
  - General landscaping.

Some of the passenger stations may require additional construction activities, parking facilities and/or bus-related roadwork. Cost estimates have been developed for the construction of park-and-ride facilities, which will be included at selected stations. Land cost for parking facilities is also included. Land costs were based on $26.50/square foot for improved land. This value was escalated to 2004 dollars based on a figure provided by FDOT District 4 staff as a typical value that could be used for estimating purposes. Each parking space was assumed to be 400 square feet in size. The cost estimate includes cost for paving, curb and gutter, landscaping and lighting. Also, the total cost estimates include costs for additional roadway network needed for station access for both automobile and bus. The costs will be in the special condition costs.

A separate parametric unit cost is developed for each of the various station types. Table 1.1 includes the parametric unit prices for both the at-grade station and aerial station.

1.4.3 Right-of-Way Acquisition

Working from the schematic drawings, right-of-way acquisition costs are estimated using estimated market-value costs applied against the land areas needed for the alignment under consideration. Several sources of right-of-way mapping, showing the existing property boundaries, are used to "overlay" the proposed alignment sketches to determine the right-of-way needs of the alignment. In some cases, a field trip will be conducted to ensure there are no major obstructions that are not readily apparent from the right-of-way drawings.

From this information, right-of-way widths are determined, paying special attention to the interface between the project and the property boundary. The right-of-way requirements along the project vary with the construction type. Aerial structure, retained structure, and at-grade construction each have different right-of-way requirements. The analysis of the right-of-way determines whether it is necessary to acquire a portion of or an entire parcel of land.

The cost of real estate along the corridor reflects an estimate of current land value (2004 dollars) at $26.50 per square foot. As noted above, this figure was provided by FDOT District 4 staff as a “rule of thumb” figure for estimating purposes only. The right-of-way estimates include costs for possible property damages, relocations, easements and miscellaneous acquisition costs.

1.4.4 Special Conditions

The CBEWTA attempts to identify and estimate all special conditions related to the guideway, as best as can be determined from the conceptual corridor-wide investigations. It is anticipated that the add-on allowances and contingencies will “cover” most of the traditional special condition items. Special condition items can include items such as:

- Street reconstruction
- Major utility relocations
- Building demolitions
- Existing bridge modifications
- Environmental mitigation costs
- Station parking construction, bus bays

Where the fixed guideway alignment crosses public or private streets, a unit price is included in special condition costs to cover the cost of embedding the track in the street, laying of grade-crossing material and rebuilding of sidewalks or intersections, if necessary.

As the schematic drawings of each transit improvement are designed, some major utility locations will be identified that possibly may need to be relocated. The major utilities that could need to be relocated consist of power line towers and substations; large drainage culverts; and major telephone, water and gas ducts or lines. Each identified major utility impact will be estimated and will be included in the special condition cost category.

As the right-of-way requirements are determined, certain existing buildings will be identified as acquisitions and require demolition. A unit price per hundred cubic feet of building demolition is developed to cover costs for demolition of the building and removal of materials. The land cost is included in the right-of-way category, and the building demolition costs are included in the special condition category.

In certain areas, existing bridges may require modifications. A bridge modification may consist of widening the deck, relocating the pier foundations or raising the bridge for vertical clearance. For each different type of bridge modification needed, a lump-sum cost estimate will be developed and included in the special condition category.

Depending upon the specific nature of the special condition costs, an internal allowance for minor utilities, mobilization and demobilization, traffic control, mitigation, and other costs may be included in the special condition costs.

1.4.5 Roadway Modification

It may be necessary to modify the existing condition of some streets. Particularly at station locations, streets may be modified to provide for a more suitable traffic pattern. A unit price per square yard is developed for a city street that includes subgrade, concrete pavement, curb and gutter, and pavement marking. The cost estimates for roadway modifications are summarized as a separate category because of the unique annualization factor applied to this type of construction. Modification of streets for at-grade crossing are based on

1.4.6 Trackwork and Special Trackwork

The unit cost for trackwork includes both materials and installation and is only applied to the LRT alternatives. The unit cost is applied to the lineal feet of single-track or route linear feet (RLF). The following types of trackwork construction are estimated:

- Ballasted track
- Direct-fixation track (track fixed on a concrete slab)

The cost for constructing the supporting subgrade, subballast or aerial structure is included in the guideway unit costs. The cost of the trackwork, either ballasted or direct fixation construction, is a separate unit cost, shown in Table 1.1. The standard rail for ballasted or direct fixation track is continuous welded rail 115RE. The ballasted trackwork unit cost includes rail, concrete ties with ballast, rail welding, tie plates, rail fasteners and rail anchors. In long aerial structures, the unit cost for direct-fixation trackwork includes emergency guard rails, direct-fixation fasteners, rail and the concrete rail plinth.

The costs for special trackwork are based on mainline construction and are either ballasted or direct-fixation construction as required. Special trackwork includes turnouts, crossovers and rail crossings. Table 1.1 shows the unit cost for special trackwork, which is net of the cost of the standard trackwork construction.

1.4.7 Communications

The communication and security facilities include station facilities, such as emergency phones, closed circuit television and public address systems, wayside facilities, and radio facilities. These functions are in direct contact with an operations control center. The parametric unit prices for communication and security facilities are included in Table 1.1.

1.4.8 Fare Collection

The cost estimates include fare collection equipment based on a barrier-free system. Each passenger station has as a minimum, four (4) ticket vending machines which make change, take dollar bills, and process zonal fares. The cost for fare collection equipment will be based on the number of passenger stations. The unit cost for a vending machine is included in Table 1.1.

1.5 VEHICLES

The capital cost estimates for the CBEWTA alternatives are based on transit vehicle cost recently purchased by transit agencies and/or reported by the American Public Transportation Association. The basic vehicle costs are provided in Table 1.1.

The number of vehicles used in the cost estimate is based on a calculation of the number of vehicles required from the travel demand model with 20 percent added as an allowance for "spare" vehicles required to maintain service when vehicles are removed from revenue services for maintenance.

1.6 ANNUALIZED COST FACTORS

The annualized capital cost is used to evaluate the cost effectiveness of an alternative. The useful life of a particular type of construction, equipment, or service is an important factor in determining the annualized costs. Table 1.2 contains a list of the various cost categories and their respective useful lifetime and annualization factors. The annualization factors determined by the Federal Transportation Administration (FTA) are based on a 10 percent discount rate.

Table 1.2 Annualization Factors Applied to the Components of Capital Cost

	Lifetime (Years)	Annualization Factor (1)
Bus Service-Related Components		
Bus Maintenance Facilities	30	.106
HOV Facilities	20	.118
New Buses	12	.147
Fixed Guideway Components		
Civil		
▪ Guideway Structure	30	.106
▪ Special Conditions	30	.106
Roadway Modifications	20	.118
Passenger Stations	30	.106
Trackwork	30	.106
Fixed Guideway Vehicle	25	.110
Automatic Train Control	30	.106
Communications & Security	30	.106
Fare Collections	25	.110
Traction Power	30	.106
Right-of-Way	100	.100

(1) Based on a 10-percent discount rate.

2 . 0 CONTINGENCY FACTORS

2.1 BACKGROUND

There are four components of a capital cost estimate: the costs associated with civil/structural and special conditions; right-of-way needed for the project; systems and trackwork needed to operate the project (such as automatic train control, communications, etc.); and the vehicles and fare equipment. In addition to these capital cost components, contingency factors are needed that account for the other costs which will accompany the direct costs of each component and to address the uncertainty that is part of estimating costs in the early stages of a project. These contingency factors include allowances for:

- Conceptual Estimate Contingency
- Alternatives Analysis Design Contingency
- Construction Contingency
- Add-on Allowance

These add-on factors are used in the final estimates as multipliers applied to the baseline construction costs to yield the full direct and indirect capital costs associated with a project. The types of indirect costs covered by the add-on factors are described below. Table 2.1 summarizes the percentages multiplied to the baseline costs to cover the cost of these items. The amount or percentage of the add-on factor applied to the direct costs is based on the actual costs incurred during the engineering design and initial construction of various transit systems. In summary, calculation of the contingency and other add-on costs results in a capital cost estimate that covers the cost to design, build and implement the project; that is, the costs required to bring the project to its first day of operation.

2.2 ENGINEERING AND MANAGEMENT

At the end of each estimate, an additional "add-on allowance" is multiplied to the base cost to cover the cost of preliminary and final engineering design, project management and construction management that are needed to eventually construct the project.

2.3 PROJECT INSURANCE

Project Insurance includes all premium costs to provide insurance coverage to all parties involved in the project, including the Contractor's labor force and equipment, engineering support on site, and agency/city staff on site. This includes Professional Liability, Comprehensive General Liability, Builder's Risk, Worker's Compensation and Employer's Liability insurance, Construction Equipment Loss or Damage, and Automobile insurance.

2.4 CONCEPTUAL ESTIMATE CONTINGENCY

A conceptual estimating contingency is included in the estimates to cover unforeseen items or quantity fluctuations and variances in unit costs that develop as the project progresses through the various stages of development. Generally, this percentage is reduced as the project progresses through the conceptual, preliminary and final stages of design.

The unforeseen items are recognized during the design process and the unit cost data is continually refined; therefore, less reserve is needed as the project progresses and design/engineering is refined and becomes more detailed. Table 2.1 lists the conceptual estimating contingency applied to the basic unit prices of the cost-estimate components.

Table 2.1 Add-On Factors Applied to the Components of Unit Cost

Description	Add-On Factor
Civil/Structural and Special Conditions	
Engineering & Management	38%
Project Insurance	7%
Conceptual Estimate Contingency	20%
Construction Contingency	10%
Right-of-Way	
Engineering & Management	17%
Project Insurance	0%
Conceptual Estimate Contingency	20%
Construction Contingency	0%
Systems and Trackwork	
Engineering & Management	40%
Project Insurance	7%
Conceptual Estimate Contingency	15%
Construction Contingency	10%
Fixed Guideway Vehicles and Fare Equipment	
Engineering & Management	4%

Project Insurance	0%
Conceptual Estimate Contingency	5%
Construction Contingency	5%

Buses

Engineering & Management	0%
Project Insurance	0%
Conceptual Estimate Contingency	0%
Construction Contingency	0%

2.5 ALTERNATIVES ANALYSIS DESIGN CONTINGENCY

During an Alternatives Analysis (AA) project, the level of design and engineering is relatively low (5 to 10 percent level), such that it is difficult to project construction cost estimates with a high degree of certainty. During Preliminary Engineering (PE) as design becomes more detailed (30 percent level), changes in plans and design can occur that increase costs. For example, additional grade separations may be identified with more detailed traffic studies or size of parking facilities may be increased as ridership forecasts are refined. In recognition of this uncertainty, a 30 percent contingency factor is added to the construction cost.

2.6 CONSTRUCTION CONTINGENCY

A 10 percent contingency is applied to the cost estimate to cover the expense of unforeseen costs incurred by contractors during construction.

2.7 ADD-ON ALLOWANCE

At the end of each estimate, an additional "add-on allowance" is multiplied to the base cost to cover the cost of preliminary and final engineering design, project management and construction management that are needed to eventually construct the project. The add-on allowance also covers the costs of administration and project management for the agency implementing the project.

3 . 0 OPERATIONS AND MAINTENANCE COSTS

3.1 COST ESTIMATING APPROACH

Operating and Maintenance Costs were estimated for each Tier 2 alternative, with all costs expressed in current (2004) dollars. The cost estimate is based on a figure of $78.96 per vehicle hours of operations for each alternatives. The dollar/hour figure is based on Broward County Transit's operating cost as reported in data provided for the National Transit Database (NTD).

Vehicle hours are calculated from a simple, one-variable model that treats projected ridership, average speed, service frequency (headway) to estimate the number of vehicles required to provide the assumed level of service and to carry the projected ridership. The number of vehicles needed for serve the peak period demand, revenue miles and revenue hours were based on outputs from the travel demand model. The total fleet size was reflects the peak period fleet size with a 20% spare ratio. The fleet size calculation was based on maximum vehicle capacities of 115 passengers for bus rapid transit (BRT) vehicles and 125 passengers for light rail transit (LRT) vehicles. These figures are based on the maximum capacity listed by transit vehicle manufacturers.

The O&M cost model to simulate LRT operations is based on a weighted average of actual FY 2001 financial and statistical data (as reported in each agency's National Transit Database report to the Federal Transit Administration) for the following 12 LRT systems:

- Bi-State Development Agency of the Missouri-Illinois Metropolitan District (St. Louis)
- Dallas Area Rapid Transit Authority (Dallas)
- Los Angeles County Metropolitan Transportation Authority (Los Angeles)
- Maryland Mass Transit Administration (Baltimore)
- Memphis Area Transit Authority
- Niagara Frontier Transportation Authority (Buffalo)
- Regional Transportation District (Denver)
- Sacramento Regional Transit District (Sacramento)
- San Diego Trolley, Inc. (San Diego)
- Santa Clara Valley Transportation Authority (San Jose)
- Tri-County Metropolitan Transportation District of Oregon (Portland)
- Utah Transit Authority (Salt Lake City)

These peer cities were selected based primarily on LRT system size and location (in the United States), to reflect representative annual O&M costs. The operating cost model tabulates costs for vehicle operations, vehicle maintenance, non-vehicle maintenance, and administration. Annual operating costs for proposed build alternatives and the Baseline/TSM alternatives are presented below in Table 3.1 2004 dollars. Note that since the Baseline/TSM operating costs are for standard, urban bus operations, the projected costs are based on Broward County Transit's operating cost per revenue hour as reported in the National Transit Database of $74 (2002 dollars), adjusted to 2004 dollars to $78.96 per revenue hour. Feeder Bus routes operating costs for the Minimum Operating Segment alternative are based on the $78.96 per revenue hour figure. Also, note that costs are for the operation of the respective alternatives only and do not include the cost of operating the total BCt system. Fleet sizes shown are for the number of vehicles to provide peak period service with a spare ratio of 20 percent.

Table 3.1 Annual Operating Costs

ALTERNATIVE:	**Fleet Size**	**Annual Revenue Hours**	**Annual Operating Costs**
Baseline/TSM	90	205,763	$16,247,007
Minimum Operating Segment			
LRT (College Ave. to Airport)	12	33,056	$12,732,993
Feeder Bus Routes (3)	68	102,601	$8,101,375
At-grade Alternatives	22	49,584	$19,656,761
Elevated Alternatives	27	49,584	$20,804,320

APPENDIX A

SELECTED FIXED GUIDEWAY TYPICAL SECTIONS

APPENDIX B

Cost Estimate Spreadsheets